US Army Corps
of Engineers
Savannah District

Federal Facilities
Georgia and South Atlantic Division

Solicitation Number
DACA21-03-R-0064
Indefinite Delivery, Multi-Task Construction and Design/Build Construction Contract for Georgia
Volume II of II
Technical Provisions - Replace BAK-12 Deck Sheaves
Technical Provisions - Demo Contracting Facilities
Technical Provisions - Repair 3rd Floor Building 3602
Technical Provisions - Replace Power Check Pad
Technical Provisions - Repair ALS Roof, Bldg. 3611
Technical Provisions - Construct Addition to Personnel Deployment Facility
Seymour Johnson AFB, NC
FY-03, Line Item 3379000
August 2003

THIS SOLICITATION IS UNRESTRICTED PURSUANT TO THE "BUSINESS OPPORTUNITY DEVELOPMENT REFORM ACT OF 1988" (PUBLIC LAW 100-656)

U.S. ARMY ENGINEER DISTRICT, SAVANNAH
CORPS OF ENGINEERS
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SAVANNAH, GEORGIA 31401-3640

SEYMOUR JOHNSON

AIR FORCE BASE

NORTH CAROLINA

Specifications

FOR

DATE: 27 November 2002

PROJECT NO: VKAG 02-1048

PROJECT TITLE: REPLACE BAK-12 DECK SHEAVES

PROJECT ENGINEER: LT NICOLE FELDPAUSCH

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SECTION 01000 -GENERAL

1. **SCOPE OF WORK:** The work covered by this specification consists of furnishing labor, equipment and material, and performing all work in connection with the Replace BAK-12 Deck Sheaves Project, VKAG 02-1048 in strict accordance with these specifications and drawings and subject to the terms and conditions of this contract.

2. **LOCATION:** The work is to be accomplished at Seymour Johnson Air Force Base, Goldsboro, North Carolina. The base is accessible by both public highway and railway.

3. **WORKWEEK:** The contractor shall do all coordination work during the regular workweek being observed by the Seymour Johnson AFB (SJAFB) Civil Engineering shop forces, which is 7:30 a.m. to 4:30 p.m., Monday through Friday, with Federal holidays excluded. The actual construction work shall be 12 hours per day, 7 am to 7 pm; Monday through Friday. Work hours for Phases II, IV, and VI shall be 24 hours a day during the specified time. Any deviation from this schedule will require 48 hours advance notice and approval of the Contracting Officer.

4. **PRINCIPLE FEATURES:** The work covered by this contract includes, but is not limited to the following:

4.1 Deck sheave, and concrete foundation, and steel tube removal

4.2 Fairlead beam installation, concrete foundation replacement and steel tube replacement

4.3 BAK-12 absorber removal/installation

5. **HAUL ROUTES:** The Contractor shall use the haul routes indicated on the plans.

6. **DISPOSITION OF NONSALVABLE MATERIALS:** All nonsalvable or unusable material shall be disposed of off base as directed by the Contracting Officer. All waste material generated by any work under this contract shall be handled, transported, stored, and disposed of off base, by the Contractor, in accordance with all applicable federal, state, or local laws, ordinances, regulations, court orders, or other types of rules or rulings having the effect of law.

7. **DISPOSITION OF SALVAGEABLE MATERIALS:** The Contractor shall be required to furnish an itemized listing of materials to be salvaged to the Base Civil Engineering material Control section, located in Bldg 3300, so that an AF Form 1348-1 can be obtained. After receiving this form, all salvable or reusable material will be delivered to the Defense Reutilization and Marketing Office (DRMO), which is located near Bldg 2620 or as directed by Contracting Officer. It should be noted that DRMO will only be open for one day per week. The contractor shall safely store all salvageable materials and schedule the delivery of them on the appropriate day of the week. Deck sheaves and absorbers shall be salvaged.

8. **SUBMITTALS REQUIRED:** Required submittals are listed on AF Form 66.

9. **BASE CIVIL ENGINEERING WORK CLEARANCE REQUEST, AF FORM 103**: The Contractor shall obtain AF Form 103, Base Civil Engineering Work Clearance Request, prior to work commencement from the Contract Management Section in Bldg 3300, 1095 Peterson Avenue. Upon receipt of an AF Form 103, the Contractor shall be responsible for locating all underground utilities. Utilities include, but are not limited to electric, water, sewer, steam, communication, telephone, fiber optic, cathodic protection, cable television, fuelnes, and natural gas. Historical drawings, as-built drawings, and topographic drawings, the accuracy of which the government doe not guarantee, are available for review at the 4th Civil Engineer Squadron, Design element located in Building 3300. The contractor shall promptly repair/replace contractor damaged utilities at no additional cost to the Government. The repair/replacement shall be acceptable to and approved by the Government.

10. **MATERIALS CONTAINING ASBESTOS:** In the event the Contractor discovers materials suspected of containing asbestos that are not identified to be removed in the plans and specifications, the Contractor shall notify the Contracting Officer. The Contractor's work shall proceed unless the materials suspected of containing asbestos are damaged or disturbed. Any suspected materials damaged or disturbed by the Contractor without permission from the Contracting Officer shall be removed by the Contractor at his expense IAW all applicable Federal, State, and local laws, ordinances, regulations, court orders, or other types of rules or rulings having the effect of law.

11. **MATERIALS CONTAINING LEAD:**

11.1 In the event the contractor discovers material suspected of containing lead that is not identified to be removed in the plans and specifications, the contractor shall notify the contracting officer. The contractor's work shall proceed unless the materials suspected of containing lead are damaged or disturbed. Any suspected materials damaged or disturbed by the contractor without permission from the Contracting Officer shall be removed by the contractor at his expense in accordance with all applicable Federal, State, and local laws, ordinances, regulations, court orders, or other types of rules or rulings having the effect of law.

11.2 The known item that contains lead in VKAG 02-1048, "Replace BAK-12 Deck Sheaves " is the paint on the deck sheaves. Contractor shall remove these items in accordance with all applicable Federal, State, and local laws, ordinances, regulations, court orders, or other types of rules or rulings having the effect of law.

12. **LABELING OF STORAGE DRUMS:** All 55 gallon or larger drums brought on base for use under this contract and containing new material or used for storage of waste materials or hazardous waste must be labeled with a Department of Transportation (DOT) Proper Shipping Name, DOT Hazardous Identification Number, the Contractor's name, a Contractor representative, and the Contractor's telephone number. Label lettering should have a minimum height of one half inch painted in white paint or other color that is in contrast with the color of the drum. The label should be sufficiently durable to equal or exceed the life (including storage and disposal) of the drum.

13. **CONTRACTOR STORAGE TRAILER(S) AND BUILDING(S):** The Contractor shall place or paint a sign on all of his storage trailer(s) and building(s) used on this contract. At a minimum, the sign shall contain the name of the Contractor and a telephone number at which the Contractor can be reached. The trailer(s) and building(s) shall be complete with gates and/or doors which can be locked. Only material for this project shall be stored in the trailer(s) or building(s). The Contractor shall remove the storage trailer(s) or building(s) within 30 days after completion of the contract and prior to submitting his final invoice. The area around the storage trailer(s) and building(s) shall be kept clean. This includes the mowing of grass during the growing season. The lawn mower shall be supplied by the Contractor

14. **CONSTRAINTS:**

14.1 Work is restricted to authorized personnel only. All contractor personnel shall register with Base Operations prior to on-site work. Registration includes obtaining a flightline drivers license for all personnel that will be driving on the runway or any taxiways. All contractor personnel shall have on their person a picture type ID card (Driver's License, etc.) at all times.

14.2 Contractor shall keep all equipment, tools and materials stored in a neat and orderly manner inside the contractor storage or staging area when not in use.

14.3 Contractor shall be tasked with continual clean-up of work area to ensure that no FOD (Foreign Object Debris) is allowed on the existing taxiways, runway, or airfield. Also, immediate and thorough cleaning of the runway, taxiway and apron after and during rubber removal, and all demolition shall be performed. Contractor shall furnish and operate a truck mounted vacuum sweeper, comparable to those used on airfields (Tempco Model 600), on all portions of the runway/ taxiway/ apron/ haul routes/ etc., affected by the work while the work is being accomplished.

14.4 Contractor shall be responsible for all site development work. All survey, grade stakes, layout verification of field conditions shall be the responsibility of the contractor.

14.5 Grassy areas disturbed by the contractor shall be re-seeded by the contractor using hydro seeding only per Grass Hydro Seeding Section 02821. Disturbed areas will be seeded prior to the completion of phase in which the disturbance occurred.

14.6 Privately owned vehicles used by the contractor personnel to commute to work are required to park in the contractor's storage area. Tracking of mud, dirt, etc., on base streets and parking lots will not be tolerated. Roads will be cleaned by the contractor immediately upon detection of debris.

14.7 Contractor shall at all times protect and preserve the property of the Government which is within the work area and could be affected by the accomplishment of the work specified and indicated, and all parties and individuals within or near the work areas who would be endangered by the work.

14.8 When night operations are to be conducted by the Contractor, all necessary lighting shall be furnished by the Contractor at no cost to the Government. Lighting shall be shaded or directed so as not to interfere with aircraft or control operations. All inspections of night work, for acceptance purposes, shall be accomplished during daylight hours.

14.9 The contractor shall maintain radio contact with the tower during all airfield construction operations. The contractor shall provide at least one radio that is compatible to the tower frequency or shall provide at least two radios on a frequency that does not interfere with the tower frequency. The contractor shall include **20 one hour runway evacuations**, including the resultant work stoppages, in the original contract price.

14.10 The government shall supply the Contractor with trailers to position at the temporary end of runway for the Arm/ Dearm personnel. The contractor is responsible for positioning and grounding the trailers during Phase II at the location as directed by the Contracting Officer or Representative, as well as repositioning them during phase IV.

14.11 TRUCK HAULING ON BASE: The contractor shall be responsible for covering open bodied vehicles transporting any materials likely to create air pollution or become debris while on base.

14.12 For Phase I and VII, the contractor shall use "Contractor Storage Area" as shown on Sheet T-1 of the plans.

15. **PHASING:** The contractor shall provide five days written notice and coordinate work with the Contracting Officer, or designated representative, before starting work at the job site. Work under this contract shall be preformed in seven phases, each with a separate notice to proceed which conforms to the time allowed for each phase. Any options and/ or estimated quantities that are added to the contract will not increase the performance period of the contract.

15.1 **Phase I:** Phase I will consist of all preparatory work performed prior to closing the runway. Upon receipt of notice to proceed for Phase I, contractor shall begin ordering, fabricating and storing equipment and materials at the staging area as approved by the Contracting Officer, or designated representative. The contractor shall have 60 days for material delivery. Submit all submittals listed on the Form 66 that can be accomplished prior to Phase II to the Contracting Officer for approval. The contractor shall begin surveying the runway during Phase I to permit work to start immediately after receipt of the Phase II notice to proceed. Aircraft flying operations will continue throughout Phase I, therefore, access to the runway will be limited to nights, some weekend time periods and limited weekday times. The contractor shall schedule his work and runway access during Phase I around the Government flying operations. The contractor shall coordinate runway surveying with the Contracting Officer, or designated representative, and Base Operations. Performance time for Phase I will be from NTP to the start of Phase II. Prior to the start of Phase II **all** equipment necessary for the completion of Phases II and III shall be located in the contractor storage area.

15.2 **Phase II** (Entire Runway Closure): Phase II shall consist of all construction work on the BAK-12s as shown in Phase II work in accordance with drawings and specifications to displace

the 08 threshold. The contractor shall be responsible for having the sufficient number of personnel and equipment in each trade to begin work at the start of Phase II, on Friday evening at 8:00 pm E.S.T and complete all work items in accordance with the plans and specifications by 8:00 am E.S.T. the following Monday (80 hours). **For the purpose of this phase, a day will be designated as one 24 hour period.** During this phase, the contractor shall also put into place the displaced threshold markings, lights, Precision Approach Slope Indicator (PAPI) system, change distance markers etc., so that Phase III can begin immediately following Phase II. The contractor is responsible in each phase to completely protect his work from adverse weather conditions. The use of tents, tarps, etc., shall be used at the contractor's discretion and expense for protection of work. **NO WEATHER DAYS CAN BE ADDED TO THE ALLOTTED PHASE TIME.** The government will have installed the EXPED barrier system by the completion of Phase II.

15.3 **Phase III** (BAK-12, 08 End Construction): Phase III work shall begin upon receipt of the Notice to Proceed for Phase III work (after completion and acceptance of Phase II work) and shall extend for 30 calendar days. **For the purpose of this phase, a day will be designated as one 12 hour period.** Phase III work includes but is not limited to removal and replacement of the BAK-12 absorber, pipe, and ramp and removal of the deck sheaves to be replaced with fairlead beams. The contractor is completely responsible to maintain sufficient personnel and equipment to complete Phase III work in the allotted time. The contractor is also responsible in each phase to completely protect his work from adverse weather conditions. The use of tents, tarps, and asphalt emulsions, etc., shall be used at the contractor's discretion and expense for protection of work. **NO WEATHER DAYS CAN BE ADDED TO THE ALLOTTED PHASE TIME**. During Phase III, flying will be regular and often. Departures away from the work area and landings over the work area are to be expected. If the contractor is pulled off the runway for an emergency situation, the time he is removed from the work area times 2, shall be added to his completion time, with a minimum of 1 hour added. Time adjustments shall be made at the end of the phase or at the completion of the work, whichever occurs first.

15.4 **Phase IV** (Entire Runway Closure): Phase IV work shall begin upon receipt of the Notice to Proceed for Phase IV work (after completion and acceptance of Phase III work). Work shall consist of all construction work as shown in Phase IV work in accordance with the drawings and specifications to replace the 08 threshold, and displace the 26 threshold. The contractor shall be responsible for having the sufficient number of personnel and equipment in each trade to begin work at by 8:00 pm E.S.T. on a Friday and complete all work items in accordance with the plans and specifications by 8:00 am E.S.T the following Monday (80 hours). **For the purpose of this phase, a day will be designated as one 24 hour period.** During this phase, the contractor shall remove the Phase II displaced threshold markings and paint similar markings in the Phase V work location. All temporary threshold lights, PAPI system, and distance "to go" makers will also be repositioned for a displaced 26 threshold. The government will move the EXPED barrier during this phase. At the completion of phase IV, the 08 threshold will have been returned to permanent location, and the 26 threshold displaced with all associated work.

15.5 **Phase V** (BAK-12, 26 End Construction): Phase V shall begin upon receipt of Notice to Proceed for Phase V work (after the completion and acceptance of Phase IV work) and shall extend for 30 calendar days (12 hour periods). **For the purpose of this phase, a day will be**

designated as one 12 hour period. Phase III work includes but is not limited to removal and replacement of the BAK-12 absorber, pipe, and ramp and removal of the deck sheaves to be replaced with fairlead beams. The contractor is completely responsible to maintain sufficient personnel and equipment to complete Phase V work in the allotted time. The contractor is also responsible in each phase to completely protect his work from adverse weather conditions. The use of tents, tarps, asphalt emulsions, etc., shall be used at the contractor's discretion and expense for protection of work. **NO WEATHER DAYS CAN BE ADDED TO THE ALLOTTED PHASE TIME.** Time adjustments shall be made at the end of the phase or at the completion of the work, whichever occurs first.

15.6 **Phase VI** (Entire Runway Closure): Phase VI shall begin upon the receipt of the Phase VI Notice to Proceed, after completion and acceptance of Phase V work. Phase VI shall require complete runway closure and return the runway to full length operations over two weekend closures. The contractor is responsible for having the sufficient number of personnel and equipment in each trade to begin work at 8:00 pm E.S.T. Friday evening and complete all work items in accordance with the plans and specifications by 8:00 am E.S.T. the following Monday. **For the purpose of this phase, a day will be designated as one 24 hour period.** This work shall include, but is not limited to, all displaced threshold paint removal, return of distance markers to the original numbers, electrical work, lighting, etc. **THE CONTRACTOR SHALL COMPLETE THIS WORK DURING THE FIRST CLOSURE.** During the second weekend closure which will be from 2000 Friday evening to 0800 the following Monday, all painting that did not occur during the previous phases shall be completed during this closure. At the completion of this phase, all runway markings to the instrument hold lines will have been replaced. Rubber removal will also be accomplished during this phase. Both weekend closures must be completed on time. If either 60 hour closure has to be extended and delays scheduled flying operations, the contractor shall be liable for liquidated damages as required by this contract.

15.7 **Phase VII:** Phase VII shall begin upon receipt of Phase VII Notice to Proceed which will begin concurrently with Phase VI. Phase VII shall consist of all operations required to clean up and restore staging/ storage areas to original conditions. Contractor shall make changes to and submit record drawings (not previously submitted) to the Contracting Officer, or designated representative, prior to the end of Phase VII. Performance time for Phase VII is 21 calendar days. **For the purpose of this phase, a day will be designated as one 12 hour period.**

16. **CONVENIENCE FACILITIES:** Existing restrooms facilities shall not be used by construction personnel. The contractor shall provide and maintain, in a neat and sanitary condition, such accommodations for the use of his employees.

17. **UTILITIES:** All utility services required for this work shall be provided by the contractor. Temporary lines, connections, installation, maintenance, and removal shall be the contractor's responsibility, and shall be approved by the Contracting Officer, or designated representative. All services are subject to discontinuance without notice to the contractor in an emergency. Three phase power is not available. Water and electricity are available for contractor use, without charge to contractor.

18. **SUPERINTENDENT AND ALTERNATIVES:** The contractor shall employ a construction superintendent and alternates to oversee all work under this contract. When work is being performed, the superintendent or alternate shall remain at the project site during all work hours (all shifts), expect for such incidental errands as required by his duties. The superintendent and alternate is responsible for the proper coordination and timeliness of the work, and for proper workmanship of all trades; therefore, his absence from the project site without a suitable substitute representative of the contractor shall be considered as damaging to the government. The ability of the superintendent, based on his knowledge and experience, are essential to the proper execution of the work, as is his ability to communicate and direct the efforts of those performing the work. The alternate superintendents shall be equally qualified to direct work and act on the contractor's behalf. Three weeks prior to start of Phase II, the contractor shall submit, in writing to the Contracting Officer, the name of the individuals who will be designated as the project superintendent and alternates. With each name, the contractor shall include a brief resume listing the project similar to this one, that the individual has managed in the past two years.

19. **TESTS:** The contractor shall accomplish all testing and laboratory work required by the specifications. All costs for testing and laboratory work required shall be included in the contractor's bid price. Testing shall be performed by an independent testing laboratory who regularly performs this type of work. The contractor shall submit the laboratory's name and credentials at the preconstruction conference for approval. The contractor shall provide results of the tests performed for this project to the Contracting Officer, or designated representative, within one workday. The contractor shall be responsible to review each section of specifications to determine the extent of his testing/ laboratory responsibility

20. **AFFIRMATIVE PROCUREMENT:** The contractor shall incorporate Affirmative Procurement requirements as per 40 CFR, Part 247 and Executive order 13101: "Greening the Government Through Waste Prevention, Recycling and Federal Acquisition." Designated items used in the execution of this contract shall meet or exceed the Environmental Protection Agency's (EPA) requirements for recycled content materials (RCM) as per EPA's Comprehensive Procurement Guidelines (CPG). The contractor shall ensure affirmative procurement requirements for CPG items are met or provide written justification that: 1) the price of a given designated item is unreasonably high, 2) there is inadequate competition (not enough sources of supply), 3) unusual and unreasonable delays would result from obtaining the item, or 4) the item does not meet the Air Force's performance specifications. Products include fly ash containing concrete.

END OF SECTION 01000

SECTION 01560 - ENVIRONMENTAL PROTECTION

1. **DEFINITIONS OF CONTAMINANTS:**

1.1 Sediment: Soil and other debris that has been eroded and transported by runoff water.

1.2 Solid Waste: Rubbish, debris, garbage, and other discarded solid materials resulting from industrial, commercial, and agricultural operations, and from community activities.

1.3 Rubbish: A variety of combustible and noncombustible wastes such as paper, boxes, glass, crockery, metal, lumber, cans, and bones.

1.4 Debris: Includes combustible and noncombustible wastes, such as ashes, waste materials that result from construction or maintenance and repair work, leaves, and tree trimmings.

1.5 Chemical Wastes: Includes salts, acids, alkalis, herbicides, pesticides, and organic chemicals.

1.6 Sewage: Wastes characterized as domestic sanitary sewage.

1.7 Garbage: Refuse and scraps resulting from preparation, cooking, dispensing, and consumption of food.

1.8 Oily Waste: Includes petroleum products and bituminous materials.

2. **ENVIRONMENTAL PROTECTION REQUIREMENTS:** Provide and maintain during the life of the contract, environmental protection as defined herein. Provide environmental protection measures as required to control pollution that develops during normal construction practice. Provide also environmental protective measures required to correct conditions that develop during the construction of permanent or temporary environmental features associated with the project. Comply with all federal, state, and local regulations pertaining to water, air, and noise pollution. Develop proposals for an environmental protection plan for the project and, prior to the commencement of the work, meet with the Contracting Officer and discuss the proposed environmental protection plan. The meeting shall develop mutual understanding relative to details of environmental protection, including measures for protecting natural resources, required reports, and measures to be taken should the Contractor fail to provide adequate protection in an adequate and timely manner. Perform a preconstruction survey of the project site and take photographs as necessary to enhance the survey.

3. **PROTECTION OF NATURAL RESOURCES:** The natural resources within the project boundaries and outside the limits of permanent work performed under this contract shall be preserved in their existing condition or restored to an equivalent or improved condition upon completion of the work.

3.1 Land Resources: Do not remove, cut, deface, injure, or destroy trees or shrubs without special permission from the Contracting Officer. Do not fasten or attach ropes, cables, or guys to

any existing nearby trees for anchorages unless specifically authorized. Where such special emergency use is authorized, the Contractor shall be responsible for any resultant damage.

3.1.1 Protection: Protect existing trees which are to remain and which may be injured, bruised, defaced, or other wise damaged by construction operations.

3.1.2 Repair or Restoration: Repair or restore to their original condition all trees or other landscape features scarred or damaged by the equipment or operations. Obtain approval of the repair or restoration from the Contracting Officer prior to its initiation.

3.1.3 Temporary Construction: Obliterate all signs of temporary construction facilities such as haul roads, work areas, structures, foundations of temporary structures, stockpiles of excess or waste materials, and all other vestiges of construction. Temporary roads, materials, and all other vestiges of construction. Temporary roads, parking areas, and similar temporary use areas shall be graded in conformance with surrounding areas, tilled, and hydro seeded. Include topsoil of nutriment during the seeding operation as necessary to reestablish a suitable stand of grass.

3.2 Water Resources: Perform all work in such a manner than any adverse environmental impact on water resources is reduced to a level acceptable to the Contracting Officer.

3.2.1 Oily Substances: Take special measures to prevent oily or other hazardous substances from entering the ground, drainage areas, or local bodies of water. Surround all temporary fuel oil, petroleum, or liquid chemical storage tanks with a temporary earth berm of sufficient size and strength to contain the contents of the tanks in the event of content leakage of spillage.

3.3 Fish and Wildlife Resources: During the performance of the work take such steps as required to prevent interference or disturbance to fish and wildlife. Do not alter water flows or otherwise significantly disturb native habitat adjacent to the project area which are critical to fish and wildlife except as may be indicated or specified.

4. **EROSION AND SEDIMENT CONTROL MEASURES:**

4.1 Burn-off: Burn-off of ground cover is not permitted.

4.2 Protection of Erodible Soils: All earthwork brought to final grade shall be immediately finished as indicated or specified. Protect immediate side slopes and backslopes upon completion of rough grading. Plan and conduct all earthwork in such a manner as to minimize the duration of exposure of unprotected soils.

4.3 Temporary Protection of Erodible Soils: Utilize the following method to prevent erosion and control sedimentation.

4.3.1 Mechanical Retardation and Control of Runoff. Mechanically retard and control the rate of runoff from the construction site. This includes construction of diversion ditches, benches, and berms, to retard and divert runoff to protected drainage courses.

5. **CONTROL AND DISPOSAL OF SOLID, CHEMICAL, AND SANITARY WASTES:** Pick up solid wastes and place in containers which are emptied by the contractor on a regular schedule. The preparation, cooking, and disposing of food are strictly prohibited on the project site. Conduct handling and disposal of wastes to prevent contamination of the site and other areas. On completion, leave areas clean and natural looking. Obliterate signs of temporary construction and activities incidental to construction of the permanent work in place.

5.1 Disposal of Rubbish and Debris: Dispose of rubbish and debris in accordance with the requirements specified herein.

5.1.1 Removal from Government Property: Remove rubbish and debris from Government property and dispose of it in compliance with federal, state, and local requirements.

5.1.2 Chemical Waste: Store chemical waste in corrosion resistant containers labeled to identify type of waste and date filled. Remove containers from the project site, and dispose of chemical waste in accordance with federal, state, and local regulations. For oil and hazardous material spills which may be large enough to violate federal, state, and local regulations, notify the Contracting Officer immediately.

5.1.2.1 Petroleum Products: Conduct fueling and lubricating of equipment and motor vehicles in a manner that affords the maximum protection against spills and evaporation. Dispose of lubricants to be discarded and excess oil in accordance with approved procedures meeting federal, state, and local regulations.

6. **DUST CONTROL:** Keep dust down at all times, including non-working hours, weekends, and holidays. Sprinkle or treat, with dust suppressors, the soil at the site, haul roads, and other areas disturbed by operations. Only wet cutting of concrete blocks, concrete, and asphalt is permitted. No unnecessary shaking of bags is permitted where bagged cement, concrete mortar and plaster is used.

7. **NOISE:** When available, make the maximum use of “low-noise-emission products” as certified by EPA. No blasting or use of explosives is permitted.

END OF SECTION 01560

SECTION 02050 - DEMOLITION

1. **AVAILABILITY OF WORK AREAS:** Areas in which salvage and demolition work are to be accomplished will be available as scheduled in the phasing.

2. **GENERAL:**

2.1 Procedures. Before beginning any cutting or demolition work, the Contractor shall carefully survey the existing work and examine the drawings and specification to determine the extent of the work. The Contractor shall take all necessary precautions to ensure against damage to existing work to remain in place, to be reused, or to remain the property of the Government, and any damage to such work shall be repaired or replaced as approved by the Contracting Officer at no additional cost to the Government. The Contractor shall carefully coordinate the work of this section with all other work and construct and maintain shoring, bracing and supports, as required. The Contractor shall ensure that the structural elements are not overloaded and be responsible for increasing structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under any part of the contract.

2.2 Protection of Existing Work.

2.2.1 Existing work to remain shall be protected from damage. Work damaged by the Contractor shall be repaired to match existing work.

2.3 Use of explosives will not be permitted.

3. **DISPOSITION OF MATERIAL:**

3.1 Unsalvable Materials. Any unsalvable materials that is removed shall be disposed of off base.

3.2 Property of Government. Remove salvaged items in a manner to prevent damage. The Contractor shall furnish an itemized list of all salvable materials to the Contract Management representative. The following items shall be salvaged as property of the Government.

3.2.1 The deck sheaves and the absorbers from the BAK-12s will be salvaged.

4. **CLEANUP:**

4.1 Debris and Rubbish. Remove debris and rubbish from the base daily. Do not allow to accumulate on site.

4.2 Debris Control. Remove and transport debris in a manner as to prevent spillage on streets or adjacent areas.

END OF SECTION 02050

SECTION 02221 - TRENCHING, BACKFILLING AND COMPACTING

PART ONE - GENERAL

1. **DESCRIPTION**: This section covers the excavation, trenching, and backfilling for the drain lines and steel piping.

1.1 Related Work Specified Elsewhere:

1.1.1 Concrete, Section 03301

1.1.2 Asphalt Paving, Section 02680

1.1.3 Grass Hydro Seeding, Section 02821

1.1.4 Topsoiling and Finished Grading, Section 02260

2. **QUALITY ASSURANCE**:

2.1 Trenching shall be done in such a manner so as to minimize disturbance to base functions and minimize soil erosion.

2.2 Backfilling shall be done in such a manner so as to have a firm unyielding fill that will not settle.

2.3 Work shall comply with the standards of the following specifications unless otherwise indicated:

2.3.1 American Society for Testing and Materials ASTM-D 2321-00

2.3.2 American Society for Testing and Materials ASTM-D 2774-94

3 **SUBMITTALS**:

3.1 Contractor shall submit to the Contracting Officer three (3) copies of all density reports.

PART TWO - PRODUCTS

4. **MATERIALS**:

4.1 Lower trench backfill material shall meet the requirements of ASTM D 2321.

4.2 Other backfill shall be free of stones larger than 6" and shall be capable being compacted to the required density.

PART THREE - EXECUTION

5. **INSPECTION**:

5.1 After trench has been excavated to the proper depth, the Contractor, and Contracting Officer or designated representative shall inspect the pipe bedding to determine if it is sufficient to bear the pipe.

5.2 Backfill material shall be inspected prior to placement for large stones and debris, which shall be removed prior to placement.

6. **PREPARATION**:

6.1 All excavation of every description and of whatever substances encountered shall be performed to the depths indicated or as otherwise specified. During excavation, material suitable for backfilling shall be piled in an orderly manner a sufficient distance from the banks of the trench to avoid overloading and to prevent slides or cave-ins. All excavated materials not required or suitable for backfill shall be removed and wasted off base. Grading shall be done as may be necessary to prevent surface water from flowing into trenches or other excavations, and any water accumulating therein shall be removed by pumping or by other approved methods. Sheeting and shoring shall be done as may be necessary for the protection of the work and for the safety of personnel.

6.2 Trenches shall be of the necessary width for proper laying of pipe. The banks of the trenches shall be as nearly vertical as practicable. Care shall be taken not to over-excavate. The bottom of the trenches shall be accurately graded to provide uniform bearing and support for each section of the pipe on undisturbed soil at every point along its entire length. Except as hereinafter specified for wet or otherwise unstable material, overdepths shall be backfilled with materials specified for backfilling the lower portion of the trenches. Whenever wet or otherwise unstable material that is incapable of properly supporting the pipe, as determined by the Contracting Officer, is encountered in the bottom of the trench, such material shall be removed to the depth required and the trench backfilled to the proper grade with coarse sand, fine gravel, or other suitable approved material.

6.3 When the trench is excavated to the plan depth or as required by these specifications, and soft or otherwise unstable material not suitable for bedding purposes is located in the bottom of the trench, the Contractor shall immediately notify the Contracting Officer for inspection and approval of the unstable bedding material to be removed.

6.4 Existing pavements cut for the removal of, or in the installation of utility lines shall be removed to neat lines and disposed off base. The replacement of pavement shall be made with pavements similar to the type removed in accordance with plan details.

7. **INSTALLATION**:

7.1 Existing utility lines shall be located by the Contractor, as well as utility lines constructed during excavation operations, shall be protected from damage during the excavation and backfilling. If damaged, the utility line shall be satisfactorily repaired by the Contractor at no additional cost to the Government.

7.2 Trenches shall be backfilled to the ground surface with selected excavated material or other material that is suitable for the specified compaction and as hereinafter specified. Trenches improperly backfilled shall be reopened to the depth required for proper compaction, then refilled and compacted as specified, or the condition shall be otherwise corrected as approved. Pavement and base course disturbed by trenching operations shall be replaced as hereinbefore specified.

7.3 Degree of compaction shall be as follows:

7.3.1 Under paved areas: six-inch layers, 95 percent Standard Dry Proctor.

7.3.2 Under turfed or seeded lawn areas. Twelve-inch layers, 85 percent Standard Dry Proctor. This requirement applies also to areas designated to be turfed or seeded.

8. **FIELD QUALITY CONTROL**:

8.1 Testing shall be the responsibility of the Contractor and shall be performed at no additional cost to the Government. Testing shall be performed by an approved commercial testing laboratory.

8.2 The following tests will be performed and are considered to be the minimum number of tests. Additional tests may be required contingent upon weather and/or soil conditions.

8.2.1 One laboratory moisture-density relation test and companion classification test for each type of soil encountered.

8.2.2 Under areas to be paved, one sand cone density test and companion classification test for each alternate lift of backfill in trenches at increments of 100 feet or fraction thereof.

8.2.3 One sand cone density test and companion classification test on each alternate lift of backfill in other areas, for each 200 linear feet of trench or fraction thereof.

9. **ADJUSTMENT AND CLEANING**:

9.1 The Contractor shall be required to regrass all existing cultivated grassed areas disturbed by the pipe installation. Regrassing shall be done in accordance with Section 02821, Bermuda Grass Hydro Seeding.

END OF SECTION 02221

SECTION 02260 - TOPSOILING AND FINISHED GRADING

PART ONE - GENERAL

1. **DESCRIPTION:**

1.1 Furnish all labor, materials, tools, equipment, and services for all topsoiling and finished grading, as indicated, in accord with provisions of Contract Documents.

1.2 Completely coordinate with work of all other trades.

1.3 Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.

1.4 See Division 1 for General Requirements.

2. **RELATED WORK:**

2.1 Trenching, Backfilling, and Compacting, Section 02221
2.2 Grass Hydro Seeding, Section 02821

3. **LOCATION OF WORK:** All areas within limits of grading and all areas outside limits of grading which are disturbed in the course of the work.

4. **QUALITY ASSURANCE:**

4.1 Finish grading tolerance: 0.1 FT plus/minus from required elevations.

5. **JOB CONDITIONS:**

5.1 Verify amount of topsoil stockpiled and determine amount of additional topsoil, if necessary to complete work.

PART TWO - PRODUCTS

6. **MATERIALS:**

6.1 Topsoil: Original surface soil typical of the area, capable of supporting native plant growth. If amount of topsoil stockpiled is less than amount necessary for the work, furnish all additional topsoil required.

7. **PREPARATION:** Correct, adjust and/or repair rough graded areas. Cut off mounds and ridges. Fill gullies and depressions. Perform other necessary repairs. Bring all sub-grades to

specified contours, even and properly compacted. Loosen surface to depth of 2 inches, minimum. Remove all stones and debris over 2 inches any dimension.

8. **PLACING TOPSOIL:** Do not place topsoil when subgrade is either wet or frozen enough to cause clodding. Spread topsoil to compacted depth of 4 inches for all disturbed earth areas. Make finished surface free of stones, sticks, or other material 1 inches or more in any dimension. Make finished surface smooth and true to required grades. Restore areas occupied by stockpiles to condition of rest of finished work.

9. **ACCEPTANCE:** Upon completion of topsoiling, obtain Contracting Officer's or Authorized Representative's acceptance of grade and surface.

END OF SECTION 02260

SECTION 02578 - PAVEMENT MARKINGS - AIRFIELD

PART ONE - GENERAL

1. **APPLICABLE PUBLICATIONS**: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

1.1 Federal Specifications and Standards:

TT-P-001952B-R-1979 (R 1979)	Paint, Reflectorized, for Airfield Runway Marking (Drop in type)
TT-B-1325B-R1978 (R 1978)	Beads, Retro Reflective, Glass (Type III, High Index of Refraction Gradation A, Coarse Drop In)
TT-P-llOC-1977	Paint, Traffic Black, Non reflectorized

PART TWO - PRODUCTS

2. **MATERIALS**: Materials will comply with the provisions of applicable related specifications. Paint will be homogeneous, be easily stirred to smooth consistency, and show no objectionable characteristics during prolonged storage. The composition and quality of the paint will be so as to produce a strong and adherent binder for reflective media, form a firm bond with the pavement on which applied, and have sufficient resistance to weathering and traffic.

2.1 Pigmented Binder: Pigmented binder (paint) covered by Federal Specification TT-P-001952 will be used for white, yellow, and red marking. Black paint shall conform to Federal Specification TT-P-110.

2.1.1 Pigmented binder (paint) shall be in new sealed containers that plainly show the designated name, color, quantity involved, date of manufacturer, manufacturer's formulation number, manufacturer's directions, and name of manufacturer, all of which shall be plainly legible at the time of use. Paint will contain 0.06 percent lead or less by weight in the total non volatile content of the paint. Contractor inspection responsibility shall be as specified in paragraph titled Quality Assurance Provisions. A proprietary brand of paint material similar in intended usage and color to that specified may be used. The paint must meet or exceed the performance and material specifications.

2.2 Reflective Media: Reflective glass spheres with a reflective index of at least 1.90 as covered in Federal Specifications TT-B-1325 will be used for reflective markings.

2.2.1 Reflective media shall be in new sealed containers that plainly show the designated name, quantity, and name of manufacturer.

2.3 Submittals. Samples of the pigmented binder (paint) and the reflective media shall be submitted to the Contracting Officer for approval. Each sample shall be submitted in factory labeled containers containing specification and batch identification numbers.

3. **APPLICATION RATES**: Application shall be at the following rates:

3.1 Pigmented binder covered by Federal Specifications TT-P-001952 and TT-P-llOC will be applied at the rate of one gallon spread evenly over a pavement area of 105 to 110 square feet.

3.2 Reflective glass spheres will be applied uniformly to wet paint at the rate of 10 pounds per gallon of paint. The Contractor shall remove any glass beads not adhered to paint and also remove excess beads.

4. **QUALITY ASSURANCE PROVISIONS**: The Contractor shall furnish manufacturer's certificates for each batch of pigmented binder and reflective media used, stating that the materials meet the applicable specifications.

5. **EQUIPMENT**: All machines, tools and equipment used in the performance of the work shall be approved and kept in satisfactory operating condition.

5.1 Paint Applicator: The equipment for applying the paint binder shall be a self propelled or mobile drawn pneumatic spraying machine with suitable arrangements of atomizing nozzles and controls to obtain specified results. The machine shall be able to apply the paint at the rate specified in Paragraph 3 at an even and uniform thickness, with clear cut edges. The spray mechanism will be operated by quick opening and closing valves within reach of the operator at all times. Paint strainers will be installed in the paint supply lines to prevent residue and foreign matter from being applied in the binder.

5.2 Reflective Media Dispenser: The dispenser shall be attached to the paint dispenser and operate automatically and simultaneously with the paint applicator through the same control mechanism. The media dispenser shall be adjustable and provide uniform flow of beads over the full stripe width at the rate specified in Paragraph 3.

6. **WEATHER LIMITATIONS**: The paint and reflective media or paint alone shall not be applied to damp or wet pavement surfaces or when inclement weather threatens, to interrupt normal work progress. Paint will not be applied when the air temperature is below 40°F or above 95°F.

7. **SURFACE PREPARATION**: All surfaces to be painted shall be thoroughly cleaned before paint application, dust, dirt and other granular surface deposits shall be removed by sweeping, blowing with compressed air, rinsing with water, or a combination of these methods, as required. Where oil or grease are present on old pavements to be marked, affected areas shall be scrubbed with several applications of trisodium phosphate solution or other approved detergent or degreaser and rinsed thoroughly after each application. After cleaning, oil soaked areas shall be sealed with cut shellac to prevent bleeding through the new paint.

8. **PAINT AND REFLECTIVE MEDIA APPLICATION**: Application shall be as follows:

8.1 After surface preparation by Paragraph 7, the paint binder will be applied at the rate specified in Paragraph 3. Work, completed or in progress, is subject to the Contracting Officer's approval. Areas not properly painted will be repainted at no cost to the Government. All spilled paints will be cleaned from the paved areas to the Contracting Officer's satisfaction.

8.1.1 The Contractor shall keep the work areas clean at all times. Paint, empty containers and other material or equipment will not be stored or allowed to accumulate on or near the paved areas.

8.2 Immediately following the paint binder application, reflective media shall be applied so as to insure that it is evenly distributed at the rate specified in Paragraph 3. If either the paint applicator or reflective media dispenser should malfunction, operations will immediately stop until the deficiency is corrected. Any area painted with malfunctioning equipment will be repainted and cleaned at the Contractor's expense.

9. **PROTECTION OF THE WORK**: The newly painted surfaces are to be protected from damage by vehicles and aircraft during the time required for paint to harden sufficiently to withstand traffic. Any damage to newly painted markings, due to the Contractor's failure to provide adequate protection will be repainted at the Contractor's expense.

END OF SECTION 02578

SECTION 02586A - REMOVAL OF PAVEMENT MARKINGS

PART ONE - GENERAL

1. **DESCRIPTION**: The work covered by this section of the specification consists of furnishing all labor, equipment, and materials required to remove 100 percent of the paint from 85 percent of each marked area, shown on the drawings for removal, on the active runway at Seymour Johnson AFB, NC or other markings applied to concrete or asphalt surfaces.

2. **METHOD OF OPERATION**:

2.1 The removal of paint on concrete surfaces shall be accomplished by the use of high pressure water. The removal of thermoplastic or other marking materials on concrete surfaces will be accomplished by abrasive contact. The contractor may use sand or abrasive material injected into the high pressure water system provided there is no damage to the asphalt or concrete pavement when removing paint markings. The use of a grinder or other approved mechanical abrasive removal devices may be permitted for asphalt surfaces.

2.2 The contractor shall test his equipment on actual areas to be cleaned. Tests shall be made on areas the full width of the equipment and at least 50 feet in length to determine the vehicle speed, water pressure, height of nozzle above the pavement, angle of contract and quantity of abrasive material to be added to satisfactorily remove paint from both Portland cement concrete and asphaltic concrete pavement. The test shall be continued until 100 percent of the paint can be removed from 85 percent of the painted area of the pavement. The test shall be continued until an acceptable surface condition is obtained and mutually agreed upon by the contractor and Contracting Officer. This sample area shall then become the standard of inspection for the remainder of the project.

2.3 Inspection shall be made on any one square foot random sample of area shown on the drawings for paint removal and shall meet or exceed the test sample to be acceptable to the Government.

2.4 Paint markings 3 feet in width or greater shall be removed at a minimum rate of 3,000 square feet per hour.

PART TWO - EXECUTION

3. **EQUIPMENT**:

3.1 The equipment used in the paint removal process shall be mounted on pneumatic tires and shall provide the nozzle pressure necessary to remove paint at the specified rated without damage to the pavement surface or joint seal materials. Any damage to the pavement surface or joint sealant shall be repaired by the contractor at his expense using a material and methods approved by the Contracting Officer within the time established for completion of the work.

3.2 When night operations are conducted by the contractor, lighting shall be shaded or directed so as not to interfere with aircraft or control operations. The government reserves the right to accept or reject night work the following day (not under artificial light conditions) after work is completed.

4. **WEATHER LIMITATIONS**:

4.1 No paint removal shall be permitted with the air temperature is less than 40 degrees F (4 degrees C), or substrate temperature is less than 35 degrees F 92 degrees C).

5. **TRUCK HAULING ON BASE**:

5.1 The contractor shall be responsible for covering open bodied vehicles transporting any materials likely to create air pollution or become debris while on base.

6. **CLEAN-UP**:

6.1 All materials and debris generated by paint removal operations shall be removed from the base and disposed of by the contractor. It shall be the responsibility of the contractor to assure proper loading of all vehicles used for transport of materials and construction debris; any spillage on-route on the base shall be recovered and disposed of off-base. Clean-up of work area shall be at the end of each work day. All clean-up activities shall be accomplished by the contractor at no additional cost to the government. The government will not furnish and operate a runway vacuum sweeper for the removal of rubber or paint.

END OF SECTION 02586A

SECTION 02587 - RUBBER REMOVAL

PART ONE – GENERAL

1. **DESCRIPTION**: The work covered by this section of the specification consists of furnishing all labor, equipment, tools, and appliances required to remove 100 percent of the rubber deposits from 85 percent of the rubber covered areas on the active Runway as described to be removed on the drawings.

PART TWO - EXECUTION

2. **METHOD OF OPERATION**:

2.1 The removal of rubber shall be accomplished by the use of high pressure water. The contractor may use sand or abrasive materials injected into the high pressure system. The use of chemicals shall not be permitted.

2.2 The contractor shall test his equipment on actual areas to be cleaned. Tests shall be made on areas the full width of the equipment and at least 50 feet in length to determine the vehicle speed, water pressure, height of nozzle above the pavement, angle of contact, and quantity of abrasive to be added to satisfactorily remove 100 percent of the rubber from 85 percent of the rubber removal area of the pavement. As described in 2.3 below. The test shall be continued until an acceptable surface condition is obtained and mutually agreed upon by the Contractor and Contracting Officer. This sample area shall then becomes the standard of inspection for the remainder of the project.

2.3 Inspection shall be made on any one square foot Random Sample of area to receive rubber removal. One hundred percent removal is required over a minimum of 85 percent of all of the cleaned area. To be acceptable to the Government, the amount of removal shall meet or exceed the test sample.

2.4 Rubber shall be removed at a minimum rate of 12,000 square feet per hour.

3. **EQUIPMENT**:

3.1 The equipment used in the rubber removal process shall be mounted on pneumatic tires and shall provide the nozzle pressure necessary to remove rubber at the specified rate without damage to the pavement surface or joint seal material. Any damage to the pavement surface or joint sealant shall be repaired by the Contractor, at his expense using materials and methods approved by the Contracting Officer, within the time established for completion of the work.

3.2 When night operations are to be conducted by the Contractor, all necessary lighting shall be furnished by the contractor at no cost to the government. Lighting shall be shaded or directed so as not to interfere with aircraft or control operations. The Government reserves the right to accept or reject night work the following day (not under artificial light conditions) after work is completed.

4. **WEATHER LIMITATIONS**:

4.1 No rubber removal shall be permitted when the air temperature is less than 40 degrees F (4 degrees C), or substrate temperature is less than 35 degrees F (2 degrees C).

5. **TRUCK HAULING ON BASE**: The Contractor shall be responsible for covering open bodied vehicles transporting any materials likely to create air pollution or become debris while on base.

6. **CLEANUP**: All materials and debris generated by rubber removal operations shall be removed from the base and disposed of by the contractor. It shall be the responsibility of the contractor to assure proper loading of all vehicles used for transport of materials and construction debris; any spillage on-route on the base shall be recovered and disposed of off-base. Clean-up of work area shall be at the end of each work day. All clean-up activities shall be accomplished by the contractor at no additional cost to the Government. The Government will not furnish and operate a runway vacuum sweeper for the removal of rubber or paint.

SECTION 02587

SECTION 02680 - ASPHALT PAVING

PART ONE - GENERAL

1. **DESCRIPTION**: This section covers asphalt pavement construction complete.

2. **APPLICABLE PUBLICATION**: The following publication of the issue listed below, but referred to thereafter by basic designation only, forms a part of this specification to the extent indicated by the references thereto.

2.1 North Carolina Department of Transportation (NCDOT) Standard Specifications for Roads and Structures, dated January 1, 1995.

PART TWO – PRODUCTS

3. **MATERIALS:**

3.1 Aggregate Base Course: A compacted thickness base course of the designated shall be placed on the prepared subgrade. Base course shall be standard size #ABC aggregate conforming to Section 520 and 1005 of the NCDOT Standard Specifications for Roads and Structures. The base course shall be placed and sloped to drain.

3.2 Bituminous concrete Base Course: A compacted thickness bituminous base course of the thickness designated shall be placed on the prepared aggregate base course. The base course shall be Type HB constructed in accordance with Section 610 and 630 of the NCDOT Standard Specifications for Roads and Structures. The base course shall be lines and grades indicated. The bituminous plant mix shall be compacted to a density of 90 percent of the maximum theoretical density.

3.3 Surface Course: Surface course shall be 3-4 inch (compacted thickness) asphalt as shown on drawings. The surface course shall be Type I-2 constructed in accordance with Section 610 and Section 645 of the NCDOT Standard Specifications for Roads and Structures. The surface shall be constructed to the lines indicated and sloped to conform to the standard drawings. Compaction shall be accomplished by use of a steel wheel roller followed by a self-propelled pneumatic-tired roller with final rolling by the steel wheel roller.

3.4 Bituminous Material.

3.4.1 Tack Coat. Tack coat shall be applied in accordance with Section 605 of the NCDOT Standard Specifications for Roads and Structures. The material shall be asphalt cement, Grade AC-20 or asphalt Grade RS-lH.

4. **ASPHALT MIXES**: All plant mixes shall be the product of a well established asphalt plant normally engaged in this work. Copies of the mix, certified for conformance with these specifications and containing the details of materials selected to meet requirements thereof shall

be submitted for approval. No paving shall be performed without approval of the material and mix certification.

5. **JOINTS**:

5.1 General. Joints between old and new pavements or between successive days' work or joints that have become cold because of delay shall be made carefully to ensure continuous bond between old and new sections of course. All joints shall have the same texture, density, and smoothness as other sections of course. Contact surfaces of previously constructed pavements that have become coated with dust, sand, or other objectionable material shall be cleaned by brushing or cut back with approved power saw, as directed. The surface against which new material is placed shall be brushed with a thin, uniform tack coat. Material shall be applied far enough in advance of placement of fresh mixture to ensure adequate curing. Care shall be taken to prevent damage or contamination of coated surface.

5.2 Transverse Joints. The roller shall pass over the unprotected end of freshly placed mixture only when placing of course is discontinued or when delivery of mixture is interrupted to the extent that unrolled material may become cold. In all cases, edge of previously placed course shall be cut back to expose an even, vertical surface the full thickness of the course. In continuing placement of asphalt, the mechanical spreader shall be positioned on transverse joint so that sufficient hot mixture will be spread to obtain joint after rolling to conform to required density and smoothness specified herein.

5.3 Longitudinal Joints. Edges of previously placed asphalt that have cooled or are irregular, honeycombed, poorly compacted, damaged, or otherwise defective, and unsatisfactory sections of the joint shall be cut back to expose clean, sound surface for full thickness of the course as directed.

5.4 Edges of pavement shall be trimmed neatly to line.

6. **PROTECTION OF PAVEMENT**: After final rolling of the pavement, no vehicular traffic of any kind shall be permitted until the pavement has cooled and hardened.

7. **SURFACE REQUIREMENTS**:

7.1 Bituminous Surface Course. Surface course, upon completion of final rolling, shall be smooth, free of any ponding of water, and true to grade and cross section. When a 10-foot straightedge is laid on the surface, the surface shall not vary more than 1/8 inch from the straightedge. Low or defective areas shall be immediately corrected by cutting out faulty areas and replacing with fresh, hot mixture, and compacting area to conform to remainder of pavement. Skin patching will not be permitted.

8. **WEATHER LIMITATIONS**:

8.1 Tack Coat. Tack coat shall be applied only when the surface is dry. The tack coat shall be applied only when the ambient temperature is 35°F or above.

8.2 Bituminous Surface Course. Bituminous courses shall be constructed only when base course is dry and when weather is not rainy. Unless otherwise directed, asphalt courses shall not be constructed when the ambient temperature is below 40°F.

9. **TESTS**: Perform the following minimum number of tests to ensure compliance with the thickness and compaction requirements for base course and bituminous concrete surface course and job-mix requirements for bituminous concrete pavement.

9.1 Thickness of bituminous concrete surface course: One test for each 500 square yards or fraction thereof.

9.2 Bituminous Concrete Job Mix Test: One test for each 400 tons of fraction thereof of each mix to determine gradation and bitumen content.

9.3 Density of Bituminous Concrete Surface Course: One field test for each 500 square yards or fraction thereof.

9.4 Batch tickets for each load of asphalt delivered to the site shall be furnished to the Contracting Officer.

END OF SECTION 02680

SECTION 02821 - GRASS HYDRO SEEDING

PART ONE - GENERAL

1. <u>DESCRIPTION:</u> This specification provides for the establishment of a permanent grass cover of Bermuda grass on all exposed earth areas resulting from cut and fill for site grading, including roadway and driveway shoulders and slopes, swales and ditches. And other area(s) specifically designated shall be gassed as hereinafter specified. Contractor shall grade and grass all areas disturbed by Contractor due to this project.

2. **<u>APPLICABLE PUBLICATIONS</u>**: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

2.1 **Federal Specification**:

O-F-241d Fertilizers, Mixed, Commercial

2.2 **U.S. Department of Agriculture**:

Federal Seed Act of August 9, 1939 (53 Stat. 1275) Rules and Regulations

2.3 **American Sod Producers Association, Inc. (ASPA) Publication:**

Guideline Specifications to Sodding (Undated)

2.4 **Association of Official Analytical Chemists (AOAC) Publications:**

Official Methods of analysis (12th Edition, 1975 & Suppl. 1, 2, 3 & 4)

3. **<u>SOURCE INSPECTIONS</u>**: The Contracting Officer shall be notified at least 10 days prior to its use in the work of the offsite sources from which the following materials are to be furnished:

3.1 **Turf Material**: Seeding material will be inspected by the Contractor quality Control Team at the growing site.

3.2 **Topsoil**: The source of topsoil will be inspected by the Contractor Quality control Team to determine the acceptability of the topsoil, including the maximum depth to which it is to be stripped. The contractor quality control team will also determine whether the selected topsoil or topsoil with grass meet the contract requirements.

4. **<u>SUBMITTALS</u>**:

4.1 **Certificates of Conformance/Compliance and Certified Laboratory Test Reports**: Before delivery, certificates of compliance/conformance shall be submitted, in triplicate,

certifying that materials meet the requirements specified. Where such certification requires a laboratory test, the test shall be certified and reported as part of the certificate of compliance. Testing shall be performed by an approved commercial testing laboratory, or may be performed by the contractor subject to approval within 30 days of submittal of test reports. Test reports of a previously tested material shall be accompanied by certificates from the manufacturer/supplier certifying that the previously tested material is identical in all respects to that proposed for this project. Certified copies of the test reports for the following materials shall be submitted to the Contractor quality Control Team. All submittals must be approved prior to material use.

a. Topsoil – for pH, salts, potash, and phosphorus.

b. Organic amendments (fertilizer, etc.) – for classification of total nitrogen, moisture, ash and organic matter. Duplicate copies of invoices shall be furnished showing quantities of each grade of fertilizer, percentage of calcium oxide or magnesium oxide, as applicable, and the percentages of limestone that pass the 100 and 8 mesh sieves. Samples of each lot of fertilizer and limestone shall be tested in accordance with Official Methods of Analysis of the Association of Official Analytical Chemists.

c. Turfing material – for purity and seed content. Contracting Officer shall be furnished duplicate signed copies of statement from vendor, certifying that each container of seed delivered is labeled in accordance with Federal Seed Act and is at least equal to requirements previously specified. This certification shall be obtained from vendor and shall be furnished on or with all copies of seed invoices. Each lot of seed will be sampled and tested in accordance with latest rules and regulations under the Federal Seed Act, at the discretion of the Contracting Officer.

4.2 **Maintenance Instructions**: Written instructions for year-round care of installed turf shall be furnished.

PART TWO - PRODUCTS

5. <u>DELIVERY, STORAGE, AND HANDLING:</u>

5.1 **Delivery:** The Contractor shall notify the Contracting Officer of the delivery schedule in advance so materials may be inspected upon arrival at the job site.

5.1.1 During delivery, turfing materials shall be protected from any drying or contamination by detrimental material.

5.1.2 Fertilizer, soil conditions and other amendment shall be delivered to the site in the original, unopened containers bearing the manufacturer's guaranteed chemical analysis, name, trademark, trade name, and conformance to State and Federal laws. In lieu of containers, fertilizer, soil conditioners, and amendments may be furnished in bulk, and a certificate from the manufacturer indicating the above information shall accompany each delivery.

5.1.3 All pesticide material, including soil fumigants, shall be delivered to the site in the original unopened containers. Containers that do not have a legible label identifying the Environmental Protection Agency registration number and the manufacturer's registered uses will be rejected.

5.2 **Storage**: Storage of materials shall be in areas designated or as approved.

5.2.1 Seed and soil conditioners and amendments shall be kept in dry storage away from contaminants, insects and rodents. Soil sterilant shall be isolated from any other landscape materials. Pesticide material shall be kept in dry storage and shall not contaminate adjacent material, and shall be handled and stored following manufacturer's directions.

6. **MATERIALS**:

6.1 **Seed**: Seed shall be State certified seed to be from the latest season's crop and unless written permission is granted otherwise, shall be delivered in original sealed packages bearing the producer's guaranteed analysis for percentages of mixtures and pure live seed. Seed shall be labeled in conformance with U.S. Department of Agriculture rules and regulations under the Federal Seed Act and applicable State seed laws. Seed that has become wet, moldy or otherwise damaged will not be acceptable. On site seed mixing will not be allowed unless performed only in the presence of the Contractor Quality control Team. Seed mixtures shall be proportioned by weight as follows:

6.1.1 Mixtures for Spring and summer Plantings: The following minimum percentage by weight of pure live seed of each variety in the mixture shall be furnished:

Species and Variety	Percentage by Weight of Each Species in Mixtures	Percentage by Weight of Pure Live Seed of Each species	Percentage by Weight of Pure Live Seed in Mixture
Bermuda (Cynodon dactylon)	25	82	20.50
Lespedeza-Korean (lespedeza stipulacea)	75	97	72.75
Total pure live seed in mixture			93.25
Weed Seed not to exceed 1 percent by weight			1.00
Other than weed and pure live seed, max			5.75
			100.00

6.1.2 Mixtures for Fall Plantings: In each lot of seed, the following minimum percentage by weight of pure live seed of each variety in the mixture shall be furnished:

Species and Variety	Percentage by Weight of Each Species in Mixtures	Percentage by Weight of Pure Live Seed of Each species	Percentage by Weight of Pure Live Seed in Mixture
Domestic Rye Grass (lolium multiflorum)	75	88	66.00
*Red Top (Agrostis alba)	25	83	20.75
Total pure live seed in mixture			86.75
Weed Seed not to exceed 1 percent by weight			1.00
Other than weed and pure live seed, max			12.25
			100.00

*The Contractor has the option of substituting KY 31 tall fescus (Festuca elation) having a minimum percentage pure live seed of 87, for the red top seed; in which case the percentage by weight of domestic rye grass seed in the mixture reduced to 60.

6.2 **Topsoil**: Natural, friable topsoil, characteristic of representative soils in the vicinity that produce heavy growths of crops, grass, or other vegetation shall be furnished.

6.2.1 Topsoil shall be the existing surface soil stripped to the depth indicated and stockpiled on the site during grading operations as specified SECTION: EXCAVATION, EMBANKMENT AND PREPARATION OF SUBGRADE FOR AIRFIELDS Topsoil shall be tested, and amended by the addition of pH adjusters and a soil conditioner as required by the test.

6.2.2 Additional topsoil, if required beyond that available from stripping operations, shall be a natural, friable soil representative of productive soils in the vicinity, furnished by the Contractor from approved sources off the site at his expense and no additional cost to the Government. It shall be obtained from well-drained borrow areas indicated and shall be free of any admixture of subsoil, foreign matter, objects larger than 1 inch in any dimension, toxic substances, and any material or substance that may be harmful to plant growth, or that may hinder grading, planting and maintenance operations. The pH range shall be 5.3 to 6.0. topsoil that does not meet this pH

range shall be amended by the addition of pH adjusters, at a rate recommended based on soil tests.

6.3 **PH Adjusters**:

6.3.1 Limestone: Agricultural-grade limestone ground to pass an 8 mesh sieve with 40 percent passing a 100 mesh sieve shall be furnished. In addition, calcareous limestone shall contain not less than 50 percent calcium oxide, and dolomitic limestone shall contain not less than 40 percent magnesium oxide. Coarser materials will be acceptable, provided the specified rates of application are increased proportionately, on the basis of quantities passing the 8 and 100 mesh sieves, but no additional payment will be made for the increased quantity. Limestone shall be delivered to the site at the Contractor's expense and no additional cost to the Government.

6.3.2 Aluminum sulfate shall be commercial grade.

6.4 **Soil** Conditioners and Amendments:

6.4.1 Peat shall be natural product of hypnum moses peat derived from a freshwater site and conforming to ASTM D 2607 except as otherwise specified. Peat shall be shredded and granulated to pass a ½ inch mesh screen and conditioned in storage piles for at least 6 months after excavation.

6.4.2 Sand shall be clean and free of toxic materials. At least 95 percent by weight shall pass a 10 mesh sieve and 10 percent by weight shall pass a 16 mesh sieve.

6.5 **Fertilizer**: Fertilizer shall be commercial grade, free flowing, uniform in composition and shall conform to applicable State and Federal regulations. Fertilizer shall conform to Fed. Spec. 0-F-241, type I, Class 1 or Type II, Class 1 and shall bear the manufacturer's guaranteed statement of analysis. Fertilizer shall contain a minimum percentage by weight of 5 percent nitrogen of which 3 percent shall be organic, 10 percent available phosphoric acid, and 15 percent potash. When slow release nitrogen forms are used in the fertilizer mixture, they shall be derived from sulfur coated urea, urea formaldehyde, plastic or polymer coated prills, or isobuylene diurea.

6.6 **Mulch**: Mulch shall be wood cellulose fiber mulch applied simultaneously with grass seed and fertilizer by the use of hydroseeding equipment. Straw, hay, or other mulch material will not be acceptable.

6.6.1 Wood Cellulous fiber mulch for use with hydraulic application of grass seed and fertilizer shall consist of specially prepared wood cellulose fiber or a combination of wood cellulose and recycled newsprint fibers, processed to contain no growth or germination-inhibiting factors and dyed an appropriate color to facilitate visual metering of the application of materials. The mulch material shall be supplied in packages having a gross weight not in excess of 100 pounds. On an air-dry weight basis, the wood cellulose fiber shall contain a maximum of 10 percent of 10 percent moisture, plus or minus 3 percent, at the time of manufacture. The pH range for either mix shall be between 4.5 and 6.5. The wood cellulose fiber shall be manufactured so that:

a. After addition and agitation in slurry tanks with fertilizers, grass seeds, water, and other approved additives, the fibers in the material will become uniformly suspended to form a homogeneous slurry.

b. When hydraulically sprayed on the ground, the material will form a blotter-like cover impregnated uniformly with grass seed.

c. The cover will allow the absorption of moisture and allow rainfall or applied water to percolate to the underlying soil. Shrinkage after wetting shall not exceed 20 percent of the surface area.

d. Suppliers shall be prepared to certify that laboratory and field testing of their products has been accomplished, and that, based upon such testing, their products meet all the foregoing requirements.

6.7 **Water**: Water shall not contain elements toxic to plant life, and shall be from a source approved prior to use in the project. Water will be available from on base fire hydrants.

6.8 **Herbicides and Pesticides**: Herbicide and pesticide use must comply with all applicable State and Federal laws. Pesticides must be registered with the U. S. Environmental Protection Agency, and approved for use by the State Cooperative Extension Service.

PART THREE – EXECUTION

7. **SITE PREPARATION:** Equipment, in good condition, shall be provided for the proper preparation of the ground and for handling and placing all materials. Equipment shall be approved before work is started.

7.1 **Preparation of Seed and Planting Beds**:

7.1.1 Tillage: After the areas required to be treated have been brought to the grades shown, the soil shall be tilled to a depth of at least 6 inches, except on slopes steeper than 2 horizontal to 1 vertical (2:1), the soil shall be tilled to a depth of at least 4 inches. On slopes between 2 horizontal to 1 vertical and 1 horizontal to 2 vertical tillage, depths shall be 2 inches. On slopes steeper than 2 horizontal to 1 vertical, no tillage will be permitted. Tillage shall be accomplished by plowing, disking, harrowing, by the use of roto-tillage machinery or other approved operations until the condition of the soil is acceptable. The work shall be performed only during periods when, in the opinion of the Contracting Officer, beneficial results are likely to be obtained. When drought, excessive moisture, o other unsatisfactory conditions prevail, the work shall be suspended when directed. Undulations or irregularities in the surface shall be leveled before the next specified operations.

7.1.2 Placing Topsoil: Topsoil shall be distributed uniformly and spread evenly to an average thickness of 3 inches, with a minimum thickness of 2 inches. Topsoil shall be spread so that planting can proceed with little additional soil preparation or additional tillage. Surface irregularities resulting from top soiling or other operations shall be leveled to prevent depressions. Grade shall be adjusted to assure that planted grade will be 1 inch below adjoining grade of any surfaced area. Topsoil shall not be placed when the subgrade is frozen, excessively wet, extremely dry excessively compacted, or in a condition detrimental to the proposed planting or grading. Soil compacted by construction equipment or soil on compacted cut slopes shall be pulverized to a minimum depth of 2 inches by disking or plowing before applying topsoil. Finished topsoil areas shall be protected from damage by vehicular or pedestrian traffic. Seeding shall be accomplished only after areas are brought to finished grade.

7.1.3 Application of Soil Conditioners: Fertilizer shall be uniformly applied at the rate of 1,200 pounds per acre. All fertilizers, pH adjusters, and soil conditioners shall be incorporated into the soil to a depth of at least 3 inches and may be incorporated as part of the tillage operation, except that lime will be applied by tillage at the rate of 2,000 pounds per acre or the amount indicated by soil tests 2 to 3 months before fertilizer is applied. Immediately before seeding, the soil shall be restored to an even condition.

7.1.4 Application of soil Amendments: soil amendments shall be spread uniformly over the soil to a depth recommended by the topsoil test and thoroughly incorporated into the existing soil to a depth of 8 inches using a rotary tiller or similar type of equipment to obtain a uniform and well pulverized soil mix. During tillage operations, all sticks, stones, roots, and other objectionable objects shall be removed.

8. **APPLICATION**:

8.1 **Planting Seasons and Conditions**: Planting shall not be done when the ground is frozen, snow covered, or in an unsatisfactory condition for planting. Planting shall be done within the following dates, unless an extension of time is granted by the Contracting Officer.

8.1.1 Seed sown from 1 March to 1 August for spring planting and from 1 August to 1 October for fall planting.

8.2 **Seeding**: Seed shall be sown between the dates specified above, unless otherwise directed in writing. A satisfactory method of sowing shall be employed, using hydraulic seeders.

8.2.1 When hydroseeding, the seed, fertilizer, and approved mulch material shall be mixed in the required amount of water to produce a homogeneous slurry and then uniformly applied under pressure at the rate of 2.5 pounds dry weight per 1,000 square feet. Wood cellulose fiber mulch shall be added after the seed and fertilizer have been thoroughly mixed and shall be applied at the rate of 1,000 pounds per acre (dry weight). Lime, when applied hydraulically, shall be a single, separate operation.

8.2.2 Erosion control material shall be installed in accordance with the manufacturer's instructions.

8.2.3 Watering: Watering of the seeded areas will be required during periods of dry weather. At such times, water shall be applied at a rate and in a manner to prevent erosion and shall be evenly distributed over the seeded area so as to ensure adequate moisture to the seedbed or root zone. Watering shall be as frequent as necessary to promote maximum growth.

8.3 **Temporary Fall/Winter Cover**: When the completion schedule of the work under the contract requires a delay in the seeding operations due to the limitation dates above, the areas not yet seeded or which do not have a vegetative cover shall be seeded immediately with a temporary fall/winter cover to protect the newly graded areas from erosion and to keep windborne dust to a minimum. The temporary cover shall be planted between 15 September and 15 November, unless otherwise directed. Planting of the temporary cover does not constitute a permanent grass cover. It shall remain the responsibility of the contractor to return to the job the following spring to plant and establish the permanent grass in accordance with the requirements of this specification. All areas shall be seeded with rye grass or fescue at the rate at the rate of 100 pounds per acre. Temporary winter cover planting shall include the application of ½ the amounts of fertilizer specified with the remaining ½ to be applied during the permanent seeding operations. The areas to be seeded to a temporary all/winter cover shall be thoroughly tilled prior to seeding the same manner as specified for the permanent planting. Areas which have been provided with temporary fall/winter cover shall be thoroughly tilled and turfed with permanent species.

8.4 **Special Seeding and Mulching equipment (At Option of Contractor)**:

8.4.1 Seeder: Equipment to be used for applying a seed-fertilizer mix over prepared slopes shall be a hydraulic seeder designed to pump and discharge a waterborne homogeneous slurry of seed, fertilizer, and wood cellulose fiber at the desired specified rate. The seeder shall be equipped with a power-driven agitator, and shall be capable of discharging up to 200 gallons per minute at 100 pounds pressure from a nozzle with clearance for passing ½ inch solids.

8.4.2 Wood Cellulose Fiber Mulch spreader: Hydraulic equipment used for the application of slurry of fertilizer, seed, and prepared wood pulp shall have a built-in agitation system with an operating capacity sufficient to agitate, suspend, and homogeneously mix a slurry containing up to 40 pounds of fiber plus a combined total of 70 pounds of fertilizer solids for each 100 gallons of water. The slurry distribution lines shall be large enough to prevent stoppage. The discharge line shall be equipped with a set of hydraulic spray nozzles that will provide even distribution of the slurry on the various gallons and shall be mounted on a traveling unit which may be either self-propelled or drawn by a separate unit that will place the slurry tank and spray nozzles near the areas to be mulched so as to provide uniform distribution without waste. The Contracting Officer may authorize equipment with smaller tank capacity, provided the equipment has the necessary agitation system and sufficient pump capacity to spray the slurry in a uniform coating over the surface of the area to be mulched.

9. **PROTECTION OF TURNED AREAS**: Immediately after seeding, the area shall be protected against traffic or other use by erecting barricades, as required. Approved warning signs shall be placed at appropriate intervals, as directed, until final acceptance.

10. **TURF ESTABLISHMENT PERIOD**:

10.1 **Length of Period**: The establishment period shall extend until conditional acceptance and/or final acceptance in conformance with the requirements of the SPECIAL CLAUSES of these specification.

10.2 **Proper Stand of Turf**: A stand of turf is considered as established and satisfactory when the new growing sprouts are visible at the surface showing not less than 9 seedlings of Bermuda grass at least 2 inches long in each square foot, and where no gaps larger than 4 inches in diameter occur anywhere in the lawn area. Seeded areas not showing satisfactory growth at the surface 30 days after planting shall be reseeded unless additional establishment time is approved.

10.3 **Maintenance During the Establishment Period**: The Contractor shall maintain the seeded and mulched areas until all work, or designated portions thereof, have been completed and accepted, repairing eroded areas and areas damaged as a result of his own operations.

10.3.1 The turned area shall be mowed to a height of 3 inches whenever weeds or other vegetation tend to shade or smother the new seedlings. The clippings shall be removed. Mowing shall be done with sharp equipment on dry grass and firm soil.

10.3.2 The turf shall be watered at such intervals and at such a rate that wilting, puddling, and excessive runoff do not occur.

10.3.3 The turf shall be fertilized after the first month of growth applying 0.50 pounds of available nitrogen per 1,000 square feet, and again in 3 months using the same mix.

10.3.4 Pesticides shall not be applied within 3 weeks of grass seed germination.

10.3.5 The Contractor shall be responsible for the proper care (maintenance) of the seeded and mulched areas until a satisfactory cover of growing Bermuda grass is visible as specified above. During this maintenance period, it will be the responsibility of the Contractor to reseed and remulch unsatisfactory with the requirements of SECTION: EXCAVATION, EMBANKMENT AND PREPARATION OF SUBGRADE FOR AIRFIELDS which forms a part of these specifications. All costs and charges in connection with work and materials necessary for maintenance and establishment of the grass, including soil for repairs, shall be borne by the contractor at his own expense and at no additional cost to the Government.

11. **FINAL ACCEPTANCE**: Upon completion of project, a final check of total quantities of fertilizer and limestone used will be made against total area treated. If minimum rates of application have not been met, additional quantities of these materials shall be distributed as directed to make up minimum application specified. Final inspection and acceptance will be at the end of the turf establishment period. Acceptance will be based upon a satisfactory stand of turf as defined above in paragraph TURF ESTABLISHMENT PERIOD.

12. **QUALITY CONTROL**: During construction, an established system of quality control shall be maintained. To assure compliance with contract requirements and the maintenance of records of all materials, equipment, and construction operations, quality control shall include but not be limited to the following:

Seeding – Specified species planted at proper rates; preparation of planting bed so as to thoroughness of tillage, depth of planting and leveling.

Fertilizing – Application of fertilizer and lime of the proper analysis, at specified rates.

Mulching – types and rates of application.

Satisfactory stand of grass – Coverage of the planted species at the end of the maintenance period, maintenance procedures including supplemental fertilizer.

A copy of all records and test data required herein, and the records of corrective action taken, shall be furnished the Contracting Officer.

END OF SECTION 02821

SECTION 03301 – CONCRETE

PART ONE - GENERAL

1. **APPLICABLE PUBLICATIONS**: The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto.

1.1 American Concrete Institute (ACI), Standards:

ACI 305R-91	Hot Weather Concreting
ACI 306R-88	Cold Weather Concreting
ACI 315-92	Details and Detailing of Concrete Reinforcement
ACI 318M-92	Building Code Requirements for Reinforced Concrete

1.2 American Society for Testing and Materials (ASTM), Publications:

C 94-94	Ready-Mixed Concrete
C 1116-91	Fiber-Reinforced Concrete and Shotcrete

2. **GENERAL**: The work shall be in conformance with ACI 318, part entitled "Construction Requirements," except as specified herein. Concrete shall conform to ASTM C 94.

3. **STORAGE**: Materials shall be stored so as not to deteriorate or become contaminated.

PART TWO - PRODUCTS

4. **MATERIALS**:

4.1 Concrete Materials: Concrete materials shall conform to ASTM C 94, cement type optional. Only one brand of any one type of cement shall be used.

4.2 Curing Materials: Curing materials shall be impervious sheet or membrane forming curing compound. Impervious sheet shall be white opaque polythylene
4 mil thick, waterproof kraft paper, or polyethylene coated burlap. Membrane forming curing compound shall be of commercial formulation, sprayable, nontoxic, and will form a film highly resistant to moisture loss from concrete while curing and will dry within 4 hours. Compound shall be clear with fugitive dye, resin base, or chlorinated rubber base type.

4.3 Dowels: Dowels shall be plain carbon steel bars, minimum yield point of 60,000 psi.

4.4 Expansion Joint Filler Strips, Premolded: Expansion joint strips shall be nonextruding, resilient bituminous or nonbituminous type commercially used in concrete paving or construction, thickness as shown on the drawings..

4.5 Form Coating: Form coating shall be nonstaining form oil or form release agent that will not deleteriously affect concrete surfaces nor impair subsequent applications.

4.6 Form Materials: Form materials shall be steel, plywood or hardboard especially made for concrete form use or other materials that will produce the specified finishes without adversely affecting the concrete surfaces.

4.7 Form Ties: Form ties shall be metal, factory fabricated removable or snap off, that will leave holes 1/2 to 1 inch in diameter and not less than 1 1/2 inches deep in surfaces to be exposed or painted and shall not project beyond the concrete elsewhere.

4.8 Joint Sealant: Hot or cold applied, made specially for sealing joints in concrete against moisture infiltration.

4.9 Reinforcement: Bars shall be deformed, ASTM A615,60 ksi yield grade, plain finish.

4.10 Non-Shrink Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 2,400 psi in 48 hours and 7,000 psi in 28 days.

5**.** **CONCRETE QUALITY**: Proportioning of concrete mixes to meet the requirements specified below shall be the Contractor's responsibility. A batch ticket shall be provided with each delivery of concrete.

5.1 Compressive Strength: Compressive strength in 28 days shall be 3000 psi. The compressive strength shall be reached in seven days when high early strength cement is used.

5.2 Entrained Air Content: Entrained air content of exposed exterior concrete shall be maintained at 5 to 7 percent by volume of concrete.

5.3 Slump: Slump shall be three inch minimum to four inch maximum for walls and two inch minimum to four inch maximum for other work. A slump test shall be taken with each delivery of concrete.

6. **FORMWORK**: Formwork shall provide concrete conforming accurately to the indicated shapes, lines, and dimensions and with surface free of offset, waviness, or bulges. Where surfaces are to be exposed or painted, panels shall be manufacturer's stock size material, using smaller panels cut to required dimensions only where required by openings and joints. Panel joints in exposed or painted work shall occur at control joints, including alignment with masonry control joints and construction joints, and shall be finished smooth where to be in contact with concrete. Exposed corners shall be chamfered, beveled, or rounded. Forms shall be coated before each use. Forms shall be removed at a time and in a manner that will not injure the concrete.

7. **REINFORCEMENT**: Reinforcement detailing and placement shall conform to ACI 315 and ACI 318. Reinforcement shall be interrupted two inches clear each side of joints in slabs on grade and perimeter joints. Tie bars in slabs on grade shall be installed at right angles to joints; accurately aligned parallel to the finished surface, and rigidly held in place and supported during concrete placement.

7.1 Concrete on Grade: Reinforcement shall be supported on precast concrete block supports specifically designed for reinforcement support. Precast concrete block supports shall be 3 by 3 inches by the height required by the contract drawings.

7.2 Concrete above grade and other areas specifically identified on the contract drawings: Reinforcement shall be supported on factory made bar supports specifically designed for reinforcement support. Supports shall be plastic protected and sized as required by the placement requirements.

8. **INSTALLATION OF ANCHORAGE ITEMS**: Anchorage items shall be of number, size, and location to ensure sufficient anchorage for purpose intended.

9. **JOINTS**:

9.1 Expansion Joint Filler: Expansion joint filler shall be installed at the proper level below the finished floor with a wood strip temporarily secured to the top thereof to form a groove not less than 3/4 inch deep. The wood strip shall be removed after the concrete has set and the groove filled with joint sealant so as to be slightly concave after drying.

10. **PLACING**: Concrete footings and exterior slabs shall be placed upon clean undisturbed surfaces free from frost, ice and water. Dry or pervious surfaces receiving concrete shall be covered with impervious sheet materials. Concrete may be placed directly on impervious surfaces that are thoroughly moistened but not muddy. Concrete shall be placed in layers not over 12 inches deep along the entire length of wall. Concrete shall be protected from freezing. Concrete to receive other construction shall be screeded to the proper level.

10.1 Cold Weather Requirements: Concrete shall not be placed unless the temperature at the base Weather Station is 35° and rising. The contractor shall use ACI 306 for additional cold weather requirements.

10.2 Hot Weather Requirements: Contractor shall use ACI 305.

10.3 The contractor shall not place concrete unless the Contracting Officer's representative is present. The contractor shall give the Contracting officer's representative a minimum of a 4 hour notice prior to placing concrete.

11. **CONSOLIDATION OF CONCRETE**: Consolidation of concrete shall be with internal concrete vibrators supplemented by handspading, rodding, and tamping. Vibrating equipment shall be adequate to thoroughly consolidate concrete.

12. **SLAB ON GRADE**: Surfaces receiving concrete slabs within the building shall be covered with a vapor barrier lapped a minimum of four inches at edges and ends. Concrete shall be compacted, screeded to grade, and prepared for the specified finish. Slabs shall be placed in panels in alternate checker board pattern or in alternate lanes divided into panels. Contracting joints shall be true to line, 1/8 inch wide, and of depth equal to approximately 1/4 of the slab thickness. Joints shall be sawed or formed by inserting fiber board strips of the required dimensions after placing concrete. Joints in permanently exposed slabs shall be filled with joint sealant.

13. **FINISHES OF CONCRETE OTHER THAN SLABS**: Fins and loose material shall be removed. Unsound concrete, voids over 1/2 inch in diameter, and tie rod and bolt holes shall be cut back to solid concrete, reamed, brush coated with cement grout, and filled solid with a stiff portland cement sand mortar mix. Patchwork shall finish flush with adjoining concrete surfaces and where exposed, shall match adjoining surfaces in texture and color. Patchwork shall be cured for 72 hours. White portland cement shall be used as needed to attain color match.

13.1 Smooth Finish: After completing the above, surfaces to be painted or exposed to view shall be thoroughly wetted and then brush coated with portland cement sand grout of thick consistency and of mixture so that final color will approximately match the concrete. White portland cement shall be used as needed to attain color match. Grout shall be cork or wood floated to fill voids, excess scraped off with a trowel, and visible grout film removed by rubbing with burlaps. Grout shall be kept damp until set.

14. **CONCRETE SLAB FINISHES**: Slab shall be finished to a true plane with no deviation exceeding 1/8 inch when tested with a 10-foot straightedge. Surfaces shall be pitched to drains. Surfaces shall be screened and floated to the required finish level with no coarse aggregate visible before finishing as specified below.

14.1 Monolithic Finish: Monolithic finish shall be given to slabs, unless otherwise specified. After the surface moisture has disappeared, floated surfaces shall be steel troweled to a smooth, even dense finish free from blemishes including trowel marks.

14.2 Nonslip Finish: Nonslip finish shall be given to stair treads, landings, exterior building entrances, vestibules, and other surfaces so indicated by brooming with a fiber bristle brush in a direction transverse to that of main traffic.

15. **CURING**: Curing shall start as soon as free water has disappeared from concrete surfaces after placing and finishing. Curing materials shall be applied and maintained so as to protect the concrete from moisture loss for seven days. Curing shall be accomplished by impervious sheet or membrane forming curing compound. Concrete shall be thoroughly wetted before covering with impervious sheet materials. Membrane forming compound shall be applied with mechanical spraying equipment at a coverage of not more than 300 square feet per gallon. Surfaces damaged during curing shall be resprayed. The compound shall not be used on surfaces to receive floor hardener or receiving applications depending on adhesion or bonding, except that resin base or chlorinated rubber base compounds may be used on floor receiving resilient flooring; surfaces to be painted; and surfaces to receive bituminous roofing or waterproofing.

END OF SECTION 03301

SECTION 05120 - STRUCTURAL STEEL

PART ONE - GENERAL

1. **APPLICABLE PUBLICATIONS**: The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto:

1.1 American Institute of Steel Construction (AISC) Publications:

S326-78	Fabrication and Erection of Structural Steel for Buildings
S314-80	Structural Joints Using ASTM A 325 or A 490 Bolts

1.2 American National Standards Institute (ANSI) Standard:

B46.1-78	Surface Texture (Surface Roughness, Waviness and Lay).

1.3 American Society for Testing and Materials (ASTM) Specifications:

A 6-84	General Requirements for Rolled Steel Plates, Shapes, Sheet-Piling, and Bars for Structural Use.
A 36-84	Structural Steel
A 325-84	High-Strength Bolts for Structural Steel Joints.
A 500-84	Cold-Formed Welded and Seamless Carbon Steel Structures Tubing in Rounds and Shapes

1.4 American Welding Society (AWS) Publications:

Dl.1-85	Structural Welding Code

2. **GENERAL**: The AISC Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings shall govern the work. Welding shall be in accordance with AWS code D1.1 and performed by certified welders. All field welders shall be currently certified under AWS and shall have their certification with them when welding operations are in progress. High strength bolting shall be in accordance with the AISC Specification for Structural Joints Using ASTM A 325.

3. **SUBMITTALS:**

3.1 Certificates of Compliance and Shop Drawings: Certificates of compliance shall be furnished for structural steel. Shop drawings shall be submitted for approval. Drawings shall include all shop and erection details. Members and connections for any portion of the structure not shown on the Contractor drawings shall be detailed by the fabricator and indicated on the shop drawings.

4. **RESPONSIBILITY FOR ERRORS:** The Contractor shall be responsible for any errors of detailing, fabrication, and for the correct fitting of the structural member.

5**.** **STORAGE:** Material shall be stored out of contact with the ground in such manner and location as will minimize contamination and deterioration.

PART TWO - PRODUCTS

6. **MATERIALS:**

6.1 Structural Steel: Structural steel shall conform to ASTM A 36, 36 Ksi yield point.

6.2 High Strength Bolts: High-strength bolts including nuts and washers shall conform to ASTM A 325.

7. **FABRICATION:** Fabrication shall be in accordance with the applicable provisions of the AISC Specification. Fabrication and assembly shall be done in the shop to the greatest extent possible. Compression joints depending on contact bearing shall have a surface roughness not in excess of 500 micro inches as determined by ANSI B46.1 and ends shall be square within the tolerances for milled ends specified in ASTM A 6. Structural steel work, except surfaces of steel to be encased in concrete, surfaces to be field welded, and contact surfaces of friction-type high strength bolted connections shall be prepared for painting in accordance with AISC Specification and primed with paint materials.

8. **ERECTION:** Erection of structural steel shall be in accordance with the applicable provisions of the AISC Specification.

8.1 Connection: Anchor bolts and other connection: Erection of structural steel shall be in accordance with the applicable provisions of the AISC Specification.

8.2 Connection: Anchor bolts and other connections between the structural steel and foundations shall be provided and shall be properly located and built into connecting work.

8.3 Base Plates and Bearing Plates: Base plates and bearing plates shall be provided. Base plates and bearing plates shall be provided with full bearing after the supported members have been plumbed and properly positioned. Separate setting plates under column base plates will not be permitted.

8.4 Field Welded Connections: Field welded structural connections shall be completed before load is applied.

8.5 Field Priming: After erection, the field bolt heads and nuts, field welds, and any abrasions in the shop coat shall be cleaned and primed with paint of the same quality as that used for the shop coats.

END OF SECTION 05120

SECTION 05500 - MISCELLANEOUS METAL

PART ONE - GENERAL

1. **APPLICABLE PUBLICATIONS**: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1.1 Federal Specifications (Fed. Spec.):

AA-S-271D & Am-1	Shelving, Storage and Display, Steel, Interchangeable, Nut and Bolt Type
AA-S-1048	Shelving, Storage and Display, Steel, Clip Type
QQ-F-461C & Am-1	Floor Plate, Steel, Rolled

1.2 The Aluminum Association (AA) Publication:

Designation System for Aluminum Finishes

Standards for Anodized Architectural Aluminum

1.3 American National Standards Institute (ANSI) Publications:

A14.3-84	Safety Requirements for Fixed Ladders

1.4 American Society for Testing and Materials (ASTM) Publications:

A 36-88	Structural Steel
A 53-88	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
A 123-84	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
A 385-80	Zinc Coating (Hot-Dip) on Assembled Steel Products
A 475-78 (R 1984)	Zinc-Coated Steel Wire Strand
A 525-87	Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, General Requirements

B 210-88 Aluminum-Alloy Drawn Seamless Tubes

1.5 American Welding Society (AWS) Standard:

D 1.1-85 Structural Welding Code-Steel

1.6 National Association of Architectural Metal Manufacturers (NAAMM) Manual (Latest Edition):

Metal Bar Grating Manual

2. **GENERAL REQUIREMENTS**: The Contractor shall verify all measurements and shall take all field measurements necessary before fabrication. Welding to or on structural steel shall be in accordance with AWS D1.1. Items specified to be galvanized, when practicable and not indicated otherwise, shall be hot-dip galvanized after fabrication. Galvanizing shall be in accordance with ASTM A 123, A 385, or A 525, as applicable. Exposed fastenings shall be compatible materials, shall generally match in color and finish, and shall harmonize with the material to which fastenings are applied. Materials and parts necessary to complete each item, even though such work is not definitely shown or specified, shall be included. Poor matching of holes for fasteners shall be cause for rejection. Fastenings shall be concealed where practicable. Thickness of metal and details of assembly and supports shall give ample strength and stiffness. Joints exposed to the weather shall be formed to exclude water.

PART TWO - PRODUCTS

3. **DISSIMILAR MATERIALS**: Where dissimilar metals are in contact, or where aluminum is in contact with concrete, mortar, masonry, wet or pressure-treated wood, or absorptive materials subject to wetting, the surfaces shall be protected with a coat of bituminous paint or asphalt varnish.

PART TWO - EXECUTION

4. **SUBMITTALS:**

4.1 Shop Drawings: Shop drawings shall be submitted in accordance with SPECIAL PROVISIONS. Shop drawings shall indicate material thickness, type, grade, and class; dimensions; and construction details. Drawings shall include catalog cuts, erection details, manufacturer's descriptive data and installation instructions, and templates. Shop drawings for the following items shall be submitted.

a. Cover Plate

b. Pipe and coupling

5. **WORKMANSHIP**: Miscellaneous metal work shall be well formed to shape and size, with sharp lines and angles and true curves. Drilling and punching shall produce clean true lines and surfaces. Welding shall be continuous along the entire area of contact except where tack welding is permitted. Exposed connections of work in place shall not be tack welded. Exposed welds shall be ground smooth. Exposed surfaces of work in place shall have a smooth finish, and unless otherwise approved, exposed riveting shall be flush. Where tight fits are required, joints shall be milled. Corner joints shall be coped or mitered, well formed, and in true alignment. Work shall be accurately set to established lines and elevations and securely fastened in place. Installation shall be in accordance with manufacturer's installation instructions and approved drawings, cut and details.

6. **ANCHORAGE:** Anchorage shall be provided where necessary for fastening miscellaneous metal items securely in place. Anchorage not otherwise specified or indicated shall include slotted inserts, expansion shields, and power-driven fasteners where approved for concrete; toggle bolts and through bolts, lag bolts, and screws for wood. Slotted inserts shall be of types required to engage with the anchors.

7. **ACCESS DOORS AND ACCESS PANELS**: Access doors and panels shall be flush type unless otherwise indicated. Frames for access doors shall be fabricated of not lighter than 16-gage steel with welded joints and anchorage for securing into construction. Access doors shall be a minimum of 14 by 20 inches and of not lighter than 14-gage steel, with stiffened edges and welded attachments. Access doors shall be hinged to frames and provided with a flush-face screw-driver-operated latch. A removable access panel not less than 12 by 12 inches shall be installed directly below each valve, flow indicator, damper, or air splitter that is located above the ceiling, other than an acoustical ceiling, and that would otherwise not be accessible. Exposed metal surfaces shall have a shop applied prime coat and two finish coats.

8. **MISCELLANEOUS:** **Steel pipe shall conform to ASTM A 53, standard weight.**

9. **SHOP PAINTING:** Unless otherwise specified, surfaces of ferrous metal, except galvanized surfaces, shall be cleaned and shop coated with the manufacturer's standard protective coating. Items to be finish painted shall not be given a bituminous protective coating. Surface shall be cleaned with solvents to remove grease and oil and with power wire-brushing or sandblasting to remove loose rust, loose mill scale, and other foreign substances. Surfaces of items embedded in concrete shall not be painted.

END OF SECTION 05500

SECTION 07540 - FLUID APPLIED ROOFING
(OVER LIGHTWEIGHT CONCRETE SUBSTRATE)

PART ONE - GENERAL

1. **DESCRIPTION:**

1.1 Work included: The work shall include, but shall not necessarily be limited to, the preparation of the roof deck, installation of moisture barrier, application f roof coating, flashing systems, and clean up.

1.2 Related work: The contractor shall review all sections of these specifications to determine items of work that will interface with the application of this roofing system. Coordination and execution of related sections shall be the sole responsibility of the contractor.

2. **APPLICABLE PUBLICATIONS**:

American Society of Testing and Materials (ASTM)

ASTM D638-91	Test Methods for Tensile Properties of Plastics
ASTM D1204-84	Test Method for Linear Dimensional Changes of Non-Rigid Thermoplastic Sheeting or Film at Elevated Temperature.
ASTM G26-93	Practice for Operating Light-Exposure Apparatus (Xenon Arc Type) With and Without Water for Exposure of Non-Metallic Surgaces.
ASTM 1653	Water Vapor Transmission of Materials
ASTM E330-90	Standard Test Method for Structural Performance of Exterior Panels by Uniform Static Air Pressure Difference
ASTM E108-93	Test Method for Fire Test of Roof Coverings
ASTM D1117-80	Standard Test Method of Testing Non-Woven Fabrics
ASTM D1682-64	Breaking Load and Elongation of Textile Fabrics
ASTM D3786-87	Hydraulic Bursting Strength of Knitted Goods

3. **QUALITY CONTROL**

2.1 Quality monitor: The contractor shall appoint a quality control monitor that shall ensure that all work within this section is performed in accordance with these specifications and the roofing manufacturer's requirements. In the event that these specifications contradict or are not congruent with the manufacturer's requirements, the most stringent requirements shall govern.

2.2 Deviations: There shall not be any deviations from these specifications unless the deviation is submitted in writing to the Contracting Officer. The request for deviation must have a letter from the roofing manufacturer's technical representative acknowledging and approving the intent and the details of the deviation. The request for deviation shall include all technical data determination as to the deviations' compliance with these specifications.

2.3 Codes and Standards: The contractor shall make him/herself thoroughly familiar with all codes, regulations, and standards governing the specified work. Any contradiction between the manufacturer's requirements and these specifications shall be brought to the attention of the Contracting Officer immediately.

2.4 Manufacturer's Technical Representative: An employee of the roofing material manufacturer shall be on site at least once every 7 calendar days during the work specified herein. The technical representative shall provide a written inspection report, during each site visit and submit the report to the government representative. The manufacturer's representative shall approve application process at specific stages before the contractor may continue.

3. **SUBMITALLS**

3.1 All the following submittals shall be submitted as a complete package bound in a three ring binder and indexed to type of material. The number of copies required shall be determined by the Contracting Officer, but shall not be less than three copies.

3.1.1 Product Data: Provide manufacturer's technical data sheets on products that make up the roofing system. This shall include, but is not limited to, coatings, reinforcing fabrics, flashing materials, roof drains, fasteners, etc.

3.1.2 Manufacturer's Installation Instructions: Submit all data sheets available through the manufacturer on the installation of the roofing system applicable to the work.

3.1.3 Manufacturer Certificate: Certify that products meet or exceed specified requirements.

4. **DELIVERY STORAGE, and HANDLING**

4.1 Deliver materials to the job site in manufacturer's unopened containers bearing the following information:

- Name of Manufacturer
- Name of Contents and Product Codes
- Net Volume of Contents
- Lot or Batch Number
- Storage Temperature Limits
- Shelf Life Expiration Date
- Mixing Instructions and Proportions of Contents
- Safety Information and Instructions

4.2 Storage of materials: Store and protect materials from damage and weather in accordance with manufacturer's instructions. Storage temperatures shall be between 40 degrees and 90 degrees F (5 and 30 degrees C). Keep out of direct sunlight.

5. **ENVIRONMENTAL CONDITIONS**

5.1 Do not apply if ambient temperatures are expected to fall below 40 degrees F (5 degrees C) or if rain is expected before the application has time to cure.

PART TWO - PRODUCTS

6. **MANUFACTURERS**

6.1 The following manufacturers were found to meet the requirements of the specifications as indicated herein. Any reference to a specific manufacturer is to establish minimum quality, performance, material, appearance, and manufacturer support standards only and not meant to restrict open competition.

6.1.1 Hydro-Stop
2635 Rourk Street
Charleston, SC 29405
(800) 739-5566
(803) 745-9602 Fax

6.1.2 Belzona Molecular
100 Charles Linberg Blvd.
Long Island, NY 11553
(515) 542-1000

6.1.3 Top-Coat
Walpole, Massachusetts
(508) 668-4128

7. **MEMBRANE COMPOUND MATERIAL**

7.1 Waterproofing Material: Liquid applied acrylic roofing system shall consist of a primer coat and three part system including: one foundation coat, one layer of reinforcing fabric, one fabric saturation coat, and at least one finish coat.

7.1.1 Foundation and Saturation Coat: This coating shall be a liquid applied water base 100% pure acrylic (i.e. not styrene, vinyl or styrene butadine) co-polymer internally plasticized to maintain elastomeric properties.

7.1.2 Finish Coat: Shall be highly flexible, ultraviolet light resistant, water base 100% pure acrylic (i.e. not styrene, vinyl or styrene butadine) co-polymer internally plasticized to maintain elastomeric properties. This coat shall contain the necessary pigment for the specified finish color.

7.1.3 Reinforcing Fabric: This material shall be non woven, stitch bonded, heat-set fabric with the following characteristics:

Weight	3 oz. per square yard
Tensile Strength	57.1 lbs. per ASTM D1682
Elongation	61.65% per ASTM D1682

Mullen Burst	176.8 lbs. per ASTM D3786
Trapezoid	16.1 lbs. per ASTM D1117

7.1.4 Cured Membrane Characteristics:

Property	Test	Result
Tensile Strength	ASTM D638	2898 psi
Elongation	ASTM D638	>250% (61% for fabric)
Dimensional-Stability	ASTM D1240	<0.44%
Weathering	ASTM G26	No effect on physical properties after 3600 hours.
Moisture Vapor	ASTM D-1653	4 perms
Wind Uplift	ASTM E330	Satisfies SFBC for roofs 150ft in Elevation
Fire Rating	ASTM E108	Class A
Algae Resistance	ASTM G-29	No Growth Support

PART THREE - EXECUTION

8. EXAMINATION

8.1 Verify that all surfaces are ready to receive work.

8.2 Verify that roof openings are firmly attached to the deck.

9. PREPARATION

9.1 Protect adjacent surfaces not designated to receive waterproofing.

9.2 Prepare all surfaces in accordance with manufacturer's instruction and do not apply waterproofing to surfaces unacceptable to the manufacturer.

10. INSTALLATION – PRIMER COAT

10.1 Apply primer coat to entire surface of the lightweight concrete deck as required by the roofing manufacturer.

11. WATERPROOFING APPLICATION

11.1 Install cant strips at internal corners, and metal drip edge on outside perimeter.

11.2 Apply 4 inch (100mm) wide strip of foundation coat, fabric, and saturation coat over cracks and non-working joints.

11.3 Apply foundation and saturation coats at a total rate of 40 sq. ft. per gal. (1.0 sq. m/L)

11.4 Apply foundation coat to the entire area. Embed fabric directly into the coating while still wet. Overlap adjacent runs of fabric 4 inches (100mm) minimum. Immediately follow with saturation coat to cover fabric and allow to dry.

11.5 Continue application of waterproofing material up vertical surfaces a minimum of 8 inches (200mm).

11.6 Apply finish coat at a coverage rate of 70 sq. ft/gal (1.7 sq. m/L)

11.7 Seal items projecting through the roof with the same coating material as on the roof, in the same process.

11.8 Apply waterproofing system to a minimum of 40 mil (1.0mm) total cured thickness.

12. CLEANING

12.1 Clean unscheduled surfaces receiving waterproofing in accordance with manufacturer's instructions.

END OF SECTION 07540

SECTION 16526 - AIRFIELD LIGHTING

PART ONE GENERAL

1. Existing airfield lighting systems shall remain in operating condition except for minimum interruptions, as approved in writing by the Contracting Officer. Prior to each interruption, all necessary materials and a sufficient labor force shall be assembled to permit completing the work within the scheduled time interval. Under no circumstances shall any of the existing airfield lighting circuits be left inoperative without making provisions for suitable temporary connections in the affected area or areas. All airfield lighting circuits covered under this contract shall be restored in such a manner that they will be operational at dusk each day. The Contractor shall submit a plan for outages and maintaining lighting and lighting control.

1.1 **APPLICABLE PUBLICATIONS**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C2 (1993)	National Electrical Safety Code
ANSI C119.1 (1986)	Sealed Insulated Underground Connector Systems Rated 600 Volts

ASSOCIATION OF EDISON ILLUMINATING COMPANIES (AEIC)

AEIC CS5 (1994)	Specification for Crosslinked-Polyethylene Insulated Shielded Power Cables Rated 5 Through 46 KY

FEDERAL AVIATION ADMINISTRATION (FAA)

FAA AC 150/5345-7	(Rev D; Change 1) L-824 Underground Electrical Cable for Airport Lighting Circuits
FAA AC 150/5345-10	(Rev E) Constant Current Regulators Regulator Monitors
FAA AC 150/5345-26	(Rev B; Changes 1 & 2) L-823 Plug and Receptacle, Cable Connectors
FAA AC 150/5345-44	(Rev F; Change 1) Taxiway and Runway Signs
FAA AC 150/5345-46	(Rev A) Runway and Taxiway Light Fixtures

FAA AC 150/5345-47	(Rev A) Isolation Transformers for Airport Lighting Systems
FAA AC 150/5370-10	(Rev A; Change 1 thru 6) Standards for specifying Construction of Airports
FAA E-982	(Rev H; Notice 1) Par-56 Lamp holder

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE STD 48	(1990) Standard Test Procedures and Requirements for High-Voltage Alternating-Current Cable Terminations

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA WC 3	(1992; Rev Feb 1994) Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy
NEMA WC 7 (1993)	Cross-Linked-Thermosetting-Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy
NEMA WC 8 (1993)	Ethylene-Propylene-Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (1996)	National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL-03	(1995; Supple) Electrical Construction Materials Directory
UL 44	(1991; Rev thru Feb 1996) Rubber-Insulated Wires and Cables
UL 83	(1991; Rev thru Mar 1996) Thermoplastic-Insulated Wires and Cables
UL 486A	(1991; Rev Oct 1991) Wire Connectors and Soldering Lugs for Use with Copper Conductors
UL 510	(1994) Insulating Tape

1.2 **GENERAL REQUIREMENTS**

Items of the same classification shall be identical including equipment, assemblies, parts, and components.

1.2.1 Code Compliance

The installation shall comply with the requirements and recommendations of NFPA 70 and ANSI C2 and local codes where required.

1.2.2 Standard Product

Material and equipment shall be a standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

1.2.3 Prevention of Corrosion

1.2.3.1 Metallic Materials: Metallic materials shall be protected against corrosion .

1.2.3.2 Ferrous Metal Hardware: Ferrous metal hardware shall be hot-dip galvanized in accordance with ASTM A 123 and ASTM A 153

1.2.3.3 Luminaires Fabricated from Ferrous Metals: Luminaires fabricated from ferrous metals, unless hot-dip galvanized or of porcelain enamel finish shall be factory finished with a weather-resistant finish. Finish color shall be the manufacturer's standard, unless otherwise indicated.

1.2.4 Verification of Dimensions: The Contractor shall become familiar with details of the work, verify dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

1.2.5 Unusual service conditions: Material or equipment to be installed in the handholes, underground shall be suitable for submerged operation.

1.3 **SYSTEM DESCRIPTION**

This project shall consist of temporarily modifying Seymour Johnson AFB airfield lighting system to accommodate displaced runway threshold and their restoring the airfield lighting system to its original configuration. See section 01000 for more detail.

1.4 **SUBMITTALS**

1.4.1 Materials and Equipment

A complete itemized listing of equipment and materials proposed for incorporation into the work. Each itemization shall include an item number, the quantity of items proposed, and the name of the manufacturer. Data composed of catalog cuts, brochures, circulars, specifications and product data, and printed information in sufficient detail and scope to verify compliance with requirements of the contract documents.

1.4.2 As-Built Drawings

Drawings that provide current factual information including deviations from, and amendments to the drawings and changes in the work, concealed and visible, shall be provided as instructed. The as-built drawings shall show all modifications to the existing systems as a result of this contract. Cable and wire shall be accurately identified as to direct-burial or in conduit and shall locate the connection and routing to and away from bases, housings, and boxes.

1.4.3 Repair Requirements

Instructions necessary to check out, troubleshoot, repair, and replace components of the systems, including integrated electrical and mechanical schematics and diagrams and diagnostic techniques necessary to enable operation and troubleshooting after acceptance of the system shall be provided for any new equipment permanently installed by the contractor.

1.4.4 Test Results

Upon completion and testing of the restored (or installed) system, performance test reports are required in booklet form showing all field tests performed to adjust each component and all field tests performed to provide compliance with the specified performance criteria. Each test shall indicate the final position of controls. Field test reports shall be written, signed and provided as each circuit or installation item is completed. Field tests shall include resistance-to-ground and resistance between conductors, and continuity measurements for each circuit. For each series circuit restored the input voltage and output current of the constant current regulator at each intensity shall be measured after restoring to the original configuration. For multiple circuits the input and output voltage of the transformer for each intensity setting shall be measured. A visual inspection of the lights operation, or of the markings appearance, or of the installation of fixtures or units installed shall be reported.

1.4.5 Materials and Equipment

When equipment or materials are specified to conform to the standards or publications and requirements of AASHTO, ANSI, ASTM, AEIC, FM, IEEE, IES, NEMA, NFPA, or UL, or to an FAA, FS, or MS, proof that the items furnished under this section of the specifications conform to the specified requirements shall be included. The label or listing in UL-03 or in FM P7825 or the manufacturer's certification or published catalog specification data stating that the items comply with applicable specifications, standards, or publications and with the manufacturer's standards will be acceptable evidence of such compliance. Certificates shall be prepared by the manufacturer when the manufacturer's published data or drawings do not indicate conformance with other requirements of these specifications.

1.4.6 Operation and Maintenance Manuals

Four copies of operation and four copies of maintenance manuals for any new equipment furnished. One complete set shall be furnished prior to performance testing and the remainder shall be furnished upon acceptance. Operating manuals shall detail the step-by-step procedures required for system startup, operation, and shutdown. Operating manuals shall include the manufacturer's name, model number, parts list, and brief description of all equipment and their basic operating features. Maintenance manuals shall list routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides. Maintenance manuals shall include conduit and equipment layout and simplified wiring and control diagrams of the system as installed.

1.4.7 Warranty

A written warranty, signed by manufacturer and principal installer, agreeing to replace or repair any contractor provided items that fail in material or workmanship within the specified warranty period.

PART TWO PRODUCTS

2. MATERIALS

Equipment and materials shall be new unless indicated or specified otherwise. Materials and equipment shall be labeled when approved by Underwriters Laboratories (UL) or Factory Mutual (FM) System. Askarel and insulating liquids containing polychlorinated biphenyls (PCB's) will not be allowed in any equipment. Equipment installed below grade in vaults, manholes, and handholes shall be the submersible type.

2.1 Electrical Tape

Electrical tape shall be UL 510 plastic insulating tape.

2.2 Wire and Cable

Conductors shall be copper except as otherwise indicated.

2.3 Conductor Sizes

Conductor size shall conform to American Wire Gage (AWG). Conductor sizes larger than No. 8 AWG shall be stranded. No. 8 AWG and smaller may be solid or stranded unless otherwise indicated.

2.4 Wire and Cable for Airfield Lighting Systems

a. Airfield lighting cable shall be FAA AC 150/5345-7,Type L-824 for crosslinked polyethylene Type C, 5000 volt cable. Series airfield lighting cable shall be unshielded. Cable shall be identified by means of surface ink printing indicate manufacture identification, size, insulation type, voltage rating and shall also be printed “FAA L-824 TYPE C”.

b. Counterpoise Wire. No. 4 AWG bare stranded copper, annealed or soft drawn.

Cable Tags

Cable tags for each cable or wire shall be installed at duct entrances entering or leaving manholes, handholes, and at each terminal within the lighting vault. Cable tags shall be stainless steel, bronze, lead strap, or copper strip, approximately 1/16 inch thick or hard plastic 1/8 inch thick suitable for immersion in salt water and impervious to petroleum products and shall be of sufficient length for imprinting the legend on one line using raised letters. Cable tags shall be permanently marked or stamped with letters not less than 1/4 inch in height as indicated. Two-color laminated plastic is acceptable. Plastic tags shall be dark colored with markings of light color to provide contrast so that identification can be easily read. Fastening material shall be of a type that will not deteriorate when exposed to water with a high saline content and to petroleum products.

2.5 Ground Rods

Ground rods shall be sectional copper-clad steel with diameter adequate to permit driving to full length of the rod, but not less than 3/4 inch in diameter and not less than 10 feet long, unless indicated otherwise.

2.6 Cable Connectors and Splices

Cable connectors in accordance with FAA AC 150/5345-26, Item L-823 shall be used for connections and splices appropriate for the type of cable. Other types of cable connectors and splices shall be of copper alloys for copper conductors. For FAA Type L-824 lighting cable, connectors shall be FAA AC 150/5345-26, Type L-823.

2.7 Transformers

Encapsulated Isolation Transformers

These transformers shall be FAA AC 150/5345-47, Type L-830. Transformer shall be provided with rating as shown on the contract drawing.

2.8 Lamps and Filters

Lamps shall be quartz and size and as indicated, or as required by fixture manufacturer for each lighting fixture required under this contract. Filters shall be of colors as indicated and conforming to the specification for the light concerned or to the standard referenced.

2.9 Lighting Fixtures

The lighting fixtures for the airfield shall be as shown in the contract drawings.

PART THREE EXECUTION

3. CABLES, GENERAL REQUIREMENTS

The type of installation, size and number of cables shall be as indicated. Conductors larger than No. 8 AWG shall be stranded. Loads shall be divided as evenly as practicable on the various phases of the system. Manufacturer's written recommendations shall be furnished for each type of splice and medium-voltage cable joint and termination, and for fireproofing application methods, and shall be approved before any work is done. Medium-voltage cable joints and terminations shall be the standard product of a manufacturer and shall be either of the factory preformed type or of the kit type containing tapes and other required parts. Medium-voltage cable joints shall be made by qualified cable splicers. Compounds and tapes shall be electrical grade suitable for the cable insulation provided and shall use design materials and techniques recommended by the manufacturer. Maximum length of cable pull and cable pulling tensions shall not exceed the cable manufacturer's recommendations.

3.1 Duct Line Installation

Cables shall be installed in duct lines . Cable splices in low-voltage cables shall be made in manholes and hand-holes only. Neutral and ground conductors shall be installed in the same duct with their associated phase conductors. Counterpoise cable shall be installed direct-burial not less than 6 inches above the uppermost duct containing electrical cable. Electrical metallic tubing shall not be installed underground or enclosed in concrete.

3.2 Medium Voltage Cable

Medium voltage cables shall be suitable for a rated circuit voltage of 5kv. Other parts of cable system such as joints and termination shall have ratings not less than the rating of the cables on which they are installed. Separable insulated connectors shall have nominal voltage ratings coordinated to associated apparatus ratings rather than cable ratings when use to connect cable apparatus. Cable shall provided with 133 percent insulation level. Neutral conductors of grounded neutral systems shall be of the same insulation material as phase conductors, except that a 600 volt insulation rating is acceptable.

3.2.1 Cable Joints

Shields shall be applied as required to continue the shielding system through each entire cable joint. Shields may be integrally molded parts of pre-formed joints. Shields shall be grounded at each joint.

3.2.1.1 Types

Separable insulated connectors of suitable construction or standard splice kits shall be used for single conductor and two-conductor cable.

3.2.1.2 Requirements

Cable joints shall provide insulation and jacket equivalent to that of the associated cable.

3.2.2 Terminations

Termination shall be IEEE STD 48, class 1 or 2, of the molded elastomer, wet-process porcelain, pre-stretched elastomer, heat-shrinkable elastomer, or tape type. Acceptable elastomers are track-resistant silicon rubber or track-resistant ethylene propylene compounds, such as ethylene propylene rubber or ethylene propylene diene monomer. Termination shall be of the outdoor type, except that where installed inside outdoor equipment housings which are sealed against normal infiltration of moisture and outside air, indoor, class 2 termination are acceptable. Class 3 termination are not acceptable. Termination, where required, shall be provided with mounting brackets suitable for intended installation and with the grounding provision for cable shielding, metalic sheath, and armor.

3.2.2.1Factory Preformed Type

Molded elastomer, Wet-process porcelain, pre-stretched, and heat-shrinkable terminations shall utilize factory preformed components to the maximum extent practicable rather than tape build-up. Termination shall have basic impulse levels as required for the system voltage level. Leakage distances shall pass the wet withstand voltage test required by IEEE STD 48 for the next higher BIL level.

3.2.2.2 Taped terminations

Tape terminations shall use standard termination kits providing suitable terminal connectors, field fabricated stress cones, and rain hoods. Termination shall be at least 12-1/2 inches long from the end of the tapered cable jacket to the start of terminal connector, or not less than the kit manufacture’s recommendations, whichever is greater.

3.3 Low Voltage Cable

Cable shall be rated 600 volts. Other parts of cable system such as splices and terminations shall be rated at not less than 600 volts. Splices in wire No. 10 AWG and smaller shall be made with an insulated, solderless, pressure type connector, conforming to the applicable requirements of UL 486A. Splices in wires No. 8 AWG single conductor cable shall be made with noninsulated,

solderless, pressure type connector, conforming to the applicable requirements of UL 486A and UL 486B. They shall the be covered with an insulation and jacket material equivalent to the conductor insulation and jacket. Splices below grade or in wet locations shall be sealed type conforming to ANSI C119.1 or shall be water proofed by a sealant filled, thick wall, heat shrinkable, thermosetting tubing or by pouring a thermosetting resin into a mold that surrounds the jointed conductor.

4. CABLE MARKER

Cable tags shall be provided for each cable at duct entrances entering or leaving manholes or handholes and at each termination within the lighting vault. Cable in each hand hole or manhole shall have not less than two tags per cable, one near each duct entrance hole. Immediately after cable installation, tags shall be permanently attached to cables and wires so that they cannot be accidentally detached.

5. FRANGIBLE REQUIREMENTS

Frangible supports, couplings, and adapters shall be installed as indicated or specified.

6. ELEVATED AIRFIELD LIGHTS

Elevated lights shall be frangibly mounted, not to exceed 14 inches in height.

7. SPLICES FOR AIRFIELD LIGHTING CABLE

7.1 Connectors

Kit type connectors shall be used to splice 5 kv single-conductor series lighting cables. During installation mating surfaces of connectors shall be covered until connected and shall be cleaned when plugged together. At the end of connector where cable inserts into the housing of connector, heat shrinkable tubing shall be installed with waterproof sealant. At joint where connectors come together, install two half-lapped layers of tape over the entire joint. Joint shall prevent entrapment of air which might subsequently loosen the joint.

8. GROUNDING SYSTEMS

8.1 Fixture Grounding

Each fixture or group of adjacent fixtures shall be grounded by a grounding circuit separate from the counterpoise system unless required otherwise or by driven ground rods if permitted. Fixtures, steel light bases or grounding bushings on steel conduits shall be connected to an independent ground rod by a No. 6 AWG bare stranded copper wire. Copper wire shall be connected to ground rods by exothermic weld or brazing.

9. ISOLATION TRANSFORMERS

Transformer lead connections shall conform to FAA AC 150/5345-26. Transformer secondary connectors shall plug directly into a mating connector on the transformer secondary leads. During installation, mating surfaces of connectors shall be covered until connected and shall be cleaned when plugged together. At the end of connector where cable inserts into the housing of connector, heat shrinkable tubing shall be installed with water proof sealant. At joint where connectors come together, install two half-lapped layers of tape over the entire joint. Joint shall prevent entrapment of air which might subsequently loosen the joint.

10. FIELD QUALITY CONTROL

The Contracting Officer shall be notified five working days prior to each test. Deficiencies found shall be corrected and tests repeated.

10.1 Operating Test

Each restored circuit shall be tested for operation. Equipment shall be demonstrated to operate in accordance with the requirements of this Section. One day and one night test shall be conducted for the contracting officer.

Distribution Conductors, 600 Volt Class

Test shall verify that no short circuits or accidental grounds exist using an instrument which applies a voltage of approximately 500 volts providing a direct reading in resistance.

Counterpoise System Test and Inspection

Continuity of counterpoise system shall be visually inspected at accessible locations. Continuity of counterpoise system to the vault grounding system shall be tested in manhole closest to the vault.

10.2 Progress Testing for Series Lighting Circuits

A megger test shall be conducted on each section of circuit or progressive combinations of sections as they are restored. Each section or progressive combination of sections shall be tested with a megohm meter providing a voltage of approximately 1000 volts, a direct reading in resistance. Results shall be documented. Faults indicated by these tests shall be eliminated before proceeding with the circuit restoration.

10.3 Final Operating Tests

After completion of restorations and the above tests, circuits, control equipment, and lights covered by the contract shall be demonstrated to be in acceptable operating condition. Each switch in the control tower lighting panels shall be operated so that each switch position is engaged at least twice. During this process, lights and associated equipment shall be observed to determine that each switch properly controls the corresponding circuit. Telephone or radio communication shall be provided between the operator and the observer. Tests shall be repeated

from the alternate control station, from the remote control points, and again from the local control switches on the regulators. Each lighting circuit shall be tested by operating the lamps at maximum brightness for not less than 30 minutes. At the beginning and at the end of this test the correct number of lights shall be observed to be burning at full brightness. One day and one night operating test shall be conducted for the Contracting Officer.

END OF SECTION 16526

SUBMITTAL CODES: A - Within 30 Days After NTP B - During Construction

SCHEDULE OF MATERIAL SUBMITTALS

PROJECT NUMBER	PROJECT TITLE	SOLICITATION CONTRACT NUMBER
VKAG 02-1048	REPLACE BAK-12 DECK SHEAVES	

TO BE COMPLETED BY PROJECT ENGINEER															TO BE COMPLETED BY CONTRACT ADMINISTRATOR					
		NUMBER OF COPIES REQUIRED																		
LINE NUMBER	ITEM OR DESCRIPTION OF ITEM CONTRACT REFERENCE, TYPE OF SUBMITTAL	CERTIFICATION OF COMPLIANCE	SHOP DRAWINGS	SAMPLES	COLOR SELECTION	MANUFACTURER'S RECOMMENDATIONS	MANUFACTURER'S WARRANTY	CATALOG DATA	OPERATING INSTRUCTIONS	OTHER	SUBMITTAL CODE	REQUIRED SUBMISSION DATE	DATE RECEIVED IN CONTRACTING	DATE TO CIVIL ENGINEERING	RETURN SUSPENSE DATE	SUBMITTAL NUMBERS	DATE CONTRACTOR NOTIFIED: APPROVED	DATE CONTRACTOR NOTIFIED: DISAPPROVED	CONTRACTOR RESUBMITTAL	FINAL APPROVAL	REMARKS
1	DENSITY REPORTS SECTION 02221 PARA 3.1									3	B										
2	STRIPING SECTION 02578 PARA 2	3									A										
3	STRIPING SECTION 02578 PARA 2.3			3							A										
4	ASPHALT SECTION 02680 PARA 3	3									A										
5	ASPHALT SECTION 02680 PARA 4									3	A										
6	ASPHALT SECTION 02680 PARA 9									3	B										
7	SEED SECTION 02821 PARA 4.1	3									A										
8	SEED SECTION 02821 PARA 4.2									3	A										
9	CONCRETE SECTION 03301 PARA 5									3	B										
10	CONCRETE SECTION 03301 PARA 16									3	B										
11	STEEL SECTION 05120 PARA 3	3									A										

SCHEDULE OF MATERIAL SUBMITTALS

PROJECT NUMBER	PROJECT TITLE	SOLICITATION CONTRACT NUMBER
VKAG 02-1048	REPLACE BAK-12 DECK SHEAVES	

TO BE COMPLETED BY PROJECT ENGINEER															TO BE COMPLETED BY CONTRACT ADMINISTRATOR					
		NUMBER OF COPIES REQUIRED																		
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																	APPROVE	DISAPPR			
12	STEEL SECTION 05120 PARA 3		3								A										
13	MISC STEEL- PLATE SECTION 05500 PARA 4.1		3								A										
14	MISC STEEL- PIPE SECTION 05500 PARA 4.1		3								A										

SEYMOUR JOHNSON

Air Force Base

Goldsboro, North Carolina

SPECIFICATIONS

FOR

DATE: 15 Jul 03

PROJECT TITLE: Demo Contracting Facilities

PROJECT NO: VKAG 03-1501

PROJECT MANAGER: Mr. Matt Makdad, P.E.

VKAG 03-1501
DEMO CONTRACTING FACILITIES

SEYMOUR JOHNSON AIR FORCE BASE

GOLDSBORO, NORTH CAROLINA

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SECTION 01000

GENERAL

1. SCOPE OF WORK: The work covered by this specification consists of furnishing all plant, labor, equipment and material, and performing all work in connection with VKAG 03-1501, "Demo Contracting Facilities" in strict accordance with these specifications and drawings and subject to the terms and conditions of this contract.

2. LOCATION: The work is to be accomplished at Seymour Johnson Air Force Base, Goldsboro, North Carolina. This base is accessible by both public highway and railway.

3. WORKWEEK: The contractor shall observe the same regular workweek being observed by the Seymour Johnson AFB Civil Engineering shop forces, which is 7:30 a.m. to 4:30 p.m., Monday through Friday, with Federal holidays excluded. Any deviation from this schedule will require 48 hours advance notice and approval of the Contracting Officer.

4. PRINCIPLE FEATURES: The work covered by this contract includes, but is not limited to the following:

A. Demolition of existing facilities 3634 and 3632 and associated utilities.

B. Site restoration to include grading and sodding.

5. HAUL ROUTES: The Contractor shall use the haul routes indicated on the plans.

6. DISPOSITION OF NONSALVABLE MATERIALS: All nonsalvable or unusable material shall be disposed of off base as directed by the Contracting Officer. All waste material generated by any work under this contract shall be handled, transported, stored, and disposed of off base, by the Contractor, in accordance with all applicable federal, state, or local laws, ordinances, regulations, court orders, or other types of rules or rulings having the effect of law.

7. SUBMITTALS REQUIRED: Required submittals are listed on AF Form 66.

8. SAFETY: All safety requirements of the U.S. Army Corps of Engineers Safety Manual 385-1-1 dated October 1996 will be strictly adhered to as related to all work covered under these specifications.

9. BASE CIVIL ENGINEERING WORK CLEARANCE REQUEST, AF FORM 103: The Contractor shall obtain AF Form 103, Base Civil Engineering Work Clearance Request, prior to commencement of work from the Contract Management Section in Bldg 3300, 1095 Peterson Avenue. Upon receipt of an AF Form 103, the Contractor shall be responsible for locating all base owned underground utilities, as well as, coordinating local utility companies to stake out utilities if not owned by the base. Historical drawings, as-built drawings, and topographic drawings are available for review at the 4th Civil Engineer Squadron, Design element located in Building 3300. Base owned utilities include but are not limited to electric, water, sewer, steam, communication, telephone, fiber optic, cathodic protection, and fuel lines. Utilities not owned by the base include but are not limited to cable TV, Southern Bell Telephone, and Natural Gas. The Contractor shall contact ULOCO and the non-base utility companies for location services. In the event that the Contractor damages a utility, which is commented in the plans, record drawings, or located by a utility locator; the Contractor shall repair/replace the utility at no additional cost to the Government. Utilities not documented, shown, or located by a locator shall be considered abandoned or unknown. Contractor damage to unknown or abandoned utilities shall be dealt with as a differing site condition.

10. MATERIALS CONTAINING ASBESTOS: In the event the Contractor discovers materials suspected of containing asbestos that is not identified to be removed in the plans and specifications, the Contractor shall notify the Contracting Officer. The Contractor's work shall proceed unless the materials suspected of containing asbestos are damaged or disturbed. Any suspected materials damaged or disturbed by the Contractor without permission from the Contracting Officer shall be removed by the Contractor at his expense IAW all applicable Federal, State, and local laws, ordinances, regulations, court orders, or other types of rules or rulings having the effect of law.

11. LABELING OF STORAGE DRUMS: All 55 gallon or larger drums brought on base for use under this contract and containing new material or used for storage of waste materials or hazardous waste must be labeled with a Department of Transportation (DOT) Proper Shipping Name, DOT Hazardous Identification Number, the Contractor's name, a Contractor representative, and the Contractor's telephone number. Label lettering should have a minimum height of one half inch painted in white paint or other color that is in contrast with the color of the drum. The label should be sufficiently durable to equal or exceed the life (including storage and disposal) of the drum.

12. CONTRACTOR STORAGE TRAILER(S) AND BUILDING(S): The Contractor shall place or paint a sign on all of his storage trailer(s) and building(s) used on this contract. At a minimum, the sign shall contain the name of the Contractor and a telephone number at which the Contractor can be reached. The trailer(s) and building(s) shall be complete with gates and/or doors, which can be locked. Only material for this project shall be stored in the trailer(s) or building(s). The Contractor shall remove the storage trailer(s) or building(s) within 30 days after completion of the contract and prior to submitting his final invoice. The area around the storage trailer(s) and building(s) shall be kept clean. This includes the mowing of grass during the growing season. The lawn mower shall be supplied by the Contractor.

12.1 The Contractor will be given a lot in the Contractor Storage Area behind Bldg 2700 for the life of the contract. The Contractor's progress schedule shall include a line item (equal to 1%) for final cleanup of this storage lot. Final payment will not be made until this final cleanup is performed by the Contractor and accepted by Seymour Johnson AFB.

13. IDENTIFICATION: The Contractor and all Sub-Contractors shall provide each employee with a picture ID which the employee shall be required to have with him/her at all times while on the job site. All vehicles operated by the Contractor or Sub-contractor shall have visible identification showing name of represented company.

14. CONSTRAINTS:

14.1 Contractor shall provide a construction fence to protect the work area from pedestrians.

14.2 Contractor shall be responsible for connection to any utilities as needed for use during the demolition.

15. PHASING:

a. Phase I: Shall consist of 60 days for approval of submittals and equipment delivery. No on-site work shall be performed.

b. Phase II: Shall consist of 60 days for completion of all on-site work.

End of Section 01000

SECTION 01560

ENVIRONMENTAL PROTECTION

1. DEFINITIONS OF CONTAMINANTS:

A. Sediment: Soil and other debris that has been eroded and transported by runoff water.

B. Solid Waste: Rubbish, debris, garbage, and other discarded solid materials resulting from industrial, commercial, and agricultural operations, and from community activities.

C. Rubbish: A variety of combustible and noncombustible wastes such as paper, boxes, glass, crockery, metal, lumber, cans, and bones.

D. Debris: Includes combustible and noncombustible wastes, such as ashes, waste materials that result from construction or maintenance and repair work, leaves, and tree trimmings.

E. Chemical Wastes: Includes salts, acids, alkalies, herbicides, pesticides, and organic chemicals.

F. Oily Waste: Includes petroleum products and bituminous materials.

2. ENVIRONMENTAL PROTECTION REQUIREMENTS: Provide environmental protection measures as required to control pollution that develops during normal demolition practice. Provide also environmental protective measures required to correct conditions that develop during the demolition of permanent or temporary environmental features associated with the project. Comply with all federal, state, and local regulations pertaining to water, air, and noise pollution. Develop proposals for an environmental protection plan for the project and, prior to the commencement of the work, meet with the Contracting Officer or authorized representative and discuss the proposed environmental protection plan. The meeting shall develop mutual understanding relative to details of environmental protection, including measures for protecting natural resources, required reports, and measures to be taken should the Contractor fail to provide adequate protection in an adequate and timely manner. Perform a preconstruction survey of the project site and take photographs as necessary to enhance the survey.

3. PROTECTION OF NATURAL RESOURCES: The natural resources within the project boundaries and outside the limits of permanent work performed under this contract shall be preserved in their existing condition or restored to an equivalent or improved condition upon completion of the work.

A. Land Resources: Except in areas indicated to be cleared, do not remove, cut, deface, injure, or destroy trees or shrubs without special permission from the Contracting Officer or authorized representative. Shrubs within a minimum of 10 feet of houses shall be removed as part of the demolition work. Do not fasten or attach ropes, cables, or guys to any existing nearby trees for anchorages unless specifically authorized. Where such special emergency use is authorized, the Contractor shall be responsible for any resultant damage.

B. Protection: Protect existing trees which are to remain and which may be injured, bruised, defaced, or other wise damaged by construction operations.

C. Repair or Restoration: Repair or restore to their original condition all trees or other landscape features scarred or damaged by the equipment or operations. Obtain approval of the repair or restoration from the Contracting Officer or authorized representative prior to its initiation.

D. Temporary Construction: Obliterate all signs of temporary construction facilities such as haul roads, work areas, structures, foundations of temporary structures, stockpiles of excess or waste materials, and all other vestiges of construction. Temporary roads, parking areas, and similar temporary use areas shall be graded in conformance with surrounding areas, tilled, and seeded with mix of rye (for winter)/fescue (for summer) and bermuda. Include topsoil and nutriment during the seeding operation as necessary to reestablish a suitable stand of grass.

E. Water Resources: Perform all work in such a manner than any adverse environmental impact on water resources is reduced to a level acceptable to the Contracting Officer or authorized representative.

1. Oily Substances: Take special measures to prevent oily or other hazardous substances from entering the ground, drainage areas, or local bodies of water.

F. Fish and Wildlife Resources: During the performance of the work take such steps as required to prevent interference or disturbance to fish and wildlife. Do not alter water flows or otherwise significantly disturb native habitat adjacent to the project area which are critical to fish and wildlife except as may be indicated or specified.

4. EROSION AND SEDIMENT CONTROL MEASURES:

A. Burn-off: Burn-off of ground cover is not permitted.

B. Protection of Erodible Soils: All earthwork brought to final grade shall be immediately finished as indicated or specified. Protect immediate side slopes and backslopes upon completion of rough grading. Plan and conduct all earthwork in such a manner as to minimize the duration of exposure of unprotected soils.

C. Temporary Protection of Erodible Soils. Utilize the following methods to prevent erosion and control sedimentation.

1. Mechanical Retardation and Control of Runoff. Mechanically retard and control the rate of runoff from the demolition site. This includes construction of diversion ditches, benches, berms, and inlet protection to retard and divert runoff to protected drainage courses and inlets.

2. Vegetation and Mulch: Provide temporary protection on all side and back slopes as soon as disturbance is completed or sufficient soil is exposed to require protection to prevent erosion as determined by the Contracting Officer's Representative. Such protection shall be by temporary seeding of fescue (summer) or rye (winter), mulching,

or netting. Stabilize slopes by methods necessary for effective erosion control, as approved by Contracting Officer's Representative.

5. CONTROL AND DISPOSAL OF SOLID, CHEMICAL, AND SANITARY WASTES: Pick up solid wastes and place in containers which are emptied by the contractor on a regular schedule. The preparation, cooking, and disposing of food are strictly prohibited on the project site. Conduct handling and disposal of wastes to prevent contamination of the site and other areas. On completion, leave areas clean and natural looking. Obliterate signs of demolition and activities incidental to demolition work.

A. Disposal of Rubbish and Debris: Dispose of rubbish and debris in accordance with the requirements specified herein. Remove rubbish and debris daily for area of work.

1. Removal from Government Property: Remove rubbish and debris from Government property and dispose of it in compliance with federal, state, and local requirements.

2. Chemical Waste: Store chemical waste in corrosion resistant containers labeled to identify type of waste and date filled. Remove containers from the project site, and dispose of chemical waste in accordance with federal, state, and local regulations. For oil and hazardous material spills which may be large enough to violate federal, state, and local regulations, notify the Contracting Officer or authorized representative immediately.

a. Petroleum Products: Conduct fueling and lubricating of equipment and motor vehicles in a manner that affords the maximum protection against spills and evaporation. Dispose of lubricants to be discarded and excess oil in accordance with approved procedures meeting federal, state, and local regulations.

6. DUST CONTROL: Keep dust down at all times, including non-working hours, weekends, and holidays. Sprinkle or treat, with dust suppressors, the soil at the site, haul roads, and other areas disturbed by operations. No dry power brooming is permitted. Instead use vacuuming, wet mopping, wet sweeping, or wet power brooming. Air Blowing is permitted only for cleaning nonparticulate debris, such as steel reinforcing bars. No sandblasting is permitted. Only wet cutting of concrete blocks, concrete, and asphalt is permitted. No unnecessary shaking of bags is permitted where bagged cement and concrete mortar is used.

7. NOISE: When available, make the maximum use of "low-noise-emission products" as certified by EPA. No blasting or use of explosives is permitted.

End of Section 1560

SECTION 01570

TRAFFIC CONTROL

1. APPLICABLE PUBLICATIONS: The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto.

A. Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD). The latest edition and all supplements.

B. Work Zone Traffic Control Standards and Guidelines.

C. North Carolina Construction and Maintenance Operations Supplement to the Manual on Uniform Traffic Control Devices.

2. DESCRIPTION: The work covered by this section consists of furnishing, erecting, maintaining, relocating, and removing traffic control devices in accordance with the plans, specifications, MUTCD, or as directed by the Contracting Officer. All traffic control devices furnished by the Contractor shall remain the property of the Contractor, unless otherwise required by the contract. Traffic control devices shall include but not be limited to signs, drums, barricades, cones, delineators, and flag personnel.

3. MATERIAL-GENERAL: Unless otherwise required, materials used in the fabrication and installation of construction traffic control devices shall be in accordance with the applicable provisions of the MUTCD. When traffic control devices are no longer required for traffic handling in the initial phase of construction requiring their use, they may be reused at various locations throughout the project provided the device is not defaced, is structurally sound, clean, and otherwise conforms to the above requirements. Traffic control devices which do not meet the requirements of this section shall not be used; and when during the life of a project, a device ceases to meet the requirements of this section, it shall be promptly removed and replaced with a conforming device at no additional compensation. The Contracting Officer shall have the authority to determine the acceptability of the traffic control devices.

4. CONSTRUCTION METHODS GENERAL: Traffic control devices shall be installed at the inception of demolition operations, and shall be properly maintained, relocated as necessary, cleaned, and operated during the time they are in use. They shall remain in place only as long as they are needed and shall be immediately removed thereafter. Where operations are performed in stages, only those devices that apply to the conditions present shall be left in place.

4.1 The location, legends, sheeting, dimensions, number of supports, and horizontal and vertical placement of warning signs, barricades, and other traffic control devices shall be required by the MUTCD or as directed by the Contracting Officer. During periods when not warranted, warning signs and other devices shall be removed from the work area, covered, or otherwise positioned so they do not convey their message to the traveling public. If covered, the covering material shall be exterior plywood and shall cover the entire face of the sign panel. The covering material shall be installed in such a manner that that the sign panel will not be defaced. Covering material shall be maintained in a neat manner during its use.

4.2 Weeds, brush, trees, construction materials, equipment, etc., shall not be allowed to obscure any traffic control device in use.

4.3 Competent and properly trained flaggers, properly attired and equipped, shall be provided when necessary to safely handle traffic through the construction zone.

4.4 The Contractor shall assume full responsibility for the continuous and expeditious maintenance of all construction warning signs, barricades, and other traffic control devices. Maintenance shall include repair and replacement of traffic control devices which in the opinion of the Contracting Officer are damaged by traffic or other means, or deteriorated beyond effectiveness. Conditions covered under maintenance shall include but not be limited to replacement due to loss of reflectivity; replacement of broken supports; plumbing of leaning signs; cleaning of dirty signs, barricades, and other devices; repairs of defaced sheeting and legend; and replacement of stolen or vandalized items. All items used for traffic control shall be maintained in satisfactory condition. Failure to maintain all traffic control devices in a satisfactory condition may be cause for suspension of construction operations until proper traffic control is re-established.

4.5 The Contractor shall continuously review and maintain all traffic handling measures to assure that adequate provisions have been made for the safety of the public and workers.

5. CONSTRUCTION: When personnel and equipment are working, and around all work areas, the Contractor shall provide traffic control as referenced in all applicable work zone standards and guidelines.

6. WORK PHASING:

6.1 When construction activity is present, the Contractor shall maintain two way, one lane traffic at all times. Only during excavation or when directed by the Contracting Officer's representative, will the road be closed. Where excavation is required, the contractor shall complete the fill and compaction to allow two lane traffic flow by the completion of the day. When construction activity is not present, the Contractor shall maintain two way, two lane traffic. No construction will be allowed in these areas before 0800 or later than 1700.

End of Section 1570

SECTION 02050

DEMOLITION

1. AVAILABILITY OF WORK AREAS: Areas in which demolition work is to be accomplished is shown on the drawings and will be available as scheduled in the phasing in section 01000.

2. GENERAL:

2.1 Procedures. Before beginning any cutting or demolition work, the Contractor shall carefully survey the existing structures and examine the drawings and specification to determine the extent of the work. The Contractor shall take all necessary precautions to ensure against damage to existing structures to remain in place, to be reused, or to remain the property of the Government, and any damage to such structures shall be repaired or replaced as approved by the Contracting Officer at no additional cost to the Government. The Contractor shall carefully coordinate the work and construct and maintain shoring, bracing and supports, as required. The Contractor shall ensure that the structural elements are not overloaded and be responsible for any temporary shoring as may be required as a result of any cutting, removal, or demolition work performed under any part of the contract.

2.2 Submittals: Provide submittals for the following:

2.2.1: Proposed dust control measures

2.2.2: Proposed noise control measures

2.2.3: Proposed air monitoring

2.2.4: All air monitoring results

2.2.5: All landfill and/or recycling center records indicating receipt and weight of materials.

2.2.6: Photographs, sufficiently detailed, of existing conditions of adjoining structures and site that may be misconstrued as damage caused by demolition operations.

2.2.7: Demolition Permit: Provide a copy of the approved state permit/notification paperwork prior to start of on-site work. Contractor responsible for submitting this paperwork to the approval authority in a timely fashion in order to meet the phasing requirements in Section 01000.

2.3 Project Conditions: The housing units to be demolished will be vacated and their use discontinued before start of work. Seymour Johnson assumes no responsibility for actual conditions of building to be demolished. Conditions at the time of inspection for bidding purposes will be maintained as far as practical. A separate asbestos abatement contractor will have performed work prior to demolition. Existing paint is less than .7% lead containing.

2.4 Structures, Walls and Partitions. Remove, in its entirety, all existing structures as indicated on the drawings.

2.5 Air Monitoring: It is the responsibility of the contractor to maintain air monitoring per all federal (EPA, OSHA, etc.), state, and local regulations during a representative portion or the entire project as required by law. There is the potential that disturbance of non-regulated small quantities of asbestos wall patching may be present that is not required to be abated. Contractor shall provide worker protection as required by all federal (EPA, OSHA, etc.), state, and local regulations in regards to the potential asbestos and lead based paint hazards.

2.6 Dust Control. The amount of dust resulting from demolition shall be controlled to prevent the spread of dust to avoid creation of a nuisance in the surrounding occupied areas. Use of water may be used if fire hydrant type connection and metering are provided by Contractor.

2.6.1 Disconnection of Utility Services. Utilities shall be disconnected and remove to the points indicated before demolition of the structure. Where such disconnection will interrupt the utility services to an area not included in the contract, arrangements for such interruption shall be made with the Contracting Officer at least 72 hours in advance of the interruption. Contractor shall immediately backfill all excavations from utility removals.

2.6.2 Burning at the project site will not be permitted.

2.7 Protection of Existing Work.

2.7.1 Existing structures to remain shall be protected from damage. Structures damaged by the Contractor shall be repaired to match existing work.

2.8 Use of explosives will not be permitted.

2.9 Pest Control: Employ a certified licensed exterminator to treat building and control rodents and vermin before and during demolition operations. All mixing by a must be done at the Entomology Shop where the only proper mixing facility on base exist. Contractor must bring with them an unopened container of the recommended termiticide/pest control (seal in tact). Mixing must be performed in line-of-sight of a DOD certified pesticide applicator; insuring proper % of final product. Sight application of chemical should be performed in line-of-sight of certified applicator to insure proper coverage, and favorable conditions for applying (raining, frozen soil conditions, soil not properly prepared, etc.) Paperwork must be presented to entomology supervisor from contractor at the time of each application.

3. EXISTING UTILITIES: Remove, abandon, and cap existing utilities as indicated on the drawings.

4. DISPOSITION OF MATERIAL:

4.1 All materials shall be disposed of off Government property on a continual basis during performance of the work. Sale of items on site is not permitted. Stockpiling of debris shall not be permitted unless to accumulate enough material for purposes of recycling. Stockpiling is subject to prior approval by the Contracting Officer's Representative based on plan for removal from site to an approved off base location in a time frame approved by Contracting Officer, not to be any later than the phasing indicated in Section 01000.

4.2 Contractor shall reclaim all freon from the heat pumps and all appliances before demolition and disposal. Thermostats containing mercury shall be turned over to the Government for disposition as noted in the plans.

4.3 Contractor is encouraged to recycle or donate as much of the demolition debris as possible. Provide the Government with documentation of the materials recycled/donated, quantities, and cost saving realized at the completion of the demolition portion of work.

5. BACKFILLING OF VOIDS:

5.1 Contractor shall provide 95% compacted fill in all areas/voids to within four inches of surrounding grade. Provide four inches of compacted topsoil for backfilling the remaining area, graded to drain with the existing site.

6. CLEANUP:

6.1 Debris and Rubbish. Remove debris and rubbish from the base daily.

6.2 Debris Control. Remove and transport debris in a manner as to prevent spillage on streets or adjacent areas. Trucks shall be covered and tailgated while hauling on base streets.

End of Section 02050

SECTION 02051

ASBESTOS REMOVAL, CLEANUP & DISPOSAL

1. GENERAL:

1.1 The term abate, as used in the plans and specifications, shall mean to remove, clean up, and dispose of asbestos containing materials (ACM). The work covered by this section includes the removal, cleanup, and disposal of materials containing asbestos.

2. DOCUMENTATION OF PERFORMANCE IN ASBESTOS REMOVAL:

2.1 The Contractor shall furnish documentation of successful performance in asbestos removal. This documentation will include names and addresses of purchasers of services and location of work performed.

2.2 The Contractor shall have at all times in his possession at his office (one copy) and in view at the job site (one copy) OSHA Regulation 29 CFR 1926.1101; Asbestos and Environmental Protection Agency 40 CFR, Part 61, Subpart M: National Emission Standard for Asbestos, Asbestos Stripping Work Practices, and Disposal of Asbestos Waste; N.C. General Statute 130A, Article 19, Asbestos Hazard Management.

3. REGULATORY REQUIREMENTS:

3.1. All asbestos removal cleanup, and disposal shall be made in accordance with:

3.1.1 N.C. General Statute 130A, Article 19 and OSHA Regulation 1926.1101 - Asbestos, permissible exposure limits for asbestos shall apply to all air samples:

3.1.1.1 Amosite	0.01 fibers/cc
3.1.1.2 Chrysotile	0.01 fibers/cc
3.1.1.3 Crocidolite	0.01 fibers/cc
3.1.1.4 All others	0.01 fibers/cc

3.2 EPA 40 CFR, Part 61, Subpart M - National Emission Standard for Asbestos, Asbestos Stripping, Stripping Work Practice, and Disposal of Asbestos Waste.

3.3 Other State and Local Agency Requirements.

4. SUBMITTALS:

4.1 Pre Removal Plan: Submit a detailed plan of the work procedures to be used in the removal and demolition of materials containing asbestos. The pre-removal plan must be approved and signed by an N. C. State accredited Asbestos Abatement Project Designer. Such plan shall include location of asbestos control areas, change rooms, layout of change rooms, interface of trades involved in the construction, sequencing of asbestos related work, disposal plan, type of wetting agent and asbestos sealer to be used, air monitoring, and a detailed description of the method to be employed in order to control pollution. Provide copies of all notifications sent to agencies. This plan must be approved prior to the start of any asbestos work. Include copies of North Carolina Asbestos Accreditation Certificates for each worker and

Accredited Supervisor and Asbestos Removal Permits/Notifications when removal quantities require by N.C. Statute 130A, Article 19.

4.2 Submit personnel and space air monitoring and final clearance reports.

4.3 Training: Submit certificates signed by each employee that the accredited employee has received current training within 12 months of scheduled removal work in the proper handling of materials that contain asbestos; understands the health implications and risks involved, including the illnesses possible from exposure to airborne asbestos fibers; understands the use and limits of the respiratory equipment to be used; and understands the results of monitoring of airborne quantities of asbestos as related to health and respiratory equipment.

4.4 Return manifest signed by company or landfill accepting custody of asbestos waste within 24 hours. Minimum information on the manifest shall include: date of disposal, quantity, sources of asbestos waste type of insulation (pipe, duct, etc.), name of certified/licensed asbestos removal Contractor.

5. REMOVAL, CLEANUP AND PREPARATION:

5.1 The Contractor shall have proper dress and equipment for all personnel. The Contractor shall provide proper decontamination facilities. The method of asbestos removal shall be conducted as required by regulation. Work areas shall be decontaminated prior to resuming other activities.

6. PHASING AND SCOPE:

6.1 Phasing of asbestos removal will be coordinated by the removal Contractor and approved by the Contracting Officer. Work shall proceed in an efficient, orderly manner due to the follow on demolition work by others.

7. REMOVAL, CLEANUP AND PREPARATION:

7.1 See plans for listing of asbestos containing materials. Contractor shall remove all items per this specification and all federal and state guidelines.

End of Section 02051

SECTION 02722

STORM SEWER SYSTEM

PART 1- GENERAL

1.01 SECTION INCLUDES

A. Site storm sewerage drainage piping, fittings and accessories, and bedding.

B. Curb inlets and junction boxes

1.02 RELATED SECTIONS

A. Section 02221 - Trenching, Backfilling, and Compacting for Utility Systems.

B. Section 03300 - Cast-in-place Concrete.

1.03 REFERENCES

A. American Society for Testing and Materials:

1.	ASTM C 76	Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
2.	ASTM C 443	Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
3.	ASTM D 698	Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using a 10 pound Rammer and 12 Inch Drop.
4.	ASTM A536	Ductile Iron Castings
5.	ASTM F667	Standard Specification for Large Diameter Corrugated Polyethylene (PE) pipe and Fittings

1.04 SUBMITTALS

A. Submit according to Section 01000.

B. Manufacturer's Certificate: Certify consistent production of both pipe and joints conforming to performance specified. Manufacturered peroid of service of at least two years.

C. Submit product data on pipe, accessories, manholes, rings, frames and grates.

1.05 JOB CONDITIONS

A. Protection of Other Utilities and Structures: Any damage done to existing utility lines, services, poles, and structures of every nature shall be repaired or replaced by the Contractor at his own expense. The approximate position of certain known underground lines are shown on the plans for information. Existing small lines are not shown. The Contractor shall locate these and other possible unknown utility lines by coordinating with the utility companies or by use of an electronic pipe finder and shall excavate and expose all existing underground lines in advance of trenching operations.

PART 2 - PRODUCTS

2.01 GENERAL

A. Storm Drain Pipe: All pipe for storm drains shall be reinforced concrete. All pipe shall be first quality, with smooth interior and exterior surfaces, free from cracks, blisters, honeycombs and other imperfections, and true to theoretical shapes and forms throughout the full length.

2.02 PIPE

A. PRECAST REINFORCED CONCRETE STORM SEWER PIPE

1. All concrete pipe shall meet the requirements of ASTM C76. When a strength class is not specified, class III pipe shall be used.
2. Cement: Unless otherwise required by the Contracting Officer, Type II Portland Cement complying with the requirements of ASTM Designation C-150 will normally be acceptable in the manufacturer of concrete pipe.
3. Fitting and Specials: Details of all fittings and specials shall be submitted to the Contracting Officer for approval. Fittings and specials shall be made up of pipe segments having the same structural qualities as the adjoining pipe and shall be as shown on the drawings and the centerline radius shall not be less than the internal diameter of the pipe.
4. Lifting Holes: Lifting holes will be allowed and will be grouted closed.
5. Acceptance of Pipe for Construction: Acceptance of the pipe shall not relieve the Contractor of full responsibility for any defects in material or workmanship of the completed pipeline. In addition to deficiencies covered by the applicable ASTM Specifications, concrete pipe which has any of the following visual defects will not be accepted.
   a. Porous areas on either the inside or the outside surface of a pipe having an area of more than five (5) square inches and a depth of more than one-half (1/2) inch.
   b. Pipe which has been patched or repaired without approval of the Contracting Officer.
   c. Exposure of the reinforcement.
   d. Pipe damaged during shipment or construction.
6. Marking: The following shall be clearly marked on the exterior surface of all pipe:
   a. ASTM Specification
   b. Class and size
   c. Date of manufacturer
   d. Name or Trade-Mark of Manufacturer
7. Joints: Unless otherwise specified, joints shall be in accordance with ASTM C-76. Joint sealer shall be required. When watertight joints are specified, joints and gasket material shall be R-4 in accordance with ASTM C443. All other joints shall be sealed with RAM-NEK, or approved equal.

2.03 INLET BOXES

A. Inlet boxes shall be constructed or masonry by the Contractor where shown on plans in accordance with NC DOT standards for non traffic areas. Provide a metal grate for each inlet.

2.04 INSPECTION AND TESTS OF PIPES

A. Upon completion of the work, or upon completion of any section of the work, the inlet boxes and storm drain pipes will be inspected and each pipe line from box to box shall present a neat, circular bore when inspected.

PART 3 - EXECUTION

3.01 INSTALLATION OF STORM SEWER SYSTEM

A. General: Include the work of furnishing and putting in place all shoring and bracing necessary to excavate and protect the work and the workmen; of doing all pumping and bailing necessary to keep the trenches free from water; of protecting all pipes, conduits, culverts, poles, wires, fences, trees, shrubbery, buildings and other public and private property along the field of operation; of doing all necessary barricading, lighting, bridging and furnishing and erecting detour signs; of removing after completion of the work all shoring and bracing not necessary to support the sides of the trenches; of removing or otherwise disposing of all surplus material, cut trees, brush and rubbish; of restoring of all property, injury to which is contemplated in this contract; and of restoring the surface of all streets, roads and rights-of- way to as good condition as they were prior to the beginning of the work.

B. Storm Drain Pipe: Where shown on plans and/or directed by the Contracting Officer, the Contractor shall install storm drain pipe in trenches. Storm drains shall be of such sizes and materials as are called for. The grade as shown on the profile is that of the invert of the pipe and that to which the work must conform. The grades shall be kept by batter boards and lines or other means approved by the Contracting Officer. Such rods, levels, straight edges, batter boards, lines, etc., as are required for the work shall be furnished by the Contractor. The bottom of the trenches shall be shaped so as to conform as nearly as possible to the outside of the pipe, particular care being taken to recess the bottom of the trench in such a manner as to relieve the bell of all load. All stumps, roots, etc., encountered in the trench, shall be completely removed before the pipe is laid. Each pipe shall be laid to the line and grade and in such a manner as to form a close concentric joint with the adjoining pipe and prevent sudden offsets of flow line. All pipes shall be laid with bells uphill.

C. Joints in the storm drain lines shall be made in accordance with the instructions of the manufacturers of the particular joint used by the Contractor. The interior of each joint of pipe shall be cleaned before laying the next joint and all foreign matter, including any joint material projecting within the pipe, shall be removed. The Contractor shall connect the new pipes with existing manholes and boxes where called for, in a neat and workmanlike manner. Pipes shall be cut flush with inside wall of the structure it enters. Where pipes are carried on supporting structures, they will be constructed and anchored as indicated on plans.

D. All trenches shall be backfilled with suitable material and the Contractor shall haul away and dispose of all surplus materials. Where pipe lines are laid under paving, the trenches shall be backfilled in layers not over 6" in thickness and thoroughly tamped to maximum compaction with mechanical tamps. Where the backfilling material is too dry for satisfactory tamping, it shall be sprinkled, and where too wet for satisfactory tamping, the materials shall be allowed to dry or dry material shall be hauled in. Trenches with unstable bottoms shall, where feasible, have unstable material removed and be backfilled with stone or other material approved by the Contracting Officer. Pipes laid in trenches where the unstable bottoms cannot be reasonably stabilized shall be bedded with Class I bedding.

E. Earth Fill Over Pipes: Where called for on the plans, or when otherwise directed by the Contracting Officer, in locations where little or no cover is obtained for the pipe, a special earth fill conforming to the details shown on the plans will be placed to provide the necessary protection for the pipe. Earth used for such fill shall be free from large pieces of rock and shall be carefully placed to avoid damage to the pipe. It shall be placed in layers around and over the pipe and compacted through the use of hand tools. Earth moving equipment will not be permitted to drive over the pipe.

F. Drainage Ditches, Channels: Ditches shall be constructed to the size, length, slope and elevations in the location as shown on the drawings, details, and profiles or as indicated by the Contracting Officer. All junctions with other ditches and storm drain pipes shall be lined with rip rap to prevent erosion due to turbulence. The basic shape of the ditches shall be as shown by cross-sections in the drawings, and the slopes and bottoms shall be compacted and smooth surfaces.

G. Cutting of Pipe:
1. Cutting of pipe shall be done in a neat and clean manner without damage to the pipe.
2. Cutting shall be done with an approved type mechanical cutter.
3. Wheel cutter shall be used when practicable.

END OF SECTION 02722

SECTION 02938

SOD

1. SCOPE: This section covers the preparation of sod and protection and maintenance of all sodded areas.

2. GENERAL:

2.1 Work to be Done: All areas resulting from site grading or other disturbed areas shall be backfilled and sodded as hereinafter specified.

2.2 Planting Date: The planting period shall conform to the following unless an extension of time is granted by the Contracting Officer.

2.2.1 Period 15 September through 15 May.

2.3 All sod shall be guaranteed for one (1) year and all components of a contractor installed irrigation system shall be guaranteed for a period of one (1) year, following Contracting Officer acceptance of the project

3. MATERIALS:

3.1 Backfill material shall be of equal quality to the surrounding topsoil.

3.2 Sod: Sod shall be centipede grass, strongly rooted, and reasonable fee of pernicious weeds and apparent disease. All sod shall be freshly cut and installed in place within 24 hours. Thickness of sod shall be two inches. The sod will be inspected during laying operations, and any sod which has been permitted to dry out or become otherwise injured during transportation or storage so that its survival after placing has been rendered doubtful will be rejected. All sod shall be of uniform thickness.

3.3 Fertilizer: Ten pounds of 5-10-10 fertilizer per 1000 feet of soil shall be used. (5-10-10 referring to the amounts of nitrogen, phosphorous, and potassium).

3.4 Sufficient amount of lime or sulfur shall be used to adjust the pH of the soil to 5.

4. BACKFILLING AND PREPARATION OF SEED BED:

4.1 General: The areas to be treated and their respective requirements for sod, fertilizer, lime, and other treatment shall include all areas disturbed by the Contractor and those shown to be sodded on the contract plans.

4.2 Soil Preparation: Those areas disturbed by the Contractor and those shown on the contract plans to be sodded shall be disked and tilled a minimum depth of three inches. The existing grass, mulch, stones over one half inch in size, sticks and rubbish, and excess soil shall be removed only after the soil is adjusted to the specified pH. No heavy objects except lawn rollers shall be moved over sodded areas after subgrade soil has been scarified.

5. SODDING

5.1 The sod shall be laid smoothly, edge to edge, and with staggered joints. Sod shall be pulled tight so that there are no gaps. The sod shall immediately be pressed firmly into contact

with the sod bed using a light-weight turf roller or other approved equipment, so as to eliminate all air pockets, provide a true and even surface, and ensure knitting without displacement of the sod or deformation of the surfaces of sodded areas. Following compaction, screened soil of good quality shall be used to fill all cracks between sods. Excess soil shall be worked into the grass with rakes or other suitable equipment. The quantity of fill soil shall be such as will cause no smothering of the grass.

5.2 Finishing: After the sodding operation has been completed, the edges of the area shall be smooth. On slopes steeper than 2 to 1 and elsewhere when so shown, the sod shall be fastened in place with suitable wooden pins or by other approved methods. The sod shall be watered and irrigated immediately after placement. Sufficient water shall be applied to wet the sod thoroughly and to wet the sod bed at least two inches deep. Watering shall be done in a manner that will avoid erosion due to the application of excessive quantities, and the watering equipment shall be of a type that will prevent damage to the finished surface.

5.3 Maintenance: Sodded areas shall be maintained, cut, and watered as necessary for 60 days following installation of the sod. When any portion of the surface becomes gullied or otherwise damaged after any part of the area has been sodded, the affected portion shall be repaired to reestablish the condition and grade of the soil prior to sodding and shall then be re-sodded as previously specified. A final inspection shall be held at the end of this sixty day period for acceptance of the sod.

END OF SECTION 02938

SECTION 16050

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following electrical materials and methods:

1. Conductors, connectors, and splices for branch circuits
2. Conduits and supporting devices for electrical components
3. Electrical identification
4. Electrical demolition
5. Cutting and patching for electrical construction
6. Touchup painting

1.2 SUBMITTALS

A. Product Data for each type of product specified is 1.1 above.

1.3 QUALITY ASSURANCE

A. Comply with NFPA 70 for components and installation.

B. Listing and Labeling: Provide products specified in this Section that are listed and labeled.

1. The Terms "Listed and Labeled": As defined in the National Electrical Code, Article 100..

C. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

1.4 SEQUENCING AND SCHEDULING

A. Coordinate electrical equipment installation with other building components, sidewalks, and exterior utilities.

B. Coordinate connecting electrical systems with exterior underground services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.

C. Coordinate installing electrical identification after completion of finishing where identification is applied to field-finished surfaces.

PART 2 - PRODUCTS

2.1 BUILDING WIRE

A.Description: Single conductor, copper. Solid conductor for No. 10 AWG and smaller; stranded conductor for larger than No. 10 AWG.

B. Thermoplastic Insulated Wire: Conform to NEMA WC 5.

C. Cross-Linked, Polyethylene Insulated Wire: Conform to NEMA WC 7.

D. Connectors and Splices: Units of size, ampacity rating, material, type, and class suitable for service indicated. Select to comply with Project's installation requirements.

2.2 SUPPORTING DEVICES

A. Hangers, anchors, sleeves, brackets, fabricated items, and fasteners are designed to provide secure support for electrical components.

1. Material: Steel, except as otherwise indicated, protected from corrosion with zinc coating or with treatment of equivalent corrosion resistance using approved alternative finish or inherent material characteristics.

2. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel, except as otherwise indicated.

D. Raceway and Cable Supports: Manufactured riser clamps, straps, and wall brackets.

E. Toggle Bolts: All-steel springhead type.

2.3 CONDUITS

A. Provide Schedule 40 PVC conduits below grade, and rigid steel conduit painted to match adjacent surfaces above grade. Provide rigid steel nipples as necessary for penetrations into equipment enclosures.

2.4 ELECTRICAL IDENTIFICATION

A. Manufacturer's Standard Products: Where more than one type is listed for a specified application, selection is Installer's option, but provide single type for each application category. Use colors prescribed by ANSI A13.1, NFPA 70, and these Specifications.

B. Colored Adhesive Marking Tape for Raceways, Wires, and Cables: Self-adhesive vinyl tape not less than 3 mils thick by 1 inch wide (0.08 mm thick by 25 mm wide).

C. Underground Line Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape with the following features:

1. Size: Not less than 4 mils thick by 6 inches wide (0.102 mm thick by 152 mm wide).

a. Compounded for permanent direct-burial service.

2. Embedded continuous metallic strip or core.

a. Printed Legend: Indicates type of underground line.

D. Engraved, Plastic-Laminated Labels: Engraving stock, melamine plastic laminate punched for mechanical fasteners 1/16-inch (1.6-mm) minimum thick. Engraved legend in black letters on white face.

2.5 TOUCHUP PAINT

A. Touch up all surfaces to match existing colors.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION REQUIREMENTS

A. Install items level, plumb, and parallel and perpendicular to other components, except where otherwise indicated.

C. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.

3.2 WIRING METHODS

A. Underground Feeders and Lighting Circuits: Type UF copper conductor in raceway for lighting circuits.

3.3 ELECTRICAL SUPPORTING METHODS

A. Damp Locations and Outdoors: Hot-dip galvanized materials.

B. Dry Locations: Steel materials.

C. Conform to manufacturer's recommendations for selecting supports.

D.Strength of Supports: Adequate to carry all present and future loads, times a safety factor of at least 4; 200-lb- (90-kg-) minimum design load.

3.4 INSTALLATION

A. Install wires in raceway according to manufacturer's written instructions and NECA's "Standard of Installation."

B. Conductor Splices: Keep to the minimum and comply with the following:

1. Install splices and taps that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors. Use waterproof submersible splices kits for connections below grade or in handholes.

2. Use splice and tap connectors that are compatible with conductor material.

C. Connect components to wiring systems and to ground 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 requirements specified in UL 486A.

D. Install devices to securely and permanently fasten and support electrical components.

E. Raceway Supports: Comply with NFPA 70 and the following requirements:

1. Conform to manufacturer's recommendations for selecting and installing supports.

2. In vertical runs, arrange support so the load produced by the weight of the raceway and the enclosed conductors is carried entirely by the conduit supports, with no weight load on raceway terminals.

F. Vertical Conductor Supports: Install simultaneously with conductors.

G. Fastening: Unless otherwise indicated, securely fasten electrical items and their supporting hardware to the enclosures or structures. Perform fastening according to the following:

1. By machine screws, welded threaded studs, or spring-tension clamps on steel.

2. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or any other items.

3. In partitions of light steel construction use sheet-metal screws.

4. Select fasteners so the load applied to any fastener does not exceed 25 percent of the proof-test load.

K. Install identification devices.

1. Install labels at each disconnect on a location for best convenience of viewing without interference with operation and maintenance of equipment.

2. Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations indicated required by codes and standards. Use consistent designations throughout the Project.

3. Identify Paths of Underground Electrical Lines: During trench backfilling, for exterior underground power lines, install continuous underground plastic line marker located directly above power and communication lines.

3.5 DEMOLITION

A. Where electrical work indicated to remain is damaged or disturbed in the course of the Work, remove damaged portions and install new products of equal capacity, quality, and functionality.

B. Accessible Work Indicated to Be Demolished: Remove exposed electrical installation in its entirety.

C. Abandoned Work: Buried raceway under roads to be abandoned in place. Cap, backfill, compact, and seed to match existing grade.

D. Removal: Remove demolished material from the Project site not less than daily.

E. Temporary Disconnection: Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation.

3.6 TRENCHING AND BACKFILLING

A. Contractor shall provide a 24” deep trench as required for installation of underground circuits. Contractor shall not cut any existing sidewalks to remain, but hand bore under them. Contractor shall backfill as soon as possible once the conduit is placed in the trench. Contractor shall compact to 90%

and providing seeding in areas where sod is not being placed. Rake out excess soil to match existing grade. Contractor responsible to establish the grass per approval of Contracting Officer.

3.7 CUTTING AND PATCHING

A. Repair disturbed surfaces to match adjacent undisturbed surfaces.

3.8 TOUCHUP PAINTING

A. Thoroughly clean damaged areas and provide primer, intermediate, and finish coats to suit the degree of damage at each location.

B. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.

3.9 OUTAGES

A. Any and all required power outages shall be scheduled with and approved by Contracting Officer's Representative not less than 48 hours in advance.

END OF SECTION 16050

SUBMITTAL CODES: A: WITHIN 30 DAYS AFTER NTP B: DURING CONSTRUCTION

SCHEDULE OF MATERIAL SUBMITTALS

PROJECT NUMBER	PROJECT TITLE	SOLICITATION/CONTRACT NUMBER
VKAG 03-1501	DEMO CONTRACTING FACILITIES	

TO BE COMPLETED BY PROJECT ENGINEER												TO BE COMPLETED BY CONTRACT ADMINISTRATOR								
		NUMBER OF COPIES REQUIRED																		
LINE NUMBER	ITEM OR DESCRIPTION OF ITEM, CONTRACT REFERENCE, TYPE OF SUBMITTAL	CERTIFICATION OF COMPLIANCE	SHOP DRAWINGS	SAMPLES	COLOR SELECTION	MANUFACTURER'S RECOMMENDATIONS	MANUFACTURER'S WARRANTY	CATALOG DATA	OPERATING INSTRUCTIONS	OTHER	SUBMITTAL CODE	REQUIRED SUBMISSION DATE	DATE RECEIVED IN CONTRACTING	DATE TO CIVIL ENGINEERING	RETURN SUSPENSE	SUBMITTAL NUMBERS	DATE CONTRACTOR NOTIFIED		CONTRACTOR RESUBMITTAL	FINAL APPROVAL	REMARKS
																	APPROVED	DISAPPROVED			
1	CONTROL MEASURES SECTION 02050 PARA 2.2.1									3	A										
2	CONTROL MEASURES SECTION 02050 PARA 2.2.2									3	A										
3	AIR MONITORING SECTION 02050 PARA 2.2.3									3	A										
4	AIR MONITORING RESULTS SECTION 02050 PARA 2.2.4									3	B										
5	LANDFILL/RECYCLE RECORDS SECTION 02050 PARA 2.2.5									3	B										
6	PHOTOS SECTION 02050 PARA 2.2.6									3	A										
7	DEMOLITION PERMIT SECTION 02050 PARA 2.2.7									3	A										
8	PRE-REMOVAL PLAN SECTION 02051 PARA 4.1									3	A										
9	REPORTS SECTION 02051 PARA 4.2									3	B										
10	TRAINING SECTION 02051 PARA 4.3	3									B										
11	RETURN MANIFESTS SECTION 02051 PARA 4.4									3	B										

SUBMITTAL CODES: A: WITHIN 30 DAYS AFTER NTP B: DURING CONSTRUCTION

SCHEDULE OF MATERIAL SUBMITTALS

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																	APPROVED	DISAPPROVED			
12	MANUFACTURER'S CERT SECTION 02722 PARA 1.2.B	3									A										
13	MATERIAL DATA SECTION 02722 PARA 1.2.C							3			A										
14	MATERIAL DATA SECTION 16050 PARA 1.2							3			A										
15																					
16																					
17																					
18																					
19																					
20																					
21																					
22																					

SEYMOUR JOHNSON
Air Force Base
Goldsboro, North Carolina
SPECIFICATIONS

FOR

DATE: SEPTEMBER 10, 2003

PROJECT TITLE: REPAIR 3RD FLOOR BUILDING 3602

PROJECT NO: VKAG 95-1131

PROJECT MANAGER: MR. MATT MAKDAD, PE

(Revised by Amendment No. 0005)

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SECTION 01000

GENERAL

1.1 SCOPE OF WORK: The work covered by this specification consists of furnishing all plant, labor, equipment and material, and performing all work in connection with the PROJECT NO. VKAG 95-1131 – REPAIR 3RD FLOOR BUILDING 3602 in strict accordance with these specifications and drawings and subject to the terms and conditions of this contract.

1.2 LOCATION: The work is to be accomplished at Seymour Johnson Air Force Base, Goldsboro, North Carolina. This base is accessible by both public highway and railway.

1.3 WORKWEEK: The contractor shall observe the same regular workweek being observed by the Seymour Johnson AFB Civil Engineering shop forces, which is 7:30 a.m. to 4:30 p.m., Monday through Friday, with Federal holidays excluded. Any deviation from this schedule will require 48 hours advance notice and approval of the Contracting Officer.

1.4 PRINCIPLE FEATURES: The work covered by this contract includes, but is not limited to the following:

A. Repair the 3rd floor of Building 3602. Repair and addition to include but not limited to the demolition and removal of the 3rd floor existing wall, floor and ceiling finishes and systems. The demolition and removal of the existing stair tower serving the 1st, 2nd and 3rd floors. The up-fit of the 3rd floor area shall include: new wall, floor and ceilings finishes; a new 4-pipe fan coil HVAC and associated piping; new electrical power distribution system for the 3rd floor and new toilet groups for the 3rd floor. A new fire sprinkler system shall be installed for all three floors. The system shall include new service main to the building, backflow preventer, riser, piping system and heads. The existing fire alarm system shall be retrofit to match the 3rd floor renovations and renovated on the 1st and 2nd floors.

B. A new entrance vestibule, stair tower, elevator and riser room addition shall be constructed in place of the demolished stair tower. The addition shall be 3 stories and provide elevator and stair access to all three floors.

1.5 HAUL ROUTES: The Contractor shall use the haul routes indicated on the plans.

1.6 DISPOSITION OF NONSALVABLE MATERIALS: All nonsalvable or unusable material shall be disposed of off base as directed by the Contracting Officer or authorized representative. All waste material generated by any work under this contract shall be handled, transported, stored, and disposed of off base, by the Contractor, in accordance with all applicable federal, state, or local laws, ordinances, regulations, court orders, or other types of rules or rulings having the effect of law.

1.7 DISPOSITION OF SALVAGEABLE MATERIALS: The Contractor shall be required to furnish an itemized listing of materials to be salvaged to the Base Civil Engineering material Control section, located in Bldg 3300, so that an AF Form 1348-1 can be obtained. After receiving this form, all salvable or reusable material will be delivered to the Defense Reutilization and Marketing Office, which is located near Bldg 2620 or as directed by Contracting Officer or authorized representative.

1.8 SUBMITTALS REQUIRED: Required submittals are listed on AF Form 66.

1.9 BASE CIVIL ENGINEERING WORK CLEARANCE REQUEST, AF FORM 103: Upon receipt of an AF Form 103, the Contractor shall be responsible for locating all underground utilities. Utilities include, but are not limited to electric, water, sewer, steam, communication, telephone, fiber optic, cathodic protection, cable television, fuel lines, and natural gas. Historical drawings, as-built drawings, and topographic drawings, the accuracy of which the government does not guarantee, are available for research and review at the 4th Civil Engineering Squadron, Design element located in Building 3300. The contractor shall promptly repair/replace contractor damaged utilities at no additional cost to the Government. The repair/replacement shall be acceptable to and approved by the Government.

1.10 MATERIALS CONTAINING ASBESTOS: In the event the Contractor discovers materials suspected of containing asbestos that is not identified to be removed in the plans and specifications, the Contractor shall notify the Contracting Officer authorized representative. The Contractor's work shall proceed unless the materials suspected of containing asbestos are damaged or disturbed. Any suspected materials damaged or disturbed by the Contractor without permission from the Contracting Officer or authorized representative shall be removed by the Contractor at his expense IAW all applicable Federal, State, and local laws, ordinances, regulations, court orders, or other types of rules or rulings having the effect of law.

1.11 LABELING OF STORAGE DRUMS: All 55 gallon or larger drums brought on base for use under this contract and containing new material or used for storage of waste materials or hazardous waste must be labeled with a Department of Transportation (DOT) Proper Shipping Name, DOT Hazardous Identification Number, the Contractor's name, a Contractor representative, and the Contractor's telephone number. Label lettering should have a minimum height of one half inch painted in white paint or other color that is in contrast with the color of the drum. The label should be sufficiently durable to equal or exceed the life (including storage and disposal) of the drum.

1.12 CONTRACTOR STORAGE TRAILER(S) AND BUILDING(S): The Contractor shall place or paint a sign on all of his storage trailer(s) and building(s) used on this contract. At a minimum, the sign shall contain the name of the Contractor and a telephone number at which the Contractor can be reached. The trailer(s) and building(s) shall be complete with gates and/or doors which can be locked. Only material for this project shall be stored in the trailer(s) or building(s). The Contractor shall remove the storage trailer(s) or building(s) within 30 days after completion of the contract and prior to

submitting his final invoice. The area around the storage trailer(s) and building(s) shall be kept clean. This includes the mowing of grass during the growing season. The lawn mower shall be supplied by the Contractor.

A. The Contractor will be given a lot in the Contractor Storage Area behind Bldg 2700 for the life of the contract. The Contractor's progress schedule shall include a line item (equal to 1%) for final cleanup of this storage lot. Final payment will not be made until this final cleanup is performed by the Contractor and accepted by the Contracting Officer or authorized representative.

1.13 CONSTRAINTS:

A. All contractor and subcontractor personnel shall have photo identification available at all times. This identification shall be visible at all times. All vehicles operated by the contractor or subcontractors shall have visible identification showing name of represented company.

1.14 PHASING:

A. The 30 days following Contractor's Notice to Proceed will be allowed for delivery of materials, equipment ordering, and submittal approval only. No on-site work shall be permitted by the Contractor during that initial 45 day period.

B. After the submittal phase, the asbestos abatement (Phase II) will take 30 days and construction (Phase III) will take 150 days.

C. The Contractor shall not proceed to Phase III until the completion of Phase II.

1.15 AFFIRMATIVE PROCUREMENT:

A. The contractor shall incorporate Affirmative Procurement requirements as per 40 CFR, Part 247 and Executive Order 13101: "Greening the Government Through Waste Prevention, Recycling and Federal Acquisition." Designated items used in the execution of this contract shall meet or exceed the Environmental Protection Agency's (EPA) requirements for recycled content materials (RCM) as per the EPA's Comprehensive Procurement Guidelines (CPG).

B. The contractor shall ensure affirmative procurement requirements for CPG items are met or provide written justification that: 1) The price of a given designated item is unreasonably high, 2) There is inadequate competition (not enough sources of supply), 3) Unusual and unreasonable delays would result from obtaining the item, or 4) The item does not meet the Air Force's performance specifications. Individual specifications contained in this contract may or may not reference the permitted use of a recycled/recovered material. Recycled/recovered materials shall be used in the quantities set forth in the EPA's CPG whether specified or not. The following products are on the CPG list and the contractor must meet the minimum percentages: fiberglass insulation, carpet cushion, concrete containing fly ash, and steel restroom dividers.

END OF SECTION 01000

SECTION 02051

ASBESTOS REMOVAL, CLEANUP & DISPOSAL

1.16 GENERAL: The term abate, as used in the plans and specifications, shall mean to remove, clean up, and dispose of asbestos containing materials (ACM). The work covered by this section includes the removal, cleanup, and disposal of materials containing asbestos.

1.17 DOCUMENTATION OF PERFORMANCE IN ASBESTOS REMOVAL:

A. The Contractor shall furnish documentation of successful performance in asbestos removal. This documentation will include names and addresses of purchasers of services and location of work performed.

B. The Contractor shall have at all times in his possession at his office (one copy) and in view at the job site (one copy) OSHA Regulation 29 CFR 1926.1101; Asbestos and Environmental Protection Agency 40 CFR, Part 61, Subpart B: National Emission Standard for Asbestos, Asbestos Stripping, Stripping Work Practices, and Disposal of Asbestos Waste; N.C. General Statute 130A, Article 19, Asbestos Hazard Management.

1.18 REGULATORY REQUIREMENTS:

A. All asbestos removal cleanup, and disposal shall be made in accordance with:
   1. N.C. General Statute 130A, Article 19 and OSHA Regulation 1926.1101 - Asbestos, permissible exposure limits for asbestos shall apply to all air samples:
      a. Amosite 0.01 fibers/cc
      b. Chrysotile 0.01 fibers/cc:
      c. Crocidolite 0.01 fibers/cc:
      d. All others 0.01 fibers/cc

B. EPA 40 CFR, Part 61, Subpart B - National Emission Standard for Asbestos, Asbestos Stripping, Stripping Work Practice, and Disposal of Asbestos Waste.

C. Other State and Local Agency Requirements.

1.19 SUBMITTALS:

A. Pre Removal Plan: Submit a detailed plan of the work procedures to be used in the removal and demolition of materials containing asbestos. The preremoval plan must be approved and signed by an N. C. State accredited Asbestos Abatement Project Designer. Such plan shall include location of asbestos control areas, change rooms, layout of change rooms, interface of trades involved in the construction, sequencing of asbestos related work, disposal plan, type of wetting agent and asbestos sealer to be used, air monitoring, and a detailed description of the method to be employed in order to control pollution. Provide copies of all notifications sent to agencies. This plan must

be approved prior to the start of any asbestos work. Include North Carolina Asbestos Accreditation Certificates for each worker and Accredited Supervisor and Asbestos Removal Permits/Notifications when removal quantities require by N.C. Statute 130A, Article 19.

B. Submit personnel and space air monitoring and final clearance reports.

C. Training: Submit certificates signed by each employee that the employee has received current accredited training within 12 months of scheduled removal work in the proper handling of materials that contain asbestos; understands the health implications and risks involved, including the illnesses possible from exposure to airborne asbestos fibers; understands the use and limits of the respiratory equipment to be used; and understands the results of monitoring of airborne quantities of asbestos as related to health and respiratory equipment.

D. Return manifest signed by company or landfill accepting custody of asbestos waste within 24 hours. Minimum information on the manifest shall include: date of disposal, quantity, sources of asbestos waste type of insulation (pipe, duct, etc.), name of certified/licensed asbestos removal Contractor.

1.20 REMOVAL, CLEANUP AND PREPARATION: The Contractor shall have proper dress and equipment for all personnel. The Contractor shall provide proper decontamination facilities. The method of asbestos removal shall be conducted as required by regulation. Work areas shall be decontaminated prior to resuming other activities.

1.21 PHASING AND SCOPE: Phasing of asbestos removal will be coordinated by the general Contractor and approved by the Contracting Officer per the removal plan.

1.22 EXISTING CONDITIONS:

A. A visual inspection, data base inquiry, and bulk sampling was accomplished April 11, 2003. The concrete ceiling decking has brown color mastic containing 5% chrysotile asbestos. The 9” x 9” gray and black color floor tile contains 10% and black mastic contains 5% chrysotile asbestos. This floor tile and mastic is in the dayroom. Brown color wall mastic in rooms 318 and 325 contains 5% tremolite asbestos. Paint results for lead content are, door jambs – tan color – 0.14% & .15% green - .29% & .48%, walls - .014% - .025%, ceilings - .025% - .035% & .057% lead by weight. The sheet rock joint material and the 2’ x 2” acoustic ceiling tile are non-asbestos containing. No other suspect asbestos or lead containing materials were identified for sampling or analysis.

B. This information is in reference to the materials and areas as identified above and does not cover any other materials or work areas at or in this facility that were not identified for inspection. Other areas and materials do contain asbestos and lead-containing paint and should not be disturbed until an inspection can be performed to determine the potential health hazard.

END OF SECTION 02051

SECTION 02070

SELECTIVE DEMOLITION

1.1 GENERAL

A. Definitions:

1. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.
2. Remove and Salvage: Detach items from existing construction and deliver them to the Government.
3. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
4. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

B. Materials Ownership: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain the Government 's property, demolished materials shall become Contractor's property and shall be removed from Project site.

C. Submittals:

1. Proposed dust-control and noise-control measures.
2. Schedule of Selective Demolition Activities: Indicate detailed sequence of selective demolition work, interruption of utility services, use of elevator and stairs, and locations of temporary partitions and means of egress.
3. Predemolition Photographs: Show existing conditions of adjoining construction and site improvements.

D. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

E. Standards: Comply with ANSI A10.6 and NFPA 241.

F. Project Conditions:

1. The Government will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so the Government 's operations will not be disrupted. Provide not less than 48 hours' notice to the Government of activities that will affect the Government 's operations.
2. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.
3. The Government assumes no responsibility for condition of areas to be selectively demolished.

a. Conditions existing at time of inspection for bidding purpose will be maintained by the Government as far as practical.

G. Storage or sale of removed items or materials on-site will not be permitted.

H. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

1.2 PRODUCTS

A. Repair Materials: Use repair materials identical to existing materials.

1. If identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
2. Use materials whose installed performance equals or surpasses that of existing materials.

1.3 EXECUTION

A. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

B. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to the Contracting Officer or authorized representative.

C. Engage a professional engineer to survey condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective demolition operations.

D. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

E. Existing Utilities: Maintain services indicated to remain and protect them against damage during selective demolition operations.

F. Utility Requirements: Locate, identify, disconnect, shut off, and seal or cap off indicated utilities serving areas to be selectively demolished.

1. If utility services are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary utilities that bypass area of selective demolition and that maintain continuity of service to other parts of building.

G. Dangerous Materials: Drain, purge, or otherwise remove, collect, and dispose of chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with selective demolition operations.

H. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Erect temporary protection, such as walks, barricades, roping, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction.
2. Protect existing site improvements, appurtenances, and landscaping to remain.

I. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

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

K. Temporary Partitions: Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise.

L. Temporary Shoring: Provide and maintain interior shoring, bracing, or structural support to preserve stability and prevent movement, settlement, or collapse of construction to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

M. Dust Control: Use water mist, temporary enclosures, and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations.

N. Disposal: Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

1. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

O. Cleaning: Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

P. Selective Demolition: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction.

2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations. Any use of “open flame” devices for demolition or construction shall require a burning permit. Contact the base Fire department prior to use of equipment.
4. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

Q. Removed and Salvaged Items: Comply with the following:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to the Government.
4. Protect items from damage during transport and storage.

R. Removed and Reinstalled Items: Comply with the following:

1. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

S. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by the Contracting Officer or authorized representative, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

T. Patching and Repairs: Promptly repair damage to adjacent construction caused by selective demolition operations.

1. Repairs: Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials.
2. Finishes: Restore exposed finishes of patched areas and extend restoration into adjoining construction in a manner that eliminates evidence of patching and refinishing.
3. Floors and Walls: Where walls or partitions that are demolished extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
4. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

U. Disposal of Demolished Materials: Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.

1. Burning: Do not burn demolished materials.
2. Disposal: Transport demolished materials off the Government's property and legally dispose of them.

END OF SECTION 02070

SECTION 02300

EARTHWORK

1.1 GENERAL

A. Definitions in this Section include the following:

1. Backfill: Soil materials used to fill an excavation.
2. Base Course: Layer placed between the subbase course and asphalt paving.
3. Bedding Course: Layer placed over the excavated subgrade in a trench before laying pipe.
4. Borrow: Satisfactory soil imported from off-site for use as fill or backfill.
5. Drainage Course: Layer supporting slab-on-grade used to minimize capillary flow of pore water.
6. Excavation: Removal of material encountered above subgrade elevations.
7. Fill: Soil materials used to raise existing grades.
8. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
9. Subbase Course: Layer placed between the subgrade and base course for asphalt paving, or layer placed between the subgrade and a concrete pavement or walk.
10. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.
11. Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

B. Existing Utilities: Do not interrupt utilities serving facilities occupied by the Government or others unless permitted in writing by the Contracting Officer and then only after arranging to provide temporary utility services according to requirements indicated.

1.2 PRODUCTS

A. Soil Materials: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: ASTM D 2487 soil classification groups GW, GP, GM, SW, SP, and SM, or a combination of these group symbols; free of rock or gravel larger than 3 inches (75 mm) in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: ASTM D 2487 soil classification groups GC, SC, ML, MH, CL, CH, OL, OH, and PT, or a combination of these group symbols.

D. Backfill and Fill: Satisfactory soil materials.

E. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch (38-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

F. Bedding: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch (25-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

G. Drainage Fill: Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch (38-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.

H. Detectable Warning Tape: Polyethylene film warning tape encasing a metallic core, minimum 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility.

1.3 EXECUTION

A. Preparation: Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Provide erosion- and sedimentation-control measures.

C. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

D. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

E. Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered, including rock, soil materials, and obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

F. Excavate for structures, pavements, and walks to indicated elevations and dimensions. Extend excavations for placing and removing concrete formwork, for installing services and other construction, and for inspections. Trim bottoms to required lines and grades to leave solid base to receive other work.

G. Excavate utility trenches to indicated gradients, lines, depths, and invert elevations of uniform widths to provide a working clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit.

1. Excavate trenches deeper than bottom of pipe elevation, 6 inches (150 mm) deeper in rock, 4 inches (100 mm) deeper elsewhere. Hand excavate for bell of pipe.

H. Proof roll subgrades, before filling or placing aggregate courses, with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof roll wet or saturated subgrades.

I. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities.

J. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill may be used when approved by the Contracting Officer or authorized representative.

K. Stockpile borrow materials and satisfactory soil materials, without intermixing, in shaped, graded, drained, and covered stockpiles. Stockpile soil materials away from edge of excavations and outside drip line of remaining trees.

L. Utility Trench Backfill: Place, compact, and shape bedding course to provide continuous support for pipes and conduits over rock and other unyielding bearing surfaces and to fill unauthorized excavations.

1. Place and compact initial backfill of satisfactory soil material or subbase material, free of particles larger than 1 inch (25 mm), to a height of 12 inches (300 mm) over the utility pipe or conduit. Place and compact final backfill of satisfactory soil material to final subgrade.
2. Install warning tape directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

M. Fill: Place and compact fill material in layers to required elevations.

N. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 2 percent of optimum moisture content.

1. Remove and replace, or scarify and air-dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

O. Compaction: Place backfill and fill materials in layers not more than 8 inches (200 mm) in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches (100 mm) in loose depth for material compacted by hand-operated tampers.

P. Compact soil to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches (300 mm) of existing subgrade and each layer of backfill or fill material at 95 percent.

2. Under walkways, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill material at 92 percent.
3. Under lawn or unpaved areas, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill material at 85 percent.

Q. Grading: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated. Grade lawns, walks, and unpaved subgrades to tolerances of plus or minus 1 inch (25 mm) and pavements and areas within building lines to plus or minus 1/2 inch (13 mm).

R. Subbase and Base Courses: Under pavements and walks, place subbase course on prepared subgrade. Place base course material over subbase. Compact to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

S. Under slabs-on-grade, place drainage course on prepared subgrade. Compact to required cross sections and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

T. Testing Agency: The Contractor will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing. 2 Tests shall be provided for each pipe trench. 2 tests shall be provide for each footing.

1. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.
2. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

U. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction.

V. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

W. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off the Government's property.

END OF SECTION 02300

SECTION 02510

WATER DISTRIBUTION

1.1 GENERAL

A. Comply with requirements of utility supplying water.

B. Comply with standards of the Contracting Officer for water-service piping.

C. Comply with NSF 61 for materials for potable water.

D. Provide listing/approval stamp, label, or other marking on piping and specialties made to specified standards.

E. Submittals: Submit the following:

1. Product Data: For valves (NRS, OS&Y), tapping sleeve and valve, underground piping materials, and fittings.
2. Approved Site Plan Drawings: Working plans, prepared according to NFPA 13 and 24 that have been approved by the Contracting Officer.
3. Field test reports and certificates: Include “Contractor’s Material and Test Certificate for Underground Piping”, purging and disinfecting reports, and hydrostatic test.
4. Warranty: Provide manufacturer’s written warranty for pipe.

1.2 PRODUCTS

A. Pipes and Tubes: Applications of the following pipe and tube materials are indicated in "Piping Applications" Paragraph.

1. Ductile-Iron, Push-on-Joint Pipe: AWWA C151, with cement-mortar lining and seal coat. Include rubber compression gasket.

B. Pipe and Tube Fittings: Applications of the following pipe and tube fitting materials are indicated in "Piping Applications" Paragraph.

1. Ductile-Iron, Push-on-Joint Fittings: AWWA C110, ductile-iron or cast-iron; or AWWA C153, ductile-iron, compact type. Include cement-mortar lining, seal coat, and rubber compression gaskets.

C. Joining Materials: Applications of the following piping joining materials are indicated in "Piping Applications" Paragraph.

1. Ductile-Iron Piping: The following materials apply:

a. Push-on Joints: AWWA C111 rubber gaskets and lubricant.

2. Pipe Couplings: Iron-body sleeve assembly, fabricated to match OD of pipes to be joined. Include sleeve, followers, gaskets, bolts and nuts, and enamel-paint finish.

D. Nonrising-Stem Gate Valves, 4-Inch NPS (DN100) and Larger: UL 262, FM approved, iron body and bonnet with flange for indicator post, bronze seating material, inside screw, 175-psig (1200-kPa) working pressure, and mechanical-joint ends. Provide with flanged ends for pit installation.

E. Rising-Stem Gate Valves, 3-Inch NPS (DN80) and Larger: AWWA C509, resilient seated; cast-iron or ductile-iron body and bonnet, OS&Y, bronze stem, 200-psig (1380-kPa) working pressure, and flanged ends.

F. Nonrising-Stem Gate Valves, 2-Inch NPS (DN50) and Smaller: MSS SP-80; body and screw bonnet of ASTM B 62 cast bronze; with Class 125 threaded ends, solid wedge, nonrising copper-silicon-alloy stem, brass packing gland, PTFE-impregnated packing, and malleable-iron handwheel.

G. Valve Boxes: Cast-iron box with top section and cover with lettering "WATER," bottom section with base of size to fit over valve and barrel approximately 5 inches (125 mm) in diameter, and adjustable cast-iron extension of length required for depth of bury of valve. Include steel tee-handle wrench with each valve box.

H. Service Boxes for Curb Stops: Cast-iron box with telescoping top section of length required for depth of bury of valve. Include cover with lettering "WATER," and bottom section with base of size to fit over curb-stop and barrel approximately 3 inches (75 mm) in diameter. Include steel tee-handle shutoff rod with each service box.

I. Ball Valves: AWWA C507, Class 250. Include interior coating according to AWWA C550.

J. Tapping Sleeve and Tapping Valve: Complete assembly, including tapping sleeve, tapping valve, and bolts and nuts. Use sleeve and valve compatible with tapping machine.

1. Tapping Sleeve: Cast- or ductile-iron, 2-piece bolted sleeve with flanged outlet for new branch connection. Sleeve may have mechanical-joint ends with rubber gaskets or sealing rings in sleeve body. Include sleeve matching size and type of pipe material being tapped and of outlet flange required for branch connection.

K. Anchorage Materials are as follows:

1. Steel: ASTM A 506, clamps, straps, and washers; ASTM A 575, rods; and ASTM A 307, bolts.
2. Iron: ASTM A 197 (ASTM A 197M), malleable-iron rod couplings and ASTM A 126, gray-iron washers.
3. Concrete Reaction Backing: Portland cement concrete mix, 3000 psig (20.7 MPa); with cement according to ASTM C 150, Type I; sand and crushed gravel according to ASTM C 33; and potable water.

L. Refer to Section 02300 "Earthwork" for underground warning tape materials. Arrange for warning tapes made of solid blue film with continuously printed black-letter caption "CAUTION--WATER LINE BURIED BELOW."

1.3 EXECUTION

A. Refer to Section 02300 "Earthwork" for excavation, trenching, and backfilling.

B. Piping Applications: Use pipe, fittings, and joining methods for piping systems according to the following applications:

1. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used in applications below, unless otherwise indicated.

2. Fire-Protection Water-Service Piping: Use ductile-iron, push-on-joint pipe and fittings; and gasketed joints.

C. Valve Applications: Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Underground Valves, 4-Inch NPS (DN100) and Larger: UL/FM, gate valves, nonrising stem, with indicator post.
2. Pit Installation Valves, 2-1/2-Inch NPS (DN65) and Larger: UL/FM, OS&Y gate valves.
3. Pit Installation Valves, 2-Inch NPS (DN50) and Smaller: MSS, nonrising-stem gate valves.

D. Joint Construction:
1. Ductile-Iron Piping, Gasketed Joints for Fire-Service Piping: According to UL 194 and AWWA C600.

E. Piping Systems - Common Requirements: Drawings indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated, unless deviations to layout are approved on Working Drawings.

1. Install fittings for changes in direction and branch connections.
2. Piping Connections: Unless otherwise indicated, make piping connections as specified below:

a. Install unions, in piping 2-inch NPS (DN50) and smaller, adjacent to each valve and at final connection to each piece of equipment with 2-inch NPS (DN50) or smaller threaded pipe connection.
b. Install flanges, in piping 2-1/2-inch NPS (DN65) and larger, adjacent to flanged valves and at final connection to each piece of equipment with flanged pipe connection.

F. Extend water-service piping and connect to water-supply source.

G. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.

H. Anchor service-entry piping to building wall.

I. Piping Installation: Install piping according to the following:

1. Water-Main Connection: Tap water main with size and in location as indicated according to requirements of water utility.
2. Make connections larger than 2-inch NPS (DN50) with tapping machine according to manufacturer's written instructions and AWWA C600. Install valve with stem pointing up and with cast-iron valve box.
3. Comply with NFPA 24 for fire-protection water-service piping materials and installation.
4. Install ductile-iron piping according to AWWA C600.
5. Bury piping with depth of cover over top at least 30 inches (750 mm), with top at least 12 inches (300 mm) below level of maximum frost penetration.

J. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:

1. Gasketed-Joint, Ductile-Iron, Potable-Water Piping: According to AWWA C600.
2. Fire-Service Piping: According to NFPA 24.
3. Apply full coat of asphalt or other acceptable corrosion-retarding material to surfaces of installed ferrous anchorage devices.

K. Valve Installation: Use mechanical-joint-end valves for 3-inch NPS (DN80) and larger underground installation. Use threaded- and flanged-end valves for installation in pits. Use nonrising-stem UL/FM gate valves for installation with indicator posts.

1. AWWA-Type Gate Valves: Comply with AWWA C600. Install underground valves with stem pointing up and with cast-iron valve box.
2. UL/FM-Type Gate Valves: Comply with NFPA 24. Install underground valves and valves in pits with stem pointing up and with vertical cast-iron indicator post.

L. Install fire department connections of types and features indicated. See Section 13916 “Fire Suppression Sprinklers”.

M. Install continuous underground plastic detectable type marking tape during back-filling of trench for underground water-service piping. Locate 6 to 8 inches (150 to 200 mm) below finished grade, directly over piping.

N. Conduct piping tests before joints are covered and after thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system.

O. Hydrostatic Tests: Test at 1-1/2 times working pressure for 2 hours. Maximum allowable leakage is 2 quarts (1.89 L) per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within above limits.

P. CLEANING

1. Flush, clean and disinfect fire suppression service piping as follows:

2. Purge new fire suppression service piping systems and parts of existing systems that have been altered, extended, or repaired before use.
3. Use purging and disinfecting procedure prescribed by the Contracting Officer or, if method is not prescribed by The Contracting Officer, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.
4. Use purging and disinfecting procedure prescribed by the Contracting Officer or, if method is not prescribed by the Contracting Officer, use procedure described in AWWA C651 or as described below:

    a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
    b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.
    c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
    d. Submit water samples in sterile bottles to the Contracting Officer. Repeat procedure if biological examination shows evidence of contamination.

Q. Prepare reports of purging and disinfecting activities.

END OF SECTION 02510

SECTION 02511

HOT-MIX ASPHALT PAVING

1.1 GENERAL

A. Submittals: Product Data, material certificates, and the following:

1. Job-Mix Designs: For each job mix proposed for the Work.

B. Installer Qualifications: Engage an experienced installer who has completed hot-mix asphalt paving similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

C. Manufacturer Qualifications: Manufacturer of hot-mix asphalt shall be a registered and approved paving mix manufacturer with authorities having jurisdiction or with the NCDOT.

D. Regulatory Requirements: Conform to applicable standards of authorities having jurisdiction for asphalt paving work on public property.

E. Asphalt-Paving Publication: Comply with AI's "The Asphalt Handbook," except where more stringent requirements are indicated.

F. Environmental Limitations: Do not apply asphalt materials if substrate is wet or excessively damp or if the following conditions are not met:

1. Prime and Tack Coats: Minimum surface temperature of 60 deg F (15.5 deg C).
2. Asphalt Base Course: Minimum surface temperature of 40 deg F (4 deg C) and rising at time of placement.
3. Asphalt Surface Course: Minimum surface temperature of 60 deg F (15.5 deg C) at time of placement.

G. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F (4 deg C) for oil-based materials, 50 deg F (10 deg C) for water-based materials, and not exceeding 95 deg F (35 deg C).

1.2 PRODUCTS

A. Coarse Aggregate: Sound; angular crushed stone; crushed gravel; or properly cured, crushed blast-furnace slag; complying with ASTM D 692.

B. Fine Aggregate: Sharp-edged natural sand or sand prepared from stone; gravel, properly cured blast-furnace slag, or combinations thereof; complying with ASTM D 1073.

C. Mineral Filler: Rock or slag dust, hydraulic cement, or other inert material complying with ASTM D 242.

D. Asphalt Cement: ASTM D 3381 for viscosity-graded material; ASTM D 946 for penetration-graded material.

E. Prime Coat: ASTM D 2027; medium-curing cutback asphalt; MC-30, MC-70, or MC-250.

F. Prime Coat: Asphalt emulsion prime conforming to state DOT requirements.

G. Herbicide: Commercial chemical for weed control, registered by Environmental Protection Agency (EPA). Provide granular, liquid, or wettable powder form.

H. Pavement-Marking Paint: Alkyd-resin type, ready-mixed, complying with FS TT-P-115, Type I, or AASHTO M-248, Type N.

I. Pavement-Marking Paint: Latex, water-base emulsion, ready-mixed, complying with FS TT-P-1952.

J. Hot-Mix Asphalt: Provide dense, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction; designed according to procedures in AI's "Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types"; and complying with the following requirements:

1. Base Course: As indicated.
2. Surface Course: As indicated.

1.3 EXECUTION

A. Proof-roll subbase using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.

1. Before placing asphalt materials, remove loose and deleterious material from substrate surfaces.

B. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions.

C. Prime Coat: Apply uniformly over surface of compacted-aggregate base at a rate of 0.15 to 0.50 gal./sq. yd. (0.7 to 2.3 L/sq. m). Apply enough material to penetrate and seal, but not flood, surface. Allow prime coat to cure for 72 hours minimum.

D. Machine place base and surface courses of hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness, when compacted.

E. Promptly correct surface irregularities in paving course behind paver. Remove excess material and fill depressions with hot-mix asphalt.

F. Construct joints to ensure continuous bond between adjoining paving sections. Construct joints free of depressions with same texture and smoothness as other sections of hot-mix asphalt course.

G. Compact each hot-mix asphalt course to an average density of 96 percent of reference laboratory density according to ASTM D 1559, but not less than 94 percent nor greater than 100 percent, and to the following tolerances:

1. Thickness: Base course, plus or minus 1/2 inch (13 mm); surface course, plus 1/4 inch (6 mm), no minus.
2. Surface Smoothness: Base course, 1/4 inch (6 mm); surface course, 1/8 inch (3 mm).

H. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt compacted by rolling to specified density and surface smoothness.

I. Apply pavement-marking paint with mechanical equipment to produce pavement markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils (0.4 mm).

END OF SECTION 02511

SECTION 02920

LAWNS AND GRASSES

1.1 SUMMARY

A. This Section includes seeding and sodding.

1.2 DEFINITIONS

A. Finish Grade: Elevation of finished surface of planting soil.

B. Manufactured Soil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

C. Planting Soil: Native or imported topsoil, manufactured topsoil, or surface soil modified to become topsoil; mixed with soil amendments.

D. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill immediately beneath planting soil.

1.3 SUBMITTALS

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

B. Planting Schedule: Indicating anticipated planting dates.

1.4 QUALITY ASSURANCE

A. Topsoil Analysis: Furnish soil analysis by a qualified soil-testing laboratory.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Sod: Harvest, deliver, store, and handle sod according to requirements in TPI's "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" in its "Guideline Specifications to Turfgrass Sodding."

1.6 LAWN MAINTENANCE

A. Begin maintenance immediately after each area is planted and continue until acceptable lawn is established, but for not less than the following periods:

1. Seeded Lawns: 60 days from date of Substantial Completion.
2. Sodded Lawns: 30 days from date of Substantial Completion.

B. Mow lawn as soon as top growth is tall enough to cut. Remove no more than 40 percent of grass-leaf growth in initial or subsequent mowings.

1.7 SEED

A. Seed Species: Tall Fescue

1.8 TURFGRASS SOD

A. Turfgrass Sod: Certified, complying with TPI's "Specifications for Turfgrass Sod Materials" in its "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture, strongly rooted, and capable of vigorous growth and development when planted.

B. Turfgrass Species: Tall Fescue

1.9 PLANTING MATERIALS

A. Topsoil: ASTM D 5268, pH range of 5.5 to 7, a minimum of 4 percent organic material content; free of stones 1 inch (25 mm) or larger in any dimension and other extraneous materials harmful to plant growth.

1. Topsoil Source: Reuse surface soil stockpiled on-site and supplement with imported or manufactured topsoil from off-site sources when quantities are insufficient. Verify suitability of stockpiled surface soil to produce topsoil.

B. Fertilizer:

1. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium.

a. Composition: [1 lb/1000 sq. ft. (0.45 kg/92.9 sq. m) of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight] <Insert composition>.

C. Mulches:

1. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

1.10 LAWN PREPARATION

A. Newly Graded Subgrades: Loosen subgrade to a minimum depth of 4 inches. Remove stones larger than 2 inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

1. Apply fertilizer directly to subgrade before loosening.

B. Unchanged Subgrades: If lawns are to be planted in areas unaltered or undisturbed by excavating, grading, or surface soil stripping operations, prepare surface soil as follows:

1. Remove existing grass, vegetation, and turf. Do not mix into surface soil.
2. Loosen surface soil to a depth of at least of 6 inches. Apply soil amendments and fertilizers according to planting soil mix proportions and mix thoroughly into top 4 inches of soil. Till soil to a homogeneous mixture of fine texture.
3. Remove stones larger than 2 inches in any dimension and sticks, roots, trash, and other extraneous matter.
4. Legally dispose of waste material, including grass, vegetation, and turf, off Government property.

C. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1 inch of finish elevation.

D. Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

E. Restore areas if eroded or otherwise disturbed after finish grading and before planting.

1.11 SEEDING SCHEDULE

	Rate	Seeding Dates	
Tall Fescue	100 lb/acre	Fall – Best	Aug. 25 – Sept. 15
		Fall – Possible	Aug. 20 – Oct. 15
		Late Winter	Feb. 15 – Mar. 21
Soil Amendments			
Apply lime (ground agricultural limestone)	4,000 lb/acre		
10-10-10 Fertilizer	1,000 lb/acre		

A. Rake seed lightly into top 1/8 inch of topsoil, roll lightly, and water with fine spray.

B. Protect seeded areas with slopes not exceeding 1:6 by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre to form a continuous blanket 1-1/2 inches in loose depth over seeded areas. Spread by hand, blower, or other suitable equipment.

C. Protect seeded areas from hot, dry weather or drying winds within 24 hours after completing seeding operations. Soak and scatter uniformly to a depth of 3/16 inch and roll to a smooth surface.

1.12 SODDING

A. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.

B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to subgrade or sod during installation. Tamp and roll lightly to ensure contact with subgrade, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.

1. Lay sod across angle of slopes exceeding 1:3.

C. Saturate sod with fine water spray within two hours of planting. During first week, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches below sod.

1.13 SATISFACTORY LAWNS

A. Satisfactory Seeded Lawn: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. (0.92 sq. m) and bare spots not exceeding 5 by 5 inches.

B. Satisfactory Sodded Lawn: At end of maintenance period, a healthy, well-rooted, even-colored, viable lawn has been established, free of weeds, open joints, bare areas, and surface irregularities.

C. Reestablish lawns that do not comply with requirements and continue maintenance until lawns are satisfactory.

END OF SECTION 02920

SECTION 03300

CAST-IN-PLACE CONCRETE

1.1 SUMMARY

A. This Section includes cast-in-place concrete, including reinforcement, concrete materials, mix design, placement procedures, and finishes.

B. See Division 2 Section 2300 "Earthwork" for drainage fill under slabs-on-grade.

1.2 SUBMITTALS

A. Product Data: For each manufactured material and product indicated.

B. Design Mixes: For each concrete mix indicated.

C. Shop Drawings: Include details of steel reinforcement placement including material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports.

D. Material certificates.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.

B. Comply with ACI 301, "Specification for Structural Concrete," including the following, unless modified by the requirements of the Contract Documents.

1. General requirements, including submittals, quality assurance, acceptance of structure, and protection of in-place concrete.
2. Formwork and form accessories.
3. Steel reinforcement and supports.
4. Concrete mixtures.
5. Handling, placing, and constructing concrete.

C. Preinstallation Conference: Conduct conference at Project site.

1.4 MATERIALS

A. Formwork: Furnish formwork and form accessories according to ACI 301.

B. Steel Reinforcement:

1. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

2. Plain-Steel Wire: ASTM A 82, as drawn.
3. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.
4. Deformed-Steel Welded Wire Fabric: ASTM A 497, flat sheet.

C. Concrete Materials:

1. Portland Cement: ASTM C 150, Type I or II or I/II.
2. Normal-Weight Aggregate: ASTM C 33, uniformly graded, not exceeding 1-1/2-inch (38-mm) nominal size.
3. Water: Complying with ASTM C 94.

D. Admixtures:

1. Air-Entraining Admixture: ASTM C 260.
2. Water-Reducing Admixture: ASTM C 494, Type A.
3. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
4. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.
5. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.

E. Vapor Retarder: Multi-ply reinforced polyethylene sheet, ASTM E 1745, Class C, not less than 7.8 mils (0.18 mm) thick; or polyethylene sheet, ASTM D 4397, not less than 10 mils (0.25 mm) thick.

F. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork].

G. Curing Materials:

1. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
2. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf.
3. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
4. Water: Potable.
5. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

1.5 CONCRETE MIXES

A. Comply with ACI 301 requirements for concrete mixtures.

B. Prepare design mixes, proportioned according to ACI 301, for normal-weight concrete determined by either laboratory trial mix or field test data bases, as follows:

1. Compressive Strength (28 Days): As shown on drawings.
2. Slump: 4 inches (100 mm).

a. Slump Limit for Concrete Containing High-Range Water-Reducing Admixture: Not more than 8 inches (200 mm) after adding admixture to plant- or site-verified, 2- to 3-inch (50- to 75-mm) slump.

C. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content of 6.0 percent within a tolerance of plus 1.0 or minus 1.5 percent.

1.6 CONCRETE MIXING

A. Ready-Mixed Concrete: Comply with ASTM C 94.

1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Not allowed.

1.7 INSTALLATION, GENERAL

A. Formwork: Design, construct, erect, shore, brace, and maintain formwork according to ACI 301.

B. Vapor Retarder: Install, protect, and repair vapor-retarder sheets according to ASTM E 1643; place sheets in position with longest dimension parallel with direction of pour.

1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.

C. Steel Reinforcement: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

D. Joints: Construct joints true to line with faces perpendicular to surface plane of concrete.

1. Construction Joints: Locate and install so as not to impair strength or appearance of concrete, at locations indicated or as approved by Architect.
2. Isolation Joints: Install joint-filler strips at junctions with slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

a. Extend joint fillers full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.

3. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:

a. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with groover tool to a radius of 1/8 inch (3 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.
b. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

E. Tolerances: Comply with ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

1.8 CONCRETE PLACEMENT

A. Comply with recommendations in ACI 304R for measuring, mixing, transporting, and placing concrete.

B. Consolidate concrete with mechanical vibrating equipment.

1.9 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defective areas repaired and patched, and fins and other projections exceeding 1/4 inch (6 mm) in height rubbed down or chipped off.

1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Completely remove fins and other projections.

1. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, dampproofing, or painting.
2. Do not apply rubbed finish to smooth-formed finish.
3. Apply smooth-rubbed finish, defined in ACI 301, to smooth-formed finished concrete.

C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

1.10 FINISHING UNFORMED SURFACES

A. General: Comply with ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Screed surfaces with a straightedge and strike off. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane before excess moisture or bleedwater appears on the surface.

1. Do not further disturb surfaces before starting finishing operations.

C. Float Finish: Apply float finish to surfaces indicated, to surfaces to receive trowel finish, and to floor and slab surfaces to be covered with fluid-applied or sheet waterproofing, or built-up or membrane roofing.

D. Trowel Finish: Apply a hard trowel finish to surfaces indicated and to floor and slab surfaces exposed to view or to be covered with resilient flooring, carpet, paint, or another thin film-finish coating system.

E. Trowel and Fine-Broom Finish: Apply a partial trowel finish, stopping after second troweling, to surfaces indicated and to surfaces where ceramic or is to be installed by either thickset or thin-set methods. Immediately after second troweling, and when concrete is still plastic, slightly scarify surface with a fine broom.

F. Nonslip Broom Finish: Apply a nonslip broom finish to surfaces indicated and to exterior concrete platforms, steps, and ramps. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.

1.11 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection, and follow recommendations in ACI 305R for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions occur before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Begin curing after finishing concrete, but not before free water has disappeared from concrete surface.

D. Cure formed and unformed concrete for at least seven days as follows:
1. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
2. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

1.12 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement. Tests will be performed according to ACI 301.

1. Testing Frequency: One composite sample for each day's pour of each concrete mix exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.

END OF SECTION 03300

SECTION 04810

UNIT MASONRY ASSEMBLIES

1.1 GENERAL

A. Submittals: In addition to Product Data, submit the following:
   1. Samples showing the full range of colors and textures available for face brick.
   2. Material Certificates: For each type of masonry unit required.

B. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by another means, as acceptable to authorities having jurisdiction.

C. Cold-Weather Requirements: Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

D. Hot-Weather Requirements: When ambient temperature exceeds 100 deg F (38 deg C), or 90 deg F (32 deg C) with a wind velocity greater than 8 mph (13 km/h), do not spread mortar beds more than 48 in. (1200 mm) ahead of masonry. Set masonry units within one minute of spreading mortar.

1.2 PRODUCTS

A. Color and Texture: As indicated by manufacturer's designations.

B. Concrete Masonry Units: ASTM C 90 and as follows:

   1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi (13.1 MPa).
   2. Weight Classification: Normal weight.
   3. Provide Type II, nonmoisture-controlled units.
   4. Provide special shapes for lintels, corners, jambs, sash, control joints, headers, bonding, and other special conditions.

C. Face Brick: ASTM C 216, Grade MW or SW, Type FBS.
   1. Initial Rate of Absorption: Less than 20 g/30 sq. in. per minute when tested per ASTM C 67.
   2. Efflorescence: When tested per ASTM C 67 and brick is rated "not effloresced."
   3. Size: Match dimensions of existing adjacent face brick.
   4. Color: Match existing adjacent face brick.

D. Mortar and Grout Materials: As follows:

   1. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction.
   2. Hydrated Lime: ASTM C 207, Type S.

3. Mortar Cement: ASTM C 1329.
4. Masonry Cement: ASTM C 91.
5. Aggregate for Mortar: ASTM C 144; except for joints less than 1/4 in. thick, use aggregate graded with 100 percent passing the No. 16 sieve.
6. Aggregate for Grout: ASTM C 404.
7. Epoxy Pointing Mortar: ASTM C 395, epoxy-resin-based material formulated for use as pointing mortar for structural-clay tile facing units.
8. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494, Type C, and recommended by the manufacturer for use in masonry mortar of composition indicated.
9. Water: Potable.

E. Steel Reinforcing Bars: ASTM A 615, Grade 60.

F. Masonry Joint Reinforcement: ASTM A 951; mill galvanized, carbon-steel wire for interior walls and hot-dip galvanized, carbon-steel wire for exterior walls.

1. Wire Size for Side Rods: W1.7 or 0.148-in. diameter.
2. Wire Size for Cross Rods: W1.7 or 0.148-in. diameter.
3. For single-wythe masonry, provide either ladder or truss type with single pair of side rods and cross rods spaced not more than 16 in. o.c.

G. Concealed Flashing: For flashing not exposed to the exterior, use one of the following, unless otherwise indicated:

1. Copper-Laminated Flashing: Manufacturer's standard laminated flashing consisting of 5-oz./sq. ft. sheet copper bonded with asphalt between 2 layers of glass-fiber cloth.

2. Rubberized-Asphalt Flashing: Manufacturer's standard composite flashing product consisting of a pliable and highly adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of 0.030 in.

3. Elastomeric Thermoplastic Flashing: Manufacturer's standard composite flashing product consisting of a polyester-reinforced ethylene interpolymer alloy 0.025 inch thick with a 0.015-in.-thick layer of rubberized-asphalt adhesive.

4. EPDM Flashing: Manufacturer's standard flashing product formed from a terpolymer of ethylene-propylene diene, complying with ASTM D 4637, 0.040 in. thick.

H. Miscellaneous Masonry Accessories: As follows:

1. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; formulated from neoprene, urethane or PVC.
2. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

I. Loose-Granular Fill Insulation: Perlite complying with ASTM C 549, Type II or IV.

J. Masonry Cleaners: As follows:

1. Job-Mixed Detergent Solution: Solution of 1/2-cup dry measure tetrasodium polyphosphate and 1/2-cup dry measure laundry detergent dissolved in 1 gal. of water.

K. Mortar and Grout Mixes: Do not use admixtures, unless otherwise indicated. Do not use calcium chloride in mortar or grout.

1. Mortar for Unit Masonry: Comply with ASTM C 270, Property Specification.

a. Extended-Life Mortar for Unit Masonry: Mortar complying with ASTM C 1142 may be used instead of mortar specified above, at Contractor's option.
b. Limit cementitious materials in mortar to portland cement, mortar cement, and lime.
c. For masonry below grade, in contact with earth, and where indicated, use Type S.
d. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.

2. Grout for Unit Masonry: Comply with ASTM C 476.

a. Use grout of type (fine or coarse) that will comply with Table 5 of ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
b. Provide grout with a slump of 8 to 11 in. as measured according to ASTM C 143.

1.3 EXECUTION

A. Cut masonry units with motor-driven saws. Allow units cut with water-cooled saws to dry before placing, unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

B. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

C. Comply with tolerances in ACI 530.1/ASCE 6/TMS 602 and the following:

1. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/4 inch in 20 feet, nor 1/2 inch maximum.
2. For conspicuous horizontal lines, such as exposed lintels, sills, parapets, and reveals, do not vary from level by more than 1/4 inch in 20 feet, nor 1/2 inch maximum.

D. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns,

and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

E. Bond Pattern for Exposed Masonry: Lay exposed masonry in bond pattern indicated; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

F. Built-in Work: As construction progresses, build in items specified under this and other Sections of the Specifications. Fill in solidly with masonry around built-in items.

G. Fill cores in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

H. Lay hollow masonry units as follows:

1. With full mortar coverage on horizontal and vertical face shells.
2. Bed webs in mortar in starting course on footings and in all courses of piers, columns, and pilasters, and where adjacent to cells or cavities to be filled with grout.
3. For starting course on footings where cells are not grouted, spread out full mortar bed, including areas under cells.

I. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than the joint thickness, unless otherwise indicated.

J. Provide continuous masonry joint reinforcement as indicated. Install with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.

1. Provide continuity at corners and wall intersections by using prefabricated "L" and "T" sections.

K. Provide masonry lintels where shown. Provide precast lintels made from concrete matching concrete masonry units in color, texture, and compressive strength and with reinforcing bars indicated or required to support loads indicated.

L. Embedded Flashing: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

M. Install weep holes in the head joints in exterior wythes of the first course of masonry immediately above embedded flashing.

1. Use round plastic tubing, or open head joints to form weep holes.
2. Space weep holes 16 inches o.c.

N. Temporary Formwork and Shores: Construct formwork and shores to support reinforced masonry elements during construction.

1. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.

O. Placing Reinforcement: Comply with requirements of ACI 530.1/ASCE 6/TMS 602.

P. Grouting: Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.

1. Comply with requirements of ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.

Q. Cleaning: Clean unit masonry as follows:

1. By dry brushing to remove mortar fins and smears before tooling joints, as work progresses.
2. After mortar is thoroughly set and cured, clean exposed masonry as follows:

a. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes.
b. Protect adjacent surfaces from contact with cleaner.
c. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing the surfaces thoroughly with clear water.
d. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2 applicable to type of stain on exposed surfaces.

R. Masonry Waste Disposal: Dispose of clean masonry waste, including broken masonry units, waste mortar, and excess or soil-contaminated sand, by crushing and mixing with fill material as fill is placed.

1. Do not dispose of masonry waste as fill within 18 inches of finished grade.
2. Remove excess, clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off the Government's property.

END OF SECTION 04810

SECTION 05120

STRUCTURAL STEEL

1.1 SUMMARY

A. This Section includes structural steel and architecturally exposed structural steel.

1.2 SUBMITTALS

A. Product Data: For each product indicated.

B. Shop Drawings: Show fabrication of structural-steel components, including connections, splices, holes, welds, and bolts.

C. Welding certificates.

1.3 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator who participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category I, conventional steel structures.

B. Comply with applicable provisions in AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."

C. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."

1.4 STORAGE AND PROTECTION

A. Store steel members off ground and protect steel members and packaged materials from erosion and deterioration.

B. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.

1.5 MATERIALS

A. Structural-Steel Shapes, Plates, and Bars: ASTM A 36/A 36M, carbon steel.

B. Cold-Formed Structural-Steel Tubing: ASTM A 500, Grade B.

C. Anchor Rods: ASTM A 36/A 36M, unheaded rods.

D. Nonhigh-Strength Bolts, Nuts, and Washers: ASTM A 307, Grade A (ASTM F 568, Property Class 4.6); carbon-steel, hex-head bolts; carbon-steel nuts; and flat, unhardened steel washers, uncoated.

E. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy hex steel structural bolts, heavy hex carbon-steel nuts, and hardened carbon-steel washers, uncoated.

F. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer.

G. Nonmetallic, Shrinkage-Resistant Grout: Premixed, ASTM C 1107, of consistency suitable for application.

1.6 FABRICATION

A. Fabricate and assemble structural steel in shop to greatest extent possible. Fabricate structural steel according to AISC specifications referenced in this Section and in Shop Drawings.

1. Comply with fabrication tolerance limits in AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel and architectural exposed structural steel.
2. Shop install and tighten nonhigh-strength bolts, except where high-strength bolts are indicated.
3. Shop install and tighten high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
4. Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.

B. Shop Priming: Shop prime steel, except surfaces embedded in concrete or mortar, surfaces to be field welded, surfaces to be high-strength bolted with slip-critical connections, and surfaces to receive sprayed-on fireproofing.

1. Surface Preparation: SSPC-SP 6, "Commercial Blast Cleaning."
2. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1.7 SOURCE QUALITY CONTROL

A. Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and to prepare test reports. Comply with Part 3, Paragraph 3.2 "Field Quality Control" Article.

1.8 ERECTION

A. Examination: Verify elevations of concrete and masonry bearing surfaces and locations of anchorages for compliance with requirements.

B. Erect structural steel accurately in locations and to elevations indicated and according to AISC specifications referenced in this Section.

C. Base and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen surfaces before setting base and bearing plates. Clean bottom surface of base and bearing plates and set on wedges, shims, or setting nuts as required.

   1. Tighten anchor bolts, cut off wedges or shims flush with edge of base or bearing plate, and pack grout solidly between bearing surfaces and plates.

D. Maintain erection tolerances of structural steel and architecturally exposed structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

E. Install and tighten non-high-strength bolts, except where high-strength bolts are indicated.

F. Install and tighten high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

G. Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.

1.9 FIELD QUALITY CONTROL

A. Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and to prepare test reports.

   1. Correct deficiencies in or remove and replace structural steel that test reports and inspections indicate do not comply with specified requirements.
   2. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.
   3. High-strength bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
   4. In addition to visual inspection, welded connections will be tested and inspected according to AWS D1.1 procedures.

END OF SECTION 05120

SECTION 05521

PIPE AND TUBE RAILINGS

1.1 SUMMARY

A. This Section includes pipe and tube handrails and railings made of the following:

1. Stainless steel.

1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance of Handrails and Railings:

1. Comply with ASTM E 985, based on testing per ASTM E 894 and ASTM E 935.
2. Capable of withstanding structural loads required by ASCE 7 without exceeding allowable design working stresses of materials involved.
3. Capable of withstanding the following structural loads without exceeding the allowable design working stress of materials involved:

a. Top Rail of Guards: Concentrated load of 200 lbf (890 N) applied at any point and in any direction, and a uniform load of 50 lbf/ft. (730 N/m) applied horizontally and concurrently with uniform load of 100 lbf/ft. (1460 N/m) applied vertically downward. Concentrated and uniform loads need not be assumed to act concurrently.

1.3 SUBMITTALS

A. Shop Drawings: Include plans, elevations, sections, details of installation, attachments to other Work.

1.4 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Stainless-Steel Pipe and Tube Railings:

a. Alumaguard.
b. Architectural Art Mfg., Inc.
c. Stainless Fabricators, Inc.

1.5 METALS

A. Stainless Steel:

1. Tubing: ASTM A 554, Grade MT [304] [316L].
2. Pipe: ASTM A 312/A 312M, Grade TP [304] [316L].
3. Plate: ASTM A 666, Type [304] [316L].
4. Castings: ASTM A 743/A 743M, Grade [CF 8 or CF 20] [CF 8M or CF 3M].

1.6 MISCELLANEOUS MATERIALS

A. Welding Electrodes and Filler Metal: Provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

B. Fasteners: Same basic metal as fastened metal; concealed, unless otherwise indicated or unavoidable, and standard with systems indicated.

C. Anchors: Fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined per ASTM E 488.

D. Shop Primers: Provide primers to comply with applicable requirements in Division 9 Section 09900 "Painting."

E. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements in FS TT-P-664; with good resistance to corrosion; and compatible with finish paint systems indicated.

F. Shop Primer for Galvanized Steel: SSPC-Paint 5, zinc-dust, zinc-oxide primer formulated for priming zinc-coated steel and for compatibility with finish paint systems indicated.

1.7 FINISHES

A. Stainless Steel:

1. 180-Grit Polished Finish: Oil-ground, uniform, textured finish.

1.8 INSTALLATION

A. General: Perform cutting, drilling, and fitting required to install handrails and railings. Set units accurately in location, alignment, and elevation.

1. Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
3. Align rails so variations from level for horizontal members and from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (5 mm in 3 m).

B. For CMU walls, use toggle anchors to attach handrails.

END OF SECTION 05521

SECTION 06105

MISCELLANEOUS CARPENTRY

1.1 GENERAL

A. Submittals:

1. Product Data: For wood-preservative and fire-retardant treatment from chemical treatment manufacturers and certification by treating plants that treated materials comply with requirements.

1.2 PRODUCTS

A. Lumber, General: DOC PS 20 and applicable rules of lumber grading agencies certified by the American Lumber Standards Committee Board of Review. Factory mark each piece of lumber with grade stamp of grading agency.

1. For exposed lumber, mark grade stamp on end or back of each piece.
2. Provide dressed lumber, S4S, unless otherwise indicated.
3. Provide dry lumber with 19 percent maximum moisture content at time of dressing for 2-inch nominal (38-mm actual) thickness or less, unless otherwise indicated.

B. Wood-Preservative-Treated Materials: AWPA C2 (lumber) and AWPA C9 (plywood), except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX).

1. Kiln-dry material after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
2. Mark each treated item with the treatment quality mark of an inspection agency approved by the American Lumber Standards Committee Board of Review.
3. Application: Treat items indicated on Drawings, and the following:

a. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
b. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
c. Wood framing members less than 18 inches (460 mm) above grade.
d. Wood floor plates that are installed over concrete slabs directly in contact with earth.

C. Fire-Retardant-Treated Materials: Where fire-retardant-treated materials are indicated, provide materials that comply with performance requirements in AWPA C20 (lumber) and AWPA C27 (plywood). Identify fire-retardant-treated wood with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.

1. Use Exterior type for exterior locations and where indicated.
2. Use Interior Type A High Temperature (HT), unless otherwise indicated.

D. Provide miscellaneous lumber for support or attachment of other construction.

1. For items of dimension lumber size, provide Construction, Stud, or No. 2 grade lumber with 19 percent maximum moisture content of any species.
2. For exposed boards, provide lumber, with 15 percent maximum moisture content, of eastern white pine, Idaho white, lodgepole, ponderosa, or sugar pine; Finish or 1 Common (Colonial) grade; NELMA, NLGA, WCLIB, or WWPA.
3. For concealed boards, provide lumber with 19 percent maximum moisture content and any of the following species and grades:

   a. Mixed southern pine, No. 2 grade; SPIB.
   b. Eastern softwoods, No. 2 Common grade; NELMA.
   c. Northern species, No. 2 Common grade; NLGA.
   d. Western woods, Construction or No. 2 Common grade; WCLIB or WWPA.

E. Miscellaneous Concealed Plywood: Exterior sheathing, span rating to suit framing in each location, and thickness as indicated but not less than 1/2 inch (13 mm).

F. Miscellaneous Concealed Oriented Strand Board: Exposure 1 sheathing, span rating to suit framing in each location, and thickness as indicated but not less than 1/2 inch (13 mm).

G. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2 inch (12.7 mm) thick.

H. Fasteners: Provide fasteners of size and type indicated.

1. Where carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
2. Power-Driven Fasteners: CABO NER-272.
3. Screws for Fastening to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings.

1.3 EXECUTION

A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

B. Securely attach carpentry work as indicated and according to applicable codes and recognized standards.

C. Countersink fastener heads on exposed carpentry work and fill holes with wood filler.

D. Wood Structural Panels: Comply with applicable recommendations contained in APA Form No. E30K, "APA Design/Construction Guide: Residential & Commercial," for types of structural-use panels and applications indicated.

E. Wood Trim Installation: Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Cope at returns and miter at corners to produce tight-fitting joints. Use scarf joints for end-to-end joints.

1. Install to tolerance of 1/8 inch in 96 inches (3 mm in 2438 mm) for level and plumb. Install adjoining finish carpentry with 1/32-inch (0.8-mm) maximum offset for flush installation and 1/16-inch (1.6-mm) maximum offset for reveal installation.

END OF SECTION 06105

SECTION 06402

INTERIOR ARCHITECTURAL WOODWORK

1.1 GENERAL

A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips, unless concealed within other construction before woodwork installation.

B. Submittals: In addition to Product Data, submit the following:

1. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
2. Samples of plastic-laminate-clad panel products, for each type, color, pattern, and surface finish.

C. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork, construction, finishes, and other requirements.

1. Provide AWI Quality Certification Program certificate indicating that woodwork complies with requirements of grades specified.

D. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

1.2 PRODUCTS

A. Wood for transparent finish: Red Oak, plain sawn or sliced.

B. Wood Products: Comply with the following:

1. Hardboard: AHA A135.4.
2. Medium-Density Fiberboard: ANSI A208.2, Grade MD.
3. Softwood Plywood: DOC PS 1, Medium Density Overlay.
4. Hardwood Plywood and Face Veneers: HPVA HP-1.

C. High-Pressure Decorative Laminate: NEMA LD 3.

D. Fire-Retardant-Treated Lumber and Plywood: Materials impregnated with fire-retardant chemical formulations to comply with AWPA C20 (lumber) and AWPA C27 (plywood), Exterior Type or Interior Type A. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Kiln-dry material after treatment.

E. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.

F. Fabrication, General: Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible, before shipment to Project site. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1. Interior Woodwork Grade: Provide Custom grade interior woodwork complying with the referenced quality standard.
2. Shop cut openings to maximum extent possible. Sand edges of cutouts to remove splinters and burrs.
3. Seal edges of openings in countertops with a coat of varnish.

G. Wood Cabinets for Transparent Finish:

1. AWI Type of Cabinet Construction: As indicated.
2. Reveal Dimension: As indicated.
3. Grain Matching: As indicated.
4. Matching of Veneer Leaves: Random Match.
5. Veneer Matching within Panel Face: Running match.
6. Semiexposed Surfaces: Thermoset decorative overlay.

H. Plastic-Laminate Countertops: As follows:

1. High-Pressure Decorative Laminate Grade: HGS.
2. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
   a. Provide Contracting Officer or authorized representative selections from manufacturer's full range of colors and finishes for selection.

3. Edge Treatment: As indicated.
4. Core Material at Sinks: Particleboard made with exterior glue, medium-density fiberboard made with exterior glue, or exterior-grade plywood.

I. Finish architectural woodwork at fabrication shop. Defer only final touchup, cleaning, and polishing until after installation.

J. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to back of paneling.

K. Transparent Finish: Comply with requirements indicated below for grade, finish system, staining, and sheen, with sheen measured on 60-degree gloss meter per ASTM D 523:

1. Grade: Custom.
2. AWI Finish System: TR-6, catalyzed polyurethane.
3. Staining: None required.
4. Wash Coat for Stained Finish: Apply a vinyl wash coat to woodwork made from closed-grain wood before staining and finishing.
5. Open-Grain Woods: Do not apply filler to open grain woods.
6. Sheen: Semigloss, 55-75 gloss units.

1.3 EXECUTION

A. Condition woodwork to average prevailing humidity conditions in installation areas and examine and complete work as required, including removal of packing and backpriming before installation.

B. Quality Standard: Install woodwork to comply with AWI Section 1700 for the same grade specified in this Section for type of woodwork involved.

C. Install woodwork level, plumb, true, and straight to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm). Shim as required with concealed shims.

D. Scribe and cut woodwork to fit adjoining work, and refinish cut surfaces and repair damaged finish at cuts.

E. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation.

   1. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches (400 mm) o.c..

G. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop. Caulk space between backsplash and wall with sealant specified in Division 7 Section 07920 "Joint Sealants."

END OF SECTION 06402

SECTION 07210

BUILDING INSULATION

1.1 SUMMARY

A. This Section includes the following:

1. Insulation under slabs-on-grade.

1.2 SUBMITTALS

A. Product Data: For each product indicated.

1.3 INSULATING MATERIALS

A. General: Provide insulating materials that comply with requirements and with referenced standards and, for preformed units, in sizes to fit applications indicated, selected from manufacturer's standard thicknesses, widths, and lengths.

B. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, 1.60 lb/cu. ft. (26 kg/cu. m), with maximum flame-spread and smoke-developed indices of 75 and 450, respectively.

1.4 AUXILIARY INSULATING MATERIALS

A. Protection Board: Premolded, semirigid asphalt/fiber composition board, 1/4 inch (6 mm) thick, formed under heat and pressure, of standard sizes.

1.5 INSTALLATION

A. General: Install insulation to comply with insulation manufacturer's written instructions applicable to products and application indicated. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

B. Install perimeter insulation on vertical surfaces by setting units in adhesive.

1. If not otherwise indicated, extend insulation a minimum of 24 inches (610 mm) below exterior grade line.
2. Protect below-grade insulation on vertical surfaces from damage during backfilling by applying protection board set in adhesive.

C. Protect top surface of perimeter under slab insulation from damage during concrete work by applying protection board.

END OF SECTION 07210

SECTION 07610

STANDING SEAM METAL ROOFING

1.1 GENERAL

A. System Description:

1. Concentrated Load Capacity: Withstand load of 250 lbs. applied to four-inch by four-inch square area located in center of panel between stiffener ribs without buckling of ribs or permanent panel distortion.

2. Water Penetration (Dynamic Pressure): No uncontrolled water penetration, other than condensation, when tested in compliance with ASTM E1646 at minimum differential pressure of 20 percent of inward acting, wind load design pressure of 6.24 psf and not more than 12 psf.

3. Air Infiltration: Provide preformed roof panel assemblies with permanent resistance to air leakage through assembly of not more than 0.09 cfm/sq. ft of fixed roof area when tested according to ASTM E1680 at static air pressure difference of 4.0 lbf/sq. ft.

4. Capacities for gauge, span or loading other than those tested may be determined by interpolation of test results within range of test data. Extrapolation for conditions outside test range is not acceptable.

1.2 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM):
1. A792-93a Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process, General Requirements.
2. D1056-91 Flexible Cellular Materials – Sponge or Expanded Rubber.
3. E1592-94 Test Method for Structural Performance of Sheet Metal Roofing and Siding Systems by Uniform Air Pressure Difference.
4. E1646-95 Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference.
5. E1680-95 Test Method for Rate of Air Leakage through Exterior Metal Roof Panel Systems.

B. Architectural Aluminum Manufacturers Association (AAMA):
1. 501-83 Methods of Test for Metal Curtain Walls.
2. 605.2-92 Voluntary Specification for High Performance Organic Coatings on Architectural Extrusions and Panels.

C. American Society of Civil Engineers (ASCE):
1. 7-95 Minimum Design Loads for Buildings and Other Structures.

D. National Roofing Contractors Association (NRCA):

1. The NRCA Construction Details – Third Edition.

E. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA):
   1. Architectural Sheet Metal Manual, Fifth Edition, 1993.

1.3 SUBMITTALS

A. Product Data: Include manufacturer's detailed material and system description, installation instructions, and engineering performance data and finish specifications.

B. Shop Drawings: Show roofing system with flashings and accessories in plan and elevation; sections and all details at full scale. Include metal thicknesses and finishes, panel lengths, joining details, anchorage details, flashings and special fabrication provisions for termination and penetrations; girt locations expansion provisions and special supports. Indicate relationships with adjacent and interfacing work.

C. Samples:
   1. Panel section, minimum 2'-0" in length by full width, indicating thickness, profile, texture and color.
   2. Submit samples of panel clips, closures, insulation and accessory items.

1.4 QUALITY ASSURANCE

A. Fabricator/Installer Qualifications:
   1. Installer trained and approved by system manufacturer, with trained supervisory personnel observing and directing work.
   2. If required, proposed fabricator/installer shall submit work and proof of adequate financial responsibility. The Contracting Officer or authorized representative reserves the right to inspect fabrication facilities in determining qualifications.

B. Fire-Test-Response Characteristics: Where fire-resistance-rated roof panel assemblies are indicated, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

C. Preinstallation Conference; Prior to beginning metal roofing work, preroofing conference will be held to review work to be accomplished.
   1. Contractor, Contracting Officer or authorized representative, metal roofing subcontractor, metal roofing system manufacturer's representative and all other subcontractors who have equipment penetrating roof or whose work involves access to roof shall be present.
   2. Contractor shall notify the Contracting Officer or authorized representative and other attending parties' at a minimum of three days prior to time for conference.
   3. Contractor shall record minutes of meeting and shall distribute copies of minutes to attending parties.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect components during fabrication, shipment, storage, handling, and erection from mechanical abuse, stains, discoloration, and corrosion.

B. Maintain strippable plastic protective film on finished surfaces until panel is erected.

C. Store materials off ground, adequately shored, and under cover and protected from wind movement, foreign material contamination, mechanical damage, cement, lime, or other corrosive substances.

D. Handle materials to prevent damage to surfaces, edges and ends of roofing sheets and sheet metal items. Damaged material shall be rejected and removed from site.

E. Protect panels from wind related damages during erection.

F. Inspect materials upon delivery. Reject and remove from site physically damaged or marred material.

1.6 WARRANTY

A. Endorse and Forward to Government Following Warranties:
   1. Manufacturer's twenty-year warranty covering replacement of defective materials, structural defects and corrosion.
   2. Applicator's five year finish warranty covering refinishing of fluoropolymer coating due to checking, crazing, peeling, chalking or fading.
   3. Installer's five-year warranty covering roofing system installation and watertightness.
   4. All warranties shall commence on Date of Completion.

1.7 ACCEPTABLE MANUFACTURERS

A. Manufacturer and Type: Berridge Manufacturers (or approved equal) "Cee-Lock", prefinished 24 "galvalume" standing seam metal roofing system in color to match Petersen's Aluminum "Dark Bronze".

B. Other Acceptable Manufacturers (or approved equal):
   1. Berridge Manufacturing Co.
   2. Carlisle Engineered Metals
   3. Merchant & Evans, Inc.
   4. Smith-Steelite, Inc.
   5. Zip-Rib, Inc.

1.8 METAL ROOFING SYSTEM

A. Materials:
   1. Panel Material: ASTM A792, 24 gauge, prefinished "Galvalume" sheet comprised of 55% aluminum, 1.6% silicon and the balance zinc.
   2. Flashing and Flat Stock Material: 24 gauge thickness galvalume of same type and finish as panels.

3. Finish on Exposed Surfaces: Two coat shop-applied, baked on fluoropolymer coating system based on Elf Arochem “Kynar 500” resin or Ausimont “Hylar 5000” resin (Polyvinylidene fluoride, PVDF), formulated by licensed manufacturer and applied by manufacturer’s approved applicator to meet AAMA Publication 605.2.
    a. Coating System: Minimum 1.3 mil dry film thickness consisting of 0.3 (+ 0.1) mil primer, minimum 1.0 mil color coat. Both color coat and clear top coat containing minimum 70% polyvinylidene fluoride resin by weight; complying with AAMA 1402, Test Method No. 7.
    b. Color: Custom to match Petersen Aluminum “Dark Bronze”.
4. Finish on Unexposed Interior Face: Neutral wash coat.
5. Protective Surfacing: Provide strippable plastic film covering on finish surfaces to prevent abrasion during fabrication, storage and handling.

B. Characteristics:
1. Configuration: Standing seams incorporating mechanically interlocked, concealed anchor clips allowing thermal movement, and of configuration which will prevent entrance or passage of water.
2. Seam Height: 1-1/2 inch minimum.
3. Panel Width: 16-1/2” o.c. between standing seams.
4. Panel Surface: Smooth.
5. Stiffener Ribs: 3/8-inch maximum , spaced 4-inches to 6-inches o.c., parallel to seams.
6. Panel Length: Full length without joints, including bends, where applicable.
7. Seam Cap: Provide shop fabricated cap for seams where cut for bends. Cap shall match seam, with mitered and sealed bend.
8. Replaceability: Individual panels shall be removable for replacement without removing adjacent panels.

C. Accessories:
1. Anchor Clips: 18 gauge domestic galvanized steel, 33 ksi yield strength, double strength, double fastener with UL imprint, designed to receive recessed mechanical anchor into decking or structural support elements, girts or blocking. Clips shall allow free thermal expansion and contraction movement, relative to structure, within full temperature ranges specified.
2. Anchors: Noncorrosive cadmium plated hardened self-drilling hexagonal head steel screws designed to meet structural loading requirements.
3. Exposed Fasteners: Stainless steel self-tapping hexagonal head screws with neoprene sealing washers. #14 size minimum, head finished to match panel color.
4. Closures: Factory pre-cut closed cell foam complying with ASTM D1056, Grade SCE-41 (EPT), and field fabricated PVC hip closures, enclosed in metal channel matching panels when used at hip and ridge.
5. Provide all miscellaneous accessories for complete installation. All accessories shall be furnished by roofing system manufacturer.
6. Roof Insulation Board: Unfaced, Flexible Glass-Fiber Board Insulation: ASTM C 612, TYPE IA; ASTM C 553, Types I, II, and III; or ASTM C 665, Type I; with maximum flame-spread and smoke-developed indices of 25 and 50, respectively; and of the following properties:
    a. Nominal density of 1.0 lb/cu. Ft. (16 kg/cu. M), thermal resistivity of 3.7 deg F x h x sq. ft./Btu x in. at 75 deg F (25.7 K x m/W at 24 deg C).

b. Combustion Characteristics: Passes ASTM E 136.

1.9 FABRICATION

A. Prefabricate metal roof panels and flashing components to maximum extent possible, forming metal work with clear, sharp, straight and uniform bends and arrises. Hem exposed edges of flashings.

B. Form flashing components from full single width sheet. Provide shop fabricated, mitered corners, joined using closed end pop rivets and joint sealant.

C. Fabricate roofing and related sheet metal work in compliance with approved shop drawings and applicable standards. Form sheet metal work with clear, sharp, and uniform arrises. Hem exposed edges.

D. Make joints in aluminum sheets using flat-lock seams, ¾-inch in width. Fill seams with exterior sealant.

E. Provide linear sheet metal items in minimum 10’-0” sections except as otherwise noted. Form flashing using single pieces for full width. Provide shop fabricated, mitered joints and corners, with minimum 2’-0” long legs.

F. Clips:
   1. Provide UL listed clip designed to allow panels to thermally expand and contract.
   2. Fabricate clips with embossings that raise underside of panels above substrate to create positive ventilation and eliminate underside-condensation and corrosion.
   3. Fabricate clips with structurally embossed outstanding legs to prevent distortion due to wind uplift forces.

1.10 DECK PREPARATION

A. Install one layer of gypsum roof deck board and insulation board to metal deck with approved noncorrosive mechanical fasteners.

B. Butt gypsum roof deck board and insulation board ends and sides together. Lay so end joints occur over crests of steel roof deck with end joints staggered 2 feet in adjacent rows.

C. Apply one layer of 30# felt over plywood and gypsum board deck substrates with horizontal overlaps and end laps staggered between layers.
   1. Lay felt parallel to ridge line with 2-1/2-inch horizontal laps and 6-inch vertical laps.

1.11 ROOFING AND FLASHING INSTALLATION

A. Inspection: Examine alignment and placement of building structure before proceeding with installation of preformed standing seam metal roofing.

B. Install roofing and flashings in compliance with approved shop drawings and within specified erection tolerances.

C. Isolate dissimilar metals and masonry or concrete from metals with bituminous paint, tape, or flexible flashing specified in Section 07600. Use gasketed fasteners where required to prevent corrosive action between fastener, substrate and panels.

D. Use exposed fasteners, prefinished to match finish of panels and trim. Limit exposed fasteners to extent indicated on shop drawings.

E. Anchorage shall allow for temperature expansion/contraction movement within specified range without stress or elongation of panels, clips or anchors. Attach clips to purlins, sleepers or track using self-drilling screws of size and spacing as determined by manufacturer's design analysis to resist specified uplift and thermal movement forces.

F. Seal laps and joints in compliance with roofing system manufacturer's product data.

G. Coordinate flashing and sheet metal work to provide weathertight conditions at roof terminations. Fabricate and install in compliance with standards of SMACNA "Architectural Sheet Metal Manual" and NRCA "Construction Details" using continuous cleats at all exposed edges.

H. Provide for temperature expansion/contraction movement of panels at roof penetrations and roof mounted equipment as recommended by system manufacturer.

I. Installed system shall be true to line and plane and free of dents, oilcans and physical defects.

J. Form joints in linear sheet metal to allow for ½-inch minimum expansion at 12'-0" o.c. maximum and 2'-0" from corners. Provide 1'-0" wide back-up plate at intersections. Form plates to profile of sheet metal item.

K. At joints in linear sheet metal items, set sheet metal over back-up plate in two beads of butyl sealant, ¼-inch in diameter, minimum. Extend sealant over all metal surfaces. Accurately mate components for positive seal. Allow no sealant to migrate onto exposed surfaces.

L. Remove damaged work and replace with new, undamaged components.

M. Applicable Erection Tolerances: Maximum variation from true planes and lines: ¼-inch in 20'-0", 3/8-inch in 40'-0" or more.

1.12 CLEANING

A. Remove protective film and clean exposed surfaces of preformed roofing and accessories after completion of installation. Leave in clean condition at Date of Completion. Touch up minor abrasions and scratches in finish to satisfaction of the Contracting Officer or authorized representative.

END OF SECTION 07610

SECTION 07841

THROUGH-PENETRATION FIRESTOP SYSTEMS

1.1 GENERAL

A. Performance Requirements: Provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly penetrated.

1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, as determined per ASTM E 814, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
2. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings, as determined per ASTM E 814, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:

    a. Penetrations located outside wall cavities.
    b. Penetrations located outside fire-resistive shaft enclosures.
    c. Penetrations located in construction containing fire-protection-rated openings.
    d. Penetrating items larger than 4-inch- (100-mm-) diameter nominal pipe or 16 sq. in. (100 sq. cm) in overall cross-sectional area.

3. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that after curing do not deteriorate when exposed to these conditions both during and after construction.

    a. For piping penetrations for wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
    b. For floor penetrations with annular spaces exceeding 4 inches (100 mm) in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved either by installing floor plates or by other means.

4. For through-penetration firestop systems exposed to view, provide products with flame-spread ratings of less than 25 and smoke-developed ratings of less than 450, as determined per ASTM E 84.

B. Submittals: In addition to Product Data for each type of product specified, submit the following:

1. Shop Drawings: For each through-penetration firestop system, show each kind of construction condition penetrated, relationships to adjoining construction, and kind of penetrating item. Include firestop design designation of testing and inspecting agency acceptable to authorities having jurisdiction.

2. Product Certificates: Signed by manufacturers of through-penetration firestop system products certifying that products furnished comply with requirements.
3. Product Test Reports: From a qualified testing agency indicating through-penetration firestop system complies with requirements, based on comprehensive testing of current products.

C. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in "Performance Requirements" Paragraph:

1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL or another agency performing testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.
2. Through-penetration firestop systems are identical to those tested per ASTM E 814 and bear classification marking of qualified testing and inspecting agency.

1.2 PRODUCTS

A. Products: Subject to compliance with requirements, provide one of the through-penetration firestop systems indicated for each application that are produced by one of the following manufacturers:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following (or approved equal):

1. DAP Inc.
2. Firestop Systems Inc.
3. Hilti Construction Chemicals, Inc.
4. RectorSeal Corporation (The).
5. 3M Fire Protection Products.
6. Tremco.
7. United States Gypsum Company.

C. Firestopping, General: Provide through-penetration firestop systems that are compatible with one another, with the substrates forming openings, and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.

D. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with "Performance Requirements" Paragraph. Use only components specified by through-penetration firestop system manufacturer and approved by the qualified testing and inspecting agency for firestop systems indicated. Accessories include, but are not limited to, the following items:

1. Permanent forming/damming/backing materials.
2. Temporary forming materials.
3. Substrate primers.

4. Collars.
5. Steel sleeves.

E. General: Provide through-penetration firestop systems containing the types of fill materials indicated in the Through-Penetration Firestop System Schedule at the end of this Section by reference to the types of materials described below. Fill materials are those referred to in directories of the referenced testing and inspecting agencies as fill, void, or cavity materials.

1. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.
2. Latex Sealants: Single-component latex formulations that after cure do not re-emulsify during exposure to moisture.
3. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
4. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized steel sheet.
5. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.
6. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
7. Mortars: Prepackaged, dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.
8. Silicone Sealants: Moisture-curing, single-component, silicone-based, neutral-curing elastomeric sealants.

1.3 EXECUTION

A. General: Install through-penetration firestop systems to comply with "Performance Requirements" Paragraph and firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

C. Identify through-penetration firestop systems with pressure-sensitive, self-adhesive, preprinted vinyl labels. Attach labels permanently to surfaces of penetrated construction on both sides of each firestop system installation where labels will be visible to anyone seeking to remove penetrating items or firestop systems. Include the following information on labels:

1. The words: "Warning--Through-Penetration Firestop System--Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Through-penetration firestop system designation of applicable testing and inspecting agency.

4. Date of installation.
5. Through-penetration firestop system manufacturer's name.
6. Installer's name.

END OF SECTION 07841

SECTION 07920

JOINT SEALANTS

1.1 GENERAL

A. Preconstruction Joint-Sealant-Substrate Tests: Submit substrate materials, representative of actual joint surfaces, to joint sealant manufacturer for laboratory testing of joint sealants for adhesion to primed and unprimed substrates and for compatibility with joint substrates and other joint-related materials.

B. Submittals: In addition to Product Data, submit the following:

1. Samples of each type and color of joint sealant required.
2. Test reports for joint sealants evidencing compliance with requirements.

1.2 PRODUCTS

A. Elastomeric Sealant Manufacturers: Subject to compliance with requirements, provide sealants by one of the following (or approved equal):

1. Silicone Sealants:

a. Dow Corning.
b. GE Silicones.
c. NUCO Industries, Inc.
d. Sonneborn Building Products Div., ChemRex Inc.
e. Tremco.

2. Urethane Sealants:

a. Polymeric Systems, Inc.
b. Sonneborn Building Products Div., ChemRex Inc.
c. Tremco.

B. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by testing and field experience.

C. Colors: Provide colors indicated for exposed joint sealants or, if not indicated, as selected by the Contracting Officer or authorized representative from manufacturer's full range for this characteristic.

D. Elastomeric Sealant Standard: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant of base polymer specified below:

1. Low-Modulus Neutral-Curing Silicone Sealant: Type S, Grade NS, Class 25, and as follows:

    a. Uses NT, G, A, and O.
    b. Additional capability, when tested per ASTM C 719, to withstand the following percentage changes in joint width and still comply with other requirements of ASTM C 920:

        1) 100 percent movement in extension and 50 percent movement in compression for a total of 150 percent movement.

    c. Applications: Window and door frames, thresholds and lintels.

2. Medium-Modulus Neutral-Curing Silicone Sealant: Type S; Grade NS; Class 25; with the additional capability, when tested per ASTM C 719, to withstand 50 percent movement in both extension and compression for a total of 100 percent movement and still comply with other requirements of ASTM C 920; and as follows:

    a. Uses NT, M, G, A, and O.
    b. Application: Glazing.

3. High-Modulus Neutral-Curing Silicone Sealant: Type S; Grade NS; Class 25; and as follows:

    a. Uses NT, M, G, A, and O.
    b. Applications: Galvanized steel and miscellaneous aluminum flashing.

4. Mildew-Resistant Silicone Sealant: Type S; Grade NS; Class 25; Uses NT, G, A, and O; formulated with fungicide; intended for sealing interior joints with nonporous substrates exposed to high humidity and temperature extremes.

5. Single-Component Nonsag Urethane Sealant: Type S; Grade NS; and as follows:

    a. Class 25.
    b. Uses NT, M, A, and O.
    c. Applications: Exterior masonry joints.

E. Latex Sealant: ASTM C 834.

F. Acoustical Sealant for Exposed and Concealed Joints: Nonsag, paintable, nonstaining latex sealant complying with ASTM C 834.

G. Acoustical Sealant for Concealed Joints: Nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission.

H. Sealant Backings, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

I. Cylindrical Sealant Backings: ASTM C 1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

1. Type O: Open-cell material.

J. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F (minus 32 deg C).

K. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint.

L. Primer: As recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated.

1.3 EXECUTION

A. General: Comply with joint sealant manufacturer's instructions for products and applications indicated.

B. Sealant Installation Standard: Comply with ASTM C 1193.

C. Acoustical Sealant Application Standard: Comply with ASTM C 919 for use of joint sealants in acoustical applications.

END OF SECTION 07920

SECTION 08110

STEEL DOORS AND FRAMES

1.1 GENERAL

A. Submittals:

1. Product Data and Shop Drawings for each type of door and frame indicated.
2. Door Schedule using same reference designations indicated on Drawings in preparing schedule for doors and frames.

B. Quality Assurance:

1. Comply with ANSI A 250.8, unless more stringent requirements are indicated.

1.2 PRODUCTS

A. Materials:

1. Hot-Rolled Steel Sheets: ASTM A 569/A 569M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
2. Cold-Rolled Steel Sheets: ASTM A 366/A 366M, Commercial Steel (CS), or ASTM A 620/A 620M, Drawing Steel (DS), Type B; stretcher-leveled standard of flatness.
3. Metallic-Coated Steel Sheets: ASTM A 653/A 653M, Commercial Steel (CS), Type B, with A40 (ZF120) zinc-iron-alloy (galvannealed) coating; stretcher-leveled standard of flatness.
4. Electrolytic Zinc-Coated Steel Sheets: ASTM A 591/A 591M, Commercial Steel (CS), Class B coating; mill phosphatized; suitable for unexposed applications; stretcher-leveled standard of flatness where used for face sheets.

B. Interior Doors: Complying with ANSI 250.8 for level and model and ANSI A250.4 for physical-endurance level indicated.

1. Level 2 and Physical Performance Level B, Model 1 (Full Flush)

C. Exterior Doors: Doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:

1. Level 3 and Physical Performance Level A, Model 1 (Full Flush).

D. Frames: Provide steel frames that comply with ANSI A250.8 and with steel sheet thickness as indicated for door level selected below:

1. For Level 2 steel doors, 0.053 inch (1.3 mm).
2. For Level 3 steel doors, 0.067 inch (1.7 mm).

3. Door Silencers: Three silencers on single-door frames and two silencers on double-door frames.
4. Supports and Anchors: Not less than 0.042-inch- (1.0-mm-) thick, zinc-coated steel sheet.
5. Wall Anchors in Masonry Construction: 0.177-inch- (4.5-mm-) diameter, steel wire complying with ASTM A 510 (ASTM A 510M) may be used in place of steel sheet.
6. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Where zinc-coated items are to be built into exterior walls, comply with ASTM A 153/A 153M, Class C or D as applicable.

E. Fabricate steel door and frame units to comply with ANSI A250.8 and to be free from defects including warp and buckle. Where practical, fit and assemble units in manufacturer's plant.

1. Exterior Doors and Frames: Fabricate from metallic-coated steel sheet. Close top and bottom edges of doors flush.
2. Interior Door Faces: Fabricate exposed faces of doors from cold-rolled steel sheet.
3. Core Construction: Manufacturer's standard core construction that produces a door complying with SDI standards.
4. Tolerances: Comply with SDI 117.
5. Prepare doors and frames to receive hardware. Reinforce doors and frames to receive surface-applied hardware. Comply with applicable requirements in ANSI A250.6 and ANSI A115 Series specifications for door and frame preparation for hardware.
6. Fabricate frames with mitered or coped and continuously welded corners and seamless face joints. Provide temporary spreader bars.
7. Provide nonremovable glazing stops on outside of exterior doors and on secure side of interior doors for glass, louvers, and other panels in doors.
8. Provide screw-applied, removable, glazing stops on inside of glass, louvers, and other panels in doors.

F. Prime Finish: Manufacturer's standard, factory-applied coat of rust-inhibiting primer complying with ANSI A250.10 for acceptance criteria.

1.3 EXECUTION

A. Install doors and frames according to Shop Drawings and manufacturer's data.

1. Frames: Install steel frames for doors and other openings, of size and profile indicated.

a. Provide at least three wall anchors per jamb. For openings 90 inches (2286 mm) or more in height, install an additional anchor at hinge and strike jambs.
b. Placing Frames: Comply with provisions in SDI 105, unless otherwise indicated. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is

completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.

1) At existing concrete or masonry construction, set frames and secure in place with machine screws and masonry anchorage devices.

2. Doors: Install to comply with ANSI A250.8. Shim as necessary to comply with SDI 122 and ANSI/DHI A115.1G. Fit non-fire-rated doors accurately in their respective frames, with the following clearances:

   a. Jambs and Head: 1/8 inch (3.2 mm).
   b. Meeting Edges, Pairs of Doors: 1/4 inch (6.4 mm).
   c. Bottom: 3/4 inch (19 mm).

B. Adjusting and Cleaning:

1. Prime-Coat Touchup: Sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer.
2. Protection Removal: Immediately before final inspection, remove protective wrappings from doors and frames.

END OF SECTION 08110

SECTION 08211

FLUSH WOOD DOORS

1.1 GENERAL

A. Submittals:

1. Product Data: For each type of door. Include factory-finishing specifications.
2. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details; location and extent of hardware blocking; mortises, holes, and cutouts; fire ratings; and other pertinent data.

B. Quality Standard: Comply with NWWDA I.S.1-A, "Architectural Wood Flush Doors."

1.2 PRODUCTS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following (or approved equal):

1. Algoma Hardwoods Inc.
2. Eggers Industries; Architectural Door Division.
3. Mohawk Flush Doors, Inc.
4. Weyerhaeuser Company.

B. Doors for Transparent Finish:

1. Grade: Custom, with Grade A faces.
2. Species and Cut: White Birch, rotary sliced.
3. Match between Veneer Leaves: Book match.
4. Assembly of Veneer Leaves on Door Faces: Balance match.
5. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.

C. Interior Veneer-Faced, Solid-Core Doors:

1. Core: Particleboard.
2. Construction: Five or seven plies with stiles and rails bonded to core, then entire unit abrasive planed before veneering.

D. Provide doors with either glued-block or structural composite lumber cores instead of particleboard cores at locations where exit devices are indicated.

E. Fabricate doors in sizes indicated for Project-site fitting.

F. Factory machine doors for hardware that is not surface applied.

1. Metal Astragals: Premachine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

G. Factory Finishing: Finish doors at factory.

1. Finish: Manufacturer's standard transparent finish.
2. Staining: As selected by Contracting Officer or authorized representative from manufacturer's full range.
3. Sheen: Semigloss.

1.3 EXECUTION

A. Manufacturer's Written Instructions: Install doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated.

B. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal cut surfaces after fitting and machining.

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

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

END OF SECTION 08211

SECTION 08410

ALUMINUM ENTRANCES AND STOREFRONTS

1.1 GENERAL

A. This Section includes the following:

1. Exterior entrance systems.

B. System Description: Provide aluminum entrance and storefront systems capable of withstanding loads and thermal and structural movement requirements indicated without failure, based on testing manufacturer's standard units in assemblies similar to those indicated for this Project. Failure includes air infiltration and water penetration exceeding specified limits; and framing members transferring stresses, including those caused by thermal and structural movement, to glazing units.

C. Glazing: Physically and thermally isolate glazing from framing members.

D. Thermally Broken Construction: Provide systems that isolate aluminum exposed to exterior from aluminum exposed to interior with a material of low thermal conductance.

E. Wind Loads: Provide entrance and storefront systems, including anchorage, capable of withstanding wind-load design pressures calculated according to requirements of authorities having jurisdiction or the American Society of Civil Engineers' ASCE 7, "Minimum Design Loads for Buildings and Other Structures," 6.4.2, "Analytical Procedure," whichever are more stringent.

1. Deflection of framing members in a direction normal to wall plane is limited to 1/175 of clear span or 3/4 inch (19 mm), whichever is smaller, unless otherwise indicated.
2. Static-Pressure Test Performance: Provide entrance and storefront systems that do not evidence material failures, structural distress, failure of operating components to function normally, or permanent deformation of main framing members exceeding 0.2 percent of clear span when tested according to ASTM E 330.

a. Test Pressure: 150 percent of inward and outward wind-load design pressures.
b. Duration: As required by design wind velocity; fastest 1 mile (1.609 km) of wind for relevant exposure category.

F. Dead Loads: Provide entrance- and storefront-system members that do not deflect an amount which will reduce glazing bite below 75 percent of design dimension when carrying full dead load. Provide a minimum 1/8-inch (3.18-mm) clearance between members and top of glazing or other fixed part immediately below. Provide a minimum 1/16-inch (1.59-mm) clearance between members and operable windows and doors.

G. Air Infiltration: Provide entrance and storefront systems with permanent resistance to air leakage through fixed glazing and frame areas of not more than 0.06 cfm/sq. ft. (0.3 L/s/sq. m) of fixed wall area when tested according to ASTM E 283 at a static-air-pressure difference of 1.57 lbf/sq. ft. (75.2 Pa).

H. Water Penetration: Provide entrance and storefront systems that do not evidence water leakage through fixed glazing and frame areas when tested according to ASTM E 331 at minimum differential pressure of 20 percent of inward-acting wind-load design pressure as defined by ASCE 7, "Minimum Design Loads for Buildings and Other Structures," but not less than 6.24 lbf/sq. ft. (299 Pa).

I. Thermal Movements: Provide entrance and storefront systems, including anchorage, that accommodate thermal movements of systems and supporting elements resulting from the following maximum change (range) in ambient and surface temperatures without buckling, damaging stresses on glazing, failure of joint sealants, damaging loads on fasteners, failure of doors or other operating units to function properly, and other detrimental effects.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

J. Condensation Resistance: Provide storefront systems with condensation resistance factor (CRF) of not less than 45 when tested according to AAMA 1503.1.

K. Average Thermal Conductance: Provide storefront systems with average U-values of not more than 0.63 Btu/sq. ft. x h x deg F (3.57 W/sq. m x K) when tested according to AAMA 1503.1.

L. Submittals: Product Data for each product specified and the following:

1. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components, provisions for expansion and contraction, and attachments to other work.

   a. For entrance systems, include hardware schedule and indicate operating hardware types, quantities, and locations.

2. Samples for Verification: Of each type of exposed finish required in manufacturer's standard sizes. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected.
3. Product Test Reports: Based on evaluation of tests performed by manufacturer and witnessed by a qualified independent testing agency, indicate compliance of entrance and storefront systems with requirements based on comprehensive testing of current systems.

M. Installer Qualifications: Engage an experienced installer to perform work of this Section who has specialized in installing entrance and storefront systems similar to those required for this Project and who is acceptable to manufacturer.

N. Product Options: Drawings indicate size, profiles, and dimensional requirements of entrance and storefront systems and are based on the specific systems indicated. Other manufacturers' systems with equal performance characteristics may be considered.

O. Welding Standards: Comply with applicable provisions of AWS D1.2, "Structural Welding Code--Aluminum."

1.2 PRODUCTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following (or approved equal):

1. Butler Manufacturing Company; Vistawall Architectural Products.
2. EFCO Corporation.
3. Kawneer Company, Inc.
4. YKK AP America Inc.

B. Materials: As follows:

1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated, complying with the requirements of standards indicated below.

   a. Sheet and Plate: ASTM B 209 (ASTM B 209M).
   b. Extruded Bars, Rods, Shapes, and Tubes: ASTM B 221 (ASTM B 221M).
   c. Extruded Structural Pipe and Tubes: ASTM B 429.
   d. Bars, Rods, and Wire: ASTM B 211 (ASTM B 211M).
   e. Welding Rods and Bare Electrodes: AWS A5.10.

2. Steel Reinforcement: Complying with ASTM A 36 (ASTM A 36M) for structural shapes, plates, and bars; ASTM A 611 for cold-rolled sheet and strip; or ASTM A 570 (ASTM A 570M) for hot-rolled sheet and strip.
3. Glazing as specified in Division 8 Section 08800 "Glazing."
4. Glazing Gaskets: Manufacturer's standard pressure-glazing system of black, resilient glazing gaskets, setting blocks, and shims or spacers, fabricated from an elastomer of type and in hardness recommended by system and gasket manufacturer to comply with system performance requirements. Provide gasket assemblies that have corners sealed with sealant recommended by gasket manufacturer.
5. Framing system gaskets, sealants, and joint fillers as recommended by manufacturer for joint type.
6. Sealants and joint fillers for joints at perimeter of entrance and storefront systems as specified in Division 7 Section 07920 "Joint Sealants."
7. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements, except containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.

C. Components: As follows:

1. Doors: Provide manufacturer's standard 1-3/4-inch- (44.5-mm-) thick glazed doors with minimum 0.125-inch- (3.2-mm-) thick, extruded tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deep penetration and fillet welded or that incorporate concealed tie-rods. Provide manufacturer's standard snap-on extruded-aluminum glazing stops and preformed gaskets.
   a. Stile Design: Medium stile; 3-1/2-inch (88.9-mm) nominal width.
2. Brackets and Reinforcements: Provide manufacturer's standard brackets and reinforcements that are compatible with adjacent materials. Provide nonstaining, nonferrous shims for aligning system components.
3. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
   a. Reinforce members as required to retain fastener threads.
   b. Do not use exposed fasteners, except for hardware application. For hardware application, use countersunk Phillips flat-head machine screws finished to match framing members or hardware being fastened, unless otherwise indicated.
4. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123 or ASTM A 153 requirements.
5. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing, compatible with adjacent materials, and of type recommended by manufacturer.
6. Weather Stripping: Manufacturer's standard replaceable weather stripping.

D. Hardware: Provide heavy-duty hardware units indicated in sizes, number, and type recommended by manufacturer for entrances indicated. Finish exposed parts to match door finish, unless otherwise indicated.
1. Ball-Bearing Butts: ANSI/BHMA A156.1, Grade 1, 5-knuckle, 4-1/2-by-4-inch (101.6-by-114.3-mm) ball-bearing butts. Provide nonremovable pins at offset pivots exposed to door outside and provide nonferrous pivots for applications exposed to weather. Provide 3 pivots at each leaf for doors up to 36 inches (914 mm) wide and 80 inches (2032 mm) tall; provide 4 pivots at each leaf for taller doors.
2. Closers, General: Comply with manufacturer's recommendations for closer size, depending on door size, exposure to weather, and anticipated frequency of use.
   a. Closing Cycle: Comply with requirements of authorities having jurisdiction or the Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG)," whichever are more stringent.
   b. Opening Force: Comply with requirements of authorities having jurisdiction or the Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG)," whichever are more stringent.
3. Surface-Mounted Overhead Closers: ANSI/BHMA A156.4, Grade 1. Provide cover and the following:
   a. Mounting: Parallel arm.
   b. Hold Open: Automatic, at angle selected by Contracting Officer or authorized representative from manufacturer's standard options.
   c. Back Check: Adjustable.

4. Door Stops: ANSI/BHMA A156.16, Grade 1, floor- or wall-mounted door stop, as appropriate for door location indicated, with integral rubber bumper.
5. Cylinders: As specified in Division 8 Section 08711 “Door Hardware”.
6. Cylinder Guard: Manufacturer's standard hardened-steel security ring with retainer plate for inside stile wall that protects lock cylinder from removal by wrenches, prying, or sawing.
7. Lockset Faceplates: Manufacturer's standard extruded-aluminum faceplate for lock type indicated that lays flush with door stile.
   a. Provide radiused faceplate with weather sweep extending full length of lock at meeting stiles of pairs of doors.
8. Vertical-Rod Exit Devices: Concealed, vertical-rod exit device complying with UL 305 requirements, with 2-point top and bottom latching that is released by a full-width crash bar or when locked down (dogged) by lock cylinder or retracting screws beneath housing.
9. Pull Handles: As selected by Contracting Officer or authorized representative from manufacturer's full range of pull handles and plates.
10. Push Bars: As selected by Contracting Officer or authorized representative from manufacturer's full range of full-door-width, single-bar push bars.
11. Thresholds: At exterior doors, provide manufacturer's standard threshold with cutouts coordinated for operating hardware, with anchors and jamb clips, and not more than 1/2-inch- (12.7-mm-) high, with beveled edges providing a floor level change with a slope of not more than 1:2, and in the following material:
    a. Material: Aluminum, mill finish.
12. Weather Sweeps: Manufacturer's standard weather sweep for application to exterior door bottoms and with concealed fasteners on mounting strips.

E. Fabrication: Fabricate components that, when assembled, will have accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

1. Forming: Form shapes with sharp profiles, straight and free of defects or deformations, before finishing.
2. Prepare components to receive concealed fasteners and anchor and connection devices.
3. Fabricate components to drain water passing joints and condensation and moisture occurring or migrating within the system to the exterior.
4. Welding: Weld components to comply with referenced AWS standard. Weld before finishing components to greatest extent possible. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
5. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
6. Storefront: Fabricate framing in profiles indicated for flush glazing (without projecting stops). Provide subframes and reinforcing of types indicated or, if not indicated, as required for a complete system. Factory assemble components to

greatest extent possible. Disassemble components only as necessary for shipment and installation.

7. Entrances: Fabricate door framing in profiles indicated. Reinforce as required to support imposed loads. Factory assemble door and frame units and factory install hardware to greatest extent possible. Reinforce door and frame units as required for installing hardware indicated. Cut, drill, and tap for factory-installed hardware before finishing components.

    a. Exterior Doors: Provide compression weather stripping at fixed stops. At other locations, provide sliding weather stripping retained in adjustable strip mortised into door edge.
    b. Interior Doors: Provide ANSI/BHMA A156.16 silencers at stops to prevent metal to metal contact. Provide 3 silencers on strike jamb of single-door frames and 2 silencers on head of double-door frames.

F. Aluminum Finishes: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.

1. Class I, Color Anodic Finish: AA-M12C22A42/A44 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 606.1 or AAMA 608.1.

    a. Color: Dark bronze.

G. Steel Priming: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying primer. Perform manufacturer's standard cleaning operations to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel. Apply manufacturer's standard corrosion-resistant primer immediately after surface preparation and pretreatment.

1.3 EXECUTION

A. Installation, General: Comply with manufacturer's written instructions for protecting, handling, and installing entrance and storefront systems. Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure nonmovement joints. Seal joints watertight.

B. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints and condensation and moisture occurring or migrating within the system to the exterior.

D. Set continuous sill members and flashing in a full sealant bed to provide weathertight construction, unless otherwise indicated. Comply with requirements of Division 7 Section 07920 "Joint Sealants."

E. Install framing components plumb and true in alignment with established lines and grades without warp or rack of framing members.

F. Install entrances plumb and true in alignment with established lines and grades without warp or rack. Lubricate operating hardware and other moving parts according to hardware manufacturers' written instructions.

1. Install surface-mounted hardware according to manufacturer's written instructions using concealed fasteners to greatest extent possible.

G. Install glazing to comply with requirements of Division 8 Section 08800 "Glazing," unless otherwise indicated.

H. Install perimeter sealant to comply with requirements of Division 7 Section 07920 "Joint Sealants," unless otherwise indicated.

I. Erection Tolerances: Install entrance and storefront systems to comply with the following maximum tolerances:

1. Variation from Plane: Limit variation from plane or location shown to 1/8 inch in 12 feet (3 mm in 3.7 m); 1/4 inch (6 mm) over total length.
2. Alignment: Where surfaces abut in line, limit offset from true alignment to 1/16 inch (1.5 mm). Where surfaces meet at corners, limit offset from true alignment to 1/32 inch (0.8 mm).
3. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch (3 mm).

J. Adjust doors and hardware to provide tight fit at contact points and weather stripping, smooth operation, and weathertight closure.

K. Remove excess sealant and glazing compounds, and dirt from surfaces.

END OF SECTION 08410

SECTION 08520

ALUMINUM WINDOWS

1.1 GENERAL

A. This Section includes single-hung aluminum windows of the performance class indicated.

B. Performance Requirements: Provide windows engineered, fabricated, and installed to withstand normal thermal movement, wind loading, and impact loading without failure, as demonstrated by testing manufacturer's standard window assemblies representing types, grades, classes, and sizes required for Project according to test methods indicated.

C. Testing shall demonstrate compliance with requirements indicated in AAMA 101 for air infiltration, water penetration, and structural performance for type, grade, and performance class of windows required. Where required design pressure exceeds the minimum for the specified window grade, comply with AAMA 101, Section 3, "Optional Performance Classes."

D. Submittals: Submit the following:

1. Product Data for each type of window required, including construction details and fabrication methods; profiles and dimensions of individual components; data on hardware, accessories, and finishes. Include recommendations for maintaining and cleaning exterior surfaces.
2. Shop Drawings showing fabrication and installation of each type of window required. Include layout and installation details, elevations at 1/4 inch = 1 foot (1:50) scale, typical window unit elevations at 3/4 inch = 1 foot (1:20) scale, and full-size section details of typical composite members.

E. Product Options: The Drawings indicate sizes, profiles, dimensional requirements, and aesthetic effects of aluminum windows and are based on the specific window types and models indicated. Other aluminum window manufacturers whose products have equal performance characteristics may be considered provided deviations in size, profile, and dimensions are minor and do not alter the aesthetic effect.

1.2 PRODUCTS

A. Aluminum Extrusions: Alloy and temper recommended for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi (150-MPa) ultimate tensile strength and not less than 0.062 inch (1.6 mm) thick at any location for main frame and sash members.

B. Fasteners: Aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted to be noncorrosive and compatible with window members, trim, hardware, anchors, and other components.

1. Where fasteners screw anchor into aluminum less than 0.125 inch (3.2 mm) thick, reinforce interior with aluminum or nonmagnetic stainless steel to receive screw threads or provide standard, noncorrosive, pressed-in, splined grommet nuts.
2. Except for application of hardware, do not use exposed fasteners. For application of hardware, use fasteners that match finish of member or hardware being fastened, as appropriate.

C. Anchors, Clips, and Window Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel complying with ASTM B 633 and of sufficient strength to withstand design pressure indicated.

D. Fixed Windows: Comply with requirements of AAMA Performance Class HC.

E. Operable Windows: Comply with requirements of AAMA Performance Class HC.

F. Fabrication: Window units to comply with indicated standards. Include a complete system for assembly of components and anchorage of window units. Provide units that are reglazable without dismantling sash or ventilator framing.

G. Thermally Improved Construction: Fabricate window units with an integral, concealed, low-conductance, thermal barrier, between exterior materials and window members exposed on interior, in a manner that eliminates direct metal-to-metal contact.

1. Weep holes and internal passages to conduct infiltrating water to exterior.
2. Glazing Stops: Screw-applied or snap-on glazing stops. Finish to match windows.

H. Preglazed Fabrication: Preglaze window units where possible and practical. Comply with glass and glazing requirements of Division 8 Section 08800 "Glazing" of these Specifications and AAMA 101.

I. Finishes: Comply with NAAMM "Metal Finishes Manual." Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.

J. Class I, Color Anodic Finish: AA-M12C22A42/A44.

1. Color: Match existing.

1.3 EXECUTION

A. Inspection: Inspect openings before installation. Verify that rough opening is correct and sill plate is level.

B. Installation: Comply with manufacturer's recommendations for installing window units, hardware, operators, and other components. Set windows plumb, level, and true to line, without warp or rack of frames or sash. Anchor securely in place.

1. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action.

C. Set sill members and other members in a bed of sealant or with joint fillers or gaskets to provide weathertight construction. Coordinate installation with wall flashings and other components of the Work.

D. Clean aluminum promptly after installing windows. Avoid damage to finishes. Remove excess glazing and sealant compounds, dirt, and other substances. Lubricate hardware and other moving parts.

E. Clean glass of preglazed units promptly after installing windows.

F. Protect installed aluminum windows to ensure that they are without damage or deterioration at the time of Completion.

END OF SECTION 08520

SECTION 08711

DOOR HARDWARE (SCHEDULED BY NAMING PRODUCTS)

1.1 GENERAL

A. Submittals: In addition to Product Data for each item specified, submit the following:
   1. Door Hardware Schedule: Organize into door hardware sets indicating type, style, function, size, label, hand, manufacturer, fasteners, location, and finish of each door hardware item.

B. Supplier Qualifications: Door hardware supplier who is or employs a qualified DHI Architectural Hardware Consultant.

C. Templates: Obtain and distribute templates for doors, frames, and other work specified to be factory prepared for installing door hardware.

1.2 PRODUCTS

A. Scheduled Door Hardware: Provide door hardware for each door to comply with requirements in this Section and door hardware sets indicated in door and frame schedule.

   1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and products equivalent in function and comparable in quality to named products.
   2. Designations: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

B. Standards: Comply with BHMA A156 series standards, Grade 1, unless Grade 2 is indicated.

C. Certified Products: Provide door hardware that is listed in one of BHMA's directories of certified products.

D. Hinges and Pivots: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.

   1. Hinge Base Metal: Unless otherwise indicated, provide the following:

      a. Exterior Hinges: Stainless steel, with stainless-steel pin.
      b. Interior Hinges: Stainless steel, with stainless-steel pin.
      c. Hinges for Fire-Rated Assemblies: Stainless steel, with stainless-steel pin.

   2. Nonremovable Pins: Provide set screw in hinge barrel that prevents removal of pin while door is closed; for outswinging exterior doors and outswinging corridor doors with locks.
   3. Machine Screws: For metal doors and frames. Install into drilled and tapped holes.

4. Wood Screws: For wood doors and frames.
5. Threaded-to-the-Head Wood Screws: For fire-rated wood doors.
6. Screws: Phillips flat-head screws. Finish screw heads to match surface of hinges.

E. Locks and Latches: As follows:

1. Provide the lockset design designated below:

a. Bored Locks: Best; 9K Series, 14L (or approved equal).

2. Dummy Trim: Match lever lock trim and escutcheons.
3. Lock Throw: Comply with labeled fire door requirements.
4. Backset: 2-3/4 inches (70 mm), unless otherwise indicated.

F. Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver, and complying with the following:

1. Number of Pins: Seven.
2. High-Security Grade: BHMA Grade 1A, listed and labeled as complying with UL 437 (Suffix A).
3. Manufacturer: Same manufacturer as for locks and latches.
4. Permanent Cores: Manufacturer's standard; finish face to match lockset; removable cores.
5. Construction Master Keys: Provide cylinders with feature that permits voiding of construction keys without cylinder removal. Provide 10 construction master keys.
6. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

a. Replace construction cores with permanent cores, as directed by Contracting Officer or authorized representative .

G. Keying System: Coordinate with Contracting Officer or authorized representative.

1. Keys: Provide nickel-silver keys permanently inscribed with a visual key control number and "DO NOT DUPLICATE" notation. In addition to one extra blank key for each lock, provide three change keys and five master keys.

H. Strikes: Manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set.

I. Closers: Comply with the following:

1. Size of Units: Factory sized, adjustable to meet field conditions and requirements for opening force.

J. Protective Trim Units: Furnish protection plates sized 1-1/2 inches (38 mm) less than door width on push side and 1/2 inch (13 mm) less than door width on pull side, by height specified in Door Hardware Schedule. Fasten with exposed machine or self-tapping screws.

K. Floor Stops: For doors, unless wall or other type stops are scheduled or indicated. Do not mount floor stops where they will impede traffic. Where floor or wall stops are not appropriate, provide overhead holders.

L. Door Gasketing: Provide continuous weather-strip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated or scheduled. Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

1. Air Leakage: Not to exceed 0.50 cfm per foot (0.000774 cu. m/s per m) of crack length for gasketing other than for smoke control, as tested according to ASTM E 283.
2. Gasketing Materials: Comply with ASTM D 2000 and AAMA 701/702.

M. Fabrication: As follows:

1. Base Metals: Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18 for finishes. Do not furnish manufacturer's standard materials if different from specified standard.
2. Fasteners: Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated. Provide steel machine or wood screws or steel through bolts for fire-rated applications.
3. Spacers or Hex Bolts: For through bolting of hollow metal doors.
4. Fasteners for Wood Doors: Comply with requirements of DHI WDHS.2, "Recommended Fasteners for Wood Doors."

1.3 EXECUTION

A. Examine doors and frames for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

B. Steel Door and Frame Preparation: Comply with DHI A115 series. Drill and tap doors and frames for surface-applied hardware according to SDI 107.

C. Wood Door Preparation: Comply with DHI A115-W series.

D. Mounting Heights: Comply with DHI requirements, unless otherwise indicated.

E. Installation: Comply with manufacturer's written instructions. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

1. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section 07920 "Joint Sealants."

F. Adjust and check each operating item of door hardware and each door to ensure proper operation or function. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with accessibility requirements. Clean operating items as necessary to restore proper function and finish.

G. Door Hardware Schedule: Provide products indicated (or approved equal) as follows:

1. Hardware Set No. 1
   a. 1-1/2 pair butts: Hager, Full Mortise BB1191, 4-1/2x4-1/2.
   b. 1 Exit Device: Von Duprin 98L.
   c. 1 Cylinder: Best, 7-pin, compatible with exit device.
   d. 1 Closer: Parallel arm, LCN, 1460 series.
   e. 1 Kickplate: 8” high.
   f. 1 set Weatherstripping: Reese, DS75D.
   g. 1 Sill Sweep: Reese, 362D.
   h. 1 Threshold: Reese, S475A.

2. Hardware Set No. 2
   a. 1-1/2 pair butts: Hager, Full Mortise BB1191, 4-1/2x4-1/2.
   b. 1 Lockset: Best, 9K Series, 14L, FW-Dormitory.
   c. 3 Silencers: Ives, 20.

3. Hardware Set No. 3
   a. 1-1/2 pair butts: Hager, Full Mortise BB1191, 4-1/2x4-1/2.
   b. 1 Push: Hager 30S, 4” x 16”
   c. 1 Pull: Hager, 34G, 4” x 16” Plate
   d. 1 Closer: Parallel arm, LCN, 1460 series.
   e. 1 Kickplate: 8” High.
   f. 3 Silencers: Ives, 20.
   g. 1 Stop.

4. Hardware Set No. 4
   a. 3 pair butts: Hager, Full Mortise BB1191, 4-1/2x4-1/2.
   b. 1 Lockset: Best 9K Series 14L, FW- Dormitory.
   c. Provide N-Passage function.
   d. 3 Silencers: Ives 20.
   e. 1 Stop.

5. Hardware Set No. 5
   a. 1-1/2 pair butts: Hager, Full Mortise BB1191, 4-1/2x4-1/2.
   b. 1 Exit Device: Von Duprin 98L.
   c. 3 Silencers: Ives 20.
   d. 1 Stop.
   e. Closer: Parallel arm LCW 1460 series.

6. Hardware Set No. 6
   a. 1-1/2 pair butts: Hager, Full Mortise BB1191, 4-1/2x4-1/2.
   b. 1 Lockset: Best, 9K Series, 14L, AB-Entrance.
   c. 1 Closer: Parallel arm, LCN, 1460 series.
   d. 1 set Weatherstripping: Reese, DS75D.

e. 1 Sill Sweep: Reese, 362D.
f. 1 Threshold: Reese, S475A.
g. 1 Stop.

7. Hardware Set No. 7
   a. 3 pair butts: Hager, Full Mortise BB1191, 4-1/2x4-1/2.
   b. 1 Lockset: Best, 9K Series, 14L, AB-Entrance.
   c. 2 Closers: Parallel arm, LCN, 1460 series.
   d. 2 sets Weatherstripping: Reese, DS75D.
   e. 2 Sill Sweeps: Reese, 362D.
   f. 2 Thresholds: Reese, S475A.
   g. 2 Stops.

8. Hardware Set No. 8
   a. 1-1/2 pair butts: Hager, Full Mortise BB1191, 4-1/2x4-1/2.
   b. 1 Cylinder: Best, 7-pin, compatible with exit device.
   c. 1 Closer: Parallel arm, LCN, 1460 series.
   d. 1 Kickplate: 8” high.

END OF SECTION 08711

SECTION 08800

GLAZING

1.1 GENERAL

A. Performance Requirements: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction. Windows and glazed doors to meet glazing requirements per UCF 4-010-01.

1. Glass Design: Glass thicknesses indicated are minimums and are for detailing only. Provide glass lites for various size openings in nominal thicknesses indicated, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:

a. Glass Thicknesses: Select minimum glass thicknesses to comply with UCF 4-010-01 & ASTM E 1300, according to the following requirements:

1) Use a minimum of ¼ inch (6 mm) nominal laminated glass for all exterior windows and glazed doors. The ¼ inch (6 mm) laminated glass consists of two nominal 1/8 inch (3 mm) glass panes bonded together with a minimum of a 0.030 inch (0.75 mm) polyvinyl-butyral (PVB) interlayer. For insulated glass units, use ¼ inch (6 mm) laminated glass inner pane as a minimum.

2) Specified Design Wind Loads: Determine design wind loads applicable to Project from basic wind speed indicated in miles per hour (meters per second) at 33 feet (10 m) above grade, according to ASCE 7, Section 6.4.2, based on mean roof heights above grade indicated on Drawings.

2. Thermal and Optical Performance Properties: As determined according to procedures indicated below:

a. Center-of-Glass U-Values: NFRC 100 methodology using LBL-35298 WINDOW 4.1 computer program, expressed as Btu/sq. ft. x h x deg F (W/sq. m x K).

b. Center-of-Glass Solar Heat Gain Coefficient: NFRC 200 methodology using LBL-35298 WINDOW 4.1 computer program.

c. Solar Optical Properties: NFRC 300.

B. Submittals: In addition to Product Data for each glass product and glazing material, submit the following:

1. Preconstruction Adhesion and Compatibility Test Report: From glazing sealant manufacturer indicating glazing sealants were tested for adhesion to glass and

glazing channel substrates and for compatibility with glass and other glazing materials.

C. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201 and ANSI Z97.1.

D. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. SIGMA Publications: SIGMA TM-3000, "Vertical Glazing Guidelines," and SIGMA TB-3001, "Sloped Glazing Guidelines."

E. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the following inspecting and testing agency:

1. Insulating Glass Certification Council.
2. Associated Laboratories, Inc.
3. National Accreditation and Management Institute.

1.2 PRODUCTS

A. Float Glass: ASTM C 1036, Type I, Quality q3; class as indicated in schedules.

B. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality q3; class, kind, and condition as indicated in schedules.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated.
2. Fabrication Process: By vertical (tong-held) or horizontal (roller-hearth) process, at manufacturer's option, except provide horizontal process where indicated as tongless or free of tong marks.

C. Pyrolytic-Coated Float Glass: With solar-reflective metallic-oxide coating applied by pyrolytic deposition process during initial manufacture, complying with requirements specified in schedules.

D. Insulating-Glass Units: Preassembled units consisting of dual-sealed lites of glass separated by a dehydrated interspace, and complying with ASTM E 774 for Class CBA units and with requirements specified in the Insulating-Glass Schedule.

E. Elastomeric Glazing Sealants: Products complying with ASTM C 920 and other requirements specified in the Glazing Sealant Schedule, in colors indicated, compatible with one another and with other materials they will contact.

F. Back-Bedding Mastic Glazing Tape: Preformed, butyl-based elastomeric tape; with or without spacer rod as recommended in writing by tape and glass manufacturers for

application indicated; complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 804.3 tape, where indicated.
2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

G. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned gaskets of material indicated below; complying with ASTM C 509, Type II, black; and of profile and hardness required to maintain watertight seal:

1. Neoprene.
2. EPDM.
3. Silicone.
4. Thermoplastic polyolefin rubber.
5. Any material indicated above.

H. Miscellaneous Glazing Materials: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

I. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing standard, to comply with system performance requirements.

1.3 EXECUTION

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation.

C. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

D. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

E. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter.

F. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents, and vandalism, during construction period.

G. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Completion. Wash glass as recommended by glass manufacturer.

1.4 GLASS SCHEDULE

A. Low-E Insulating Glass IG-[1]:

1. Overall Unit Thickness and Thickness of Each Lite: 25 and 6 mm.

2. Indoor Lite: Type I (transparent glass, flat), Class 1 (clear) float glass.

a. Kind FT (fully tempered as required by code to be fully tempered).

3. Outdoor Lite: Type I (transparent glass, flat) float glass.

a. Class 1 (clear).

b. Kind FT (fully tempered as required by code to be fully tempered).

4. Low-Emissivity Coating: Pyrolytic on third surface.

END OF SECTION 08800

SECTION 09260

GYPSUM BOARD ASSEMBLIES

1.1 GENERAL

A. Submittals: Product Data for each type of product indicated.

B. Fire-Test-Response Characteristics: For gypsum board assemblies with fire-resistance ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

1.2 PRODUCTS

A. Steel Partition and Soffit Framing: Comply with ASTM C 754 for conditions indicated.

1. Steel Sheet Components: Complying with ASTM C 645 requirements for metal and with manufacturer's standard corrosion-resistant zinc coating.
2. Steel Studs and Runners: ASTM C 645, in depth indicated.

a. Minimum Base Metal Thickness: 0.027 inch (0.7 mm).

3. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

a. Minimum Base Metal Thickness: 0.027 inch (0.7 mm).

4. Cold-Rolled Channel Bridging: 0.0538-inch (1.37-mm) bare steel thickness, with minimum 1/2-inch- (12.7-mm-) wide flange, and in depth indicated.

a. Clip Angle: 1-1/2 by 1-1/2 inch (38.1 by 38.1 mm), 0.068-inch- (1.73-mm-) thick, galvanized steel.

5. Hat-Shaped, Rigid Furring Channels: ASTM C 645, in depth indicated.

a. Minimum Base Metal Thickness: 0.0179 inch (0.45 mm).

6. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Panel Size, General: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.

C. Gypsum Wallboard: ASTM C 36.

1. Regular Type: In thickness indicated and with long edges tapered.
2. Type X: In thickness indicated and with long edges tapered.

D. Sag-Resistant Gypsum Wallboard: ASTM C 36, manufactured to have more sag resistance than regular-type gypsum board, 1/2-inch (12.7-mm) thick, and with long edges tapered. Apply on ceiling surfaces.

E. Interior Trim: ASTM C 1047.

1. Cornerbead: Use at outside corners**,** unless otherwise indicated.
2. LC-Bead (J-Bead): Use at exposed panel edges.

F. Joint Treatment Materials, General: Comply with ASTM C 475.

G. Joint Tape:

1. Interior Gypsum Wallboard: Paper.

H. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, flanges of trim accessories, and fasteners, use drying-type, all-purpose compound.

   a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use drying-type, all-purpose compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.

I. Acoustical Sealant for Exposed and Concealed Joints: Nonsag, paintable, nonstaining, latex sealant complying with ASTM C 834 that effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

J. Auxiliary Materials: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

1. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

2. Isolation Strip at Exterior Walls:

   a. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
   b. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit steel stud size.

3. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

a. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

1.3 EXECUTION

A. Installing Steel Framing, General: Comply with ASTM C 754, and ASTM C 840 requirements that apply to framing installation.

B. Installing Steel Partition and Soffit Framing:

1. Where studs are installed directly against exterior walls, install isolation strip between studs and wall.
2. Extend partition framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.
3. Frame door openings to comply with GA-600 and with gypsum board manufacturer's applicable written recommendations, unless otherwise indicated. Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

    a. Install two studs at each jamb, unless otherwise indicated.
    b. Extend jamb studs through suspended ceilings and attach to underside of floor or roof structure above.

4. Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.

C. Polyethylene Vapor Retarder: Install to comply with requirements specified in Division 7 Section 07210 "Building Insulation."

D. Gypsum Board Application: Comply with ASTM C 840 and GA-216.

1. Space screws a maximum of 12 inches (304.8 mm) o.c. for vertical applications.
2. Space fasteners in panels that are tile substrates a maximum of 8 inches (203.2 mm) o.c.
3. On ceilings, apply gypsum panels before wall/partition board application to the greatest extent possible and at right angles to framing, unless otherwise indicated.
4. On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

    a. Stagger abutting end joints not less than one framing member in alternate courses of board.
    b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.

5. Single-Layer Fastening Methods: Apply gypsum panels to supports with steel drill screws.
6. Laminating to Substrate: Comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

E. Installing Trim Accessories: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

F. Finishing Gypsum Board Assemblies: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

1. Prefill open joints and damaged surface areas.
2. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
3. Gypsum Board Finish Levels: Finish panels to levels indicated below, according to ASTM C 840, for locations indicated:

a. Level 4: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges at panel surfaces that will be exposed to view, unless otherwise indicated.

END OF SECTION 09260

SECTION 09511

ACOUSTICAL PANEL CEILINGS

1.1 GENERAL

A. Submittals: In addition to Product Data for each type of acoustical panel and suspension system required, submit the following:

1. 6-inch- (150-mm-) square samples of each acoustical panel type, pattern, and color.
2. Set of 12-inch- (300-mm-) long samples of exposed suspension system members, including moldings, for each color and system type required.

B. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:

1. Fire-response tests were performed by UL, ITS/Warnock Hersey, or another independent testing and inspecting agency that is acceptable to authorities having jurisdiction and that performs testing and follow-up services.
2. Surface-burning characteristics of acoustical panels comply with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84.

1.2 PRODUCTS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, those indicated for each designation in the Acoustical Panel Ceiling Schedule.

B. Acoustical Panels: Manufacturer's standard panels complying with ASTM E 1264 classifications, unless otherwise indicated, and with requirements indicated in the Acoustical Panel Ceiling Schedule.

1. Mounting Method for Measuring Noise Reduction Coefficient: Type E-400 per ASTM E 795.

C. Metal Suspension System: Manufacturer's standard direct-hung suspension system complying with applicable ASTM C 635 requirements and with requirements indicated in the Acoustical Panel Ceiling Schedule.

D. Finishes and Colors for Metal Suspension System, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.

E. Suspension System Attachment Devices: Fabricated from corrosion-resistant materials and sized for five times design load indicated in ASTM C 635, Table 1, Direct Hung, unless otherwise indicated.

F. Wire Hangers, Braces, and Ties: Zinc-coated, carbon-steel wire complying with ASTM A 641/A 641M, Class 1 zinc coating, soft temper. Size wire diameter so its stress at three times hanger design load (ASTM C 635, Table 1, Direct Hung) will be less than yield stress of wire, but provide not less than 0.106-inch- (2.69-mm-) diameter wire.

G. Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that fit acoustical panel edge details and suspension systems indicated; formed from sheet metal of same material and finish as that used for exposed flanges of suspension system runners.

1.3 EXECUTION

A. General: Install acoustical panel ceilings to comply with publications referenced below per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

1. Standard for Ceiling Suspension System Installations: Comply with ASTM C 636.

B. Secure ceiling hangers from suspension system members to building's structural members. Install hangers plumb and free from contact with other objects within ceiling plenum. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure; that are appropriate for substrate; and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.

1. Do not support ceilings directly from permanent metal forms, or floor or roof deck. Do not attach hangers to steel deck tabs.
2. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers, unless otherwise indicated; and provide hangers not more than 8 inches (200 mm) from ends of each member.

C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

D. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

E. Install acoustical panels with undamaged edges and fitted accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

1.4 ACOUSTICAL PANEL CEILING SCHEDULE

A. Acoustical Tile No. 1 (AT-1)
1. Armstrong 507M, or approved equal, natural fissured, medium textured.
2. Angled tegular edge design.
3. 24”x24”x3/4” size.
4. White color.
5. 0.65 NRC; 35 CAC.

6. 0.80 light reflectance coefficient.
7. Armstrong Prelude 15/16” Exposed Tee grid or approved equal; white color.

END OF SECTION 09511

SECTION 09651

RESILIENT TILE FLOORING

1.1 GENERAL

A. Submittals: As follows:

1. Product Data: For each type of product specified.

2. Samples: Of each different color and pattern of product specified.

3. Maintenance Data: For resilient floor tile to include in the maintenance manuals.

1.2 PRODUCTS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, those indicated for each designation in the Acoustical Panel Ceiling Schedule.

B. Vinyl Composition Floor Tile: Products complying with ASTM F 1066 and with requirements specified in the Resilient Tile Flooring Schedule.

C. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based formulation provided or approved by flooring manufacturer for applications indicated.

D. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

E. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edge of tiles, and in maximum available lengths to minimize running joints.

1.3 EXECUTION

A. Examine substrates, areas, and conditions where installation of resilient products will occur, with Installer present, for compliance with manufacturer's requirements. Verify that substrates and conditions are satisfactory for resilient product installation and comply with requirements specified.

1. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by flooring manufacturer.
2. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Preparation: Comply with resilient product manufacturer's written installation instructions for preparing substrates indicated to receive resilient products.

C. Tile Installation: Comply with tile manufacturer's written installation instructions.

1. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half of a tile at perimeter.

a. Lay tiles square with room axis, unless otherwise indicated.

2. Match tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered.

a. Lay tiles in basket-weave pattern with grain direction alternating in adjacent tiles.

D. Resilient Accessory Installation: Install resilient accessories according to manufacturer's written installation instructions.

E. Clean and protect resilient products according to manufacturer's written recommendations. Clean resilient products after installation and not more than 4 days before dates scheduled for inspections intended to establish date of Completion in each area of Project.

1.4 RESILIENT TILE SCHEDULE

A. Vinyl Composition Tile:

1. Products: Mannington, Tarkett, Armstrong (or approved equal).

2. Color: To be selected by Contracting Officer or authorized representative from manufacturer’s full range of standard colors.

3. Class: Class 2.

4. Wearing surface: Smooth.

5. Thickness: 0.125 in.

6. Size 12 inch by 12 in.

END OF SECTION 09651

SECTION 09653

RESILIENT WALL BASE AND ACCESSORIES

1.1 SUMMARY

A. This Section includes resilient the following:

1. Wall base.

1.2 SUBMITTALS

A. Product Data: For each product indicated.

B. Samples: For each product and for each color, pattern, and texture required.

1.3 PROJECT CONDITIONS

A. Maintain a temperature of not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C) in spaces to receive resilient accessories for at least 48 hours before installation, during installation, and for at least 48 hours after installation, unless manufacturer's written recommendations specify longer time periods.

1. After postinstallation period, maintain a temperature of not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

B. Install resilient accessories after other finishing operations, including painting, have been completed.

1.4 WALL BASE

A. Wall Base: Rubber, FS SS-W-40, Type I.

1. Color and Pattern: As selected from manufacturer's full range.
2. Style: Cove with top-set toe.
3. Minimum Thickness: 1/8 inch (3.2 mm).
4. Height: 4 inches (101.6 mm).
5. Lengths: Cut lengths 48 inches (1219.2 mm) long or coils in lengths standard with manufacturer, but not less than 96 feet (29.26 m).
6. Outside Corners: Job formed or premolded.
7. Inside Corners: Job formed or premolded.
8. Surface: Smooth.

1.5 INSTALLATION

A. Before installing resilient wall base:

1. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
2. Move resilient products and installation accessories into spaces where they will be installed at least 48 hours before installation, unless longer conditioning periods are recommended in writing by manufacturer. Install products only after they are at the same temperature as the space where they are to be installed.
3. Broom and vacuum clean substrates to be covered immediately before installing resilient products. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Adhesively install resilient wall base. Place resilient products so they are butted to adjacent materials.

C. Apply resilient wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

1. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
2. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
3. Do not stretch base during installation.
4. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient wall base with manufacturer's recommended adhesive filler material.

D. Immediately after installing resilient products, remove adhesive and other surface blemishes using cleaner recommended by resilient product manufacturers.

END OF SECTION 09653

SECTION 09680

CARPET

1.1 SUMMARY

A. This Section includes tufted carpet.

1.2 SUBMITTALS

A. Product Data: For each product indicated.

B. Shop Drawings: Include the following:

1. Seam locations.
2. Pile direction.
3. Insets and borders.
4. Transition, and other accessory strips.
5. Transition details to other flooring materials.

C. Samples: For each for each carpet and exposed accessory and for each color and pattern required.

D. Product Schedule: Use same room and product designations indicated on Drawings and in schedules.

E. Maintenance data.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104, Section 5, "Storage and Handling."

1.5 PROJECT CONDITIONS

A. General: Comply with CRI 104, Section 6.1, "Site Conditions; Temperature and Humidity."

B. Environmental Limitations: Do not install carpet until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

C. Do not install carpet over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by manufacturer.

1.6 WARRANTY

A. Carpet Warranty: Manufacturer's standard form in which manufacturer agrees to replace carpet that does not comply with requirements or that fails within 10 years from date of Substantial Completion. Warranty does not include deterioration or failure of carpet from unusual traffic, failure of substrate, vandalism, or abuse. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, and delamination.

B. Carpet Cushion Warranty: Manufacturer's standard form agreeing to replace carpet cushion that does not comply with requirements or that fails within 10 years from date of Substantial Completion. Warranty does not include deterioration or failure of carpet cushion from unusual traffic, failure of substrate, vandalism, or abuse. Failure includes, but is not limited to, permanent indentation or compression.

1.7 CARPET

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

B. Products: Subject to compliance with requirements, provide one of the following:

1. Karsten Bigelow; Stati-Tuft (or approved equal).

a. Color and Pattern: As selected from manufacturer's full range.

C. Fiber Content:

D. Surface Pile Weight: 28 oz/sq. yd. excluding weight of backings.

E. Primary Backing: Manufacturer's standard.

F. Secondary Backing: Manufacturer’s standard.

G. Width: 12 feet.

1.8 WALL BASE

A. Products: Johnsonite, Roppe, or Approved Equal.

B. Color: To be selected by Contracting Officer or authorized representative from manufacturer’s full range of colors.

C. Style: Cove with top set toe.

D. Minimum Thickness: 1/8 inch.

E. Height: 4 inches.

1.9 INSTALLATION

A. Comply with CRI 104, Section 8, Direct Glue-Down.

B. Maintain uniformity of carpet direction and lay of pile. At doorways, center seams under door in closed position. Bind or seal cut edges as recommended by carpet manufacturer.

C. Install pattern parallel to walls and borders.

END OF SECTION 09680

SECTION 09900

PAINTING

1.1 GENERAL

A. This Section includes surface preparation and field painting of exposed exterior and interior items and surfaces.

1. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

B. Paint exposed surfaces, except where the paint schedules indicate that a surface or material is not to be painted or is to remain natural. If the paint schedules do not specifically mention an item or a surface, paint the item or surface the same as similar adjacent materials or surfaces whether or not schedules indicate colors. If the schedules do not indicate color or finish, the Contracting Officer or authorized representative will select from standard colors and finishes available.

C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

1. Labels: Do not paint over Underwriters Laboratories (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

D. Submittals: For each paint system specified, provide the following:

1. Material List: Provide an inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
2. Manufacturer's Information: Provide manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.

E. Source Limitations: Obtain block fillers, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.

F. Deliver materials to the Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label.

G. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain containers in clean condition, free of foreign materials and residue. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily.

H. Project Conditions: Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

1.2 PRODUCTS

A. Material Compatibility: Provide block fillers, primers, undercoats, and finish-coat materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified. Paint-material containers not displaying manufacturer's product identification will not be acceptable.

C. Colors: Contractor to provide color selections to the Contracting Officer or authorized representative for approval.

1.3 EXECUTION

A. Examine substrates, areas, and conditions under which painting will be performed for compliance with paint application requirements. Do not begin to apply paint until unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.

B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates.

C. Preparation: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before surface preparation and painting. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

D. Cleaning: Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease before cleaning. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

E. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition.

1. Cementitious Materials: Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation. Use abrasive blast-cleaning methods if recommended by paint manufacturer.

a. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's written instructions.

2. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with the Steel Structures Painting Council's (SSPC) recommendations.

   a. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with the same primer as the shop coat.

3. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

F. Materials Preparation: Mix and prepare paint materials according to manufacturer's written instructions.

1. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
2. Use only thinners approved by paint manufacturer and only within recommended limits.

G. Application: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.

1. Paint surface treatments, and finishes are indicated in the schedules.
2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
3. Provide finish coats that are compatible with primers used.
4. The term "exposed surfaces" includes areas visible when permanent or built-in items are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.
5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before the final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
6. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
7. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
8. Sand lightly between each succeeding enamel or varnish coat.

H. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. The number of coats and the film thickness required are the same regardless of application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
2. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
3. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and where application of another coat of paint does not cause the undercoat to lift or lose adhesion.

I. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.

J. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer.

K. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by the manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn through or other defects due to insufficient sealing.

L. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

M. Field Quality Control: The Government reserves the right to engage the services of an independent testing agency to sample the paint material being used. Samples of material delivered to the Project will be taken, identified, sealed, and certified in the presence of the Contractor.

1. The testing agency will perform appropriate tests as required by the Government.
2. If tests show material being used does not comply with specified requirements, the Contractor shall remove noncomplying paint from the site, pay for testing, and repaint surfaces previously coated with the rejected paint. If necessary, the Contractor may be required to remove rejected paint from previously painted surfaces if, on repainting with specified paint, the 2 coatings are incompatible.

N. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.

1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

O. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Contracting Officer or Authorized Representative.

P. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.

1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

1.4 PAINT SCHEDULE

A. Concrete Masonry Units: Provide the following finish systems over interior concrete masonry block units:

1. Low-Luster, Acrylic-Enamel Finish: Two finish coats over a block filler.

a. Block Filler: High performance, latex-based, block filler applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 5.0 mils.
b. First and Second Coats: Low-luster (eggshell or satin), acrylic-latex, interior enamel applied at spreading rate recommended by manufacturer to achieve a total dry film thickness of not less than 2.8 mils.

B. Gypsum Board: Provide the following finish systems over interior gypsum board surfaces:

1. Low-Luster, Acrylic-Enamel Finish: Two finish coats over a primer.

a. Primer: Latex-based, interior primer at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mil.
b. First and Second Coats: Low-luster (eggshell or satin), acrylic-latex, interior enamel applied at spreading rate recommended by manufacturer to achieve a total dry film thickness of not less than 2.8 mils.

C. Ferrous Metal: Provide the following finish systems over ferrous metal:

1. Low-Luster, Acrylic-Enamel Finish: Two finish coats over a primer.

a. Primer: Quick-drying, rust-inhibitive, alkyd-based or epoxy-metal primer, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.5 mils.
b. First and Second Coats: Low-luster (eggshell or satin), acrylic-latex, interior enamel applied at spreading rate recommended by manufacturer to achieve a total dry film thickness of not less than 2.8 mils.

D. Zinc-Coated Metal: Provide the following finish systems over zinc-coated metal:

1. Low-Luster, Acrylic-Enamel Finish: Two finish coats over a primer.

   a. Primer: Galvanized metal primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.
   b. First and Second Coats: Low-luster (eggshell or satin), acrylic-latex, interior enamel applied at spreading rate recommended by manufacturer to achieve a total dry film thickness of not less than 2.8 mils.

E. Interior Stain and Natural-Finish Woodwork Schedule:

1. Natural-Varnish Finish: Two finish coats of varnish over a sealer coat and a filler coat.

   a. Filler Coat: Open-grain wood filler.
   b. Sealer Coat: Clear sanding sealer.
   c. Finish Coats: Interior polyurethane-based clear satin.

END OF SECTION 09900

SECTION 10155

TOILET COMPARTMENTS

1.1 GENERAL

A. Submittals: Include the following:

1. Product Data: For each type of toilet compartment and screen specified.
2. Shop Drawings: For fabrication and installation of toilet compartment and screen assemblies.
3. Samples: Manufacturer's color charts consisting of sections of actual units showing the full range of colors, textures, and patterns available for each type of compartment or screen indicated.

1.2 PRODUCTS

A. Steel Sheets for Color-Coated Finish: Provide mill-phosphatized steel sheet, in manufacturer's standard baked finish and thicknesses, that is leveled to stretcher-leveled flatness and that complies with the requirements of ASTM A 591 (ASTM A 591M), Class C; or ASTM A 653 (ASTM A 653M), in manufacturer's standard coating designation.

B. Stainless-Steel Sheet: ASTM A 666, Type 302 or 304, that is leveled to stretcher-leveled flatness, in manufacturer's standard directional-polish finish and thicknesses.

C. Core Material for Metal-Faced Units: Manufacturer's standard sound-deadening honeycomb of resin-impregnated kraft paper in thickness required to provide finished thickness of 1 inch (25 mm) minimum for doors, panels, and screens and 1-1/4 inches (32 mm) minimum for pilasters.

D. Pilaster Shoes and Sleeves (Caps): ASTM A 666, Type 302 or 304 stainless steel, not less than 0.0312 inch (0.8 mm) thick and 3 inches (75 mm) high, finished to match hardware.

E. Stirrup Brackets: Manufacturer's standard ear or U-brackets for attaching panels and screens to walls and pilasters of chrome-plated, nonferrous, cast zinc alloy (zamac) or clear-anodized aluminum.

F. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories of chrome-plated, nonferrous, cast zinc alloy (zamac) or clear-anodized aluminum.

G. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile in manufacturer's standard finish.

H. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel or brass, finished to match hardware, with theft-resistant-

type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use hot-dip galvanized or other rust-resistant, protective-coated steel.

I. Fabrication: As follows:

1. Provide standard doors, panels, screens, and pilasters fabricated for compartment system. Provide units with cutouts and drilled holes to receive compartment-mounted hardware, accessories, and grab bars, as indicated.

    a. Provide internal reinforcement in metal units for compartment-mounted hardware, accessories, and grab bars, as indicated.

2. Overhead-Braced-and-Floor-Anchored Compartments: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, fasteners, and anchors at pilasters to suit floor conditions. Make provisions for setting and securing continuous head rail at top of each pilaster. Provide shoes at pilasters to conceal supports and leveling mechanism.
3. Wall-Hung Screens: Provide units in sizes indicated of same construction and finish as compartment panels, unless otherwise indicated.
4. Doors: Unless otherwise indicated, provide 24-inch- (610-mm-) wide in-swinging doors for standard toilet compartments and 36-inch- (914-mm-) wide out-swinging doors with a minimum 32-inch- (813-mm-) wide clear opening for compartments indicated to be handicapped accessible.

    a. Hinges: Manufacturer's standard self-closing type that can be adjusted to hold door open at any angle up to 90 degrees.
    b. Latch and Keeper: Manufacturer's standard surface-mounted latch unit with combination rubber-faced door strike and keeper designed for emergency access. Provide units that comply with accessibility requirements of authorities having jurisdiction at compartments indicated to be handicapped accessible.
    c. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent door from hitting compartment-mounted accessories.
    d. Door Bumper: Manufacturer's standard rubber-tipped bumpers at out-swinging doors or entrance screen doors.
    e. Door Pull: Manufacturer's standard unit that complies with accessibility requirements of authorities having jurisdiction at out-swinging doors. Provide units on both sides of doors at compartments indicated to be handicapped accessible.

1.3 EXECUTION

A. Installation: Comply with manufacturer's written installation instructions. Install units rigid, straight, plumb, and level. Provide clearances of not more than 1/2 inch (13 mm) between pilasters and panels and not more than 1 inch (25 mm) between panels and walls. Secure units in position with manufacturer's recommended anchoring devices.

1. Secure panels to walls and panels with not less than 2 stirrup brackets attached near top and bottom of panel. Locate wall brackets so holes for wall anchors occur in masonry or tile joints. Align brackets at pilasters with brackets at walls.

B. Overhead-Braced-and-Floor-Anchored Compartments: Secure pilasters to floor and level, plumb, and tighten. Secure continuous head rail to each pilaster with not less than 2 fasteners. Hang doors and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

C. Wall-Hung Screens: Attach with anchoring devices according to manufacturer's written instructions and to suit supporting structure. Set units level and plumb and to resist lateral impact.

D. Hardware Adjustment: Adjust and lubricate hardware according to manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors and swing doors in entrance screens to return to fully closed position.

END OF SECTION 10155

SECTION 10200

LOUVERS AND VENTS

1.1 SUMMARY

A. This Section includes extruded-aluminum louvers.

1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide louvers capable of withstanding the effects of gravity loads and wind loads based on a uniform pressure of 30 lbf/sq. ft. (1436 Pa), acting inward or outward, without permanent deformation of louver components, noise or metal fatigue caused by louver blade rattle or flutter, or permanent damage to fasteners and anchors.

B. Air-Performance, Water-Penetration, and Wind-Driven Rain Ratings: As demonstrated by testing manufacturer's stock units according to AMCA 500-L.

1.3 SUBMITTALS

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

1.4 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Louvers (or approved equal):

a. Airline Products Co.
b. Airolite Company (The).
c. Arrow United Industries.
d. Carnes Company, Inc.
e. Construction Specialties, Inc.
f. Greenheck.
g. Industrial Louvers, Inc.
h. Louvers & Dampers, Inc.
i. Metal Form Manufacturing Company, Inc.
j. NCA Manufacturing, Inc.
k. Ruskin Company; Tomkins PLC.

1.5 MATERIALS

A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy 6063-T5 or T-52.

B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy 3003 or 5005.

C. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 (Z275) zinc coating, mill phosphatized.

D. Stainless-Steel Sheet: ASTM A 666, Type 304, with No. [4] [6] finish.

E. Fasteners: Of same basic metal and alloy as fastened metal or 300 Series stainless steel.

1.6 FABRICATION, GENERAL

A. Fabricate frames to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

B. Join frame members to each other and to louver blades with fillet welds concealed from view.

C. Join frame members to each other and to louver blades with fillet welds, threaded fasteners, or both, as standard with louver manufacturer, concealed from view.

1.7 EXTRUDED-ALUMINUM LOUVERS

A. Horizontal, Drainable-Blade Louver:

1. Frame and Blade Nominal Thickness: Not less than 0.060 inch (1.5 mm) for blades and 0.080 inch (2.0 mm) for frames.
2. Performance Requirements:

    a. Free Area: Not less than 8.0 sq. ft. (0.74 sq. m) for 48-inch- (1.2-m-) wide by 48-inch- (1.2-m-) high louver.

3. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

1.8 LOUVER SCREENS

A. General: Provide screen at interior face of each exterior louver.

B. Louver Screen Frames: Same kind and form of metal as indicated for louver to which screens are attached.

C. Louver Screening:

1. Bird Screening: Aluminum, 1/2-inch- (12.7-mm-) square mesh, 0.063-inch (1.6-mm) wire.

1.9 FINISHES

A. Aluminum, Baked-Enamel Finish: Clean with inhibited chemicals and apply conversion coating and primer/topcoat system complying with AAMA 2603, except with a minimum dry film thickness of 1.5 mils (0.04 mm), medium gloss.

1. Color: To be approved by Contracting Officer or authorized representative.

1.10 INSTALLATION

A. Locate and place louvers and vents level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

D. Repair damaged finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

E. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.

END OF SECTION 10200

SECTION 10425

SIGNS

1.1 SUMMARY

A. This Section includes the following:

1. Panel signs.

1.2 SUBMITTALS

A. Product Data: For each product indicated.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other Work.

1. Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings.

C. Samples: For each exposed finish.

1.3 MATERIALS

A. Cast Acrylic Sheet: Cast (not extruded or continuous cast) methyl methacrylate monomer plastic sheet with minimum flexural strength of 16,000 psi (110 MPa) per ASTM D 790 and minimum allowable continuous service temperature of 176 deg F (80 deg C).

1. Opaque Sheet: Colored, in colors as selected from manufacturer's full range.

B. Fasteners: Use concealed fasteners fabricated from metals that are not corrosive to sign material and mounting surface.

C. Anchors and Inserts: Use nonferrous metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

D. Colored Coatings for Acrylic Plastic Sheet: Use colored coatings, including inks and paints for copy and background colors, recommended by acrylic manufacturers for optimum adherence to surface and that are nonfading for application intended.

1.4 PANEL SIGNS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Andco Industries Corp.
2. APCO Graphics, Inc.
3. ASI Sign Systems, Inc.
4. Best Manufacturing Company.
5. Mohawk Sign Systems.

B. Unframed Panel Signs: Fabricate with smooth edges mechanically finished.

1. Edge Condition: Square cut.
2. Corner Condition: Square.

C. Raised Copy: Machine-cut copy characters from matte-finished opaque acrylic sheet and chemically weld onto acrylic sheet forming sign panel face. Produce precisely formed characters with square cut edges free from burrs and cut marks.

1. Panel Material: Matte-finished opaque acrylic sheet.
2. Raised-Copy Thickness: Not less than 1/32 inch (0.8 mm).

1.5 FINISHES

A. Colors and Surface Textures: For exposed sign material that requires selection of materials with integral or applied colors, surface textures or other appearance characteristics, provide color matches as selected from manufacturer's full range, unless otherwise indicated.

1.6 INSTALLATION

A. Install signs level, plumb, and at height indicated, with sign surfaces free from distortion or other defects in appearance.

B. Wall-Mounted Panel Signs:

1. Vinyl-Tape Mounting: Use double-sided foam tape to mount signs to smooth, nonporous surfaces. Do not use this method for vinyl-covered or rough surfaces.
2. Silicone-Adhesive Mounting: Use liquid silicone adhesive recommended by sign manufacturer to attach sign units to irregular, porous, or vinyl-covered surfaces. Use double-sided vinyl tape where recommended by sign manufacturer to hold sign in place until adhesive has fully cured.

END OF SECTION 10425

SECTION 10520

FIRE-PROTECTION SPECIALTIES

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Division 1, Section 01000 “General”, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Portable fire extinguishers.
2. Fire-protection cabinets for the following:

a. Portable fire extinguishers.

B. Related Sections include the following:

1. Specification Section 09900 "Painting" for field-painting fire-protection cabinets.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire-protection specialties.

1. Fire Extinguishers: Include rating and classification.
2. Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain fire extinguishers and cabinets through one source from a single manufacturer.

B. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Standard for Portable Fire Extinguishers."

C. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1.5 COORDINATION

A. Coordinate size of cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

1.6 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Fire-Protection Cabinets:

a. J.L. Industries, Inc.
b. Larsen's Manufacturing Company.
c. Potter-Roemer; Div. of Smith Industries, Inc.

1.7 MATERIALS

A. Cold-Rolled Steel Sheet: Carbon steel, complying with ASTM A 366/A 366M, commercial quality, stretcher leveled, temper rolled.

B. Aluminum: Alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated, and as follows:

1. Sheet: ASTM B 209 (ASTM B 209M).
2. Extruded Shapes: ASTM B 221 (ASTM B 221M).

1.8 PORTABLE FIRE EXTINGUISHERS

A. General: Provide fire extinguishers of type, size, and capacity for each cabinet and other locations indicated.

B. Multipurpose Dry-Chemical Type: UL-rated 4-A:60-B:C, 10-lb (4.5-kg) nominal capacity, in enameled-steel container.

1.9 FIRE-PROTECTION CABINETS

A. Cabinet Construction: Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Weld joints and grind smooth. Miter and weld perimeter door frames.

1. Fire-Rated Cabinets: Listed and labeled to meet requirements of ASTM E 814 for fire-resistance rating of wall where it is installed.

a. Construct fire-rated cabinets with double walls fabricated from 0.0478-inch- (1.2-mm-) thick, cold-rolled steel sheet lined with minimum 5/8-inch- (16-mm-) thick, fire-barrier material.
b. Provide factory-drilled mounting holes.

2. Cabinet Metal: Enameled-steel sheet.

3. Shelf: Same metal and finish as cabinet.

B. Cabinet Type: Suitable for the following:

1. Fire extinguisher.

C. Cabinet Mounting: Suitable for the following mounting conditions:

1. Semirecessed: Cabinet box partially recessed in walls of shallow depth to suit style of trim indicated.

D. Cabinet Trim Style: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

1. Exposed Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).

a. Rolled-Edge Trim: 2 1/2-inch (64-mm) backbend depth.

E. Cabinet Trim Material: Manufacturer's standard, as follows:

1. Stainless-steel sheet.

F. Door Material: Manufacturer's standard, as follows:

1. Stainless-steel sheet.

G. Door Glazing: Manufacturer's standard, as follows:

1. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, as follows:

a. Class 1 (clear).

H. Door Style: Manufacturer's standard design, as follows:

1. Fully glazed panel with frame.

I. Door Construction: Fabricate doors according to manufacturer's standards, of materials indicated, and coordinated with cabinet types and trim styles selected.

1. Provide minimum 1/2-inch- (13-mm-) thick door frames, fabricated with tubular stiles and rails, and hollow-metal design.

J. Door Hardware: Provide manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated. Provide either lever handle with cam-action latch, or exposed or concealed door pull and friction latch. Provide concealed or continuous-type hinge permitting door to open 180 degrees.

1.10 ACCESSORIES

A. Mounting Brackets: Manufacturer's standard steel, designed to secure extinguisher, of sizes required for types and capacities of extinguishers indicated, with plated or baked-enamel finish.

1. Provide brackets for extinguishers located in cabinets.

B. Door Locks: Provide cylinder lock, with all cabinets keyed alike.

C. Identification: Provide lettering to comply with authorities having jurisdiction for letter style, color, size, spacing, and location. Locate as indicated by the Contracting Officer.

1. Identify fire extinguisher in cabinet with the words "FIRE EXTINGUISHER" applied to door.

a. Application Process: Vinyl letters.
b. Lettering Color: Black.
c. Orientation: Vertical.

1.11 COLORS AND TEXTURES

A. Colors and Textures: As selected by the Contracting Officer or authorized representative from manufacturer's full range for these characteristics.

1.12 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Cabinet Finishes: Provide manufacturer's standard baked-enamel paint for the following:

1. Interior of cabinets.

1.13 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where recessed and semirecessed cabinets are to be installed.

B. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged units.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

1.14 INSTALLATION

A. Comply with manufacturer's written instructions for installing fire-protection specialties.

B. Install in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.

1. Fasten cabinets to structure, square and plumb.

1.15 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust cabinet doors that do not swing or operate freely.

B. Refinish or replace cabinets and doors damaged during installation.

C. Provide final protection and maintain conditions that ensure that cabinets and doors are without damage or deterioration at the time of project completion.

END OF SECTION 10520

SECTION 10801

TOILET AND BATH ACCESSORIES

1.1 GENERAL

A. Submittals: Manufacturer's Product Data. Include construction details, material descriptions and thicknesses, dimensions, profiles, fastening and mounting methods, specified options, and finishes for each type of accessory specified.

B. Product Options: Accessory requirements, including those for materials, finishes, dimensions, capacities, and performance, are established by specific products indicated in the Toilet and Bath Accessory Schedule on drawings.

1. Products of other manufacturers with equal characteristics, as judged solely by the Contracting Officer or authorized representative, may be provided.

1.2 PRODUCTS

A. Materials: As follows:

1. Stainless Steel: ASTM A 666, Type 304, with No. 4 finish (satin), in 0.0312-inch (0.8-mm) minimum nominal thickness, unless otherwise indicated.
2. Brass: ASTM B 19, leaded and unleaded flat products; ASTM B 16 (ASTM B 16M), rods, shapes, forgings, and flat products with finished edges; ASTM B 30, castings.
3. Sheet Steel: ASTM A 366/A 366M, cold rolled, commercial quality, 0.0359-inch (0.9-mm) minimum nominal thickness; surface preparation and metal pretreatment as required for applied finish.
4. Galvanized Steel Sheet: ASTM A 653/A 653M, G60 (Z180).
5. Chromium Plating: ASTM B 456, Service Condition Number SC 2 (moderate service), nickel plus chromium electrodeposited on base metal.
6. Baked-Enamel Finish: Factory-applied, gloss-white, baked-acrylic-enamel coating.
7. Mirror Glass: ASTM C 1036, Type I, Class 1, Quality q2, nominal 6.0 mm thick, with silvering, electroplated copper coating, and protective organic coating complying with FS DD-M-411.
8. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
9. Fasteners: Screws, bolts, and other devices of same material as accessory unit, tamper and theft resistant when exposed, and of galvanized steel when concealed.
10. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to the Contracting Officer or authorized representative.

1.3 EXECUTION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

1. Secure mirrors to walls in concealed, tamper-resistant manner with special hangers, toggle bolts, or screws. Set units level, plumb, and square at locations indicated, according to manufacturer's written instructions for substrate indicated.
2. Install grab bars to withstand a downward load of at least 250 lbf (1112 N), when tested according to method in ASTM F 446.

B. Adjust accessories for unencumbered, smooth operation and verify that the mechanisms function properly. Replace damaged or defective items.

C. Remove temporary labels and protective coatings.

D. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 10801

SECTION 13916

FIRE-SUPPRESSION SPRINKLERS

1.1 GENERAL

A. Design sprinkler working plans and obtain approval from authorities having jurisdiction.

B. Design sprinkler piping according to the following and obtain approval from authorities having jurisdiction:

1. Include 10 percent margin of safety for available water flow and pressure.
2. Sprinkler Occupancy Hazard Classifications: As follows:

   a. Mechanical Room: Ordinary Hazard, Group 2.

   b. All Other Areas: Light Hazard.

3. Minimum Density for Automatic-Sprinkler Piping Design: As follows:

   a. Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm over area of room.

   b. Light Hazard Occupancy: 0.10 gpm over 3,000 sq. ft.

4. Maximum Protection Area per Sprinkler: As follows:

   a. Mechanical Room: 130 sq. ft.

   b. All Other Areas: 200 sq. ft.

C. Components and Installation: Capable of producing piping systems with 175-psig (1200-kPa) minimum working-pressure rating.

D. Submittals: Submit the following:

1. Product Data: For valves (NRS, OS&Y, check), piping materials and fittings, pipe couplings, hangers and upper attachments, water motor gong, flow switch, tamper switch, back flow preventer, post indicator, sprinkler head guards, fire department connection, and all sprinkler heads.
2. Warranty: provide manufacturer’s written warranty for pipe, pipe fittings, pipe couplings, and sprinkler heads.
3. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction. Include hydraulic calculations. A Professional Fire Protection Engineer registered in the state of North Carolina shall seal drawings and hydraulic calculations.
4. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping", hydrostatic test reports, and purging and disinfecting reports.

5. Furnish samples of each sprinkler head, escutcheon, and guard.
6. Provide operating instructions for: flow switch, tamper switch, water motor gong, alarm check valve, and backflow preventer.

E. Manufacturer Qualifications: Firms whose equipment, specialties, and accessories are listed by product name and manufacturer in UL's "Fire Protection Equipment Directory" and FM's "Fire Protection Approval Guide" and that comply with other requirements indicated.

F. Sprinkler Components: Listing/approval stamp, label, or other marking by a testing agency acceptable to authorities having jurisdiction.

G. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

H. NFPA Standards: Equipment, specialties, accessories, installation, and testing complying with the following:

1. NFPA 13, "Installation of Sprinkler Systems."

1.2 PRODUCTS

A. Piping: Refer to "Piping Applications" Paragraph for applications of pipe, tube, fitting, and joining materials.

B. Ductile-Iron Pipe: AWWA C151, push-on-joint type; with cement-mortar lining and seal coat according to AWWA C104. Include rubber gasket according to AWWA C111.

C. Standard-Weight Steel Pipe: ASTM A 53, ASTM A 135, or ASTM A 795; Schedule 40 in NPS 6 (DN150) and smaller, and Schedule 30 in NPS 8 (DN200) and larger.

D. Schedule 30 Steel Pipe: ASTM A 135 or ASTM A 795, with wall thickness less than Schedule 40 and equal to or greater than Schedule 30 or ASTM A 795 and ASME B36.10M, Schedule 30 wrought-steel pipe.

E. Schedule 10 Steel Pipe: ASTM A 135 or ASTM A 795, Schedule 10 in NPS 5 (DN125) and smaller and NFPA 13 specified wall thickness in NPS 6 to NPS 10 (DN150 to DN250).

F. Ductile-Iron Fittings: AWWA C110, ductile-iron or cast-iron push-on-joint type; or AWWA C153, ductile-iron, compact push-on-joint type. Include cement-mortar lining and seal coat according to AWWA C104 and rubber gaskets according to AWWA C111.

G. Cast-Iron Threaded Flanges: ASME B16.1.

H. Cast-Iron Threaded Fittings: ASME B16.4.

I. Malleable-Iron Threaded Fittings: ASME B16.3.

J. Steel, Threaded Couplings: ASTM A 865.

K. Steel Welding Fittings: ASTM A 234/A 234M, ASME B16.9, or ASME B16.11.

L. Steel Flanges and Flanged Fittings: ASME B16.5.

M. Steel, Grooved-End Fittings: UL-listed and FM-approved, ASTM A 47 (ASTM A 47M), malleable iron or ASTM A 536, ductile iron; with dimensions matching steel pipe and ends factory grooved according to AWWA C606.

N. Transition Couplings: AWWA C219, sleeve type, or other manufactured fitting the same size as, with pressure rating at least equal to, and with ends compatible with piping to be joined.

O. Fire-Protection-Service Valves: UL listed and FM approved, with minimum 175-psig (1200-kPa) nonshock working-pressure rating. Valves for grooved-end piping may be furnished with grooved ends instead of type of ends specified.

1. Gate Valves, NPS 2 (DN50) and Smaller: UL 262; cast-bronze, threaded ends; solid wedge; OS&Y; and rising stem.
2. Indicating Valves, NPS 2-1/2 (DN65) and Smaller: UL 1091; ball-type, bronze body with threaded ends; and integral indicating device.
3. Gate Valves, NPS 2-1/2 (DN65) and Larger: UL 262, iron body, bronze mounted, taper wedge, OS&Y, and rising stem. Include replaceable, bronze, wedge facing rings and flanged ends.
4. Swing Check Valves, NPS 2 (DN50) and Smaller: UL 312 or MSS SP-80, Class 150; bronze body with bronze disc and threaded ends.
5. Swing Check Valves, NPS 2-1/2 (DN65) and Larger: UL 312, cast-iron body and bolted cap, with bronze disc or cast-iron disc with bronze-disc ring and flanged ends.
6. Indicator Post Gate Valves: UL 262, iron body, bronze mounted, solid-wedge disc, and nonrising stem with operating nut and flanged ends. Paint bronze color per Contracting Officer.
7. Indicator Posts: UL789, horizontal, wall-type, cast-iron body, with windows for target plates that indicate valve position, extension rod and coupling, locking device, and red enamel finish.
   a. Operation: Hand wheel.

P. Alarm Check Valves: UL 193, 175-psig (1200-kPa) working pressure, designed for horizontal or vertical installation, with cast-iron flanged inlet and outlet, or grooved outlet, bronze grooved seat with O-ring seals, and single-hinge pin and latch design. Include trim sets for bypass, drain, electric sprinkler alarm switch, pressure gages, retarding chamber, fill-line attachment with strainer, and drip cup assembly.

Q. Ball Drip Valves: UL 1726, automatic drain valve, NPS 3/4 (DN20), ball check device with threaded ends.

R. Automatic Sprinklers: With heat-responsive element complying with the following:

1. UL 199, for applications except residential.

S. Sprinkler Types and Categories: Nominal 1/2-inch (12.7-mm) orifice for "Ordinary" temperature classification rating, unless otherwise indicated or required by application.

T. Sprinkler types, features, and options include the following:

1. Pendent sprinklers.
2. Sidewall sprinklers.
3. Sidewall, dry-type sprinklers.
4. Upright sprinklers.

U. Sprinkler Finishes: Chrome-plated, bronze, and painted.

V. Sprinkler Escutcheons: Chrome-plated steel, one piece, flat, unless otherwise indicated.

W. Sprinkler Guards: Wire-cage type, including fastening device for attaching to sprinkler.

X. Specialty Sprinkler Fittings: UL listed and FM approved; made of steel, ductile iron, or other materials compatible with piping.

Y. Locking-Lug Fittings: Unacceptable.

Z. Mechanical-Cross Fittings: UL 213, ductile-iron housing with pressure-responsive gaskets, bolts, and threaded or locking-lug outlets.

AA. Drop-Nipple Fittings: UL 1474, with threaded inlet, threaded outlet, and seals; adjustable.

BB. Sprinkler, Drain and Alarm Test Fittings: UL-listed, cast- or ductile-iron body; with threaded inlet and outlet, test valve, and orifice and sight glass.

CC. Sprinkler, Branch-Line Test Fittings: UL-listed, brass body; with threaded inlet and capped drain outlet and threaded outlet for sprinkler.

DD. Sprinkler, Inspector's Test Fittings: UL-listed, cast- or ductile-iron housing; with threaded inlet and drain outlet and sight glass.

EE. Wall, Fire Department Connection: UL 405; cast-brass body, inlets with threads according to NFPA 1963 and matching local fire department sizes and threads, and back outlet with pipe threads. Include brass, lugged caps, gaskets and brass chains; and brass, lugged swivel connection and check devices or clappers for each hose connection inlet; and round, brass, escutcheon plate with marking "AUTO SPKR & STANDPIPE."

1. Type: Exposed mounting.
2. Escutcheon Plate: Rectangular.
3. Finish: Painted enamel finish, bronze color as approved by the Contracting Officer.

FF. Water-Motor-Operated Alarms: UL 753, mechanical-operation type with pelton-wheel operator with shaft length, bearings, and sleeve to suit wall construction and 10-inch-(250-mm-) diameter, cast-aluminum alarm gong with red-enamel factory finish. Include NPS 3/4 (DN20) inlet and NPS 1 (DN25) drain connections.

GG. Water-Flow Indicators: UL 346; electrical-supervision, vane-type water-flow detector; with 250-psig (1725-kPa) pressure rating; and designed for horizontal or vertical installation. Include two single-pole, double-throw, circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.

HH. Valve Supervisory Switches: UL 753; electrical; single-pole, double throw; with normally closed contacts. Include design that signals controlled valve is in other than fully open position.

II. Pressure Gages: UL 393, 3-1/2- to 4-1/2-inch- (90- to 115-mm-) diameter dial with dial range of 0 to 250 psig (0 to 1725 kPa).

JJ. Flanged Pipe Support: See Detail C/F4. Construct from plate steel of thickness indicated conforming to ASTM A36/A36M. All welding procedures and personnel shall conform to AWS D1.1 “Structural Welding Code – Steel”. Prime with fast curing, lead and chromate free, universal modified alkyd primer complying with FS TT-P-664.

KK. Double-Check-Valve Backflow Prevention Assemblies: UL 312, FM approved; with two UL 312, FM-approved, iron-body, 175-psig (1207-kPa) working-pressure, flanged-end check valves and two UL 262, FM-approved, iron-body, outside screw and yoke, flanged, 175-psig (1207-kPa) working-pressure gate valves.

1. Maximum Pressure Loss: **5 psig (35 kPa)** through middle 1/3 of flow range.

1.3 EXECUTION

A. Preparation: Fire-hydrant flow tests are indicated on Drawing F2. Use results for system design calculations. Any additional tests shall be performed by base personnel.

B. Piping Applications: Use according to the following:

1. Do not use welded joints with galvanized steel pipe.
2. Flanges, unions, and transition and special fittings with pressure ratings the same as or higher than system's pressure rating may be used in aboveground applications, unless otherwise indicated.
3. Piping between Fire Department Connections and Check Valves: Use galvanized, standard-weight steel pipe with threaded ends; cast- or malleable-iron threaded fittings; and threaded joints.
4. Underground Service-Entrance Piping: Use ductile-iron, push-on-joint pipe and fittings and restrained joints.
5. Sprinkler Feed Mains and Risers: Use the following:

   a. NPS 4 (DN100) and Smaller: Standard-weight steel pipe with threaded ends, cast- or malleable-iron threaded fittings, and threaded joints.
   b. NPS 4 (DN100) and Smaller: Standard-weight steel pipe with grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.

c. NPS 4 (DN100) and Smaller: Standard-weight steel pipe with plain ends, steel welding fittings, and welded joints.
d. NPS 4 (DN100) and Smaller: Schedule 40 steel pipe with threaded ends, cast- or malleable-iron threaded fittings, and threaded joints.
e. NPS 4 (DN100) and Smaller: Schedule 30 steel pipe with roll-grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
f. NPS 4 (DN100) and Smaller: Schedule 10 steel pipe with roll-grooved ends; steel, grooved-end fittings; and grooved joints.
g. NPS 4 (DN100) and Smaller: Schedule 10 steel pipe with plain ends, steel welding fittings, and welded joints.

6. Wet-Pipe, Sprinkler Branch Piping: Use the following:

a. Sprinkler-Piping Option: Specialty sprinkler fittings, NPS 2 (DN50) and smaller, including mechanical-T fittings, may be used downstream from sprinkler zone valves.
b. NPS 1-1/2 (DN40) and Smaller: Standard-weight steel pipe with threaded ends, cast- or malleable-iron threaded fittings, and threaded joints.
c. NPS 1-1/2 (DN40) and Smaller: Standard-weight steel pipe with plain ends, steel welding fittings, and welded joints.
d. NPS 1-1/2 (DN40) and Smaller: Schedule 10 steel pipe with plain ends, steel welding fittings, and welded joints.
e. NPS 2 (DN50): Standard-weight steel pipe with threaded ends, cast- or malleable-iron threaded fittings, and threaded joints.
f. NPS 2 (DN50): Standard-weight steel pipe with cut grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
g. NPS 2 (DN50): Standard-weight steel pipe with plain ends, steel welding fittings, and welded joints.
h. NPS 2 (DN50): Schedule 30 steel pipe with grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
i. NPS 2 (DN50): Schedule 10 steel pipe with roll-grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
j. NPS 2 (DN50): Schedule 10 steel pipe with plain ends, steel welding fittings, and welded joints.
k. NPS 2-1/2 to NPS 3-1/2 (DN65 to DN90): Standard-weight steel pipe with threaded ends, cast- or malleable-iron threaded fittings, and threaded joints.
l. NPS 2-1/2 to NPS 3-1/2 (DN65 to DN90): Standard-weight steel pipe with cut grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
m. NPS 2-1/2 to NPS 3-1/2 (DN65 to DN90): Standard-weight steel pipe with plain ends, steel welding fittings, and welded joints.
n. NPS 2-1/2 to NPS 3-1/2 (DN65 to DN90): Schedule 30 steel pipe with roll-grooved ends; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
o. NPS 2-1/2 to NPS 3-1/2 (DN65 to DN90): Schedule 10 steel pipe with roll-grooved ends; steel, grooved-end fittings; and grooved joints.
p. NPS 2-1/2 to NPS 3-1/2 (DN65 to DN90): Schedule 10 steel pipe with plain ends, steel welding fittings, and welded joints.

C. Valve Applications: Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Fire-Protection-Service Valves: UL listed and FM approved for applications where required by NFPA 13.

   a. Shutoff Duty: Use gate valves.

2. General-Duty Valves: For applications where UL-listed and FM-approved valves are not required by NFPA 13.

   a. Shutoff Duty: Use gate valves.

D. Joint Construction:

1. Steel-Piping, Grooved Joints: Use Schedule 40 steel pipe with cut-grooved ends and Schedule 30 or thinner steel pipe with roll-grooved ends; steel, grooved-end fittings; and steel, keyed couplings. Assemble joints with couplings, gaskets, lubricant, and bolts according to coupling manufacturer's written instructions.
2. Brazed Joints: Use AWS A5.8, BCuP-3 or BCuP-4 filler metals.
3. Locking-Lug-Fitting, Twist-Locked Joints: Unacceptable.
4. Provide “Mega-Lug” flange on service entrance piping for connection of interior flanged piping.

E. Service-Entrance Piping: Connect interior sprinkler piping to underground water-service piping of size and in location indicated on drawing detail A/F4 for service entrance to building. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping.

F. Backflow Preventer Installation:
1. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of Contracting Officer.
2. Do not install backflow preventers with relief drain in space subject to flooding.
3. Do not install bypass piping around backflow preventers.
4. Support NPS 2-1/2 (DN 65) and larger backflow preventers, valves, and piping near floor as indicated by detail A/F4.

G. Piping Installation:

1. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval before deviating from approved working plans.
2. Install underground service-entrance piping according to NFPA 24 and with restrained joints.
3. Use approved fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
4. Install unions adjacent to each valve in pipes NPS 2 (DN50) and smaller. Unions are not required on flanged devices or in piping installations using grooved joints.

5. Install flanges or flange adapters on valves, apparatus, and equipment having NPS 2-1/2 (DN65) and larger connections.
6. Install "Inspector's Test Connections" in sprinkler piping, complete with shutoff valve, sized and located according to NFPA 13.
7. Install sprinkler piping with drains for complete system drainage.
8. Install sprinkler zone control valves, test assemblies, and drain risers adjacent to sprinkler risers when sprinkler branch piping is connected to sprinkler risers.
9. Install ball drip valves to drain piping between fire department connections and check valves. Drain to floor drain or outside building.
10. Install alarm devices in piping systems.
11. Hangers and Supports: Comply with NFPA 13 for hanger materials and installation.
12. Install piping with grooved joints according to manufacturer's written instructions. Construct rigid piping joints, unless otherwise indicated.
13. Install pressure gages on riser or feed main and at each sprinkler test connection. Include pressure gages with connection not less than NPS 1/4 (DN8) and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.
14. Install specialty sprinkler fittings according to manufacturer's written instructions.

H. Valve Installation: Install fire-protection specialty valves, trim, fittings, controls, and specialties according to NFPA 13, manufacturer's written instructions, and authorities having jurisdiction.

1. Gate Valves: Install fire-protection-service valves supervised-open, located to control sources of water supply except from fire department connections. Provide permanent identification signs indicating portion of system controlled by each valve.
2. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water supply sources.
3. Alarm Check Valves: Install valves in vertical position for proper direction of flow, including bypass check valve and retard chamber drain-line connection.

I. Sprinkler Applications: Use sprinklers according to the following:

1. Rooms without Ceilings: Upright sprinklers.
2. Rooms with Suspended Ceilings: Pendent sprinklers.
3. Wall Mounting: Sidewall sprinklers.
4. Spaces Subject to Freezing: Upright; pendent, dry-type; and sidewall, dry-type sprinklers.
5. Sprinkler Finishes: Use sprinklers with the following:

   a. Upright, Pendent, and Sidewall Sprinklers: Chrome-plated in finished spaces exposed to view and rough bronze in unfinished spaces not exposed to view.

J. Install sprinklers in suspended ceilings in center of narrow dimension of acoustical panels.

K. Connect water supplies to sprinklers. Include backflow preventers.

L. Connect piping to specialty valves, specialties, fire department connections, and accessories.

M. Connection of alarm devices to fire alarm is specified in Specification Section 16721, “Fire Detection, Alarm and Radio Type Reporting System”.

N. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13. This includes hydraulic design information sign.

O. Flush, test, and inspect sprinkler piping according to NFPA 13, "System Acceptance" Chapter.

END OF SECTION 13916

SECTION 14240

HYDRAULIC ELEVATORS

1.1 SUMMARY

A. This Section includes hydraulic passenger elevators.

1.2 SUBMITTALS

A. Product Data: Include capacities, sizes, performances, operations, safety features, finishes, and similar information for each elevator required.

B. Shop Drawings: Show plans, elevations, sections, and large-scale details indicating service at each landing, machine room layout, relationships with other construction, and locations of equipment and signals. Indicate maximum and average power demands.

C. Samples: For each exposed finish.

D. Manufacturer Certificates: Signed by elevator manufacturer certifying that hoistway, pit, and machine room layout and dimensions, as shown on Drawings, and electrical service, as shown and specified, are adequate for elevator system being provided.

E. Maintenance manuals.

F. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.

G. Required Maintenance Equipment: Provide one set to Contracting Officer of all routine maintenance and diagnostic tools specific to the elevator provided.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with local governing regulations and with applicable provisions in ASME A17.1, "Safety Code for Elevators and Escalators."

1. Project's Seismic Risk Zone: 2.

B. Accessibility Requirements: In addition to local governing regulations, comply with Section 4.10 in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines (ADAAG)."

1.4 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, provide 12 months' full maintenance service. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting.

1.5 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide hydraulic elevators by one of the following:

1. Dover Elevator Systems.
2. Fujitec America, Inc.
3. Montgomery KONE Inc.
4. Schindler Elevator Corp.
5. Schumacher Elevator Co.
6. Thyssen Elevator Group North America.

1.6 MATERIALS AND COMPONENTS

A. General: Provide manufacturer's standard elevator systems, published by manufacturer as included in standard pre-engineered elevator systems and as required for a complete system.

B. Pump Units: Positive-displacement type with a maximum of 10 percent variation between no load and full load and with minimum pulsations.

1. Pump: Mounted on top of oil tank with vibration isolation mounts and enclosed in prime-painted steel enclosure lined with 1-inch- (25-mm-) thick, glass-fiber insulation board
2. Motor Starting: Wye delta.

C. Hydraulic Silencers: Containing pulsation-absorbing material in a blowout-proof housing at pump unit.

D. Protective Cylinder Casings: PVC pipe casings complying with ASME A17.1, of sufficient size to provide not less than 1-inch (25-mm) clearance from cylinder, and extending above pit floor.

E. Car Frame and Platform: Welded steel units.

F. Finish Materials:

1. Satin Stainless Steel: ASTM A 666, Type 304, with No. 4, directional satin finish.
2. Enameled-Steel Sheet: Cold-rolled steel sheet complying with ASTM A 366/A 366M, matte finish, stretcher-leveled standard of flatness; hot-rolled steel sheet complying with ASTM A 569/A 569M may be used for door frames. Provide with factory-applied enamel finish.

   a. Colors: As selected by the Contracting Officer or authorized representative.

3. Prime-Painted Steel Sheet: Cold-rolled steel sheet, ASTM A 366/A 366M, or hot-rolled steel sheet, ASTM A 569/A 569M, with factory-applied rust-inhibitive primer.
4. Plastic Laminate: High-pressure type complying with NEMA LD 3, Type HGS.

    a. Colors, Textures, and Patterns: As selected from manufacturer's full range by the Contracting Officer or authorized representative.

1.7 OPERATION SYSTEMS

A. Provide manufacturer's standard microprocessor operation system of the type indicated.

Single Elevator, Two Stops: Provide "automatic operation" as defined in ASME A17.1. Must comply with NFPA 3-9.3, Elevator Recall for Fire Fighters Service and 3-9.4, Elevator Shutdown.

1.8 SIGNAL EQUIPMENT

A. General: Satin stainless-steel signal equipment with hall-call and car-call buttons that light when activated and remain lit until call has been fulfilled. Fabricate lighted elements of acrylic or other permanent, nonyellowing translucent plastic.

B. Car Control Stations: Manufacturer's standard car control stations mounted in return panel adjacent to car door, unless otherwise indicated.

C. Emergency Communication System: Complying with ASME A17.1 and the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines (ADAAG)." On activation, system dials preprogrammed number of monitoring station and identifies elevator location to monitoring station. System provides two-way voice communication without using a handset and provides visible signals that indicate when system has been activated and when monitoring station has responded. System is contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply.

D. Fire Department Communication System: Telephone jack in each car and required conductors in traveling cable for fire department communication system.

E. Car Position Indicator: Locate above car door or above car control station and include audible signal to indicate to passengers that car is either stopping at or passing each of the floors served.

    1. Include travel direction arrows if not included in car control station.

F. Hall Push-Button Stations: Locate at each landing for each elevator or group of elevators as indicated.

G. Hall Lanterns: Units with illuminated arrows.

1. With each lantern, include audible signals. Signals sound once for up and twice for down.

H. Hall Position Indicators: Locate above each hoistway entrance at ground floor.

I. Corridor Call Station Pictograph Signs: Matching hall push-button stations with text and graphics according to ASME A17.1, Appendix H.

1.9 DOOR REOPENING DEVICES

A. Infrared Array: Uniform array of 36 or more microprocessor-controlled, infrared light beams projecting across car entrance. Interruption of one or more of the light beams causes doors to stop and reopen.

1.10 ELEVATOR CAR ENCLOSURES

A. General: Provide manufacturer's standard steel-framed car enclosures with nonremovable wall panels, suspended ceiling, trim, accessories, access doors, doors, power door operators, sills (thresholds), lighting, and ventilation.

1. Floor Finish: carpet provided by others.
2. Metal Wall Panels: Flush hollow-metal construction, fabricated from metal indicated.
3. Fabricate car door frame integrally with front wall of car.
4. Stainless-Steel Doors: Flush, hollow-metal construction, fabricated from stainless steel.
5. Sills: Extruded aluminum, with grooved surface, 1/4 inch (6.4 mm) thick.
6. Luminous Ceiling: Fluorescent light fixtures and ceiling panels of translucent acrylic or other permanent rigid plastic complying with flammability requirements.
7. Handrails: Manufacturer's standard metal handrails.

1.11 HOISTWAY ENTRANCES

A. General: Manufacturer's standard horizontal-sliding, door-and-frame hoistway entrances complete with track systems, hardware, sills, and accessories.

1. Where gypsum board wall construction is indicated, provide self-supporting frames with reinforced head sections.
2. Enameled-Steel Frames: Formed steel sheet.
3. Stainless-Steel Frames: Formed stainless-steel sheet.
4. Stainless-Steel Doors: Flush, hollow-metal construction, fabricated from stainless steel.
5. Sills: Extruded aluminum, with grooved surface, 1/4 inch (6.4 mm) thick.
6. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107.

1.12 ELEVATORS

A. Elevator No. 01:

1. Type: Holeless, single-acting, beside-the-car, single cylinder.
2. Rated Load: 2100 lb (953 kg).
3. Rated Speed: 100 fpm (0.51 m/s).
4. Car Enclosures:

    a. Inside Width: 84 inches.
    b. Inside Depth: 72 inches.
    c. Inside Height: 96 inches.
    d. Front Walls: Satin stainless steel with integral car door frames.
    e. Side and Rear Wall Panels: Satin stainless steel.
    f. Door Faces (Interior): Satin stainless steel.

5. Hoistway Entrances:

    a. Width: 36 inches (914 mm).
    b. Height: 84 inches (2134 mm).
    c. Type: Single-speed side sliding.
    d. Frames:

        1) First Floor: Satin stainless steel.
        2) Basement Floors: Satin stainless steel.
        3) Other Floors: Satin stainless steel.

    e. Doors:

        1) First Floor: Satin stainless steel.
        2) Basement Floors: Satin stainless steel.
        3) Other Floors: Satin stainless steel.

6. Additional Requirements:

    a. Provide inspection certificate in each car, mounted under acrylic cover with satin stainless-steel frame.

1.13 INSTALLATION

A. Excavation for Jack: Drill excavation in each elevator pit to accommodate installation of cylinders; comply with applicable requirements in Division 2 Section 02300 "Earthwork."

1. Provide waterproof well casings to retain walls of well hole.

B. Install cylinders in protective casings within well casings after removing water and debris and providing a permanent waterproof seal at bottom of well casing.

1. Align cylinders and fill space between well casing and protective casing with fine sand.

C. Install cylinders plumb and accurately centered for elevator car position and travel. Anchor securely in place, supported at pit floor. Seal between protective casing and pit floor with 4 inches (100 mm) of nonshrink, nonmetallic grout.

D. Leveling Tolerance: 1/4 inch (6 mm), up or down, regardless of load and direction of travel.

E. Set sills flush with finished floor surface at landing. Fill space under sill solidly with nonshrink, nonmetallic grout.

1.14 FIELD QUALITY CONTROL

A. Acceptance Testing: On completion of elevator installation and before permitting use (either temporary or permanent) of elevators, perform acceptance tests as required and recommended by ASME A17.1 and by governing regulations and agencies.

1.15 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain elevators. Review emergency provisions and train Owner's personnel in procedures to follow in identifying sources of operational failures or malfunctions.

1.16 PROTECTION

A. Temporary Use: Do not use elevators for construction purposes unless cars are provided with temporary enclosures, either within finished cars or in place of finished cars, to protect finishes from damage.

1. Provide full maintenance service by skilled, competent employees of elevator Installer for elevators used for construction purposes.

END OF SECTION 14240

SECTION 15050

BASIC MECHANICAL MATERIALS AND METHODS

1.1 GENERAL

A. Definitions include the following:

1. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.
2. Exposed, Interior Installations: Exposed to view indoors.
3. Exposed, Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions.
4. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants.
5. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures.

B. The following are industry abbreviations for plastic and rubber materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. CPVC: Chlorinated polyvinyl chloride plastic.
3. NP: Nylon plastic.
4. PE: Polyethylene plastic.
5. PVC: Polyvinyl chloride plastic.
6. CR: Chlorosulfonated polyethylene synthetic rubber.
7. EPDM: Ethylene-propylene-diene terpolymer rubber.

C. Equipment selection of higher electrical characteristics, physical dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. Any proposed equipment increases shall be at no additional cost to the Government. If minimum energy ratings or efficiencies of equipment are specified, equipment must meet design and commissioning requirements.

1.2 PRODUCTS

A. Refer to individual Division 15 piping Sections for pipe and fitting materials and joining methods and for special joining materials not listed below.
1. Plastic Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer.
2. Solder Filler Metal: ASTM B 32, Alloy Sn95, Alloy Sn94, or Alloy Sb5, unless otherwise indicated.
3. Brazing Filler Metals: AWS A5.8, BCuP Series or Alloy BAg1, unless otherwise indicated.

4. Solvent Cements: ASTM D 2235 for ABS piping, ASTM F 493 for CPVC piping, and ASTM D 2564 with ASTM F 656 primer for PVC piping.

B. Dielectric Fittings: Combination of copper alloy and ferrous; threaded, solder, plain, and weld-neck end types matching piping system materials; with insulating material suitable for system fluid, pressure, and temperature.

1. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).
2. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).
3. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

C. Flexible Connectors: Fabricated from materials suitable for system fluid and that will provide flexible pipe connections. Include 125-psig (860-kPa) minimum working-pressure rating, threaded ends for 2-inch NPS (DN50) and smaller, and flanged ends for 2-1/2-inch NPS (DN65) and larger.

1. Rubber, Flexible Connectors: CR or EPDM elastomer rubber construction, with multiple plies of NP fabric, molded and cured in hydraulic presses. Include 125-psig (860-kPa) minimum working-pressure rating at 220 deg F (104 deg C).

D. Steel, Sheet-Metal Sleeves: 0.0239-inch (0.6-mm) minimum thickness, galvanized, round tube closed with welded longitudinal joint.

E. Steel Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized, plain ends.

F. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.

G. Escutcheons: Manufactured wall, ceiling, and floor plates; deep-pattern type if required to conceal protruding fittings and sleeves. Include ID to closely fit around pipe, tube, and insulation of insulated piping and OD to completely cover opening.

1. Cast Brass: One-piece or split casting, with concealed hinge; set screw; and polished chrome-plated finish.
2. Stamped Steel: Split plate, with concealed hinge, spring clips, and chrome-plated finish.

H. Identifying Devices and Labels: Manufacturer's standard products.

1. Equipment Nameplates: Metal nameplate with operational data engraved or stamped; permanently fastened to equipment in accessible and visible location. Include manufacturer, product name, model number, serial number, capacity, operating and power characteristics, and labels of tested compliances.
2. Stencils: Standard stencils, prepared for required applications with letter sizes complying with recommendations of ASME A13.1 for piping and similar applications, but not less than 1-1/4-inch- (30-mm-) high letters for ductwork and

not less than 3/4-inch- (19-mm-) high letters for access door signs and similar operational instructions.

a. Material: Fiberboard or brass.
b. Stencil Paint: Standard exterior-type stenciling enamel; black, unless otherwise indicated; either brushing grade or pressurized spray-can form and grade.
c. Identification Paint: Standard identification enamel of colors indicated or, if not otherwise indicated for piping systems, comply with ASME A13.1 for colors.

3. Snap-on Plastic Pipe Markers: Manufacturer's standard preprinted, semirigid, snap on, color-coded, complying with ASME A13.1.
4. Pressure-Sensitive Pipe Markers: Manufacturer's standard preprinted, permanent adhesive, color-coded, pressure-sensitive vinyl, complying with ASME A13.1.
5. Plastic Duct Markers: Manufacturer's standard color-coded, laminated plastic. Include green for cold air; yellow for hot air; yellow/green or green for supply air; blue for exhaust, outside, return, and mixed air; and as recommended by ASME A13.1 for hazardous exhausts.

   a. Nomenclature: Include direction of airflow; duct service, origin, and destination; and design cubic feet per meter (liters per second).

6. Engraved Plastic-Laminate Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore. Fabricate in sizes required for message, engrave with standard letter style, of sizes and with wording to match equipment identification, punch for mechanical fastening, and 1/16-inch (1.6-mm) minimum thickness. Include self-tapping stainless-steel screws or contact-type permanent adhesive.
7. Plastic Equipment Markers: Color-coded, laminated plastic. Include green for cooling equipment; yellow for heating equipment; yellow/green or green for combination cooling and heating equipment; brown for energy reclamation equipment; blue for other equipment; and as recommended by ASME A13.1 for hazardous equipment. Include name and plan number, service, design capacity, design parameters, and size approximate 2-1/2 by 4 inches (65 by 100 mm) for control devices, dampers, and valves; and 4-1/2 by 6 inches (115 by 150 mm) for equipment.
8. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in mechanical identification, with corresponding designations indicated. Use numbers, lettering, and wording indicated for proper identification and operation/maintenance of mechanical systems and equipment.

I. Grout: ASTM C 1107, Grade B, nonshrink and nonmetallic, premixed and factory packaged; and 5000-psig (34.5-MPa), 28-day compressive strength design mix.

1.3 EXECUTION

A. Piping Systems - Common Requirements: Install piping as described below, unless piping Sections specify otherwise. Division 15 piping Sections specify unique installation requirements.

B. General Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated.

C. Install components with pressure rating equal to or greater than system operating pressure.

D. Install piping in concealed locations, except in equipment rooms and service areas.

E. Install exposed piping at right angles or parallel to building walls.

F. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.

G. Install piping to allow application of insulation plus 1-inch (25-mm) clearance around insulation as space allows.

H. Locate groups of pipes parallel to each other, spaced to permit valve servicing.

I. Install fittings for changes in direction and branch connections.

J. Install pipe escutcheons for pipe penetrations of concrete and masonry walls, wall board partitions, and suspended ceilings according to the following:

1. Chrome-Plated Piping: Cast brass, one piece, with set screw, and polished chrome-plated finish. Use split-casting escutcheons if required, for existing piping.
2. Uninsulated Piping Wall Escutcheons: Cast brass or stamped steel, with set screw.
3. Insulated Piping: Cast brass or stamped steel; with concealed hinge, spring clips, and chrome-plated finish.
4. Piping in Utility Areas: Cast brass or stamped steel, with set-screw or spring clips.

K. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces, except extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor.
2. Install sleeves large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

a. Steel Pipe Sleeves: For pipes smaller than 6-inch NPS (DN150), in exterior walls.

b. PVC or Steel Pipe Sleeves: For pipes smaller than 6-inch NPS (DN150), unless otherwise indicated.
c. Steel, Sheet-Metal Sleeves: For pipes 6-inch NPS (DN150) and larger, penetrating gypsum-board partitions.

3. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants. Use Type S, Grade NS, Class 25, Use O neutral-curing silicone sealant, unless otherwise indicated.
4. Aboveground, Exterior-Wall, Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeve for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals. Assemble and install mechanical sleeve seals according to manufacturer's written instructions.

L. Verify final equipment locations for roughing-in. Refer to manufacturer’s equipment submittal data for roughing-in requirements for individual pieces of equipment.

M. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping specification Sections. Ream ends of pipes and tubes and remove burrs; bevel plain ends of steel pipe; and remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly. Construct soldered joints according to AWS's "Soldering Manual," Chapter "The Soldering of Pipe and Tube" or CDA's "Copper Tube Handbook"; brazed joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube"; threaded joints according to ASME B1.20.1; and welded joints according to AWS D10.12, "Recommended Practices and Procedures for Welding Low Carbon Steel Pipe."

1. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Comply with ASTM F 402 for safe handling practice of cleaners, primers, and solvent cements, and join ABS piping according to ASTM D 2235 and ASTM D 2661, CPVC piping according to ASTM D 2846 and ASTM F 493, PVC pressure piping according to ASTM D 2672, and PVC nonpressure piping according to ASTM D 2855.

N. Piping Connections: Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping 2-inch NPS (DN50) and smaller, adjacent to each valve and at final connection to each piece of equipment with 2-inch NPS (DN50) or smaller threaded pipe connection.
2. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
3. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

O. Painting and Finishing: All exposed exterior mechanical equipment and materials shall be painted a color as selected by the Contracting Officer or authorized representative. Apply semigloss, acrylic-enamel finish to exposed piping according to the following:

1. Interior, Ferrous Piping and Ferrous Supports: Finish coat over enamel undercoat and primer.
2. Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

P. Concrete Bases: Construct concrete equipment bases of dimensions indicated, but not less than 4 inches (100 mm) larger than supported unit in both directions. Follow supported equipment manufacturer's setting templates for anchor bolt and tie locations. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement.

Q. Erection of Metal Supports and Anchorage: Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment. Comply with AWS D1.1, "Structural Welding Code--Steel," for welding.

R. Cutting and Patching: Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of trades involved. Repair cut surfaces to match adjacent surfaces.

S. Grouting: Install nonmetallic nonshrink grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors.

END OF SECTION 15050

SECTION 15055

MOTORS

1.1 GENERAL

A. Definitions:

1. Factory-Installed Motor: A motor installed by motorized-equipment manufacturer as a component of equipment.
2. Field-Installed Motor: A motor installed at Project site and not factory installed as an integral component of motorized equipment.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70 – NATIONAL ELECTRICAL CODE.

D. Motors shall comply with efficiency requirements of the North Carolina Energy Code.

1.2 PRODUCTS

A. Motor Requirements:

1. Motor requirements apply to factory-installed and field-installed motors except as follows:

   a. Different ratings, performance, or characteristics for a motor are specified in another Section.
   b. Manufacturer for a factory-installed motor requires ratings, performance, or characteristics, other than those specified in this Section, to meet performance specified.

B. Motor Characteristics:

1. Motors 1/2 HP and Larger: Three phase.
2. Motors Smaller Than 1/2 HP: Single phase.
3. Frequency Rating: 60 Hz.
4. Voltage Rating: NEMA standard voltage selected to operate on nominal circuit voltage to which motor is connected.
5. Service Factor: 1.15 for open dripproof motors; 1.15 for totally enclosed motors.
6. Duty: Continuous duty at ambient temperature of 105 deg F (40 deg C) and at altitude of 3300 feet (1005 m) above sea level.

7. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.
8. Enclosure: Open dripproof.

C. Polyphase Motors: NEMA MG 1, Design B, medium induction motor.

1. Efficiency: As prescribed by the latest North Carolina Building Code, Volume X – Energy, Chapter 4, Section 401.2.
2. Stator: Copper windings, unless otherwise indicated.

    a. Multispeed motors shall have separate winding for each speed.

3. Rotor: Squirrel cage, unless otherwise indicated.
4. Bearings: Double-shielded, prelubricated ball bearings suitable for radial and thrust loading.
5. Temperature Rise: Match insulation rating, unless otherwise indicated.
6. Insulation: Class F, unless otherwise indicated.
7. Code Letter Designation:

    a. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.

8. Enclosure: Cast iron for motors 1.0 hp and larger; rolled steel for motors smaller than 1.0 hp.

    a. Finish: Manufacturer’s standard enamel.

D. Polyphase Motors with Additional Requirements:

1. Motors Used with Reduced-Inrush Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
2. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

    a. Designed with critical vibration frequencies outside operating range of controller output.
    b. Temperature Rise: Matched to rating for Class B insulation.
    c. Insulation: Class H.
    d. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

3. Rugged-Duty Motors: Totally enclosed, with 1.25 minimum service factor, greased bearings, integral condensate drains, and capped relief vents. Windings insulated with nonhygroscopic material.

    a. Finish: Chemical-resistant paint over corrosion-resistant primer.

4. Source Quality Control: Perform the following tests on each motor according to NEMA MG 1:

    a. Measure winding resistance.
    b. Read no-load current and speed at rated voltage and frequency.
    c. Measure locked rotor current at rated frequency.
    d. Perform high-potential test.

E. Single-Phase Motors:

1. One of the following, to suit starting torque and requirements of specific motor application:

    a. Permanent-split capacitor.
    b. Split-phase start, capacitor run.
    c. Capacitor start, capacitor run.

2. Shaded-Pole Motors: Shaded pole motors shall not be provided.
3. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.
4. Bearings: Ball type for belt-connected motors and other motors with high radial forces on motor shaft; sealed, prelubricated-sleeve type for other single-phase motors.
5. Source Quality Control: Perform the following tests on each motor according to NEMA MG 1:

    a. Measure winding resistance.
    b. Read no-load current and speed at rated voltage and frequency.
    c. Measure locked rotor current at rated frequency.
    d. Perform high-potential test.

1.3 EXECUTION

A. Motor Installation:

1. Anchor each motor assembly to base, adjustable rails, or other support, arranged and sized according to manufacturer's written instructions. Attach by bolting. Level and align with load transfer link.

B. Field Quality Control:

1. Prepare for acceptance tests as follows:

    a. Run each motor with its controller. Demonstrate correct rotation, alignment, and speed at motor design load.
    b. Test interlocks and control features for proper operation.
    c. Verify that current in each phase is within nameplate rating.

2. Testing: Perform the following field quality-control testing:

   a. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.15.1. Certify compliance with test parameters.
   b. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

C. Adjusting: Align motors, bases, shafts, pulleys and belts. Tension belts according to manufacturer's written instructions.

END OF SECTION 15055

SECTION 15060

HANGERS AND SUPPORTS

1.1 SUMMARY

A. This Section includes hangers and supports for mechanical system piping and equipment.

1.2 PERFORMANCE REQUIREMENTS

A. Design channel support systems for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

B. Design heavy-duty steel trapezes for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

1.3 SUBMITTALS

A. Product Data: For each type of pipe hanger, channel support system component, and thermal-hanger shield insert indicated.

B. Welding certificates.

1.4 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."

1.5 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

1.6 MANUFACTURED UNITS

A. Pipe Hangers, Supports, and Components: MSS SP-58, factory-fabricated components.

1. Available Manufacturers:

a. B-Line Systems, Inc.
b. Grinnell Corp.
c. Michigan Hanger Co., Inc.

2. Galvanized, Metallic Coatings: For piping and equipment that will not have field-applied finish.
3. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

B. Channel Support Systems: MFMA-2, factory-fabricated components for field assembly.

1. Available Manufacturers:

a. B-Line Systems, Inc.
b. Grinnell Corp.
c. Michigan Hanger Co., Inc.

2. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.
3. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

C. Thermal-Hanger Shield Inserts: 100-psi minimum compressive-strength insulation, encased in sheet metal shield.

1. Available Manufacturers:
a.
b. Michigan Hanger Co., Inc.
c. Pipe Shields, Inc.
d. Rilco Manufacturing Co., Inc.

2. Material for Cold Piping: ASTM C 552, Type I cellular glass or water-repellent-treated, ASTM C 533, Type I calcium silicate with vapor barrier.
3. Material for Hot Piping: ASTM C 552, Type I cellular glass or water-repellent-treated, ASTM C 533, Type I calcium silicate.
4. For Trapeze or Clamped System: Insert and shield cover entire circumference of pipe.
5. For Clevis or Band Hanger: Insert and shield cover lower 180 deg rees of pipe.
6. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

1.7 MISCELLANEOUS MATERIALS

A. Powder-Actuated Drive-Pin Fasteners: Powder-actuated-type, drive-pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

C. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars, black and galvanized.

D. Grout: ASTM C 1107, Grade B, factory-mixed and -packaged, nonshrink and nonmetallic, dry, hydraulic-cement grout.

1. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.
2. Properties: Nonstaining, noncorrosive, and nongaseous.
3. Design Mix: 5000-psi, 28-day compressive strength.

1.8 APPLICATIONS

A. Specific hanger requirements are specified in Sections specifying equipment and systems.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Specification Sections.

C. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Adjustable Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
2. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.
3. Adjustable Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
4. U-Bolts (MSS Type 24): For support of heavy pipe, NPS 1/2 to NPS 30.
5. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30, from 2 rods if longitudinal movement caused by expansion and contraction might occur.
6. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

D. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.

E. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.

2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.

F. Building Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. C-Clamps (MSS Type 23): For structural shapes.
3. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

   a. Light (MSS Type 31): 750 lb.
   b. Medium (MSS Type 32): 1500 lb.
   c. Heavy (MSS Type 33): 3000 lb.

G. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe, 360-deg ree insert of high-density, 100-psi minimum compressive-strength, water-repellent-treated calcium silicate or cellular-glass pipe insulation, same thickness as adjoining insulation with vapor barrier and encased in 360-deg ree sheet metal shield.

1.9 INSTALLATION

A. Pipe Hanger and Support Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Channel Support System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems. Field assemble and install according to manufacturer's written instructions.

C. Heavy-Duty Steel Trapeze Installation: Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated, heavy-duty trapezes. Support pipes of various sizes together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

D. Install building attachments within concrete slabs or attach to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, and expansion joints, and at changes in direction of piping. Install concrete

inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

E. Install powder-actuated drive-pin fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.

F. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

G. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

H. Install hangers and supports to allow controlled thermal movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

J. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping," is not exceeded.

K. Insulated Piping: Comply with the following:

1. Attach clamps and spacers to piping.

    a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    c. Do not exceed pipe stress limits according to ASME B31.9.

2. Install MSS SP-58, Type 39 protection saddles, if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
3. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span arc of 180 deg rees.
4. Shield Dimensions for Pipe: Not less than the following:

    a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.

5. Insert Material: Length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

1.10 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure above or to support equipment above floor. Place grout under supports for equipment and make smooth bearing surface.

1.11 METAL FABRICATION

A. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports. Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations. Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

1.12 ADJUSTING

A. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

1.13 PAINTING

A. Touching Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 15060

SECTION 15075

MECHANICAL IDENTIFICATION

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Division 1 Specification Section, apply to this Section.

1.2 SUMMARY

A. This Section includes mechanical identification materials and devices.

1.3 SUBMITTALS

A. Product Data: For identification materials and devices.

1.4 QUALITY ASSURANCE

A. Comply with ASME A13.1, "Scheme for the Identification of Piping Systems" for lettering size, length of color field, colors, and viewing angles of identification devices.

1.5 SEQUENCING AND SCHEDULING

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Install identifying devices before installing acoustical ceilings and similar concealment.

1.6 IDENTIFYING DEVICES AND LABELS

A. General: Products specified are for applications referenced in other Division 15 Sections. If more than single type is specified for listed applications, selection is Installer's option.

B. Equipment Nameplates: Metal permanently fastened to equipment with data engraved or stamped.

1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and essential data.
2. Location: Accessible and visible.

C. Snap-On Plastic Pipe Markers: Manufacturer's standard preprinted, semirigid, snap-on type. Include color-coding according to ASME A13.1, unless otherwise indicated.

D. Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): Full-band pipe markers, extending 360 degrees around pipe at each location.

E. Lettering: Manufacturer's standard preprinted captions as selected by the Contracting Officer or authorized representative.

F. Engraved Plastic-Laminate Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.

1. Engraving: Engraver's standard letter style, of sizes and with terms to match equipment identification.
2. Thickness: 1/8 inch (3 mm), unless otherwise indicated.
3. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

G. Plastic Equipment Markers: Manufacturer's standard laminated plastic, in the following color codes:

1. Green: Cooling equipment and components.
2. Yellow: Heating equipment and components.
3. Blue: Equipment and components that do not meet criteria above.
4. Hazardous Equipment: Use colors and designs recommended by ASME A13.1.
5. Terminology: Match schedules as closely as possible. Include the following:

a. Name and plan number.
b. Equipment service.
c. Design capacity.
d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.

6. Size: 2-1/2 by 4 inches (65 by 100 mm) for control devices, dampers, and valves; 4-1/2 by 6 inches (115 by 150 mm) for equipment.

1.7 LABELING AND IDENTIFYING PIPING SYSTEMS

A. Install pipe markers on each system. Include arrows showing normal direction of flow.

B. Marker Type: Plastic markers, with application systems. Install on pipe insulation segment where required for hot, noninsulated pipes.

C. Fasten markers on pipes and insulated pipes smaller than 6 inches (150 mm) OD by one of following methods:

1. Snap-on application of pretensioned, semirigid plastic pipe marker.

D. Locate pipe markers and color bands where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior nonconcealed locations according to the following:

1. Near each control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Mark each pipe at branch, where flow pattern is not obvious.
3. Near major equipment items and other points of origination and termination.
4. Spaced at a maximum of 50-foot (15-m) intervals along each run. Reduce intervals to 25 feet (7.5 m) in areas of congested piping and equipment.
5. On piping above removable acoustical ceilings, except omit intermediately spaced markers.

1.8 EQUIPMENT SIGNS AND MARKERS

A. Install engraved plastic-laminate signs or equipment markers on or near each major item of mechanical equipment. Include signs for the following general categories of equipment:

1. Condensers, and similar motor-driven units.
2. Fans, blowers, primary balancing dampers, and mixing boxes.
3. Packaged HVAC units.

B. Plasticized Tags: Install within concealed space, to reduce amount of text in exposed sign outside concealment, if equipment to be identified is concealed above acoustical ceiling or similar concealment.

1.9 ADJUSTING AND CLEANING

A. Relocate mechanical identification materials and devices that have become visually blocked by work of this or other Divisions.

END OF SECTION 15075

SECTION 15081

DUCT INSULATION

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Division 1 Specification Section, apply to this Section.

1.2 SUMMARY

A. This Section includes semirigid and flexible duct and plenum insulation; insulating cements; field-applied jackets; accessories and attachments; and sealing compounds.

B. Related Section includes the following:

1. Division 15 Section 15083 "Pipe Insulation" for insulation for piping systems.

1.3 SUBMITTALS

A. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.

B. Installer Certificates: Signed by the Contractor certifying that installers comply with requirements.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate clearance requirements with duct Installer for insulation application.

1.7 SCHEDULING

A. Schedule insulation application after testing duct systems. Insulation application may begin on segments of ducts that have satisfactory test results.

1.8 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following (or approved equal):

1. Mineral-Fiber Insulation:

a. CertainTeed Manson.
b. Knauf FiberGlass GmbH.
c. Owens-Corning Fiberglas Corp.
d. Schuller International, Inc.

1.9 INSULATION MATERIALS

A. Mineral-Fiber Blanket Thermal Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II, without facing and with all-service jacket manufactured from kraft paper, reinforcing scrim, aluminum foil, and vinyl film.

1.10 FACTORY-APPLIED JACKETS

A. General: ASTM C 921, Type 1, unless otherwise indicated.

B. Foil and Paper Jacket: Laminated, glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil.

1.11 ACCESSORIES AND ATTACHMENTS

A. Glass Cloth and Tape: Comply with MIL-C-20079H, Type I for cloth and Type II for tape. Woven glass-fiber fabrics, plain weave, presized a minimum of 8 oz./sq. yd. (270 g/sq. m).

1. Tape Width: 4 inches (100 mm).

1.12 VAPOR RETARDERS

A. Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

1.13 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

1.14 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

1.15 GENERAL APPLICATION REQUIREMENTS

A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; and free of voids throughout the length of ducts and fittings.

B. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each duct system.

C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Apply multiple layers of insulation with longitudinal and end seams staggered.

E. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.

F. Keep insulation materials dry during application and finishing.

G. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.

H. Apply insulation with the least number of joints practical.

I. Apply insulation over fittings and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated.

J. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic. Apply insulation continuously through hangers and around anchor attachments.

K. Insulation Terminations: For insulation application where vapor retarders are indicated, seal ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.

L. Apply insulation with integral jackets as follows:

1. Pull jacket tight and smooth.
2. Joints and Seams: Cover with tape and vapor retarder as recommended by insulation material manufacturer to maintain vapor seal.
3. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to duct flanges and fittings.

M. Cut insulation according to manufacturer's written instructions to prevent compressing insulation to less than 75 percent of its nominal thickness.

N. Install vapor-retarder mastic on ducts and plenums scheduled to receive vapor retarders.

1. Ducts with Vapor Retarders: Overlap insulation facing at seams and seal with vapor-retarder mastic and pressure-sensitive tape having same facing as insulation. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-retarder seal.
2. Ducts without Vapor Retarders: Overlap insulation facing at seams and secure with outward clinching staples and pressure-sensitive tape having same facing as insulation.

1.16 MINERAL-FIBER INSULATION APPLICATION

A. Blanket Applications for Ducts and Plenums: Secure blanket insulation with adhesive.

1. Apply adhesives according to manufacturer's recommended coverage rates per square foot, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation segment with 1/2-inch (13-mm) staples, 1 inch (25 mm) o.c., and cover with pressure-sensitive tape having same facing as insulation.
4. Apply insulation on rectangular duct elbows and transitions with a full insulation segment for each surface. Apply insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
5. Insulate duct stiffeners, hangers, and flanges that protrude beyond the insulation surface with 6-inch- (150-mm-) wide strips of the same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with anchor pins spaced 6 inches (150 mm) o.c.
6. Apply vapor-retarder mastic to open joints, breaks, and punctures for insulation indicated to receive vapor retarder.

1.17 DUCT SYSTEM APPLICATIONS

A. Insulation materials and thicknesses are specified in schedules at the end of this Section.

B. Materials and thicknesses for systems listed below are specified in schedules at the end of this Section.

C. Insulate the following plenums and duct systems:

1. Indoor concealed supply and outside-air ductwork.

D. Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:

1. Factory-insulated flexible ducts.
2. Factory-insulated plenums, casings, terminal boxes, and filter boxes and sections.
3. Flexible connectors.
4. Vibration-control devices.
5. Testing agency labels and stamps.
6. Nameplates and data plates.
7. Access panels and doors in air-distribution systems.

1.18 INDOOR DUCT AND PLENUM APPLICATION SCHEDULE

A. Service: Rectangular and round, supply and outdoor air ducts, concealed.

1. Material: Mineral-fiber blanket.
2. Thickness: 1-1/2 inches (38 mm).
3. Number of Layers: One.
4. Factory-Applied Jacket: Foil and paper.
5. Vapor Retarder Required: Yes.

END OF SECTION 15081

SECTION 15083

PIPE INSULATION

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes preformed, rigid and flexible pipe insulation; insulating cements; field-applied jackets; accessories and attachments; and sealing compounds.

1.3 SUBMITTALS

A. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets with requirements indicated. Include dates of tests.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 15 Section 15060 "Hangers and Supports."

B. Coordinate clearance requirements with piping Installer for insulation application.

1.7 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Mineral-Fiber Insulation:

   a. CertainTeed Manson.
   b. Knauf FiberGlass GmbH.
   c. Owens-Corning Fiberglas Corp.
   d. Schuller International, Inc.

2. Flexible Elastomeric Thermal Insulation:

   a. Armstrong World Industries, Inc.
   b. Rubatex Corp.

3. Polyolefin Insulation:

   a. Armstrong World Industries, Inc.
   b. IMCOA.

4. Closed-Cell Phenolic-Foam Insulation:

   a. Kooltherm Insulation Products, Ltd.

1.8 INSULATION MATERIALS

A. Mineral-Fiber Insulation: Glass fibers bonded with a thermosetting resin complying with the following:

1. Preformed Pipe Insulation: Comply with ASTM C 547, Type 1, with factory-applied, all-purpose, vapor-retarder jacket.

2. Fire-Resistant Adhesive: Comply with MIL-A-3316C in the following classes and grades:

   a. Class 1, Grade A for bonding glass cloth and tape to unfaced glass-fiber insulation, for sealing edges of glass-fiber insulation, and for bonding lagging cloth to unfaced glass-fiber insulation.
   b. Class 2, Grade A for bonding glass-fiber insulation to metal surfaces.

3. Vapor-Retarder Mastics: Fire- and water-resistant, vapor-retarder mastic for indoor applications. Comply with MIL-C-19565C, Type II.

4. Mineral-Fiber Insulating Cements: Comply with ASTM C 195.

5. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

B. Flexible Elastomeric Thermal Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

1. Adhesive: As recommended by insulation material manufacturer.
2. Ultraviolet-Protective Coating: As recommended by insulation manufacturer.

C. Polyolefin Insulation: Unicellular polyethylene thermal plastic, preformed pipe insulation. Comply with ASTM C 534, Type I, except for density.

1. Adhesive: As recommended by insulation material manufacturer.

D. Closed-Cell Phenolic-Foam Insulation: Preformed pipe insulation of rigid, expanded, closed-cell structure. Comply with ASTM C 1126, Type III, Grade 1.

E. Prefabricated Thermal Insulating Fitting Covers: Comply with ASTM C 450 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.

1.9 FIELD-APPLIED JACKETS

A. Standard PVC Fitting Covers: Factory-fabricated fitting covers manufactured from 20-mil-thick, high-impact, ultraviolet-resistant PVC.

1. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories for the disabled.
2. Adhesive: As recommended by insulation material manufacturer.

1.10 ACCESSORIES AND ATTACHMENTS

A. Glass Cloth and Tape: Comply with MIL-C-20079H, Type I for cloth and Type II for tape. Woven glass-fiber fabrics, plain weave, presized a minimum of 8 oz./sq. yd..

1. Tape Width: 4 inches.

1.11 VAPOR RETARDERS

A. Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

1.12 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

1.13 PREPARATION

A. Surface Preparation: Clean and dry pipe and fitting surfaces. Remove materials that will adversely affect insulation application.

1.14 GENERAL APPLICATION REQUIREMENTS

A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.

B. Refer to schedules at the end of this Section for materials, forms, jackets, and thickness required for each piping system.

C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Apply insulation with longitudinal seams at top and bottom of horizontal pipe runs.

E. Apply multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.

H. Keep insulation materials dry during application and finishing.

I. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.

J. Apply insulation with the least number of joints practical.

K. Apply insulation over fittings, valves, and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated. Refer to special instructions for applying insulation over fittings, valves, and specialties.

L. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic.

1. Apply insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor retarders are indicated, extend insulation on anchor legs at least 12 inches from point of attachment to pipe and taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.

3. Install insert materials and apply insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by the insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect the jacket from tear or puncture by the hanger, support, and shield.

M. Insulation Terminations: For insulation application where vapor retarders are indicated, taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.

N. Apply adhesives and mastics at the manufacturer's recommended coverage rate.

O. Apply insulation with integral jackets as follows:

1. Pull jacket tight and smooth.
2. Circumferential Joints: Cover with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip and spaced 4 inches o.c.
3. Longitudinal Seams: Overlap jacket seams at least 1-1/2 inches. Apply insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.

   a. Exception: Do not staple longitudinal laps on insulation having a vapor retarder.

4. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to flanges, unions, valves, and fittings.
5. At penetrations in jackets for thermometers and pressure gages, fill and seal voids with vapor-retarder mastic.

P. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and floors.

Q. Fire-Rated Wall and Partition Penetrations: Apply insulation continuously through penetrations of fire-rated walls and partitions.

R. Floor Penetrations: Apply insulation continuously through floor assembly.

1. For insulation with vapor retarders, seal insulation with vapor-retarder mastic where floor supports penetrate vapor retarder.

1.15 MINERAL-FIBER INSULATION APPLICATION

A. Apply insulation to straight pipes and tubes as follows:

1. Secure each layer of preformed pipe insulation to pipe with wire, tape, or bands without deforming insulation materials.

2. Where vapor retarders are indicated, seal longitudinal seams and end joints with vapor-retarder mastic. Apply vapor retarder to ends of insulation at intervals of 15 to 20 feet to form a vapor retarder between pipe insulation segments.
3. For insulation with factory-applied jackets, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets with vapor retarders, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by the insulation material manufacturer and seal with vapor-retarder mastic.

B. Apply insulation to flanges as follows:

1. Apply preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Apply canvas jacket material with manufacturer's recommended adhesive, overlapping seams at least 1 inch, and seal joints with vapor-retarder mastic.

C. Apply insulation to fittings and elbows as follows:

1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When premolded insulation elbows and fittings are not available, apply mitered sections of pipe insulation, or glass-fiber blanket insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire, tape, or bands.
3. Cover fittings with standard PVC fitting covers.

D. Apply insulation to valves and specialties as follows:

1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When premolded insulation sections are not available, apply glass-fiber blanket insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, arrange insulation for access to stainer basket without disturbing insulation.
3. Apply insulation to flanges as specified for flange insulation application.
4. Use preformed standard PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.

1.16 FLEXIBLE ELASTOMERIC THERMAL INSULATION APPLICATION

A. Apply insulation to straight pipes and tubes as follows:

1. Follow manufacturer's written instructions for applying insulation.

2. Seal longitudinal seams and end joints with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

B. Apply insulation to flanges as follows:

1. Apply pipe insulation to outer diameter of pipe flange.
2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of the same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

C. Apply insulation to fittings and elbows as follows:

1. Apply mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

D. Apply insulation to valves and specialties as follows:

1. Apply preformed valve covers manufactured of the same material as pipe insulation and attached according to the manufacturer's written instructions.
2. Apply cut segments of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, fabricate removable sections of insulation arranged to allow access to stainer basket.
3. Apply insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

1.17 POLYOLEFIN INSULATION APPLICATION

A. Apply insulation to straight pipes and tubes as follows:

1. Follow manufacturer's written instructions for applying insulation.
2. For split tubes, seal longitudinal seams and end joints with manufacturer's recommended adhesive.
3. For self-adhesive insulation, staple longitudinal seams after sealing. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

B. Apply insulation to flanges as follows:

1. Apply pipe insulation to outer diameter of pipe flange.

2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polyolefin sheet insulation of the same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

C. Apply insulation to fittings and elbows as follows:

1. Apply mitered sections of polyolefin pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

D. Apply insulation to valves and specialties as follows:

1. Apply preformed valve covers manufactured of the same material as pipe insulation and attached according to the manufacturer's written instructions.
2. Apply cut segments of polyolefin pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, fabricate removable sections of insulation arranged to allow access to stainer basket.
3. Apply insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

1.18 CLOSED-CELL PHENOLIC-FOAM INSULATION APPLICATION

A. Apply insulation to straight pipes and tubes as follows:

1. Secure each layer of insulation to pipe with wire, tape, or bands without deforming insulation materials.
2. Where vapor retarders are indicated, seal longitudinal seams and end joints with vapor-retarder mastic.
3. For insulation with factory-applied jackets, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets with vapor retarders, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by the insulation material manufacturer and seal with vapor-retarder mastic.

B. Apply insulation to flanges as follows:

1. Apply preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of block insulation of the same material and thickness as pipe insulation.
4. Apply canvas jacket material with manufacturer's recommended adhesive, overlapping seams at least 1 inch, and seal joints with vapor-retarder mastic.

C. Apply insulation to fittings and elbows as follows:

1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When premolded sections of insulation are not available, apply mitered sections of phenolic-foam insulation. Secure insulation materials with wire, tape, or bands.
3. Cover fittings with standard PVC fitting covers.

D. Apply insulation to valves and specialties as follows:

1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When premolded sections of insulation are not available, apply mitered segments of phenolic-foam insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, arrange insulation for access to stainer basket without disturbing insulation.
3. Apply insulation to flanges as specified for flange insulation application.
4. Use preformed standard PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.

1.19 FINISHES

A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of the insulation manufacturer's recommended protective coating.

1.20 PIPING SYSTEM APPLICATIONS

A. Insulation materials and thicknesses are specified in schedules at the end of this Section.

B. Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:

1. Flexible connectors.
2. Fire-suppression piping.
3. Chrome-plated pipes and fittings, unless potential for personnel injury.
4. Air chambers, unions, strainers, check valves, plug valves, and flow regulators.

1.21 INSULATION APPLICATION SCHEDULE, GENERAL

A. Refer to insulation application schedules for required insulation materials, vapor retarders, and field-applied jackets.

B. Application schedules identify piping system and indicate pipe size ranges and material, thickness, and jacket requirements.

1.22 INTERIOR INSULATION APPLICATION SCHEDULE

A. Service: Domestic hot and recirculated hot water.

1. Operating Temperature: 60 to 140 deg F.
2. Insulation Material: Flexible elastomeric; Polyolefin; or Closed-cell phenolic foam.
3. Insulation Thickness: Apply the following insulation thicknesses:

   a. Copper Pipe, ½ inch to 2 inches: ½ inch insulation thickness

4. Field-Applied Jacket: None.
5. Vapor Retarder Required: No.
6. Finish: None.
7.

B. Service: Condensate drain piping.

1. Operating Temperature: 35 to 75 deg F.
2. Insulation Material: Flexible elastomeric or Polyolefin.
3. Insulation Thickness: ½ inch
4. Field-Applied Jacket: None.
5. Vapor Retarder Required: Yes.
6. Finish: None.

C. Service: Exposed sanitary drains and domestic water supplies and stops for fixtures for the disabled.

1. Operating Temperature: 35 to 120 deg F.
2. Insulation Material: Flexible elastomeric or Polyolefin.
3. Insulation Thickness: ¾ inch
4. Field-Applied Jacket: PVC P-trap and supply covers.
5. Vapor Retarder Required: No.
6. Finish: None.

D. Service: Chilled-water supply and return.

1. Operating Temperature: 35 to 75 deg F.
2. Insulation Material: Flexible elastomeric; Polyolefin; or Closed-cell phenolic foam.
3. Insulation Thickness: Apply the following insulation thicknesses:

a. Steel Pipe, 1/2 inch to 2 inch pipe size: ½ inch insulation thickness.
b. Steel Pipe, Larger than 2 inch pipe size: ¾ inch insulation thickness

4. Field-Applied Jacket: None.
5. Vapor Retarder Required: Yes.
6. Finish: None.

E. Service: Heating hot-water supply and return.

1. Operating Temperature: 100 to 200 deg F.
2. Insulation Material: Mineral fiber.
3. Insulation Thickness: Apply the following insulation thicknesses:

a. Steel Pipe, ½ inch to 1-1/2 pipe size: 1 inch thick insulation.
b. Steel Pipe, 2 inch to 4 inch pipe size: 1-1/2 inch insulation

4. Field-Applied Jacket: None.
5. Vapor Retarder Required: No.
6. Finish: None.

END OF SECTION 15083

SECTION 15110

VALVES

1.1 SUMMARY

A. This Section includes the following general-duty valves:

1. Copper-alloy ball valves.
2. Ferrous-alloy butterfly valves.
3. Bronze check valves.
4. Gray-iron check valves.
5. Bronze gate valves.

1.2 SUBMITTALS

A. Product Data: For each type of valve indicated. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include list indicating valve and its application. Include rated capacities; furnished specialties; and accessories.

1.3 QUALITY ASSURANCE

A. ASME Compliance: ASME B31.9 for building services piping valves.

B. ASME Compliance for Ferrous Valves: ASME B16.10 and ASME B16.34 for dimension and design criteria.

C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.4 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

1.5 VALVES, GENERAL

A. Refer to Part 3 "Valve Applications" Article for applications of valves.

B. Bronze Valves: NPS 2 and Smaller: Threaded ends, unless otherwise indicated.

C. Ferrous Valves NPS 2-1/2 and Larger: Flanged ends, unless otherwise indicated.

D. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

E. Valve Sizes: Same as upstream pipe, unless otherwise indicated.

F. Valve Actuators:

1. Handwheel: For valves other than quarter-turn types.
2. Lever Handle: For quarter-turn valves NPS 6 and smaller.

G. Extended Valve Stems: On insulated valves.

H. Valve Flanges: ASME B16.1 for cast-iron valves, ASME B16.5 for steel valves, and ASME B16.24 for bronze valves.

I. Valve Bypass and Drain Connections: MSS SP-45.

1.6 COPPER-ALLOY BALL VALVES

A. Available Manufacturers:

1. Two-Piece, Copper-Alloy Ball Valves:

a. Conbraco Industries, Inc.; Apollo Div.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Hammond Valve.
c. Jamesbury, Inc.

B. Copper-Alloy Ball Valves, General: MSS SP-110.

C. Two-Piece, Copper-Alloy Ball Valves: Brass or bronze body with full-port, chrome-plated bronze ball; PTFE or TFE seats; and 600-psig minimum CWP rating and blowout-proof stem.

1.7 FERROUS-ALLOY BUTTERFLY VALVES

A. Available Manufacturers:

1. Full-Lug, Ferrous-Alloy Butterfly Valves:

a. American Valve, Inc.
b. Milwaukee Valve Company.
c. Tyco International, Ltd.; Tyco Valves & Controls.

B. Ferrous-Alloy Butterfly Valves, General: MSS SP-67, Type I, for tight shutoff, with disc and lining suitable for potable water, unless otherwise indicated.

C. Single-Flange, 150-psig CWP Rating, Ferrous-Alloy Butterfly Valves: Full-lug type with one- or two-piece stem.

1.8 BRONZE CHECK VALVES

A. Available Manufacturers:

1. Type 4, Bronze, Swing Check Valves with Nonmetallic Disc:

a. Cincinnati Valve Co.
b. Milwaukee Valve Company.
c. Walworth Co.

B. Bronze Check Valves, General: MSS SP-80.

C. Type 4, Class 125, Bronze, Swing Check Valves: Bronze body with nonmetallic disc and bronze seat.

1.9 BRONZE GATE VALVES

A. Available Manufacturers:

1. Type 2, Bronze, Rising-Stem, Solid-Wedge Gate Valves:

a. American Valve, Inc.
b. Crane Co.; Crane Valve Group; Stockham Div.
c. Milwaukee Valve Company.

B. Bronze Gate Valves, General: MSS SP-80, with ferrous-alloy handwheel.

C. Type 2, Class 125, Bronze Gate Valves: Bronze body with rising stem and bronze solid wedge and union-ring bonnet.

1.10 VALVE APPLICATIONS

A. Refer to piping paragraphs below for specific valve applications. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball, butterfly, or gate valves.
2. Throttling Service: Angle, ball, or butterfly valves.
3. Pump Discharge: Swing-check valves.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.

C. Chilled-Water Piping: Use the following types of valves:

1. Ball Valves, NPS 2 and Smaller: Two-piece, 600-psig CWP rating, copper alloy.
2. Butterfly Valves, NPS 2-1/2 and Larger: Single-flange, 150-psig CWP rating, ferrous alloy, with EPDM liner.
3. Swing Check Valves, NPS 2 and Smaller: Type 4, Class 125, bronze.
4. Gate Valves, NPS 2 and Smaller: Type 2, Class 125, bronze.

D. Domestic (Makeup) Water Piping: Use the following types of valves:

1. Ball Valves, NPS 2 and Smaller: Two-piece, 600-psig CWP rating, copper alloy.

E. Heating Water Piping: Use the following types of valves:

1. Ball Valves, NPS 2 and Smaller: Two-piece, 600-psig CWP rating, copper alloy.
2. Butterfly Valves, NPS 2-1/2 and Larger: Single-flange, 150-CWP rating, ferrous alloy, with EPDM liner.
3. Swing Check Valves, NPS 2 and Smaller: Type 4, Class 125, bronze.
4. Gate Valves, NPS 2 and Smaller: Type 2, Class 125, bronze.

1.11 VALVE INSTALLATION

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

C. Locate valves for easy access and provide separate support where necessary.

D. Install valves in horizontal piping with stem at or above center of pipe.

E. Install valves in position to allow full stem movement.

F. Install check valves for proper direction of flow and as follows:

1.12 JOINT CONSTRUCTION

A. Refer to Division 15 Section 15050 "Basic Mechanical Materials and Methods" for basic piping joint construction.

B. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

1.13 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

END OF SECTION 15110

SECTION 15122

METERS AND GAGES

1.1 SUMMARY

A. This Section includes meters and gages for mechanical systems.

1.2 SUBMITTALS

A. Product Data: For each product indicated. Include scale range, ratings, and calibrated performance curves for each meter, gage, fitting, specialty, and accessory specified.

1.3 MANUFACTURERS

A. In other Part 2 articles where subparagraphs titles below introduce lists, the following requirements apply for product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified.

1.4 THERMOMETERS

A. Scale Range: Temperature ranges for services listed are as follows:

1. Hot Water: 30 to 300 deg F, with 2-degree scale divisions (0 to 150 deg C, with 1-degree scale divisions).

B. Liquid-in-Glass Thermometers: Comply with ASTM E 1.

1. Available Products:

a. Dresser Industries, Inc., Instrument Div.; Weksler Instruments Operating Unit.
b. Ernst Gage Co.
c. Palmer Instruments, Inc.
d. Trerice, H. O. Co.
e. Weiss Instruments, Inc.
f. Winter's Thermogauges, Inc.

2. Case: Die cast and aluminum finished in baked-epoxy enamel, glass front, spring secured, 9 inches (230 mm) long.
3. Adjustable Joint: Finish to match case, 180-degree adjustment in vertical plane, 360-deg ree adjustment in horizontal plane, with locking device.
4. Tube: Red or blue reading, organic-liquid filled with magnifying lens.
5. Scale: Satin-faced nonreflective aluminum with permanently etched markings.

6. Stem: Copper-plated steel, aluminum, or brass for separable socket; of length to suit installation.

C. Thermometer Wells: Fitting with protective well for installation in threaded pipe fitting to hold test thermometer.

1. Material (in Steel Piping): Stainless steel.
2. Extension-Neck Length: Nominal thickness of 2 inches (50 mm), but not less than thickness of insulation. Omit extension neck for wells for piping not insulated.
3. Insertion Length: To extend to one-third of diameter of pipe.
4. Cap: Threaded, with chain permanently fastened to socket.
5. Heat-Transfer Fluid: Oil or graphite.

1.5 PRESSURE GAGES

A. Pressure Gages: ASME B40.1; phosphor-bronze bourdon-tube type with bottom connection; dry type, unless liquid-filled-case type is indicated.

1. Available Products:

a. AMETEK, Inc., U.S. Gauge Div.
b. Dresser Industries, Inc., Instrument Div.; Weksler Instruments Operating Unit.
c. Ernst Gage Co.
d. Trerice, H. O. Co.
e. Weiss Instruments, Inc.

2. Case: Drawn steel, brass, or aluminum with 4-1/2-inch- (115-mm-) diameter, glass lens.
3. Connector: Brass, NPS 1/4 (DN 8).
4. Scale: White-coated aluminum with permanently etched markings.
5. Accuracy: Plus or minus 2 percent of middle 50 percent of scale.
6. Range: Comply with the following:

a. Vacuum: 30 inches Hg of vacuum to 15 psig of pressure (100 kPa of vacuum to 103 kPa of pressure).
b. Fluids under Pressure: Two times the operating pressure.

7. Pressure-Gage Fittings

a. Valves: NPS 1/4 (DN 8) brass or stainless-steel needle type.
b. Syphons: NPS 1/4 (DN 8) coil of brass tubing with threaded ends.
c. Snubbers: ASME B40.5, NPS 1/4 (DN 8) brass bushing with corrosion-resistant porous-metal disc of material suitable for system fluid and working pressure.

1.6 THERMOMETER INSTALLATION

A. Install thermometers and adjust vertical and tilted positions.

B. Install where shown on the drawings.

C. Install thermometer wells in vertical position in piping tees where fixed thermometers are indicated.

1.7 PRESSURE GAGE INSTALLATION

A. Install pressure gages in piping tees with pressure-gage valve located on pipe at most readable position.

B. Install liquid-filled-type pressure gages at suction and discharge of each pump.

1. Install pressure-gage needle valve and snubber in piping to pressure gages.

END OF SECTION 15122

SECTION 15140

DOMESTIC WATER PIPING

1.1 GENERAL

A. Performance Requirements: Provide components and installation capable of producing domestic water piping systems with the following minimum working-pressure ratings, unless otherwise indicated:

1. Domestic Water Distribution Piping: 125 psig (860 kPa).

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. Comply with NSF 61, "Drinking Water System Components-Health Effects; Sections 1 through 9," for potable domestic water piping and components.

1.2 PRODUCTS

A. Piping Materials: Refer to "Piping Applications" Paragraph for applications of pipe, tube, fitting, and joining materials.

1. Soft Copper Tube: ASTM B 88, Types K and L (ASTM B 88M, Types A and B), water tube, annealed temper.

a. Copper Pressure Fittings: ASME B16.22, wrought-copper, solder-joint fittings.
b. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end.
c. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.

1.3 EXECUTION

A. Piping Applications:

1. Aboveground Domestic Water Piping: Use the following piping materials for each size range:

a. NPS 1-1/2 (DN 40) and Smaller: Hard copper tube, Type L; copper pressure fittings; and soldered joints.

B. Piping Installation: Refer to Division 15 Section 15050 "Basic Mechanical Materials and Methods" for basic piping installation.

1. Install aboveground domestic water piping level without pitch and plumb.
2. Fill water piping. Check components to determine that they are not air bound and that piping is full of water.

C. Perform the following steps before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.

D. Check plumbing equipment and verify proper settings, adjustments, and operation. Do not operate water heaters before filling with water.

E. Check plumbing specialties and verify proper settings, adjustments, and operation.

F. Joint Construction: Refer to Division 15 Section 15050 "Basic Mechanical Materials and Methods" for basic piping joint construction.

1. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

G. Hanger and Support Installation: Refer to Division 15 Section 15060 "Hangers and Supports" for pipe hanger and support devices. Install the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Individual, Straight, Horizontal Piping Runs: According to the following:

a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.

H. Install supports according to Division 15 Section 15060 "Hangers and Supports."

1. Support vertical piping and tubing at base and at each floor.
2. Rod diameter may be reduced 1 size for double-rod hangers, to a minimum of 3/8-inch (10 mm).

I. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 (DN 20) and Smaller: 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
2. NPS 1 and NPS 1-1/4 (DN 25 and DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.

J. Install supports for vertical copper tubing every 10 feet (3 m).

K. Connections: Drawings indicate general arrangement of piping, fittings, and specialties.

1. Install piping adjacent to equipment and machines to allow service and maintenance.
2. Connect domestic water piping to exterior water service piping. Use transition fitting to join dissimilar piping materials.

L. Field Quality Control:

1. Inspect domestic water piping as follows:

a. Do not enclose, cover, or put piping into operation until it is inspected and approved by Contracting Officer's Representative.
b. During installation, provide the contracting officer's authorized representative at least 24 hours notice before inspection must be made. Perform tests specified below in presence of Contracting Officer's Representative:

1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2) Final Inspection: Arrange for final inspection by Contracting Officer's Representative to observe tests specified below and to ensure compliance with requirements.

2. Reinspection: If Contracting Officer's Representative finds that piping will not pass test or inspection, make required corrections and arrange for reinspection.
3. Test domestic water piping as follows:

a. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
b. Leave uncovered and unconcealed new, altered, extended, or replaced domestic water piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
c. Cap and subject piping to static water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
d. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.

M. Clean and disinfect domestic water piping as follows:

1. Purge new piping and parts of existing domestic water piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures as described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
b. Fill and isolate system according to either of the following:

1) Fill system or part thereof with water/chlorine solution with at least 50 ppm (50 mg/L) of chlorine. Isolate with valves and allow to stand for 24 hours.
2) Fill system or part thereof with water/chlorine solution with at least 200 ppm (200 mg/L) of chlorine. Isolate and allow to stand for three hours.

c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.

d. Testing of water samples shall be performed by an independent laboratory. Contractor shall submit water samples in sterile bottles for testing. Contractor is responsible for cost of all lab sampling and testing. Results of the test shall be forwarded to the Contracting Officer's authorized representative for review and approval. Repeat procedures if biological examination shows contamination.

N. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION 15140

SECTION 15150

SANITARY WASTE AND VENT PIPING

1.1 SUMMARY

A. This Section includes soil and waste, sanitary drainage and vent piping inside the building.

1.2 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; "NSF-drain" for plastic drain piping; "NSF-tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer piping.

1.3 PIPING MATERIALS

A. Steel Pipe: ASTM A 53, Type E or S, Grade A or B, Schedule 40, galvanized. Include ends matching joining method.

1. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53 or ASTM A 106, Schedule 40, galvanized, seamless steel pipe. Include ends matching joining method.
2. Malleable-Iron Unions: ASME B16.39; Class 150; hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface; and female threaded ends.

B. Hard Copper Tube: ASTM B 88, Types L and M (ASTM B 88M, Types B and C), water tube, drawn temper.

1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought- copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end.
3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

C. PVC Pipe: ASTM D 2665, solid-wall drain, waste, and vent.

1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.

1.4 PIPING APPLICATIONS

A. Aboveground, Soil, Waste, and Vent Piping: Use the following piping materials for each size range:
   1. NPS 1-1/4 and NPS 1-1/2 (DN 32 and DN 40): PVC pipe, PVC socket fittings, and solvent-cemented joints.
   2. NPS 2 to NPS 4 (DN 50 to DN 100): PVC pipe, PVC socket fittings, and solvent-cemented joints.
   3. Steel Pipe Nipples.

B. Underground, Soil, Waste, and Vent Piping: Use the following piping materials for each size range:
   1. NPS 2 to NPS 4 (DN 50 to DN 100): PVC pipe, PVC socket fittings, and solvent-cemented joints.

1.5 PIPING INSTALLATION

A. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

B. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 deg rees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

C. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

D. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:

   1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 (DN 80) and smaller; 1 percent downward in direction of flow for piping NPS 4 (DN 100) and larger.
   2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
   3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

E. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.

F. Do not enclose, cover, or put piping into operation until it is inspected and approved by Contracting Officer’s Representative.

1.6 JOINT CONSTRUCTION

A. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

1.7 HANGER AND SUPPORT INSTALLATION

A. Install supports for vertical copper tubing every 10 feet (3 m).

B. Install hangers for ABS and PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 48 inches (1200 mm) with 3/8-inch (10-mm) rod.
2. NPS 3 (DN 80): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.

C. Install supports for vertical PVC piping every 48 inches (1200 mm).

D. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

1.8 FIELD QUALITY CONTROL

A. During installation, notify Contracting Officer’s Representative at least 24 hours before inspection must be made. Perform tests specified below in presence of Contracting Officer or authorized representative.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by Contracting Officer or authorized representative to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If Contracting Officer’s Representative find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by Contracting Officer’s Representative.

D. Test sanitary drainage and vent piping according to procedures of Contracting Officer’s Representative.

1. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
2. Prepare reports for tests and required corrective action.

1.9 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

1.10 PROTECTION

A. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

END OF SECTION 15150

SECTION 15181

HYDRONIC PIPING

1.1 SUMMARY

A. This Section includes piping, special-duty valves, and hydronic specialties for hot-water heating, and chilled-water cooling water systems; makeup water for these systems; condensate drain piping.

B. See Division 15 Section 15050 "Basic Mechanical Materials and Methods" for general piping materials and installation requirements.

C. See Division 15 Section 15185 "Hydronic Pumps" for pumps, motors, and accessories for hydronic piping.

D. See Division 15 Section 15900 "HVAC Instrumentation and Controls" for temperature-control valves and sensors.

1.2 SUBMITTALS

A. Product Data: For each type of special-duty valve indicated. Include flow and pressure drop curves based on manufacturer's testing for diverting fittings, and self-contained automatic flow-control valves.

B. Welding certificates.

C. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Welding: Qualify processes and operators according to the ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

B. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.

1.4 COORDINATION

A. Piping space is limited. Coordinate piping locations, heights, and routing with electrical, fire protection, and other trades to avoid interferences, piping low spots, and piping high spots that inhibit proper flow and operation of the hydronic systems.

B. Coordinate pipe fitting pressure classes with products specified in related Sections.

1.5 PIPES, TUBES, AND FITTINGS

A. General: Refer to Part 3 "Piping Applications" Article for applications of pipe and fitting materials.

B. Steel Pipe and Fittings:

1. Steel Pipe, NPS 2 and Smaller: ASTM A 53, Type S seamless, Grade A, Schedule 40, black steel, plain ends.
2. Steel Pipe, NPS 2-1/2 through NPS 12: ASTM A 53, Type E (electric-resistance welded), Grade A, Schedule 40, black steel, plain ends.
3. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53, Schedule 40, black steel; seamless for NPS 2 and smaller and electric-resistance welded for NPS 2-1/2 and larger.
4. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250.
5. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300.
6. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300.
7. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced.

C. PVC Plastic Pipe: ASTM D 1785, Schedules 40 DWV, plain ends.

1. PVC Plastic Pipe Fittings: Socket-type pipe fittings, ASTM D 2466 for Schedule 40 pipe
2. PVC Solvent Cement: ASTM D 2564.

1.6 VALVES

A. General-Duty Valves: Gate, globe, check, ball, and butterfly valves are specified in Division 15 Section 15110.

B. Safety Valves: Diaphragm-operated, bronze or brass body with brass and rubber, wetted, internal working parts; shall suit system pressure and heat capacity and shall comply with the ASME Boiler and Pressure Vessel Code, Section IV.

C. Self-Contained Automatic Flow Control Valves: Factory set to maintain constant flow with plus or minus 5 percent over system pressure fluctuations and equipped with a readout kit including flow meter, probes, hoses, flow charts, and carrying case. Each valve shall be factory marked with the zone identification, valve number, and flow rate. Valve shall be line size and be grey-iron or brass body, designed for 175 psig at 200 deg F with stainless-steel piston and spring. Provide FDI Autoflow, Griswold, or equivalent.

1.7 HYDRONIC SPECIALTIES

A. Manual Air Vent: Bronze body and nonferrous internal parts; 150-psig working pressure; 225 deg F operating temperature; manually operated with screwdriver or thumbscrew; with NPS 1/8 discharge connection and NPS 1/2 inlet connection.

B. Automatic Air Vent: Designed to vent automatically with float principle; bronze body and nonferrous internal parts; 150-psig working pressure; 240 deg F operating temperature; with NPS 1/4 discharge connection and NPS 1/2 inlet connection.

C. Expansion Tank: Welded carbon steel, rated for operating pressure and temperature or minimum 125-psig working pressure and 240 deg F operating temperature. Separate air charge from system water to maintain design expansion capacity by a flexible butyl-rubber bladder securely sealed into tank. Include hose-end gate drain valve, pressure gage with minimum 3-inch dial, and air-charging fitting. Provide tank in vertical configuration to be supported on floor. Factory fabricate and test tank with taps installed and labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

D. Tangential Air Separator: Carbon steel, constructed and stamped for 125 psi at 350F in accordance with Section VIII, Division 1 of the ASME Boiler & Pressure Vessel Code. Provide line size separator without strainer. Finish in manufacturer's standard finish and field insulate. Provide with high-capacity automatic air vent. Bell & Gossett, TACO, or equivalent.

E. Y-Pattern Strainers: 125-psig working pressure; cast-iron body (ASTM A 126, Class B), flanged ends for NPS 2-1/2 and larger, threaded connections for NPS 2 and smaller, bolted cover, perforated stainless-steel basket, and bottom drain connection.

1.8 PIPING APPLICATIONS

A. Hot and Chilled Water: Aboveground, use Schedule 40 steel pipe with threaded joints for sizes 2 inch or below; welded joints for sizes 2½ inches and above .

B. Condensate Drain Lines: Schedule 40, PVC pipe with solvent-welded joints.

1.9 VALVE APPLICATIONS

A. Unless otherwise indicated, use the following general-duty valve types for applications indicated:

1. Shutoff Duty: Gate, ball, and butterfly valves.
2. Install shutoff duty valves at each branch connection to supply mains, at supply connection to each piece of equipment, unless only one piece of equipment is connected in the branch line. Install throttling duty valves at each branch connection to return mains, at return connections to each piece of equipment, and elsewhere as indicated.
3. Install check valves at each pump discharge and elsewhere as required to control flow direction.

B. Unless otherwise indicated, use the following special-duty valve types for applications indicated:

1. Install self-contained automatic flow control valves as indicated on the drawings and elsewhere as required to facilitate system balancing.

2. Install safety valves on hot-water generators and elsewhere as required by the ASME Boiler and Pressure Vessel Code. Install safety-valve discharge piping, without valves, to floor. Comply with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, for installation requirements.

1.10 PIPING INSTALLATIONS

A. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

B. Install piping at a uniform grade of 0.2 percent upward in direction of flow.

C. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

D. Unless otherwise indicated, install branch connections to mains using tee fittings in main pipe, with the takeoff coming out the bottom of the main pipe. For up-feed risers, install the takeoff coming out the top of the main pipe.

E. Install strainers on supply side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and elsewhere as indicated. Install NPS 3/4 nipple and ball valve in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.

F. Anchor piping for proper direction of expansion and contraction.

1.11 HANGERS AND SUPPORTS

A. Hanger, support, and anchor devices are specified in Division 15 Section "Hangers and Supports, Section 15060". Comply with requirements below for maximum spacing of supports. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:

    a. NPS 3/4: Maximum span, 7 feet; minimum rod size, 1/4 inch.
    b. NPS 1: Maximum span, 7 feet; minimum rod size, 1/4 inch.
    c. NPS 1-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
    d. NPS 2: Maximum span, 10 feet; minimum rod size, 3/8 inch.
    e. NPS 2-1/2: Maximum span, 11 feet; minimum rod size, 3/8 inch.
    f. NPS 3: Maximum span, 12 feet; minimum rod size, 3/8 inch.

5. Install hangers for PVC Schedule 40 drain piping according to manufacturer's recommendations:

    a. Support pipe to avoid low points and sags in horizontal runs.
    b. Piping shall be supported to provide a minimum of 1/8 inch slope per 1 linear foot of run.

1.12 PIPE JOINT CONSTRUCTION

A. Refer to Division 15 Section 15050 "Basic Mechanical Materials and Methods" for joint construction requirements for threaded, welded, and flanged joints in steel piping; and solvent-welded joints for PVC piping.

1.13 HYDRONIC SPECIALTIES INSTALLATION

A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.

1. Install automatic air vents in mechanical equipment rooms only at high points of system piping, at heat-transfer coils, and elsewhere as required for system air venting.
2. Install piping to expansion tank with a 2 percent upward slope toward tank.
3. Install air separators in pump suction lines where shown on drawings. Install drain valve on units NPS 2 and larger.
4. Install expansion tanks. Use manual vent for initial fill to establish proper water level in tank.

    a. Support tank from floor or structure above with sufficient strength to carry weight of tank, piping connections, and fittings, plus weight of a full tank of water. Do not overload building components and structural members.

1.14 TERMINAL EQUIPMENT CONNECTIONS

A. Size for supply and return piping connections shall be same as for equipment connections.

B. Install control valves in accessible locations close to connected equipment.

C. Install ports for pressure and temperature gages at coil inlet and outlet connections.

1.15 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.

B. Prepare hydronic piping and perform testing according to ASME B31.9. Prepare written report of testing.

1.16 ADJUSTING

A. Mark calibrated nameplates of pump discharge valves after hydronic system balancing has been completed, to permanently indicate final balanced position.

B. Perform these adjustments before operating the system:

1. Open valves to fully open position. Close coil bypass valves.
2. Check pump for proper direction of rotation.
3. Set automatic fill valves for required system pressure.
4. Check air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
5. Set temperature controls so all coils are calling for full flow.
6. Check operation of automatic bypass valves.
7. Check and set operating temperatures of boiler and chillers to design requirements.
8. Lubricate motors and bearings.

1.17 CLEANING

A. Flush hydronic piping systems with clean water. Remove and clean or replace strainer screens. After cleaning and flushing hydronic piping systems, but before balancing, remove disposable fine-mesh strainers in pump suction strainers.

END OF SECTION 15181

SECTION 15185

HYDRONIC PUMPS

1.1 SUMMARY

A. This Section includes the following:

1. In-line circulators.
2. Vertical in-line pumps.
3. Pump accessories.

1.2 SUBMITTALS

A. Product Data: Include certified performance curves and rated capacities; furnished specialties; final impeller dimensions; and accessories for each pump indicated. Indicate pump's operating point on curves.

B. Shop Drawings: Show pump layout and connections. Include Setting Drawings with templates for installing foundation and anchor bolts and other anchorages.

1. Wiring Diagrams: Power, signal, and control wiring.

C. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. UL Compliance: Fabricate and label pumps to comply with UL 778, "Motor-Operated Water Pumps," for construction requirements.

B. Regulatory Requirements: Fabricate and test steam condensate pumps to comply with HI 1.1-1.5, "Centrifugal Pumps for Nomenclature, Definitions, Application and Operation," and HI 1.6, "Centrifugal Pump Tests."

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.4 MANUFACTURERS

A. In other Part 2 articles where subparagraphs titles below introduce lists, the following requirements apply for product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

1.5 GENERAL PUMP REQUIREMENTS

A. Pump Units: Factory assembled and tested.

B. Motors: Include built-in, thermal-overload protection and grease-lubricated ball bearings. See Division 15 Section 15055 "Motors" for general motor requirements.

1.6 VERTICAL IN-LINE PUMPS

A. Centrifugal, flexible-coupled, single-stage, radially split case design. Include vertical-mounting, bronze-fitted design and mechanical seals rated for 125-psig minimum working pressure and a continuous water temperature of 225 deg F.

1. Available Manufacturers (Or Approved Equal):

   a. Armstrong Pumps, Inc.
   b. Bell & Gossett ITT; Div. of ITT Fluid Technology Corp.
   c. Taco; Fabricated Products Div.

2. Casing: Cast iron, with threaded companion flanges for piping connections smaller than NPS 3, drain plug at low point of volute, and threaded gage tappings at inlet and outlet connections.
3. Impeller: ASTM B 584, cast bronze, statically and dynamically balanced, closed, overhung, single suction, and keyed to shaft.
4. Shaft and Sleeve: Ground and polished stainless-steel shaft with bronze sleeve.
5. Seals: Mechanical, with carbon-steel rotating ring, stainless-steel spring, ceramic seat, and flexible bellows and gasket.
6. Motor: Directly mounted to pump casing and with lifting and supporting lugs in top of motor enclosure.

1.7 PUMP INSTALLATION

A. Install pumps to provide access for periodic maintenance, including removing motors, impellers, couplings, and accessories.

B. Support pumps and piping separately so piping is not supported by pumps.

C. Suspend in-line pumps using continuous-thread hanger rod and vibration-isolation hangers.

1.8 CONNECTIONS

A. Install piping adjacent to machine to allow service and maintenance.

B. Connect piping to pumps. Install valves that are the same size as piping connected to pumps.

C. Install suction and discharge pipe sizes equal to or greater than diameter of pump nozzles.

D. Install shutoff valve on suction side of vertical in-line pumps.

E. Install pressure gages on pump suction and discharge. Install at integral pressure-gage tappings where provided.

F. Install electrical connections for power, controls, and devices. Electrical power and control wiring and connections are specified in Division 16 Sections.

G. Ground equipment.

END OF SECTION 15185

SECTION 15410

PLUMBING FIXTURES

1.1 GENERAL

A. Submit Product Data for selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports and indicate materials and finishes, dimensions, construction details, and flow-control rates for each type of fixture indicated.

B. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.

1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities," and Public Law 101-336, "Americans with Disabilities Act," about plumbing fixtures for people with disabilities.

E. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.

F. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

G. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

H. Comply with the following applicable standards and other requirements specified for plumbing fixtures:

1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
2. Hand Sinks: NSF 2 construction.
3. Vitreous-China Fixtures: ASME A112.19.2M.
4. Water-Closet, Flush Valve, Tank Trim: ASME A112.19.5.
5. Water-Closet, Flushometer Tank Trim: ASSE 1037.

1.2 PRODUCTS

A. Refer to plumbing plans for fixture information.

1.3 EXECUTION

A. Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Fixture Installation:

1. Assemble fixtures, trim, fittings, and other components according to manufacturers' written instructions.
2. For wall-hanging fixtures, install off-floor supports affixed to building substrate.
   a. Use carrier supports without waste fitting for fixtures with tubular waste piping.
3. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.
4. Install wall-hanging fixtures with tubular waste piping attached to supports.
5. Install counter-mounting fixtures in and attached to casework.
6. Install fixtures level and plumb according to manufacturers' written instructions and roughing-in drawings.
7. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

   a. Exception: Use ball or gate valve if stops are not specified with fixture. Refer to Division 15 Section 15110 "Valves" for general-duty valves.

8. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
9. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.
10. Install flushometer valves for accessible water closets with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.
11. Install toilet seats on water closets.

D. Ground equipment.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

E. Field Quality Control:

1. Verify that installed fixtures are categories and types specified for locations where installed.
2. Check that fixtures are complete with trim, faucets, fittings, and other specified components.
3. Inspect installed fixtures for damage. Replace damaged fixtures and components.

4. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

F. Adjust water pressure at faucets, and flushometer valves to produce proper flow and stream.

G. Replace washers and seals of leaking and dripping faucets and stops.

H. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:

1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
2. Remove sediment and debris from drains.

I. Provide protective covering for installed fixtures and fittings.

J. Do not allow use of fixtures for temporary facilities unless approved in writing by the Contracting Officer or authorized representative.

END OF SECTION 15410

SECTION 15430

PLUMBING SPECIALTIES

1.1 GENERAL

A. Plumbing specialties shall bear label, stamp, or other markings of specified testing agency.

B. Comply with ASME B31.9, "Building Services Piping," for piping materials and installation.

C. Comply with NSF 61, "Drinking Water System Components--Health Effects, Sections 1 through 9," for potable domestic water plumbing specialties.

1.2 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each product.

1.3 PRODUCTS

A. Trap Seal Primer Valves: ASSE 1018, water-supply-fed type, with the following characteristics:

1. 125-psig (860-kPa) minimum working pressure.
2. Bronze body with atmospheric-vented drain chamber.
3. Inlet and Outlet Connections: NPS 1/2 (DN 15) threaded, union, or solder joint.
4. Gravity Drain Outlet Connection: NPS 1/2 (DN 15) threaded or solder joint.
5. Finish: Chrome plated.

B. Water Hammer Arresters: ASSE 1010 or PDI-WH 201, metal-bellows type.

C. Cleanouts: Comply with ASME A112.36.2M.

1. Application: Floor cleanout.
2. Body or Ferrule Material: Cast iron.
3. Clamping Device: Not required.
4. Outlet Connection: Threaded.
5. Closure: Brass plug with straight threads and gasket.
6. Adjustable Housing Material: Cast iron.
7. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
8. Frame and Cover Shape: [Round].
9. Top Loading Classification: Medium Duty.

D. Floor Drains: Comply with ASME A112.21.1M.

1. Application: Floor drain.

2. Body Material: Gray iron.
3. Seepage Flange: Not required.
4. Clamping Device: Not required.
5. Outlet: Bottom.
6. Sediment Bucket: Not required.
7. Top or Strainer Material: Nickel bronze.
8. Top of Body and Strainer Finish: Nickel bronze.
9. Top Shape: Round.
10. Top Loading Classification: Medium Duty.
11. Funnel: Not required.
12. Trap Material: Cast iron.
13. Trap Pattern: Standard P-trap.
14. Trap Features: Trap seal primer valve drain connection.

1.4 EXECUTION

A. Refer to Division 15 Section 15050 "Basic Mechanical Materials and Methods" for piping joining materials, joint construction, and basic installation requirements.

B. Install trap seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

C. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4 (DN 100). Use NPS 4 (DN 100) for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet (15 m) for piping NPS 4 (DN 100) and smaller and 100 feet (30 m) for larger piping.

D. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:

   a. Radius, 30 Inches (750 mm) or Less: Equivalent to 1 percent slope, but not less than 1/4-inch (6.35-mm) total depression.
3. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

E. Install individual shutoff valve in each water supply to plumbing specialties. Use ball, gate, or globe valve if specific valve is not indicated. Install shutoff valves in accessible locations. Refer to Division 15 Section 15110 "Valves" for general-duty ball, butterfly, check, gate, and globe valves.

F. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

G. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

H. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

I. Connect plumbing specialties to piping specified in other Division 15 Sections.

J. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

K. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 15430

SECTION 15763

FAN COIL UNITS

1.1 SUMMARY

A. This Section includes fan coil units and accessories.

1.2 SUBMITTALS

A. Product Data: Include specialties and accessories for each unit type and configuration indicated.

B. Shop Drawings: Submit the following for each fan coil unit type and configuration:

1. Plans, elevations, sections, and details.
2. Details of anchorages and attachments to structure and to supported equipment.
3. Wiring Diagrams: Power, signal, and control wiring.
4. Equipment schedules to include rated capacities, furnished specialties, and accessories.

C. Field quality control test reports.

D. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.4 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fan Coil Unit Filters: Furnish 1 spare filter for each filter installed.

1.5 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following or their equivalent:

1. Airtherm Manufacturing Company.

2. Carrier Corp.
3. McQuay International.
4. Trane Company (The); North American Commercial Group.

1.6 CONFIGURATION

A. Horizontal Units: An assembly including filter, chassis, coil, drain pan, fan, and motor in blow-through configuration with hydronic cooling coil and hydronic heating coil.

1.7 MATERIALS

A. Chassis: Galvanized steel, with flanged edges.

B. Coil Section Insulation: 1-inch (25-mm) duct liner complying with ASTM C 1071 and attached with adhesive complying with ASTM C 916.

1. Fire-Hazard Classification: Duct liner and adhesive shall have a maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84.

C. Drain Pans: Galvanized steel, with connection for drain. Drain pan shall be insulated with polystyrene or polyurethane insulation. Drain pan shall be formed to slope from all directions to drain connection.

D. Cabinet: Galvanized steel, with removable panels.
1. Horizontal Unit Bottom Panels: Fastened to unit with cam fasteners and hinge and attached with safety chain; with integral stamped grilles.

E. Cabinet Finish: Bonderize, phosphatize, and flow-coat with baked-on primer with manufacturer's standard paint applied to factory-assembled and -tested fan coil unit before shipping.

1.8 WATER COILS

A. Primary Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch (2.5 mm) and with manual air vent. Coils shall be rated for a minimum working pressure of 300 psig (2068 kPa) and a maximum entering water temperature of 275 deg F (135 deg C).

1.9 FAN

A. Centrifugal, with forward-curved, double-width wheels and fan scrolls made of galvanized steel or thermoplastic material; directly connected to the motor.

1.10 FAN MOTORS

A. Motors for Direct-Drive Units: Permanent-split capacitor, multispeed motor with integral thermal-overload protection and resilient mounts.

B. Wiring Terminations: Match conductor materials and sizes of connecting power circuit. Connect motor to chassis wiring with plug connection.

1.11 ACCESSORIES

A. Steel subbase, height as indicated.

B. Steel recessing flanges for recessing fan coil units into ceiling.

C. Filters: 1-inch- (25-mm-) thick, throwaway filters in fiberboard frames.

D. Condensate Pump: Mini-split type. Furnish loose with each fan coil unit. Condensate pump unit shall be Sauermann SI 2750 or equivalent rated to operate on 115 VAC/ 1 Phase.

E. Outdoor air inlet connection with manual volume damper. Damper shall be either single blade butterfly type or sliding blast-gate type.

1.12 CONTROL SYSTEMS

A. Four-Pipe, Valve Cycle: Wall-mounted thermostat, with deadband and manual fan-speed switch, cycles electric valves.

1.13 SOURCE QUALITY CONTROL

A. Test and rate units according to ARI 440.

B. Test unit coils according to ASHRAE 33.

1.14 INSTALLATION

A. Install fan coil units to comply with NFPA 90A.

B. Suspend fan coil units from structure with rubber-in-shear vibration isolators (rubber hangers).

C. Install wall-mounting thermostats and switch controls in electrical outlet boxes at heights to match lighting controls.

D. Install new filters in each fan coil unit immediately after Test and Balance procedures are complete.

E. Install condensate pump on each fan coil unit as shown on drawings and interlocked to shut off unit in the event of excess condensate.

1.15 CONNECTIONS

A. Unless otherwise indicated, install shutoff valve and union or flange at each connection.

B. Install piping adjacent to machine to allow service and maintenance.

1.16 FIELD QUALITY CONTROL

A. Testing: Perform the following field quality-control testing and report results in writing:

1. After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
2. Operate electric heating elements through each stage to verify proper operation and electrical connections.
3. Test and adjust controls and safeties.

B. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.

END OF SECTION 15763

SECTION 15815

DUCTWORK

1.1 GENERAL

A. Submittals: Product Data.

B. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," unless otherwise indicated.

C. Comply with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems," unless otherwise indicated.

1.2 PRODUCTS

A. Galvanized, Sheet Steel: Lock-forming quality; ASTM A 653/A 653M, G90 (Z275) coating designation; mill-phosphatized finish for surfaces of ducts exposed to view.

B. Reinforcement Shapes and Plates: Galvanized steel reinforcement where installed on galvanized, sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

C. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for 36-inch (900-mm) length or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

D. Joint and Seam Tape: 2 inches (50 mm) wide; glass-fiber fabric reinforced.

E. Joint and Seam Sealant: One-part, nonsag, solvent-release-curing, polymerized butyl sealant, formulated with a minimum of 75 percent solids.

F. Building Attachments: fasteners, or structural-steel fasteners appropriate for building materials.

G. Hanger Materials: Galvanized, sheet steel or round, threaded steel rod.

H. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

I. Trapeze and Riser Supports: Galvanized steel shapes complying with ASTM A 36/A 36M.

J. Duct Fabrication: Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction with galvanized, sheet steel, according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible." Comply with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.

K. Static-Pressure Classifications: Unless otherwise indicated, construct ducts to the following:

1. Supply Ducts: 1-inch wg (750 Pa).
2. Outdoor Air Ducts: 1-inch wg (500 Pa), negative pressure.

L. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches (480 mm) and larger and 0.0359 inch (0.9 mm) thick or less, with more than 10 sq. ft. (0.93 sq. m) of unbraced panel area, unless ducts are lined.

M. Flexible Ducts, Insulated: Comply with UL 181, Class 1. Factory-fabricated, insulated, round duct, with an outer jacket enclosing 1-1/2-inch- (38-mm-) thick, glass-fiber insulation around a continuous inner liner.

1. Reinforcement: Steel-wire helix encapsulated in inner liner.
2. Outer Jacket: Polyethylene film.
3. Inner Liner: Polyethylene film.

N. Pressure Rating: 6-inch wg (1500 Pa) positive, 1/2-inch wg (125 Pa) negative.

O. Flexible Duct Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action, in sizes 3 to 18 inches (75 to 450 mm) to suit duct size.

P. Adhesives: High strength, quick setting, neoprene based, and waterproof.

1.3 EXECUTION

A. Drawings indicate general arrangement of ducts, fittings, and accessories.

B. Construct and install each duct system for the specific duct pressure classification indicated.

C. Install ducts with fewest possible joints.

D. Install fabricated fittings for changes in directions, changes in size and shape, and connections.

E. Install couplings tight to duct wall surface with a minimum of projections into duct.

F. Install ducts, unless otherwise indicated, vertically and horizontally, parallel and perpendicular to building lines; avoid diagonal runs.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch (25 mm), plus allowance for insulation thickness.

I. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions, unless specifically indicated.

J. Coordinate layout with suspended ceiling, lighting layouts, and similar finished work.

K. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same metal thickness as duct. Overlap opening on four sides by at least 1-1/2 inches (38 mm).

L. Seam and Joint Sealing: Seal duct seams and joints according to the duct pressure class indicated and as described in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

1. Pressure Classification Less Than 2-Inch wg (500 Pa): Transverse joints.
2. Seal externally insulated ducts before insulation installation.

M. Install rigid round and rectangular metal duct with support systems indicated in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

N. Support horizontal ducts within 24 inches (600 mm) of each elbow and within 48 inches (1200 mm) of each branch intersection.

O. Connect equipment with flexible connectors according to Division 15 Section 15820 "Duct Accessories."

P. For branch, outlet and inlet, and terminal unit connections, comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

Q. Flexible ductwork shall be limited to 6 linear feet. Install flexible ductwork in non-compressed form free of kinks.

END OF SECTION 15815

SECTION 15820

DUCT ACCESSORIES

1.1 GENERAL

A. Submittals: Product Data for backdraft dampers, volume dampers, duct-mounted access doors and panels, and flexible ducts.

B. NFPA Compliance: Comply with the following NFPA standards:

1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

1.2 PRODUCTS

A. Galvanized, Sheet Steel: Lock-forming quality; ASTM A 653/A 653M, G90 (Z275) coating designation; mill-phosphatized finish for surfaces of ducts exposed to view.

B. Tie Rods: Galvanized steel, 1/4- (6-mm) minimum diameter for 36-inch (900-mm) length or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

C. Backdraft Dampers: Suitable for horizontal or vertical installations.

1. Frame: 0.052-inch- (1.3-mm-) thick, galvanized, sheet steel, with welded corners and mounting flange.
2. Blades: 0.025-inch- (0.6-mm-) thick, roll-formed aluminum.
3. Blade Seals: Felt, vinyl, or neoprene.
4. Blade Axles: Galvanized steel.
5. Tie Bars and Brackets: Galvanized steel.
6. Return Spring: Adjustable tension.

D. Manual-Volume Dampers: Factory fabricated with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.

E. Standard Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, standard leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.

1. Steel Frames: Hat-shaped, galvanized, sheet steel channels, minimum of 0.064 inch (1.62 mm) thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls; and flangeless frames where indicated for installation in ducts.
2. Blade Axles: Galvanized steel.
3. Tie Bars and Brackets: Galvanized steel.

F. Jackshaft: 1-inch- (25-mm-) diameter, galvanized steel pipe rotating within a pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.

G. Damper Hardware: Zinc-plated, die-cast core with dial and handle made of 3/32-inch- (2.4-mm-) thick zinc-plated steel, and a 3/4-inch (19-mm) hexagon locking nut.

H. Turning Vanes: Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

1. Manufactured Turning Vanes: Fabricate of 1-1/2-inch- (38-mm-) wide, curved blades set 3/4 inch (19 mm) o.c.; support with bars perpendicular to blades set 2 inches (50 mm) o.c.; and set into side strips suitable for mounting in ducts.

I. Flexible Connector Fabric: Glass fabric double coated with polychloroprene.

1. Minimum Weight: 26 oz./sq. yd. (880 g/sq. m).
2. Tensile Strength: 480 lbf/inch (84 N/mm) in the warp, and 360 lbf/inch (63 N/mm) in the filling.

J. Flexible Ducts, Insulated: Comply with UL 181, Class 1. Factory-fabricated, insulated, round duct, with an outer jacket enclosing 1-1/2-inch- (38-mm-) thick, glass-fiber insulation around a continuous inner liner.

1. Reinforcement: Steel-wire helix encapsulated in inner liner.
2. Outer Jacket: Polyethylene film.
3. Inner Liner: Polyethylene film.

K. Pressure Rating: 6-inch wg (1500 Pa) positive, 1/2-inch wg (125 Pa) negative.

L. Flexible Duct Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action, in sizes 3 to 18 inches (75 to 450 mm) to suit duct size.

M. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

1.3 EXECUTION

A. Install duct accessories according to applicable details shown in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts and NAIMA's "Fibrous Glass Duct Construction Standards" for fibrous-glass ducts.

B. Provide test holes at fan inlet and outlet and elsewhere as indicated.

C. Install duct access panels for access to both sides of duct coils. Install duct access panels downstream from volume dampers, turning vanes, and equipment.

1. Install duct access panels to allow access to interior of ducts for cleaning, inspecting, adjusting, and maintaining accessories and terminal units.
2. Install access panels on side of duct where adequate clearance is available.

D. Label access doors according to Division 15 Section 15075 "Mechanical Identification."

END OF SECTION 15820

SECTION 15838

TOILET EXHAUST FANS

1.1 SUMMARY

A. This Section includes the following:

1. Roof-mounted exhausters.

1.2 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:

1. Certified fan performance curves with system operating conditions indicated.
2. Certified fan sound-power ratings.
3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
4. Material gages and finishes, including color charts.
5. Dampers, including housings, linkages, and operators.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Power, signal, and control wiring.
2. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.

C. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.

C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

D. UL Standard: Power ventilators shall comply with UL 705.

1.4 MANUFACTURERS

A. In other Part 2 articles where subparagraphs titles below introduce lists, the following requirements apply for product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

1.5 CENTRIFUGAL ROOF VENTILATORS

A. Description: Belt-driven or direct-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories.

1. Manufacturers:

a. Acme Engineering & Mfg. Corp.
b. Carnes Company HVAC.
c. Central Blower Co.
d. Cook, Loren Company.
e. Greenheck Fan Corp.
f. Hartzell Fan, Inc.
g. ILG Industries, Inc./American Coolair Corp.
h. Penn Ventilation Companies, Inc.

B. Housing: Removable, spun-aluminum, dome top and outlet baffle; one-piece, aluminum base with venturi inlet cone.

C. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.

D. Belt-Driven Drive Assembly: Resiliently mounted to housing, with the following features:

1. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
2. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
3. Pulleys: Cast-iron, adjustable-pitch motor pulley.
4. Fan and motor isolated from exhaust airstream.

E. Accessories:

1. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
2. Bird Screens: Removable, 1/2-inch (13-mm) mesh, aluminum or brass wire.
3. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.

F. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch- (40-mm-) thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch (40-mm) wood nailer. Size as required to suit roof opening and fan base.

1. Configuration: Self-flashing without a cant strip, with mounting flange.
2. Overall Height:16 inches (400 mm).
3. Metal Liner: Galvanized steel.
4. Hinged Subbase: Galvanized-steel hinged arrangement permitting service and maintenance.

1.6 MOTORS

A. Refer to Division 15 Section 15055 "Motors" for general requirements for factory-installed motors.

B. Motor Construction: NEMA MG 1, general purpose, continuous duty, Design B.

C. Enclosure Type: Open dripproof.

1.7 FIELD QUALITY CONTROL

A. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.

B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.

END OF SECTION 15838

SECTION 15855

DIFFUSERS, REGISTERS, AND GRILLES

1.1 GENERAL

A. Submittals: Product Data for each model indicated.

1.2 PRODUCTS

A. Diffusers, registers, and grilles are scheduled on Drawings.

1.3 EXECUTION

A. Install diffusers, registers, and grilles level and plumb, according to manufacturer's written instructions, Coordination Drawings, original design, and referenced standards.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practicable. For units installed in lay-in ceiling panels, locate units in the center of the panel. Where architectural features or other items conflict with installation, notify Contracting Officer or authorized representative for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connection to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

D. Install diffusers, registers, and grilles according to NFPA 90A, "Standard for the Installation of Air-Conditioning and Ventilating Systems."

E. After installation of diffusers, registers, and grilles, inspect exposed finish. Clean exposed surfaces to remove burrs, dirt, and smudges. Replace diffusers, registers, and grilles that have damaged finishes.

END OF SECTION 15855

SECTION 15900

HVAC INSTRUMENTATION AND CONTROLS

1.1 SUMMARY

A. This Section includes control equipment for HVAC systems and components, including control components for fan coil units and pumps.

B. See "Sequences of Operation" at the end of this Section for requirements that relate to operation of control components specified in this Section.

1.2 SUBMITTALS

A. Product Data: Include manufacturer's technical literature for each control device indicated, labeled with setting or adjustable range of control. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.
2. Wiring Diagrams: Power, signal, and control wiring.
3. Details of control panel faces, including controls, instruments, and labeling.
4. Schedule of dampers including size, leakage, and flow characteristics.
5. Schedule of valves including leakage and flow characteristics.

C. Field quality-control test reports.

D. Operation and maintenance data.

E. Qualification Data: For firms and persons specified in "Quality Assurance" Article.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who is an authorized representative of the automatic control system manufacturer for both installation and maintenance of units required for this Project.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilation Systems."

1.4 COORDINATION

A. Coordinate location of thermostats, other exposed control sensors with plans and room details before installation.

1.5 CONTROL PANELS

A. Control Panels: Unitized cabinet with suitable brackets for wall or floor mounting, located adjacent to each system under automatic control. Provide common keying for all panels.

1. Fabricate panels of 0.06-inch-thick, furniture-quality steel, or extruded-aluminum alloy, totally enclosed, with hinged doors and keyed lock and with manufacturer's standard shop-painted finish.
2. Panel-Mounted Equipment: Temperature controllers, relays, and automatic switches; except safety devices. Mount devices with adjustments accessible through front of panel.
3. Door-Mounted Equipment: Flush-mount (on hinged door) manual switches, including damper-positioning switches, changeover switches, thermometers, and gages.
4. Graphics: Color-coded graphic, laminated-plastic displays on doors, schematically showing system being controlled, with protective, clear plastic sheet bonded to entire door.

1.6 ANALOG CONTROLLERS

A. Electric, Outdoor-Air Thermostat: Remote-bulb or bimetal rod-and-tube type, with adjustable set point with scale range from 50 deg F to 90 deg F, and single- or double-pole contacts. Provide sunshade for mounting of outdoor bulb. For cycling hot water and chilled water pumps. Provide Invensys, Honeywell, Johnson or equivalent.

B. Electric, Differential Pressure Controller: Bellows type, proportional controller with 135 ohm potentiometer; 24 VAC, 3-wire modulating control; adjustable main spring; high-low taps; metal case. For controlling hydronic bypass valves. Provide Invensys, Honeywell, Johnson or equivalent. Provide Invensys, Honeywell, Johnson or equivalent

C. Electric Liquid Thermostat (Aquastat): Single-stage, single bulb thermostat for use with immersed thermowell. Setpoint adjustment range –40 F to 120 F chilled water; 100 F to 260 F hot water. Snap action SPDT switch rated for 9.8 FLA at 120 Volts. Strap-on fixed setpoint aquastats shall not be allowed. For cycling hot water and chilled water pumps. Provide Invensys, Honeywell, Johnson or equivalent.

D. Fan Coil Thermostats and Fan Speed Controller: See Section 15763 – Fan Coil Units.

1.7 ACTUATORS

A. Electronic Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque. Coordinate to insure compatibility with fan coil unit control package. Valve actuators shall be fully modulating.

1. Valves: Size for torque required for valve close-off at maximum pump differential pressure.

1.8 CONTROL VALVES

A. Control Valves: Factory fabricated, of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated.

B. Globe Valves NPS 2 and Smaller: Bronze body, bronze trim, rising stem, renewable composition disc, and screwed ends with backseating capacity repackable under pressure.

C. Hydronic system globe valves shall have the following characteristics:

1. Rating: Class 125 for service at 125 psig and 250 deg F operating conditions.
2. Internal Construction: Replaceable plugs and seats of stainless steel or brass.

   a. Single-Seated Valves: Cage trim provides seating and guiding surfaces for plug on top and bottom of guided plugs.
   b. Double-Seated Valves: Balanced plug; cage trim provides seating and guiding surfaces for plugs on top and bottom of guided plugs.

3. Sizing: 3-psig maximum pressure drop at design flow rate.
4. Flow Characteristics: Two-way valves shall have equal percentage characteristics. Operators shall close valves against pump shutoff head.

1.9 INSTALLATION

A. Install equipment level and plumb.

B. Verify location of thermostats and other exposed control sensors with plans and room details before installation. Locate at 48” above finished floor.

C. Install labels and nameplates to identify control components according to Division 15 Section Mechanical Identification."

D. Install hydronic instrument wells, valves, and other accessories according to Division 15 Section "Hydronic Piping."

1.10 ELECTRICAL WIRING AND CONNECTION INSTALLATION

A. Install raceways, boxes, and cabinets according to Division 16 Section "Raceways and Boxes."

B. Install building wire and cable according to Division 16 Section "Conductors and Cables."

C. Install signal and communication cable.

1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.
2. Install exposed cable in raceway.
3. Install concealed cable in raceway.
4. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.
5. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
6. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.

1.11 CONNECTIONS

A. Install piping adjacent to machine to allow service and maintenance.

B. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.

C. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

D. Ground equipment.

1.12 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove malfunctioning units, replace with new units, and retest.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment, and retest.
3. Calibration test controllers by disconnecting input sensors and stimulating operation with compatible signal generator.

B. Replace damaged or malfunctioning controls and equipment.

1. Start, test, and adjust control systems.
2. Demonstrate compliance with requirements, including calibration and testing, and control sequences.
3. Adjust, calibrate, and fine tune circuits and equipment to achieve sequence of operation specified.

1.13 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC instrumentation and controls.

1.14 SEQUENCES OF OPERATION

A. PRIMARY HOT WATER AND CHILLED WATER SUPPLY TEMPERATURE-CONTROL SEQUENCES.

1. Heating hot water and cooling chilled water supply temperature control are based on existing control systems and sequences. Existing temperature control sequences are not to be modified or adjusted in this project.

B. CHILLED WATER PUMP CONTROL SEQUENCE

1. Chilled water pump CHWP-1 shall operate independently of the existing dual temperature pump. As outdoor air temperature rises above 70 F setpoint (adjustable) and 45 F chilled water supply is available as sensed by the aquastat (adjustable), chilled water pump CHWP-1 shall energize. On a fall in outdoor air temperature below 70 F setpoint or loss of 45 F chilled water, the chilled water pump shall deenergize.

C. HOT WATER PUMP CONTROL SEQUENCE

1. Hot water pump HWP-1 shall operate independently of the existing dual temperature pump. As outdoor air temperature falls below 65 F setpoint (adjustable) and 130 F hot water supply is available as sensed by the aquastat (adjustable), hot water pump HWP-1 shall energize. On a rise in outdoor air temperature above 65 F setpoint or loss of 130 F hot water, the hot water pump shall deenergize.

D. DIFFERENTIAL PRESSURE CONTROL (HOT & CHILLED WATER)

1. Differential setpoint shall be determined with all 2-way valves open to fan coil units and bypass valves closed. As 2-way valves to coils modulate closed creating a rise in system differential pressure, the bypass valve shall modulate open to maintain differential pressure setpoint. Bypass valves shall be controlled by a differential pressure controller.
2. Bypass valves are sized for approximately 30 percent of system flow. Pumps will ride curve at fully opened bypass.

E. FAN COIL UNITS

1. On a rise in space temperature above 70 F setpoint (adjustable) the hot water coil valve shall modulate closed. The chilled water and hot water valve shall remain closed through a deadband until space temperature rises to 75 F. On a further rise in space temperature above 75 F setpoint (adjustable) the chilled water valve shall modulate open. Upon a fall in space temperature, the opposite

sequence shall occur. Hot water and chilled water valves shall be controlled from each unit's individual space thermostat.

2. Fan speeds shall be manually operated from a wall-mounted speed controller.

3. Each fan coil unit shall be interlocked to its condensate pump safety switch to shut down the unit in the event of condensate backup as detected by the pump sensor.

END OF SECTION 15900

SECTION 15990

TESTING, ADJUSTING, AND BALANCING

1.1 SUMMARY

A. This Section includes testing, adjusting, and balancing HVAC systems to produce design objectives, including the following:

1. Balancing airflow and water flow within distribution systems, including submains, branches, and terminals, to indicated quantities according to specified tolerances.
2. Adjusting total HVAC systems to provide indicated quantities.
3. Measuring electrical performance of HVAC equipment.
4. Setting quantitative performance of HVAC equipment.
5. Verifying that automatic control devices are functioning properly.
6. Reporting results of activities and procedures specified in this Section.

1.2 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. AMCA: Air Movement and Control Association.

C. NEBB: National Environmental Balancing Bureau.

D. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.

1.3 SUBMITTALS

A. Strategies and Procedures Plan: Testing, adjusting, and balancing strategies and step-by-step procedures. Include a complete set of report forms intended for use on this Project.

B. Certified Testing, Adjusting, and Balancing Reports: Prepared on approved forms certified by the testing, adjusting, and balancing Agent.

1.4 QUALITY ASSURANCE

A. Agent Qualifications: Engage a testing, adjusting, and balancing agent certified by AABC or NEBB.

B. Certification of Testing, Adjusting, and Balancing Reports: Certify testing, adjusting, and balancing field data reports. This certification includes the following:

1. Review field data reports to validate accuracy of data and to prepare certified testing, adjusting, and balancing reports.

2. Certify that testing, adjusting, and balancing team complied with approved testing, adjusting, and balancing plan and procedures specified and referenced in this Specification.

C. Testing, Adjusting, and Balancing Reports: Use standard forms from AABC's "National Standards for Testing, Adjusting, and Balancing."

D. Instrumentation Calibration: Calibrate instruments at least every six months or more frequently if required by the instrument manufacturer.

1.5 PROJECT CONDITIONS

A. Full Owner Occupancy: The Owner will occupy the site and existing building during the entire testing, adjusting, and balancing period. Cooperate with the Owner during testing, adjusting, and balancing operations to minimize conflicts with the Owner's operations.

1.6 COORDINATION

A. Coordinate efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist testing, adjusting, and balancing activities.

B. Perform testing, adjusting, and balancing after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

1.7 WARRANTY

A. National Project Performance Guarantee: Provide a guarantee on AABC'S "National Standards" forms stating that AABC will assist in completing the requirements of the Contract Documents if the testing, adjusting, and balancing Agent fails to comply with the Contract Documents.

1.8 EXAMINATION

A. Examine the Contract Documents to become familiar with project requirements and to discover conditions in systems' designs that may preclude proper testing, adjusting, and balancing of systems and equipment.

1. Verify that balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.

B. Examine approved submittal data of HVAC systems and equipment.

C. Examine equipment performance data, including fan and pump curves. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Specification Sections have been performed.

D. Examine system and equipment test reports.

E. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.

F. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.

G. Examine fan coil units to ensure clean filters have been installed and equipment with functioning controls is ready for operation.

H. Examine strainers for clean screens and proper perforations.

I. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

J. Examine equipment for installation and for properly operating safety interlocks and controls.

K. Examine automatic temperature system components to verify the following:

1. Valves and other controlled devices operate by the intended controller.
2. Valves are in the position indicated by the controller.
3. Integrity of valves for free and full operation and for tightness of fully closed and fully open positions.
4. Automatic modulating and shutoff valves, including two-way valves, are properly connected.
5. Thermostats are located to avoid adverse effects of sunlight, drafts, and cold walls.
6. Sensors are located to sense only intended conditions.
7. Sequence of operation for control modes is according to the Contract Documents.
8. Controller set points are set at design values. Observe and record system reactions to changes in conditions. Record default set points if different from design values.
9. Interlocked systems are operating.
10. Changeover from heating to cooling mode occurs according to design values.

L. Report deficiencies discovered before and during performance of testing, adjusting, and balancing procedures.

1.9 PREPARATION

A. Prepare a testing, adjusting, and balancing plan that includes strategies and step-by-step procedures.

B. Complete system readiness checks and prepare system readiness reports. Verify the following:

1. Permanent electrical power wiring is complete.
2. Hydronic systems are filled, clean, and free of air.
3. Automatic temperature-control systems are operational.
4. Equipment access doors are securely closed.
5. Isolating and balancing valves are open and control valves are operational.
6. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
7. Windows and doors can be closed so design conditions for system operations can be met.

1.10 TESTING AND BALANCING PROCEDURES

A. Perform testing and balancing procedures on each system according to procedures contained in AABC national standards or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems".

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to the insulation Specifications for this Project.

C. Mark equipment settings with paint or other suitable, permanent identification material, including damper-control positions, valve indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

1.11 TOLERANCES

A. Set HVAC system airflow and water flow rates within the following tolerances:

1. Air Outlets and Inlets: 0 to minus 10 percent.
2. Heating-Water Flow Rate: 0 to minus 10 percent.
3. Cooling-Water Flow Rate: 0 to minus 5 percent.

1.12 REPORTS

A. Status Reports: As Work progresses, prepare reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a

separate report for each system and each building floor for systems serving multiple floors.

B. Final Report: Typewritten, or computer printout in letter-quality font, on standard bond paper, bound in three-ring, loose-leaf binder, and tabulated and divided into sections by tested and balanced systems.

1. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing agent.
2. Include a list of instruments used for procedures, along with proof of calibration.
3. Final Report Contents: In addition to certified field report data, include the following:

    a. Pump curves.
    b. Fan curves.
    c. Manufacturers' test data.
    d. Field quality-control test reports prepared by system and equipment installers.
    e. Other information relative to equipment performance, but do not include approved Shop Drawings and Product Data.

4. General Report Data: In addition to form titles and entries, include the following data in the final report, as applicable:

    a. Title page.
    b. Name and address of testing, adjusting, and balancing Agent.
    c. Project name.
    d. Project location.
    e. Architect's name and address.
    f. Engineer's name and address.
    g. Contractor's name and address.
    h. Report date.
    i. Signature of testing, adjusting, and balancing Agent who certifies the report.
    j. Summary of contents, including the following:

        1) Design versus final performance.
        2) Notable characteristics of systems.
        3) Description of system operation sequence if it varies from the Contract Documents.

    k. Nomenclature sheets for each item of equipment.
    l. Data for terminal units, including manufacturer, type size, and fittings.
    m. Notes to explain why certain final data in the body of reports vary from design values.
    n. Test conditions for fans and pump performance forms, including the following:

        1) Settings for outside-air dampers.
        2) Conditions of filters.
        3) Cooling coil, wet- and dry-bulb conditions.

4) Settings for hydronic differential-pressure controllers.
5) Other system operating conditions that affect performance.

5. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present with single-line diagrams and include the following:

a. Quantities of outside, supply, and return airflows.
b. Water flow rates.
c. Duct, outlet, and inlet sizes.
d. Pipe and valve sizes and locations.
e. Balancing stations.

1.13 ADDITIONAL TESTS

A. Within 90 days of completing testing, adjusting, and balancing, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial testing, adjusting, and balancing procedures were not performed during near-peak summer and winter conditions, perform additional inspections, testing, and adjusting during near-peak summer and winter conditions.

END OF SECTION 15990

SECTION 16060

GROUNDING AND BONDING

1.1 SUMMARY

A. Extent of electrical grounding and bonding work is indicated by the Drawings and Schedules and as specified herein. Grounding and bonding work is defined to encompass systems, circuits, and equipment.

B. Type of electrical grounding and bonding work specified in this section includes the following:

1. Solidly grounded.

C. Applications of electrical grounding and bonding work in this section includes the following:

1. Electrical power systems.
2. Ground bars.
3. Raceways.
4. Enclosures.
5. Equipment.

D. Refer to other Division 16 sections for wires/cables, electrical raceways, boxes and fittings, and wiring devices which are required in conjunction with electrical grounding and bonding work.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Install grounding and bonding products of firms regularly engaged in the manufacture of these materials, including stranded cable, grounding rods, and bonding jumpers.

B. Electrical Code Compliance: Comply with the applicable State electrical code requirements of the authority having jurisdiction, and NEC as applicable to electrical grounding and bonding, pertaining to systems, circuits and equipment.

C. UL Compliance: Comply with applicable requirements of UL Standards No.'s 467, "Electrical Grounding and Bonding Equipment," and 869, "Electrical Service Equipment," pertaining to grounding and bonding of systems, circuits and equipment. In addition, comply with UL Standard 486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors." Provide grounding and bonding products which are UL listed and/or labeled for their intended usage.

1.3 SUBMITTALS

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

1.4 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, manufacturers offering grounding products which may be incorporated in the work include, but are not limited to, the following (or approved equal):

1. B-Line Systems, Inc.
2. Burndy Corporation.
3. Gould Inc.
4. Ideal Industries, Inc.
5. Thomas & Betts Corp.

1.5 MATERIALS AND PRODUCTS

A. General: Except as otherwise indicated, provide electrical grounding and bonding systems indicated; with assembly of materials, including, but not limited to, cables/wires, connectors, solderless lug terminals, ground bars, bonding jumpers, and additional accessories needed for a complete installation.

1. Where more than one type component product meets indicated requirements, selection is Contractor's option.
2. Where materials or components are not indicated, provide products which comply with NEC and UL requirements and with established industry standards for those applications indicated.

B. Conductors: Unless otherwise indicated, provide electrical grounding conductors for grounding system connections that match power supply wiring materials and are sized according to NEC.

C. Bonding Connectors, Terminals and Clamps: Provide electrical bonding connectors, terminals, lugs and clamps as recommended by bonding connector, terminal and clamp manufacturers for indicated applications.

D. Ground Bars: 1-1/2" wide x 1/4” thick copper ground bar.

E. Electrical Grounding Connection Accessories: Provide electrical insulating tape, bonding straps, as recommended by accessories manufacturers for type service indicated.

1.6 EXAMINATION

A. Examine areas and conditions under which electrical grounding and bonding connections are to be made and notify the Contracting Officer or authorized representative in writing of conditions detrimental to proper completion of work.

B. Do not proceed with work until unsatisfactory conditions have been corrected.

1.7 INSTALLATION OF ELECTRICAL GROUNDING AND BONDING SYSTEMS

A. General: Install electrical grounding and bonding systems as indicated, in accordance with manufacturer's instructions and applicable portions of NEC, OSHA, and NECA's "Standard of Installation," and in accordance with recognized industry practices to ensure that products comply with requirements.

B. Provide a separate, insulated equipment grounding conductor from each device to ground buses in panelboards. Terminate each end on a grounding lug, bus, or insulated grounding bushing.

C. Provide grounding system per the Drawings and Article 250 of the NEC. Provide green equipment grounding conductor for all electrical raceways.

D. Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values for connectors and bolts. Where manufacturer's torquing requirements are not indicated, tighten connections to comply with tightening torque values specified in UL 486A to assure permanent and effective grounding.

E. Provide clamp-on connectors on clean metal contact surfaces, to ensure electrical conductivity and circuit integrity.

1.8 FIELD QUALITY CONTROL

A. Upon completion of installation of electrical grounding and bonding systems, test ground resistance with ground resistance tester.

1. Where tests show resistance-to-ground is over 25 ohms, take appropriate action to reduce resistance to 25 ohms, or less, by driving additional ground rods.
2. Retest grounding system to demonstrate compliance.

B. Provide written certified testing report indicating resistance-to-ground value.

END OF SECTION 16060

SECTION 16120

CONDUCTORS AND CABLES

1.1 SUMMARY

A. Extent of electrical wire and cable work is indicated by the Drawings and Schedules for low voltage wire and cable - 600V and below.

B. Types of electrical wire, cable, and connectors specified in this section include but are not limited to the following:

1. Copper conductors.
2. Fixture wires.
3. Split-bolt connectors.
4. Wirenut connectors.

C. Applications of electrical wire, cable, and connectors required for this Project include but are not limited to the following:

1. For power distribution circuits.
2. For building lighting circuits.
3. For appliance and equipment circuits.
4. For motor-branch circuits.

1.2 SUBMITTALS

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

1.3 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of electrical wire and cable products of types, sizes, and ratings required.

B. NEC Compliance: Comply with NEC requirements as applicable to construction, installation and color coding of electrical wires and cables.

C. UL Compliance: Provide wiring/cabling and connector products which are UL listed and/or labeled.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver wire and cable properly packaged in factory-fabricated type containers, or wound on NEMA-specified type wire and cable reels.

B. Store wire and cable in clean dry space in original containers. Protect products from weather, damaging fumes, construction debris and traffic.

C. Handle wire and cable carefully to avoid abrading, puncturing and tearing wire and cable insulation and sheathing. Ensure that dielectric resistance integrity of wires/cables is maintained.

1.5 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products of one of the following (for each type of wire, cable, and connector) (or approved equal):

B. Wire and Cable:

1. American Insulated Wire Corp.
2. Cabelec Corp.
3. General Cable Corp.
4. Okonite Company.
5. Rome Cable Corp.
6. Southwire Company.
7. Triangle PWC, Inc.

C. Connectors:

1. AMP, Inc.
2. Appleton Electric Co.; Emerson Electric Co.
3. Electrical Products Div.; Midland-Ross Corp.
4. Ideal Industries, Inc.
5. 3M Company
6. O-Z/Gedney Co.
7. Square D Company.
8. Thomas & Betts Corp.

1.6 SECONDARY VOLTAGE 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. Provide copper conductors with conductivity of not less than 98% at 68 degrees F.

B. Building Wires: 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 Contractor to comply with project's installation requirements, NEC and NEMA standards. Select from the following UL types, those wires with construction features which fulfill project requirements:

1. Type THWN: For dry and wet locations; maximum operating temperature 75 degrees C (167 degrees F). Insulation, flame-retardant, moisture- and heat-resistant, thermoplastic; outer covering, nylon jacket; conductor, annealed copper.

2. Type THHN (Interior Branch Circuits): For dry and damp locations; maximum operating temperature 90 degrees C (194 degrees F). Insulation, flame-retardant, heat-resistant, thermoplastic; outer covering, nylon jacket; conductor, annealed copper.

C. Cables: Provide UL type factory-fabricated cables of sizes, ampacity ratings, and materials and jacketing/sheathing as indicated for services indicated. Where not indicated, provide proper selection as determined by Contractor to comply with installation requirements, NEC and NEMA standards.

D. Conductors No. 10 and smaller may be solid or stranded and conductors larger than No. 10 shall be stranded. Control wire shall be stranded copper.

E. Connectors:

1. General: Provide UL type factory-fabricated, metal connectors of sizes, ampacity ratings, materials, types and classes for applications and for services indicated.
2. Where not indicated, provide proper selection as determined by the Installer to comply with the project's installation requirements, and with NEC and NEMA standards.
3. Select from the following, those types, classes, kinds and styles of connectors to fulfill project requirements:

a. Type: Pressure, threaded.
b. Class: Insulated.
c. Kind: Copper (for Cu to Cu connection).
d. Style: Tap, pigtail, wirenut, split bolt, T-connections.

1.7 INSTALLATION OF WIRES AND CABLES

A. General: Install wires and wiring connectors as indicated, in compliance with applicable requirements of NEC, NEMA, OSHA, 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. Use no wire smaller than 12 AWG for power and lighting circuits, and no smaller than 14 AWG for control wiring (fire alarm).

D. Use 10 AWG conductor for 20 ampere, 120 volt branch circuit home runs longer than 120 feet, unless otherwise noted on the Drawings.

E. Place an equal number of conductors for each phase of a circuit in same raceway, unless indicated otherwise on the Drawings.

F. Neatly train and lace wiring inside boxes, equipment and panelboards.

G. Make conductor lengths for parallel circuits equal.

H. Conductors shall be color coded; (1) ground leads, green; (2) grounded neutral leads, white (120 volts); (3) ungrounded phase wires, black, red, and blue (208Y/120V); (4) ungrounded phase wires, brown, orange, and yellow (480Y/277V); (5) switch leg travellers, purple.

I. Install exposed cables parallel and perpendicular to surfaces, or exposed structural members, and follow surface contours, where possible.

J. Completely and thoroughly swab raceway system before installing conductors.

K. Branch circuit wiring shall not loop through receptacle terminals, but shall be connected by means of conductor taps joined to branch circuit conductors. At end of run, branch circuit conductors may terminate on receptacle terminals.

L. Position all splices in pull boxes and junction boxes of adequate volume so they are accessible from the removable cover side of the box.

M. Conductors for signal systems shall be continuous and shall be terminated on terminal strips or terminate in a manner approved by the system's manufacturer.

N. All neutrals and ground wires in panels shall be labeled with numbered tape to indicate the circuits being served.

O. Pull conductors simultaneously where more than one is being installed in same raceway.

P. Use pulling compound or lubricant, where necessary; compound used must not deteriorate conductor or insulation.

Q. Use pulling means including fish tape, cable, rope and basket weave wire/cable grips which will not damage cables or raceway.

R. Keep conductor splices to minimum.

S. Install splices and taps which possess equivalent or better mechanical strength and insulation ratings than conductors being spliced.

T. Use splice and tap connectors which are compatible with conductor material.

U. 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 Standard 486A and B.

V. Conductors manufactured more than twelve months prior to date of delivery to site shall not be used.

1.8 WIRING CONNECTIONS AND TERMINATIONS

A. Splice only in accessible junction boxes.

B. Splices, taps and attachments of fittings and lugs shall be electrically and mechanically secure. Connectors and lugs shall be correct size for conductors jointed.

C. Solid conductors, namely those sized No. 10 AWG copper, and smaller, shall be spliced by using Ideal "Wing-Nuts," 3M Co.'s "Scotchlox" or T&B "Piggy" conductors (or approved equal) in junction boxes and light fixtures, except recessed fixtures as noted below.

1. "Sta-Kon" or other permanent type crimp connectors shall not be used.
2. Contractor shall use Ideal "Wing-Nuts" for splicing recessed lighting fixture leads to branch circuit conductors.

D. Stranded conductors, namely No. 8 AWG and larger, shall be spliced by UL listed mechanical connectors plus gum tape, plus friction or plastic tape. Solderless mechanical connectors, for splices and tape provided with UL listed insulating covers, may be used instead of mechanical connectors plus tape.

E. Conductors, in all cases, shall be continuous from outlet to outlet, and no splicing shall be made except within outlet or junction boxes, troughs, and gutters.

F. Lugs for conductors No. 6 through No. 1/0 AWG shall be copper, split bolt type with spacer. Lugs for connectors No. 2/0 AWG and larger shall be copper 2-bolt type with spacer. Lugs shall be as manufactured by AMP, Inc. (or approved equal).

G. Taping of joints shall be made using special oil resistant vinyl plastic tape; UL listed, rated 105 degrees C, Scotch Electrical Tape No. 33+ or reviewed equal.

H. Splices in grounding conductors No. 8 AWG and larger shall be by means of exothermic welding and termination shall be by means of approved grounding connectors. Soldering shall not be used.

I. Thoroughly clean wires before installing lugs and connectors.

J. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.

K. Terminate spare conductors with electrical tape.

1.9 FIELD QUALITY CONTROL

A. 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.

1.10 WIRE AND CABLE INSTALLATION SCHEDULE

A. Exposed Interior Locations: Building wire in raceway.

B. Above Accessible Ceilings: Building wire in raceway.

C. Exterior Locations: Building wire in raceway.

END OF SECTION 16120

SECTION 16130

RACEWAYS AND BOXES

1.1 SUMMARY

A. Extent of raceway work is indicated by the Drawings and Schedules.

B. Types of raceways specified in this section include the following:

1. Electrical metallic tubing (EMT).
2. Flexible metal conduit.
3. Liquid-tight flexible metal conduit.
4. Rigid steel conduit (RSC).
5. Rigid nonmetallic conduit.
6. Surface metal raceways.

C. This section specifies the following raceways:

1. Raceways installed within buildings.

D. Types of electrical boxes and fittings specified in this section include the following.

1. Outlet boxes.
2. Junction boxes.
3. Pull boxes.
4. Bushings.
5. Locknuts.
6. Knockout closures.

1.2 SUBMITTALS

A. Product data for each type of product specified.

1.3 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of raceway systems of types and sizes required.

B. Manufacturers: Firms regularly engaged in manufacture of electrical boxes and fittings of types and sizes required.

1.4 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/or labeled.

1. UL No. 1: Flexible Metal Conduit
2. UL No. 6: Rigid Steel Conduit, Zinc Coated
3. UL No. 6: Rigid Steel Conduit, Enameled
4. UL No. 651: Schedule 40 and 80 Rigid PVC
5. UL No. 797: Electrical Metallic Tubing, Zinc Coated

C. NEC Compliance: Comply with applicable requirements of the latest edition of the NEC pertaining to construction and installation of raceway systems.

D. ANSI Publications:

1. C80.1 Rigid Steel Conduit, Zinc Coated
2. C80.2 Rigid Steel Conduit, Enameled
3. C80.3 Electrical Metallic Tubing, Zinc Coated

E. UL Compliance: Comply with applicable requirements of UL 50, UL 514-Series, and UL 886 pertaining to electrical boxes and fittings. Provide electrical boxes and fittings which are UL listed and/or labeled.

F. NEMA Compliance: Comply with applicable requirements of NEMA Stds/Pub No's OS1, OS2, and Pub 250 pertaining to outlet and device boxes, covers and box supports.

1.5 METAL CONDUIT AND TUBING

A. General: Provide metal conduit, tubing and fittings of types, grades, sizes and weights for each service indicated. Where types and grades are not indicated, provide proper selection determined by Installer to fulfill wiring requirements, and comply with applicable portions of NEC for raceways.

B. Rigid Steel Conduit (RSC): Low carbon malleable iron, cadmium plated or hot-dipped galvanized inside and outside, with threaded ends, minimum size ¾ inch. Threaded Fittings - alloy steel, galvanized.

C. Electrical Metallic Tubing (EMT): High strength galvanized, minimum size ¾ inch, maximum size two (2") inch. Fittings shall be made of same finish and material as tubing. Use compression type fittings only.

D. Flexible Metal Conduit: Formed with continuous length of spirally wound, interlocked zinc-coated strip steel, minimum size ½ inch, for connections to recessed lighting fixture only.

1. Flexible Metal Conduit Fittings: Provide conduit fittings for use with flexible steel conduit of threadless hinged clamp type.

2. Straight Terminal Connectors: One piece body, female end with clamp and deep slotted machine screw for securing conduit, and male threaded end provided with locknut.
3. 45 degrees or 90 degrees Terminal Angle Connectors: Two-piece body construction with removable upper section female end with clamp and deep slotted machine screw for securing conduit, and male threaded end provided with locknut.

E. Liquidtight Flexible Metal Conduit: Provide liquid-tight flexible metal conduit; construct of single strip, flexible, continuous, interlocked, and double-wrapped steel; galvanized inside and outside; coated with liquid-tight jacket of flexible polyvinyl chloride (PVC), 3/4-inch minimum size.

1. Manufacturers:
   a. Sealtite Type "UA" Anaconda, Liquatite Type "LA"
   b. Electri-Flex Co., International Metal Hose Co.
   c. Universal Metal Hose Company "Sealflex-U".
2. Fittings shall be Series "6000" as manufactured by:
   a. Thomas & Betts
   b. Crouse-Hinds
   c. Electri-Flex.
3. Where an external ground is required, fittings shall be Series "5200GR" or "5300GR."
4. Special care shall be taken to be sure that conduit bending radius limitations are not exceeded.

F. Expansion/Deflection Fittings: Watertight Type "XC" or Type "DX" with integral bonding jumper for rigid metal conduit permitting movement up to ¾ inch in any direction and angular deflection up to 30 degrees from normal in all directions as manufactured by:

1. Crouse-Hinds.
2. O-Z/Gedney.
3. Appleton.

G. Sealing Fittings or Bushings: Series "EYS", "EZD" or "EZS" (as applicable) as manufactured by:

1. Crouse-Hinds.
2. Pyle National.
3. Appleton.

H. Thruwall Sealing Fittings: Type "WKS" as manufactured by:

1. O-Z/Gedney.
2. Appleton.
3. Crouse-Hinds.

I. Fire-Seal Fittings: Type "CFSI" as manufactured by:

1. O-Z/Gedney.

2. Appleton.
3. Crouse-Hinds.

J. EMT Conduit Couplings:

1. Compression: Type "5120" (raintight) as manufactured by:
   a. Thomas & Betts.
   b. Raco.
   c. O-Z/Gedney.
2. Couplings shall be of steel construction.
3. Screw type couplings are not premitted.

K. EMT Conduit Connectors:

1. Compression: Type "5123" (raintight, insulated throat) as manufactured by:
   a. Thomas & Betts.
   b. Raco.
   c. O-Z/Gedney.
2. Connectors shall be of steel construction.
3. Screw type connectors are not premitted.

L. Conduit Bushings:

1. Insulated: Type "B" or "SBT" (as applicable) as manufactured by:
   a. O-Z/Gedney.
   b. Steel City.
   c. Myers.
2. Grounding: Type "BLG" as manufactured by:
   a. O-Z/Gedney.
   b. Thomas & Betts.
   c. Myers.

M. Conduit Locknuts:

1. Case-hardened locknuts shall be equal to Series No. 140 by:
   a. Thomas & Betts.
   b. Midwest Electric.
   c. O-Z/Gedney.

1.6 MISCELLANEOUS MATERIAL AND FITTINGS

A. Pulling in Wire: Provide 5/32 inch polyethylene rope.

B. Thread lubricant/sealant shall be Type "STL" as manufactured by:

1. Crouse-Hinds.
2. Greenlee Tool.
3. Ideal Industries.

C. When required on joints for heat producing elements (such as lighting fixtures), thread lubricant shall be Type "HTL" as manufactured by:

1. Crouse-Hinds.
2. Ideal Industries.
3. 3M Company.

D. Nest Back Spacers: Type "NG" by:

1. O-Z/Gedney.
2. Appleton.
3. Raco.

E. Conduit Bodies:

1. Provide galvanized cast-metal conduit bodies of types, shapes and sizes as required to fulfill job requirements and NEC requirements.
2. Construct conduit bodies with threaded-conduit-entrance ends, removable covers, either cast or of galvanized steel, and corrosion-resistant screws.
3. Manufacturers: Subject to compliance with requirements, provide conduit bodies of one of the following:
   a. Appleton Electric; Div. of Emerson Electric Co.
   b. Crouse-Hinds Co.
   c. Killark Electric Mfg. Co.

1.7 NONMETALLIC CONDUIT

A. General: Nonmetallic conduit shall be used for exterior applications only. Provide nonmetallic conduit and fittings of types, sizes and weights for each service indicated. Where types and grades are not indicated, provide proper selection determined by Installer to fulfill wiring requirements which comply with provisions of NEC for raceways.

B. Electrical Plastic Conduit (PVC):

1. Extra Heavy Wall Conduit: Schedule 80, 90degreesC, constructed of polyvinyl chloride and conforming to NEMA TC-2, for direct burial, or concrete-encased use, UL listed and in conformity with NEC Article 347.
2. All vertical ells shall be heavy wall rigid steel conduit.

C. PVC Conduit Fittings: NEMA TC 3, mate and match to conduit or tubing type and material.

D. Conduit, and Tubing Accessories: Provide conduit, tubing and duct accessories of types, sizes, and materials, complying with manufacturer's published product information, which mate and match conduit and tubing.

1.8 WIREWAYS

A. General: Provide electrical wireways of types, grades, sizes, and number of channels for each type of service as indicated. Provide complete assembly of raceway including, but not limited to, couplings, offsets, elbows, expansion joints, adapters, holddown straps, end caps, and other components and accessories as required for a complete system.

1. Indoors, wireway shall be NEMA 1.
2. The wireways shall include all necessary accessories and fittings to make a complete installation.
3. NEMA 1 wireway shall be Bulletin F-40 as manufactured by Hoffman, Square D or Parker Electrical.
4. Outside wireways shall be NEMA 3R.

B. Lay-in Wireways: Construct lay-in wireways with hinged covers, in accordance with UL 870.

1. Select units to allow fastening hinged cover closed without use of parts other than standard lengths, fittings and connectors. Provide captive type screws.
2. Construct units to be capable of sealing cover in closed position with sealing ears.
3. Provide wireways with knockouts.
4. Covers may require field splicing to be installed in accordance with N.E.C..

C. Connectors: Provide wireway connectors suitable for "lay-in" conductors, with connector covers permanently attached so that removal is not necessary to utilize the lay-in feature.

D. Finish: Protect sheet metal parts with rust inhibiting coating and baked enamel finish. Plate finish hardware to prevent corrosion. Protect screws installed toward inside of wireway with spring nuts to prevent wire insulation damage.

1.9 ELECTRICAL SURFACE METAL RACEWAYS

A. Two-piece type with single compartment, length as indicated. Provide nominal 4-3/4" x 3-9/16" with flush, snap-on cover. Factory gray enamel finish. Provide couplings, elbows, connectors, circuit breakers (rated 20AIP to protect receptacles indicated on the Drawings), wiring, receptacles (rated as noted on the Drawings). Provide insulated equipment ground conductor. Wire and mount receptacles on 18" centers. Install devices as indicated in raceway on the Drawings. Raceway shall be Wiremold G-6000.

1. Color shall be manufacturer's standard finish color unless noted otherwise.
2. All electrical surface metal raceways and components shall be painted two (2) coats to match existing surface on which it is mounted.
3. Include all fittings, elbows, connectors, covers, grounding devices, boxes, and extensions.

B. Boxes for Surface Raceways: Designed, manufactured and supplied by raceway manufacturer for use with specified raceway.

C. Manufacturers: Subject to compliance with requirements, provide surface metal raceways of one of the following:

1. Power-Strut Div., Youngstown Sheet and Tube Co.
2. Square D Company
3. Wiremold Company

1.10 BOXES AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

B. Interior Outlet Boxes (or approved equal):

1. Appleton Electric
2. Emerson Electric Co.
3. General Signal Co.
4. Harvey Hubbell Inc.
5. Midland-Ross Corp.
6. O-Z/Gedney
7. RACO Div.
8. Thomas & Betts Co.

C. Raintight Outlet Boxes (or approved equal):

1. Appleton Electric
2. Arrow-Hart Div.
3. Crouse-Hinds Co.
4. Emerson Electric Co.
5. General Signal Co.
6. Harvey Hubbell, Inc.
7. O-Z/Gedney

D. Junction and Pull Boxes (or approved equal):

1. Appleton Electric
2. Arrow-Hart Div.
3. Emerson Electric Co.
4. General Signal Co.
5. O-Z/Gedney Co.
6. Spring City Electrical Mfg. Co.

E. Bushings, Lockout Closures and Locknuts (or approved equal):

1. AMP, Inc.
2. General Signal Co.
3. Harvey Hubbell Inc.
4. Midland-Ross Corp.
5. O-Z/Gedney Co.
6. RACO Div.

7. Thomas & Betts Co., Inc.

1.11 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.

1. Construct outlet boxes with mounting holes, and with cable and conduit-size knockout openings in bottom and sides.
2. Provide boxes with threaded screw holes, with corrosion-resistant cover and grounding screws for fastening surface and device type box covers, and for equipment grounding.

B. 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 Contractor's code-compliance option.

C. Device Boxes: Provide galvanized coated flat rolled sheet-steel non-gangable device boxes, of shapes, cubic inch capacities, and sizes, including box depths as indicated, suitable for installation at respective locations.

1. 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.
2. Provide cable clamps and corrosion-resistant screws for fastening cable clamps, and for equipment type grounding.
3. Where multi-device boxes are required, provide gangable boxes where more than one device is mounted together.

D. 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 Contractor's code-compliance option.

E. Raintight Outlet Boxes: Provide NEMA 3R corrosion-resistant cast-metal raintight 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 suitable configured for each application, including face plate gaskets and corrosion-resistant plugs and fasteners.

F. Junction and Pull Boxes: Provide galvanized code-gage sheet steel junction and pull boxes, no knockouts, UL listed, 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. Boxes larger than 12" in any dimension shall be provided with hinged cover.
2. Provide steel barriers in boxes with feeder circuits of different voltages.

G. Bushings, Knockout Closures and Locknuts: Provide corrosion-resistant box knockout closures, conduit locknuts and malleable iron conduit insulated bushings, offset connectors, of types and sizes, to suit respective installation requirements and applications.

1.12 GENERAL

A. All installation shall comply with the NEC and OSHA.

1.13 EXAMINATION

A. Examine areas and conditions under which raceways are to be installed, and substrate which will support raceways.

B. Notify Contracting officer's representative in writing of conditions detrimental to proper completion of the work.

C. Do not proceed with work until unsatisfactory conditions have been corrected.

1.14 INSTALLATION OF CONDUITS

A. Install conduit concealed unless indicated otherwise on the Drawings. Maintain minimum distance of six (6") inches from parallel runs of flues, steam or hot water pipes.

B. Use liquid-tight flexible metal conduit for connections to motors, transformers and other equipment subject to vibration and in areas subject to moisture.

C. Use flexible metal conduit for connections to recessed and/or semi-recessed lighting fixtures.

D. Space groups of conduits uniformly. For bends and offsets, use an approved hickey or bending machine.

E. Cut all conduit with hacksaw or approved cutting machine and ream after threading to remove all burrs.

F. Fasten conduit securely to outlets, junctions and pullboxes to ensure firm electrical contact.

1. Join conduit with approved couplings.
2. No running threads will be allowed.
3. Install insulated bushings and double locknuts on threaded conduits entering or leaving sheet metal outlet, junction, or pull boxes, and cabinets.

4. Install grounding bushings on all conduits entering an enclosure such as a motor control center from below where the conduit is not attached to the enclosure.
5. Bond all bushings to ground bus using conductor the same size as the equipment grounding conductor in the conduit.
6. Install compression type connectors with insulated throats on electrical metallic tubing entering or leaving sheet metal outlet, junction or pull boxes and cabinets.

G. Avoid condensation pockets in installations. Keep conduit, fittings, and boxes free from foreign matter, before, during and after installation.

H. Do not use EMT in wet areas, in floor slabs, within outside walls below grade, below grade, or exposed except on ceilings and in vertical runs no less than four (4') feet above floor.

I. Use electrical surface metal raceway for extensions of circuits only where specifically indicated on the Drawings.

J. Not more than one (1) exposed conduit shall be run down to an exposed wall switch or outlet box.

K. Use expansion/deflection fittings where rigid metal conduits pass from existing building structures to additions on new foundations, every 200 feet linear run maximum, and where otherwise indicated on the Drawings.

L. Use thruwall sealing fittings where conduits enter buildings or vaults below finished grade.

M. Conduits less than one (1") inch may be installed in concrete but shall not cross each other. Installation of larger conduits in concrete must be approved by Engineer.

N. Do not use aluminum conduit on this project.

O. Support runs of metallic conduit at least every eight (8') feet.

P. Support runs of non-metallic conduit at least as required by NEC Table 352.30.

Q. Install runs of conduit parallel or perpendicular to walls, structural members or intersections of vertical planes and ceilings. Provide right angle turns consisting of fittings or symmetrical bends.

R. Support conduits within one (1') foot of all changes in direction. Supports shall include wall brackets, trapeze hangers, strap hangers or pipe straps secured to hollow masonry with toggle bolts, to brick and concrete with expansion bolts, to metal surfaces with machine screws and to wood with wood screws.

S. The use of wooden plugs (inserted in masonry), tie wire or nails as fastening media is prohibited.

T. Conduit shall not be supported from metal roof deck.

U. Provide pitchpocket where conduit penetrates roof.

V. Conduit shall not penetrate concrete bases designed for vibration isolation.

W. Apply thread lubricant/sealant to joints of all conduit buried in earth or concrete encased.

X. Use PVC conduit only where specifically indicated on the Drawings.

1. Schedule 80 PVC shall be used in floor slabs within the building limits, in underground site distribution and shall be concrete encased where detailed on the Drawings.

Y. Install fire-seal fittings or UL classified foam sealant where conduits penetrate concrete floor slabs or masonry walls required to be fire rated.

Z. Use nest back spacers in conjunction with conduit spacers or clamp backs when additional spacing away from mounting surface is required.

AA. All conduits shall be installed as high as possible in the ceiling cavity. Coordinate all conduit installation with ductwork.

BB. 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.

CC. Install miscellaneous fittings such as reducers, chase nipples, 3-piece unions, split coupling, and plugs that have been specifically designed and manufactured for their particular application.

DD. Use roughing-in dimensions of electrically operated unit furnished by supplier.

EE. Set conduit and boxes for connection to units only after receiving review of dimensions and after checking location with other trades.

FF. Provide nylon pull string in empty conduits where indicated.

GG. Test conduits required to be installed, but left empty, with ball mandrel.

HH. Clear any conduit which rejects ball mandrel.

II. Pay costs involved for restoration of conduit and surrounding surfaces to original condition.

JJ. Cut conduits straight, properly ream, and cut threads for heavy wall conduit deep and clean.

KK. Field-bend conduit with benders designed for purpose so as not to distort or vary internal diameter.

LL. Size conduits to meet NEC, except no conduit smaller than ¾ inch shall be installed.

MM. Fasten conduit terminations in sheet metal enclosures by 2 locknuts, and terminate with insulated bushing. Install locknuts inside and outside of enclosure.

NN. Conduits are not to cross pipe shafts or ventilating duct openings.

OO. Support riser conduit at each floor level with clamp hangers.

PP. Use of running threads at conduit joints and terminations is prohibited. Where required, use 3-piece union or split coupling.

QQ. Complete installation of electrical raceways before starting installation of cables/wires within raceways.

RR. Support exposed conduit by use of hangers, clamps or clips.

1. Support conduit within 3'-0" of each outlet box, junction box, cabinet or fitting and on each side of bends and on spacing not to exceed following: Rigid metal conduits up to 1": 6'-0"; 1-1/4" and over: 8'-0"; EMT up to 1": 5'-0"; 1-1/4" and over: 8'-0".
2. Arrange conduit supports to prevent distortion of alignment by wire pulling operations.
3. Fasten conduit using galvanized straps, caddy clamps, lay-in adjustable hangers, clevis hangers, or bolted split stamped galvanized hangers.
4. Requirements for exposed conduits also apply to conduits installed in space above hung ceilings.

SS. Exposed Conduits:

1. Exposed conduits are not to be installed in finished areas unless indicated otherwise on drawings.
2. Install conduits as not to damage or run through structural members. Avoid horizontal or cross runs in building partitions or side walls.
3. Install exposed conduits and extensions from concealed conduit systems neatly, parallel with, or at right angles to walls of building.
4. Install exposed conduit work as not to interfere with ceiling inserts, lights or ventilation ducts or outlets.
5. Run conduits for outlets on waterproof walls exposed. Set anchors for supporting conduit on waterproof wall in waterproof cement.
6. Requirements for exposed conduit also apply to conduits installed in space above hung ceilings.

TT. Non-Metallic Conduit:

1. Make solvent cemented joints in accordance with recommendations of manufacturer.
2. Install PVC conduits in accordance with NEC.

UU. Conduit Fittings:

1. Construct locknuts for securing conduit to metal enclosure with sharp edge for digging into metal, and ridged outside circumference for proper fastening.
2. Install insulated throat connectors for terminating EMT.

3. Install insulated type bushings for terminating conduits. Bushings are to have flared bottom and ribbed sides. Upper edge to have phenolic insulating ring molded into bushing.
4. Miscellaneous fittings such as reducers, chase nipples, 3-piece unions, split coupling, and plugs to be specifically designed for their particular application.

VV. Install expansion fittings in all raceways wherever structural expansion joints are crossed.

WW. Make changes in direction of raceway run with proper fittings, supplied by raceway manufacturer.

XX. Properly support and anchor raceways for their entire length by structural materials. Raceways are not to span any space unsupported.

YY. Use boxes as supplied by raceway manufacturer wherever junction, pull or devices boxes are required. Standard electrical "handy" boxes, etc. shall not be permitted for use with surface raceway installations.

ZZ. Arrange conduit to maintain headroom and present a neat appearance.

AAA. Route exposed conduit and conduit above accessible ceilings parallel and perpendicular to walls and adjacent piping.

BBB. Group conduits in parallel runs where practical and use conduit rack constructed of steel channel with conduit straps or clamps. Provide space for 25% additional conduit.

CCC. Do not fasten and/or hang conduit with wire or perforated pipe straps. Remove all wire used for temporary conduit support during construction, before conductors are pulled.

DDD. Bring conduit to the shoulder of fittings and couplings and fasten securely. Raceways shall be cut to proper length so ends fit accurately in outlets.

EEE. Use conduit hubs for fastening conduit to cast boxes, and for fastening conduit to sheet metal boxes in damp or wet locations.

FFF. Install no more than the equivalent of three (3) 90 degree bends between boxes.

GGG. Use conduit bodies to make sharp changes in direction, as around beams.

HHH. Use hydraulic one-shot conduit bender for bends in conduit smaller than 2" size, or factory elbows for bends in conduit 2" and larger. Bends in metallic conduit shall be made while "cold."

III. Avoid moisture traps where possible; where unavoidable, provide junction box with drain fitting at conduit low point.

JJJ. Use suitable conduit caps to protect installed conduit against entrance of dirt and moisture.

KKK. EMT shall not be permitted in exterior walls or underground.

LLL. Where conduit penetrates fire rated walls, provide pipe sleeve two sizes larger than conduit; seal opening around conduit with UL listed foamed silicone elastomer compound.

MMM. Route conduit through roof openings for piping and ductwork where possible; otherwise, route through roof jack with pitch pocket.

NNN. Combining of circuits other than as indicated on the Drawings shall not be permitted.

OOO. Bolts, clamps, screws and expansion bolts shall be used in securing conduit, equipment, etc. Holes for lead shields shall be drilled in solid brick or concrete and must be neatly cemented after bolts are in place.

1.15 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 NEC, OSHA, 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 weathertight 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. Where receptacles are shown back-to-back in walls, they shall be mounted in separate boxes, a minimum of 6" apart (24" in acoustic rated walls) and connected together using flex with ground wire. Flex will not be acceptable for system grounding. The flex shall have a loop for limiting sound transmissions. Outlet boxes shall be equipped with plaster rings of appropriate depth to finish flush with finished wall. Outlets in exposed masonry walls shall be equipped with extra deep square corner tile rings so that boxes may be installed in brick walls or in the core of the block.

G. Aluminum products shall not be installed.

H. Position recessed outlet boxes accurately to allow for surface finish thickness.

I. Do not use round boxes unless noted otherwise on the Drawings.

J. Fasten electrical boxes firmly and rigidly to substrates, or structural surfaces to which attached, or solidly embed electrical boxes in concrete or masonry. Boxes shall be supported independently of conduit.

K. Provide electrical connections for installed boxes.

L. Electrical box locations indicated on the Drawings are approximate unless dimensioned. Verify location of outlets prior to rough-in. Outlet may be relocated by the Contracting Officer or authorized representative at no additional cost.

M. Locate and install to maintain headroom and to present a neat appearance.

N. Use multiple gang boxes where more than one device is mounted together; do not use sectional boxes. Provide barriers to separate wiring of different voltage systems.

O. Install boxes in walls without damaging wall insulation.

P. Position outlets to locate luminaries as indicated on the Drawings.

Q. Align wall mounted outlet boxes for switches, thermostats, and similar devices.

R. Subsequent to installation of boxes, protect boxes from construction debris and damage.

S. Support all outlet boxes as required by the NEC. Suspended outlet boxes shall be independently supported from raceway by means of 1/4" all thread rod to structure.

T. All outlet boxes or plaster rings shall finish flush with finished wall or ceiling. Outlets which do not finish flush (recessed) shall be equipped with copper tube stand-off nipples of proper length to hold wiring device securely in place. Wiring device shall be secure and shall not push in or rock.

1.16 GROUNDING

A. Upon completion of installation work, properly ground electrical boxes and demonstrate compliance with requirements of Section 16060 – GROUNDING AND BONDING.

1.17 JUNCTION AND OUTLET BOX IDENTIFICATION:

A. Identify each junction and outlet box cover with color and the type system that is within the box. Sample identifications are as follows:

B. Fire Alarm (Red): Name “FIRE ALARM”.

C. The written labels above shall be neatly and legibly marked on the outside of the box covers using a permanent black ink marker.

END OF SECTION 16130

SECTION 16140

WIRING DEVICES

1.1 SUMMARY

A. This Section includes receptacles, connectors, switches, and finish plates.

1.2 DEFINITIONS

A. GFCI: Ground-fault circuit interrupter.

1.3 SUBMITTALS

A. Product Data: For each product specified.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

B. Comply with NEMA WD 1.

C. Comply with NFPA 70.

1.5 COORDINATION

A. Receptacles for Government-Furnished Equipment: Match plug configurations.

1. Cord and Plug Sets: Match equipment requirements.

1.6 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Wiring Devices (or approved equal):
   a. Bryant Electric, Inc.
   b. Eagle Electric Manufacturing Co., Inc.
   c. GE Company; GE Wiring Devices.
   d. Hubbell, Inc.; Wiring Devices Div.
   e. Killark Electric Manufacturing Co.
   f. Leviton Manufacturing Co., Inc.
   g. Pass & Seymour/Legrand; Wiring Devices Div.

1.7 RECEPTACLES

A. Provide NEMA configuration 5-20R duplex 125 Volt grounding type receptacles rated for 20 Amperes unless otherwise indicated on the Drawings.

B. Receptacles shall be specification grade, Bryant "5362" series, Hubbell "5352" series, P&S "5362" series, G.E., "5362" series, Sylvania "5362" series or Slater "5362" series (or approved equal).

C. Receptacle color shall be ivory in finished areas and brown in unfinished areas.

1.8 OTHER RECEPTACLES

A. Receptacles requiring a current or voltage rating or configuration different from duplex convenience receptacles shall be as indicated on the Drawings.

B. Provide other receptacles with quality, material and workmanship at least equal to that specified for duplex convenience receptacles.

C. Ground fault interrupter receptacles shall have the following features:

1. UL listed: UL 943 Class A
2. Configuration: Duplex, NEMA 5-20R
3. Trip Current: 5 plus or minus 1 milliampere
4. Trip Speed: 0.025 second maximum
   a. Front-accessible test and reset pushbuttons
   b. Manufacturer and type (or approved equal):
      1) Harvey Hubbell, Inc.: GP5362
      2) Pass & Seymour, Inc.: 2091
      3) Slater: SIR-20-F

1.9 PENDANT CORD/CONNECTOR DEVICES

A. Description: Matching, locking type, plug and receptacle body connector, NEMA WD 6, Configurations L5-20P and L5-20R, Heavy-Duty grade.

1. Body: Nylon with screw-open cable-gripping jaws and provision for attaching external cable grip.
2. External Cable Grip: Woven wire-mesh type made of high-strength galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

1.10 CORD AND PLUG SETS

A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.

1. Cord: Rubber-insulated, stranded-copper conductors, with type SOW-A jacket. Green-insulated grounding conductor, and equipment-rating ampacity plus a minimum of 30 percent.
2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

1.11 SWITCHES

A. Provide totally enclosed, 20 Ampere, 120/277 Volt, quite AC general-use snap switches.

B. Switches shall be single pole, double pole, three-way, four-way, locking or with pilot light as indicated on the drawings.

C. Switches shall be specification grade, Bryant "4900" series, Hubbell "1220" series, P& S "20AC" series, G.E. "5950" series, Sylvania "1221A" series or Slater "720" series (or approved equal).

D. Switch color shall be ivory in finished areas and brown in unfinished areas.

1.12 WALL PLATES

A. Provide wall plates for single and combination wiring devices of types, sizes, and ganging, and cutouts as indicated.

B. Sectional wall plates shall not be used. Select plates which mate and match wiring devices to which attached.

1. Plate securing screws: Metal with head color to match plate finish.
2. Material for finished spaces: Smooth, high impact thermoplastic, color of ivory.
3. Material for unfinished spaces: Stainless steel.

1.13 INSTALLATION

A. All work shall be in accordance with NEC and OSHA requirements.

B. Install devices and assemblies plumb and secure.

C. Install wall plates when painting is complete.

D. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical, and grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

E. Protect devices and assemblies during painting.

F. Where adjacent to doors, coordinate with architectural drawings to ensure switches are installed on strike side of door.

G. Locate switches approximately 48 inches (centerline) above finished floor elevation unless otherwise indicated.

H. Locate receptacles approximately 18 inches (centerline) above finished floor elevation unless otherwise indicated.

I. Install wiring devices only in electrical boxes which are clean (free from excess building materials, dirt, and debris).

1.14 IDENTIFICATION

A. Switches: Where three or more switches are ganged, and elsewhere as indicated, identify each switch with approved legend engraved on wall plate.

B. Receptacles: Identify panelboard and circuit number from which served. Use machine-printed, pressure-sensitive, durable wire markers or tags within outlet boxes.

1.15 CONNECTIONS

A. Connect wiring device grounding terminal to branch-circuit equipment grounding conductor.

B. Tighten electrical connectors and terminals according to manufacturers published torque-tightening values. If manufacturers torque values are not indicated, use those specified in UL 486A and UL 486B.

1.16 FIELD QUALITY CONTROL

A. Test wiring devices for proper polarity and ground continuity. Use Hubbel model HBL5200 or equal.

B. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.

C. Replace damaged or defective components.

1.17 CLEANING

A. Internally clean devices, device outlet boxes, and enclosures. Replace stained or improperly painted wall plates or devices.

END OF SECTION 16140

SECTION 16442

PANELBOARDS

1.1 SUMMARY

A. Extent of panelboard, load-center and enclosure work, including cabinets and cutout boxes is indicated by the Drawings and Schedules.

B. Types of panelboard and enclosures required for the project include the following:

1. Lighting and appliance panelboards.

C. Refer to other Division 16 sections for wires/cables, electrical boxes and fittings, and raceway work required in conjunction with installation of panelboards and enclosures.

D. Wire/cables, electrical boxes and fittings, and raceways required in conjunction with the installation of panelboards and enclosures are specified in other Division 16 sections.

1.2 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of panelboards and enclosures, of types, sizes, and ratings required, whose products are UL listed and/or labeled for the purpose intended.

B. Electrical Code Compliance: Comply with applicable State code requirements of the authority having jurisdiction and NEC Article 384 as applicable to installation and construction of electrical panelboards and enclosures.

C. UL Compliance: Comply with applicable requirements of Std No. 67, "Electric Panelboards," and Stds No.'s 50, 869, 486A, 486B, and 1053 pertaining to panelboards, accessories and enclosures. Provide units which are UL listed and/or labeled.

D. Special-Use Markings: Provide panelboards, constructed for special-use, with appropriate UL marks which indicates that they are suitable for special type of use/application including service entrance equipment.

E. NEMA Compliance: Comply with NEMA Stds Pub/No. 250 "Enclosures for Electrical Equipment (1000 Volts Maximum)," Pub/No. PB 1, "Panelboards," and Pub/No. PB 1.1, "Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 volts or Less."

1.3 SUBMITTALS

A. Product Data: Submit manufacturer’s data on panelboards and enclosures.

B. Shop Drawings: Submit layout drawings of panelboards showing accurately scaled basic equipment sections, auxiliary compartments and combination sections. In addition, show special relationships of units to associated equipment.

1.4 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide panelboard products of one of the following (for each type and rating of panelboard and enclosure) (or approved equal):

1. Cutler-Hammer/Westinghouse
2. General Electric Company.
3. Square D Company.

1.5 PANELBOARDS

A. General: Except as otherwise indicated, provide panelboards, bolt-on breakers, integral common trip, enclosures and ancillary components, of types, sizes, and ratings indicated, which comply with manufacturer's standard materials; design and construction in accordance with published product information; equip with proper number of unit panelboard devices as required for complete installation. Where types, sizes, or ratings are not indicated, comply with NEC, UL and established industry standards for those applications indicated.

B. Lighting and Appliance Panelboards: Provide factory assembled, dead front safety constructed, lighting and appliance panelboards circuit breaker type, in sizes and ratings indicated, with panelboard switching and protective devices in quantities, ratings, types, characteristics and with arrangement indicated; with anti-turn solderless pressure type main lug connections approved for use with copper conductors.

1. Construct with rectangular shaped bus bars (Phase, neutral and ground) of solid copper, with conductivity not less than 98%, which are securely mounted and braced, and with solderless lugs bolted to main bus bars, and with full sized neutral bus and bare uninsulated ground bus suitable for bolting to enclosures, suitable for service with 208Y/120 volt, 3 phase, 4 wire system.
2. Provide suitable lugs on neutral bus for outgoing feeders requiring neutral connections.
3. Provide molded case main and branch circuit bolt-on breaker types for each circuit, with toggle handles that indicate when tripped.
4. Branch circuit breakers for lighting circuits shall be Type "SWD"; for air conditioning and appliance circuits, Type "HACR."
5. Where multiple pole breakers are indicated, provide with integral common trip so overload on one pole will trip all poles simultaneously.
6. Minimum integrated short circuit rating for branch circuit breakers shall be as noted on the Drawings.
7. Select enclosures as noted on drawings fabricated by same manufacturer as panelboards, which mate and match properly with panelboards.

C. Panelboard Enclosures: Provide galvanized sheet steel cabinet type enclosures, in sizes and NEMA types as indicated, code-gage, minimum 16-gage thickness. Construct with no knockouts and code sized wiring gutters.

1. Provide fronts with adjustable trim clamps, and doors with flush locks and keys, all panelboard enclosures keyed alike, with concealed piano door hinges and door swings as indicated.
2. Equip with interior circuit-directory frame, and card with clear plastic covering.
3. Provide baked gray enamel finish over a rust inhibitor coating.
4. Design enclosures for recessed or surface mounting, as indicated on drawings.
5. Provide enclosures which are fabricated by same manufacturer as panelboards, which mate properly with panelboards to be enclosed.

D. Molded Case Circuit Breakers: Provide factory assembled, molded case circuit breakers of frame sizes, characteristics, and ratings including RMS symmetrical interrupting ratings indicated.

1. Select breakers with permanent thermal and instantaneous magnetic trip, and with fault current limiting protection, ampere ratings as indicated.
2. Construct with overcenter, trip free, toggle type operating mechanisms with quick-make, quick-break action and positive handle trip indication.
3. Construct breakers for mounting and operating in any physical position, and operating in an ambient temperature of 40 degrees C.
4. Provide breakers with mechanical screw type removable connector lugs, AL/CU rated.
5. Breaker terminals shall be approved for conductors rated 60/75 degrees C, and shall be identified accordingly on each breaker.

E. Panelboard Accessories: Provide panelboard accessories and devices including, but not necessarily limited to, cartridge and plug time-delay type fuses, circuit-breakers, ground-fault protection units, etc., as recommended by panelboard manufacturer for ratings and applications indicated.

F. Short Circuit Rating: Unless otherwise indicated, panelboards and all devices will have a minimum short circuit withstand rating of 10,000 RMS symmetrical amperes for 208/120 volt power lighting and appliance panelboards.

G. Series rated panelboards are premitted provided all NEC and UL requirements are satisfied, and series rating data is submitted to the Contracting Officer or authorized representative.

H. All main breakers shall be individually vertical mounted.

1.6 EXAMINATION

A. Examine areas and conditions under which panelboards and enclosures are to be installed, and notify the Contracting Officer or authorized representative in writing of conditions detrimental to proper completion of work.

B. Do not proceed with work until unsatisfactory conditions have been corrected.

1.7 INSTALLATION OF PANELBOARDS

A. General: Install panelboards and enclosures as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC standards, OSHA, and NECA's "Standard of Installation," and in compliance with recognized industry practices to ensure that products fulfill requirements.

B. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Stds 486A and B.

C. Fasten enclosures firmly to walls and structural surfaces, ensuring that they are permanently and mechanically anchored.

D. Provide properly wired electrical connections for panelboards within enclosures.

E. Fill out panelboard's circuit directory card with typewriter upon completion of installation work.

F. All neutral and ground wires shall have taped on numbers at panels indicating circuits served.

G. Install panelboards approximately 6 feet 6 inches (top) above finished floor elevation unless otherwise indicated.

1.8 FIELD QUALITY CONTROL

A. Prior to energization of electrical circuitry, check all accessible connections to manufacturer's tightening torque specifications.

B. Prior to energization, check panelboards for electrical continuity of circuits, and for short-circuits.

1.9 GROUNDING

A. Provide equipment grounding connections for panelboards as indicated.

B. Tighten connections to comply with tightening torques specified in UL Stds 486A to assure permanent and effective grounds.

C. Upon completion of installation work, properly ground panelboards and demonstrate compliance with requirements of Division 16 Section 16060 – GROUNDING AND BONDING.

1.10 ADJUSTING AND CLEANING

A. Adjust operating mechanisms for free mechanical movement.

B. Touch-up scratched or marred surfaces to match original finishes.

1.11 DEMONSTRATION

A. Subsequent to wire and cable hookups, energize panelboards and demonstrate functioning in accordance with requirements.

B. Where necessary, correct malfunctioning units, and then retest to demonstrate compliance.

END OF SECTION 16442

SECTION 16515

INTERIOR LIGHTING FIXTURES

1.1 SUMMARY

A. Extent, location, and details of interior lighting fixture work are indicated on drawings and in schedules.

B. Types of interior lighting fixtures in this section include the following:

1. Fluorescent.
2. Incandescent.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer’s product data and installation instructions on each type of interior lighting fixture and component.

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of interior lighting fixtures of sizes, types and ratings required, whose products are UL listed and/or labeled.

B. Codes and Standards:

1. Electrical Code Compliance: Comply with applicable State code requirements of the authority having jurisdiction and NEC Articles 220 and 410 as applicable to installation, and construction of interior building lighting fixtures.
2. NEMA Compliance: Comply with applicable requirements of NEMA Stds Pub/No.'s LE 1 and LE 2 pertaining to lighting equipment.
3. UL Compliance: Comply with UL standards, including UL 486A and B, pertaining to interior lighting fixtures. Provide interior lighting fixtures and components which are UL listed and labeled.
4. CBM Labels: Provide electronic fluorescent lamp ballasts which comply with Certified Ballast Manufacturers Association standards and carry the CBM label.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver interior lighting fixtures in factory-fabricated containers or wrappings, which properly protect fixtures from damage.

B. Store interior lighting fixtures in original packaging. Store inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, humidity, laid flat and blocked off ground.

C. Handle interior lighting fixtures carefully to prevent damage, breaking, and scoring of finishes. Do not install damaged units or components; replace with new.

1.5 SEQUENCING AND SCHEDULING

A. Coordinate with other work including wires/cables, electrical boxes and fittings, and raceways, to properly interface installation of interior lighting fixtures with other work.

B. Sequence interior lighting installation with other work to minimize possibility of damage and soiling during remainder of construction.

1.6 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide interior lighting units of one of the following (for each type of interior lighting unit) (or approved equal):

1. General Electric Co.
2. Hubbell
3. Holophane Div; Johns-Manville Corp.
4. Lithonia
5. Daybrite

B. Fluorescent Ballasts:

1. Advance Transformer Co.
2. Electronic Ballast Technology
3. Magnatek
4. Osvam

C. Lamps

1. General Electric
2. Osvam-Sylvania
3. Phillips

1.7 INTERIOR LIGHTING FIXTURES

A. General: Provide lighting fixtures, of sizes, types and ratings indicated; complete with, but not limited to, housings, energy efficient ballasts, starters, wiring, poles and standards.

B. Wiring: Provide electrical wiring within fixture suitable for connecting to branch circuit wiring.

C. Fluorescent Lamp Ballasts: Provide solid state low-temperature, high power-factor, Class P, UL Listed integrated electronic ballasts, capable of operating lamp types indicated.

1. Ballasts shall be Electronic Integrated Circuit type.

    a. Ballast sound levels shall not exceed Class A ambient noise levels.
    b. Ballast shall maintain constant light output of all rapid start fluorescent lamps over operating ranges of 90V to 145V (120V ballasts) and 200V to 320V (277V ballasts).
    c. Input current Total Harmonic Distortion content shall be below 15 percent (expressed in percentage of full light output current level).
    d. Ballast shall have an average lamp current crest factor below 1.4.
    e. Where applicable, ballasts shall meet minimum efficacy standards of Public Law No. 100-357, National Appliance Energy Conservation Amendments of 1988.
    f. Ballast shall be rapid startup.
    g. Ballast shall withstand line transients ad defined in ANSI/IEEE C62.41, Category A.
    h. Ballast case temperature shall not exceed 25 degrees C temperature rise over 40 degrees C ambient.
    i. Ballast shall have a frequency of operation of 20 kHz or greater, and operate without visible flicker.
    j. Ballast shall have a power factor of 90% or above.
    k. Ballast shall not contain polychlorinated biphenyls (PCB's).
    l. Ballast shall meet the requirements of the Federal Communications Commission Rules and Regulations, Part 18, Class A.

D. Lamps:

1. All lamps used on this Project shall be by one manufacturer.
2. All lamps of a particular type shall be from one production run.
3. Provide fluorescent lamps of energy saving types and wattages as indicated on the Drawings.
4. Provide HID lamps in types and wattages indicated on the Drawings.

E. Interior Lighting Fixture Types:

1. General: Fixtures must comply with minimum requirements as stated herein. Review architectural drawings and specifications to verify ceiling types, modules, suspension systems appropriate to installation.
2. Refer to the Fixture Schedule on the Drawings for specific fixture types and requirements.

F. Fluorescent Dimmer Switch:

1. Wall box dimmers shall be provided with sufficient capacity for control of the loads as identified on the drawings. All dimmers shall be UL listed.
2. Contractor shall furnish all equipment, labor and other services for proper installation of the dimmers. Contractor shall run separate neutral wires to prevent dimmer interaction and neutral harmonic current rise.
3. Each dimmer shall have a linear slide intensity control and air-gap switch for positive disconnect of voltage to the loads. Dimmers shall be capable of operating at rated load without adversely affecting design lifetime. Dimmers shall

have power failure memory and restore to the saved levels set prior to the power being interrupted.

4. Dimmers shall exhibit a smooth continuous square law dimming curve, and be filtered to minimize interference with properly installed radio and AV equipment.
5. Contractor shall provide multi-gang screwless faceplates for installations of dimmers and designer-style switches ganged as specified. Color shall be ivory or white as specified on the drawings. Faceplate shall attach without exposed fasteners.

1.8 EXAMINATION

A. Examine areas and conditions under which lighting fixtures are to be installed, and substrate for supporting lighting fixtures.

B. Notify Contracting Officer or authorized representative in writing of conditions detrimental to proper completion of the work.

C. Do not proceed with work until unsatisfactory conditions have been corrected.

1.9 INSTALLATION OF INTERIOR LIGHTING FIXTURES

A. Install interior lighting fixtures at locations and heights as indicated, in accordance with fixture manufacturer's written instructions, applicable requirements of NEC, OHSA, NECA's "Standard of Installation," NEMA standards, and with recognized industry practices to ensure that lighting fixtures fulfill requirements.

B. Provide fixtures and/or fixture outlet boxes with hangers to properly support fixture weight. Submit design of hangers, method of fastening, other than indicated or specified herein, for review by Contracting Officer or authorized representative.

C. Install flush mounted fixtures properly to eliminate light leakage between fixture frame and finished surfaces.

D. Provide plaster frames for recessed fixtures installed in other than suspended grid type acoustical ceiling systems. Brace frames temporarily to prevent distortion during handling.

E. Fasten fixtures securely to indicated structural supports; and ensure that pendant fixtures are plumb and level. Provide individually mounted pendant fixtures longer than two (2') feet with twin stem hangers. Provide stem hanger with ball aligners and provisions for minimum one (1") inch vertical adjustment. Mount continuous rows of fixtures with an additional stem hanger greater than number of fixtures in the row. Provide clips for securing layin fixtures in grid ceiling system.

F. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Stds 486A, and the National Electrical Code.

G. Support surface mounted fixtures greater than two (2') feet in length at one other point in addition to the outlet box fixture stud.

H. Surface mounted fluorescent fixtures shall be mounted using 1/4" threaded rod at each end and rods shall be attached to the building structure above the ceiling. Ceiling grid tees shall not be used for supporting surface mounted fixtures.

1.10 FIELD QUALITY CONTROL

A. Replace defective and burned out lamps for a period of one year following the Date of Substantial Completion.

B. At Date of Substantial Completion, replace lamps in interior lighting fixtures which are observed to be noticeably dimmed after Contractor's use and testing, as judged by Contracting officer’s representative.

1.11 GROUNDING

A. Provide equipment grounding connections for interior lighting fixtures as indicated and as specified in Division 16 Section 16060 – GROUNDING AND BONDING.

B. Tighten connections to comply with tightening torques specified in UL Std 486A to assure permanent and effective grounds.

1.12 ADJUSTING AND CLEANING

A. Clean interior lighting fixtures of dirt and construction debris upon completion of installation. Clean fingerprints and smudges from lenses.

B. Protect installed fixtures from damage during remainder of construction period.

1.13 DEMONSTRATION

A. Upon completion of installation of interior lighting fixtures, and after building circuitry has been energized, apply electrical energy to demonstrate capability and compliance with requirements.

B. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.

END OF SECTION 16515

SECTION 16525

EXTERIOR LIGHTING FIXTURES

1.1 SUMMARY

A. Types of exterior lighting fixtures in this section include the following:

1. Metal Halide.

1.2 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of exterior building lighting fixtures of types and ratings required.

B. Codes and Standards:

1. NEC Compliance: Comply with NEC as applicable to installation and construction of exterior building lighting fixtures.
2. NEMA Compliance: Comply with applicable requirements of NEMA Stds Pub/No.'s FA 1, LE 1 and LE 2 pertaining to lighting equipment.
3. UL Compliance: Comply with UL standards, including Stds 486A and B, pertaining to exterior lighting fixtures. Provide exterior lighting fixtures which are UL listed and/or labeled.

1.3 SUBMITTALS

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

1.4 DELIVERY, STORAGE AND HANDLING

A. Handle lighting fixtures carefully to prevent damage, breaking, and scoring. Do not install damaged fixtures or components; replace with new.

B. Store lighting fixtures in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.

1.5 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated into the work include, but are not limited to, the following (or approved equal):

B. Exterior Lighting Fixtures:

1. General Electric Co.

2. GTE Sylvania, Inc.
3. Holophane
4. Hubbell Lighting.
5. Lithonia Lighting.
6. Sterner Lighting.

C. Metal Halide Ballasts:

1. Advance Transformer Co.
2. General Electric Co. (Hendersonville)
3. Holophane Div.; Johns-Manville Corp.
4. Jefferson Electric Co.
5. Universal Transformer Co.

1.6 EXTERIOR LIGHTING FIXTURES

A. General: Provide lighting fixtures, of sizes, types and ratings indicated; complete with, but not limited to, housings, energy efficient ballasts, starters and wiring.

B. Wiring: Provide electrical wiring within fixture suitable for connection to branch circuit wiring.

C. Metal Halide Lamp Ballasts: Provide Metal Halide lamp ballasts, capable of operating lamp types with ratings indicated; reactor type, high power-factor, core and coil assembly encapsulated in non-melt resin; install capacitor outside ballast encapsulation for easy field replacement.

D. Lamps:

1. All lamps used on this Project shall be by one manufacturer.
2. All lamps of a particular type shall be from one production run.
3. Provide Metal Halide lamps in types and wattages indicated on the Drawings.

E. Exterior Lighting Fixture Types:

1. General: Refer to the Fixture Schedule for types and requirements of exterior lighting fixtures.

1.7 INSPECTION

A. Examine areas and conditions under which lighting fixtures are to be installed, and substrate which will support lighting fixtures.

B. Do not proceed with work until unsatisfactory conditions have been corrected.

1.8 INSTALLATION OF EXTERIOR LIGHTING FIXTURES

A. Install exterior lighting fixtures at locations and heights as indicated, in accordance with fixture manufacturer's written instructions, applicable requirements of NEC, NECA's "Standard of Installation," NEMA standards, and with recognized industry practices to ensure that lighting fixtures fulfill requirements.

B. Coordinate with other electrical work as appropriate to properly interface installation of exterior lighting fixtures with other work.

C. Tighten connectors and terminals, including screws and bolts, to comply with tightening torques specified in UL Stds 486A.

D. Fasten fixtures securely to poles; and ensure that poles and fixtures are plumb.

1.9 ADJUSTING AND CLEANING

A. Clean exterior lighting fixtures of dirt and debris upon completion of installation.

B. Protect installed fixtures from damage during construction period.

1.10 FIELD QUALITY CONTROL

A. Upon completion of installation of exterior lighting fixtures, and after building circuitry has been energized, apply electrical energy to demonstrate capability and compliance with requirements.

B. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.

C. Replace defective and burned out lamps for a period of one year following the Date of Substantial Completion.

D. At the Date of Substantial Completion, replace lamps in exterior lighting fixtures which are observed to be noticeably dimmed after Contractor's use and testing as judged by the Contracting Officer or authorized representative.

1.11 GROUNDING

A. Tighten connections to comply with tightening torques specified in UL Std 486A to assure permanent and effective grounds.

B. Provide equipment grounding connections for exterior lighting fixtures as indicated and as specified in Section 16060 – GROUNDING AND BONDING.

END OF SECTION 16525

SECTION 16535

EMERGENCY LIGHTING

1.1 SUMMARY

A. Extent of emergency lighting work is indicated by Drawings and Schedules.

B. Types of emergency lighting fixtures in this section include the following:

1. Unitized battery powered fixtures.
2. Exit fixtures.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer’s product data and installation instructions on each type of emergency lighting fixture and component.

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of emergency lighting fixtures of types and ratings required, whose products are UL listed and/or labeled.

B. Codes and Standards:

1. NEC Compliance: Comply with NEC as applicable to installation and construction of emergency lighting.
2. NEMA Compliance: Comply with applicable requirements of NEMA Std Pub No.'s 1B 4, 1B 5, and FA 1 pertaining to emergency lighting.
3. UL Compliance: Provide emergency lighting fixtures which are UL listed and/or labeled.
4. NFPA Compliance: Comply with applicable requirements of NFPA 99, "Health Care Facilities" and NFPA 101, "Life Safety Code."

1.4 DELIVERY, STORAGE AND HANDLING

A. Handle lighting fixtures carefully to prevent damage, breaking, and scoring. Do not install damaged fixtures or components; replace with new.

B. Store lighting fixtures in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.

1.5 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, manufacturers offering emergency lighting equipment which may be incorporated in the work include the following (or approved equal):

B. Exit Fixtures:

1. Chloride Inc.
2. Emergi-Lite Electronics
3. Exide Electronics Corp.
4. Hubbell Lighting, Inc.
5. Lightalarms Electronics Corp.
6. Lithonia Lighting Inc.
7. Shield Source, Inc.

C. Unitized Battery Powered Fixtures:

1. Chloride Systems USA, Inc.
2. Exide Electronics Corp.
3. Hubbell Lighting, Inc.
4. Lightalarms Electronics Corp.
5. Lithonia Lighting, Inc.

1.6 EMERGENCY LIGHTING FIXTURES

A. General: Provide lighting fixtures, of sizes, types and ratings indicated; complete with, but not limited to, housings, energy efficient lamps, lamp holders, reflectors, energy-efficient ballasts, starters, and wiring.

B. Wiring: Provide wiring within fixtures for connection to branch circuit wiring.

C. Exit Fixtures - Battery Powered: Provide surface, wall, or ceiling mounted fixtures as indicated. Select fixture with standard exterior finish and red lamps (6 -inch), with capability for adjusting exit arrows as indicated. Provide LED type lamps for normal and emergency operation, dual voltage (120/277 V.), Universal mounting, universal arrows. Furnish battery powered unit with automatic charging, complete with nickel-cadmium battery which automatically connects low voltage lamp to battery power upon loss, and disconnect upon restoration of normal AC supply.

D. Unitized Battery Powered Fixtures:

1. General: Various fixture types are indicated below. Fixtures must comply with minimum requirements as stated herein.
2. Emergency Units: Provide battery powered, dual voltage (120/277 V.), self-contained units and solid-state, UL listed, fully automatic charger and transfer/brownout circuit and low-voltage battery disconnect; full 3-year warranty plus 15-year prorated warranty.

    a. Provide enclosure constructed in accordance with NEMA 1 standards, high impact thermoplastic.

b. Supply maintenance-free lead-calcium battery for 6 volt operation capable of supply connected load for minimum period of 90 minutes to end voltage or 87-1/2% of nominal battery voltage.
c. Provide unit-mounted and/or remote-mounted head as indicated on the Drawings, rated 6 volt, 5.4 watts tungsten lamps.

3. Accessories: Provide following accessories mounted on unit cabinet:

a. Unit test switch.
b. AC "ON" pilot light.
c. Battery life expectancy alarm.
d. Heavy-duty wall mounting bracket.

1.7 INSTALLATION OF EMERGENCY LIGHTING FIXTURES

A. Install emergency lighting fixtures at locations and heights as indicated, in accordance with fixture manufacturer's written instructions, applicable requirements of NEC, NECA's "Standard of Installation," NEMA standards, and with recognized industry practices to ensure that lighting fixtures fulfill requirements.

B. Coordinate with other electrical work as appropriate to properly interface installation of emergency lighting fixtures with other work.

1.8 ADJUSTING AND CLEANING

A. Clean emergency lighting fixtures of dirt and debris upon completion of installation.

B. Protect installed fixtures from damage during remainder of construction period.

1.9 GROUNDING

A. Provide equipment grounding connections for emergency lighting fixtures as indicated.

B. Tighten connections to comply with tightening torques specified in UL Std 486A to assure permanent and effective grounds.

C. Upon completion of installation work, properly ground emergency lighting and demonstrate compliance with requirements of Division 16 Section 16060 – GROUNDING AND BONDING.

1.10 FIELD QUALITY CONTROL

A. Upon completion of installation of emergency lighting fixtures, and after building circuitry has been energized with normal power source, apply electrical energy to demonstrate capability and compliance with requirements.

B. Test emergency lighting to demonstrate operation under emergency conditions.

C. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.

END OF SECTION 16535

SECTION 16721

FIRE DETECTION, ALARM AND RADIO TYPE REPORTING SYSTEM

1.1 GENERAL

A. Dormitory 3602 currently has a Simplex 4002 Fire Alarm Control Panel with a BT2-3 Monaco Transceiver. Because Dormitory 3602 will be sprinkled, all smoke and heat detectors from the first and second floors are to be removed with the exception of the smoke detector in electrical room 116 on the first floor which will remain.

B. The third floor will be totally renovated and will require new initiating devices and alarm indicating devices.

C. The new additions to the first and second floors will require new initiating devices and alarm indicating devices.

D. Connections will be needed for tamper switches, flow switches, and post indicating valve.

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only. All publications shall be referred to in their latest edition, including any revisions thereof.

1. American National Standards Institute(ANSI)

ANSI C62.41	Recommended Practice for Surge Voltage in Low-Voltage AC Power Circuits

2. National Fire Protection Association (NFPA)

NFPA 70	National Electrical Code
NFPA 72	National Fire Alarm Code
NFPA 78	Lightning Protection Code
NFPA 90A	Installation of Air Conditioning and Ventilation Systems

3. Underwriters Laboratories, Inc. (UL)

UL Directory	Fire Protection Equipment Directory
UL 06	Rigid Metal Conduit

UL 38	Manually Actuated Signaling Boxes for Use with Fire-Protective Signaling Systems
UL 268	Smoke Detectors for Fire Protective Signaling Systems
UL 268A	Smoke Detectors for Duct Application
UL 464	Audible Signal Appliances
UL 521	Heat Detectors for Fire Protective Signaling Systems
UL 797	Electrical Metallic Tubing
UL 864	Control Units for Fire Protective Signaling Systems

1.3 GENERAL REQUIREMENTS

A. Products: The Contractor shall provide additional initiating devices and alarm indicating appliances to an existing low voltage, automatic integrated transceiver/fire alarm control panel as manufactured by Simplex with Monaco BT2-3 transceiver.

B. Any additional modules required are to be purchased and installed by certified personnel.

C. Verification of Dimensions: The contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer or authorized representative of any discrepancy before performing the work.

D. Compliance: The fire detection and internal alarm system shall be configured in accordance with NFPA 72. The equipment furnished shall be compatible and be UL listed or FM approved or approved or listed by a nationally recognized testing laboratory in accordance with the applicable NFPA standards.

E. Manufacturer's Services: Services of a manufacturer's representative who is certified in the installation, maintenance, adjustment, operation and repair, of the equipment specified shall be provided. The representative shall supervise the installation, adjustment, programming, testing and certification of the equipment.

F. Delivery and Storage: All equipment delivered and placed in storage shall be protected from the weather, humidity and temperature variations, dirt, dust, and other contaminates.

G. Programming: Contractor is required to fully program the transceiver and the D-500 to communicate by zone and remote test.

1.4 SYSTEM DESIGN

A. Operation: Existing system is a Simplex 4002 fire alarm system and additional device shall be incorporated to maintain system integrity. The system is activated into the alarm mode by actuation of any alarm initiating device. The system shall remain in the alarm mode until any initiating device is reset and the fire alarm control panel is manually reset and restored to normal. Electrical supervision shall be Style D in accordance with NFPA 72. All circuits shall be capable of operating under a single ground or open condition, as specified in NFPA 72. All textual, audible and visual devices and systems shall comply with NFPA 72.

B. Operational Features. The existing system shall be modified to accommodate additional pull stations and alarm indicating devices as shown on drawing:

1. Class A (Style D) alarm initiating (zone) circuits for connection of detection devices.
2. Auxiliary zone circuits for connection of non-powered alarm initiating devices such as tamper switches or manual pull stations.
3. Class A (Style D) indicating (bell) circuits for connection of audible and visual alarm evacuation signaling devices; each circuit may be programmed as silenceable or nonsilenceable. When Class A is selected, two circuits are provided; one circuit operates for common alarms and one circuit is programmable for specific zone alarms or for common alarm operation.
4. Zone programming capability which allows entry of a zone identification number, thirteen character description and type. Each zone is programmed for standard, supervisory, verification, positive alarm sequence, or water-flow warm operation; the auxiliary zones may also be programmed for tamper or for publicly accessible manual pull station.
5. An alarm condition on a circuit shall automatically deactivate the air handling units throughout the building.
6. Zones for alarm initiating circuits shall be arranged as indicated on the contract drawings.
7. Alarm functions. An alarm condition on a circuit shall automatically initiate the following functions:
   a. Transmission of a signal (by zone and general alarm/general trouble) over the station fire reporting system.
   b. Visual indication of the alarmed zone on the fire alarm control panel annunciator.
   c. Continuous sounding of alarm indicating devices throughout the building.
   d. Operation of the smoke control system.
   e. Deactivation of the air handling, exhaust fans units throughout the building.

1.5 SUBMITTALS

A. Installer Qualification. Installer must have five years experience in the installation of fire alarm systems and possess a minimum LEVEL II certificate from the NATIONAL INSTITUTE FOR CERTIFICATION IN ENGINEERING TECHNOLOGIES (NICET) in the sub-field FIRE PROTECTION ENGINEERING TECHNOLOGY (FIRE ALARM SYSTEMS). No fire alarm work is to be done with non-certified personnel (ie. electrican, helper, etc.).

B. Shop Drawings. Shop drawings shall be submitted and shall consist of a complete set of equipment and materials, including manufacturer's descriptive and technical literature; performance charts and curves; catalog cuts; and installation instructions. Detail drawings shall also contain complete wiring and schematic diagrams and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Drawings shall show proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearances for maintenance and operation.

C. Test Reports. Upon completion and testing of the installed system, test reports shall be submitted in booklet form showing all field tests performed to prove compliance with the specified performance criteria. Each test report shall indicate the final position of controls.

D. Operation and Maintenance Manuals.

1. The contractor shall furnish the Contracting Officer or authorized representative six complete copies of operating instructions outlining step-by-step procedures required for system start up, operation and shut down. The instructions shall include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and their basic operating features.
2. The contractor shall furnish the Contracting Officer or authorized representative six copies of maintenance instructions listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guide. The instructions shall include conduit layout, equipment layout and simplified wiring, and control diagrams of the system installed.

E. Spare Parts Data. After approval of the shop drawings the contractor shall furnish spare parts data for each different item of materials and equipment specified. The data shall include a complete list of parts and supplied, with current unit prices and source of supply, and a list of the parts recommended by the manufacturer to be replaced after 3 years of service.

F. As Built Drawings. PRIOR TO PERFORMANCE AND ACCEPTANCE TESTING, The contractor shall submit two legible copies of all fire alarm drawings showing the "as-built" system. The detail drawings of the fire detection system shall be signed by a Fire Protection Engineer. The drawings shall consist of a complete list of equipment and material, including manufacturer's descriptive and technical literature and catalog cuts. The drawings shall also contain complete wiring and schematic diagrams for the equipment furnished, equipment layout, and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. The detailed point-to-point wiring diagram showing all points of connection shall include connections between system devices, appliances, control panels, supervised devices, and all equipment that is activated by the control panel.

G. Certificates of Completion. PRIOR TO PERFORMANCE AND ACCEPTANCE TESTING, a Certificate of Completion per NFPA 72 shall be given to the Contracting Officer or authorized representative. "NOTE" The individual signing the certificate is warranting that the fire alarm system has been installed per NFP, NEC, UL and Air Force specifications and codes.

1.6 OVER VOLTAGE AND SURGE PROTECTION

A. Power Line Surge Protection. All equipment connected to alternating current circuits shall be protected from power line surges. Equipment shall meet requirements of ANSI C62.41. Surge protector shall be a Delta LA 301 or equal.

1.7 DELIVERY AND STORAGE

A. All equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variation, dirt and dust, any other contaminants.

1.8 MANUAL FIRE ALARM STATIONS:

A. Manual fire alarm stations shall conform to the applicable requirements of the UL 38. Manual stations shall be connected into alarm initiating circuits. Stations shall be single action type. Stations shall be finished in red, with raised letter operating instructions of contrasting color. Stations requiring the breaking of glass or plastic panels for operation are not acceptable. Stations employing glass rods are not acceptable. The use of a key or wrench shall be required to reset the station. Gravity or mercury switches are not acceptable. Switches and contacts shall be rated for the voltage and current upon which they shall operate. Stations shall have a separate screw terminal for each conductor. Where boxes must be surface mounted, boxes shall be painted the same color as the fire alarm manual stations. All manual pull stations located in the public areas shall have clear shield protective tamper cover placed over them.

1.9 NOTIFICATION APPLIANCES

A. Audible/visual appliances shall be heavy duty and conform to the applicable requirements of UL 464. Devices shall be connected into alarm indicating circuits. All devices shall have separate screw terminals for each conductor.

B. Visual notification appliances shall be factory assembled. Units shall be suitable for use in an electrically supervised circuit and shall have a visual indication by high intensity optic lens and flash tubes.

C. Combination Audible/Visual Notification Appliances. Combination audible/visual appliances shall be factory assembled. Units shall be suitable for use in an electrically supervised circuit and shall have a sound output rating of at least 85 dBA at 10 feet. Visual indication shall be accomplished by high intensity optic lens and flash tubes.

1.10 FIRE DETECTION AND ALARM SYSTEM PERIPHERAL EQUIPMENT

A. Conduit shall comply with UL 06 and UL 797.

B. Wiring. All wiring shall be copper. Wiring for strobe light circuits shall be No. 14 AWG minimum. Wiring for 120 v AC power shall be No. 12 AWG minimum. Wiring for power limited circuits shall be No. 16 AWG minimum/Power wiring and control wiring shall be isolated. Wiring to tamper switches, flow switches and PIV shall be No. 14 AWG

minimum. All wiring shall conform to NFPA 70. All conductors shall be color coded. Wiring code color shall remain uniform throughout the circuit. Pigtail or T-tap connections are unacceptable.

1.11 INSTALLATION

A. All work shall be installed as shown and in accordance with the manufacturer's diagrams and recommendations, unless otherwise specified.

B. Wiring. Wiring for systems shall be installed in 1/2 inch minimum diameter conduit; however the wiring for the fire alarm system shall not be installed in conduits, junction boxes with conductors of lighting and power systems. No more than one conductor shall be installed under any screw terminal. All circuits conductors entered or leaving any mounting box, outlet box enclosure or cabinet shall be connected to terminals with each terminal marked in accordance with the wiring diagram for identification. Connections shall be made with either crimp-on terminal spade lugs or with approved pressure type terminal blocks. The use of wire nut type connectors are prohibited in the system. All wiring within any control equipment shall be readily accessible without removing any component parts. The fire alarm equipment manufacturer's representative shall be present for the connection of wiring to the control panel.

C. Painting. All junction boxes shall be painted red.

D. Notification Appliances. Devices shall be mounted 6 feet 8 inches above the finished floor elevation, or 6 inches below finished ceiling, if limited by ceiling height.

E. Grounding. Grounding shall be provided to building ground.

F. Manual Pull Stations shall be installed at approximately 4 feet (center) above finished floor elevation unless otherwise indicated.

1.12 TESTING

A. The contractor shall notify the Contracting Officer or authorized representative 30 days before the performance and acceptance tests are to be conducted. The Contractor shall provide battery calculations for the fire alarm system to the Contracting Officer or authorized representative 30 days prior to the acceptance test. The test shall be performed in the presence of the Contracting Officer or authorized representative under the supervision of the fire alarm system manufacturer's qualified representative. The contractor shall furnish all instruments, equipment and personnel required for the tests.

B. Preliminary Tests. Upon completion of the installation, the system shall be subjected to functional and operational performance tests including tests of each installed initiating and notification appliance. Tests shall include the meggering of all system conductors to determine that the system is free from grounded, shorted and open circuits. The megger test shall be conducted prior to the installation of fire alarm equipment.

C. Acceptance Test. The testing shall be in accordance with NFPA 72 and shall verify that all previous deficiencies have been corrected. The test shall include the following:

1. Test of each function of the control panel.
2. Test of each circuit in both trouble and normal modes.
3. Test of alarm initiating devices in both normal and trouble conditions.
4. Test of each control circuit and device.
5. Test of each alarm notification appliance.
6. Test of the battery charger and batteries.
7. Complete operational test under emergency power supply.
8. Visual inspection of all wiring connections.
9. Opening the circuit at each alarm initiating and indicating device to test the wiring supervisory feature.
10. Test of the as-built drawings to insure that they are correct.

END OF SECTION 16721

SUBMITTAL CODES: A: 30 DAYS AFTER NTP B: DURING CONSTRUCTION

SCHEDULE OF MATERIAL SUBMITTALS

PROJECT NUMBER: VKAG 95-1131

PROJECT TITLE: REPAIR 3RD FLOOR BUILDING 3602

SOLICITATION/CONTRACT NUMBER:

TO BE COMPLETED BY PROJECT ENGINEER													TO BE COMPLETED BY CONTRACT ADMINISTRATOR								
		NUMBER OF COPIES REQUIRED																			
LINE NUMBER	ITEM OR DESCRIPTION OF ITEM, CONTRACT REFERENCE, TYPE OF SUBMITTAL	CERTIFICATION OF COMPLIANCE	SHOP DRAWINGS	SAMPLES	COLOR SELECTION	MANUFACTURER'S RECOMMENDATIONS	MANUFACTURER'S WARRANTY	CATALOG DATA	OPERATING INSTRUCTIONS	OTHER	SUBMITTAL CODE	REQUIRED SUBMISSION DATE	DATE RECEIVED IN CONTRACTING	DATE TO CIVIL ENGINEERING	RETURN SUSPENSE	SUBMITTAL NUMBERS	DATE CONTRACTOR NOTIFIED		CONTRACTOR RESUBMITTAL	FINAL APPROVAL	REMARKS
																	APPROVED	DISAPPROVED			
1	**02051 PARA 1.4.A** ASBESTOS REMOVAL, CLNUP…									3	A										
2	**02051 PARA 1.4.B** ASBESTOS REMOVAL, CLNUP…									3	B										
3	**02051 PARA 1.4.C** ASBESTOS REMOVAL, CLNUP…	3									A										
4	**02051 PARA 1.4.D** ASBESTOS REMOVAL, CLNUP…									3	B										
5	**02070 PARA 1.1.C.1** SELECTIVE DEMOLITION									3	A										
6	**02070 PARA 1.1.C.2** SELECTIVE DEMOLITION									3	A										
7	**02070 PARA 1.1.C.3** SELECTIVE DEMOLITION									3	A										
8	**02510 PARA 1.1, E.1** PIPE							3			A										
9	**02510 PARA 1.1, E.1** PIPE FITTINGS							3			A										
10	**02510 PARA 1.1, E.1** GATE VALVES							3			A										
11	**02510 PARA 1.1, E.1** TAPPING SLEEVE							3			A										
12	**02510 PARA 1.1, E.2** SITE PLAN		3								A										

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																	APPROVED	DISAPPROVED			
13	**02510 PARA 1.1, E.3** HYDROSTATIC TEST	3									B										
14	**02510 PARA 1.1, E.3** PURGING & DISINFECTION REPTS	3									B										
15	**02510 PARA 1.1, E.3** BELOW GROUND PIPING	3									B										
16	**02510 PARA 1.1, E.4** WARRANTY						3				B										
17	**02511 PARA 1.1.A** HOT-MIX ASPHALT PAVING							3			A										
18	**02511 PARA 1.1.A** HOT-MIX ASPHALT PAVING	3									A										
19	**02511 PARA 1.1.A.1** HOT-MIX ASPHALT PAVING									3	A										
20	**02920 PARA 1.1.A** LAWNS AND GRASSES							3			A										
21	**02920 PARA 1.1.A** LAWNS AND GRASSES									3	A										
22	**03300 PARA 1.2.A** CAST IN PLACE CONCRETE							3			A										
23	**03300 PARA 1.2.B** CAST IN PLACE CONCRETE									3	A										
24	**03300 PARA 1.2.C** CAST IN PLACE CONCRETE		3								A										

SUBMITTAL CODES: A: 30 DAYS AFTER NTP B: DURING CONSTRUCTION

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																	APPROVED	DISAPPROVED			
25	**03300 PARA 1.2.D** CAST IN PLACE CONCRETE	3									A										
26	**04810 PARA 1.1.A** UNIT MASONRY ASSEMBLIES							3			A										
27	**04810 PARA 1.1.A.1** UNIT MASONRY ASSEMBLIES			3							A										
28	**04810 PARA 1.1.A.2** UNIT MASONRY ASSEMBLIES	3									A										
29	**05120 PARA 1.2.A** STRUCTURAL STEEL							3			A										
30	**05120 PARA 1.2.B** STRUCTURAL STEEL		3								A										
31	**05120 PARA 1.2.C** STRUCTURAL STEEL	3									A										
32	**05521 PARA 1.3.A** PIPE AND TUBE RAILINGS		3								A										
33	**06105 PARA 1.1.A.** MISC. CARPENTRY							3			A										
34	**06105 PARA 1.1.A.** MISC. CARPENTRY	3									A										
35	**06402 PARA 1.1.B** INTERIOR ARCH. WOODWORK							3			A										
36	**06402 PARA 1.1.B.1.** INTERIOR ARCH. WOODWORK		3								A										

SUBMITTAL CODES: A: 30 DAYS AFTER NTP B: DURING CONSTRUCTION

SCHEDULE OF MATERIAL SUBMITTALS

PROJECT NUMBER: VKAG 95-1131

PROJECT TITLE: REPAIR 3RD FLOOR BUILDING 3602

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TO BE COMPLETED BY PROJECT ENGINEER												TO BE COMPLETED BY CONTRACT ADMINISTRATOR								
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LINE NUMBER	ITEM OR DESCRIPTION OF ITEM, CONTRACT REFERENCE, TYPE OF SUBMITTAL	CERTIFICATION OF COMPLIANCE	SHOP DRAWINGS	SAMPLES	COLOR SELECTION	MANUFACTURER'S RECOMMENDATIONS	MANUFACTURER'S WARRANTY	CATALOG DATA	OPERATING INSTRUCTIONS	OTHER	SUBMITTAL CODE	REQUIRED SUBMISSION DATE	DATE RECEIVED IN CONTRACTING	DATE TO CIVIL ENGINEERING	RETURN SUSPENSE	SUBMITTAL NUMBERS	DATE CONTRACTOR NOTIFIED		CONTRACTOR RESUBMITTAL	FINAL APPROVAL	REMARKS
																	APPROVED	DISAPPROVED			
37	**06402 PARA 1.1.B.2.** INTERIOR ARCH. WOODWORK			3							A										
38	**07210 PARA 1.2.A** BUILDING INSULATION							3			A										
39	**07610 PARA 1.3.A** STANDING SEAM MTL ROOFING							3			A										
40	**07610 PARA 1.3.B** STANDING SEAM MTL ROOFING		3								A										
41	**07610 PARA 1.3.C.1** STANDING SEAM MTL ROOFING			3							A										
42	**07610 PARA 1.3.C.2** STANDING SEAM MTL ROOFING			3							A										
43	**07841 PARA 1.1.B** THRU-PENET. FIRE STOP SYS							3			A										
44	**07841 PARA 1.1.B.1.** THRU-PENET. FIRE STOP SYS		3								A										
45	**07841 PARA 1.1.B.2.** THRU-PENET. FIRE STOP SYS	3									A										
46	**07841 PARA 1.1.B.3.** THRU-PENET. FIRE STOP SYS									3	A										
47	**07920 PARA 1.1.B.** JOINT SEALANTS							3			A										
48	**07920 PARA 1.1.B.1.** JOINT SEALANTS			3							A										

SUBMITTAL CODES: A: 30 DAYS AFTER NTP B: DURING CONSTRUCTION

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PROJECT TITLE: REPAIR 3RD FLOOR BUILDING 3602

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																	APPROVED	DISAPPROVED			
49	**07920 PARA 1.1.B.2.** JOINT SEALANTS	3									A										
50	**08110 PARA 1.1.A.1.** STEEL DOORS AND FRAMES							3			A										
51	**08110 PARA 1.1.A.1.** STEEL DOORS AND FRAMES		3								A										
52	**08110 PARA 1.1.A.2.** STEEL DOORS AND FRAMES									3	A										
53	**08211 PARA 1.1.A.1.** FLUSH WOOD DOORS							3			A										
54	**08211 PARA 1.1.A.2.** FLUSH WOOD DOORS		3								A										
55	**08410 PARA 1.1.L** ALUMINUM ENTRANCES AND STORE FRONTS							3			A										
56	**08410 PARA 1.1.L.1.** ALUMINUM ENTRANCES AND STORE FRONTS		3								A										
57	**08410 PARA 1.1.L.1.a.** ALUMINUM ENTRANCES AND STORE FRONTS									3	A										
58	**08410 PARA 1.1.L.2.** ALUMINUM ENTRANCES AND STORE FRONTS			3							A										
59	**08410 PARA 1.1.L.3.** ALUMINUM ENTRANCES AND STORE FRONTS	3									A										
60	**08520 PARA 1.1.D.1** ALUMINUM WINDOWS							3			A										

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																	APPROVED	DISAPPROVED			
61	**08520 PARA 1.1.D.2** ALUMINUM WINDOWS		3								A										
62	**08711 PARA 1.1.A.** DOOR HARDWARE							3			A										
63	**08711 PARA 1.1.A.1** DOOR HARDWARE									3	A										
64	**08711 PARA 1.2.B** DOOR HARDWARE									3	A										
65	**08711 PARA 1.2.C** DOOR HARDWARE			3							A										
66	**08800 PARA 1.1.B.** GLAZING							3			A										
67	**08800 PARA 1.1.B.1.** GLAZING	3									A										
68	**09260 PARA 1.1.A.** GYPSUM BOARD ASSEMBLIES							3			A										
69	**09511 PARA 1.1.A** ACOUSTICAL PANEL CEILINGS							3			A										
70	**09511 PARA 1.1.A.1.** ACOUSTICAL PANEL CEILINGS			3							A										
71	**09511 PARA 1.1.A.2.** ACOUSTICAL PANEL CEILINGS			3							A										
72	**09651 PARA 1.1.A.1.** RESILIENT TILE FLOORING							3			A										

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73	**09651 PARA 1.1.A.2.** RESILIENT TILE FLOORING			3							A										
74	**09651 PARA 1.1.A.3.** RESILIENT TILE FLOORING					3					A										
75	**09653 PARA 1.2.A.** RESILIENT WALL BASE AND ACCESSORIES							3			A										
76	**09653 PARA 1.2.B.** RESILIENT WALL BASE AND ACCESSORIES			3							A										
77	**09680 PARA 1.2A** CARPET							3			A										
78	**09680 PARA 1.2B** CARPET		3								A										
79	**09680 PARA 1.2C** CARPET			3							A										
80	**09680 PARA 1.2D** CARPET									3	A										
81	**09680 PARA 1.2E** CARPET					3					A										
82	**09900 PARA 1.1.D.1.** PAINTING									3	A										
83	**09900 PARA 1.1.D.2.** PAINTING							3			A										
84	**10155 PARA 1.1.A.1.** TOILET COMPARTMENTS							3			A										

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85	**10155 PARA 1.1.A.2.** TOILET COMPARTMENTS		3								A										
86	**10155 PARA 1.1.A.3.** TOILET COMPARTMENTS			3							A										
87	**10200 PARA 1.3.A** LOUVERS AND VENTS							3			A										
88	**10425 PARA 1.2.A.** SIGNS							3			A										
89	**10425 PARA 1.2.B.** SIGNS		3								A										
90	**10425 PARA 1.2.C.** SIGNS			3							A										
91	**10520 PARA 1.3.A.1** FIRE-PROTECTION SPECIALTIES							3			A										
92	**10520 PARA 1.3.A.2** FIRE-PROTECTION SPECIALTIES							3			A										
93	**10801 PARA 1.1.A.** TOILET AND BATH ACCESS.							3			A										
94	**13916 PARA 1.1, D.1** PIPE							3			A										
95	**13916 PARA 1.1, D.1** PIPE FITTINGS							3			A										
96	**13916 PARA 1.1, D.1** PIPE COUPLINGS							3			A										

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97	**13916 PARA 1.1, D.1** SPRINKLER HEADS, ESCUTCHEONS, & GUARDS							3			A										
98	**13916 PARA 1.1, D.1** GATE VALVES							3			A										
99	**13916 PARA 1.1, D.1** FLOW SWITCH							3			A										
100	**13916 PARA 1.1, D.1** CHECK VALVES							3			A										
101	**13916 PARA 1.1.D.1** HANGERS & UPPER ATTCHMTS							3			A										
102	**13916 PARA 1.1, D.1** ALARM CHECK VALVE							3			A										
103	**13916 PARA 1.1, D.1** BACKFLOW PREVENTER							3			A										
104	**13916 PARA 1.1, D.1** FIRE DEPT CONNECTION							3			A										
105	**13916 PARA 1.1, D.1** POST INDICATOR							3			A										
106	**13916 PARA 1.1, D.1** TAMPER SWITCH							3			A										
107	**13916 PARA 1.1, D.2** PIPE						3				A										
108	**13916 PARA 1.1, D.2** PIPE FITTINGS						3				A										

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																	APPROVED	DISAPPROVED			
109	**13916 PARA 1.1, D.2** PIPE COUPLINGS						3				A										
110	**13916 PARA 1.1, D.2** SPRINKLER HEADS, ESCUTCHEONS, & GUARDS						3				A										
111	**13916 PARA 1.1, D.3** WET SYSTEM		3								A										
112	**13916 PARA 1.1, D.4** HYDROSTATIC TEST	3									B										
113	**13916 PARA 1.1, D.4** ABOVE GROUND PIPING	3									B										
114	**13916 PARA 1.1.D.5** SPRINKLER HEADS, ESCUTCHEONS, & GUARDS			3							A										
115	**13916 PARA 1.1, D.6** FLOW SWITCH								3		A										
116	**13916 PARA 1.1, D.6** WATER MOTOR GONG								3		A										
117	**13916 PARA 1.1, D.6** ALARM CHECK VALVE								3		A										
118	**13916 PARA 1.1, D.6** BACKFLOW PREVENTER								3		A										
119	**13916 PARA 1.1, D.6** TAMPER SWITCH								3		A										
120	**13916 PARA 1.1, D.4** PURGING & DISINFECTING RPT	3									B										

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																	APPROVED	DISAPPROVED			
121	**14240 PARA 1.2 A** HYDRAULIC ELEVATORS							3			A										
122	**14240 PARA 1.2 G** HYDRAULIC ELEVATORS									3	A										
123	**14240 PARA 1.2 B** HYDRAULIC ELEVATORS		3								A										
124	**14240 PARA 1.2 C** HYDRAULIC ELEVATORS			3							A										
125	**14240 PARA 1.2 D** HYDRAULIC ELEVATORS					3					A										
126	**14240 PARA 1.2 E** HYDRAULIC ELEVATORS								3		A										
127	**14240 PARA 1.2 F** HYDRAULIC ELEVATORS	3									A										
128	**15060 PARA 1.3.A** HANGERS AND SUPPORTS							3			A										
129	**15060 PARA 1.3.B** HANGERS AND SUPPORTS	3									A										
130	**15075 PARA 1.3.A.** MECHANICAL IDENTIFICATION							3			A										
131	**15081 PARA 1.3.A.** DUCT INSULATION							3			A										
132	**15081 PARA 1.3.B.** DUCT INSULATION	3									A										

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133	**15083 PARA 1.3.A.** PIPE INSULATION							3			A										
134	**15083 PARA 1.3.B.** PIPE INSULATION	3									A										
135	**15110 PARA 1.2A** VALVES							3			A										
136	**15122 PARA 1.2A** METERS AND GAGES							3			A										
137	**15140 PARA 1.3.M.d** DOMESTIC WATER PIPING	3									B										
138	**15150 PARA 1.2.A** SANITARY WASTE AND VENT							3			A										
139	**15150 PARA 3.5.C** SANITARY WASTE AND VENT	3									B										
140	**15181 PARA 1.2.A** HYDRONIC PIPING							3			A										
141	**15181 PARA 1.2.B** HYDRONIC PIPING	3									A										
142	**15181 PARA 1.2.C** HYDRONIC PIPING								3		B										
143	**15185 PARA 1.2A** HYDRONIC PUMPS							3			A										
144	**15185 PARA 1.2B** HYDRONIC PUMPS		3								A										
145	**15185 PARA 1.2.B.1** HYDRONIC PUMPS		3								A										

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																	APPROVED	DISAPPROVED			
146	**15185 PARA 1.2.C** HYDRONIC PUMPS								3		B										
147	**15410 PARA 1.1.A.** PLUMBING FIXTURES							3			A										
148	**15430 PARA 1.2.A.** PLUMBING SPECIALTIES							3			A										
149	**15763 PARA 1.2.A** FAN COIL UNITS							3			A										
150	**15763 PARA 1.2.B** FAN COIL UNITS		3								A										
151	**15763 PARA 1.2.C** FAN COIL UNITS	3									A										
152	**15763 PARA 1.2.D** FAN COIL UNITS								3		A										
153	**15815 PARA 1.1.A.** METAL DUCTS							3			A										
154	**15820 PARA 1.1.A.** DUCT ACCESSORIES							3			A										
155	**15838 PARA 1.2.A.** POWER VENTILATORS							3			A										
156	**15838 PARA 1.2.B.** POWER VENTILATORS		3								A										
157	**15838 PARA 1.2.C.** POWER VENTILATORS							3			A										

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																	APPROVED	DISAPPROVED			
158	**15855 PARA 1.1.A.** DIFFUSERS, REGISTERS, GRILL							3			A										
159	**15900 PARA 1.2.A.** HVAC INSTR. & CONTROLS							3			A										
160	**15900 PARA 1.2.B.** HVAC INSTR. & CONTROLS		3								A										
161	**15900 PARA 1.2.C.** HVAC INSTR. & CONTROLS								3		B										
162	**15900 PARA 1.2.C.** HVAC INSTR. & CONTROLS	3									B										
163	**15900 PARA 1.2.D.** HVAC INSTR. & CONTROLS								3		B										
164	**15900 PARA 1.2.E.** HVAC INSTR. & CONTROLS	3									A										
165	**15940 PARA1.2A** SEQUENCE OF OPERATION		3								A										
166	**15990 PARA 1.3.A.** TESTING, ADJUSTING, BALANC.									3	A										
167	**15990 PARA 1.3.B.** TESTING, ADJUSTING, BALANC.	3									B										
168	**16060 PARA 1.3.A.** GROUNDING AND BONDING							3			A										
169	**16120 PARA 1.2.A.** CONDUCTORS AND CABLES							3			A										

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																	APPROVED	DISAPPROVED			
170	**16124 PARA 1.4.B** MED VOLT DIST POWER CABLES							3			A										
171	**16124 PARA 1.4.C** MED VOLT DIST POWER CABLES									3	A										
172	**16130 PARA 1.2.A.** RACEWAYS AND BOXES							3			A										
173	**16140 PARA 1.3.A.** WIRING DEVICES							3			A										
174	**16442 PARA 1.3.A** PANELBOARDS							3			A										
175	**16442 PARA 1.3.B** PANELBOARDS		3								A										
176	16515 PARA 1.2A INTERIOR LIGHTING FIXTURES							3			A										
177	**16525 PARA 1.2.A** INTERIOR LIGHTING FIXTURES							3			A										
178	**16525 PARA 1.3.A.** EXTERIOR LIGHTING FIXTURES							3			A										
179	**16535 PARA 1.2.A.** EMERGENCY LIGHTING							3			A										
180	**16721 PARA 1.5.A.** **FIRE DETECTION, ALARM** TYPE REPORTING SYS.									3	A										
181	**16721 PARA 1.5.B.** **FIRE DETECTION, ALARM** TYPE REPORTING SYS.		3								A										

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182	**16721 PARA 1.5.C.** **FIRE DETECTION, ALARM** TYPE REPORTING SYS.									3	A										
183	**16721 PARA 1.5.D.** **FIRE DETECTION, ALARM** TYPE REPORTING SYS.									3	A										
184	**16721 PARA 1.5.E.** **FIRE DETECTION, ALARM** TYPE REPORTING SYS.									3	A										
185	**16721 PARA 1.5.F.** **FIRE DETECTION, ALARM** TYPE REPORTING SYS.									3	A										
186	**16721 PARA 1.5.G.** **FIRE DETECTION, ALARM** TYPE REPORTING SYS.	3									B										

SEYMOUR JOHNSON
AIR FORCE BASE
NORTH CAROLINA

Specifications

FOR

DATE: 25 April, 2002

PROJECT NO: VKAG 97-1139

PROJECT TITLE: REPLACE POWER CHECK PAD

PROJECT ENGINEER: LT KEVIN GOLART

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SECTION 01000 -GENERAL

1. SCOPE OF WORK: The work covered by this specification consists of furnishing all plant, labor, equipment and material, and performing all work in connection with VKAG 97-1139 "Replace Power Check Pad" in strict accordance with these specifications and drawings and subject to the terms and conditions of this contract.

2. LOCATION: The work is to be accomplished at Seymour Johnson Air Force Base, Goldsboro, North Carolina. This base is accessible by both public highway and railway.

3. WORKWEEK: The contractor shall observe the same regular workweek being observed by the Seymour Johnson AFB Civil Engineering shop forces, which is 7:30 a.m. to 4:30 p.m., Monday through Friday, with Federal holidays excluded. Any deviation from this schedule will require 48 hours advance notice and approval of the Contracting Officer.

4. PRINCIPLE FEATURES: The work covered by this contract includes, but is not limited to the following:

4.1 Furnishing of all plant, labor, equipment and materials for the installation of a new blast deflector foundation, blast deflector, and associated landscaping.

4.2 Demolition of existing mechanical blast deflector foundation, mechanical blast deflector, and earth covered blast deflector.

4.3 The above description of work is for the purpose of general information only and is not intended to include and describe every feature or item of work or to define the scope of work.

5. HAUL ROUTES: The Contractor shall use the haul routes indicated on the plans.

6. DISPOSITION OF NONSALVABLE MATERIALS: All nonsalvable or unusable material shall be disposed of off base as directed by the Contracting Officer. All waste material generated by any work under this contract shall be handled, transported, stored, and disposed of off base, by the Contractor, in accordance with all applicable federal, state, or local laws, ordinances, regulations, court orders, or other types of rules or rulings having the effect of law.

7. DISPOSITION OF SALVAGEABLE MATERIALS: The Contractor shall be required to furnish an itemized listing of materials to be salvaged to the Base Civil Engineering material Control section, located in Bldg 3300, so that an AF Form 1348-1 can be obtained. After receiving this form, all salvable or reusable material will be delivered to the Defense reutilization and Marketing Office, which is located near Bldg 2620 or as directed by Contracting Officer.

8. SUBMITTALS REQUIRED: Required submittals are listed on AF Form 66.

9. BASE CIVIL ENGINEERING WORK CLEARANCE REQUEST, AF FORM 103: The Contractor shall obtain AF Form 103, Base Civil Engineering Work Clearance Request, prior to work commencement from the Contract Management Section in Bldg 3300, 1095 Peterson Avenue. Upon receipt of an AF Form 103, the Contractor shall be responsible for locating all base owned underground utilities, as well as, coordinating local utility companies to stake out utilities if not owned by the base. Historical drawings, as-built drawings, and topographic

drawings are available for review at the 4th Civil Engineer Squadron, Design element located in Building 3300. Base owned utilities include but are not limited to electric, water, sewer, steam, communication, telephone, fiber optic, cathodic protection, and fuel lines. Utilities not owned by the base include but are not limited to cable TV, Southern Bell Telephone, and Natural Gas. The Contractor shall contact ULOCO and the non-base utility companies for location services. In the event that the Contractor damages a utility which is commented in the plans, record drawings, or located by a utility locator, the Contractor shall repair/replace the utility at no additional cost to the Government. Utilities not documented, shown, or located by a locator shall be considered abandoned or unknown. Contractor damage to unknown or abandoned utilities shall be dealt with as a differing site condition.

10. MATERIALS CONTAINING ASBESTOS: In the event the Contractor discovers materials suspected of containing asbestos that is not identified to be removed in the plans and specifications, the Contractor shall notify the Contracting Officer. The Contractor's work shall proceed unless the materials suspected of containing asbestos are damaged or disturbed. Any suspected materials damaged or disturbed by the Contractor without permission from the Contracting Officer shall be removed by the Contractor at his expense IAW all applicable Federal, State, and local laws, ordinances, regulations, court orders, or other types of rules or rulings having the effect of law.

11. LABELING OF STORAGE DRUMS: All 55 gallon or larger drums brought on base for use under this contract and containing new material or used for storage of waste materials or hazardous waste must be labeled with a Department of Transportation (DOT) Proper Shipping Name, DOT Hazardous Identification Number, the Contractor's name, a Contractor representative, and the Contractor's telephone number. Label lettering should have a minimum height of one half inch painted in white paint or other color that is in contrast with the color of the drum. The label should be sufficiently durable to equal or exceed the life (including storage and disposal) of the drum.

12. CONTRACTOR STORAGE TRAILER(S) AND BUILDING(S): The Contractor shall place or paint a sign on all of his storage trailer(s) and building(s) used on this contract. At a minimum, the sign shall contain the name of the Contractor and a telephone number at which the Contractor can be reached. The trailer(s) and building(s) shall be complete with gates and/or doors which can be locked. Only material for this project shall be stored in the trailer(s) or building(s). The Contractor shall remove the storage trailer(s) or building(s) within 30 days after completion of the contract and prior to submitting his final invoice. The area around the storage trailer(s) and building(s) shall be kept clean. This includes the mowing of grass during the growing season. The lawn mower shall be supplied by the Contractor.

12.1 The Contractor will be given a lot in the Contractor Storage Area behind Bldg 2700 for the life of the contract. The Contractor's progress schedule shall include a line item (equal to 1%) for final cleanup of this storage lot. Final payment will not be made until this final cleanup is performed by the Contractor and accepted by Seymour Johnson AFB.

13. CONSTRAINTS:

13.1 Work is restricted to authorized personnel only. All contractor personnel shall register with Base Operations prior to on-site work. Registration includes obtaining a flightline drivers license for all personnel that will be driving on the runway or any taxiways. All contractor personnel shall have on their person a picture type ID card (Driver's License, etc.) at all times.

13.2 Contractor shall keep all equipment, tools and materials stored in a neat and orderly manner inside the contractor storage or staging area when not in use.

13.3 Contractor shall be tasked with continual clean-up of work area to ensure that no FOD (Foreign Object Debris) is allowed on the existing taxiways, runway, or airfield. Contractor shall be responsible for all site development work. All survey, grade stakes, layout verification of field conditions shall be the responsibility of the contractor. Grassy areas disturbed by the shall be re-seeded by the contractor.

13.4 Privately owned vehicles used by the contractor personnel to commute to work are required to park in the contractor's storage area. Tracking of mud, dirt, etc., on taxiways will not be tolerated.

13.5 TRUCK HAULING ON BASE: The contractor shall be responsible for covering open bodied vehicles transporting any materials likely to create air pollution or become debris while on base.

14. PHASING

A. Phase 1: The Contractor will be given 60 days for material submittal/delivery. No on site work shall be permitted during this phase.

B. Phase 2: The contractor shall complete all onsite work. All work to be completed within 90 days of the start of Phase 2.

15. AFFIRMATIVE PROCUREMENT

The contractor shall incorporate Affirmative Procurement requirements as per 40 CFR, Part 247 and Executive order 13101: "Greening the Government Through Waste Prevention, Recycling and Federal Acquisition." Designated items used in the execution of this contract shall meet or exceed the Environmental Protection Agency's (EPA) requirements for recycled content materials (RCM) as per the EPA's Comprehensive Procurement Guidelines (CPG). The contractor/engineer shall ensure affirmative procurement requirements for CPG items are met or provide written justification that: 1) the price of a given designated item is unreasonably high, 2) there is inadequate competition (not enough sources of supply), 3) unusual and unreasonable delays would result from obtaining the item, or 4) the item does not meet the Air Force's performance specifications. Individual specifications contained in this contract may or may not reference the permitted use of a recycled/recovered material. Recycled/recovered materials shall be used in the quantities set forth in the EPA's CPG whether specified or not. The following products are on the CGP list and the contractor must meet the minimum percentages: Concrete containing flyash.

END OF SECTION 01000

SECTION 01560 - ENVIRONMENTAL PROTECTION

1. **DEFINITIONS OF CONTAMINANTS:**

1.1 Sediment: Soil and other debris that has been eroded and transported by runoff water.

1.2 Solid Waste: Rubbish, debris, garbage, and other discarded solid materials resulting from industrial, commercial, and agricultural operations, and from community activities.

1.3 Rubbish: A variety of combustible and noncombustible wastes such as paper, boxes, glass, crockery, metal, lumber, cans, and bones.

1.4 Debris: Includes combustible and noncombustible wastes, such as ashes, waste materials that result from construction or maintenance and repair work, leaves, and tree trimmings.

1.5 Chemical Wastes: Includes salts, acids, alkalis, herbicides, pesticides, and organic chemicals.

1.6 Sewage: Wastes characterized as domestic sanitary sewage.

1.7 Garbage: Refuse and scraps resulting from preparation, cooking, dispensing, and consumption of food.

1.8 Oily Waste: Includes petroleum products and bituminous materials.

2. **ENVIRONMENTAL PROTECTION REQUIREMENTS:** Provide and maintain during the life of the contract, environmental protection as defined herein. Provide environmental protection measures as required to control pollution that develops during normal construction practice. Provide also environmental protective measures required to correct conditions that develop during the construction of permanent or temporary environmental features associated with the project. Comply with all federal, state, and local regulations pertaining to water, air, and noise pollution. Develop proposals for an environmental protection plan for the project and, prior to the commencement of the work, meet with the Contracting Officer and discuss the proposed environmental protection plan. The meeting shall develop mutual understanding relative to details of environmental protection, including measures for protecting natural resources, required reports, and measures to be taken should the Contractor fail to provide adequate protection in an adequate and timely manner. Perform a preconstruction survey of the project site and take photographs as necessary to enhance the survey.

3. **PROTECTION OF NATURAL RESOURCES:** The natural resources within the project boundaries and outside the limits of permanent work performed under this contract shall be preserved in their existing condition or restored to an equivalent or improved condition upon completion of the work.

3.1 Land Resources: Do not remove, cut, deface, injure, or destroy trees or shrubs without special permission from the Contracting Officer. Do not fasten or attach ropes, cables, or guys to

any existing nearby trees for anchorages unless specifically authorized. Where such special emergency use is authorized, the Contractor shall be responsible for any resultant damage.

3.1.1 Protection: Protect existing trees which are to remain and which may be injured, bruised, defaced, or other wise damaged by construction operations.

3.1.2 Repair or Restoration: Repair or restore to their original condition all trees or other landscape features scarred or damaged by the equipment or operations. Obtain approval of the repair or restoration from the Contracting Officer prior to its initiation.

3.1.3 Temporary Construction: Obliterate all signs of temporary construction facilities such as haul roads, work areas, structures, foundations of temporary structures, stockpiles of excess or waste materials, and all other vestiges of construction. Temporary roads, materials, and all other vestiges of construction. Temporary roads, parking areas, and similar temporary use areas shall be graded in conformance with surrounding areas, tilled, and hydro seeded. Include topsoil of nutriment during the seeding operation as necessary to reestablish a suitable stand of grass.

3.2 Water Resources: Perform all work in such a manner than any adverse environmental impact on water resources is reduced to a level acceptable to the Contracting Officer.

3.2.1 Oily Substances: Take special measures to prevent oily or other hazardous substances from entering the ground, drainage areas, or local bodies of water. Surround all temporary fuel oil, petroleum, or liquid chemical storage tanks with a temporary earth berm of sufficient size and strength to contain the contents of the tanks in the event of content leakage of spillage.

3.3 Fish and Wildlife Resources: During the performance of the work take such steps as required to prevent interference or disturbance to fish and wildlife. Do not alter water flows or otherwise significantly disturb native habitat adjacent to the project area which are critical to fish and wildlife except as may be indicated or specified.

4. **EROSION AND SEDIMENT CONTROL MEASURES:**

4.1 Burn-off: Burn-off of ground cover is not permitted.

4.2 Protection of Erodible Soils: All earthwork brought to final grade shall be immediately finished as indicated or specified. Protect immediate side slopes and backslopes upon completion of rough grading. Plan and conduct all earthwork in such a manner as to minimize the duration of exposure of unprotected soils.

4.3 Temporary Protection of Erodible Soils: Utilize the following method to prevent erosion and control sedimentation.

4.3.1 Mechanical Retardation and Control of Runoff. Mechanically retard and control the rate of runoff from the construction site. This includes construction of diversion ditches, benches, and berms, to retard and divert runoff to protected drainage courses.

5. **CONTROL AND DISPOSAL OF SOLID, CHEMICAL, AND SANITARY WASTES:** Pick up solid wastes and place in containers which are emptied by the contractor on a regular schedule. The preparation, cooking, and disposing of food are strictly prohibited on the project site. Conduct handling and disposal of wastes to prevent contamination of the site and other areas. On completion, leave areas clean and natural looking. Obliterate signs of temporary construction and activities incidental to construction of the permanent work in place.

5.1 Disposal of Rubbish and Debris: Dispose of rubbish and debris in accordance with the requirements specified herein.

5.1.1 Removal from Government Property: Remove rubbish and debris from Government property and dispose of it in compliance with federal, state, and local requirements.

5.1.2 Chemical Waste: Store chemical waste in corrosion resistant containers labeled to identify type of waste and date filled. Remove containers from the project site, and dispose of chemical waste in accordance with federal, state, and local regulations. For oil and hazardous material spills which may be large enough to violate federal, state, and local regulations, notify the Contracting Officer immediately.

5.1.2.1 Petroleum Products: Conduct fueling and lubricating of equipment and motor vehicles in a manner that affords the maximum protection against spills and evaporation. Dispose of lubricants to be discarded and excess oil in accordance with approved procedures meeting federal, state, and local regulations.

6. **DUST CONTROL:** Keep dust down at all times, including non-working hours, weekends, and holidays. Sprinkle or treat, with dust suppressors, the soil at the site, haul roads, and other areas disturbed by operations. Only wet cutting of concrete blocks, concrete, and asphalt is permitted. No unnecessary shaking of bags is permitted where bagged cement, concrete mortar and plaster is used.

7. **NOISE:** When available, make the maximum use of “low-noise-emission products” as certified by EPA. No blasting or use of explosives is permitted.

END OF SECTION 01560

SECTION 02050 - DEMOLITION

1. **AVAILABILITY OF WORK AREAS:** Areas in which salvage and demolition work are to be accomplished will be available upon receipt of the notice to proceed.

2. **GENERAL:**

2.1 Procedures. Before beginning any cutting or demolition work, the Contractor shall carefully survey the existing work and examine the drawings and specification to determine the extent of the work. The Contractor shall take all necessary precautions to ensure against damage to existing work to remain in place, to be reused, or to remain the property of the Government, and any damage to such work shall be repaired or replaced as approved by the Contracting Officer at no additional cost to the Government. The Contractor shall carefully coordinate the work of this section with all other work and construct and maintain shoring, bracing and supports, as required. The Contractor shall ensure that the structural elements are not overloaded and be responsible for increasing structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under any part of the contract.

2.2 Foundation removal: Removal shall be performed in a manner such that adjacent concrete or asphalt shall not be disturbed, including spalling edges, breaking joints, etc. If adjacent exiting pavement or new foundation is broken, spalled, or displaced by removal operations, the pavement shall be replaced or repaired to the satisfaction of the Contracting Officer or authorized representative at no expense to the government.

2.3 Use of explosives will not be permitted.

2.4 Dust Control. The amount of dust resulting from demolition shall be controlled to prevent dust from spreading and creating a nuisance in the surrounding area.

3. **DISPOSITION OF MATERIAL:**

3.1 Unsalvable Materials. Any unsalvable materials that is removed shall be disposed of off base.

3.2 Debris and Rubbish. Remove debris and rubbish from the base daily. Do not allow accumulation on site.

3.3 Debris Control. Remove and transport debris in a manner as to prevent spillage on streets or adjacent areas.

3.4 Burning at the project site will not be permitted.

END OF SECTION 02050

SECTION 02100 - SITE CLEARING

1. PREPARATION:

   A. Protection: Execute work to ensure protection of adjacent buildings and property against damage. Do not interfere with use of utilities or adjacent buildings or property and maintain free, safe passage to and from same. Protect trees, plant life, other natural topographic features of site that are to remain or those of adjacent property. Repair or replace property damaged or destroyed as a result of this operation.

   B. Utilities:
      1. Protect existing active utilities when encountered and record locations accurately on Record Drawings.

      2. Report utilities discovered not shown on Drawings.

      3. Do not disturb existing utility services which are to remain.

2. CLEARING:

   A. Clear from construction area site vegetation, boulders, loose soil, debris, and other material which will interfere with normal construction operation. Remove waste from property.

   B. Promptly remove from property, debris resulting from demolition and clearing unless otherwise directed.

   C. Do not burn combustible debris on site. Leave premises clean, neat, and orderly.

3. CLEANING:

   A. During the course of the work and on completion of the work, remove excess materials, equipment and debris and dispose of off the Base. Do not allow to accumulate. Control vegetation such as grass and weeds. Leave work in clean condition.

END OF SECTION 02110

SECTION 02222 - EARTHWORK

1.0 **GENERAL**

1.1 **Description**

1.1.1 Furnish all labor, materials, tools, equipment, and services for all earthwork, as indicated, in accord with provisions of Contract Documents. Completely coordinate with work of all other trades.

1.1.2 Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.

1.1.3. See Division 1 for General Requirements.

1.2 QUALITY ASSURANCE

1.2.1 Perform all work in accordance with requirements of local and state codes, with requirements of OSHA, and in accord with federal requirements.

1.2.2 Reference Standards:

ASTM D 698-00a	Test for Laboratory Compaction Characteristics of Soil Using Standard Effort
ASTM D 1557-00	Tests for Moisture Density Relations of Soils and Soil Aggregate Mixtures Using a 10 LB Rammer and a 18 IN Drop
ASTM D 4253-00	Test Methods for Maximum Index Density of Soils Using a Vibratory Table
ASTM D 4254-00	Test Methods for Minimum Index Density of Soils and Calculation of Relative Density
ASTM D 2487-00	Classification of Soils for Contracting Officering Purposes

1.2.3. Topsoiling and Finished Grading. Comply with requirements of Section 02260.

2.0 **PRODUCTS**

2.1 **Soils**

2.1.1 General: Use soils free of organic matter, refuse, rocks and lumps greater than 4 inches in diameter and other deleterious matter. Concrete rubble may be grater than 4” but smaller than 1

foot.

2.1.2 Classification: For the purpose of this specification, soils to be used as fill material are grouped into seven classes according to soil properties and characteristics.

2.1.2.1 Class I - Angular, 6 to 40-mm (1/4 to 1-1/2 in.), graded stone, including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone, crushed gravel, and crushed shells.

2.1.2.2 Class II - Coarse sands and gravels with maximum practical size of 44 mm (1-1/2 in.), including variously graded sands and gravels containing small percentages of fines, generally granular and non-cohesive, either wet or dry. Soil Types GW, GP, SW, and SP are included in this class.

2.1.2.3 Class III - Fine sand and clayey gravels, including fine sands, sand-clay mixtures, and gravel-clay mixtures. Soil Types GM, GC, SM, and SC are included in this class.

2.1.2.4 Class IV - Silt, silty clays, and clays, including inorganic clays and silts of medium to high plasticity and liquid limits. Soil Types MH, ML, CH, and CL are included in this class. These materials are not recommended for bedding, haunching, or initial backfill.

2.1.2.5 Class V - This class includes the organic soils, OL, OH, and PT as well as soils containing frozen earth, debris, rocks, larger than 40 mm (1-1/2 in.) in diameter, and other foreign materials. These materials are not recommended for bedding, haunching or initial backfill.

2.1.2 Topsoil: Natural, friable soil free of subsoil, stumps, rocks larger than 2 inches in diameter, weeds and other material detrimental to plant growth.

2.1.3 Fill Beneath Pavement and Foundations: Fill material used beneath pavement and for road shoulders shall be Class II or III.

2.1.4 General Fill: General fill material not otherwise specified shall be Class II or III.

2.1.5 Trench Backfill: Material used for bedding, haunching and initial backfill if required shall be as specified in Section 02221.

2.1.6 Fill and backfill: Selected material from site earthwork or from off site borrow.

3.0 **PROTECTION**

3.1 **Protection**

3.1.1 Protect existing surface and subsurface features on site and adjacent to site as follows:

3.1.2 Provide barricades, coverings, or other types of protection necessary to prevent damage to

existing items indicated to remain in place.

3.1.3 Protect and maintain bench marks, and monuments or other established reference points. If disturbed or destroyed, replace at own expense to full satisfaction of Contracting Officer.

3.1.4 Verify location and existence of utilities. Omission or inclusion of utility items does not constitute non-existence or definite location. Secure and examine local records for location data.

3.1.5 Take necessary precautions to protect existing utilities from damage due to any construction activity. Repair damages to utility items at own expense.

3.1.6 Provide full access to premises, fire hydrants, street crossings, sidewalks and other points as designated by Contracting Officer to prevent serious interruption of travel.

3.1.7 Maintain stockpiles and earthworks in such a manner to prevent inconvenience or damage to structures on site or adjoining land.

3.1.8 Avoid surcharge or earthwork procedures which can result in heaving, caving or slides.

3.1.9 Salvageable items: Carefully remove items to be salvaged, and store as directed by Contracting Officer.

3.1.10 Legally dispose of waste materials off site as directed in Division 1. Burning, as a means of waste disposal, is not permitted.

3.2 **Site Earthwork and Grading**

3.2.1 The work includes all operations in connection with earthwork, borrow, construction of fills and embankments, rough grading, and disposal of excess materials in connection with the preparation of the site(s).

3.2.2 Perform earthwork and grading as required by the drawings.

3.2.2.1 Drawings may indicate both existing grade and finished grade required for construction of project. Stake out all structures, piping, and establish their elevations. Perform other layout work required.

3.2.2.2 Protection of existing facilities: Maintain existing utility lines (either overhead or underground), sidewalks, structures, pavement indicated on drawings, or mentioned in specifications, free of damage. Any item known or unknown or not properly location that is inadvertently damaged shall be repaired to original condition. Notify Contracting Officer of any utility damage at once so that emergency measures may be taken. All repairs to be made and paid for by Contractor.

3.2.2.3 Preparation of ground surface for embankments or fills: all topsoil, debris, and organic material, unsuitable existing fill soils, and soft or loose unsuitable natural soils should be

excavated from the area and stockpiled for future fill. Areas that reveal excessive pumping or in the opinion of the Contracting Officer or Authorized Representative should be excavated and replaced with additional compacted structural/embankment fill.

3.2.2.4. Protection of finish grade: During construction, shape and drain embankment and earthworks. Maintain ditches and drains to provide drainage at all times. Protect graded areas against action of elements prior to acceptance of work. Reestablish grade where settlement or erosion occurs.

3.2.3 Borrow: Provide necessary amount of approved fill compacted to density equal to that indicated in this specification. Include cost of all borrow material in original proposal. Fill material to be approved by Contracting Officer or Authorized Representative prior to placement.

3.2.4 Construct embankments and fills as required by the drawings:

3.2.4.1. Construct embankments and fills at locations and to lines of grade indicated. Completed fill shall correspond to shape of typical cross section or contour indicated regardless of method used to show shape, size, and extent of line and grade of completed work.

3.2.4.2. Provide fill material which meets the requirements of Part 2.1 of this specification and is free from roots, organic matter, trash, frozen material, and stones having maximum dimension greater than 4 IN. Insure that stones larger than 4 inches, are not placed in upper 3 inches of fill or embankment. Do not place material in layers greater than 30 inch loose thickness for concrete rubble or 12 inch for soil. Place layers horizontally and compact each layer prior to placing additional fill.

3.2.4.3. Compact by sheepsfoot, pneumatic rollers, vibrators, or by other equipment as required to obtain specified density. Control moisture for each layer necessary to meet requirements of compaction.

3.3 **Compaction Testing and Control**

3.3.1 Moisture density requirements for all materials that are to be compacted to be as approved by Contracting Officer.

3.3.2 Extent of compaction testing will be as necessary to assure compliance with specifications.

3.3.3 Give adequate notice to Contracting Officer when ready for compaction or subgrade testing and inspection. Minimum of 24 hour advance notice to be given.

3.3.4 Should any moisture density test fail to meet specification requirements, perform corrective work as necessary.

3.3.5 Contractor shall pay for all costs associated with corrective work and retesting resulting from failing tests at no additional cost to the government.

3.4 **Compaction Density Requirements**

3.4.1 Perform compaction of soils and all work associated with that effort with equipment designed for and suitable to provide the compaction requirements.

3.4.2 Obtain approval of Contracting Officer or designated representative with regard to suitability of soils and acceptable subgrade prior to subsequent operations.

3.4.3 Provide dewatering system necessary to successfully complete compaction and construction requirements.

3.4.4 Remove frozen loose, wet or soft material and replace with suitable material as required by Contracting Officer.

3.4.5 Stabilize subgrade with well graded granular materials as required by Contracting Officer.

3.4.6 Assure by results of testing that compaction densities comply with the following requirements:

3.4.6.1 Sitework:		
	Location	Compaction Density
	Under Paved Areas	95% ASTM D698
	Sidewalks and Piping	100 % ASTM D698, for last lift
	Unpaved Areas	85% ASTM D698
3.4.6.2 Specific areas:		
	Location	Compaction Density
	Under Foundations,	95% ASTM D698
	Equipment support pads	95% ASTM D698
	Slabs on Grade	95% ASTM D698

3.5 **Special Requirements**

3.5.1 Erosion control: Conduct work to minimize erosion of site. Construct stilling areas to settle and detain eroded material. Remove eroded material washed off site. Clean site, taxiways, streets, etc daily of any spillage of dirt, rocks or debris from equipment entering or leaving site.

END OF SECTION 02222

SECTION 02445 - BLAST DEFLECTORS

PART 1 GENERAL

1.01 DESCRIPTION

A. General:

1. Furnish all plant, labor, materials, tools, equipment, and services for installation of a 12' nominal height blast deflector, as indicated, in accordance with provisions of Contract Documents.

2. Completely coordinate with work of all other trades.

3. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.

4. See Division 1 for General Requirements.

5. See Section 03300 "Cast-In-Place Concrete".

1.02 QUALITY ASSURANCE

A. Perform all work in accordance with requirements of local and state codes, with requirements of OSHA, and in accord with federal requirements.

B. The Contractor will submit shop drawings to the Contracting Officer for approval. The Contractor will be held responsible for all errors in fabrication, and for the structural integrity of the blast deflector.

PART 2 PRODUCTS

2.01 BLAST DEFLECTOR

A. The blast deflector shall be Lynnco Type GS12-2 as manufactured by Blast Deflectors, Inc., or approved equal. The deflector shall be of the curved, non-perforated, galvanized, corrugated type, with corrugations running in a horizontal direction.

B. Deflector shall be capable of deflecting entire blast envelope upwards at a minimum angle of 60 degrees under no wind conditions. Deflector shall be designed for full afterburner run-up with GE-F100-PW-220 and similar engines, at minimum distance of 70 feet from leading edge of deflector.

C. Structural frames, which support the deflecting surface, will be of structural shapes, rolled, punched and prefabricated for bolting together at site. Deflecting surface will be of galvanized corrugated steel with minimum of 2 oz. Zinc coating per Fed. Spec. WW-P-00405. Sheets shall have a section modulus of not less than .0163 inches cubed per inch and shall be of corrosion resistant steel with yield point in 50,000-psi range.

D. All bolts subject to blast temperatures will be of SAE 1038 steel, heat-treated. All nuts, except on anchor bolts, will be of the all-steel, self-locking type.

E. Anchorage for the blast deflector shall be as recommended by the manufacturer and shall be installed under the supervision of deflector manufacturer, who shall be responsible for guaranteeing the integrity of the anchorage system.

F. The foundation for the blast deflector shall be installed in accordance with manufacturer recommendations and approved submitted shop drawings.

PART 3 EXECUTION

3.00 ASSEMBLY

A. All components will be assembled by bolting together with flat washers, under bolt heads, and half oval washers between nuts and corrugated sheets. Welding, brazing or burning of holes is not permitted. Al nuts and bolts will be tightened to torques specified by the manufacturer.

B. All bolts, nuts and washers will be cadmium or zinc plated. All structural members, parts, and corrugated metal will be hot dip galvanized with a minimum coating of 2.0 oz. Zinc per square foot of surface. Painting of galvanized surfaces is not required, but any galvanized surface badly scratched or marred, will be regalvanized or otherwise repaired to the satisfaction of the Contracting Officer.

C. Blast deflector shall be grounded in accordance with local and federal standards.

END OF SECTION 02445

SECTION 02260 - TOPSOILING AND FINISHED GRADING

1. **DESCRIPTION:**

1.1 Furnish all labor, materials, tools, equipment, and services for all topsoiling and finished grading, as indicated, in accord with provisions of Contract Documents.

1.2 Completely coordinate with work of all other trades.

1.3 Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.

1.4 See Division 1 for General Requirements.

2. **RELATED WORK:**

Earthwork: Section 02222.

3. **LOCATION OF WORK:** All areas within limits of grading and all areas outside limits of grading which are disturbed in the course of the work.

4. **QUALITY ASSURANCE:**

4.1 Finish grading tolerance: 0.1 FT plus/minus from required elevations.

5. **JOB CONDITIONS:**

5.1 Verify amount of topsoil stockpiled and determine amount of additional topsoil, if necessary to complete work.

6. **MATERIALS:**

6.1 Topsoil: Original surface soil typical of the area, capable of supporting native plant growth. If amount of topsoil stockpiled is less than amount necessary for the work, furnish all additional topsoil required as specified in Section 02222, EARTHWORK.

7. **PREPARATION:** Correct, adjust and/or repair rough graded areas. Cut off mounds and ridges. Fill gullies and depressions. Perform other necessary repairs. Bring all sub-grades to specified contours, even and properly compacted. Loosen surface to depth of 2 inches, minimum. Remove all stones and debris over 2 inches any dimension.

8. **PLACING TOPSOIL:** Do not place topsoil when subgrade is either wet or frozen enough to cause clodding. Spread topsoil to compacted depth of 4 inches for all disturbed earth areas. Make finished surface free of stones, sticks, or other material 1 inches or more in any dimension.

Make finished surface smooth and true to required grades. Restore areas occupied by stockpiles to condition of rest of finished work.

9. **ACCEPTANCE:** Upon completion of topsoiling, obtain Contracting Officer's or Authorized Representative's acceptance of grade and surface.

END OF SECTION 02260

SECTION 02485 - TURF

1. Scope: This section covers the preparation of planting beds; furnishing, planting, and covering limestone, fertilizer and seeds; compacting seed beds; furnishing, placing and securing mulch: and protection and maintenance of all seeded grass areas.

2. GENERAL:

   A. Work to be Done: Work to include new seeding and mulch and repairs to disturbed areas resulting from site preparation. New seeding and disturbed areas shall be backfilled and grassed as hereinafter specified.

   B. All turf shall be guaranteed for one (1) year and all components of a contractor installed irrigation system shall be guaranteed for a period of one (1) year, following Contracting Officer acceptance of the project

3. MATERIALS:

   A. Backfill material shall be of equal quality to the surrounding topsoil.

   B. Seed shall be labeled in accordance with the U.S. Department of Agriculture Rules and Regulations under the Federal Seed Act in effect on the date of solicitation. Seed shall be furnished in sealed containers unless exception is granted in writing by the Contracting Officer. Seed that has become wet, moldy or otherwise damaged in transit or in storage will not be acceptable. The minimum percentage of weight of pure live seed in each lot of seed shall be as follows:

KIND OF SEED	MINIMUM PERCENTAGE OF PURE LIVE SEED	MAXIMUM PERCNETAGE OF WEED SEED
Bermuda (Hulled)	95	0.50
Bermuda (Unhulled)	95	0.50
Rye Grass	95	0.50

   C. Mulch composed of threshed straw or cereal grain, pine needles or wood fiber shall be free of objectionable weed seeds or other harmful material. Mulch shall be used by the Contractor as required to prevent erosion of seeded areas.

   D. Fertilizer shall be a 10-10-10 commercial mixed grade, uniform in composition, free flowing and suitable for application with approved equipment, delivered to the site in bags or other convenient containers, each fully labeled, conforming trademark, and warranty of the producer.

   E. Lime shall be ground limestone containing not less than 85 percent of total carbonates and shall be ground to such fineness that 100 percent will pass through a No. 10 sieve and at least 90 percent will pass through a 20 mesh sieve, and 50 percent will pass the No. 100 sieve. Coarser materials will be acceptable provided the specified rates of application are increased proportionately, on the basis of quantities passing the 100 mesh sieve where zero passage indicates doubling the application rate, but no additional payment will be made for the increased quantity.

F. Topsoil, Furnished: Furnish sufficient additional topsoil for backfill to maintain elevation shown on the drawings and all other areas disturbed by the Contractor. Topsoil depth shall be 4" when compacted for grassed areas. Topsoil furnished shall be naturally sandy loam, fertile and friable, and possessing characteristics of representative productive soils of the vicinity.

4. SEEDING:

A. Prior to seeding, any previously prepared seedbed areas compacted or damaged be interim rains, traffic, or other causes, shall be reworked to restore the ground condition previously specified. Seed shall be planted at the rate specified.

B. The Contractor shall accomplish seeding, and mulching by hydroseed application or broadcast methods. If hydroseed is used, seeding shall be performed at the rates appropriate for the site. Wood cellulose fiber mulch and tackifier/binder agents at the rates recommended by the manufacture of the specific fiber mulch used, shall be combined with water to provide a slurry. Hydraulic applications shall be performed in such a manner that the liquid carrier will uniformly distribute the material over the entire area to be seeded at rates not less than indicated herein. No final compaction shall be performed. The seeded area shall be watered after seeding and the soil shall be moistened to a depth of 2 to 4 inches.

C. Seeding shall proceed as quickly as possible following the establishment of finished contour elevations

D. Coordinate planting during normal planting seasons for each type of material required.

E. In the absence of hydroseeding equipment, seeding may be done by broadcast methods and mulched with hay or straw. Broadcast methods shall conform to the following procedure:

1. After the topsoil is placed and before it is raked to true lines and rolled, lime shall be spread evenly over the topsoil surface and thoroughly incorporated with the top 3 inches of topsoil by heavy raking. Lime shall be applied at the rate consistent with local county extension agent recommendations but no less than 2,000 pounds per acre.

2. Fertilizer shall be uniformly spread and immediately mixed with the upper 2 inches of topsoil at the rate consistent with local county agent recommendations but no less than 1,200 pounds per acre.

3. Immediately following this presentation, the seed shall be uniformly applied and lightly raked into the surface. Lightly roll the surface and water with fine spray.

4. All seeded areas shall be mulched with clean small-grain straw at a rate of 1-1/2 to 2 tons per acre. Asphalt emulsion shall be applied uniformly at a rate of 300 gallons per acre to tack the mulch, unless otherwise shown

on the plans. Mechanical tacking using a V-type wheel land packer, a scalloped disk land packer or other suitable equipment will be considered on a case-by-case basis as approved by the Contracting Officer.

5. The Contractor shall keep all seeded areas watered and in good condition, reseeding if and when necessary until a good, healthy uniform growth is established over the entire area seeded. The Contractor shall also maintain these areas throughout construction and during remedial cleanup operations, as specified.

6. On slopes, the Contractor shall provide against washouts by using an approved method. Any washout area shall be re-graded and reseeded at the Contractor's expense until a good stand of grass is established.

5. BACKFILLING AND PREPARTION OF SEED BED:

A. General: The areas to be treated and their respective requirements for seed, fertilizer, lime, and other treatment shall include all areas disturbed by the Contractor and those shown on the contract plans.

B. Soil Preparation: Those areas disturbed by the Contractor and those shown on the contract plans to be seeded shall be scarified a minimum depth of four inches. The existing grass, stones over 1 inch in size, sticks and rubbish, and excess soil shall be removed. No heavy objects except lawn rollers shall be moved over grass seeded areas after subgrade soil has been scarified. After existing soil has been prepared, spread additional topsoil necessary to bring the area to the finished grade required. The topsoil shall be spread evenly, smoothed, and lightly compacted. Areas where topsoil does not require removal, scarify as above, smooth, an remove sticks, stones, and rubbish.

7. SOWING SEED:

A. General: all seeding work shall be done between the specified planting dates using seed mixtures and rates of applications as listed below, except as otherwise directed in writing by the Contracting Officer. A satisfactory method of sowing shall be employed, making use of approved seeders, mechanical hand seeders, or other approved methods. Hand sowing will not be allowed. If during inspection, during seeding operations or after there is a show of green, there is an indication that strips wider than the space between the rows planted have been left unplanted, or that other areas have been skipped, the Contracting Officer may require the sowing of additional seed on these areas at no additional cost to the Government. The seed shall be sown at the following rate:

KIND OF SEED:		MINIMUM LBS/ACRE
Period 1 (April - September)		
Hulled Common Bermuda		65
Un-Hulled Common Bermuda		65
	TOTAL	130
Period 2 (October - March)		
Rye (Annual)		130
Un-Hulled Common Bermuda		130
	TOTAL	260

8. MAINTENANCE:

A. Maintenance: Turf shall be maintained, cut, and watered as necessary for 60 days following installation. When any portion of the surface becomes gullied or otherwise damaged after any part of the area has been placed, the affected portion shall be repaired to reestablish the condition and grade of the soil prior to placement and shall then be re-seeded as previously specified. A final inspection shall be held at the end of this sixty day period for acceptance of the work.

END OF SECTION

SECTION 03300 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes cast-in-place concrete, including reinforcement, concrete materials, mix design, placement procedures, and finishes.

B. See Division 2 Section "Earthwork" for drainage fill under slabs-on-grade.

1.2 SUBMITTALS

A. Product Data: For each manufactured material and product indicated.

B. Design Mixes: For each concrete mix indicated.

C. Shop Drawings: Include details of steel reinforcement placement including material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports.

D. Testing: Provide compressive strength tests as indicated in Section 3.6.

1.3 QUALITY ASSURANCE

A. Comply with ACI 301, "Specification for Structural Concrete," including the following, unless modified by the requirements of the Contract Documents.

1. General requirements, including submittals, quality assurance, acceptance of structure, and protection of in-place concrete.
2. Formwork and form accessories.
3. Steel reinforcement and supports.
4. Concrete mixtures.
5. Handling, placing, and constructing concrete.

C. Preinstallation Conference: Conduct conference at Project site.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Formwork: Furnish formwork and form accessories according to ACI 301.

B. Steel Reinforcement:

1. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

C. Concrete Materials:

1. Portland Cement: ASTM C 150, Type I.
2. Normal-Weight Aggregate: ASTM C 33, uniformly graded, not exceeding 1-1/2-inch (38-mm) nominal size.
4. Water: Complying with ASTM C 94.

D. Admixtures as required:
1. Air-Entraining Admixture: ASTM C 260.
2. Water-Reducing Admixture: ASTM C 494, Type A.
3. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
4. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.
5. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.

E. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber

F. Curing Materials:
1. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
2. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf.
3. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

2.2 CONCRETE MIXES

A. Comply with ACI 301 requirements for concrete mixtures.

B. Prepare design mixes, proportioned according to ACI 301, for normal-weight concrete determined by either laboratory trial mix or field test data bases, as follows:
1. Compressive Strength (28 Days): 4000 psi (27.6 Mpa
2. Slump: 3 inches
a. Slump Limit for Concrete Containing High-Range Water-Reducing Admixture: Not more than 8 inches (200 mm) after adding admixture to plant- or site-verified, 2- to 3-inch (50- to 75-mm) slump.

C. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content of 4 to 6 percent.
1. Air content of trowel-finished interior concrete floors shall not exceed 3.0 percent.

2.3 CONCRETE MIXING

A. Ready-Mixed Concrete: Comply with ASTM C 94

1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

B. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mix type, mix time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Formwork: Design, construct, erect, shore, brace, and maintain formwork according to ACI 301.

B. Steel Reinforcement: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

C. Joints: Construct joints true to line with faces perpendicular to surface plane of concrete.

1. Construction Joints: Locate and install so as not to impair strength of concrete
2. Joints will not be installed within 6 inches of blast deflector anchor bolts
3. Isolation Joints: Install joint-filler strips at junctions as required
   a. Extend joint fillers full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
4. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:
   a. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with groover tool to a radius of 1/8 inch (3 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.
   b. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Tolerances: Comply with ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

3.2 CONCRETE PLACEMENT

A. Comply with recommendations in ACI 304R for measuring, mixing, transporting, and placing concrete.

B. Do not add water to concrete during delivery, at Project site, or during placement.

C. Consolidate concrete with mechanical vibrating equipment.

3.3 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defective areas repaired and patched, and fins and other projections exceeding 1/4 inch (6 mm) in height rubbed down or chipped off.
    1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Completely remove fins and other projections.
    1. Apply smooth-rubbed finish, defined in ACI 301, to smooth-formed finished concrete.

3.4 FINISHING UNFORMED SURFACES

A. General: Comply with ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Screed surfaces with a straightedge and strike off. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane before excess moisture or bleedwater appears on the surface.
    1. Do not further disturb surfaces before starting finishing operations.

C. Float Finish: Apply float finish to surfaces indicated, to surfaces to receive trowel finish, and to floor and slab surfaces to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

D. Nonslip Broom Finish: Apply a nonslip broom finish to surfaces indicated and to exterior concrete platforms, steps, and ramps. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.

3.5 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection, and follow recommendations in ACI 305R for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions occur before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Begin curing after finishing concrete, but not before free water has disappeared from concrete surface.

D. Cure formed and unformed concrete for at least seven days as follows:

1. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

2. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Contractor will engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement.

B. Compressive Strength Tests: Specimens shall be tested using the procedures in ASTM C-39.

1. Testing Frequency: One composite sample for each day's pour of each concrete mix less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.

END OF SECTION 03300

SECTION 02580 - JOINT SEALING IN CONCRETE

1. **APPLICABLE PUBLICATION**: The publications listed below forms a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1.1 **American Society for Testing and Materials (ASTM)**

D 3569-95(2000)	Joint Sealant, Hot-Applied, Elastomeric, Jet-Fuel-Resistant-Type for Portland Cement Concrete Pavements
D 5893	Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements

1.2 **Federal Specification** (Fed. Spec):

SS-S-200E Type M	Sealants, Joint, Jet Fuel Resistant, Cold Applied for Portland Cement Concrete and Asphalt Cement Concrete

2. **DELIVERY AND STORAGE OF MATERIALS**: Materials delivered to the site shall be inspected for damage, unloaded, and stored with minimum handling. Materials shall be handled so as to ensure joint installation in the prescribed manner. The job site shall have storage facilities to keep materials at the manufacturer's recommended temperatures.

3. **SUBMITTALS**: Submittals shall be as follows:

3.1 **Manufacturer's Recommendations.** Printed copies of the manufacturer's recommendations and literature shall be furnished to the Contracting Officer before use. Material shall not be installed until the submittal is approved.

3.2 **Test Reports.** Certified copies of test reports showing conformance to applicable material specifications shall be sent to and approved by the Contracting Officer before use.

3.2.1 **Manufacturer’s Catalog Data**

3.2.1.1 Joint Sealant: Submit catalog cuts, specifications, material Safety Data sheets and other information documenting conformance to contract requirements for both types of sealant.

3.2.1.2 Instructions: Instructions shall include, but not limited to: storage requirements, ambient temperature and humidity ranges, and moisture condition of joints for successful installation; requirements for preparation of joints; safety heating temperature; mixing instructions; installation equipment and procedures; application and disposal requirements; compatibility of sealant with filler material; curing requirements; and restrictions to be adhered to in order to

reduce hazards to personnel or to the environment. Submit instructions at least 14 days after receipt of written notice to proceed.

3.2.1.3 Equipment List: Submit an equipment list and description of the equipment to be used and a statement from the supplier of the joint sealant that the proposed equipment is acceptable for installing the specified sealant.

4. **MATERIALS:** Materials will be as follows:

4.1 **Self-Leveling Silicone Joint Sealant** for concrete (Dow Corning 890 SL or equal) shall be used on all joints with one of more sides of existing concrete, or areas one slab wide, and shall conform to the following requirements: Silicone sealant shall be self leveling, non-acid curing, and meet the following requirements:

Test	Test Method	Requirements
Weight Loss	ASTM C 792 Modified *	10% maximum
Flow	ASTM C 639 (Type I)	Smooth and Level
Extrusion Rate	ASTM C 603	30 seconds maximum
Tack Free Time	ASTM C 679	5 hours maximum
Hardness (Shore 00) **	ASTM C 661	30-80
Tensile Stress at 150 Percent Elongation	ASTM D 412 (Die C)	30 psi maximum
Percent elongation **	ASTM D 412 (Die C)	700 minimum
Accelerated Weathering***	ASTM C 793	Pass 5000 hours
Bond and Movement Capability	ASTM C 719	Pass 10 cycles at +50 percent movement (no adhesion or cohesion failure)
Flame Resistance	FS SS-S-200	Pass

* Percent weight loss of wet (uncured) sample after placing in forced-draft oven maintained at 70° + 2°C and 50% + 5% humidity.

** Specimen cured 21 days at 23°C + 2°C and 50% + 5% humidity.

*** For the Accelerated weathering test, in lieu of testing of actual joint sealant to be sued of on the project, a report of a factory test, performed within two years of contract award, may be submitted.

5.2 **Type M Sealants:** Shall conform to SS-S-200 Type M. This sealant can be used on all joints including where joints join Asphalt Cement Concrete to PCC.

5.3 **Backer Material.** Backer material shall be extruded butyl or polychloroprene foam rubber, as specified in Paragraph 7, PREPARATION OF JOINTS.

5.4 **Primers.** When the proposed sealant manufacturer recommends, primers shall be used following the manufacturer's instruction.

6. **EQUIPMENT:** All machines, tools, and equipment will be inspected and approved by the Contracting Officer before use and kept in satisfactory condition.

6.1 **Sealing Equipment.**

6.1.1 Silicone Sealant: Equipment shall be air powered pump, components, and hoses as recommended by the sealant manufacturer. Hoses and seals shall be lined to prevent moisture penetration and withstand pumping pressures. Equipment shall be free of contamination from previously used or other type sealant. Before using the equipment in this work, the contractor shall furnish the supplier's certification that the specific equipment model and serial number is recommended for use with the sealing compound to be installed. The initially approved equipment shall be maintained in good working condition in all respects, serviced in accordance with the supplier's instructions, and shall not be altered without obtaining prior approval.

6.2 **Concrete Saw:** A self-propelled power saw with water-cooled diamond or abrasive saw blades shall be provided for cutting joints with the widths and depths required, or for refacint joints where surface films of old sealants cannot be readily removed by sandblasting. Select saw adequatley powered and sized to cut specific opening with not more than two passes of the saw through the joint.

6.3. **Type M Cold Applied Sealant**: Machine Mixable Use application equipment as specified and approved by material manufacturer application.

7. **PREPARATION OF JOINTS:** Immediately before sealant installation, the joints shall be thoroughly cleaned until all laitance, curing compound, filler, and protrusions of hardened concrete are removed from the joint sides and upper edges. The following operations shall be used to clean the joints. A power driven concrete saw blade shall saw through all sawed and filler type joints to loosen and remove material until the joint groove is clear and open to full specified width and depth. Compressed air shall blow all loosened material from the joint. The exposed joint faces and the pavement surfaces extending at least ½ inch from the joint edges shall be sandblasted using a multiple pass technique, until the surface is free of dust, dirt, curing compound, filler, and other material that might prevent bonding of the sealant to the concrete. Sand of proper size and quality shall be used in the sandblasting operation. At least 150 cubic feet per minute of air at a nozzle pressure of 90 pounds per square inch shall be used for sandblasting and final cleaning of the joints. After final cleaning and immediately before filling, the joints shall be blown out with compressed air and left completely free of sand and water. For liquid type joint sealant, only the top portion of the joint shall be sealed with sealant to the depth indicated. The lower portion of the joint shall be plugged or sealed off with a backer material to prevent sealant entrance. The backer material used to seal off the lower portion of the joint shall be an approved compressible, nonshrink, nonreactive with the sealant, and nonabsorptive type extruded butyl or polychloroprene foam rubber. The diameter of the backer rod shall be the size recommended by the manufacturer for the size of the sawcut joint. It shall not be stretched during insertion into the joint.

8. **JOINT SEAL INSTALLATION:** Joints shall be sealed immediately after the concrete-curing period or when weather permits. The joint walls shall be surface dry, and atmospheric and

pavement temperatures shall be above 50°F at the sealant application time. Open joints that cannot be sealed under those conditions shall receive an approved temporary seal to prevent foreign material infiltration. When rain interrupts sealing operations, joints shall be recleaned before installing sealant. The joints shall be filled from the bottom up to within the specified recess from the pavement surface, plus or minus 1/16 inch, using equipment for the type of sealant to be installed. Excess of spilled sealant shall be removed from the pavement by approved methods and shall be discarded. Traffic shall not be permitted over newly sealed pavement until authorized by the Contracting Officer. Joints shall be checked frequently to ensure that the newly installed sealant is cured to a tack free condition within 3 hours. The in-place sealant shall have complete bonds to the concrete at both edges of the joint and will be free of any voids or trapped air throughout the entire project, with NO exceptions. Any joint sealants found with these defects shall be removed and replaced immediately and correctly at the contractor's expense.

8.1 **Liquid Sealant.** Joints shall be filled from the bottom up. Excess or spilled sealant shall be removed immediately. Traffic shall not be permitted over newly sealed pavement until authorized by the Contracting Officer. When the manufacturer supplies a primer, it shall be applied evenly to the joint faces following the manufacturer's recommendations.

8.2 **Final Acceptance.** In place sealant which fails to completely bond to the joint wall surfaces, develops cohesive failures within the sealant, contains voids or entrapped air, or fails to set to a tack free condition within 24 hours will be rejected. Rejected sealant shall be removed from the joint, wasted, and replaced to the satisfaction of the Contracting Officer, at no cost to the Government. Sealants may be rejected at any time prior to final acceptance of the project.

END OF SECTION 02580

SUBMITTAL CODES: A: 30 DAYS AFTER NTP B: DURING CONSTRUCTION

SCHEDULE OF MATERIAL SUBMITTALS

PROJECT NUMBER	PROJECT TITLE	SOLICITATION/CONTRACT NUMBER
VKAG 97-1139	REPAIR POWER CHECK PAD	

TO BE COMPLETED BY PROJECT ENGINEER													TO BE COMPLETED BY CONTRACT ADMINISTRATOR								
		NUMBER OF COPIES REQUIRED																			
LINE NUMBER	ITEM OR DESCRIPTION OF ITEM, CONTRACT REFERENCE, TYPE OF SUBMITTAL	CERTIFICATION OF COMPLIANCE	SHOP DRAWINGS	SAMPLES	COLOR SELECTION	MANUFACTURER'S RECOMMENDATIONS	MANUFACTURER'S WARRANTY	CATALOG DATA	OPERATING INSTRUCTIONS	OTHER	SUBMITTAL CODE	REQUIRED SUBMISSION DATE	DATE RECEIVED IN CONTRACTING	DATE TO CIVIL ENGINEERING	RETURN SUSPENSE	SUBMITTAL NUMBERS	DATE CONTRACTOR NOTIFIED		CONTRACTOR RESUBMITTAL	FINAL APPROVAL	REMARKS
																	APPROVED	DISAPPROVED			
1	PRODUCT DATA SECTION 02222 PARA 3.3									3	B										
2	PRODUCT DATA SECTION 02233 PARA 9.1.1									3	B										
3	SHOP DRAWINGS SECTION 02445 PARA 1.02 B		3								A										
4	PRODUCT DATA SECTION 02580 PARA 3.1					3					A										
5	PRODUCT DATA SECTION 02580 PARA 3.2									3	A										
6	PRODUCT DATA SECTION 02580 PARA 3.2.1							3			A										
7	SHOP DRAWINGS SECTION 03300 PARA 1.2.C	3									A										
8	TESTING SECTION 03300 PARA 1.2.D									3	B										
9	PRODUCT DATA SECTION 03300 PARA 2.3.B									3	B										

SEYMOUR JOHNSON

Air Force Base

Goldsboro, North Carolina

SPECIFICATIONS

FOR

DATE: August 25, 2000

PROJECT TITLE: REPAIR ALS ROOF, BLDG. 3611

PROJECT NO: VKAG 99-1130

PROJECT MANAGER: Mr. Robert Villarreal

SPECIFICATIONS

DIVISION 1 GENERAL REQUIREMENTS

01000 GENERAL

DIVISION 2 SITE CONSTRUCTION

02070 SELECTIVE DEMOLITION

DIVISION 5 METALS

05310 METAL DECK
05400 COLD-FORMED METAL FRAMING

DIVISION 6 WOOD AND PLASTICS

06105 MISCELLANEOUS CARPENTRY

DIVISION 7 THERMAL AND MOISTURE PROTECTION

07531 EPDM MEMBRANE ROOFING
07600 FLASHING AND SHEET METAL
07610 STANDING SEAM METAL ROOFING
07920 JOINT SEALANTS

SECTION 01000

GENERAL

1.1 SCOPE OF WORK: The work covered by this specification consists of furnishing all plant, labor, equipment and material, and performing all work in connection with PROJECT No. VKAG 99-1130 – REPAIR ALS ROOF, BUILDING 3611 in strict accordance with these specifications and drawings and subject to the terms and conditions of this contract.

1.2 LOCATION: The work is to be accomplished at Seymour Johnson Air Force Base, Goldsboro, North Carolina. This base is accessible by both public highway and railway.

1.3 WORKWEEK: The contractor shall observe the same regular workweek being observed by the Seymour Johnson AFB Civil Engineering shop forces, which is 7:30 a.m. to 4:30 p.m., Monday through Friday, with Federal holidays excluded. Any deviation from this schedule will require 48 hours advance notice and approval of the Contracting Officer or authorized representative.

1.4 PRINCIPLE FEATURES: The work covered by this contract includes, but is not limited to the following:

A. Install standing seam metal roof and support system over existing facility.

1.5 HAUL ROUTES: The Contractor shall use the haul routes indicated on the plans.

1.6 DISPOSITION OF NONSALVABLE MATERIALS: All nonsalvable or unusable material shall be disposed of off base as directed by the Contracting Officer or authorized representative. All waste material generated by any work under this contract shall be handled, transported, stored, and disposed of off base, by the Contractor, in accordance with all applicable federal, state, or local laws, ordinances, regulations, court orders, or other types of rules or rulings having the effect of law.

1.7 SUBMITTALS REQUIRED: Required submittals are listed on AF Form 66.

1.8 BASE CIVIL ENGINEERING WORK CLEARANCE REQUEST, AF FORM 103: The Contractor shall obtain AF Form 103, Base Civil Engineering Work Clearance Request, prior to work commencement from the Contract Management Section in Bldg 3300, 1095 Peterson Avenue. Upon receipt of an AF Form 103, the Contractor shall be responsible for locating all base owned underground utilities, as well as, coordinating local utility companies to stake out utilities if not owned by the base.

Historical drawings, as-built drawings, and topographic drawings are available for review at the 4th Civil Engineer Squadron, Design element located in Building 3300. Base owned utilities include but are not limited to electric, water, sewer, steam, communication, telephone, fiber optic, cathodic protection, and fuel lines. Utilities not owned by the base include but are not limited to cable TV, Southern Bell Telephone, and Natural Gas. The Contractor shall contact ULOCO and the non-base utility companies for location services. In the event that the Contractor damages a utility which is commented in the plans, record drawings, or located by a utility locator, the Contractor shall repair/replace the utility at no additional cost to the Government. Utilities not documented, shown, or located by a locator shall be considered abandoned or unknown. Contractor damage to unknown or abandoned utilities shall be dealt with as a differing site condition.

1.9 SAFETY: All safety requirements of the U.S. Army Corps of Engineers Safety Manual 385-1-1 dated October 1996 will be strictly adhered to as related to all work covered under these specifications.

1.10 MATERIALS CONTAINING ASBESTOS: In the event the Contractor discovers materials suspected of containing asbestos that is not identified to be removed in the plans and specifications, the Contractor shall notify the Contracting Officer or authorized representative. The Contractor's work shall proceed unless the materials suspected of containing asbestos are damaged or disturbed. Any suspected materials damaged or disturbed by the Contractor without permission from the Contracting Officer or authorized representative shall be removed by the Contractor at his expense IAW all applicable Federal, State, and local laws, ordinances, regulations, court orders, or other types of rules or rulings having the effect of law.

1.11 LABELING OF STORAGE DRUMS: All 55 gallon or larger drums brought on base for use under this contract and containing new material or used for storage of waste materials or hazardous waste must be labeled with a Department of Transportation (DOT) Proper Shipping Name, DOT Hazardous Identification Number, the Contractor's name, a Contractor representative, and the Contractor's telephone number. Label lettering should have a minimum height of one half inch painted in white paint or other color that is in contrast with the color of the drum. The label should be sufficiently durable to equal or exceed the life (including storage and disposal) of the drum.

1.12 CONTRACTOR STORAGE TRAILER(S) AND BUILDING(S): The Contractor shall place or paint a sign on all of his storage trailer(s) and building(s) used on this contract. At a minimum, the sign shall contain the name of the Contractor and a telephone number at which the Contractor can be reached. The trailer(s) and building(s) shall be complete with gates and/or doors which can be locked. Only material for this project shall be stored in the trailer(s) or building(s). The Contractor shall remove the storage trailer(s) or building(s) within 30 days after completion of the contract and prior to submitting his final invoice. The area around the storage trailer(s) and building(s) shall

be kept clean. This includes the mowing of grass during the growing season. The lawn mower shall be supplied by the Contractor.

A. The Contractor will be given a lot in the Contractor Storage Area behind Bldg 2700 for the life of the contract. The Contractor's progress schedule shall include a line item (equal to 1%) for final cleanup of this storage lot. Final payment will not be made until this final cleanup is performed by the Contractor and accepted by Seymour Johnson AFB.

1.13 PHASING:

A. The 60 days following Contractor's Notice to Proceed (Phase I) will be allowed for delivery of materials, equipment ordering, and submittal approval only. No on-site work shall be permitted by the Contractor during that initial 60 day period.

B. After the submittal phase, construction (Phase II) will take 120 days.

1.14 AFFIRMATIVE PROCUREMENT:

A. The contractor shall incorporate Affirmative Procurement requirements as per 40 CFR, Part 247 and Executive Order 13101: "Greening the Government Through Waste Prevention, Recycling and Federal Acquisition." Designated items used in the execution of this contract shall meet or exceed the Environmental Protection Agency's (EPA) requirements for recycled content materials (RCM) as per the EPA's Comprehensive Procurement Guidelines (CPG). The contractor/engineer shall ensure affirmative procurement requirements for CPG items are met or provide written justification that: 1) The price of a given designated item is unreasonably high, 2) There is inadequate competition (not enough sources of supply), 3) Unusual and unreasonable delays would result from obtaining the item, or 4) The item does not meet the Air Force's performance specifications.

END OF SECTION 01000

SECTION 02070

SELECTIVE DEMOLITION

PART 1 - GENERAL

A. Definitions:

1. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.
2. Remove and Salvage: Detach items from existing construction and deliver them to the Government.
3. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
4. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

B. Materials Ownership: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Government's property, demolished materials shall become Contractor's property and shall be removed from Project site.

C. Standards: Comply with ANSI A10.6 and NFPA 241.

D. Project Conditions:

1. The Government will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so the Government's operations will not be disrupted. Provide not less than 48 hours' notice to the Government of activities that will affect the Government's operations.
2. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.
3. The Government assumes no responsibility for condition of areas to be selectively demolished.

    a. Conditions existing at time of inspection for bidding purpose will be maintained by the Government as far as practical.

E. Storage or sale of removed items or materials on-site will not be permitted.

F. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

A. Repair Materials: Use repair materials identical to existing materials.

1. If identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
2. Use materials whose installed performance equals or surpasses that of existing materials.

PART 3 - EXECUTION

A. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

B. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to the Contracting Officer.

C. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

D. Existing Utilities: Maintain services indicated to remain and protect them against damage during selective demolition operations.

E. Utility Requirements: Locate, identify, disconnect, shut off, and seal or cap off indicated utilities serving areas to be selectively demolished.

1. If utility services are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary utilities that bypass area of selective demolition and that maintain continuity of service to other parts of building.

F. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction.
2. Protect existing site improvements, appurtenances, and landscaping to remain.

G. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

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

I. Dust Control: Use water mist, temporary enclosures, and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations.

J. Disposal: Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

1. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

K. Cleaning: Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

L. Selective Demolition: Demolish and remove existing construction only to the extent required by new construction and not before proper permit has been obtained and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction.
2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
4. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

M. Existing Facilities: Comply with building manager's requirements for using and protecting elevators, stairs, walkways, loading docks, building entries, and other building facilities during selective demolition operations.

N. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Contracting Officer or authorized representative, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

O. Patching and Repairs: Promptly repair damage to adjacent construction caused by selective demolition operations.

1. Repairs: Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials.
2. Finishes: Restore exposed finishes of patched areas and extend restoration into adjoining construction in a manner that eliminates evidence of patching and refinishing.
3. Floors and Walls: Where walls or partitions that are demolished extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

4. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

P. Disposal of Demolished Materials: Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.

1. Burning: Do not burn demolished materials.
2. Disposal: Transport demolished materials off the Government's property and legally dispose of them.

END OF SECTION 02070

SECTION 05310

STEEL DECK

PART 1 - GENERAL

A. Submittals: In addition to Product Data for each type of deck and accessory, submit the following:

1. Shop Drawings showing layout and types of deck panels, anchorage details, reinforcing channels, pans, deck openings, special jointing, accessories, and attachments to other construction.
2. Product certificates signed by steel deck manufacturers certifying that products furnished comply with requirements.

B. Quality Assurance: Comply with AISI's "Specification for the Design of Cold-Formed Steel Structural Members" for calculating structural characteristics of steel deck.

1. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

PART 2 - PRODUCTS

A. Steel Roof Deck: Fabricate panels to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 29, and the following:

1. Galvanized Steel Sheet: ASTM A 653.
2. Deck Profile: Type 3 N, deep rib.
3. Profile Depth: 3 inches.
4. Design Uncoated-Steel Thickness: 0.0598 inches.

B. Accessories: Steel deck manufacturer's standard accessory materials, including mechanical fasteners, closure strips, pour stops, and closures for deck.

C. Galvanizing Repair Paint: ASTM A 780, with dry film containing a minimum of 94 percent zinc dust by weight.

PART 3 - EXECUTION

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 29, manufacturer's written instructions, and requirements in this Section.

1. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
2. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

3. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to decking.
4. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of decking, and support of other work.
5. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

    a. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

B. Roof Deck Accessories: Install ridge and valley plates, finish strips, cover plates, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld to substrate to provide a complete deck installation.

C. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

END OF SECTION 05310

SECTION 05400

COLD-FORMED METAL FRAMING

PART 1 - GENERAL

A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads without deflections greater than the following:

1. Roof Trusses: Vertical deflection of 1/240 for total load and 1/360 for live load of the span.

B. Submittals: In addition to Product Data, submit the following:

1. Shop Drawings showing layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
2. Structural analysis data signed and sealed by the qualified professional engineer in the State of North Carolina responsible for their preparation.

C. Quality Assurance: Comply with AISI's "Specification for the Design of Cold-Formed Steel Structural Members" for calculating structural characteristics of cold-formed metal framing.

1. Engineering Responsibility: Engage a qualified professional engineer who is legally qualified to practice in the State of North Carolina and who is experienced in providing engineering services of the kind indicated to prepare design calculations, Shop Drawings, and other structural data.
2. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

PART 2 - PRODUCTS

A. Steel Sheet: ASTM A 653, structural steel, G60 zinc coating, Grade 33 for minimum uncoated steel thickness of 0.0428 inch or 50 for minimum uncoated steel thickness of 0.0538 inch and greater.

B. Roof Truss Members: Manufacturer's standard C-shaped steel sections, of web depths indicated, unpunched, with stiffened flanges, complying with ASTM C 955, of minimum uncoated-steel thickness and flange width indicated on Shop Drawings.

C. Fabricate steel-framing accessories of the same material and finish used for framing members, with a minimum yield strength of 33,000 psi, of manufacturer's standard thickness and configuration, unless otherwise indicated.

D. Steel Shapes, Plates, and Clips: ASTM A 36, zinc coated by hot-dip process according to ASTM A 123.

E. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153.

F. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

G. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.

H. Mechanical Fasteners: Corrosion-resistant-coated, self-drilling, self-threading steel drill screws.

I. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035.

J. Soffit Furring Channels (Furring Members): Commercial steel sheet with manufacturer’s standard corrosion resistant zinc coating.

1. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch (22.2 mm) deep.

PART 3 - EXECUTION

A. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to ASTM C 1007, manufacturer's written recommendations, and requirements in this Section.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed metal framing members by welding or screw fastening, as standard with fabricator. Wire tying of framing members is not permitted.
3. Install framing members in one-piece lengths.
4. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed.
5. Install insulation in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
6. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.

B. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

C. Truss Installation: Install, bridge, and brace trusses according to Shop Drawings. Do not alter, cut, or remove framing members or connections of trusses.

1. Erect trusses with plane of truss webs plumb and parallel to each other, align, and accurately position at spacings indicated.
2. Erect trusses without damaging framing members or connections.
3. Align webs of bottom chords and load-bearing studs or continuously reinforce track to transfer loads to structure. Anchor trusses securely at all bearing points.
4. Install continuous bridging and permanently brace trusses as indicated.

D. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

END OF SECTION 05400

SECTION 06105

MISCELLANEOUS CARPENTRY

PART 1 - GENERAL

A. Submittals:

1. Product Data: For wood-preservative and fire-retardant treatment from chemical treatment manufacturers and certification by treating plants that treated materials comply with requirements.

PART 2 - PRODUCTS

A. Lumber, General: DOC PS 20 and applicable rules of lumber grading agencies certified by the American Lumber Standards Committee Board of Review. Factory mark each piece of lumber with grade stamp of grading agency.

1. For exposed lumber, mark grade stamp on end or back of each piece.
2. Provide dressed lumber, S4S, unless otherwise indicated.
3. Provide dry lumber with 19 percent maximum moisture content at time of dressing for 2-inch nominal (38-mm actual) thickness or less, unless otherwise indicated.

B. Wood-Preservative-Treated Materials: AWPA C2 (lumber) and AWPA C9 (plywood), except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX).

1. Kiln-dry material after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
2. Mark each treated item with the treatment quality mark of an inspection agency approved by the American Lumber Standards Committee Board of Review.
3. Application: Treat items indicated on Drawings, and the following:

a. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
b. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
c. Wood framing members less than 18 inches (460 mm) above grade.
d. Wood floor plates that are installed over concrete slabs directly in contact with earth.

C. Fire-Retardant-Treated Materials: Where fire-retardant-treated materials are indicated, provide materials that comply with performance requirements in AWPA C20 (lumber) and AWPA C27 (plywood). Identify fire-retardant-treated wood with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.

1. Use Exterior type for exterior locations and where indicated.
2. Use Interior Type A High Temperature (HT), unless otherwise indicated.

D. Provide miscellaneous lumber for support or attachment of other construction.

1. For items of dimension lumber size, provide Construction, Stud, or No. 2 grade lumber with 19 percent maximum moisture content of any species.
2. For exposed boards, provide lumber, with 15 percent maximum moisture content, of eastern white pine, Idaho white, lodgepole, ponderosa, or sugar pine; Finish or 1 Common (Colonial) grade; NELMA, NLGA, WCLIB, or WWPA.
3. For concealed boards, provide lumber with 19 percent maximum moisture content and any of the following species and grades:

   a. Mixed southern pine, No. 2 grade; SPIB.
   b. Eastern softwoods, No. 2 Common grade; NELMA.
   c. Northern species, No. 2 Common grade; NLGA.
   d. Western woods, Construction or No. 2 Common grade; WCLIB or WWPA.

E. Miscellaneous Concealed Plywood: Exterior sheathing, span rating to suit framing in each location, and thickness as indicated but not less than 1/2 inch (13 mm).

F. Fasteners: Provide fasteners of size and type indicated.

1. Where carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
2. Power-Driven Fasteners: CABO NER-272.
3. Screws for Fastening to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings.

PART 3 - EXECUTION

A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

B. Securely attach carpentry work as indicated and according to applicable codes and recognized standards.

C. Countersink fastener heads on exposed carpentry work and fill holes with wood filler.

D. Wood Structural Panels: Comply with applicable recommendations contained in APA Form No. E30K, "APA Design/Construction Guide: Residential & Commercial," for types of structural-use panels and applications indicated.

E. Wood Trim Installation: Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Cope at returns and miter at corners to produce tight-fitting joints. Use scarf joints for end-to-end joints.

1. Install to tolerance of 1/8 inch in 96 inches (3 mm in 2438 mm) for level and plumb. Install adjoining finish carpentry with 1/32-inch (0.8-mm) maximum offset for flush installation and 1/16-inch (1.6-mm) maximum offset for reveal installation.

END OF SECTION 06105

SECTION 07531

EPDM MEMBRANE ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes mechanically fastened membrane roofing system.

1.2 SUBMITTALS

A. Product Data: For each product indicated.

B. Maintenance data.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's warranty.

B. Source Limitations: Obtain components for membrane roofing system approved by roofing membrane manufacturer.

C. Fire-Test-Response Characteristics: Provide membrane roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL, FMG, or another testing and inspecting agency acceptable to authorities having jurisdiction.

1. Exterior Fire-Test Exposure: Class A; ASTM E 108, for application and roof slopes indicated.

D. Preinstallation Conference: Conduct conference at Project site.

1.4 PROJECT CONDITIONS

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

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period. Failure includes roof leaks.

1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 EPDM ROOFING MEMBRANE

A. EPDM Roofing Membrane: ASTM D 4637, Type I, nonreinforced uniform, flexible sheet made from EPDM, and as follows:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the manufacturers specified (or approved equal):

   a. Carlisle SynTec Incorporated.
   b. Celotex Corporation.
   c. Firestone Building Products Company.
   d. Johns Manville International, Inc.

2. Thickness: 45 mils (1.1 mm), nominal.
3. Exposed Face Color: Black.

2.2 AUXILIARY MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.

B. Sheet Flashing: 60-mil- (1.5-mm-) thick EPDM, partially cured or cured, according to application.

C. Bonding Adhesive: Manufacturer's standard bonding adhesive.

D. Seaming Material: Manufacturer's standard synthetic-rubber polymer primer and 3-inch- (75-mm-) wide minimum, butyl splice tape with release film.

E. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.

F. Miscellaneous Accessories: Provide lap sealant, water cutoff mastic, metal termination bars, metal battens, pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, in-seam sealants, termination reglets, cover strips, and other accessories.

2.3 INSULATION ACCESSORIES

A. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.

B. Cover Board: DOC PS 2, Exposure 1, oriented strand board, 7/16 inch (11 mm) thick.

PART 3 - EXECUTION

3.1 PREPARATION

A. Install existing cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Loosely butt cover boards together and fasten to roof deck.

3.2 MECHANICALLY FASTENED ROOFING MEMBRANE INSTALLATION

A. Install roofing membrane over area to receive roofing according to roofing system manufacturer's written instructions. Unroll roofing membrane and allow to relax before installing.

B. Start installation of roofing membrane in presence of roofing system manufacturer's technical personnel.

C. Accurately align roofing membranes and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

D. Mechanically or adhesively fasten roofing membrane securely at terminations and perimeter of roofing.

E. Adhesive Seam Installation: Clean both faces of splice areas, apply splicing cement, and firmly roll side and end laps of overlapping roofing membranes according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of roofing membrane terminations.

F. Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape, and firmly roll side and end laps of overlapping roofing membranes according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of roofing membrane terminations.

G. Repair tears, voids, and lapped seams in roofing that does not meet requirements.

H. In-Splice Attachment: Secure one edge of roofing membrane using fastening plates or battens centered within membrane splice and mechanically fasten roofing membrane to roof deck. Field-splice seam.

I. Through-Membrane Attachment: Secure roofing membrane using fastening plates or battens and mechanically fasten roofing membrane to roof deck. Cover battens and fasteners with a continuous strip.

3.3 BASE FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.

B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply bonding adhesive to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.

E. Terminate and seal top of sheet flashings[and mechanically anchor to substrate through termination bars].

3.4 FIELD QUALITY CONTROL

A. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Contracting Officer.

B. Repair or remove and replace components of membrane roofing system where test results or inspections indicate that they do not comply with specified requirements.

END OF SECTION 07531

SECTION 07600

FLASHING AND SHEET METAL

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

A. Aluminum Association (AA):
   1. 1980 Aluminum Sheet Metal Work in Building Construction, Section 5.

B. American Society for Testing and Materials (ASTM):
   1. B32-93 Solder Metal.
   2. B209-93 Aluminum and Aluminum-Alloy Sheet and Plate.
   3. B221-93 Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
   4. D412-92 Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers – Tension.
   5. D4586-93 Asphalt Roof Cement, Asbestos Free.

C. Architectural Aluminum Manufacturers Association (AAMA):
   1. 605.2-92 Voluntary Specification for High Performance Organic Coatings on Architectural Extrusions and Panels.
   2. 809.2-92 Non-Drying Sealants.

D. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA):
   1. Architectural Sheet Metal Manual, Fifth Edition, 1993.

1.2 SUBMITTALS

A. Product Data: Manufacturer's printed installation instructions for all prefabricated products.

B. Shop Drawings: Clearly detail shaping, jointing, length of sections, fastening, sealing, and installation details.
   1. Indicate materials, gauges, or thicknesses.

1.3 COORDINATION

A. Properly coordinate flashing and sheet metal work with related work to insure work is properly installed; gravel guards, flashing aprons and other work built into roofing are properly stripped-in, and base flashings are properly counterflashed where roofing terminates.

B. Verify designs necessary to accomplish required performance of flashing systems; where modifications are deemed necessary, submit detailed drawings and describe proposed modifications.

1.4 WARRANTY

A. Contractor guarantees and warrants Work of this Section to be in compliance with Contract Documents and free from faults and defects in materials and workmanship for period of two years from Date of Substantial Completion.

B. Warrant fluoropolymer coating to remain free of checking, crazing, peeling, chalking or fading for period of five years from Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SHEET MATERIALS

A. Aluminum Sheet: ASTM B209, alloy 3003-H14, minimum 0.032-inch (20 gauge) thick, except as otherwise indicated, premium fluoropolymer coating, unless directed otherwise.
   1. Coping: .125-inch thick formed aluminum.
   2. Cleat: .0625-inch thick formed aluminum.
   3. Finish:
      a. Factory Finish: Premium fluoropolymer in color to match Petersen Aluminum “Dark Bronze”.
      b. Colored Anodic: AA-M12C22A42, Architectural Class 1, bronze anodic coating to match Petersen Aluminum “Dark Bronze”.

B. Aluminum; Extruded: Manufacturer’s standard extrusions of sizes and profiles indicated, ASTM B221, alloy 6063-T52, 0.080-inch thick minimum thickness for primary legs of extrusions.

C. Flexible Flashing: 60 mil thick flexible sheet of EPDM synthetic rubber.

D. Self-Healing Flashing: Cold-applied, self adhering membrane composed of high strength polyethylene film coated on one side with thick layer of adhesive-consistency rubberized asphalt, fully adhered, 40 mil thick; self-healing.
   1. Acceptable Products (or approved equal):
      a. Jiffy Seal Waterproofing Systems “Ice and Water Guard”.
      b. Nord Bitumi US, Inc. “Nord Shield”.
      c. W. R. Grace & Co. “Ice and Water Shield”.
   2. Retaining Bar: 1/8-inch by one-inch hot-dipped galvanized bar.

E. Soffit Vents: Alcoa Building Products “Vent-A-Strip” (or approved equal) soffit vent constructed of ASTM B209, alloy 3005-H25, aluminum sheet with minimum tensile strength of 26,000 psi and minimum yield strength of 22,000 psi. Provide in 8’-0” lengths; prefinished with fluoropolymer coating in color selected by Contracting Officer or authorized representative.

2.2 GUTTERS AND DOWNSPOUTS

A. Provide gutters and downspouts in shapes and sizes indicated, with mitered and welded corners. Include steel straps formed from at least 0.028-inch thick, galvanized steel sheet; hangers or other attachment devices; screens; end plates; and trim and other accessories indicated or required for complete installation.

B. Additional features: provide items below fabricated from the same metal as gutters and downspouts.
   1. Leaf guard with hold-down clips.

C. Provide gutters and downspouts fabricated from the following metal:
   1. Formed-aluminum sheet in thickness indicated, but not less than the following:
      a. Thickness: 0.032 inch.

2.3 ACCESSORY MATERIALS AND COMPONENTS

A. Bituminous Paint: SSPC-Paint 12, minimum 30 mils thick cold applied asphalt mastic.

B. Fasteners: Same material or compatible with sheet metal being fastened.
   1. Nails: 12 gauge, flat head annular thread type, of sufficient length to penetrate wood not less than one-inch.
   2. Screws: No. 10 gauge flat head wood screws for attachment to wood, No. 10 gauge round head sheet metal screws for attachment to metals.
   3. Expansion Shields: Lead or bronze sleeves.
   4. Bolts: Furnished complete with nuts and washers.
   5. Rivets: Round head closed end type.
   6. Blind Clips and Cleats: Same gauge as sheet metal.

C. Flashing Reglets: Fry Reglet Corp. (or approved equal) “Springlok Flashing System Type MA” and “Springlok Flashing System Type SM (Expand-O-Seal)”.
   1. Other Acceptable Manufacturers (or approved equal):
      a. Hickman; W. P. Hickman Co.
      b. MM Systems Corp.

D. Mastic: AAMA 809.2, nonskinning, nondrying, butyl polyisobutylene polymer.

E. Sealant: Specified in Section 07920.

F. Premium Fluoropolymer Coating Finish: Two coat coil applied, baked on fluoropolymer coating system based on minimum 70% Elf Atochem “Kynar 500” or Ausimont, Inc. “Hylar 5000 resin” (Polyvinylidene fluoride, PVDF), formulated by licensed Kynar

manufacturer and applied by manufacturer's approved applicator to meet AAMA 605.2. provide minimum 0.90 mil dry film thickness consisting of primer and minimum 0.75 mil dry film thickness color coat. Color to match Petersen Aluminum "Dark Bronze". Work to receive fluoropolymer coating includes gutters and downspouts.

G. Splash Blocks: Precast concrete, minimum 3,000 psi at 28 days, sizes and profiles indicated in Drawings.

H. Weep Wicks: ¼-inch o.d. x 12-inch long untreated cotton sash cord.

I. Weep Tubes: Standard 3/8-inch o.d. x 4-inch long clear plastic weep hole.
   1. AA Wire Products Company "AA223 Weep Holes" (or approved equal).
   2. Dur-O-Wal, Inc. "D/A 1005" (or approved equal).
   3. National Wire Products Corporation "No. 999 Plastic Weep Holes" (or approved equal).

J. Welding Rods: Type recommended by stainless steel sheet manufacturer for type stainless steel provided.

2.4 FABRICATION

A. Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance and performance.

B. Form sections in 10 foot lengths. Make allowances for expansion at joints. Provide shop fabricated, mitered and jointed corners, maximum 2-foot long legs.

C. Fabricate nonmoving seams in sheet metal with flat lock seams. For metal, other than aluminum, tin edges to be seamed, form seams and solder.

D. Make joints in aluminum sheets less than 0.040-inch thick using flat lock seams, ¾-inch wide. Fill seams with exterior sealant and rivet.

E. Make riveted joints using solid shank rivets or pop rivets as applicable. Pop rivets shall be closed end type.

F. Wipe and wash clean soldered joints, immediately after soldering, to remove traces of flux.

G. Hem exposed edges of flashings on underside ½".

H. Apply flexible flashing or bituminous paint on surfaces where expected to be in contact with cementitious materials or dissimilar metals.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install flashings and sheet metal to properly prepared, clean, dry, and sound surfaces.

B. Except as otherwise indicated, comply with manufacturer's installation instructions and recommendations and to conform to best standard practices outlined in SMACNA "Architectural Sheet Metal Manual".

C. Cut, fit and drill as necessary to accommodate related Work. Provide accessories necessary for complete watertight sheet metal installation.

D. Provide screws and bolts of size and type best suited for particular purpose. Unless otherwise specified, confine nailing to sheet metal less than 12-inches wide.
   1. Secure flashings in place using specified type fasteners. Use exposed fasteners in locations approved by Contracting Officer or authorized representative. When using exposed fasteners, they are to be of the same finish as flashings.

E. Supply reglets to respective trade for installation. Coordinate their correct placement.

F. Install surface mounted reglets true-to-lines and levels. Seal top of reglets with silicone sealant specified in Section 07920.

G. Install flashing receivers with fasteners and washers on 12-inch centers.

H. Install metal flashings into reglets to form tight fit. Seal flashings into reglets with sealant.

I. Pre-tin metal edges where soldered seams are required. Thoroughly heat seam, sweat solder through full seam width. Perform soldering immediately after applying flux. Solder all flat locked seams.

J. Construct sheet metal work watertight, with lines, arrises, and angles sharp and true, with plane surfaces free from waves and buckles.

K. Do not place dissimilar materials in contact, nor in position where drainage across them will occur. Separate dissimilar metals with tape, roofing cement, flexible flashing or self-healing flashing.

L. Counterflash mechanical and electrical items projecting through membrane roofing.

M. Install counterflashings over base flashings where roof surfaces intersect vertical surfaces. Install counterflashing in sealant compatible with roofing and waterproofing systems. Install after base flashing is complete.

N. Form counterflashing in 10 foot lengths. Turn down over base flashings not less than 4-inches. Form to provide spring action against base flashings. Fold back bottom edge of counterflashing ½-inch on underside. Lap end joints not less than 3-inches, do not solder or weld. Set in concealed continuous bead of butyl sealant; ¼-inch in diameter minimum. Make flashings continuous at angles. At corners and transitions, provide separate piece with maximum 2'-0" long legs.

O. Construct counter flashing at masonry construction as two pieces; receiver and counterflashing. Install insert as well is constructed extending into wall 4-inches minimum and turning up ½-inch. Install flashing after installation of base flashing; locking into insert with flat lock joint.

P. Install prefinished aluminum gutters and downspouts.
   1. Prefabricate gutters in continuous lengths with soldered endcaps.
   2. Flash and seal gutters to downspouts.
   3. Attach downspout to wall with hangers 2 gauges heavier than downspout spaced on maximum 3 foot centers.
   4. Provide precast splash block under downspout outfall.

Q. Install continuous cleat using stainless steel fasteners. At joints install 12-inch backup plates. Install shop fabricated corners. Leave ¼-inch between section ends centered over backup plates.

R. Secure cleats and backup plates to wood nailers on 4-inch centers set in mastic. Attach cleats to metal with self-drilling self-tapping screws.

S. At joints in linear sheet metal items, set sheet metal over back-up plate in two beads of sealant, ¼-inch in diameter, minimum. Extend sealant over all metal surfaces. Accurately mate components for positive seal. Allow no sealant to migrate onto exposed surfaces.

T. Copings: Install formed 0.125-inch thick prefinished aluminum coping and attach securely to continuous cleat at each side of parapet wall.
   1. Set copings over 60 mil EPDM flexible flashing membrane, trimmed even with bottom edge of cleats, and sealed at laps watertight using manufacturer's recommended adhesive. Secure copings with front and back continuous cleats only; do not penetrate coping with mechanical anchor.
   2. Install cover plates at joints between sections, set in full beds of sealant ½-inch from edges of plates and make weathertight fit, allowing for expansion and contraction in compliance with SMACNA standard details.

U. Sheet Metal Expansion Joints:
   1. Provide slip type expansion joints in continuous runs of sheet metal.
   2. Unless indicated otherwise, space expansion joints approximately 30 feet apart.

END OF SECTION 07600

SECTION 07610

STANDING SEAM METAL ROOFING

PART 1 - GENERAL

A. System Description:

1. Design and Performance Criteria:

a. Thermal Movement: Completed metal roofing and flashing system capable of withstanding expansion and contraction of components caused by temperature range from -10° F to +120 ° F without buckling, producing excess stress on structure, anchors or fasteners, or reducing performance ability.

2. Uniform Wind Load Capacity:

a. Capacity determined in compliance with AA publication “Specification for Aluminum Structures”, 1986 Edition, and principles of ASTM E330, Procedure A, adapted to testing roof panels as follows:

(7.1) Roof test specimens either full length or representative of main body of roof, free from edge restraint of perimeter attachments, continuous over one or more supports, and containing at least five panel modules for standing seam roof.

(7.2) No attachments are permitted at sides or end perimeter other than those that occur uniformly throughout roof. Side and end seals shall be flexible and in no way restrain crosswise distortion of panels.

(7.2.1) Panels and accessories production materials of same type and thickness proposed for use on Project.

(10.1.1) Seals or film shall not span any crevices or cracks that may tend to separate under pressure.

b. Installed roof system shall withstand positive or negative design wind loading pressures complying with 1994 Uniform Building Code with 1997 Revisions and 1994 North Carolina State Building Code with 1999 Revisions, with maximum system deflection of L/140 and maximum panel deflection of 0.04% and in compliance with ASCE 7-93, UL 90 and ASTM E1592.

3. Concentrated Load Capacity: Withstand load of 250 lbs. applied to four-inch by four-inch square area located in center of panel between stiffener ribs without buckling of ribs or permanent panel distortion.

4. Water Penetration (Dynamic Pressure): No uncontrolled water penetration, other than condensation, when tested in compliance with ASTM E1646 at minimum differential pressure of 20 percent of inward acting, wind load design pressure of 6.24 psf and not more than 12 psf.

5. Air Infiltration: Provide preformed roof panel assemblies with permanent resistance to air leakage through assembly of not more than 0.09 cfm/sq. ft of fixed roof area when tested according to ASTM E1680 at static air pressure difference of 4.0 lbf/sq. ft.

6. Capacities for gauge, span or loading other than those tested may be determined by interpolation of test results within range of test data. Extrapolation for conditions outside test range is not acceptable.

1.2 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM):
   1. A792-93a Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process, General Requirements.
   2. D1056-91 Flexible Cellular Materials – Sponge or Expanded Rubber.
   3. E1592-94 Test Method for Structural Performance of Sheet Metal Roofing and Siding Systems by Uniform Air Pressure Difference.
   4. E1646-95 Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference.
   5. E1680-95 Test Method for Rate of Air Leakage through Exterior Metal Roof Panel Systems.

B. Architectural Aluminum Manufacturers Association (AAMA):
   1. 501-83 Methods of Test for Metal Curtain Walls.
   2. 605.2-92 Voluntary Specification for High Performance Organic Coatings on Architectural Extrusions and Panels.

C. American Society of Civil Engineers (ASCE):
   1. 7-95 Minimum Design Loads for Buildings and Other Structures.

D. National Roofing Contractors Association (NRCA):
   1. The NRCA Construction Details – Third Edition.

E. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA):
   1. Architectural Sheet Metal Manual, Fifth Edition, 1993.

1.3 SUBMITTALS

A. Product Data: Include manufacturer's detailed material and system description, installation instructions, and engineering performance data and finish specifications.

B. Shop Drawings: Show roofing system with flashings and accessories in plan and elevation; sections and all details at full scale. Include metal thicknesses and finishes, panel lengths, joining details, anchorage details, flashings and special fabrication provisions for termination and penetrations; girt locations expansion provisions and special supports. Indicate relationships with adjacent and interfacing work.

C. Samples:
   1. Panel section, minimum 2'-0" in length by full width, indicating thickness, profile, texture and color.
   2. Submit samples of panel clips, closures, insulation and accessory items.

D. Design Calculations: Submit design calculations, indicating compliance with specified performance criteria. Design calculations shall bear seal of registered engineer licensed to practice in the State of North Carolina. Indicate that engineer has reviewed shop drawings.

E. Test Reports:
   1. Submit reports by independent testing laboratory to support structural calculations and show compliance with specified performance criteria.
   2. Tests shall have been made for substantially identical systems within ranges of specified performance criteria.
   3. If test data is not available, or if data does not represent project conditions, Contractor shall be responsible for securing satisfactory tests by independent testing agency acceptable to Contracting Officer or authorized representative, with all costs of such testing borne by Contractor.

1.4 QUALITY ASSURANCE

A. Fabricator/Installer Qualifications:
   1. Installer trained and approved by system manufacturer, with trained supervisory personnel observing and directing work.
   2. If required, proposed fabricator/installer shall submit work and proof of adequate financial responsibility. Contracting Officer or authorized representative reserves the right to inspect fabrication facilities in determining qualifications.

B. Fire-Test-Response Characteristics: Where fire-resistance-rated roof panel assemblies are indicated, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

C. Preinstallation Conference; Prior to beginning metal roofing work, preroofing conference will be held to review work to be accomplished.
   1. Contractor, Contracting Officer or authorized representative, metal roofing subcontractor, metal roofing system manufacturer's representative and all other subcontractors who have equipment penetrating roof or whose work involves access to roof shall be present.
   2. Contractor shall notify Contracting Officer or authorized representative and other attending parties' minimum three days prior to time for conference.

3. Contractor shall record minutes of meeting and shall distribute copies of minutes to attending parties.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect components during fabrication, shipment, storage, handling, and erection from mechanical abuse, stains, discoloration, and corrosion.

B. Maintain strippable plastic protective film on finished surfaces until panel is erected.

C. Store materials off ground, adequately shored, and under cover and protected from wind movement, foreign material contamination, mechanical damage, cement, lime, or other corrosive substances.

D. Handle materials to prevent damage to surfaces, edges and ends of roofing sheets and sheet metal items. Damaged material shall be rejected and removed from site.

E. Protect panels from wind related damages during erection.

F. Inspect materials upon delivery. Reject and remove from site physically damaged or marred material.

1.6 WARRANTY

A. Endorse and Forward to Government Following Warranties:
   1. Manufacturer's twenty-year warranty covering replacement of defective materials, structural defects and corrosion.
   2. Applicator's five year finish warranty covering refinishing of fluoropolymer coating due to checking, crazing, peeling, chalking or fading.
   3. Installer's five-year warranty covering roofing system installation and watertightness.
   4. All warranties shall commence on Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturer and Type: Berridge Manufacturers (or approved equal) "Zee-Lock", double-seamed, prefinished 24 "galvalume" standing seam metal roofing system in color to match Petersen's Aluminum "Dark Bronze".

B. Other Acceptable Manufacturers (or approved equal):
   1. Berridge Manufacturing Co.
   2. Carlisle Engineered Metals
   3. Merchant & Evans, Inc.
   4. Smith-Steelite, Inc.
   5. Zip-Rib, Inc.

2.2 METAL ROOFING SYSTEM

A. Materials:
   1. Panel Material: ASTM A792, 24 gauge, prefinished “Galvalume” sheet comprised of 55% aluminum, 1.6% silicon and the balance zinc.
   2. Flashing and Flat Stock Material: 24 gauge thickness galvalume of same type and finish as panels.
   3. Finish on Exposed Surfaces: Two coat shop-applied, baked on fluoropolymer coating system based on Elf Arochem “Kynar 500” resin or Ausimont “Hylar 5000” resin (Polyvinylidene fluoride, PVDF), formulated by licensed manufacturer and applied by manufacturer’s approved applicator to meet AAMA Publication 605.2.
      a. Coating System: Minimum 1.3 mil dry film thickness consisting of 0.3 (+ 0.1) mil primer, minimum 1.0 mil color coat. Both color coat and clear top coat containing minimum 70% polyvinylidene fluoride resin by weight; complying with AAMA 1402, Test Method No. 7.
      b. Color: Custom to match Petersen Aluminum “Dark Bronze”.
   4. Finish on Unexposed Interior Face: Neutral wash coat.
   5. Protective Surfacing: Provide strippable plastic film covering on finish surfaces to prevent abrasion during fabrication, storage and handling.

B. Characteristics:
   1. Configuration: Standing seams incorporating mechanically seamed sidelap, concealed anchor clips allowing thermal movement, and of configuration which will prevent entrance or passage of water.
   2. Seam Height: 2 inch minimum.
   3. Panel Width: 16” o.c. between standing seams.
   4. Panel Surface: Smooth.
   5. Stiffener Ribs: 3/8-inch maximum , spaced 4-inches to 6-inches o.c., parallel to seams.
   6. Panel Length: Full length without joints, including bends, where applicable.

C. Accessories:
   1. Anchor Clips: 18 gauge domestic galvanized steel, 33 ksi yield strength, double strength, double fastener with UL imprint, designed to receive recessed mechanical anchor into decking or structural support elements, girts or blocking. Clips shall allow free thermal expansion and contraction movement, relative to structure, within full temperature ranges specified.
   2. Anchors: Noncorrosive cadmium plated hardened self-drilling hexagonal head steel screws designed to meet structural loading requirements.
   3. Exposed Fasteners: Stainless steel self-tapping hexagonal head screws with neoprene sealing washers. #14 size minimum, head finished to match panel color.
   4. Closures: Factory pre-cut closed cell foam complying with ASTM D1056, Grade SCE-41 (EPT), and field fabricated PVC hip closures, enclosed in metal channel matching panels when used at hip and ridge.
   5. Provide all miscellaneous accessories for complete installation. All accessories shall be furnished by roofing system manufacturer.
   6. Building Felt: ASTM D226, Type II, No. 30, asphalt-saturated organic felts.

7. Waterproof Underlayment: Cold-applied, self adhering membrane composed of high strength polyethylene film coated on one side with thick layer of adhesive-consistency rubberized asphalt, fully adhered, 40 mils thick; self-healing.
   a. Protecto Wrap Co. “Jiffy Seal” (or approved equal).
   b. Nord Bitumi US, Inc. “Nordshield Ice and Water Guard” (or approved equal).
   c. W. R. Grace & Co. “Bituthene Ice and Water Shield” (or approved equal).
   d. Polyguard Products, Inc. “Polyguard Deck Guard” (or approved equal).
8. Composite Polyisocyanurate Roof Board Insulation: ASTM C1289, rigid cellular polyisocyanurate thermal insulation classified by facer type as follows:
   a. Facer Type: ASTM C1289, Type V, oriented strand board (OSB), complying with DOC PS2 or APA PRP-108, Exposure 1, 7/16-inch thick on one major surface and Type II, felt or glass-fiber mat on other surface.
   b. Acceptable Products:
      1) Atlas Roofing Corp. “AC Foam Nailbase” (or approved equal).
      2) Celotex Corp. “Hy-Therm Nail-Line Roof Insulation” (or approved equal).
      3) NRG Barriers “Nailboard” (or approved equal).
      4) RMAX, Inc. “RMAX Nailable Base” (or approved equal).

2.3 FABRICATION

A. Prefabricate metal roof panels and flashing components to maximum extent possible, forming metal work with clear, sharp, straight and uniform bends and arrises. Hem exposed edges of flashings.

B. Form flashing components from full single width sheet. Provide shop fabricated, mitered corners, joined using closed end pop rivets and joint sealant.

C. Fabricate roofing and related sheet metal work in compliance with approved shop drawings and applicable standards. Form sheet metal work with clear, sharp, and uniform arrises. Hem exposed edges.

D. Make joints in aluminum sheets using flat-lock seams, ¾-inch in width. Fill seams with exterior sealant.

E. Provide linear sheet metal items in minimum 10’-0” sections except as otherwise noted. Form flashing using single pieces for full width. Provide shop fabricated, mitered joints and corners, with minimum 2’-0” long legs.

F. Clips:
   1. Provide UL listed clip designed to allow panels to thermally expand and contract.
   2. Fabricate clips with embossings that raise underside of panels above substrate to create positive ventilation and eliminate underside-condensation and corrosion.
   3. Fabricate clips with structurally embossed outstanding legs to prevent distortion due to wind uplift forces.

PART 3 - EXECUTION

3.1 DECK PREPARATION

A. Install composite roof board insulation to metal deck with approved noncorrosive mechanical fasteners spaced to meet wind uplift criteria.

B. Apply one layer of 30# felt over plywood and gypsum board deck substrates with horizontal overlaps and end laps staggered between layers.
   1. Lay felt parallel to ridge line with 2-1/2-inch horizontal laps and 6-inch vertical laps.

C. On valleys and ridges and areas where ice and water may stand, install one layer of waterproof underlayment in compliance with manufacturer's printed instructions.

D. Omit felt underlayment at areas of waterproof underlayment. Lap felt underlayment over waterproof underlayment as recommended by manufacturer, but not less than 2-inches.

3.2 ROOFING AND FLASHING INSTALLATION

A. Inspection: Examine alignment and placement of building structure before proceeding with installation of preformed standing seam metal roofing.

B. Install roofing and flashings in compliance with approved shop drawings and within specified erection tolerances.

C. Isolate dissimilar metals and masonry or concrete from metals with bituminous paint, tape, or flexible flashing specified in Section 07600. Use gasketed fasteners where required to prevent corrosive action between fastener, substrate and panels.

D. Use exposed fasteners, prefinished to match finish of panels and trim. Limit exposed fasteners to extent indicated on shop drawings.

E. Anchorage shall allow for temperature expansion/contraction movement within specified range without stress or elongation of panels, clips or anchors. Attach clips to purlins, sleepers or track using self-drilling screws of size and spacing as determined by manufacturer's design analysis to resist specified uplift and thermal movement forces.

F. Seal laps and joints in compliance with roofing system manufacturer's product data.

G. Coordinate flashing and sheet metal work to provide weathertight conditions at roof terminations. Fabricate and install in compliance with standards of SMACNA "Architectural Sheet Metal Manual" and NRCA "Construction Details" using continuous cleats at all exposed edges.

H. Provide for temperature expansion/contraction movement of panels at roof penetrations and roof mounted equipment as recommended by system manufacturer.

I. Installed system shall be true to line and plane and free of dents, oilcans and physical defects.

J. Form joints in linear sheet metal to allow for ½-inch minimum expansion at 12’-0” o.c. maximum and 2’-0” from corners. Provide 1’-0” wide back-up plate at intersections. Form plates to profile of sheet metal item.

K. At joints in linear sheet metal items, set sheet metal over back-up plate in two beads of butyl sealant, ¼-inch in diameter, minimum. Extend sealant over all metal surfaces. Accurately mate components for positive seal. Allow no sealant to migrate onto exposed surfaces.

L. Remove damaged work and replace with new, undamaged components.

M. Applicable Erection Tolerances: Maximum variation from true planes and lines: ¼-inch in 20’-0”, 3/8-inch in 40’-0” or more.

3.3 CLEANING

A. Remove protective film and clean exposed surfaces of preformed roofing and accessories after completion of installation. Leave in clean condition at Date of Substantial Completion. Touch up minor abrasions and scratches in finish to satisfaction of Contracting Officer or authorized representative.

END OF SECTION 07610

SECTION 07920

JOINT SEALANTS

PART 1 - GENERAL

A. Preconstruction Joint-Sealant-Substrate Tests: Submit substrate materials, representative of actual joint surfaces, to joint sealant manufacturer for laboratory testing of joint sealants for adhesion to primed and unprimed substrates and for compatibility with joint substrates and other joint-related materials.

B. Submittals: In addition to Product Data, submit the following:

1. Samples of each type and color of joint sealant required.
2. Test reports for joint sealants evidencing compliance with requirements.

PART 2 - PRODUCTS

A. Elastomeric Sealant Manufacturers: Subject to compliance with requirements, provide sealants by one of the following (or approved equal):

1. Silicone Sealants:
   a. Dow Corning.
   b. GE Silicones.
   c. NUCO Industries, Inc.
   d. Sonneborn Building Products Div., ChemRex Inc.
   e. Tremco.

2. Urethane Sealants:
   a. Polymeric Systems, Inc.
   b. Sonneborn Building Products Div., ChemRex Inc.
   c. Tremco.

B. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by testing and field experience.

C. Colors: Provide colors indicated for exposed joint sealants or, if not indicated, as selected by Contracting Officer or authorized representative from manufacturer's full range for this characteristic.

D. Elastomeric Sealant Standard: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant of base polymer specified below:

1. Low-Modulus Neutral-Curing Silicone Sealant: Type S, Grade NS, Class 25, and as follows:

a. Uses NT, G, A, and O.
b. Additional capability, when tested per ASTM C 719, to withstand the following percentage changes in joint width and still comply with other requirements of ASTM C 920:

1) 100 percent movement in extension and 50 percent movement in compression for a total of 150 percent movement.

c. Applications: Window and door frames, thresholds and lintels.

E. Medium-Modulus Neutral-Curing Silicone Sealant: Type S; Grade NS; Class 25; with the additional capability, when tested per ASTM C 719, to withstand 50 percent movement in both extension and compression for a total of 100 percent movement and still comply with other requirements of ASTM C 920; and as follows:

1. Uses NT, M, G, A, and O.
2. Application: Glazing.

F. High-Modulus Neutral-Curing Silicone Sealant: Type S; Grade NS; Class 25; and as follows:

1. Uses NT, M, G, A, and O.
2. Applications: Galvanized steel and miscellaneous aluminum flashing.
3. Mildew-Resistant Silicone Sealant: Type S; Grade NS; Class 25; Uses NT, G, A, and O; formulated with fungicide; intended for sealing interior joints with nonporous substrates exposed to high humidity and temperature extremes.

G. Single-Component Nonsag Urethane Sealant: Type S; Grade NS; and as follows:

1. Class 25.
2. Uses NT, M, A, and O.
3. Applications: Exterior masonry joints.
4. Latex Sealant: ASTM C 834.

H. Acoustical Sealant for Exposed and Concealed Joints: Nonsag, paintable, nonstaining latex sealant complying with ASTM C 834.

1. Acoustical Sealant for Concealed Joints: Nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission.
2. Sealant Backings, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
3. Cylindrical Sealant Backings: ASTM C 1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
   a. Type O: Open-cell material.

4. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F (minus 32 deg C).
5. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint.
6. Primer: As recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated.

PART 3 - EXECUTION

A. General: Comply with joint sealant manufacturer's instructions for products and applications indicated.

B. Sealant Installation Standard: Comply with ASTM C 1193.

C. Acoustical Sealant Application Standard: Comply with ASTM C 919 for use of joint sealants in acoustical applications.

END OF SECTION 07920

SEYMOUR JOHNSON

Air Force Base

Goldsboro, North Carolina

SPECIFICATIONS

FOR

DATE: March 9, 2001

PROJECT TITLE: CONSTRUCT ADDITION TO PERSONNEL DEPLOYMENT FACILITY

PROJECT NO: VKAG 99-1137

PROJECT MANAGER: Mr. Carl Clayton

PROGRESS BY TEAMWORK

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SECTION 01000

GENERAL

1.1 SCOPE OF WORK: The work covered by this specification consists of furnishing all plant, labor, equipment and material, and performing all work in connection with VKAG 99-1137, CONSTRUCT ADDITION TO PERSONNEL DEPLOYMENT FACILITY, BLDG. 4743 in strict accordance with these specifications and drawings and subject to the terms and conditions of this contract.

1.2 LOCATION: The work is to be accomplished at Seymour Johnson Air Force Base, Goldsboro, North Carolina. This base is accessible by both public highway and railway.

1.3 WORKWEEK: The contractor shall observe the same regular workweek being observed by the Seymour Johnson AFB Civil Engineering shop forces, which is 7:30 a.m. to 4:30 p.m., Monday through Friday, with Federal holidays excluded. Any deviation from this schedule will require 48 hours advance notice and approval of the Contracting Officer.

1.4 PRINCIPLE FEATURES: The work covered by this contract includes, but is not limited to the following:

A. Site demolition, grading, excavation, and building construction including mechanical and electrical systems to Construct Addition to Personnel Deployment Facility.

1.5 HAUL ROUTES: The Contractor shall use the haul routes indicated on the plans.

1.6 DISPOSITION OF NONSALVAGEABLE MATERIALS: All nonsalvageable or unusable material shall be disposed of off base as directed by the Contracting Officer. All waste material generated by any work under this contract shall be handled, transported, stored, and disposed of off base, by the Contractor, in accordance with all applicable federal, state, or local laws, ordinances, regulations, court orders, or other types of rules or rulings having the effect of law.

1.7 DISPOSITION OF SALVAGEABLE MATERIALS: The Contractor shall be required to furnish an itemized listing of materials to be salvaged to the Base Civil Engineering material Control section, located in Bldg 3300, so that an AF Form 1348-1 can be obtained. After receiving this form, all salvable or reusable material will be delivered to the Defense reutilization and Marketing Office, which is located near Bldg 2620 or as directed by Contracting Officer.

1.8 SUBMITTALS REQUIRED: Required submittals are listed on AF Form 66.

1.9 BASE CIVIL ENGINEERING WORK CLEARANCE REQUEST, AF FORM 103: The Contractor shall obtain AF Form 103, Base Civil Engineering Work Clearance Request,

prior to work commencement from the Contract Management Section in Bldg 3300, 1095 Peterson Avenue. Upon receipt of an AF Form 103, the Contractor shall be responsible for locating all base owned underground utilities, as well as, coordinating local utility companies to stake out utilities if not owned by the base. Historical drawings, as-built drawings, and topographic drawings are available for review at the 4th Civil Engineer Squadron, Design element located in Building 3300. Base owned utilities include but are not limited to electric, water, sewer, steam, communication, telephone, fiber optic, cathodic protection, and fuel lines. Utilities not owned by the base include but are not limited to cable TV, Southern Bell Telephone, and Natural Gas. The Contractor shall contact ULOCO and the non-base utility companies for location services. In the event that the Contractor damages a utility which is commented in the plans, record drawings, or located by a utility locator, the Contractor shall repair/replace the utility at no additional cost to the Government. Utilities not documented, shown, or located by a locator shall be considered abandoned or unknown. Contractor damage to unknown or abandoned utilities shall be dealt with as a differing site condition.

1.10 CONSTRAINTS:

A. Building 4743 shall remain open during the construction. The contractor shall schedule work in a manner that will require a minimum of down time and disruptions to the existing facility. Any necessary down time shall be coordinated with Contracting Officer or authorized representative.

B. In the event of military use of the facility, a work stoppage may be required. If this should happen, coordination shall be with Contracting Officer or authorized representative.

1.11 SAFETY: All safety requirements of the U.S. Army Corps of Engineers Safety Manual 385-1-1 dated October 1996 will be strictly adhered to as related to all work covered under these specifications.

1.12 MATERIALS CONTAINING ASBESTOS: In the event the Contractor discovers materials suspected of containing asbestos that is not identified to be removed in the plans and specifications, the Contractor shall notify the Contracting Officer. The Contractor's work shall proceed unless the materials suspected of containing asbestos are damaged or disturbed. Any suspected materials damaged or disturbed by the Contractor without permission from the Contracting Officer shall be removed by the Contractor at his expense IAW all applicable Federal, State, and local laws, ordinances, regulations, court orders, or other types of rules or rulings having the effect of law.

1.13 LABELING OF STORAGE DRUMS: All 55 gallon or larger drums brought on base for use under this contract and containing new material or used for storage of waste materials or hazardous waste must be labeled with a Department of Transportation (DOT) Proper Shipping Name, DOT Hazardous Identification Number, the Contractor's name, a Contractor representative, and the Contractor's telephone number. Label lettering should have a minimum height of one half inch painted in white paint or other color that is in contrast with the color of the drum. The label should be sufficiently

durable to equal or exceed the life (including storage and disposal) of the drum.

1.14 CONTRACTOR STORAGE TRAILER(S) AND BUILDING(S): The Contractor shall place or paint a sign on all of his storage trailer(s) and building(s) used on this contract. At a minimum, the sign shall contain the name of the Contractor and a telephone number at which the Contractor can be reached. The trailer(s) and building(s) shall be complete with gates and/or doors which can be locked. Only material for this project shall be stored in the trailer(s) or building(s). The Contractor shall remove the storage trailer(s) or building(s) within 30 days after completion of the contract and prior to submitting his final invoice. The area around the storage trailer(s) and building(s) shall be kept clean. This includes the mowing of grass during the growing season. The lawn mower shall be supplied by the Contractor.

A. All temporary facilities, enclosures, etc. shall be constructed so as to protect the flight line and aircraft in the event of high winds or inclement weather. Contractor shall be required to at all times to remove any items or construction debris from this project that are dropped or blown onto the flight line and taxiway areas.

B. The Contractor will be given a lot in the Contractor Storage Area behind Bldg 2700 for the life of the contract. The Contractor's progress schedule shall include a line item (equal to 1%) for final cleanup of this storage lot. Final payment will not be made until this final cleanup is performed by the Contractor and accepted by Seymour Johnson AFB.

1.15 PHASING:

A. The 60 days following Contractor's Notice to Proceed (Phase I) will be allowed for delivery of materials, equipment ordering, and submittal approval only. No on-site work shall be permitted by the Contractor during that initial 60 day period.

B. After the submittal phase, Construction Performance Period (Phase II) is 145 days.

1.16 AFFIRMATIVE PROCUREMENT:

A. The contractor shall incorporate Affirmative Procurement requirements as per 40 CFR, Part 247 and Executive Order 13101: "Greening the Government Through Waste Prevention, Recycling and Federal Acquisition." Designated items used in the execution of this contract shall meet or exceed the Environmental Protection Agency's (EPA) requirements for recycled content materials (RCM) as per the EPA's Comprehensive Procurement Guidelines (CPG).

B. The contractor/engineer shall ensure affirmative procurement requirements for CPG items are met or provide written justification that: 1) The price of a given designated item is unreasonably high, 2) There is inadequate competition (not

enough sources of supply), 3) Unusual and unreasonable delays would result from obtaining the item, or 4) The item does not meet the Air Force's performance specifications.

END OF SECTION 01000

SECTION 01560

ENVIRONMENTAL PROTECTION

1.1 DEFINITIONS OF CONTAMINANTS:

A. Sediment: Soil and other debris that has been eroded and transported by runoff water.

B. Solid Waste: Rubbish, debris, garbage, and other discarded solid materials resulting from industrial, commercial, and agricultural operations, and from community activities.

C. Rubbish: A variety of combustible and noncombustible wastes such as paper, boxes, glass, crockery, metal, lumber, cans, and bones.

D. Debris: Includes combustible and noncombustible wastes, such as ashes, waste materials that result from construction or maintenance and repair work, leaves, and tree trimmings.

E. Chemical Wastes: Includes salts, acids, alkalies, herbicides, pesticides, and organic chemicals.

F. Sanitary Waters:

1. Sewage: Wastes characterized as domestic sanitary sewage.
2. Garbage: Refuse and scraps resulting from preparation, cooking, dispensing, and consumption of food.

G. Oily Waste: Includes petroleum products and bituminous materials.

1.2 ENVIRONMENTAL PROTECTION REQUIREMENTS: Provide and maintain during the life of the contract, environmental protection as defined herein. Provide environmental protection measures as required to control pollution that develops during normal construction practice. Provide also environmental protective measures required to correct conditions that develop during the construction of permanent or temporary environmental features associated with the project. Comply with all federal, state, and local regulations pertaining to water, air, and noise pollution. Develop proposals for an environmental protection plan for the project and, prior to the commencement of the work, meet with the Contracting Officer and discuss the proposed environmental protection plan. The meeting shall develop mutual understanding relative to details of environmental protection, including measures for protecting natural resources, required reports, and measures to be taken should the Contractor fail to provide adequate protection in an adequate and timely manner. Perform a preconstruction survey of the

project site to enhance the survey.

1.3 PROTECTION OF NATURAL RESOURCES: The natural resources within the project boundaries and outside the limits of permanent work performed under this contract shall be preserved in their existing condition or restored to an equivalent or improved condition upon completion of the work.

A. Land Resources: Except in areas indicated to be cleared, do not remove, cut, deface, injure, or destroy trees or shrubs without special permission from the Contracting Officer. Do not fasten or attach ropes, cables, or guys to any existing nearby trees for anchorages unless specifically authorized. Where such special emergency use is authorized, the Contractor shall be responsible for any resultant damage.

1. Protection: Protect existing trees which are to remain and which may be injured, bruised, defaced, or other wise damaged by construction operations.
2. Repair or Restoration: Repair or restore to their original condition all trees or other landscape features scarred or damaged by the equipment or operations. Obtain approval of the repair or restoration from the Contracting Officer prior to its initiation.
3. Temporary Construction: Obliterate all signs of temporary construction facilities such as haul roads, work areas, structures, foundations of temporary structures, stockpiles of excess or waste materials, and all other vestiges of construction. Temporary roads, materials, and all other vestiges of construction. Temporary roads, parking areas, and similar temporary use areas shall be graded in conformance with surrounding areas, tilled, and seeded. Include topsoil of nutriment during the seeding operation as necessary to reestablish a suitable stand of grass. The seeding operation shall be as specified in Section 02485.

B. Water Resources: Perform all work in such a manner than any adverse environmental impact on water resources is reduced to a level acceptable to the Contracting Officer.

1. Oily Substances: Take special measures to prevent oily or other hazardous substances from entering the ground, drainage areas, or local bodies of water. Surround all temporary fuel oil, petroleum, or liquid chemical storage tanks with a temporary earth berm of sufficient size and strength to contain the contents of the tanks in the event of content leakage of spillage.

C. Fish and Wildlife Resources: During the performance of the work take such steps as required to prevent interference or disturbance to fish and wildlife. Do not alter water flows or otherwise significantly disturb native habitat adjacent to the project area which are critical to fish and wildlife except as may be indicated or specified.

1.4 EROSION AND SEDIMENT CONTROL MEASURES:

A. Burn-off: Burn-off of ground cover is not permitted.

B. Protection of Erodible Soils: All earthwork brought to final grade shall be immediately finished as indicated or specified. Protect immediate side slopes and backslopes upon completion of rough grading. Plan and conduct all earthwork in such a manner as to minimize the duration of exposure of unprotected soils.

C. Temporary Protection of Erodible Soils. Utilize the following methods to prevent erosion and control sedimentation.

1. Mechanical Retardation and Control of Runoff. Mechanically retard and control the rate of runoff from the construciton site. This includes construction of diversion ditches, benches, and berms, to retard and divert runoff to protected drainage courses.
2. Sediment Basins: Trap sediment in temporary sediment basins. Select basin size to accommodate the runoff of a local 5 year storm. Pump dry and remove accumulated sediment after each storm. Use a paved weir or vertical overflow pipe for overflow. Remove collected sediment from the site. Institute effluent quality monitoring programs as required by state and local environmental agencies.
3. Vegetation and Mulch: Provide temporary protection on all side and back slopes as soon as rough grading is completed or sufficient soil is exposed to require protection to prevent erosion. Such protection shall be by accelerated growth of permanent vegetation, temporary vegetation, mulching, or netting. Stabilize slopes by hydroseeding, anchoring mulch in place, covering with anchored netting, sodding or such combination of these and other methods necessary for effective erosion control.

1.5 CONTROL AND DISPOSAL OF SOLID, CHEMICAL, AND SANITARY WASTES: Pick up solid wastes and place in containers which are emptied by the contractor on a regular schedule. The preparation, cooking, and disposing of food are strictly prohibited on the project site. Conduct handling and disposal of wastes to prevent contamination of the site and other areas. On completion, leave areas clean and natural looking. Obliterate signs of temporary construction and activities incidental to construction of the permanent work in place.

A. Disposal of Rubbish and Debris: Dispose of rubbish and debris in accordance with the requirements specified herein.

1. Removal from Government Property: Remove rubbish and debris from Government property and dispose of it in compliance with federal, state, and local requirements.
2. Chemical Waste: Store chemical waste in corrosion resistant containers labeled to identify type of waste and date filled. Remove containers from the project site, and dispose of chemical waste in accordance with federal, state, and local regulations. For oil and hazardous material spills which may be large enough to violate federal, state, and local regulations, notify the Contracting Officer immediately.

a. Petroleum Products: Conduct fueling and lubricating of equipment and motor vehicles in a manner that affords the maximum protection against spills and evaporation. Dispose of lubricants to be discarded and excess oil in accordance with approved procedures meeting federal, state, and local regulations.

1.6 DUST CONTROL: Keep dust down at all times, including non-working hours, weekends, and holidays. Sprinkle or treat, with dust suppressors, the soil at the site, haul roads, and other areas disturbed by operations. No dry power brooming is permitted. Instead use vacuuming, wet mopping, wet sweeping, or wet power brooming. Air Blowing is permitted only for cleaning nonparticulate debris, such as steel reinforcing bars. No sandblasting is permitted unless dust therefrom is confined. Only wet cutting of concrete blocks, concrete, and asphalt is permitted. No unnecessary shaking of bags is permitted where bagged cement, concrete mortar and plaster is used.

1.7 NOISE: When available, make the maximum use of “low-noise-emission products” as certified by EPA. No blasting or use of explosives is permitted.

END OF SECTION 01560

SECTION 02070

SELECTIVE DEMOLITION

1 GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Demolition and removal of concrete sidewalk and pavement.
2. Demolition and removal of curb and gutter.
3. Repair procedures for selective demolition operations.

1.2 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Excess subbase for fill in pavement area.

C. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.3 MATERIALS OWNERSHIP

A. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain the Government's property, demolished materials shall become Contractor's property and shall be removed from Project site.

1.4 SUBMITTALS

A. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.5 QUALITY ASSURANCE

A. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.

B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

1.6 PROJECT CONDITIONS

A. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.

1. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from authorities having jurisdiction.

B. The Government assumes no responsibility for condition of areas to be selectively demolished.

1. Conditions existing at time of inspection for bidding purpose will be maintained by the Government as far as practical.
2. Before selective demolition, the Government will remove the following items:
   a. Surface equipment and mobile units.
3. Storage or sale of removed items or materials on-site will not be permitted.

C. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

2 PRODUCTS

2.1 REPAIR MATERIALS

A. Use repair materials identical to existing materials.

1. If identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
2. Use materials whose installed performance equals or surpasses that of existing materials.

B. Comply with material and installation requirements specified in individual Specification Sections.

3 EXECUTION

3.1 EXAMINATION

A. Verify that utilities will not be affected by demolition.

B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.

D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to the Contracting Officer or authorized representative.

E. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.2 UTILITY SERVICES

A. Existing Utilities: Maintain services indicated to remain and protect them against damage during selective demolition operations.

B. Do not interrupt existing utilities serving occupied or operating facilities unless authorized in writing by the contracting officer or authorized representative and authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to the contracting officer or authorized representative and to authorities having jurisdiction.

1. Provide at least 72 hours' notice to the Government if shutdown of service is required during changeover.

3.3 PREPARATION

A. Dangerous Materials: Drain, purge, or otherwise remove, collect, and dispose of chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with selective demolition operations.

1. Pest Control: Employ a certified, licensed exterminator to treat building and to control rodents and vermin before and during selective demolition operations.

B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

C. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

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

E. Temporary Partitions: Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise.

F. Temporary Shoring: Provide and maintain exterior shoring, bracing, or structural support to preserve stability and prevent movement, settlement, or collapse of construction to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

3.4 POLLUTION CONTROLS

A. Dust Control: Use water mist, temporary enclosures, and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations.

B. Disposal: Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

C. Cleaning: Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

3.5 SELECTIVE DEMOLITION

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations:

B. Existing Facilities: Comply with building manager's requirements for using and protecting stairs, walkways, loading docks, building entries, and other building facilities during selective demolition operations.

C. Removed and Salvaged Items: Comply with the following:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to the Government.
4. Transport items to the Government's storage area designated by the Government.
5. Protect items from damage during transport and storage.

D. Removed and Reinstalled Items: Comply with the following:

1. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Engineer, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

F. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals, using power-driven saw, then remove concrete between saw cuts.

G. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.

3.6 PATCHING AND REPAIRS

A. General: Promptly repair damage to adjacent construction caused by selective demolition operations.

B. Patching and Repairs: Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials.

C. Finishes: Restore exposed finishes of patched areas and extend restoration into adjoining construction in a manner that eliminates evidence of patching and refinishing.

D. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an

even-plane surface of uniform appearance.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off the Government's property and legally dispose of them.

END OF SECTION 02070

SECTION 02230

SITE CLEARING

1 GENERAL

A. Materials Ownership: Except for materials indicated to be stockpiled or to remain Government's property, cleared materials shall become Contractor's property and shall be removed from the site.

B. Traffic: Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from the Government and authorities having jurisdiction.

1.2 PRODUCTS

A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Division 2 Section "Earthwork."

1. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.

1.3 EXECUTION

A. Locate and clearly flag trees and vegetation to remain or to be relocated.

B. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to the Government.

C. Erect and maintain a temporary fence around drip line of individual trees or around perimeter drip line of groups of trees to remain. Remove fence when construction is complete.

1. Where excavation for new construction is required within drip line of trees, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.

D. Do not excavate within drip line of trees, unless otherwise indicated.

E. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by the Contracting Officer or authorized representative.

F. Utilities: Locate, identify, disconnect, and seal or cap off utilities indicated to be removed. Do not interrupt utilities serving facilities occupied by the Government or others unless permitted. Arrange to provide temporary utility services.

1. Excavate for and remove underground utilities indicated to be removed.

G. Clearing and Grubbing: Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction. Removal includes digging out stumps and obstructions and grubbing roots.

1. Fill depressions with satisfactory soil material. Place fill material in horizontal layers not exceeding 8-inch (200-mm) loose depth, and compact each layer to a density equal to adjacent original ground.

H. Topsoil Stripping: Remove sod and grass before stripping topsoil. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.

I. Site Improvements: Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.

J. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials, including trash and debris, and legally dispose of them off the Government's property.

END OF SECTION 02230

SECTION 02300

EARTHWORK

1.1 GENERAL

A. Definitions in this Section include the following:

1. Backfill: Soil materials used to fill an excavation.
2. Base Course: Layer placed between the subbase course and asphalt paving.
3. Bedding Course: Layer placed over the excavated subgrade in a trench before laying pipe.
4. Borrow: Satisfactory soil imported from off-site for use as fill or backfill.
5. Drainage Course: Layer supporting slab-on-grade used to minimize capillary flow of pore water.
6. Excavation: Removal of material encountered above subgrade elevations.
   a. Additional Excavation: Excavation below subgrade elevations as directed by Contracting Officer or authorized representative. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
   b. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated dimensions without direction by Contracting Officer or authorized representative. Unauthorized excavation, as well as remedial work directed by Contracting Officer or authorized representative, shall be without additional compensation.
7. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
8. Subbase Course: Layer placed between the subgrade and base course for asphalt paving, or layer placed between the subgrade and a concrete pavement or walk.
9. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.
10. Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

B. Existing Utilities: Do not interrupt utilities serving facilities occupied by the Government or others unless permitted in writing by the Contracting Officer or authorized representative and then only after arranging to provide temporary utility services according to requirements indicated.

1.2 PRODUCTS

A. Soil Materials: Provide borrow soil materials when sufficient satisfactory soil

materials are not available from excavations.

B. Satisfactory Soils: ASTM D 2487 soil classification groups GW, GP, GM, SW, SP, and SM, or a combination of these group symbols; free of rock or gravel larger than 3 inches (75 mm) in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: ASTM D 2487 soil classification groups GC, SC, ML, MH, CL, CH, OL, OH, and PT, or a combination of these group symbols.

D. Backfill and Fill: Satisfactory soil materials.

E. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch (38-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

F. Bedding: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch (25-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

G. Drainage Fill: Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch (38-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.

H. Detectable Warning Tape: Polyethylene film warning tape encasing a metallic core, minimum 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility.

1.3 EXECUTION

A. Preparation: Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Provide erosion- and sedimentation-control measures.

C. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

D. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

E. Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered, including rock, soil materials, and obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

F. Excavate for structures, pavements, and walks to indicated elevations and dimensions. Extend excavations for placing and removing concrete formwork, for installing services and other construction, and for inspections. Trim bottoms to required lines and grades to leave solid base to receive other work.

G. Excavate utility trenches to indicated gradients, lines, depths, and invert elevations of uniform widths to provide a working clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit.

1. Excavate trenches deeper than bottom of pipe elevation, 6 inches (150 mm) deeper in rock, 4 inches (100 mm) deeper elsewhere, to allow for bedding course. Hand excavate for bell of pipe.

H. Proof roll subgrades, before filling or placing aggregate courses, with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof roll wet or saturated subgrades.

I. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities.

J. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill may be used when approved by Contracting Officer or authorized representative.

1. Fill unauthorized excavations under other construction or utility pipe as directed by the Contracting Officer or authorized representative.

K. Stockpile borrow materials and satisfactory soil materials, without intermixing, in shaped, graded, drained, and covered stockpiles. Stockpile soil materials away from edge of excavations and outside drip line of remaining trees.

L. Utility Trench Backfill: Place, compact, and shape bedding course to provide continuous support for pipes and conduits over rock and other unyielding bearing surfaces and to fill unauthorized excavations.

1. Place and compact initial backfill of satisfactory soil material or subbase material, free of particles larger than 1 inch (25 mm), to a height of 12 inches (300 mm) over the utility pipe or conduit. Place and compact final backfill of satisfactory soil material to final subgrade.
2. Install warning tape directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

M. Fill: Place and compact fill material in layers to required elevations.

N. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 2 percent of optimum moisture content.

1. Remove and replace, or scarify and air-dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

O. Compaction: Place backfill and fill materials in layers not more than 8 inches (200 mm) in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches (100 mm) in loose depth for material compacted by hand-operated tampers.

P. Compact soil to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches (300 mm) of existing subgrade and each layer of backfill or fill material at 95 percent.
2. Under walkways, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill material at 92 percent.
3. Under lawn or unpaved areas, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill material at 85 percent.

Q. Grading: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated. Grade lawns, walks, and unpaved subgrades to tolerances of plus or minus 1/2 inch (13 mm) and pavements and areas within building lines to plus or minus 1/2 inch (13 mm).

R. Subbase and Base Courses: Under pavements and walks, place subbase course on prepared subgrade. Place base course material over subbase. Compact to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

S. Under slabs-on-grade, place drainage course on prepared subgrade. Compact to required cross sections and thickness to not less than 95 percent of maximum

dry unit weight according to ASTM D 698.

T. Testing Agency: Contractor will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.

1. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.
2. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

U. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction.

V. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

W. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off the Government's property.

END OF SECTION 02300

SECTION 02511

HOT-MIX ASPHALT PAVING

1.1 GENERAL

A. Submittals: Product Data, material certificates, and the following:

1. Job-Mix Designs: For each job mix proposed for the Work.

B. Installer Qualifications: Engage an experienced installer who has completed hot-mix asphalt paving similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

C. Manufacturer Qualifications: Manufacturer of hot-mix asphalt shall be a registered and approved paving mix manufacturer with authorities having jurisdiction or with the NCDOT.

D. Regulatory Requirements: Conform to applicable standards of authorities having jurisdiction for asphalt paving work on public property.

E. Asphalt-Paving Publication: Comply with AI's "The Asphalt Handbook," except where more stringent requirements are indicated.

F. Environmental Limitations: Do not apply asphalt materials if substrate is wet or excessively damp or if the following conditions are not met:

1. Prime and Tack Coats: Minimum surface temperature of 60 deg F (15.5 deg C).
2. Asphalt Base Course: Minimum surface temperature of 40 deg F (4 deg C) and rising at time of placement.
3. Asphalt Surface Course: Minimum surface temperature of 60 deg F (15.5 deg C) at time of placement.

G. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F (4 deg C) for oil-based materials, 50 deg F (10 deg C) for water-based materials, and not exceeding 95 deg F (35 deg C).

1.2 PRODUCTS

A. Coarse Aggregate: Sound; angular crushed stone; crushed gravel; or properly cured, crushed blast-furnace slag; complying with ASTM D 692.

B. Fine Aggregate: Sharp-edged natural sand or sand prepared from stone; gravel, properly cured blast-furnace slag, or combinations thereof; complying with ASTM D 1073.

C. Mineral Filler: Rock or slag dust, hydraulic cement, or other inert material complying with ASTM D 242.

D. Asphalt Cement: ASTM D 3381 for viscosity-graded material; ASTM D 946 for penetration-graded material.

E. Prime Coat: ASTM D 2027; medium-curing cutback asphalt; MC-30, MC-70, or MC-250.

F. Prime Coat: Asphalt emulsion prime conforming to state DOT requirements.

G. Tack Coat: ASTM D 977, emulsified asphalt or ASTM D 2397, cationic emulsified asphalt, slow setting, factory diluted in water, of suitable grade and consistency for application.

H. Herbicide: Commercial chemical for weed control, registered by Environmental Protection Agency (EPA). Provide granular, liquid, or wettable powder form.

I. Pavement-Marking Paint: Alkyd-resin type, ready-mixed, complying with FS TT-P-115, Type I, or AASHTO M-248, Type N.

J. Pavement-Marking Paint: Latex, water-base emulsion, ready-mixed, complying with FS TT-P-1952.

K. Wheel Stops: Precast, air-entrained concrete, 2500-psi (17.2-MPa) minimum compressive strength, approximately 6 inches (150 mm) high, 9 inches (225 mm) wide, and 84 inches (2130 mm) long. Provide chamfered corners and drainage slots on underside, and provide holes and galvanized steel dowels for anchoring to substrate.

L. Hot-Mix Asphalt: Provide dense, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction; designed according to procedures in AI's "Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types"; and complying with the following requirements:

1. Base Course: As indicated.
2. Surface Course: As indicated.

1.3 EXECUTION

A. Proof-roll subbase using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.

   1. Before placing asphalt materials, remove loose and deleterious material from substrate surfaces.

B. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions.

C. Prime Coat: Apply uniformly over surface of compacted-aggregate base at a rate of 0.15 to 0.50 gal./sq. yd. (0.7 to 2.3 L/sq. m). Apply enough material to penetrate and seal, but not flood, surface. Allow prime coat to cure for 72 hours minimum.

D. Tack Coat: Apply uniformly to existing surfaces of previously constructed asphalt or portland cement concrete paving and to surfaces abutting or projecting into new, hot-mix asphalt pavement. Apply at a uniform rate of 0.05 to 0.15 gal./sq. yd. (0.2 to 0.7 L/sq. m) of surface. Allow tack coat to cure undisturbed before paving.

   1. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

E. Machine place base and surface courses of hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness, when compacted.

F. Promptly correct surface irregularities in paving course behind paver. Remove excess material and fill depressions with hot-mix asphalt.

G. Construct joints to ensure continuous bond between adjoining paving sections. Construct joints free of depressions with same texture and smoothness as other sections of hot-mix asphalt course.

H. Compact each hot-mix asphalt course to an average density of 96 percent of reference laboratory density according to ASTM D 1559, but not less than 94 percent nor greater than 100 percent, and to the following tolerances:

   1. Thickness: Base course, plus or minus 1/2 inch (13 mm); surface course, plus 1/4 inch (6 mm), no minus.
   2. Surface Smoothness: Base course, 1/4 inch (6 mm); surface course, 1/8 inch (3 mm).

I. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt compacted by rolling to specified density and surface smoothness.

J. Apply pavement-marking paint with mechanical equipment to produce pavement markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils (0.4 mm).

K. Securely attach wheel stops into pavement with not less than 2 galvanized steel dowels embedded in precast concrete at one-third points. Firmly bond each dowel to wheel stop and to pavement.

END OF SECTION 02511

SECTION 02530

SANITARY SEWERAGE

1.1 GENERAL

A. Submit Product Data for pipe and cleanouts.

B. Submit Shop Drawings for precast concrete manholes, including frames and covers.

1.2 PRODUCTS

A. Piping Materials: Refer to "Piping Applications" Paragraph for applications.

1. PVC Sewer Pipe and Fittings: ASTM D 3034, SDR 35, for gasketed joints.
   a. Gaskets: ASTM F 477, elastomeric seals.
2. Sleeve-Type Pipe Couplings: ASTM C 1173, rubber or elastomeric sleeve and band assembly fabricated to mate with OD of pipes to be joined, for nonpressure joints.
3. Ductile Iron Casing Pipe: Provide 12” diameter, plain-beveled end ductile iron pipe in accordance with ANSI/AWWA C151/A21.51, Thickness Class 50.

B. Concrete: Cast in place according to ACI 318, ACI 350R, and the following:

1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

C. Portland Cement Design Mix: 4000 psi (27.6 MPa) minimum, with 0.45 maximum water-cementitious materials ratio.

1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60 (Grade 400), deformed steel.

D. Structure Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi (27.6 MPa) minimum, with 0.45 maximum water-cementitious materials ratio. Include channels and benches in manholes.

1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
   a. Invert Slope: 1 percent through manhole.
   b. Invert Slope: 2 percent through manhole.

2. Benches: Concrete, sloped to drain into channel.
   a. Slope: 8 percent.
   b. Slope: 4 percent.

E. Ballast: Portland cement design mix, 3000 psi (20.7 MPa) minimum, with 0.58 maximum water-cementitious materials ratio.

1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60 (Grade 400), deformed steel.

F. Protective Coatings: One- or two-coat, coal-tar epoxy; 15-mil (0.38-mm) minimum thickness, unless otherwise indicated; factory or field applied to the following surfaces:

1. Concrete Manholes: On exterior and interior surfaces.
2. Manhole Frames and Covers: On entire surfaces.

G. PVC Cleanouts: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

1.3 EXECUTION

A. Excavating, trenching, and backfilling are specified in Division 2 Section "Earthwork."

B. Identification: Materials and their installation are specified in Division 2 Section "Earthwork." Arrange for installing green warning tapes directly over piping and at outside edges of underground structures.

1. Use detectable warning tape over nonferrous piping and over edges of underground structures.

C. Piping Applications: Include watertight joints.

1. NPS 8 (DN200): PVC sewer pipe and fittings, gaskets, and gasketed joints.

D. Sleeve-Type Pipe Couplings: Use where required to join piping and no other appropriate method is specified. Do not use instead of specified joining methods.

E. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewerage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical.

F. Install piping beginning at low point, true to grades and alignment indicated with

unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements. Maintain swab or drag in line, and pull past each joint as it is completed.

G. Use proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

H. Butt-weld casing pipe sections and remove interior burrs and beads to provide a smooth interior surface to insert 8-inch diameter PVC gravity sanitary sewer pipe at proposed grade.

I. Install gravity-flow piping and connect to building's sanitary drains, of sizes and in locations indicated. Terminate piping as indicated.

1. Install 8” piping pitched down in direction of flow, at minimum slope of 0.4 percent, unless otherwise indicated.

J. Extend sanitary sewerage piping and connect to building's sanitary drains, of sizes and in locations indicated. Terminate piping as indicated.

K. Pipe Joint Construction and Installation: Join and install pipe and fittings according to installations indicated.

1. PVC Sewer Pipe and Fittings: As follows:
   a. Join pipe and gasketed fittings with gaskets according to ASTM D 2321.
   b. Install according to ASTM D 2321.
2. Join piping made of different materials or dimensions with couplings made for this application. Use couplings that are compatible with and that fit both systems' materials and dimensions.

L. Concrete Placement: Place cast-in-place concrete according to ACI 318 and ACI 350R.

M. Make connections to existing piping and underground structures so finished Work complies as nearly as practical with requirements specified for new Work.

N. Protect existing piping and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

O. Clear interior of piping and structures of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is

completed.

1. Place plug in end of incomplete piping at end of day and when work stops.
2. Flush piping between manholes and other structures to remove collected debris, if required by authorities having jurisdiction.

P. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches (600 mm) of backfill is in place, and again at completion of Project.

1. Defects requiring correction include the following:
   a. Alignment: Less than full diameter of inside of pipe is visible between structures.
   b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
   c. Crushed, broken, cracked, or otherwise damaged piping.
   d. Infiltration: Water leakage into piping.
   e. Exfiltration: Water leakage from or around piping.
2. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
3. Reinspect and repeat procedure until results are satisfactory.

Q. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. Submit separate reports for each test.
5. If authorities having jurisdiction do not have published procedures, perform tests as follows:
   a. Sanitary Sewerage: Perform hydrostatic test.

      1) Allowable leakage is maximum of 50 gal. per inch of nominal pipe size per mile (4.6 L per millimeter of nominal pipe size per kilometer) of pipe, during 24-hour period.
      2) Close openings in system and fill with water.
      3) Purge air and refill with water.
      4) Disconnect water supply.
      5) Test and inspect joints for leaks.
      6) Option: Test ductile-iron piping according to AWWA C600, Section "Hydrostatic Testing." Use test pressure of at least 10 psig (69 kPa).
   b. Sanitary Sewerage: Perform air test according to UNI-B-6.
6. Leaks and loss in test pressure constitute defects that must be repaired.
7. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

END OF SECTION 02530

SECTION 02630

STORM DRAINAGE

1.1 GENERAL

A. Submit Product Data for backwater valves, cleanouts, and drains.

B. Submit Shop Drawings for precast concrete manholes and catch basins.

1.2 PRODUCTS

A. Piping Materials: Refer to "Piping Applications" Paragraph for applications.

1. Tongue and Groove, Reinforced Concrete Pipe: ASTM C 76, CSR Hydro Conduit or approved equal.
   a. Gaskets: ASTM C 564, rubber, compression type, thickness to match class of pipe.

B. Curb Inlets: Made with vertical curb opening, of materials and dimensions according to utility standards.

C. Concrete: Cast in place according to ACI 318, ACI 350R, and the following:

1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

D. Portland Cement Design Mix: 4000 psi (27.6 MPa) minimum, with 0.45 maximum water-cementitious materials ratio.

1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60 (Grade 400), deformed steel.

E. Ballast: Portland cement design mix, 3000 psi (20.7 MPa) minimum, with 0.58 maximum water-cementitious materials ratio.

1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60 (Grade 400), deformed steel.

F. Protective Coatings: One- or two-coat, coal-tar epoxy; 15-mil (0.38-mm) minimum thickness, unless otherwise indicated; factory or field applied to the following surfaces:

1. Concrete Catch Basins: On exterior and interior surfaces.
2. Catch Basin Frames and Grates: On entire surfaces.

G. PVC Cleanouts: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

1.3 EXECUTION

A. Excavating, trenching, and backfilling are specified in Division 2 Section "Earthwork."

B. Identification: Materials and their installation are specified in Division 2 Section "Earthwork." Arrange for installing green warning tapes directly over piping and at outside edges of underground structures.

1. Use warning tape or detectable warning tape over ferrous piping.
2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

C. Piping Applications: Include watertight, silttight, or soiltight joints.

1. NPS 18 to NPS 36 (DN450 to DN900): PVC sewer pipe and fittings, gaskets, and gasketed joints.

D. Sleeve-Type Pipe Couplings: Use where required to join piping and no other appropriate method is specified. Do not use instead of specified joining methods.

E. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical.

F. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab or drag in line, and pull past each joint as it is completed.

G. Use manholes for changes in direction, unless fittings are indicated. Use fittings for branch connections, unless direct tap into existing sewer is indicated.

H. Use proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

I. Install gravity-flow piping and connect to building's storm drains, of sizes and in locations indicated. Terminate piping as indicated.

1. Install piping pitched down in direction of flow, at minimum slope of 1 percent, unless otherwise indicated.
2. Install piping with 36-inch (1000-mm) minimum cover.

J. Extend storm drainage piping and connect to building's storm drains, of sizes and in locations indicated. Terminate piping as indicated.

K. Pipe Joint Construction and Installation: Join and install pipe and fittings according to installations indicated.

1. PVC Sewer Pipe and Fittings: As follows:
   a. Join pipe and gasketed fittings with gaskets according to ASTM D 2321.
   b. Install according to ASTM D 2321.
2. Join piping made of different materials or dimensions with couplings made for this application. Use couplings that are compatible with and that fit both systems' materials and dimensions.

L. Catch-Basin Installation: Set frames and grates to elevations indicated.

M. Concrete Placement: Place cast-in-place concrete according to ACI 318 and ACI 350R.

N. Install cleanouts and riser extension from sewer pipe to cleanout at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

1. Set cleanout frames and covers in earth in cast-in-place concrete block, 18 by 18 by 12 inches (450 by 450 by 300 mm) deep. Set with tops 1 inch (25 mm) above surrounding grade.
2. Set cleanout frames and covers in concrete pavement with tops flush with pavement surface.

O. Install drains in locations indicated.

1. Embed drains in 4-inch (100-mm) minimum depth of concrete around bottom and sides.
2. Set drain frames and covers with tops flush with pavement surface.

P. Make connections to existing piping and underground structures so finished Work complies as nearly as practical with requirements specified for new Work.

Q. Protect existing piping and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that

may accumulate.

R. Clear interior of piping and structures of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed.

1. Place plug in end of incomplete piping at end of day and when work stops.
2. Flush piping between manholes and other structures to remove collected debris, if required by Contracting Officer or authorized representative.

S. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches (600 mm) of backfill is in place, and again at completion of Project.

1. Defects requiring correction include the following:
   a. Alignment: Less than full diameter of inside of pipe is visible between structures.
   b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
   c. Crushed, broken, cracked, or otherwise damaged piping.
   d. Infiltration: Water leakage into piping.
   e. Exfiltration: Water leakage from or around piping.
2. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
3. Reinspect and repeat procedure until results are satisfactory.

END OF SECTION 02630

SECTION 02751

CEMENT CONCRETE PAVEMENT

1.1 GENERAL

A. Submittals: In addition to Product Data, submit design mixes for each concrete pavement mix.

1. Submit material certificates signed by manufacturers certifying that each concrete material complies with requirements.

B. Quality Assurance: Comply with ACI 301, "Specification for Structural Concrete," unless modified by the requirements of the Contract Documents.

1. Installer Qualifications: An experienced installer who has completed pavement work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
2. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.

1.2 PRODUCTS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.

B. Steel Reinforcement Materials: As follows:

1. Plain-Steel Welded Wire Fabric: ASTM A 185, flat sheets.
2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
3. Plain Steel Wire: ASTM A 82, as drawn.
4. Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening steel reinforcement; manufactured according to CRSI's "Manual of Standard Practice"

C. Synthetic Fiber:

1. Fibrillated or monofilament polypropylene fibers engineered and designed for use in concrete, complying with ASTM C 1116, Type III, ½ to 1-1/2 inches long. Uniformly disperse in concrete mix at manufacturer’s recommended rate, but not less than 1.5 lb/cu. yd.

D. Concrete Materials: As follows:

1. Portland Cement: ASTM C 150, Type I.

a. Fly Ash: ASTM C 618, Type F. Fly ash shall be obtained from one source for the concrete delivered to the project and not exceed 20 percent of the total cementitous material.

2. Aggregate: ASTM C 33, uniformly graded, from a single source.
3. Water: ASTM C 94.

E. Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cement and to be compatible with other admixtures, as follows:

1. Air-Entraining Admixture: ASTM C 260.
2. Water-Reducing Admixture: ASTM C 494, Type A.
3. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
4. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.
5. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.

F. Curing Materials: As follows:

1. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) dry.
2. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
3. Water: Potable.
4. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
5. Clear Solvent-Borne Liquid-Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.
6. Clear Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

G. Related Materials: As follows:

1. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

H. Concrete Mixes: Prepare design mixes, proportioned according to ACI 211.1 and ACI 301, with the following properties:

1. Compressive Strength (28 Days): 4500 psi.
2. Maximum Water-Cementitious Materials Ratio: 0.50.
3. Slump Limit: 4 inches.
4. Air Content: 4.5 to 7.5 percent.

I. Ready-Mixed Concrete: Comply with requirements and with ASTM C 94.

1.3 EXECUTION

A. Surface Preparation: Proof-roll prepared subbase, and remove loose material from surface.

B. Forms: Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations.

C. Joints: Locate and install construction, isolation, contraction, and expansion joints as indicated.

D. Concrete Placement: Comply with recommendations in ACI 304R for measuring, mixing, transporting, and placing concrete. Place concrete in a continuous operation within planned joints or sections.

1. Moisten subbase to provide a uniform dampened condition at time concrete is placed.
2. Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping according to recommendations in ACI 309R.
3. Screed and initial-float concrete surfaces with darby or bull float before excess moisture or bleed water appears on the surface.
4. Protect concrete from cold or hot weather during mixing, placing, and curing.

E. Evaporation Retarder: Apply to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

F. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and the concrete surface has stiffened sufficiently to permit operations. Float surfaces to true planes with gaps below 10-foot-long, unleveled straightedge not to exceed 1/4 inch. Cut down high spots, and fill low spots. Refloat surface immediately to uniform granular texture.

1. Medium-to-Fine-Textured Broom Finish: Draw a soft bristle broom across float-finished concrete surface, perpendicular to line of traffic, to provide a uniform, fine-line texture.

G. Curing: Begin curing after finishing concrete, but not before free water has disappeared from concrete surface. Cure concrete by one or a combination of the following methods:

1. Moisture cure concrete by water, continuous fog spray, continuously wet absorptive cover, or by moisture-retaining-cover curing. Keep surfaces continuously moist for not less than seven days.
2. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

H. Remove and replace concrete pavement that is broken, damaged, or defective,

or does not meet requirements in this Section.

I. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement.

J. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 02751

SECTION 02764

PAVEMENT JOINT SEALANTS

1.1 GENERAL

A. Preconstruction Joint-Sealant-Substrate Tests: Submit substrate materials, representative of actual joint surfaces, to joint sealant manufacturer for laboratory testing of joint sealants for adhesion to primed and unprimed substrates and for compatibility with joint substrates and other joint-related materials.

B. Submittals: In addition to Product Data, submit the following:

1. Samples of each type and color of joint sealant required.
2. Certified test reports for joint sealants evidencing compliance with requirements.

1.2 PRODUCTS

A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by testing and field experience.

B. Colors: Provide color indicated for exposed joint sealants or, if not indicated, as selected by Contracting Officer or Authorized Representative from manufacturer’s full range for this characteristic.

C. Cold-Applied Joint Sealants: Provide manufacturer's standard products complying with the following requirements:

1. Multicomponent Jet-Fuel-Resistant Sealant for Concrete: Pourable, chemically curing elastomeric formulation complying with the following requirements for formulation and with ASTM C 920 for type, grade, class, and uses indicated.
   a. Urethane Formulation: Type M; Grade P; Class 12-1/2; Uses T, M, and as applicable to joint substrates indicated, O.
   b. Coal-Tar-Modified Polymer Formulation: Type M; Grade P; Class 25; Uses T and as applicable to joint substrates indicated, O.
   c. Bitumen-Modified Urethane Formulation: Type M; Grade P; Class 25; Uses T, M. and ass applicable to joint substrates indicated, O.

D. Joint-Sealant Backer Materials: Nonstaining; compatible with joint substrates, sealants, primers and other joint fillers; and approved for applications indicated by joint sealant manufacturer based on field experience and laboratory testing.

1. Round Backer Rod for Cold- and Hot-Applied Sealants: ASTM D 5249,

Type 1, of diameter and density required to control sealant depths and prevent bottom-side adhesion of sealant.

E. Primers: As recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

1.3 EXECUTION

A. General: Comply with joint sealant manufacturer's written instructions applicable to products and applications indicated.

B. Provide recessed joint configuration for silicone sealants of recess depth 1/8” and at locations indicated.

END OF SECTION 02764

SECTION 02920

LAWNS AND GRASSES

1.1 GENERAL

A. Submittals: In addition to Product Data for each type of product indicated, submit a planting schedule indicating anticipated planting dates.

B. Topsoil Analysis: Furnish soil analysis by a qualified soil-testing laboratory.

C. Lawn Maintenance: Begin maintenance immediately after each area is planted and continue until acceptable lawn is established, but for not less than the following periods:

1. Seeded Lawns: 60 days from date of Substantial Completion.
2. Mow lawn as soon as top growth is tall enough to cut. Remove no more than 40 percent of grass-leaf growth in initial or subsequent mowings.

1.2 PRODUCTS

A. Seed Species: Tall Fescue.

B. Topsoil: ASTM D 5268, pH range of 5.5 to 7, a minimum of 4 percent organic material content; free of stones 1 inch (25 mm) or larger in any dimension and other extraneous materials harmful to plant growth.

1. Topsoil Source: Reuse surface soil stockpiled on-site and supplement with imported or manufactured topsoil from off-site sources when quantities are insufficient. Verify suitability of stockpiled surface soil to produce topsoil.

C. Fertilizer:

1. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in composition suitable for site conditions.

D. Mulches:

1. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

1.3 EXECUTION

A. Newly Graded Subgrades: Loosen subgrade to a minimum depth of 4 inches. Remove stones larger than 2 inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off the Government's property.

1. Apply fertilizer (if needed) directly to subgrade before loosening.

B. Unchanged Subgrades: If lawns are to be planted in areas unaltered or undisturbed by excavating, grading, or surface soil stripping operations, prepare surface soil as follows:

1. Remove existing grass, vegetation, and turf. Do not mix into surface soil.
2. Loosen surface soil to a depth of at least of 6 inches. Apply fertilizer and mix thoroughly into top 4 inches of soil. Till soil to a homogeneous mixture of fine texture.
3. Remove stones larger than 2 inches in any dimension and sticks, roots, trash, and other extraneous matter.
4. Legally dispose of waste material, including grass, vegetation, and turf, off the Government's property.

C. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1 inch of finish elevation.

D. Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

E. Restore areas if eroded or otherwise disturbed after finish grading and before planting.

F. Seeding: Sow seed at the rate located on Seeding Schedule shown on Drawing C2.

1. Rake seed lightly into top 1/8 inch of topsoil, roll lightly, and water with fine spray.
2. Protect seeded areas with slopes not exceeding 1:6 by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre to form a continuous blanket 1-1/2 inches in loose depth over seeded areas. Spread by hand, blower, or other suitable equipment.
3. Protect seeded areas from hot, dry weather or drying winds within 24 hours after completing seeding operations. Soak and scatter uniformly to a depth of 3/16 inch and roll to a smooth surface.

G. Satisfactory Seeded Lawn: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 5 by 5 inches.

H. Reestablish lawns that do not comply with requirements and continue maintenance until lawns are satisfactory.

END OF SECTION 02920

SECTION 03300

CAST-IN-PLACE CONCRETE

1.1 GENERAL

A. Submittals: In addition to Product Data, submit design mixes and the following for each concrete mix:

1. Shop Drawings detailing fabrication, bending, and placement.
2. Material certificates signed by product manufacturers certifying that product complies with requirements.

B. Quality Assurance: Comply with ACI 301, "Specification for Structural Concrete," and ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

1. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.

1.2 PRODUCTS

A. Steel Reinforcement: As follows:

1. Reinforcing Bars: ASTM A 615, Grade 60, deformed.
2. Plain-Steel Wire: ASTM A 82, as drawn.

B. Synthetic Fiber:

1. Fibrillated or monofilament polypropylene fibers engineered and designed for use in concrete, complying with ASTM C 1116, Type III, ½ to 1-1/2 inches long. Uniformly disperse in concrete mix at manufacturer's recommended rate, but not less than 1.5 lb/cu. yd.

C. Concrete Materials: As follows:

1. Portland Cement: ASTM C 150, Type I.
2. Aggregate: ASTM C 33, uniformly graded, from a single source throughout the project.
3. Water: ASTM C 94, shall be clean, fresh, free from oil, organic matter, or other deleterious substances.
4. Air-Entraining Admixture: ASTM C 260, Products shall be (or approved equal):
   a. Air-Mix or AEA 92 by the Euclid Chemical Company.
   b. MB-VR by Master Builders.
   c. Darex Series or Daravair Series by W.R. Grace & Co.
5. Water-Reducing Admixture: ASTM C 494, Type A. Shall not contain more chloride ions than are present in municipal drinking water. Products

shall be (or approved equal):

a. Eucon WR-75 by The Euclid Chemical Company.
b. Pozzolith 200N by Master Builders.
c. WRDA Series by W.R. Grace & Co.

6. High-Range, Water-Reducing Admixture (Superplasticizer): ASTM C 494, Type F. Shall not contain more chloride ions than are present in municipal drinking water. Products shall be (or approved equal):
   a. Eucon 37 by The Euclid Chemical Company.
   b. Rheobuild 1000 by Master Builders.
   c. ADVA Series or Davacon Series by W.R. Grace & Co.
7. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E. Shall not contain more chloride ions than are present in municipal drinking water. The admixture manufacturer must have long-term non-corrosive test data from an independent testing laboratory (of at least a year's duration) using an acceptable accelerated corrosion test method such as that using electrical potential measures. Products shall be (or approved equal):
   a. Accelguard 80 by The Euclid Chemical Company.
   b. Polarset or Lubricon NCA by W. R. Grace Company.
8. Water-Reducing and Retarding Admixture: ASTM C 494, Type D. Water Reducing, Retarding Admixture: Shall not contain more chloride ions than are present in municipal drinking water. Products shall be (or approved equal):
   a. Eucon Retarder-75 by The Euclid Chemical Company.
   b. Possolith 100XR by Master Builders.
   c. Daratard-17 by W.R. Grace & Co.
9. Fly Ash: ASTM C 618, Type F. Fly ash shall be obtained from one source for the concrete delivered to the project and not exceed 20 percent of the total cementitous material.

D. Related Materials: As follows:

1. Self-Expanding Strip Waterstops: Rectangular or trapezoidal strip, sodium bentonite or other hydrophylic material.
2. Vapor Retarder: Polyethylene sheet, ASTM D 4397, thickness on Drawings.
3. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
4. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
5. Epoxy-Bonding Adhesive: ASTM C 881, two-component epoxy resin, of type, class, and grade to suit requirements.

E. Curing Materials: As follows:

1. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
2. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) dry.
3. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

4. Clear, Solvent-Borne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.
5. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.
6. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
7. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

F. Concrete Mixes: Prepare design mixes, proportioned according to ACI 211.1 and ACI 301, with the following properties:

1. Compressive Strength (28 Days): 3,000 psi or as indicated on Drawings.
2. Slump: 3 to 4 inches.
3. Air Content: 4.5 to 7.0 percent for all exterior concrete subject to freezing and thawing.

G. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, and furnish batch ticket information.

H. Non-shrink Grout:

1. The non-shrink grout shall be:
   a. Euco NS by The Euclid Chemical Company.
   b. Five Star Grout by the U.S. Grout Corporation.

   The factory pre-mixed grout shall conform to ASTM C1107, “Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink).” In addition, the grout manufacturer shall furnish test data from an independent laboratory indicating that the grout when placed at a fluid consistency shall achieve 95 percent bearing under a 4' x 4' base plate.

2. The high flow grout shall be used where high fluidity and/or increase placing time is required. Products shall be:
   a. Euco Hi-Flow Grout by The Euclid Chemical Company.
   b. Masterflow 928 by Master Builders.

   The factory pre-mixed grout shall conform to ASTM C1107, “Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-Shrink).” In addition, the grout manufacturer shall furnish test data from an independent laboratory indicating that the grout when placed at a fluid consistency shall achieve 95 percent bearing under a 18” x 36” base plate.

1.3 EXECUTION

A. Design, construct, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until concrete structure can support such loads.

B. Place and secure anchorage devices and other embedded items required for

adjoining work that is attached to or supported by cast-in-place concrete. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

C. Leave formwork, for beam soffits, joists, slabs, and other structural elements, that supports weight of concrete in place until concrete has achieved 28-day design compressive strength.

D. Comply with ACI 318, ACI 301, and recommendations in ACI 347R for design, installation, and removal of shoring and reshoring.

E. Vapor Retarder: Place, protect, and repair vapor-retarder sheets according to ASTM E 1643.

F. Steel Reinforcement: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

G. Joints: Locate and install construction, isolation, and contraction joints.

H. Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions.

I. Concrete Placement: Deposit concrete continuously and avoid segregation. Deposit concrete in forms in horizontal layers no deeper than 24 inches, avoiding cold joints.

1. Consolidate concrete with mechanical vibrating equipment.
2. Screed and initial-float concrete floors and slabs using bull floats or darbies to form a uniform and open-textured surface plane, free of humps or hollows, before excess moisture or bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
3. Comply with ACI 306.1 for cold-weather concrete placement.
4. Place concrete according to recommendations in ACI 305R when hot-weather conditions exist.

J. Finish formed surfaces as follows:

1. Apply rough-formed finish, defined in ACI 301, to concrete surfaces indicated or not exposed to public view.
2. Apply smooth-formed finish, defined in ACI 301, to concrete surfaces indicated and exposed to public view or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, or painting.

3. Apply smooth-rubbed finish to smooth-formed finished concrete surfaces indicated or exposed to public view.

K. Finishing Floors and Slabs: Comply with recommendations in ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Finish unformed surfaces as follows:

1. Float Finish: Apply float finish to surfaces indicated, to surfaces to receive trowel finish, and to floor and slab surfaces to be covered with fluid-applied or sheet waterproofing.
2. Trowel Finish: Apply a hard trowel finish to surfaces indicated and to floor and slab surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin film-finish coating system.
3. Nonslip Broom Finish: Apply a nonslip broom finish to surfaces indicated and to exterior concrete platforms, steps, and ramps. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.

L. Concrete Protection and Curing: Protect concrete from excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with recommendations in ACI 305R for hot-weather protection during curing.

1. Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause excessive moisture loss.
2. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
3. Cure formed and unformed concrete for at least seven days by moisture curing, moisture-retaining-cover curing, or curing compound.
4. Cure and seal floors and slabs with a curing and sealing compound according to manufacturer's written instructions.

M. Testing Agency: Contractor shall engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement.

N. Defective Concrete: Repair and patch defective areas when approved. Remove and replace concrete that cannot be repaired and patched.

END OF SECTION 03300

SECTION 04810

UNIT MASONRY ASSEMBLIES

1.1 GENERAL

A. Submittals: In addition to Product Data, submit the following:

1. Samples showing the full range of colors and textures available for exposed masonry units.
2. Material Certificates: For each type of masonry unit required.

B. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by another means, as acceptable to authorities having jurisdiction.

C. Cold-Weather Requirements: Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

D. Hot-Weather Requirements: When ambient temperature exceeds 100 deg F (38 deg C), or 90 deg F (32 deg C) with a wind velocity greater than 8 mph (13 km/h), do not spread mortar beds more than 48 inches (1200 mm) ahead of masonry. Set masonry units within one minute of spreading mortar.

1.2 PRODUCTS

A. Color and Texture: As indicated by manufacturer's designations.

B. Concrete Masonry Units: ASTM C 90 and as follows:

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi (13.1 MPa).
2. Weight Classification: Normal weight.
3. Provide Type II, nonmoisture-controlled units.
4. Provide special shapes for lintels, corners, jambs, sash, control joints, headers, bonding, and other special conditions.

C. Face Brick: ASTM C 216, Grade MW or SW, Type FBS.

1. Initial Rate of Absorption: Less than 20 g/30 sq. in. per minute when tested per ASTM C 67.
2. Efflorescence: When tested per ASTM C 67 and brick is rated "not effloresced."

3. Size: Match dimensions of existing adjacent face brick.
4. Color: Match existing adjacent face brick.

D. Mortar and Grout Materials: As follows:

1. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction.
2. Hydrated Lime: ASTM C 207, Type S.
3. Mortar Cement: ASTM C 1329.
4. Masonry Cement: ASTM C 91.
5. Aggregate for Mortar: ASTM C 144; except for joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
   a. Colored-Mortar Aggregates: Natural-colored sand or ground marble, granite, or other sound stone; of color necessary to produce required mortar color.
6. Aggregate for Grout: ASTM C 404.
7. Epoxy Pointing Mortar: ASTM C 395, epoxy-resin-based material formulated for use as pointing mortar for structural-clay tile facing units.
8. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494, Type C, and recommended by the manufacturer for use in masonry mortar of composition indicated.
9. Water: Potable.

E. Steel Reinforcing Bars: ASTM A 615, Grade 60.

F. Masonry Joint Reinforcement: ASTM A 951; mill galvanized, carbon-steel wire for interior walls and hot-dip galvanized, carbon-steel wire for exterior walls.

1. Wire Size for Side Rods: W1.7 or 0.148-inch diameter.
2. Wire Size for Cross Rods: W1.7 or 0.148-inch diameter.
3. For single-wythe masonry, provide either ladder or truss type with single pair of side rods and cross rods spaced not more than 16 inches o.c.

G. Concealed Flashing: For flashing not exposed to the exterior, use one of the following, unless otherwise indicated:

1. Copper-Laminated Flashing: Manufacturer's standard laminated flashing consisting of 5-oz./sq. ft. sheet copper bonded with asphalt between 2 layers of glass-fiber cloth.
2. Rubberized-Asphalt Flashing: Manufacturer's standard composite flashing product consisting of a pliable and highly adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of 0.030 inch.
3. Elastomeric Thermoplastic Flashing: Manufacturer's standard composite flashing product consisting of a polyester-reinforced ethylene interpolymer alloy 0.025 inch thick with a 0.015-inch-thick layer of rubberized-asphalt adhesive.
4. EPDM Flashing: Manufacturer's standard flashing product formed from a terpolymer of ethylene-propylene diene, complying with ASTM D 4637, 0.040 inch thick.

H. Miscellaneous Masonry Accessories: As follows:

1. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; formulated from neoprene, urethane or PVC.
2. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

I. Loose-Granular Fill Insulation: Perlite complying with ASTM C 549, Type II or IV.

J. Masonry Cleaners: As follows:

1. Job-Mixed Detergent Solution: Solution of 1/2-cup dry measure tetrasodium polyphosphate and 1/2-cup dry measure laundry detergent dissolved in 1 gal. of water.

K. Mortar and Grout Mixes: Do not use admixtures, unless otherwise indicated. Do not use calcium chloride in mortar or grout.

1. Mortar for Unit Masonry: Comply with ASTM C 270, Property Specification.
   a. Extended-Life Mortar for Unit Masonry: Mortar complying with ASTM C 1142 may be used instead of mortar specified above, at Contractor's option.
   b. Limit cementitious materials in mortar to portland cement, mortar cement, and lime.
   c. For masonry below grade, in contact with earth, and where indicated, use Type S.
   d. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.
2. Grout for Unit Masonry: Comply with ASTM C 476.
   a. Use grout of type (fine or coarse) that will comply with Table 5 of ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
   b. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143.

L. Source Quality Control: Contractor will engage a qualified independent testing agency to perform source quality-control testing indicated below. Payment for these services will be made by the Government.

1. Concrete Masonry Unit Tests: For each type of concrete masonry unit indicated, units will be tested according to ASTM C 140.

1.3 EXECUTION

A. Cut masonry units with motor-driven saws. Allow units cut with water-cooled saws to dry before placing, unless wetting of units is specified. Install cut units

with cut surfaces and, where possible, cut edges concealed.

B. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

C. Comply with tolerances in ACI 530.1/ASCE 6/TMS 602 and the following:

1. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/4 inch in 20 feet, nor 1/2 inch maximum.
2. For conspicuous horizontal lines, such as exposed lintels, sills, parapets, and reveals, do not vary from level by more than 1/4 inch in 20 feet, nor 1/2 inch maximum.

D. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

E. Bond Pattern for Exposed Masonry: Lay exposed masonry in bond pattern indicated; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

F. Built-in Work: As construction progresses, build in items specified under this and other Sections of the Specifications. Fill in solidly with masonry around built-in items.

G. Fill cores in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

H. Lay hollow masonry units as follows:

1. With full mortar coverage on horizontal and vertical face shells.
2. Bed webs in mortar in starting course on footings and in all courses of piers, columns, and pilasters, and where adjacent to cells or cavities to be filled with grout.
3. For starting course on footings where cells are not grouted, spread out full mortar bed, including areas under cells.

I. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than the joint thickness, unless otherwise indicated.

J. Provide continuous masonry joint reinforcement as indicated. Install with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.

1. Provide continuity at corners and wall intersections by using prefabricated "L" and "T" sections.

K. Provide masonry lintels where shown. Provide precast lintels made from concrete matching concrete masonry units in color, texture, and compressive strength and with reinforcing bars indicated or required to support loads indicated.

L. Embedded Flashing: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

M. Install weep holes in the head joints in exterior wythes of the first course of masonry immediately above embedded flashing.

1. Use round plastic tubing, or open head joints to form weep holes.
2. Space weep holes 16 inches o.c.

N. Temporary Formwork and Shores: Construct formwork and shores to support reinforced masonry elements during construction.

1. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.

O. Placing Reinforcement: Comply with requirements of ACI 530.1/ASCE 6/TMS 602.

P. Grouting: Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.

1. Comply with requirements of ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.

Q. Cleaning: Clean unit masonry as follows:

1. By dry brushing to remove mortar fins and smears before tooling joints, as work progresses.
2. After mortar is thoroughly set and cured, clean exposed masonry as follows:
   a. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes.
   b. Protect adjacent surfaces from contact with cleaner.
   c. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing the surfaces thoroughly with clear water.

d. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2 applicable to type of stain on exposed surfaces.

R. Masonry Waste Disposal: Dispose of clean masonry waste, including broken masonry units, waste mortar, and excess or soil-contaminated sand, by crushing and mixing with fill material as fill is placed.

1. Do not dispose of masonry waste as fill within 18 inches of finished grade.
2. Remove excess, clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off the Government's property.

END OF SECTION 04810

SECTION 06105

MISCELLANEOUS CARPENTRY

1.1 GENERAL

A. Submittals:

1. Product Data: For wood-preservative and fire-retardant treatment from chemical treatment manufacturers and certification by treating plants that treated materials comply with requirements.

1.2 PRODUCTS

A. Lumber, General: DOC PS 20 and applicable rules of lumber grading agencies certified by the American Lumber Standards Committee Board of Review. Factory mark each piece of lumber with grade stamp of grading agency.

1. For exposed lumber, mark grade stamp on end or back of each piece.
2. Provide dressed lumber, S4S, unless otherwise indicated.
3. Provide dry lumber with 19 percent maximum moisture content at time of dressing for 2-inch nominal (38-mm actual) thickness or less, unless otherwise indicated.

B. Wood-Preservative-Treated Materials: AWPA C2 (lumber) and AWPA C9 (plywood), except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX).

1. Kiln-dry material after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
2. Mark each treated item with the treatment quality mark of an inspection agency approved by the American Lumber Standards Committee Board of Review.
3. Application: Treat items indicated on Drawings, and the following:
   a. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
   b. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
   c. Wood framing members less than 18 inches (460 mm) above grade.
   d. Wood floor plates that are installed over concrete slabs directly in contact with earth.

C. Fire-Retardant-Treated Materials: Where fire-retardant-treated materials are indicated, provide materials that comply with performance requirements in AWPA C20 (lumber) and AWPA C27 (plywood). Identify fire-retardant-treated wood with appropriate classification marking of UL, U.S. Testing, Timber

Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.

1. Use Exterior type for exterior locations and where indicated.
2. Use Interior Type A High Temperature (HT), unless otherwise indicated.

D. Provide miscellaneous lumber for support or attachment of other construction.

1. For items of dimension lumber size, provide Construction, Stud, or No. 2 grade lumber with 19 percent maximum moisture content of any species.
2. For exposed boards, provide lumber, with 15 percent maximum moisture content, of eastern white pine, Idaho white, lodgepole, ponderosa, or sugar pine; Finish or 1 Common (Colonial) grade; NELMA, NLGA, WCLIB, or WWPA.
3. For concealed boards, provide lumber with 19 percent maximum moisture content and any of the following species and grades:
   a. Mixed southern pine, No. 2 grade; SPIB.
   b. Eastern softwoods, No. 2 Common grade; NELMA.
   c. Northern species, No. 2 Common grade; NLGA.
   d. Western woods, Construction or No. 2 Common grade; WCLIB or WWPA.

E. Shelving: 3/4-inch (19-mm) boards of same species and grade indicated above for exposed boards.

F. Clothes Rods: 1-1/2-inch- (38-mm-) diameter, clear, kiln-dried hardwood rods oraluminum tubes.

G. Miscellaneous Concealed Plywood: Exterior sheathing, span rating to suit framing in each location, and thickness as indicated but not less than 1/2 inch (13 mm).

H. Miscellaneous Concealed Oriented Strand Board: Exposure 1 sheathing, span rating to suit framing in each location, and thickness as indicated but not less than 1/2 inch (13 mm).

I. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2 inch (12.7 mm) thick.

J. Fasteners: Provide fasteners of size and type indicated.

1. Where carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
2. Power-Driven Fasteners: CABO NER-272.

3. Screws for Fastening to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings.

1.3 EXECUTION

A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

B. Securely attach carpentry work as indicated and according to applicable codes and recognized standards.

C. Countersink fastener heads on exposed carpentry work and fill holes with wood filler.

D. Wood Structural Panels: Comply with applicable recommendations contained in APA Form No. E30K, "APA Design/Construction Guide: Residential & Commercial," for types of structural-use panels and applications indicated.

E. Wood Trim Installation: Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Cope at returns and miter at corners to produce tight-fitting joints. Use scarf joints for end-to-end joints.

1. Install to tolerance of 1/8 inch in 96 inches (3 mm in 2438 mm) for level and plumb. Install adjoining finish carpentry with 1/32-inch (0.8-mm) maximum offset for flush installation and 1/16-inch (1.6-mm) maximum offset for reveal installation.

END OF SECTION 06105

SECTION 06402

INTERIOR ARCHITECTURAL WOODWORK

1.1 GENERAL

A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips, unless concealed within other construction before woodwork installation.

B. Submittals: In addition to Product Data, submit the following:

1. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
2. Samples of plastic-laminate-clad panel products, for each type, color, pattern, and surface finish.

C. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork, construction, finishes, and other requirements.

1. Provide AWI Quality Certification Program certificate indicating that woodwork complies with requirements of grades specified.

D. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

1.2 PRODUCTS

A. Wood for transparent finish: Red Oak, plain sawn or sliced.

B. Wood Products: Comply with the following:

1. Hardboard: AHA A135.4.
2. Medium-Density Fiberboard: ANSI A208.2, Grade MD.
3. Particleboard: ANSI A208.1, Grade M-2.
4. Softwood Plywood: DOC PS 1, Medium Density Overlay.
5. Hardwood Plywood and Face Veneers: HPVA HP-1.

C. High-Pressure Decorative Laminate: NEMA LD 3.

D. Fire-Retardant-Treated Lumber and Plywood: Materials impregnated with fire-retardant chemical formulations to comply with AWPA C20 (lumber) and AWPA

C27 (plywood), Exterior Type or Interior Type A. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Kiln-dry material after treatment.

E. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.

F. Fabrication, General: Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible, before shipment to Project site. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1. Interior Woodwork Grade: Provide Custom grade interior woodwork complying with the referenced quality standard.
2. Shop cut openings to maximum extent possible. Sand edges of cutouts to remove splinters and burrs.
3. Seal edges of openings in countertops with a coat of varnish.

G. Wood Cabinets for Transparent Finish:

1. AWI Type of Cabinet Construction: As indicated.
2. Reveal Dimension: As indicated.
3. Grain Matching: As indicated.
4. Matching of Veneer Leaves: Random Match.
5. Veneer Matching within Panel Face: Running match.
6. Semiexposed Surfaces: Thermoset decorative overlay.

H. Plastic-Laminate Cabinets: As follows:

1. AWI Type of Cabinet Construction: Flush overlay.
2. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:
   a. Horizontal Surfaces Other Than Tops: HGS.
   b. Postformed Surfaces: HGP.
   c. Vertical Surfaces: HGS.
   d. Edges: HGS.
3. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

   a. Provide Contracting Officer or authorized representative selections from laminate manufacturer's full range of colors and finishes.
4. Provide dust panels of 1/4-inch (6.4-mm) plywood or tempered hardboard above compartments and drawers, unless located directly under tops.

I. Plastic-Laminate Countertops: As follows:

1. High-Pressure Decorative Laminate Grade: HGS.

2. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
   a. Provide Contracting Officer or authorized representative selections from manufacturer's full range of colors and finishes.
3. Edge Treatment: As indicated.
4. Core Material at Sinks: Particleboard made with exterior glue, medium-density fiberboard made with exterior glue, or exterior-grade plywood.

J. Finish architectural woodwork at fabrication shop. Defer only final touchup, cleaning, and polishing until after installation.

K. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to back of paneling.

L. Transparent Finish: Comply with requirements indicated below for grade, finish system, staining, and sheen, with sheen measured on 60-degree gloss meter per ASTM D 523:

1. Grade: Custom.
2. AWI Finish System: TR-6, catalyzed polyurethane.
3. Staining: None required.
4. Wash Coat for Stained Finish: Apply a vinyl wash coat to woodwork made from closed-grain wood before staining and finishing.
5. Open-Grain Woods: Do not apply filler to open grain woods.
6. Sheen: Semigloss, 55-75 gloss units.

1.3 EXECUTION

A. Condition woodwork to average prevailing humidity conditions in installation areas and examine and complete work as required, including removal of packing and backpriming before installation.

B. Quality Standard: Install woodwork to comply with AWI Section 1700 for the same grade specified in this Section for type of woodwork involved.

C. Install woodwork level, plumb, true, and straight to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm). Shim as required with concealed shims.

D. Scribe and cut woodwork to fit adjoining work, and refinish cut surfaces and repair damaged finish at cuts.

E. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails for exposed fastening,

countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation.

1. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches (400 mm) o.c..

G. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop. Caulk space between backsplash and wall with sealant specified in Division 7 Section "Joint Sealants."

END OF SECTION 06402

SECTION 07210

BUILDING INSULATION

1.1 GENERAL

A. Submittals: Product Data for each type of insulation indicated.

1.2 PRODUCTS

A. General: Provide insulating materials that comply with requirements and with referenced standards For preformed units, provide sizes to fit applications indicated, selected from manufacturer's standard thicknesses, widths, and lengths.

B. Faced Mineral-Fiber Blanket Insulation:

1. ASTM C 665, Type III (blankets with reflective membrane facing), Class A (membrane-faced surface with a flame spread of 25 or less); Category 1 (membrane is a vapor barrier), faced with foil-scrim-polyethylene vapor-retarder membrane on one face; consisting of fibers manufactured from glass.

1.3 EXECUTION

A. Installation:

1. General: Install insulation to comply with insulation manufacturer's written instructions applicable to products and application indicated. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

B. Installation of General Building Insulation: Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

1. Install mineral-fiber blankets in cavities formed by framing members according to the following requirements:
   a. Use blanket widths and lengths that fill the cavities formed by framing members.
   b. Place blankets in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
2. For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically and support faced

blankets by taping stapling flanges to flanges of metal studs.

END OF SECTION 07210

SECTION 07841

THROUGH-PENETRATION FIRESTOP SYSTEMS

1.1 GENERAL

A. Performance Requirements: Provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly penetrated.

1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, as determined per ASTM E 814, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
2. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings, as determined per ASTM E 814, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:
   a. Penetrations located outside wall cavities.
   b. Penetrations located outside fire-resistive shaft enclosures.
   c. Penetrations located in construction containing fire-protection-rated openings.
   d. Penetrating items larger than 4-inch- (100-mm-) diameter nominal pipe or 16 sq. in. (100 sq. cm) in overall cross-sectional area.
3. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that after curing do not deteriorate when exposed to these conditions both during and after construction.
   a. For piping penetrations for wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
   b. For floor penetrations with annular spaces exceeding 4 inches (100 mm) in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved either by installing floor plates or by other means.
4. For through-penetration firestop systems exposed to view, provide products with flame-spread ratings of less than 25 and smoke-developed ratings of less than 450, as determined per ASTM E 84.

B. Submittals: In addition to Product Data for each type of product specified, submit the following:

1. Shop Drawings: For each through-penetration firestop system, show each kind of construction condition penetrated, relationships to adjoining construction, and kind of penetrating item. Include firestop design designation of testing and inspecting agency acceptable to authorities having jurisdiction.
2. Product Certificates: Signed by manufacturers of through-penetration firestop system products certifying that products furnished comply with requirements.

3. Product Test Reports: From a qualified testing agency indicating through-penetration firestop system complies with requirements, based on comprehensive testing of current products.

C. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in "Performance Requirements" Paragraph:

1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL or another agency performing testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.
2. Through-penetration firestop systems are identical to those tested per ASTM E 814 and bear classification marking of qualified testing and inspecting agency.

1.2 PRODUCTS

A. Products: Subject to compliance with requirements, provide one of the through-penetration firestop systems indicated for each application that are produced by one of the following manufacturers:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following (or approved equal):

1. DAP Inc.
2. Firestop Systems Inc.
3. Hilti Construction Chemicals, Inc.
4. RectorSeal Corporation (The).
5. 3M Fire Protection Products.
6. Tremco.
7. United States Gypsum Company.

C. Firestopping, General: Provide through-penetration firestop systems that are compatible with one another, with the substrates forming openings, and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.

D. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with "Performance Requirements" Paragraph. Use only components specified by through-penetration firestop system manufacturer and approved by the qualified testing and inspecting agency for firestop systems indicated. Accessories include, but are not limited to, the following items:

1. Permanent forming/damming/backing materials.
2. Temporary forming materials.
3. Substrate primers.

4. Collars.
5. Steel sleeves.

E. General: Provide through-penetration firestop systems containing the types of fill materials indicated in the Through-Penetration Firestop System Schedule at the end of this Section by reference to the types of materials described below. Fill materials are those referred to in directories of the referenced testing and inspecting agencies as fill, void, or cavity materials.

1. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.
2. Latex Sealants: Single-component latex formulations that after cure do not re-emulsify during exposure to moisture.
3. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
4. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized steel sheet.
5. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.
6. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
7. Mortars: Prepackaged, dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.
8. Silicone Sealants: Moisture-curing, single-component, silicone-based, neutral-curing elastomeric sealants.

1.3 EXECUTION

A. General: Install through-penetration firestop systems to comply with "Performance Requirements" Paragraph and firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

C. Identify through-penetration firestop systems with pressure-sensitive, self-adhesive, preprinted vinyl labels. Attach labels permanently to surfaces of penetrated construction on both sides of each firestop system installation where labels will be visible to anyone seeking to remove penetrating items or firestop systems. Include the following information on labels:

1. The words: "Warning--Through-Penetration Firestop System--Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Through-penetration firestop system designation of applicable testing and inspecting agency.
4. Date of installation.
5. Through-penetration firestop system manufacturer's name.
6. Installer's name.

END OF SECTION 07841

SECTION 07920

JOINT SEALANTS

1.1 GENERAL

A. Preconstruction Joint-Sealant-Substrate Tests: Submit substrate materials, representative of actual joint surfaces, to joint sealant manufacturer for laboratory testing of joint sealants for adhesion to primed and unprimed substrates and for compatibility with joint substrates and other joint-related materials.

B. Submittals: In addition to Product Data, submit the following:

1. Samples of each type and color of joint sealant required.
2. Test reports for joint sealants evidencing compliance with requirements.

1.2 PRODUCTS

A. Elastomeric Sealant Manufacturers: Subject to compliance with requirements, provide sealants by one of the following (or approved equal):

1. Silicone Sealants:
   a. Dow Corning.
   b. GE Silicones.
   c. NUCO Industries, Inc.
   d. Sonneborn Building Products Div., ChemRex Inc.
   e. Tremco.

2. Urethane Sealants:
   a. Polymeric Systems, Inc.
   b. Sonneborn Building Products Div., ChemRex Inc.
   c. Tremco.

B. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by testing and field experience.

C. Colors: Provide colors indicated for exposed joint sealants or, if not indicated, as selected by Contracting Officer’s Representative from manufacturer's full range for this characteristic.

D. Elastomeric Sealant Standard: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant of base polymer specified below:

1. Low-Modulus Neutral-Curing Silicone Sealant: Type S, Grade NS,

Class 25, and as follows:

a. Uses NT, G, A, and O.
b. Additional capability, when tested per ASTM C 719, to withstand the following percentage changes in joint width and still comply with other requirements of ASTM C 920:

7) 100 percent movement in extension and 50 percent movement in compression for a total of 150 percent movement.

c. Applications: Window and door frames, thresholds and lintels.

2. Medium-Modulus Neutral-Curing Silicone Sealant: Type S; Grade NS; Class 25; with the additional capability, when tested per ASTM C 719, to withstand 50 percent movement in both extension and compression for a total of 100 percent movement and still comply with other requirements of ASTM C 920; and as follows:

a. Uses NT, M, G, A, and O.
b. Application: Glazing.

3. High-Modulus Neutral-Curing Silicone Sealant: Type S; Grade NS; Class 25; and as follows:

a. Uses NT, M, G, A, and O.
b. Applications: Galvanized steel and miscellaneous aluminum flashing.

4. Mildew-Resistant Silicone Sealant: Type S; Grade NS; Class 25; Uses NT, G, A, and O; formulated with fungicide; intended for sealing interior joints with nonporous substrates exposed to high humidity and temperature extremes.

5. Single-Component Nonsag Urethane Sealant: Type S; Grade NS; and as follows:

a. Class 25.
b. Uses NT, M, A, and O.
c. Applications: Exterior masonry joints.

E. Latex Sealant: ASTM C 834.

F. Acoustical Sealant for Exposed and Concealed Joints: Nonsag, paintable, nonstaining latex sealant complying with ASTM C 834.

G. Acoustical Sealant for Concealed Joints: Nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission.

H. Sealant Backings, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

I. Cylindrical Sealant Backings: ASTM C 1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

1. Type O: Open-cell material.

J. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F (minus 32 deg C).

K. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint.

L. Primer: As recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated.

1.3 EXECUTION

A. General: Comply with joint sealant manufacturer's instructions for products and applications indicated.

B. Sealant Installation Standard: Comply with ASTM C 1193.

C. Acoustical Sealant Application Standard: Comply with ASTM C 919 for use of joint sealants in acoustical applications.

END OF SECTION 07920

SECTION 08110

STEEL DOORS AND FRAMES

1.1 GENERAL

A. Submittals:

1. Product Data and Shop Drawings for each type of door and frame indicated.
2. Door Schedule using same reference designations indicated on Drawings in preparing schedule for doors and frames.

B. Quality Assurance:

1. Comply with ANSI A 250.8, unless more stringent requirements are indicated.

1.2 PRODUCTS

A. Materials:

1. Hot-Rolled Steel Sheets: ASTM A 569/A 569M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
2. Cold-Rolled Steel Sheets: ASTM A 366/A 366M, Commercial Steel (CS), or ASTM A 620/A 620M, Drawing Steel (DS), Type B; stretcher-leveled standard of flatness.
3. Metallic-Coated Steel Sheets: ASTM A 653/A 653M, Commercial Steel (CS), Type B, with A40 (ZF120) zinc-iron-alloy (galvannealed) coating; stretcher-leveled standard of flatness.
4. Electrolytic Zinc-Coated Steel Sheets: ASTM A 591/A 591M, Commercial Steel (CS), Class B coating; mill phosphatized; suitable for unexposed applications; stretcher-leveled standard of flatness where used for face sheets.

B. Interior Doors: Complying with ANSI 250.8 for level and model and ANSI A250.4 for physical-endurance level indicated.

1. Level 2 and Physical Performance Level B, Model 1 (Full Flush)

C. Exterior Doors: Doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:

1. Level 3 and Physical Performance Level A, Model 1 (Full Flush).

D. Frames: Provide steel frames that comply with ANSI A250.8 and with steel sheet thickness as indicated for door level selected below:

1. For Level 2 steel doors, 0.053 inch (1.3 mm).

2. For Level 3 steel doors, 0.067 inch (1.7 mm).
3. Door Silencers: Three silencers on single-door frames and two silencers on double-door frames.
4. Supports and Anchors: Not less than 0.042-inch- (1.0-mm-) thick, zinc-coated steel sheet.
5. Wall Anchors in Masonry Construction: 0.177-inch- (4.5-mm-) diameter, steel wire complying with ASTM A 510 (ASTM A 510M) may be used in place of steel sheet.
6. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Where zinc-coated items are to be built into exterior walls, comply with ASTM A 153/A 153M, Class C or D as applicable.

E. Fabricate steel door and frame units to comply with ANSI A250.8 and to be free from defects including warp and buckle. Where practical, fit and assemble units in manufacturer's plant.

1. Exterior Doors and Frames: Fabricate from metallic-coated steel sheet. Close top and bottom edges of doors flush.
2. Interior Door Faces: Fabricate exposed faces of doors from cold-rolled steel sheet.
3. Core Construction: Manufacturer's standard core construction that produces a door complying with SDI standards.
4. Tolerances: Comply with SDI 117.
5. Prepare doors and frames to receive hardware. Reinforce doors and frames to receive surface-applied hardware. Comply with applicable requirements in ANSI A250.6 and ANSI A115 Series specifications for door and frame preparation for hardware.
6. Fabricate frames with mitered or coped and continuously welded corners and seamless face joints. Provide temporary spreader bars.
7. Provide nonremovable glazing stops on outside of exterior doors and on secure side of interior doors for glass, louvers, and other panels in doors.
8. Provide screw-applied, removable, glazing stops on inside of glass, louvers, and other panels in doors.

F. Prime Finish: Manufacturer's standard, factory-applied coat of rust-inhibiting primer complying with ANSI A250.10 for acceptance criteria.

1.3 EXECUTION

A. Install doors and frames according to Shop Drawings and manufacturer's data.

1. Frames: Install steel frames for doors and other openings, of size and profile indicated.

a. Provide at least three wall anchors per jamb. For openings 90 inches (2286 mm) or more in height, install an additional anchor at hinge and strike jambs.
b. Placing Frames: Comply with provisions in SDI 105, unless otherwise indicated. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set.

After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.

8) At existing concrete or masonry construction, set frames and secure in place with machine screws and masonry anchorage devices.

2. Doors: Install to comply with ANSI A250.8. Shim as necessary to comply with SDI 122 and ANSI/DHI A115.1G. Fit non-fire-rated doors accurately in their respective frames, with the following clearances:
   a. Jambs and Head: 1/8 inch (3.2 mm).
   b. Meeting Edges, Pairs of Doors: 1/4 inch (6.4 mm).
   c. Bottom: 3/4 inch (19 mm).

B. Adjusting and Cleaning:

1. Prime-Coat Touchup: Sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer.
2. Protection Removal: Immediately before final inspection, remove protective wrappings from doors and frames.

END OF SECTION 08110

SECTION 08331

OVERHEAD COILING DOORS

1 GENERAL

1.1 SUMMARY

A. This Section includes the following types of overhead coiling doors:

1. Insulated service doors.
2. Counter doors.

1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide overhead coiling doors capable of withstanding the effects of gravity loads and the following loads and stresses without evidencing permanent deformation of door components:

1. Wind Load: Uniform pressure (velocity pressure) of 20 lbf/sq. ft. (960 Pa), acting inward and outward.

B. Operational Life: Design components to operate for not less than 20,000 cycles.

1. Operation Cycle: One complete cycle begins with door in closed position. Door is then moved to open position and back to closed position.
2. Include tamperproof cycle counter.

1.3 SUBMITTALS

A. Product Data: For each product indicated.

B. Shop Drawings: Include plans, elevations, sections, details of installation, and attachments to other Work.

1. Verify openings by field measurements before fabrication and indicate measurements on Shop Drawings.

C. Samples: For each exposed finish.

2 PRODUCTS

2.1 DOOR CURTAIN AND CONSTRUCTION

A. Door Curtain: Interlocking slats in continuous length for width of door. Unless

otherwise indicated, slats of material thickness recommended by door manufacturer for performance, size, and type of door indicated.

1. Steel Door Curtain Slats: Structural-quality, cold-rolled galvanized steel sheets, ASTM A 653/A 653M, with G90 (Z275) zinc coating.
2. Slat Type: Flat profile.
3. Insulation: Fill slat with rigid cellular polystyrene or polyurethane-foam-type thermal insulation with maximum flame-spread and smoke-developed indices of 75 and 450, respectively, according to ASTM E 84. Enclose insulation completely within metal slat faces.
   a. Inside Curtain Slat Face: Match material of outside metal curtain slat.

B. Endlocks, General: Locate locks on every other curtain slat for curtain alignment and resistance against lateral movement.

1. Service Door Endlocks: Malleable-iron castings galvanized after fabrication, and secured to curtain slats with galvanized rivets, or high-strength nylon.

C. Windlocks: Malleable-iron castings secured to curtain slats with galvanized rivets or high-strength nylon, as required to comply with wind load.

D. Curtain Jamb Guides: Steel angles, or channels and angles, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading.

1. Counter Doors: Prevent metal-to-metal contact and minimize noise of travel with continuous integral wear strips and prevent overtravel of curtain with removable stops on guides.
2. Service Doors: Build up units with not less than 3/16-inch- (5-mm-) thick, galvanized steel sections complying with ASTM A 36/A 36M, and ASTM A 123. Slot bolt holes for guide adjustment. Prevent overtravel of curtain with removable stops on guides and hold windlocks with continuous bar.

2.2 HOODS AND ACCESSORIES

A. Hood: Form to enclose coiled curtain and operating mechanism at opening head and act as weatherseal. Contour to suit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Provide closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting projecting beyond wall face. Provide intermediate support brackets as required to prevent sag.

1. Steel-Door Hoods: Fabricate from not less than 0.028-inch (0.7-mm) thick, hot-dip galvanized steel sheet that matches slat material.
2. Shape: Round.

B. Weatherseals: Replaceable, adjustable, continuous, compressible weather-

stripping gaskets fitted to bottom and at top of exterior doors, unless otherwise indicated. At door head, use 1/8-inch- (3-mm-) thick, replaceable, continuous sheet secured to inside of curtain coil hood.

1. Jamb Seals: Replaceable, adjustable, continuous, flexible, 1/8-inch- (3-mm-) thick seals of flexible vinyl, rubber, or neoprene at door jambs for weathertight installation.

C. Fabricate locking device assembly with lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bar to engage through slots in tracks.

1. Locking Bars: Full-disc Cremone type, both jamb sides.
   a. Operation: From inside only.

D. Counterbalancing Mechanism: Adjustable, oil-tempered, heat-treated steel helical torsion springs mounted around structural carbon-steel pipe, and contained in barrel of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. (2.5 mm/m) of span under full load; with grease-sealed bearings or self-lubricating graphite bearings.

1. Mounting Brackets: Cast-iron or cold-rolled steel plate with bell-mouth guide groove for curtain.

E. Manual Door Operator: Push up; lift or pull for counter doors with operation not exceeding 25 lbf (111 N); Chain hoist for service doors.

2.3 FINISHES

A. Steel Finish: Manufacturer's standard powder coating.

1. Color and Gloss: As selected from manufacturer's full range.

B. Galvanized-Steel Finish: Manufacturer's standard powder coating.

1. Color and Gloss: As selected from manufacturer's full range.

3 EXECUTION

3.1 INSTALLATION

A. General: Install door and operating equipment complete with necessary hardware, jamb and head mold strips, anchors, inserts, hangers, and equipment supports.

B. Lubricate bearings and sliding parts; adjust doors to operate easily, free from warp, twist, or distortion and fitting weathertight for entire perimeter.

END OF SECTION 08331

SECTION 08520

ALUMINUM WINDOWS

1 GENERAL

A. This Section includes single-hung aluminum windows of the performance class indicated.

B. Performance Requirements: Provide windows engineered, fabricated, and installed to withstand normal thermal movement, wind loading, and impact loading without failure, as demonstrated by testing manufacturer's standard window assemblies representing types, grades, classes, and sizes required for Project according to test methods indicated.

C. Testing shall demonstrate compliance with requirements indicated in AAMA 101 for air infiltration, water penetration, and structural performance for type, grade, and performance class of windows required. Where required design pressure exceeds the minimum for the specified window grade, comply with AAMA 101, Section 3, "Optional Performance Classes."

D. Submittals: Submit the following:

1. Product Data for each type of window required, including construction details and fabrication methods; profiles and dimensions of individual components; data on hardware, accessories, and finishes. Include recommendations for maintaining and cleaning exterior surfaces.
2. Shop Drawings showing fabrication and installation of each type of window required. Include layout and installation details, elevations at 1/4 inch = 1 foot (1:50) scale, typical window unit elevations at 3/4 inch = 1 foot (1:20) scale, and full-size section details of typical composite members.

E. Product Options: The Drawings indicate sizes, profiles, dimensional requirements, and aesthetic effects of aluminum windows and are based on the specific window types and models indicated. Other aluminum window manufacturers whose products have equal performance characteristics may be considered provided deviations in size, profile, and dimensions are minor and do not alter the aesthetic effect.

1.2 PRODUCTS

A. Aluminum Extrusions: Alloy and temper recommended for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi (150-MPa) ultimate tensile strength and not less than 0.062 inch (1.6 mm) thick at any

location for main frame and sash members.

B. Fasteners: Aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted to be noncorrosive and compatible with window members, trim, hardware, anchors, and other components.

1. Where fasteners screw anchor into aluminum less than 0.125 inch (3.2 mm) thick, reinforce interior with aluminum or nonmagnetic stainless steel to receive screw threads or provide standard, noncorrosive, pressed-in, splined grommet nuts.
2. Except for application of hardware, do not use exposed fasteners. For application of hardware, use fasteners that match finish of member or hardware being fastened, as appropriate.

C. Anchors, Clips, and Window Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel complying with ASTM B 633 and of sufficient strength to withstand design pressure indicated.

D. Fixed Windows: Comply with requirements of AAMA Performance Class HC.

E. Operable Windows: Comply with requirements of AAMA Performance Class HC.

F. Fabrication: Window units to comply with indicated standards. Include a complete system for assembly of components and anchorage of window units. Provide units that are reglazable without dismantling sash or ventilator framing.

G. Thermally Improved Construction: Fabricate window units with an integral, concealed, low-conductance, thermal barrier, between exterior materials and window members exposed on interior, in a manner that eliminates direct metal-to-metal contact.

1. Weep holes and internal passages to conduct infiltrating water to exterior.
2. Glazing Stops: Screw-applied or snap-on glazing stops. Finish to match windows.

H. Preglazed Fabrication: Preglaze window units where possible and practical. Comply with glass and glazing requirements of Division 8 Section "Glazing" of these Specifications and AAMA 101.

I. Finishes: Comply with NAAMM "Metal Finishes Manual." Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.

J. Class I, Color Anodic Finish: AA-M12C22A42/A44.

1. Color: Dark bronze.

1.3 EXECUTION

A. Inspection: Inspect openings before installation. Verify that rough opening is correct and sill plate is level.

B. Installation: Comply with manufacturer's recommendations for installing window units, hardware, operators, and other components. Set windows plumb, level, and true to line, without warp or rack of frames or sash. Anchor securely in place.

1. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action.

C. Set sill members and other members in a bed of sealant or with joint fillers or gaskets to provide weathertight construction. Coordinate installation with wall flashings and other components of the Work.

D. Clean aluminum promptly after installing windows. Avoid damage to finishes. Remove excess glazing and sealant compounds, dirt, and other substances. Lubricate hardware and other moving parts.

E. Clean glass of preglazed units promptly after installing windows.

F. Protect installed aluminum windows to ensure that they are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 08520

SECTION 08711

DOOR HARDWARE (SCHEDULED BY NAMING PRODUCTS)

1.1 GENERAL

A. Submittals: In addition to Product Data for each item specified, submit the following:

1. Door Hardware Schedule: Organize into door hardware sets indicating type, style, function, size, label, hand, manufacturer, fasteners, location, and finish of each door hardware item.

B. Supplier Qualifications: Door hardware supplier who is or employs a qualified DHI Architectural Hardware Consultant.

C. Templates: Obtain and distribute templates for doors, frames, and other work specified to be factory prepared for installing door hardware.

1.2 PRODUCTS

A. Scheduled Door Hardware: Provide door hardware for each door to comply with requirements in this Section and door hardware sets indicated in door and frame schedule.

1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and products equivalent in function and comparable in quality to named products.
2. Designations: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

B. Standards: Comply with BHMA A156 series standards, Grade 1, unless Grade 2 is indicated.

C. Certified Products: Provide door hardware that is listed in one of BHMA's directories of certified products.

D. Hinges and Pivots: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.

1. Hinge Base Metal: Unless otherwise indicated, provide the following:
   a. Exterior Hinges: Stainless steel, with stainless-steel pin.
   b. Interior Hinges: Stainless steel, with stainless-steel pin.

c. Hinges for Fire-Rated Assemblies: Stainless steel, with stainless-steel pin.

2. Nonremovable Pins: Provide set screw in hinge barrel that prevents removal of pin while door is closed; for outswinging exterior doors and outswinging corridor doors with locks.
3. Machine Screws: For metal doors and frames. Install into drilled and tapped holes.
4. Wood Screws: For wood doors and frames.
5. Threaded-to-the-Head Wood Screws: For fire-rated wood doors.
6. Screws: Phillips flat-head screws. Finish screw heads to match surface of hinges.

E. Locks and Latches: As follows:

1. Provide the lockset design designated below:
   a. Bored Locks: Best; 9K Series, 14L (or approved equal).
2. Dummy Trim: Match lever lock trim and escutcheons.
3. Lock Throw: Comply with labeled fire door requirements.
4. Backset: 2-3/4 inches (70 mm), unless otherwise indicated.

F. Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver, and complying with the following:

1. Number of Pins: Six.
2. High-Security Grade: BHMA Grade 1A, listed and labeled as complying with UL 437 (Suffix A).
3. Manufacturer: Same manufacturer as for locks and latches.
4. Permanent Cores: Manufacturer's standard; finish face to match lockset; removable cores.
5. Construction Master Keys: Provide cylinders with feature that permits voiding of construction keys without cylinder removal. Provide 10 construction master keys.
6. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.
   a. Replace construction cores with permanent cores, as directed by Owner.

G. Keying System: Coordinate with Contracting Officer’s Representative.

1. Keys: Provide nickel-silver keys permanently inscribed with a visual key control number and "DO NOT DUPLICATE" notation. In addition to one extra blank key for each lock, provide three change keys and five master keys.

H. Strikes: Manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set.

I. Closers: Comply with the following:

1. Size of Units: Factory sized, adjustable to meet field conditions and

requirements for opening force.

J. Protective Trim Units: Furnish protection plates sized 1-1/2 inches (38 mm) less than door width on push side and 1/2 inch (13 mm) less than door width on pull side, by height specified in Door Hardware Schedule. Fasten with exposed machine or self-tapping screws.

K. Floor Stops: For doors, unless wall or other type stops are scheduled or indicated. Do not mount floor stops where they will impede traffic. Where floor or wall stops are not appropriate, provide overhead holders.

L. Door Gasketing: Provide continuous weather-strip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated or scheduled. Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

1. Air Leakage: Not to exceed 0.50 cfm per foot (0.000774 cu. m/s per m) of crack length for gasketing other than for smoke control, as tested according to ASTM E 283.
2. Gasketing Materials: Comply with ASTM D 2000 and AAMA 701/702.

M. Fabrication: As follows:

1. Base Metals: Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18 for finishes. Do not furnish manufacturer's standard materials if different from specified standard.
2. Fasteners: Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated. Provide steel machine or wood screws or steel through bolts for fire-rated applications.
3. Spacers or Sex Bolts: For through bolting of hollow metal doors.
4. Fasteners for Wood Doors: Comply with requirements of DHI WDHS.2, "Recommended Fasteners for Wood Doors."

1.3 EXECUTION

A. Examine doors and frames for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

B. Steel Door and Frame Preparation: Comply with DHI A115 series. Drill and tap doors and frames for surface-applied hardware according to SDI 107.

C. Wood Door Preparation: Comply with DHI A115-W series.

D. Mounting Heights: Comply with DHI requirements, unless otherwise indicated.

E. Installation: Comply with manufacturer's written instructions. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

1. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

F. Adjust and check each operating item of door hardware and each door to ensure proper operation or function. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with accessibility requirements. Clean operating items as necessary to restore proper function and finish.

G. Door Hardware Schedule: Provide products indicated (or approved equal) as follows:

1. Hardware Set No. 1
   a. 1-1/2 pair butts: Hager, Full Mortise BB1191, 4-1/2x4-1/2.
   b. 1 Exit Device: Von Duprin 98L.
   c. 1 Cylinder: Best, 6-pin, compatible with exit device.
   d. 1 Closer: Parallel arm, LCN, 1460 series.
   e. 1 Kickplate: 8” high.
   f. 1 set Weatherstripping: Reese, DS75D.
   g. 1 Sill Sweep: Reese, 362D.
   h. 1 Threshold: Reese, S475A.

2. Hardware Set No. 2
   a. 3 pair butts: Hager, Full Mortise BB1191, 4-1/2x4-1/2.
   b. 2 Exit Device: Von Duprin, 9827L.
   c. 2 Cylinders: Best, 6-pin compatible with exit device.
   d. 2 Closers: Parallel arm LCN, 1460 series.
   e. 1 Astragal: Reese, 393D.
   f. 1 set Weatherstripping: Reese, DS75D.
   g. 2 Sill Sweep: Reese, 362D.
   h. 1 Threshold: Reese, S475A.

3. Hardware Set No. 3
   a. 1-1/2 pair butts: Hager, Full Mortise BB1191, 4-1/2x4-1/2.
   b. 1 Lockset: Best, 9K Series, 14L, R-Classroom.
   c. 1 Closer: Parallel arm, LCN, 1460 series.
   d. 1 Kickplate: 8” High.
   e. 3 Silencers: Ives, 20.
   f. 1 Wall Stop: Glynn-Johnson WB35.

4. Hardware Set No. 4
   a. 1-1/2 pair butts: Hager, Full Mortise BB1191, 4-1/2x4-1/2.
   b. 1 Push: Hager 30S, 4” x 16”
   c. 1 Pull: Hager, 34G, 4” x 16” Plate
   d. 1 Closer: Parallel arm, LCN, 1460 series.
   e. 1 Kickplate: 8” High.
   f. 3 Silencers: Ives, 20.

5. Hardware Set No. 5
   a. 1-1/2 pair butts: Hager, Full Mortise BB1191, 4-1/2x4-1/2.
   b. 1 Exit Device: Von Duprin 98L with ALK (Alarm Kit).
   c. 1 Cylinder: Best, 6-pin, compatible with exit device.
   d. 1 Closer: Parallel arm, LCN, 1460 series.
   e. 1 Kickplate: 8” high.
   f. 1 set Weatherstripping: Reese, DS75D.
   g. 1 Sill Sweep: Reese, 362D.
   h. 1 Threshold: Reese, S475A.

6. Hardware Set No. 6
   a. 3 pair butts: Hager, Full Mortise BB1191, 4-1/2x4-1/2.
   b. 1 Lockset: Best, 9K Series, 14L, R-Classroom.
   c. 1 Dummy Trim.
   d. 1 set Flush Bolts: Glynn-Johnson, FB6.
   e. 1 Astragal: Reese, 393D.
   f. 2 Closers: Parallel arm LCN, 1460 series.
   g. 4 Silencers: Ives 20.
   h. 2 Kick Plates: 8” high.

END OF SECTION 08711

SECTION 08800

GLAZING

1.1 GENERAL

A. Performance Requirements: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

1. Glass Design: Glass thicknesses indicated are minimums and are for detailing only. Provide glass lites for various size openings in nominal thicknesses indicated, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:
   a. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300, according to the following requirements:

   9) Specified Design Wind Loads: Determine design wind loads applicable to Project from basic wind speed indicated in miles per hour (meters per second) at 33 feet (10 m) above grade, according to ASCE 7, Section 6.4.2, based on mean roof heights above grade indicated on Drawings.
2. Thermal and Optical Performance Properties: As determined according to procedures indicated below:
   a. Center-of-Glass U-Values: NFRC 100 methodology using LBL-35298 WINDOW 4.1 computer program, expressed as Btu/sq. ft. x h x deg F (W/sq. m x K).
   b. Center-of-Glass Solar Heat Gain Coefficient: NFRC 200 methodology using LBL-35298 WINDOW 4.1 computer program.
   c. Solar Optical Properties: NFRC 300.

B. Submittals: In addition to Product Data for each glass product and glazing material, submit the following:

1. Preconstruction Adhesion and Compatibility Test Report: From glazing sealant manufacturer indicating glazing sealants were tested for adhesion to glass and glazing channel substrates and for compatibility with glass and other glazing materials.

C. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201 and ANSI Z97.1.

D. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in

this Section or in referenced standards.

1. SIGMA Publications: SIGMA TM-3000, "Vertical Glazing Guidelines," and SIGMA TB-3001, "Sloped Glazing Guidelines."

E. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the following inspecting and testing agency:

1. Insulating Glass Certification Council.
2. Associated Laboratories, Inc.
3. National Accreditation and Management Institute.

1.2 PRODUCTS

A. Float Glass: ASTM C 1036, Type I, Quality q3; class as indicated in schedules.

B. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality q3; class, kind, and condition as indicated in schedules.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated.
2. Fabrication Process: By vertical (tong-held) or horizontal (roller-hearth) process, at manufacturer's option, except provide horizontal process where indicated as tongless or free of tong marks.

C. Pyrolytic-Coated Float Glass: With solar-reflective metallic-oxide coating applied by pyrolytic deposition process during initial manufacture, complying with requirements specified in schedules.

D. Sputter-Coated Float Glass: With metallic-oxide or metallic-nitride coating deposited by vacuum deposition process after manufacture and heat treatment (if any), complying with requirements specified in schedules.

E. Insulating-Glass Units: Preassembled units consisting of dual-sealed lites of glass separated by a dehydrated interspace, and complying with ASTM E 774 for Class CBA units and with requirements specified in the Insulating-Glass Schedule.

F. Elastomeric Glazing Sealants: Products complying with ASTM C 920 and other requirements specified in the Glazing Sealant Schedule, in colors indicated, compatible with one another and with other materials they will contact.

G. Back-Bedding Mastic Glazing Tape: Preformed, butyl-based elastomeric tape;

with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 804.3 tape, where indicated.
2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

H. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned gaskets of material indicated below; complying with ASTM C 509, Type II, black; and of profile and hardness required to maintain watertight seal:

1. Neoprene.
2. EPDM.
3. Silicone.
4. Thermoplastic polyolefin rubber.
5. Any material indicated above.

I. Miscellaneous Glazing Materials: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

J. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing standard, to comply with system performance requirements.

1.3 EXECUTION

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation.

C. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

D. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

E. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter.

F. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents, and vandalism, during construction period.

G. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended by glass manufacturer.

1.4 GLASS SCHEDULE

A. Low-E Insulating Glass IG-[1]:

1. Overall Unit Thickness and Thickness of Each Lite: 25 and 6 mm.
2. Indoor Lite: Type I (transparent glass, flat), Class 1 (clear) float glass.
   a. Kind FT (fully tempered).
3. Outdoor Lite: Type I (transparent glass, flat) float glass.
   a. Class 1 (clear).
   b. Kind FT (fully tempered).
4. Low-Emissivity Coating: Pyrolytic on second surface or sputtered on second surface.

END OF SECTION 08800

SECTION 09511

ACOUSTICAL PANEL CEILINGS

1.1 GENERAL

A. Submittals: In addition to Product Data for each type of acoustical panel and suspension system required, submit the following:

1. 6-inch- (150-mm-) square samples of each acoustical panel type, pattern, and color.
2. Set of 12-inch- (300-mm-) long samples of exposed suspension system members, including moldings, for each color and system type required.

B. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:

1. Fire-response tests were performed by UL, ITS/Warnock Hersey, or another independent testing and inspecting agency that is acceptable to authorities having jurisdiction and that performs testing and follow-up services.
2. Surface-burning characteristics of acoustical panels comply with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84.

1.2 PRODUCTS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, those indicated for each designation in the Acoustical Panel Ceiling Schedule.

B. Acoustical Panels: Manufacturer's standard panels complying with ASTM E 1264 classifications, unless otherwise indicated, and with requirements indicated in the Acoustical Panel Ceiling Schedule.

1. Mounting Method for Measuring Noise Reduction Coefficient: Type E-400 per ASTM E 795.

C. Metal Suspension System: Manufacturer's standard direct-hung suspension system complying with applicable ASTM C 635 requirements and with requirements indicated in the Acoustical Panel Ceiling Schedule.

D. Finishes and Colors for Metal Suspension System, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.

E. Suspension System Attachment Devices: Fabricated from corrosion-resistant materials and sized for five times design load indicated in ASTM C 635, Table 1, Direct Hung, unless otherwise indicated.

F. Wire Hangers, Braces, and Ties: Zinc-coated, carbon-steel wire complying with ASTM A 641/A 641M, Class 1 zinc coating, soft temper. Size wire diameter so its stress at three times hanger design load (ASTM C 635, Table 1, Direct Hung) will be less than yield stress of wire, but provide not less than 0.106-inch- (2.69-mm-) diameter wire.

G. Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that fit acoustical panel edge details and suspension systems indicated; formed from sheet metal of same material and finish as that used for exposed flanges of suspension system runners.

1.3 EXECUTION

A. General: Install acoustical panel ceilings to comply with publications referenced below per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

1. Standard for Ceiling Suspension System Installations: Comply with ASTM C 636.

B. Secure ceiling hangers from suspension system members to building's structural members. Install hangers plumb and free from contact with other objects within ceiling plenum. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure; that are appropriate for substrate; and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.

1. Do not support ceilings directly from permanent metal forms, or floor or roof deck. Do not attach hangers to steel deck tabs.
2. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers, unless otherwise indicated; and provide hangers not more than 8 inches (200 mm) from ends of each member.

C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

D. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

E. Install acoustical panels with undamaged edges and fitted accurately into

suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

1.4 ACOUSTICAL PANEL CEILING SCHEDULE

A. Acoustical Tile No. 1 (AT-1)

1. Armstrong 507M, or approved equal, natural fissured, medium textured.
2. Angled tegular edge design.
3. 24”x24”x3/4” size.
4. White color.
5. 0.65 NRC; 35 CAC.
6. 0.80 light reflectance coefficient.
7. Armstrong Prelude 15/16” Exposed Tee grid or approved equal; white color.

END OF SECTION 09511

SECTION 09651

RESILIENT TILE FLOORING

1.1 GENERAL

A. Submittals: As follows:

1. Product Data: For each type of product specified.

1.2 PRODUCTS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, those indicated for each designation in the Acoustical Panel Ceiling Schedule.

B. Vinyl Composition Floor Tile: Products complying with ASTM F 1066 and with requirements specified in the Resilient Tile Flooring Schedule.

C. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based formulation provided or approved by flooring manufacturer for applications indicated.

D. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

E. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edge of tiles, and in maximum available lengths to minimize running joints.

1.3 EXECUTION

A. Examine substrates, areas, and conditions where installation of resilient products will occur, with Installer present, for compliance with manufacturer's requirements. Verify that substrates and conditions are satisfactory for resilient product installation and comply with requirements specified.

1. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by flooring manufacturer.
2. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Preparation: Comply with resilient product manufacturer's written installation instructions for preparing substrates indicated to receive resilient products.

C. Tile Installation: Comply with tile manufacturer's written installation instructions.

1. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half of a tile at perimeter.
   a. Lay tiles square with room axis, unless otherwise indicated.
2. Match tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered.

   a. Lay tiles in basket-weave pattern with grain direction alternating in adjacent tiles.

D. Resilient Accessory Installation: Install resilient accessories according to manufacturer's written installation instructions.

E. Clean and protect resilient products according to manufacturer's written recommendations. Clean resilient products after installation and not more than 4 days before dates scheduled for inspections intended to establish date of Substantial Completion in each area of Project.

1.4 RESILIENT TILE SCHEDULE

A. Vinyl Composition Tile:

1. Products: Mannington, Tarkett, Armstrong (or approved equal).
2. Color: To be selected by Contracting Officer or authorized representative from manufacturer’s full range of standard colors.
3. Class: Class 2.
4. Wearing surface: Smooth.
5. Thickness: 0.125 inch.
6. Size 12 inch by 12 inch.

END OF SECTION 09651

SECTION 09653

RESILIENT WALL BASE AND ACCESSORIES

1 GENERAL

1.1 SUMMARY

A. This Section includes resilient the following:

1. Wall base.

1.2 SUBMITTALS

A. Product Data: For each product indicated.

B. Samples: For each product and for each color, pattern, and texture required.

1.3 PROJECT CONDITIONS

A. Maintain a temperature of not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C) in spaces to receive resilient accessories for at least 48 hours before installation, during installation, and for at least 48 hours after installation, unless manufacturer's written recommendations specify longer time periods.

1. After postinstallation period, maintain a temperature of not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

B. Install resilient accessories after other finishing operations, including painting, have been completed.

2 PRODUCTS

2.1 WALL BASE

A. Wall Base: Rubber, FS SS-W-40, Type I.

1. Color and Pattern: As selected from manufacturer's full range.
2. Style: Cove with top-set toe.
3. Minimum Thickness: 1/8 inch (3.2 mm).
4. Height: 4 inches (101.6 mm).
5. Lengths: Cut lengths 48 inches (1219.2 mm) long or coils in lengths standard with manufacturer, but not less than 96 feet (29.26 m).
6. Outside Corners: Job formed or premolded.

7. Inside Corners: Job formed or premolded.
8. Surface: Smooth.

3 EXECUTION

3.1 INSTALLATION

A. Before installing resilient wall base:

1. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
2. Move resilient products and installation accessories into spaces where they will be installed at least 48 hours before installation, unless longer conditioning periods are recommended in writing by manufacturer. Install products only after they are at the same temperature as the space where they are to be installed.
3. Broom and vacuum clean substrates to be covered immediately before installing resilient products. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Adhesively install resilient wall base. Place resilient products so they are butted to adjacent materials.

C. Apply resilient wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

1. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
2. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
3. Do not stretch base during installation.
4. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient wall base with manufacturer's recommended adhesive filler material.

D. Immediately after installing resilient products, remove adhesive and other surface blemishes using cleaner recommended by resilient product manufacturers.

END OF SECTION 09653

SECTION 09800

ACOUSTICAL WALL PANELS

1 GENERAL

1.1 WORK INCLUDED

A. Acoustical Wall and Ceiling Panels.

1.2 SUBMITTALS

A. Submit the following:

1. Product Data: Manufacturer's catalog information edited to indicate specific products and related accessories to be provided for this Project.
2. Samples: One 8 x 10 inch sample for each color available in fabric specified or selected to the AE for color selection.
3. Maintenance Data: Recommended procedures for normal cleaning and removal of stains. Include precautions in use of cleaning materials that may be detrimental to surfaces.

1.3 QUALITY ASSURANCE

A. Acoustical Wall Panel Fire-Test-Response Characteristics: Provide products with flame-spread and smoke-developed indices of not more than 25 and 450, respectively, per ASTM E 84 as determined by a testing agency acceptable to authorities having jurisdiction.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect products against damage during delivery and handling.

B. Store all items in a clean, dry storage area.

C. Maintain temperature in storage area above 40 degrees F, without excessive humidity.

1.5 PROJECT CONDITIONS

A. Install under same temperature and humidity conditions that will normally exist when the building is occupied.

B. Maintain temperature of all areas to receive acoustical wall treatment at 70 degrees F for 72 hours before, during, and 48 hours after application.

C. Remove material from packaging and allow to acclimatize in area of installation 24 hours before application.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to replace acoustical wall panels that fail in performance, materials, and workmanship within five years from date of Substantial Completion. Failure in performance includes, but is not limited to, acoustical performance. Failure in materials includes, but is not limited to, sagging or distortion of facing or warping of core.

2 PRODUCTS

2.1 ACOUSTICAL WALL AND CEILING PANELS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include the following (or approved equal):

1. Tectum “V-Line” Panels or approved equal.

B. Panel Characteristics:

1. Thickness: 1 ½”.
2. Beveled Edge Panel Width: 23 ¾”.
3. Length: 6 to 12 foot in 12-inch increments.
4. Finish: Painted White.

C. Mounting Accessories: Manufacturers standard accessories for securely mounting panels.

1. Provide all fasteners and metal furring strips for a complete single source installation.

3 EXECUTION

3.1 EXAMINATION

A. Examine surfaces scheduled to receive wall panels for unevenness, irregularities, and dampness that would affect quality and execution of work. Do not proceed with work until satisfactory conditions have been corrected.

3.2 INSTALLATION:

A. See that substrate is acceptable for the successful completion of the work of this Section prior to starting work.

B. Conform to manufacturer's installation details. All fastening devices shall be concealed in completed installation.

C. Prior to final inspection and/or occupancy of the building by the Government, review installation and replace all damaged panels, leaving installation complete and ready for occupancy by the Government without further work.

3.3 CLEANING

A. Clean exposed surfaces of acoustical wall panels to comply with manufacturer's instructions for cleaning and final touch up of minor finish damage.

B. Remove work which cannot be successfully cleaned and repaired to permanantly eliminate evidence of damage.

3.4 PROTECTION

A. Provide required protection for the acoustical wall panels, including temperature, humidity limitations and dust control so that the work will be without damage and deterioration at the time of acceptance by the Government.

END OF SECTION 09800

SECTION 09900

PAINTING

1 GENERAL

A. This Section includes surface preparation and field painting of exposed exterior and interior items and surfaces.

1. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

B. Paint exposed surfaces, except where the paint schedules indicate that a surface or material is not to be painted or is to remain natural. If the paint schedules do not specifically mention an item or a surface, paint the item or surface the same as similar adjacent materials or surfaces whether or not schedules indicate colors. If the schedules do not indicate color or finish, the Contracting Officer or Authorized Representative will select from standard colors and finishes available.

C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

1. Labels: Do not paint over Underwriters Laboratories (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

D. Submittals: For each paint system specified, provide the following:

1. Material List: Provide an inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
2. Manufacturer's Information: Provide manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.

E. Source Limitations: Obtain block fillers, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.

F. Deliver materials to the Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label.

G. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain containers in clean condition, free of foreign materials and residue. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily.

H. Project Conditions: Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

1.2 PRODUCTS

A. Material Compatibility: Provide block fillers, primers, undercoats, and finish-coat materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified. Paint-material containers not displaying manufacturer's product identification will not be acceptable.

C. Colors: Provide color selections made by the Contracting Officer’s Representative.

1.3 EXECUTION

A. Examine substrates, areas, and conditions under which painting will be performed for compliance with paint application requirements. Do not begin to apply paint until unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.

B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates.

C. Preparation: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before surface preparation and painting. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

D. Cleaning: Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease before cleaning. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

E. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition.

1. Cementitious Materials: Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
    a. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's written instructions.

2. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with the Steel Structures Painting Council's (SSPC) recommendations.
    a. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with the same primer as the shop coat.

3. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

F. Materials Preparation: Mix and prepare paint materials according to manufacturer's written instructions.

1. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
2. Use only thinners approved by paint manufacturer and only within recommended limits.

G. Application: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.

1. Paint colors, surface treatments, and finishes are indicated in the schedules.
2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
3. Provide finish coats that are compatible with primers used.
4. The term "exposed surfaces" includes areas visible when permanent or built-in items are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.
5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before the final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.

6. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
7. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
8. Sand lightly between each succeeding enamel or varnish coat.

H. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. The number of coats and the film thickness required are the same regardless of application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
2. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
3. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and where application of another coat of paint does not cause the undercoat to lift or lose adhesion.

I. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.

J. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer.

K. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by the manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn through or other defects due to insufficient sealing.

L. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

M. Field Quality Control: The Government reserves the right to engage the services of an independent testing agency to sample the paint material being used. Samples of material delivered to the Project will be taken, identified, sealed, and certified in the presence of the Contractor.

1. The testing agency will perform appropriate tests as required by the Government.
2. If tests show material being used does not comply with specified requirements, the Contractor shall remove noncomplying paint from the site, pay for testing, and repaint surfaces previously coated with the rejected paint. If necessary, the Contractor may be required to remove rejected paint from previously painted surfaces if, on repainting with specified paint, the 2 coatings are incompatible.

N. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.

1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

O. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Contracting Officer or Authorized Representative.

P. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.

1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

1.4 PAINT SCHEDULE

A. Concrete Masonry Units: Provide the following finish systems over interior concrete masonry block units:

1. Low-Luster, Acrylic-Enamel Finish: Two finish coats over a block filler.

a. Block Filler: High performance, latex-based, block filler applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 5.0 mils.
b. First and Second Coats: Low-luster (eggshell or satin), acrylic-latex, interior enamel applied at spreading rate recommended by manufacturer to achieve a total dry film thickness of not less than 2.8 mils.

B. Gypsum Board: Provide the following finish systems over interior gypsum board surfaces:

1. Low-Luster, Acrylic-Enamel Finish: Two finish coats over a primer.
a. Primer: Latex-based, interior primer at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mil.

b. First and Second Coats: Low-luster (eggshell or satin), acrylic-latex, interior enamel applied at spreading rate recommended by manufacturer to achieve a total dry film thickness of not less than 2.8 mils.

C. Ferrous Metal: Provide the following finish systems over ferrous metal:

1. Low-Luster, Acrylic-Enamel Finish: Two finish coats over a primer.
   a. Primer: Quick-drying, rust-inhibitive, alkyd-based or epoxy-metal primer, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.5 mils.
   b. First and Second Coats: Low-luster (eggshell or satin), acrylic-latex, interior enamel applied at spreading rate recommended by manufacturer to achieve a total dry film thickness of not less than 2.8 mils.

D. Zinc-Coated Metal: Provide the following finish systems over zinc-coated metal:

1. Low-Luster, Acrylic-Enamel Finish: Two finish coats over a primer.
   a. Primer: Galvanized metal primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.
   b. First and Second Coats: Low-luster (eggshell or satin), acrylic-latex, interior enamel applied at spreading rate recommended by manufacturer to achieve a total dry film thickness of not less than 2.8 mils.

END OF SECTION 09900

SECTION 10155

TOILET COMPARTMENTS

1.1 GENERAL

A. Submittals: Include the following:

1. Product Data: For each type of toilet compartment and screen specified.
2. Shop Drawings: For fabrication and installation of toilet compartment and screen assemblies.
3. Samples: Manufacturer's color charts consisting of sections of actual units showing the full range of colors, textures, and patterns available for each type of compartment or screen indicated.

1.2 PRODUCTS

A. Steel Sheets for Color-Coated Finish: Provide mill-phosphatized steel sheet, in manufacturer's standard baked finish and thicknesses, that is leveled to stretcher-leveled flatness and that complies with the requirements of ASTM A 591 (ASTM A 591M), Class C; or ASTM A 653 (ASTM A 653M), in manufacturer's standard coating designation.

B. Stainless-Steel Sheet: ASTM A 666, Type 302 or 304, that is leveled to stretcher-leveled flatness, in manufacturer's standard directional-polish finish and thicknesses.

C. Core Material for Metal-Faced Units: Manufacturer's standard sound-deadening honeycomb of resin-impregnated kraft paper in thickness required to provide finished thickness of 1 inch (25 mm) minimum for doors, panels, and screens and 1-1/4 inches (32 mm) minimum for pilasters.

D. Pilaster Shoes and Sleeves (Caps): ASTM A 666, Type 302 or 304 stainless steel, not less than 0.0312 inch (0.8 mm) thick and 3 inches (75 mm) high, finished to match hardware.

E. Stirrup Brackets: Manufacturer's standard ear or U-brackets for attaching panels and screens to walls and pilasters of chrome-plated, nonferrous, cast zinc alloy (zamac) or clear-anodized aluminum.

F. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories of chrome-plated, nonferrous, cast zinc alloy (zamac) or clear-anodized aluminum.

G. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile in manufacturer's standard finish.

H. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel or brass, finished to match hardware, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use hot-dip galvanized or other rust-resistant, protective-coated steel.

I. Fabrication: As follows:

1. Provide standard doors, panels, screens, and pilasters fabricated for compartment system. Provide units with cutouts and drilled holes to receive compartment-mounted hardware, accessories, and grab bars, as indicated.
   a. Provide internal reinforcement in metal units for compartment-mounted hardware, accessories, and grab bars, as indicated.

2. Overhead-Braced-and-Floor-Anchored Compartments: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, fasteners, and anchors at pilasters to suit floor conditions. Make provisions for setting and securing continuous head rail at top of each pilaster. Provide shoes at pilasters to conceal supports and leveling mechanism.
3. Wall-Hung Screens: Provide units in sizes indicated of same construction and finish as compartment panels, unless otherwise indicated.
4. Doors: Unless otherwise indicated, provide 24-inch- (610-mm-) wide in-swinging doors for standard toilet compartments and 36-inch- (914-mm-) wide out-swinging doors with a minimum 32-inch- (813-mm-) wide clear opening for compartments indicated to be handicapped accessible.
   a. Hinges: Manufacturer's standard self-closing type that can be adjusted to hold door open at any angle up to 90 degrees.
   b. Latch and Keeper: Manufacturer's standard surface-mounted latch unit with combination rubber-faced door strike and keeper designed for emergency access. Provide units that comply with accessibility requirements of authorities having jurisdiction at compartments indicated to be handicapped accessible.
   c. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent door from hitting compartment-mounted accessories.
   d. Door Bumper: Manufacturer's standard rubber-tipped bumpers at out-swinging doors or entrance screen doors.
   e. Door Pull: Manufacturer's standard unit that complies with accessibility requirements of authorities having jurisdiction at out-swinging doors. Provide units on both sides of doors at compartments indicated to be handicapped accessible.

1.3 EXECUTION

A. Installation: Comply with manufacturer's written installation instructions. Install units rigid, straight, plumb, and level. Provide clearances of not more than 1/2 inch (13 mm) between pilasters and panels and not more than 1 inch (25 mm) between panels and walls. Secure units in position with manufacturer's recommended anchoring devices.

1. Secure panels to walls and panels with not less than 2 stirrup brackets attached near top and bottom of panel. Locate wall brackets so holes for wall anchors occur in masonry or tile joints. Align brackets at pilasters with brackets at walls.

B. Overhead-Braced-and-Floor-Anchored Compartments: Secure pilasters to floor and level, plumb, and tighten. Secure continuous head rail to each pilaster with not less than 2 fasteners. Hang doors and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

C. Wall-Hung Screens: Attach with anchoring devices according to manufacturer's written instructions and to suit supporting structure. Set units level and plumb and to resist lateral impact.

D. Hardware Adjustment: Adjust and lubricate hardware according to manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors and swing doors in entrance screens to return to fully closed position.

END OF SECTION 10155

SECTION 10425

SIGNS

1 GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Panel signs.

1.2 SUBMITTALS

A. Product Data: For each product indicated.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other Work.

1. Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings.

C. Samples: For each exposed finish.

2 PRODUCTS

2.1 MATERIALS

A. Cast Acrylic Sheet: Cast (not extruded or continuous cast) methyl methacrylate monomer plastic sheet with minimum flexural strength of 16,000 psi (110 MPa) per ASTM D 790 and minimum allowable continuous service temperature of 176 deg F (80 deg C).

1. Opaque Sheet: Colored, in colors as selected from manufacturer's full range.

B. Fasteners: Use concealed fasteners fabricated from metals that are not corrosive to sign material and mounting surface.

C. Anchors and Inserts: Use nonferrous metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

D. Colored Coatings for Acrylic Plastic Sheet: Use colored coatings, including inks and paints for copy and background colors, recommended by acrylic manufacturers for optimum adherence to surface and that are nonfading for application intended.

2.2 PANEL SIGNS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Andco Industries Corp.
2. APCO Graphics, Inc.
3. ASI Sign Systems, Inc.
4. Best Manufacturing Company.
5. Mohawk Sign Systems.

B. Unframed Panel Signs: Fabricate with smooth edges mechanically finished.

1. Edge Condition: Square cut.
2. Corner Condition: Square.

C. Raised Copy: Machine-cut copy characters from matte-finished opaque acrylic sheet and chemically weld onto acrylic sheet forming sign panel face. Produce precisely formed characters with square cut edges free from burrs and cut marks.

1. Panel Material: Matte-finished opaque acrylic sheet.
2. Raised-Copy Thickness: Not less than 1/32 inch (0.8 mm).

2.3 FINISHES

A. Colors and Surface Textures: For exposed sign material that requires selection of materials with integral or applied colors, surface textures or other appearance characteristics, provide color matches as selected from manufacturer's full range, unless otherwise indicated.

3 EXECUTION

3.1 INSTALLATION

A. Install signs level, plumb, and at height indicated, with sign surfaces free from distortion or other defects in appearance.

B. Wall-Mounted Panel Signs:

1. Vinyl-Tape Mounting: Use double-sided foam tape to mount signs to smooth, nonporous surfaces. Do not use this method for vinyl-covered or rough surfaces.
2. Silicone-Adhesive Mounting: Use liquid silicone adhesive recommended by sign manufacturer to attach sign units to irregular, porous, or vinyl-covered surfaces. Use double-sided vinyl tape where recommended by sign manufacturer to hold sign in place until adhesive has fully cured.

END OF SECTION 10425

SECTION 10530

ALUMINUM DOORWAY/WALKWAY CANOPY SYSTEM

1 GENERAL

1.1 SECTION INCLUDES

A. This Section includes installation and erection of aluminum doorway/walkway canopy systems, both free standing and wall mounted. Canopies shall be installed where shown on drawings.

1.2 REFERENCES

A. AA (Aluminum Association) – Designation System for Aluminum Finishes.

B. AAMA 606.1 – Specifications and Inspection Methods for Integral Color Anodic Finishes for Architectural Aluminum.

C. AAMA 608.1 – Specification and Inspection Methods for Electrolytically Deposited Color Anodic Finishes for Architectural Aluminum.

D. ASCE 7-93 – Calculations for 90 MPA Wind Loads.

E. ASTM A123 – Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

F. ASTM B209 and 209M – Aluminum and Aluminum-Alloy Sheet and Plate.

G. ASTM B221 and 221M – Aluminum-Alloy Extruded Bar, Rod, Wire, Shape, and Tube.

1.3 SYSTEM DESCRIPTION

A. Aluminum canopy system includes an all-extruded structural system of anodized aluminum. The system shall be shop fabricated, factory finished and include all related flashing, anchorage and attachment devices required for a complete installation.

1.4 PERFORMANCE REQUIREMENTS

A. System Design: Design and size components to withstand dead and live loads caused by positive and negative wind pressure as calculated in accordance with 1996 North Carolina Building Code.

B. Structure shall be designed for expansion/contraction caused by temperature changes of 120°F with expansion joints provided, if required, and shown on the shop drawings. Such joints shall have no metal-to-metal contact between deck and beam or clamps. The expansion/contraction within system components shall cause no detrimental effect to system components or anchorage.

C. Water shall drain internally from deck to beams to downspouts, spouting out at ground level as shown on the drawings.

1.5 SUBMITTALS

A. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners and internal drainage details.

B. Shop Drawings: Indicate system dimensions, construction and flashing details, affected related work and expansion/contraction joint location and details. Shop drawings shall also show design of column footings based on manufacturers recommendations.

1.6 QUALITY ASSURANCE

A. Manufacturer and Installer: Company specializing in manufacturing aluminum glazing systems with minimum five years documented experience.

B. Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State of North Carolina.

1.7 DELIVERY, STORAGE, AND PROTECTION

A. Material and Equipment: Transport, handle, store, and protect products as required by the Manufacturer.

B. Protect finished aluminum surfaces with wrapping or strippable coating. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Material and Equipment: Provide protection from environmental conditions affecting products on site per Manufacturers recommendation.

B. Do not install sealants with ambient temperature is less than 40 degrees F during and 48 hours after installation.

1.9 WARRANTY

A. Correct defective Work within a five-year period after substantial completion.

B. Warranty: Include coverage for complete system for failure to meet specified requirements.

2 PRODUCTS

2.1 MANUFACTURERS

A. Royal Aluminum

B. Superior Metal Products Company

C. Or Approved Equal

2.2 MATERIALS

A. Extruded Aluminum: ASTM B221, 6063 alloy, T6 temper.

B. Fasteners: Stainless steel or manufacturers standard.

2.3 COMPONENTS

A. Roof Deck: Roll-formed aluminum sheet with interlocking seams. Identify by drawing:

1. Royal W-Pan: 12” ½ x 2 ½ or approved equal.
2.
3. Extruded sections shall interlock in a homogenous structural unit, with

joint designed and fabricated into structurally rigid shape, which is self-flashing. Interlocking joints shall be 12” on center except at each end where two pasterings shall be 8” on center. Fastening may be self-riveted by upsetting the metal or by screws or rivets. These fastenings shall have minimum shear strength of 350 lbs. each. Roof deck on simple spans of 15’ or more shall be assembled with camber sufficient to neutralize deflection caused by the dead load of the material and to provide possible drainage from the center of the deck.

B. Columns, Beams, and Fascias: Extruded aluminum sections of sizes and shapes indicated.

2.4 SEALANT MATERIALS

A. Sealant and Backing Materials:

1. Sealant Used Within System (Not Used for Glazing): As recommended by manufacturer.

2.5 FABRICATION

A. Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.

B. Prepare components to receive anchor devices. Fabricate anchors.

2.6 FINISHES

A. Finish Coatings: AAMA Architectural Class I Color Anodic Coating, AA-M10C22A42, color as indicated on Color Schedule.

B. Concealed Steel Items: Manufacturers standard.

C. Apply one coat of bituminous paint to concealed aluminum and steel surfaces in contact with cementitious or dissimilar materials.

D. Extent of Finish:

1. Apply factory coating to all surfaces exposed at completed assemblies.
2. Apply factory finish to surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.
3. Apply touch-up materials recommended by coating manufacturer for field application to cut ends and minor damage to factory applied finish.

3 EXECUTION

3.1 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.

3.2 INSTALLATION

A. Erection to occur to verified dimensions and elevations shown on approved shop drawings.

B. Install canopy system in accordance with manufacturer's instructions and applicable AAMA guidelines.

C. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

D. Provide alignment attachments and shims to permanently fasten system to building structure.

E. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

3.3 APPROVED ERECTOR

A. Erection shall be performed by an installer approved by the manufacturer, or as approved by the Contracting Officer or Authorized Representative.

3.4 ERECTION TOLERANCES

A. Maximum Variation from Plumb: 0.06 inches every 3 ft non-cumulative or 1/16 inches per 10 ft, whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

3.5 CLEANING

A. Remove protective materials from pre-finished aluminum surfaces.

B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

C. Remove excess sealant by method acceptable to sealant manufacturer.

3.6 PROTECTION OF FINISHED WORK

A. Protect finished Work from damage.

END OF SECTION 10530

SECTION 10801

TOILET AND BATH ACCESSORIES

1 GENERAL

A. Submittals: Manufacturer's Product Data. Include construction details, material descriptions and thicknesses, dimensions, profiles, fastening and mounting methods, specified options, and finishes for each type of accessory specified.

B. Product Options: Accessory requirements, including those for materials, finishes, dimensions, capacities, and performance, are established by specific products indicated in the Toilet and Bath Accessory Schedule on drawings.

1. Products of other manufacturers with equal characteristics, as judged solely by Contracting Officer or authorized representative, may be provided.

1.2 PRODUCTS

A. Materials: As follows:

1. Stainless Steel: ASTM A 666, Type 304, with No. 4 finish (satin), in 0.0312-inch (0.8-mm) minimum nominal thickness, unless otherwise indicated.
2. Brass: ASTM B 19, leaded and unleaded flat products; ASTM B 16 (ASTM B 16M), rods, shapes, forgings, and flat products with finished edges; ASTM B 30, castings.
3. Sheet Steel: ASTM A 366/A 366M, cold rolled, commercial quality, 0.0359-inch (0.9-mm) minimum nominal thickness; surface preparation and metal pretreatment as required for applied finish.
4. Galvanized Steel Sheet: ASTM A 653/A 653M, G60 (Z180).
5. Chromium Plating: ASTM B 456, Service Condition Number SC 2 (moderate service), nickel plus chromium electrodeposited on base metal.
6. Baked-Enamel Finish: Factory-applied, gloss-white, baked-acrylic-enamel coating.
7. Mirror Glass: ASTM C 1036, Type I, Class 1, Quality q2, nominal 6.0 mm thick, with silvering, electroplated copper coating, and protective organic coating complying with FS DD-M-411.
8. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
9. Fasteners: Screws, bolts, and other devices of same material as accessory unit, tamper and theft resistant when exposed, and of galvanized steel when concealed.
10. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to the Government's representative.

1.3 EXECUTION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

1. Secure mirrors to walls in concealed, tamper-resistant manner with special hangers, toggle bolts, or screws. Set units level, plumb, and square at locations indicated, according to manufacturer's written instructions for substrate indicated.
2. Install grab bars to withstand a downward load of at least 250 lbf (1112 N), when tested according to method in ASTM F 446.

B. Adjust accessories for unencumbered, smooth operation and verify that the mechanisms function properly. Replace damaged or defective items.

C. Remove temporary labels and protective coatings.

D. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 10801

SECTION 11160

LOADING DOCK EQUIPMENT

1 GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Transparent strip door curtains.

1.2 SUBMITTALS

A. Product Data: For each type of loading dock equipment indicated. Include rated capacities.

B. Shop Drawings: Include plans, elevations, sections, details, wiring diagrams, and attachments to other Work.

1. Provide templates for anchors and bolts anchored to permanent construction.

C. Maintenance data.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer, approved by manufacturer to install and maintain manufacturer's products.

2 PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where paragraph titles below introduce lists, the following requirements apply for product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

B. Basis-of-Design Product: The design for loading dock equipment is based on the product named in the Loading Dock Equipment Schedule. Subject to compliance with requirements, provide either the named product or a comparable product by

one of the other manufacturers specified for each type of equipment.

2.2 TRANSPARENT STRIP DOOR CURTAINS

A. Available Manufacturers (or approved equal):

1. Chalfant Sewing Fabricators, Inc.
2. Chase-Duras Industries.
3. Rite-Hite Corporation.
4. W. B. McGuire Co., Inc.; Division of Overhead Door Corporation.

B. General: Door curtains consisting of overlapping strips of extruded, transparent PVC, suspended from top of opening to form a sealed door curtain. Strips of length required to suit opening height with sufficient number in unit to close opening width with overlap indicated.

C. Strip Material: Curved, clear, transparent strips extruded from PVC. Strips with manufacturer's standard method of attachment to overhead mounting system indicated.

1. Grade: Standard-grade PVC designed to withstand a temperature range of minus 30 to plus 160 deg F (minus 34 to plus 71 deg C).
2. Strip Width: 6 inches (152 mm) wide and 0.060 inch (1.5 mm) thick.
3. Overlap: Two-thirds overlap.

3 EXECUTION

3.1 INSTALLATION

A. Transparent Strip Door Curtains: Attach door curtain mounting system to lintel with screw anchors or toggle bolts. Mount curtain strips to achieve overlap indicated.

END OF SECTION 11160

SECTION 13125

METAL BUILDING SYSTEMS

1 GENERAL

A. System Performance Requirements: Provide a complete, integrated set of metal building system manufacturer's standard mutually dependent components and assemblies that form a metal building system capable of withstanding structural and other loads, thermally induced movement, and exposure to weather without failure or infiltration of water into building interior. Include primary and secondary framing, roof and wall panels, and accessories complying with requirements indicated.

1. Metal Building System Design: Of size, spacing, slope, and spans indicated.
2. Structural Performance: Engineer metal building systems according to procedures in MBMA's "Low Rise Building Systems Manual", and loads indicated on the Drawings.
3. Thermal Movements: Provide metal building roof and wall panel systems that allow for thermal movements resulting from maximum change (range) in ambient and surface temperatures.

B. Submittals: Submit Product Data and the following:

1. Shop Drawings: Include plans, elevations, sections, details, structural analysis, anchor-bolt plans, structural-framing drawings, roof and wall panel layout drawings, personnel door schedule, and attachments to other Work.
2. Samples: For factory-applied color finishes.
3. Letter of Design Certification: Signed and sealed by a qualified professional engineer. Include the following:
   a. Name and location of Project.
   b. Order number.
   c. Name of manufacturer.
   d. Name of Contractor.
   e. Building dimensions and roof slope.
   f. Indicate compliance with AISC and AISI standards.
   g. Governing building code and year of edition.
   h. Design loads and load combinations.
   i. Building-use category and its effect on load importance factors.
   j. Statement that metal building system and components were designed and produced in an AISC-Certified Facility by an AISC-Certified Manufacturer.

C. Regulatory Requirements: Fabricate and label structural framing to comply with special inspection requirements at point of fabrication for welding and other connections required by authorities having jurisdiction.

D. Coordinate size and location of concrete foundations and casting of anchor-bolt inserts into foundation walls and footings. Concrete, reinforcement, and formwork requirements are specified in Division 3 Section "Cast-in-Place Concrete."

1.2 PRODUCTS

A. Structural-Steel Shapes: ASTM A 36 or ASTM A 529.

B. Steel Plate, Bar, or Strip: ASTM A 529, ASTM A 570, or ASTM A 572; 50,000-psi minimum yield strength.

C. Steel Tubing or Pipe: ASTM A 500, Grade B; ASTM A 501; or ASTM A 53, Grade B.

D. Structural-Steel Sheet: Hot-rolled, ASTM A 570, Grade 50; hot-rolled, ASTM 568; or cold-rolled, ASTM A 611, structural-quality, matte (dull) finish.

E. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653, structural quality, Grade 50, with G60 coating designation; mill phosphatized.

F. Metallic-Coated Steel Sheet Prepainted with Coil Coating: Comply with ASTM A 755 and the following requirements:

1. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792, Class AZ50 coating, Grade 40; structural quality.

G. Non-High-Strength Bolts, Nuts, and Washers: ASTM A 307, Grade A; carbon-steel, hex-head bolts; carbon-steel nuts; and flat, unhardened steel washers, uncoated.

H. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts, heavy hex carbon-steel nuts, and hardened carbon-steel washers, uncoated.

I. Anchor Rods, Bolts, Nuts, and Washers: As follows:

1. Unheaded Rods: ASTM A 36.
2. Unheaded Rods: ASTM A 572, Grade 50.
3. Headed Bolts: ASTM A 307, Grade A; carbon-steel, hex-head bolts; and carbon-steel nuts.
4. Headed Bolts: ASTM A 325, Type 1, heavy hex steel structural bolts and heavy hex carbon-steel nuts.

5. Headed Bolts: ASTM A 490, Type 1, heavy hex steel structural bolts and heavy hex carbon-steel nuts.
6. Washers: ASTM A 36/A 36M.

J. Primer: Manufacturer's standard, lead- and chromate-free, nonasphaltic, rust-inhibiting primer.

K. Metallic-Coated Steel Sheet Prepainted with Coil Coating for Roof and Wall Panels: Comply with ASTM A 755and the following requirements:

1. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792, Class AZ50 coating, Grade 40; structural quality.

L. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing; 1/2 inch wide and 1/8 inch thick.

M. Joint Sealant: ASTM C 920; one-part elastomeric polyurethane, polysulfide, or silicone-rubber sealant; of type, grade, class, and use classifications required to seal joints in panels and remain weathertight; and as recommended by metal building system manufacturer.

N. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat.

O. Nonmetallic, Shrinkage-Resistant Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout, complying with ASTM C 1107, of consistency suitable for application.

P. Shop Primer for Galvanized Metal Surfaces: Zinc dust, zinc-oxide primer selected by manufacturer for compatibility with substrate. Comply with FS TT-P-641.

Q. Finish Painting: Refer to Division 9 Section "Painting."

R. Structural Framing: Manufacturer's standard framing, designed to withstand required loads and specified requirements and as follows:

1. Fabrication: Shop-fabricate framing components to indicated size and section with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly. Shop prime with specified primer after fabrication.

a. Tolerances: Comply with MBMA's "Low Rise Building Systems Manual": Chapter IV, Section 9, "Fabrication and Erection Tolerances."

2. Primary Framing: Includes transverse and lean-to frames; rafter, rake, and canopy beams; sidewall, intermediate, end-wall, and corner columns; and wind bracing.

   a. Rigid Clear Span or Modular Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Provide interior columns fabricated from round steel pipe or tube, or shop-welded, built-up steel plates.
   b. Frame Configuration: Single gable.
   c. Exterior Column Type: Tapered.
   d. Rafter Type: Tapered.
3. End-Wall and Corner Columns: I-shaped sections fabricated from structural-steel shapes; shop-welded, built-up steel plates; or C-shaped, cold-formed, structural-steel sheet; with minimum thickness of 0.0747 inch.
4. End-Wall Rafters: C-shaped, cold-formed, structural-steel sheet; with minimum thickness of 0.0598 inch.
5. Secondary Framing: Fabricate from cold-formed, structural-steel sheet or roll-formed, metallic-coated steel sheet prepainted with coil coating, unless otherwise indicated, to comply with the following:
   a. Purlins: C- or Z-shaped sections; fabricated from minimum 0.0598-inch thick steel sheet, built-up steel plates, or structural-steel shapes; minimum 2-1/2-inch wide flanges; depth as indicated.
   b. Girts: C- or Z-shaped sections; fabricated from minimum 0.0598-inch thick steel sheet, built-up steel plates, or structural-steel shapes. Form ends of Z-sections with stiffening lips angled 45 to 50 degrees to flange and with minimum 2-1/2-inch wide flanges; depth as indicated.
   c. Eave Struts: Unequal-flange, C-shaped sections; fabricated from 0.0598-inch thick steel sheet, built-up steel plates, or structural-steel shapes.
   d. Flange and Sag Bracing: Minimum 1-5/8-by-1-5/8-inch structural-steel angles, with a minimum thickness of 0.0598 inch.
   e. Base or Sill Angles: Minimum 3-by-2-by-0.0747-inch zinc-coated (galvanized) steel sheet.
   f. Purlin and Girt Clips: Minimum 0.0747-inch thick, zinc-coated (galvanized) steel sheet.
   g. Secondary End-Wall Framing: Manufacturer's standard sections fabricated from minimum 0.0747-inch thick, zinc-coated (galvanized) steel sheet.
   h. Framing for Openings: Channel shapes; fabricated from minimum 0.0598-inch thick, cold-formed, structural-steel sheet or structural-steel shapes. Frame head and jamb of door openings, and head, jamb, and sill of other openings.
   i. Miscellaneous Structural Members: Manufacturer's standard sections fabricated from cold-formed, structural-steel sheet; built-

up steel plates; or zinc-coated (galvanized) steel sheet; designed to withstand required loads.

S. Roof Panels: Manufacturer's standard panels complying with the following:

1. Standing-Seam, Vertical-Rib Roof Panels: Fabricate flat-pan panels from metallic-coated steel sheets prepainted with coil coating, factory formed to provide 16-inch (406-mm) coverage; with 2-inch- (51-mm-) high, inverted-L, vertical ribs at panel edges. Design panels for mechanical attachment to roof purlins using concealed clips in side laps. Factory apply sealant at each interlocking joint. Comply with the following:
   a. Material: Aluminum-zinc alloy-coated steel.
   b. Metal Thickness: 0.0239 inch (0.60 mm).
   c. Joint Type: As standard with manufacturer.
   d. Clip System: Floating to accommodate thermal movement.
2. Roof Panel Accessories: Provide components required for a complete roof panel assembly. Match materials and finishes of roof panels, unless otherwise indicated.
   a. Thermal Spacer Blocks: Where panels attach directly to purlins, provide 1-inch thick, thermal spacer blocks; fabricated from extruded polystyrene.
3. Exterior Finish: Apply the following coil coating to roof panels and accessories:
   a. Fluoropolymer Two-Coat System: Thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat, with a total minimum dry film thickness of 1 mil (0.025 mm).
4. Concealed Finish for Roof Panels: Apply pretreatment and manufacturer's standard white or light-colored backer finish, consisting of prime coat and wash coat with a total minimum dry film thickness of 0.5 mil (0.013 mm).

T. Wall Panels: Provide manufacturer's standard uninsulated panels complying with the following:

1. Ribbed Panels: Fabricate from metallic-coated steel sheets prepainted with coil coating, factory formed to provide 36-inch (914-mm) coverage, with raised trapezoidal major ribs at 12 inches (305 mm) o.c. Design panels for mechanical attachment to structure using exposed fasteners, lapping major ribs at panel edges. Comply with the following:
   a. Material: Aluminum-zinc alloy-coated steel.
   b. Metal Thickness: 0.0239 inch (0.60 mm).
   c. Panel Thickness: 1.250 inches (32 mm).
2. Wall Panel Accessories: Provide components required for a complete wall panel assembly. Match materials and finishes of panels.
3. Exposed Finish for Exterior Panels: Apply the following coil coating:
   a. Fluoropolymer Two-Coat System: Thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat, with a total minimum dry film thickness of 1 mil (0.025 mm).
4. Concealed Finish: Apply pretreatment and manufacturer's standard white

or light-colored backer finish, consisting of prime coat and wash coat with a total minimum dry film thickness of 0.5 mil (0.013 mm).

U. Fascia Panels: Manufacturer's standard panels matching roof panel profile and material.

1. Finish: Match finish and color of roof panels.
2. Finish: Match finish and color of wall panels.

V. Soffit Panels: Manufacturer's standard panels matching wall panel profile and material.

1. Finish: Match finish and color of roof panels.
2. Finish: Match finish and color of wall panels.

W. Accessories: Metal building system manufacturer's standard units, fabricated from zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating, of thickness indicated; in same finish as roof and wall panels.

1. Fasteners: Provide fasteners with heads matching color of roof or wall sheets by means of plastic caps or factory-applied coating.
2. Flashing and Trim: 0.0179-inch metal thickness. Provide flashing and trim as required to seal against weather and to provide finished appearance.
3. Gutters and Downspouts: 0.0179-inch metal thickness, sized according to SMACNA's "Architectural Sheet Metal Manual." Furnish gutter supports spaced 36 inches o.c., fabricated from same metal as gutters. Finish gutters to match roof fascia and rake trim. Finish downspouts to match wall panels.
4. Roof Ventilators: Gravity type, complete with hardware, flashing, closures, and fittings.
   a. Continuous or Sectional Ridge-Type: Factory-engineered and -fabricated, continuous unit; minimum 0.0179-inch metal thickness. Provide complete with side baffles, ventilator assembly, end caps, splice plates, reinforcing diaphragms, bird screens, and dampers. Finish ventilators to match roof panels.

      10) Throat Size: 9 or 12 inches, as standard with manufacturer, and as required to comply with ventilation requirements.
5. Louvers: Refer to Division 10 Section "Louvers and Vents."
6. Roof Curbs: 0.0478-inch metal thickness; with welded top box and bottom skirt, and integral full-length cricket. Fabricate curb subframing of minimum 0.0598-inch thick, angle-, C-, or Z-shaped steel sheet; insulated with 1-inch thick rigid insulation. Finish roof curbs to match roof panels.
7. Closures: Closed-cell, laminated polyethylene; minimum 1-inch thick, flexible closure strips; cut or premolded to match roof and wall panel profile.
8. Pipe Flashing: Premolded, EPDM pipe collar with flexible aluminum ring bonded to base.

1.3 EXECUTION

A. Examination: Before erection proceeds, survey elevations and locations of concrete and masonry bearing surfaces, baseplates, and anchor bolts to receive structural framing. Verify compliance with requirements and metal building system manufacturer's tolerances.

B. Erect metal building system according to manufacturer's written instructions, erection drawings, and the following:

1. Baseplates and Bearing Plates: Clean concrete and masonry bearing surfaces and roughen surfaces before setting baseplates and bearing plates.
   a. Set baseplates and bearing plates for structural members on wedges, shims, or setting nuts.
   b. Tighten anchor bolts after supported members have been positioned and plumbed.
   c. Pack grout solidly between bearing surfaces and plates so no voids remain.
2. Framing, General: Align and adjust framing members before permanently fastening to compensate for discrepancies in elevations and alignment. Erect framing true to line, level, plumb, rigid, and secure.
   a. Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional engineer.
   b. Maintain structural stability of frame during erection.
3. Primary Framing and End Walls: Level baseplates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use grout to obtain uniform bearing and to maintain a level base-line elevation. Moist cure grout for not less than seven days after placement.
   a. Make field connections using high-strength bolts. Tighten bolts by turn-of-the-nut method.
4. Secondary Framing: Fasten secondary framing to primary framing using clips with field connections using non-high-strength bolts. Hold rigidly to a straight line by sag rods.
   a. Provide supplemental framing at entire perimeter of openings, including doors, windows, louvers, ventilators, and other penetrations of roof and walls.
5. Bracing: Install bracing in roof and sidewalls where indicated on erection drawings.
6. Framing for Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to building structural frame.

C. Roof Panel Installation: Provide roof panels of full length from eave to ridge when possible. Install panels perpendicular to purlins. Rigidly fasten eave end of roof panels and allow ridge end free movement due to thermal expansion and contraction. Predrill panels. Fasten roof panels to purlins at location and

spacing determined by manufacturer. Flash and seal roof panels with weather closures at eaves, rakes, and at perimeter of all openings.

1. Standing-Seam Roof Panels: Fasten roof panels to purlins with concealed clips at each standing-seam joint. Install clips over top of insulation. Crimp standing seams with manufacturer-approved motorized seamer tool.
2. Lap-Seam Roof Panels: Fasten roof panels to purlins with exposed fasteners at each lapped joint. Provide sealant tape at lapped joints of roof panels and between panels and protruding equipment, vents, and accessories.

D. Wall Panel Installation: Provide panels full height of building when possible. Install panels perpendicular to girts. Flash and seal wall panels with weather closures under eaves and rakes, along lower panel edges, and at perimeter of all openings. Install wall panels on exterior side of girts. Attach panels to supports with fasteners as recommended by manufacturer.

E. Fascia and Soffit Panel Installation: Provide panels full width of fasciae and soffits. Install panels perpendicular to support framing.

1. Fascia Panels: Align bottom of panels. Flash and seal panels with weather closures where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.
2. Soffit Panels: Flash and seal panels with weather closures where soffit meets walls and at perimeter of all openings.

F. Accessory Installation: Install gutters, downspouts, ventilators, louvers, and other accessories according to manufacturer's written instructions and SMACNA's "Architectural Sheet Metal Manual," with positive anchorage to building and weathertight mounting. Coordinate installation with flashings and other components. Provide for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated.

1. Provide elbow at base of downspout to direct water away from building.

G. Structural-Steel Erection Tolerances: Comply with erection tolerance limits of AISC S303, "Code of Standard Practice for Steel Buildings and Bridges."

H. Source and Field Quality Control: Government will engage a qualified independent testing agency to perform quality-control testing and special inspections, and to prepare test reports.

1. Special inspections of shop fabrications will not be required when fabrication is performed by a fabricator registered and approved by authorities having jurisdiction to perform such work without special inspection.
2. Shop- and field-bolted connections will be visually inspected.
3. Shop- and field-bolted connections will be tested and inspected according

to RCSC's "Load and Resistance Factor Design Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

4. In addition to visual inspection, shop welding will be inspected and tested according to AWS D1.1.

I. Adjusting: After completing installation, including work by other trades, lubricate, test, and adjust doors, windows, and accessory units to operate easily, free from warp, twist, or distortion.

J. Damaged Panels: Replace panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

K. Touchup Painting: Immediately after erection, clean, prepare, and prime or reprime welds, bolted connections, and abraded surfaces of prime-painted primary and secondary framing, accessories, and bearing plates. Repair damaged galvanized coatings on exposed surfaces with galvanized repair paint.

END OF SECTION 13125

SECTION 15050

BASIC MECHANICAL MATERIALS AND METHODS

1.1 GENERAL

A. Definitions include the following:

1. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.
2. Exposed, Interior Installations: Exposed to view indoors.
3. Exposed, Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions.
4. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants.
5. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures.

B. The following are industry abbreviations for plastic and rubber materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. CPVC: Chlorinated polyvinyl chloride plastic.
3. NP: Nylon plastic.
4. PE: Polyethylene plastic.
5. PVC: Polyvinyl chloride plastic.
6. CR: Chlorosulfonated polyethylene synthetic rubber.
7. EPDM: Ethylene-propylene-diene terpolymer rubber.

C. Equipment selection of higher electrical characteristics, physical dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. Any proposed equipment increases shall be at no additional cost to the Government. If minimum energy ratings or efficiencies of equipment are specified, equipment must meet design and commissioning requirements.

1.2 PRODUCTS

A. Refer to individual Division 15 piping Sections for pipe and fitting materials and joining methods and for special joining materials not listed below.

1. Plastic Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer.
2. Solder Filler Metal: ASTM B 32, Alloy Sn95, Alloy Sn94, or Alloy Sb5, unless otherwise indicated.

3. Brazing Filler Metals: AWS A5.8, BCuP Series or Alloy BAg1, unless otherwise indicated.
4. Solvent Cements: ASTM D 2235 for ABS piping, ASTM F 493 for CPVC piping, and ASTM D 2564 with ASTM F 656 primer for PVC piping.

B. Dielectric Fittings: Combination of copper alloy and ferrous; threaded, solder, plain, and weld-neck end types matching piping system materials; with insulating material suitable for system fluid, pressure, and temperature.

1. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).
2. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).
3. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

C. Flexible Connectors: Fabricated from materials suitable for system fluid and that will provide flexible pipe connections. Include 125-psig (860-kPa) minimum working-pressure rating, threaded ends for 2-inch NPS (DN50) and smaller, and flanged ends for 2-1/2-inch NPS (DN65) and larger.

1. Rubber, Flexible Connectors: CR or EPDM elastomer rubber construction, with multiple plies of NP fabric, molded and cured in hydraulic presses. Include 125-psig (860-kPa) minimum working-pressure rating at 220 deg F (104 deg C).

D. Steel, Sheet-Metal Sleeves: 0.0239-inch (0.6-mm) minimum thickness, galvanized, round tube closed with welded longitudinal joint.

E. Steel Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized, plain ends.

F. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.

G. Escutcheons: Manufactured wall, ceiling, and floor plates; deep-pattern type if required to conceal protruding fittings and sleeves. Include ID to closely fit around pipe, tube, and insulation of insulated piping and OD to completely cover opening.

1. Cast Brass: One-piece or split casting, with concealed hinge; set screw; and polished chrome-plated finish.
2. Stamped Steel: Split plate, with concealed hinge, spring clips, and chrome-plated finish.

H. Identifying Devices and Labels: Manufacturer's standard products.

1. Equipment Nameplates: Metal nameplate with operational data engraved or stamped; permanently fastened to equipment in accessible and visible location. Include manufacturer, product name, model number, serial number, capacity, operating and power characteristics, and labels of tested compliances.
2. Stencils: Standard stencils, prepared for required applications with letter sizes complying with recommendations of ASME A13.1 for piping and similar applications, but not less than 1-1/4-inch- (30-mm-) high letters for ductwork and not less than 3/4-inch- (19-mm-) high letters for access door signs and similar operational instructions.
    a. Material: Fiberboard or brass.
    b. Stencil Paint: Standard exterior-type stenciling enamel; black, unless otherwise indicated; either brushing grade or pressurized spray-can form and grade.
    c. Identification Paint: Standard identification enamel of colors indicated or, if not otherwise indicated for piping systems, comply with ASME A13.1 for colors.
3. Snap-on Plastic Pipe Markers: Manufacturer's standard preprinted, semirigid, snap on, color-coded, complying with ASME A13.1.
4. Pressure-Sensitive Pipe Markers: Manufacturer's standard preprinted, permanent adhesive, color-coded, pressure-sensitive vinyl, complying with ASME A13.1.
5. Plastic Duct Markers: Manufacturer's standard color-coded, laminated plastic. Include green for cold air; yellow for hot air; yellow/green or green for supply air; blue for exhaust, outside, return, and mixed air; and as recommended by ASME A13.1 for hazardous exhausts.
    a. Nomenclature: Include direction of airflow; duct service, origin, and destination; and design cubic feet per meter (liters per second).
6. Engraved Plastic-Laminate Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore. Fabricate in sizes required for message, engrave with standard letter style, of sizes and with wording to match equipment identification, punch for mechanical fastening, and 1/16-inch (1.6-mm) minimum thickness. Include self-tapping stainless-steel screws or contact-type permanent adhesive.
7. Plastic Equipment Markers: Color-coded, laminated plastic. Include green for cooling equipment; yellow for heating equipment; yellow/green or green for combination cooling and heating equipment; brown for energy reclamation equipment; blue for other equipment; and as recommended by ASME A13.1 for hazardous equipment. Include name and plan number, service, design capacity, design parameters, and size approximate 2-1/2 by 4 inches (65 by 100 mm) for control devices, dampers, and valves; and 4-1/2 by 6 inches (115 by 150 mm) for equipment.
8. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in mechanical identification, with corresponding designations indicated. Use numbers, lettering, and wording indicated for proper identification and operation/maintenance of mechanical systems and equipment.

I. Grout: ASTM C 1107, Grade B, nonshrink and nonmetallic, premixed and factory packaged; and 5000-psig (34.5-MPa), 28-day compressive strength design mix.

1.3 EXECUTION

A. Piping Systems - Common Requirements: Install piping as described below, unless piping Sections specify otherwise. Division 15 piping Sections specify unique installation requirements.

B. General Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated.

C. Install components with pressure rating equal to or greater than system operating pressure.

D. Install piping in concealed locations, except in equipment rooms and service areas.

E. Install exposed piping at right angles or parallel to building walls.

F. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.

G. Install piping to allow application of insulation plus 1-inch (25-mm) clearance around insulation.

H. Locate groups of pipes parallel to each other, spaced to permit valve servicing.

I. Install fittings for changes in direction and branch connections.

J. Install pipe escutcheons for pipe penetrations of concrete and masonry walls, wall board partitions, and suspended ceilings according to the following:

1. Chrome-Plated Piping: Cast brass, one piece, with set screw, and polished chrome-plated finish. Use split-casting escutcheons if required, for existing piping.
2. Uninsulated Piping Wall Escutcheons: Cast brass or stamped steel, with set screw.

3. Insulated Piping: Cast brass or stamped steel; with concealed hinge, spring clips, and chrome-plated finish.
4. Piping in Utility Areas: Cast brass or stamped steel, with set-screw or spring clips.

K. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces, except extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor.
2. Install sleeves large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
   a. Steel Pipe Sleeves: For pipes smaller than 6-inch NPS (DN150), in exterior walls.
   b. PVC or Steel Pipe Sleeves: For pipes smaller than 6-inch NPS (DN150), unless otherwise indicated.
   c. Steel, Sheet-Metal Sleeves: For pipes 6-inch NPS (DN150) and larger, penetrating gypsum-board partitions.
3. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants. Refer to Division 7 Section "Joint Sealants" for materials. Use Type S, Grade NS, Class 25, Use O neutral-curing silicone sealant, unless otherwise indicated.
4. Aboveground, Exterior-Wall, Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeve for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals. Assemble and install mechanical sleeve seals according to manufacturer's written instructions.

L. Verify final equipment locations for roughing-in. Refer to other Sections of these Specifications for roughing-in requirements.

M. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping specification Sections. Ream ends of pipes and tubes and remove burrs; bevel plain ends of steel pipe; and remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly. Construct soldered joints according to AWS's "Soldering Manual," Chapter "The Soldering of Pipe and Tube" or CDA's "Copper Tube Handbook"; brazed joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube"; threaded joints according to ASME B1.20.1; and welded joints according to AWS D10.12, "Recommended Practices and Procedures for Welding Low Carbon Steel Pipe."

1. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Comply with ASTM F 402 for safe handling practice of cleaners, primers, and solvent cements, and join ABS piping according to ASTM D 2235 and ASTM D 2661, CPVC piping according to ASTM D 2846 and ASTM F 493, PVC pressure piping according to ASTM D 2672, and PVC nonpressure piping according to

ASTM D 2855.

N. Piping Connections: Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping 2-inch NPS (DN50) and smaller, adjacent to each valve and at final connection to each piece of equipment with 2-inch NPS (DN50) or smaller threaded pipe connection.
2. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
3. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

O. Painting and Finishing: Refer to Division 9 Section "Painting" for paint materials, surface preparation, and application of paint. All exposed exterior mechanical equipment and materials shall be painted a color as selected by the Contracting Officer or authorized representative. Apply semigloss, acrylic-enamel finish to exposed piping according to the following:

1. Interior, Ferrous Piping and Ferrous Supports: Finish coat over enamel undercoat and primer.
2. Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

P. Concrete Bases: Construct concrete equipment bases of dimensions indicated, but not less than 4 inches (100 mm) larger than supported unit in both directions. Follow supported equipment manufacturer's setting templates for anchor bolt and tie locations. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."

Q. Erection of Metal Supports and Anchorage: Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment. Comply with AWS D1.1, "Structural Welding Code--Steel," for welding.

R. Cutting and Patching: Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of trades involved. Repair cut surfaces to match adjacent surfaces.

S. Grouting: Install nonmetallic nonshrink grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors.

END OF SECTION 15050

SECTION 15055

MOTORS

1.1 GENERAL

A. Definitions:

1. Factory-Installed Motor: A motor installed by motorized-equipment manufacturer as a component of equipment.
2. Field-Installed Motor: A motor installed at Project site and not factory installed as an integral component of motorized equipment.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70 – NATIONAL ELECTRICAL CODE.

D. Motors shall comply with efficiency requirements of the North Carolina Energy Code.

1.2 PRODUCTS

A. Motor Requirements:

1. Motor requirements apply to factory-installed and field-installed motors except as follows:
   a. Different ratings, performance, or characteristics for a motor are specified in another Section.
   b. Manufacturer for a factory-installed motor requires ratings, performance, or characteristics, other than those specified in this Section, to meet performance specified.

B. Motor Characteristics:

1. Motors 1/2 HP and Larger: Three phase.
2. Motors Smaller Than 1/2 HP: Single phase.
3. Frequency Rating: 60 Hz.
4. Voltage Rating: NEMA standard voltage selected to operate on nominal circuit voltage to which motor is connected.
5. Service Factor: 1.15 for open dripproof motors; 1.15 for totally enclosed motors.
6. Duty: Continuous duty at ambient temperature of 105 deg F (40 deg C) and at altitude of 3300 feet (1005 m) above sea level.
7. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and

environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

8. Enclosure: Open dripproof.

C. Polyphase Motors: NEMA MG 1, Design B, medium induction motor.

1. Efficiency: As prescribed by the latest North Carolina Building Code, Volume X – Energy, Chapter 4, Section 401.2.
2. Stator: Copper windings, unless otherwise indicated.
   a. Multispeed motors shall have separate winding for each speed.
3. Rotor: Squirrel cage, unless otherwise indicated.
4. Bearings: Double-shielded, prelubricated ball bearings suitable for radial and thrust loading.
5. Temperature Rise: Match insulation rating, unless otherwise indicated.
6. Insulation: Class F, unless otherwise indicated.
7. Code Letter Designation:
   a. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.
8. Enclosure: Cast iron for motors 1.0 hp and larger; rolled steel for motors smaller than 1.0 hp.
   a. Finish: Gray enamel.

D. Polyphase Motors with Additional Requirements:

1. Motors Used with Reduced-Inrush Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
2. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
   a. Designed with critical vibration frequencies outside operating range of controller output.
   b. Temperature Rise: Matched to rating for Class B insulation.
   c. Insulation: Class H.
   d. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
3. Rugged-Duty Motors: Totally enclosed, with 1.25 minimum service factor, greased bearings, integral condensate drains, and capped relief vents. Windings insulated with nonhygroscopic material.
   a. Finish: Chemical-resistant paint over corrosion-resistant primer.
4. Source Quality Control: Perform the following tests on each motor according to NEMA MG 1:
   a. Measure winding resistance.
   b. Read no-load current and speed at rated voltage and frequency.
   c. Measure locked rotor current at rated frequency.
   d. Perform high-potential test.

E. Single-Phase Motors:

1. One of the following, to suit starting torque and requirements of specific motor application:

a. Permanent-split capacitor.
b. Split-phase start, capacitor run.
c. Capacitor start, capacitor run.

2. Shaded-Pole Motors: Do not use shaded pole motors.
3. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.
4. Bearings: Ball type for belt-connected motors and other motors with high radial forces on motor shaft; sealed, prelubricated-sleeve type for other single-phase motors.
5. Source Quality Control: Perform the following tests on each motor according to NEMA MG 1:
   a. Measure winding resistance.
   b. Read no-load current and speed at rated voltage and frequency.
   c. Measure locked rotor current at rated frequency.
   d. Perform high-potential test.

1.3 EXECUTION

A. Motor Installation:

1. Anchor each motor assembly to base, adjustable rails, or other support, arranged and sized according to manufacturer's written instructions. Attach by bolting. Level and align with load transfer link.

B. Field Quality Control:

1. Prepare for acceptance tests as follows:
   a. Run each motor with its controller. Demonstrate correct rotation, alignment, and speed at motor design load.
   b. Test interlocks and control features for proper operation.
   c. Verify that current in each phase is within nameplate rating.
2. Testing: Perform the following field quality-control testing:
   a. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.15.1. Certify compliance with test parameters.
   b. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

C. Adjusting: Align motors, bases, shafts, pulleys and belts. Tension belts according to manufacturer's written instructions.

END OF SECTION 15055

SECTION 15060

HANGERS AND SUPPORTS

1.1 GENERAL

A. Design channel support systems for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

B. Design heavy-duty steel trapezes for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

C. Design seismic restraint hangers and supports for piping and equipment.

D. Design and obtain approval from authorities having jurisdiction for seismic restraint hangers and supports for piping and equipment.

1.2 PRODUCTS

A. Pipe Hangers, Supports, and Components: MSS SP-58, factory-fabricated components.

1. Galvanized, Metallic Coatings: For piping and equipment that will not have field-applied finish.
2. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

B. Channel Support Systems: MFMA-2, factory-fabricated components for field assembly.

1. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.
2. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

C. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

D. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars, black and galvanized.

1.3 EXECUTION

A. Specific hanger requirements are specified in Sections specifying equipment and systems.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Specification Sections.

C. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Adjustable Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30 (DN15 to DN750).
2. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24 (DN20 to DN600), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
3. Adjustable Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN15 to DN200).
4. U-Bolts (MSS Type 24): For support of heavy pipe, NPS 1/2 to NPS 30 (DN15 to DN750).

D. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20 (DN20 to DN500), if longer ends are required for riser clamps.

E. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.

F. Building Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
2. C-Clamps (MSS Type 23): For structural shapes.
3. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
   a. Light (MSS Type 31): 750 lb (340 kg).
   b. Medium (MSS Type 32): 1500 lb (675 kg).
   c. Heavy (MSS Type 33): 3000 lb (1350 kg).
4. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

5. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

G. Pipe Hanger and Support Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

H. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

I. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

K. Equipment Supports: Fabricate structural-steel stands to suspend equipment from structure above or to support equipment above floor. Place grout under supports for equipment and make smooth bearing surface.

END OF SECTION 15060

SECTION 15071

MECHANICAL VIBRATION AND ISOLATORS

1.1 GENERAL

A. Definitions:

1. Effective peak velocity related acceleration coefficient.

B. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."

1.2 PRODUCTS

A. Elastomeric Isolator Pads: Oil- and water-resistant elastomer or natural rubber, arranged in single or multiple layers, molded with a nonslip pattern and galvanized steel baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment.

1. Material: Standard neoprene.
2. Durometer Rating: 45.
3. Number of Layers: 2.

B. Elastomeric Hangers: Double-deflection type, with molded, oil-resistant rubber or neoprene isolator elements bonded to steel housings with threaded connections for hanger rods. Color-code or otherwise identify to indicate capacity range.

C. Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.

1.3 EXECUTION

A. Adjust active height of spring isolators.

B. Adjust seismic restraints to permit free movement of equipment within normal mode of operation.

C. Torque anchor bolts according to equipment manufacturer's written recommendations to resist seismic forces.

END OF SECTION 15071

SECTION 15075

MECHANICAL IDENTIFICATION

1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes mechanical identification materials and devices.

1.3 SUBMITTALS

A. Product Data: For identification materials and devices.

1.4 QUALITY ASSURANCE

A. Comply with ASME A13.1, "Scheme for the Identification of Piping Systems" for lettering size, length of color field, colors, and viewing angles of identification devices.

1.5 SEQUENCING AND SCHEDULING

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Install identifying devices before installing acoustical ceilings and similar concealment.

2 PRODUCTS

2.1 IDENTIFYING DEVICES AND LABELS

A. General: Products specified are for applications referenced in other Division 15 Sections. If more than single type is specified for listed applications, selection is

Installer's option.

B. Equipment Nameplates: Metal permanently fastened to equipment with data engraved or stamped.

1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and essential data.
2. Location: Accessible and visible.

C. Snap-On Plastic Pipe Markers: Manufacturer's standard preprinted, semirigid, snap-on type. Include color-coding according to ASME A13.1, unless otherwise indicated.

D. Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): Full-band pipe markers, extending 360 degrees around pipe at each location.

E. Lettering: Manufacturer's standard preprinted captions as selected by the Contracting Officer or authorized representative.

F. Engraved Plastic-Laminate Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.

1. Engraving: Engraver's standard letter style, of sizes and with terms to match equipment identification.
2. Thickness: 1/8 inch (3 mm), unless otherwise indicated.
3. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

G. Plastic Equipment Markers: Manufacturer's standard laminated plastic, in the following color codes:

1. Green: Cooling equipment and components.
2. Yellow: Heating equipment and components.
3. Blue: Equipment and components that do not meet criteria above.
4. Hazardous Equipment: Use colors and designs recommended by ASME A13.1.
5. Terminology: Match schedules as closely as possible. Include the following:
   a. Name and plan number.
   b. Equipment service.
   c. Design capacity.
   d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.
6. Size: 2-1/2 by 4 inches (65 by 100 mm) for control devices, dampers,

and valves; 4-1/2 by 6 inches (115 by 150 mm) for equipment.

3 EXECUTION

3.1 LABELING AND IDENTIFYING PIPING SYSTEMS

A. Install pipe markers on each system. Include arrows showing normal direction of flow.

B. Marker Type: Plastic markers, with application systems. Install on pipe insulation segment where required for hot, noninsulated pipes.

C. Fasten markers on pipes and insulated pipes smaller than 6 inches (150 mm) OD by one of following methods:

1. Snap-on application of pretensioned, semirigid plastic pipe marker.

D. Locate pipe markers and color bands where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior nonconcealed locations according to the following:

1. Near each control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Mark each pipe at branch, where flow pattern is not obvious.
3. Near major equipment items and other points of origination and termination.
4. Spaced at a maximum of 50-foot (15-m) intervals along each run. Reduce intervals to 25 feet (7.5 m) in areas of congested piping and equipment.
5. On piping above removable acoustical ceilings, except omit intermediately spaced markers.

3.2 EQUIPMENT SIGNS AND MARKERS

A. Install engraved plastic-laminate signs or equipment markers on or near each major item of mechanical equipment. Include signs for the following general categories of equipment:

1. Condensers, and similar motor-driven units.
2. Fans, blowers, primary balancing dampers, and mixing boxes.
3. Packaged HVAC central-station and zone-type units.

B. Plasticized Tags: Install within concealed space, to reduce amount of text in exposed sign outside concealment, if equipment to be identified is concealed above acoustical ceiling or similar concealment.

3.3 ADJUSTING AND CLEANING

A. Relocate mechanical identification materials and devices that have become visually blocked by work of this or other Divisions.

END OF SECTION 15075

SECTION 15081

DUCT INSULATION

1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes semirigid and flexible duct and plenum insulation; insulating cements; field-applied jackets; accessories and attachments; and sealing compounds.

B. Related Sections include the following:

1. Division 15 Section "Equipment Insulation" for insulation materials and application for pumps, tanks, hydronic specialties, and other equipment.
2. Division 15 Section "Pipe Insulation" for insulation for piping systems.

1.3 SUBMITTALS

A. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.

B. Installer Certificates: Signed by the Contractor certifying that installers comply with requirements.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate clearance requirements with duct Installer for insulation application.

1.7 SCHEDULING

A. Schedule insulation application after testing duct systems. Insulation application may begin on segments of ducts that have satisfactory test results.

2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following (or approved equal):

1. Mineral-Fiber Insulation:
   a. CertainTeed Manson.
   b. Knauf FiberGlass GmbH.
   c. Owens-Corning Fiberglas Corp.
   d. Schuller International, Inc.

2.2 INSULATION MATERIALS

A. Mineral-Fiber Board Thermal Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IB, without facing and with all-service jacket manufactured from kraft paper, reinforcing scrim, aluminum foil, and vinyl film.

2.3 FIELD-APPLIED JACKETS

A. General: ASTM C 921, Type 1, unless otherwise indicated.

B. Foil and Paper Jacket: Laminated, glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil.

2.4 ACCESSORIES AND ATTACHMENTS

A. Glass Cloth and Tape: Comply with MIL-C-20079H, Type I for cloth and Type II for tape. Woven glass-fiber fabrics, plain weave, presized a minimum of 8 oz./sq. yd. (270 g/sq. m).

1. Tape Width: 4 inches (100 mm).

B. Bands: 3/4 inch (19 mm) wide, in one of the following materials compatible with jacket:

1. Stainless Steel: ASTM A 666, Type 304; 0.020 inch (0.5 mm) thick.

2.5 VAPOR RETARDERS

A. Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL APPLICATION REQUIREMENTS

A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; and free of voids throughout the length of ducts and fittings.

B. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each duct system.

C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Apply multiple layers of insulation with longitudinal and end seams staggered.

E. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.

F. Keep insulation materials dry during application and finishing.

G. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.

H. Apply insulation with the least number of joints practical.

I. Apply insulation over fittings and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated.

J. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic. Apply insulation continuously through hangers and around anchor attachments.

K. Insulation Terminations: For insulation application where vapor retarders are indicated, seal ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.

L. Apply insulation with integral jackets as follows:

1. Pull jacket tight and smooth.
2. Joints and Seams: Cover with tape and vapor retarder as recommended by insulation material manufacturer to maintain vapor seal.
3. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to duct flanges and fittings.

M. Cut insulation according to manufacturer's written instructions to prevent compressing insulation to less than 75 percent of its nominal thickness.

N. Install vapor-retarder mastic on ducts and plenums scheduled to receive vapor retarders.

1. Ducts with Vapor Retarders: Overlap insulation facing at seams and seal with vapor-retarder mastic and pressure-sensitive tape having same facing as insulation. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-retarder seal.

2. Ducts without Vapor Retarders: Overlap insulation facing at seams and secure with outward clinching staples and pressure-sensitive tape having same facing as insulation.

O. Roof Penetrations: Apply insulation for interior applications to a point even with top of roof flashing.

1. Seal penetrations with vapor-retarder mastic.
2. Apply insulation for exterior applications tightly joined to interior insulation ends.
3. Seal insulation to roof flashing with vapor-retarder mastic.

P. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and partitions, except fire-rated walls and partitions.

3.4 MINERAL-FIBER INSULATION APPLICATION

A. Blanket Applications for Ducts and Plenums: Secure blanket insulation with adhesive.

1. Apply adhesives according to manufacturer's recommended coverage rates per square foot, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation segment with 1/2-inch (13-mm) staples, 1 inch (25 mm) o.c., and cover with pressure-sensitive tape having same facing as insulation.
4. Apply insulation on rectangular duct elbows and transitions with a full insulation segment for each surface. Apply insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
5. Insulate duct stiffeners, hangers, and flanges that protrude beyond the insulation surface with 6-inch- (150-mm-) wide strips of the same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with anchor pins spaced 6 inches (150 mm) o.c.
6. Apply vapor-retarder mastic to open joints, breaks, and punctures for insulation indicated to receive vapor retarder.

B. Board Applications for Ducts: Secure board insulation with adhesive.

1. Apply adhesives according to manufacturer's recommended coverage rates per square foot, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation segment with 1/2-inch (13-

mm) staples, 1 inch (25 mm) o.c., and cover with pressure-sensitive tape having same facing as insulation.

4. Apply insulation on rectangular duct elbows and transitions with a full insulation segment for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Apply insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
5. Apply vapor-retarder mastic to open joints, breaks, and punctures for insulation indicated to receive vapor retarder.

3.5 FIELD-APPLIED JACKET APPLICATION

A. Apply glass-cloth jacket, where indicated, directly over bare insulation or insulation with factory-applied jackets.

1. Apply jacket smooth and tight to surface with 2-inch (50-mm) overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- (1.6-mm-) thick coats of jacket manufacturer's recommended adhesive.
3. Completely encapsulate insulation with jacket, leaving no exposed raw insulation.

3.6 DUCT SYSTEM APPLICATIONS

A. Insulation materials and thicknesses are specified in schedules at the end of this Section.

B. Materials and thicknesses for systems listed below are specified in schedules at the end of this Section.

C. Insulate the following plenums and duct systems:

1. Indoor concealed supply-, return-, and outside-air ductwork.
2. Indoor exposed supply-, return-, and outside-air ductwork.

D. Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:

1. Factory-insulated flexible ducts.
2. Factory-insulated plenums, casings, terminal boxes, and filter boxes and sections.
3. Flexible connectors.
4. Vibration-control devices.
5. Testing agency labels and stamps.
6. Nameplates and data plates.
7. Access panels and doors in air-distribution systems.

3.7 INDOOR DUCT AND PLENUM APPLICATION SCHEDULE

A. Service: Rectangular and round, supply, return, and exhaust air ducts, concealed.

1. Material: Mineral-fiber blanket.
2. Thickness: 1-1/2 inches (38 mm).
3. Number of Layers: One.
4. Field-Applied Jacket: Foil and paper.
5. Vapor Retarder Required: Yes.

B. Service: Rectangular supply and return-air ducts, exposed.

1. Material: Mineral-fiber board.
2. Thickness: 1-1/2 inches (38 mm).
3. Number of Layers: One.
4. Field-Applied Jacket: Glass cloth.
5. Vapor Retarder Required: Yes.

END OF SECTION 15081

SECTION 15083

PIPE INSULATION

1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes preformed, rigid and flexible pipe insulation; insulating cements; field-applied jackets; accessories and attachments; and sealing compounds.

1.3 SUBMITTALS

A. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.

B. Samples: For each type of insulation and jacket. Identify each Sample, describing product and intended use. Submit Samples in the following sizes:

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 15 Section "Hangers and Supports."

B. Coordinate clearance requirements with piping Installer for insulation application.

1.7 SCHEDULING

A. Schedule insulation application after testing piping systems. Insulation application may begin on segments of piping that have satisfactory test results.

2 PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following (or approved equal):

1. Mineral-Fiber Insulation:
   a. CertainTeed Manson.
   b. Knauf FiberGlass GmbH.
   c. Owens-Corning Fiberglas Corp.
   d. Schuller International, Inc.

2.2 INSULATION MATERIALS

A. Mineral-Fiber Insulation: Glass fibers bonded with a thermosetting resin complying with the following:

1. Preformed Pipe Insulation: Comply with ASTM C 547, Type 1, with factory-applied, all-purpose, vapor-retarder jacket.
2. Fire-Resistant Adhesive: Comply with MIL-A-3316C in the following classes and grades:
   a. Class 1, Grade A for bonding glass cloth and tape to unfaced glass-fiber insulation, for sealing edges of glass-fiber insulation, and for bonding lagging cloth to unfaced glass-fiber insulation.
   b. Class 2, Grade A for bonding glass-fiber insulation to metal surfaces.
3. Vapor-Retarder Mastics: Fire- and water-resistant, vapor-retarder mastic for indoor applications. Comply with MIL-C-19565C, Type II.

B. Prefabricated Thermal Insulating Fitting Covers: Comply with ASTM C 450 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.

2.3 FIELD-APPLIED JACKETS

A. General: ASTM C 921, Type 1, unless otherwise indicated.

B. Foil and Paper Jacket: Laminated, glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil.

C. Embossed aluminum jacket with aluminum bands.

D. Standard PVC Fitting Covers: Factory-fabricated fitting covers manufactured from 20-mil- (0.5-mm-) thick, high-impact, ultraviolet-resistant PVC.

1. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories for the disabled.
2. Adhesive: As recommended by insulation material manufacturer.

2.4 ACCESSORIES AND ATTACHMENTS

A. Glass Cloth and Tape: Comply with MIL-C-20079H, Type I for cloth and Type II for tape. Woven glass-fiber fabrics, plain weave, presized a minimum of 8 oz./sq. yd. (270 g/sq. m).

1. Tape Width: 4 inches (100 mm).

B. Bands: 3/4 inch (19 mm) wide, in one of the following materials compatible with jacket:

1. Stainless Steel: ASTM A 666, Type 304; 0.020 inch (0.5 mm) thick.

C. Wire: 0.080-inch (2.0-mm), nickel-copper alloy; 0.062-inch (1.6-mm), soft-annealed, stainless steel; or 0.062-inch (1.6-mm), soft-annealed, galvanized steel.

2.5 VAPOR RETARDERS

A. Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for

installation and other conditions affecting performance of insulation application.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry pipe and fitting surfaces. Remove materials that will adversely affect insulation application.

3.3 GENERAL APPLICATION REQUIREMENTS

A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.

B. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each piping system.

C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Apply insulation with longitudinal seams at top and bottom of horizontal pipe runs.

E. Apply multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.

H. Keep insulation materials dry during application and finishing.

I. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.

J. Apply insulation with the least number of joints practical.

K. Apply insulation over fittings, valves, and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated. Refer to special instructions for applying insulation over fittings, valves, and specialties.

L. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic.

1. Apply insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor retarders are indicated, extend insulation on anchor legs at least 12 inches (300 mm) from point of attachment to pipe and taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
3. Install insert materials and apply insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by the insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect the jacket from tear or puncture by the hanger, support, and shield.

M. Insulation Terminations: For insulation application where vapor retarders are indicated, taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.

N. Apply adhesives and mastics at the manufacturer's recommended coverage rate.

O. Apply insulation with integral jackets as follows:

1. Pull jacket tight and smooth.
2. Circumferential Joints: Cover with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip and spaced 4 inches (100 mm) o.c.
3. Longitudinal Seams: Overlap jacket seams at least 1-1/2 inches (40 mm). Apply insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches (100 mm) o.c.
   a. Exception: Do not staple longitudinal laps on insulation having a vapor retarder.
4. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to flanges, unions, valves, and fittings.
5. Seal penetrations with vapor-retarder mastic.

6. Apply insulation for exterior applications tightly joined to interior insulation ends.

P. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and floors.

3.4 MINERAL-FIBER INSULATION APPLICATION

A. Apply insulation to straight pipes and tubes as follows:

1. Secure each layer of preformed pipe insulation to pipe with wire, tape, or bands without deforming insulation materials.
2. Where vapor retarders are indicated, seal longitudinal seams and end joints with vapor-retarder mastic. Apply vapor retarder to ends of insulation at intervals of 15 to 20 feet (4.5 to 6 m) to form a vapor retarder between pipe insulation segments.
3. For insulation with factory-applied jackets, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets with vapor retarders, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by the insulation material manufacturer and seal with vapor-retarder mastic.

B. Apply insulation to fittings and elbows as follows:

1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When premolded insulation elbows and fittings are not available, apply mitered sections of pipe insulation, or glass-fiber blanket insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire, tape, or bands.
3. Cover fittings with standard PVC fitting covers.
4. Cover fittings with heavy PVC fitting covers. Overlap PVC covers on pipe insulation jackets at least 1 inch (25 mm) at each end. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.

3.5 FIELD-APPLIED JACKET APPLICATION

A. Foil and Paper Jackets: Apply foil and paper jackets where indicated.

1. Draw jacket material smooth and tight.
2. Apply lap or joint strips with the same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Apply jackets with 1-1/2-inch (40-mm) laps at longitudinal seams and 3-inch- (75-mm-) wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-retarder mastic.

3.6 FINISHES

A. Glass-Cloth Jacketed Insulation: Paint insulation finished with glass-cloth jacket as specified in Division 9 Section "Painting."

3.7 PIPING SYSTEM APPLICATIONS

A. Insulation materials and thicknesses are specified in schedules at the end of this Section.

B. Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:

1. Vibration-control devices.
2. Chrome-plated pipes and fittings, unless potential for personnel injury.
3. Air chambers, unions, strainers, check valves, plug valves, and flow regulators.

3.8 FIELD QUALITY CONTROL

A. Inspection: Perform the following field quality-control inspections, after installing insulation materials, jackets, and finishes, to determine compliance with requirements:

1. Inspect fittings and valves randomly selected by Contracting Officer or authorized representative.

B. Insulation applications will be considered defective if sample inspection reveals noncompliance with requirements. Remove defective Work and replace with new materials according to these Specifications.

C. Reinstall insulation and covers on fittings and valves uncovered for inspection according to these Specifications.

3.9 INSULATION APPLICATION SCHEDULE, GENERAL

A. Refer to insulation application schedules for required insulation materials, vapor retarders, and field-applied jackets.

B. Application schedules identify piping system and indicate pipe size ranges and material, thickness, and jacket requirements.

3.10 INTERIOR INSULATION APPLICATION SCHEDULE

A. Service: Domestic hot and cold.

1. Operating Temperature: 50 to 140 deg F (15 to 60 deg C).
2. Insulation Material: Mineral fiber.
3. Insulation Thickness: Apply the following insulation thicknesses:
   a. Copper Pipe, ½" – 1": 1" mineral fiber.

4. Vapor Retarder Required: Yes.

END OF SECTION 15083

SECTION 15110

VALVES

1 GENERAL

A. ASME Compliance: ASME B31.9 for building services piping valves except domestic hot- and cold-water piping.

B. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.2 PRODUCTS

A. Refer to valve application paragraphs for applications of valves.

B. Bronze Valves: NPS 2 (DN 50) and smaller with threaded ends, unless otherwise indicated.

C. Valve Actuators: Handwheel for valves other than quarter-turn types and lever handle for quarter-turn valves.

D. Copper-Alloy Ball Valves, General: MSS SP-110.

1. Two-Piece, Copper-Alloy Ball Valves: Brass or bronze body with full-port, chrome-plated bronze ball; PTFE or TFE seats; and 600-psig (4140-kPa) minimum CWP rating and blowout-proof stem.

1.3 EXECUTION

A. Valve Applications: Refer to piping Sections for specific valve applications. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball.
2. Throttling Service: Ball.

B. Domestic Water Piping: Use the following types of valves:

1. Ball Valves, NPS 2 (DN 50) and Smaller: Two-piece, 400-psig (2760-kPa), CWP rating, copper alloy.

C. Valve Installation:

1. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and

specialties.

2. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
3. Locate valves for easy access and provide separate support where necessary.
4. Install valves in horizontal piping with stem at or above center of pipe.
5. Install valves in position to allow full stem movement.
6. Install check valves for proper direction of flow and swing check valves in horizontal position with hinge pin level.

D. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

E. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

END OF SECTION 15110

SECTION 15140

DOMESTIC WATER PIPING

1.1 GENERAL

A. Performance Requirements: Provide components and installation capable of producing domestic water piping systems with the following minimum working-pressure ratings, unless otherwise indicated:

1. Domestic Water Distribution Piping: 125 psig (860 kPa).

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. Comply with NSF 61, "Drinking Water System Components-Health Effects; Sections 1 through 9," for potable domestic water piping and components.

1.2 PRODUCTS

A. Piping Materials: Refer to "Piping Applications" Paragraph for applications of pipe, tube, fitting, and joining materials.

1. Soft Copper Tube: ASTM B 88, Types K and L (ASTM B 88M, Types A and B), water tube, annealed temper.
   a. Copper Pressure Fittings: ASME B16.22, wrought-copper, solder-joint fittings.
   b. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end.
   c. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.

1.3 EXECUTION

A. Piping Applications:

1. Aboveground Domestic Water Piping: Use the following piping materials for each size range:
   a. NPS 1-1/2 (DN 40) and Smaller: Hard copper tube, Type L; copper pressure fittings; and soldered joints.

B. Piping Installation: Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping installation.

1. Install aboveground domestic water piping level without pitch and plumb.
2. Fill water piping. Check components to determine that they are not air

bound and that piping is full of water.

C. Perform the following steps before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.

D. Check plumbing equipment and verify proper settings, adjustments, and operation. Do not operate water heaters before filling with water.

E. Check plumbing specialties and verify proper settings, adjustments, and operation.

F. Joint Construction: Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

1. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

G. Hanger and Support Installation: Refer to Division 15 Section "Hangers and Supports" for pipe hanger and support devices. Install the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Individual, Straight, Horizontal Piping Runs: According to the following:
   a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.

H. Install supports according to Division 15 Section "Hangers and Supports."

1. Support vertical piping and tubing at base and at each floor.
2. Rod diameter may be reduced 1 size for double-rod hangers, to a minimum of 3/8-inch (10 mm).

I. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 (DN 20) and Smaller: 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
2. NPS 1 and NPS 1-1/4 (DN 25 and DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.

J. Install supports for vertical copper tubing every 10 feet (3 m).

K. Connections: Drawings indicate general arrangement of piping, fittings, and specialties.

1. Install piping adjacent to equipment and machines to allow service and maintenance.
2. Connect domestic water piping to exterior water service piping. Use transition fitting to join dissimilar piping materials.

L. Field Quality Control:

1. Inspect domestic water piping as follows:
   a. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
   b. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
2. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
3. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
4. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
5. Test domestic water piping as follows:
   a. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
   b. Leave uncovered and unconcealed new, altered, extended, or replaced domestic water piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
   c. Cap and subject piping to static water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
   d. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.

M. Clean and disinfect domestic water piping as follows:

1. Purge new piping and parts of existing domestic water piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction or, if methods are not prescribed, procedures described in either AWWA C651 or AWWA C652 or as described below:
   a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
   b. Fill and isolate system according to either of the following:
      1) Fill system or part thereof with water/chlorine solution with at least 50 ppm (50 mg/L) of chlorine. Isolate with valves and allow to stand for 24 hours.

2) Fill system or part thereof with water/chlorine solution with at least 200 ppm (200 mg/L) of chlorine. Isolate and allow to stand for three hours.

c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.

d. Testing of water samples shall be performed by an independent laboratory. Contractor shall submit water samples in sterile bottles for testing. Results of the test shall be forwarded to the Contracting Officer or authorized representative for review and approval. Repeat procedures if biological examination shows contamination.

N. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION 15140

SECTION 15150

SANITARY WASTE AND VENT PIPING

1 GENERAL

1.1 SUMMARY

A. This Section includes soil and waste, sanitary drainage and vent piping inside the building.

1.2 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; "NSF-drain" for plastic drain piping; "NSF-tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer piping.

2 PRODUCTS

2.1 PIPING MATERIALS

A. Steel Pipe: ASTM A 53, Type E or S, Grade A or B, Schedule 40, galvanized. Include ends matching joining method.

1. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53 or ASTM A 106, Schedule 40, galvanized, seamless steel pipe. Include ends matching joining method.
2. Malleable-Iron Unions: ASME B16.39; Class 150; hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface; and female threaded ends.
3. Cast-Iron, Threaded, Drainage Fittings: ASME B16.12, galvanized.
4. Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, galvanized, standard pattern.
5. Cast-Iron Flanges: ASME B16.1, Class 125.
6. Cast-Iron, Flanged Fittings: ASME B16.1, Class 125, galvanized.
7. Steel-Piping, Expansion Joints: Compound, galvanized steel fitting with telescoping body and slip-pipe section. Include packing rings, packing, limit rods, chrome-plated finish on slip-pipe section, and flanged ends.
8. Steel-Piping, Double Expansion Joints: Compound, galvanized steel

fitting with telescoping body and two slip-pipe sections. Include packing rings, packing, limit rods, chrome-plated finish on slip-pipe sections, and flanged ends.

B. Hard Copper Tube: ASTM B 88, Types L and M (ASTM B 88M, Types B and C), water tube, drawn temper.

1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought- copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end.
3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

C. PVC Pipe: ASTM D 2665, solid-wall drain, waste, and vent.

1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.

3 EXECUTION

3.1 PIPING APPLICATIONS

A. Aboveground, Soil, Waste, and Vent Piping: Use [any of]the following piping materials for each size range:

1. NPS 1-1/4 and NPS 1-1/2 (DN 32 and DN 40): PVC pipe, PVC socket fittings, and solvent-cemented joints.
2. NPS 2 to NPS 4 (DN 50 to DN 100): PVC pipe, PVC socket fittings, and solvent-cemented joints.

B. Underground, Soil, Waste, and Vent Piping: Use [any of]the following piping materials for each size range:

1. NPS 2 to NPS 4 (DN 50 to DN 100): PVC pipe, PVC socket fittings, and solvent-cemented joints.

3.2 PIPING INSTALLATION

A. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

B. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change

direction of flow more than 90 deg rees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

C. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

D. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:

1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 (DN 80) and smaller; 1 percent downward in direction of flow for piping NPS 4 (DN 100) and larger.
2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

E. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.

F. Do not enclose, cover, or put piping into operation until it is inspected and approved by Contracting Officer or authorized representative.

3.3 JOINT CONSTRUCTION

A. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.4 HANGER AND SUPPORT INSTALLATION

A. Install supports for vertical copper tubing every 10 feet (3 m).

B. Install hangers for [ABS] [and] [PVC] piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 48 inches (1200 mm) with 3/8-inch (10-mm) rod.
2. NPS 3 (DN 80): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.

C. Install supports for vertical PVC piping every 48 inches (1200 mm).

D. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.5 FIELD QUALITY CONTROL

A. During installation, notify Contracting Officer or authorized representative at least 24 hours before inspection must be made. Perform tests specified below in presence of Contracting Officer or authorized representative.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by Contracting Officer or authorized representative to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If Contracting Officer or authorized representative find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by Contracting Officer or authorized representative.

D. Test sanitary drainage and vent piping according to procedures of Contracting Officer or authorized representative.

1. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
2. Prepare reports for tests and required corrective action.

3.6 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.7 PROTECTION

A. Exposed ABS Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

END OF SECTION 15150

SECTION 15183

REFRIGERANT PIPING

1 GENERAL

A. ASHRAE Standard: Comply with ASHRAE 15, "Safety Code for Mechanical Refrigeration."

B. ASME Standard: Comply with ASME B31.5, "Refrigeration Piping."

C. UL Standard: Provide products complying with UL 207, "Refrigerant-Containing Components and Accessories, Nonelectrical"; or UL 429, "Electrically Operated Valves."

1.2 PRODUCTS

A. Copper Tube and Fittings:

1. Drawn-Temper Copper Tube: ASTM B 280, Type ACR.
2. Annealed-Temper Copper Tube: ASTM B 280, Type ACR.
3. Wrought-Copper Fittings: ASME B16.22.
4. Wrought-Copper Unions: ASME B16.22.
5. Bronze Filler Metals: AWS A5.8, Classification: BAg-1 (silver).

1.3 EXECUTION

A. Piping Applications:

1. Aboveground, within Building: Type ACR drawn-copper tubing.

B. Piping Installation:

1. Install refrigerant piping according to ASHRAE 15.
2. Basic piping installation requirements are specified in Division 15 Section "Basic Mechanical Materials and Methods."
3. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
4. Pipe Joint Construction:
   a. Braze joints according to Division 15 Section "Basic Mechanical Materials and Methods."
   b. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide) during brazing to prevent scale formation.

C. Test and inspect refrigerant piping according to ASME B31.5, Chapter VI.

1. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure.
2. Test high- and low-pressure side piping of each system at not less than the lower of the design pressure or the setting of pressure relief device protecting high and low side of system.
    a. System shall maintain test pressure at the manifold gage throughout duration of test.
    b. Test joints and fittings by brushing a small amount of soap and glycerine solution over joint.
    c. Fill system with nitrogen to raise a test pressure of 150 psig (1035 kPa) or higher as required by authorities having jurisdiction.
    d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

D. Adjust thermostatic expansion valve to obtain proper evaporator superheat requirements.

E. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

F. Adjust set-point temperature of the conditioned air or chilled-water controllers to the system design temperature.

G. Before installing copper tubing other than Type ACR, clean tubing and fittings with trichloroethylene.

H. Replace core of filter-dryer after system has been adjusted and design flow rates and pressures are established.

I. Charge system using the following procedures:

1. Install core in filter-dryer after leak test but before evacuation.
2. Evacuate entire refrigerant system with a vacuum pump to a vacuum of 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig (14 kPa).
4. Charge system with a new filter-dryer core in charging line. Provide full-operating charge.

END OF SECTION 15183

SECTION 15410

PLUMBING FIXTURES

1.1 GENERAL

A. Submit Product Data for selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports and indicate materials and finishes, dimensions, construction details, and flow-control rates for each type of fixture indicated.

B. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.

1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities," and Public Law 101-336, "Americans with Disabilities Act," about plumbing fixtures for people with disabilities.

E. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.

F. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

G. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

H. Comply with the following applicable standards and other requirements specified for plumbing fixtures:

1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
2. Hand Sinks: NSF 2 construction.
3. Plastic Shower Enclosures: ANSI Z124.2.
4. Slip-Resistant Bathing Surfaces: ASTM F 462.
5. Vitreous-China Fixtures: ASME A112.19.2M.

6. Water-Closet, Flush Valve, Tank Trim: ASME A112.19.5.
7. Water-Closet, Flushometer Tank Trim: ASSE 1037.

1.2 PRODUCTS

1.3 EXECUTION

A. Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Fixture Installation:

1. Assemble fixtures, trim, fittings, and other components according to manufacturers' written instructions.
2. For wall-hanging fixtures, install off-floor supports affixed to building substrate.
   a. Use carrier supports without waste fitting for fixtures with tubular waste piping.
3. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.
4. Install wall-hanging fixtures with tubular waste piping attached to supports.
5. Install counter-mounting fixtures in and attached to casework.
6. Install fixtures level and plumb according to manufacturers' written instructions and roughing-in drawings.
7. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
   a. Exception: Use ball or gate valve if stops are not specified with fixture. Refer to Division 15 Section "Valves" for general-duty valves.
8. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
9. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.
10. Install flushometer valves for accessible water closets with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.
11. Install toilet seats on water closets.

D. Ground equipment.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are

not indicated, use those specified in UL 486A and UL 486B.

E. Field Quality Control:

1. Verify that installed fixtures are categories and types specified for locations where installed.
2. Check that fixtures are complete with trim, faucets, fittings, and other specified components.
3. Inspect installed fixtures for damage. Replace damaged fixtures and components.
4. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

F. Adjust water pressure at faucets, shower valves, and flushometer valves to produce proper flow and stream.

G. Replace washers and seals of leaking and dripping faucets and stops.

H. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:

1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
2. Remove sediment and debris from drains.

I. Provide protective covering for installed fixtures and fittings.

J. Do not allow use of fixtures for temporary facilities unless approved in writing by the Contracting Officer or authorized representative.

END OF SECTION 15410

SECTION 15430

PLUMBING SPECIALTIES

1.1 GENERAL

A. Plumbing specialties shall bear label, stamp, or other markings of specified testing agency.

B. Comply with ASME B31.9, "Building Services Piping," for piping materials and installation.

C. Comply with NSF 61, "Drinking Water System Components--Health Effects, Sections 1 through 9," for potable domestic water plumbing specialties.

1.2 PRODUCTS

A. Wheel-Handle Wall Hydrants: Frost-proof design similar to ASME A112.21.3M, for wall mounting with wheel-handle operation, NPS 1/2 or NPS 3/4 (DN 15 or DN 20) threaded or solder-joint inlet, casing and operating rod to match wall thickness, and projecting outlet with ASME B1.20.7 garden-hose threads on outlet. Include wall clamp; integral vacuum breaker or nonremovable, damnable hose-connection vacuum breaker complying with ASSE 1011 and garden-hose threads complying with ASME B1.20.7 on outlet.

B. Trap Seal Primer Valves: ASSE 1018, water-supply-fed type, with the following characteristics:

1. 125-psig (860-kPa) minimum working pressure.
2. Bronze body with atmospheric-vented drain chamber.
3. Inlet and Outlet Connections: NPS 1/2 (DN 15) threaded, union, or solder joint.
4. Gravity Drain Outlet Connection: NPS 1/2 (DN 15) threaded or solder joint.
5. Finish: Chrome plated.

C. Water Hammer Arresters: ASSE 1010 or PDI-WH 201, metal-bellows type.

D. Cleanouts: Comply with ASME A112.36.2M.

1. Application: Floor cleanout.
2. Body or Ferrule Material: Cast iron.
3. Clamping Device: Not required.
4. Outlet Connection: Threaded.
5. Closure: Brass plug with straight threads and gasket.

6. Adjustable Housing Material: Cast iron.
7. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
8. Frame and Cover Shape: [Round].
9. Top Loading Classification: Medium Duty.

E. Floor Drains: Comply with ASME A112.21.1M.

1. Application: Floor drain.
2. Body Material: Gray iron.
3. Seepage Flange: Not required.
4. Clamping Device: Not required.
5. Outlet: Bottom.
6. Sediment Bucket: Not required.
7. Top or Strainer Material: Nickel bronze.
8. Top of Body and Strainer Finish: Nickel bronze.
9. Top Shape: Round.
10. Top Loading Classification: Light Duty.
11. Funnel: Not required.
12. Trap Material: Cast iron.
13. Trap Pattern: Standard P-trap.
14. Trap Features: Trap seal primer valve drain connection.

1.3 EXECUTION

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for piping joining materials, joint construction, and basic installation requirements.

B. Install trap seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

C. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4 (DN 100). Use NPS 4 (DN 100) for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet (15 m) for piping NPS 4 (DN 100) and smaller and 100 feet (30 m) for larger piping.

D. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
   a. Radius, 30 Inches (750 mm) or Less: Equivalent to 1 percent slope, but not less than 1/4-inch (6.35-mm) total depression.

3. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

E. Install individual shutoff valve in each water supply to plumbing specialties. Use ball, gate, or globe valve if specific valve is not indicated. Install shutoff valves in accessible locations. Refer to Division 15 Section "Valves" for general-duty ball, butterfly, check, gate, and globe valves.

F. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

G. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

H. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

I. Connect plumbing specialties to piping specified in other Division 15 Sections.

J. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

K. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 15430

SECTION 15738

SPLIT-SYSTEM HEAT PUMP SYSTEMS

1.1 GENERAL

A. Submittals: Product Data, including rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories for each type of product indicated.

1. Shop Drawings: Diagram power, signal, and control wiring and differentiate between manufacturer-installed and field-installed wiring.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.2 PRODUCTS

A. Evaporator-Fan Cabinet: Enameled steel with removable panels on front and ends.

1. Insulation: Faced, glass-fiber, duct liner.
2. Drain Pans: Galvanized steel, with connection for drain; insulated.

B. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with thermal- expansion valve.

C. Electric Coil: Helical, nickel-chrome, resistance-wire heating elements with refractory ceramic support bushings; automatic-reset thermal cutout; built-in magnetic contactors; manual-reset thermal cutout; airflow proving device; and one-time fuses in terminal box for overcurrent protection.

D. Evaporator Fan: Forward-curved, double-width wheel of galvanized steel; directly connected to motor.

E. Evaporator Fan Motor: Multispeed, PSC type.

F. Filters: 1-inch- (25-mm-) thick, disposable type in fiberboard frames.

G. Wiring Terminations: Connect motor to chassis wiring with plug connection.

H. Air-Cooled Compressor Condenser: Steel casing, finished with baked enamel,

with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.

1. Compressor: Hermetically sealed, reciprocating or scroll type, with crankcase heater and mounted on vibration isolation. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
2. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with liquid subcooler.
3. Fan: Aluminum-propeller type, directly connected to motor.
4. Motor: Permanently lubricated, with integral thermal-overload protection.
5. Low Ambient Kit: Permits operation down to 35 deg F (2 deg C).
6. Mounting Base: Polyethylene.
7. Refrigerant Circuit: Reversing valve.

1.3 EXECUTION

A. Install units level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

C. Install ground-mounted, compressor-condenser components on 4-inch- (100-mm-) thick, reinforced concrete base; 4 inches (100 mm) larger on each side than unit. Concrete, reinforcement, and formwork are specified in Division 3, "Cast-in-Place Concrete." Coordinate anchor installation with concrete base.

D. Install ground-mounted, compressor-condenser components on polyethylene mounting base.

E. Install compressor-condenser components on restrained, spring isolators with a minimum static deflection of 1 inch (25 mm). Refer to Division 15 Section "Mechanical Vibration Controls and Seismic Restraints."

F. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

G. Install piping adjacent to unit to allow service and maintenance.

H. Unless otherwise indicated, connect piping with unions and shutoff valves to allow units to be disconnected without draining piping. Refer to piping system Sections for specific valve and specialty arrangements.

I. Ground equipment: Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

END OF SECTION 15738

SECTION 15815

METAL DUCTS

1.1 GENERAL

A. Submittals: Product Data.

B. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," unless otherwise indicated.

C. Comply with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems," unless otherwise indicated.

1.2 PRODUCTS

A. Galvanized, Sheet Steel: Lock-forming quality; ASTM A 653/A 653M, G90 (Z275) coating designation; mill-phosphatized finish for surfaces of ducts exposed to view.

B. Reinforcement Shapes and Plates: Galvanized steel reinforcement where installed on galvanized, sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

C. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for 36-inch (900-mm) length or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

D. Joint and Seam Tape: 2 inches (50 mm) wide; glass-fiber fabric reinforced.

E. Joint and Seam Sealant: One-part, nonsag, solvent-release-curing, polymerized butyl sealant, formulated with a minimum of 75 percent solids.

F. Building Attachments: fasteners, or structural-steel fasteners appropriate for building materials.

G. Hanger Materials: Galvanized, sheet steel or round, threaded steel rod.

H. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

I. Trapeze and Riser Supports: Galvanized steel shapes complying with ASTM A 36/A 36M.

J. Duct Fabrication: Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction with galvanized, sheet steel, according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible." Comply with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.

K. Static-Pressure Classifications: Unless otherwise indicated, construct ducts to the following:

1. Supply Ducts: 2-inch wg (750 Pa).
2. Return Ducts: 2-inch wg (500 Pa), negative pressure.
3. Exhaust Ducts: 2-inch wg (500 Pa), negative pressure.

L. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches (480 mm) and larger and 0.0359 inch (0.9 mm) thick or less, with more than 10 sq. ft. (0.93 sq. m) of unbraced panel area, unless ducts are lined.

M. Double Wall Duct and Fitting Fabrication:

1. Ducts: Fabricate double-wall (insulated) ducts with an outer shell and an inner duct. Dimensions indicated are for inner ducts.
   a. Outer Shell: Base metal thickness on outer-shell dimensions. Fabricate outer-shell lengths 2 inches (50 mm) longer than inner duct and insulation and in metal thickness specified for single-wall duct.
   b. Insulation: 1-inch- (25-mm-) thick fibrous glass, unless otherwise indicated. Terminate insulation where double-wall duct connects to single-wall duct or uninsulated components, and reduce outer shell diameter to inner duct diameter.
   11) Thermal Conductivity (k-Value): 0.26 at 75 deg F (0.037 at 24 deg C) mean temperature.
   c. Solid Inner Ducts: Use the following sheet metal thicknesses and seam construction:
   12) Ducts 9 to 42 Inches (225 to 1070 mm) in Diameter: 0.019 inch (0.5 mm) with single-rib spiral-seam construction.

1.3 EXECUTION

A. Duct installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of ducts, fittings, and accessories.

B. Construct and install each duct system for the specific duct pressure classification indicated.

C. Install ducts with fewest possible joints.

D. Install fabricated fittings for changes in directions, changes in size and shape, and connections.

E. Install couplings tight to duct wall surface with a minimum of projections into duct.

F. Install ducts, unless otherwise indicated, vertically and horizontally, parallel and perpendicular to building lines; avoid diagonal runs.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch (25 mm), plus allowance for insulation thickness.

I. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions, unless specifically indicated.

J. Coordinate layout with suspended ceiling, lighting layouts, and similar finished work.

K. Electrical Equipment Spaces: Route ductwork to avoid passing through transformer vaults and electrical equipment spaces and enclosures.

L. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same metal thickness as duct. Overlap opening on four sides by at least 1-1/2 inches (38 mm).

M. Seam and Joint Sealing: Seal duct seams and joints according to the duct pressure class indicated and as described in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

1. Pressure Classification Less Than 2-Inch wg (500 Pa): Transverse joints.
2. Seal externally insulated ducts before insulation installation.

N. Install rigid round and rectangular metal duct with support systems indicated in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

O. Support horizontal ducts within 24 inches (600 mm) of each elbow and within 48 inches (1200 mm) of each branch intersection.

P. Connect equipment with flexible connectors according to Division 15 Section "Duct Accessories."

Q. For branch, outlet and inlet, and terminal unit connections, comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

END OF SECTION 15815

SECTION 15820

DUCT ACCESSORIES

1.1 GENERAL

A. Submittals: Product Data for backdraft dampers, manual-volume dampers, duct-mounted access doors and panels, and flexible ducts.

B. NFPA Compliance: Comply with the following NFPA standards:

1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

1.2 PRODUCTS

A. Galvanized, Sheet Steel: Lock-forming quality; ASTM A 653/A 653M, G90 (Z275) coating designation; mill-phosphatized finish for surfaces of ducts exposed to view.

B. Tie Rods: Galvanized steel, 1/4- (6-mm) minimum diameter for 36-inch (900-mm) length or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

C. Backdraft Dampers: Suitable for horizontal or vertical installations.

D. Frame: 0.052-inch- (1.3-mm-) thick, galvanized, sheet steel, with welded corners and mounting flange.

E. Blades: 0.025-inch- (0.6-mm-) thick, roll-formed aluminum.

F. Blade Seals: Felt, vinyl, or neoprene.

G. Blade Axles: Galvanized steel.

H. Tie Bars and Brackets: Galvanized steel.

I. Return Spring: Adjustable tension.

J. Manual-Volume Dampers: Factory fabricated with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.

K. Standard Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, standard leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.

1. Steel Frames: Hat-shaped, galvanized, sheet steel channels, minimum of 0.064 inch (1.62 mm) thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls; and flangeless frames where indicated for installation in ducts.
2. Blade Axles: Galvanized steel.
3. Tie Bars and Brackets: Galvanized steel.

L. Jackshaft: 1-inch- (25-mm-) diameter, galvanized steel pipe rotating within a pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.

M. Damper Hardware: Zinc-plated, die-cast core with dial and handle made of 3/32-inch- (2.4-mm-) thick zinc-plated steel, and a 3/4-inch (19-mm) hexagon locking nut.

N. Turning Vanes: Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

1. Manufactured Turning Vanes: Fabricate of 1-1/2-inch- (38-mm-) wide, curved blades set 3/4 inch (19 mm) o.c.; support with bars perpendicular to blades set 2 inches (50 mm) o.c.; and set into side strips suitable for mounting in ducts.

O. Flexible Connector Fabric: Glass fabric double coated with polychloroprene.

1. Minimum Weight: 26 oz./sq. yd. (880 g/sq. m).
2. Tensile Strength: 480 lbf/inch (84 N/mm) in the warp, and 360 lbf/inch (63 N/mm) in the filling.

P. Flexible Ducts, Insulated: Comply with UL 181, Class 1. Factory-fabricated, insulated, round duct, with an outer jacket enclosing 1-1/2-inch- (38-mm-) thick, glass-fiber insulation around a continuous inner liner.

1. Reinforcement: Steel-wire helix encapsulated in inner liner.
2. Outer Jacket: Polyethylene film.
3. Inner Liner: Polyethylene film.

Q. Pressure Rating: 6-inch wg (1500 Pa) positive, 1/2-inch wg (125 Pa) negative.

R. Flexible Duct Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action, in sizes 3 to 18 inches (75 to 450 mm) to suit duct size.

S. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

1.3 EXECUTION

A. Install duct accessories according to applicable details shown in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts and NAIMA's "Fibrous Glass Duct Construction Standards" for fibrous-glass ducts.

B. Install volume dampers in lined duct; avoid damage to and erosion of duct liner.

C. Provide test holes at fan inlet and outlet and elsewhere as indicated.

D. Install duct access panels for access to both sides of duct coils. Install duct access panels downstream from volume dampers, turning vanes, and equipment.

1. Install duct access panels to allow access to interior of ducts for cleaning, inspecting, adjusting, and maintaining accessories and terminal units.
2. Install access panels on side of duct where adequate clearance is available.

E. Label access doors according to Division 15 Section "Mechanical Identification."

END OF SECTION 15820

SECTION 15838

POWER VENTILATORS

1 GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Centrifugal roof ventilators.

1.2 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:

1. Certified fan performance curves with system operating conditions indicated.
2. Motor ratings and electrical characteristics, plus motor and electrical accessories.

B. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.

C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

D. UL Standard: Power ventilators shall comply with UL 705.

1.4 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Belts: One set for each belt-driven unit.

2 PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraphs titles below introduce lists, the following requirements apply for product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

2.2 CENTRIFUGAL ROOF VENTILATORS

A. Description: Belt-driven or direct-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories.

1. Manufacturers:
   a. Aerovent; a Twin City Fan Company.
   b. Carnes Company HVAC.
   c. Cook, Loren Company.
   d. Greenheck Fan Corp.
   e. Hartzell Fan, Inc.
   f. ILG Industries, Inc./American Coolair Corp.
   g. Or approved equal.

B. Housing: Removable, spun-aluminum, dome top and outlet baffle; square, one-piece, aluminum base with venturi inlet cone.

C. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.

D. Belt-Driven Drive Assembly: Resiliently mounted to housing, with the following features:

1. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
2. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
3. Pulleys: Cast-iron, adjustable-pitch motor pulley.
4. Fan and motor isolated from exhaust airstream.

E. Accessories:

1. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
2. Bird Screens: Removable, 1/2-inch (13-mm) mesh, aluminum or brass

wire.

3. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.

F. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch- (40-mm-) thick, rigid, fiberglass insulation adhered to inside walls. Size as required to suit roof opening and fan base.

1. Overall Height: 8 inches (200 mm).

2.3 MOTORS

A. Refer to Division 15 Section "Motors" for general requirements for factory-installed motors.

B. Motor Construction: NEMA MG 1, general purpose, continuous duty, Design B.

C. Enclosure Type: Open dripproof.

2.4 SOURCE QUALITY CONTROL

A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

3 EXECUTION

3.1 INSTALLATION

A. Secure roof-mounting fans to roof curbs with cadmium-plated hardware. Refer to Division 7 Section "Roof Accessories" for installation of roof curbs.

B. Install units with clearances for service and maintenance.

C. Label units according to requirements specified in Division 15 Section "Mechanical Identification."

3.2 CONNECTIONS

A. Duct installation and connection requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 15 Section "Duct Accessories."

3.3 FIELD QUALITY CONTROL

A. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.

B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Refer to Division 15 Section "Testing, Adjusting, and Balancing" for testing, adjusting, and balancing procedures.

D. Replace fan and motor pulleys as required to achieve design airflow.

E. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.

END OF SECTION 15838

SECTION 15845

AIR TERMINALS

1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Single-duct air terminals.

B. Related Sections include the following:

1. Division 15 Section "Duct Insulation" for external insulation of air terminals.

1.3 SUBMITTALS

A. Product Data: Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories for each model indicated. Include a schedule showing drawing designation, room location, number furnished, model number, size, and accessories furnished.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loadings, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring.

C. Maintenance Data: List of parts for each type of air terminal and troubleshooting maintenance guide to include in the maintenance manuals specified in Division 1.

1.4 QUALITY ASSURANCE

A. Product Options: Drawings and schedules indicate requirements of air terminals and are based on specific systems indicated. Other manufacturers' systems with equal performance characteristics may be considered. Refer to Division 1

Section "Substitutions."

B. Listing and Labeling: Provide electrically operated air terminals specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.
2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.

C. NFPA Compliance: Install air terminals according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."

D. Comply with NFPA 70 for electrical components and installation.

2 PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering air terminals that may be incorporated into the Work include, but are not limited to, the following:

1. Air System Components; Krueger Div.
2. Anemostat Products Div.
3. Carnes Co., Inc.
4. Carrier Corp.
5. Environmental Technologies.
6. Nailor Industries Inc.
7. Titus.
8. Trane Co. (The).
9. York International Corp.

2.2 SINGLE-DUCT AIR TERMINALS

A. Configuration: Volume-damper assembly inside unit casing. Locate control components inside protective metal shroud.

B. Casings: Steel or aluminum sheet metal of the following minimum thicknesses:

1. 0.0239-inch (0.6-mm) steel.

C. Casing Lining: Minimum of 1/2-inch- (13-mm-) thick, neoprene- or vinyl-coated, fibrous-glass insulation; 1.5-lb/cu. ft. (24-kg/cu. m) density, complying with NFPA 90A requirements and UL 181 erosion requirements. Secure lining to prevent delamination, sagging, or settling.

D. Access: Removable panels to permit access to dampers and other parts requiring service, adjustment, or maintenance; with airtight gasket and quarter-turn latches.

E. Volume Damper: Construct of galvanized steel with peripheral gasket and self-lubricating bearings.

1. Maximum Damper Leakage: 2 percent of nominal airflow at 1-inch wg (250-Pa) inlet static pressure.
2. Damper Position: Normally open.

F. Electric Controls: 24-V damper actuator with wall-mounted electric thermostat and appropriate mounting hardware.

2.3 SOURCE QUALITY CONTROL

A. Testing Requirements: Test and rate air terminals according to ARI 880, "Industry Standard for Air Terminals."

B. Identification: Label each air terminal with plan number, nominal airflow, maximum and minimum factory-set airflows, coil type, and ARI certification seal.

3 EXECUTION

3.1 INSTALLATION

A. Install air terminals level and plumb, according to manufacturer's written instructions, rough-in drawings, original design, and referenced standards; and maintain sufficient clearance for normal service and maintenance.

B. Connect ductwork to air terminals according to Division 15 ductwork Sections.

3.2 CONNECTIONS

A. Install piping adjacent to air terminals to allow service and maintenance.

B. Electrical: Comply with applicable requirements in Division 16 Sections.

C. Ground equipment.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values

are not indicated, use those specified in UL 486A and UL 486B.

3.3 FIELD QUALITY CONTROL

A. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.4 CLEANING

A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris, and repair damaged finishes.

3.5 COMMISSIONING

A. Verify that installation of each air terminal is according to the Contract Documents.

B. Check that inlet duct connections are as recommended by air terminal manufacturer to achieve proper performance.

C. Check that controls and control enclosure are accessible.

D. Verify that control connections are complete.

E. Check that nameplate and identification tag are visible.

F. Verify that controls respond to inputs as specified.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train the Government's maintenance personnel as specified below:

1. Train the Government's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.
2. Schedule training with the Government with at least 7 days' advance notice.

END OF SECTION 15845

SECTION 15855

DIFFUSERS, REGISTERS, AND GRILLES

1 GENERAL

A. Submittals: Product Data for each model indicated.

1.2 PRODUCTS

A. Diffusers, registers, and grilles are scheduled on Drawings.

1.3 EXECUTION

A. Install diffusers, registers, and grilles level and plumb, according to manufacturer's written instructions, Coordination Drawings, original design, and referenced standards.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practicable. For units installed in lay-in ceiling panels, locate units in the center of the panel. Where architectural features or other items conflict with installation, notify Contracting Officer or authorized representative for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connection to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

D. Install diffusers, registers, and grilles according to NFPA 90A, "Standard for the Installation of Air-Conditioning and Ventilating Systems."

E. After installation of diffusers, registers, and grilles, inspect exposed finish. Clean exposed surfaces to remove burrs, dirt, and smudges. Replace diffusers, registers, and grilles that have damaged finishes.

END OF SECTION 15855

SECTION 15990

TESTING, ADJUSTING, AND BALANCING

1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes testing, adjusting, and balancing HVAC systems to produce design objectives, including the following:

1. Balancing airflow within distribution systems, including submains, branches, and terminals, to indicated quantities according to specified tolerances.
2. Adjusting total HVAC systems to provide indicated quantities.
3. Measuring electrical performance of HVAC equipment.
4. Verifying that automatic control devices are functioning properly.
5. Reporting results of the activities and procedures specified in this Section.

1.3 DEFINITIONS

A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.

B. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to design quantities.

C. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.

D. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.

E. Report Forms: Test data sheets for recording test data in logical order.

F. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

G. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.

H. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.

I. Test: A procedure to determine quantitative performance of a system or equipment.

J. Testing, Adjusting, and Balancing Agent: The entity responsible for performing and reporting the testing, adjusting, and balancing procedures.

K. AABC: Associated Air Balance Council.

L. AMCA: Air Movement and Control Association.

M. NEBB: National Environmental Balancing Bureau.

N. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.

1.4 SUBMITTALS

A. Certified Testing, Adjusting, and Balancing Reports: Submit 3 copies of reports prepared, as specified in this Section, on approved forms certified by the testing, adjusting, and balancing Agent.

1.5 QUALITY ASSURANCE

A. Testing, Adjusting, and Balancing Reports: Use testing, adjusting, and balancing Agent's standard forms approved by the Contracting Officer or authorized representative.

B. Instrumentation Calibration: Calibrate instruments at least every 6 months or more frequently if required by the instrument manufacturer.

1.6 COORDINATION

A. Perform testing, adjusting, and balancing after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

2 PRODUCTS (Not Applicable)

3 EXECUTION

3.1 EXAMINATION

A. Examine Contract Documents to become familiar with project requirements and to discover conditions in systems' designs that may preclude proper testing, adjusting, and balancing of systems and equipment.

1. Contract Documents are defined in the General and Supplementary Conditions of the Contract.
2. Verify that balancing devices, such as test ports, flow-control devices, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.

B. Examine approved submittal data of HVAC systems and equipment.

C. Examine equipment performance data, including fan curves. Relate performance data to project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system. Calculate system effect factors to reduce the performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10; or in SMACNA's "HVAC Systems--Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.

D. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Specification Sections have been performed.

E. Examine system and equipment test reports.

F. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, flow-control devices, and manual volume

dampers, are properly installed, and their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.

G. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.

H. Examine air-handling equipment to ensure clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

I. Report deficiencies discovered before and during performance of testing, adjusting, and balancing procedures.

3.2 GENERAL TESTING AND BALANCING PROCEDURES

A. Perform testing and balancing procedures on each system according to the procedures contained this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to the insulation Specifications for this Project.

C. Mark equipment settings with paint or other suitable, permanent identification material, including damper-control positions, fan-speed-control levers, and similar controls and devices, to show final settings.

3.3 FUNDAMENTAL AIR SYSTEMS' BALANCING PROCEDURES

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Determine the best locations in main and branch ducts for accurate duct airflow measurements.

C. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

D. Verify that motor starters are equipped with properly sized thermal protection.

E. Check dampers for proper position to achieve desired airflow path.

F. Check for airflow blockages.

G. Check condensate drains for proper connections and functioning.

3.4 CONSTANT-VOLUME AIR SYSTEMS' BALANCING PROCEDURES

A. The procedures in this Article apply to constant-volume supply-, return-, and exhaust-air systems.

B. Adjust fans to deliver total design airflows within the maximum allowable rpm listed by the fan manufacturer.

1. Measure fan static pressures to determine actual static pressure as follows:

a. Measure static pressure directly at the fan outlet or through the flexible connection.
b. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.

2. Measure static pressure across each air-handling unit component.
a. Simulate dirty filter operation and record the point at which maintenance personnel must change filters.

3. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Compare actual system effect factors with calculated system effect factors to identify where variations occur. Recommend corrective action to align design and actual conditions.

4. Adjust fan speed higher or lower than design with the approval of the Government. Make required adjustments to pulley sizes, motor sizes, and electrical connections to accommodate fan-speed changes.

5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure no overload will occur. Measure amperage in full cooling, full heating, and economizer modes to determine the maximum required brake horsepower.

C. Adjust volume dampers for main duct, submain ducts, and major branch ducts to design airflows within specified tolerances.

1. Measure static pressure at a point downstream from the balancing

damper and adjust volume dampers until the proper static pressure is achieved.

a. Where sufficient space in submains and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submains and branch ducts to design airflows within specified tolerances.

3.5 MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer, model, and serial numbers.
2. Motor horsepower rating.
3. Motor rpm.
4. Efficiency rating if high-efficiency motor.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

3.6 HEAT-TRANSFER COILS

A. Electric-Heating Coils: Measure the following data for each coil:

1. Nameplate data.
2. Airflow.
3. Entering- and leaving-air temperatures at full load.
4. Voltage and amperage input of each phase at full load and at each incremental stage.
5. Calculated kW at full load.
6. Fuse or circuit-breaker rating for overload protection.

3.7 TEMPERATURE TESTING

A. During testing, adjusting, and balancing, report need for adjustment in temperature regulation within the automatic temperature-control system.

B. Measure indoor wet- and dry-bulb temperatures every other hour for a period of 2 successive 8-hour days, in each separately controlled zone, to prove correctness of final temperature settings. Measure when the building or zone is occupied.

C. Measure outside-air, wet- and dry-bulb temperatures.

3.8 TOLERANCES

A. Set HVAC system airflow and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans: Plus 5 to plus 10 percent.
2. Air Outlets and Inlets: 0 to minus 10 percent.

3.9 FINAL REPORT

A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in 3-ring binder, tabulated and divided into sections by tested and balanced systems.

B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.

1. Include a list of the instruments used for procedures, along with proof of calibration.

C. Final Report Contents: In addition to the certified field report data, include the following:

1. Fan curves.
2. Manufacturers' test data.
3. Field test reports prepared by system and equipment installers.
4. Other information relative to equipment performance, but do not include approved Shop Drawings and Product Data.

D. General Report Data: In addition to the form titles and entries, include the following data in the final report, as applicable:

1. Title page.
2. Name and address of testing, adjusting, and balancing Agent.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of testing, adjusting, and balancing Agent who certifies the report.
10. Summary of contents, including the following:
    a. Design versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.
11. Nomenclature sheets for each item of equipment.
12. Data for terminal units, including manufacturer, type size, and fittings.
13. Notes to explain why certain final data in the body of reports vary from design values.
14. Test conditions for fan performance forms, including the following:

a. Settings for outside-, return-, and exhaust-air dampers.
b. Conditions of filters.
c. Cooling coil, wet- and dry-bulb conditions.
d. Fan drive settings, including settings and percentage of maximum pitch diameter.
e. Settings for supply-air, static-pressure controller.
f. Other system operating conditions that affect performance.

E. System Diagrams: Include schematic layouts of air distribution systems. Present with single-line diagrams and include the following:

1. Quantities of outside, supply, return, and exhaust airflows.
2. Duct, outlet, and inlet sizes.
3. Terminal units.
4. Balancing stations.

F. Air-Handling Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data: Include the following:
   a. Unit identification.
   b. Location.
   c. Make and type.
   d. Model number and unit size.
   e. Manufacturer's serial number.
   f. Unit arrangement and class.
   g. Discharge arrangement.
   h. Sheave make, size in inches (mm), and bore.
   i. Sheave dimensions, center-to-center and amount of adjustments in inches (mm).
   j. Number of belts, make, and size.
   k. Number of filters, type, and size.
2. Motor Data: Include the following:
   a. Make and frame type and size.
   b. Horsepower and rpm.
   c. Volts, phase, and hertz.
   d. Full-load amperage and service factor.
   e. Sheave make, size in inches (mm), and bore.
   f. Sheave dimensions, center-to-center and amount of adjustments in inches (mm).
3. Test Data: Include design and actual values for the following:
   a. Total airflow rate in cfm (L/s).
   b. Total system static pressure in inches wg (Pa).
   c. Fan rpm.
   d. Discharge static pressure in inches wg (Pa).
   e. Filter static-pressure differential in inches wg (Pa).
   f. Coil static-pressure differential in inches wg (Pa).
   g. Outside airflow in cfm (L/s).
   h. Return airflow in cfm (L/s).
   i. Outside-air damper position.

G. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data: Include the following:
   a. System identification.
   b. Location.
   c. Make and type.
   d. Model number and size.
   e. Manufacturer's serial number.
   f. Arrangement and class.
   g. Sheave make, size in inches (mm), and bore.
   h. Sheave dimensions, center-to-center and amount of adjustments in inches (mm).
2. Motor Data: Include the following:
   a. Make and frame type and size.
   b. Horsepower and rpm.
   c. Volts, phase, and hertz.
   d. Full-load amperage and service factor.
   e. Sheave make, size in inches (mm), and bore.
   f. Sheave dimensions, center-to-center and amount of adjustments in inches (mm).
   g. Number of belts, make, and size.
3. Test Data: Include design and actual values for the following:
   a. Total airflow rate in cfm (L/s).
   b. Total system static pressure in inches wg (Pa).
   c. Fan rpm.
   d. Discharge static pressure in inches wg (Pa).
   e. Suction static pressure in inches wg (Pa).

H. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data: Include the following:
   a. System and air-handling unit number.
   b. Location and zone.
   c. Traverse air temperature in deg F (deg C).
   d. Duct static pressure in inches wg (Pa).
   e. Duct size in inches (mm).
   f. Duct area in sq. ft. ((sq. m)).
   g. Design airflow rate in cfm (L/s).
   h. Design velocity in fpm (m/s).
   i. Actual airflow rate in cfm (L/s).
   j. Actual average velocity in fpm (m/s).
   k. Barometric pressure in psig (Pa).

END OF SECTION 15990

SECTION 16060

GROUNDING AND BONDING

1 GENERAL

1.1 SUMMARY

A. Extent of electrical grounding and bonding work is indicated by the Drawings and Schedules and as specified herein. Grounding and bonding work is defined to encompass systems, circuits, and equipment.

B. Type of electrical grounding and bonding work specified in this section includes the following:

1. Solidly grounded.

C. Applications of electrical grounding and bonding work in this section includes the following:

1. Electrical power systems.
2. Grounding rods.
3. Raceways.
4. Service equipment.
5. Enclosures.
6. Equipment.

D. Refer to other Division 16 sections for wires/cables, electrical raceways, boxes and fittings, and wiring devices which are required in conjunction with electrical grounding and bonding work.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Install grounding and bonding products of firms regularly engaged in the manufacture of these materials, including stranded cable, grounding rods, and bonding jumpers.

B. Electrical Code Compliance: Comply with the applicable State electrical code requirements of the authority having jurisdiction, and NEC as applicable to electrical grounding and bonding, pertaining to systems, circuits and equipment.

C. UL Compliance: Comply with applicable requirements of UL Standards No.'s 467, "Electrical Grounding and Bonding Equipment," and 869, "Electrical Service Equipment," pertaining to grounding and bonding of systems, circuits and equipment. In addition, comply with UL Standard 486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors." Provide grounding and

bonding products which are UL listed and/or labeled for their intended usage.

2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, manufacturers offering grounding products which may be incorporated in the work include, but are not limited to, the following (or approved equal):

1. B-Line Systems, Inc.
2. Burndy Corporation.
3. Gould Inc.
4. Ideal Industries, Inc.
5. Thomas & Betts Corp.

2.2 MATERIALS AND PRODUCTS

A. General: Except as otherwise indicated, provide electrical grounding and bonding systems indicated; with assembly of materials, including, but not limited to, cables/wires, connectors, solderless lug terminals, grounding rods, bonding jumpers, and additional accessories needed for a complete installation.

1. Where more than one type component product meets indicated requirements, selection is Contractor's option.
2. Where materials or components are not indicated, provide products which comply with NEC and UL requirements and with established industry standards for those applications indicated.

B. Conductors: Unless otherwise indicated, provide electrical grounding conductors for grounding system connections that match power supply wiring materials and are sized according to NEC.

C. Bonding Connectors, Terminals and Clamps: Provide electrical bonding connectors, terminals, lugs and clamps as recommended by bonding connector, terminal and clamp manufacturers for indicated applications.

D. Grounding Rods: Steel with copper welded exterior, 3/4" diameter by 10 feet.

E. Electrical Grounding Connection Accessories: Provide electrical insulating tape, bonding straps, as recommended by accessories manufacturers for type service indicated.

3 EXECUTION

3.1 TESTING

A. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.

B. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Measure ground resistance not less than two full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests, by the fall-of-potential method according to IEEE 81.

3.2 EXAMINATION

A. Examine areas and conditions under which electrical grounding and bonding connections are to be made and notify the Contracting Officer or authorized representative in writing of conditions detrimental to proper completion of work.

B. Do not proceed with work until unsatisfactory conditions have been corrected.

3.3 INSTALLATION OF ELECTRICAL GROUNDING AND BONDING SYSTEMS

A. General: Install electrical grounding and bonding systems as indicated, in accordance with manufacturer's instructions and applicable portions of NEC, OSHA, and NECA's "Standard of Installation," and in accordance with recognized industry practices to ensure that products comply with requirements.

B. Install grounding systems as designed and submit certified test report on grounding system.

C. Coordinate with other electrical work as necessary to interface installation of electrical grounding and bonding system work with other work.

D. Ground electrical service system neutral at service entrance equipment to grounding rod(s), grounded copper water pipe, and foundation building steel.

E. Ground each separately-derived system neutral to an effectively grounded copper water pipe or grounded building steel.

F. Connect together system neutral, service equipment enclosures, exposed

noncurrent carrying metal parts of electrical equipment, metal raceway systems, grounding conductor in raceways and cables, receptacle ground connectors, and cold water systems.

G. Provide ground clamps for grounding conductors to underground grounding rods, unless exothermic grounding system is specified.

H. Provide a separate, insulated equipment grounding conductor from each device to ground buses in panelboards. Terminate each end on a grounding lug, bus, or insulated grounding bushing.

I. Provide grounding system per the Drawings and Article 250 of the NEC. Provide green equipment grounding conductor for all electrical raceways.

J. Connect grounding electrode conductors to copper water pipe using a suitable grounding clamp as indicated on the Drawings. Provide conduit grounding hubs and water pipe ground clamps as required.

K. Use minimum #6 AWG copper conductor for communications service grounding conductor. Leave 10 feet of slack conductor at terminal board.

L. Connect grounding electrode conductors to 1-inch diameter, or greater, metallic cold water pipe using a suitably sized ground clamp.

M. Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values for connectors and bolts. Where manufacturer's torquing requirements are not indicated, tighten connections to comply with tightening torque values specified in UL 486A to assure permanent and effective grounding.

N. Apply corrosion-resistant finish to field connections, buried metallic grounding and bonding products, and places where factory applied protective coatings have been destroyed, which are subjected to corrosive action.

O. Provide clamp-on connectors on clean metal contact surfaces, to ensure electrical conductivity and circuit integrity.

P. Provide PVC conduit for ground wire in concrete. Do not use metallic conduit.

END OF SECTION 16060

SECTION 16120

CONDUCTORS AND CABLES

1 GENERAL

1.1 SUMMARY

A. Extent of electrical wire and cable work is indicated by the Drawings and Schedules for low voltage wire and cable - 600V and below.

B. Types of electrical wire, cable, and connectors specified in this section include but are not limited to the following:

1. Copper conductors.
2. Fixture wires.
3. Tap type connectors.
4. Split-bolt connectors.
5. Wirenut connectors.

C. Applications of electrical wire, cable, and connectors required for this Project include but are not limited to the following:

1. For power distribution circuits.
2. For building lighting circuits.
3. For appliance and equipment circuits.
4. For motor-branch circuits.

1.2 SUBMITTALS

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

1.3 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of electrical wire and cable products of types, sizes, and ratings required.

B. NEC Compliance: Comply with NEC requirements as applicable to construction, installation and color coding of electrical wires and cables.

C. UL Compliance: Provide wiring/cabling and connector products which are UL listed and/or labeled.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver wire and cable properly packaged in factory-fabricated type containers, or wound on NEMA-specified type wire and cable reels.

B. Store wire and cable in clean dry space in original containers. Protect products from weather, damaging fumes, construction debris and traffic.

C. Handle wire and cable carefully to avoid abrading, puncturing and tearing wire and cable insulation and sheathing. Ensure that dielectric resistance integrity of wires/cables is maintained.

2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products of one of the following (for each type of wire, cable, and connector) (or approved equal):

B. Wire and Cable:

1. American Insulated Wire Corp.
2. Cabelec Corp.
3. General Cable Corp.
4. Okonite Company.
5. Rome Cable Corp.
6. Southwire Company.
7. Triangle PWC, Inc.

C. Connectors:

1. AMP, Inc.
2. Appleton Electric Co.; Emerson Electric Co.
3. Electrical Products Div.; Midland-Ross Corp.
4. Ideal Industries, Inc.
5. 3M Company
6. O-Z/Gedney Co.
7. Square D Company.
8. Thomas & Betts Corp.

2.2 SECONDARY VOLTAGE 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. Provide copper conductors with conductivity of not less than 98% at 68? F.

B. Building Wires: 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 Contractor to comply with project's installation requirements, NEC and NEMA standards. Select from the following UL types, those wires with construction features which fulfill project requirements:

1. Type THW: For dry and wet locations; maximum operating temperature 75? C (167? F). Insulation, flame-retardant, moisture- and heat-resistant, thermoplastic; conductor, annealed copper.
2. Type THWN: For dry and wet locations; maximum operating temperature 75? C (167? F). Insulation, flame-retardant, moisture- and heat-resistant, thermoplastic; outer covering, nylon jacket; conductor, annealed copper.
3. Type RHW (Feeders 4/0 and larger and Underground Feeders): For dry and wet locations; maximum operating temperature 75? C (167? F). Insulation, moisture- and heat-resistant EP rubber; outer covering, moisture-resistant, flame-retardant, nonmetallic covering; conductor, annealed copper.
4. Type THHN (Interior Branch Circuits): For dry and damp locations; maximum operating temperature 90? C (194? F). Insulation, flame-retardant, heat-resistant, thermoplastic; outer covering, nylon jacket; conductor, annealed copper.

C. Cables: Provide UL type factory-fabricated cables of sizes, ampacity ratings, and materials and jacketing/sheathing as indicated for services indicated. Where not indicated, provide proper selection as determined by Contractor to comply with installation requirements, NEC and NEMA standards.

D. Conductors No. 10 and smaller may be solid or stranded and conductors larger than No. 10 shall be stranded. Control wire shall be stranded copper.

E. Connectors:

1. General: Provide UL type factory-fabricated, metal connectors of sizes, ampacity ratings, materials, types and classes for applications and for services indicated.
2. Where not indicated, provide proper selection as determined by the Installer to comply with the project's installation requirements, and with NEC and NEMA standards.
3. Select from the following, those types, classes, kinds and styles of connectors to fulfill project requirements:

    a. Type: Pressure, threaded.
    b. Class: Insulated.
    c. Kind: Copper (for Cu to Cu connection).

d. Style: Tap, pigtail, wirenut, split bolt, T-connections.

3 EXECUTION

3.1 INSTALLATION OF WIRES AND CABLES

A. General: Install wires and wiring connectors as indicated, in compliance with applicable requirements of NEC, NEMA, OSHA, 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. Use no wire smaller than 12 AWG for power and lighting circuits, and no smaller than 14 AWG for control wiring (fire alarm).

D. Use 10 AWG conductor for 20 ampere, 120 volt branch circuit home runs longer than 50 feet, unless otherwise noted on the Drawings.

E. Place an equal number of conductors for each phase of a circuit in same raceway, unless indicated otherwise on the Drawings.

F. Neatly train and lace wiring inside boxes, equipment and panelboards.

G. Make conductor lengths for parallel circuits equal.

H. Conductors shall be color coded; (1) ground leads, green; (2) grounded neutral leads, white (120 volts); (3) ungrounded phase wires, black, red, and blue (208Y/120V); (4) ungrounded phase wires, brown, orange, and yellow (480Y/277V); (5) switch leg travellers, purple.

I. Install exposed cables parallel and perpendicular to surfaces, or exposed structural members, and follow surface contours, where possible.

J. Completely and thoroughly swab raceway system before installing conductors.

K. Branch circuit wiring shall not loop through receptacle terminals, but shall be connected by means of conductor taps joined to branch circuit conductors. At

end of run, branch circuit conductors may terminate on receptacle terminals.

L. Position all splices in pull boxes and junction boxes of adequate volume so they are accessible from the removable cover side of the box.

M. Conductors for signal systems shall be continuous and shall be terminated on terminal strips or terminate in a manner approved by the system's manufacturer.

N. All neutrals and ground wires in panels shall be labeled with numbered tape to indicate the circuits being served.

O. Pull conductors simultaneously where more than one is being installed in same raceway.

P. Use pulling compound or lubricant, where necessary; compound used must not deteriorate conductor or insulation.

Q. Use pulling means including fish tape, cable, rope and basket weave wire/cable grips which will not damage cables or raceway.

R. Keep conductor splices to minimum.

S. Install splices and taps which possess equivalent or better mechanical strength and insulation ratings than conductors being spliced.

T. Use splice and tap connectors which are compatible with conductor material.

U. 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 Standard 486A and B.

V. Conductors manufactured more than twelve months prior to date of delivery to site shall not be used.

3.2 WIRING CONNECTIONS AND TERMINATIONS

A. Splice only in accessible junction boxes.

B. Splices, taps and attachments of fittings and lugs shall be electrically and mechanically secure. Connectors and lugs shall be correct size for conductors jointed.

C. Solid conductors, namely those sized No. 10 AWG copper, and smaller, shall be spliced by using Ideal "Wing-Nuts," 3M Co.'s "Scotchlox" or T&B "Piggy" conductors (or approved equal) in junction boxes and light fixtures, except recessed fixtures as noted below.

1. "Sta-Kon" or other permanent type crimp connectors shall not be used.
2. Contractor shall use Ideal "Wing-Nuts" for splicing recessed lighting fixture leads to branch circuit conductors.

D. Stranded conductors, namely No. 8 AWG and larger, shall be spliced by UL listed mechanical connectors plus gum tape, plus friction or plastic tape. Solderless mechanical connectors, for splices and tape provided with UL listed insulating covers, may be used instead of mechanical connectors plus tape.

E. Conductors, in all cases, shall be continuous from outlet to outlet, and no splicing shall be made except within outlet or junction boxes, troughs, and gutters.

F. Lugs for conductors No. 6 through No. 1/0 AWG shall be copper, split bolt type with spacer. Lugs for connectors No. 2/0 AWG and larger shall be copper 2-bolt type with spacer. Lugs shall be as manufactured by AMP, Inc. (or approved equal).

G. Taping of joints shall be made using special oil resistant vinyl plastic tape; UL listed, rated 105? C, Scotch Electrical Tape No. 33+ or reviewed equal.

H. Splices in grounding conductors No. 8 AWG and larger shall be by means of exothermic welding and termination shall be by means of approved grounding connectors. Soldering shall not be used.

I. Thoroughly clean wires before installing lugs and connectors.

J. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.

K. Terminate spare conductors with electrical tape.

3.3 FIELD QUALITY CONTROL

A. Prior to energization, test wires and cables for electrical continuity and for short circuits. Verify proper phasing connections.

B. 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.

3.4 WIRE AND CABLE INSTALLATION SCHEDULE

A. Exposed Interior Locations: Building wire in raceway.

B. Above Accessible Ceilings: Building wire in raceway.

C. Exterior Locations: Building wire in raceway.

D. Underground Locations: Building wire in raceway.

END OF SECTION 16120

SECTION 16130

RACEWAYS AND BOXES

1 GENERAL

1.1 SUMMARY

A. Extent of raceway, boxes and associated fittings work is indicated by the Drawings and Schedules.

B. Types of raceways specified in this section include the following:

1. Flexible metal conduit.
2. Liquid-tight flexible metal conduit.
3. Rigid steel conduit (RSC).
4. Rigid nonmetallic conduit.

C. This section specifies the following raceways:

1. Raceways installed within buildings
2. Raceways installed in earth beneath building concrete slabs.

D. Types of electrical boxes and fittings specified in this section include the following.

1. Outlet boxes.
2. Junction boxes.
3. Pull boxes.
4. Bushings.
5. Locknuts.
6. Knockout closures.

1.2 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

1.3 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of raceway systems of types and sizes required.

B. Manufacturers: Firms regularly engaged in manufacture of electrical boxes and fittings of types and sizes required.

1.4 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/or labeled.

1. UL No. 1: Flexible Metal Conduit
2. UL No. 6: Rigid Steel Conduit, Zinc Coated
3. UL No. 6: Rigid Steel Conduit, Enameled
4. UL No. 651: Schedule 40 and 80 Rigid PVC

C. NEC Compliance: Comply with NEC as applicable to construction and installation of raceway systems, electrical wiring boxes and fittings.

D. UL Compliance: Comply with applicable requirements of UL 50, UL 514-Series, and UL 886 pertaining to electrical boxes and fittings. Provide electrical boxes and fittings which are UL listed and/or labeled.

E. NEMA Compliance: Comply with applicable requirements of NEMA Stds/Pub No.'s OS1, OS2 and Pub 250 pertaining to outlet and device boxes, covers and box supports.

F. ANSI Publications:

1. C80.1 Rigid Steel Conduit, Zinc Coated
2. C80.2 Rigid Steel Conduit, Enameled

2 PRODUCTS

2.1 METAL CONDUIT AND TUBING

A. General: Provide metal conduit, tubing and fittings of types, grades, sizes and weights for each service indicated. Where types and grades are not indicated, provide proper selection determined by Installer to fulfill wiring requirements, and comply with applicable portions of NEC for raceways.

B. Rigid Steel Conduit (RSC): Low carbon malleable iron, cadmium plated or hot-dipped galvanized inside and outside, with threaded ends, minimum size ¾ inch. Threaded Fittings - alloy steel, galvanized.

C. Flexible Metal Conduit: Formed with continuous length of spirally wound,

interlocked zinc-coated strip steel, minimum size ½ inch, for connections to recessed lighting fixture only.

1. Flexible Metal Conduit Fittings: Provide conduit fittings for use with flexible steel conduit of threadless hinged clamp type.
2. Straight Terminal Connectors: One piece body, female end with clamp and deep slotted machine screw for securing conduit, and male threaded end provided with locknut.
3. 45 degree or 90 degree Terminal Angle Connectors: Two-piece body construction with removable upper section female end with clamp and deep slotted machine screw for securing conduit, and male threaded end provided with locknut.

D. Liquidtight Flexible Metal Conduit: Provide liquid-tight flexible metal conduit; construct of single strip, flexible, continuous, interlocked, and double-wrapped steel; galvanized inside and outside; coated with liquid-tight jacket of flexible polyvinyl chloride (PVC), 3/4-inch minimum size.

1. Manufacturers (or approved equal):
   a. Sealtite Type "UA" Anaconda, Liquatite Type "LA"
   b. Electri-Flex Co., International Metal Hose Co.
   c. Universal Metal Hose Company "Sealflex-U".
2. Fittings shall be Series "6000" as manufactured by (or approved equal):
   a. Thomas & Betts
   b. Crouse-Hinds
   c. Electri-Flex.
3. Where an external ground is required, fittings shall be Series "5200GR" or "5300GR."
4. Special care shall be taken to be sure that conduit bending radius limitations are not exceeded.

E. Expansion/Deflection Fittings: Watertight Type "XC" or Type "DX" with integral bonding jumper for rigid metal conduit permitting movement up to ¾ inch in any direction and angular deflection up to 30 degrees from normal in all directions as manufactured by (or approved equal):

1. Crouse-Hinds.
2. O-Z/Gedney.
3. Appleton.

F. Sealing Fittings or Bushings: Series "EYS", "EZD" or "EZS" (as applicable) as manufactured by (or approved equal):

1. Crouse-Hinds.
2. Pyle National.
3. Appleton.

G. Thruwall Sealing Fittings: Type "WKS" as manufactured by (or approved equal):

1. O-Z/Gedney.
2. Appleton.

3. Crouse-Hinds.

H. Fire-Seal Fittings: Type "CFSI" as manufactured by (or approved equal):

1. O-Z/Gedney.
2. Appleton.
3. Crouse-Hinds.

I. Conduit Bushings:

1. Insulated: Type "B" or "SBT" (as applicable) as manufactured by (or approved equal):
   a. O-Z/Gedney.
   b. Steel City.
   c. Myers.
2. Grounding: Type "BLG" as manufactured by (or approved equal):
   a. O-Z/Gedney.
   b. Thomas & Betts.
   c. Myers.

J. Conduit Locknuts:

1. Case-hardened locknuts shall be equal to Series No. 140 by (or approved equal):
   a. Thomas & Betts.
   b. Midwest Electric.
   c. O-Z/Gedney.

2.2 MISCELLANEOUS MATERIAL AND FITTINGS

A. Pulling in Wire: Provide 5/32 inch polyethylene rope.

B. Thread lubricant/sealant shall be Type "STL" as manufactured by (or approved equal):

1. Crouse-Hinds.
2. Greenlee Tool.
3. Ideal Industries.

C. When required on joints for heat producing elements (such as lighting fixtures), thread lubricant shall be Type "HTL" as manufactured by (or approved equal):

1. Crouse-Hinds.
2. Ideal Industries.
3. 3M Company.

D. Nest Back Spacers: Type "NG" by (or approved equal):

1. O-Z/Gedney.
2. Appleton.

3. Raco.

E. Conduit Bodies:

1. Provide galvanized cast-metal conduit bodies of types, shapes and sizes as required to fulfill job requirements and NEC requirements.
2. Construct conduit bodies with threaded-conduit-entrance ends, removable covers, either cast or of galvanized steel, and corrosion-resistant screws.
3. Manufacturers: Subject to compliance with requirements, provide conduit bodies of one of the following (or approved equal):
   a. Appleton Electric; Div. of Emerson Electric Co.
   b. Crouse-Hinds Co.
   c. Killark Electric Mfg. Co.

2.3 NONMETALLIC CONDUIT

A. General: Provide nonmetallic conduit and fittings of types, sizes and weights for each service indicated. Where types and grades are not indicated, provide proper selection determined by Installer to fulfill wiring requirements which comply with provisions of NEC for raceways.

B. Electrical Plastic Conduit (PVC):

1. Extra Heavy Wall Conduit: Schedule 80, 90? C, constructed of polyvinyl chloride and conforming to NEMA TC-2, for direct burial, or concrete-encased use, UL listed and in conformity with NEC Article 347.
2. All vertical ells shall be heavy wall rigid steel conduit.

C. PVC Conduit Fittings: NEMA TC 3, mate and match to conduit or tubing type and material.

D. Conduit, and Tubing Accessories: Provide conduit, tubing and duct accessories of types, sizes, and materials, complying with manufacturer's published product information, which mate and match conduit and tubing.

2.4 BOXES AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

B. Interior Outlet Boxes (or approved equal):

1. Appleton Electric
2. Emerson Electric Co.
3. General Signal Co.
4. Harvey Hubbell Inc.

5. Midland-Ross Corp.
6. O-Z/Gedney
7. RACO Div.
8. Thomas & Betts Co.

C. Raintight Outlet Boxes (or approved equal):

1. Appleton Electric
2. Arrow-Hart Div.
3. Crouse-Hinds Co.
4. Emerson Electric Co.
5. General Signal Co.
6. Harvey Hubbell, Inc.
7. O-Z/Gedney

D. Junction and Pull Boxes (or approved equal):

1. Appleton Electric
2. Arrow-Hart Div.
3. Emerson Electric Co.
4. General Signal Co.
5. O-Z/Gedney Co.
6. Spring City Electrical Mfg. Co.

E. Bushings, Lockout Closures and Locknuts (or approved equal):

1. AMP, Inc.
2. General Signal Co.
3. Harvey Hubbell Inc.
4. Midland-Ross Corp.
5. O-Z/Gedney Co.
6. RACO Div.
7. Thomas & Betts Co., Inc.

2.5 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.

B. Construct outlet boxes with mounting holes, and with cable and conduit-size knockout openings in bottom and sides.

C. Provide boxes with threaded screw holes, with corrosion-resistant cover and grounding screws for fastening surface and device type box covers, and for equipment grounding.

D. 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 Contractor's code-compliance option.

E. Device Boxes: Provide galvanized coated flat rolled sheet-steel non-gangable device boxes, of shapes, cubic inch capacities, and sizes, including box depths as indicated, suitable for installation at respective locations.

1. 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.
2. Provide cable clamps and corrosion-resistant screws for fastening cable clamps, and for equipment type grounding.
3. Where multi-device boxes are required, provide gangable boxes where more than one device is mounted together.

F. 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 Contractor's code-compliance option.

G. Raintight Outlet Boxes: Provide NEMA 3R corrosion-resistant cast-metal raintight 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 suitable configured for each application, including face plate gaskets and corrosion-resistant plugs and fasteners.

H. Junction and Pull Boxes: Provide galvanized code-gage sheet steel junction and pull boxes, no knockouts, UL listed, 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. Boxes larger than 12" in any dimension shall be provided with hinged cover.
2. Provide steel barriers in boxes with feeder circuits of different voltages.

I. Bushings, Knockout Closures and Locknuts: Provide corrosion-resistant box knockout closures, conduit locknuts and malleable iron conduit insulated bushings, offset connectors, of types and sizes, to suit respective installation requirements and applications.

3 EXECUTION

3.1 GENERAL

A. All installation shall comply with the NEC and OSHA.

3.2 EXAMINATION

A. Examine areas and conditions under which raceways are to be installed, and substrate which will support raceways.

B. Notify Contracting Officer or authorized representative in writing of conditions detrimental to proper completion of the work.

C. Do not proceed with work until unsatisfactory conditions have been corrected.

3.3 INSTALLATION OF CONDUITS

A. Install conduit concealed unless indicated otherwise on the Drawings. Maintain minimum distance of six (6") inches from parallel runs of flues, steam or hot water pipes.

B. Use liquid-tight flexible metal conduit for connections to motors, transformers and other equipment subject to vibration and in areas subject to moisture.

C. Use flexible metal conduit for connections to recessed and/or semi-recessed lighting fixtures.

D. Space groups of conduits uniformly. For bends and offsets, use an approved hickey or bending machine.

E. Cut all conduit with hacksaw or approved cutting machine and ream after threading to remove all burrs.

F. Fasten conduit securely to outlets, junctions and pullboxes to ensure firm electrical contact.

1. Join conduit with approved couplings.
2. No running threads will be allowed.
3. Install insulated bushings and double locknuts on threaded conduits entering or leaving sheet metal outlet, junction, or pull boxes, and cabinets.
4. Install grounding bushings on all conduits entering an enclosure such as

a motor control center from below where the conduit is not attached to the enclosure.

5. Bond all bushings to ground bus using conductor the same size as the equipment grounding conductor in the conduit.
6. Install compression type connectors with insulated throats on electrical metallic tubing entering or leaving sheet metal outlet, junction or pull boxes and cabinets.

G. Avoid condensation pockets in installations. Keep conduit, fittings, and boxes free from foreign matter, before, during and after installation.

H. Not more than one (1) exposed conduit shall be run down to an exposed wall switch or outlet box.

I. Use expansion/deflection fittings where rigid metal conduits pass from existing building structures to additions on new foundations, every 200 feet linear run maximum, and where otherwise indicated on the Drawings.

J. Use thruwall sealing fittings where conduits enter buildings or vaults below finished grade.

K. Conduits less than one (1") inch may be installed in concrete but shall not cross each other. Installation of larger conduits in concrete must be approved by Engineer.

L. Do not use aluminum conduit on this project.

M. Support runs of metallic conduit at least every eight (8') feet.

N. Support runs of non-metallic conduit at least as required by NEC Table 347-8.

O. Install runs of conduit parallel or perpendicular to walls, structural members or intersections of vertical planes and ceilings. Provide right angle turns consisting of fittings or symmetrical bends.

P. Support conduits within one (1') foot of all changes in direction. Supports shall include wall brackets, trapeze hangers, strap hangers or pipe straps secured to hollow masonry with toggle bolts, to brick and concrete with expansion bolts, to metal surfaces with machine screws and to wood with wood screws.

Q. The use of wooden plugs (inserted in masonry), tie wire or nails as fastening media is prohibited.

R. Support conduit risers exposed in wire shafts at each floor level with approved U-clamp hangers.

S. Install empty conduit for future use as indicated on the Drawings. Conduit shall be complete with rope, junction and outlet boxes.

T. Conduit shall not be supported from metal roof deck.

U. Provide pitchpocket where conduit penetrates roof.

V. Conduit shall not penetrate concrete bases designed for vibration isolation.

W. Apply thread lubricant/sealant to joints of all conduit buried in earth or concrete encased.

X. Paint all metallic conduits buried in earth or concrete encased with two (2) coats of black asphaltum.

Y. Conduits buried in earth outside buildings shall have 30 inches (minimum) cover unless otherwise noted on the Drawings.

Z. Use PVC conduit only where specifically indicated on the Drawings.

AA. Install fire-seal fittings or UL classified foam sealant where conduits penetrate concrete floor slabs or masonry walls required to be fire rated.

BB. Use nest back spacers in conjunction with conduit spacers or clamp backs when additional spacing away from mounting surface is required.

CC. All conduits shall be installed as high as possible in the ceiling cavity. Coordinate all conduit installation with ductwork.

DD. 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.

EE. Install miscellaneous fittings such as reducers, chase nipples, 3-piece unions, split coupling, and plugs that have been specifically designed and manufactured for their particular application.

FF. Use roughing-in dimensions of electrically operated unit furnished by supplier.

GG. Set conduit and boxes for connection to units only after receiving review of dimensions and after checking location with other trades.

HH. Test conduits required to be installed, but left empty, with ball mandrel.

II. Clear any conduit which rejects ball mandrel.

JJ. Pay costs involved for restoration of conduit and surrounding surfaces to original condition.

KK. Cut conduits straight, properly ream, and cut threads for heavy wall conduit deep and clean.

LL. Field-bend conduit with benders designed for purpose so as not to distort or vary internal diameter.

MM. Size conduits to meet NEC, except no conduit smaller than ¾ inch shall be installed.

NN. Fasten conduit terminations in sheet metal enclosures by 2 locknuts, and terminate with insulated bushing. Install locknuts inside and outside of enclosure.

OO. Conduits are not to cross pipe shafts or ventilating duct openings.

PP. Support riser conduit at each floor level with clamp hangers.

QQ. Use of running threads at conduit joints and terminations is prohibited. Where required, use 3-piece union or split coupling.

RR. Complete installation of electrical raceways before starting installation of cables/wires within raceways.

SS. Support exposed conduit by use of hangers, clamps or clips.

1. Support conduit within 3'-0" of each outlet box, junction box, cabinet or fitting and on each side of bends and on spacing not to exceed following:

Rigid metal conduits up to 1": 6'-0"; 1-1/4" and over: 8'-0"; EMT up to 1": 5'-0"; 1-1/4" and over: 8'-0".

2. Arrange conduit supports to prevent distortion of alignment by wire pulling operations.
3. Fasten conduit using galvanized straps, caddy clamps, lay-in adjustable hangers, clevis hangers, or bolted split stamped galvanized hangers.
4. Requirements for exposed conduits also apply to conduits installed in space above hung ceilings.

TT. Concealed Conduits:

1. Metallic raceways installed underground or in floors below grade, or outside are to have conduit threads painted with corrosion inhibiting compound before couplings are assembled. Draw up coupling and conduit sufficiently tight to ensure watertightness.
2. For floors-on-grade, install conduits under rock and concrete slabs.
3. Install underground conduits minimum of 24"below finished grade for 600 volt and below, and 36” below finished grade for above 600 volt.

UU. Exposed Conduits:

1. Install conduits as not to damage or run through structural members. Avoid horizontal or cross runs in building partitions or side walls.
2. Install exposed conduits and extensions from concealed conduit systems neatly, parallel with, or at right angles to walls of building.
3. Install exposed conduit work as not to interfere with ceiling inserts, lights or ventilation ducts or outlets.
4. Run conduits for outlets on waterproof walls exposed. Set anchors for supporting conduit on waterproof wall in waterproof cement.
5. Requirements for exposed conduit also apply to conduits installed in space above hung ceilings.

VV. Non-Metallic Conduit:

1. Make solvent cemented joints in accordance with recommendations of manufacturer.
2. Install PVC conduits in accordance with NEC.

WW. Conduit Fittings:

1. Construct locknuts for securing conduit to metal enclosure with sharp edge for digging into metal, and ridged outside circumference for proper fastening.
2. Install insulated type bushings for terminating conduits. Bushings are to have flared bottom and ribbed sides. Upper edge to have phenolic insulating ring molded into bushing.
3. Miscellaneous fittings such as reducers, chase nipples, 3-piece unions, split coupling, and plugs to be specifically designed for their particular application.

XX. Install expansion fittings in all raceways wherever structural expansion joints are

crossed.

YY. Make changes in direction of raceway run with proper fittings, supplied by raceway manufacturer.

ZZ. Properly support and anchor raceways for their entire length by structural materials. Raceways are not to span any space unsupported.

AAA. Use boxes as supplied by raceway manufacturer wherever junction, pull or devices boxes are required. Standard electrical "handy" boxes, etc. shall not be permitted for use with surface raceway installations.

BBB. Arrange conduit to maintain headroom and present a neat appearance.

CCC. Route exposed conduit and conduit above accessible ceilings parallel and perpendicular to walls and adjacent piping.

DDD. Group conduits in parallel runs where practical and use conduit rack constructed of steel channel with conduit straps or clamps. Provide space for 25% additional conduit.

EEE. Do not fasten and/or hang conduit with wire or perforated pipe straps. Remove all wire used for temporary conduit support during construction, before conductors are pulled.

FFF. Bring conduit to the shoulder of fittings and couplings and fasten securely. Raceways shall be cut to proper length so ends fit accurately in outlets.

GGG. Use conduit hubs for fastening conduit to cast boxes, and for fastening conduit to sheet metal boxes in damp or wet locations.

HHH. Install no more than the equivalent of three (3) 90 degree bends between boxes.

III. Use conduit bodies to make sharp changes in direction, as around beams.

JJJ. Use hydraulic one-shot conduit bender for bends in conduit smaller than 2" size, or factory elbows for bends in conduit 2" and larger. Bends in metallic conduit shall be made while "cold."

KKK. Avoid moisture traps where possible; where unavoidable, provide junction box with drain fitting at conduit low point.

LLL. Use suitable conduit caps to protect installed conduit against entrance of dirt and moisture.

MMM. Where conduit penetrates fire rated walls, provide pipe sleeve two sizes larger than conduit; seal opening around conduit with UL listed foamed silicone elastomer compound.

NNN. Route conduit through roof openings for piping and ductwork where possible; otherwise, route through roof jack with pitch pocket.

OOO. Combining of circuits other than as indicated on the Drawings shall not be permitted.

PPP. Bolts, clamps, screws and expansion bolts shall be used in securing conduit, equipment, etc. Holes for lead shields shall be drilled in solid brick or concrete and must be neatly cemented after bolts are in place.

QQQ. Coordinate computer systems conduit installation with Contracting Officer.

3.4 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 NEC, OSHA, 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 weathertight 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. Where receptacles are shown back-to-back in walls, they shall be mounted in separate boxes, a minimum of 6" apart (24" in acoustic rated walls) and connected together using flex with ground wire. Flex will not be acceptable for system grounding. The flex shall have a loop for limiting sound transmissions. Outlet boxes shall be equipped with plaster rings of appropriate depth to finish flush with finished wall. Outlets in exposed masonry walls shall be equipped with extra deep square corner tile rings so that boxes may be installed in brick walls or in the core of the block.

G. Aluminum products shall not be installed.

H. Position recessed outlet boxes accurately to allow for surface finish thickness.

I. Do not use round boxes unless noted otherwise on the Drawings.

J. Fasten electrical boxes firmly and rigidly to substrates, or structural surfaces to which attached, or solidy embed electrical boxes in concrete or masonry. Boxes shall be supported independently of conduit.

K. Provide electrical connections for installed boxes.

L. Electrical box locations indicated on the Drawings are approximate unless dimensioned. Verify location of outlets prior to rough-in. Outlet may be relocated by the Contracting Officer or authorized representative at no additional cost.

M. Locate and install to maintain headroom and to present a neat appearance.

N. Use multiple gang boxes where more than one device is mounted together; do not use sectional boxes. Provide barriers to separate wiring of different voltage systems.

O. Install boxes in walls without damaging wall insulation.

P. Position outlets to locate luminaries as indicated on the Drawings.

Q. Align wall mounted outlet boxes for switches, thermostats, and similar devices.

R. Subsequent to installation of boxes, protect boxes from construction debris and damage.

S. Support all outlet boxes as required by the NEC. Suspended outlet boxes shall be independently supported from raceway by means of 1/4" all thread rod to structure.

T. All outlet boxes or plaster rings shall finish flush with finished wall or ceiling. Outlets which do not finish flush (recessed) shall be equipped with copper tube stand-off nipples of proper length to hold wiring device securely in place. Wiring device shall be secure and shall not push in or rock.

3.5 GROUNDING

A. Upon completion of installation work, properly ground electrical boxes and demonstrate compliance with requirements of Section 16060 – GROUNDING AND BONDING.

3.6 JUNCTION AND OUTLET BOX IDENTIFICATION:

A. Identify each junction and outlet box cover with color and the type system that is within the box. Sample identifications are as follows:

B. Fire Alarm (Red): Name “FIRE ALARM”.

C. The written labels above shall be neatly and legibly marked on the outside of the box covers using a permanent black ink marker.

END OF SECTION 16130

SECTION 16140

WIRING DEVICES

1 GENERAL

1.1 SUMMARY

A. This Section includes receptacles, connectors, switches, and finish plates.

1.2 DEFINITIONS

A. GFCI: Ground-fault circuit interrupter.

1.3 SUBMITTALS

A. Product Data: For each product specified.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

B. Comply with NEMA WD 1.

C. Comply with NFPA 70.

1.5 COORDINATION

A. Receptacles for Government-Furnished Equipment: Match plug configurations.

1. Cord and Plug Sets: Match equipment requirements.

2 PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements,

manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Wiring Devices (or approved equal):

    a. Bryant Electric, Inc.
    b. Eagle Electric Manufacturing Co., Inc.
    c. GE Company; GE Wiring Devices.
    d. Hubbell, Inc.; Wiring Devices Div.
    e. Killark Electric Manufacturing Co.
    f. Leviton Manufacturing Co., Inc.
    g. Pass & Seymour/Legrand; Wiring Devices Div.

2.2 RECEPTACLES

A. Provide NEMA configuration 5-20R duplex 125 Volt grounding type receptacles rated for 20 Amperes unless otherwise indicated on the Drawings.

B. Receptacles shall be specification grade, Bryant "5362" series, Hubbell "5352" series, P&S "5362" series, G.E., "5362" series, Sylvania "5362" series or Slater "5362" series (or approved equal).

2.3 OTHER RECEPTACLES

A. Receptacles requiring a current or voltage rating or configuration different from duplex convenience receptacles shall be as indicated on the Drawings.

B. Provide other receptacles with quality, material and workmanship at least equal to that specified for duplex convenience receptacles.

C. Ground fault interrupter receptacles shall have the following features:

1. UL listed: UL 943 Class A
2. Configuration: Duplex, NEMA 5-20R
3. Trip Current: 5 plus or minus 1 milliampere
4. Trip Speed: 0.025 second maximum
    a. Front-accessible test and reset pushbuttons
    b. Manufacturer and type (or approved equal):
        1) Harvey Hubbell, Inc.: GP5362
        2) Pass & Seymour, Inc.: 2091
        3) Slater: SIR-20-F

2.4 PENDANT CORD/CONNECTOR DEVICES

A. Description: Matching, locking type, plug and receptacle body connector, NEMA WD 6, Configurations L5-20P and L5-20R, Heavy-Duty grade.

1. Body: Nylon with screw-open cable-gripping jaws and provision for attaching external cable grip.
2. External Cable Grip: Woven wire-mesh type made of high-strength galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.5 CORD AND PLUG SETS

A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.

1. Cord: Rubber-insulated, stranded-copper conductors, with type SOW-A jacket. Green-insulated grounding conductor, and equipment-rating ampacity plus a minimum of 30 percent.
2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.6 SWITCHES

A. Provide totally enclosed, 20 Ampere, 120/277 Volt, quite AC general-use snap switches.

B. Switches shall be single pole, double pole, three-way, four-way, locking or with pilot light as indicated on the drawings.

C. Switches shall be specification grade, Bryant "4900" series, Hubbell "1220" series, P& S "20AC" series, G.E. "5950" series, Sylvania "1221A" series or Slater "720" series (or approved equal).

2.7 WALL PLATES

A. Normal Power: Provide plates possessing the following additional construction features:

1. Material and Finish: Lexan plastic with nylon screws.

B. Wallplates: Provide wallplates for single and combination wiring devices, of types, sizes, and with ganging and cutouts as indicated.

1. Sectional wallplates shall not be used. Select plates which mate and match wiring devices to which attached.
2. Construct with metal screws for securing plates to devices; stainless screw heads to match finish of plates; wallplates shall be stainless steel. Provide plates possessing the following additional construction features:
   a. Material and Finish (Finished Areas): 0.040" thick, Type 302 satin finished stainless steel.
   b. Material and Finish (Unfinished Areas): Steel plate, galvanized.

c. Material and Finish (Wet Areas): Die cast metal, gasketed and UL listed for "wet locations".

2.8 FINISHES

A. Color: Ivory, unless otherwise indicated or required by Code.

3 EXECUTION

3.1 INSTALLATION

A. All work shall be in accordance with NEC and OSHA requirements.

B. Install devices and assemblies plumb and secure.

C. Install wall plates when painting is complete.

D. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical, and grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

E. Protect devices and assemblies during painting.

F. Where adjacent to doors, coordinate with architectural drawings to ensure switches are installed on strike side of door.

G. Locate switches approximately 48 inches (centerline) above finished floor elevation unless otherwise indicated.

H. Locate receptacles approximately 18 inches (centerline) above finished floor elevation unless otherwise indicated.

I. Install wiring devices only in electrical boxes which are clean (free from excess building materials, dirt, and debris).

J. Install galvanized steel wallplates in unfinished spaces.

3.2 IDENTIFICATION

A. Switches: Where three or more switches are ganged, and elsewhere as indicated, identify each switch with approved legend engraved on wall plate.

B. Receptacles: Identify panelboard and circuit number from which served. Use machine-printed, pressure-sensitive, abrasion-resistant label tape on face of plate and durable wire markers or tags within outlet boxes.

3.3 CONNECTIONS

A. Connect wiring device grounding terminal to branch-circuit equipment grounding conductor.

B. Tighten electrical connectors and terminals according to manufacturers published torque-tightening values. If manufacturers torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

A. Test wiring devices for proper polarity and ground continuity. Use Hubbel model HBL5200 or equal.

B. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.

C. Replace damaged or defective components.

3.5 CLEANING

A. Internally clean devices, device outlet boxes, and enclosures. Replace stained or improperly painted wall plates or devices.

END OF SECTION 16140

SECTION 16515

INTERIOR LIGHTING FIXTURES

1 GENERAL

1.1 SUMMARY

A. Extent, location, and details of interior lighting fixture work are indicated on drawings and in schedules.

B. Types of interior lighting fixtures in this section include the following:

1. Fluorescent.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer’s product data and installation instructions on each type of interior lighting fixture and component.

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of interior lighting fixtures of sizes, types and ratings required, whose products are UL listed and/or labeled.

B. Codes and Standards:

1. Electrical Code Compliance: Comply with applicable State code requirements of the authority having jurisdiction and NEC Articles 220, 410, and 510 as applicable to installation, and construction of interior building lighting fixtures.
2. NEMA Compliance: Comply with applicable requirements of NEMA Stds Pub/No.'s LE 1 and LE 2 pertaining to lighting equipment.
3. UL Compliance: Comply with UL standards, including UL 486A and B, pertaining to interior lighting fixtures. Provide interior lighting fixtures and components which are UL listed and labeled.
4. CBM Labels: Provide electronic fluorescent lamp ballasts which comply with Certified Ballast Manufacturers Association standards and carry the CBM label.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver interior lighting fixtures in factory-fabricated containers or wrappings, which properly protect fixtures from damage.

B. Store interior lighting fixtures in original packaging. Store inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, humidity, laid flat and blocked off ground.

C. Handle interior lighting fixtures carefully to prevent damage, breaking, and scoring of finishes. Do not install damaged units or components; replace with new.

1.5 SEQUENCING AND SCHEDULING

A. Coordinate with other work including wires/cables, electrical boxes and fittings, and raceways, to properly interface installation of interior lighting fixtures with other work.

B. Sequence interior lighting installation with other work to minimize possibility of damage and soiling during remainder of construction.

2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide interior lighting units of one of the following (for each type of interior lighting unit) (or approved equal):

1. General Electric Co.
2. Hubbell
3. Holophane Div; Johns-Manville Corp.
4. Lithonia
5. Daybrite

B. Fluorescent Ballasts:

1. Advance Transformer Co.
2. Electronic Ballast Technology
3. Magnatek
4. Osvam

C. Lamps

1. General Electric
2. Osvam-Sylvania
3. Phillips

2.2 INTERIOR LIGHTING FIXTURES

A. General: Provide lighting fixtures, of sizes, types and ratings indicated; complete with, but not limited to, housings, energy efficient ballasts, starters, wiring, poles and standards.

B. Wiring: Provide electrical wiring within fixture suitable for connecting to branch circuit wiring.

C. Fluorescent Lamp Ballasts: Provide solid state low-temperature, high power-factor, Class P, UL Listed integrated electronic ballasts, capable of operating lamp types indicated.

1. Ballasts shall be Electronic Integrated Circuit type.
   a. Ballast sound levels shall not exceed Class A ambient noise levels.
   b. Ballast shall maintain constant light output of all rapid start fluorescent lamps over operating ranges of 90V to 145V (120V ballasts) and 200V to 320V (277V ballasts).
   c. Input current Total Harmonic Distortion content shall be below 15 percent (expressed in percentage of full light output current level).
   d. Ballast shall have an average lamp current crest factor below 1.4.
   e. Where applicable, ballasts shall meet minimum efficacy standards of Public Law No. 100-357, National Appliance Energy Conservation Amendments of 1988.
   f. Ballast shall be rapid startup.
   g. Ballast shall withstand line transients ad defined in ANSI/IEEE C62.41, Category A.
   h. Ballast case temperature shall not exceed 25? C temperature rise over 40? C ambient.
   i. Ballast shall have a frequency of operation of 20 kHz or greater, and operate without visible flicker.
   j. Ballast shall have a power factor of 90% or above.
   k. Ballast shall not contain polychlorinated biphenyls (PCB's).
   l. Ballast shall meet the requirements of the Federal Communications Commission Rules and Regulations, Part 18, Class A.
   m. Ballast for fixtures in Outbrief Room 103 shall be electronic type for dimming service.

D. Lamps:

1. All lamps used on this Project shall be by one manufacturer.
2. All lamps of a particular type shall be from one production run.
3. Provide fluorescent lamps of energy saving types and wattages as indicated on the Drawings.

E. Interior Lighting Fixture Types:

1. General: Fixtures must comply with minimum requirements as stated herein. Review architectural drawings and specifications to verify ceiling

types, modules, suspension systems appropriate to installation.

2. Refer to the Fixture Schedule on the Drawings for specific fixture requirements.

3 EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions under which lighting fixtures are to be installed, and substrate for supporting lighting fixtures.

B. Notify Contracting officer’s representative in writing of conditions detrimental to proper completion of the work.

C. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF INTERIOR LIGHTING FIXTURES

A. Install interior lighting fixtures at locations and heights as indicated, in accordance with fixture manufacturer's written instructions, applicable requirements of NEC, OHSA, NECA's "Standard of Installation," NEMA standards, and with recognized industry practices to ensure that lighting fixtures fulfill requirements.

B. Provide fixtures and/or fixture outlet boxes with hangers to properly support fixture weight. Submit design of hangers, method of fastening, other than indicated or specified herein, for review by Contracting officer’s representative.

C. Fasten fixtures securely to indicated structural supports; and ensure that pendant fixtures are plumb and level. Provide individually mounted pendant fixtures longer than two (2') feet with twin stem hangers. Provide stem hanger with ball aligners and provisions for minimum one (1") inch vertical adjustment. Mount continuous rows of fixtures with an additional stem hanger greater than number of fixtures in the row. Provide clips for securing layin fixtures in grid ceiling system.

D. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Stds 486A and B, and the National Electrical Code.

3.3 FIELD QUALITY CONTROL

A. Replace defective and burned out lamps for a period of one year following the Date of Substantial Completion.

B. At Date of Substantial Completion, replace lamps in interior lighting fixtures which are observed to be noticeably dimmed after Contractor's use and testing, as judged by Contracting officer’s representative.

3.4 GROUNDING

A. Provide equipment grounding connections for interior lighting fixtures as indicated and as specified in Section 16060 – GROUNDING AND BONDING.

B. Tighten connections to comply with tightening torques specified in UL Std 486A to assure permanent and effective grounds.

3.5 ADJUSTING AND CLEANING

A. Clean interior lighting fixtures of dirt and construction debris upon completion of installation. Clean fingerprints and smudges from lenses.

B. Protect installed fixtures from damage during remainder of construction period.

3.6 DEMONSTRATION

A. Upon completion of installation of interior lighting fixtures, and after building circuitry has been energized, apply electrical energy to demonstrate capability and compliance with requirements.

B. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.

END OF SECTION 16515

SECTION 16525

EXTERIOR LIGHTING FIXTURES

1 SUMMARY

A. Types of exterior lighting fixtures in this section include the following:

1. Incandescent.
2. High pressure sodium.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions on each type of exterior lighting fixture and component.

1.3 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of exterior building lighting fixtures of types and ratings required.

B. Codes and Standards:

1. NEC Compliance: Comply with NEC as applicable to installation and construction of exterior building lighting fixtures.
2. NEMA Compliance: Comply with applicable requirements of NEMA Stds Pub/No.'s FA 1, LE 1 and LE 2 pertaining to lighting equipment.
3. UL Compliance: Comply with UL standards, including Stds 486A and B, pertaining to exterior lighting fixtures. Provide exterior lighting fixtures which are UL listed and/or labeled.
4. CBM Labels: Provide fluorescent lamp ballasts which comply with Certified Ballast Manufacturers Association standards and carry the CBM label.

1.4 DELIVERY, STORAGE AND HANDLING

A. Handle lighting fixtures carefully to prevent damage, breaking, and scoring. Do not install damaged fixtures or components; replace with new.

B. Store lighting fixtures in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.

2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated into the work include the following (or approved equal):

B. Exterior Lighting Fixtures:

1. General Electric Co.
2. GTE Sylvania, Inc.
3. Holophane
4. Hubbell Lighting.
5. Lithonia Lighting.
6. Sterner Lighting.

C. Fluorescent Ballasts:

1. Advance Transformer Co.
2. Jefferson Electric Co.
3. Universal Mfg. Co.
4. Valmont Industries, Inc.

D. High Intensity Discharge Ballasts:

1. Advance Transformer Co.
2. General Electric Co. (Hendersonville)
3. Holophane Div.; Johns-Manville Corp.
4. Jefferson Electric Co.
5. Universal Transformer Co.

2.2 EXTERIOR LIGHTING FIXTURES

A. General: Provide lighting fixtures, of sizes, types and ratings indicated; complete with, but not limited to, housings, energy efficient ballasts, starters and wiring.

B. Wiring: Provide electrical wiring within fixture suitable for connection to branch circuit wiring as follows:

1. NEC Type AF for 120 volts, minimum No. 18 AWG.
2. NEC Type SF-2 for 277 volts, minimum No. 18 AWG.

C. Fluorescent-Lamp Ballasts: Provide low-temperature, high power-factor, low energy fluorescent lamp ballasts, capable of operating lamp types indicated.

D. High-Intensity-Discharge Lamp Ballasts: Provide HID lamp ballasts, capable of operating lamp types with ratings indicated; reactor type, high power-factor, core and coil assembly encapsulated in non-melt resin; install capacitor outside ballast encapsulation for easy field replacement.

E. Provide HID lamp ballasts, which properly mates and matches lamps to electrical supply by providing appropriate voltages and impedances for which lamps are designed. Design ballasts to operate lamp within the lamp manufacturer's specifications.

F. Lamps:

1. All lamps used on this Project shall be by one manufacturer.
2. All lamps of a particular type shall be from one production run.
3. Provide HID lamps in types and wattages indicated on the Drawings.
4. Provide incandescent lamps in types and wattages as indicated on the Drawings.

G. Exterior Lighting Fixture Types:

1. General: Refer to the Fixture Schedule for types and requirements of exterior lighting fixtures.

3 EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions under which lighting fixtures are to be installed, and substrate which will support lighting fixtures.

B. Notify Contracting Officer’s Representative in writing of conditions detrimental to proper completion of work.

C. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF EXTERIOR LIGHTING FIXTURES

A. Install exterior lighting fixtures at locations and heights as indicated, in accordance with fixture manufacturer's written instructions, applicable requirements of NEC, NECA's "Standard of Installation," NEMA standards, and with recognized industry practices to ensure that lighting fixtures fulfill requirements.

B. Coordinate with other electrical work as appropriate to properly interface installation of exterior lighting fixtures with other work.

C. Tighten connectors and terminals, including screws and bolts, to comply with tightening torques specified in UL Stds 486A and B.

D. Fasten fixtures securely to poles; and ensure that poles and fixtures are plumb.

3.3 ADJUSTING AND CLEANING

A. Clean exterior lighting fixtures of dirt and debris upon completion of installation.

B. Protect installed fixtures from damage during construction period.

3.4 FIELD QUALITY CONTROL

A. Upon completion of installation of exterior lighting fixtures, and after building circuitry has been energized, apply electrical energy to demonstrate capability and compliance with requirements.

B. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.

C. Replace defective and burned out lamps for a period of one year following the Date of Substantial Completion.

D. At the Date of Substantial Completion, replace lamps in exterior lighting fixtures which are observed to be noticeably dimmed after Contractor's use and testing as judged by the Contracting Officer or authorized representative.

3.5 GROUNDING

A. Tighten connections to comply with tightening torques specified in UL Std 486A to assure permanent and effective grounds.

B. Provide equipment grounding connections for exterior lighting fixtures as indicated and as specified in Section 16060 – GROUNDING AND BONDING.

END OF SECTION 16525

SECTION 16535

EMERGENCY LIGHTING

1 GENERAL

1.1 SUMMARY

A. Extent of emergency lighting work is indicated by Drawings and Schedules.

B. Types of emergency lighting fixtures in this section include the following:

1. Unitized battery powered fixtures.
2. Exit fixtures.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer’s product data and installation instructions on each type of emergency lighting fixture and component.

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of emergency lighting fixtures of types and ratings required, whose products are UL listed and/or labeled.

B. Codes and Standards:

1. NEC Compliance: Comply with NEC as applicable to installation and construction of emergency lighting.
2. NEMA Compliance: Comply with applicable requirements of NEMA Std Pub No.'s 1B 4, 1B 5, and FA 1 pertaining to emergency lighting.
3. UL Compliance: Provide emergency lighting fixtures which are UL listed and/or labeled.
4. NFPA Compliance: Comply with applicable requirements of NFPA 99, "Health Care Facilities" and NFPA 101, "Life Safety Code."

1.4 DELIVERY, STORAGE AND HANDLING

A. Handle lighting fixtures carefully to prevent damage, breaking, and scoring. Do not install damaged fixtures or components; replace with new.

B. Store lighting fixtures in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.

2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, manufacturers offering emergency lighting equipment which may be incorporated in the work include the following (or approved equal):

B. Exit Fixtures:

1. Chloride Inc.
2. Emergi-Lite Electronics
3. Exide Electronics Corp.
4. Lightalarms Electronics Corp.
5. Lithonia Lighting Inc.
6. Shield Source, Inc.

C. Unitized Battery Powered Fixtures:

1. Chloride Systems USA, Inc.
2. Exide Electronics Corp.
3. Lightalarms Electronics Corp.
4. Lithonia Lighting, Inc.

2.2 EMERGENCY LIGHTING FIXTURES

A. General: Provide lighting fixtures, of sizes, types and ratings indicated; complete with, but not limited to, housings, energy efficient lamps, lamp holders, reflectors, energy-efficient ballasts, starters, and wiring.

B. Wiring: Provide wiring within fixtures for connection to branch circuit wiring.

C. Exit Fixtures - Battery Powered: Provide surface, wall, or ceiling mounted fixtures as indicated. Select fixture with standard exterior finish and red lamps (6 -inch), with capability for adjusting exit arrows as indicated. Provide LED type lamps for normal and emergency operation, dual voltage (120/277 V.), Universal mounting, universal arrows. Furnish battery powered unit with automatic charging, complete with nickel-cadmium battery which automatically connects low voltage lamp to battery power upon loss, and disconnect upon restoration of normal AC supply.

D. Unitized Battery Powered Fixtures:

1. General: Various fixture types are indicated below. Fixtures must comply with minimum requirements as stated herein.
2. Emergency Units: Provide battery powered, dual voltage (120/277 V.),

self-contained units and solid-state, UL listed, fully automatic charger and transfer/brownout circuit and low-voltage battery disconnect; full 3-year warranty plus 15-year prorated warranty.

a. Provide enclosure constructed in accordance with NEMA 1 standards, high impact thermoplastic.
b. Supply maintenance-free lead-calcium battery for 6 volt operation capable of supply connected load for minimum period of 90 minutes to end voltage or 87-1/2% of nominal battery voltage.
c. Provide unit-mounted and/or remote-mounted head as indicated on the Drawings, rated 6 volt, 5.4 watts tungsten lamps.

3. Accessories: Provide following accessories mounted on unit cabinet:
   a. Unit test switch.
   b. Voltmeter.
   c. Ammeter.
   d. AC "ON" pilot light.
   e. Battery life expectancy alarm.
   f. Heavy-duty wall mounting bracket.

3 EXECUTION

3.1 INSTALLATION OF EMERGENCY LIGHTING FIXTURES

A. Install emergency lighting fixtures at locations and heights as indicated, in accordance with fixture manufacturer's written instructions, applicable requirements of NEC, NECA's "Standard of Installation," NEMA standards, and with recognized industry practices to ensure that lighting fixtures fulfill requirements.

B. Coordinate with other electrical work as appropriate to properly interface installation of emergency lighting fixtures with other work.

3.2 ADJUSTING AND CLEANING

A. Clean emergency lighting fixtures of dirt and debris upon completion of installation.

B. Protect installed fixtures from damage during remainder of construction period.

3.3 GROUNDING

A. Provide equipment grounding connections for emergency lighting fixtures as indicated.

B. Tighten connections to comply with tightening torques specified in UL Std 486A

to assure permanent and effective grounds.

C. Upon completion of installation work, properly ground emergency lighting and demonstrate compliance with requirements of Section 16060 – GROUNDING AND BONDING.

3.4 FIELD QUALITY CONTROL

A. Upon completion of installation of emergency lighting fixtures, and after building circuitry has been energized with normal power source, apply electrical energy to demonstrate capability and compliance with requirements.

B. Test emergency lighting to demonstrate operation under emergency conditions.

C. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.

END OF SECTION 16535

SECTION 16551

AREA LIGHTING

1 GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of area lighting work is indicated by Drawings and Schedules.

B. Applications of area lighting specified in this section include the following:

1. Personnel Deployment Facility Site

C. Wires/cables, raceways, and electrical boxes and fittings are specified in Section 16130 “RACEWAYS AND BOXES”, and Section 16120 “CONDUCTORS AND CABLES.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer’s data on area lighting units including, but not limited to, fabricated poles and standards, mast arms, luminaires, brackets, and lamps.

1.3 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of area lighting units, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. NEC Compliance: Comply with NEC as applicable to location and installation of lighting poles and standards.

C. UL Compliance: Provide lighting components and fittings which are UL listed and labeled.

D. ANSI Compliance: Comply with applicable requirements of ANSI C2, "National Electrical Safety Code", pertaining to construction and installation of poles and standards.

E. NEMA Compliance: Comply with NEMA standards pertaining to area lighting

units.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Handle metal lighting standards and brackets carefully to prevent breakage, denting and scoring finish.

B. Deliver lighting fixtures and fittings wrapped in factory- fabricated fiberboard type containers.

C. Store lighting fixtures and fittings in original cartons and protect from construction traffic debris.

2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide area lighting units of one of the following (for each type of area lighting unit) (or approved equal):

1. General Electric Co.
2. Harvey Hubbell Inc.
3. Holophane Div; Johns-Manville Corp.
4. Lithonia
5. Valmont Industries, Inc.

2.2 MATERIALS AND COMPONENTS

A. General: Provide area lighting units of sizes, types and ratings as indicated in the lighting fixture schedule on the Drawings, complete with, but not limited to, poles/standards, brackets, luminaires and other components and accessories required for complete area lighting systems:

2.3 LIGHTING STANDARDS AND POLES

A. Metal Lighting Standards: Provide metal, raceway-type, lighting poles and standards, 100 MPH wind load rating, of sizes and types indicated, comprised of shafts and tenon joints. Equip with grounding connections readily accessible from handhole base access doors; and constructed of the following materials and additional construction features:

1. Material: Squared non-tapered aluminum pole.
2. Configuration: Anchor base type with handhole and cover where

indicated.

3. Metal Lighting Standard Accessories: Provide accessories for metal lighting standards, including anchor bolts, as recommended by standard manufacturer, of sizes and materials needed to fulfill loading and erection application requirements.
4. Color of pole shall be Dark Bronze.

2.4 LIGHTING BRACKETS

A. Provide corrosion-resistant, metal brackets, cantilevered without under braces, of sizes and styles indicated.

1. Material: Aluminum.

2.5 LUMINAIRES

A. General: Provide corrosion-resistant, aluminum luminaires, of sizes, types and styles as indicated in "FIXTURE SCHEDULE" on the Drawings.

3 EXECUTION

3.1 INSTALLATION

A. Install area lighting units as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC, OHSA, NESC and NEMA standards, and with recognized industry practices to ensure that lighting units fulfill requirements.

B. Coordinate with other electrical work as necessary to properly interface installation of area lighting with other work.

C. Use belt slings or rope (not chain or cable) to raise and set finished poles and standards to protect finishes.

D. Set poles and standards plumb. Support adequately during backfilling, or anchoring to foundations.

3.2 GROUNDING

A. Provide equipment grounding connections, sufficiently tight to assure a permanent and effective ground, for each area lighting unit as indicated.

B. Upon completion of installation work, properly ground area lighting and

demonstrate compliance with requirements of Section 16060 GROUNDING AND BONDING.

3.3 FIELD QUALITY CONTROL

A. Upon completion of installation of area lighting, and after lighting circuitry has been energized with normal power source, test lighting system to demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at the site, then retest to demonstrate compliance; otherwise, remove and replace with new units and proceed with retesting.

END OF SECTION 16551

SECTION 16721

FIRE DETECTION, ALARM AND RADIO TYPE REPORTING SYSTEM

1 GENERAL

1.1 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only. All publications shall be referred to in their latest edition, including any revisions thereof.

1. American National Standards Institute(ANSI)

ANSI C62.41	Recommended Practice for Surge Voltage in Low-Voltage AC Power Circuits

2. National Fire Protection Association (NFPA)

NFPA 70	National Electrical Code
NFPA 72	National Fire Alarm Code
NFPA 78	Lightning Protection Code
NFPA 90A	Installation of Air Conditioning and Ventilation Systems

3. Underwriters Laboratories, Inc. (UL)

UL Directory	Fire Protection Equipment Directory
UL 06	Rigid Metal Conduit
UL 38	Manually Actuated Signaling Boxes for Use with Fire-Protective Signaling Systems
UL 268	Smoke Detectors for Fire Protective Signaling Systems
UL 268A	Smoke Detectors for Duct Application
UL 464	Audible Signal Appliances
UL 521	Heat Detectors for Fire Protective Signaling Systems
UL 797	Electrical Metallic Tubing
UL 864	Control Units for Fire Protective Signaling Systems

1.2 GENERAL REQUIREMENTS

A. Products: The Contractor shall provide additional initiating devices and alarm indicating appliances to an existing low voltage, automatic integrated transceiver/fire alarm control panel as manufactured by Monaco Enterprises, Inc. of Spokane, Washington, Model M-1.

B. Any additional modules required are to be purchased and installed by certified personnel.

C. Verification of Dimensions: The contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer or authorized representative of any discrepancy before performing the work.

D. Compliance: The fire detection and internal alarm system shall be configured in accordance with NFPA 72. The equipment furnished shall be compatible and be UL listed or FM approved or approved or listed by a nationally recognized testing laboratory in accordance with the applicable NFPA standards.

E. Manufacturer's Services: Services of a manufacturer's representative who is certified in the installation, maintenance, adjustment, operation and repair, of the equipment specified shall be provided. The representative shall supervise the installation, adjustment, programming, testing and certification of the equipment.

F. Delivery and Storage: All equipment delivered and placed in storage shall be protected from the weather, humidity and temperature variations, dirt, dust, and other contaminates.

G. Programming: Contractor is required to fully program the transceiver and the D-500 to communicate by zone and remote test.

1.3 SYSTEM DESIGN

A. Operation: Existing system is a complete, supervised Monaco fire alarm system and additional device shall be incorporated to maintain system integrity. The system is activated into the alarm mode by actuation of any alarm initiating device. The system shall remain in the alarm mode until any initiating device is reset and the fire alarm control panel is manually reset and restored to normal. Electrical supervision shall be Style D in accordance with NFPA 72. All circuits shall be capable of operating under a single ground or open condition, as specified in NFPA 72. All textual, audible and visual devices and systems shall comply with NFPA 72.

B. Operational Features. The existing system shall be modified to accommodate additional pull stations, duct smoke detector, heat detectors and alarm indicating devices as shown on drawing:

1. Class A (Style D) alarm initiating (zone) circuits for connection of detection devices.
2. Auxiliary zone circuits for connection of non-powered alarm initiating

devices such as tamper switches, heat detectors or manual pull stations.

3. Class A (Style D) indicating (bell) circuits for connection of audible and visual alarm evacuation signaling devices; each circuit may be programmed as silenceable or nonsilenceable. When Class A is selected, two circuits are provided; one circuit operates for common alarms and one circuit is programmable for specific zone alarms or for common alarm operation.
4. Zone programming capability which allows entry of a zone identification number, thirteen character description and type. Each zone is programmed for standard, supervisory, verification, positive alarm sequence, or water-flow warm operation; the auxiliary zones may also be programmed for tamper or for publicly accessible manual pull station.
5. An alarm condition on a circuit shall automatically deactivate the air handling units throughout the building.
6. Zones for alarm initiating circuits shall be arranged as indicated on the contract drawings.
7. Alarm functions. An alarm condition on a circuit shall automatically initiate the following functions:
    a. Transmission of a signal (by zone and general alarm/general trouble) over the station fire reporting system.
    b. Visual indication of the alarmed zone on the fire alarm control panel annunciator..
    c. Continuous sounding of alarm indicating devices throughout the building.
    d. Operation of the smoke control system.
    e. Deactivation of the air handling, exhaust fans units throughout the building.

1.4 SUBMITTALS

A. Installer Qualification. Installer must have five years experience in the installation of fire alarm systems and possess a minimum LEVEL II certificate from the NATIONAL INSTITUTE FOR CERTIFICATION IN ENGINEERING TECHNOLOGIES (NICET) in the sub-field FIRE PROTECTION ENGINEERING TECHNOLOGY (FIRE ALARM SYSTEMS). No fire alarm work is to be done with non-certified personnel (ie. electrican, helper, etc.)

B. Shop Drawings. Shop drawings shall be submitted and shall consist of a complete set of equipment and materials, including manufacturer's descriptive and technical literature; performance charts and curves; catalog cuts; and installation instructions. Detail drawings shall also contain complete wiring and schematic diagrams and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Drawings shall show proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearances for maintenance and operation.

C. Test Reports. Upon completion and testing of the installed system, test reports shall be submitted in booklet form showing all field tests performed to prove

compliance with the specified performance criteria. Each test report shall indicate the final position of controls.

D. Operation and Maintenance Manuals.

1. The contractor shall furnish the Contracting Officer or authorized representative six complete copies of operating instructions outlining step-by-step procedures required for system start up, operation and shut down. The instructions shall include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and their basic operating features.
2. The contractor shall furnish the Contracting Officer or authorized representative six copies of maintenance instructions listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guide. The instructions shall include conduit layout, equipment layout and simplified wiring, and control diagrams of the system installed.

E. Spare Parts Data. After approval of the shop drawings the contractor shall furnish spare parts data for each different item of materials and equipment specified. The data shall include a complete list of parts and supplied, with current unit prices and source of supply, and a list of the parts recommended by the manufacturer to be replaced after 3 years of service.

F. As Built Drawings. PRIOR TO PERFORMANCE AND ACCEPTANCE TESTING, The contractor shall submit two legible copies of all fire alarm drawings showing the "as-built" system. The detail drawings of the fire detection system shall be signed by a Fire Protection Engineer. The drawings shall consist of a complete list of equipment and material, including manufacturer's descriptive and technical literature and catalog cuts. The drawings shall also contain complete wiring and schematic diagrams for the equipment furnished, equipment layout, and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. The detailed point-to-point wiring diagram showing all points of connection shall include connections between system devices, appliances, control panels, supervised devices, and all equipment that is activated by the control panel.

G. Certificates of Completion. PRIOR TO PERFORMANCE AND ACCEPTANCE TESTING, a Certificate of Completion per NFPA 72 shall be given to the Contracting Officer or authorized representative. "NOTE" The individual signing the certificate is warranting that the fire alarm system has been installed per NFP, NEC, UL and Air Force specifications and codes.

1.5 OVER VOLTAGE AND SURGE PROTECTION

A. Power Line Surge Protection. All equipment connected to alternating current circuits shall be protected from power line surges. Equipment shall meet

requirements of ANSI C62.41. Surge protector shall be a Delta LA 301 or equal.

1.6 DELIVERY AND STORAGE

A. All equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variation, dirt and dust, any other contaminants.

2 PRODUCTS

2.1 Manual Fire Alarm Stations:

A. Manual fire alarm stations shall conform to the applicable requirements of the UL 38. Manual stations shall be connected into alarm initiating circuits. Stations shall be single action type. Stations shall be finished in red, with raised letter operating instructions of contrasting color. Stations requiring the breaking of glass or plastic panels for operation are not acceptable. Stations employing glass rods are not acceptable. The use of a key or wrench shall be required to reset the station. Gravity or mercury switches are not acceptable. Switches and contacts shall be rated for the voltage and current upon which they shall operate. Stations shall have a separate screw terminal for each conductor. Where boxes must be surface mounted, boxes shall be painted the same color as the fire alarm manual stations. All manual pull stations located in the public areas shall have clear shield protective tamper cover placed over them.

2.2 FIRE DETECTING DEVICES

A. Fire detecting devices shall comply with the applicable requirements of NFPA 72, NFPA 90A, UL 268, UL 268A, and UL 521. The detectors shall be provided as indicated. Detector base shall have terminals for making connections. No solder connections will be allowed. Detectors shall be connected into alarm initiating circuits.

B. Heat Detectors. Detector shall be as indicated. Detector, shall be rated for a minimum of 50 foot spacing (smooth ceiling rated) in accordance with UL521. Detector coverage shall be 2500 square feet minimum, with maximun 25 feet from the wall. Detector shall have screw terminals for making all wiring connections. Detector shall have LED lamp indicator.

1. Fixed temperature detectors. Fixed temperature detectors shall be outlet box mounted and supported independently of wiring connections. Detectors located in the mechanical /electrical room, kitchen or other areas with unconditioned air shall be rated for 200 degree F.
2. Combination Fixed-Temperature and Rate-of-Rise Detectors. Detectors shall be outlet box mounted and supported independently of wiring

connections. Contacts shall be self-resetting after response to rate-of-rise principle. Under fixed temperature actuation, the detector shall have a permanent external indication which is readily visible.

C. Smoke Detectors. Detectors shall be designed for detection of abnormal smoke densities by the ionization principle. Detectors shall contain a visible indicator lamp that shows when the unit is in alarm condition. Detectors shall not be adversely affected by vibration or pressure. Detectors shall be the plug-in type in which the detector base contains terminals for making all wiring connections. Detectors that are in concealed (above false ceilings, etc) locations shall be provided with a remote visible indicator lamp.

1. Duct Smoke Detectors. Detectors shall have a duct housing, mounted exterior to the duct, with factory perforated sampling tubes, in accordance with UL 268 and UL 268A. Activation of a detector shall cause shutdown of the associated air-handling unit. Detectors shall be mounted in readily accessible locations. Detectors shall be capable of activation a remote indicating lamp on a remote annunciator. Detectors shall be furnished and wired by electrical contractor and installed by HVAC contractor.

2.3 NOTIFICATION APPLIANCES

A. Audible appliances shall be heavy duty and conform to the applicable requirements of UL 464. Devices shall be connected into alarm indicating circuits. All devices shall have separate screw terminals for each conductor.

B. Combination Audible/Visual Notification Appliances. Combination audible/visual appliances shall be factory assembled. Units shall be suitable for use in an electrically supervised circuit and shall have a sound output rating of at least 85 dBA at 10 feet. Visual indication shall be accomplished by high intensity optic lens and flash tubes.

2.4 FIRE DETECTION AND ALARM SYSTEM PERIPHERAL EQUIPMENT

A. Conduit shall comply with UL 06 and UL 797.

B. Wiring. All wiring shall be copper. Wiring for strobe light circuits shall be No. 14 AWG minimum. Wiring for 120 v AC power shall be No. 12 AWG minimum. Wiring for power limited circuits shall be No. 16 AWG minimum/Power wiring and control wiring shall be isolated. All wiring shall conform to NFPA 70. All conductors shall be color coded. Wiring code color shall remain uniform throughout the circuit. Pigtail or T-tap connections are unacceptable.

3 EXECUTION

3.1 INSTALLATION

A. All work shall be installed as shown and in accordance with the manufacturer's diagrams and recommendations, unless otherwise specified.

B. Wiring. Wiring for systems shall be installed in 1/2 inch minimum diameter conduit; however the wiring for the fire alarm system shall not be installed in conduits, junction boxes with conductors of lighting and power systems. No more than one conductor shall be installed under any screw terminal. All circuits conductors entered or leaving any mounting box, outlet box enclosure or cabinet shall be connected to terminals with each terminal marked in accordance with the wiring diagram for identification. Connections shall be made with either crimp-on terminal spade lugs or with approved pressure type terminal blocks. The use of wire nut type connectors are prohibited in the system. All wiring within any control equipment shall be readily accessible without removing any component parts. The fire alarm equipment manufacturer's representative shall be present for the connection of wiring to the control panel.

C. Detectors. Detectors shall be installed in accordance with NFPA 72. Detectors shall be at least 12 inches from any part of lighting fixtures. Detectors shall be located at least 3 feet from diffusers of air handling systems. Each detector shall be provided with appropriate mounting hardware as required by its mounting location. Detectors which mount in free space shall be mounted directly to the end of the stubbed down rigid conduit drop. Conduit drops shall be firmly secured to minimize detector sway. Where length of conduit drop from ceiling or wall surface exceeds 3 feet, sway bracing shall be provided.

D. Painting. All junction boxes shall be painted red.

E. Notification Appliances. Devices shall be mounted 6 feet 8 inches above the finished floor elevation, or 6 inches below finished ceiling, if limited by ceiling height.

F. Grounding. Grounding shall be provided to building ground.

G. Manual Pull Stations shall be installed at approximately 4 feet (center) above finished floor elevation unless otherwise indicated.

3.2 TESTING

A. The contractor shall notify the Contracting Officer or authorized representative 30 days before the performance and acceptance tests are to be conducted. The Contractor shall provide battery calculations for the fire alarm system to the Contracting Officer or authorized representative 30 days prior to the acceptance test. The test shall be performed in the presence of the Contracting Officer or authorized representative under the supervision of the fire alarm system

manufacturer's qualified representative. The contractor shall furnish all instruments, equipment and personnel required for the tests.

B. Preliminary Tests. Upon completion of the installation, the system shall be subjected to functional and operational performance tests including tests of each installed initiating and notification appliance. Tests shall include the meggering of all system conductors to determine that the system is free from grounded, shorted and open circuits. The megger test shall be conducted prior to the installation of fire alarm equipment. Smoke detector bases shall be equipped with jumpers for the megger test. If deficiencies are found, corrections shall be made and the system shall be retested to assure that is functional.

C. Acceptance Test. The testing shall be in accordance with NFPA 72 and shall verify that all previous deficiencies have been corrected. The test shall include the following:

1. Test of each function of the control panel.
2. Test of each circuit in both trouble and normal modes.
3. Test of alarm initiating devices in both normal and trouble conditions.
4. Test of each control circuit and device.
5. Test of each alarm notification appliance.
6. Test of the battery charger and batteries.
7. Complete operational test under emergency power supply.
8. Visual inspection of all wiring connections.
9. Opening the circuit at each alarm initiating and indicating device to test the wiring supervisory feature.
10. Test of the as-built drawings to insure that they are correct.

END OF SECTION 16721

SECTION 16741

TELEPHONE/DATA COMMUNICATION SYSTEM

1 GENERAL

1.1 SUMMARY

A. Provide telephone/data communication raceway and system work as indicated by the Drawings.

B. Types of telephone/data communication components required for project include the following:

1. Wall jacks.
2. Cables.
3. Outlet boxes.
4. Raceways.

C. Extent of telephone raceways system work shall be as indicated by the Drawings.

D. Types of telephone raceway system required for project include the following:

E. Raceway

F. Telephone/Data outlet boxes shall be as indicated on drawings.

1.2 QUALITY ASSURANCE

A. NEC Compliance: Comply with NEC as applicable to communication system materials and installations.

B. NEMA/ICEA Compliance: Comply with NEMA/ICEA Stds. Pub/No.'s WC-5, "Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy".

C. IMSA Compliance: Comply with applicable requirements of International Municipal Signal Association (IMSA) standards 19-1 and 20-1 pertaining to signals, controls, and communications.

1.3 SUBMITTALS

A. Product Data: Submit catalog cuts for each type of cable, jacks, etc., which shall be furnished to the job. Submittals for raceways and boxes shall meet the requirements of related sections in these Specifications.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store materials in original factory containers bearing the manufacturer's label intact. Protect by storing materials in an indoor location until needed during construction.

2 PRODUCTS

2.1 TERMINAL PANELS

A. Terminal Panels: All terminal panels shall be 3/4" thick plywood painted on all sides and edges with 2 coats of fire retardant paint. Provide D-rings on all sides for cable routing.

2.2 SYSTEM

A. All equipment, devices, and materials furnished shall be compatible with the existing system.

2.3 COMPONENTS

A. Cables:

1. General:
   a. UL listed.
2. Category 5 Cables:
   a. Non-plenum category 5 unshielded twisted pair cables shall be insulated #24 AWG solid copper conductors, twisted into pairs and sheathed in a PVC jacket. Color code shall be Blue for Data and Gray for Telephone.

B. Outlets:

1. All outlets shall be as indicated on the Drawings.

C. Faceplates:

1. Faceplates shall be designed with straight port openings to accept jacks of front load type. category *5* jacks, fiber outlets, and other outlets indicated on the Drawings.
2. Faceplates shall have identification strips (at top and bottom) with

removable cover.

3. Color: ivory.

D. Outlets with 4 jacks (2-data and 2–telephone) shall be configured with data jacks on the left and telephone jacks on the right.

E. Jacks (Telecommunications Outlet Connectors):

1. RJ45 type, category 5 compliant for voice jacks,and category 5 compliant for data jacks.
2. Comply with FCC Part 68, R1997.
3. UL listed and CSA certified.
4. Color: data jacks and telephone shall be ivory.
5. Only one manufacturer of Telecommunication Outlet Jacks and Faceplates shall be used throughout the project.

F. Unless otherwise indicated on the Drawings, telecommunications outlets shall be flush-mounted unless otherwise specified on the drawings.

3 EXECUTION

3.1 TESTING

A. Continuity testing shall be performed by the installer.

3.2 INSTALLATION

A. General: All work, including equipment and system grounding, shall conform to the requirements of the National Electrical Code and NECA's "Standards of Installation".

B. Cables shall be installed in conduits. Provide all telephone/data communications as detailed on the Drawings.

C. Coordinate all outlet locations with the Contracting Officer. The Contracting Officer reserves the right to make minor adjustments based upon office furniture layouts. All locations shall be accessible.

D. Coordinate with other electrical work, including raceways, electrical boxes and fittings, as necessary to interface installation of telephone raceways with other work.

E. In finished spaces, run all conduit concealed. In exposed structure areas, and in

unfinished space, run all conduit tight to the structure and parallel/perpendicular to the building lines.

F. All cables shall be routed from jack to terminal panel unspliced, No splicing of cables shall be permitted.

G. Label to denote outlet served. This label requirement shall be accomplished by stenciling cable at both ends.

H. All raceways and outlets shall be properly supported.

I. Provide an insulated Type "BLG" ground bushing on the end of the conduit to protect the wire(s) from abrasion where cables enter or exit the open end of a conduit.

J. The length of each horizontal cable from the terminal panel on each floor to the outlet shall not exceed 295’ / 90 m.

K. Observe the bending radius and pulling strength requirements of the cables during handling and installation.

L. Complete work above ceiling prior to ceiling tile installation.

M. Ensure that the maximum pulling tensions of the specified distribution cables are not exceeded and cable bends maintain the proper radius during the placement of the facilities.

N. Jacks shall be wired per the pair assignments indicated in ANSI/TIA/EIA 568A-1995 designation T568B wiring plan see drawings.

END OF SECTION 16741

SUBMITTAL CODES: A: 30 DAYS AFTER NTP B: DURING CONSTRUCTION

SCHEDULE OF MATERIAL SUBMITTALS

PROJECT NUMBER	PROJECT TITLE	SOLICITATION/CONTRACT NUMBER
VKAG 99-1137	Construct Addition to Personnel Deployment Facility	

TO BE COMPLETED BY PROJECT ENGINEER													TO BE COMPLETED BY CONTRACT ADMINISTRATOR								
		NUMBER OF COPIES REQUIRED																			
LINE NUMBER	ITEM OR DESCRIPTION OF ITEM, CONTRACT REFERENCE, TYPE OF SUBMITTAL	CERTIFICATES OF COMPLIANCE	SHOP DRAWINGS	SAMPLES	COLOR SELECTION	MAINT. INSTRUCTIONS RECOMMENDATIONS	MAINT. INSTRUCTIONS WARRANTY	CATALOG DATA	OPERATING INSTRUCTIONS	OTHER	SUBMITTAL CODE	REQUIRED SUBMISSION DATE	DATE RECEIVED IN CONTRACTING	DATE TO CIVIL ENGINEERING	RETURN SUSPENSE	SUBMITTAL NUMBERS	DATE CONTRACTOR NOTIFIED: APPROVED	DATE CONTRACTOR NOTIFIED: DISAPPROVED	CONTRACTOR RESUBMITTAL	FINAL APPROVAL	REMARKS
1	**02070 PARA 1.4 A** SELECTIVE DEMOLITION									3	A										
2	**02511 PARA 1.1A** HOT MIX ASPHALT PAVING									3	A										
3	**02530 PARA 1.1A** SANITARY SEWERAGE							3			A										
4	**02530 PARA 1.1A** SANITARY SEWERAGE		3								A										
5	**02630 PARA 1.1A** STORM DRAINAGE							3			A										
6	**02630 PARA 1.1B** STORM DRAINAGE		3								A										
7	**02751 PARA 1.1A** CEMENT CONCRETE PAVEMENT							3			A										
8	**02764 PARA 1.1 B1** PAVEMENT JOINT SEALANTS			3							A										
9	**02764 PARA 1.1 B2** PAVEMENT JOINT SEALANTS	3									A										
10	**02821 PARA 1.2A** CHAIN LINK FENCES & GATES							3			A										
11	**02920 PARA 1.1A** LAWNS AND GRASSES							3			A										

SUBMITTAL CODES: A: 30 DAYS AFTER NTP B: DURING CONSTRUCTION

SCHEDULE OF MATERIAL SUBMITTALS

PROJECT NUMBER	PROJECT TITLE	SOLICITATION/CONTRACT NUMBER
VKAG 99-1137	Construct Addition to Personnel Deployment Facility	

TO BE COMPLETED BY PROJECT ENGINEER													TO BE COMPLETED BY CONTRACT ADMINISTRATOR								
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LINE NUMBER	ITEM OR DESCRIPTION OF ITEM, CONTRACT REFERENCE, TYPE OF SUBMITTAL	CERTIFICATES OF COMPLIANCE	SHOP DRAWINGS	SAMPLES	COLOR SELECTION	MANUFACTURERS RECOMMENDATIONS	MANUFACTURERS WARRANTY	CATALOG DATA	OPERATING INSTRUCTIONS	OTHER	SUBMITTAL CODE	REQUIRED SUBMISSION DATE	DATE RECEIVED IN CONTRACTING	DATE TO CIVIL ENGINEERING	RETURN SUSPENSE	SUBMITTAL NUMBERS	DATE CONTRACTOR NOTIFIED: APPROVED	DATE CONTRACTOR NOTIFIED: DISAPPROVED	CONTRACTOR RESUBMITTAL	FINAL APPROVAL	REMARKS
12	**03300 PARA 1.1** CONCRETE	3									A										
13	**03300 PARA 1.1** CONCRETE		3								A										
14	**04810 PARA 1.1A1** UNIT MASONRY ASSEMBLIES							3			A										
15	**04810 PARA 1.1A2** UNIT MASONRY ASSEMBLIES			3							A										
16	**04810 PARA 1.1A3** UNIT MASONRY ASSEMBLIES	3									A										
17	**06105 PARA 1.1A** MISC. CARPENTRY							3			A										
18	**06402 PARA 1.1B1** INTERIOR ARCH. WOODWORK		3								A										
19	**06402 PARA 1.1B2** INTERIOR ARCH. WOODWORK			3							A										
20	**07210 PARA 1.1A** BUILDING INSULATION							3			A										
21	**07841 PARA 1.1 B1** THRU-PENET. FIRE STOP SYS		3								A										
22	**07841 PARA 1.1 B2** THRU-PENET. FIRE STOP SYS	3									A										

SUBMITTAL CODES: A: 30 DAYS AFTER NTP B: DURING CONSTRUCTION

SCHEDULE OF MATERIAL SUBMITTALS

PROJECT NUMBER	PROJECT TITLE	SOLICITATION/CONTRACT NUMBER
VKAG 99-1137	Construct Addition to Personnel Deployment Facility	

TO BE COMPLETED BY PROJECT ENGINEER													TO BE COMPLETED BY CONTRACT ADMINISTRATOR								
		NUMBER OF COPIES REQUIRED																			
LINE NUMBER	ITEM OR DESCRIPTION OF ITEM, CONTRACT REFERENCE, TYPE OF SUBMITTAL	CERTIFICATES OF COMPLIANCE	SHOP DRAWINGS	SAMPLES	COLOR SELECTION	MAINT. INSTRUCTIONS RECOMMENDATIONS	MAINT. INSTRUCTIONS WARRANTY	CATALOG DATA	OPERATING INSTRUCTIONS	OTHER	SUBMITTAL CODE	REQUIRED SUBMISSION DATE	DATE RECEIVED IN CONTRACTING	DATE TO CIVIL ENGINEERING	RETURN SUSPENSE	SUBMITTAL NUMBERS	DATE CONTRACTOR NOTIFIED: APPROVED	DATE CONTRACTOR NOTIFIED: DISAPPROVED	CONTRACTOR RESUBMITTAL	FINAL APPROVAL	REMARKS
23	**07841 PARA 1.1 B3** THRU-PENET. FIRE STOP SYS									3	A										
24	**07920 PARA 1.1B** JOINT SEALANTS							3			A										
25	**07920 PARA 1.1B1** JOINT SEALANTS			3							A										
26	**07920 PARA 1.1B2** JOINT SEALANTS	3									A										
27	**08110 PARA 1.1A1** STEEL DOORS AND FRAMES		3								A										
28	**08110 PARA 1.1A1** STEEL DOORS AND FRAMES							3			A										
29	**08110 PARA 1.1A2** STEEL DOORS AND FRAMES									3	A										
30	**08331 PARA 1.3A** OVERHEAD COILING DOORS							3			A										
31	**08331 PARA 1.3 B** OVERHEAD COILING DOORS		3								A										
32	**08331 PARA 1.3 C** OVERHEAD COILING DOORS			3							A										
33	**08520 PARA 1.1 D1** ALUMINUM WINDOWS							3			A										

SUBMITTAL CODES: A: 30 DAYS AFTER NTP B: DURING CONSTRUCTION

SCHEDULE OF MATERIAL SUBMITTALS

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34	**08520 PARA 1.1 D2** ALUMINUM WINDOWS		3								A										
35	**08711 PARA 1.1A** DOOR HARDWARE							3			A										
36	**08711 PARA 1.1A1** DOOR HARDWARE									3	A										
37	**08800 PARA 1.1 B** GLAZING							3			A										
38	**08800 PARA 1.1 B1** GLAZING	3									A										
39	**09511 PARA 1.1A1** ACOUSTICAL PANEL CEILINGS			3							A										
40	**09511 PARA 1.1A2** ACOUSTICAL PANEL CEILINGS			3							A										
41	**09651 PARA 1.1A** RESILIENT TILE FLOORING							3			A										
42	**09653 PARA 1.2A** RESILIENT WALL BASE & ACCESS.							3			A										
43	**09653 PARA 1.2B** RESILIENT WALL BASE & ACCESS.			3							A										
44	**09800 PARA 1.2A1** ACOUSTICAL WALL PANELS							3			A										

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45	**09800 PARA 1.2A2** ACOUSTICAL WALL PANELS			3								A										

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46	**09800 PARA 1.2A3** ACOUSTICAL WALL PANELS					3					A										
47	**09900 PARA 1.1D1** PAINTING									3	A										
48	**09900 PARA 1.1D2** PAINTING							3			A										
49	**10801 PARA 1.1A** TOILET & BATH ACCESSORIES							3			A										
50	**10155 PARA 1.1A1** TOILET COMPARTMENTS							3			A										
51	**10155 PARA 1.1A2** TOILET COMPARTMENTS		3								A										
52	**10155 PARA 1.1A3** TOILET COMPARTMENTS			3							A										
53	**10425 PARA 1.2A** SIGNS							3			A										
54	**10425 PARA 1.2B** SIGNS		3								A										
55	**10425 PARA 1.2C** SIGNS			3							A										
56	**10530 PARA 1.5A** ALUMINUM CANOPY SYSTEM		3								A										

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57	**10530 PARA 1.5A** ALUMINUM CANOPY SYSTEM							3			A										
58	**11160 PARA 1.2A** LOADING DOCK EQUIPMENT							3			A										
59	**11160 PARA 1.2B** LOADING DOCK EQUIPMENT		3								A										
60	**11160 PARA 1.2C** LOADING DOCK EQUIPMENT									3	A										
61	**12760 PARA 1.3A** TELESCOPING STANDS							3			A										
62	**12760 PARA 1.3B** TELESCOPING STANDS		3							3	A										
63	**12760 PARA 1.3C** TELESCOPING STANDS			3							A										
64	**12760 PARA 1.3D** TELESCOPING STANDS									3	A										
61	**13125 PARA 1.1** METAL BUILDING SYSTEMS	3									A										
62	**13125 PARA 1.1** METAL BUILDING SYSTEMS		3								A										
63	**13125 PARA 1.1** METAL BUILDING SYSTEMS			3							A										

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64	**15075 PARA 1.3** MECHANICAL IDENTIFICATION							3			A										
65	**15081 PARA 1.3** DUCT INSULATION							3			A										
66	**15081 PARA 1.3** DUCT INSULATION	3									A										
67	**15083 PARA 1.3** PIPE INSULATION							3			A										
68	**15083 PARA 1.3** PIPE INSULATION			3							A										
69	**15140 PARA 1.3** DOMESTIC WATER PIPING									3	A										
70	**15410 PARA 1.1** PLUMBING FIXTURES							3			A										
71	**15738 PARA 1.1** SPLIT SYSTEM HEAT PUMP UNITS		3								A										
72	**15738 PARA 1.1** SPLIT SYSTEM HEAT PUMP UNITS							3			A										
73	**15815 PARA 1.1** METAL DUCTS							3			A										
74	**15820 PARA 1.1** DUCT ACCESSORIES							3			A										

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75	**15838 PARA 1.2** POWER VENTILATORS							3			A										
76	**15838 PARA 1.2** POWER VENTILATORS								3		A										
77	**15855 PARA 1.1** DIFFUSERS, REGISTERS & GRILLES							3			A										
78	**15990 PARA 1.4** TESTING, ADJ. & BALANCING									3	B										
79	**16515 PARA 1.2** INTERIOR LIGHTING FIXTURES							3			A										
80	**16525 PARA 1.2** EXTERIOR LIGHTING FIXTURES							3			A										
81	**16535 PARA 1.2** EMERGENCY LIGHTING							3			A										
82	**16721 PARA 1.4 E** ALL FIRE ALARM HARDWARE									3	A										
83	**16721 PARA 1.4 B** ALL FIRE ALARM HARDWARE		3								A										
84	**16721 PARA 1.4 C** ALL FIRE ALARM HARDWARE									3	A										
85	**16721 PARA 1.4 D** ALL FIRE ALARM HARDWARE									3	A										

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86	**16721 PARA 1.4 A** ALL FIRE ALARM HARDWARE									3	A										
87	**16721 PARA 1.4 F** ALL FIRE ALARM HARDWARE									3	B										
88	**16721 PARA 1.4 G** ALL FIRE ALARM HARDWARE									3	B										
89	**16120 PARA 1.2** CONDUCTORS AND CABLES							3			A										
90	**16130 PARA 1.2** RACEWAYS AND BOXES							3			A										
91	**16140 PARA 1.3** WIRING DEVICES							3			A										
92	**16551 PARA 1.2** AREA LIGHTING							3			A										
93	**16741 PARA 1.3A** TEL/DATA COMM SYSTEM							3			A										