PROJECT MANUAL

FOR SOLICITATION

CONVERT CHURCH’S CHICKEN TO
POPEYE’S
EXCHANGE MAIN STORE

REDSTONE ARSENAL, AL

AAFES PROJECT NUMBER 0887-15-000001

25 July 2017

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PWBA 161103
SECTION 00 01 02

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_convert Church's Chicken to Popeye's_

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**Convert Church’s Chicken to Popeye’s**

_EXCHANGE MAIN STORE, REDSTONE ARSENAL, AL_

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SUBSTITUTIONS

PART 1 - GENERAL

1.01 CONTRACTING OFFICER'S APPROVAL
   A. The contract is based on materials and methods described in the contract documents.
   B. The Contracting Officer will consider proposals for substitution of materials, equipment and methods only when such proposals are accompanied by full and complete technical data and all other information required by the Contracting Officer to evaluate the proposed substitution.
   C. Do not substitute materials or equipment, unless such substitution has been specifically approved for this Work by the Contracting Officer.
   D. All substitution requests submitted during solicitation (bid phase) must be received by the Contracting Officer no later than 10 days prior to solicitation due date, in which case the Bidder will not be liable for costs of the Contracting Officer's review.

1.02 "OR EQUAL"
   A. Where the phrase "or equal" or "or approved equivalent" or "or equal as approved in advance by the Contracting Officer" occurs in the Contract Documents, do not assume that material and equipment will be approved as equal by the Contracting Officer unless the item has been specifically approved for this work by the Contracting Officer.
   B. The decision of the Contracting Office shall be final.

1.03 AVAILABILITY OF SPECIFIED ITEMS
   A. Verify prior to bidding that all specified items will be available in time for installation during orderly and timely progress of the Work.
   B. In the event specified item or items will not be so available, notify the Contracting Officer 10 days prior to receipt of proposals.
   C. Costs of delays because of non-availability of specified items, when such delays could have been avoided by the Contractor, will be back-charged as necessary and shall not be borne by EXCHANGE.

1.04 SUBSTITUTIONS FOLLOWING AWARD OF CONTRACT
   A. Substitutions for Cause: Not later than 15 days prior to time required for preparation and review of submittals. The submittal must include a justification explaining the rationale for the requested substitution.
   B. Substitutions for Convenience: Not allowed after contract award.

PART 2 – PRODUCTS (NOT USED)
PART 3 – EXECUTION (NOT USED)

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SUMMARY

PART 1  GENERAL

1.01  STATEMENT OF WORK

A.  The work covered by these specifications consists of furnishing all plant, supervision, labor, equipment, materials and incidentals necessary to perform all operations required to complete the work, all in accordance with these specifications and the applicable drawings, and subject to the terms and conditions of the contract.

1.02  THE WORK TO BE PERFORMED IS LOCATED AT REDSTONE ARSENAL, ALABAMA.

A.  Principal Features:

1.  The work to be performed in connection with this project includes, but is not necessarily limited to the following:
   a.  Convert space in building housing Church's Chicken into a new Popeye's retail outlet. Work includes plumbing, mechanical and electrical work; interior wall modifications, casework, and new finishes. Exterior work includes a new Popeye's canopy at the existing drive-up window, and sitework revisions to the drive-up service layout.
   b.  Provide required plumbing, mechanical, and electrical systems upgrades and modifications to support new work.
   c.  Provide all other work shown on the drawings and/or described in the specifications and miscellaneous incidental work not shown which is required for the complete work of the project.

B.  The Contractor is advised to take note of the following General Provisions of the Contract:

   Cleaning up; Material and Workmanship; Accident Prevention; Protection of Existing Vegetation, Structures, Utilities and Improvements; Operation and Storage Areas; Site Investigation; Permits and Responsibilities. Copies of the General Provisions may be obtained from the Contracting Officer.

1.03  SPECIAL BASE REQUIREMENTS

A.  Regular business hours during the week for the Department of Public Works are 7:00AM to 4:00PM, Monday through Friday, excluding Federal Holidays. The EXCHANGE normal business hours of operation are from 9:00AM to 7:00PM, Monday through Saturday and 10:00AM to 8:00PM on Sundays. On Holidays the EXCHANGE is open from 10:00AM to 6:00PM. Due to the unique nature and aggressive schedule of this project, the Contractor may be required to work 24 hours a day/7 days a week. Also, many items of work can only be performed at night after hours once the EXCHANGE is closed to customers. The EXCHANGE will be available to the Contractor on a 24/7 basis. A 24 hour advance notice to the EXCHANGE General Manager is required to confirm on site security is available during non-operation hours. Failure on the part of the Contractor to give this advance notice may result in the facility not being accessible for work. The Contractor shall coordinate this work schedule closely with the EXCHANGE store manager and notify the Installation Military Police prior to performing work after normal business hours.

B.  The Contractor is to be familiar with the requirements for gaining daily access to the base. All workers, subcontractors and material deliveries will require permits to gain site entry.

C.  Redstone Arsenal may require special access requirements during times of heightened security measures and/or force protection events requiring the Contractor to adjust schedules and access accordingly. Advance notice will be given to the Contractor as soon as possible in the event of such an occurrence.

1.04  UTILITIES (WATER, GAS AND ELECTRICITY)

A.  Existing water and electricity sources may be used on this project.

B.  The Contractor will not be charged for consumption of utilities (water, gas and electricity) during this project.
C. The Contractor shall provide and use proper backflow prevention devices. The Contractor shall provide documentation of proper/current certification of installers.

1.05 LAYING OUT WORK

A. Dimensions and elevations indicated in layout of work shall be verified by the Contractor. Discrepancies between drawings, specifications, and conditions shall be referred to the Contracting Officer in writing for adjustment before work affected is performed. Failure to make such notifications shall place responsibility upon the Contractor to carry out work in a satisfactory and workmanlike manner.

B. The Contractor shall be held responsible for the location and elevation of all the construction contemplated by the construction documents.

C. Prior to commencing work, the Contractor shall carefully compare and check all Architectural, Civil, Structural, Mechanical, and Electrical drawings, each with the other, that in any way affect the locations of elevation of the work to be executed by him, and should any discrepancy be found, he shall immediately report the same to the Contracting Officer for verifications and adjustment. Any duplication of work made necessary by failure or neglect on the Contractor's part to comply with this function shall be done at his sole expense.

D. The drawings accompanying these specifications indicate generally the design and arrangement of all apparatus, fixtures, accessories, etc. necessary to complete the work required. The exact location or arrangement of equipment is subject to minor changes necessitated by field conditions and shall be made as required without additional cost to EXCHANGE. Measurements shall be verified by actual observations at the construction site, and the Contractor shall be responsible for all work fitting into place in a satisfactory and workmanlike manner meeting the approval of the Contracting Officer.

1.06 EXISTING OVERHEAD OR UNDERGROUND WORK

A. Carefully check the site where this project is to be erected and observe any overhead wires and equipment. Any such work shall be moved, replaced, or protected, as required, whether or not shown or specified.

B. Attention is directed to the existence of pipe and other underground improvements which are shown on the drawings. All reasonable precautions shall be taken to preserve and protect all such improvements shown on the drawings.

C. Locations of underground lines, shown on the drawings, are based on the best available sources, but are to be regarded as approximate only. Exercise extreme care in locating and identifying these lines before excavating in adjacent areas.

1.07 INTERRUPTION OF EXISTING UTILITIES SERVICES

A. The Contractor shall perform the work under this Contract with a minimum of outage time for all utilities. Interruption shall be by approved section of the utility. In some cases, the Contractor may be required to perform the work while the existing utility is in service. The existing utility services may be interrupted only when approved by the Contracting Officer. When it is necessary to interrupt the existing utilities, the Contractor shall notify the Contracting Officer and facilities engineer in writing at least seven days in advance of the time he desires the existing service to be interrupted. The interruption time shall be kept to a minimum. Depending upon the activities at the facility which require continuous service from the existing utility, an interruption may not be subject to schedule at the time desired by the Contractor. In such cases the interruption may have to be scheduled at a time of minimum requirement of demand for the utility. The amount of time requested by the Contractor for interruption of existing utility services shall be as approved by the Contracting Officer.

1.08 EXCAVATION

A. Prior to commencing any excavation work the Contractor shall obtain a valid Excavation Permit, from the Facilities Engineers Office. It shall be the Contractor’s responsibility to obtain the necessary signatures and coordination for the permit.
1.09 WELDING PERMIT
A. Prior to beginning any welding, use of open flame device, or any activity that produces sparks, obtain a “hot work permit” from Fire Emergency Services. The permit shall be renewed each day welding or open flame devices will be used. Depending on the type and location of hot work, these permits can be issued for multiple days.

1.10 BARRICADES AND WARNING DEVICES
A. The Contractor shall provide barricades and lighting devices, in accordance with Manual for Uniform Traffic Control Devices by the State Department of Transportation, latest Edition, at all points of excavation and construction in vehicle traffic areas.

1.11 PROTECTION FOR OPEN FLAME DEVICES
A. When open flame and/or spark producing devices, i.e., acetylene oxygen welding equipment, electric arc welding, etc., are employed for job accomplishment, the following procedures are mandatory:
   1. Inspect all surroundings and equipment to insure that combustible substances are not present in any area where contact of metal at a temperature above the flashpoint of any compound is possible.
   2. Ensure that no open containers or spills of combustible substances are present.
   3. Ensure that ignition is not possible by conduction, convection, radiation, or dispersion of molten metal.
   4. Proper protection equipment and practices will be used, i.e., fireproof blankets, wetting of surrounding area, removal of combustible materials where practicable, earth filled backing and portable fire extinguishers of proper type on hand.
   5. When the above devices are being used notify the Installation Fire Department 24 hours ahead of usage.

1.12 FIRE PROTECTION
B. The Contractor shall at all times maintain good housekeeping practices to reduce the risk of fire damage. All scrap materials, rubbish, and trash shall be removed daily from in and about the building and shall not be permitted to be scattered on adjacent property.
C. Suitable storage space shall be provided 50 feet minimum outside the building area for storing flammable materials and paints; no storage will be permitted in the building. Excess flammable liquids being used inside the building shall be kept in closed metal containers and removed from the building during unused periods.
D. Contractor shall provide a fire extinguisher at each location where cutting and welding is being performed. Where electric or gas welding or cutting is done, interposed shields of incombustible material shall be used to protect against fire damage due to sparks and hot metal. When temporary heating devices are used, a watchman shall be present to cover periods when other workmen are not on the premises.
E. The Contractor shall provide fire extinguishers in accordance with the recommendations of NFPA No. 10 and 241. However, in all cases a minimum of four fire extinguishers shall be available for each building.
F. Fire Codes: The Contractor shall obey all requirements of the National Fire Codes, and Base/Post Fire Regulations, as they relate to his work on base/post.

1.13 WORK BY OTHERS (IF APPLICABLE)
A. Work not included: Except for such auxiliary work as is shown or specified or is necessary as a part of the construction, the following work is not included in the Contract:
   1. Any work shown, but marked “NOT IN CONTRACT” (NIC).
   2. Any work indicated to be furnished and installed by the EXCHANGE or AAFES (EF/EI).
3. Any work indicated to be furnished and installed by the Vendors or Concessionaires.

1.14 EXCHANGE-FURNISHED AND INSTALLED EQUIPMENT (IF APPLICABLE)
   A. See Specification Section 01 10 17 - Exchange Furnished and Installed Equipment (EF/EI).

1.15 EXCHANGE FURNISHED-CONTRACTOR INSTALLED EQUIPMENT (IF APPLICABLE)
   A. See Specification Section 01 10 18 - Exchange Furnished Contractor Installed Equipment (EF/CI).

1.16 ALIGNMENT OF JOINTS IN FINISH MATERIALS
   A. It shall be the responsibility of the Contractor to make certain in the installation of jointed floor, wall, and ceiling and pavement materials that:
      1. The joints line through in a straight line and in both directions wherever possible.
      2. The joints relate to all openings and breaks in the structure and be symmetrically placed wherever possible. This includes heating registers, light fixtures, equipment, etc.
      3. If, because of the non-related sizes of the various materials and locations of openings, etc., it is not possible to accomplish the above, the Contractor shall meet with the Contracting Officer to determine the most satisfactory arrangement. The Contractor shall establish center lines for all trades.

1.17 INTEGRATING WORK
   A. All streets, buildings, and other improvements shall be protected from damage.
   B. Contractor's operations shall be confined to the immediate vicinity of the project work and shall not in any way interfere with or obstruct the ingress or egress to and from street or adjacent property.
   C. If new work is to be connected to existing work, special care shall be exercised not to disturb or damage the existing work more than necessary. All damaged work shall be replaced, repaired, and restored to its original condition at no cost to the EXCHANGE.

1.18 HEADROOM UNDER PIPES
   A. All horizontal runs of plumbing and heating pipes and/or electrical conduit suspended from ceilings shall provide for a maximum headroom clearance, but in no case shall this clearance be less than 7'-0" without written consent from the Contracting Officer. Where piping or conduit is left exposed within a room, the same shall run true to plumb, horizontal or intended planes. Where possible, uniform margins are to be maintained between parallel lines and/or adjacent wall, floor, or ceiling surfaces.

1.19 PATCHING GOVERNMENT-OWNED FACILITIES
   A. Government-owned structures, facilities, streets, curbs, walks, etc., that are damaged or removed due to required excavations or other construction work, shall be patched, repaired or replaced, and be left in their original state of repair by the Contractor, to the satisfaction of the Contracting Officer and of authorities having jurisdiction thereof.

1.20 LOCATION OF EQUIPMENT AND PIPING
   A. Drawings showing location of equipment, piping, ductwork, etc., are diagrammatic and job conditions shall not always permit their installation in the location shown. When this situation occurs, it shall be brought to the Contracting Officer's attention immediately and the relocation determined in a joint conference. The Contractor will be held responsible for the relocating of any items without first obtaining the Contracting Officer's approval. He shall remove and relocate such items at his own expense if so directed by the Contracting Officer.
   B. On the project site where work occurs, it is not anticipated that any of the following will be encountered. If encountered, do not disturb these items or similar items:
      1. Buried tanks.
      2. Buried piping monitoring wells.
      3. Oil/water separators.
1.21 OVERLOADING
A. The Contractor shall be responsible for overloading any part or parts of structures beyond their safe calculated carrying capacities by placing of materials, equipment, tools, machinery, or any other item thereon. No loads shall be placed on floors or roofs before they have attained their permanent and safe strength.

1.22 STANDARDS
A. Any material specified by reference to the number, symbol, or title of a specific standard such as Commercial Standard, a Federal Specification, a trade association standard, or other similar standard shall comply with the requirements in the latest revision thereof, and any amendment or supplement thereto, in effect on the date of invitation for proposals, except as limited to type, class, or grade, or modified in such reference, and except as otherwise indicated.
B. The standard referred to, except as modified in the specifications, shall have full force and effect as though printed in these specifications. These standards are not furnished to bidders for the reason that the manufacturers and trades involved are assumed to be familiar with their requirements.
1. Where Federal Specifications are referred to as a measure of quality and standard, they refer to Federal Specifications established by the Procurement Division of the United States Government and are available from the Superintendent of Documents, U.S. Government Printing Office.
2. Where Federal Specification numbers are used, they refer to the latest edition including amendments thereto.
3. Where Commercial Standards are referred to as a measure of quality, standard, and method of fabrication, they refer to Commercial Standards issued by the U.S. Department of Commerce.
4. Where ASTM Serial Numbers are used, they refer to the latest tentative specifications, standards specifications, standards methods, or standard method of testing issued by the American Society for Testing and Materials.

1.23 CERTIFICATE OF CONFORMANCE
A. Except where tests and/or inspections in connection with structural materials are specified or required by applicable laws, rules, and regulations, manufacturer's certificate covering conformance with the requirements of the above mentioned Federal Specifications and Commercial Standards may be acceptable in lieu of such items. Such certificates shall be furnished to the Contracting Officer for all items so specified.

1.24 OCCUPANCY BY THE EXCHANGE
A. EXCHANGE shall reserve the right and privilege of partial occupancy during and prior to the absolute completion of the total work. Access shall be allowed at all times to the EXCHANGE and its own Contractors in the endeavor.
B. Contractor shall maintain the means of egress for facility occupants at all times during demolition and construction phases.

1.25 TESTS AND REPORTS
A. See Specification Section 01 40 00 - Quality Requirements.
B. No geotechnical report was prepared for this project. Conditions are not expected to be materially different from those obtaining when building and site improvements were originally executed.

1.26 REFERENCES
A. All references to the word "Government" or "EXCHANGE" in the specifications shall mean Army and Air Force Exchange Service (AAFES).
B. Wherever the word "provide" is used in the Contract Documents as a directive, it shall be interpreted as meaning "provide and install completely and ready for use".
C. Definitions:
1. Vendor: Person or persons selling any material item.
2. Base, Post, Installation or Facility: Military facility where the project is being built or remodeled.
3. Concessionaire: Person who is directly responsible for the lease of and operation of the concessions such as Beauty Shop, Barber Shop, and Laundry/Dry Cleaners.
4. Architect-Engineer: That person or firm responsible for preparing the working drawings and specifications.
5. AAFES or EXCHANGE: Army and Air Force Exchange Service.
6. Inspection Agency: Project Inspector contracted by EXCHANGE.

1.27 TOXIC MATERIALS

A. Removal or disposal of toxic materials or asbestos is not included in this contract. If the Contractor encounters such materials, he shall immediately notify the Contracting Officer.

B. Abatement of hazardous materials is not part of the work of this Contract. If hazardous materials are encountered or suspected, the General Contractor shall stop work immediately and contact the EXCHANGE Contracting Officer for direction on how to proceed.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION
SECTION 01 10 17
EXCHANGE FURNISHED AND INSTALLED EQUIPMENT (EF/EI)

PART 1 - GENERAL

1.01 EXCHANGE FURNISHED AND INSTALLED PROPERTY (EF/EI)
   A. Certain items of equipment will be furnished and installed by EXCHANGE. See drawing references to (EF/EI)
   B. The Contractor shall provide for and cooperate with personnel installing EXCHANGE furnished materials and equipment, should overlap of work occur.
   C. Schedule: Contractor shall schedule early completion of designated areas for beneficial occupancy by EXCHANGE usage prior to completion of entire project per approved Phasing plans.
   D. EXCHANGE will furnish and install equipment as indicated on Fixture and/or Equipment Plans in the drawings.
   E. Contractor’s Duties:
      1. Provide access for EXCHANGE personnel.
      2. Coordinate work and cooperate with the installers of the EF/EI equipment so that installation can be accomplished in accordance with construction schedule.
      3. Provide mechanical and electrical connections to EF/EI equipment and building systems.
      4. Provide security for designated areas.
      5. Schedule equipment delivery dates and installation times to coordinate with the overall schedule. Provide EXCHANGE advance notice so equipment can be ordered on time.
   F. EXCHANGE Duties:
      1. Inspect designated area prior to use and issue statement of acceptance of area for installation of property.
      2. Provide custodial services for designated areas during use after beneficial occupancy.

1.02 DELIVERY DATE CHANGES
   A. Requests by Contractor to change designated delivery dates shall be made in writing at least 30 days in advance of the designated delivery date. If the Contractor is not ready to accept delivery of EXCHANGE furnished property the Contractor shall be responsible for storage and re-delivery cost. Should EXCHANGE be unable to effect the change, or should the Contractor fail to submit his request within the time stated above, the Contractor's obligation under this contract and as stated herein shall not be relieved and further, the Contractor will have no basis upon which to file a claim under these conditions.

1.03 EXCHANGE ACTIVITIES AFFECTING PROGRESS OF WORK:
   A. Serving Areas & Food Preparation Areas: Schedule date of use and possession of food preparation serving areas 30 days prior to completion of project.
   B. Construction in each area at date scheduled for its use and possession by EXCHANGE shall be sufficiently complete, in accordance with Contract Documents, so that EXCHANGE may occupy the area for the use for which it is intended. Comply with Contract Clauses titled Inspection of Construction, and Use and Possession Prior to Completion.

1.04 ACCEPTANCE OF AREAS FOR BENEFICIAL OCCUPANCY
   A. Inspection: Prior to acceptance by EXCHANGE of an area for beneficial occupancy, the Contracting Officer will conduct an inspection of the specific area. A list of deficiencies will be provided to the Contractor.
   B. Acceptance: If the Contracting Officer determines the specific area is sufficiently complete for beneficial occupancy by EXCHANGE, the area will be accepted in writing with the exception of the deficiencies listed. The deficiencies listed shall be completed or corrected prior to final acceptance at the completion of the project.
C. Damage: Damage resulting from EXCHANGE’S use will not be considered the Contractor's responsibility.

D. Refer to clause entitled "Final Inspection and Acceptance" of the EXCHANGE "General Provisions."

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION

3.01 FINAL CONNECTIONS

A. All final electrical connections to EXCHANGE and Vendor furnished and installed equipment shall be made by the Contractor as part of the construction contract. The GC shall construct all openings, furnish and install required sleeves and conduit, and furnish and install all reinforcing, miscellaneous supports, angles, plates, anchors, and bolts necessary to secure EXCHANGE-furnished equipment in place. Final hookup of plumbing fixtures is by the GC.

B. The Contractor shall provide for and cooperate with personnel installing EXCHANGE-furnished materials and equipment should overlap of work occur.

END OF SECTION
SECTION 01 10 18
EXCHANGE FURNISHED, CONTRACTOR INSTALLED EQUIPMENT (EF/CI)

PART 1 - GENERAL

1.01  EXCHANGE FURNISHED / CONTRACTOR INSTALLED EQUIPMENT (EF/CI):

A. EXCHANGE furnished/Contractor installed equipment shall be handled in accordance with the "Army and Air Force Exchange Service General Provisions" clause entitled "Exchange Furnished Property."

B. The material noted below will be furnished by the Exchange and shall be installed by the Contractor. See drawing references to (EF/CI). The Contractor shall provide for and cooperate with personnel furnishing the designated material.

C. All food service equipment must be approved by the National Sanitation Foundation, NSF

D. Contractor's Duties:
   1. Designate required delivery date for each product. Notify the Contracting Officer in writing at least 60 days in advance of the date that EXCHANGE furnished equipment and furnishings will be needed. Shop drawings indicating dimensional locations of all plumbing and electrical rough-ins will be furnished by EXCHANGE.
   2. The equipment will be received at the job site by a representative of EXCHANGE who will jointly, with the Contractor, verify condition and quantities. The representative will then effect receipted transfer of custody of the equipment to the Contractor.
   3. Unload, handle, store (on-site), protect, uncrate, assemble, install, set in final position, align, join, level, and make all utility connections to all items of equipment. Installation shall be performed in accordance with the specifications, equipment plans, and schedules shown on the Drawings and the rough-in drawings provided by EXCHANGE.
   4. Construct all openings, furnish and install required sleeves and furnish and install all reinforcing, miscellaneous supports, angles, plates, anchors, and bolts necessary to secure EXCHANGE furnished equipment in place.
   5. Repair or replace items damaged as a result of Contractor's operations.
   6. Apply finish indicated, if any.
   7. The installation shall be complete in all respects, including mechanical and electrical hook ups, and put into good operating condition.

E. EXCHANGE Duties:
   1. Deliver all EXCHANGE furnished items to the job site. Schedule delivery date with supplier in accordance with Progress Chart.
   2. Provide Contractor with installation drawings and instructions upon request.
   3. Provide Contractor with shop drawings indicating dimensional locations of all plumbing and electrical rough-ins upon request.

1.02  DELIVERY

A. Contractor shall unload, handle, store, protect, uncrate, assemble, set in final position, align, join, and level all Exchange-Furnished material, and shall make all utility connections thereto. EXCHANGE will provide supervision for installation of the material.

B. The material will be received at job site by a representative of the local EXCHANGE who, together with the Contractor, will jointly verify conditions and quantities. The representative of the local EXCHANGE will then effect receipted transfer of custody of the material to the Contractor. Material damaged by or during construction operations shall be replaced at no additional cost to EXCHANGE.

1.03  FAILURE TO VERIFY

A. Failure to execute above required verifications shall not relieve the Contractor of responsibility for proper installation of the material, which shall be installed without additional cost to EXCHANGE.
1.04 DELIVERY DATE CHANGES:
   A. Requests by Contractor to change designated delivery dates shall be made in writing at least 60 days in advance of the designated delivery date. If the Contractor is not ready to accept delivery of EXCHANGE furnished equipment the Contractor shall be responsible for storage and delivery cost. Should EXCHANGE be unable to effect the change, or should the Contractor fail to submit his request within the time stated above, the Contractor's obligation under this contract and as stated herein shall not be relieved and further, the Contractor will have no basis upon which to file a claim under these conditions.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 INSTALLATION
   A. The GC shall construct all openings, furnish and install required sleeves and conduit, and furnish and install all reinforcing, miscellaneous supports, angles, plates, anchors, and bolts necessary to secure EXCHANGE-furnished equipment in place. All final electrical connections to EXCHANGE-furnished equipment shall be made by the Contractor as part of the Construction Contract.

3.02 SCHEDULE OF MATERIALS AND EQUIPMENT (EF/CI)
   A. Refer to individual schedules and notes on each sheet.
   B. Contractor is responsible to provide all MEP connections and final hookups at all EF/EI equipment and fixtures as required as well as at the EF/CI equipment.

END OF SECTION
SECTION 01 10 60
SAFETY POLICIES AND PROCEDURES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Contractor-required health and safety plan.
   1. Contractor is responsible for reading the Risk Assessment Plan and following the directions therein.
   2. Contractor must maintain OSHA permissible exposure limits related by the risk assessment: That is, 25 ppm (170 mg/cubic meter) during any 8 hour work shift for a 40-hour week
B. Sample Safety Plan: Attached.
C. Sample Construction Hazard Plan: Attached.

1.02 RELATED SECTIONS

A. Section 01 33 00 - Submittals: Construction Hazard Plan, Job Safety and Health Plan, Emergency Response Plan.
B. Section 01 35 43 - Environmental Protection.
C. Section 01 78 39 - Project Record Documents.

1.03 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 the basic designation only.
   1. OSHA 1910 REG - 29CFR, OSHA 1910.120

1.04 SUBMITTALS

A. Submittals for EXCHANGE Approval: The following items shall be submitted for EXCHANGE approval:
   1. Designation of Safety Representative: The Contractor shall designate in writing a qualified employee, OSHA Trained under 1910.120, responsible for the overall supervision of all accident prevention activities. Duties shall include ensuring applicable safety requirements are incorporated into work methods and inspecting the job site to ensure that safety measures and instructions are actually being applied. This person shall be on site at all times that work is in progress.
   2. The Contractor shall be trained/certified in OSHA 1910.120 procedures. All other employees performing site work will meet OSHA 1910 training requirements for their job capacity.
B. Submittals for Information Only: The following items shall be Contractor certified:
   1. Job Hazard Analysis: Contractor shall develop a job hazard analysis for presentation at the Pre-Construction Conference. The Contractor’s job hazard analysis shall list potential hazards that could arise during the course of the work.
   2. Job Safety and Health Plan.
      a. The Contractor shall develop a Job Safety and Health Plan for presentation at the Pre-Construction Conference. The Contractor’s Safety Plan shall make whatever provisions are necessary to conduct the work in accordance with current OSHA standards.
      b. The Safety and Health Plan must specifically address the excavation portion of construction and will be specific to perchloroethylene (tetrachloroethylene) (PCE), and incorporate decontamination procedures for personnel and equipment, continuous vapor monitoring, a prohibition against eating in proximity to the site, and a prohibition against the smoking of tobacco products in the proximity to the site.
      c. The following are minimum requirements for the Safety and Health Plan:
1) The Contractor is responsible for all compounds and degradation products addressed by the Risk Assessment Plan.

2) Specialized Designs: Specialized designs will be provided when the situation requires. Examples of such designs include, but are not limited to, vapor barriers in areas of known vapor hazard.

3) Safety Plans: Safety Plans will be the responsibility of the Contractor for construction areas identified by the installation and/or EXCHANGE as areas of known hazards only. These plans are required by 29 CFR 1910 and are the responsibility of the Contractor. This requirement will be coordinated through the Health and Safety Program of the Installation by the Contractor.

4) Minimum Requirements for the Safety and Health Plan are as follows:
   (a) Must be kept on site, and must be written.
   (b) Will contain a hazard analysis (safety and health risk) for each site task and operation (to be supplied by the Installation).
   (c) Will include employee training (per paragraph (3) of 1910.120).
   (d) Will include personal protective equipment to be used by employees for each of the site tasks and operations (paragraph (g) (5) of 1910.120).
   (e) Will include provision for medical surveillance (paragraph (f) of 1910.120).
   (f) Will include the frequency and types of air monitoring, personal monitoring, environmental sampling techniques, instruments to be used (their maintenance and calibration).
   (g) Will include a site control program (per paragraph (d) of 1910.120) to be coordinated with the installation.
   (h) Will include a decontamination procedure (per paragraph (k) of 1910.120).
   (i) Will include an emergency response plan (per paragraph (1) of 1910.120).
   (j) Will include a confined space entry procedure (per 1910.146, 147 or program equivalent).
   (k) Will include provision for spill containment (per paragraph (j) of 1910.120).
   (l) Will include pre-entry briefings (prior to each site task activity) for all employees involved in the task, supervision, or emergency response.
   (m) Written verification of adherence to the "plan" by a Safety and Health Supervisor is required (the supervisor must meet the 1910.120 training requirements for supervisors).
   (n) Deficiencies will be corrected immediately upon discovery and after consultation with the EXCHANGE Contracting Officer and Installation Safety Office.

   d. Hazard Response Plan: The unplanned or non-predicted discovery of such hazards as transite pipe, contaminated soils, and other possible hazards will be addressed within an Emergency Response Plan (EMR) by all contractors. This requirement will be coordinated through the Health and Safety Program of the military installation by the Contractor (sample provided).

   e. Material Safety Data Sheets will be maintained at the site for all hazardous materials in use.

1.05 MONTHLY SAFETY MEETINGS

   A. The Installation will schedule subsequent safety meetings with Contractor and subcontractor personnel on a monthly basis. The EXCHANGE and Installation representatives will attend periodically. Minutes of safety meetings shall be prepared and signed by the Contractor. Concurrence shall be signed by the Inspection Section and the original shall be submitted to the Contracting Officer for inclusion in the contract file.

1.06 ACCIDENT REPORTING AND RECORD KEEPING

   A. Accident reporting and record keeping shall be in accordance with Installation requirements. Telephonic reports of injuries or property damage will be made as soon as possible after the incident and will be followed by a copy of an Accident Report.
1.07 LIFE OF CONTRACT REQUIREMENTS
   A. The Contractor shall comply with all provisions of this Section during the life of the Contract.

1.08 HEAD PROTECTION (HARD HATS)
   A. All work sites under this Contract are designated Hard Hat Areas. The Contractor shall post the area and shall ensure that all personnel, vendors and visitors use hard hats while within the limits of the work site.

PART 2 - PRODUCTS (NOT USED)
PART 3 - EXECUTION (NOT USED)
END OF SECTION
SAMPLE

SAFETY PLAN

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

1.1 US ARMY CORPS OF ENGINEERS:
EM 385-1-1 U.S. Army Corps of Engineers Safety and Health Requirements Manual

1.2 NATIONAL FIRE PROTECTION ASSOCIATION (NFPA):
NFPA 70-1993 National Electric Code (NEC)

1.3 SOCIETY OF AUTOMOTIVE ENGINEERS (SAE):
J 994-85 Alarm, Backup, Electric-Performance, Test, and Application, Recommended Practice.

2. GENERAL: Work safety is of paramount importance. The Contractor shall comply with the Contract Clause in the Solicitation entitled ACCIDENT PREVENTION, including the U.S. Army Corps of Engineers Safety and Health Requirements Manual referred to therein in addition to the provisions of this specification.

3. SAFETY PROGRAM: The U.S. Army Corps of Engineers Safety and Health Requirements Manual, EM 385-1-1, and all subsequent revisions to in the Contract Clause ACCIDENT PREVENTION of this contract, are hereby supplemented as follows:

a. The Contractor shall designate an employee responsible for overall supervision of accident prevention activities. Such duties shall include:

   1. Assuring applicable safety requirements are incorporated in work methods
   2. Inspecting the work to ensure that safety measure and instructions are actually applied.

   The proposed safety supervisor's name and qualifications shall be submitted in writing for approval to the Contracting Officer's Representative. This individual must have prior experience as a safety engineer or be able to demonstrate his/her familiarity and understanding of the safety requirements over a prescribed trial period. The safety engineer shall have the authority to act on behalf of the Contractor's general management to take whatever action is necessary to assure compliance with safety requirements. The safety supervisor is required to be on the site when work is being performed.

b. Prior to commencement of any work at a job site, a preconstruction safety meeting shall be held between the Contractor and the Corps of Engineers Area/Resident Engineer to discuss the Contractor's safety program and in particular to review the following submittals:

   1. Contracts Accident Prevention Plan: An acceptable accident prevention plan, written by the prime contractor for the specific work and implementing in detail the pertinent requirements of EM 385-1-1, shall be submitted for Government approval.
2. Activity Phase Hazard Analysis Plan: Prior to beginning each major phase of work, an activity hazard analysis (phase plan) shall be prepared by the Contractor for that phase of work and submitted to the Contracting Officer's Representative for approval. A phase is defined as an operation involving a type of work presenting hazards not experienced in previous operations or where a new subcontractor or work crew is to perform work. The analysis shall address the hazards for each activity performed in the phase and shall present the procedures and safeguards necessary to eliminate the hazards or reduce the risk of an acceptable level.

c. Subsequent jobsite safety meetings shall be held as follows:

1. A safety meeting shall be held at least once a month for all supervisors on the project to review past activities, to plan ahead for new or changed operations and to establish safe working procedures to anticipate hazards. An outline report of each monthly meeting shall be submitted to the Contracting Officer's Representative.

2. At least one safety meeting shall be conducted weekly, or whenever new crews begin work, by the appropriate field supervisors or foreman for all workers. An outline report of the meeting giving date, time, attendance, subjects discussed and who conducted it shall be maintained and copies furnished the designated authority on request.

4. ACCIDENTS: Chargeable accidents are to be investigated by both Contractor personnel and the Contracting Officer.

4.1 ACCIDENT REPORTING, ENG FORM 3394: Section I, paragraph 01.D, of EM 385-1-1 and the Contract Clause entitled ACCIDENT PREVITION are amended as follows: The prime Contractor shall report on Eng Form 3394, supplied by the Contracting Officer, all injuries to his employees or subcontractors that result in lost time and all damage to property and/or equipment in excess of $2,000 per incident. Verbal notification of such accident shall be made to the Contracting Officer within 72 hours following such accidents. The written report shall include the following:

a. A description of the circumstances leading up to the accident, the cause of the accident, and corrective measures taken to prevent recurrence.

b. A description of the injury and name and location of the medical facility giving examination and treatment.

c. A statement as to whether or not the employee was permitted to return to work after examination and treatment by the doctor, and if not, an estimate or statement of the number of days lost from work. If there have been days lost from work, state whether or not the employee has been re-examined and declared fit to resume work as of the date of the report.

4.2 OSHA Requirements:

4.2.1 OSHA Log: A copy of the Contractors' OSHA Log of Injuries shall be forwarded monthly to the Contracting Officer.

A. The Contractor shall comply with all provisions of this section during the life of the contract.

4.2.2 OSHA Inspections: Contractors shall immediately notify the Contracting Officer when an OSHA Compliance Official (Federal or State Representative) presents his/her credentials and informs the Contractor that the workplace will be inspected for OSHA compliance. Contractors shall also notify the Contracting Officer upon determination that an exit interview will taken place upon completion of an OSHA inspection. (NABSA).
5. SUBMITTALS FOR GOVERNMENT APPROVAL: Submittals shall be in accordance with Section 01 33 00 CONTRACTOR SUBMITTAL PROCEDURES. All required submittals of items specified in this section shall be for information only, except for those items including, but not limited to, the following which shall be submitted for Government approval:

a. Written designation of safety representative.

b. Written project specific accident prevention plan.

c. Written activity phase hazard analysis plan.

END OF SAMPLE SAFETY PLAN
SAMPLE

CONSTRUCTION HAZARD PLAN

TO BE ACCOMPLISHED BY THE GENERAL CONTRACTOR FOR CONSTRUCTION AND POSTED IN
ALL CONSTRUCTION TRAILERS

SHOULD AN UNPREDICTED DISCOVERY OF A HAZARDOUS MATERIAL OR CONDITION BE MADE
DURING CONSTRUCTION THE FOLLOWING SEQUENCE OF ACTIONS IS REQUIRED WHEN THERE IS
NO IMMEDIATE THREAT TO LIFE OR PROPERTY

<table>
<thead>
<tr>
<th>ITEM</th>
<th>FIRST ACTION</th>
<th>NOTIFY</th>
<th>TELEPHONE #</th>
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<tbody>
<tr>
<td>Transite Pipe</td>
<td>Cease Activity in area of discovery</td>
<td>1. BCE</td>
<td>1. BCE</td>
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<td></td>
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<td>2. AAFES Contracting Officer and/or CME</td>
<td>2. AAFES Contracting Officer and/or CME</td>
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<td>3. AAFES Environmental Engineer when Unable to Contact 1,2</td>
<td>3. AAFES Environmental Engineer when Unable to Contact 1,2</td>
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<tr>
<td>Contaminated Soil</td>
<td>Cease Activity in area of discovery</td>
<td>Same as above</td>
<td>Same as above</td>
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<td></td>
<td>cover with plastic</td>
<td></td>
<td></td>
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<tr>
<td>Buried Munitions</td>
<td>Cease Activity</td>
<td>Same as above</td>
<td>Same as above</td>
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<td>UST</td>
<td>Same as above</td>
<td>Same as above</td>
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<tr>
<td>Other</td>
<td>Should there be an immediate threat to life or property, the emergency response plan for the installation, which is to be on file at the construction side, is to be followed in every detail. An example of this procedure is the rupture of a fuel line, liquid or natural gas.</td>
<td>END OF SAMPLE CONSTRUCTION HAZARD PLAN</td>
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</tbody>
</table>
SECTION 01 13 00
SAFETY REGULATIONS AND CODES

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

A. Reference Standards.
B. Licenses and Permits
C. Safety.
D. Fire Safety.
E. Use of Lasers.
F. Ozone Depleting Substances.
G. Lead Base Paint.
H. Cleaning & Debris Control
I. Nuisance Dumping & Polluting Activities
J. Stormwater Pollution Prevention
K. Contaminated Soil
L. Suspected Hazardous Materials
M. Oil-Filled or Impregnated Electrical Components
N. Spill Response and Reporting
O. Waste Disposal and Environmental Protection.

1.02 REFERENCE STANDARDS

A. Federal, State and Local Codes and Ordinances take precedence over these Specifications and Drawings where conflicts occur, unless the Drawings or Specifications call for more stringent requirements. Notify the Contracting Officer in writing of conflicts.
B. Comply with all applicable laws, building and construction codes, OSHA Safety and Health Regulations and applicable requirements of any governmental agency under whose jurisdiction this Work is being performed.
C. Obtain a copy of standards referenced in the various Specification Sections. Maintain a copy at the jobsite during execution of Work to which the standard applies.
D. Construction that is not governed by the contract specifications will be governed by the more stringent provisions of the latest published edition or statute adopted edition, of the following applicable codes, regulations and standards.
   1. Americans With Disabilities Act Accessibility Guidelines
   2. Army Regulations
   3. American Society of Mechanical Engineers
   4. Code of Federal Regulations
   5. Federal Acquisition Regulations
   7. International Mechanical Code
   8. International Plumbing Code
  11. Occupational Safety and Health Act
E. Other applicable codes and standards as applicable or as referenced by the individual specification Sections.
1.03 LICENSES AND PERMITS
A. The Contractor shall obtain and maintain current for the duration of this Contract, all required Federal, State and local licenses and permits. All associated fees and taxes shall be paid by the Contractor without additional cost to the Government.
B. Obtain from Installation Security all required vehicle and entry permits.
C. Obtain from the Contracting Officer any additional Installation required permits. Current permit requirements shall be provided to the Contractor at the Pre-Construction Conference.

1.04 SAFETY
A. Comply with all Federal and State regulations concerning safety of personnel and equipment. All Contractor personnel shall wear hard hats and steel toe safety shoes while on the project site. In addition, all personnel shall wear hearing protection (ear muffs or ear plugs) when inside the power plant, excluding office areas, restrooms, break rooms and other “quiet” areas.
B. Ensure that lock out, tag out procedures are established and used as directed by 29 CFR 1910.145. Comply with the lock out, tag out procedures in use. Ensure that Contractor’s personnel on site are trained on the government’s procedures.
C. Comply with all safety, traffic and protection requirements in effect on Installation. Government will brief the Contractor on these requirements at the Pre-Construction Conference.
D. Provide safety barriers around open excavations, openings in floors and other hazards created by the Contractor’s activities.
E. The Contracting Officer may direct the Contractor to cease activities which, in his opinion, are unsafe.

1.05 FIRE SAFETY
A. Comply with all fire safety and protection requirements in effect at Installation. Government will brief the Contractor on these requirements at the Pre-Construction Conference.
B. Prior to beginning any welding, use of open flame device, or any activity that produces sparks, obtain a “hot work permit” from the Installation Fire Department. The permit shall be renewed each day welding or open flame devices will be used.
C. If the contract work requires numerous days of hot work, the Contractor may elect to have one of his on-site personnel designated as a Permit Authorizing Individual (PAI). The Contractor’s PAI may issue hot work permits at the work site, thus avoiding the requirement for daily permits issued by the Fire Department.
D. The Contractor’s PAI shall be the on-site superintendent, a foreman, the Contractor’s Safety Manager, or other individual with sufficient knowledge and experience to recognize unsafe work practices or conditions and having authority to stop work immediately if such unsafe practices or conditions are observed. To be designated as a PAI, a person must schedule and successfully complete PAI certification training offered by the Installation Fire Department. PAI certification training is estimated to last 60 to 90 minutes.
E. Fire Department personnel may periodically visit the site to ensure the Contractor is complying with fire safety requirements. A Permit Authorizing Individual’s (PAI) certification may be revoked if the PAI has failed to issue permits on days when hot work is performed, or if unsafe practices or conditions are observed.
F. Questions concerning these requirements may be directed to Installation Fire Department.
G. The Contractor shall notify the Fire Department Fire Protection Office a minimum of 48 hours before, and again immediately prior to, temporarily closing any street or paved building access, interrupting water service to any fire hydrant or interrupting the operation of any fire detection, alarm or suppression system. The Fire Department shall be immediately notified upon reopening closed areas, restoration of water service to any fire hydrant, or reactivation of any detection, alarm or suppression system. This notification requirement is in addition to other contract requirements.
H. Provide a 10 lb-capacity, ABC fire extinguisher at all work areas.
I. Report a Fire: Dial 911.

1.06 USE OF LASERS
A. Submit a written request for approval at least 30 calendar days before commencement of activities which require the use of a laser.

B. Submit request to the Installation’s Radiation Safety Officer (RSO) with a courtesy copy to the Contracting Officer. Request shall include:
   1. Description/Characteristics:
      a. Manufacturer.
      b. Model.
      c. Number of same units.
      d. Serial number(s).
      e. Laser medium.
      f. Mode of operation (i.e. continuous wave (CW), single pulse, multiple pulse).
      g. Maximum exposure time (train length).
      h. Ime (sec) & wave length.
      i. Energy/pulse (J) or CW power (W).
      j. Pulse repetition frequency.
      k. Pulse width.
      l. Beam diameter (at 1/e point).
      m. Beam divergence (at 1/e point).
   2. The part of the EXCHANGE contract describing work to be done and the inclusive dates of such work.
   3. An acknowledgment that the RSO may make initial and periodic checks to ensure the Contractor is following applicable radiological health and safety practices which prevent unnecessary exposures to Installation personnel.

1.07 OZONE DEPLETING SUBSTANCES
A. No ozone depleting substances (refrigerants or any other compounds) shall be used in any capacity on this project unless specifically approved by the HazMat.

1.08 LEAD BASE PAINT
A. No paint with a lead content of 0.06 percent or greater shall be used in any capacity on this project unless specifically approved by the HazMat.

1.09 CLEANING AND DEBRIS CONTROL
A. During the term of this Contract, the Contractor shall remove any materials and equipment that are not required for the completion of the work as promptly as possible. All debris shall be removed from the site and legally disposed of. The Contractor shall take particular care to eliminate any hazards created by these operations.

B. The Contractor is responsible for any damage caused by the debris without additional cost to the Government.

C. The Contractor shall maintain at all times during the work at this Project Site a strict windblown debris control program. This program shall ensure no windblown debris or other debris from the work shall contaminate or interfere with any access to or operation of any facility or any parking area, road or street.

1.10 NUISANCE DUMPING AND POLLUTING ACTIVITIES
A. Polluting, dumping, or discharging of any harmful, nuisance, or regulated materials (such as concrete truck washout, vehicle maintenance fluids, residue from saw cutting operations, solid waste or hazardous substances) into building drains, site drains, streams, waterways, holding ponds or to the ground surface is not permitted. The Contractor shall be responsible for any and all damages resulting from dumping or discharges. Further, the Contractor shall conduct activities in such a fashion to avoid creating any legal nuisance, including but not limited to, suppression of noise and dust, control of erosion, and implementation of other measures as necessary to minimize off site impacts of work activities.
B. Fugitive Dust emissions (airborne dust generated by vehicles operating on unpaved surfaces, transfer or transport of dust producing materials, etc.) shall be controlled at the construction site, along haul routes and at staging areas. Water spraying shall be conducted as necessary to minimize fugitive dust generation.

1.11 STORMWATER POLLUTION PREVENTION
A. Prior to clearing, grading or excavating, the Contractor shall obtain a Storm Water Pollution Prevention (SWPP) permit from the Alabama Department of Health and a National Pollution Discharge Elimination System (NPDES) permit from the Environmental Protection Agency (EPA). Submit the SWPP Plan to the Contracting Officer for review and approval prior to submitting the plan to NDDOH. Ensure SWPP Plan includes Best management Practices. Additional permits may be required and shall be the responsibility of the Contractor

B. If contaminated ground water is encountered, the contractor must notify DPW immediately via the 24/7 spill phone.

1.12 CONTAMINATED SOIL
A. If unexpected contaminated soil is encountered while performing work, stop work immediately and contact the Contracting officer. Do not resume work until approved by the Contracting Officer.

1.13 SUSPECTED HAZARDOUS MATERIALS
A. Any suspect hazardous materials encountered during demolition or construction shall immediately be brought to the attention of the Contracting Officer’s representative. Work shall not resume until the Contracting Officer is satisfied that the materials are not hazardous. Should they be found to be hazardous, the Contractor shall immediately take steps to contain the material, so further damage and contamination does not occur. The Contractor shall then submit a proposal for removal.

1.14 OIL-FILLED OR IMPREGNATED ELECTRICAL COMPONENTS
A. Notify Installation Environmental Safety Office before demolition or installation of any oil-filled electrical equipment (for example: transformers and regulators). All transformers (both PCB and non-PCB-containing) and light ballasts (unless labeled “No PCBs”) shall be disposed through the Installation’s Hazardous Material and Waste Handling facility.

1.15 SPILL RESPONSE AND REPORTING
A. Spills of hazardous waste, hazardous materials or non-regulated substances such as oils, antifreeze, grease, latex paint, hydraulic fluid, etc. shall immediately be reported to local, state and federal agencies and proper clean-up action. Also, report all spills to the Installation Fire Department by calling 911 at any time, 24/7.

B. The Contractor is encouraged to have a supply of absorbent pads on-site to aid in immediate clean-up of smaller spills, such as oil, coolant or hydraulic fluid leaks from vehicles or equipment.

C. Spill notification placards are to be placed on the job site. Installation DPW will provide format and required locations prior to construction.

D. The Contractor shall develop a spill plan. The format for the plan will be provided by Installation DPW prior to construction.

1.16 WASTE DISPOSAL AND ENVIRONMENTAL PROTECTION
A. The Contractor shall comply, and ensure that all subcontractors comply, with all Federal, State, local laws, and regulations, ordinances and standards related to environmental pollution control and abatement in effect and the specific requirements stated elsewhere in the Contract Documents.

B. All hazardous wastes as defined in 40 CFR, Part 261, shall be collected and disposed of in accordance with 40 CFR, Parts 260-268. The Contractor is responsible for properly storing, marking, labeling, securing and transporting hazardous wastes. All hazardous wastes shall be collected in Contractor-furnished DOT/UN approved containers and taken to the Installation
Hazardous Waste Facility for disposal. Call the Hazardous Waste Facility prior to transporting wastes to the facility to coordinate delivery of the waste materials. The Contractor shall not store hazardous waste on base for more than 30 days.

C. Any previously unidentified suspected hazardous materials encountered during performance of the work of the contract shall immediately be brought to the attention of the Contracting Officer.

D. All general construction wastes, other than those specifically allowed, or required, to be disposed of on-base shall be legally disposed at an off-post sanitary landfill.

E. Comply with the requirements of the Installation’s Hazardous Waste Management Plan (HWMP).

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION - (NOT USED)

END OF SECTION
WASTE DISPOSAL

The Contractor shall obtain all permits required by federal, state and local laws for the construction activities involved. The Contractor shall perform all work in such a manner as to minimize the polluting of air, water or land and shall, within reasonable limits, control noise and the disposal of solid waste materials, as well as other pollutants. The Contractor shall ensure that all construction, repair, maintenance operations and practices and waste disposal performed under this contract shall be in strict compliance with all applicable city, county, state and federal environmental laws and regulations.

1. Hazardous and Non-hazardous Waste Disposal: There are no known existing sources of hazardous waste involved with this project. If the Contractor generates or discovers suspected hazardous waste it shall be brought to the immediate attention of the Contracting Officer for review and direction on how to proceed with handling and disposal. As part of the proposed implementation above and prior to on-site construction, the Contractor shall submit for approval, a plan for storing, characterizing and disposing of hazardous and non-hazardous waste materials resulting from the work under this contract. Waste includes, but is not limited to, paint waste, paint equipment cleaners and used paint containers. If any waste material is dumped in unauthorized areas, the Contractor shall remove the materials and restore the area to the condition of the adjacent undisturbed areas. Where directed and approved by the Contracting Officer, contaminated ground shall be excavated, characterized, stored, disposed of and replaced with suitable fill material at the expense of the Contractor. All waste disposal shall be in strict accordance with local, state and federal requirements and regulations. Waste paint, paint equipment cleaners and used paint containers shall be disposed of off base by the Contractor, at the Contractors’ expense. Any soil contaminated through spillage shall be removed and disposed of in accordance with the requirements specified herein. Soil that is required to be removed shall be replaced by similar soil approved by the Contracting Officer.
SECTION 01 14 50
CUTTING AND PATCHING

PART 1 - GENERAL

1.01 SECTION INCLUDES
A. Requirements and limitations for cutting and patching of Work.

1.02 RELATED SECTIONS
A. Section 01 10 00 - Summary.
B. Section 01 33 00 - Submittals.
C. Section 02 41 16 - Selective Demolition.
D. Section 07 01 50 - Maintenance of Membrane Roofing.
E. Individual Product Specification Sections:
   1. Cutting and patching incidental to work of the section.
   2. Advance notification to other sections of openings required in work of those sections.
   3. Limitations on cutting structural members.

1.03 SUBMITTALS
A. Submit written request in advance of cutting or alteration which affects:
   1. Structural integrity of any element of Project.
   2. Integrity of weather exposed or moisture resistant element.
   3. Efficiency, maintenance, or safety of any operational element.
   5. Work of EXCHANGE or separate contractor.
B. Include in request:
   1. Identification of Project.
   2. Location and description of affected Work.
   3. Necessity for cutting or alteration.
   4. Description of proposed Work and Products to be used.
   5. Alternatives to cutting and patching.
   6. Effect on work of EXCHANGE or separate contractor.
   7. Written permission of affected separate contractor.
   8. Date and time work will be executed.

PART 2 – PRODUCTS

2.01 MATERIALS
A. Primary Products: Those required for original installation.

PART 3 – EXECUTION

3.01 EXAMINATION
A. Examine existing conditions prior to commencing Work, including elements subject to damage or movement during cutting and patching.
B. After uncovering existing Work, assess conditions affecting performance of work.
C. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION
A. Provide temporary supports to ensure structural integrity of the Work. Provide devices and methods to protect other portions of Project from damage.
B. Provide protection from elements for areas which may be exposed by uncovering work.

3.03 CUTTING
A. Execute cutting and fitting to complete the Work.
B. Uncover work to install improperly sequenced work.
C. Remove and replace defective or non-conforming work.
D. Remove samples of installed work for testing when requested.
E. Provide openings in the Work for penetration of mechanical and electrical work.
F. Employ skilled and experienced installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.
G. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

3.04 PATCHING
A. Execute patching to complement adjacent Work.
B. Fit Products together to integrate with other Work.
C. Execute work by methods to avoid damage to other Work, and which will provide appropriate surfaces to receive patching and finishing.
D. Employ original installer to perform patching for weather exposed and moisture resistant elements, and sight-exposed surfaces.
E. Restore work with new Products in accordance with requirements of Contract Documents.
F. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
G. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material, to full thickness of the penetrated element.
H. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

END OF SECTION
PART 1 GENERAL

1.01 REQUESTS FOR INFORMATION (RFIS)
   A. RFI Forms: Software-generated form acceptable to Architect and EXCHANGE Project Manager.
   B. Architect's Action: Allow seven working days for Architect's response for each RFI.
   C. RFI Log: Maintain a tabular log of RFIs. Submit log weekly.

1.02 PRECONSTRUCTION MEETING
   A. The Contracting Officer and/or Contracting Officer’s representative will schedule and preside at preconstruction meeting.
   B. Attendance Required:
      1. Contracting Officers and/or Contracting Officer’s representative and other Headquarters EXCHANGE representatives.
      2. Local and regional EXCHANGE representatives.
      3. Installation representative (Engineering, Fire Marshall, Security, etc.).
      4. Contractor.
      5. Major Sub-contractors.
   C. Agenda:
      1. Execution of Notice to Proceed.
      3. Submission of list of sub-contractors.
      4. Review of EXCHANGE checklist of contract requirements.
      5. Discussion of Schedule.
      6. Discussion of critical sequencing.
      7. Designation of responsible personnel.
      8. Processing of field decisions and change orders.
      9. Submission of applications for payment.
     10. Submittal of shop drawings.
     11. Procedures for maintaining record documents.
     12. Fire and safety procedures.
     15. Housekeeping procedures.
     16. Use of premises
        a. Office and storage locations.
        b. Personnel parking.
        c. Major equipment deliveries.
        d. Other issues pertinent to completing the contract.
   D. Meeting minutes: Minutes will be taken by the A/E and distributed to EXCHANGE, Contractor, and Installation Engineer.

1.03 PROGRESS MEETINGS
   A. The contractor shall schedule and preside at monthly progress meetings.
   B. The contractor shall make arrangements for meetings, prepare agenda with copies for participants.
   C. Location of Meetings: Construction office, or as directed in the notice.
   D. Attendance Required:
      1. Contractor's project manager.
      2. Contractor's superintendent.
3. Major sub-contractors and suppliers.
4. EXCHANGE representative (EXCHANGE’s option).

E. Agenda:
1. Review minutes of previous meetings.
2. Review of work progress.
3. Field observations, problems and decisions.
4. Identification of problems which impede planned progress.
5. Review of submittals schedule and status of submittals.
6. Review of off-site fabrication and delivery schedules.
7. Maintenance of progress schedule.
8. Corrective measures to regain projected schedules.
9. Coordination of projected progress.
10. Maintenance of quality and work standards.
11. Effect of proposed changes on progress schedule and coordination.
12. Other business relating to work.

F. Meeting Minutes: A/E shall record meeting minutes, and distribute copies to the participants (including the EXCHANGE Contracting Officer, within three (3) business days of the meeting.

1.04 PROJECT MEETINGS

A. The Contractor shall schedule and preside at other project meetings when required.

B. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect, and EXCHANGE’s Commissioning Authority of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
   b. Options.
   c. Related RFIs.
   d. Related Change Orders.
   e. Purchases.
   f. Deliveries.
   g. Submittals.
   h. Review of mockups.
   i. Possible conflicts.
   j. Compatibility requirements.
   k. Time schedules.
   l. Weather limitations.
   m. Manufacturer’s written instructions.
   n. Warranty requirements.
   o. Compatibility of materials.
   p. Acceptability of substrates.
   q. Temporary facilities and controls.
   r. Space and access limitations.
   s. Regulations of authorities having jurisdiction.
   t. Testing and inspecting requirements.
   u. Installation procedures.
   v. Coordination with other work.
   w. Required performance results.
   x. Protection of adjacent work.
   y. Protection of construction and personnel.
3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.

4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.

5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

C. Coordination Meetings: At weekly intervals, in addition to specific meetings held for other purposes.

PART 2 - PRODUCTS (NOT USED)
PART 3 - EXECUTION (NOT USED)

END OF SECTION
SECTION 01 32 00
CONSTRUCTION PROGRESS DOCUMENTATION

PART 1   GENERAL
1.01   SECTION INCLUDES
   A. Format.
   B. Content.
   C. Revisions to schedules.
   D. Submittals.
   E. Progress photographs.

1.02   RELATED SECTIONS
   A. General Provisions of the EXCHANGE Contract for Construction, Article entitled: "Schedule and Progress."
   B. Section 01 10 00 - Summary.
   C. Section 01 33 00 - Submittals.

1.03   GENERAL
   A. The Contractor-prepared progress chart shall serve as a guide in managing the construction progress.
   B. In preparing this system, the scheduling of construction shall be the responsibility of the Contractor.
   C. The schedules shall be prepared using the Critical Path Method (CPM).

1.04   FORMAT
   A. Prepare schedules as a horizontal bar chart with separate bar for each major portion of work or operation, identifying first workday of each week.
   B. The format shall be such to enable the Contracting Officer to evaluate the reasonableness of the proposed schedule and to determine if the actual construction is on schedule.

1.05   CONTENT
   A. Show complete sequence of construction by activity with dates for beginning and completion of each element of construction.
   B. Identify each item by specification section number.
   C. Show accumulated percentage of completion of each item and total percentage of Work completed as of the first day of each month.
   D. Indicate delivery dates for EXCHANGE furnished products.

1.06   REVISIONS TO SCHEDULES
   A. Indicate progress of each activity to date of submittal and projected completion date of each activity.
   B. Identify activities modified since previous submittal, major changes in scope and other identifiable changes which could affect the schedule.
   C. Provide narrative report with each submittal describing work accomplished during the previous period, the work scheduled for the next period, anticipated problem areas and delays and impact on the schedule. Report corrective action taken or proposed.

1.07   SUBMITTALS
   A. Submit a preliminary schedule through the Contracting Officer defining the Contractor's proposed operations for the first sixty (60) of the contract within ten (10) days after date of Notice to Proceed. Indicate the Contractor's general approach for the balance of the project.
Include the cost of the activities expected to be completed or partially completed before submission and approval of the complete progress schedule.

B. Upon approval of the preliminary schedule by the Contracting Officer and within thirty (30) calendar days after the Notice to Proceed, the Contractor shall submit the complete Progress Schedule.

C. Submit revised Progress Schedules with each monthly Application for Payment.

D. Submit the number of opaque reproductions which Contractor requires plus four (4) copies which will be retained by Contracting Officer.

1.08 DISTRIBUTION

A. Distribute copies of reviewed schedules to project site file, subcontractors, suppliers and other concerned parties.

B. Instruct recipients to promptly report in writing, problems anticipated by projections indicated in schedules.

1.09 PROGRESS PHOTOGRAPHS

A. Submit new photographs at least once a month, within 3 days after exposure.

B. Photography Type: Digital; electronic files.

C. Provide photographs of site and construction throughout progress of Work produced by an experienced photographer, acceptable to Contracting Officer's Representative.

D. In addition to periodic, recurring views, take photographs of each of the following events:
   1. Existing building exteriors and interiors, prior to beginning work, as evidence of existing project conditions.
   2. New exterior construction, in progress and upon completion.
   3. New interior construction, in progress and upon completion.
   4. Final completion, minimum of ten (10) photos.

E. Views:
   1. Consult with Contracting Officer's Representative for instructions on views required.
   2. Provide factual presentation.
   3. Provide correct exposure and focus, high resolution and sharpness, maximum depth of field, and minimum distortion.
   4. Point of View Sketch: Provide sketch identifying point of view of each photograph.

F. Digital Photographs: 24 bit color, minimum resolution of 1600 by 1200 ("2 megapixel"), in JPG format; provide files unaltered by photo editing software.
   1. Delivery Medium: Via email, and with separate project record photo CD.
   2. File Naming: Include project identification, date and time of view, and view identification.
   3. Point of View Sketch: Include digital copy of point of view sketch with each electronic submittal; include point of view identification in each photo file name.
   4. PDF File: Assemble all JPG photos into printable pages in PDF format, with 1 photo per page, each photo labeled with file name; one PDF file per submittal.
   5. Photo CD(s): Provide 2 copies including all photos cumulative to date and PDF file(s), with files organized in separate folders by submittal date.
      a. Provide 1 Photo CD each to Contracting Officer's Representative and Architect on a monthly basis.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION
PART 1   GENERAL

1.01   SECTION INCLUDES
   A. Submittal procedures.
   B. Construction progress schedules.
   C. Shop Drawings.
   D. Samples.
   E. Product Data.
   F. Certificates.

1.02   RELATED SECTIONS
   A. Section 01 10 00 - Summary.
   B. Section 01 32 00 - Construction Progress Documentation.
   C. Section 01 78 39 - Project Record Documents.

1.03   SUBMITTAL PROCEDURES
   A. Transmit each submittal with EXCHANGE Form 4450-48, Shop Drawings and Material Approval Submittal.
   B. Sequentially number the transmittal form. Revise submittals with original number and a sequential alphabetic suffix.
   C. Identify Project, Contractor, subcontractor or supplier; pertinent drawing and detail number, and specification section number, as appropriate.
   D. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
   E. Schedule submittals to expedite the Project. Transmit submittals to Contracting Officer. Coordinate submission of related items.
   F. Identify variations from Contract Documents and Product or system limitations which may be detrimental to successful performance of the completed Work. Failure to identify such variations will not relieve the Contractor of the responsibility for completing the work in full accordance with the Contract Documents even though such submittals are approved by the Contracting Officer.
   G. Prior to approval of the material/product submitted, the contractor shall include with the submittal a written certification that the material/product contains no asbestos. This certificate is mandatory before approval will be issued.
   H. Provide space for Contractor and Contracting Officer review stamps.
   I. When revised for resubmission, identify all changes made since previous submission.
   J. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.

1.04   CONSTRUCTION PROGRESS SCHEDULES
   A. Submit preliminary Progress Schedule within ten (10) days of the Notice to Proceed.
   B. Submit complete (final) Progress Schedule within thirty (30) days of the Notice to Proceed.
   C. Submit monthly revisions of Progress Schedule.
   D. Refer to Section 01 32 00 - Construction Progress Documentation, for submittal information.

1.05   SHOP DRAWINGS
   A. Shop Drawings For Review:
1. Submitted to Contracting Officer for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.
2. Shop drawings shall be prepared by a qualified detailer.
3. Minimum sheet size for shop drawings shall be 8 1/2" x 11".
4. After review, and distribute copies in accordance with Submittal Procedures article above and for record documents purposes described in Section 01 77 00 - Project Closeout.

B. Shop Drawings For Project Close-out:
1. Submitted for the EXCHANGE's benefit during and after project completion.

C. Indicate special utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
1. Submit the number of opaque reproductions which Contractor requires, plus three (four on structural, mechanical, and electrical submittals) copies which will be retained by Contracting Officer.

1.06 SAMPLES
A. Samples For Review:
1. Submitted to Contracting Officer for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.
2. After review, produce duplicates and distribute in accordance with Submittal Procedures article above and for record documents purposes described in Section 01 77 00 - Project Closeout.

B. Samples For Information:
1. Submitted for the Contracting Officer's knowledge as project administrator or for EXCHANGE.

C. Samples For Selection:
1. Submitted to Contracting Officer for aesthetic, color, or finish selection.
2. Submit samples of finishes from the full range of manufacturers' standard colors, or in custom colors (if so stated in the product specification section), textures, and patterns for Contracting Officer selection.
3. After review, distribute in accordance with Submittal Procedures article above and for record documents purposes described in Section 01 77 00 - Project Closeout.

D. Submit samples to illustrate functional and aesthetic characteristics of the Product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.

E. Include identification on each sample, with full Project information.

F. Submit the number of samples specified in individual specification sections; two of which will be retained by Contracting Officer.

G. Reviewed samples which may be used in the Work are indicated in individual specification sections.

H. Coordinate sample submittals with respective shop drawings.

1.07 PRODUCT DATA
A. Submit Manufacturer's catalog sheets, brochures, diagrams, schedules, performance charts, specifications, illustrations, and other descriptive data.

B. Product data that relates to shop drawings or samples must be submitted with the respective shop drawings or samples.

1.08 CERTIFICATES
A. When specified in individual specification sections, submit certification by the manufacturer, installation/application subcontractor, or the Contractor to Contracting Officer, in quantities specified for Product Data.
B. Certify that material or Product conforms to or exceeds specified requirements. Submit supporting reference data, test results, affidavits, and/or certifications as appropriate.

C. Certificates may be recent or previous test results on material or Product, but must be acceptable to Architect/Engineer.

1.09 LIMITATIONS AND CONTRACTOR’S RESPONSIBILITIES

A. Submittals will be reviewed for the limited purpose of checking for conformance with the design concept and the information shown in the drawing and specifications. These reviews shall not include review of the accuracy for completeness of details. A review shall not indicate that the reviewer has checked the entire system of which the reviewed item is a component. The reviewer shall not be required to review partial submissions.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION
SECTION 01 33 10
WEATHER TABLE

PART 1 - GENERAL

1.01 WEATHER TABLE
A. Information and data furnished or referred to in the weather table is furnished for the Contractor's information.

1.02 CONTRACT TIME LIMIT
A. The Contract time limits include weather conditions that are shown in the weather table listed below.

1.03 TIME EXTENSIONS FOR UNUSUALLY SEVERE WEATHER
A. This provision specifies the procedure for determination of time extensions for unusually severe weather affecting exterior work in accordance with the Contract. The following listing defines the monthly anticipated adverse weather days for the contract period and is based on NOAA data for the geographic location of the project.

MONTHLY ANTICIPATED ADVERSE WEATHER CALENDAR DAYS
REDSTONE ARSENAL, ALABAMA

<table>
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<th>JAN</th>
<th>FEB</th>
<th>MAR</th>
<th>APR</th>
<th>MAY</th>
<th>JUN</th>
<th>JUL</th>
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1. The listing of anticipated adverse weather will constitute the base line for monthly weather time evaluations.
2. Throughout the Contract, each month actual adverse weather days will be recorded on a calendar basis (including weekends and holidays) and compared to the monthly anticipated adverse weather in this listing.
3. The term "actual adverse weather days" shall include days impacted by actual adverse weather.
4. The number of actual adverse weather days affecting exterior work shall be calculated chronologically from the first to the last day in each month.
5. Adverse weather days must prevent work for 50 percent or more of the Contractor's work day and delay work critical to the timely completion of the project.
6. If the number of actual adverse weather days exceeds the number of days anticipated in the above listing, the Contractor may submit in writing to the Contracting Officer a request for a time extension within 30 days of the adverse weather. If not submitted in the 30 day period, the request will not be considered.
7. Based upon the above listing, the Contracting Officer will determine if the time extension for the Contractor is warranted.
8. The Contracting Officer will then convert any qualifying delays to calendar days and issue a modification in accordance with contract.
9. Any Time extensions granted under this provision will be at no cost to EXCHANGE.

PART 2 PRODUCTS – NOT USED
PART 3 EXECUTION – NOT USED

END OF SECTION
SECTION 01 35 43
ENVIRONMENTAL PROTECTION

PART 1 GENERAL

1.01 DESCRIPTION

A. The work covered by this section consists of furnishing all labor materials, and equipment and performing all work required for the prevention of environmental degradation during and as a result of construction operations under this contract. These requirements are in addition to any environmental protection requirements elsewhere in these specifications. For the purpose of this specification, environmental pollution is defined as the presence of chemical, physical, or biological elements or agents, not naturally occurring at the site, which adversely affect human health or welfare; unfavorably alter ecological balances important to human life; affect other species of importance to humans; or degrade the utility of the environment for aesthetic and recreational purposes. The control of environmental pollution by the Contractor requires consideration of air, water, and land, and involves noise control, solid waste management and management of radiant energy and radioactive materials, as well as other pollutants. This section also requires the protection of cultural and historic resources.

B. Contractor shall coordinate the work of this section with the work called for under the various Earthwork and Utilities Sections.

1.02 CONTRACTOR’S GENERAL ENVIRONMENTAL COMPLIANCE OBLIGATIONS

A. Work under this contract is to be performed on a government facility. All environmental rules applying to contractor operations elsewhere will also apply on the government facility. Contractor (and any subcontractor, agent or representative) shall comply with all Applicable Federal, State, and local laws and regulations providing for environmental protection and pollution control and abatement. These include but are not limited to: the Clean Air Act, Clean Water Act, Resource Conservation and Recovery Act, Comprehensive Environmental Response, Compensation and Liability Act, Toxic Substances Control Act, Federal Insecticide Fungicide and Rodenticide Act, Coastal Zone Management Act, Endangered Species Act, National Historic Preservation Act, Safe Drinking Water Act, Emergency Planning and Community Right-to-Know Act, Oil Pollution Act, Archaeological Resources Protection Act, and Pollution Prevention Act. Contractor has the duty to determine for itself where such laws and regulations apply. Although the Contractor may request assistance from the Contracting Officer in delineating applicable environmental laws and regulations. Contractor has an independent responsibility to make its own determination and to do so in a timely fashion.

1.03 FINES OR PENALTIES FOR ENVIRONMENTAL NON-COMPLIANCE

A. The Contractor shall be responsible for paying any fines or penalties assessed against EXCHANGE or the Installation or the Army or the Air Force for violations of environmental laws or regulations resulting from acts or omissions of the Contractor or its employees, subcontractors, or agents. This obligation is in addition to any fines or penalties that may be assessed against the Contractor for the same conduct. Contractor may either reimburse these fines or penalties through the Contracting Officer, or with the consent of the Contracting Officer, the Contractor may pay such fines or penalties directly to the regulatory agency or agencies concerned.

1.04 CONTRACTOR’S LIABILITY FOR ENVIRONMENTAL DAMAGES

A. Contractor agrees to hold harmless and indemnify EXCHANGE (which includes the Army, Air Force, or other Department of Defense component, as appropriate) for any and all damages of any kind resulting from environmentally harmful activities by the Contractor, Contractor’s employees or agents of subcontractors. “Damages” includes but is not limited to personal injury, property damages (including diminution of value), or death, environmental restoration and response costs, natural resource damages, expert witness and attorney’s fees, and reimbursement or any and all expenses incurred to obtain permits as a result of Contractor’s failure to identify or obtain permits for itself or AAFES.
1.05 CONTACT WITH ENVIRONMENTAL REGULATORY OFFICIALS
   A. Contractor shall immediately advise the Contracting Officer and the installation environmental office of the content of all contacts with federal, state, or local environmental regulators, before, during, and after the performance of this contract concerning the performance of this contract.

1.06 PERMITS FOR EQUIPMENT USED BY CONTRACTOR IN PERFORMING EXCHANGE CONTRACTS.
   A. For equipment used in the performance of this contract, Contractor shall obtain in Contractor’s name and at no additional expense to EXCHANGE, all permits, coordination’s, certifications other regulatory authorization necessary to perform and complete the work required by this contract under applicable environmental laws and regulations. “Applicable environmental laws and regulations” includes but is not limited to: the Clean Air Act, Clean Water Act, Resource Conservation and Recovery Act, Comprehensive Environmental Response, Compensation and Liability Act, (CERCLA), Toxic Substances Control Act, Federal Insecticide Fungicide and Rodenticide Act, Coastal Zone Management Act, Endangered Species Act, National Historic preservation Act, Safe Drinking Water Act, Emergency Planning and Community Right-to-Know Act, Oil Pollution Act, and Pollution Prevention Act and State, County, and Local laws and regulations on the same subjects.

1.07 PERMITS NEEDED FOR CONSTRUCTION, EXCAVATION, MODIFICATION, RENOVATION, DEMOLITION, INSTALLATION, OR OTHER ALTERATION OF BUILDINGS, STRUCTURES, EQUIPMENT, INSTALLATIONS, REAL PROPERTY OR SYSTEMS
   A. Contractor shall identify all Federal, State, County, or local permits, coordination, certifications or other regulatory authorization requirements under all applicable environmental laws and regulations as defined in (a) above. Contractor shall then prepare and submit in draft all applicable permit applications, coordinations, notices, or other required filings, together with all supporting data to the Contracting Officer for review. Permit applications or notifications or other documents that must be submitted by EXCHANGE will be submitted by EXCHANGE, and any documents that must be submitted by the Contractor will be returned after review to the Contractor for submission. No work requiring permit or other written authorization shall proceed before the Contractor has the permit or authorization or a copy thereof in its possession.

PART 2 - MATERIALS

2.01 RECYCLED MATERIALS
   A. Materials used in this contract shall be to the greatest extent practicable and consistent with financial prudence, made of recycled materials or of materials that are recyclable. Where construction debris such as concrete or asphalt or wood can be recycled, this alternative will be considered.

2.02 ASBESTOS
   A. Asbestos will not be used or included in this project.

2.03 POLYCHLORINATED BIPHENYLS (PCBS)
   A. PCBs will not be used or included in this project.

2.04 LEAD-BASED PAINT
   A. Lead-based paint will not be used or included in this project.

2.05 OZONE-DEPLETING SUBSTANCES
   A. “Class I substance,” as used in this clause, means any substance designated as class I by the Environmental Protection Agency (EPA)(40 CFR Part 82), including but not limited to chlorofluorocarbons, halons, carbon tetrachloride, and methyl chloroform.
   B. “Class II substance,” as used in this clause, means any substance designated as class II by EPA (40 CFR Part 82), including but not limited to, hydrochlorofluorocarbons.
   C. As required by 42 USC 7671 (b), (c), and (d) and 40 CFR Part 82, Subpart E, the Contractor shall label products which contain class I or class II ozone-depleting substances or are
manufactured with a process that uses class I or class II ozone-depleting substances, or containers of class I or class II ozone-depleting substances as follows:

WARNING: Contains (or manufactured with, if applicable) ____________________,* (a) substance(s) which harm(s) public health and the environment by destroying ozone in the upper atmosphere.

* The Contractor shall insert the name of the substance(s).

D. The Contractor shall comply with the applicable requirements of Sections 608 and 609 of the Clean Air Act (42 USC 7671g, National Recycling and Emission Reduction Program and 7671h, Servicing of Motor Vehicle Air Conditioners) as each or both apply to the contract.

2.06 PESTICIDES
A. Except as may be specified elsewhere in this contract, Contractor will not use or apply pesticides (such as herbicides or weed-killers, insecticides, or rodenticides) without specific written prior approval of the Contracting Officer.

PART 3 EXECUTION (WORK PRACTICES)
3.01 GENERAL: SITE DISTURBANCE DURING CONSTRUCTION ACTIVITIES
A. Contractor shall use industry-recognized best management practices to avoid creation of fugitive dust emissions and to avoid and control storm water runoff from the construction site and any temporary roads that may be used for access to it. Water sprinkling may be used to control dust. Contractor shall perform all work under this contract in such a manner that no pollutants of any kind are released into ditches, storm drains, streams, lakes, or other surface waters on or connected to the site.

3.02 PROTECTION OF WATER RESOURCES
A. General: The General Contractor shall not pollute storm drainage, streams, lakes, or reservoirs with fuels, oils, bitumens, calcium chloride, acids, construction wastes, or other harmful materials or pollutants. It is the responsibility of the General Contractor to determine and comply with all applicable federal, state, regional, municipal, and other regulations.
B. Spillage: The General Contractor shall take special measures to prevent chemical, fuels, oils, greases, bituminous materials, waste washings, herbicides, cement, and surface drainage from entering public waters. In the event of a spill, the Contractor must make all required notifications to federal, state, or local authorities and will notify the Contracting Officer immediately.
C. Washing and Curing Water: Water used in aggregate processing, concrete curing, foundation, and concrete lift clean-up and other waste water shall not be allowed to enter the storm drainage system.

3.03 PROTECTION OF LAND RESOURCES
A. General: It is intended that the land resources within the project boundaries and outside the limits of permanent work performed under this contract be preserved in their present condition or be restored to a condition after completion of construction that will appear to the natural and not detract from the appearance of the project. The General Contractor shall limit his construction activities to areas defined by the Drawings or Specifications.
B. Prevention of Landscape Defacement: Except in areas marked on the plans to be cleared, the General Contractor shall not deface, remove, cut, injure or destroy trees or shrubs without specific written authority. Trees designated to be saved shall be protected from either excavation or filling within the root zone. No ropes, cables, or guys shall be fastened or attached to any existing tree for anchorage unless specifically authorized by the Contracting Officer. The General Contractor shall in any event be responsible for any damage resulting from such use.
C. Restoration of Landscape Damage: Any trees or other landscape features scarred or damaged by the General Contractor’s equipment or operations shall be restored as nearly as possible to the original condition at the General Contractor’s expense. The Contracting Officer will decide what method of restoration shall be used, and whether damaged trees shall be treated and healed or removed and disposed of under requirements for clearing and grubbing. All scars made on trees not designated on the plans to be removed by equipment construction operations, or by the removal of limbs larger than 1-inch in diameter shall be coated immediately with an approved tree wound dressing. All trimming or pruning shall be performed in an approved manner by experienced landscape personnel. Tree trimming with axes shall not be permitted. Trees that are to remain, either within or outside established clearing limits, that are subsequently damaged by the General Contractor and are beyond saving in the opinion of the Contracting Officer, shall be immediately removed and replaced with a nursery-grown tree of the same species.

3.04 CONTROL OF AIR EMISSIONS

A. Contractor’s actions shall conform to all federal, state, and local requirements for the control of air emissions during work under this contract. Trucks leaving the site will be brushed or washed to remove all practicable amounts of dust or other material that may become airborne. Contractor will ensure that all internal construction vehicles and equipment used will have the lowest practicable emissions characteristics and be maintained in optimum operating condition for the reduction of air emissions. Where use of electric motors instead of internal combustion engines is feasible, electric motors will be used during construction.

3.05 POLLUTION PREVENTION

A. The Contractor should use prior planning to find those materials that will minimize the creation of waste in general and hazardous waste in particular. Recycling should be considered and implemented at every practicable stage of the project.

3.06 WASTE DISPOSAL

A. Pollution Prevention: The Contractor should use prior planning to find those materials and work practices that will minimize the creation of waste in general and hazardous waste in particular.

B. Hazardous Waste Generation, Handling, and Disposal: Work done under this contract is to be performed on a government facility. According to rules and procedures of the United States Environmental Protection Agency, the federal facility is required to have a generator identification number under the Resource Conservation and Recovery Act (RCRA) and to be responsible for wastes (as defined under RCRA) produced, managed, stored, disposed on, or transported from the facility. Accordingly, Contractor will, to the greatest extent practicable, use materials, processes, and techniques that will avoid the creation of hazardous waste. Contractor shall prepare and follow a written waste management and disposal plan for all hazardous wastes generated on the site. Prior to generation of any hazardous wastes, contractor will coordinate planned activities regarding hazardous materials and hazardous waste with the Contracting Officer. Contractor shall submit a written waste management plan, through the Contracting officer, to installation environmental office. Contractor shall follow this plan once it has been approved by the Contracting Officer. Under no circumstances will Contractor bring onto the site hazardous waste that has been generated elsewhere. All hazardous waste will be properly disposed of by the Contractor in accordance with all federal, state, and local requirements.

C. Disposal of Non-RCRA Wastes: All non-hazardous wastes generated on the site as a result of this contract must be disposed of properly, in accordance with all federal, state, and local requirements. Materials will be recycled whenever practicable. Prior to creation of such wastes, the Contractor will submit to the installation environmental management function, through the Contracting Officer, a plan for disposal of wastes. Such plan shall include the types of waste to be created, how they shall be stored, managed and disposed. Contractor shall follow this plan once it has been approved by the installation and Contracting Officer. Such wastes will not be created until approved by the Contracting Officer.

D. Construction Debris:
1. Debris from demolition of existing structures will ordinarily be removed to a location on the Installation, as designated by the installation authorities.

2. If a location on the Installation is not available, other sections in this contract may require the Contractor to remove clean construction debris from the site to a location of the contractor’s choosing off the installation. (Site soil or other site media are not covered by this paragraph.) Debris will be recycled or disposed of in accordance with all applicable federal, state, and local rules. Such debris must be free of all contamination, including but not limited to, lead paint, asbestos, and insecticides. Prior to removal of any construction debris, that debris must be certified by the installation to be free of contamination and of no value to the United States, and this certification must be provided to the Contracting Officer. To expedite work, this may be accomplished by a telex or other suitable electronic means, however, the original certification form must be provided to the Contracting Officer. No form is prescribed for this certification so long as all necessary information is provided and the document is signed by an authorized installation representative. However, an example is provided at the end of this section of the specifications, and this form may be used. All construction debris removed from the installation must be covered by a certification. The Contractor must arrange with installation POC whether all debris will be covered by one certification or if several certifications will be required.

E. Consolidated Waste Disposal Plans: Contractor may, at Contractor’s option submit for approval as specified above one consolidated plan for handling hazardous and non-hazardous wastes.

F. Earthwork and Removal of Potentially Contaminated Media:
1. Unless otherwise specified elsewhere in this contract, the site has been inspected and is, consistent with best professional judgment, free of environmental contamination or pollution. However, work under this contract will be performed on a military installation, where the history of prior military and industrial activities is not necessarily completely known. The following provisions prohibit the removal from the installation of soil or other materials found on site and are included, in an abundance of caution, for the protection of EXCHANGE, the installation, and the Contractor.
2. Notwithstanding any another clause in this contract, including but not limited to all standard site work general provisions; no media by-product resulting from site preparation, construction or excavation shall be moved off the post, base, or installation where the construction is occurring. If the construction is off the post, base or installation, no media by-product shall be moved off the construction site.
3. The Contractor shall: (1) leave the media in place at the site, subject to appropriate erosion control; or (2) haul the media to and place it at a location on the installation that has been designated wither in this contract or in writing by the Contracting Officer; and (3) if unforeseen difficulties arise, such as excessive quantity of media is generated, the Contractor shall advise the Contracting Officer and shall not remove media from the site without written authorization from the Contracting Officer.

3.07 DEFINITIONS
A. Media – Any soil, water, or air, moved, disturbed or released from a site.
B. The terms hazardous, waste, pollutant, contaminate, substance have the same means and usage here as they commonly do in the CERCLA, RCRA, FWPCS, CAA, TSCA, and SDWA respectively.

3.08 UNEXPECTED SITE CONDITIONS
A. CONTAMINATED SOIL OR GROUNDWATER:
1. Unless otherwise specified elsewhere in this contract, site has been inspected and is, consistent with best professional judgment, free of environmental contamination of pollution. However, unforeseen conditions can always arise. Contractor or subcontractor personnel may encounter soil or groundwater that is suspected to be contaminated, either because of odors, colors, free liquids, unexpected construction debris, or other suspicious conditions. Should this occur, Contractor will immediately notify the Contracting Officer.
and the installation environmental office and take necessary initial measures to protect
workers, the site, and other personnel.

B. UNEXPECTED ARTIFACTS OR RELICS:
   1. Should Contractor employees in the course of site preparation or other work on this
      contract find unexpected historic or archaeological remains, such as bones, arrow points,
      pottery remnants, foundations, or other evidence or previous uses of the site, Contractor
      will cease further site-disturbing activity and immediately notify the Contracting Officer and
      installation environmental office.

INSTALLATION CERTIFICATION FOR CLEAN CONSTRUCTION DEBRIS TO BE REMOVED
FROM EXCHANGE PROJECT SITE

As representative of ________________________________________(insert name of
Installation), I am authorized to certify, and hereby do so certify, that the construction
debris to be removed from the EXCHANGE project site at:

_____________________________________________________________________
(describe project and list address, for example Main Exchange Project, 111 Road A, X
installation) has been inspected and is of no value to the United States and is free of all
contamination, including but not limited to: lead paint, asbestos, PCBs, and pesticides.

CERTIFICATION:

Signed: __________________________________________________________
Date:     _________________________

Printed Name, Rank or Grade, and Duty Title:
____________________________________________________

ORIGINAL OF THIS FORM MUST BE PROVIDED TO CONTRACTING OFFICER

END OF SECTION
SECTION 01 40 00
QUALITY REQUIREMENTS

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

A. The General Contractor (GC) shall establish a quality control system to perform sufficient inspection and tests of all items of work, including that of the subcontractor(s) to insure conformation to applicable specifications and drawings with respect to the materials, workmanship, construction, finish and functional performance. GC is responsible for the quality of his work and the work of all the subcontractors. Tests of materials and/or special inspections will be made, when required by the specifications, by applicable law, rules and regulations in accordance with respective Sections of the specifications. Where required, the GC shall employ and pay for the services of an Independent Testing Agency to perform specific services and testing. Examples of such services are tests of fill materials, concrete materials, concrete mix design, asphalt concrete laboratory testing of materials proposed and calculations for asphalt concrete mixtures, etc.

B. GC shall arrange and pay for all services and testing which are not specifically indicated to be provided by EXCHANGE. All testing agencies used shall be approved by the Government.

C. If a material is not required to be field tested, the Contracting Officer may require the supplier to furnish with each delivery of such material, a certificate bearing legal signature of said supplier, stating that such material complies with specification requirements.

D. If any work or material requiring tests and inspections is executed, enclosed or covered before tests and inspections are made, or test reports distributed, the GC shall, at his own expense, uncover such part of this work or material and keep it uncovered until such tests and inspections have been made and test reports distributed. If work or material so tested and inspected shall not be found to conform to the requirements of the Construction Documents, it shall be deemed and construed to be defective materials or faulty workmanship and the GC, at its own expense, shall replace work or material removed and repair all work disturbed thereby.

1.02 RELATED REQUIREMENTS

A. See Section 01 33 00 - Submittals, for submittal procedures.

B. Related requirements and tests are specified in Divisions 2 through 33.

1.03 EXCHANGE RESPONSIBILITY

A. EXCHANGE will employ and pay for the services of an Independent Testing Agency to perform specified quality control testing during construction, as indicated in the various specification sections.

1.04 CONTRACTOR’S RESPONSIBILITES

A. Cooperate with the Contracting Officer and Independent Testing Agency Laboratory personnel and provide access to work and to manufacturer’s operations.
   1. Provide samples of materials to be tested, in required quantities.
   2. Furnish incidental labor and facilities required to provide access to work to be tested; to obtain and handle samples at the site; to facilitate inspections and tests; and for Independent Testing Agency Laboratory’s exclusive use for storage and curing of test samples.
   3. Notify Laboratory sufficiently in advance of operations to allow for its assignment of personnel and scheduling of tests.
   4. When tests or inspections cannot be performed after such notice, reimburse Government for Independent Testing Agency personnel and travel expenses incurred by the Government due to the GC’s negligence.

B. Provide to the testing agency the preliminary design mix proposed to be used for concrete, and other materials mixes which require control by the testing laboratory.

C. Furnish copies of products test reports as required.
D. Employ and pay for the services of the testing agency to perform additional inspection, sampling and testing required:
   1. For the GC's convenience.
   2. When initial tests indicate work does not comply with Contract Documents.
   3. When, in the opinion of the Contracting Officer, additional tests or inspections are required because of the manner in which the GC executes the work. Examples of such tests and inspections are:
      a. Tests of materials substituted for previously accepted substituted or specified materials.
      b. Re-tests made necessary by failure of material to comply with the requirements of the specifications.
      c. Load tests made necessary because of portions of the structure not fully meeting specifications or plan requirements.

E. The use of EXCHANGE’S or GC's independent testing services shall in no way relieve the GC of the responsibility to furnish materials and construction in full compliance with the plans and specifications.

F. The Contractor shall coordinate with both EXCHANGE and his own testing laboratories so that the work will be inspected and tested according to contract requirements. This coordination includes notification of when tests should be taken, easy access to the work, and general cooperation in every way to insure proper control of the work.

G. Upon completion of the project, submit a notarized certificate stating tests for this work were made in accordance with provisions of these specifications and, further, all such tests and reports made were reported as required. This certificate shall list all tests and dates when work was completed.

1.05 QUALIFICATION OF TESTING AGENCY

A. Meet basic requirements of ASTM E329 - "Standards of Recommended Practice for Inspection and Testing Agencies for Concrete, Steel and Bituminous Materials as Used in Construction," latest edition.

B. Authorized to operate in the state in which the project is located.

1.06 TESTING AGENCY RESPONSIBILITIES

A. Cooperate with the Contracting Officer and GC; provide qualified personnel after due notice.

B. Perform specified instructions, observations, sampling and testing of materials and methods of construction.
   1. Comply with specified standards.

C. Promptly notify the Contracting Officer and GC of observed irregularities, deficiencies, or non-conformance of work or products.

D. Promptly submit written report of each test and inspection. Each report shall include:
   1. Date issued.
   2. Project title and number.
   3. Testing laboratory name, address and telephone number.
   4. Name and signature of laboratory inspector.
   5. Date and time of sampling or inspection.
   6. Record of temperature.
   7. Date of test.
   8. Identification of product and specification section.
   9. Location of sample or test in the project.
   10. Type of inspection or test.
   11. Results of tests and compliance with Contract Documents.
   12. Interpretation of test results, when requested by the Contracting Officer.

E. Report results of all tests in writing simultaneously to the following:
1. Contracting Officer or authorized representative: 3 copies
2. Site Inspector: 1 copy
3. General Contractor: 1 copy
4. Architect/Engineer: 1 copy

F. Perform additional tests as required by the Contracting Officer.
   1. Additional Tests: The testing service will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by the Contracting Officer. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42, or by other methods as directed. Contractor shall pay for such tests when unacceptable concrete is verified.

G. Upon completion of the project, submit a notarized certificate stating tests for this work were made in accordance with provisions of these Specifications and, further, all such tests and reports made for job were reported as required.

1.07 LIMITATIONS OF AUTHORITY OF TESTING AGENCY

A. Agency is not authorized to:
   1. Release, revoke, alter or enlarge on requirements of Contract Documents.
   2. Approve or accept any portion of the work.
   3. Assume any duties of the GC.
   4. Stop the Work.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION
SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

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

1.02 RELATED REQUIREMENTS
A. Section 01 10 00 - Summary: Work restrictions and limitations on utility interruptions.
B. Section 01 59 00 - Field Offices and Sheds.

1.03 USE CHARGES
A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, occupants of Project, testing agencies, and authorities having jurisdiction.
B. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.
C. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.04 INFORMATIONAL SUBMITTALS
A. Site Plan: Submit site plan showing locations of field offices, storage sheds, utility hookups, staging areas, lay-down areas, Conex areas, and parking areas for construction personnel.
B. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.
C. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.
D. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.
   1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
   2. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.
   3. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
E. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:
   1. Locations of dust-control partitions at each phase of work.
   2. HVAC system isolation schematic drawing.
   3. Location of proposed air-filtration system discharge.
   5. Other dust-control measures.
   6. Contractor shall provide any required testing and balancing of the HVAC system(s).
1.05 QUALITY ASSURANCE
   A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
   B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.
   C. Accessible Temporary Egress: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines.

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

PART 2 PRODUCTS

2.01 MATERIALS
   A. Chain-Link Fencing: Minimum 2-inch, 0.148-inch-thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch OD line posts and 2-7/8-inch OD corner and pull posts, with 1-5/8-inch OD top rails.
   B. Portable Chain-Link Fencing: Minimum 2-inch, 0.148-inch-thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch OD line posts and 2-7/8-inch OD corner and pull posts, with 1-5/8-inch OD top and bottom rails. Provide galvanized-steel bases for supporting posts.
   C. Wood Enclosure Fence: Plywood, 6 feet high, framed with four 2-by-4-inch rails, with preservative-treated wood posts spaced not more than 8 feet apart.
   D. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.
   E. Dust-Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches.
   F. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

2.02 TEMPORARY FACILITIES
   A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
   B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:
      1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
      2. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V AC duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot-square tack and marker boards.
      3. Coffee machine and supplies; drinking water.
      4. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 76 deg F.
      5. Lighting fixtures capable of maintaining average illumination of 50 fc at desk height.
      6. See Section 01 59 00 - Field Offices and Sheds, for further requirements.
   C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
      1. Store combustible materials apart from building.
2.03 EQUIPMENT

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

B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
   1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
   2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
   3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille in system and remove at end of construction and clean HVAC system as required in Section 01 77 00 - Project Closeout.

C. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 EXECUTION

3.01 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
   1. Locate facilities to limit site disturbance as specified in Section 01 10 00 - Summary.

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

3.02 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.
   1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

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

C. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

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

F. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.
   1. Prior to commencing work, isolate the HVAC system in area where work is to be performed according to coordination drawings.
      a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
      b. Maintain negative air pressure within work area using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.
   2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.
3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.

G. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
   1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.

H. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.

I. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
   1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

J. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install one telephone line(s) for each field office.
   1. Provide additional telephone lines for the following:
      a. Provide a dedicated telephone line for each facsimile machine in each field office.
   2. At each telephone, post a list of important telephone numbers.
      a. Police and fire departments.
      b. Ambulance service.
      c. Contractor's home office.
      d. Contractor's emergency after-hours telephone number.
      e. Architect's office.
      f. Engineers' offices.
      g. Owner's office.
      h. Principal subcontractors' field and home offices.
   3. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.

K. Electronic Communication Service: Provide a desktop computer in the primary field office adequate for use by Architect and Owner to access Project electronic documents and maintain electronic communications. Equip computer with not less than the following:
   1. Processor: Intel Pentium D or Intel Core Duo, 3.0 GHz processing speed.
   2. Memory: 4 gigabyte.
   4. Display: 22-inch LCD monitor with 256-Mb dedicated video RAM.
   5. Full-size keyboard and mouse.
   7. Operating System: Microsoft Windows 7 or higher.
   8. Productivity Software:
      a. Microsoft Office Professional, Windows 7 or higher, including Word, Excel, and Outlook.
      b. Adobe Reader 10.0 or higher.
      c. WinZip 7.0 or higher.
   9. Printer: "All-in-one" unit equipped with printer server, combining color printing, photocopying, scanning, and faxing, or separate units for each of these three functions.
   10. Internet Service: Broadband modem, router and ISP, equipped with hardware firewall, providing minimum 384 Kbps upload and 1 Mbps download speeds at each computer.
   11. Internet Security: Integrated software, providing software firewall, virus, spyware, phishing, and spam protection in a combined application.
3.03 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:
   1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
   2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Traffic Controls: Comply with requirements of authorities having jurisdiction.
   1. Protect existing site improvements to remain including curbs, pavement, and utilities.
   2. Maintain access for fire-fighting equipment and access to fire hydrants.

C. Parking: Provide temporary or use designated areas of Owner’s existing parking areas, if available and approved by the Exchange for construction personnel.

D. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
   1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
   2. Remove snow and ice as required to minimize accumulations.

E. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
   1. Identification Signs: Provide construction site signage as specified in Section 01 58 00.
   2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
      a. Provide temporary, directional signs for construction personnel and visitors.
   3. Maintain and touchup signs so they are legible at all times.


G. Cleaning: Comply with progress cleaning requirements in Section 01 71 00 - Cleaning.

H. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
   1. Truck cranes and similar devices used for hoisting materials are considered “tools and equipment” and not temporary facilities.

3.04 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
   1. Comply with work restrictions specified in Section 01 10 00 - Summary.

C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, in accordance with requirements of authorities having jurisdiction.
   1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant- protection zones.
   2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
   3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
   4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.
D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

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

F. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

G. Covered Walkway: Erect protective, covered walkway for passage of individuals through or adjacent to Project site. Coordinate with entrance gates, other facilities, and obstructions. Comply with regulations of authorities having jurisdiction and requirements indicated on Drawings.
   1. Construct covered walkways using scaffold or shoring framing.
   2. Provide overhead decking, protective enclosure walls, handrails, barricades, warning signs, exit signs, lights, safe and well-drained walkways, and similar provisions for protection and safe passage.
   3. Paint and maintain appearance of walkway for duration of the Work.

H. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
   1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.
   2. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct fire-rated assemblies having the required fire resistance.
   3. Insulate partitions to control noise transmission to occupied areas.
   4. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
      a. Provide a pair of 3’ x 7’ doors in temporary partitions at main access points for construction activities and equipment access.
      b. Provide single 3’ x 7’ doors in temporary partitions at other required access points for construction workers or emergency egress.
   5. Protect air-handling equipment.
   6. Provide walk-off mats at each entrance through temporary partition.

I. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.
   1. Prohibit smoking in construction areas.
   2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
   3. Develop and supervise an overall fire-prevention and protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
   4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.
3.05 MOISTURE AND MOLD CONTROL

3.06 OPERATION, TERMINATION, AND REMOVAL
   A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
   B. Maintenance: Maintain facilities in good operating condition until removal.
      1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
   C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
   D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
      1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
      2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
      3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 01 77 00 - Project Closeout.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES
A. Project identification sign.
B. Project informational signs.
C. Maintenance.
D. Removal.

1.02 RELATED REQUIREMENTS
A. Section 01 10 00 - Summary: Responsibility to provide signs.

1.03 QUALITY ASSURANCE
A. Design sign and structure to withstand American Society of Civil Engineers (ASCE) Standard 7, 120 miles/hr wind velocity @ 3 seconds.
B. Sign Painter: Experienced as a professional sign painter for minimum three years.
C. Finishes, Painting: Adequate to withstand weathering, fading, and chipping for duration of construction.

1.04 SUBMITTALS
A. See Section 01 33 00 - Submittals, for submittal procedures.
B. Attached sign exemplars are current proposed templates from EXCHANGE. Obtain most recent sign template from EXCHANGE prior to producing sign layout.
C. Shop Drawing: Show content, layout, lettering, color, foundation, structure, sizes and grades of members.

PART 2 PRODUCTS

2.01 SIGN MATERIALS
A. Structure and Framing: New, wood, structurally adequate.
B. Sign Surfaces: Exterior grade plywood with medium density overlay, minimum 3/4 inch thick, 48 inches x 96 inches.
C. Rough Hardware: Galvanized.
D. Paint and Primers: Exterior quality, two coats, colors as selected.
E. Lettering: Exterior quality paint, colors as selected.

2.02 PROJECT IDENTIFICATION SIGN
A. One painted sign of construction, design, and content shown on one of the attachments, at location designated.
B. Graphic Design, Colors, Style of Lettering: Designated by Contracting Officer’s Representative.

2.03 PROJECT INFORMATIONAL SIGNS
A. Painted informational signs of same colors and lettering as Project Identification sign, or standard products; size lettering to provide legibility at 100 foot distance.
B. Provide at each field office, storage shed. Relocate as Work progress requires.

PART 3 EXECUTION

3.01 INSTALLATION
A. Install project identification sign within 30 days after date fixed by Notice to Proceed.
B. Erect at designated location.
C. Erect supports and framing on secure foundation, rigidly braced and framed to resist wind loadings.
D. Install sign surface plumb and level, with butt joints. Anchor securely.
E. Paint exposed surfaces of sign, supports, and framing.

3.02 MAINTENANCE
A. Maintain signs and supports clean; repair deterioration and damage.

3.03 REMOVAL
A. Remove signs, framing, supports, and foundations at completion of Project and restore the area.

3.04 ATTACHMENTS
A. Preferred Sign
B. Alternate Sign

END OF SECTION
PROJECT NAME
INSTALLATION LOCATION

CONTRACTOR'S NAME
CITY, STATE

ARCHITECT'S NAME
CITY, STATE

Alternate

Another project funded using earnings from your Exchange purchases.
SECTION 01 59 00
FIELD OFFICES AND SHEDS

PART 1 - GENERAL

1.01 SECTION INCLUDES
   A. Temporary field offices and sheds.
   B. Maintenance and cleaning.
   C. Removal.

1.02 RELATED SECTIONS
   A. Section 01 10 00 - Summary.
   B. Section 01 50 00 - Temporary Facilities and Controls.

PART 2 - PRODUCTS

2.01 MATERIALS, EQUIPMENT, FURNISHINGS
   A. Materials, Equipment, Furnishings: Serviceable, new or used, adequate for required purpose.

2.02 CONSTRUCTION
   A. Portable or mobile buildings, or buildings constructed with floors raised above ground, securely fixed to foundations, with steps and landings at entrance doors.
   B. Construction: Structurally sound, secure, weather tight enclosures for office and storage spaces. Maintain during progress of Work; remove at completion of Work.
   C. Temperature Transmission Resistance of Floors, Walls, and Ceilings: Compatible with occupancy and storage requirements.
   D. Exterior Materials: Weather resistant, finished in one color acceptable to Contracting Officer.
   E. Interior Materials in Offices: Sheet type materials for walls and ceilings, pre-finished or painted; resilient floors and bases.
   F. Lighting for Offices: 50 foot candles at desk top height, exterior lighting at entrance doors.
   G. Fire Extinguishers: One 10 lb. standard dry chemical (ABC) type fire extinguisher at each office and each storage area.
   H. Interior Materials in Storage Sheds: As required to provide specified conditions for storage of products.

2.03 ENVIRONMENTAL CONTROL
   A. Heating, Cooling, and Ventilating for Offices: Automatic equipment to maintain 68 degrees F heating and 76 degrees F cooling.
   B. Storage Spaces: Heating and ventilation as needed to maintain Products in accordance with Contract Documents; adequate lighting for maintenance and inspection of Products.

2.04 CONTRACTOR OFFICE AND FACILITIES
   A. Size: For Contractor's needs and to provide space for project meetings. Minimum size: 150 square feet.
   B. Telephone: The Contractor shall install, maintain and pay for telephone service for the Contractor's field office including an answering device and outside bell.
   C. Internet, E-Mail and Fax: Install, maintain and pay for services for the Contractor's Field Office.
   D. Furnishings in Meeting Area: Conference table and chairs to seat at least ten persons; racks and files for Contract Documents, submittals, and project record documents.
   E. Other Furnishings: Contractor's option.
   F. Equipment: Six (6) adjustable band protective helmets for visitors, one 10 inch outdoor weather thermometer and a weather protected bulletin board for posting information required by the contract.
2.05 CONTRACTING OFFICER'S FIELD OFFICE
   A. Separate space for sole use by the EXCHANGE Contracting Officer, with separate entrance
door with new lock and two keys.
   B. Area: Minimum 150 sq ft, minimum dimension 8 ft.
   C. Windows: Minimum three minimum total area of 10 percent of floor area, with operable sash
   and insect screens. Locate to provide views of construction area.
   D. Electrical Distribution Panel: Two circuits minimum, 110 volt, single phase service.
   E. Minimum four 110 volt duplex convenience outlets, one on each wall.
   F. Telephone: The Contractor shall install, maintain and pay for telephone service to the
   Contracting Officer's field office, including an answering device. The Contractor shall pay for
   basic service and local calls only, but will not pay for long distance calls.
   G. Furnishings:
      1. One desk 54 x 30 inch, with three drawers.
      2. One drafting table 36 x 72 inch, with one equipment drawer.
      3. Plan rack to hold working Drawings, shop drawings, and record documents.
      4. One standard four-drawer legal size metal filing cabinet with locks and two keys per lock.
      5. Six linear ft of metal bookshelves.
      6. Two swivel arm chairs.
      7. Two straight chairs.
      8. One drafting table stool.
      9. One tackboard 36 x 30 inch.
     10. One waste basket per desk and table.

2.06 STORAGE AREAS AND SHEDS
   A. Size to storage requirements for products of individual Sections, allowing for access and orderly
   provision for maintenance and for inspection of products.

PART 3 - EXECUTION
3.01 PREPARATION
   A. Fill and grade sites for temporary structures to provide drainage away from buildings.

3.02 INSTALLATION
   A. Install office spaces ready for occupancy 15 days after date of Notice to Proceed.
   B. Employee Residential Occupancy: Not permitted on Installation property.

3.03 MAINTENANCE AND CLEANING
   A. Weekly cleaning services for offices; periodic cleaning and maintenance for office and storage
   areas.
   B. Maintain approach walks free of mud, water, and snow.

3.04 REMOVAL
   A. At completion of Work remove buildings, foundations, utility services, and debris. Restore
   areas.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES
A. General product requirements.
B. Transportation, handling, storage and protection.
C. Product option requirements.
D. Substitution limitations and procedures.
E. Procedures for Owner-supplied products.
F. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS
A. Section 00 04 04 - Substitutions.
B. Section 01 10 17 - EXCHANGE Furnished and Installed Equipment (EF/EI).
C. Section 01 10 18 - EXCHANGE Furnished, Contractor Installed Equipment (EF/CI).
D. Section 01 40 00 - Quality Requirements: Product quality monitoring.
E. Section 01 74 19 - Construction Waste Management and Disposal: Waste disposal requirements potentially affecting packaging and substitutions.

1.03 SUBMITTALS
A. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
   1. Submit within 15 days after date of Agreement.
   2. For products specified only by reference standards, list applicable reference standards.
B. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
C. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
D. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
   1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.
E. Indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

PART 2 PRODUCTS

2.01 EXISTING PRODUCTS
A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by the Contract Documents.
B. Unforeseen historic items encountered remain the property of the Owner; notify Owner promptly upon discovery; protect, remove, handle, and store as directed by Owner.
C. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Owner, or otherwise indicated as to remain the property of the Owner, become the property of the Contractor; remove from site.

2.02 NEW PRODUCTS
A. Provide new products unless specifically required or permitted by the Contract Documents.
B. DO NOT USE products having any of the following characteristics:
1. Made using or containing CFC’s or HCFC’s.
2. Made of wood from newly cut old growth timber.
3. Containing lead, cadmium, asbestos.
C. Provide interchangeable components of the same manufacture for components being replaced.
D. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Size terminal lugs to NFPA 70, include lugs for terminal box.
E. Cord and Plug: Provide minimum 6 foot cord and plug including grounding connector for connection to electric wiring system. Cord of longer length is specified in individual specification sections.

2.03 PRODUCT OPTIONS
A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.
B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.
C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.04 MAINTENANCE MATERIALS
A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.
B. Deliver and place in location as directed; obtain receipt prior to final payment.

PART 3 EXECUTION
3.01 SUBSTITUTION PROCEDURES
A. Section 00 04 04 - Substitutions specifies time restrictions and methodology for submitting requests for substitutions during the bidding period.
1. AFTER THE CONTRACT IS AWARDED, NO FURTHER SUBSTITUTIONS WILL BE PERMITTED.

3.02 OWNER-SUPPLIED PRODUCTS
A. See Section 01 10 17 - EXCHANGE Furnished and Installed Equipment (EF/EI): Schedules of Materials and Equipment (EF/EI).
B. See Section 01 10 18 - EXCHANGE Furnished, Contractor Installed Equipment (EF/CI): Schedule of Materials and Equipment (EF/CI).
C. Owner's Responsibilities:
   1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.
   2. Arrange and pay for product delivery to site.
   3. On delivery, inspect products jointly with Contractor.
   4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
   5. Arrange for manufacturers’ warranties, inspections, and service.
D. Contractor's Responsibilities:
   1. Review Owner reviewed shop drawings, product data, and samples.
   2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.
   3. Handle, store, install and finish products.
   4. Repair or replace items damaged after receipt.

3.03 TRANSPORTATION AND HANDLING
A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.
B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.
C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
D. Transport and handle products in accordance with manufacturer’s instructions.
E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.
H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.04 STORAGE AND PROTECTION
A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.
B. Store and protect products in accordance with manufacturers’ instructions.
C. Store with seals and labels intact and legible.
D. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.
E. For exterior storage of fabricated products, place on sloped supports above ground.
F. Provide bonded off-site storage and protection when site does not permit on-site storage or protection.
G. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.
H. Comply with manufacturer’s warranty conditions, if any.
I. Do not store products directly on the ground.
J. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
K. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
L. Prevent contact with material that may cause corrosion, discoloration, or staining.
M. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
N. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION
SECTION 01 65 00
STARTING OF SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES
   A. Starting Systems.
   B. Demonstration and instructions.
   C. Testing, adjusting and balancing.

1.02 RELATED SECTIONS
   A. Section 01 40 00 - Quality Requirements: Manufacturers field reports.
   B. Section 01 77 00 - Project Closeout: System operation and maintenance data and extra materials.
   C. Section 23 05 93 - Testing, Adjusting and Balancing for HVAC: System Commissioning.

1.03 STARTING SYSTEMS
   A. Coordinate schedule for start-up of various equipment and systems.
   B. Notify Contracting Officer seven (7) working days prior to start-up of each item.
   C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions which may cause damage.
   D. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
   E. Verify that wiring and support components for equipment are complete and tested.
   F. Execute start-up under supervision of applicable manufacturer’s representative and/or Contractors’ personnel in accordance with manufacturers’ instructions.
   G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
   H. Submit a written report in accordance with Section 01 33 00 that equipment or system has been properly installed and is functioning correctly.

1.04 DEMONSTRATION AND INSTRUCTIONS
   A. Demonstrate operation and maintenance of products to EXCHANGE and Facility personnel two weeks prior to date of final inspection.
   B. Demonstrate project equipment by a qualified representative who is knowledgeable about the project.
   C. For equipment of systems requiring seasonal operation, perform demonstration for other season within six months.
   D. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with AAFES/Installation personnel in detail to explain all aspects of operation and maintenance.
   E. Demonstrate start-up, operation, control adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at agreed time at designated location.
   F. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.
   G. The amount of time required for instruction on each item of equipment and system is that specified in individual sections.

1.05 TESTING, ADJUSTING AND BALANCING
   A. EXCHANGE will appoint, employ, and pay for services of an independent firm to perform testing, adjusting, and balancing.
   B. The independent firm will perform services specified in Section 23 05 93.
C. Reports will be submitted by the independent firm to the Contracting Officer indicating observations and results of tests and indicating compliance or non-compliance with the requirements of the Contract Documents.

PART 2 – PRODUCTS (NOT USED)
PART 3 – EXECUTION (NOT USED)

END OF SECTION
SECTION 01 71 00
CLEANING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Progress Cleaning.
B. Final Cleaning.

1.02 RELATED SECTIONS

A. General Provisions of the Contract.
B. Section 01 10 00 - Summary.
C. Section 01 14 50 - Cutting and Patching.
D. Section 01 50 00 – Temporary Facilities and Controls.
E. Individual Specification Sections - Cleaning Requirements.

1.03 SAFETY REQUIREMENTS

A. Standards: Maintain project in accordance with the following safety and insurance standards:
      Requirements", as referred to in General Provisions, Paragraph: Accident Prevention.

B. O.S.H.A. Standards:
   1. The Contractor shall be required to comply with OSHA Requirements in 29 CFR 1926 and
      29 CFR in 1910. The OSHA Standards are subject to change, and such changes may
      affect the Contractor in his performance under the contract. It is the Contractor's
      responsibility to know such changes, effective dates of changes, and comply with all
      requirements.

C. Hazards Control:
   1. Store volatile wastes in covered metal containers and remove from premises daily.
   2. Prevent accumulation of wastes which create hazardous conditions.
   3. Provide adequate ventilation during the use of volatile or noxious substances.

D. Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution
   laws.
   1. Do not burn or bury rubbish and waste materials on the installation.
   2. Do not dispose of volatile wastes such as mineral spirits, oil, or paint thinner in storm or
      sanitary drains.
   3. Do not dispose of wastes into streams or waterways.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Use only cleaning materials recommended by the manufacturer of the surface to be cleaned.
B. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

PART 3 - EXECUTION

3.01 PROGRESS CLEANING

A. Execute cleaning to ensure that the building, grounds, and public properties are maintained free
   from accumulations of waste materials and rubbish.
B. Maintain site in a clean and orderly condition.
C. Wet down dry materials and rubbish to lay dust and prevent blowing dust.
D. Remove waste materials, debris, and rubbish from site and legally dispose of at public or private
   dumping areas off of Government property.
E. Vacuum clean interior building areas when ready to receive finish painting, and continue
   cleaning to eliminate dust.
F. Handle materials in a controlled manner with as few handlings as possible; do not drop or throw materials from heights. Open free-fall chutes are not permitted.

G. Schedule cleaning operations so that dust and other contaminants resulting from the cleaning process will not fall on wet, newly painted surfaces.

3.02 FINAL CLEANING

A. Employ professional cleaners for final cleaning.

B. In preparation for substantial completion or occupancy, conduct final inspection of sight-exposed interior and exterior surfaces and of concealed spaces.

C. Remove grease, dust, dirt, stains, temporary labels, fingerprints, and other foreign materials from sight-exposed interior and exterior finished surfaces; polish surfaces so designated to shine; finish vacuum carpeted and soft surfaces.

D. Repair, patch, and touch-up marred surfaces to specified finish, to match adjacent surfaces.

E. Clean debris from roofs, gutters, downspouts, and drainage systems.

F. Broom clean paved surfaces; rake clean other surfaces of grounds.

G. Clean all glass.

H. Replace air conditioning filters if units were operated during construction.

I. Clean ducts, blowers, and coils, if air HVAC units were operated without filters during construction.

J. Maintain cleaning until project, or portion thereof, is occupied by EXCHANGE.

END OF SECTION
SECTION 01 77 00  
PROJECT CLOSEOUT

PART 1 - GENERAL

1.01 SECTION INCLUDES
A. Substantial Completion.
B. Final Inspections.
C. Operation and Maintenance Manual requirements.
D. Operation and Maintenance Instruction requirements.
E. DD Form 1354 requirements.
F. Warranty requirements.

1.02 RELATED SECTIONS
A. General Provisions of the Contract: Final Acceptance and Payment.
B. Section 01 33 00 - Submittals.
C. Section 01 65 00 - Starting of Systems.
D. Section 01 71 00 - Cleaning.
E. Section 01 78 39 - Project Record Documents.

1.03 SUBSTANTIAL COMPLETION
A. Preliminary Procedures: Before requesting Substantial Completion inspection, provide the following.
1. Contractor's list of incomplete items (punch list).
   a. Submit PDF electronic file.
   b. Submit paper copies.
2. Six copies of all Operation and Maintenance Manuals and all other close-out materials. These items shall be organized in 3-ring binders as described below.
4. A digital copy of the "As-Built" Record Drawings and Specifications in PDF format, submitted to the Contracting Officer and Architect.
5. Warranties, maintenance service agreements, and similar documents.
6. Releases, occupancy permits, and operating certificates.
7. Tools, spare parts, and extra materials, delivered to Contracting Officer's Representative.
8. Final changeover of locks performed.
9. Startup testing completed.
11. Temporary facilities removed.
12. Owner advised of heat and utility changeover.
13. Owner advised of pending insurance changeover.
15. Owner's personnel instructed in operation, adjustment, and maintenance of equipment and systems, including demonstration and training videotapes submitted.

B. Contractor:
1. Submit written certification to Contracting Officer that project, or designated portion of Project, is substantially complete.
2. Submit list of major items to be completed or corrected.

C. Contracting Officer will make an inspection after receipt of certification.

D. Should Contracting Officer consider that work is substantially complete:
1. Contractor shall prepare, and submit to Contracting Officer, a list of items to be completed or corrected, as determined by the inspection.
2. Contracting Officer will prepare and issue a Certificate of Substantial Completion, containing:
   a. Date of Substantial Completion.
   b. Contractor's list of items to be completed or corrected, verified, and amended by Contracting Officer.
   c. The time within which Contractor shall complete or correct work of listed items.
   d. Time and date EXCHANGE will assume possession of work or designated portion thereof.
   e. Responsibilities of EXCHANGE and Contractor for:
      1) Utilities.
      2) Operation of mechanical, electrical, and other systems.
      3) Maintenance and cleaning.
      4) Security.
      5) Signatures of:
         (a) Contracting Officer.
         (b) Contractor.
3. EXCHANGE occupancy of project or designated portion of project:
   a. Contractor shall:
      1) Perform final cleaning in accordance with Section 01 71 00.
      2) EXCHANGE will occupy project, under provisions stated in Certificate of Substantial Completion.
   4. Contractor: Complete work listed for completion or correction, within designated time.
E. Should Contracting Officer consider that work is not substantially complete:
   1. He shall immediately notify Contractor, in writing, stating reasons.
   2. Contractor: Complete work, and send second written notice to Contracting Officer, certifying that project, or designated portion of project, is substantially complete.
   3. Contracting Officer will reinspect work.

1.04 FINAL INSPECTION
A. Contractor shall submit written certification that:
   1. Contract documents have been reviewed.
   2. Project has been inspected for compliance with contract documents.
   3. Work has been completed in accordance with Contract Documents.
   4. Equipment and systems have been tested in presence of Facility Representatives and are operational.
   5. Project is completed and ready for final inspection.
B. Contracting Officer will make final inspection after receipt of certification.
C. Should the Contracting Officer consider that work is finally complete in accordance with requirements of contract documents, he shall request Contractor to make project closeout submittals.
D. Should the Contracting Officer consider that work is not finally complete:
   1. He shall notify Contractor, in writing, stating reasons.
   2. Contractor shall take immediate steps to remedy the stated deficiencies, and send second written notice to the Contracting Officer certifying that work is complete.
   3. The Contracting Officer will reinspect work.

1.05 PROJECT RECORD DOCUMENTS
A. Project Record Documents: Provide as specified in Section 01 78 39.

1.06 OPERATION AND MAINTENANCE MANUALS
A. Submit data bound in 8-1/2 x 11 inch text pages, three D side ring binders with durable plastic covers.
B. Prepare binder cover with printed title "Operation and Maintenance Manual," title of project, and subject matter of binder when multiple binders are required.
C. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.

D. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, typed on 24 pound white paper, in three parts as follows:
   1. Part 1: Directory, listing names, addresses, and telephone numbers of Contractor, Subcontractors, and major equipment suppliers.
   2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
      a. Significant design criteria.
      b. List of equipment.
      c. Catalogue data on plumbing fixtures, valves, water heaters, heating and cooling equipment, temperature control, fan, electrical panels, service entrance equipment and light fixtures.
      d. Parts list for each component.
      e. Operating instructions.
      f. Valve chart.
      g. Maintenance instructions for equipment and systems.
      h. Start-up procedures.
      i. Emergency procedures.
      j. Shut-down procedures.
      k. Manufacturer's name, type, color designation for ceramic tile, resilient flooring, windows, doors, brick, concrete block, paint, roofing and other materials.
      l. Maintenance instructions for finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
   3. Part 3: Project documents and certificates, including the following:
      a. Shop drawings and product data.
      b. Air and water balance reports.
      c. Certificates.
      d. Photocopies of warranties.
      e. Training Sessions attendance roster.
      f. Warranties.

E. Submit six (6) hard copies and one PDF digital copy of the Operation and Maintenance Manuals to the Contracting Officer.
   1. Make any additions or revisions to the Operation and Maintenance Manuals as directed by the Contracting Officer or Architect following Substantial Completion review.

1.07 OPERATION AND MAINTENANCE INSTRUCTION

A. The Contractor shall provide, at his expense, manufacturer's representatives to completely check out all mechanical and electrical systems and items covered by the drawings and specifications. This requirement shall be scheduled just prior to, and during the initial start up. After all systems are functioning properly, the representatives shall instruct Facility Maintenance Personnel in the proper operation and maintenance of each item. In addition to instructions given at the project, the Facility Maintenance Personnel shall be given a classroom instruction course on operation and maintenance of the systems. Training sessions shall be limited to four (4) continuous hours where practical. Schedule additional four (4) hour sessions as required.

1.08 DD FORM 1354

A. Preparation of DD Form 1354 "Transfer and Acceptance of Military Real Property": At the conclusion of the project the Contractor will compile and furnish to the Contracting Officer certain costs and quantity data of materials and systems furnished and installed. A list of items for which the costs and quantity data are required will be furnished to the Contractor. Such information will be returned to the Contracting Officer within 10 days from the receipt of the list.
   1. Form is attached at the end of this Section.
1.09 WARRANTY AND EXTENDED WARRANTIES

A. Upon completion of project, prior to final payment, guarantees required by technical divisions of Specifications shall be properly executed in quadruplicate by subcontractors and submitted to Contracting Officer. Delivery of guarantees shall not relieve Contractor from any obligation assumed under contract.

B. Submit guarantee covering entire project for one year. In addition, where separate guarantees for certain portions of work are for longer periods, General Contractor’s guarantee shall be extended to cover such longer periods.

C. Guarantees shall become valid and operative upon issuance of Certificate of Inspection and Acceptance by EXCHANGE. Guarantees shall not apply to work where damage is a result of abuse, neglect by EXCHANGE, or its successor(s) in interest.

PART 2 - PRODUCTS (NOT USED)
PART 3 - EXECUTION (NOT USED)

END OF SECTION
SUGGESTED INSTRUCTIONS FOR PREPARING DD FORM 1354
(TRANSFER AND ACCEPTANCE OF MILITARY REAL PROPERTY)

1. The page number and the total number of pages comprising each transfer shall be shown in the space provided at the top right-hand part of the form.

2. When two or more pages are required, Items 27 through 29 shall be completed only on the final page. In such cases, the bottom portion of the form shall be torn off of all pages, except the final page, at the line above Items 27 and 28.

ITEM 1 - Self – explanatory

ITEM 2 - Primarily for Navy use, the district number will be assigned by area or district public works office in accordance with coding pattern set forth in NAVEXOS P-1570, par. 3805-7, Item 6. For Army use, enter appropriate Army Engineer district where construction is performed and/or from which the transfer is made. For transfer of construction to the Air Force, enter appropriate Army Engineer district or the district number assigned by area, or Naval district public works office from which the construction transfer is made.

ITEM 4 - For Navy use only, see NAVEXOS P-1570, par. 3805-7, Item 5.

ITEM 5 - Enter date of preparation.

ITEM 6 – For Army use, enter appropriate Army job and directive number. For Air Force use, enter base job number, as appropriate, when form is used for transfer within the Air Force.

ITEM 7 – For Army use, or for transfer of construction to the Air Force, enter separate series of numbers, by fiscal year, for each installation to which real property is transferred; e.g., for FY 1962 show 62-1, 62-2, etc. For Navy use, this serial number will be assigned by respective area or district public works office and will represent the numerical sequence of submissions by respective contract number.

ITEM 8 – Insert appropriate contract number.

ITEM 9 – Self-explanatory.

ITEM 10 – 12: Instructions for Items 2, 3 and 4 apply. (not applicable for Air For Use.)

ITEM 13 – For Navy use only. Insert the accounting number assigned to or used by the activity named in accordance with Item 9. See NAVEXOS P-1570, par. 3805-7, Item 10.

ITEM 14 – For Navy use only. Insert the accounting number assigned to the activity performing the official property accounting for the activity shown in Item 9. See NAVCompt Manual, Vol. 2, Chapter 5, for accounting numbers.

ITEM 15 – Insert an “X” in the appropriate box of block (A) to indicate whether the transfer involves new construction, existing facilities or capital improvements to existing facilities. If the “other” category is used, explain in remarks, Item 31. Additionally, insert an “X” in the appropriate box of block (B) to indicate whether transfer is being made at time of beneficial occupancy, physical completion or financial completion (with respect to new construction). If the “other” category is used, explain in remarks, Item 31.

ITEM 16 – Enter the code number assigned to identify the project with the appropriate construction authorization law.

ITEM 17 – Each single entry will be identified as an item number and this item number will be shown in this column.

ITEM 18 – 19: Category Code and Description. Enter the category code and description (see DoD Instruction 4165.3 (reference (a)) or attachment 1 to enclosure 1 to DoD Instruction 4165.14 (reference (b)) that appropriately describes the primary use for which the facility (buildings, structures, utilities) is designed. Not more than one category code (Item 18) will be listed as a line item (Item 17).
ITEM 20 – Number of Units in terms of buildings or other structures.

ITEM 21 – Type – enter type of construction; i.e., “P” for permanent, “S” for semipermanent or “T” for temporary.

ITEM 22 – Enter the unit of measure abbreviation, such as “SF” for square feet, etc. (see attachment 2 to enclosure 1 to DoD Instruction 4165.14 (reference (b)).

ITEM 23 – Enter total quantity as described in Item 22.

ITEM 24 – Indicate by item number, category code, and description the appropriate cost. In those instances where a document is prepared which lists items carrying costs which, in some cases, may be final and in others may be preliminary, each cost figure by line item will carry an alphabetical suffix of (P) for preliminary or (F) for final.


#First amendment (Ch 1, 7/28/67)
## TRANSFER AND ACCEPTANCE OF MILITARY REAL PROPERTY

<table>
<thead>
<tr>
<th>ITEM NO.</th>
<th>CATEGORY CODE</th>
<th>FACILITY</th>
<th>NO. OF UNITS</th>
<th>TYPE</th>
<th>UNIT OF MEAS</th>
<th>TOTAL QUANTITY</th>
<th>COST</th>
<th>DRAWING NUMBERS</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
<td>18</td>
<td>19</td>
<td>20</td>
<td>21</td>
<td>22</td>
<td>23</td>
<td>24</td>
<td>25</td>
<td>26</td>
</tr>
</tbody>
</table>

27. STATEMENT OF COMPLETION: The facilities listed hereon are in accordance with maps, drawings, and specifications and change orders approved by the authorized representative of the using agency except for the deficiencies listed on the reverse side.

28. ACCEPTED BY (Signature) DATE

TRANSFERRED BY (Signature) DATE

Title (Area Engr./Base Engr./DPWO) TITLE (Post Engr./Base Engr./Navy Rep.)

29. PROPERTY VOUCHER NUMBER

---

**DD FORM** 1 NOV 61 1354
SUPERSEDES ENG FORMS 290 AND 290B AND NAVDOCKS FORM 2317
30. CONSTRUCTION DEFICIENCIES

This form has been designed and issued for use in connection with the transfer of military real property between the military departments and to or from other government agencies. It supersedes ENG Forms 290 and 290B (formerly used by the Army and Air Force) and NAVDOCKS Form 2317 (formerly used by the Navy).

Existing instruction issued by the military departments relative to the preparation of the three superseded forms are applicable to this form to the extent that the various items and columns on the superseded forms have been retained. Additional instructions, as appropriate, will be promulgated by the military departments in connection with any new items appearing hereon.

With the issuance of this DD form, it is not intended that the department shall revise and reprint manuals and directives simply to show the number of this DD form. Such action can be accomplished through the normal course of revision for other reasons.

31. REMARKS
ITEMS FOR DD FORM 1354

CATEGORY CODES: VERIFY FOR ARMY FACILITIES AND AIR FORCE FACILITIES OF THE SAME DESCRIPTION • • • (ABBREVIATION-NOMENCLATURE)

* DESCRIPTION: ARMY AIR FORCE

SHOPPING CENTER: (EXCH MAIN RETL) : 740-53 (EXCH SALES STORE) 740111
SHOPPETTE (EXCHANGE BRANCH) :740-50 (EXCH BRANCH) 740382
CLASS SIX (CLASS VI) :740-84 (BSE PACKAGE STORE) 740269
CAR CARE CENTER (EXCH SVC STA) :740-52 (EXCH SVC STN) 740383
BURGER KING (POST RESTAURANT) :740-64 (EXCH CAFE SNK BAR) 722345

CATEGORY CODE DESCRIPTION COST

1. BUILDING SQUARE FOOTAGE:
   A. RETAIL AREAS:___________SF
   B. ADMIN/EMPLOYEE AREA________SF
   C. MPA:___________SF
   D. SERVICES ACTIVITIES:________________SF
   E. FOOD ACTIVITIES________SF.
   F. MALL/PUBLIC TOILETS:________________SF
   G. MERCH. EQUIP. RM______SF
   H. TOTAL BLDG:___________SF

   2. BUILDING $ _____________________

   (TOTAL CONTRACT PRICE LESS THE SUM OF THE FOLLOWING)

   3. HEATING, VENTILATION & AIR CONDITIONING SYSTEM $ _____________________

   TOTAL:_________________TONS

   (AR)826-11 OVER 100 TONS (AC PL OV 110 TN)
   (AF)826123 OVER 100 TONS (A/C PLT OVET 100 TN)
   (AR)826-12 26-100 TONS (AC PL-26-100 TN)
   (AF)826122 25-100 TONS (A/C PLT 25<100 TN)
   (AR)826-13 6-25 TONS (AC PL  6-25- TN)
   (AF)890121 5-25 TONS (A/C PL 5 TO 25 TN)

4. FIRE PROTECTION SYSTEM (FIRE ALARM SYS)
   AUTOMATIC SPRINKLER SYSTEM $ _____________________

   (AR)880-50 (AUTO SPNLKR SYS)
   (AF)880221 (AUTO FR DTECTN SYS)

   TOTAL:NUMBER OF HEADS______________

   FOAM FIRE SPRINKLER SYSTEM $ _____________________

   (AR)880-60 (AUTO SPNLKR SYS)
   (AF)980235 (DRY CHEM SYS)

   TOTAL:NUMBER OF HEADS______________

   (AR)843-11 FIRE HYDRANTS $ _____________________
   (AF)843315 (FR HYDR)

5. UNDERGROUND ELECTRICAL SYSTEM (INCLUDE. METER $ _____________________

   (AR)812-42 UNGD ELEC DISTR)
   (AF) (SEC DISTR LNE UG)
   (AF)890181 (UTIL LNE DUCTS)

   TOTAL SERVICE TO BUILDING:___________L.F OF_____IN. CONDUIT
   AND_______________CONDUCTOR
## ITEMS FOR DD FORM 1354 (CONTINUED)

<table>
<thead>
<tr>
<th>CATEGORY CODE</th>
<th>DESCRIPTION</th>
<th>COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>6. ELECTRICAL TRANSFORMER</td>
<td>$ ______________________</td>
<td></td>
</tr>
<tr>
<td>(AR)813-60</td>
<td>TRANSFORMER</td>
<td></td>
</tr>
<tr>
<td>(AF)812225</td>
<td>PRIM DISTR LNE UG</td>
<td></td>
</tr>
<tr>
<td>PAD MOUNTED TRANSFORMER</td>
<td>________ KVA</td>
<td></td>
</tr>
<tr>
<td>7. NATURAL GAS LINE TO BUILDING (INC. METER)</td>
<td>$ ______________________</td>
<td></td>
</tr>
<tr>
<td>(AR)824-10</td>
<td>GAS PIPE LIBE</td>
<td></td>
</tr>
<tr>
<td>(AF)824464</td>
<td>GAS MAINS</td>
<td></td>
</tr>
<tr>
<td>TOTAL SERVICE TO BUILDING:</td>
<td>________ L.F. OF ________ IN. PIPE</td>
<td></td>
</tr>
<tr>
<td>(MATERIAL:</td>
<td>___________________________ )</td>
<td></td>
</tr>
<tr>
<td>8. UNDERGROUND TELEPHONE</td>
<td>$ ______________________</td>
<td></td>
</tr>
<tr>
<td>(AR)...</td>
<td>UNDG TELEPHONE</td>
<td></td>
</tr>
<tr>
<td>(AF)135583</td>
<td>TEL DUCT FCLTY</td>
<td></td>
</tr>
<tr>
<td>(AF)890181</td>
<td>UTIL LNE DUCTS</td>
<td></td>
</tr>
<tr>
<td>TOTAL SERVICE TO BUILDING:</td>
<td>________ L.F. OF ________ IN. CONDUIT</td>
<td></td>
</tr>
<tr>
<td>9. SANITARY SEWER SYSTEM</td>
<td>$ ______________________</td>
<td></td>
</tr>
<tr>
<td>(AR)832-10</td>
<td>SANITARY SEWER</td>
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</tr>
<tr>
<td>(AF)932267</td>
<td>SAN SEWAGE MAIN</td>
<td></td>
</tr>
<tr>
<td>TOTAL SERVICE TO BUILDING:</td>
<td>________ L.F. OF ________ IN. PIPE</td>
<td></td>
</tr>
<tr>
<td>(MATERIAL:</td>
<td>___________________________ )</td>
<td></td>
</tr>
<tr>
<td>10. GREASE INTERCEPTOR</td>
<td>$ ______________________</td>
<td></td>
</tr>
<tr>
<td>(AR)833-90</td>
<td>LOCAL DESCRIPTION</td>
<td></td>
</tr>
<tr>
<td>CAPACITY</td>
<td>________ GALLONS</td>
<td></td>
</tr>
<tr>
<td>11. STORM SEWER SYSTEM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(AR)871-10</td>
<td>STORM SEWER</td>
<td></td>
</tr>
<tr>
<td>(AF)871183</td>
<td>STRM DRN DSPL</td>
<td></td>
</tr>
<tr>
<td>TOTAL SERVICE TO BUILDING:</td>
<td>________ L.F. OF ________ IN. PIPE</td>
<td></td>
</tr>
<tr>
<td>(MATERIAL:</td>
<td>___________________________ )</td>
<td></td>
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<tr>
<td>TOTAL NUMBER OF DROP INLETS:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. DOMESTIC WATER SYSTEM</td>
<td>$ ______________________</td>
<td></td>
</tr>
<tr>
<td>(AR)842-10</td>
<td>WATER PIPE LN P</td>
<td></td>
</tr>
<tr>
<td>(AF)842245</td>
<td>WTR DISTR MAINS</td>
<td></td>
</tr>
<tr>
<td>TOTAL SERVICE TO BUILDING:</td>
<td>________ L.F. OF ________ IN. PIPE</td>
<td></td>
</tr>
<tr>
<td>(MATERIAL:</td>
<td>___________________________ ) (INCLUDING METER &amp; BACK FLOW PREVENTER)</td>
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<tr>
<td>13. LANDSCAPE IRRIGATION SYSTEM</td>
<td>$ ______________________</td>
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</tr>
<tr>
<td>(AR)871-30</td>
<td>IRRIGATION FAC</td>
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<tr>
<td>TOTAL NUMBER OF HEADS:</td>
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<td></td>
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<tr>
<td>14. DUMPSTER ENCLOSURE</td>
<td>$ ______________________</td>
<td></td>
</tr>
<tr>
<td>(AR)833-12</td>
<td>REFUSE COLL BLD</td>
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<tr>
<td>TOTAL AREA:</td>
<td>________ S.F.</td>
<td></td>
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ITEMS FOR DD FORM 1354  (CONTINUED)

<table>
<thead>
<tr>
<th>CATEGORY CODE</th>
<th>DESCRIPTION</th>
<th>COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>15. PAVING (NON ORGANIZATION VEHICLE PARKING)</td>
<td>(AR)852-15  (NON ORG VEH PRK) (AF)852262  (VEH PKING N/ORGN) TOTAL ASPHALT PAVING:_________S.Y. OF _______IN. THICK W/_______IN. BASE MATERIAL TOTAL CONCRETE PAVING:_________S.Y. OF _______IN. THICK W/_______IN. BASE MATERIAL</td>
<td></td>
</tr>
<tr>
<td>16. CONCRETE WALKS, SLABS &amp; PADS</td>
<td>(AR)852-20  (SIDEWALK) (AF)852289  (SIDEWALK) PEDESTRIAN TRAFFIC TOTAL AREA:___________S.F. (EXCLUDING PAVER TILES)</td>
<td></td>
</tr>
<tr>
<td>17. CONCRETE CURBS &amp; GUTTERS</td>
<td>(AR)851-10  (ROADS PAVED) (AF)851143  (CURBS &amp; GUTTERS) TOTAL AREA:___________L.F.</td>
<td></td>
</tr>
<tr>
<td>18. EXTERIOR SITE LIGHTING (EXT LIGHTING)</td>
<td>(AR)812-30  (EXTERNAL LIGHTING) (AF)812926  (EXTERIOR AREA LTG) TOTAL NUMBER OF POLES______________</td>
<td></td>
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<tr>
<td>19. LANDSCAPING (RELATED LAND IMPROV NB)</td>
<td>(AR)871-75  (RELATED LAND IMPROV NB)</td>
<td></td>
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<tr>
<td>20. GASOLINE DISPENSING SYSTEMS</td>
<td>(AR)411-90  (LOCAL DESCRIPTION) UNDERGROUND STORAGE TANKS: NUMBER OF TANKS:_________ SIZE:_______ GALLONS NUMBER OF DISPENSERS:_________ NUMBER OF HOSES:___________ CANOPY SIZE:______ SF $___________ KIOSKS: NUMBER_______MGFR_________ COST $___________</td>
<td></td>
</tr>
<tr>
<td>21. CHAIN LINK FENCING (FENCE OR WALLS)</td>
<td>(AR)872-10  (FENCE OR WALLS) (AF)872248  (FENCE INTERIOR) TOTAL LINEAR FEET:___________L.F.</td>
<td></td>
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<tr>
<td>22. TOTAL CONSTRUCTION COSTS:</td>
<td>$________________________</td>
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</tr>
</tbody>
</table>
ITEMS FOR DD FORM 1354  (CONTINUED)

ADDITIONAL INFORMATION REQUIRED

MECHANICAL SYSTEMS

H.V.A.C. UNITS

<table>
<thead>
<tr>
<th>#</th>
<th>MANUFACTURER</th>
<th>MODEL #</th>
<th>CAPACITY</th>
<th>SERIAL #</th>
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EXHAUST FANS

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SUPPLY FANS

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<tr>
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|    |              |         |          |          |

CHILLER

BOILER

HEAT PUMP

ROOFTOP A/C UNITS

DOCK LEVELERS

DOCK SHELTERS

ELECTRICAL

DISTRIBUTION PANELS / LIGHT FIXTURES

<table>
<thead>
<tr>
<th>ITEM NO</th>
<th>MANUFACTURER</th>
<th>MODEL NUMBER</th>
<th>QUANTITY</th>
<th>DESCRIPTION</th>
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PLUMBING

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</table>

WATER HEATER

WATER CLOSET

WATER CLOSET (H.C.)

URINAL

LAVATORY

LAVATORY (H.C.)

FLOOR SINKS(____#)

FLOOR DRAINS(____#)

MOP SINK

ROOF DRAINS (____#)
ITEMS FOR DD FORM 1354 (CONTINUED)

ADDITIONAL INFORMATION REQUIRED

FIRE PROTECTION SYSTEMS FOR FOOD ACTIVITIES

ANSUL CHEMICAL FIRE SUPPRESSION SYSTEM
TYPE OF SYSTEM: __________
TOTAL NUMBER OF:
   HEADS ______ AUTO MAN RELEASE ______
   REMOTE MANUAL PULL STATIONS ______
   SNAP ACTION ASSEMBLIES __________
   MECHANICAL GAS SHUTOFF VALVES ______

ITEMS REQUIRED IN CLOSE OUT DOCUMENTS

1. GENERAL CONTRACTOR’S TESTING / TRAINING REPORTS:
   A. TEST AND BALANCE REPORT ON MECHANICAL SYSTEMS
   B. CERTIFICATION OF GROUNDING (RESISTANCE) POWER
   C. INSTRUCTION / TRAINING SESSIONS ON ALL
      MECH/ELEC/EQUIPMENT (INCLUDING PARTICIPANTS’ ROSTER)
2. GENERAL CONTRACTOR’S WARRANTY
3. ROOF(S) WARRANTY
4. ELECTRIC WARRANTY
5. HVAC WARRANTY
6. GREENHOUSE WARRANTY
7. TERMITE PROTECTION GUARANTEE
8. GENERAL CONTRACTOR’S STATEMENT ON “NO ASBESTOS BEARING
   MATERIALS” USED IN CONSTRUCTION
**TRANSFER AND ACCEPTANCE OF DoD REAL PROPERTY**

The public reporting burden for this collection of information is estimated to average 30 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or any other aspect of this collection of information, including suggestions for reducing the burden, to the Department of Defense, Washington Headquarters Services, Executive Services Directorate, Information Management Division, 4800 Mark Center Drive, Alexandria, VA 22350-3100 (0704-0188). Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

**PLEASE DO NOT RETURN YOUR COMPLETED FORM TO THE ABOVE ORGANIZATION.**

1. FROM (Organization Name)
2. DATE PREPARED (YYYYMMDD)
3. PROJECT/JOB NUMBER
4. SERIAL NUMBER

5. TO (Organization - Installation Code and Name)
6. RPSUID/SITENAME/INSTCODE/INSTNAME
7. CONTRACT NUMBER(S)
8. TRANSACTION DETAILS
   a. METHOD (X all that apply)
      - ACQUISITION BY CONSTRUCTION
      - TRANSFER BETWEEN SERVICES
      - CAPITAL IMPROVEMENT
      - INVENTORY ADJUSTMENT
   b. WHEN/EVENT (X one)
      - TOTAL ASSET PLACED-IN-SERVICE
      - PARTIAL ASSET PLACED-IN-SERVICE
   c. TYPE (X one)
      - DRAFT
      - FINAL
      - INTERIM

|-------------|------------------|------------|-------------------|------------------------|---------------|---------------|-----------------|----------------------|----------------|----------------------|--------|----------------|-------------|----------------|----------------|

24. STATEMENT OF COMPLETION. The facilities listed hereon are in accordance with maps, drawings, and specifications and change orders approved by the authorized representative of the using agency except for the deficiencies listed on the reverse side.

| 25a. ACCEPTED BY (Typed Name and Signature) |
| b. DATE SIGNED (YYYYMMDD) |
| c. TITLE (DPWRPAO) |
| 26. PROPERTY VOUCHER NUMBER |

DD FORM 1354, AUG 2013

PREVIOUS EDITION MAY BE USED.
### INSTRUCTIONS

**GENERAL.** This form has been designed and issued for use in connection with the transfer of military real property between the military departments and to or from other government agencies. It supersedes ENG Forms 290 and 290B (formerly used by the Army and Air Force) and NAVDOCKS Form 2317 (formerly used by the Navy).

Existing instructions issued by the military departments relative to the preparation of DD Form 1354 are applicable to this revised form to the extent that the various items and columns on the superseded forms have been retained. The military departments may promulgate additional instructions, as appropriate.

For detailed instructions on how to fill out this form, please refer to Unified Facilities Criteria (UFC) 1-300-08, dated 16 April 2009 or later.

**SPECIFIC DATA ITEMS.**

1. **From.** Name of the transferring agency.
2. **Date Prepared.** Date of actual preparation. Enter all dates in YYYYMMDD format (Example: March 31, 2010 = 20100331).
3. **Project/Job Number.** Project number on a DD Form 1391 or Individual Job Order Number.
4. **Serial Number.** Sequential serial number assigned by the preparing organization (e.g., 2010-0001).
5. **To.** Name and address of the receiving installation, activity, and Service of the transferring individual or agent.
6. **RPSUID/SITENAME/INSTCODE/INSTNAME.** Site Unique Identifier and name or installation code and name where the constructed facility is located.
7. **Contract Number(s).** Contract number(s) for this project.
8. **Placed-In-Service Date.** RPA Placed In Service Date. This is the date the asset is actually placed-in-service.
9. **Transaction Details.**
   a. **Method of Transaction.** Mark (X) as many boxes as apply.
   b. **When/Event.** When or event causing preparation of DD Form 1354. X only one box.
   c. **Type.** Draft, Interim, or final DD Form 1354. X only one box.
10. **Item Number.** Use a separate item number for each facility, no item number for additional usages.
11. **Facility Number.** Assigned in accordance with the Installation/Base Master Numbering Plan.
12. **RPUID.** Identified in Real Property Inventory.
13. **Category Code.** The category code describes the facility usage.
14. **Type.** Type of construction: P for Permanent; S for Semi-permanent; T for Temporary.
15. **Sustainability Code.** Reports whether or not an asset meets the sustainability guidelines set forth in Section 2(g) of Executive Order 13514. Valid values are: 1 (asset meets the guidelines); 2 (asset does not meet the guidelines); 3 (asset not evaluated); 4 (asset not subject to guidelines).
16. **Total Quantity UM 1.** The total area for the measure identified in Item 15. Use negative numbers for demolition.
17. **Other: UM 2.** Unit of Measure 2 is the capacity or other measurement unit (e.g., LF, MB, EA, etc.).
18. **Total Quantity UM 2.** The total capacity/other for the measure identified in Item 17.
19. **Cost.** Cost for each facility; for capital improvements to existing facilities, show amount of increase only. If there is no increase for the capital improvement, enter N/A.
20. **Fund Source.** Enter the Fund Source Code for this item.
21. **Funding Organization.** Enter the code for the organization responsible for acquiring this facility.
22. **Interest Code.** Enter the code that reflects government interest or ownership in the facility.
23. **Item Remarks.** Remarks pertaining only to the item number identified in Item 9; show cost sharing.
24. **Statement of Completion.** Typed name, signature, title, and date of signature by the responsible transferring individual or agent.
25. **Accepted By.** Typed name, signature, title, and date of signature by the RPAO or accepting official.
26. **Property Voucher Number.** Next sequential number assigned by the RPAO in voucher register.
27. **Construction Deficiencies.** List construction deficiencies in project during contractor turnover inspection.
28. **Project Remarks.** Project level remarks and continuation of blocks.

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**DD FORM 1354 (BACK), AUG 2013**
SECTION 01 78 39
PROJECT RECORD DOCUMENTS

PART 1 - GENERAL
1.01 RELATED REQUIREMENTS
   A. Section 01 33 00 – Submittals.

1.02 RECORD FIELD DATA
   A. General: Maintain at job site, two complete sets of Contract Documents. During construction, both sets shall be marked to show all deviations in actual construction from the Contract Documents.
      1. Red Markers: Indicate all additions.
      2. Green Markers: Indicate all deletions.
   B. Record Documents: The drawings shall show, but no be limited to, the following information:
      1. Locations and description of any utility lines and other installations of any kind or description known to exist within the construction area. Include dimensions and/or survey coordinates to permanent features.
      2. Locations and dimensions of any changes within the building or structure and the accurate location and dimension of all underground utilities and facilities.
      3. Correct grade or alignment of roads, structures and utilities if any changes were made from Contract Drawings.
      4. Correct elevations if changes were made in site grading.
      5. Changes in details of design or additional information obtained from shop drawings prepared or furnished by the Contractor including, but not limited to:
         a. Fabrication erection
         b. Installation and placing details
         c. Pipe sizes
         d. Insulation materials
         e. Equipment pad dimensions
      6. Topography and grades of all drainage.
      7. All changes or modifications from the original design.
      8. Where contract drawings or specifications allow options, only the option actually used in the construction shall be shown on the Record Drawings. The option not used shall be deleted.
   C. Record Field Data: All deviations shall be shown in the same general detail utilized in the Contract Documents. Marking of the documents shall continue throughout construction to keep the documents up to date.
      1. Additional Data: The Contractor shall maintain the following:
         a. Full size marked-up drawings.
         b. Survey notes
         c. Sketches
         d. Nameplate data
         e. Pricing information
         f. Description and serial number of all equipment
      2. Record field data shall be available for inspection by the Contracting Officer whenever requested and shall be jointly inspected for accuracy and completeness by the Contracting Officer and Contractor. Failure to keep record field data current shall be sufficient justification to withhold a retained percentage from the monthly Application for Payment.
   D. Submittal of Record Field Data:
      1. Submit two sets to the Contracting Officer a minimum of 20 calendar days prior to the date of final inspection.
      2. The Contractor shall make all corrections identified during Contractor Officer review and resubmit corrected data within ten (10) calendar days of receipt.
3. When data is accepted as complete, one set of documents will be returned to the Contractor for completion of the Record Documents.

1.03 RECORD ELECTRONIC FILE DOCUMENTS

A. Electronic File Format: No earlier than 30 days after award, the Contracting Officer will provide one set of AutoCAD electronic file format contract drawings to be used for preparation of Record Drawings.
   1. Media: ISO – 9660 CD
   2. The Contractor shall verify usability of AutoCAD files and notify the Contracting Officer of any discrepancies within 30 calendar days of receipt. Any discrepancies will be corrected and files returned to the Contractor.
   3. The Contractor shall incorporate all deviations from the original Contract Documents as recorded in the approved “Record Field Data” as indicated in Paragraph 1.2.C above.
   4. The Contractor shall also incorporate all written modifications to the Contract Documents which were issued by amendment or contract modification.
   5. All revisions and changes shall be incorporated:
      a. Items marked deleted shall be deleted.
      b. Clouds around new items shall be removed.

B. Electronic File Submittal: Submit a complete set of Record Drawings in AutoCAD electronic file format no later than 30 days after final acceptance. The Record Drawings shall be done in equal quality to the originals, including line work, line weights, lettering and symbols. Identify each drawing with the word “RECORD” in block letters at least 3/8” high above the title block. The date of completion and the words “Revised Record” shall be placed in the revision block above the latest revision notation.
   1. Format: AutoCAD Release 2005 ‘DWG’ format. All support files required to display or plot the files in the same manner as they were developed shall be delivered along with the files, including but not limited to:
      a. Font files
      b. Menu files
      c. Plotter setup
      d. Referenced files
   2. Layering: Conform to AIA Standard Document, “CAD Layer Guidelines,” latest version. An explanatory list of which layer is used at which drawing and an explanatory list of all layers which do not conform to the standard AIA CAD Layer Guidelines including any user definable fields permitted by the guidelines shall be provided with each submittal.
   3. Electronic File Deliverable Media: ISO 9660 Format CD-ROM. Submit three (3) complete sets of disks and one complete set of full size reproducible prints taken from the disks. Each disk shall have a clearly marked label stating the Contractor’s firm name, project name and location, submittal type (record) and date. Each submittal shall be accompanied by a hard copy transmittal sheet that contains the above information along with tabulated information about each file as shown below:
      | Electronic File Name | Plate Number | Drawing Title |
      |-----------------------|--------------|--------------|
   a. Include electronic version of the table.
   4. Submit one copy of the CD-Rom and one set of full-size Mylar reproducibles of the drawings to the Building Records staff person at the facility.

1.04 SUBMITTAL OF FINAL RECORD DRAWINGS

A. Complete and return the final record documents and the approved preliminary record documents to the Contracting Officer within 30 calendar days of final acceptance.
   1. All drawings from the original contract documents shall be included, including drawings where no changes were made.
   2. The drawings will be returned to the Contractor if corrections are necessary.
   3. The Contractor shall make all corrections and shall return the drawings to the Contracting Officer within seven (7) calendar days of receipt.
1.05 RECORD DOCUMENT COST
   A. All costs incurred by the Contractor in the proportion and furnishing of record documents, including electronic file format, shall be included in the contract price and no separate payment will be made for this work.
   1. Approval and acceptance of the final record documents shall be accomplished before final payment is made to the Contractor.

1.06 SYSTEM ACCEPTANCE TESTING
   A. Provide one set of marked-up record drawings at the time of system acceptance testing. These record drawings shall be in addition to the submittal of marked-up record drawings specified elsewhere in the contract.

PART 2 – PRODUCTS (NOT USED)
PART 3 – EXECUTION (NOT USED)

END OF SECTION
SECTION 01 91 13
GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Commissioning Team:
   1. Members representing contractor, including Project superintendent and subcontractors, installers, suppliers, and specialists.
   2. Members representing Owner, including Commissioning Authority (CxA), facility user and operation and maintenance personnel, and Architect and engineering design professionals.

B. EXCHANGE Responsibilities:
   1. Provide Operating (OPR) and Basis of Design (BoD) documentation.
   2. Assign operation and maintenance personnel and schedule them for commissioning activities.

C. Contractor's Responsibilities: Assign personnel and schedule them for commissioning activities.

D. CxA's Responsibilities:
   1. Organize and lead commissioning team.
   2. Provide commissioning plan.
   3. Convene commissioning team meetings.
   4. Provide Project-specific checklists and test procedures.
   5. Verify the execution of commissioning process activities using random sampling.
   6. Prepare and maintain Issues Log.
   7. Prepare and maintain completed construction checklist log.
   8. Witness systems, assemblies, equipment, and component startup.
   9. Compile test data, inspection reports, and certificates; include them in the systems manual and commissioning process report.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
SECTION 02 41 16
SELECTIVE DEMOLITION

PART 1 - GENERAL

1.01 SECTION INCLUDES
A. Demolition and removal of selected portions of a building.
B. Demolition and removal of selected site elements.
C. Removal of selected interior finishes in areas to be modernized.
D. Patching and repairs.

1.02 RELATED REQUIREMENTS
A. Section 01 10 00 - Summary: Use of the building and phasing requirements.
B. Section 01 14 50 - Cutting and Patching.
C. Section 01 32 00 - Construction Progress Documentation.
D. Section 01 50 00 - Temporary Facilities and Controls: Temporary utilities, temporary construction and support facilities, temporary security and protection facilities, and environmental protection measures for selective demolition operations.
E. Division 21 Sections for cutting, patching, or relocating Fire Sprinkler items.
F. Division 22 Sections for cutting, patching, or relocating Plumbing items.
G. Division 23 Sections for cutting, patching, or relocating HVAC items.
H. Division 26 Sections for cutting, patching, or relocating Electrical items.

1.03 DEFINITIONS
A. Remove: Remove and legally dispose of items except those indicated to be reinstalled, salvaged, or to remain EXCHANGE property.
B. Remove and Salvage: Items indicated to be removed and salvaged remain EXCHANGE property. Remove, clean, and pack or crate items to protect against damage. Identify contents of containers and deliver to EXCHANGE's designated storage area.
C. Remove and Reinstall: Remove items indicated; clean, service, and otherwise prepare them for reuse; store and protect against damage. Reinstall items in the same locations or in locations indicated.
D. Existing to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by the Contracting Officer, items may be removed to a suitable, protected storage location during selective demolition and then cleaned and reinstalled in their original locations.

1.04 MATERIALS OWNERSHIP
A. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain EXCHANGE property, demolished materials shall become the Contractor's property and shall be removed from the site and legally disposed of off Installation.

1.05 SUBMITTALS
A. See Section 01 33 00 - Submittals, for submittal procedures.
B. Schedule of selective demolition activities indicating the following:
   1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity.
   2. Interruption of utility services.
   3. Coordination for shutoff, capping, and continuation of utility services.
   4. Detailed sequence of selective demolition and removal work to ensure uninterrupted progress of EXCHANGE's on-site operations.
   5. Coordination of EXCHANGE's continuing occupancy of portions of existing building and of EXCHANGE's partial occupancy of completed Work.
C. Photographs or videotape, sufficiently detailed, of existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by selective demolition operations.
   1. Refer to Section 01 32 00 for further requirements.
D. Record drawings at Project close-out according to Section 01 78 39 - Project Record Documents.
   1. Identify and accurately locate capped utilities and other subsurface structural, electrical, or mechanical conditions.

1.06 PROJECT CONDITIONS
A. EXCHANGE will occupy portions of the building immediately adjacent to selective demolition area. Conduct selective demolition so that EXCHANGE's operations will not be disrupted. Provide not less than 72 hours' notice to EXCHANGE of activities that will affect EXCHANGE's operations.
B. EXCHANGE assumes no responsibility for actual condition of buildings to be selectively demolished.
   1. Conditions existing at time of inspection for bidding purpose will be maintained by EXCHANGE as far as practical.
C. Provide secure temporary closure at exterior wall openings where existing infills are removed or new openings created.
D. Where existing opening infills in the retail sales area are scheduled for demolition, maintain interior wall furring and finishes.

PART 2 - PRODUCTS

2.01 REPAIR MATERIALS
A. Use repair materials identical to existing materials.
   1. Where 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

3.01 EXAMINATION
A. Verify that utilities have been disconnected and capped.
B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
C. When unanticipated mechanical, electrical, or structural elements that conflict with the intended function or design are encountered, investigate and measure the nature and extent of the conflict. Promptly submit a written report to the Contracting Officer.
D. Survey the condition of the building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of the structure or adjacent structures during selective demolition.
E. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.02 UTILITY SERVICES
A. Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
   1. Do not interrupt existing utilities serving occupied or operating facilities, except when authorized in writing by EXCHANGE and authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to EXCHANGE and to governing authorities.
a. Provide not less than 72 hours notice to EXCHANGE if shutdown of service is required during changeover.

B. Utility Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services serving building to be selectively demolished.
   1. Arrange to shut off indicated utilities with utility companies.
   2. Where utility services are required to be removed, relocated, or abandoned, provide bypass connections to maintain continuity of service to other parts of the building before proceeding with selective demolition.
   3. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal the remaining portion of pipe or conduit after bypassing.

C. Utility Requirements: Refer to Divisions 21, 22, 23, and 26 Sections for shutting off, disconnecting, removing, and sealing or capping utility services. Do not start selective demolition work until utility disconnecting and sealing have been completed and verified in writing.

3.03 PREPARATION

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

B. Conduct demolition operations and remove debris to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from EXCHANGE and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

C. Conduct demolition operations to prevent injury to people and damage to adjacent buildings and facilities to remain. Ensure safe passage of people around selective demolition area.
   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.
   3. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
   4. Provide temporary weather protection, during interval between demolition and removal of existing construction, on exterior surfaces and new construction to ensure that no water leakage or damage occurs to structure or interior areas.
   5. Protect walls, ceilings, floors, and other existing finish work that are to remain and are exposed during selective demolition operations.
   6. Cover and protect furniture, furnishings, and equipment that have not been removed.

D. Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise.
   1. Construct dustproof partitions of not less than nominal 4-inch studs, 5/8-inch gypsum wallboard with joints taped on occupied side, and 1/2-inch fire-retardant plywood on the demolition side.
   2. Insulate partition to provide noise protection to occupied areas.
   3. Seal joints and perimeter. Equip partitions with dustproof doors and security locks.
   4. Protect air-handling equipment.
   5. Weatherstrip openings.

E. Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent movement, settlement, or collapse of building to be selectively demolished.
   1. Strengthen or add new supports when required during progress of selective demolition.

3.04 POLLUTION CONTROLS

A. Use water mist, temporary enclosures, and other suitable methods to limit the spread of dust and dirt. Comply with governing environmental protection regulations.
1. Do not use water when it may damage existing construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

B. 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.

C. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before start of selective demolition.

3.05 SELECTIVE DEMOLITION
A. Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete 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. To minimize disturbance of adjacent surfaces, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
   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. Maintain adequate ventilation when using cutting torches.
   5. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
   6. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
   7. Locate selective demolition equipment throughout the structure and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
   8. Dispose of demolished items and materials promptly. On-site storage or sale of removed items is prohibited.
   9. Return elements of construction and surfaces to remain to condition existing before start of selective demolition operations.

B. Demolish concrete and masonry in small sections. Cut concrete and masonry at junctures with construction to remain, using power-driven masonry saw or hand tools; do not use power-driven impact tools.

C. Break up and remove concrete slabs on grade, unless otherwise shown to remain.

D. Remove resilient floor coverings and adhesive according to recommendations of the Resilient Floor Covering Institute's (RFCI) "Recommended Work Practices for the Removal of Resilient Floor Coverings" and Addendum.
   1. Remove residual adhesive and prepare substrate for new floor coverings by one of the methods recommended by RFCI.

E. Remove air-conditioning equipment without releasing refrigerants.

3.06 PATCHING AND REPAIRS
A. Promptly patch and repair holes and damaged surfaces caused to adjacent construction by selective demolition operations.

B. Patching is specified in Section 01 14 50 - Cutting and Patching.

C. Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials.
D. Restore exposed finishes of patched areas and extend finish restoration into adjoining construction to remain in a manner that eliminates evidence of patching and refinishing.

E. Patch and repair floor and wall surfaces in the new space where demolished walls or partitions extend one finished area into another. Provide a flush and even surface of uniform color and appearance.
   1. Closely match texture and finish of existing adjacent surface.
   2. Patch with durable seams that are as invisible as possible. Comply with specified tolerances.
   3. Where patching smooth painted surfaces, extend final paint coat over entire unbroken surface containing the patch after the surface has received primer and second coat.
   4. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
   5. Inspect and test patched areas to demonstrate integrity of the installation, where feasible.

F. Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

G. Patch and repair roof decks and roof membrane systems caused by selective demolition operations.

3.07 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 EXCHANGE's property and legally dispose of them. Dispose all contaminated materials to an approved disposal site.

3.08 CLEANING

A. Sweep the building broom clean on completion of selective demolition operation.

B. Change filters on air-handling equipment on completion of selective demolition operations.

END OF SECTION
SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL
1.01 SECTION INCLUDES
   A. This Section specifies cast-in-place concrete, including formwork, reinforcing, mix design, placement procedures, and finishes.

1.02 RELATED REQUIREMENTS
   A. Section 01 14 50 - Cutting and Patching.

1.03 SUBMITTALS
   A. See Section 01 33 00 - Submittals, for submittal procedures.
   B. Product Data: For proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, waterstops, joint systems, underslab vapor barriers, curing compounds, dry-shake finish materials, and others as requested by Contracting Officer.
   C. Shop drawings for reinforcement for fabrication, bending, and placement of concrete reinforcement. Comply with ACI SP-66 (88), "ACI Detailing Manual", showing bar schedules, stirrup spacing, diagrams of bent bars, and arrangement of concrete reinforcement. Include special reinforcement required for openings through concrete structures. All wall reinforcement must be shown in elevation.
   D. Samples of materials as requested by Contracting Officer, including names, sources, and descriptions.
   E. Laboratory test reports for concrete materials and mix design test.
   F. Materials certificates in lieu of materials laboratory test reports when permitted by Contracting Officer. Materials certificates shall be signed by manufacturer and Contractor, certifying that each material item complies with or exceeds specified requirements. Provide certification from admixture manufacturers that chloride content complies with specification requirements.

1.04 QUALITY ASSURANCE
   A. Codes and Standards: Comply with provisions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified:
      1. ACI 318, "Building Code Requirements for Reinforced Concrete."
      2. Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice."
      3. ACI 301 "Specifications for Structural Concrete for Buildings."
   B. EXCHANGE will engage and pay a testing lab to control testing during construction.
   C. Materials and installed work may require testing and retesting at any time during progress of work. Allow free access to material stockpiles and facilities.

PART 2 - PRODUCTS
2.01 FORM MATERIALS
   A. Forms for Exposed Finish Concrete: Plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings. Provide panel with sufficient thickness to withstand pressure of newly-placed concrete without how or deflection.
      1. Use exterior grade plywood complying with U.S. Product Standard PS-1 Medium Density Overlay, Class 1 or better, mill-oiled and edge-sealed.
      2. Forms for Unexposed Finish Concrete: Plywood, lumber, metal, or another acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit.
      3. Form Coatings: Provide commercial formulation form-coating compounds with a maximum VOC of 350 mg/l that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
4. Form Ties: Factory-fabricated, adjustable-length, removable or snap-off metal form ties designed to prevent form deflection and to prevent spalling of concrete upon removal. Provide units that will leave no metal closer than 1-1/2 inches to exposed surface.
   a. Provide ties that, when removed, will leave holes not larger than 1 inch diameter in concrete surface.

2.02 REINFORCING MATERIALS
   A. Reinforcing Bars: ASTM A615, Grade 60, deformed for #4 and larger bars. ASTM A615, Grade 40, deformed for #3 bars.
   B. Steel Wire: ASTM A82, plain, cold-drawn steel.
   D. Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire bar-type supports complying with CRSI specifications.
      1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
   E. Rebar Dowel Anchoring Epoxy: Quikrete High Strength Anchoring Epoxy: www.quikrete.com; or approved equivalent.

2.03 CONCRETE MATERIALS
   A. Portland Cement: ASTM C150, Type I or Type II.
      1. Use one brand of cement throughout project.
   B. Normal-Weight Aggregates: ASTM C33 and as herein specified. Provide aggregates from a single source for exposed concrete.
      1. For exposed exterior surfaces, do not use fine or coarse aggregates containing spalling-causing deleterious substances.
      2. Local aggregates not complying with ASTM C33 but that special tests or actual service have shown to produce concrete of adequate strength and durability may be used when acceptable to Contracting Officer.
   C. Water: Potable.
   D. Admixtures, General: Provide admixtures for concrete that contain not more than 0.1 percent chloride ions. Calcium chloride is not acceptable. Provide admixture manufacturer's written certification that chlorideion content complies with specific requirements.
   E. Air-Entraining Admixture: ASTM C260, certified by manufacturer to be compatible with other required admixtures.
      1. Products: Subject to compliance with requirements, provide one of the following:
         b. "Air-Mix" or "Perma-Air", Euclid Chemical Co.
         c. "Darex AEA" or "Daravair", W.R. Grace & Co.
         d. "MB-VR" or "Micro-Air", Master Builders, Inc.
         f. "Sika AER", Sika Corp.
   F. Water-Reducing Admixture: ASTM C494, Type A.
      1. Products: Subject to compliance with requirements, provide one of the following:
         b. "PSI N", Cormix.
         c. "Eucon WR-75", Euclid Chemical Co.
         e. "Pozzolith Normal" or "Polyheed", Master Builders, Inc.
         g. "Plastocrete 161", Sika Corp.
   G. High-Range Water-Reducing Admixture (Super Plasticizer): ASTM C494, Type F or Type G.
1. Products: Subject to compliance with requirements, provide one of the following:
   b. "PSI Super", Cormix.
   c. "Eucon 37", Euclid Chemical Co.
   d. "WRDA 19" or "Daracem", W.R. Grace & Co.
   e. "Rheobuild", Master Builders, Inc.
   g. "Sikament 300", Sika Corp.

H. Water-Reducing, Accelerating Admixture: ASTM C494, Type E.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. "Q-Set", Conspec Marketing & Manufacturing Co.
      b. "Gilco Accelerator", Cormix.
      c. "Accelguard 80", Euclid Chemical Co.
      e. "Pozzutec 20", Master Builders, Inc.

I. Water-Reducing, Retarding Admixture: ASTM C494, Type D.
   1. Products: Subject to compliance with requirements, provide one of the following:
      b. "Eucon Retarder 75", Euclid Chemical Co.
      d. "Pozzolith R", Master Builders, Inc.
      e. "Protard", Prokrete Industries.

2.04 RELATED MATERIALS

A. Granular (Porous) Fill: Pea Gravel (beneath concrete floor slabs): Natural stone, free draining, washed, free of clay, shale, and organic matter.
   1. Graded in accordance with ASTM C136, within the following limits:
      b. Maximum Size: 5/8 inch.

B. Underslab Vapor Barrier: Multi-layer, fabric-, cord-, grid-, or aluminum-reinforced polyethylene or equivalent, complying with ASTM E1745, Class A; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs. The use of single ply polyethylene is prohibited.
   1. Accessory Products: Vapor barrier manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations in vapor barrier.
   2. Products:

C. Moisture-Retaining Cover: One of the following, complying with ASTM C171.
   1. Waterproof paper.
   2. Polyethylene film.
   3. Polyethylene-coated burlap.

D. Cure and Seal Compound: Typical concrete slab liquid membrane forming curing compound to be "Ashford Formula", Concrete Distribution, Inc., 1203 W. Spring Creek Place, Springville UT 84663 (801-489-5663) approximately 200 square feet per gallon in locations not receiving polished concrete floor finish.
2.05 BONDING PRODUCTS

A. Epoxy Bonding System: Complying with ASTM C881/C881M and of Type required for specific application.
   1. Locations for Use:
      a. Bonding fresh concrete to hardened concrete.
   2. Products:

2.06 PROPORTIONING AND DESIGN OF MIXES

A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. If trial batch method used, use an independent testing facility acceptable to Contracting Officer for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing.

B. Slabs on Grade: It is the intent of the design that slabs on grade receive special attention for mix design. The submitted slab mix design is to incorporate proportioning to minimize paste content (minimize total water content) and provide a well-graded aggregate with maximum aggregate size (1-inch preferred). Gap graded mixes with primarily 3/4-inch aggregate and sand will not be allowed.

C. Submit written reports to Contracting Officer for each proposed mix for each class of concrete at least 15 days prior to start of Work. Do not begin concrete production until proposed mix designs have been reviewed by Contracting Officer.

D. Design mixes to provide normal weight concrete properties as follows, except where higher strength is noted on the drawings or in the specifications:
   1. Minimum Compressive Strength: 4000 psi, when tested in accordance with ASTM C39/C39M at 28 days.
   2. Water/Cement Ratio: Maximum 50 percent by weight.
   3. Total Air Content: 2 to 4 percent typical, except 5 to 7 percent for concrete exposed to freeze-thaw cycles, determined in accordance with ASTM C173/C173M.

E. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, as accepted by Contracting Officer. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Contracting Officer before using in Work.

2.07 ADMIXTURES

A. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.

B. Use nonchloride accelerating admixture in concrete slabs placed at ambient temperatures below 50 deg F.

C. Use high-range water-reducing admixture (HRWR) in pumped concrete, concrete for industrial slabs, architectural concrete, parking structure slabs, concrete required to be watertight, and concrete with water/cement ratios below 0.50.

D. Use air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content within ranges indicated.

E. Use admixtures for water reduction and set control in strict compliance with manufacturer's directions.
2.08 CONCRETE MIXING
   A. Ready-Mixed Concrete: Comply with requirements of ASTM C94, and as specified.
      1. When air temperature is between 85 deg F and 90 deg F, reduce mixing and delivery time
         from 1-1/2 hours to 75 minutes, and when air temperature is above 90 deg F, reduce
         mixing and delivery time to 60 minutes.

2.09 REPAIR MATERIALS
   A. Repair Underlayment Beneath Floor Finishes: Cement-based, polymer-modified, self-leveling
      product that can be applied in thicknesses from 1/8-inch and that can be feathered at edges to
      match adjacent floor elevations.
      1. Cement Binder: ASTM C150, portland cement or hydraulic or blended hydraulic cement
         as defined in ASTM C219.
      2. Primer: Product of underlayment manufacturer recommended for substrate, conditions,
         and application.
      3. Aggregate: Well-graded, washed gravel, 1/8- to 1/4-inch or coarse sand as recommended
         by underlayment manufacturer.
      4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM
         C 109/C109M.
   B. Repair Topping: Traffic-bearing, cement-based, polymer-modified, self-leveling product that
      can be applied in thicknesses from 1/4-inch.
      1. Cement Binder: ASTM C150, portland cement or hydraulic or blended hydraulic cement
         as defined in ASTM C219.
      2. Primer: Product of topping manufacturer recommended for substrate, conditions and
         application.
      3. Aggregate: Well-graded, washed gravel, 1/8- to 1/4-inch or coarse sand as recommended
         by topping manufacturer.
      4. Compressive Strength: Not less than 5700 psi at 28 days when tested according to ASTM
         C109/C109M.

2.10 CONCRETE TYPES (INTERIOR AND EXTERIOR SLABS):
   A. As indicated, provide concrete of specified strengths and mix designs with the following
      appearance characteristics:
      2. Portland cement, broom finish, exterior.

PART 3 - EXECUTION

3.01 GENERAL
   A. Coordinate the installation of joint materials and underslab vapor barriers with placement of
      forms and reinforcing steel.

3.02 FORMS
   A. General: Design, erect, support, brace, and maintain formwork to support vertical and lateral,
      static and dynamic loads that might be applied until concrete structure can support such loads.
      Construct formwork so concrete members and structures are of correct size, shape, alignment,
      elevation, and position. Maintain formwork construction tolerances complying with ACI 347.
   B. Construct forms to sizes, shapes, lines, and dimensions shown and to obtain accurate
      alignment, location, grades, level, and plumb work in finished structures. Provide for openings,
      offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking,
      screeds, bulkheads, anchorages and inserts, and other features required in the Work. Use
      selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to
      prevent leakage of cement paste.
   C. Fabricate forms for easy removal without hammering or prying against concrete surfaces.
      Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces.
      Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom
forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like for easy removal.

D. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

E. Chamfer exposed corners and edges as indicated, using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

F. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.

G. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before concrete is placed. Retighten forms and bracing before concrete placement, as required, to prevent mortar leaks and maintain proper alignment.

3.03 PLACING REINFORCEMENT

A. General: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports and as herein specified.
   1. Avoiding cutting or puncturing underslab vapor barrier during reinforcement placement and concreting operations.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as approved by Contracting Officer.

D. Place reinforcement to maintain at least minimum coverages for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire fabric in as long lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

F. Rebar Dowels: When repairing concrete slabs that have been trenched, or where new concrete slabs abut existing concrete slabs, dowel existing concrete slabs to new concrete. Drill minimum 4 inch deep holes into edges of existing concrete slabs at 16 inches on center maximum, and anchor #3 rebar dowels in holes with epoxy adhesive.

3.04 JOINTS

A. Construction Joints: Locate and install construction joints as indicated on the structural drawings or, if not indicated, locate so as not to impair strength and appearance of the structure, as acceptable to Contracting Officer.

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

C. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints except as indicated otherwise. Do not continue reinforcement through sides of strip placements.

D. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.
E. Isolation Joints in Slabs-on-Ground: Construct isolation joints in slabs-on-ground at points of contact between slabs-on-ground and vertical surfaces, such as column pedestals, foundation walls, grade beams, and elsewhere, as indicated.
   1. Joint filler and sealant materials are specified in Section 07 92 00 - Joint Sealants.

F. Contraction (Control) Joints in Slabs-on-Ground: Construct contraction joints in slabs-on-ground to form panels of patterns as shown. Use saw cuts 1/8-inch wide by one-fourth slab depth.
   1. Contraction joints in unexposed floor slabs may be formed by saw cuts as soon as possible after slab finishing as may be safely done without dislodging aggregate. Joints MUST be made within 6 hours of finishing floors, and in no case shall cuts be made later than 12 hours from placement.
   2. Apply joint sealant to all exposed contraction joints. Color selected to match adjacent surface. Joint sealant material is specified in Section 07 92 00 - Joint Sealants.

3.05 INSTALLATION OF EMBEDDED ITEMS

A. General: Set and build into work anchorage devices and other embedded items required for other work that is attached to or supported by cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached thereto.

B. Forms for Slabs: Set edge forms, bulkheads, and intermediate screed strips for slabs to obtain required elevations and contours in finished surfaces. Provide and secure units to support screed strips using strike-off templates or compacting-type screeds.

3.06 UNDERSLAB VAPOR BARRIER

A. Slabs on Grade: Install vapor barrier under interior slabs on grade and elsewhere as indicated. Lap joints minimum 6 inches. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor barrier before covering.
   1. Vapor Barrier Over Granular Fill: Install compactible granular fill before placing vapor barrier as shown on the drawings. Do not use sand.
   2. Installation: Comply with ASTM E1643.

3.07 PREPARATION OF FORM SURFACES

A. General: Coat contact surfaces of forms with an approved, nonresidual, low-VOC, form-coating compound before placing reinforcement.

B. Do not allow excess form-coating material to accumulate in forms or come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer’s instructions. Clean reused forms of concrete residue, repair and patch as required to return forms to acceptable surface condition.

C. Coat steel forms with a nonstaining, rust-preventative material. Rust-stained steel formwork is not acceptable.

3.08 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work.

B. General: Comply with ACI 304, “Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete,” and as herein specified.

C. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete that has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation at its final location.

D. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers no deeper than 24 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.
1. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI 309.

2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of the machine. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.

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

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

2. Bring slab surfaces to correct level with a straightedge and strike off. Use bull floats or darbies to smooth surface free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.

3. Maintain reinforcing in proper position on chairs during concrete placement.

F. Hot-Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.

1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 deg F. Mixing water may be chilled or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Use of liquid nitrogen to cool concrete is Contractor's option.

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

3. Fog spray forms, reinforcing steel, and subgrade just before placing concrete.

4. Use water-reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions, when acceptable to Contracting Officer.

G. Cold-Weather Placing: Comply with provisions of ACI 306 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.

   a. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

   b. Do not use calcium chloride, salt, and other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.

3.09 FINISH OF FORMED SURFACES

A. Rough-Form Finish: For formed concrete surfaces not exposed to view in the finish Work or concealed by other construction. This is the concrete surface having texture imparted by form-facing material used, with tie holes and defective areas repaired and patched, and fins and other projections exceeding 1/4-inch in height rubbed down or chipped off.

B. Smooth-Form Finish: For formed concrete surfaces exposed to view or to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, painting, or another similar system. This is an as-cast concrete surface obtained with selected form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas with fins and other projections completely removed and smoothed.

C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces occurring 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.

3.10 MONOLITHIC SLAB FINISHES

A. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as hereinafter specified:
1. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating, using float blades or float shoes only, when surface water has disappeared, when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats or by hand-floating if area is small or inaccessible to power units. Check and level surface plane to tolerances of overall minimum Ff 35-Ff 25 with local minimum Ff 21-Ff 15. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

B. Trowel Finish: Apply a trowel finish to monolithic slab surfaces to be exposed to view and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or other thin film-finish coating system.
1. After floating, begin first trowel-finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and with surface leveled to tolerances of Ff20 - Ff 17. Grind smooth any surface defects that would telegraph through applied floor covering system, including edge curling at joints.

3.11 CONCRETE CURING AND PROTECTION

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry, and windy weather protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply in accordance with manufacturer's instructions after screeding and bull floating, but before power floating and troweling.

B. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.

C. Curing Methods: Perform curing of concrete by curing and sealing compound, by moist curing, by moisture-retaining cover curing, and by combinations thereof, as herein specified.
1. Provide moisture curing by following methods:
   a. Keep concrete surface continuously wet by covering with water.
   b. Use continuous water-fog spray.
   c. Cover concrete surface with specified absorptive cover, thoroughly saturate cover with water, and keep continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with a 4-inch lap over adjacent absorptive covers.
   d. Provide moisture-cover curing as follows:
      1) Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
   e. Provide curing and sealing compound to exposed interior slabs and to exterior slabs, walks, and curbs as follows:
      1) Apply specified curing and sealing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours and after surface water sheen has disappeared). Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.
      2) Use membrane curing compounds that will not affect surfaces to be covered with finish materials applied directly to concrete.
D. Curing Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces, by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

E. Curing Unformed Surfaces: Cure unformed surfaces, such as slabs, floor topping, and other flat surfaces, by application of appropriate curing method.

F. Final cure concrete surfaces to receive liquid floor hardener or finish flooring by use of moisture-retaining cover, unless otherwise directed.

3.12 REMOVAL OF FORMS
A. General: Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations, and provided curing and protection operations are maintained.

3.13 REUSE OF FORMS
A. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-coating compound as specified for new formwork.

B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use "patched" forms for exposed concrete surfaces except as acceptable to Contracting Officer.

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

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations, as shown on drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with certified diagrams or templates of manufacturer furnishing machines and equipment. Grout base plates and foundations as indicated using specified non-shrink grout. Use non-metallic grout for exposed conditions.

3.15 CONCRETE SURFACE REPAIRS
A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to Contracting Officer.
   1. Cut out honeycomb, rock pockets, voids over 1/4 inch in any dimension, and holes left by tie rods and bolts down to solid concrete but in no case to a depth less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with specified bonding agent. Place patching mortar before bonding compound has dried.
   2. For exposed-to-view surfaces, blend white Portland cement and standard Portland cement so that, when dry, patching mortar will match surrounding color. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

B. Repair of Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Contracting Officer. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on surface, and stains and other discolorations that cannot be removed by cleaning.
Flush out form tie holes and fill with dry-pack mortar or precast cement cone plugs secured in place with bonding agent.

1. Repair concealed formed surfaces, where possible, that contain defects that affect the concrete's durability. If defects cannot be repaired, remove and replace the concrete.

C. Repair of Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for trueness of slope and smoothness by using a template having the required slope.

1. Repair finished unformed surfaces that contain defects that affect the concrete's durability. Surface defects, as such, include crazing and cracks in excess of 0.01-inch wide or that penetrate to reinforcement or completely through nonreinforced sections regardless of width, spalling, popouts, honeycombs, rock pockets, and other objectionable conditions.

2. Correct high areas in unformed surfaces by grinding after concrete has cured at least 14 days.

3. Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out low areas and replacing with patching compound. Finish repaired areas to blend into adjacent concrete. Proprietary underlayment compounds may be used when acceptable to Contracting Officer.

4. Repair defective areas, except random cracks and single holes not exceeding 1 inch in diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding compound. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

5. Correct low areas in existing slab by scarifying surface, priming and finishing with patching compound blended into adjacent concrete.

D. Repair isolated random cracks and single holes not over 1 inch in diameter by dry-pack method. Groove top of cracks and cut out holes to sound concrete and clean of dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Mix dry-pack consisting of one part Portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Place dry-pack before sound concrete with clean, square cuts and expose reinforcing steel with at least 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding compound. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Keep patched area continuously moist for not less than 72 hours.

E. Perform structural repairs with prior approval of Contracting Officer for method and procedure, using specified epoxy adhesive and mortar.

F. Repair methods not specified above may be used, subject to acceptance of Contracting Officer.

3.16 QUALITY CONTROL TESTING DURING CONSTRUCTION

A. General: EXCHANGE will employ a testing laboratory to perform tests and to submit test reports.

B. Sampling and testing for quality control during concrete placement may include the following, as directed by Contracting Officer.

C. Sampling Fresh Concrete: ASTM C172, except modified for slump to comply with ASTM C94.

1. Slump: ASTM C143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.

2. Air Content: ASTM C173, volumetric method for lightweight or normal weight concrete; ASTM C231, pressure method for normal weight concrete; one for each day's pour of each type of air-entrained concrete.

3. Concrete Temperature: Test hourly when air temperature is 40 deg F and below, when 80 deg F and above, and each time a set of compression test specimens is made.

4. Compression Test Specimen: ASTM C31; one set of four standard cylinders for each compressive-strength test, unless otherwise directed. Mold and store cylinders for laboratory-cured test specimens except when field-cure test specimens are required.
5. Compressive-Strength Tests: ASTM C39; at least one set for each day's pour, or not less than once for each 150 cubic yards of concrete, or not less than once for each 5,000 SF of surface area for slabs or walls; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.
   a. When frequency of testing will provide fewer than five strength tests for a given class of concrete, conduct testing from at least five randomly selected batches or from each batch if fewer than five are used.
   b. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.
   c. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength, and no individual strength test result falls below specified compressive strength by more than 500 psi.

D. Test results will be reported in writing to Contracting Officer, Structural Engineer, ready-mix producer, and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the Project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day tests and 28-day tests.

E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

F. Additional Tests: The testing service will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Contracting Officer. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42, or by other methods as directed. Contractor shall pay for such tests when unacceptable concrete is verified.

END OF SECTION
SECTION 05 40 00
COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Heavy-gage formed steel stud interior wall and bulkhead framing (18 gage and heavier).

1.02 RELATED REQUIREMENTS
A. Section 06 10 00 - Rough Carpentry: Wood blocking and miscellaneous framing.
B. Section 09 21 16 - Gypsum Board Assemblies: Lightweight, non-load bearing metal stud framing (20 gage and lighter) and glass mat faced gypsum drywall.
C. Section 09 51 00 - Acoustical Ceilings: Ceiling suspension system.

1.03 REFERENCE STANDARDS
A. AISI S100-12 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2012.
C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
D. ASTM C955 - Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases; 2011c.

1.04 ADMINISTRATIVE REQUIREMENTS
A. Coordinate with work of other sections that is to be installed in or adjacent to the metal framing system, including but not limited to structural anchors, cladding anchors, utilities, insulation, and firestopping.

1.05 SUBMITTALS
A. See Section 01 33 00 - Submittals, for submittal procedures.
B. Product Data: Provide data on standard framing members; describe materials and finish, product criteria, limitations.
C. Product Data: Provide manufacturer's data on factory-made framing connectors, showing compliance with requirements.
D. Shop Drawings: Indicate component details, framed openings, bearing, anchorage, loading, welds, and type and location of fasteners, and accessories or items required of related work.
   1. Indicate stud and purlin layout.
   2. Describe method for securing studs to tracks and for welded or screwed framing connections.
   3. Provide design engineer's stamp on shop drawings.
E. Manufacturer's Installation Instructions: Indicate special procedures, conditions requiring special attention.

1.06 QUALITY ASSURANCE
A. Designer Qualifications: Design framing system under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State in which the Project is located.
B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, and with minimum three years of documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience and approved by manufacturer.

D. Metal stud manufacturer shall be responsible for detailing all connections.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Framing:

B. Framing Connectors and Accessories:
   1. Same manufacturer as metal framing.

2.02 FRAMING SYSTEM

A. Provide primary and secondary framing members, bridging, bracing, plates, gussets, clips, fittings, reinforcement, and fastenings as required to provide a complete framing system.

B. Design Criteria: Provide completed framing system having the following characteristics:
   1. Design: Calculate structural characteristics of cold-formed steel framing members according to AISI S100-12.
   2. Structural Performance: Design, engineer, fabricate, and erect to withstand specified design loads for project conditions within required limits.
   3. Design Loads: In accordance with applicable codes.
   4. Live load deflection meeting the following, unless otherwise indicated:
      a. Design non-axial loadbearing framing to accommodate not less than 1/2 in vertical deflection.
   5. Able to tolerate movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.
   6. Able to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

C. Shop fabricate framing system to the greatest extent possible.

D. Deliver to site in largest practical sections.

2.03 FRAMING MATERIALS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Studs and Track: ASTM C955; studs formed to channel, "C", or "Sigma" shape with punched web; U-shaped track in matching nominal width and compatible height.
   1. Gage and Depth: As indicated on the drawings. Provide heavier gage if required to meet specified performance levels. Minimum thicknesses shall be as follows:
      a. 18 Gage: 43 mils, 0.0428 inch.
      b. 16 Gage: 54 mils, 0.0538 inch.
      c. 14 Gage: 68 mils, 0.0677 inch.
      d. 12 Gage: 97 mils, 0.0966 inch.

C. Framing Connectors: Factory-made, formed steel sheet.
1. Material: ASTM A653/A653M SS Grade 40 (minimum), with G90/Z275 hot dipped galvanized coating for base metal thickness less than 10 gage, 0.1345 inch, and factory punched holes and slots.
2. Structural Performance: Maintain load and movement capacity required by applicable code, when evaluated in accordance with AISI S100-12.
3. Movement Connections: Provide mechanical anchorage devices that accommodate movement using slotted holes, shouldered screws or screws and anti-friction or stepped bushings, while maintaining structural performance of framing. Provide movement connections where indicated on drawings.
   a. Where continuous studs bypass structural supports, connect stud to support in manner allowing vertical movement of support without affecting studs; allow for minimum movement of 1/2 inch.
   b. Where top of stud wall terminates below structural floor or roof, connect studs to structure in manner allowing vertical movement of structure without affecting studs; allow for minimum movement of 1/2 inch.
   c. Provide top track preassembled with connection devices spaced to fit stud spacing indicated on drawings; minimum track length of 10 feet.
5. Wall Stud Bridging Connections: Provide mechanical load-transferring devices that accommodate wind load torsion and weak axis buckling induced by axial compression loads. Provide bridging connections where indicated on the drawings.
6. Products: Equivalent to the following:
   g. Simpson Strong Tie, By-Pass Movement Connectors; SCB, size as required: www.strongtie.com.
   i. Simpson Strong Tie, Head of Wall Movement Connectors; SCW 5.5 Head-of-Wall Clip: www.strongtie.com.

2.04 ACCESSORIES
   A. Bracing, Furring, Bridging: Formed sheet steel, thickness determined for conditions encountered; finish to match framing components.
   B. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.05 FASTENERS
   A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot dip galvanized per ASTM A153/A153M.
   1. Products:
      a. ITW Commercial Construction North America; ITW CCNA-Buildex Teks Select Series: www.ITWBuildex.com; or approved equivalent.
   B. Anchorage Devices: Powder actuated.
   C. Welding: In conformance with AWS D1.1/D1.1M.
PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that building framing components are ready to receive work.
B. Verify field measurements and adjust installation as required.

3.02 INSTALLATION OF STUDS

A. Install components in accordance with manufacturers’ instructions and ASTM C1007 requirements.
B. Align floor and ceiling tracks; locate to wall layout. Secure in place with fasteners at maximum 16 inches on center. Coordinate installation of sealant with floor and ceiling tracks.
C. Cut framing members by sawing or shearing; do not torch cut.
D. Place studs at 16 inches on center; not more than 2 inches from abutting walls and at each side of openings. Connect studs to tracks using fastener method.
   1. Locate and install mechanical fasteners according to Shop Drawings, complying with requirements for spacing, edge distances, and screw penetration.
E. Construct corners using minimum of three studs. Install double studs at wall openings, door and window jambs.
F. Install load bearing studs full length in one piece. Splicing of studs is not permitted.
G. Install load bearing studs, brace, and reinforce to develop full strength and achieve design requirements.
H. Coordinate placement of insulation in multiple stud spaces made inaccessible after erection.
I. Install intermediate studs above and below openings to align with wall stud spacing.
J. Provide deflection allowance in stud track, directly below horizontal building framing at non-load bearing framing.
K. Attach cross studs to studs for attachment of fixtures anchored to walls.
L. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.
M. Install horizontal bridging in stud walls at maximum spacing of 48 inches o.c.
N. Touch-up field welds and damaged galvanized surfaces with primer.

3.03 TOLERANCES

A. Maximum Variation from True Position: 1/4 inch.
B. Maximum Variation of any Member from Plane: 1/8 inch.

END OF SECTION
SECTION 05 50 00
METAL FABRICATIONS

PART 1 GENERAL
1.01 SECTION INCLUDES
   A. Steel pipe bollards.

1.02 RELATED REQUIREMENTS
   A. Section 03 30 00 - Cast-in-Place Concrete: Placement of metal fabrications in concrete.

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS
   A. See Section 01 33 00 - Submittals, for submittal procedures.
   B. Shop Drawings: Indicate materials, finishes, profiles and sizes. Include erection drawings, elevations, and details where applicable.

PART 2 PRODUCTS
2.01 MATERIALS - STEEL
   B. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATED ITEMS
   A. Bollards: Steel pipe, 6-inch diameter, Schedule 40, concrete filled, crowned cap; galvanized finish.
      1. Pipe shall be 8'-0" long minimum.

2.03 FINISHES - STEEL
   A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
   B. Galvanizing of Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements. Provide minimum 2.0 oz/sq ft galvanized coating.

PART 3 EXECUTION
3.01 EXAMINATION
   A. Verify that field conditions are acceptable and are ready to receive work.

3.02 INSTALLATION
   A. Install items plumb and level, free from defects.
   B. Provide sufficient temporary bracing to maintain true alignment until completion of erection.
   C. After erection, prime abrasions of galvanized steel surfaces.

3.03 TOLERANCES
   A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
   B. Maximum Offset From True Alignment: 1/4 inch.

END OF SECTION
SECTION 06 10 00
ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Preservative treated wood materials.
B. Miscellaneous framing and sheathing.
C. Concealed wood blocking, nailers, and supports.

1.02 RELATED REQUIREMENTS
A. Section 01 14 50 - Cutting and Patching.
B. Section 05 40 00 - Cold Formed Metal Framing: Heavy-gage stud wall and bulkhead framing.
C. Section 06 40 23 - Interior Architectural Woodwork: Interior woodwork specially fabricated for this Project.
D. Section 09 21 16 - Gypsum Board Assemblies: Light-gage metal stud framing, glass mat faced gypsum drywall.

1.03 REFERENCE STANDARDS
D. SPIB (GR) - Grading Rules; 2014.

1.04 SUBMITTALS
A. See Section 01 33 00 - Submittals, for submittal procedures.
B. Product Data: Provide technical data on wood preservative materials.
C. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.

1.05 DELIVERY, STORAGE, AND HANDLING
A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS
A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
   1. Species: Southern Pine, unless otherwise indicated.
   2. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
   3. Lumber of other species or grades is acceptable provided structural and appearance characteristics are equivalent to or better than products specified.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS
A. Grading Agency: Southern Pine Inspection Bureau, Inc; SPIB (GR).
B. Sizes: Nominal sizes as indicated on drawings, S4S.
C. Moisture Content: S-dry or MC19.
D. Stud Framing (2 by 2 through 2 by 6):
   1. Species: Southern Pine.
   2. Grade: No. 2.
E. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
   1. Lumber: S4S, No. 2 or Standard Grade.
   2. Boards: Standard or No. 3.

2.03 CONSTRUCTION PANELS
A. Plywood Sheathing: PS 1, Grade C-C, Exterior Exposure, 3/4 inch thickness.

2.04 ACCESSORIES
A. Fasteners and Anchors:
   2. Drywall Screws: Bugle head, hardened steel, power driven type, length to achieve full penetration of sheathing substrate.
   3. Anchors: Bolt or ballistic fastener for anchorages to steel.
B. Toggle Bolt Fasteners: For anchorage of non-structural items to hollow masonry.
C. Expansion Shield Fasteners: For anchorage of non-structural items to solid masonry and concrete.
D. Powder Actuated Fasteners: For anchorage of non-structural items to steel.

2.05 FACTORY WOOD TREATMENT
A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
   1. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.
B. Preservative Treatment:
   1. Manufacturers:
C. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative.
   1. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
   2. Treat lumber exposed to weather.
   3. Treat lumber in contact with roofing, flashing, or waterproofing.
   4. Treat lumber in contact with masonry or concrete.
   5. Treat lumber less than 18 inches above grade.
   6. Treat lumber in other locations as indicated.
D. Preservative Pressure Treatment of Plywood Above Grade: AWPA U1, Use Category UC2 and UC3B, Commodity Specification F using waterborne preservative.
   1. Kiln dry plywood after treatment to maximum moisture content of 19 percent.
   2. Treat plywood in contact with roofing, flashing, or waterproofing.
   3. Treat plywood in contact with masonry or concrete.
   4. Treat plywood less than 18 inches above grade.
   5. Treat plywood in other locations as indicated.

PART 3 EXECUTION
3.01 PREPARATION
A. Coordinate installation of rough carpentry members specified in other sections.

3.02 INSTALLATION - GENERAL
A. Select material sizes to minimize waste.
B. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.03 FRAMING INSTALLATION

A. Set structural members level, plumb, and true to line. Discard pieces with defects that would lower required strength or result in unacceptable appearance of exposed members.

B. Make provisions for temporary construction loads, and provide temporary bracing sufficient to maintain structure in true alignment and safe condition until completion of erection and installation of permanent bracing.

C. Install structural members full length without splices unless otherwise specifically detailed.

D. Comply with member sizes, spacing, and configurations indicated, and fastener size and spacing indicated, but not less than required by applicable codes and AWC (WFCM) Wood Frame Construction Manual.

E. Install horizontal spanning members with crown edge up and not less than 1-1/2 inches of bearing at each end.

F. Frame wall openings with two or more studs at each jamb; support headers on cripple studs.

3.04 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.

C. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

D. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

E. Provide the following specific non-structural framing and blocking:
   1. Cabinets and shelf supports.
   2. Wall brackets.
   3. Handrails.
   4. Grab bars.
   5. Towel and bath accessories.
   6. Wall-mounted door stops.
   7. Chalkboards and marker boards.
   8. Wall paneling and trim.
   9. Joints of rigid wall coverings that occur between studs.

3.05 ROOF-RELATED CARPENTRY

A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.

B. Provide wood curb at all roof openings except where prefabricated curbs are specified and where specifically indicated otherwise. Form corners by alternating lapping side members.

C. Wood Nailers: Provide wood nailers at all perimeters and other locations where indicated on the drawings, of total height matching the total thickness of insulation being used.
   1. Install with 1/8 inch gap between each length and at each change of direction.
   2. Mechanically fasten to deck to resist force of 250 lbf per linear foot.
   3. Provide screw fasteners recommended by manufacturer for conditions encountered. Minimum fastener requirements for each wood nailer are as follows:
      a. Space screws 18 inches o.c., maximum, with a minimum 1 inch thread embedment.
      b. Use three anchors per length of wood nailer minimum.
3.06 INSTALLATION OF CONSTRUCTION PANELS
   A. Sheathing: Secure with long dimension perpendicular to studs, with ends over firm bearing and staggered, using screws.

3.07 SITE APPLIED WOOD TREATMENT
   A. Apply preservative treatment compatible with factory applied treatment at site-sawn cuts, complying with manufacturer's instructions.
   B. Allow preservative to dry prior to erecting members.

3.08 TOLERANCES
   A. Framing Members: 1/4 inch from true position, maximum.
   B. Variation from Plane: 1/4 inch in 10 feet maximum, and 1/2 inch in 30 feet maximum.

3.09 CLEANING
   A. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.
   B. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION
SECTION 06 40 23
INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.01 SECTION INCLUDES
   A. Front counter.
   B. Solid surfacing material for countertops (EF/CI).
   C. Counter support legs (CF/CI).
   D. Wood plank siding and trim (EF/CI).

1.02 RELATED REQUIREMENTS
   A. Section 06 10 00 - Rough Carpentry: Wood stud framing and plywood sheathing at Front Counter.
   B. Section 09 21 16 - Gypsum Board Assemblies: Glass mat faced gypsum board tile substrate at Front Counter.
   C. Section 09 30 00 - Tiling: Tile finish at Front Counter.
   D. Section 09 77 33 - Glass Fiber Reinforced Plastic Panels: FRP finish at Front Counter.

1.03 SUBMITTALS
   A. See Section 01 33 00 - Submittals, for submittal procedures.
   B. Product data on stainless steel counter support legs.
   C. Shop drawings showing location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
      1. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcing specified in other Sections.

1.04 QUALITY ASSURANCE
   A. Fabricator Qualifications: Firm experienced in producing architectural woodwork similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units without delaying the Work.
   B. Quality Standard: Except as otherwise indicated, comply with the following standard:

1.05 DELIVERY, STORAGE, AND HANDLING
   A. Protect woodwork during transit, delivery, storage, and handling to prevent damage, soilage, and deterioration.
   B. Do not deliver woodwork until painting and similar operations that could damage, soil, or deteriorate woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas whose environmental conditions meet requirements specified in "Project Conditions."

1.06 PROJECT CONDITIONS
   A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet-work is completed, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.
   B. Field Measurements: Where woodwork is indicated to be fitted to other construction, check actual dimensions of other construction by accurate field measurements before fabrication, and show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
1. Verify locations of concealed framing, blocking, reinforcements, and furring that support woodwork by accurate field measurements before being enclosed. Record measurements on final shop drawings.

1.07 COORDINATION
A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

PART 2 - PRODUCTS

2.01 MATERIALS
A. General: Provide materials that comply with requirements of the AWI quality standard for each type of woodwork and quality grade indicated.

B. Solid-Surfacing Material (EF/CI): Homogeneous solid sheets of filled plastic resin complying with material and performance requirements in ANSI Z124.3, for Type 5 or Type 6, without a precoated finish.
   1. Products: See Finishes Legend.

C. Counter Support Legs (CF/CI): ASTM A167, Type 304 commercial grade stainless steel, No. 4 finish, adjustable height, with nylon button feet.

D. Wood Plank Siding and Trim (EF/CI): As indicated on drawings.

2.02 INSTALLATION MATERIALS
A. Screws: Select material, type, size, and finish required for each use. Comply with ASME B18.6.1 for applicable requirements.
   1. For metal framing supports, provide screws as recommended by metal-framing manufacturer.

B. Nails: Select material, type, size, and finish required for each use. Comply with FS FF-N-105 for applicable requirements.

C. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed steel or lead expansion bolt devices for drilled-in-place anchors.

2.03 FABRICATION, GENERAL
A. Interior Woodwork Grade: Provide interior woodwork complying with the referenced quality standard and of the following grade:
   1. Grade: Custom.

B. Fabricate woodwork to dimensions, profiles, and details indicated.

C. Complete fabrication, including assembly, finishing, and hardware application, before shipment to Project site to maximum extent possible. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

D. Shop-cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Smooth edges of cutouts and, where located in countertops and similar exposures, seal edges with a water-resistant coating.

E. Provide adjustable height stainless steel legs with nylon button feet. Fasten legs to counter securely and rigidly.

PART 3 - EXECUTION

3.01 PREPARATION
A. Condition woodwork to average prevailing humidity conditions in installation areas before installing.
B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including back priming and removal of packing.

3.02 INSTALLATION

A. Quality Standard: Install woodwork to comply with AWI Section 1700 for the same grade specified in Part 2 of this Section for type of woodwork involved.

B. Install woodwork plumb, level, true, and straight with no distortions. Shim as required with concealed shims. Install to a tolerance of 1/8 inch in 96 inches for plumb and level (including tops).

C. Scribe and cut woodwork to fit adjoining work and refinish cut surfaces or repair damaged finish at cuts.

D. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for complete installation.

   1. Anchor securely to base units and other support systems as indicated.

F. Wood Plank Siding and Trim: Install in accordance with supplier's recommendations.

3.03 ADJUSTING AND CLEANING

A. Repair damaged and defective woodwork where possible to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

3.04 PROTECTION

A. Provide final protection and maintain conditions in a manner acceptable to fabricator and Installer that ensures that woodwork is without damage or deterioration at the time of Substantial Completion.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES
A. Protection of and modifications to existing roofing system, as required, to accommodate performance of new work as indicated.

1.02 RELATED REQUIREMENTS
A. Section 01 14 50 - Cutting and Patching: Protection of existing work to remain; cutting and patching.
B. Section 02 41 16 - Selective Demolition.
C. Section 06 10 00 - Rough Carpentry: Roofing nailers for roof curbs.
D. Division 23 - HVAC: Roof curbs for rooftop-mounted equipment.

1.03 ADMINISTRATIVE REQUIREMENTS
A. Coordinate with affected mechanical and electrical work associated with roof penetrations.

1.04 QUALITY ASSURANCE
A. The existing Exchange roof is covered under existing roof warranties.
   1. The Contractor shall obtain information about existing warranties from the Owner, and shall conduct his work in a manner that protects existing roof surfaces and maintains existing warranties.
B. To maintain the existing warranty, the Contractor shall follow the manufacturer's instructions to modify and/or repair the roof as necessary to accomplish any new work required.
   1. Warranties typically require that any repairs, modifications or additions to the roofing system be approved in writing in advance.
C. All modifications and/or repairs must be done in accordance with the manufacturer's instructions.
D. Roofing modifications and/or repairs to any roof currently under warranty must be performed by a roofing contractor approved by the roofing manufacturer.
E. Manufacturer Approval: Provide written approval from the roofing manufacturer, including the following:
   1. Approval of the installing Roofing Contractor.
   2. Approved installation details.
   3. Verification that the existing warranty will remain in effect.

1.05 FIELD CONDITIONS
A. Do not remove existing rooftop equipment or roofing membrane when weather conditions threaten the integrity of the building contents or intended continued occupancy.
B. Maintain continuous temporary protection prior to and during performance of any new work and installation of any required roofing system modifications.

PART 2 PRODUCTS

2.01 MATERIALS
A. All materials used in modifications and/or repairs to existing roofing system shall be as approved by the manufacturer of the existing warranted roof system.

PART 3 EXECUTION

3.01 GENERAL
A. Modifications to Existing Roof Membrane: The Roofing Contractor shall be responsible for making modifications to the existing roof as necessary to tie into new construction.
   1. Any work shall be approved by the roofing manufacturer in writing in advance.
2. A weathertight and leak-free roof shall be provided.
3. Work shall be done in accordance with roof manufacturer’s recommendations.
4. Modifications shall be included under the existing warranty.

3.02 FIELD QUALITY CONTROL

A. Manufacturer's Field Reports: If manufacturer's technical representative is required to make any site visits before, during, or after performance of roofing modifications, provide copies of any field reports to Architect and Contracting Officer.

END OF SECTION
SECTION 07 92 00
JOINT SEALANTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Joint sealants for the following locations:
   1. Exterior joints in vertical surfaces and nontraffic horizontal surfaces as indicated below:
      a. Control joints in masonry walls.
      b. Control and expansion joints in cast-in-place concrete.
      c. Perimeter joints between adjacent materials and frames of doors and windows.
      d. Other joints as indicated.
   2. Exterior joints in horizontal traffic surfaces as indicated below:
      a. Control, expansion, and isolation joints in cast-in-place concrete slabs.
      b. Other joints as indicated.
   3. Interior joints in vertical surfaces and horizontal nontraffic surfaces as indicated below:
      a. Control and expansion joints on exposed interior surfaces of exterior walls.
      b. Perimeter joints of exterior openings where indicated.
      c. Tile control and expansion joints.
      d. Perimeter joints between interior wall surfaces and frames of interior doors.
      e. Perimeter joints of plumbing fixtures.
      f. Other joints as indicated.
   4. Interior joints in horizontal traffic surfaces as indicated below:
      a. Control and expansion joints in cast-in-place concrete slabs.
      b. Control and expansion joints in tile floors.
      c. Other joints as indicated.

1.02 RELATED REQUIREMENTS

A. Section 09 30 00 - Tiling: Sealing tile joints.
B. Section 09 51 00 - Acoustical Ceilings: Sealing edge moldings at perimeter of acoustical ceilings.

1.03 SYSTEM PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that have been produced and installed to establish and to maintain watertight and airtight continuous seals without causing staining or deterioration of joint substrates.
B. Provide joint sealants for interior applications that have been produced and installed to establish and maintain airtight continuous seals that are water resistant and cause no staining or deterioration of joint substrates.

1.04 SUBMITTALS

A. See Section 01 33 00 - Submittals, for submittal procedures.
B. Product data from manufacturers for each joint sealant product required.
C. Certification by joint sealant manufacturer that sealants plus the primers and cleaners required for sealant installation comply with local regulations controlling use of volatile organic compounds.
D. Samples for initial selection purposes in form of manufacturer's standard bead samples, consisting of strips of actual products showing full range of colors available, for each product exposed to view.
E. Certificates from manufacturers of joint sealants attesting that their products comply with specification requirements and are suitable for the use indicated.
F. Product test reports for each type of joint sealants indicated, evidencing compliance with requirements specified.
1.05 QUALITY ASSURANCE
   A. Single Source Responsibility for Joint Sealant Materials: Obtain joint sealant materials from a single manufacturer for each different product required.

1.06 DELIVERY, STORAGE, AND HANDLING
   A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multicomponent materials.
   B. Store and handle materials in compliance with manufacturer’s recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.07 PROJECT CONDITIONS
   A. Environmental Conditions: Do not proceed with installation of joint sealants under the following conditions:
      1. When ambient and substrate temperature conditions are outside the limits permitted by joint sealant manufacturer.
      2. When joint substrates are wet.
   B. Joint Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than allowed by joint sealant manufacturer for application indicated.
   C. Joint Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

1.08 SEQUENCING AND SCHEDULING
   A. Sequence installation of joint sealants to occur not less than 21 nor more than 30 days after completion of waterproofing, unless otherwise indicated.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL
   A. Compatibility: Provide joint sealants, joint fillers, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
   B. Colors: Provide color of exposed joint sealants to comply with the following:
      1. Provide selections made by Contracting Officer from manufacturer's full range of standard colors for products of type indicated.

2.02 ELASTOMERIC JOINT SEALANTS
   A. Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing elastomeric sealants that comply with ASTM C 920, including those requirements referencing ASTM C 920 classifications for Type, Grade, Class, and Uses.
   B. Exterior joints in vertical surfaces and nontraffic horizontal surfaces:
      1. One-Part Nonsag Silicone Sealant: Grade NS, Class 25 minimum; Uses NT, A, G, M, O; neutral curing, non-staining, fugus-resistant, non-bleeding.
      2. Multi-Part Nonsag Urethane Sealant: Grade NS, Class 25; Type M; Uses NT, M, A, and as applicable to joint substrates indicated, O.
   C. Exterior and interior joints in horizontal traffic surfaces:
      1. Multi-Part Pourable Urethane Sealant: Grade P, Class 25; Type M; Uses T, M, G, A, and as applicable to joint substrates indicated, O.
   D. Interior joints in vertical surfaces and horizontal nontraffic surfaces:
      1. One-Part Mildew-Resistant Silicone Sealant: Grade NS, Class 25; Type S; Uses NT, G, A, and as applicable to nonporous joint substrates indicated, O; formulated with fungicide; intended for sealing interior joints with nonporous substrates and subject to in-service exposure to conditions of high humidity and temperature extremes.
E. Available Products: Subject to compliance with requirements, elastomeric sealants which may be incorporated in the Work included, but are not limited to, the following:

1. One-Part Nonsag Silicone Sealant:

2. One-Part Mildew-Resistant Silicone Sealant:
   a. "Dow-Corning 786," Dow Corning Corp.
   c. "Tremsil 200," Tremco Corp.

3. Multi-Part Nonsag Urethane Sealant for Use NT:
   b. "Dynatrol II"; Pecora Corp.
   c. "MasterSeal NP 2," BASF Corp.
   d. "Dymeric," Tremco Inc.

4. Multi-Part, Pourable, Urethane Sealant for Use T:
   c. "MasterSeal SL 2," BASF Corp.
   d. "THC-900," Tremco Inc.

2.03 LATEX JOINT SEALANTS

A. Interior joints in gypsum wall board and woodwork.

B. General: Provide manufacturer's standard one-part, nonsag, mildew-resistant, paintable latex sealant of formulation indicated that is recommended for exposed applications on interior and protected exterior locations and that accommodates indicated percentage change in joint width existing at time of installation without failing either adhesively or cohesively.

C. Siliconized Acrylic Sealant: Provide product complying with ASTM C 834, Type OP, that accommodates joint movement of not less than 5 percent in both extension and compression for a total of at least 10 percent.

D. Products: Subject to compliance with requirements, provide one of the following:

   1. Siliconized Acrylic Sealant:

2.04 JOINT SEALANT BACKING

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Plastic Foam Joint Fillers: Preformed, compressible, resilient, nonstaining, nonwaxing, nonextruding strips of flexible plastic foam of material indicated below and of size, shape, and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

   1. Open-cell polyurethane foam.
   2. Closed-cell polyethylene foam, nonabsorbent to liquid water and gas, nonoutgassing in unruptured state.
   3. Any material indicated above.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape as recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.
2.05 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming in any way joint substrates and adjacent nonporous surfaces, and formulated to promote optimum adhesion of sealants with joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint sealant performance. Do not proceed with installation of joint sealants until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with recommendations of joint sealant manufacturer and the following requirements:
   1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
   2. Clean concrete, masonry, unglazed surfaces of ceramic tile, and similar porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.
   3. Remove laitance and form release agents from concrete.
   4. Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile, and other nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

B. Joint Priming: Prime joint substrates where indicated or where recommended by joint sealant manufacturer based on preconstruction joint sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's recommendations. Confine primers to areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.03 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint sealant manufacturer's printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Installation of Sealant Backings: Install sealant backings to comply with the following requirements:
   1. Install joint fillers of type indicated to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
      a. Do not leave gaps between ends of joint fillers.
b. Do not stretch, twist, puncture, or tear joint fillers.
c. Remove absorbent joint fillers that have become wet prior to sealant application and replace with dry material.

2. Install bond breaker tape between sealants where backer rods are not used between sealants and joint fillers or back of joints.

D. Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability. Install sealants at the same time sealant backings are installed.

E. Tooling of Nonsag Sealants: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets, and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

1. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

3.04 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.05 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so that and installations with repaired areas are indistinguishable from original work.

END OF SECTION
SECTION 09 21 16
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal stud interior wall framing.
B. Glass-mat-faced gypsum wallboard.
C. Coated glass-mat-faced gypsum backing board.
D. Joint treatment and accessories.

1.02 RELATED REQUIREMENTS

A. Section 05 40 00 - Cold Formed Metal Framing: Metal stud framing heavier than 20 gage.
B. Section 06 10 00 - Rough Carpentry: Wood blocking product and execution requirements.
C. Section 09 30 00 - Tiling.
D. Section 09 90 00 - Painting.

1.03 REFERENCE STANDARDS

A. AISI S100-12 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2012.
B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
G. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2015.
H. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2014.
N. GA-226 - Application of Gypsum Board to Form Curved Surfaces; Gypsum Association; 2008.

1.04 SUBMITTALS

A. See Section 01 33 00 - Submittals, for submittal procedures.
B. Product Data: Provide data on metal framing, glass mat faced gypsum board, accessories, and joint finishing system.
C. Product Data: Provide manufacturer’s data on partition head to structure connectors, showing compliance with requirements.
1.05 QUALITY ASSURANCE
   A. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum 3 years of experience.

PART 2 PRODUCTS
2.01 GYPSUM BOARD ASSEMBLIES
   A. Provide completed assemblies complying with ASTM C840 and GA-216.
      1. See PART 3 for finishing requirements.

2.02 METAL FRAMING MATERIALS
   A. Manufacturers - Metal Framing, Connectors, and Accessories:

   B. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing as follows:
      1. Maximum Deflection:
         a. Typical Drywall Partitions: L/240 at 5 psf, unless otherwise indicated.
            1) All interior metal studs shall be minimum 20 gage, 3-5/8 inches deep, unless otherwise indicated.
         b. Veneer Assemblies: L/360 at 5 psf.
            1) Veneer assemblies include drywall partitions with ceramic tile, porcelain tile, veneer plaster, or other applied hard finishes.
            2) All interior gypsum drywall partitions to receive an applied veneer finish such as ceramic or porcelain tile shall be framed of minimum 20 gage, 3-5/8 inch deep, 33 mils thick (0.0329 inch) cold-formed metal studs. Heavier gage studs, if indicated or required to meet deflection requirements, are specified in Section 05 40 00.
      2. Studs: "C" shaped with flat or formed webs, with knurled faces, and minimum 1.625-inch flanges with flange return lips.
         a. Provide 20 gage or heavier studs at all locations. Do not use any 22 or 25 gage studs.
         1) Studs heavier than 20 gage are specified in Section 05 40 00.

   C. Loadbearing Studs for Application of Gypsum Board: As specified in Section 05 40 00.

   D. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws and anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition.
      1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI S100-12.
      3. Provide components UL-listed for use in UL-listed fire-rated head of partition joint systems of fire rating and movement required.
      4. Deflection and Firestop Track:
         a. Provide mechanical anchorage devices as described above that accommodate deflection while maintaining the fire-rating of the wall assembly.
5. Products:
6. Provide top track preassembled with connection devices spaced to fit stud spacing indicated on drawings; minimum track length of 12 feet.

2.03 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:

B. Glass-Mat-Faced Gypsum Wallboard: Glass-mat-faced gypsum panels as defined in ASTM C1658/C1658M, suitable for paint finish.
   1. Application:
      a. Glass-mat-faced gypsum panels shall be used at all interior locations, except where coated glass-mat-faced gypsum backing board is required beneath tile finishes.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   3. Thickness:

C. Coated Glass-Mat-Faced Gypsum Backing Board For Wet Areas:
   1. Application:
      a. Wall surfaces scheduled to receive tile base or wall tile.
      b. Walls and ceilings at custodial, bathroom, locker, or shower areas to be painted.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   3. Coated Glass-Mat-Faced Board: Coated glass-mat water-resistant gypsum backing panel as defined in ASTM C1178.
      a. Thickness:
         1) Walls: 5/8 inch.
      b. Products:
         1) Georgia-Pacific Gypsum; Product "DensShield Tile Backer."
         2) National Gypsum Company; Product "Gold Bond eXP Tile Backer."
         3) USG; Product "Durock Brand Glass-Mat Tile Backer Board."

2.04 ACCESSORIES

A. Finishing Accessories: ASTM C1047, galvanized steel or rolled zinc, unless otherwise indicated, with either knurled and perforated or expanded flanges, and beaded for concealment of flanges in joint compound.
   1. Types: Provide corner beads, L-type edge-trim beads, LC-type edge-trim beads, and one-piece control joint beads.
   2. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead at exposed panel edges.
   3. Products:
      a. Same manufacturer as framing materials.

B. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
   1. Tape: 2 inch wide, coated glass fiber tape for joints and corners, for use on glass-mat-faced substrates.
   2. Chemical hardening type joint compound, for use on glass-mat-faced substrates.
C. High Build Drywall Surfacer: Vinyl acrylic latex-based coating for spray application, designed to take the place of skim coating and separate paint primer in achieving Level 5 finish.

D. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inch in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion resistant.

E. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws, corrosion resistant.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify that project conditions are appropriate for work of this section to commence.

3.02 FRAMING INSTALLATION
A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.

B. Studs: Space studs at 16 inches on center.
   1. Extend partition framing to structure where indicated and to 6 inches above ceiling at other locations.
   2. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.

C. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jamb.

D. Blocking: Install wood blocking as specified in Section 06 10 00 for support of:
   1. Framed openings.
   2. Wall mounted cabinets.
   3. Plumbing fixtures.
   4. Wall mounted door hardware.

3.03 BOARD AND GLASS-MAT-FACED BOARD INSTALLATION
A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Single-Layer Non-Rated: Install gypsum board or glass-mat-faced gypsum board, as required, in most economical direction, with ends and edges occurring over firm bearing.

C. Glass-Mat-Faced Gypsum Board: Use glass-mat-faced gypsum board at all locations, except where otherwise indicated.

D. Coated Glass-Mat-Faced Gypsum Board: Use coated glass-mat-faced gypsum board at wall surfaces to receive tile base or wall tile.

E. Installation on Metal Framing: Use screws for attachment of gypsum board.

F. Curved Surfaces: Apply gypsum board to curved substrates in accordance with GA-226.

3.04 INSTALLATION OF TRIM AND ACCESSORIES
A. Control Joints: Place control joints at locations indicated, or if not indicated, consistent with lines of building spaces and as follows:
   1. Not more than 30 feet apart on walls over 50 feet long.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where edge of gypsum board would otherwise be exposed or semi-exposed. Provide type with face flange to receive joint compound.
   1. Install "L" bead where work is tightly abutted to other construction.
   2. Install "LC" bead where edge is exposed, revealed, gasketed, or sealant-filled (including expansion joints).
   3. Semi-finishing edge trim will not be allowed.
3.05 JOINT TREATMENT

A. Glass-Mat-Faced Gypsum Board: Use fiberglass joint tape, bedded and finished with chemical hardening type joint compound.

B. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
   1. Level 5: Walls and ceilings in all public areas, offices, and break rooms; walls to receive vinyl wall covering; walls and ceilings to receive semi-gloss or gloss paint finish.
   2. Level 4: Walls in MPA and back-of-house areas; walls to receive FRP finish; walls behind cabinetry or store fixtures; walls to receive tile finish.
   3. Level 3: Walls to receive textured wall finish.
   4. Level 1: Wall areas above finished ceilings, whether or not accessible in the completed construction.

C. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
   1. Feather coats of joint compound so that camber is maximum 1/32 inch.
   2. Taping, filling and sanding is not required at base layer of double layer applications.

D. Where Level 5 finish is indicated, spray apply high build drywall surfercer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

3.06 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION
SECTION 09 30 00
TILING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tile for floor applications.
B. Tile for wall base applications.
C. Tile for wall applications.
D. Ceramic trim.
E. Setting and grouting materials.

1.02 RELATED REQUIREMENTS

A. Section 01 14 50 - Cutting and Patching.
B. Section 05 40 00 - Cold-Formed Metal Framing: Heavy gage studs, if required, for gypsum
drywall partitions to receive applied tile finishes.
C. Section 07 92 00 - Joint Sealants: Sealing joints between tile work and adjacent construction
and fixtures.
D. Section 09 21 16 - Gypsum Board Assemblies: Installation of lightgage metal framing;
installation of coated glass-mat-faced gypsum backing board as wall tile substrate.

1.03 REFERENCE STANDARDS

A. ANSI A108/A118/A136.1 - American National Standard Specifications for the Installation of
Ceramic Tile (Compendium); 2013.1.
B. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the
Wet-Set Method, with Portland Cement Mortar; 2014.
C. ANSI A108.1b - American National Standard Specifications for Installation of Ceramic Tile on a
Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar; 1999
(Reaffirmed 2010).
D. ANSI A108.1c - Specifications for Contractors Option: Installation of Ceramic Tile in the
Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured
Portland Cement Mortar Bed with Dry-Set or Latex-Portland Cement; 1999 (Reaffirmed 2010).
E. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with
Organic Adhesives or Water Cleanable Tile-Setting Epoxy Adhesive; 2009 (Revised).
F. ANSI A108.5 - American National Standard Specifications for Installation of Ceramic Tile on a
Cured Portland Cement Mortar or Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).
G. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with
Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy; 1999 (Reaffirmed
2010).
H. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with
Chemical Resistant Furan Resin Mortar and Grout; 1999 (Reaffirmed 2010).
I. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with
Modified Epoxy Emulsion Mortar/Grout; 1999 (Reaffirmed 2010).
1999 (Reaffirmed 2010).
K. ANSI A108.11 - American National Standard for Interior Installation of Cementitious Backer
Units; 2010 (Revised).
L. ANSI A108.12 - American National Standard for Installation of Ceramic Tile with EGP (Exterior
glue plywood) Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).


1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.05 PERFORMANCE REQUIREMENTS

A. Dynamic Coefficient of Friction (DCOF): For level interior surfaces expected to be walked on when wet, tile shall have the following minimum wet DCOF AcuTest value, in accordance with ANSI A137.1:
   1. Level Interior Spaces: 0.42 or greater.

1.06 SUBMITTALS

A. See Section 01 33 00 - Submittals, for submittal procedures.

B. Product Data: Provide manufacturers’ data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.

C. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details.

D. Samples: Mount tile and apply grout on two plywood panels, minimum 18 by 18 inches in size illustrating pattern, color variations, and grout joint size variations.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Master Grade Certificate: Submit for each type of tile, signed by the tile manufacturer and tile installer.

G. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Do not install solvent-based products in an unventilated environment.

B. Maintain ambient and substrate temperature of 50 degrees F during installation of mortar materials.

PART 2 PRODUCTS

2.01 TILE

A. Products: Basis of Specification is Dal-Tile Corporation and Crossville Ceramics products indicated on the drawings. If other products are required, they will be listed on the drawings.

B. Porcelain Tile for Floors, Base and Walls:  ANSI A137.1, standard grade.
   1. Moisture Absorption:  0 to 0.5 percent as tested in accordance with ASTM C373.
   2. Size, Thickness and Shape:  As indicated on drawings.
   3. Colors:  As scheduled.
   4. Trim Units:  Matching bullnose shapes in sizes indicated.
   5. Products:  As indicated on drawings.

C. Quarry Tile for Floors and Base:  ANSI A137.1, standard grade.
   1. Moisture Absorption:  Less than 30 percent as tested in accordance with ASTM C373.
   2. Size:  6 by 6 inch, nominal.
   3. Thickness:  1/2 inch, nominal.
   4. Edges:  Cushioned.
   5. Surface Finishes:  As indicated.
   6. Color(s):  As scheduled.
   7. Trim Units:
      a. Base:  Bullnose, 6 x 6 inch, nominal.
   8. Products:  As indicated on drawings.

D. Glass Tile:  ANSI A137.2, standard grade.
   1. Mosaic Tiles:
      a. Size:  1 by 1 inch, nominal, tiles on 12 by 12 inch, nominal, mesh backing.
      b. Thickness:  1/4 inch.
   2. Moisture Absorption:  0 to 0.5 percent as tested in accordance with ASTM C373.
   3. Color(s):  As scheduled.
   4. Products:  As indicated on drawings.

2.02 TRIM AND ACCESSORIES

A. Porcelain and Quarry Tile Trim:  Matching surface bullnose shapes in sizes indicated.
   1. Applications:
      a. Open Edges:  Bullnose.
      b. Inside and Outside Corners:  Coved.
      c. Floor to Wall Joints:  Cove base.
   2. Manufacturers:  Same as for tile.

2.03 SETTING & GROUTING MATERIALS

A. Epoxy Mortar and Grout:  ANSI A118.3.
   1. Applications:  Porcelain tile floors and base, glass tile at walls, quarry tile floors and base.
   2. Basis of Design:  Bostik Inc;  "EzPoxy EzClean" 100% solids epoxy mortar and grout;  www.bostik.com/us.
   3. Color(s):  As scheduled.
   4. Substitutions:  See Section 01 60 00 - Product Requirements.

2.04 ACCESSORY MATERIALS

A. Concrete Floor Slab Crack Isolation Membrane:  Material complying with ANSI A118.12; not intended as waterproofing.
   1. Type:  Fluid-applied.
   2. Thickness:  As required by manufacturer to achieve the following:
      a. Crack Resistance:  No failure at 1/8 inch gap, minimum.
   3. Products:
   4. Accessories:  Provide any primers, joint fillers, pre-treatment materials or other accessory materials recommended by the system manufacturer for jobsite conditions encountered.
PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.
   B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.
   C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of setting materials to sub-floor surfaces.
   D. Verify that concrete sub-floor surfaces are ready for tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within limits recommended by tile manufacturer, setting materials manufacturer, or crack isolation membrane manufacturer.
   E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION
   A. Protect surrounding work from damage.
   B. Vacuum clean surfaces and damp clean.
   C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.

3.03 INSTALLATION - GENERAL
   A. Install crack isolation membrane in accordance with applicable requirements of ANSI standards, manufacturer's instructions, and TCNA (HB) recommendations.
   B. Install tile and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.13, manufacturer's instructions, and TCNA (HB) recommendations.
   C. Lay tile to patterns indicated. Do not interrupt tile pattern through openings.
   D. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.
   E. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.
   F. Form internal angles square and external angles bullnosed.
   G. Sound tile after setting. Replace hollow sounding units.
   H. Keep control and expansion joints free of mortar, grout, and adhesive.
   I. Prior to grouting, allow installation to completely cure; minimum of 48 hours.
   J. Grout tile joints unless otherwise indicated.
   K. Movement Joints: At tile-to-tile control or expansion joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.
      1. Expansion Joints: Comply with TCNA (HB) Detail EJ171 or Detail EJ171D.
      2. Contraction Joints: Comply with TCNA (HB) Detail EJ171B.
      3. Perimeter Joints: Comply with TCNA (HB) Detail EJ171G.

3.04 INSTALLATION - FLOORS - THIN-SET METHODS
   A. Over all interior concrete substrates, provide crack isolation membrane installed in accordance with manufacturer's recommendations and TCNA (HB) Method F125-Full.
   B. Install tile over crack isolation membrane in accordance with TCNA (HB) Method F131, using epoxy mortar and grout.
   C. Coordinate sealing of movement joints with Section 07 92 00.

3.05 INSTALLATION - WALL TILE
   A. Over coated glass mat backer board on studs, install in accordance with TCNA (HB) Method W245.
1. Install tile with epoxy mortar and grout.
2. Coordinate sealing of movement joints with Section 07 92 00.

3.06 CLEANING
   A. Clean tile and grout surfaces.

3.07 PROTECTION
   A. Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION
SECTION 09 51 00
ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Suspended metal grid ceiling system.
B. Acoustical units.

1.02 REFERENCE STANDARDS
D. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2014.

1.03 ADMINISTRATIVE REQUIREMENTS
A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
B. Do not install acoustical units until after interior wet work is dry.

1.04 SUBMITTALS
A. See Section 01 33 00 - Submittals, for submittal procedures.
B. Product Data: Provide data on suspension system components and acoustical units.
C. Samples: Submit two samples at least 4 x 8 inch in size illustrating material and finish of acoustical units.
D. Samples: Submit two samples each, 12 inches long, of suspension system main runner, cross runner, and perimeter molding.
E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.05 FIELD CONDITIONS
A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

1.06 PROJECT CONDITIONS
A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
B. Install acoustical units after interior wet work is dry.

1.07 EXTRA MATERIALS
A. Provide 100 sq ft of each type of acoustical unit for Owner's use in maintenance of project.

PART 2 PRODUCTS

2.01 ACOUSTICAL UNITS
A. Manufacturers:
B. Acoustical Units - General: ASTM E1264, Class A.
C. Acoustical Panels Type ACT-1: Vinyl faced mineral fiber, ASTM E1264 Type X, with the following characteristics:
   1. Location: For use at Food Service areas; see Finish Schedule on drawings.
   2. Size: 24 x 24 inches.
   5. Light Reflectance: 79 percent, determined as specified in ASTM E1264.
   7. Edge: Square.
   10. Product: 56099 "Clean Room ClimaPlus" by USG Interiors, Inc.
   11. Suspension System: Exposed grid, Type "Donn DXLA".

2.02 SUSPENSION SYSTEM(S)
A. Manufacturers:
B. Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and hold down clips as required.
C. Exposed Suspension System: Formed hot-dipped galvanized steel, commercial quality cold rolled; intermediate-duty.
   1. Profile: Tee; 15/16 inch wide face.
   2. Construction: Double web.
   4. Product:
      a. Aluminum Cap: "Donn DXLA" manufactured by USG Interiors, Inc.
         1) Location: For use at Food Service areas; see Finish Schedule on drawings.

2.03 ACCESSORIES
A. Support Channels and Hangers: Hot-dipped Galvanized steel; size and type to suit application and ceiling system flatness requirement specified.
B. Perimeter Moldings: Same material and finish as grid.
   1. At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid.
C. Acoustical Sealant For Perimeter Moldings: Non-hardening, non-skinning, for use in conjunction with suspended ceiling system.
D. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify existing conditions before starting work.
B. Verify that layout of hangers will not interfere with other work.

3.02 INSTALLATION - SUSPENSION SYSTEM
A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.
B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
C. Locate system on room axis according to reflected plan.
D. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.

E. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

F. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

H. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.

I. Do not eccentrically load system or induce rotation of runners.

J. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
   1. Install in bed of acoustical sealant.
   2. Use longest practical lengths.
   3. Overlap and rivet corners.

3.03 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Fit border trim neatly against abutting surfaces.

D. Install units after above-ceiling work is complete.

E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

F. Cutting Acoustical Units:
   1. Cut to fit irregular grid and perimeter edge trim.
   2. Make field cut edges of same profile as factory edges.
   3. Double cut and field paint exposed reveal edges.

G. Where round obstructions and bullnose concrete block corners occur, provide preformed closures to match perimeter molding.

H. Install hold-down clips on panels within 10 ft of an exterior door.

3.04 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION
SECTION 09 77 33
GLASS FIBER REINFORCED PLASTIC PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Glass fiber reinforced plastic (FRP) panels.
B. Trim.

1.02 REFERENCE STANDARDS
F. FDA Food Code - Chapter 6 - Physical Facilities; current edition with Supplements, if any.
G. FM 4880 - Class 1 Fire Rating of Insulated Wall or Wall and Roof/Ceiling Panels, Interior Finish Materials or Coatings and Exterior Wall Systems; 2010.

1.03 SUBMITTALS
A. See Section 01 33 00 - Submittals, for submittal procedures.
B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
C. Samples: Submit two samples 6 x 6 inch in size illustrating material and surface design of panels.

1.04 DELIVERY, STORAGE, AND HANDLING
A. Store panels flat, indoors, on a clean, dry surface. Remove packaging and allow panels to acclimate to room temperature for 48 hours prior to installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. Glass Fiber Reinforced Plastic Panels: Equivalent to the following:

2.02 PANEL SYSTEMS
A. Wall Panels:
   1. Panel Size: 4 by 10 feet.
   4. Color: P 100 White Class A.
   5. Attachment Method: Adhesive only, with trim and sealant in joints.

2.03 MATERIALS
A. Panels: Glass fiber reinforced plastic (FRP), complying with ASTM D5319.
   1. Surface Burning Characteristics: Maximum flame spread index of 25 and smoke developed index of 450; when system tested in accordance with ASTM E84.
   2. Class 1 fire rated when tested in accordance with FM 4880.
   3. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
4. Scratch Resistance: Barcol hardness score greater than 35, when tested in accordance with ASTM D2583.
5. Impact Strength: Greater than 7.0 ft lb force per inch, when tested in accordance with ASTM D256.
6. Surface Characteristics and Cleanability: Provide products that are smooth, durable, and easily cleanable, in compliance with FDA Food Code, Chapter 6 - Physical Facilities.

B. Trim: Vinyl; color coordinating with panel.
C. Adhesive: Type recommended by panel manufacturer.
D. Sealant: Silicone; white.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify existing conditions and substrate flatness before starting work.
B. Verify that substrate conditions are ready to receive the work of this section.

3.02 INSTALLATION - WALLS
A. Install panels in accordance with manufacturer's instructions.
B. Cut and drill panels with carbide tipped saw blades, drill bits, or snips.
C. Apply adhesive to the back side of the panel using trowel as recommended by adhesive manufacturer.
D. Apply panels to wall with seams plumb and pattern aligned with adjoining panels.
E. Install panels with manufacturer's recommended gap for panel field and corner joints.
F. Place trim on panel before fastening edges, as required.
G. Fill channels in trim with sealant before attaching to panel.
H. Install trim with adhesive.
I. Seal gaps at floor, ceiling, and between panels with applicable sealant to prevent moisture intrusion.
J. Remove excess sealant after paneling is installed and prior to curing.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.
B. Field application of paints, stains, varnishes, and other coatings.
C. Scope: Finish all interior and exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
   1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
   2. Exposed surfaces of steel lintels and ledge angles.
   3. Prime surfaces to receive wall coverings.
   4. Mechanical and Electrical:
      a. In finished areas, paint all insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
      b. In finished areas, paint shop-primed items.
D. Do Not Paint or Finish the Following Items:
   1. Items fully factory-finished unless specifically so indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
   5. Non-metallic roofing and flashing.
   6. Stainless steel, anodized aluminum, bronze, terne, and lead items.
   7. Marble, granite, slate, and other natural stones.
   8. Floors, unless specifically so indicated.
   9. Ceramic and other tiles.
   11. Glass.
   12. Acoustical materials, unless specifically so indicated.
   13. Concealed pipes, ducts, and conduits.

1.02 DEFINITIONS

A. Conform to ASTM D16 for interpretation of terms used in this section.

1.03 REFERENCE STANDARDS

D. GreenSeal GS-11 - Paints and Coatings; 2013.

1.04 SUBMITTALS

A. See Section 01 33 00 - Submittals, for submittal procedures.
B. Product Data: Provide data on all finishing products, including VOC content.
C. Samples: Submit two paper chip samples illustrating range of colors available for each surface finishing product scheduled.
D. Certification: By manufacturer that all paints and coatings comply with VOC limits specified.
E. Certification: By manufacturer that all paints and coatings do not contain any of the prohibited chemicals specified; GreenSeal GS-11 certification is not required but if provided shall constitute acceptable certification.

F. Manufacturer's Instructions: Indicate special surface preparation procedures and substrate conditions requiring special attention.

G. Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.06 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

D. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

E. Minimum Application Temperature for Varnish Finishes: 65 degrees F for interior or exterior, unless required otherwise by manufacturer's instructions.

F. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide all paint and coating products used in any individual system from the same manufacturer; no exceptions.

B. Provide all paint and coating products from the same manufacturer to the greatest extent possible.

C. Paints and Transparent Finishes:

D. Primer Sealers: Same manufacturer as top coats.

E. Block Fillers: Same manufacturer as top coats.

2.02 PAINTS AND COATINGS - GENERAL

A. Paints and Coatings: Ready mixed, unless intended to be a field-catalyzed coating.
   1. Provide paints and coatings of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
   2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
   3. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
4. Supply each coating material in quantity required to complete entire project's work from a single production run.
5. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.

B. Primers: Where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.

C. Volatile Organic Compound (VOC) Content:
1. Provide coatings that comply with the most stringent requirements specified in the following:
      1) Opaque, Flat: 50 g/L, maximum.
      2) Opaque, Nonflat: 150 g/L, maximum.
      3) Opaque, High Gloss: 250 g/L, maximum.
      4) Varnishes: 350 g/L, maximum.
   b. Architectural coatings VOC limits of the State in which the Project is located.
2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

D. Chemical Content: The following compounds are prohibited:
1. Intentionally added methylene chloride or perchloroethylene.
2. Aromatic Compounds: In excess of 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
3. Acrolein, acrylonitrile, anthimony, benzene, butyl benzyl phthalate, cadmium, di(2-ethylhexyl) phthalate, di-n-butyl phthalate, di-n-octyl phthalate, 1,2-dichlorobenzene, diethyl phthalate, dimethyl phthalate, ethylbenzene, formaldehyde, hexavalent chromium, isophorone, lead, mercury, methyl ethyl ketone, methyl isobutyl ketone, methylene chloride, naphthalene, toluene (methylbenzene), 1,1,1-trichloroethane, vinyl chloride.

E. Flammability: Comply with applicable code for surface burning characteristics.

F. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Contracting Officer's Representative from the manufacturer's full line.

G. Colors: As indicated on drawings
1. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling they are mounted on/under.

2.03 PAINT SYSTEMS - EXTERIOR

A. Masonry/Concrete/Stucco/EIFS: Opaque, 100% Acrylic, Elastomeric, Waterproofing Coating:
   1. Two coats of elastomeric coating; BASF "MasterProtect EL 750 Fine," applied to achieve a total dry-film thickness (DFT) of 16-20 mils.

B. Ferrous, Galvanized, and Aluminum Metals: Opaque, 100% Acrylic:
      a. Touch-up shop primer with rust-inhibitive primer recommended by top coat manufacturer.
   2. Semi-Gloss: Two coats of S-W "Sher-Cryl HPA (B66-350), applied to achieve a dry-film thickness (DFT) of 2.5 - 4.0 mils per coat.

2.04 PAINT SYSTEMS - INTERIOR

A. Wood, Opaque, Acrylic Latex:
   1. Primer: One coat of S-W Premium Wall & Wood Primer (B28W8111).

B. Wood, Transparent, Varnish, Stain:
   1. Filler coat (for open grained wood only) of S-W "Sher-Wood" Natural Filler.
   2. One coat of stain; S-W "Wood Classics" Interior Oil Stain.
3. One coat of varnish; S-W "Wood Classics" Waterborne Polyurethane Varnish, Gloss.
4. One coat of varnish; S-W "Wood Classics" Waterborne Polyurethane Varnish, Satin.

C. **Concrete/Masonry**, Opaque, Latex, 3 Coat:
   1. One coat of block filler; S-W PrepRite Block Filler (B25W25). Provide additional coats as necessary to fill all voids in concrete masonry surfaces.

D. **Ferrous Metals, Primed, and Galvanized Metals**, Opaque, Acrylic Latex:

E. **Aluminum, Unprimed**, Opaque, Acrylic Latex:

F. **Gypsum Board/Glass Mat Faced Gypsum Board/Plaster**, Opaque, Acrylic Latex:
   1. Primer: One coat of S-W "Pro-Mar 200" Zero VOC Interior Latex Primer (B28-2600).

2.05 **ACCESSORY MATERIALS**

A. Accessory Materials: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required to achieve the finishes specified whether specifically indicated or not; commercial quality.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3  **EXECUTION**

3.01 **EXAMINATION**

A. Do not begin application of coatings until substrates have been properly prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

D. If substrate preparation is the responsibility of another installer, notify Contracting Officer's Representative of unsatisfactory preparation before proceeding.

E. Test shop-applied primer for compatibility with subsequent cover materials.

F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
   1. Gypsum Wallboard: 12 percent.
   2. Plaster and Stucco: 12 percent.
   3. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
   4. Interior Wood: 15 percent, measured in accordance with ASTM D4442.

3.02 **PREPARATION**

A. Clean surfaces thoroughly and correct defects prior to coating application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or repair existing coatings that exhibit surface defects.

D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

E. Seal surfaces that might cause bleed through or staining of topcoat.

F. Remove mildew from impervious surfaces by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

G. Concrete and Unit Masonry Surfaces to be Painted: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate.
phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

H. Gypsum Board Surfaces to be Painted: Fill minor defects with filler compound. Spot prime defects after repair.
   1. Where existing paper or vinyl wallcoverings are encountered on walls to be painted, remove wallcovering and skim coat wall to achieve a Level 5 finish prior to painting.

I. Stucco Surfaces to be Painted: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

J. Aluminum Surfaces to be Painted: Remove surface contamination by steam or high pressure water. Remove oxidation with acid etch and solvent washing. Apply etching primer immediately following cleaning.

K. Galvanized Surfaces to be Painted: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.

L. Uncorroded Uncoated Steel and Iron Surfaces to be Painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint entire surface; spot prime after repairs.

M. Shop-Primed Steel Surfaces to be Finish Painted: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.

N. Interior Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

O. Interior Wood Surfaces to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats. Prime concealed surfaces with gloss varnish reduced 25 percent with thinner.

P. Metal Doors to be Painted: Prime and paint metal door top and bottom edge surfaces to match face of door.

3.03 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Apply products in accordance with manufacturer’s instructions.

C. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.

D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

E. Apply each coat to uniform appearance.

F. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.

G. Number of coats indicated is the minimum number of coats to be provided. Full coverage is required for each coat. Provide additional coats as necessary to provide full coverage or dry film thicknesses indicated.

H. Sand wood and metal surfaces lightly between coats to achieve required finish.

I. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

J. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.
K. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT
   A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
   B. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.05 CLEANING
   A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.06 PROTECTION
   A. Protect finished coatings until completion of project.
   B. Touch-up damaged coatings after Substantial Completion.

END OF SECTION
SECTION 10 26 00
WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES
   A. Wall protection systems.
      1. Corner guards.

1.02 RELATED REQUIREMENTS
   A. Section 06 10 00 - Rough Carpentry: Wood blocking and grounds for corner guards.

1.03 SUBMITTALS
   A. See Section 01 33 00 - Submittals, for submittal procedures.
   B. Product data for each wall surface protection system component and installation accessory required, including installation methods for each type of substrate. Provide written data on each required component including physical characteristics, such as durability, resistance to fading, and flame resistance.

1.04 QUALITY ASSURANCE
   A. Installer Qualifications: Engage an experienced Installer who has previously installed wall surface protection systems similar in material, design, and extent to the systems indicated for this Project.
   B. Single Source Responsibility: Obtain each color, grade, finish, and type of wall surface protection system component from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.

1.05 DELIVERY, STORAGE, AND HANDLING
   A. Deliver materials to Project site in original factory wrappings and containers, clearly labeled with identification of manufacturer, brand name, quality or grade, and fire hazard classification.

1.06 MAINTENANCE
   A. Maintenance Instructions: Provide the manufacturer's instructions for maintenance of installed work. Include recommended methods and frequency for maintaining optimum condition under anticipated traffic and use conditions. Include precautions against cleaning materials and methods that may be detrimental to finishes and performance.

PART 2 - PRODUCTS

2.01 MANUFACTURERS
   A. Subject to compliance with requirements, provide products by one of the following:
      1. American Floor Products Co., Inc.
      2. Balco, Inc.
      4. Construction Specialties, Inc.
      5. K. J. Miller Corporation.
      7. Pawling Corporation.
      8. Tepromark International, Inc.
      10. Tubular Specialties.
      12. McCue Corporation.

2.02 CORNER GUARDS
   A. Stainless-Steel Corner Guards: Paper-covered, satin-finish, 0.0625-inch (1.6-mm) minimum, stainless-steel sheet corner guards; height as indicated. Provide 90-degree turn, unless
otherwise indicated; and formed edges. Stainless steel plate Type 304 minimum 0.625 inches thick.

1. Provide corner guards in shapes, as noted below and as detailed on the drawings.
   a. Wing Size: 1-1/2 by 1-1/2 inches.
   c. Fasteners: Nonmagnetic stainless steel screws.
   d. Corner Radius: 1/8 inch (3.2 mm).
   e. Height: 10'-0", except where otherwise indicated.

2.03 FABRICATION
   A. General: Fabricate wall and door protection systems to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thicknesses of components.
   B. Fabricate components with tight seams and joints with exposed edges rolled. Provide surfaces free of evidence of wrinkling, chipping, uneven coloration, dents, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

PART 3 - EXECUTION

3.01 EXAMINATION
   A. Examine areas and conditions in which wall surface protection components and wall protection systems will be installed.
      1. Complete all finishing operations, including painting, before beginning installation of wall surface protection system materials.
   B. Do not proceed with installations until unsatisfactory conditions have been corrected.

3.02 PREPARATION
   A. General: Prior to installation, clean substrate to remove dust, debris, and loose particles.

3.03 INSTALLATION
   A. General: Install products in accordance with manufacturer's recommendations.
   B. Install wall surface protection units plumb, level, and true to line without distortions.
      1. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished work.

3.04 CLEANING
   A. General: Immediately upon completion of installation, clean metal components in accordance with the manufacturer's recommendations.
   B. Remove surplus materials, rubbish, and debris resulting from installation upon completion of work and leave areas of installation in neat, clean condition.

END OF SECTION
SECTION 10 44 13
FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Portable fire extinguishers.
B. Fire-protection accessories.

1.02 SUBMITTALS
A. See Section 01 33 00 - Submittals, for submittal procedures.
B. 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.

1.03 QUALITY ASSURANCE
A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Standard for Portable Fire Extinguishers."
B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
   1. Provide extinguishers listed and labeled by FM.

PART 2 PRODUCTS

2.01 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. Fire Extinguishers and Accessories:

2.02 PORTABLE FIRE EXTINGUISHERS
A. Wet Chemical Class "K" Kitchen Extinguishers: 2-1/2 gallon nominal capacity; UL-rated 2-A:K.

2.03 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.
B. Identification: Provide lettering to comply with authorities having jurisdiction for letter style, color, size, spacing, and location. Locate as indicated by Architect.
   1. Identify bracket-mounted extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to wall surface.

PART 3 EXECUTION

3.01 EXAMINATION
A. Examine fire extinguishers for proper charging and tagging.
   1. Remove and replace damaged, defective, or undercharged units.

3.02 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.

END OF SECTION
SECTION 11 40 00
FOOD SERVICE EQUIPMENT (EF/CI)

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Built in food equipment, walk-in refrigeration, hoods.

1.02 RELATED REQUIREMENTS
A. Section 01 10 17 - Exchange Furnished and Installed Equipment (EF/EI).
B. Section 01 10 18 - Exchange Furnished, Contractor Installed Equipment (EF/CI).
C. Division 22 Section - Plumbing Piping.
D. Division 22 Section - Plumbing Specialties: Grease interceptor.
E. Division 23 Section - Food Service Ventilation Systems.
F. Division 26 - Electrical.

1.03 REFERENCES
A. ASTM A167 - Stainless and Heat-resisting Chromium-nickel Steel Plate, Sheet and Strip.
C. ASTM A446 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.
D. ASTM C1036 - Flat Glass.
E. ASTM C1048 - Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass.
F. NEMA LD3 - High Pressure Decorative Laminates.
H. NFPA 96 - Removal of Smoke and Grease Laden Vapors from Commercial Cooking Equipment.
I. NGA - National Gas Association: Appliances.
J. NSF - National Sanitation Foundation: Appliances.

1.04 PERFORMANCE REQUIREMENTS
A. Load Supporting Components: Reinforced frame support system and surfaces where indicated so that surfaces may safely support a load of 200 lbs concentrated on one square foot in any area on the component surface, with no indentation showing on surface, and with permanent set not exceeding 0.005 inches.

1.05 SUBMITTALS
A. See Section 01 33 00 - Submittals, for submittal procedures.
B. Shop Drawings: Indicate in large scale detail, fabricated equipment showing construction methods, type and gage of metal, hardware and fittings, plan front elevation, a minimum of one cross-section, and utility requirements as to types and sizes and locations. Illustrate complicated parts of typical items in cut-away perspective. For control systems, indicate service connections, characteristics, and wiring diagrams.
C. Product Data: Provide data on appliances; indicate configuration, sizes, materials, finishes, locations, and utility connections and locations.
D. Samples: Submit two (2) samples, 6" x 6" inch in size illustrating equipment and finish.
E. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.
F. Manufacturer's Certificate: Certify that Products meet or exceed UL and specified requirements.
1.06 OPERATION AND MAINTENANCE DATA
   A. Submit under provisions of Section 01 77 00.
   B. Operation Data: Provide operating data for the specified equipment.
   C. Maintenance Data: Provide lubrication and periodic maintenance requirement schedules.

1.07 QUALITY ASSURANCE
   A. Perform Work as follows:
      1. Cooler and Freezer Units: Listed by Underwriters Laboratories, Inc. (UL) standards.
      4. Fabricated Equipment: Shall be installed in accordance with the following codes: NFPA - National Fire Protection Association requirements, NGA - National Gas Association requirements, NSF - National Sanitation Foundation requirements.

1.08 QUALIFICATIONS
   A. Fabricator: Company specializing in performing the work of this section with minimum five (5) years experience.

1.09 REGULATORY REQUIREMENTS
   A. Conform to applicable code for utility requirements.
   B. Products Requiring Electrical Connection: Listed and classified by Underwriters’ Laboratories, Inc., as suitable for the purpose specified and indicated.

1.10 PRE-INSTALLATION CONFERENCE
   A. Convene one week prior to commencing work of this section, under provisions of Section 01 31 00.

1.11 DELIVERY, STORAGE, AND HANDLING
   A. Deliver, store, protect and handle products to site under provisions of Section 01 60 00.
   B. Store products clear of floor in a manner to prevent damage.
   C. Coordinate size of access and route to place of installation.

1.12 SCHEDULING
   A. Schedule work under the provisions of Section 01 31 00.
   B. Schedule Work to immediately follow installation of utilities and precede installation of room finishes.

1.13 COORDINATION
   A. Coordinate the work with location and placement of utilities. Coordinate characteristics of utilities with requirements of food service equipment.

1.14 WARRANTY
   A. Provide five (5) year warranty under provisions of Section 01 77 00.
   B. Warranty: Include replacement or repair of scheduled equipment, refrigerant and compressors, including disconnection of defective unit, and connection of replacement unit.

PART 2 PRODUCTS
2.01 EQUIPMENT SCHEDULE
   A. Equipment Schedule: Refer to Drawings.
   B. Provide rough-in hardware, supports and connections, attachment devices, closure trim, and accessories.

2.02 MATERIALS
   A. Sheet Steel: ASTM A446, 1.25 oz/sq ft galvanized coating.
B. Stainless Steel: ASTM A167, Type 304 commercial grade, No. 4 finish.
C. Sealants: Silicone, bacteria resistant type.

2.03 FABRICATION - GENERAL
A. Fabricate sheet material for work surfaces, facings, shelves, and drain boards of straight lengths in one continuous sheet when less than 12 ft in length. Fit and attach integral sinks. Weld metal joints for lengths over 12 ft.
B. Weld and form edges, ends, and joints smooth. Grind welds of stainless steel smooth and flush; polish to match adjacent surfaces.
C. Cut and drill components for service outlets and fixtures.
D. Fix leg mounted units by dowelling to floor with 1/4 inch stainless steel pins, where vibration or oscillation is anticipated.
E. Provide stainless steel legs with adjustable feet. Fasten legs to equipment securely and rigidly.
F. Install nylon button feet on bearing surface of any item positioned on a finished surface.
G. Isolate rotating or reciprocating machinery to prevent noise and vibration.
H. Provide indirect drain piping from equipment to terminate over nearest waste receptor.
I. Accommodate site installation of other services or equipment.
J. Shop assemble work where possible.
K. Stainless Steel Fastenings and Fittings: Bolt and screw with countersunk flat heads at visible or accessible surfaces. Use concealed fastenings where possible.

2.04 METAL WALL PANELS
A. Trimark, custom stainless steel mill finish. Contact: Lisa Wood 816-746-5077.

2.05 FINISHES
A. All Components: Shop pre-finish.
B. Metal (Except Stainless Steel): Degrease and phosphate etch, prime and apply minimum two coats factory baked epoxy enamel, color as selected.
C. Stainless Steel: No. 4 finish.
D. Bituminous Paint: Sound deaden internal surfaces of metal work and underside of metal counters.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify ventilation outlets, service connections, and supports are correct and in required location.
B. Verify that electric power is available and of the correct characteristics.

3.02 INSTALLATION
A. Install items in accordance with manufacturers' instructions.
B. Insulate to prevent electrolysis between dissimilar metals.
C. Weld and grind joints in steel work tight, without open seams, where necessary due to limitations of sheet sizes or installation requirements.
D. Sequence installation and erection to ensure correct mechanical and electrical utility connections are achieved.
E. Cut, fit, and patch where necessary. Provide cutting and patching of items of this section required for installation or services of equipment.
F. Cut and drill components for service outlets, fixtures, and fittings.
G. Use anchoring devices appropriate for equipment and expected usage.
H. Provide sealant to achieve clean joint with adjacent building finishes and between abutting components.

3.03 ADJUSTING
   A. Adjust work under provisions of Section 01 65 00.
   B. Adjust equipment and apparatus to ensure proper working order and conditions.
   C. Remove and replace equipment creating excessive noise or vibration.

3.04 CLEANING
   A. Clean work under provisions of 01 71 00.
   B. Remove masking or protective covering from stainless steel and other finished surfaces.
   C. Wash and clean equipment.
   D. Polish glass, plastic, hardware and accessories, fixtures and fittings.

3.05 DEMONSTRATION
   A. Provide systems demonstration under provisions of Section 01 65 00.
   B. Test equipment prior to demonstration.
   C. At completion of work, provide qualified and trained personnel to demonstrate operation of each item of equipment and instruct Owner in operating procedures and maintenance.
   D. Individual Performing Demonstration: Fully knowledgeable of all operating and service aspects of equipment.

3.06 PROTECTION OF FINISHED WORK
   A. Protect finished Work.
   B. Remove protective coverings from pre-finished work.

END OF SECTION
SECTION 21 13 00
FIRE-SUPPRESSION SPRINKLER SYSTEMS

PART 1  GENERAL

1.01 SECTION INCLUDES
A. Wet-pipe sprinkler system.
B. Dry-pipe sprinkler system.
C. System design, installation, and certification.
D. Fire department connections.

1.02 RELATED REQUIREMENTS
A. Section 28 31 00 - Fire Detection and Alarm.
B. Section 21 05 00 - Common Work Results for Fire Suppression: Pipe, fittings, and valves.
C. Section 21 05 48 - Vibration and Seismic Controls for Fire Suppression Piping and Equipment.
D. Section 21 05 53 - Identification for Fire Suppression Piping and Equipment.
E. Section 14 91 00 - Facility Chutes: Sprinkler heads inside chutes.
F. Section 22 05 48 - Vibration and Seismic Controls for Plumbing Piping and Equipment.
G. Section 22 05 53 - Identification for Plumbing Piping and Equipment.
H. Section 26 27 17 - Equipment Wiring: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS
C. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements; 2006.

1.04 ADMINISTRATIVE REQUIREMENTS
A. Preinstallation Meeting: Convene one week before starting work of this section.

1.05 SUBMITTALS
A. See Section 01 33 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

C. Shop Drawings:
   1. Submit preliminary layout of finished ceiling areas indicating only sprinkler locations coordinated with ceiling installation.
   2. Indicate hydraulic calculations, detailed pipe layout, hangers and supports, sprinklers, components and accessories. Indicate system controls.
   3. Submit shop drawings to authority having jurisdiction for approval. Submit proof of approval to Architect.

D. Samples: Submit two of each style of sprinkler specified.

E. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.

F. Manufacturer's Certificate: Certify that system has been tested and meets or exceeds specified requirements and code requirements.

G. Operation and Maintenance Data: Include components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Sprinklers: Type and size matching those installed, in quantity required by referenced NFPA design and installation standard.
   3. Sprinkler Wrenches: For each sprinkler type.

1.06 QUALITY ASSURANCE

A. Maintain one copy of referenced design and installation standard on site.

B. Conform to UL requirements.

C. Designer Qualifications: Design system under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in State in which the project is located.

D. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

E. Equipment and Components: Provide products that bear UL label or marking.

F. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.07 MOCK-UP

A. Provide components for installation in mock-up.

B. Mock-up may not remain as part of the Work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Store products in shipping containers and maintain in place until installation. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. Sprinklers, Valves, and Equipment:

2.02 SPRINKLER SYSTEM

A. Sprinkler System:  Provide coverage for entire building.

B. Occupancy:  Ordinary hazard, Group 1; comply with NFPA 13.

C. Water Supply:  Determine volume and pressure from water flow test data.
   1. Revise design when test data available prior to submittals.

D. Interface system with building control system.

E. Provide fire department connections where indicated.

F. Storage Cabinet for Spare Sprinklers and Tools:  Steel, located adjacent to alarm valve.

G. Pipe Hanger Fasteners:  Attach hangers to structure using appropriate fasteners, as follows:
   2. Concrete Screw Type Anchors:  Complying with ICC-ES AC193.

2.03 SPRINKLERS

A. Suspended Ceiling Type:  Semi-recessed pendant type with matching push on escutcheon plate.
   1. Response Type:  Quick.
   2. Coverage Type:  Standard.
   3. Finish:  Chrome plated.
   4. Escutcheon Plate Finish:  Chrome
   5. Fusible Link:  Fusible solder link type temperature rated for specific area hazard.

B. Exposed Area Type:  Pendant upright type with guard.
   1. Response Type:  Quick.
   2. Coverage Type:  Standard.
   4. Fusible Link:  Fusible link type temperature rated for specific area hazard.

C. Sidewall Type:  Semi-recessed horizontal sidewall type with matching push on escutcheon plate.
   1. Response Type:  Quick.
   2. Coverage Type:  Standard.
   3. Finish:  Chrome plated.
   4. Escutcheon Plate Finish:  Brushed Chrome
   5. Fusible Link:  Fusible link type temperature rated for specific area hazard.

D. Dry Sprinklers:  Semi-recessed pendant type with matching escutcheon plate.
   1. Response Type:  Quick.
   2. Coverage Type:  Standard.
   3. Finish:  Chrome plated.
   4. Cover Plate Finish:  Chrome
   5. Fusible Link:  Fusible link type temperature rated for specific area hazard.

E. Storage Sprinklers:  Concealed upright type with guard.
   1. Response Type:  Standard.
   2. Finish:  Chrome plated.
   4. Fusible Link:  Fusible solder link type temperature rated for specific area hazard.
F. Guards: Finish to match sprinkler finish.

2.04 PIPING SPECIALTIES

A. Wet Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber faced clapper to automatically actuate water motor alarm and electric alarm, with pressure retard chamber and variable pressure trim; with test and drain valve.

B. Dry Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber faced clapper to automatically actuate water motor alarm and electric alarm, with accelerator; with test and drain valve.

C. Water Motor Alarm: Hydraulically operated impeller type alarm with aluminum alloy chrome plated gong and motor housing, nylon bearings, and inlet strainer.

D. Electric Alarm: Electrically operated chrome plated gong with pressure alarm switch.

E. Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two contacts; rated 10 amp at 125 volt AC and 2.5 amp at 24 volt DC.

F. Fire Department Connections:
   1. Type: Flush mounted wall type with brass finish.
   2. Outlets: Two way with thread size to suit fire department hardware; threaded dust cap and chain of matching material and finish.
   4. Label: "Sprinkler - Fire Department Connection".

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with referenced NFPA design and installation standard.

B. Install equipment in accordance with manufacturer's instructions.

C. Install buried shut-off valves in valve box. Provide post indicator.

D. Provide approved double check valve assembly at sprinkler system water source connection.

E. Locate fire department connection with sufficient clearance from walls, obstructions, or adjacent siamese connectors to allow full swing of fire department wrench handle.

F. Locate outside alarm gong on building wall as indicated.

G. Place pipe runs to minimize obstruction to other work.

H. Place piping in concealed spaces above finished ceilings.

I. Center sprinklers in two directions in ceiling tile and provide piping offsets as required.

J. Apply masking tape or paper cover to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Remove after painting. Replace painted sprinklers.

K. Flush entire piping system of foreign matter.

L. Install guards on sprinklers where indicated.

M. Hydrostatically test entire system.

N. Require test be witnessed by Fire Marshal.

O. All valves shall be fully supervised. Provide switches equal to
3.02 INTERFACE WITH OTHER PRODUCTS
   A. Ensure required devices are installed and connected as required to fire alarm system.

END OF SECTION
SECTION 22 05 00

COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:
   1. Piping materials and installation instructions common to most piping systems.
   2. Transition fittings.
   3. Dielectric fittings.
   4. Mechanical sleeve seals.
   5. Sleeves.
   7. Equipment installation requirements common to equipment sections.
   8. Painting and finishing.

1.03 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspace, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

E. The following are industry abbreviations for plastic materials:
   1. CPVC: Chlorinated polyvinyl chloride plastic.
   2. PVC: Polyvinyl chloride plastic.

1.04 QUALITY ASSURANCE

A. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.06 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of
construction, to allow for plumbing installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces. Provide access doors and frames under this section. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.02 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.

2.03 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.

1. Available Manufacturers:
   a. Epco Sales, Inc.
   c. Zurn Industries, Inc.; Wilkins Div.

D. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

1. Manufacturers:
   a. Calpico, Inc.
   b. Lochinvar Corp.

E. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

1. Available Manufacturers:
   a. Perfection Corp.
   b. Precision Plumbing Products, Inc.
   c. Sioux Chief Manufacturing Co., Inc.
   d. Victaulic Co. of America.

2.04 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
PART 3 - EXECUTION

3.01 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Sleeves are not required for core-drilled holes.

M. Permanent sleeves are not required for holes formed by removable PE sleeves.

N. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

O. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.

P. Verify final equipment locations for roughing-in.

Q. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.02 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
   2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

G. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
   1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.

3.03 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:
   1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
   2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
   3. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.04 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

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

D. Install equipment to allow right of way for piping installed at required slope.

3.05 PAINTING

A. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.06 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.
3.07 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor plumbing materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

END OF SECTION
SECTION 22 05 23

GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Brass ball valves.
   2. Iron, butterfly valves.

B. Related Sections:
   1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.
   2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

1.02 DEFINITIONS

A. CWP: Cold working pressure.
B. EPDM: Ethylene propylene copolymer rubber.
C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
D. NRS: Nonrising stem.
E. OS&Y: Outside screw and yoke.
F. RS: Rising stem.
G. SWP: Steam working pressure.

1.03 SUBMITTALS

A. Product Data: For each type of valve indicated.

1.04 QUALITY ASSURANCE

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
B. ASME Compliance:
   1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
   2. ASME B31.9 for building services piping valves.
C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
   1. Protect internal parts against rust and corrosion.
   2. Protect threads, flange faces, grooves, and weld ends.
   3. Set angle, gate, and globe valves closed to prevent rattling.
   4. Set ball valves open to minimize exposure of functional surfaces.
   5. Set butterfly valves closed or slightly open.

B. Use the following precautions during storage:
   1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS FOR VALVES

A. Refer to valve schedule articles for applications of valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

D. Valve Actuator Types:
   1. Handlever: For quarter-turn valves NPS 6 and smaller.

E. Valve-End Connections:
   1. Flanged: With flanges according to ASME B16.1 for iron valves.
   2. Grooved: With grooves according to AWWA C606.
   4. Threaded: With threads according to ASME B1.20.1.

2.02 BRASS BALL VALVES

A. Two-Piece, Full-Port, Brass Ball Valves with Brass Trim:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Crane Co.; Crane Valve Group; Crane Valves.
      b. Crane Co.; Crane Valve Group; Jenkins Valves.
      c. Hammond Valve.
      d. Jamesbury; a subsidiary of Metso Automation.
      e. Jomar International, LTD.
      f. Kitz Corporation.
      g. Milwaukee Valve Company.
      h. NIBCO INC.
      i. Red-White Valve Corporation.
      j. Watts.
   2. Description:
      b. SWP Rating: 150 psig (1035 kPa).
      c. CWP Rating: 600 psig (4140 kPa).
      d. Body Design: Two piece.
      e. Body Material: Forged brass.
      f. Ends: Threaded.
      g. Seats: PTFE or TFE.
      h. Stem: Brass.
      i. Ball: Chrome-plated brass.
      j. Port: Full.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.02 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install check valves for proper direction of flow and as follows:
   1. Swing Check Valves: In horizontal position with hinge pin level.

3.03 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.04 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:
   1. Shutoff Service: Ball or butterfly valves.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

C. Select valves, except wafer types, with the following end connections:
   1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
   2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.

3.05 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:
   1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
   2. Ball Valves: Two piece, full port, brass or bronze with stainless-steel trim.
   3. Bronze Swing Check Valves: Class 125, bronze disc.

B. Pipe NPS 2-1/2 and Larger:
   1. Ball Valves NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
SECTION 22 05 29
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

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

1.02 SUMMARY
   A. This Section includes the following hangers and supports for plumbing system piping and equipment:
      1. Steel pipe hangers and supports.
      2. Trapeze pipe hangers.
      3. Metal framing systems.
      4. Thermal-hanger shield inserts.
      5. Fastener systems.
      6. Pipe stands.
      7. Pipe positioning systems.
      8. Equipment supports.

1.03 DEFINITIONS
   A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.
   B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.04 PERFORMANCE REQUIREMENTS
   A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
   B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
   C. Design seismic-restraint hangers and supports for piping and equipment.

1.05 SUBMITTALS
   A. Product Data: For the following:
      1. Steel pipe hangers and supports.
      2. Thermal-hanger shield inserts.

PART 2 - PRODUCTS

2.01 MANUFACTURERS
   A. In other Part 2 articles where titles below introduce lists, the following requirements apply to 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, manufacturers specified.
      2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 STEEL PIPE HANGERS AND SUPPORTS
   A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3
"Hanger and Support Applications" Article for where to use specific hanger and support types.

B. Manufacturers:
1. AAA Technology & Specialties Co., Inc.
2. Bergen-Power Pipe Supports.
4. Carpenter & Paterson, Inc.
5. Empire Industries, Inc.
6. ERICO/Michigan Hanger Co.
7. Globe Pipe Hanger Products, Inc.
8. Grinnell Corp.
9. GS Metals Corp.
11. PHD Manufacturing, Inc.
12. PHS Industries, Inc.
13. Piping Technology & Products, Inc.
14. Tolco Inc.

2.03 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.04 METAL FRAMING SYSTEMS

A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

B. Manufacturers:
2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
3. GS Metals Corp.
5. Thomas & Betts Corporation.
6. Tolco Inc.
7. Unistrut Corp.; Tyco International, Ltd.

C. Coatings: Manufacturer's standard finish unless bare metal surfaces are indicated.

2.05 THERMAL-HANGER SHIELD INSERTS

A. Description: 100-psig minimum, compressive-strength insulation insert encased in sheet metal shield.

B. Manufacturers:
1. Carpenter & Paterson, Inc.
2. ERICO/Michigan Hanger Co.
3. PHS Industries, Inc.
4. Pipe Shields, Inc.
5. Rilco Manufacturing Company, Inc.
6. Value Engineered Products, Inc.

C. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass with vapor barrier.
D. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass.

E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

G. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.06 FASTENER SYSTEMS

A. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers:
   b. Empire Industries, Inc.
   c. Hilti, Inc.
   d. ITW Ramset/Red Head.
   e. MKT Fastening, LLC.
   f. Powers Fasteners.

2.07 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, system of metal brackets, clips, and straps for positioning piping in pipe spaces for plumbing fixtures for commercial applications.

B. Manufacturers:
   2. HOLDRITE Corp.; Hubbard Enterprises.
   3. Samco Stamping, Inc.

2.08 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

PART 3 - EXECUTION

3.01 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use padded hangers for piping that is subject to scratching.

F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
2. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8.
3. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
4. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
5. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2.

G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system 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 (DN 20 to DN 500), if longer ends are required for riser clamps.

H. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

I. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

J. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

K. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

L. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

3.02 HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.
1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

D. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

F. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

G. Install lateral bracing with pipe hangers and supports to prevent swaying.

H. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping.

I. Load Distribution: Install hangers and supports so 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 (for building services piping) are not exceeded.

3.03 EQUIPMENT SUPPORTS
A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

3.04 METAL FABRICATIONS
A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.05 ADJUSTING
A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.06 PAINTING
A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
   1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION
SECTION 22 05 53
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL
1.01 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY
A. Section Includes:
   1. Equipment labels.
   2. Warning signs and labels.
   3. Pipe labels.
   4. Stencils.
   5. Valve tags.
   6. Warning tags.

1.03 SUBMITTALS
A. Product Data: For each type of product indicated.

1.04 COORDINATION
A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
B. Coordinate installation of identifying devices with locations of access panels and doors.
C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS
2.01 PIPE LABELS
A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
B. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
   1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
   2. Lettering Size: At least 1-1/2 inches high.

PART 3 - EXECUTION
3.01 PREPARATION
A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.
3.02 PIPE LABEL INSTALLATION

A. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 20 feet along each run.

END OF SECTION
SECTION 22 07 00
PLUMBING INSULATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Insulation Materials:
      a. Flexible elastomeric.
      b. Mineral fiber.
   2. Adhesives.
   3. Mastics.
   4. Sealants.
   5. Factory-applied jackets.
   7. Field-applied cloths.
   8. Field-applied jackets.
  10. Securements.

1.02 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

B. Qualification Data: For qualified Installer.

C. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

D. Field quality-control reports.

1.03 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.05 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application and equipment Installer for equipment insulation application.
1.06 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.01 INSULATION MATERIALS

A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Mineral-Fiber, Preformed Pipe Insulation:
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Johns Manville; Micro-Lok.
      b. Knauf Insulation; 1000(Pipe Insulation.
      c. Manson Insulation Inc.; Alley-K.
      d. Owens Corning; Fiberglas Pipe Insulation.
   2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.02 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Childers Products, Division of ITW; CP-82.
   2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.03 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Childers Products, Division of ITW; CP-35.
      b. Foster Products Corporation, H. B. Fuller Company; 30-90.
      c. Vimasco Corporation; 749.
   2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
   3. Service Temperature Range: Minus 20 to plus 180 deg F.

2.04 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When
factory-applied jackets are indicated, comply with the following:
1. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

2.05 TAPES
A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
   1. Products: Subject to compliance with requirements, provide one of the following the Work include, but are not limited to, the following:
      a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
      b. Compac Corp.; 104 and 105.
      c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
      d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
   2. Width: 3 inches.
   3. Thickness: 11.5 mils.
   5. Elongation: 2 percent.
   6. Tensile Strength: 40 lbf/inch in width.
   7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

2.06 SECUREMENTS
A. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

PART 3 - EXECUTION
3.01 EXAMINATION
A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
   1. Verify that systems and equipment to be insulated have been tested and are free of defects.
   2. Verify that surfaces to be insulated are clean and dry.
   3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION
A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.03 GENERAL INSTALLATION REQUIREMENTS
A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment and piping including fittings, valves, and specialties.
B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment and pipe system as specified in insulation system schedules.
C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
E. Install multiple layers of insulation with longitudinal and end seams staggered.
F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
   1. Install insulation continuously through hangers and around anchor attachments.
   2. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
   3. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:
   1. Draw jacket tight and smooth.
   2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
   3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
      a. For below ambient services, apply vapor-barrier mastic over staples.
   4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
   5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above ambient services, do not install insulation to the following:
   1. Testing agency labels and stamps.
   2. Nameplates and data plates.
   3. Cleanouts.

3.04 PENETRATIONS

A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
   1. Comply with requirements in Division 07 Section "Penetration Firestopping" and fire-resistive joint sealers.

C. Insulation Installation at Floor Penetrations:
   1. Pipe: Install insulation continuously through floor penetrations.
   2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.05 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
   1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
   2. Insulate pipe elbows using preformed fitting insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
   3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Bond pieces with adhesive.
   4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.

3.06 MINERAL-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:
   1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
   2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
   3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
   4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:
   1. Install preformed pipe insulation to outer diameter of pipe flange.
   2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:
   1. Install preformed sections of same material as straight segments of pipe insulation.

D. Insulation Installation on Valves and Pipe Specialties:
   1. Install preformed sections of same material as straight segments of pipe insulation when available.
   2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
   3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
   4. Install insulation to flanges as specified for flange insulation application.

3.07 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option. Insulation is required where copper tubing is noted for use in mechanical rooms. Refer to drawings for size and extent.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
   1. Underground piping.

3.08 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:
   1. Insulation shall be the following:
      a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick. May be reduced to ½'' thick in walls and chases.

B. Domestic Hot Water and Hot Water Return:
   1. Insulation shall be the following:
      a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick. May be reduced to ½'' thick in walls and chases.

C. Horizontal Storm Piping:
   1. Insulation shall be the following:
      a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick. Insulation shall turn up or down onto vertical section. Cover entire roof drain body.

END OF SECTION
SECTION 22 11 16
DOMESTIC WATER PIPING

PART 1 - GENERAL

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

1.02 SUMMARY
   A. Section Includes:
      1. Under-building slab and aboveground domestic water pipes, tubes, fittings, and specialties inside the building.
      2. Flexible connectors.
      3. Escutcheons.
      4. Sleeves and sleeve seals.
      5. Wall penetration systems.

1.03 SUBMITTALS
   A. Product Data: For the following products:
      1. Piping Materials.
      2. Escutcheons.
      3. Sleeves and sleeve seals.
      4. Water penetration systems.

1.04 QUALITY ASSURANCE
   A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
   B. Comply with NSF 14 for plastic, potable domestic water piping and components.
   C. Comply with NSF 61 for potable domestic water piping and components.

PART 2 - PRODUCTS

2.01 PIPING MATERIALS
   A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.02 COPPER TUBE AND FITTINGS
   A. Hard Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B) water tube, drawn temper.
      4. 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.

2.03 DUCTILE-IRON PIPE AND FITTINGS
   A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
      1. Standard-Pattern, Mechanical-Joint Fittings: AWWA C110, ductile or gray iron.
      2. Compact-Pattern, Mechanical-Joint Fittings: AWWA C153, ductile iron.
a. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.
   1. Standard-Pattern, Push-on-Joint Fittings: AWWA C110, ductile or gray iron.
      b. Compact-Pattern, Push-on-Joint Fittings: AWWA C153, ductile iron.
         1) Gaskets: AWWA C111, rubber.

2.04 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick or ASME B16.21, nonmetallic and asbestos free, unless otherwise indicated; full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

D. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.05 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.

B. Dielectric Unions:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      b. Central Plastics Company.
      c. EPPO Sales, Inc.
      d. Hart Industries International, Inc.
      e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
      f. Zurn Plumbing Products Group; Wilkins Water Control Products.
      g. Description:
         1) Pressure Rating: 150 psig.
         2) End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      b. Central Plastics Company.
      c. EPPO Sales, Inc.
      d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
      e. Description:
         1) Factory-fabricated, bolted, companion-flange assembly.
         2) Pressure Rating: 150 psig.
         3) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
2.06 SLEEVES

A. Cast-Iron Wall Pipes: Fabricated of cast iron, and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc-coated, with plain ends.

PART 3 - EXECUTION

3.01 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages and Division 22 Section "Domestic Water Piping Specialties" for drain valves and strainers.

C. Install shutoff valve immediately upstream of each dielectric fitting.

D. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for pressure-reducing valves.

E. Install domestic water piping level and plumb.

F. Rough-in domestic water piping for water-meter installation according to utility company’s requirements.

G. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

H. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

I. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

J. Install piping adjacent to equipment and specialties to allow service and maintenance.

K. Install piping to permit valve servicing.

L. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.

M. Install piping free of sags and bends.

N. Install fittings for changes in direction and branch connections.

O. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
P. Install pressure gages on suction and discharge piping from each plumbing pump and packaged booster pump. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages.

3.02 JOINT CONSTRUCTION
A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
C. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.03 VALVE INSTALLATION
A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for valve installations.
B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball valves for piping NPS 2 and smaller.
C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping. Drain valves are specified in Division 22 Section "Domestic Water Piping Specialties."
   1. Hose-End Drain Valves: At low points in water mains, risers, and branches.

3.04 TRANSITION FITTING INSTALLATION
A. Install transition couplings at joints of dissimilar piping.

3.05 HANGER AND SUPPORT INSTALLATION
A. Comply with requirements in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.
B. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.
   1. Vertical Piping: MSS Type 8 or 42, clamps.
   2. Individual, Straight, Horizontal Piping Runs:
      a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
C. Support vertical piping and tubing at base and at each floor.
D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
E. Install hangers for piping with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 3/4 and Smaller: 36 inches with 3/8-inch rod.
   2. NPS 1 and NPS 1-1/4: 60 inches with 3/8-inch rod.
   3. NPS 1-1/2 and NPS 2: 72 inches with 3/8-inch rod.
   4. NPS 2-1/2: 84 inches with 1/2-inch rod.
F. Install supports for vertical copper tubing every 10 feet.

3.06 CONNECTIONS
A. Drawings indicate general arrangement of piping, fittings, and specialties.
B. Install piping adjacent to equipment and machines to allow service and maintenance.
C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
   1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
   2. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Comply with requirements in Division 22 plumbing fixture Sections for connection sizes.

3.07 SLEEVE INSTALLATION

A. General Requirements: Install sleeves for pipes and tubes passing through penetrations in floors, partitions, roofs, and walls.

B. Sleeves are not required for core-drilled holes.

C. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestop materials and installations.

3.08 WALL PENETRATION SYSTEM INSTALLATION

A. Install wall penetration systems in new, exterior concrete walls.

B. Assemble wall penetration system components with sleeve pipe. Install so that end of sleeve pipe and face of housing are flush with wall. Adjust locking devices to secure sleeve pipe in housing.

3.09 IDENTIFICATION

A. Identify system components. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification materials and installation.

B. Label pressure piping with system operating pressure.

3.10 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Piping Inspections:
   1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
   2. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
      a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
      b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
      c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
      d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

C. Piping Tests:
   1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.

3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.

4. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.

5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.

6. Prepare reports for tests and for corrective action required.

D. Domestic water piping will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.11 ADJUSTING

A. Perform the following adjustments before operation:
   1. Close drain valves, hydrants, and hose bibbs.
   2. Open shutoff valves to fully open position.
   3. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.12 CLEANING

A. Clean and disinfect potable domestic water piping as follows:
   1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
   2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
      a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
      b. Fill and isolate system according to either of the following:
         1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
         2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
         3) Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
         4) Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
   B. Prepare and submit reports of purging and disinfecting activities.
   C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.13 PIPING SCHEDULE

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

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Under-building-slab, domestic water piping, NPS 3” and smaller, shall be the following:
   1. Ductile Iron.
D. Aboveground domestic water piping, located in ceiling of first floor level and risers, shall be the following:
   1. Provide Type L copper tube for all hot, cold, and hot return piping.

3.14 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
   2. Drain Duty: Hose-end drain valves.

B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

END OF SECTION
SECTION 22 11 19
DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

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

1.02 SUMMARY
A. This Section includes the following domestic water piping specialties:
   1. Water pressure-reducing valves.
   2. Strainers.
   3. Outlet boxes.
   4. Hose bibbs.
   5. Wall hydrants.
   6. Drain valves.
   7. Trap-seal primer valves.

1.03 PERFORMANCE REQUIREMENTS
A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

1.04 SUBMITTALS
A. Product Data: For each type of product indicated.
B. Field quality-control test reports.
C. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

1.05 QUALITY ASSURANCE
A. NSF Compliance:
   1. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

PART 2 - PRODUCTS

2.01 HOSE BIBBS
A. Hose Bibbs HB:
   4. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
   5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
   8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
   10. Finish for Finished Rooms: Chrome or nickel plated.
   11. Operation for Equipment Rooms: Wheel handle or operating key.
   12. Operation for Service Areas: Operating key.
14. Include operating key with each operating-key hose bibb.
15. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.02 WALL HYDRANTS

A. Nonfreeze Wall Hydrants WH:
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      b. MIFAB, Inc.
      c. Prier Products, Inc.
      e. Tyler Pipe; Wade Div.
      f. Watts Drainage Products Inc.
      g. Woodford Manufacturing Company.
      h. Zum Plumbing Products Group; Light Commercial Operation.
   5. Operation: Loose key.
   6. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
   8. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
   13. Operating Keys(s): Two with each wall hydrant.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
B. Install water regulators with inlet and outlet shutoff valves and bypass with memory-stop balancing valve. Install pressure gages on inlet and outlet.
C. Install outlet boxes recessed in wall. Install 2-by-4-inch fire-retardant-treated-wood blocking wall reinforcement between studs. Fire-retardant-treated-wood blocking is specified in Division 06 Section "Rough Carpentry."
D. Install water hammer arresters in water piping according to PDI-WH 201.
E. Install supply-type, 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.

3.02 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.
3.03 FIELD QUALITY CONTROL

A. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

END OF SECTION
SECTION 22 13 16
SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

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

1.02 SUMMARY
   A. This Section includes the following for soil, waste, and vent piping inside the building:
      1. Pipe, tube, and fittings.

1.03 DEFINITIONS
   A. PVC: Polyvinyl chloride plastic.

1.04 PERFORMANCE REQUIREMENTS
   A. Components and installation shall be capable of withstanding the following minimum working
      pressure, unless otherwise indicated:

1.05 SUBMITTALS
   A. Product Data: For pipe, tube, fittings, and couplings.

1.06 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.

PART 2 - PRODUCTS

2.01 MANUFACTURERS
   A. In other Part 2 articles where titles below introduce lists, the following requirements apply to
      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,
         manufacturers specified.
      2. Manufacturers: Subject to compliance with requirements, provide products by one of the
         manufacturers specified.

2.02 PIPING MATERIALS
   A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining
      materials.

2.03 PVC PIPE AND FITTINGS
   A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
      1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste,
         and vent patterns.
   B. Solvent Cement and Adhesive Primer:
      1. Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated
according to 40 CFR 59, Subpart D (EPA Method 24).

2. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. PVC Pipe shall not be used in any return air. Provide no-hub cast iron in plenums.

PART 3 - EXECUTION

3.01 PIPING APPLICATIONS

A. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.

B. Aboveground, soil and waste piping NPS 4 and smaller shall be the following:
   1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints (except return plenums).

C. Aboveground, soil and waste piping NPS 5 and larger shall be the following:
   1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints (except return plenums).

D. Aboveground, vent piping NPS 4 and smaller shall be the following:
   1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints (except return plenums).

E. Aboveground, vent piping NPS 5 and larger shall be the following:
   1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints (except return plenums).

F. Underground, soil, waste, and vent piping NPS 4 and smaller shall be the following:
   1. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

G. Underground, soil and waste piping NPS 5 and larger shall be the following:
   1. Solid-wall, Schedule 40, PVC pipe; PVC socket fittings; and solvent-cemented joints.

3.02 PIPING INSTALLATION

A. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."

B. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

C. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

D. 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.

E. 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 2" and smaller; 1 percent downward in direction of flow for piping NPS 3" 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.

F. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

G. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.

H. Install underground PVC soil and waste drainage piping according to ASTM D 2321.

I. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.03 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."

3.04 HANGER AND SUPPORT INSTALLATION

A. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:
   1. Vertical Piping: MSS Type 8 or Type 42, clamps.
   2. Install individual, straight, horizontal piping runs according to the following:
      a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.

B. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
   2. NPS 3: 48 inches with 1/2-inch rod.
   3. NPS 4 and 5: 48 inches with 5/8-inch rod.
   4. NPS 6: 48 inches with 3/4-inch rod.

C. Install supports for vertical PVC piping every 48 inches.

D. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.05 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:
   1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
   2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
   3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. **Equipment:** Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

### 3.06 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. **Roughing-in Inspection:** Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.

2. **Final Inspection:** Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. **Reinspection:** If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. **Reports:** Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.

3. **Roughing-in Plumbing Test Procedure:** Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.

4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.

5. Prepare reports for tests and required corrective action.

### 3.07 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.

### 3.08 PROTECTION

A. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

**END OF SECTION**
SECTION 22 13 19
SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

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

1.02 SUMMARY
A. This Section includes the following sanitary drainage piping specialties:
   1. Cleanouts.
   2. Floor drains.
   3. Roof flashing assemblies.
   4. Through-penetration firestop assemblies.
   5. Miscellaneous sanitary drainage piping specialties.
   6. Flashing materials.

1.03 QUALITY ASSURANCE

1.04 COORDINATION
A. Coordinate size and location of roof penetrations.

PART 2 - PRODUCTS

2.01 CLEANOUTS
A. Exposed Metal Cleanouts:
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   3. Basis-of-Design Product: Subject to compliance with requirements, provide or a comparable product by one of the following:
      b. MIFAB, Inc.
      d. Tyler Pipe; Wade Div.
      e. Watts Drainage Products Inc.
      f. Zurn Plumbing Products Group; Specification Drainage Operation.
      g. Josam Company; Blucher-Josam Div.
   4. Size: Same as connected drainage piping
   7. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

2.02 FLOOR DRAINS
A. Cast-Iron Floor Drains: FD
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide or a comparable product by one of the following:
   b. MIFAB, Inc.
   d. Watts Drainage Products Inc.
   e. Zurn Plumbing Products Group; Light Commercial Operation.
   f. Zurn Plumbing Products Group; Specification Drainage Operation.
5. Pattern: Floor drain.
7. Outlet: Bottom.
8. Top or Strainer Material: Bronze.
10. Top Shape: Round.
11. Dimensions of Top or Strainer: 6" 

2.03 FLOOR SINKS:
A. Cast-Iron Floor Sinks: FS
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   b. MIFAB, Inc.
   d. Watts Drainage Products Inc.
   e. Zurn Plumbing Products Group; Light Commercial Operation.
   f. Zurn Plumbing Products Group; Specification Drainage Operation.
5. Pattern: Floor sink.
7. Outlet: Bottom.
8. Top or Strainer Material: Bronze.
10. Top Shape: Round.
11. Dimensions of Top or Strainer: 12"

3.01 INSTALLATION
A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
   1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless
larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

E. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated:
   1. Position floor drains for easy access and maintenance.
   2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
   3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
   4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

F. Assemble open drain fittings and install with top of hub 2 inches above floor.

G. Install deep-seal traps on floor drains.

H. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
   1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
   2. Size: Same as floor drain inlet.

I. Install wood-blocking reinforcement for wall-mounting-type specialties.

J. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

K. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

2.04 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

2.05 FIELD QUALITY CONTROL

A. Tests and Inspections:
   1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
   2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

2.06 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.
SECTION 23 05 10
BASIC MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES
A. Description of Basic Mechanical Requirements. Applies to all Division 23 sections.

1.02 RELATED SECTIONS
A. Requirements of Division 1, General Provisions.

1.03 DEFINITIONS
A. "Provide" means to furnish and install, complete and ready for operation.

1.04 REFERENCES
B. ANSI: American National Standards Institute, Inc.
E. ASHRAE: American Society of Heating, Refrigeration and Air Conditioning Engineers.
F. ASME: American Society for Mechanical Engineers.
H. FM: Factory Mutual.
J. NEMA: National Electrical Manufacturer's Association.
L. MSS: Manufacturer's Standardization Society of the Valve and Fitting Industry.
M. SMACNA: Sheet Metal and Air Conditioning Contractor's National Association.
N. UL: Underwriters Laboratories, Inc.

1.05 REGULATORY REQUIREMENTS
A. Comply with current edition, unless otherwise noted, of the following codes and standards.
   1. ANSI B31.9 - Building Services Piping.
   4. NFPA 54 - National Fuel Gas Code
   5. NFPA 70 - National Electrical Code
   6. NFPA 90A - Installation of Air Conditioning and Ventilating Systems
   7. NFPA 91 - Exhaust Systems for Air Conveying of Materials
   9. IBC - International Building Code, with Mechanical, Plumbing and Gas Codes
B. Permits, Licenses, Inspections and Fees.
1. Obtain and pay for all permits, licenses, inspections and fees, and comply with all rules, 
laws and ordinances pertaining to the Contractor's portion of the Work.
2. Obtain and pay for certificates of required inspections, and file certificates with Owner.
3. All usage fees or charges based on utility flow rates, or assessments based on utility 
system amortization shall be paid by the Owner.

1.06 PRODUCT REQUIREMENTS
A. Provide new standard, first-grade materials throughout.
B. Multiple items of similar equipment shall be the product of the same manufacturer.
C. Substitutions:
   1. Comply with the provisions of Division 1, Section “Product Requirements” and the 
      following.
   2. When several manufacturers are named in the specifications, the corresponding products 
      and models made by the specified manufacturers will be accepted and Contractor may 
      base his bid on any one of those products. However, if the Contractor's bid is based on 
      products other than the scheduled or specified basis of design, it shall be understood that 
      there will be no extra cost involved whatsoever, and the effect on other trades has been 
      included in the Contractor's proposal. Coordination with other trades for substituted 
      equipment or use of products other than the named basis of design shall be the 
      responsibility of the Contractor furnishing the equipment.
   3. The basis of design manufacturer's equipment has been used to determine space 
      requirements. Should another approved manufacturer's equipment be used in preparing 
      proposals, Contractor shall be responsible for determining that said equipment will fit space 
      allocated. Submission of shop drawings or product data on such equipment shall be 
      considered as indicating that the Contractor has reviewed the space requirements and the 
      submitted equipment will fit the space allocated with due consideration given to access 
      required for maintenance and code purposes.
   4. Each bidder may submit to the Architect a list of any substitutes which he proposes to use 
      in lieu of the equipment or material named in the specifications with a request for the 
      approval of proposed substitutes. To be considered, such requests must be delivered to 
      the office of the Architect not later than 10 days prior to bid due date. The submittal shall 
      include the following:
      a. Specific equipment or material proposed for substitution giving manufacturer, catalog 
         and model number.
      b. All performance and dimensional data necessary for comparison of the proposed 
         substitute with the equipment or material specified.
      c. A statement setting forth any changes in other materials, equipment or other Work 
         that incorporation of the substitute may require.
   5. The burden of proof of the merit of the proposed substitute is upon the proposer. The 
      Architect's decision of approval or disapproval of a proposed substitution is final.
   6. All bidders will be advised by addenda of proposed substitutes which are found to be 
      acceptable. Do not rely upon approvals made in any other manner.

1.07 SUBMITTAL
A. Submit under provisions of Division 1, Section “Submittal Procedures” and the following:
B. Product Data: Submit to the Architect and obtain his approval of a complete list of materials and 
equipment which are to be furnished under Division 23.
   1. List shall be complete with manufacturer's names, catalog number, dimensions, 
specifications, rating data and options utilized. Capacities shall be in the terms specified.
   2. Call attention to deviations from specified items as to operation and physical dimensions.
3. Performance curves for equipment such as fans and pumps shall be included.
4. Final equipment orders shall not be placed until submittals have been returned marked "No Exceptions Noted" or "Make Corrections Noted".
5. Bind all equipment submittals and provide index tab for each type of equipment. Submit all at one time. Reserve two sets for project close-out documents.
6. Revise the following paragraph to suit project requirements

C. Shop Drawings: Before starting work, submit and obtain approval from Architect of detailed drawings of the following, fully dimensioned (including elevations of ductwork and piping) and drawn to 1/4" to 1'-0" scale. Submit one sepia and one print of each drawing. Failure to submit shop drawings will make the Contractor responsible for changes required to facilitate installation.
   1. Ductwork (coordinate diffuser locations with reflected ceiling plan). See Section “Ductwork”.
   2. Complete layouts for powerhouse mechanical equipment rooms and fan rooms showing:
      a. Support column locations.
      b. Location and dimensions of equipment foundation and pads.
      c. Location and dimension of equipment and apparatus including electrical control panels, starters, service and coil pull areas.
      d. Coordinate with Electrical Contractor and indicate electrical equipment location(s) i.e., panels, electrical conduit runs and stubs for motors, code clearances, etc.
      e. Dimensioned floor drain locations.
   3. Equipment piping.
   4. Submit complete automatic temperature control system control and power wiring diagrams for approval before installing controls. See Division 23 Section - “HVAC Instrumentation and Controls”.

1.08 QUALITY ASSURANCE
A. Installer’s Qualifications: Firm experienced in installation of systems similar in complexity to those required for this project, plus the following:
   1. Acceptable to or licensed by manufacturer.
   2. Not less than 3 years experience with systems.
   3. Successfully completed not less than 5 comparable scale projects using this system.

1.09 SUMMARY OF WORK
A. Scope: Provide all labor, materials, equipment and services necessary for the completion of all mechanical work shown or specified, except work specified to be done or furnished by others, complete and ready for operation.
B. Equipment Furnished by Others.
   1. Connect or install equipment shown on mechanical drawings that requires plumbing and/or mechanical connections.
   2. Provide piping, shut-off valves and unions required for a complete installation.

1.10 DRAWING INTERPRETATION AND COORDINATION
A. Plans are intended to show size, capacity, approximate location, direction and general relationship of one phase to another, but not exact detail or arrangement.
B. Do not scale drawings for location of system components. Check all measurements, location of pipe, ducts, and equipment with the detail architectural, structural, and electrical drawings and conditions existing in the field and lay out work so as to fit in with ceiling grids, lighting and other parts.
C. Make minor adjustments in the field as required to provide the optimum result to facilitate ease of service, efficient operation and best appearance.
D. Where doubt arises as to the meaning of the plans and specifications, obtain the Architect's written decision before proceeding with parts affected; otherwise assume liability for damage to other work and for making necessary corrections to work in question.

E. Refer to Architectural Drawings for all dimensions, and locations of ceiling diffusers and sprinkler heads.

1.11 PROJECT/SITE CONDITIONS

A. Visiting Site: Visit site and become familiar with location and various conditions affecting work. No additional allowance will be granted because of lack of knowledge of such conditions.

B. Determine sizes and verify locations of existing utilities near site.

C. Cause as little interference or interruption of existing utilities and services as possible. Schedule work which will cause interference or interruption in advance with Owner, authorities having jurisdiction, and all affected trades.

1.12 SUBMITTALS FOR PROJECT CLOSEOUT

A. Submit under provisions of Division 1 Section - “Closeout Procedures”, Section “Project Record Documents” and the following.

B. Record Drawings:
   1. Keep accurate record of corrections, variations, and deviations, including those required by change orders to the Air Conditioning, Plumbing and Fire Protection drawings.
   2. Accurately show location, size and elevation of new exterior work dimensioned from permanent structure.
   3. Record changes daily on a set of bluelines kept at the job site.
   4. Submit bluelines marked as noted above to Architect for review prior to request for final payment.
   5. Marked bluelines will be returned to Contractor for use in preparing record drawings.
   6. Retain subparagraph above for Contractor prepared and subparagraph for Engineer prepared record drawings.
   7. Marked bluelines will be used by the Engineer in preparing record drawings.
   8. Drawings: Provide one complete set of mylar reproducible drawings indicating the actual completed installation of the Work.

C. Prior to the issuance of a certificate for final payment, submit to Architect and obtain his approval of the following:

D. Modify the following subparagraphs to suit project requirements
   1. Record drawings - sheet metal work (mylar sepia reproducibles).
   2. Record drawings - piping (mylar sepia reproducibles)
   3. Record drawings - control systems (reproducibles).
   4. Control manufacturer’s letter of certification (2).
   5. Air balance report (2). (See Division 23, Section - “Testing, Adjusting and Balancing”.)
   6. Equipment Submittal Data (2).
   7. Equipment operating and maintenance manuals (2).
   8. Equipment warranty dates and guarantees (2).
   9. List of Owner’s Personnel who have received operating and maintenance instructions.
   10. Letter certifying and signed by Owner or his representative that the Owner or his representative has received the extra materials specified for each system:
       a. Spare filters.

1.13 TEMPORARY USE OF MECHANICAL EQUIPMENT
A. Use of new installed mechanical equipment to provide heat, air conditioning, ventilation and plumbing during construction will be permitted subject to compliance with the following provisions:
  1. Units shall be properly lubricated, balanced, and aligned. Vibrations must be eliminated.
  2. Automatic temperature control systems for preheat coils shall function properly and all safety controls shall function to prevent coil freeze-up damage.
  3. The air filtering system utilized shall be that which is designed for the system when complete, and all filter elements shall be replaced at completion of construction and prior to testing and balancing of system.
  4. All return air and outside air openings shall have temporary filter media installed over inlet side of opening and secured air tight there to.

B. Prior to final inspection, the equipment or parts used which show wear and tear beyond normal, shall be replaced with identical replacements, at no additional cost to the Owner.

C. Warranty dates shall start at Date of Substantial Completion. Provide extended warranty from manufacturer to cover time period between start-up and substantial completion.

D. This paragraph shall not reduce the requirements of the mechanical specifications sections.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION
SECTION 23 05 13

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Single phase electric motors.
B. Variable Frequency Controllers
C. Three phase electric motors.

1.02 RELATED REQUIREMENTS

A. Section 26 27 17 - Equipment Wiring: Electrical characteristics and wiring connections.
B. Section 26 29 13 - Enclosed Controllers.

1.03 REFERENCE STANDARDS

A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; American Bearing Manufacturers Association, Inc.; 1990 (Reapproved 2008).
C. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association; 2009, Revision 1 - 2010.
D. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide wiring diagrams with electrical characteristics and connection requirements.
C. Test Reports: Indicate test results verifying nominal efficiency and power factor for three phase motors larger than 1/2 horsepower.
D. Manufacturer's Installation Instructions: Indicate setting, mechanical connections, lubrication, and wiring instructions.
E. Operation Data: Include instructions for safe operating procedures.
F. Maintenance Data: Include assembly drawings, bearing data including replacement sizes, and lubrication instructions.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacture of electric motors for Commercial use, and their accessories, with minimum three years documented product development, testing, and manufacturing experience.
B. Conform to NFPA 70.
C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING
A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.

1.07 WARRANTY
A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
B. Provide five year manufacturer warranty for motors larger than 20 horsepower.

PART 2 PRODUCTS
2.01 MANUFACTURERS
B. Gould: www.gould.com
C. Marathon Electric: www.marathonelectric.com

2.02 GENERAL CONSTRUCTION AND REQUIREMENTS
A. Electrical Service:
   1. Motors 1/2 HP and Smaller: 115 volts, single phase, 60 Hz.
   2. Motors Larger than 1/2 Horsepower: 208 volts, three phase, 60 Hz.
B. Construction:
   1. Open drip-proof type except where specifically noted otherwise.
   2. Design for continuous operation in 40 degrees C environment.
   3. Design for temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
C. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, efficiency.
D. Wiring Terminations:
   1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.
   2. For fractional horsepower motors where connection is made directly, provide threaded conduit connection in end frame.

2.03 APPLICATIONS
A. Exception: Motors less than 250 watts, for intermittent service may be the equipment manufacturer's standard and need not conform to these specifications.
B. Single phase motors for shaft mounted fans or blowers: Permanent split capacitor type.

2.04 SINGLE PHASE POWER - SPLIT PHASE MOTORS
A. Starting Torque: Less than 150 percent of full load torque.
B. Starting Current: Up to seven times full load current.
C. Breakdown Torque: Approximately 200 percent of full load torque.
D. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve or ball bearings.
E. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

2.05 SINGLE PHASE POWER - PERMANENT-SPLIT CAPACITOR MOTORS
A. Starting Torque: Exceeding one fourth of full load torque.
B. Starting Current: Up to six times full load current.
C. Open Drip-proof or Enclosed Air Over Enclosure: Class A (50 degrees C temperature rise) insulation, minimum 1.0 Service Factor, prelubricated sleeve or ball bearings, automatic reset overload protector.

2.06 THREE PHASE POWER - SQUIRREL CAGE MOTORS
A. Starting Torque: Between 1 and 1-1/2 times full load torque.
B. Starting Current: Six times full load current.
C. Power Output, Locked Rotor Torque, Breakdown or Pull Out Torque: NEMA Design B characteristics.
E. Insulation System: NEMA Class B or better.
F. Testing Procedure: In accordance with IEEE 112. Load test motors to determine free from electrical or mechanical defects in compliance with performance data.
G. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.
H. Thermistor System (Motor Frame Sizes 254T and Larger): Three PTC thermistors imbedded in motor windings and epoxy encapsulated solid state control relay for wiring into motor starter; refer to Section 26 29 13.
I. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA STD 9, L-10 life of 20,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.
J. Sound Power Levels: To NEMA MG 1.
K. Weatherproof Epoxy Sealed Motors: Epoxy seal windings using vacuum and pressure with rotor and starter surfaces protected with epoxy enamel; bearings double shielded with waterproof non-washing grease.
L. Nominal Efficiency: As scheduled at full load and rated voltage when tested in accordance with IEEE 112.
M. Nominal Power Factor: As scheduled at full load and rated voltage when tested in accordance with IEEE 112.

2.07 STARTERS
A. Acceptable Manufacturers:
   1. Allen-Bradley
   2. Siemens
   3. General Electric
4. Square D  
5. Westinghouse

B. NEMA rated only. IEC rated starters not acceptable.

C. Use only one manufacturer for all motor starter equipment on this project.

D. Magnetic Motor Starters:  
   1. Line Voltage Non-Reversing.  
      a. Horsepower rated, tested, labeled and sized per NEMA, with field replaceable main 
         contacts, external manual resets, melting-alloy overload protection in all phases [and 
         low voltage/phase loss protection].

E. Combination Magnetic Motor Starters:  
   1. Magnetic starters as specified above.  
   2. Rejection fuse clips sized for dual element fuses.  
   4. Defeatable cover interlocks.  
   5. Padlockable indicating handles.

F. Enclosure:  
   1. NEMA Type 1 enclosures for general purpose interior dry locations.  
   2. NEMA Type 3R enclosures in exterior or damp locations.  
   3. NEMA Type 4 enclosures in wet locations.

G. Accessories:  
   1. Each starter shall incorporate  
      b. Control power transformer sized to support those devices shown on the drawings with 
         120V secondary coil with 2 primary and 1 secondary fuses.  
      c. Provide number of N.O. and N.C. auxiliary contacts as required by control sequence.  
   2. Pushbutton Station momentary contact type with green start button, red stop button and 
      legend plate.

H. Manual Motor Starters:  
   1. For single phase motors, without internal thermal overload protection, provide manual 
      motor starters mounted in single gang electrical box.  
   2. Outside equipment rooms provide flush mounted enclosure with cover plate and identify.  
   3. Overload protection: Size according to nameplate current. Not required on single phase 
      motors equipped with internal thermal protection.  
   4. Provide integral pilot light where scheduled.

2.08 VARIABLE FREQUENCY CONTROLLERS  
A. For each motor so specified provide variable frequency drive (VFD). VFD shall be 
   self-contained with all components in a NEMA 1 enclosure.

B. VFD shall utilize pulse width modulation (PWM) technology.

C. The complete VFD, including all specified options, shall be UL listed.

D. The VFD shall have a DC link reactor to minimize power line harmonics. VFD's without a DC 
   link reactor shall provide a 3% impedance line reactor. (Input current rating of drive shall not 
   exceed output rating. Submit data for compliance.)

E. The VFD's full load amp rating shall meet or exceed NEC Table 430-150. The VFD shall be 
   able to provide full rated output current continuously, 110% of rated current for 60 seconds and 
   220% of rated current for up to 1 second while starting.

F. Input and output power circuit switching can be done without interlocks or damage to the VFD.
(If manufacturer requires, contractor to provide interlock devices and wiring.)

G. Protective Features
1. Class 20 I2t electronic motor overload protection for single motor applications and thermal-mechanical overloads for multiple motor applications.
2. Protection against input transients, loss of AC line phase, short circuit, ground fault, over voltage, under voltage, drive over temperature and motor.
3. Protect VFD from sustained power or phase loss. The VFD shall incorporate a 5 second control power loss ride through to eliminate nuisance tripping.
4. Drive shall have semi-conductor rated input fuses to protect power components.
5. The drive shall be fitted with output line reactors.
6. Drive shall catch a rotating motor operating forward or reverse up to full speed.

H. Interface Features
1. Local/Hand, Stop/Reset and Remote/Auto selector switches shall be provided to start and stop the drive and determine the speed reference.
3. A red FAULT light and a green POWER-ON light shall be provided.
4. The drive shall be fitted with an RS 232 or 485 serial communications port and be supplied with software to display all monitoring, fault, alarm and status signals.
5. Set point control interface (PID control) shall be standard in the unit.
6. Floating point control interface shall be provided to increase/decrease speed in response to switch closures.
7. The following displays shall be accessible from the control panel in actual units: Reference Signal Percent, Output Frequency, Output Amps, Motor HP, Motor kW, kWhr, Output Voltage, No Load Warning, DC Bus Voltage, Drive Temperature (% until trip) and Motor Speed (in percent speed).
8. Drive will sense the loss of load and signal a no load/broken belt warning or fault.
9. Eight programmable digital inputs shall be provided for interfacing with the systems control and safety interlock circuitry.
10. Two programmable relay outputs shall be provided for remote indication of drive status.
11. Two programmable analog inputs shall be provided and shall accept a direct-or-reverse acting signal. Analog reference inputs accepted shall include 0-10 V dc, 0-20 mA and 4-20 mA.
12. Two programmable analog outputs shall be provided for indication of drive status. These outputs shall be programmable for output speed, voltage, frequency, amps and input kW.
13. Under fire mode conditions the VFD shall automatically default to a preset speed.
14. Provide simple connection for 2 position safety limit controls to shut down drive under all operating modes (local, auto).

I. Adjustments:
1. VFD shall have an adjustable carrier frequency of 2 to 14 kHz through 60 HP and 2 to 4.5 kHz above 60 HP.
2. Two preset speeds shall be provided.
3. Adjustable acceleration and deceleration ramps shall be provided.
4. Adjustable current limit settings shall be provided.
5. If VFD trips on one of the following conditions, the VFD shall be programmable for automatic or manual reset: under voltage, over voltage, current limit, inverter overload and motor overload.

6. The number of restart attempts shall be selectable from 0 through 10 and the time between attempts shall be adjustable from 0 through 10 seconds.

7. VFD's are priced now such that can provide spare drive for about same cost as a by-pass. Also, one drive size may be able to be spare for several motors. See equipment schedule for spare options. UAB wants bypass.

J. Bypass
1. Unless noted otherwise, provide a manual bypass consisting of a door interlocked main fused disconnect padlockable in the off position, a built-in motor starter and a four position DRIVE/OFF/LINE/TEST switch controlling three contactors. In the DRIVE position, the motor is operated at an adjustable speed from the drive. In the OFF position, the motor and drive are disconnected. In the LINE position, the motor is operated at full speed from the AC power line and power is disconnected from the drive, so that service can be performed. In the TEST position, the motor is operated at full speed from the AC line power.

K. Service Conditions
1. Ambient temperature, -10 to 40°C (14 to 104°F).
2. 0 to 95% relative humidity, non-condensing.
3. AC line voltage variation, -10 to +10% of nominal with full output.
4. Drive shall be capable of operating a motor up to 50 feet away without derating or field modification.
5. Provide output filter to limit voltage at motor terminals for all drives located more than 50 feet from motor (cooling tower).

L. Quality Assurance
1. The complete VFD shall be factory tested.
2. All optional features shall be functionally tested at the factory for proper operation.

M. Start-up Service
1. Provide factory start-up commissioning of the variable frequency drive and its optional circuits by a factory certified service technician who is experienced in start-up and repair services. The commissioning personnel shall be the same personnel that will provide the factory service and warranty repairs at the customer's site. Start-up services shall include checking for proper operation and installation for the VFD, its options and its interface wiring to the building automation system and programming in step-overs for critical fan speeds [verify critical speeds with cooling tower manufacturer].

N. Provide factory check-out and start-up service. Verify with cooling tower supplier critical speeds and provide step-overs as required.

O. Approved manufacturers: AC Tech QC300 series, Graham, Cutter Hammer, ABB or approved equal.

PART 3 EXECUTION

3.01 INSTALLATION
A. Install in accordance with manufacturer's instructions.
B. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.
C. Check line voltage and phase and ensure agreement with nameplate.
SECTION 23 05 53
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1  GENERAL
1.01 SECTION INCLUDES
   A. Nameplates.
   B. Tags.
   C. Valve Schedule.
   D. Pipe Markers.

1.02 RELATED REQUIREMENTS
   A. Section 09 90 00 - Painting and Coating: Identification painting.

1.03 REFERENCE STANDARDS
   A. ASME A13.1 - Scheme for the Identification of Piping Systems; The American Society of
      Mechanical Engineers; 2007.
      (Reapproved 2007).

1.04 SUBMITTALS
   A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
   B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
   C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location,
      function, and valve manufacturer's name and model number.
   D. Product Data: Provide manufacturers catalog literature for each product required.

PART 2  PRODUCTS
2.01 IDENTIFICATION APPLICATIONS
   A. Air Handling Units: Nameplates.
   B. Air Terminal Units: Tags.
   C. Automatic Controls: Tags. Key to control schematic.
   D. Control Panels: Nameplates.
   E. Dampers: Ceiling tacks, where located above lay-in ceiling.
   F. Ductwork: Nameplates.
   H. Instrumentation: Tags.
   I. Piping: Tags.
   J. Pumps: Nameplates.
   K. Small-sized Equipment: Tags.
   L. Thermostats: Nameplates.
M. Valves: Tags and ceiling tacks where located above lay-in ceiling.

2.02 NAMEPLATES

A. Manufacturers:
   5. Letter Height: 1/4 inch.

2.03 TAGS

A. Manufacturers:

B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

C. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.04 PIPE MARKERS

A. Manufacturers:

B. Color: Conform to ASME A13.1.

C. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

2.05 VALVE SCHEDULES

A. Valve Schedules: For each piping system, on standard-size bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

   1. Valve-Schedule Frames: Glazed display frame for removable mounting on masonry walls for each page of valve schedule. Include mounting screws.
   2. Frame: Extruded aluminum.
   3. Glazing: ASTM C 1036, Type I, Class 1, Glazing Quality B, 2.5-mm, single-thickness glass.

2.06 CEILING TACKS

A. Manufacturers:

B. Description: Steel with 3/4 inch diameter color coded head.

C. Color code as follows:
   1. HVAC Equipment: Yellow.
2. Fire Dampers and Smoke Dampers: Red.

PART 3  EXECUTION

3.01 PREPARATION
A. Degrease and clean surfaces to receive adhesive for identification materials.
B. Prepare surfaces in accordance with Section 09 90 00 for stencil painting.

3.02 INSTALLATION
A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
B. Install tags with corrosion resistant chain.
C. Install plastic pipe markers in accordance with manufacturer's instructions.
D. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION
SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Testing, adjustment, and balancing of air systems.
B. Measurement of final operating condition of HVAC systems.
C. Commissioning activities.

1.02 RELATED REQUIREMENTS
A. Section 01 21 00 - Allowances: Inspection and testing allowances.
B. Section 01 40 00 - Quality Requirements: Employment of testing agency and payment for services.
C. Section 01 91 13 - General Commissioning Requirements: Commissioning requirements that apply to all types of work.
D. Section 23 08 00 - Commissioning of HVAC.

1.03 REFERENCE STANDARDS
D. SMACNA (TAB) - HVAC Systems Testing, Adjusting, and Balancing; Sheet Metal and Air Conditioning Contractors' National Association; 2002.

1.04 SUBMITTALS
A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
   1. Submit to Architect.
   2. Submit six weeks prior to starting the testing, adjusting, and balancing work.
   3. Include certification that the plan developer has reviewed the contract documents, the equipment and systems, and the control system with the Architect and other installers to sufficiently understand the design intent for each system.
   4. Include at least the following in the plan:
      a. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
      b. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
      c. Identification and types of measurement instruments to be used and their most recent calibration date.
      d. Discussion of what notations and markings will be made on the duct and piping
drawings during the process.

e. Final test report forms to be used.

f. Detailed step-by-step procedures for TAB work for each system and issue, including:
   1) Terminal flow calibration (for each terminal type).
   2) Diffuser proportioning.
   3) Branch/submain proportioning.
   4) Total flow calculations.
   5) Rechecking.
   6) Diversity issues.

g. Expected problems and solutions, etc.

h. Procedures for formal deficiency reports, including scope, frequency and distribution.

C. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and
   balancing of systems and equipment to achieve specified performance.
   1. Revise TAB plan to reflect actual procedures and submit as part of final report.
   2. Submit draft copies of report for review prior to final acceptance of Project. Provide final
      copies for Architect and for inclusion in operating and maintenance manuals.
   3. Provide reports in soft cover, letter size, 3-ring binder manuals, complete with index page
      and indexing tabs, with cover identification at front and side. Include set of reduced
      drawings with air outlets and equipment identified to correspond with data sheets, and
      indicating thermostat locations.
   4. Include actual instrument list, with manufacturer name, serial number, and date of
      calibration.
   5. Form of Test Reports: Where the TAB standard being followed recommends a report
      format use that; otherwise, follow ASHRAE Std 111.
   6. Units of Measure: Report data in I-P (inch-pound) units only.
   7. Include the following on the title page of each report:
      a. Name of Testing, Adjusting, and Balancing Agency.
      b. Address of Testing, Adjusting, and Balancing Agency.
      c. Telephone number of Testing, Adjusting, and Balancing Agency.
      d. Project name.
      e. Project location.
      f. Project Architect.
      g. Project Engineer.
      h. Project Contractor.
      i. Report date.

PART 2  PRODUCTS - NOT USED

PART 3  EXECUTION

3.01 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:
   1. AABC MN-1, AABC National Standards for Total System Balance.

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work
   prior to Substantial Completion of the project.

C. Where HVAC systems and/or components interface with life safety systems, including fire and
   smoke detection, alarm, and control, coordinate scheduling and testing and inspection
   procedures with the authorities having jurisdiction.

D. TAB Agency Qualifications:
   1. Company specializing in the testing, adjusting, and balancing of systems specified in this
      section.
2. Having minimum of three years documented experience.

3. Certified by one of the following:

E. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.02 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
   1. Systems are started and operating in a safe and normal condition.
   2. Temperature control systems are installed complete and operable.
   3. Proper thermal overload protection is in place for electrical equipment.
   4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
   5. Duct systems are clean of debris.
   6. Fans are rotating correctly.
   7. Fire and volume dampers are in place and open.
   8. Air coil fins are cleaned and combed.
   9. Access doors are closed and duct end caps are in place.
  10. Air outlets are installed and connected.
  11. Duct system leakage is minimized.
  12. Hydronic systems are flushed, filled, and vented.
  13. Pumps are rotating correctly.
  14. Proper strainer baskets are clean and in place.
  15. Service and balance valves are open.

B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.

3.03 PREPARATION

A. Hold a pre-balancing meeting at least one week prior to starting TAB work.

3.04 ADJUSTMENT TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 10 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.05 RECORDING AND ADJUSTING

A. Ensure recorded data represents actual measured or observed conditions.

B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

C. Mark on the drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.

D. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

E. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.
3.06 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.

B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

E. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

K. Where modulating dampers are provided, take measurements and balance at extreme conditions.

L. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches positive static pressure near the building entries.

M. For variable air volume system powered units set volume controller to air flow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable air volume temperature control.

N. On fan powered VAV boxes, adjust air flow switches for proper operation.

3.07 WATER SYSTEM PROCEDURE

A. Adjust water systems to provide required or design quantities.

B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gauges to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.
C. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.

D. Effect system balance with automatic control valves fully open to heat transfer elements.

E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.

F. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

3.08 COMMISSIONING

A. See Sections 01 91 13 and 23 08 00 for additional requirements.

B. Perform prerequisites prior to starting commissioning activities.

C. Fill out Prefunctional Checklists for:
   1. Air side systems.
   2. Water side systems.

D. Furnish to the Commissioning Authority, upon request, any data gathered but not shown in the final TAB report.

E. Re-check a random sample equivalent to 10 percent of the final TAB report data as directed by Commissioning Authority.
   1. Original TAB agency shall execute the re-checks, witnessed by the Commissioning Authority.
   2. Use the same test instruments as used in the original TAB work.
   3. Failure of more than 10 percent of the re-checked items of a given system shall result in the rejection of the system TAB report; rebalance the system, provide a new system TAB report, and repeat random re-checks.
   4. For purposes of re-check, failure is defined as follows:
      a. Air Flow of Supply and Return: Deviation of more than 10 percent of instrument reading.
      b. Minimum Outside Air Flow: Deviation of more than 20 percent of instrument reading; for inlet vane or VFD OSA compensation system using linear proportional control, deviation of more than 30 percent at intermediate supply flow.
      c. Temperatures: Deviation of more than one degree F.
      d. Air and Water Pressures: Deviation of more than 10 percent of full scale of test instrument reading.
      e. Sound Pressures: Deviation of more than 3 decibels, with consideration for variations in background noise.

   5. For purposes of re-check, a whole system is defined as one in which inaccuracies will have little or no impact on connected systems; for example, the air distribution system served by one air handler or the hydronic chilled water supply system served by a chiller or the condenser water system.

F. In the presence of the Commissioning Authority, verify that:
   1. Final settings of all valves, splitters, dampers and other adjustment devices have been permanently marked.
   2. The air system is being controlled to the lowest possible static pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from fan to diffuser having all balancing dampers wide open and that during full cooling of all terminal units taking off downstream of the static pressure sensor, the terminal unit on the critical leg has its
damper 90 percent or more open.
3. The water system is being controlled to the lowest possible pressure while still meeting
design loads, less diversity; this shall include a review of TAB methods, established control
setpoints, and physical verification of at least one leg from the pump to the coil having all
balancing valves wide open and that during full cooling the cooling coil valve of that leg is
90 percent or more open.

3.09 SCOPE

A. Test, adjust, and balance the following:
   1. Plumbing Pumps
   2. HVAC Pumps
   3. Water Tube Boilers
   4. Air Cooled Water Chillers
   5. Packaged Roof Top Heating/Cooling Units
   6. Air Coils
   7. Terminal Heat Transfer Units
   8. Air Handling Units
   9. Fans
   10. Air Terminal Units
   11. Air Inlets and Outlets
   12. Variable Refrigerant Flow Air Terminal Units

3.10 MINIMUM DATA TO BE REPORTED

A. Electric Motors:
   1. Manufacturer
   2. Model/Frame
   3. HP/BHP
   4. Phase, voltage, amperage; nameplate, actual, no load
   5. RPM
   6. Service factor
   7. Starter size, rating, heater elements
   8. Sheave Make/Size/Bore

B. V-Belt Drives:
   1. Identification/location
   2. Required driven RPM
   3. Driven sheave, diameter and RPM
   4. Belt, size and quantity
   5. Motor sheave diameter and RPM
   6. Center to center distance, maximum, minimum, and actual

C. Pumps:
   1. Identification/number
   2. Manufacturer
   3. Size/model
   4. Impeller
   5. Service
   6. Design flow rate, pressure drop, BHP
   7. Actual flow rate, pressure drop, BHP
   8. Discharge pressure
   9. Suction pressure
   10. Total operating head pressure
   11. Shut off, discharge and suction pressures
   12. Shut off, total head pressure
D. Combustion Equipment:
   1. Boiler manufacturer
   2. Model number
   3. Serial number
   4. Firing rate
   5. Overfire draft
   6. Gas meter timing dial size
   7. Gas meter time per revolution
   8. Gas pressure at meter outlet
   9. Gas flow rate
   10. Heat input
   11. Burner manifold gas pressure
   12. Heat output

E. Chillers:
   1. Identification/number
   2. Manufacturer
   3. Capacity
   4. Model number
   5. Serial number
   6. Evaporator entering water temperature, design and actual
   7. Evaporator leaving water temperature, design and actual
   8. Evaporator pressure drop, design and actual
   9. Evaporator water flow rate, design and actual

F. Cooling Coils:
   1. Identification/number
   2. Location
   3. Service
   4. Manufacturer
   5. Air flow, design and actual
   6. Entering air DB temperature, design and actual
   7. Entering air WB temperature, design and actual
   8. Leaving air DB temperature, design and actual
   9. Leaving air WB temperature, design and actual
   10. Water flow, design and actual
   11. Water pressure drop, design and actual
   12. Entering water temperature, design and actual
   13. Leaving water temperature, design and actual
   14. Saturated suction temperature, design and actual
   15. Air pressure drop, design and actual

G. Heating Coils:
   1. Identification/number
   2. Location
   3. Service
   4. Manufacturer
   5. Air flow, design and actual
   6. Water flow, design and actual
   7. Water pressure drop, design and actual
   8. Entering water temperature, design and actual
   9. Leaving water temperature, design and actual
   10. Entering air temperature, design and actual
   11. Leaving air temperature, design and actual
   12. Air pressure drop, design and actual
H. Air Moving Equipment:
   1. Location
   2. Manufacturer
   3. Model number
   4. Serial number
   5. Arrangement/Class/Discharge
   6. Air flow, specified and actual
   7. Return air flow, specified and actual
   8. Outside air flow, specified and actual
   9. Total static pressure (total external), specified and actual
   10. Inlet pressure
   11. Discharge pressure
   12. Sheave Make/Size/Bore
   13. Number of Belts/Make/Size
   14. Fan RPM

I. Return Air/Outside Air:
   1. Identification/location
   2. Design air flow
   3. Actual air flow
   4. Design return air flow
   5. Actual return air flow
   6. Design outside air flow
   7. Actual outside air flow
   8. Return air temperature
   9. Outside air temperature
   10. Required mixed air temperature
   11. Actual mixed air temperature
   12. Design outside/return air ratio
   13. Actual outside/return air ratio

J. Exhaust Fans:
   1. Location
   2. Manufacturer
   3. Model number
   4. Serial number
   5. Air flow, specified and actual
   6. Total static pressure (total external), specified and actual
   7. Inlet pressure
   8. Discharge pressure
   9. Sheave Make/Size/Bore
   10. Number of Belts/Make/Size
   11. Fan RPM

K. Duct Traverses:
   1. System zone/branch
   2. Duct size
   3. Area
   4. Design velocity
   5. Design air flow
   6. Test velocity
   7. Test air flow
   8. Duct static pressure
   9. Air temperature
   10. Air correction factor
L. Duct Leak Tests:
1. Description of ductwork under test
2. Duct design operating pressure
3. Duct design test static pressure
4. Duct capacity, air flow
5. Maximum allowable leakage duct capacity times leak factor
6. Test apparatus
   a. Blower
   b. Orifice, tube size
   c. Orifice size
   d. Calibrated
7. Test static pressure
8. Test orifice differential pressure
9. Leakage

M. Air Monitoring Stations:
1. Identification/location
2. System
3. Size
4. Area
5. Design velocity
6. Design air flow
7. Test velocity
8. Test air flow

N. Flow Measuring Stations:
1. Identification/number
2. Location
3. Size
4. Manufacturer
5. Model number
6. Serial number
7. Design Flow rate
8. Design pressure drop
9. Actual/final pressure drop
10. Actual/final flow rate
11. Station calibrated setting

O. Terminal Unit Data:
1. Manufacturer
2. Type, constant, variable, single, dual duct
3. Identification/number
4. Location
5. Model number
6. Size
7. Minimum static pressure
8. Minimum design air flow
9. Maximum design air flow
10. Maximum actual air flow
11. Inlet static pressure

P. Air Distribution Tests:
1. Air terminal number
2. Room number/location
3. Terminal type
4. Terminal size
5. Area factor  
6. Design velocity  
7. Design air flow  
8. Test (final) velocity  
9. Test (final) air flow  
10. Percent of design air flow

END OF SECTION
SECTION 23 07 13
DUCT INSULATION

PART 1  GENERAL

1.01  SECTION INCLUDES
A. Duct insulation.
B. Duct Liner.
C. Fire-Proofing Duct Wrap
D. Insulation jackets.

1.02  RELATED REQUIREMENTS
A. Section 09 90 00 - Painting and Coating: Painting insulation jackets.
B. Section 22 05 53 - Identification for Plumbing Piping and Equipment.
C. Section 23 05 53 - Identification for HVAC Piping and Equipment.
D. Section 23 31 00 - HVAC Ducts and Casings: Glass fiber ducts.

1.03  REFERENCE STANDARDS
M. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association; 2005.
1.04 SUBMITTALS
A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
C. Manufacturer’s Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

1.05 QUALITY ASSURANCE
A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section with not less than three years of documented experience.
B. Applicator Qualifications: Company specializing in performing the type of work specified in this section, with minimum 3 years of experience and approved by manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING
A. Accept materials on site in original factory packaging, labelled with manufacturer’s identification, including product density and thickness.
B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.07 FIELD CONDITIONS
A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS
2.01 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION
A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84, NFPA 255, or UL 723.

2.02 GLASS FIBER, FLEXIBLE
A. Manufacturer:
B. Insulation: ASTM C553; flexible, noncombustible blanket.
   1. 'K' value: 0.26 at 75 degrees F, when tested in accordance with ASTM C518.
   2. Maximum Service Temperature: 450 degrees F.
   3. Maximum Water Vapor Sorption: 5.0 percent by weight.
C. Vapor Barrier Jacket:
   1. Kraft paper with glass fiber yarn and bonded to aluminized film.
   2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
   3. Secure with pressure sensitive tape.
D. Tie Wire: Annealed steel, 16 gage.
2.03 GLASS FIBER, RIGID

A. Manufacturer:

B. Insulation: ASTM C612; rigid, noncombustible blanket.
1. 'K' value: 0.24 at 75 degrees F, when tested in accordance with ASTM C518.
2. Maximum service temperature: 450 degrees F.
3. Maximum Water Vapor Sorption: 5.0 percent.

C. Vapor Barrier Jacket:
1. Kraft paper with glass fiber yarn and bonded to aluminized film.
2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
3. Secure with two coats of vapor barrier mastic and glass tape.

D. Vapor Barrier Tape:
1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

E. Indoor Vapor Barrier Finish:
1. Vinyl emulsion type acrylic, compatible with insulation, white color.

2.04 JACKETS

A. Canvas Jacket: UL listed 6 oz/sq yd plain weave cotton fabric treated with dilute fire retardant lagging adhesive.

B. Mineral Fiber (Outdoor) Jacket: Asphalt impregnated and coated sheet, 50 lb/square.

1. Thickness: 0.016 inch sheet.
2. Finish: Smooth.
4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
5. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.
6. Metal Jacket Bands: 3/8 inch wide; 0.010 inch thick stainless steel.

2.05 FIREPROOFING DUCT WRAP

A. Manufacturer: Thermal Ceramics “FireMaster Duct Wrap.”

B. Grease Duct Enclosure: UL 1978/ASTM E119; flexible, foil laminated fire barrier system designed to provide two-hour fire protection and zero clearance in grease duct applications.
3. Maximum service temperature: 23000 degrees F.
4. 'K' value: ASTM C518, 0.22 at 70 degrees F.

C. Jacket:
1. Aluminum foil bonded to blanket.

D. Banding Material:
1. ¾ inch wide, 0.015 inch thick stainless steel banding.

E. Mechanical Fasteners:
1. 10 gage, 4 inch long, copper coated steel pins with 1-1/2 inch x 1-1/2 inch speed clips.

2.06 DUCT LINER

A. Manufacturers:

B. Insulation: Non-corrosive, incombustible glass fiber complying with ASTM C1071; rigid board; impregnated surface and edges coated with poly vinyl acetate polymer, or acrylic polymer.
   2. Apparent Thermal Conductivity:  Maximum of 0.31 at 75 degrees F.
   3. Service Temperature:  Up to 250 degrees F.
   4. Rated Velocity on Coated Air Side for Air Erosion:  5,000 fpm, minimum.
   5. Minimum Noise Reduction Coefficients:
      a. 1/2 inch Thickness: 0.30.
      b. 1 inch Thickness: 0.45.
      c. 1-1/2 inches Thickness: 0.60.
      d. 2 inch Thickness: 0.70.

C. Adhesive:  Waterproof, fire-retardant type, ASTM C916.

D. Liner Fasteners:  Galvanized steel, impact applied or welded with integral, or press-on head.

PART 3  EXECUTION

3.01 EXAMINATION

A. Verify that ducts have been tested before applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Insulated ducts conveying air below ambient temperature:
   1. Provide insulation with vapor barrier jackets.
   2. Finish with tape and vapor barrier jacket.
   3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
   4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

D. Insulated ducts conveying air above ambient temperature:
   1. Provide with or without standard vapor barrier jacket.
   2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.
E. Ducts Exposed in Mechanical Equipment Rooms or Finished Spaces (below 10 feet above finished floor):  Finish with canvas jacket sized for finish painting.

F. Exterior Applications:  Provide insulation with vapor barrier jacket.  Cover with with calcined aluminum jacket with seams located on bottom side of horizontal duct section.

G. External Duct Insulation Application:
1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
2. Secure insulation without vapor barrier with staples, tape, or wires.
3. Install without sag on underside of duct.  Use adhesive or mechanical fasteners where necessary to prevent sagging.  Lift duct off trapeze hangers and insert spacers.
4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

H. Fire-Proofing Duct Wrap Application
1. Attach fireproofing to ductwork per duct wrap manufacturer's instructions.
2. Wrap hanger support system per duct wrap manufacturer's instructions.
3. Provide removable covers protected with duct wrap for access to duct access doors.

I. Duct and Plenum Liner Application:
1. Adhere insulation with adhesive for 90 percent coverage.
2. Secure insulation with mechanical liner fasteners.  Refer to SMACNA HVAC Duct Construction Standards - Metal and Flexible for spacing.
4. Seal liner surface penetrations with adhesive.
5. Duct dimensions indicated are net inside dimensions required for air flow.  Increase duct size to allow for insulation thickness.

3.03 SCHEDULES

A. Exhaust Ducts Within 10 ft of Exterior Openings:  Duct Liner, 1" Thick.

B. Exhaust Ducts Within 10 ft of Exhaust Fan:  Duct Liner, 1" Thick.

C. Outside/Make Up Air Ducts:  Flexible Glass Fiber Insulation, 2" Thick.

D. Plenums:  Flexible Glass Fiber Insulation, 2" Thick.

E. Supply and Return Air Ducts:  Flexible Glass Fiber Insulation, 2" Thick.

F. Return and Relief Ducts in Mechanical Rooms:  Rigid Glass Fiber Insulation, 2" Thick.

F. Kitchen Hood Grease Exhaust Ducts
1. Grease duct fireproofing duct wrap thickness as required to provide UL Listed, 2 hour grease duct enclosure rating and zero clearance to combustible materials.
2. Extent:  Entire concealed duct from hood to exhaust fan connection unless noted otherwise.

END OF SECTION
SECTION 23 09 13
INSTRUMENTATION AND CONTROL DEVICES FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Thermostats.
B. Humidistats.
C. Control valves.
D. Automatic dampers.
E. Damper operators.
F. Miscellaneous accessories.

1.02 RELATED REQUIREMENTS

A. Section 22 05 19 - Meters and Gages for Plumbing Piping: Thermometer sockets, gage taps.
B. Section 23 05 19 - Meters and Gages for HVAC Piping: Thermometer sockets, gage taps.
D. Section 23 22 13 - Steam and Condensate Heating Piping: Installation of control valves, flow switches, temperature sensor sockets, gage taps.
E. Section 23 33 00 - Air Duct Accessories: Installation of automatic dampers.
F. Section 23 09 23 - Direct-Digital Control System for HVAC.
G. Section 26 27 26 - Wiring Devices: Elevation of exposed components.
H. Section 26 27 17 - Equipment Wiring: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

B. NEMA DC 3 - Residential Controls - Electrical Wall-Mounted Room Thermostats; National Electrical Manufacturers Association; 2008.
C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); National Electrical Manufacturers Association; 2008.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide description and engineering data for each control system component. Include sizing as requested. Provide data for each system component and software module.

C. Shop Drawings: Indicate complete operating data, system drawings, wiring diagrams, and written detailed operational description of sequences. Submit schedule of valves indicating size, flow, and pressure drop for each valve. For automatic dampers indicate arrangement, velocities, and static pressure drops for each system.

D. Design Data: Provide design data for sizing and selection of compressor.

E. Manufacturer's Instructions: Provide for all manufactured components.

F. Project Record Documents: Indicate complete operating data, system drawings, wiring diagrams, and written detailed operational description of sequences. Submit schedule of valves indicating size, flow, and pressure drop for each valve. For automatic dampers indicate arrangement, velocities, and static pressure drops for each system.

G. Operation and Maintenance Data: Include inspection period, cleaning methods, recommended cleaning materials, and calibration tolerances.

H. Warranty: Submit manufacturers warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum 3 years experience approved by manufacturer.

C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 EQUIPMENT - GENERAL

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

2.02 CONTROL PANELS

A. Unitized cabinet type for each system under automatic control with relays and controls mounted in cabinet and temperature indicators, pressure gages, pilot lights, push buttons and switches flush on cabinet panel face.

B. NEMA 250, general purpose utility enclosures with enamelled finished face panel.

C. Provide common keying for all panels.

2.03 CONTROL VALVES

A. Globe Pattern:
   1. Up to 2 inches: Bronze body, bronze trim, rising stem, renewable composition disc, screwed ends with backseating capacity repackable under pressure.
      a. Product:
2. Over 2 inches: Iron body, bronze trim, rising stem, plug-type disc, flanged ends, renewable seat and disc.
3. Hydronic Systems:
   a. Rate for service pressure of 125 psig at 250 degrees F.
   b. Replaceable plugs and seats of stainless steel.
   c. Size for 3 psig maximum pressure drop at design flow rate.
   d. Two way valves shall have equal percentage characteristics, three way valves linear characteristics. Size two way valve operators to close valves against pump shut off head.

B. Butterfly Pattern:
   1. Iron body, bronze disc, resilient replaceable seat for service to 180 degrees F wafer or lug ends, extended neck.
      a. Product:
         1) Substitutions: See Section 01 60 00 - Product Requirements.
   2. Hydronic Systems:
      a. Rate for service pressure of 125 psig at 250 degrees F.
      b. Size for 1 psig maximum pressure drop at design flow rate.

C. Electronic Operators:
   1. Valves shall spring return to normal position as indicated on freeze, fire, or temperature protection.
   2. Select operator for full shut off at maximum pump differential pressure.

2.04 DAMPERS

A. Performance: Test in accordance with AMCA 500-D.
B. Frames: Galvanized steel, welded or riveted with corner reinforcement, minimum 12 gage.
C. Blades: Galvanized steel, maximum blade size 8 inches wide, 48 inches long, minimum 22 gage, attached to minimum 1/2 inch shafts with set screws.
D. Blade Seals: Synthetic elastomeric inflatable mechanically attached, field replaceable.
E. Jamb Seals: Spring stainless steel.
F. Shaft Bearings: Oil impregnated sintered bronze.
G. Linkage Bearings: Oil impregnated sintered bronze.
H. Leakage: Less than one percent based on approach velocity of 2000 ft/min and 4 inches wg.
I. Maximum Pressure Differential: 6 inches wg.
J. Temperature Limits: -40 to 200 degrees F.

2.05 DAMPER OPERATORS

A. General: Provide smooth proportional control with sufficient power for air velocities 20 percent greater than maximum design velocity and to provide tight seal against maximum system pressures. Provide spring return for two position control and for fail safe operation.
   1. Provide sufficient number of operators to achieve unrestricted movement throughout damper range.
   2. Provide one operator for maximum 36 sq ft damper section.
B. Pilot Positioners: Starting point adjustable from 2 to 12 psig and operating span adjustable from 5 to 13 psig.
C. Electric Operators:
   1. Spring return, adjustable stroke motor having oil immersed gear train, with auxiliary end
switch.

D. Inlet Vane Operators:
1. High pressure with pilot positioners and sufficient force to move vanes when fan is started with vanes in closed position. Return vane operator to closed position on fan shutdown.

2.06 HUMIDISTATS
A. Room Humidistats:
1. Wall mounted, proportioning type.
2. Throttling range: Adjustable 2 percent relative humidity.
3. Operating range: 30 to 80 percent.
4. Maximum temperature: 110 degrees F.
5. Cover: Set point indication.

B. Limit Duct Humidistat:
1. Insertion, two position type.
2. Throttling range: Adjustable 2 percent relative humidity.
3. Operating range: 20 to 80 percent.
4. Maximum temperature: 150 degrees F.

2.07 INPUT/OUTPUT SENSORS
A. Temperature Sensors:
B. Humidity Sensors:
1. Elements: Accurate within 5 percent full range with linear output.
2. Room Sensors: With locking cover matching pneumatic thermostats used, span of 10 to 60 percent relative humidity.

C. Static Pressure Sensors:
1. Unidirectional with ranges not exceeding 150 percent of maximum expected input.
2. Temperature compensate with typical thermal error or 0.06 percent of full scale in temperature range of 40 to 100 degrees F.
3. Accuracy: One percent of full scale with repeatability 0.3 percent.
4. Output: 0 - 5 vdc with power at 12 to 28 vdc.
5. Product:

D. Equipment Operation Sensors:
1. Status Inputs for Fans: Differential pressure switch with adjustable range of 0 to 5 inches wg.
2. Status Inputs for Pumps: Differential pressure switch piped across pump with adjustable pressure differential range of 8 to 60 psi.
4. Product:

E. Carbon Monoxide Detectors:
1. Single or multichannel dual level detectors, using solid state sensors with three year minimum life. Sensor replacement shall take maximum 15 minutes. Suitable over temperature range of 23 to 130 degrees F.
2. Provide individual indicators and contractors for each level, initially calibrated for 50 ppm and 100 ppm.
3. Maximum response time to 100 ppm CO calibration gas: Two minutes.
4. Product:
   a. Substitutions: See Section 01 60 00 - Product Requirements.

2.08 THERMOSTATS
A. Electric Room Thermostats:
   1. Type: NEMA DC 3, 24 volts, with setback/setup temperature control.
   2. Service: cooling and heating.
   3. Covers: Locking with set point adjustment, with thermometer.

B. Line Voltage Thermostats:
   1. Integral manual On/Off/Auto selector switch, single or two pole as required.
   2. Dead band: Maximum 2 degrees F.
   3. Cover: Locking with set point adjustment, with thermometer.

C. Room Thermostat Accessories:
   1. Thermostat Covers: Brushed aluminum.
   2. Insulating Bases: For thermostats located on exterior walls.
   3. Thermostat Guards: Metal mounted on separate base.
   4. Adjusting Key: As required for device.

D. Outdoor Reset Thermostat:
   1. Remote bulb or bimetal rod and tube type, proportioning action with adjustable throttling range, adjustable setpoint.
   2. Scale range: -10 to 70 degrees F.

E. Immersion Thermostat:
   1. Remote bulb or bimetallic rod and tube type, proportional action with adjustable setpoint and adjustable throttling range.

F. Airstream Thermostats:
   1. Remote bulb or bimetallic rod and tube type, proportional action with adjustable setpoint in middle of range and adjustable throttling range.
   2. Averaging service remote bulb element: 7.5 feet.

G. Electric Low Limit Duct Thermostat:
   1. Snap acting, single pole, single throw, manual reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or below setpoint,
   2. Bulb length: Minimum 20 feet.
   3. Provide one thermostat for every 20 sq ft of coil surface.

H. Fire Thermostats:
   1. UL labeled, factory set in accordance with NFPA 90A.

I. Heating/Cooling Valve Top Thermostats:
   1. Proportional acting for proportional flow, molded rubber diaphragm, remote bulb liquid filled element, direct and reverse acting at differential pressure to 25 psig, cast housing with position indicator and adjusting knob.

2.09 TRANSMITTERS

A. Building Static Pressure Transmitter:
   1. One pipe, direct acting, double bell, scale range 0.01 to 6.0 inch wg positive or negative, and sensitivity of 0.0005 inch wg. Transmit electronic signal to receiver with matching scale range.

B. Pressure Transmitters:
   1. One pipe direct acting indicating type for gas, liquid, or steam service, range suitable for system, proportional electronic output.

C. Temperature Transmitters:
   1. One pipe, directly proportional output signal to measured variable, linearity within plus or
minus 1/2 percent of range for 200 degree F span and plus or minus 1 percent for 50 degree F span, with 50 degrees F temperature range, compensated bulb, averaging capillary, or rod and tube operation on 20 psig input pressure and 3 to 15 psig output.

D. Humidity Transmitters:
   1. One pipe, directly proportioned output signal to measured variable, linearity within plus or minus 1 percent for 70 percent relative humidity span, capable of withstanding 95 percent relative humidity without loss of calibration.

PART 3  EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.
B. Verify that systems are ready to receive work.
C. Sequence work to ensure installation of components is complementary to installation of similar components in other systems.
D. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.
E. Ensure installation of components is complementary to installation of similar components.
F. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Check and verify location of thermostats with plans and room details before installation. Locate 60 inches above floor. Align with lighting switches and humidistats. Refer to Section 26 27 26.
C. Provide guards on thermostats in entrances.
D. Install damper motors on outside of duct in warm areas. Do not install motors in locations at outdoor temperatures.
E. Mount control panels adjacent to associated equipment on vibration free walls or free standing angle iron supports. One cabinet may accommodate more than one system in same equipment room. Provide engraved plastic nameplates for instruments and controls inside cabinet and engraved plastic nameplates on cabinet face.
F. Install "hand/off/auto" selector switches to override automatic interlock controls when switch is in "hand" position.
G. Provide conduit and electrical wiring in accordance with Section 26 27 17. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.
3.03 MAINTENANCE

A. Provide service and maintenance of control system for one year from Date of Substantial Completion.

B. Provide complete service of controls systems, including call backs, and submit written report of each service call.

C. In addition to normal service calls, make minimum of 2 complete normal inspections of approximately 2 hours duration to inspect, calibrate, and adjust controls.

END OF SECTION
SECTION 23 09 23
DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Control equipment.
B. Software.

1.02 RELATED REQUIREMENTS
A. Section 23 09 13 - Instrumentation and Control Devices for HVAC.
B. Section 26 27 17 - Equipment Wiring: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS
A. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition
   Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and
   Supplements.

1.04 SYSTEM DESCRIPTION
A. Automatic temperature control field monitoring and control system using field programmable
   micro-processor based units.
B. Base system on distributed system of fully intelligent, stand-alone controllers, operating in a
   multi-tasking, multi-user environment on token passing network, with central and remote
   hardware, software, and interconnecting wire and conduit.
C. Include computer software and hardware, operator input/output devices, control units, local area
   networks (LAN), sensors, control devices, actuators.
D. Controls for variable air volume terminals, radiation, reheat coils, unit heaters, fan coils, and the
   like when directly connected to the control units. Individual terminal unit control is specified in
   Section 23 09 13.
E. Provide control systems consisting of thermostats, control valves, dampers and operators,
   indicating devices, interface equipment and other apparatus and accessories required to
   operate mechanical systems, and to perform functions specified.
F. Include installation and calibration, supervision, adjustments, and fine tuning necessary for
   complete and fully operational system.

1.05 SUBMITTALS
A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data for each system component and software module.
C. Shop Drawings:
   1. Indicate trunk cable schematic showing programmable control unit locations, and trunk
      data conductors.
   2. List connected data points, including connected control unit and input device.
   3. Indicate system graphics indicating monitored systems, data (connected and calculated)
      point addresses, and operator notations. Provide demonstration diskette containing
      graphics.
   4. Show system configuration with peripheral devices, batteries, power supplies, diagrams,
      modems, and interconnections.
5. Indicate description and sequence of operation of operating, user, and application software.

D. Manufacturer's Instructions: Indicate manufacturer's installation instructions for all manufactured components.

E. Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors.
   1. Revise shop drawings to reflect actual installation and operating sequences.
   2. Include submittals data in final "Record Documents" form.

F. Operation and Maintenance Data:
   1. Include interconnection wiring diagrams complete field installed systems with identified and numbered, system components and devices.
   2. Include keyboard illustrations and step-by-step procedures indexed for each operator function.
   3. Include inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.

G. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Perform work in accordance with NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section with minimum 3 years experience approved by manufacturer.

D. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.07 PRE-INSTALLATION MEETING

A. Convene one week before starting work of this Section.

B. Require attendance of parties directly affecting the work of this Section.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer's warranty for field programmable micro-processor based units.

1.09 MAINTENANCE SERVICE

A. Provide service and maintenance of energy management and control systems for one years from Date of Substantial Completion.

B. Provide two complete inspections per year, one in each season, to inspect, calibrate, and adjust controls as required, and submit written reports.
C. Provide complete service of systems, including call backs. Make minimum of 2 complete normal inspections of approximately 4 hours duration in addition to normal service calls to inspect, calibrate, and adjust controls, and submit written reports.

1.10 PROTECTION OF SOFTWARE RIGHTS

A. Prior to delivery of software, the Owner and the party providing the software will enter into a software license agreement with provisions for the following:
   1. Limiting use of software to equipment provided under these specifications.
   2. Limiting copying.
   3. Preserving confidentiality.
   4. Prohibiting transfer to a third party.

PART 2 PRODUCTS

2.01 MANUFACTURERS


2.02 OPERATOR STATION

A. Work Station:
   1. Configuration: IBM-compatible Intel Core i7 based microcomputer system or better.
   2. Minimum memory: 4000 Mb RAM.
   6. Mouse: Software supported mouse with support software including self building menus and displays of system operations and functions.

2.03 CONTROL UNITS

A. Units: Modular in design and consisting of processor board with programmable RAM memory, local operator access and display panel, and integral interface equipment.

B. Battery Backup: For minimum of 48 hours for complete system including RAM without interruption, with automatic battery charger.

C. Control Units Functions:
   1. Monitor or control each input/output point.
   2. Completely independent with hardware clock/calendar and software to maintain control independently.
   3. Acquire, process, and transfer information to operator station or other control units on network.
   4. Accept, process, and execute commands from other control unit's or devices or operator stations.
   5. Access both data base and control functions simultaneously.
6. Record, evaluate, and report changes of state or value that occur among associated points. Continue to perform associated control functions regardless of status of network.

7. Perform in stand-alone mode:
   a. Start/stop.
   b. Duty cycling.
   c. Automatic Temperature Control.
   d. Demand control via a sliding window, predictive algorithm.
   e. Event initiated control.
   f. Calculated point.
   g. Scanning and alarm processing.
   h. Full direct digital control.
   i. Trend logging.
   j. Global communications.
   k. Maintenance scheduling.

D. Global Communications:
   1. Broadcast point data onto network, making that information available to all other system control units.
   2. Transmit any or all input/output points onto network for use by other control units and utilize data from other control units.

E. Input/Output Capability:
   1. Discrete/digital input (contact status).
   2. Discrete/digital output.
   3. Analog input.
   4. Analog output.

F. Monitor, control, or address data points. Mix shall include analog inputs, analog outputs, pulse inputs, pulse outputs and discrete inputs/outputs, as required. Install control units with minimum 30 percent spare capacity.

G. Point Scanning: Set scan or execution speed of each point to operator selected time from 1 to 250 seconds.

H. Upload/Download Capability: Download from or upload to operator station. Upload/Download time for entire control unit database maximum 10 seconds on hard wired LAN, or 60 seconds over voice grade phone lines.

I. Test Mode Operation: Place input/output points in test mode to allow testing and developing of control algorithms on line without disrupting field hardware and controlled environment. In test mode:

J. Local display and adjustment panel: Integral to control unit, containing digital display, and numerical keyboard. Display and adjust:
   1. Input/output point information and status.
   2. Controller set points.
   3. Controller tuning constants.
   4. Program execution times.
   5. High and low limit values.
   7. Set/display date and time.
   8. Control outputs connected to the network.
  10. Perform control unit diagnostic testing.
  11. Points in "Test" mode.
2.04 LOCAL AREA NETWORK (LAN)

A. Provide communication between control units over local area network (LAN).
B. LAN Capacity: Not less than 60 stations or nodes.
C. Break in Communication Path: Alarm and automatically initiate LAN reconfiguration.
D. Communication Techniques: Allow interface into network by multiple operation stations and by auto-answer/auto-dial modems. Support communication over telephone lines utilizing modems.
E. Transmission Median: Fiber optic or single pair of solid 24 gauge twisted, shielded copper cable.
F. Network Support: Time for global point to be received by any station, shall be less than 3 seconds. Provide automatic reconfiguration if any station is added or lost. If transmission cable is cut, reconfigure two sections with no disruption to system's operation, without operator intervention.

2.05 OPERATING SYSTEM SOFTWARE

A. Input/Output Capability From Operator Station:
   1. Request display of current values or status in tabular or graphic format.
   2. Command selected equipment to specified state.
   3. Initiate logs and reports.
   5. Add, delete, or change points within each control unit or application routine.
   6. Change point input/output descriptors, status, alarm descriptors, and engineering unit descriptors.
   7. Add new control units to system.
   8. Modify and set up maintenance scheduling parameters.
   9. Develop, modify, delete or display full range of color graphic displays.
   10. Automatically archive select data even when running third party software.
   11. Provide capability to sort and extract data from archived files and to generate custom reports.
   12. Support two printer operations.
      a. Alarm printer: Print alarms, operator acknowledgements, action messages, system alarms, operator sign-on and sign-off.
      b. Data printer: Print reports, page prints, and data base prints.
   13. Select daily, weekly or monthly as scheduled frequency to synchronize time and date in digital control units. Accommodate daylight savings time adjustments.
   14. Print selected control unit data base.

B. Operator System Access: Via software password with minimum 30 access levels at work station and minimum 3 access levels at each control unit.

C. Data Base Creation and Support: Changes shall utilize standard procedures. Control unit shall automatically check work station data base files upon connection and verify data base match. Minimum capability shall include:
   1. Add and delete points.
   2. Modify any point parameter.
   3. Change, add, or delete English language descriptors.
   4. Add, modify, or delete alarm limits.
   5. Add, modify, or delete points in start/stop programs, trend logs, etc.
   6. Create custom relationship between points.
   7. Create or modify DDC loops and parameters.
8. Create or modify override parameters.
9. Add, modify, and delete any applications program.
10. Add, delete, develop, or modify dynamic color graphic displays.

D. Dynamic Color Graphic Displays:
1. Utilizes custom symbols or system supported library of symbols.
2. Sixteen (16) colors.
3. Sixty (60) outputs of real time, live dynamic data per graphic.
4. Dynamic graphic data.
5. 1,000 separate graphic pages.
6. Modify graphic screen refresh rate between 1 and 60 seconds.

E. Operator Station:
1. Accept data from LAN as needed without scanning entire network for updated point data.
2. Interrogate LAN for updated point data when requested.
3. Allow operator command of devices.
4. Allow operator to place specific control units in or out of service.
5. Allow parameter editing of control units.
6. Store duplicate data base for every control unit and allow down loading while system is on line.
7. Control or modify specific programs.
8. Develop, store and modify dynamic color graphics.
9. Provide data archiving of assigned points and support overlay graphing of this data utilizing up to four (4) variables.

F. Alarm Processing:
1. Off normal condition: Cause alarm and appropriate message, including time, system, point descriptor, and alarm condition. Select alarm state/value and which alarms shall cause automatic dial-out.
2. Critical alarm or change-of-state: Display message, stored on disk for review and sort, or print.
3. Print on line changeable message, up to 60 characters in length, for each alarm point specified.
4. Display alarm reports on video. Display multiple alarms in order of occurrence.
5. Define time delay for equipment start-up or shutdown.
6. Allow unique routing of specific alarms.
7. Operator specifies if alarm requires acknowledgement.
8. Continue to indicate unacknowledged alarms after return to normal.
9. Alarm notification:
   a. Automatic print.
   b. Display indicating alarm condition.
   c. Selectable audible alarm indication.

G. Event Processing: Automatically initiate commands, user defined messages, take specific control actions or change control strategy and application programs resulting from event condition. Event condition may be value crossing operator defined limit, change-of-state, specified state, or alarm occurrence or return to normal.

H. Automatic Restart: Automatically restart field equipment on restoration of power. Provide time delay between individual equipment restart and time of day start/stop.

I. Messages:
1. Automatically display or print user-defined message subsequent to occurrence of selected events.
2. Compose, change, or delete any message.
3. Display or log any message at any time.
4. Assign any message to any event.

J. Reports:
   1. Manually requested with time and date.
   2. Long term data archiving to hard disk.
   3. Automatic directives to download to transportable media such as floppy diskettes for storage.
   4. Data selection methods to include data base search and manipulation.
   5. Data extraction with mathematical manipulation.
   6. Data reports shall allow development of XY curve plotting, tabular reports (both statistical and summary), and multi-point timed based plots with not less than four (4) variables displayed.
   7. Generating reports either normally at operator direction, or automatically under work station direction.
   8. Reports may either manually displayed or printed, or may be printed automatically on daily, weekly, monthly, yearly or scheduled basis.
   9. Include capability for statistical data manipulation and extraction.
   10. Provide capability to generate four types of reports: Statistical detail reports, summary reports, trend graphic plots, x-y graphic plots.

K. Parameter Save/Restore: Store most current operating system, parameter changes, and modifications on disk or diskette.

L. Data Collection:
   1. Automatically collect and store in disk files.
   2. Daily electrical energy consumption, peak demand, and time of peak demand for up to electrical meters over 2 year period.
   3. Daily consumption for up to 30 meters over a 2 year period.
   4. Daily billable electrical energy consumption and time for up to 1024 zones over a 10 year period.
   5. Provide archiving of stored data for use with system supplied custom reports.

M. Graphic Display: Support graphic development on work station with software features:
   1. Page linking.
   2. Generate, store, and retrieve library symbols.
   3. Single or double height characters.
   4. Sixty (60) dynamic points of data per graphic page.
   5. Pixel level resolution.
   6. Animated graphics for discrete points.
   7. Analog bar graphs.
   8. Display real time value of each input or output line diagram fashion.

N. Maintenance Management:
   1. Run time monitoring, per point.
   2. Maintenance scheduling targets with automatic annunciation, scheduling and shutdown.
   3. Equipment safety targets.
   4. Display of maintenance material and estimated labor.
   5. Target point reset, per point.

O. Advisories:
   1. Summary which contains status of points in locked out condition.
   2. Continuous operational or not operational report of interrogation of system hardware and programmable control units for failure.
   3. Report of power failure detection, time and date.
   4. Report of communication failure with operator device, field interface unit, point, programmable control unit.
2.06 LOAD CONTROL PROGRAMS

A. General: Support inch-pounds and SI (metric) units of measurement.

B. Automatic Time Scheduling:
   2. Support up to seven (7) normal day schedules, seven (7) "special day" schedules and two (2) temporary day schedules.
   3. Special days schedule shall support up to 30 unique date/duration combinations.
   4. Any number of loads assigned to any time program; each load can have individual time program.
   5. Each load assigned at least 16 control actions per day with 1 minute resolution.
   6. Time schedule operations may be:
      a. Start.
      b. Optimized Start.
      c. Stop.
      d. Optimized Stop.
      e. Cycle.
      f. Optimized Cycle.
   7. Minimum of 30 holiday periods up to 100 days in length may be specified for the year.
   8. Create temporary schedules.
   9. Broadcast temporary "special day" date and duration.

C. Start/Stop Time Optimization:
   1. Perform optimized start/stop as function of outside conditions, inside conditions, or both.
   2. Adaptive and self-tuning, adjusting to changing conditions unattended.
   3. For each point under control, establish and modify:
      a. Occupancy period.
      b. Desired temperature at beginning of occupancy period.
      c. Desired temperature at end of occupancy period.

D. Night Setback/Setup Program: Reduce heating space temperature setpoint or raise cooling space temperature setpoint during unoccupied hours; in conjunction with scheduled start/stop and optimum start/stop programs.

E. Calculated Points: Define calculations and totalization computed from monitored points (analog/digital points), constants, or other calculated points.
   1. Employ arithmetic, algebraic, Boolean, and special function operations.
   2. Treat calculated values like any other analog value, use for any function that a "hard wired point" might be used.

F. Event Initiated Programming: Event may be initiated by any data point, causing series of controls in a sequence.
   1. Define time interval between each control action between 0 to 3600 seconds.
   2. Output may be analog value.
   3. Provide for "skip" logic.
   4. Verify completion of one action before proceeding to next. If not verified, program shall be able to skip to next action.
G. Direct Digital Control: Each control unit shall provide Direct Digital Control software so that the operator may customize control strategies and sequences of operation by defining the appropriate control loop algorithms and choosing the optimum loop parameters.
   1. Control loops: Defined using “modules” that are analogous to standard control devices.
   2. Output: Paired or individual digital outputs for pulse-width modulation, and analog outputs, as required.
   3. Firmware:
      a. PID with analog or pulse-width modulation output.
      b. Floating control with pulse-width modulated outputs.
      c. Two-position control.
      d. Primary and secondary reset schedule selector.
      e. Hi/Lo signal selector.
      f. Single pole double throw relay.
      g. Single pole double throw time delay relay with delay before break, delay before make and interval time capabilities.
   4. Direct Digital Control loops: Downloaded upon creation or on operator request. On sensor failure, program shall execute user defined failsafe output.
   5. Display: Value or state of each of the lines which interconnect DDC modules.

H. Fine Tuning Direct Digital Control PID or floating loops:
   1. Display information:
      a. Control loop being tuned
      b. Input (process) variable
      c. Output (control) variable
      d. Setpoint of loop
      e. Proportional band
      f. Integral (reset) Interval
      g. Derivative (rate) Interval
   2. Display format: Graphic, with automatic scaling; with input and output variable superimposed on graph of "time" vs "variable".

I. Trend logging:
   1. Each control unit will store samples of control unit’s data points.
   2. Update file continuously at discretely assignable intervals.
   3. Automatically initiate upload request and then store data on hard disk.
   4. Time synchronize sampling at operator specified times and intervals with sample resolution of one minute.
   5. Co-ordinate sampling with on/off state of specified point.
   6. Display trend samples on work station in graphic format. Automatically scale trend graph with minimum 60 samples of data in plot of time vs data.

2.07 HVAC CONTROL PROGRAMS

A. General:
   1. Support Inch-pounds and SI (metric) units of measurement.
   2. Identify each HVAC Control system.

B. Optimal Run Time:
   1. Control start-up and shutdown times of HVAC equipment for both heating and cooling.
   2. Base on occupancy schedules, outside air temperature, seasonal requirements, and interior room mass temperature.
   3. Start-up systems by using outside air temperature, room mass temperatures, and adaptive model prediction for how long building takes to warm up or cool down under different conditions.
4. Use outside air temperature to determine early shut down with ventilation override.
5. Analyze multiple building mass sensors to determine seasonal mode and worse case condition for each day.
6. Operator commands:
   a. Define term schedule
   b. Add/delete fan status point.
   c. Add/delete outside air temperature point.
   d. Add/delete mass temperature point.
   e. Define heating/cooling parameters.
   f. Define mass sensor heating/cooling parameters.
   g. Lock/unlock program.
   h. Request optimal run time control summary.
   i. Request optimal run time mass temperature summary.
   j. Request HVAC point summary.
   k. Request HVAC saving profile summary.
7. Control Summary:
   a. HVAC Control system begin/end status.
   b. Optimal run time lock/unlock control status.
   c. Heating/cooling mode status.
   d. Optimal run time schedule.
   e. Start/Stop times.
   f. Selected mass temperature point ID.
   g. Optimal run time system normal start times.
   h. Occupancy and vacancy times.
   i. Optimal run time system heating/cooling mode parameters.
8. Mass temperature summary:
   a. Mass temperature point type and ID.
   b. Desired and current mass temperature values.
   c. Calculated warm-up/cool-down time for each mass temperature.
   d. Heating/cooling season limits.
   e. Break point temperature for cooling mode analysis.
9. HVAC point summary:
   a. Control system identifier and status.
   b. Point ID and status.
   c. Outside air temperature point ID and status.
   d. Mass temperature point ID and point.
   e. Calculated optimal start and stop times.
   f. Period start.
C. Supply Air Reset:
   1. Monitor heating and cooling loads in building spaces, terminal reheat systems, both hot deck and cold deck temperatures on dual duct and multizone systems, single zone unit discharge temperatures.
   2. Adjust discharge temperatures to most energy efficient levels satisfying measured load by:
      a. Raising cooling temperatures to highest possible value.
      b. Reducing heating temperatures to lowest possible level.
   3. Operator commands:
      a. Add/delete fan status point.
      b. Lock/unlock program.
      c. Request HVAC point summary.
      d. Add/Delete discharge controller point.
      e. Define discharge controller parameters.
      f. Add/delete air flow rate.
      g. Define space load and load parameters.
4. Control summary:
   a. HVAC control system status (begin/end).
   b. Supply air reset system status.
   c. Optimal run time system status.
   d. Heating and cooling loop.
   e. High/low limits.
   f. Deadband.
   g. Response timer.
   h. Reset times.

5. Space load summary:
   a. HVAC system status.
   b. Optimal run time status.
   c. Heating/cooling loop status.
   d. Space load point ID.
   e. Current space load point value.
   f. Control heat/cool limited.
   g. Gain factor.
   h. Calculated reset values.
   i. Fan status point ID and status.
   j. Control discharge temperature point ID and status.
   k. Space load point ID and status.
   l. Air flow rate point ID and status.

2.08 CHILLER CONTROL PROGRAMS

A. Control function of condenser water reset, chilled water reset, and chiller sequencing. Support inch-pounds and SI (metric) units of measurement.

B. Condenser Water Reset: Automatically reset controlled condenser water temperature using measured outside wet bulb temperature and load being handled.

C. Chilled Water Reset: Automatically reset controlled chilled water temperature satisfying cooling coil requiring greatest cooling.

D. Chiller Sequencing: Determine which combination of chillers will most efficiently satisfy chilled water load, by cycling chillers, based on comparing load to switchover limits defined for each chiller.

2.09 PROGRAMMING APPLICATION FEATURES

A. Trend Point:
   1. Sample up to 10 points, real or computed, with each point capable of collecting 10 samples at intervals specified in minutes, hours, days, or month.
   2. Output trend logs as line graphs or bar graphs. Output graphic on terminal, with each point for line and bar graphs designated with a unique pattern, vertical scale either actual values or percent of range, and horizontal scale time base. Print trend logs up to 12 columns of one point/column.

B. Alarm Messages:
   1. Allow definition of minimum of 10 messages, each having minimum length of 255 characters for each individual message.
2. Assign alarm messages to system messages including point's alarm condition, point's off-normal condition, totalized point's warning limit, hardware elements advisories.
3. Output assigned alarm with "message requiring acknowledgement".
4. Operator commands include define, modify, or delete; output summary listing current alarms and assignments; output summary defining assigned points.

C. Weekly Scheduling:
1. Automatically initiate equipment or system commands, based on preselected time schedule for points specified.
2. Provide program times for each day of week, per point, with one minute resolution.
3. Automatically generate alarm output for points not responding to command.
4. Provide for holidays, minimum of 366 consecutive holidays.
5. Operator commands:
   a. System logs and summaries.
   b. Start of stop point.
   c. Lock or unlock control or alarm input.
   d. Add, delete, or modify analog limits and differentials.
   e. Adjust point operation position.
   f. Change point operational mode.
   g. Open or close point.
   h. Enable/disable, lock/unlock, or execute interlock sequence or computation profile.
   i. Begin or end point totalization.
   j. Modify totalization values and limits.
   k. Access or secure point.
   l. Begin or end HVAC or load control system.
   m. Modify load parameter.
   n. Modify demand limiting and duty cycle targets.
6. Output summary: Listing of programmed function points, associated program times, and respective day of week programmed points by software groups or time of day.

D. Interlocking:
1. Permit events to occur, based on changing condition of one or more associated master points.
2. Binary contact, high/low limit of analog point or computed point shall be capable of being utilized as master. Same master may monitor or command multiple slaves.
3. Operator commands:
   a. Define single master/multiple master interlock process.
   b. Define logic interlock process.
   c. Lock/unlock program.
   d. Enable/disable interlock process.
   e. Execute terminate interlock process.
   f. Request interlock type summary.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify existing conditions before starting work.
B. Verify that conditioned power supply is available to the control units and to the operator work station. Verify that field end devices, wiring, and pneumatic tubing is installed prior to installation proceeding.

3.02 INSTALLATION
A. Install control units and other hardware in position on permanent walls where not subject to
excessive vibration.

B. Install software in control units and in operator work station. Implement all features of programs to specified requirements and appropriate to sequence of operation. Refer to Section 23 09 93.

C. Provide conduit and electrical wiring in accordance with Section 26 27 17. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.

3.03 MANUFACTURER'S FIELD SERVICES

A. Start and commission systems. Allow sufficient time for start-up and commissioning prior to placing control systems in permanent operation.

B. Provide service engineer to instruct Owner's representative in operation of systems plant and equipment for 3 day period.

3.04 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate complete and operating system to Owner.

END OF SECTION
PART 1  GENERAL

1.01 SECTION INCLUDES

A. Metal ductwork.
B. Nonmetal ductwork.
C. Kitchen hood ductwork.
D. Duct cleaning.

1.02 RELATED REQUIREMENTS

A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.
B. Section 07 84 00 - Firestopping.
C. Section 09 90 00 - Painting and Coating: Weld priming, weather resistant, paint or coating.
D. Section 11 40 00 - Foodservice Equipment: Supply of kitchen range hoods for placement by this Section.
E. Section 23 10 30.51 - HVAC Air Duct Cleaning: Cleaning ducts after completion of installation.
F. Section 23 07 13 - Duct Insulation: External insulation and duct liner.
G. Section 23 33 00 - Air Duct Accessories.
H. Section 23 36 00 - Air Terminal Units.
I. Section 23 37 00 - Air Outlets and Inlets.
J. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC.

1.03 REFERENCE STANDARDS

F. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2010.
M. NFPA 90B - Standard for the Installation of Warm Air Heating and Air Conditioning Systems; National Fire Protection Association; 2009.
P. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association; 2005.
Q. SMACNA (FGD) - Fibrous Glass Duct Construction Standards; Sheet Metal and Air Conditioning Contractors' National Association; 2003.

1.04 SUBMITTALS
A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data for duct materials and duct liner.
C. Shop Drawings: Indicate duct fittings, particulars such as gages, sizes, welds, and configuration prior to start of work for 1” pressure class and higher systems.
D. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual.
E. Manufacturer's Certificate: Certify that installation of glass fiber ductwork meet or exceed specified requirements.
F. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.05 QUALITY ASSURANCE
A. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum 3 years of documented experience.

1.06 REGULATORY REQUIREMENTS
A. Construct ductwork to NFPA 90A and NFPA 90B standards.

1.07 FIELD CONDITIONS
A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

PART 2 PRODUCTS
2.01 DUCT ASSEMBLIES
A. All Ducts: Galvanized steel, unless otherwise indicated.
B. Low Pressure Supply (Heating Systems): 2 inch w.g. pressure class, galvanized steel.

C. Low Pressure Supply (System with Cooling Coils): 2 inch w.g. pressure class, galvanized steel.

D. Return and Relief: 1 inch w.g. pressure class, galvanized steel.

E. General Exhaust: 1 inch w.g. pressure class, galvanized steel.

F. Kitchen Cooking Hood Exhaust: 1 inch w.g. pressure class, un-galvanized steel.

G. Dishwasher Exhaust: 1 inch w.g. pressure class, galvanized steel or stainless steel.
   1. Construct of 18 gage stainless steel using continuous external welded joints in rectangular sections.

H. Outside Air Intake: 1 inch w.g. pressure class, galvanized steel.

I. Combustion Air: 1/2 inch w.g. pressure class, galvanized steel.

J. Transfer Air and Sound Boots: 1 inch w.g. pressure class.

2.02 MATERIALS

A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G90/Z275 coating.

B. Un-Galvanized Steel for Ducts: ASTM A1008/A1008M, Designation CS, cold-rolled commercial steel.

C. Stainless Steel for Ducts: ASTM A240/A240M, Type 304.

D. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
   1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
   2. VOC Content: Not more than 250 g/L, excluding water.
   3. Surface Burning Characteristics: Flame spread of zero, smoke developed of zero, when tested in accordance with ASTM E84.

E. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

F. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:
   3. Concrete Screw Type Anchors: Complying with ICC-ES AC193.
   5. Concrete Adhesive Type Anchors: Complying with ICC-ES AC308.
   6. Other Types: As required.

G. Flexible Ducts:

H. Insulated Flexible Ducts for Pressure Classes 2" and under:
   1. Manufacturers:
      a. Flexmaster Model Type 5.
      b. Technaflex Model WK.
      c. Thermoflex Model M-KE.
   2. UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound spring steel wire; fiberglass insulation; polyethylene vapor barrier film.
a. Pressure Rating: 10 inches WG positive and 1.0 inches WG negative.
b. Maximum Velocity: 4000 fpm.
c. Temperature Range: -20 degrees F to 210 degrees F.

I. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
2. VOC Content: Not more than 250 g/L, excluding water.
3. Surface Burning Characteristics: Flame spread of zero, smoke developed of zero, when tested in accordance with ASTM E 84.

J. Hanger Rod: ASTM A 36/A 36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

2.03 DUCTWORK FABRICATION
A. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.
B. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
C. Provide airfoil turning vanes when rectangular elbows must be used.
D. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
E. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.
F. Fabricate continuously welded round and oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard. Joints shall be minimum 4 inch cemented slip joint, brazed or electric welded. Prime coat welded joints.
G. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.
H. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

2.04 DUCT MANUFACTURERS
A. Metal-Fab, Inc: www.mtlfab.com.
C. Eastern Sheet Metal, Inc: www.easternsheetmetal.com

2.05 MANUFACTURED DUCTWORK AND FITTINGS
A. Manufacture in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
2.06 KITCHEN HOOD EXHAUST DUCTWORK

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, SMACNA Kitchen Ventilation Systems and Food Service Equipment Fabrication & Installation Guidelines and, and NFPA 96. Ducts shall be fully welded, and light tested.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

B. Install in accordance with manufacturer's instructions.

C. Kitchen Hood Exhaust: Provide residue traps at base of vertical risers with provisions for clean out.

D. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.

E. Install and seal metal and flexible ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

F. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

G. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

H. Use crimp joints with or without bead for joining round duct sizes 8 inch and smaller with crimp in direction of air flow.

I. Use double nuts and lock washers on threaded rod supports.

J. Connect terminal units to supply ducts directly or with one foot maximum length of flexible duct. Do not use flexible duct to change direction.

K. Connect diffusers or light troffer boots to low pressure ducts directly or with 5 feet maximum length of flexible duct held in place with strap or clamp.

L. Provide residue traps in kitchen hood exhaust ducts at base of vertical risers with provisions for clean out.

M. Use stainless steel for ductwork exposed to view and stainless steel or carbon steel for ducts where concealed.

N. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

O. At exterior wall louvers, seal duct to louver frame and install blank-out panels.
3.02 CLEANING

A. Clean duct systems with high power vacuum machines. Protect equipment that could be harmed by excessive dirt with filters, or bypass during cleaning. Provide adequate access into ductwork for cleaning purposes.

END OF SECTION
SECTION 23 33 00
AIR DUCT ACCESSORIES

PART 1  GENERAL

1.01 SECTION INCLUDES
   A. Air turning devices/extractors.
   B. Backdraft dampers - metal.
   C. Duct access doors.
   D. Duct test holes.
   E. Fire dampers.
   F. Flexible duct connections.
   G. Volume control dampers.

1.02 RELATED REQUIREMENTS
   A. Section 23 31 00 - HVAC Ducts and Casings.
   B. Section 26 27 17 - Equipment Wiring: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS
   B. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association; 2005.

1.04 SUBMITTALS
   A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
   B. Product Data: Provide for shop fabricated assemblies including volume control dampers and duct access doors. Include electrical characteristics and connection requirements.
   C. Shop Drawings: Indicate for shop fabricated assemblies including volume control dampers and duct access doors.
   D. Manufacturer's Installation Instructions: Provide instructions for fire dampers.
   E. Project Record Drawings: Record actual locations of access doors.

1.05 QUALITY ASSURANCE
   A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
   B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect dampers from damage to operating linkages and blades.

PART 2 PRODUCTS

2.01 AIR TURNING DEVICES/EXTRACTORS

A. Manufacturers:

B. Multi-blade device with blades aligned in short dimension; steel construction; with individually adjustable blades, mounting straps.

2.02 BACKDRAFT DAMPERS - METAL

A. Manufacturers:
   3. Greenheck: www.greenheck.com
   4. CESCO Products: www.cescoproducts.com
   5. Air Balance Inc.: www.airbalance.com

2.03 DUCT ACCESS DOORS

A. Manufacturers:
   4. Greenheck: www.greenheck.com
   5. Flexmaster USA: www.flexmasterusa.com
   6. CESCO Products: www.cescoproducts.com

B. Fabrication: Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ducts, install minimum 1 inch thick insulation with sheet metal cover.
   1. Less Than 12 inches Square: Secure with sash locks.
   2. Up to 18 inches Square: Provide two hinges and two sash locks.
   3. Up to 24 x 48 inches: Three hinges and two compression latches with outside and inside handles.
   4. Larger Sizes: Provide an additional hinge.

C. Access doors with sheet metal screw fasteners are not acceptable.

2.04 DUCT TEST HOLES

A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

2.05 FIRE DAMPERS

A. Manufacturers:
3. CESCO Products:  www.cescoproducts.com
5. Greenheck:  www.greenheck.com

B. Fabricate in accordance with NFPA 90A and UL 555, and as indicated.
C. Ceiling Dampers: Galvanized steel, 22 gage frame and 16 gage flap, two layers 0.125 inch ceramic fiber on top side and one layer on bottom side for round flaps, with locking clip.
D. Horizontal Dampers: Galvanized steel, 22 gage frame, stainless steel closure spring, and lightweight, heat retardant non-asbestos fabric blanket.
E. Curtain Type Dampers: Galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for horizontal installations. Configure with blades out of air stream except for 1.0 inch pressure class ducts up to 12 inches in height.
F. Fusible Links: UL 33, separate at 160 degrees F with adjustable link straps for combination fire/balancing dampers.

2.06 FLEXIBLE DUCT CONNECTIONS
A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.
1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz per sq yd.
2. Metal: 3 inches wide, 24 gage thick galvanized steel.
C. Lead Vinyl Sheet: Minimum 0.55 inch thick, 0.87 lbs per sq ft, 10 dB attenuation in 10 to 10,000 Hz range.
1. Minimum Weight: 24 oz./sq. yd.
2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
3. Service Temperature: Minus 50 to plus 250 deg F.

2.07 VOLUME CONTROL DAMPERS
A. Manufacturers:
   1. Louvers & Dampers, Inc;
   2. Nailor Industries Inc; Model
   3. Air Balance Inc.:  www.airbalance.com
   4. Flexmaster USA:  www.flexmasterusa.com
   5. Ruskin Company; Model
B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.
C. Single Blade Dampers: Fabricate for duct sizes up to 6 x 30 inch.
D. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 x 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.

E. Spin Ins:
   1. Branch duct connections for connecting round low pressure duct to rectangular low pressure ducts.
   3. Manufacturer: Flexmaster FL with stand-off or equivalent.

F. End Bearings: Except in round ducts 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon or sintered bronze bearings.

G. Quadrants:
   1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
   2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
   3. Where rod lengths exceed 30 inches provide regulator at both ends.

PART 3 EXECUTION

3.01 PREPARATION
A. Verify that electric power is available and of the correct characteristics.

3.02 INSTALLATION
A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible. Refer to Section 23 31 00 for duct construction and pressure class.

B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

C. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide for cleaning kitchen exhaust ducts in accordance with NFPA 96. Provide minimum 8 x 8 inch size for hand access, size for shoulder access, and as indicated. Provide 4 x 4 inch for balancing dampers only. Review locations prior to fabrication.

D. Provide duct test holes where indicated and required for testing and balancing purposes.

E. Provide fire dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by authorities having jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

F. Demonstrate re-setting of fire dampers to Owner's representative.

G. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.

H. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.
I. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.

J. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

END OF SECTION
SECTION 23 34 23
HVAC POWER VENTILATORS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Roof exhausters.
B. Ceiling exhaust fans.

1.02 RELATED REQUIREMENTS
A. Section 23 05 13 - Common Motor Requirements for HVAC Equipment.
B. Section 23 33 00 - Air Duct Accessories: Backdraft dampers.

1.03 REFERENCE STANDARDS
F. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association; 2009, Revision 1 - 2010.

1.04 SUBMITTALS
A. See Section 01 33 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and electrical characteristics and connection requirements.
C. Manufacturer's Instructions: Indicate installation instructions.
D. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.
E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Fan Belts: One set for each individual fan.

1.05 QUALITY ASSURANCE
A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING
A. Deliver fans as factory-assembled units, to the extent allowable by shipping limitations, with protective crating and covering.
B. Lift and support units with manufacturer's designated lifting or supporting points.
C. Protect motors, shafts, and bearings from weather and construction dust.

1.07 FIELD CONDITIONS
A. Permanent ventilators may be used for ventilation during construction only after ductwork is clean, filters are in place, bearings have been lubricated, and fan has been test run under observation.

PART 2 PRODUCTS
2.01 MANUFACTURERS
C. Acme; www.acmefan.com.

2.02 POWER VENTILATORS - GENERAL
A. Performance Ratings: Determined in accordance with AMCA 210 and bearing the AMCA Certified Rating Seal.
B. Sound Ratings: AMCA 301, tested to AMCA 300, and bearing AMCA Certified Sound Rating Seal.
C. Fabrication: Conform to AMCA 99.
D. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.
E. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
F. Kitchen Range Hood Exhaust Fans: Comply with requirements of NFPA 96 and UL762.

2.03 ROOF EXHAUSTERS
A. Performance Ratings:
   1. Motor: Refer to Section 23 05 13.
B. Fan Unit: V-belt or direct driven as indicated, with spun aluminum housing; resilient mounted motor; 1/2 inch mesh, 0.62 inch thick aluminum wire birdscreen; square base to suit roof curb with continuous curb gaskets.
C. Roof Curb: 14 inch high self-flashing of galvanized steel with continuously welded seams, built-in cant strips, interior baffle with acoustic insulation, curb bottom, and factory installed nailer strip.
D. Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor and wall mounted solid state speed controller.
E. Backdraft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, and blades linked.
F. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.
G. Kitchen Range Hood Exhaust Fans: Comply with requirements of NFPA 96 and UL762.

2.04 CABINET AND CEILING EXHAUST FANS
A. Performance Ratings:
   1. Motor: Refer to Section 23 05 13.
B. Centrifugal Fan Unit: V-belt or direct driven with galvanized steel housing lined with acoustic insulation, resilient mounted motor, gravity backdraft damper in discharge.
C. Disconnect Switch: Cord and plug in housing for thermal overload protected motor and wall mounted solid state speed controller.

D. Grille: Molded white plastic.

E. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Secure roof exhausters with cadmium plated steel lag screws to roof curb.

C. Extend ducts to roof exhausters into roof curb. Counter flash duct to roof opening.

D. Hung Cabinet Fans:
   1. Install fans with resilient mountings and flexible electrical leads.
   2. Install flexible connections specified in Section 23 33 00 between fan and ductwork. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.

E. Provide sheaves required for final air balance.

F. Install backdraft dampers on inlet to roof and wall exhausters.

G. Provide backdraft dampers on outlet from cabinet and ceiling exhauster fans and as indicated.

3.02 FIELD QUALITY CONTROL

A. Equipment Startup Checks:
   1. Verify that shipping, blocking, and bracing are removed.
   2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
   3. Verify that cleaning and adjusting are complete.
   4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
   5. Verify lubrication for bearings and other moving parts.
   6. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
   7. Disable automatic temperature-control operators.

B. Starting Procedures:
   1. Energize motor and adjust fan to indicated rpm.
   2. Measure and record motor voltage and amperage.

C. 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.

D. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Shut unit down and reconnect automatic temperature-control operators.

F. Refer to "Testing, Adjusting, and Balancing" for testing, adjusting, and balancing procedures.

G. Replace fan and motor pulleys as required to achieve design airflow.

H. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.

I. On completion of installation, internally clean fans according to manufacturer's written instructions. Remove foreign material and construction debris. Vacuum fan wheel and cabinet.
J. After completing system installation, including outlet fitting and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.

END OF SECTION
SECTION 23 34 33
AIR CURTAINS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Air curtains.

1.02 REFERENCE STANDARDS

1.03 SUBMITTALS
A. Submit under provisions of Section 01 33 00.
B. Product Data: Manufacturer's descriptive literature for products specified in this section; indicate options specified.
   1. Manufacturer's instructions: Printed installation instructions for each product specified.
C. Shop Drawings: Indicate installation and connection details for air curtains.
D. Operation and Maintenance Data: Manufacturer's printed instructions for operating and maintaining air curtain components.
E. Warranty Documents: Issued and executed by manufacturer.

1.04 DELIVERY, STORAGE, AND HANDLING
A. Store products of this section in manufacturer's unopened packaging until installation.
B. Maintain dry, heated storage area for products of this section until installation of products.

1.05 WARRANTY
A. Supply manufacturer's standard warranty against defects in product workmanship and materials.

PART 2 PRODUCTS

2.01 MANUFACTURERS

2.02 AIR CURTAINS
A. Product Description: Self-contained electrically-operated air curtain for mounting at head of door openings.
   1. Maximum Mounting Height: 7 feet.
B. Housing:
   1. Material: Galvanized steel.
   2. Finish: Painted epoxy.
C. Blower Assembly: Heavy-duty motor; forward curved centrifugal fans, double inlet, double width.
D. Performance: Tested in accordance with AMCA 220.
   1. Average Outlet Velocity: 1400 feet per minute.
   2. Air Flow: 1900 cubic feet per minute.
      a. Volume Adjustment: Discharge dampers.
E. Control: ON/OFF control; air curtain turns on when door is opened and off when door is closed.
F. Operating Noise Level: 54 dBA.
   1. Measured 10 feet from unit.
G. No heat.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that required utilities are in correct location and are of correct capacities for specified products.
B. Verify that mounting surfaces have sufficient strength to support units.
C. Verify that space is ready for installation of units.
D. Verify clearances required to maintain the units and to protect combustible materials.

3.02 INSTALLATION

A. Install air curtains in accordance with shop drawings and manufacturer's printed installation instructions.
B. Maintain clearances required to maintain the units and to protect combustible materials.
C. Ensure proper connection to utilities.

END OF SECTION
SECTION 23 38 13
COMMERCIAL-KITCHEN HOODS

PART 1 - GENERAL

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

1.2 SUMMARY
   A. This Section includes Type I and Type II commercial kitchen hoods.

1.3 DEFINITIONS
   A. Listed Hood: A hood, factory fabricated and tested for compliance with UL 710 by a testing agency acceptable to authorities having jurisdiction.
   B. Standard Hood: A hood, usually field fabricated, which complies with design, construction, and performance criteria of applicable national and local codes.
   C. Type I Hood: A hood designed for grease exhaust applications.
   D. Type II Hood: A hood designed for heat and steam removal and for other non-grease applications.

1.4 SUBMITTALS
   A. Product Data: For the following:
      1. Kitchen hoods.
      2. Filters/baffles.
      3. Fire-suppression systems.
      4. Lighting fixtures.
   B. Shop Drawings: Signed and sealed by a qualified professional engineer.
      1. Shop Drawing Scale: 1/4 inch = 1 foot (1:50).
      2. Show plan view, elevation view, sections, roughing-in dimensions, service requirements, duct connection sizes, and attachments to other work.
      3. Show cooking equipment plan and elevation to confirm minimum code-required overhang.
      4. Indicate performance, exhaust and makeup air airflow, and pressure loss at actual Project-site elevation.
      5. Show water-supply and drain piping connections.
      6. Show control cabinets.
      7. Show fire-protection cylinders, piping, actuation devices, and manual control devices.
8. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.


11. Piping Diagrams: Detail fire-suppression piping and components and differentiate between manufacturer-installed and field-installed piping. Include roughing-in requirements for drain connections. Show cooking equipment plan and elevation to illustrate fire-suppression nozzle locations.

   a. Piping Diagram Scale: 1/4 inch = 1 foot (1:50).

C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

   1. Coordination Drawing Scale: 1/4 inch = 1 foot (1:50).
   2. Suspended ceiling assembly components.
   3. Structural members to which equipment will be attached.
   4. Roof framing and support members for duct penetrations.
   5. Items penetrating finished ceiling, including the following:

      a. Lighting fixtures.
      b. Air outlets and inlets.
      c. Speakers.
      d. Sprinklers.
      e. Access panels.
      f. Moldings on hoods and accessory equipment.

D. Welding certificates.

E. Manufacturer Seismic Qualification Certification: Submit certification that commercial kitchen hoods, accessories, and components will withstand seismic forces defined in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment." Include the following:

   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

      a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
      b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

   2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

   3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

F. Field quality-control test reports.
1.5 QUALITY ASSURANCE

A. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.


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. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.6 COORDINATION

A. Coordinate equipment layout and installation with adjacent Work, including lighting fixtures, HVAC equipment, plumbing, and fire-suppression system components.

1.7 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. Furnish one complete set(s) of grease filters/baffles.

PART 2 - PRODUCTS

2.1 HOOD MATERIALS

A. Stainless-Steel Sheet: ASTM A 666, Type 304.

1. Minimum Thickness: 0.050 inch (1.3 mm).
2. Finish: Comply with SSINA's "Finishes for Stainless Steel" for recommendations for applying and designating finishes.
   a. Finish shall be free from tool and die marks and stretch lines and shall have uniform, directionally textured, polished finish indicated, free of cross scratches. Grain shall run with long dimension of each piece.

3. Concealed Stainless-Steel Surfaces: ASTM A 480/A 480M, No. 2B finish (bright, cold-rolled, unpolished finish).
5. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

B. Carbon-Steel Sheets: ASTM A 1008/A 1008M, cold-rolled sheets; commercial quality; with oiled, exposed matte finish.
1. Minimum Thickness: 0.043 inch (1.09 mm).

C. Galvanized-Steel Sheet: Lock-forming quality; ASTM A 653/A 653M, G90 (Z275) coating designation.
   1. Minimum Thickness: 0.052 inch (1.32 mm).

D. Zinc-Coated Steel Shapes: ASTM A 36/A 36M, zinc coated according to ASTM A 123/A 123M requirements.

E. Sealant: ASTM C 920; Type S, Grade NS, Class 25, Use NT. Elastomeric sealant shall be NSF certified for commercial kitchen hood application. Sealants, when cured and washed, shall comply with requirements in 21 CFR, Section 177.2600, for use in areas that come in contact with food.
   1. Color: As selected by Architect from manufacturer's full range.
   2. Backer Rod: Closed-cell polyethylene, in diameter larger than joint width.

F. Sound Dampening: NSF-certified, nonabsorbent, hard-drying, sound-deadening compound for permanent adhesion to metal in minimum 1/8-inch (3-mm) thickness that does not chip, flake, or blister.

G. Gaskets: NSF certified for end-use application indicated; of resilient rubber, neoprene, or PVC that is nontoxic, stable, odorless, nonabsorbent, and unaffected by exposure to foods and cleaning compounds, and that passes testing according to UL 710.

2.2 GENERAL HOOD FABRICATION REQUIREMENTS

A. Welding: Use welding rod of same composition as metal being welded. Use methods that minimize distortion and develop strength and corrosion resistance of base metal. Make ductile welds free of mechanical imperfections such as gas holes, pits, or cracks.
   1. Welded Butt Joints: Full-penetration welds for full-joint length. Make joints flat, continuous, and homogenous with sheet metal without relying on straps under seams, filling in with solder, or spot welding.
   2. Grind exposed welded joints flush with adjoining material and polish to match adjoining surfaces.
   3. Where fasteners are welded to underside of equipment, finish reverse side of weld smooth and flush.
   5. After zinc-coated steel is welded, clean welds and abraded areas and apply SSPC-Paint 20, high-zinc-dust-content, galvanizing repair paint to comply with ASTM A 780/A 780M.

B. For metal butt joints, comply with SMACNA's "Kitchen Equipment Fabrication Guidelines."

C. Where stainless steel is joined to a dissimilar metal, use stainless-steel welding material or fastening devices.

D. Form metal with break bends that are not flaky, scaly, or cracked in appearance; where breaks mar uniform surface appearance of material, remove marks by grinding, polishing, and finishing.
E. Sheared Metal Edges: Finish free of burrs, fins, and irregular projections.

F. In food zones, as defined in NSF, fabricate surfaces free from exposed fasteners.

G. Cap exposed fastener threads, including those inside cabinets, with stainless-steel lock washers and stainless-steel cap (acorn) nuts.

H. Fabricate pipe slots on equipment with turned-up edges sized to accommodate service and utility lines and mechanical connections.

I. Fabricate enclosures, including panels, housings, and skirts, to conceal service lines, operating components, and mechanical and electrical devices including those inside cabinets, unless otherwise indicated.

J. Fabricate seismic restraints according to SMACNA's "Kitchen Equipment Fabrication Guidelines," Appendix 1, "Guidelines for Seismic Restraints of Kitchen Equipment."

K. Fabricate equipment edges and backsplashes according to SMACNA's "Kitchen Equipment Fabrication Guidelines."

L. Fabricate enclosure panels to ceiling and wall as follows:
   1. Fabricate panels on all exposed side(s) with same material as hood, and extend from ceiling to top of hood canopy and from canopy to wall.
   2. Wall Offset Spacer: Minimum of 3 inches (75 mm).
   3. Wall Shelves and Overshelves: Fabricate according to SMACNA's "Kitchen Equipment Fabrication Guidelines," with minimum 0.0625-inch- (1.58-mm-) thick, stainless-steel shelf tops.

2.3 TYPE I EXHAUST HOOD FABRICATION

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

C. Basis-of-Design Product: The hood provide shall be CaptiveAire model BD-2.

D. Weld all joints exposed to grease with continuous welds, and make filters/baffles or grease extractors and makeup air diffusers easily accessible for cleaning.
   1. Fabricate hoods according to NSF 2, "Food Equipment."
   2. Hoods shall be listed and labeled, according to UL 710, by a testing agency acceptable to authorities having jurisdiction.
   3. Hoods shall be designed, fabricated, and installed according to NFPA 96.
   4. Include access panels as required for access to fire dampers and fusible links.
   5. Duct Collars: Minimum 0.0598-inch- (1.5-mm-) thick steel at least 3 inches (75 mm) long, continuously welded to top of hood and at corners. Fabricate a collar with a 0.5-inch- (13-mm-) wide duct flange.
   6. Duct-Collar Fire Dampers: Collar and damper shall comply with UL 710 testing and listing required for the entire hood.
a. Collar: Minimum 0.0598-inch (1.5-mm) thick stainless steel, at least 3 inches (75 mm) long, continuously welded to top of hood and at corners. Fabricate a collar with a minimum 0.5-inch (13-mm) wide duct flange.
b. Blades: Minimum 0.1046-inch (2.7-mm) thick stainless steel, counterbalanced to remain closed after actuation.
d. Fusible Link: Replaceable, 212 deg F (100 deg C) rated.

E. Hood Configuration: Exhaust  
   1. Makeup air shall be introduced through the rooftop air conditioning equipment.

F. Hood Style: See Schedules

G. Filters/Baffles: Removable, stainless-steel. Fabricate stainless steel for filter frame and removable collection cup and pitched trough. Exposed surfaces shall be pitched to drain to collection cup. Filters/baffles shall be tested according to UL 1046, "Grease Filters for Exhaust Ducts," by an NRTL acceptable to authorities having jurisdiction.

H. Lighting Fixtures: Surface-mounted incandescent fixtures and lamps with lenses sealed vapor-tight. Wiring shall be installed in conduit on hood exterior. Number and location of fixtures shall provide a minimum of 70 fc (753 lx) at 30 inches (762 mm) above finished floor.

   1. Light switches shall be mounted on front panel of hood canopy or in hood control panel.
   2. Lighting Fixtures: Incandescent complying with UL 1598.

I. Hood Controls: Hood or Wall-mounting control cabinet, factory wired to control groups of adjacent hoods, and fabricated of stainless steel.

   1. Exhaust Fan: On-off switches shall start and stop the exhaust fan. Interlock exhaust fan with fire-suppression system to operate fan(s) during fire-suppression-agent release and to remain in operation until manually stopped. Include red pilot light to indicate fan operation. Motor starters shall comply with Division 26 Section "Enclosed Controllers."
   2. Photocell and Temperature Control: Cycle makeup air and exhaust-air fans on and off, based on temperature at hood discharge and opacity of smoke in hood. Interlock fan control with fire-suppression system to operate during fire-suppression-agent release and to remain in operation until manually stopped. Provide air-purge fan and conduit to photocell and reflector to avoid grease accumulation that will negatively affect performance of system.
   3. Photocell and Temperature Control: Change speed (off, low, and high) of makeup air and exhaust-air fans with speed switch, based on temperature at hood discharge and opacity of smoke in hood. Interlock fan control with fire-suppression system to operate at high speed during fire-suppression-agent release and to remain in high-speed operation until manually stopped. Provide air-purge fan and conduit to photocell and reflector to avoid grease accumulation that will negatively affect performance of system. Controller shall limit exhaust-duct velocity between <Insert minimum velocity> and <Insert maximum velocity>. Controller shall limit supply quantity to <Insert minimum quantity> for proper operation of makeup air unit.
   4. Photocell and Temperature Control: Vary speed of makeup air and exhaust-air fans with variable-frequency controllers, based on temperature at hood discharge and opacity of smoke in hood. Interlock fan control with fire-suppression system to operate at high speed during fire-suppression-agent release and to remain in high-speed operation until manually stopped. Provide air-purge fan and conduit to photocell and reflector to avoid grease accumulation that will negatively affect performance of system. Controller shall limit exhaust-duct velocity between <Insert minimum velocity> and <Insert maximum velocity>.
velocity>. Controller shall limit supply quantity to <Insert minimum quantity> for proper operation of makeup air unit.

5. High-Temperature Control: Alarm shall sound and cooking equipment shall shut down before hood discharge temperature rises to actuation temperature of fire-suppression system.

J. Capacities and Characteristics: See schedules.

2.4 TYPE II EXHAUST HOOD FABRICATION

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

C. Basis-of-Design Product: Hood shall be Captive-Aire Model ND-2 as scheduled.

D. Fabricate hoods according to NSF 2, "Food Equipment."

E. Fabricate hoods to comply with SMACNA's "HVAC Duct Construction Standards: Metal and Flexible."

F. Hood Configuration: Exhaust.

G. Hood Type: Heat and vapor and Condensate removal.

H. Hood Style: See Schedule

I. Condensate Hood Baffles: Removable, stainless-steel baffles to drain into a hood drain trough, and stainless-steel drain piping.

J. Capacities and Characteristics: See Schedules

2.5 WET-CHEMICAL FIRE-SUPPRESSION SYSTEM

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

C. Basis-of-Design Product: Subject to compliance with requirements, provide a comparable product by one of the following:

1. Ansul Incorporated; a Tyco International Ltd. Company.

D. Description: Engineered distribution piping designed for automatic detection and release or manual release of fire-suppression agent by hood operator. Fire-suppression system shall be
listed and labeled for complying with NFPA 17A, "Wet Chemical Extinguishing Systems," by a qualified testing agency acceptable to authorities having jurisdiction.

1. Steel Pipe, NPS 2 (DN 50) and Smaller: ASTM A 53/A 53M, Type S, Grade A, Schedule 40, plain ends.
3. Piping, fusible links and release mechanism, tank containing the suppression agent, and controls shall be factory installed. Controls shall be in stainless-steel control cabinet mounted on wall. Furnish manual pull station for wall mounting. Exposed piping shall be covered with chrome-plated aluminum tubing. Exposed fittings shall be chrome plated.
5. Furnish electric-operated gas shutoff valve with clearly marked open and closed indicator for field installation.
6. Fire-suppression system controls shall be integrated with controls for fans, lights, and fuel supply and located in a single cabinet for each group of hoods immediately adjacent.
7. Wiring shall have color-coded, numbered terminal blocks and grounding bar. Spare terminals for fire alarm, optional wiring to start fan with fire alarm, red pilot light to indicate fan operation, and control switches shall all be factory wired in control cabinet with relays or starters. Include spare terminals for fire alarm, and wiring to start fan with fire alarm.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before equipment installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Complete field assembly of hoods where required.

1. Make closed butt and contact joints that do not require filler.
2. Grind field welds on stainless-steel equipment smooth, and polish to match adjacent finish. Comply with welding requirements in Part 2 "General Hood Fabrication Requirements" Article.

B. Install hoods and associated services with clearances and access for maintaining, cleaning, and servicing hoods, filters/baffles, grease extractor, and fire-suppression systems according to manufacturer's written instructions and requirements of authorities having jurisdiction.

C. Make cutouts in hoods where required to run service lines and to make final connections, and seal openings according to UL 1978.

D. Securely anchor and attach items and accessories to walls, floors, or bases with stainless-steel fasteners, unless otherwise indicated.
E. Install hoods to operate free from vibration.

F. Install seismic restraints according to SMACNA's "Kitchen Equipment Fabrication Guidelines," Appendix 1, "Guidelines for Seismic Restraints of Kitchen Equipment."

G. Install trim strips and similar items requiring fasteners in a bed of sealant. Fasten with stainless-steel fasteners at 48 inches (1200 mm) o.c. maximum.

H. Install sealant in joints between equipment and abutting surfaces with continuous joint backing, unless otherwise indicated. Provide airtight, watertight, vermin-proof, sanitary joints.

I. Install lamps, with maximum recommended wattage, in equipment with integral lighting.

J. Set initial temperatures, and calibrate sensors.

K. Set field-adjustable switches.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping with clearance to allow service and maintenance.

C. Install reduced-pressure backflow preventer on washer-water supply. Backflow preventer is specified in Division 22 Section "Domestic Water Piping Specialties."

D. Install washer-water drain piping full size of hood connection to an adjacent floor drain or floor sink.

E. Makeup Water Connection: Comply with applicable requirements in Division 22 Section "Domestic Water Piping Specialties" for valves and accessories on piping connections to water-cooled units.

F. Connect ducts according to requirements in Division 23 Section "Air Duct Accessories." Install flexible connectors on makeup air supply duct. Weld exhaust-duct connections with continuous liquidtight joint.

G. Install fire-suppression piping for remote-mounted suppression systems according to NFPA 17A, "Wet Chemical Extinguishing Systems."

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

C. Perform tests and inspections.
1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Tests and Inspections:

1. Test each equipment item for proper operation. Repair or replace equipment that is defective, including units that operate below required capacity or that operate with excessive noise or vibration.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Test water, drain, gas, and liquid-carrying components for leaks. Repair or replace leaking components.
4. Perform hood performance tests required by authorities having jurisdiction.
5. Perform fire-suppression system performance tests required by authorities having jurisdiction.

E. Prepare test and inspection reports.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial kitchen hoods. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION
SECTION 26 01 01
ELECTRICAL – GENERAL PROVISIONS

PART 1 - GENERAL

1.01 GENERAL CONDITIONS

A. The accompanying General Conditions shall apply to and form a part of this Section.

1.02 GENERAL REQUIREMENTS

A. Carefully examine General Conditions, other specification Sections, and other drawings (in addition to electrical), in order to be fully acquainted with their effect on electrical work.

B. Do all work in compliance with all applicable codes, laws and ordinances, the National Electrical Code (hereinafter referred to as “Code” or “NEC”), and the regulations of the local authorities having jurisdiction. Obtain and pay for any and all required permits, inspections, certificates of inspections and approval, and the like, and deliver such certificates to the Contracting Officer.

C. Cooperate with other trades and contractors at job. Perform work in such manner and at such times as not to delay work of other trades. Complete all work as soon as the condition of the structure and installation of equipment will permit. Patch, in a satisfactory manner and by the proper craft, any work damaged by electrical workmen.

1.03 DEFINITIONS

A. Provide: Furnish all materials, hardware, equipment, labor and services required for the installation of complete and properly working equipment and/or systems as shown on the drawings and described herein.

B. Wire: Furnish all conduit, wiring, materials, hardware, equipment, labor and services required for complete and proper operation and/or control of equipment and/or systems as shown on the drawings and described herein.

C. Install: Furnish all conduit, wiring, materials, hardware, equipment, labor and services required for the complete and properly working installation of equipment and/or systems as shown on the drawings and described herein.

D. Work: A complete and properly working installation of materials for equipment and/or systems as shown on the drawings and described herein.

E. AWG: American Wire Gage.


H. OSHA: Occupation Safety and Health Administration.

I. UL: Underwriter's Laboratories, Inc.


K. IEEE: Institute of Electrical and Electronic Engineers.


1.04 CONTINUITY OF SERVICE

A. Note that this is an operating facility. Any work that may cause a disturbance or interruption in the normal operation of this facility must be carefully coordinated with the Contracting Officer and Owner.

B. Electrical service interruptions to equipment, panelboards serving equipment, or equipment vital to the continued operation of this facility shall be avoided where possible.

C. Special steps shall be taken to minimize such occurrences, however, when a service interruption or a disruption to normal building operation is unavoidable, the owner shall be notified a minimum of two (2) weeks in advance, in writing. No electrical service interruptions to the normal operation shall take place without written approval of the submitted request.

D. The request for electrical service interruption shall clearly indicate all equipment affected by the service interruption, the anticipated duration of the interruption, and a detailed description of arrangements for temporary service(s), if required.

E. All service interruptions shall be scheduled for early morning hours, or other off peak times, as directed by the owner. The electrical contractor shall include in his bid, all premium time charges for such scheduling.

F. Commercial electrical service interruptions may require temporary service arrangements to be made by the electrical contractor. Where an existing stand-by generator is not available for use during the interruption, or is not of sufficient capacity to maintain normal operation during the interruption, the electrical contractor shall include in his bid, the costs of providing such temporary services and standby generation equipment as is required.

G. Electrical service to systems necessary for continued operation shall be maintained in all instances with only a minimum of service interruption time being permissible. Where extended service interruptions to such equipment are unavoidable, the electrical contractor shall furnish and install temporary services as required to maintain operations.

H. No allowances will be made for additional costs incurred by the electrical contractor for premium time work or for the provision of standby generation equipment and/or temporary services after a contract is entered into.

1.05 DRAWINGS

A. Indicate only diagrammatically the extent, general character and approximate location of work. Where work is indicated but with minor details omitted, furnish and install it complete and so as to perform its intended functions. For building details and mechanical equipment follow architectural, structural, and mechanical drawings and fit electrical work thereto.

B. Take finish dimensions at the job site in preference to scale dimensions.

C. Except as above noted, make no changes or deviations from the work as shown or specified except on written order of the Contracting Officer.

D. Obtain from manufacturer's data on all equipment, the dimensions of which may affect electrical work. Use this data to coordinate proper service characteristics, entry locations, etc., and to ensure minimum clearances are maintained.
1.06 QUALIFICATIONS OF CONTRACTOR

A. The electrical contractor shall have had experience of at least the same size and scope as this project, on at least two other projects, within the last 5 years in order to be qualified to bid this project. This qualification shall also apply to his subcontractors.

B. Workmen shall be experienced in their respective trade. Workmanship of installed work shall be first class and will be so judged by the Contracting Officer. Substandard work shall be removed and replaced.

C. Qualifications stated for the electrical contractor shall also apply to any subcontractors employed by the electrical contractor during the course of this work.

1.07 SITE VISIT

A. The Bidders shall visit the site to thoroughly familiarize themselves with existing conditions prior to submitting their bid. No allowances will be made for lack of knowledge of existing conditions.

1.08 ELECTRICAL SERVICE CHARACTERISTICS

A. Main services are existing and are as shown on drawings.

1.09 WARRANTY

A. See GENERAL CONDITIONS (one-Year warranty of conformance with drawings and specifications).

B. In addition to the foregoing warranty, Contractor shall and does hereby warrant all materials and equipment furnished under this Division of the Specifications to be free from defects and to function or operate satisfactorily for one year after final acceptance of the work, and that any items not meeting this requirement will be made good by him without cost to owner, provided such defects or failures are not due to abuse, neglect, or lack of reasonable and ordinary maintenance.

PART 2 - PRODUCTS

2.01 APPROVED MATERIALS AND DEVICES

A. Where not otherwise specified, provide only new, standard first grade materials throughout, conforming to standards established by Underwriter's Laboratories, Inc., and so marked and labeled, together with manufacturer's brand or trademark. All equipment subject to approval of Contracting Officer before installation. All like items shall be of one manufacture.

B. Any equipment or materials shown on the drawings to be removed and reinstalled shall be cleaned and, if necessary repaired to first class condition prior to reinstallation.

2.02 ELECTRICAL EQUIPMENT

A. Where shown on the drawings or specified herein, furnish and install electrical equipment.

B. Furnish all materials, hardware, equipment, labor and services required for the installation of complete and properly working installations as shown on the drawings and described herein.

C. References in these specifications to a particular manufacturer or model number shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition. Equipment by manufacturers other than those specified shall be submitted for review in accord with Section 26 01 02.
D. All equipment shall be installed by qualified a workman who shall have reviewed all manufacturer's data for purposes of coordinating service characteristics, entry locations, mounting requirements, dimensions, etc.

E. The contractor shall cooperate with the Owner, other trades, etc. for coordination of their requirements or the effects of the installed equipment on the overall project.

2.03 AUXILIARY SYSTEMS

A. Where shown on the drawings or specified herein, furnish and install electrical auxiliary systems.

B. Furnish all materials, hardware, equipment, labor and services required for the installation of a complete and properly working systems as shown on the drawings and described herein.

C. References in these specifications to a particular manufacturer or model number shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition. Equipment by manufacturers other than those specified shall be submitted for review in accord with Section 26 01 02.

D. All systems equipment shall be installed by qualified systems technicians in the employ of the systems contractor, or by qualified workmen in the employ of the Contractor under the supervision of qualified representatives of the manufacturer. "Qualified representatives" shall be factory authorized or certified by the systems equipment manufacturer.

E. The systems technicians and/or contractor shall cooperate with the Owner, other trades, etc. for coordination of their requirements or the effects of the installed systems on the overall project.

PART 3 - EXECUTION

3.01 WORKMANSHIP

A. The work shall be in accordance with the NEC and the rules and regulations of local bodies having jurisdiction.

B. All work shall be executed in a workmanlike manner and shall present a neat and mechanical appearance upon completion.

C. Care shall be exercised that all items are plumb, straight, level.

D. Care shall be exercised so that not less than code clearance is allowed for all panels, switchboards, etc. Do not allow other trades to infringe on this clearance. Minimum code clearance shall be as required by Article 110 of the NEC.

E. Care shall be exercised that no piping, ducts, or equipment foreign to the electrical equipment or architectural appurtenances shall be allowed to be installed in, enter or pass through the exclusively dedicated spaces above, adjacent to and below switchboards and panelboards as set forth in Article 384, paragraph 4, of the NEC.

F. Balance load as equally as practicable on all feeders, circuits and panelboard buses.

3.02 ACCEPTANCE TESTING

A. Upon completion of work, the entire wiring system shall be tested, and shall be shown to be in perfect working condition in accordance with the intent of the specifications and drawings. It shall be the responsibility of the Electrical Contractor to have all systems ready for operation and to have an electrician available to operate same in accordance with and under the supervision of the inspection representative of the Contracting Officer. The electrician shall be available to assist in removal of panelboard fronts, etc., to permit inspection as required.
3.03 TESTS

A. Upon completion of the work, test the individual systems including all feeders, branches, outlets, lighting, motors, apparatus and appliance, with a 1000 VDC insulation tester (with a 0-200 megohm full scale). All conductors shall have insulation tested when the wiring system is complete and a log kept of the circuit name, date and megger readings.

B. Test each new receptacle and record the ground loop impedance adjacent to the device on the "As-Built" drawings.

C. Test each new GFI protected outlet with a 5 ma test current and record the trip time adjacent to the device on the "As-Built" drawings.

D. Provide all instruments, labor and materials required for tests designated.

E. All test reports shall be typed and signed by the person who made the tests.

3.04 SEISMIC REQUIRE

A. This installation is located in a seismic region. All equipment shall be constructed and installed with all necessary bracing required for the seismic region.

END OF SECTION
SECTION 26 01 02
ELECTRICAL – SCOPE OF WORK

PART 1 - GENERAL

1.01 WORK REQUIRED

A. Arrange with local utility companies for such services as shown or herein specified.
B. Removal or relocation of all electrical services located on or crossing through the project area, either above or below, which would obstruct the construction of the project or conflict in any manner with the completed project or any code pertaining thereto.
C. Complete electric lighting systems, power systems and auxiliary systems as shown or herein specified.
D. Alterations and additions to electrical systems in existing building.
E. Furnishing and installation of all electrical items shown on plans or herein specified, unless shown or specified otherwise.
F. Furnishing and installation of disconnect switches for motors.
G. Connection of all equipment requiring electrical connection, mentioned in this Section or shown on drawings, whether furnished by electrical contractor or others.
H. Complete alterations and additions to existing telephone/data system.

PART 2 - PRODUCTS

2.01 PROPOSED SUBSTITUTES

A. Submit to Contracting Officer ten (10) days prior to bid date three (3) copies of any items which are proposed as substitutes for those specified.
B. Requested Lighting Substitutions require full photometric calculations with print-outs for all spaces as noted in the fixture schedule notes.

2.02 SHOP DRAWINGS AND CATALOG DATA

A. Submit to Contracting Officer within fifteen (15) days after award of contract, prior to purchasing, six (6) copies of manufacturer's shop drawings and catalog data for the items listed below.
B. Engineer’s CAD/electronic drawing files will be available, upon request, for the convenience of the Contractor in preparation of shop drawings or record drawings. Prior to delivery by the Engineer, a service fee of $50.00 per drawing file and a signed agreement will be required between the Engineer and Contractor acknowledging the limited permissible use of the requested files. Drawing files will be in the Engineer’s standard CAD format, without borders, titles and Engineer’s seals.
C. All shop drawings of a specific item or system shall be in one submittal and shall be marked to clearly identify the manufacturer, the intended use of the item, and if not readily apparent, the intended location for installation of the item.
D. Shop drawings of all power equipment shall contain exact details of device placement, phasing and numbering, in form of elevations, for each piece of equipment.
E. Shop drawings submittals shall include:

- Dry type transformers
- Safety Switches
- Lighting Fixtures
- Wireways
- Cable
- Wiring Devices
- Fire Alarm System Alterations and Additions
- Existing Circuit and Equipment Drawings
- As required by individual sections of these Specifications

F. Shop Drawings for the following items may consist of typewritten lists, listing manufacture with description, to be used (one only for each item).

- Building Wire
- Conduit: Rigid, I.M.C., E.M.T.
- EMT Couplings and Connectors
- Wire Connectors

G. Obtain manufacturer's data on all equipment requiring electrical service and review it for purposes of coordinating service characteristics, entry locations, mounting requirements, dimensions, etc. Verify that the electrical service requirements are as shown on the electrical drawings or, if at variance to that shown, indicate the area of nonconformance. Submit one copy of this data with shop drawings, along with a statement of the following:

1. The information contained in the submittal includes data on all equipment within the scope of this project which will require electrical service or coordination with electrical work.
2. The information contained in the submittal has been reviewed by the electrical contractor, with the general contractor's project manager, and that the electrical service requirements will be coordinated with the information obtained from the manufacturer's data.

The statement shall identify the source of the information and shall be signed by the representative of the electrical contractor responsible for obtaining and coordinating the information and the general contractor's project manager. Failure to submit confirmation of equipment coordination shall be construed as the contractor's acknowledgment that any changes to and/or additional electrical work and/or materials required due to equipment electrical service requirements which do not conform to the electrical drawings will be provided at no additional cost.

H. Obtain data on all ceilings and review it for purposes of coordinating mounting requirements, dimensions, recess depth etc., of light fixtures. Verify that the proposed mounting trim and hardware are correct for the ceiling to be utilized and that depth of recessed light fixtures will not be in conflict with HVAC equipment, ductwork, structural members, etc. Submit one copy of this data with shop drawings, along with a statement of the following:
The information contained in the submittal has been reviewed by the electrical contractor and the general contractor’s project manager and the mounting details are correct for the proposed application.

The statement shall identify the source of the information and shall be signed by the representative of the electrical contractor and the general contractor’s project manager. Failure to submit confirmation of ceiling coordination shall be construed as the contractor’s acknowledgment that all electrical work in the ceiling has been coordinated and that any changes and/or additional work or materials, if required due to conflicts in or above the ceiling, will be provided at no additional cost.

I. Obtain data on all casework and review it for purposes of coordinating electrical service to equipment, mounting requirements, dimensions, etc. Submit a statement of the following:

All casework within the scope of this project which will require coordination with electrical work has been reviewed and coordinated by the electrical contractor with the general contractor’s project manager.

The statement shall identify the source of the information and shall be signed by the representative of the electrical contractor responsible for obtaining and coordinating the information and the general contractor’s project manager. Failure to submit confirmation of casework coordination shall be construed as the contractor’s acknowledgment that all electrical work in, near, or associated with casework has been coordinated and that any changes and/or additional work or materials, if required due to conflicts will be provided at no additional cost.

PART 3 - EXECUTION

3.01 MOTORS STARTERS AND CONTROLS

A. Unless otherwise specified or shown, all motors will be furnished and installed under other sections of these specifications.

B. Unless otherwise specified or shown, all individually mounted starters and/or equipment control contactors shall be furnished but not installed under other sections of these specifications.

C. Installation of individual mounted starters, equipment control contactors and all power wiring connections to all motors, starters, equipment control contactors and equipment shall be performed under this section of these specifications.

D. Unless otherwise specified or shown, all control items will be furnished, installed and wired in conduit under other sections of these specifications. The electrical contractor shall furnish and install a control power circuit to each HVAC or plumbing control panel or junction box requiring same. Control circuits shall, unless noted otherwise, be individual 20 ampere, 120 volt circuits run from the nearest receptacle panel.

E. Where required by the NEC or local codes, each motor or piece of equipment required to have a disconnecting means within sight of the motor or equipment shall be so equipped. All such disconnects shall be furnished and installed under this section of these specifications unless provided as part of an equipment package furnished under other sections. This requirement shall apply whether shown on the drawings or not.

F. Where required by the NEC or local codes, each piece of HVAC equipment required to have a 15 ampere, 120 volt, receptacle within sight of the motor or equipment shall be so equipped. All such receptacles shall be furnished and installed under this section of these specifications unless provided as part of an equipment package furnished under other sections. Receptacles shall be equipped with weatherproof covers and Class "A" ground fault protection where located out of doors or subject to moisture and shall be wired to the nearest general convenience outlet circuit. This requirement shall apply whether shown on the drawings or not.
G. Where shown on the HVAC or electrical drawings for exhaust fans to be controlled with room lights, the electrical contractor shall furnish, install and wire complete a control relay for each exhaust fan. Exhaust fan control relays shall be mounted in NEMA 1 enclosures, at the exhaust fan, and shall have coil voltage to match lighting system and contacts as required by motor voltage and amperage.

H. A power circuit shall be supplied for plenum lighting in each HVAC air handling units (AHU) equipped with light fixtures. The electrical contractor shall furnish, install and wire complete a 120 volt circuit from the nearest receptacle circuit in the AHU room.

3.02 EXCAVATION, CUTTING, PATCHING

A. Perform all excavating and cutting as required to receive electrical work, and after inspection and approval of work by Contracting Officer, do all required backfilling, patching and repairing. Obtain specific approval of Contracting Officer before cutting into any structural members.

B. For all such work employ competent workmen, and finish a neat and workmanlike manner, equal to quality and appearance to adjacent work.

3.03 FIRESTOPPING

A. Wall, floor and smoke/fire barrier penetrations shall be sealed as required to maintain the fire rating of the penetrated barrier. Sealant materials shall be UL listed for use in the fire barrier in which they are to be applied. Application of fire barrier sealants shall be in strict accordance with the manufacturers UL listed assembly per NEC 300-21, SBC705.4 and other applicable codes.

B. Fire protection sealants may be applied in moldable putty, wraps, strips or with a caulking gun as required by jobsite conditions. Penetrations which are too large for sealing with caulk alone shall be repaired to match existing and then sealed with moldable putty, strips or wraps as required by the sealant manufacturer to achieve a fire rating equal, or exceeding, the partition penetrated.

C. Fire protection sealants shall be as follows (NO EXCEPTIONS):

3M Brand:

- Fire Barrier - Moldable Putty MPS-2 STIX
- Fire Barrier - CP 25WP/ CP 25WP+ Caulk
- Fire Barrier - FS-195 / FS-195+ Wrap or Strip
- Interam Firedam 150 Caulk

Flame Stop Distribution, Inc.

- Flame Stop V
- Flame Stop VP with Retaining Fixture

Specified Technologies, Inc.

- Specseal Sealant
- Specseal Putty
- Specseal Mortar
- Specseal Collar

Metacaulk Fire Stop by Rectorseal Corporation

- Metacaulk 950
Hilti

Hilti FS 605, High Performance Firestop Sealant
Hilti FS 611A, Intumescent Firestop Sealant
Hilti FS 635, Trowelable Firestop Compound

D. Rated wall penetrations for voice, data and other auxiliary systems cables, not run in conduit completely to backboards, shall be made with combination pathway and firestop sleeves consisting of individual 3 inch by 3 inch by 10.5 inch long wireways with preinstalled intumescent material which expands when exposed to fire or excessive heat to completely seal the pathway irregardless of the number and/or size of cables contained. Unless shown otherwise on the drawings, furnish at least four sleeves at each penetration indicated. Furnish greater quantities of sleeves where required to run full width of each cable tray system terminating outside of a voice/data equipment room. Combination cable pathway and firestop devices shall be EZ-Path as manufactured by Specified Technologies, Inc. or approved equal.

E. Panelboards, equipment enclosures, outlet boxes, etc. installed in fire rated partitions shall be boxed in with wall board or other suitable fire rated material as required to maintain or restore the fire rating of the assembly.

3.04 ROOF PENETRATION

A. Furnish roof flashings for all equipment installed under this Section that penetrates the roof. Appropriate flashings are specified under Roofing and Sheet Metal Section. Supply these flashings for installation under Roofing and Sheet Metal Section.

3.05 PAINTING

A. Finish painting of any exposed raceways is not included in this Section. (See Painting and Finishing Section).

3.06 IDENTIFICATION

A. Identification nameplates shall be laminated plastic.

B. Each panelboard shall be equipped with a nameplate with 1/4" minimum letters.

C. Each individual mounted circuit breaker, switch, starter, contactor and/or any other control or protective device shall be equipped with a nameplate with 1/4" minimum letters. Nameplates on fusible equipment shall state fuse size.

D. Each branch circuit in a panelboard shall be identified.
   1. Panelboards with covers and directory pockets shall have typewritten directories.
   2. Panelboards without directories shall have a nameplate with 1/8" minimum letters installed adjacent to each circuit device stating equipment fed and fuse size, if applicable.

E. Nameplates shall be white micarta with black core.

F. Each junction box shall be marked to identify the system it serves. The following color coding system shall be spray painted, with plenum rated paint, on each box cover:
   1. Normal Power System - Galvanized
   2. Fire Alarm System - Red

G. Junction boxes containing power circuits shall have associated panel and circuit numbers printed on the cover.
3.07 STORAGE OF MATERIALS
   A. Store all materials to prevent damage from rust, corrosion, physical injury, etc.
   B. Keep site clean of accumulation of cartons, trash, debris, etc.

3.08 ALTERATIONS AND ADDITIONS TO ELECTRICAL SYSTEMS IN EXISTING BUILDING
   A. Work in existing building shall be performed as indicated or required to perform its intended function on Electrical and architectural plans. This Contract shall include removing, relocating, extending, etc., any items of electrical nature required to facilitate work as indicated. All circuits interrupted by rework shall be extended and left energized. All contractors bidding on the project shall visit the site to determine the extent of work, removal, etc., required to implement the work indicated on the drawings.

3.09 MODIFICATIONS TO EXISTING PANELBOARDS
   A. New circuit breakers shall be installed in existing panelboards as shown on the drawings.
   B. New Circuit breakers installed in existing panelboards shall be by the same manufacturer as the panelboard and shall be mechanically and electrically identical to existing circuit breakers.
   C. Furnish and install all necessary hardware as required for the addition of new circuit breakers. Where existing conditions do not permit installation of additional circuit breakers in the existing enclosure, install subfeed lugs and extend the existing panelboard feeder to a new panelboard section and install the new circuit breakers therein. New panelboard sections, when required, shall be of the same or greater ampere and voltage rating as the existing panelboard.
   D. A new ground bus shall be installed in any panel, not so equipped, to which a new circuit is run containing a separate equipment grounding conductor.

3.10 "AS BUILT" DRAWINGS
   A. A set of electrical plans shall be kept on the job site on which all changes from the contract drawings are recorded, in red, on a day-to-day basis.

3.11 OPERATIONS AND MAINTENANCE INSTRUCTION
   A. At the completion of the job, the electrical contractor shall turn over to Owner one (1) set of marked "as built" drawings, three (3) sets of all equipment catalog and maintenance data and three (3) sets of shop drawings on all equipment requiring same. The contractor shall explain and demonstrate all systems to the Owner's representative(s).

3.12 ACCESS PANELS
   A. Access panels for electrical equipment, devices, junction boxes, etc., shall be provided where building finishes do not allow access. This Contractor shall furnish and have installed appropriate access panels except when such panels are specified otherwise in other sections of these specifications, in which case, this Contractor shall coordinate panel locations with the installing Contractor.

END OF SECTION
PART 1 - GENERAL

1.01 SCOPE

A. The electrical contractor shall visit the site to determine the extent of demolition work as required by the drawings and specifications.

B. All electrical conduit, wiring, devices, fixtures, etc. required to be removed to allow for new construction, abandoned as a result of new construction, or currently not in service shall be removed as part of this contract. Exposed conduits and conduits in accessible areas shall be removed completely; conduits concealed in floors, walls and above non-accessible ceilings may be capped and abandoned after removal of all conductors.

C. Existing floor outlets found to not be located to coordinate with new equipment layouts shall be removed completely.

D. Existing electrical equipment and circuitry not being removed or reworked under this contract, but located so as to be affected by the work under this contract, shall remain in service. Such circuits, equipment, etc., shall be extended, relocated or removed and reinstalled as required to accommodate new construction.

E. Where new HVAC and Plumbing work requires relocation of existing electrical work such relocation shall be provided.

F. All active devices, wiring and feeders shall remain in service.

PART 2 - PRODUCTS

2.01 NEW MATERIALS

A. Where existing electrical conduits, junction boxes and wiring are required to be relocated, new materials used shall match existing. Furnish and install conduits, wiring, hardware, boxes, disconnect switches, etc. as required for extension of existing circuits and/or relocation of existing electrical equipment. New cable splices, if required, shall be made with insulated compression type butt splices.

2.02 MATERIALS REMOVED

A. All materials removed, unless otherwise specified, shall be removed from the site and disposed of by the contractor.

2.03 MATERIALS REMOVED AND REINSTALLED

A. Any equipment or materials shown on the drawings or specified to be removed and reinstalled shall be cleaned and, if necessary, repaired to first class condition prior to reinstallation.

PART 3 - EXECUTION

3.01 WORKMANSHIP

A. The contractor shall take care not to damage adjacent equipment, structure, etc. not to be demolished. Where existing devices or equipment are removed, existing finishes shall be repaired where such repair is not shown under new work.

3.02 “AS-BUILT” DRAWINGS

A. The contractor shall trace and identify all existing circuits within the project area and so note on his as-built drawings. The drawings shall clearly identify service panelboards, circuit numbers and conduit routings.

END OF SECTION
PART 1 - GENERAL

1.01 SCOPE

A. This section outlines the quality and type of conductors to be used in the various systems, locations and conditions.

PART 2 - PRODUCTS

2.01 WIRE AND CABLE 600 VOLT

A. Conductors shall have current carrying capacities as per NEC, #12 minimum except for controls, and fixture wire.

B. Conductors for general use, sized #10 and smaller, shall be solid copper. Conductors #8 and larger, and any size to motors or vibrating equipment shall be stranded copper.

C. All conductor insulation shall be 600 volt.

D. Insulation for branch circuits in dry locations only, sized #10 and smaller, shall be color coded, nylon jacketed, PVC, type THHN-THWN.

E. Insulation for feeders, #8 and larger, and for circuits run in wet locations and below grade shall be cross-linked polyethylene insulation type RHH-RHW/USE or type XHHW.

F. Conductor color codes shall be as set forth below.

2.02 FIXTURE WIRE

A. Fixture wire shall be Type SF-2 except that type THHN or XHHW may be used in the channel of and flex to fluorescent fixtures.

2.03 CONTROL WIRE

A. Control wire shall be #14, 19 strand, type THHN-THWN, rated 90 degrees C full color range.

2.04 MANUFACTURER

A. Wire and cable shall be manufactured by Rome, Cerro, Colonial, General Cable, Essex, Aetna, AIW, Encore or Southwire.

2.05 WIRE CONNECTIONS

A. Wire connections, #10 and smaller, shall be made with T&B Sta-Kon wire joints PT Series complete with insulating caps, (installed with WT161 Tool or C WT2000 Tool), Ideal Wing Nuts, or Buchanan Elec. Products B Cap or Series 2000 Pres-sure connectors complete with nylon snap-on insulators (installed with C24 pressure tool).

B. On wire larger than #10, shall be made with approved solderless connectors and covered with Scotch #33 electrical tape so that the insulation is equal to conductor insulation.

C. Connection of stranded conductors, #8 and larger, to bus bars in switchboards, panelboards, equipment enclosures, junction boxes, etc. shall be made with individual lugs, size as required by conductor, bolted to bus bar with full size bolts and nuts with lock washers.
PART 3 - EXECUTION

3.01 INSTALLATION OF WIRE AND CABLE

A. No conductor shall be smaller than #12 except where designated on the drawings or hereinafter specified.

B. Multi-wire lighting branch circuits, properly phased as required to share the system neutral, shall be utilized as indicated on the drawings. No more than three (3) branch circuits may be installed in a conduit raceway unless specifically shown on the drawings.

C. Conductors in 120 volt, branch circuit homeruns which exceed 75 feet in length from the panelboard to the first outlet shall be increased at least one AWG size to compensate for voltage drop.

D. All joints and splices in wire shall be made with approved solder-less connectors, and covered so that insulation is equal to the conductor insulation.

E. Conductors and conduits shall be continuous between outlets. No splices shall be pulled into conduit.

F. No conductor shall be pulled until conduit is cleaned of all foreign matter.

G. Where installed in panelboards, cabinets, wireways, switches and equipment wire and cable shall be neatly formed and tied.

H. Where conductors are run in parallel, each conductor making up the feeder shall be exactly the same length, the same size, and the same type of conductor with the same insulation. Further, each group of conductors making up a phase or neutral must be bonded at both ends in the same manner.

I. In installing the main service, additional slack conductors shall be provided as required by the electric utility for connection to their equipment.

3.02 OUTLETS AND BRANCH CIRCUITS

A. Outlets shall be connected to branch circuits as indicated on drawings by circuit number adjacent to outlet symbols. No more outlets than are indicated shall be connected to a circuit.

3.03 WIRE AND CABLE COLOR CODING

A. A color coding system as listed below shall be followed throughout the entire network of branch circuits.

<table>
<thead>
<tr>
<th>Voltage</th>
<th>Phase</th>
<th>Color</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>120/208</td>
<td>A</td>
<td>Black</td>
<td>Yellow</td>
</tr>
<tr>
<td></td>
<td>A-Neutral</td>
<td>White/Black Stripe</td>
<td>Gray/Yellow Stripe</td>
</tr>
<tr>
<td>277/480</td>
<td>B</td>
<td>Red</td>
<td>Orange</td>
</tr>
<tr>
<td></td>
<td>B-Neutral</td>
<td>White/Red Stripe</td>
<td>Gray/orange Stripe</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>Blue</td>
<td>Brown</td>
</tr>
<tr>
<td></td>
<td>C-Neutral</td>
<td>White/Blue Stripe</td>
<td>Gray/Brown Stripe</td>
</tr>
<tr>
<td></td>
<td>Equipment Ground</td>
<td>Green</td>
<td>Green</td>
</tr>
<tr>
<td></td>
<td>Isolated Ground</td>
<td>Green/Yellow Stripe</td>
<td>Green/Yellow Stripe</td>
</tr>
</tbody>
</table>

B. Phase conductors sized #10 AWG and below, and neutral and grounding conductors sized #6 and below, shall have permanently colored insulation. Phase conductors sized #8 AWG and above, and neutral and grounding conductors sized #4 and above, shall be color coded by either permanently colored insulation or by means of colored tape applied to the conductor within 12" of each termination and in each enclosure, junction box, etc.
C. Control Conductors: Shall be color coded by use of color coded "tracers". No control circuit shall have two identical conductors.

END OF SECTION
SECTION 26 05 19.2
METALLIC SHEATHED CABLE

PART 1 - GENERAL

1.01 SCOPE
A. This section outlines the quality and type of wiring assemblies specified as metallic sheathed cable assemblies for use in the various systems, locations and conditions.

1.02 PERMITTED USE
A. Metallic sheathed cable may be considered for use only where in accordance with requirements of all local and state authorities, the owner and all applicable codes.
B. Metallic sheathed cable and fittings may be utilized in lieu of EMT conduit and wiring, in trade size 1/2” only, for branch circuits only, except where noted otherwise.
C. Feeders and motor circuits shall be run in EMT, IMC or rigid as specified.

1.03 PRODUCT LISTING
A. All Metallic sheathed cable, fittings, etc., shall be UL listed.

1.04 MANUFACTURER
A. Metallic sheathed cable assemblies shall be manufactured by AFC, Southwire or approved equal.

PART 2 - PRODUCTS

2.01 METALLIC SHEATHED CABLE
A. Type MC cable shall consist of manufactured cables containing insulated copper phase, neutral and grounding conductors, #12 AWG minimum, in an aluminum or galvanized steel, spiral wrapped, flexible jacket. Conductor insulation shall be color coded, rated 90°C. Insulation on grounding conductors shall be green.

2.02 CONDUCTORS
A. All conductors shall be copper with 600 volt insulation, #12 minimum shall be solid with color coded, insulation type THW, THHN-THWN or equivalent.
B. An individual neutral conductor shall be run for each phase conductor. Insulation for each individual neutral conductor shall be white with a colored stripe to match the phase conductor served.
C. A separate, full size, insulated copper equipment grounding conductor shall be run in each cable. Insulation for equipment grounding conductors shall be green.
D. Where noted as isolated ground circuits, "IG", a separate, full size, insulated copper, isolated grounding conductor shall be run in addition to the equipment grounding conductor. Insulation for isolated grounding conductors shall be green with a yellow stripe, insulation for equipment grounding conductors shall be green.

2.03 METALLIC SHEATH
A. Metallic cable sheath consist of flexible aluminum or galvanized steel spiral wrapped around conductors to form a complete assembly.
2.04 FITTINGS

A. Fittings and connectors utilized with type MC cable shall be specifically rated for use with the installed cable. Terminations to equipment enclosures, junction/outlet boxes, etc. shall be made with fittings with insulated throats.

2.05 WIRE CONNECTIONS

A. #10 and smaller connections shall be made with T&B Sta-Kon wire joints PT Series complete with insulating caps, (installed with WT161 Tool or C WT2000 Tool), Ideal Wing Nuts, or Buchanan Elec. Products B Cap or Series 2000 Presure connectors complete with nylon snap-on insulators (installed with C24 pressure tool).

PART 3 - EXECUTION

3.01 PERMITTED USE

A. Metallic sheathed cable may be utilized for branch circuits where concealed in ceiling or walls and exposed where there is no danger of mechanical injury.

B. Metallic sheathed cable may not, under any circumstance, be run where exposed to weather or moisture.

3.02 INSTALLATION OF METALLIC SHEATHED CABLE

A. Follow methods which are appropriate and approved for the location and conditions involved. Where not otherwise shown, specified, or approved in a particular case, run all wiring concealed.

B. Installation of MC cable shall be in strict accordance with the manufacturer's requirements. The Electrical Contractor shall use the cable manufacturer's specified tools for cutting and stripping cable metal jacket and installing fittings. These tools shall be available for inspection at each project visit by the Contracting Officer or his representative.

C. Installation of Metallic sheathed cable shall be in accordance with Article 334 of the NEC.

D. All joints and splices in wire shall be made with approved solder-less connectors, and covered so that insulation is equal to the conductor insulation.

E. Conductors and cable sheaths shall be continuous between outlets.

F. Connectors shall be steel, set screw or compression type, equipped with insulating throats, specifically listed for use with type MC cable.

G. Where cables enter boxes they shall be secured in place with approved insulating fittings.

H. Install cable runs to avoid proximity to steam or hot water pipes. In no place shall a cable be run within 6" of such pipes except where crossing is unavoidable, then cable shall be kept at least 3" from the covering of the pipe crossed.

I. Before installing cables for motors and fixed appliances, check location of motor and/or appliance connections to locate and arrange cables appropriately. Connections to all motors and/or any equipment which has moving or vibrating parts shall be flexible, and shall generally not exceed 24" in length.

J. Fasten cable securely in place by means of approved clamps, hangers, supports and fastenings. Arrangement and methods of fastening all cables shall be subject to Contracting Officer's direction and approval. Use only approved clamps, galvanized wire may not be used in any instance.
K. All cables shall be supported at each coupling, fitting, outlet box, junction box, cabinet or equipment enclosure in accordance with the NEC. Supports shall be independent of ducts, plumbing piping, ceiling supports, etc. Cables shall not be supported by junction boxes, pull boxes, fixtures, etc.

3.03 OUTLETS AND BRANCH CIRCUITS

A. Outlets shall be connected to branch circuits as indicated on drawings by circuit number adjacent to outlet symbols. No more outlets than are indicated shall be connected to a circuit.

B. A color coding system as listed below shall be followed throughout the entire network of branch circuits.

<table>
<thead>
<tr>
<th>Voltage</th>
<th>120/208</th>
<th>277/480V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase Color</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A Black</td>
<td></td>
<td>Yellow</td>
</tr>
<tr>
<td>A-Neutral</td>
<td>White/Black Stripe</td>
<td>Gray/Yellow Stripe</td>
</tr>
<tr>
<td>B Red</td>
<td></td>
<td>Orange</td>
</tr>
<tr>
<td>B-Neutral</td>
<td>White/Red Stripe</td>
<td>Gray/Orange Stripe</td>
</tr>
<tr>
<td>C Blue</td>
<td></td>
<td>Brown</td>
</tr>
<tr>
<td>C-Neutral</td>
<td>White/Blue Stripe</td>
<td>Gray/Brown Stripe</td>
</tr>
<tr>
<td>Equipment Ground</td>
<td>Green</td>
<td>Green</td>
</tr>
<tr>
<td>Isolated Ground</td>
<td>Green/Yellow Stripe</td>
<td>Green/Yellow Stripe</td>
</tr>
</tbody>
</table>

C. Conductors shall have permanently colored insulation.

3.04 TESTING

A. All MC cable shall be megger tested and the results submitted with close-out documents.

END OF SECTION
SECTION 26 05 26

GROUNDING

PART 1 - GENERAL

1.01 SCOPE

A. This section deals with the grounding of non-current carrying conductive surfaces of equipment.

B. All grounded connections shall be installed in accordance with the National Electrical Code and all local codes and requirements. Such codes shall be considered minimum requirements and installation of the grounding system shall insure freedom from dangerous shock voltage exposure and provide a low impedance ground fault path to permit operation of overcurrent and ground fault protection devices.

PART 2 - PRODUCTS

2.01 CONDUCTORS

A. Grounding conductors shall be insulated copper unless specifically shown or specified otherwise.

B. Grounding conductors shall be identified by green insulation or by green tape.

C. All buried grounding system wire shall be bare, solid, soft-drawn, annealed, copper sized #2/0 AWG minimum, or as shown on drawings.

2.02 GROUND RODS

A. Ground rods shall be 5/8 inch by 10 feet, copperweld unless noted otherwise on the drawings.

2.03 CONNECTIONS

A. The connection of a grounding conductor to ground rods or building steel shall be by means of a cadweld or thermoweld process.

B. Grounding conductor connections to conduit terminations shall be made with approved ground bushings.

PART 3 - EXECUTION

3.01 CADWELDING

A. Cadwelding shall be performed in strict accordance with the manufacturer's requirements.

B. All personnel performing cadwelding shall have been trained by factory certified representatives and proof of this training shall be presented to the Architect/Engineer at the time of Cadweld inspection.

C. Cadwelding shall not be performed during conditions of high humidity which inhibit the process from proper bonding. Consult the Manufacturer's instructions for acceptable conditions and do not attempt any Cadwelding during such times as these conditions do not exist.

D. Cadweld molds shall be sized and configured for the specific welding application. Molds which have been field modified for application other than their original purpose will not be utilized under any circumstance. Cadweld "one shot" connections shall not be utilized.
E. In no circumstances will worn out or loose Cadweld molds be utilized. Molds which experience "blow out" during the welding process shall be replaced immediately and any welds made which exhibit evidence of incomplete welding shall be cut off and rewelded.

3.02 SEPARATELY DERIVED SYSTEMS

A. Separately derived systems (dry type transformers with primary and secondary electrically isolated and secondary having a grounded circuit neutral conductor) shall be grounded in accordance with NEC Section 250-30.

B. The grounding electrode shall be the nearest available effectively grounded structural member and the nearest available effectively grounded cold water pipe. Where the cold water bonding point is not the point of entry into the building, a #1/0 copper (min.) jumper shall be installed around any valve, pressure regulator, water meter, etc., which is within the building between the bonding point and the point of entry into the building.

3.03 EQUIPMENT GROUNDING

A. An equipment grounding conductor (sized in accordance with Table 250-122 of the NEC unless shown or specified elsewhere to be larger) shall be installed in the same raceway with all circuit conductors.

B. Equipment grounding conductors shall be bonded at each enclosure. Where an equipment grounding bus, bonded to the equipment enclosure, is provided, all equipment grounding conductors shall be connected thereto. Where an equipment grounding bus is not provided, grounding bushings shall be utilized on enclosure terminations of conduits.

END OF SECTION
SECTION 26 05 33.1
RACEWAYS - METAL

PART 1 - GENERAL

1.01 SCOPE

A. This section deals with the materials to be used as metal raceways, connections, and supports.

PART 2 - PRODUCTS

A. Conduit: Rigid and IMC shall be galvanized outside and inside by hot dipping. EMT shall be Electro-Galvanized. Conduit shall be as manufactured by Republic, Wheatland, Triangle, Pittsburgh Standard, Youngstown, or Allied.

B. Sealtight flexible metal conduit shall consist of flexible galvanized steel tubing with a liquidtight jacket of PVC. All flexible conduit shall have a copper bonding conductor wound into conduit body.

C. Couplings and connectors on rigid and IMC shall be standard threaded type, galvanized outside and inside by hot dipping. Clamp type and threadless are not acceptable. Couplings and connectors, for rigid and IMC shall be as manufactured by Raco or Appleton.

D. EMT connectors shall be steel, set screw or compression type, equipped with insulating throats. Steel set screw couplings shall be O-Z/Gedney 4000ST series, T & B 5031 - 5049 series, Midwest Electric series 1450 or equal series of Raco. Compression couplings shall be O-Z/Gedney 7000ST or 7000RST series, T & B 5123 - 5623 series, Midwest Electric series 1650, or equal series of Raco. Cast metal couplings will not be approved for any location.

E. EMT couplings shall be steel, set screw or compression type. Steel set screw connectors shall be O-Z/Gedney 5000S series, T & B 5030 - 5046 series, Midwest Electric series 460 or equal series of Raco. Compression type connectors shall be O-Z/Gedney 6000S or 6000RS series, T & B 5120 - 5620 series, Midwest Electric series 660, or equal series of Raco. Cast metal connectors will not be approved for any location.

F. Connectors raintight: Meyers or approved equal.

G. Bushings on rigid and IMC shall be threaded malleable iron with integral noncombustible insulator. Rigid and IMC bushings shall be O-Z/Gedney "IBC" series, T & B BIM series, Midwest Electric series 1031 - 1043 or equal by Penn Union. Grounding bushings shall be O-Z/Gedney "IBC-L" series, T & B 3870 - 3999 series, Midwest Electric GLL series or equal by Penn Union.

H. Watertight Flex Connectors: O-Z/Gedney, Raco, or Midwest Electric with insulating throat.

I. Conduit clamps and supports shall be as manufactured by T & B, Midwest Electric, or O-Z/Gedney.

J. Conduit fittings shall be manufactured by Pyle-National, Appleton, Crouse-Hinds, or Russellslo.

PART 3 - EXECUTION

3.01 CONDUIT, TYPE OF INSTALLATION

A. EMT may be utilized for branch circuits and auxiliary systems where concealed in ceiling or walls and exposed where there is no danger of mechanical injury in accordance with paragraph "B", below.
B. Unless shown or specified otherwise, rigid or IMC conduit shall be used as follows:
   (a) For service entrances
   (b) In all cases in floor slabs,
   (c) For exterior use or other areas exposed to moisture,
   (d) Where danger of mechanical injury exists,
   (e) For feeders, and
   (f) Where EMT or non-metallic conduit is not specifically permitted.

### 3.02 INSTALLATION OF CONDUIT EMT, IMC, RIGID

A. Conduits shall be sized in accordance with the latest National Electrical Code except where shown to be larger on the drawings or when required by local Code.

B. Follow methods which are appropriate and approved for the location and conditions involved. Where not otherwise shown, specified, or approved in a particular case, run all wiring concealed.

C. Where rigid and/or IMC conduits enter boxes they shall be secured in place by approved locknuts and bushing.

D. Where EMT enters boxes they shall be secured in place with approved insulating fittings.

E. Conduit ends shall be plugged during construction.

F. Any auxiliary systems conduit not run complete to an outlet box or enclosure shall be terminated with an insulating bushing to protect the system cable. This includes, but is not limited to conduits stubbed out above lay-in ceilings, run across sections of non-accessible ceilings, stubbed out at terminal boards, stubbed out to cable trays, sleeves through walls, etc.

G. Empty conduits shall be equipped with a 100 lb. test nylon pull cord.

H. The use of running threads is absolutely prohibited. All conduit shall be jointed with approved conduit couplings. All couplings on IMC and rigid conduit shall be threaded.

I. Install conduit runs to avoid proximity to steam or hot water pipes. In no place shall a conduit be run within 6" of such pipes except where crossing is unavoidable, then conduit shall be kept at least 3" from the covering of the pipe crossed.

J. Before installing raceways for motors and fixed appliances, check location of motor and appliances connections to locate and arrange raceways appropriately. Provide flexible conduit connections to all motors and/or any equipment which has moving or vibrating parts. Flexible conduit shall generally not exceed 24" in length and shall in all cases be equipped with a ground wire, bonded at both ends. Sealtight flexible conduit shall be used in all areas exposed to moisture.

K. Exposed conduit runs shall be run parallel and/or right angles to building walls and/or partitions.

L. Fasten conduit securely in place by means of approved conduit clamps, hangers, supports and fastenings. Arrangement and methods of fastening all conduits shall be subject to Contracting Officer’s direction and approval. Use only approved clamps, galvanized wire may not be used in any instance.

M. Junction or outlet boxes in or above ceilings shall be supported independently from conduits or ceiling support by all thread rod secured to roof or floor structure above.
N. All conduits shall be supported within 3 feet of each coupling, fitting, outlet box, junction box, cabinet or equipment enclosure. Conduit supports shall be independent of ducts, plumbing piping, ceiling supports, etc. Conduits shall not be supported by junction boxes, pull boxes, fixtures, etc.

O. Multiple conduit runs shall be supported by trapeze hangers, run tight against the ceiling.

P. All conduit connections to sheet metal cabinets or enclosures subject to the elements shall terminate by use of raintight hubs.

Q. All exposed conduit threads, metal supports, etc., exposed to the elements or exterior of building shall be painted with rust preventive paint.

R. No conduit with an external diameter larger than 1/3 the thickness of the slab, shall be placed in the slab and conduits in the slab shall not be spaced closer than 3 diameters on center.

S. No conduit shall be run in slag or fill under the ground floor slab. Where running in the slab is not permissible, conduits shall be run in trenches, 18" minimum, below grade and backfilled.

T. Where conduit crosses a structural expansion joint an approved conduit expansion fitting will be installed.

END OF SECTION
SECTION 26 05 33.3
OUTLET AND JUNCTION BOXES

PART 1 - GENERAL

1.01 SCOPE

A. This section outlines the quality, type and installation of outlet and junction boxes for general and special use.

PART 2 - PRODUCTS

2.01 CEILING AND WALL OUTLET BOXES

A. Outlet boxes shall be standard type, with knockouts, made of hot dipped galvanized steel, Steel City, Raco, Appleton, or Bowers.

B. Single wall outlet boxes shall be two gang with single gang trim rings.

C. Wall outlet boxes installed in 4” or greater walls shall be 3-1/2” deep. Wall outlet boxes installed walls less than 4” shall be maximum depth permitted wall construction.

D. Ceiling outlet boxes shall be 4” octagon 2-1/8” deep or larger as required due to number of wires.

E. Boxes shall be provided with approved 3/8” fixture studs when required to support stem mounted light fixtures.

F. Except when located in exposed concrete block, switch and receptacle boxes shall be 4” square with trim ring for single gang installation. Appropriate gang boxes shall be used for mounting ganged switches.

G. When installed in exposed concrete block, switch and receptacle boxes shall be square type designed for exposed block installation.

2.02 JUNCTION BOXES

A. Sheet metal junction boxes, through 4-11/16”, shall be standard type of hot dipped galvanized steel, with knockouts, Steel City, Raco, Appleton, Bowers or approved equal.

B. Cast metal junction boxes, through 4-11/16”, shall be type FS, FD, JB, GS, or SEH as required for application.

C. Sheet metal junction boxes larger than 4-11/16” shall be NEMA 1, Code gauge steel, flush or surface mounted as indicated and shall be Hoffman or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION OF CEILING OUTLET BOXES

A. Outlet boxes in or above ceilings shall be securely fastened directly to structural members or suspended from structural members by all-thread rod. Ceiling mounted boxes shall not be supported by ceiling tiles or ceiling suspension wires.

B. There shall be no more knockouts opened in any outlet box than are actually required.
C. Chandeliers shall be supported independently of outlet boxes by 3/8" fixture studs.

3.02 INSTALLATION OF WALL OUTLET BOXES

A. Outlet boxes shall be securely fastened to structural members and shall not be supported by dry wall, gypsum board, plaster, etc. The device or plate installed in conjunction with the outlet box shall not be used for support.

B. Surface fixture outlet boxes shall be set so edge of cover comes flush with finished surface.

C. There shall be no more knockouts opened in any outlet box than are actually required.

D. Boxes shall be sealed during construction.

E. Under no circumstances shall through-the-wall boxes be used. Back to back boxes shall be staggered at least 3 inches, except in fire rated partitions, in which case, back to back boxes shall be staggered at least 24 inches.

F. Outlet boxes two gangs and wider shall not be supported by attachment clips or any means which supports the boxes from less than two opposite sides of the box. Such outlet boxes in stud walls shall be supported securely by support members spanning between studs.

G. Conduit entry into wall outlet boxes shall not utilize center knockouts. Knockouts to either left or right of center shall be utilized to allow more room for wire or cable routing to devices mounted on single gang trim rings.

H. Outlet boxes installed in fire rated partitions shall be boxed in with wall board or other suitable fire rated material as required to maintain or restore the fire rating of the assembly.

3.03 INSTALLATION OF JUNCTION BOXES

A. Provide junction or pull boxes where shown on the drawings and as required to facilitate installing conductors. Such boxes shall be "Code" sized unless required to be larger by the plans or other sections of these specifications. All junction boxes shall be accessible.

B. Junction boxes shall be securely fastened to be securely fastened directly to structural members or suspended from structural members by all-thread rod, independent of ductwork, plumbing, etc. Ceiling mounted junction boxes shall not be supported by EMT conduit fittings, ceiling tiles or ceiling suspension wires.

C. There shall not be more knockouts opened in any box than are actually required.

D. Boxes shall be properly protected during construction and shall be cleaned of all foreign matter before conductors are installed.

E. Boxes to be imbedded in concrete shall be properly leveled and anchored in place before the concrete is poured.

END OF SECTION
SECTION 26 22 13

DRY TYPE TRANSFORMERS

PART 1 - GENERAL

1.01 SCOPE

A. Transformers shall be rated for indoor service unless shown, otherwise provide single or three
phase, with KVA ratings as shown on the drawings.

PART 2 - PRODUCTS

2.01 TRANSFORMER INSULATION

A. Transformer insulation shall be Class H.

2.02 TEMPERATURE RATINGS

A. Transformers shall be constructed so that under full load the average conductor temperature rise
does not exceed 150 deg. C.

2.02 TAPS

A. Transformers 30 KVA and above shall have 2-2 1/2% taps above and 4-2 1/2% taps below normal
rated primary voltage.

B. Transformers below 30 KVA shall have 2 - 5% taps below normal rated primary voltage.

2.03 SOUND RATING

A. The transformer core and coil shall be mounted on vibration isolator pads. Sound levels shall not
exceed NEMA and ASA Standards. Certified test data shall be submitted at the request of the
Engineer.

2.04 ENCLOSURE

A. The transformer shall be protected by a ventilated metal enclosure. Ventilating openings shall have
baffles. The enclosure shall be degreased, cleaned, phosphatized, primed and finished with baked
enamel.

2.05 MANUFACTURER

A. Transformers shall be GE, Siemens, Cutler Hammer, Square "D", or approved equal.

PART 3 - EXECUTION

3.01 MOUNTING

A. Transformers shall be floor mounted unless shown otherwise on the drawings.

B. Transformers shown to be suspended from building structural members shall do so on 4 steel rods
unless directed otherwise, as high as possible, or at height directed. The contractor shall supply
additional supports as may be required due to size and weight.
C. Transformers shall not be mounted above lay-in ceilings or in areas with restricted ventilation.

D. Where transformers are to be wall mounted, additional support and bracing shall be added to the wall as required to support the weight of the unit.

E. The contractor shall use extreme care to eliminate noise and vibration.

1. On suspended units, install an in-line spring isolator, in each rod, sized in accordance with actual weight of unit installed. In-line isolators shall be Amber/Booth Type PBSR, Consolidated Kinetics Type SRH or approved equal.

2. Floor mounting units shall be mounted on free standing spring isolators sized in accordance with actual weight of unit installed. Floor mounted spring isolators shall be Amber/Booth Type LXS, Consolidated Kinetics Type SM or approved equal.

3. All final connections to transformers shall be made with flexible conduit.

E. Adequate space shall be allowed around all ventilation openings, 6” minimum, or greater as specified by the manufacturer.

3.02 GROUNDING

A. Each transformer shall be grounded as set forth in Section 26 05 26 of these specifications.

END OF SECTION
SECTION 26 24 16.1
PANELBOARDS-LIGHTING/RECEPTACLE

PART 1 - GENERAL

1.01 SCOPE

   A. Furnish and install circuit breaker lighting and/or receptacle panelboards as shown on the drawings and
      as specified herein. Panelboards shall be dead front type manufactured in accordance with
      Underwriter's Laboratories, Inc., standard of panelboards and enclosing cabinets and be so labeled.

   B. Panelboards shall be factory assembled.

   C. Where required, lighting/receptacle panelboards shall be labeled for use as service entrance equipment.

PART 2 - PRODUCTS

2.01 PANELBOARD BOXES

   A. Panelboard boxes shall be fabricated from sheet steel (galvanized or equivalent rust-resistant). The size
      of the wiring gutters and gauge of steel shall be in accordance with NEMA and U.L. Standards for
      panelboards unless shown or specified to be larger.

   B. Boxes shall not be furnished with pre-punched knockouts except where otherwise noted.

   C. Boxes for panelboards shall be 20 inches wide.

2.02 PANELBOARD FRONTS AND TRIMS

   A. Fronts shall be designed for surface or flush mounting as shown on the drawings and shall include
      hinged door, lock and latch.

   B. Fronts for flush panels shall overlap the box by a minimum of 3/4 inch all around. Surface fronts shall
      have the same overall dimensions as the box.

   C. Fronts shall be secured to one side of the enclosure with screws and hinged to allow entire cover
      assembly to be opened to provide access to bussing and panelboard live parts without removal of the
      complete cover. A hinged inner door, with key lock, shall provide access to circuit breaker trip handles
      only and shall expose no live parts.

   D. Fronts shall be Code gauge steel with interior and exterior surfaces cleaned and finished with gray
      baked enamel over a rust-inhibiting phosphatized coating.

   E. Locks shall be flush, cylinder type, held in place by concealed screws to a captive nuts welded to the
      inside of the door. All panelboard locks shall be keyed alike.

   F. A framed circuit directory with clear plastic cover shall be affixed to the inside of the door.

   G. Panelboards shall have no exposed or accessible live parts when the front is installed whether the door
      is open or closed.
2.03 PANELBOARD BUS ASSEMBLY

A. Bus bars shall be silver plated copper. All connectors shall be plated.

B. Bussing shall be arranged for distributed phase arrangement so that one, two, and/or three pole breakers may be installed in any location. The removal, replacement or installation of circuit breaker units shall be allowable without disturbing adjacent units and without drilling or tapping.

C. Ampacity, service voltage, service entrance (main breakers or lugs) and branch breakers shall be as shown on the drawings.

D. Neutral bars shall be full sized and equipped with lugs to accommodate all conductors to be connected. Where indicated, neutral bars and feeder lugs shall be rated for doubled neutral conductors.

E. Ground bars shall be furnished in all panelboards, equipped with lugs to accommodate all conductors to be connected. Where more than one ground bar is furnished, each shall be interconnected with a conductor sized not less than the panelboard feeder grounding conductor.

F. Panelboards having more than 42 poles shall be furnished in equal bus sections not exceeding 42 poles each, and mounted in equal sized enclosures.

2.04 CIRCUIT BREAKER ARRANGEMENT

A. Circuit breakers shall be bolt-on, factory installed.

B. The entire left row shall be filled, then begin top right.

C. Breakers shall be numbered vertically beginning top left. Multi-section panelboards shall be numbered consecutively through all sections.

D. Circuit breaker numbers shall be plastic or metallic, permanently attached to trim. Stick-on paper numbers will not be accepted.

2.05 CIRCUIT BREAKERS

A. Circuit breakers shall be quick-make, quick-break, thermal magnetic, trip indicating, molded case type, alternating current. Breakers shall trip free of the handle and tripping shall be indicated by the handle assuming a position between "OFF" and "ON". Multiple pole breakers shall have internal common trip with single operating handle; external handle ties are not acceptable.

B. Single pole breakers shall be UL listed as "Switching Breakers" and shall carry the "SWD" marking.

C. Breakers shall be bolt-on type.

D. Where noted on the panelboard schedule or on the plans ground fault circuit protection breakers shall be provided:

1. Circuit breakers sized 15 ampere, 20 ampere, and 30 ampere, 1 and 2 pole, shall have integral Class A ground fault protection (5 milliampere sensitivity). This feature shall not require additional panelboard space.

2. Circuit breakers sized 40 amperes and above and all 3 pole units shall utilize external sensors.
and control circuit breakers via shunt trip units. Sensitivity shall be adjustable from 4 to 12 amperes. Each circuit breaker unit shall be equipped with all necessary wiring, hardware, etc., required for a complete independently functioning unit. Current transformers and controls may be externally mounted to panelboards in NEMA 1 enclosures or if space permits, mounted in panelboard enclosure. Reset controls shall be readily accessible and shall not require the removal of panelboard covers, etc.

E. Main Breakers shall be industrial frame equal to GE “E” frame.

F. Other breaker accessories shall be furnished as shown on the drawings.

2.06 PANELBOARD EQUIPMENT SHORT CIRCUIT RATING

A. Each panelboard, as a complete unit, shall have a short circuit current rating equal to or greater than the integrated equipment rating shown on the panelboard schedule or on the plans. This rating shall be established by testing with the overcurrent devices mounted in the panelboard. Where rating is not shown larger on the drawings, the minimum integrated equipment short circuit rating shall be 10,000 amperes symmetrical. Panelboards shall be marked with their maximum short circuit current rating at the supply voltage.

2.07 SPECIAL REQUIREMENTS

A. Any special requirements on the drawings, such as for increased interrupting rating, ground fault protection, etc., shall supersede these specifications, but only insofar as that particular requirement is concerned.

B. Manufacturer’s data on actual equipment electrical service requirements shall be utilized for selection of overcurrent protective device ratings. Verify equipment coordination with the electrical contractor as set forth in Section 16011 of these specifications.

C. Changes in overcurrent protection device ratings to coordinate with actual equipment electrical service requirements shall be provided at no additional cost.

D. Panelboards larger than 400A shall conform to the requirements for power panels.

2.08 SPARE CIRCUIT BREAKERS AND SPACES

A. Each panelboard shall be equipped with spare 20 ampere, 1 pole circuit breakers and full circuit breaker frame size, 1 pole spaces each equipped with necessary bussing and hardware for installation of additional circuit breakers. Unless noted otherwise on the drawings, each panelboard shall be equipped with spare 20 ampere, 1 pole circuit breakers in quantity no less than 10% of the active circuit breaker pole spaces and 20% space only units for full size, 1 pole circuit breakers.

2.09 MANUFACTURER

A. Panelboards shall be as manufactured by GE, Siemens, Square “D”, Cutler Hammer or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. All panelboard dimensions shall be carefully checked and coordinated with the proper trades to ensure proper mounting space and support.
B. Panelboards to be surface mounted on exterior walls shall be secured to two (2) vertical runs of 7/8" x 1-5/8" steel strut each 8'- 0" minimum in length and securely anchored to the wall by means of lead anchors or toggle bolts.

C. Wiring in panelboard gutters shall be done in a neat and workmanlike manner. Wiring shall be grouped into neat bundles and secured with NON-METALLIC tie wraps.

D. Panelboard directories shall be typewritten and shall be field verified by the contractor to ensure accuracy. Directories shall include adequate descriptions to allow accurate identification of the load and location served.

END OF SECTION
PART 1 - GENERAL

1.01 SCOPE

A. Furnish and install power panelboards as shown on the drawings and as specified herein. Power panelboards shall be dead front type, manufactured in accordance with Underwriter's Laboratories, Inc., standard of panelboards and enclosing cabinets and be so labeled.

B. Panelboards shall be factory assembled.

C. Panelboards shall contain circuit breakers as shown in the panelboard schedule on the drawings.

D. Panelboards shall be labeled for use as service entrance equipment where required.

PART 2 - PRODUCTS

2.01 PANELBOARD BOXES

A. The panelboard assembly shall be enclosed in a sheet steel cabinet of rigidity and gauge as specified in UL Standards 50.

B. Single section cabinets shall not exceed 72 inches in height unless noted otherwise on the drawings. Boxes shall have a minimum width of 26 inches. Clear space from bottom of lugs to bottom of gutter shall be in accordance with U.L. Standards.

C. Panelboard boxes shall be galvanized or equivalent rust-resistant.

D. The size of the wiring gutter shall be in accordance with U.L. Standards 67 except where noted to be larger.

2.02 PANELBOARD FRONTS AND TRIMS

A. Surface mounted power panelboards shall not be equipped with a separate door to conceal overcurrent protection devices unless noted otherwise on drawings or specified herein. Each top, bottom and side wireway shall be provided with an individual wireway section cover secured to the panelboard enclosure with screws.

B. Surface mounted power panelboards shall be equipped with fronts which have the same overall dimensions as the box.

C. Flush mounted power panelboards shall be equipped with a separate door to conceal overcurrent protection devices. Flush fronts with doors shall overlap the box by a minimum of 3/4 inch all around.

D. Fronts shall have interior and exterior steel surfaces cleaned and finished with gray baked enamel over a rust-inhibiting phosphatized coating.

E. Panelboards shall have no exposed or accessible live parts when the front is installed.

F. Where a panelboard door is required, the cabinet front shall be made from a single sheet of full finished steel with a door cutout to form a door frame. Doors shall flush mount in the face of the trim attached by a full height piano hinge. Doors 48" and under shall be secured with a cylinder lock held in place by concealed screws and captive nuts welded to the inside of the door; doors which exceed
48" shall be equipped with a three-point latch. All panelboard locks shall be keyed alike. A framed circuit directory with clear plastic cover shall be affixed to the inside of the door.

G. Power panelboard fronts with doors shall be of double hinged door construction. The entire cover assembly shall be hinged and secured closed with screws. The cover assembly shall open to provide access to bussing and panelboard live parts without removal of the complete cover. The hinged inner door shall provide access to circuit breaker trip handles only and shall expose no live parts.

2.02 PANELBOARD BUS ASSEMBLY

A. Power panelboard bussing shall be rated as shown in the panelboard schedules on the drawings. Such ratings shall be established by heat rise test with maximum hot spot temperature on any connector or bus bar not to exceed 50 degree C. rise above ambient, at full rated load.

B. Bussing shall be silver plated copper.

C. Ampacity, service voltage, service entrance (main breakers, main switches or lugs) and branch breakers shall be as shown on the drawings.

D. Neutral bars shall be full sized and equipped with lugs to accommodate all conductors to be connected. Where indicated, neutral bars and feeder lugs shall be rated for double neutral conductors.

E. Ground bars shall be furnished in all panelboards, equipped with lugs to accommodate all conductors to be connected. Where more than one ground bar is furnished, each shall be interconnected with a conductor sized not less than the panelboard feeder grounding conductor. Each ground bus shall be sized 25% minimum of panelboard bussing.

2.03 CIRCUIT BREAKERS

A. Circuit breakers shall be arranged so that the face of each breaker shall be flush with the other breakers. Large permanent, individual circuit numbers shall be affixed to each breaker in a uniform position. Tripped indication shall be clearly shown by the breaker handle taking a position between "ON" and "OFF". The breaker ampere rating shall be clearly visible when the breaker is installed in the panelboard. Unless otherwise shown on the drawings or specified, circuit breakers shall be standard molded case type.

B. Circuit breakers shall be bolt-in or, where panelboard bus is of I-line construction, shall be equipped with bolted bus connectors.

C. Standard Molded Case Circuit Breakers: shall be quick-make, quick-break, thermal magnetic type for alternating current. Each pole shall provide inverse time delay overload and instantaneous short circuit protection. Multi-pole breakers shall be internal common trip with single operating handle. Circuit breakers shall be trip free so that contacts cannot be held closed against abnormal circuits. Breakers shall be completely enclosed in a molded case and shall be GE "E" frame or larger.

D. Current Limiting Circuit Breakers:

Where noted on the drawings to be current limiting (CLF or CLB) circuit breakers shall be energy limiting type with a maximum interrupting rating of 100,000 RMS. Current limiting circuit breakers shall be of molded case construction and shall consist of a common trip, thermal-magnetic circuit breaker with an independently operating limiter section in series with each pole. Current limiting circuit breakers shall meet the requirements for standard molded case breakers but shall include in addition a limiter section. The limiter section shall consist of current limiting elements electrically coordinated with the conventional circuit breaker trip elements. The current limiter section shall
insure that all breaker poles are opened simultaneously. Where fuses are used to accomplish current limiting they shall have blown fuse indicators. The breaker shall automatically trip and remain open when a fuse is blown or the limiter section cover plate is removed. Where current limitation is by means of electromagnetic and electrodynamic operation the current limiter section shall automatically reset.

E. Circuit breakers 200 amperes and larger shall be provided with Adjustable Long Time, Long Time Delay, Short Time, Short Time Delay and Instantaneous trip functions.

2.05 PANELBOARD EQUIPMENT SHORT CIRCUIT RATING

A. Each panelboard, as a complete unit, shall have a short circuit current rating equal to or greater than the integrated equipment rating shown on the panelboard schedule or on the plans. This rating shall be established by testing with the overcurrent devices mounted in the panelboard. Where the rating is not shown larger on the drawings the minimum integrated equipment short circuit rating shall be 18,000 amperes symmetrical. Panelboards shall be marked with their maximum short circuit current rating at the supply voltage and shall be UL listed.

2.06 SPECIAL REQUIREMENTS

A. Any special requirements on the drawings, such as for increased interrupting rating, ground fault protection, etc., shall supersede these specifications, but only insofar as that particular requirement is concerned.

B. Manufacturer's data on actual equipment electrical service requirements shall be utilized for selection of overcurrent protective device ratings. Verify equipment coordination with the electrical contractor as set forth in Section 16011 of these specifications.

C. Changes in overcurrent protection device ratings to coordinate with actual equipment electrical service requirements shall be provided at no additional cost.

2.07 SPARE CIRCUIT BREAKERS AND SPACES

A. Each panelboard shall be equipped with spare circuit breakers as shown on the drawings.

B. Each panelboard shall be equipped with full circuit breaker frame size, 1 pole spaces each equipped with necessary bussing and hardware for installation of additional circuit breakers. Unless noted otherwise on the drawings, each panelboard shall be equipped with space only units for full size, circuit breakers in quantity no less than 20% of the active circuit breaker pole spaces.

2.08 MANUFACTURER

A. Panelboards shall be as manufactured by GE, Siemens, Square "D", Cutler Hammer, or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. All panelboard dimensions shall be carefully checked and coordinated with the proper trades to ensure proper mounting space and support.

B. Panelboards to be surface mounted on exterior walls shall be secured to two (2) vertical runs of 7/8" x 1-5/8" steel strut each 8'- 0" minimum in length and securely anchored to the wall by means of lead anchors or toggle bolts.
C. Wiring in panelboard gutters shall be done in a neat and workmanlike manner. Wiring shall be grouped into neat bundles and secured with approved NON-METALLIC tie wraps.

3.02 BRANCH CIRCUIT IDENTIFICATION

A. Each branch circuit overcurrent device installed in a power panelboard shall be identified by an engraved nameplate mounted adjacent to the device. Nameplates on fusible devices shall state circuit identification and fuse size.

END OF SECTION
SECTION 26 27 26
BASIC DEVICES

PART 1 - GENERAL

1.01 SCOPE

A. This section outlines the quality and requirements of the Basic Devices, switches, receptacles, etc., to be used and the installation instructions for the devices.

PART 2 - PRODUCTS

2.01 WIRING DEVICES

A. Switches and receptacles shall be specification grade AC type as manufactured by Hubbell, Leviton or P & S.

B. Switches shall be silent operation toggle rated 20 amperes, 120/277 volts AC. All switches shall be equipped with screw terminals for bonding grounding electrode conductors. Switches shall be Hubbell CSB120 series or equal.

C. Receptacles shall be side wired, specification grade, in NEMA configuration as shown on drawings. Unless otherwise noted, general use outlets shall be 20 ampere, 120 volt duplex receptacles, Hubbell Catalog #5362 or equal.

D. Where noted on the drawings, and/or required by code, receptacles shall be GFCI protected by integral Class “A” ground fault protection (5 milliampere sensitivity). Unless noted otherwise all “GFI” receptacles shall be duplex, rated 20 amperes, 120 volts with “TEST” and “RESET” buttons and feed through feature for ground fault protection of all devices on the load side of the unit. "GFI" receptacles shall be Hubbell Catalog #GF-5362 or equal.

2.02 PLATES AND ACCESSORIES

A. All devices shall have proper plates, trim, etc.

B. Plates shall be standard size and of the same manufacturer as devices. Oversize plates are not acceptable.

C. Where plates are required to be engraved, the engraving shall be 3/16 inch high. Letters shall be permanent, non-smear black. Stamping shall not be considered equal to engraving.

D. Plates shall be 302 stainless steel or brass except where other-wise specified or noted on the drawings.

E. Receptacles installed in wet locations shall be equipped with a device plate and hinged outlet cover assembly which is UL listed for wet locations while in use. Receptacles shall be listed for use in wet locations. The hinged cover shall be gasketed on the top and sides and equipped with reliefs on the bottom to permit cords to exit while the cover is closed. The cover shall also be gasketed to seal to the outlet box. Wet location covers shall be manufactured by TayMac or approved equal.

F. Surface mounted devices with exposed conduit in unfinished areas shall have galvanized metal plates with rounded edges.
2.03 FINISHES

A. Devices and plates shall be grey with stainless steel, brown with brass, grey with galvanized metal.

PART 3 - EXECUTION

3.01 MOUNTING HEIGHTS AND LOCATIONS

A. Symbols on drawings and mounting heights are approximate. Exact locations and mounting heights shall be determined on the job and it shall be the Contractor's responsibility to coordinate with all trades to ensure correct installation, i.e., over counters in or above back-splashes, in block walls, tile, and other specific construction features.

B. Outlets, unless otherwise shown shall be located with the center line of outlet boxes the following distance above the finished floor:
   - Receptacles, General: 1'-6"
   - Telephone Outlets: 1'-6"
   - Receptacles Over Counters: 3'-8" or 2" above backsplash
   - Switches, General: 4'-0"
   - Fire Alarm Manual Stations: 4'-0" (handle)
   - Fire Alarm Visual Alarm Devices: 6'-8"
   - Clock Outlets: 7'-6"
   - Bells, Interior: 7'-6"
   - Bells, Exterior: 10'-0"

C. All device mounting heights shall be in accordance with the Americans with Disabilities Act (ADA) and all Federal, State, and Local requirements for making buildings accessible to the handicapped.

3.02 GENERAL MOUNTING

A. Verify all door swings with Architectural. Locate boxes for light switches within 4 inches of door trim on the strike side.

B. Where switches are shown grouped together they shall be installed under a single plate. Where required, barriers shall be provided in the outlet box.

C. Where receptacles, telephone outlets, and auxiliary system outlets are shown on the drawings grouped together they shall be installed with 4 inches between outlets.

D. All receptacles installed out of doors and in bathrooms, kitchens, break rooms, laundry rooms, attics, basements etc, and within 6'-0" of sinks, showers or normally wet or damp locations shall be GFCI protected.

E. All receptacles for vending machines and drinking fountains shall be GFCI protected.

F. All GFCI protected receptacles or devices shall be located to be readily accessible for reset without moving appliances or equipment and without requiring the use of ladders.

G. Devices and associated plates shall not be used as support. Outlet boxes shall be rigidly supported from structural members.

3.03 SAFETY OUTLETS

A. All receptacles in areas accessible to children under twelve years of age shall be tamperproof, GFCI protected.
B. All receptacles in areas accessible to students on the first floor shall be tamperproof, GFCI protected

END OF SECTION
SECTION 26 28 13
FUSES

PART 1 - GENERAL
1.01 SCOPE
   A. Furnish and install fuses as shown on the drawings and specified herein.

1.02 MANUFACTURER
   A. Fuses shall be as manufactured by Bussman Manufacturing Company, Shawmut, Littlefuse, or approved equal. Numbers shown in this Specification are those of Bussman.

PART 2 - PRODUCTS
2.01 FUSES
   A. Shall be time-delay type U.L. listed with a minimum interrupting rating of 100,000 amperes symmetrical.
   B. Shall be dual element, Fusetron.

PART 3 - EXECUTION
3.01 INSTALLATION
   A. Fuses shall be sized as shown on Drawings.
   B. One spare set of fuses shall be furnished for each size used. One additional spare set of fuses shall be furnished for each five sets of same size fuses used.

END OF SECTION
SECTION 26 28 16.1
SAFETY SWITCHES

PART 1 - GENERAL

1.01 SCOPE

A. This section deals with fused and non-fused safety switches.
B. All safety switches shall be NEMA Heavy duty type.

1.02 SERVICE RATING

A. Where required, safety switches shall be labeled for use as service entrance equipment.

PART 2 - PRODUCTS

2.01 SAFETY SWITCHES

A. Shall be quick-make, quick-break, fused or non-fused as shown. Switch blades shall be fully visible in the off position with the door open.
B. General use fusible switches shall have provisions for dual element fuses, UL Class K-5.
C. Disconnect switches for isolating motors served by VFD’s shall have one set of form “C” auxiliary contacts as required by the VFD equipment supplier to signal the VFD to shut down if the switch is opened while the motor is running.
D. The switch cover shall have a defeatable dual interlock to prevent inadvertent opening of the cover with the switch in the "ON" position. Handles shall provisions for padlocking in the "OFF" position.
E. Switches shall be horsepower rated.

2.02 NEUTRALS

A. Insulated neutrals bars shall be furnished in all safety switch enclosures which contain neutral conductors.

2.03 GROUND BARS

A. Ground bars shall be furnished in all safety switch enclosures.

2.04 MANUFACTURER

A. Switches shall be as manufactured by Square "D", Siemens, Cutler Hammer or approved equal.

PART 3 - EXECUTION

3.01 SAFETY SWITCHES

A. Safety switches shall be installed as shown on the plans and in accordance with the NEC.
B. Disconnect switches for motors shall be rated in horsepower and shall be sized for motor served.
C. Disconnect switches for non-motor loads shall be sized in accordance with equipment full load current.
D. Disconnect switches for isolating motors served by VFD's shall have 2 #12 control conductors, run with the service conductors from the VFD, to connect the form "C" auxiliary contacts in the disconnect switch to the VFD to shut down the VFD if the switch is opened while the motor is running. Provide an engraved white micarta nameplate with ¼" black letters at each motor isolation switch stating:

"CAUTION, THIS SWITCH IS FOR ISOLATION PURPOSES ONLY, DO NOT OPEN UNDER LOAD. THIS MOTOR IS SERVED BY A VFD IN ROOM ____. THE DISCONNECT IN THE VFD MUST BE OPENED PRIOR TO SERVICING THIS MOTOR.

E. Safety switches installed indoors, in dry locations, shall be NEMA I. Safety switches installed in locations subject to moisture shall be rain-tight, NEMA 3R, except where other types of enclosures are shown on the plans.

F. Adequate support shall be provided for mounting safety switches. Safety switches shall be securely attached to building structure in all possible instances.

END OF SECTION
SECTION 26 50 00

LIGHTING MATERIALS AND METHODS

PART 1 - GENERAL

1.01 SCOPE

A. This section outlines the quality and installation requirements for lighting fixtures, LED’s, drivers, pole mounted luminaires, poles and mounting hardware.

B. Lighting fixtures shall be manufactured in accordance with Underwriter’s Laboratories, Inc., and so labeled.

C. All LED fixtures shall be provided with a full five (5) year replacement warranty.

PART 2 - PRODUCTS

2.01 FIXTURES

A. Lighting fixtures shall be furnished as shown in Lighting Fixtures Schedule on drawing.

B. It shall specifically be the responsibility of the Contractor to verify the exact type ceiling and depth of all recessed fixtures and to furnish correct mounting trims and accessories for the specified and/or approved fixtures as required for the ceiling in which the fixtures are to be installed.

C. Recessed fixtures shall be equipped with pre-wired junction boxes and mounting hardware as required.

D. Recessed fixtures shall be rated for type ceiling installed. Units installed in insulated or lay-in ceiling shall be either insulated ceiling (IC) rated or shall be thermally protected (TP).

E. Each luminaire shall be equipped with a line side disconnecting means in compliance with NEC Article 410.73, paragraph G.

2.02 LED LUMINAIRES AND DRIVERS

A. All Luminaires


2. Comply with IES LM-80-08 Approved Method for electrical and photometric measurement of SSL product.

3. Comply with In-Situ testing for more reliable results.

4. LED’s shall be Restriction of Hazardous Substances Directive (RoHS) compliant.

5. LED arrays shall be sealed, high performance, long life type; minimum 70% rated output at 50,000 hours.

6. LED luminaires shall deliver a minimum of 60 lumens per watt. LED’s shall be “Bin No. 1” quality.

7. Drivers shall be solid state and accept 120 through 277 VAC at 60 Hz input.
8. The LED light source shall be fully dimmable to 1% with use of compatible dimmer switch designated for low voltage loads.

9. LED color temperatures:
   - CRI> 85, 2700°K as noted +/- 145°K.
   - CRI> 85, 3000°K as noted +/- 200°K
   - CRI> 85, 4000°K as noted +/- 275°K.
   - CRI> 85, 5000°K as noted +/- 283°K.

10. Luminaires shall have internal thermal protection.

11. Luminaires shall not draw power in the off state. Luminaires with integral occupancy, motion, photo-controls, or individually addressable luminaires with external control and intelligence are exempt from this requirement. The power draw for such luminaires shall not exceed 0.5 watts when in the off state.

12. Color spatial uniformity shall be within .004 of CIE 1976 diagram.

13. Color maintenance over rated life shall be within .007 of CIE 1976.

14. Indoor luminaires shall have a minimum CRI of 85.

15. Luminaire manufacturers shall adhere to device manufacturer guidelines, certification programs, and test procedures for thermal management.

16. LED package(s)/module(s)/array(s) used in qualified luminaires shall deliver a minimum 70% of initial lumens, when installed, for a minimum of 50,000 hours.

17. Luminaires shall be fully accessible from below ceiling plane for changing drivers, power supplies and arrays.

18. Luminaires shall be furnished with a 10kV/10kA surge suppressor per IEEE/ANSI C6241 CAT A.

B. Power Supplies and Drivers

1. Power Factor: 0.90 or higher.

2. Maximum driver case temperature not to exceed driver manufacturer recommended operation.

3. Output operating frequency: 60Hz.


5. Total Harmonic Distortion Rating: 10% Maximum.

6. Meet electrical and thermal conditions as described in LM-80 Section 5.0.

7. Primary Current: Confirm primary current with Drawings.


9. Compatibility: Certified by manufacturer for use with individually specified luminaire and individually specified control components.
10. Solid-state control components to be integral or external per each specified luminaire. Remote control gear to be enclosed in Class 1, Class 2, or NEMA 3R enclosures as required.

2.03 STANDBY BATTERY PACKS
A. Standby battery packs installed in fixtures shall be self-contained, factory installed units complete with a Nicad battery pack, charger and transfer mechanism mounted in the with a test button and derangement signal mounted so that unit can be tested or monitored without opening doors, covers, etc.
B. Standby battery packs installed in fixtures shall be capable producing a minimum output of 1400 lumens for a minimum of 90 minutes upon normal power failure.
C. Standby battery packs shall be as manufactured by Chloride, Bodine, IOTA or approved equal.

2.04 STEMS
A. Fixture stems shall be ball aligner type, swivel below canopy, 30 degrees from vertical and shall be painted to match fixture trim.
B. Individually mounted fixtures shall be threaded into ball aligner sockets which are suspended from fixture studs, 3/8 inch minimum, in a ceiling outlet box secured to building structural members.
C. In finished areas stems shall be painted to match fixtures.

PART 3 - EXECUTION
3.01 INSTALLATION OF FIXTURES
A. Support of all fixtures shall be responsibility of the Electrical Contractor.
B. Lay-in fixtures for grid type ceilings:
   1. Shall be supported independently of the ceiling grid, from ceiling structural, at 4 points.
   2. Shall each be independently wired from an above ceiling junction box by a flexible conduit not exceeding 6'-0" nor less than 4'-0" in length. Under no circumstances shall grid fixtures be nipple together.
   3. Troffers installed in gyp board ceilings shall be lay-in type for mounting in grid ceilings and furnished with ceiling frame kits to be mounted in the ceiling and permit the troffer to be wired with flex and dropped-in as in a grid ceiling installation. Each frame shall be supported at 4 points from structure above ceiling.
C. All flex shall contain an insulated grounding conductor secured to fixture body and junction box by means of bonding screws.
D. Ceiling mounted fixtures shall be supported independently of ceiling or ceiling tiles from structural members of building.
E. Surface mounted light fixtures shall be mounted with provisions for air circulation, generally 1/2" minimum.
F. Fixtures in continuous rows, other than recessed grid type, shall be connected by nipples with locknuts and bushings and wired together through fixture channels.
G. Suspended fixtures shall be chain hung and wired with flexible cord from a ceiling mounted outlet box.

H. Stems on individual fixtures shall utilize ball aligner sockets secured to fixture studs in ceiling outlet boxes. Safety chains shall be secured from ceiling structural to the fixture body to prevent the fixture from falling in the event the normal mounting should fail. Large surface or pendant incandescent luminaires (in excess of 20 pounds) shall be secured with a 3/8" rod run through the outlet box to structure above and anchored independent of ceiling and conduit systems.

I. All stems utilized for electrical service to light fixtures shall contain an insulated grounding conductor secured to fixture body and junction box by means of bonding screws.

3.02 WARRANTY

A. Fixtures shall be furnished with a five (5) year manufacturer replacement warranty.

END OF SECTION
SECTION 28 31 00
FIRE ALARM SYSTEM / LIFE SAFETY SYSTEM

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. This section is a Division 28 Basic Electrical Materials and Methods section, and is part of each Division 28 section making reference to fire alarm systems.

B. Drawings and General Provisions of the contract, including General and Supplementary Conditions, Division 01 Specification sections and all Division 28 sections, apply to this section.

1.02 DESCRIPTION

A. Provide all design, equipment, installation and testing for the system herein described and obtain the Authority Having Jurisdiction’s acceptance.

B. Quantity or Placement of Devices: This specification makes no representation to the quantity or location of devices required to satisfy the authority having jurisdiction. It is the responsibility of the Contractor to coordinate with the Authority Having Jurisdiction to ensure that the completed installation satisfies all requirements of the governing codes.

1.03 SIGNAL SUBCONTRACTOR

A. The Signal Subcontractor shall submit written certification that the proposed fire alarm system complies with the following. These certifications shall accompany submittals:

1. Compliance with NFPA Standards 72, 101 and 110 as applicable. The design, engineering and construction will be in accordance with Unified Facilities Criteria (UFC) 4-740-06 and UFC 3-600-01.

2. All equipment installed in the system including the interconnecting wiring is UL listed for the purpose and appropriately cross listed.

3. All equipment installed in the system including the interconnecting wiring is UL listed for the purpose and appropriately cross listed.

4. UFC 4-021-01 Compliant Mass Notification/Life Safety System.

B. A proposed maintenance agreement contract for this project shall be included with submittals indicating:

1. The installation is covered by a maintenance agreement between the Government and a UL listed fire alarm company whereby the service company issuing the certificate bears responsibility for inspecting, testing, maintaining, and providing any necessary repairs.

2. Documentation is maintained on the alarm system including description of system operation, location of alarm equipment throughout the area protected, initial acceptance tests and the performance of periodic testing and maintenance.
3. An executed maintenance agreement for the system shall also be forwarded to the Contracting Officer, upon certification of this fire alarm system, for the Contracting Officer’s consideration in selecting a system maintenance and confidence testing fire alarm company.

C. Authority Having Jurisdiction: The Authority Having Jurisdiction for this project is to be determined by the Contractor.

1.04 LISTING REQUIREMENTS

A. Listing Requirements: All fire detection and alarm components furnished under this section shall be UL listed in the fire equipment list or FM, approved for fire signaling or fire suppression use. All accessory equipment shall be manufactured with UL listed components.

B. Reference Standards (Edition currently adopted by Authority Having Jurisdiction):

   - NFPA 72 National Fire Alarm Code
   - UFC Uniform Fire Code
   - UFC 4-021-01 Mass Notification Systems, Unified Facilities Criteria (UFC)
   - UFC 3-600-01 Fire Protection Engineering for Facilities Unified Facilities Criteria (UFC)
   - NFPA 70 National Electrical Code with local amendments
   - NFPA 110 Standard for Emergency and Standby Power Systems
   - UMC Uniform Mechanical Code (duct smoke detectors) with local amendments
   - ADA American Disabilities Act

1.05 DRAWINGS AND DOCUMENTATION

A. Fire Alarm / Mass Notification System Drawings:

1. The Contractor shall evaluate, evacuate and prepare a voice system design as required for proper detection and alarm annunciation consistent with the characteristics of the products he proposes to incorporate into the system.

2. Contractor shall prepare a design which includes all design equipment and installation necessary to obtain Authority Having Jurisdiction acceptance.

B. Submittal Data:

1. Design and Installation Drawings:

   a) Drawings shall be reproduced electronically in digital format in DXF format on 24”x36” velum plots or approved equal. Submitted drawings shall have Authority Having Jurisdiction approval marked thereon. Layout plan drawings, interconnect drawings, and wiring diagrams submitted without Authority Having Jurisdiction approval will not be reviewed.
b) Show a general layout of the complete system including equipment arrangement. It shall be the responsibility of the fire alarm contractor to verify dimensions and assure compatibility all other systems interfacing with the fire alarm system.

c) Identify on the drawings the Class A raceway system and conductor sizes and types with number of conductors in each conduit. Provide each raceway and device with a unique alphanumeric identification.

d) Indicate on the point to point wiring diagrams, interconnecting wiring within the panel between modules, and connecting wiring to the field device terminals.

e) Designs of attachments to building structure shall meet the requirements of UBC, Seismic Zone as directed by Authority Having Jurisdiction. Submit detailed mathematical analysis of the design.

f) Interconnect Drawings: Show only external connections between equipment and devices. All wires shall be identified with alphanumeric designators and all termination points shall show the correct terminal identification.

g) Wiring Diagrams: Show the general physical arrangement of the component parts of the equipment and the connection of all internal wiring. All components, wires, terminal strips and terminals shall be identified with alphanumeric designators. Wiring system shall be Class A.

h) Equipment mounting details: Show the mounting location for all floor and wall mounted equipment including distance from floor and column lines, and fabrication details for all special mounting brackets. Details shall also provide any special installation instructions. These details may be included on the plan drawings if space allows.

i) Layout Plan Drawings: Show every device provided under this section in its relative spatial location. Sections and elevations shall be utilized as necessary to accurately describe the installed location of all devices.

2. Provide voltage drop calculations indicating the system ability to furnish power at a minimum of 90 percent of nameplate listing in a standby power condition with all devices in alarm utilizing the proposed wire type and size. It shall be demonstrated that no single wire run between a circuit and its most remote device exceeds the manufacturers recommendations for wire length, circuit resistance or circuit wire to wire and wire to ground capacity.

3. Itemize all battery loads under standby and alarm conditions. Auxiliary power supplies and transponder battery calculations shall demonstrate the ability of the batteries to supply the required secondary power for a period of twenty four hours with no external power applied and furnish power for worst case alarm signaling for five minutes at the end of this period with all devices in alarm and all device LED's lighted. Battery sizing shall be at a factor of 1.5 times the results of this mathematical requirement to account for battery aging between replacements and for system modifications and expansions.

4. Catalog sheets: Show the color, configuration and dimensions of the equipment or device described. Provide technical specifications, such as operating voltage, operating temperature and humidity limitations, mounting and wiring information and a description of the function and operation of the device.
5. Recommended Spare Parts List: Submit a listing of all devices and components recommended for Contracting Officer purchase as spare parts to support the system herein. The list shall include recommended quantities for all items. Unit prices guaranteed for 90 days after submittal shall be listed for all items.

6. Scheduled Testing: Include step-by-step procedures for performance testing every fire alarm device and system output to demonstrate functionality in accordance with specification requirements.

7. Operation and Maintenance Manuals: Refer to Division 26, Section ‘Common Work Results for Electrical Systems’. Manuals shall be typewritten or printed instructions which contain the following minimum information:
   a) Complete operating instructions
   b) Preventative maintenance instructions
   c) Catalog sheets on all devices and equipment
   d) Manufacturers operation and maintenance instructions
   e) Reduced 11”x17” copies of all system drawings

8. Record Drawings: All review drawings shall be revised to reflect the accurate As-Built condition. Working plans shall show actual, accurate locations of devices, and actual routing of conduit and location of end of line devices. The Contractor shall provide five sets of vellum plots and three electronic CD’s of the Record Drawings.

1.06 DESIGN REQUIREMENTS

A. The system shall provide for multiple zones of alarm including the following:
   1. Sprinkler water flow and tamper switch(es)
   2. Smoke detection
   3. Heat detection
   4. Cooking hood fire suppression
   5. Other fire suppression systems
   6. Manual pull stations
   7. Spares
   8. Mass Notification
   9. Class A Wiring System in ¾” conduit
   10. Provide other additional zones as required by Authority Having Jurisdiction
   11. Provide single mode 2-strand fiber optic cable to fire alarm cabinet from Base demarc backboard in inner duct within 1” conduit, per facility standards.
   12. Reader boards shall be electronic at all exit door locations.
   13. Provide wireless transceivers for reporting all zones to facility Fire Department with 12 spare zones.

B. Thermal detectors:
   1. Shall be provided to detect a high temperature condition in required areas.
   2. Thermal detectors shall be located in accordance with guidelines in NFPA 72E or manufacturers UL (or FM, if applicable) listed spacing.
   3. Thermal detectors shall not be installed immediately above heating appliances.
4. Thermal detectors, rated as required, shall be provided to detect a high temperature condition in ceiling and roof structure cavities as required by code authority.

C. A combination of ionization and photoelectric detectors shall be provided to detect fire conditions in the required areas. Detectors shall be installed where required by the Authority Having Jurisdiction. Detectors shall be located in accordance with the NFPA guidelines on the spacing not to exceed 30 lineal feet and 900 square feet.

D. A rechargeable battery supply shall be provided to automatically operate the entire fire detection and alarm system, including detectors, control panel, remote fire annunciator, alarm sounding devices and auxiliary control equipment (unless otherwise specified herein) in the event of a loss of primary power for 72 hours. The batteries shall be sized at 150 percent of size prescribed by code.

E. Manual fire alarm stations, connected to alarm zones, shall be provided as required by the Authority Having Jurisdiction.

F. Audible and visual evacuation alarms shall be provided as required by the Authority Having Jurisdiction and comply with ADA requirements. All notification appliance circuits shall be Class A, Style Z. All notification appliance circuits shall have a minimum circuit output rating of 2 amps at 24 V dc; 50 watts at 25 V audio and 35 watts at 70 V audio. The notification circuits shall be power limited.

G. Remote fire annunciators shall be provided and installed to individually annunciate alarms for each of the fire zones, and a fire alarm control panel (FACP) trouble condition.

H. Provide a weatherproof audible and visual evacuation alarm (95 dB at 10 feet minimum) on building exterior at side of building directed by the Authority Having Jurisdiction.

I. Provide automatic releases for all doors as required by the Authority Having Jurisdiction. Connection to door hardware shall be made as directed by door hardware manufacturer. Coordinate device requirements with doors, hardware, and adjacent mounting surfaces to assure that doors are held in a position acceptable to the Contracting Officer and Authority Having Jurisdiction.

J. System shall be capable of remote monitoring at either a monitoring station or the fire department. Coordinate the interface requirements with the Contracting Officer. Provide remote radio transmitter per Government requirements.

K. Interfaces between air handling and fire suppression systems and the fire alarm system shall be accomplished utilizing interposing relays with a dry contact. See requirements in Divisions 23 and 26. Provide for each zone of alarm and duct detector that actuates in an alarm condition. Coordinate with Divisions 23 and 26 to insure proper sequencing of air handling and fire suppression systems.

L. Provide interface to the mass notification panel to shut down the fire alarm signals both audible and visual, upon a mass notification alarm condition. During any mass notification alert message, the fire alarm horns/strobes shall be silenced so that the mass notification message can be heard throughout.

1.07 SYSTEM OPERATION

A. Activation of any alarm causing device (manual station, smoke detector, water flow switch, heat detector, etc.) shall cause the following actions and indications:
1. Initiate a pre-signal alarm at main control panel, and begin a time delay sequence. If the staff can confirm that the alarm is false, the general alarm shall be cancelled. If the alarm condition is valid, the general alarm shall be initiated after the time delay.

2. Indicate the fire device and/or fire zone on remote annunciators and/or graphic annunciators.

3. Initiate shut down and/or start of supply and exhaust fans through the interposing relays to evacuate or restrain smoke movement.

4. Energize extinguishing systems for containment of the fire where appropriate.

5. Close all fire doors, smoke doors, and fire dampers.

6. Activate the off site alarm (central reporting).

B. Activation of any supervisory condition causing device (tamper switch, valve supervision device, fire pump trouble, generator trouble, low temperature thermostat, low water level) shall initiate a supervisory alarm signal at main control panel, and remote annunciators.

C. Any system trouble caused by wiring failure including open circuits, grounded circuits and shorted circuits on circuitry required to be supervised in this manner; communications loss, device removal, battery low voltage, power loss, charger failure or failure in any device shall cause the following actions and indications:

1. Initiate a fire alarm system trouble signal at the fire alarm control panel.

2. Indicate a trouble condition at remote annunciators and/or graphic annunciators.

D. All signal circuits including evacuation circuits, trouble circuits and supervisory indicating circuits, but not including water flow indication circuits, shall be acknowledged by means of a switch on the control panel front. Subsequent alarm receptions shall cause the alarm signals to resound indicating the reception of a new alarm condition. The signals shall also be caused to resound by the re-operation of the signal silence switch allowing evacuation signaling from the silence switch without keyboard commands when an alarm condition exists.

E. Labels: Indicating lights and controls shall be permanently labeled as to their function.

1.08 ACCEPTANCE TEST PROCEDURE

A. Submit for approval, prior to testing, an acceptance testing procedure meetings the requirements of this section.

B. Submit, for system record, all required data as compiled during installation and testing upon completion of the acceptance testing procedure. This data shall be loose-leaf bound and labeled as system acceptance testing information.

C. Submit for system record, a completed ‘fire alarm/mass notification system certification and description’ as included in NFPA 72, 2016 Edition.
PART 2-PRODUCTS

2.01 EQUIPMENT

A. All equipment shall be new and the latest state of the art equipment as marketed by a single manufacturer. The equipment shall be installed in a fashion consistent with the listings to perform all functions and indications as described herein. All equipment shall be listed for fire alarm system use by the UL or listed by FM. The system shall be comprised of all equipment, software, firmware, raceways, wire and wiring as required to furnish a complete and operating system in full compliance with this specification and the contract documents.

B. Fire Alarm /Mass Notification Control Panel: The FACP shall be the addressable type and modular in construction and shall be comprised of but not limited to the hardware, and software required to perform the required functions. The fire alarm control panel shall consist of:

1. Surface mounted steel cabinet with indicator viewing window, hinged door and cylinder lock, factory finished in baked enamel.

2. System power supplies, including necessary transformers rectifiers, regulators, filters and surge protection as required for system operation, capable of powering the system in a worst case condition with all devices in an alarm condition and local alarm devices lighted without exceeding the listed ratings.

3. System processors capable of processing all incoming alarm signals and issuing any output commands required as a result of the alarm reception.

4. Emergency power supply batteries shall be sealed, gelled-electrolyte, designed for fire alarm service.

5. A completely automatic, solid state battery charger shall be provided to maintain the batteries in fully charged condition. The charger shall be capable of charging the batteries from 75 percent of full charge to 100 percent of full charge within 24 hours.

6. Common module shall supply the power necessary for the FACP and all detectors that require power. A green AC power-on LED shall indicate the normal condition of the system. Common alarm and trouble LEDs, voltage outputs, and relays shall be provided. Individual yellow supervisory LEDs shall be provided for primary AC power failure indication, ground fault detection, reverse polarity feature disconnect, low battery voltage, indicating circuit trouble. An audible trouble signal shall sound when any trouble condition occurs. A silence switch shall be provided to silence the audible signal but the trouble LEDs shall remain lighted until the trouble condition is repaired and the system is reset. To prevent the silence switch from being inadvertently left in an abnormal position, the switch shall be self-restoring and any new trouble occurrence shall reinitate the audible signal.

7. System ground fault detection shall be provided for the entire FACP. Upon detection of a resistance to ground indicating deterioration of the circuit, the common trouble signal shall be activated and the ground fault LED shall light. Fault conditions shall be designated style D for initiating devices and Style 6 for signaling circuit.

8. Provide a reverse polarity circuit that is a distinct circuit utilized for no other purpose. A reverse polarity switch shall be provided for system testing. The reverse polarity yellow LED shall light whenever the reverse polarity circuit is disconnected and a trouble signal shall be indicated. Output terminal connections shall be provided for a central station transmitter. Transmitter is not part of this contract and shall be supplied by the Owner. Provide wire in conduit to the telephone panel.
9. Accessory relay module shall have relays suitable for fan shutdown, damper positioning, and door holder release. Relays shall have a minimum contact rating of five amperes, resistive, at 120 volts AC or 28 volts DC. Screw terminals for wiring terminations shall be provided.

C. Monitoring and Control: The fire alarm control panel shall include the following capabilities and features:

1. Detector real time condition readout in an analog value to allow tracking of detector condition and maintenance. Scheduling as well as performing required NFPA calibrated sensitivity testing. Detectors reaching a pre-defined percentage of the individually programmed alarm setting and maintaining that setting for a period of 24 hours shall display an alarm message to indicate the need for maintenance.

2. The ability to individually assign any automatic smoke detector to perform an alarm verification cycle as defined by the UL to eliminate false alarms as a result of transitory environmental smoke, electrical transients all system processors to accomplish an automatic restart if required, generate a trouble message and revert to the default, stand alone mode if necessary.

D. Remote Annunciators: Remote annunciator panels shall provide visual indication and be dead front construction with nomenclature for alphanumeric annunciation applied with a photo emulsion technology and finish trim in anodized aluminum. Locate adjacent to entry designated by Authority Having Jurisdiction for fire department use. Provide an indicator for each zone. Provide additional indicators as required by the Authority Having Jurisdiction.

E. System Power:

1. Primary power for the FACP and the secondary power battery chargers shall each be obtained from the power panelboard. Connect primary power circuit to emergency generator if available.

2. Secondary Power Supply:

   a) Provide sealed gelled electrolyte batteries as the secondary power supply for the fire alarm control panel and each system transponder. The battery supply shall be calculated to operate its load in a supervisory mode for a period of 72 hours with no primary power applied and at the end of that period operate its alarm mode for a period of fifteen minutes. Batteries shall be sized to carry 1.5 times the calculated size to compensate for deterioration and aging during the battery life cycle. Batteries shall be housed in the control cabinet or a separate cabinet with adequate cell separation to prevent accidental discharge. Batteries shall be equipped with post and nut or one blade terminals. Slip on tap terminals are not acceptable. If housed in a separate cabinet, a fuse block shall be provided within the battery cabinet.

   b) Provide battery charging circuitry for each standby battery bank in the system low voltage power supply or as a separate circuit. The charger shall be automatic in design, adjusting the charge rate to the condition of the batteries. Battery charge rate and terminal voltage shall be read using the fire alarm control panel LCD display in the service mode and indicated directly in volts and amps. Meters reading in percentage are not acceptable. Charger shall be housed in the main fire alarm control panel or the battery cabinet.
F. Manual Stations: Provide double action type with no break glass/plastic bar feature, keyed flush or surface mounted devices as required. Station shall be equipped with terminal strip and pressure style screw terminals for the connection of field wiring. Devices utilizing rotary switches, pins, jumpers or staples are not acceptable. Surface mounted stations shall be mounted using a baked red enamel outlet box. Manual pull boxes shall open with a screwdriver or an Allen wrench.

G. Heat detectors shall be rate compensated type, rated at 135 degrees (except where noted otherwise). Detectors shall be constructed to compensate for the thermal inertia inherent in detectors due to the thermal mass, and alarm at the set point. Detector bases shall be of the twist lock style and shall be provided with an indicating light to verify operation which shall latch on in an alarm condition and screw type pressure terminals for the connection of field wiring. Removal of the detector from its base shall cause a system trouble signal. Devices utilizing rotary switches, pins, jumpers or staples are not acceptable.

H. Photoelectric Smoke Detectors: Light refraction technology smoke detectors shall have a high rejection of false signals caused by electrical noise and electrical transients and shall be capable of being checked for sensitivity without being removed from its twist lock base. The reading of the detector sensitivity shall yield a discrete electrical value for logging and tracking of status to determine the maintenance and cleaning requirements. Detectors not yielding a calibrated value indicating sensitivity shall not be acceptable. The detector shall be readily dissembled to gain access to the detection chamber for cleaning and maintenance. Detectors shall be used for open area protective coverage and shall be insensitive to air velocity.

I. Ionization Smoke Detectors: Dual chamber and self-compensating for ambient temperature and humidity and shall be capable of being checked for sensitivity without being removed from its twist lock base. The reading of the detector sensitivity shall yield a discrete electrical value for logging and tracking of status to determine the maintenance and cleaning requirements. The detector shall be readily dissembled to gain access to the detection chamber for cleaning and maintenance. Detectors shall be used for open area protective coverage and shall be insensitive to air velocity.

J. Duct Detectors:

1. Air duct smoke detectors shall be sampling photoelectric or ionization type for sensing of products of combustion within the air stream of ducted fan systems. The devices shall include necessary sampling tube extensions and sensitivity adjustments for detection of products of combustion across the width of the duct. The device shall actuate upon nominal two percent light obscuration per foot. Visual indication of normal and alarm/trouble shall be incorporated into the exposed surface of the device. Auxiliary contacts shall be provided for connection to stop the respective fan system. Wiring for fan shut down shall be installed by the Contractor.

2. The detectors furnished shall be approved for use in environments as covered by FM, UL 268a and UL 268. Detectors furnished shall be available in the following configurations to serve all possibilities:

   a) High Velocity: As listed for use in HVAC duct detection applications of air velocities of up to 1200 feet per minute.

   b) Low Velocity: As listed for use in HVAC duct detection applications of velocities between 500 and 4000 feet per minute.
3. Detector bases are to be low profile twist lock type with screw clamp terminals and self-wiping contacts. A security lock shall be installed in those areas where indicated on the drawings as requiring tamper resistant installation. Bases shall be capable of installation on a four inch square or octagonal electrical outlet box. The detector base shall be equipped with an indicating LED that shall flash to indicate system communications and shall change state to a steady ‘on’ when the detector reaches the selected threshold for alarm and communicates that alarm to the system. The specified LED functions shall indicate detector state whether the system is in the normal mode or the standby power mode. Removal of the detector from the base shall cause a system trouble condition with and display a distinctive trouble code on the control panel display indicating the zone of the trouble condition.

K. Evacuation Alarm Signals:

1. Evacuation alarm devices shall be combination ceiling mounted speakers and white strobe lights to provide both audible and visual indications. All notification appliance circuits shall be Class A, Style Z. The notification circuits shall be power limited.

2. Provide flush ceiling speakers and outside wall mounted speakers for audible alarm generation. Sound pressure levels shall comply with applicable codes and shall satisfy the Authority Having Jurisdiction.

3. Provide a strobe type integral with assembly. Intensity per ADA requirements.

4. The device shall be fully enclosed, heavy duty, suitable for mounting on a standard four inch square outlet box.

5. Network Wiring: The system supplied shall utilize node-to-node, direct-wired multi-priority peer-to-peer network operations. The system shall utilize independently addressed, output modules. The peer-to-peer network shall contain multiple nodes consisting of the main controller, remote control panels and LED/LED nodes. Each node is an equal, active functional node of the network, which is capable of making all local decisions and generating network tasks to other nodes in the event of node failure or communication failures between nodes.

L. Smoke Door Release Mechanisms: Where required by the Authority Having Jurisdiction, provide combination door closer/holder as a separately mounted device. Electrical characteristics of door holder mechanisms shall be coordinated for proper operation of magnetic release from fire alarm system. Manual override release shall be possible at any time.

M. Remote Indicators: Indicator (LED or lamp) mounted in escutcheon plate for flush mounting in ceiling or wall. Normal condition shall be compatible with area smoke detector indicators (i.e. illumination upon alarm, extinguish upon return to normal).

N. Spare Parts: Deliver the following:

- One zone module of each type
- Two of each type of detector
- One manual pull station
- One alarm horn/strobe unit
PART 3-EXECUTION

3.01 INSTALLATION

A. The installation of the system shall meet all requirements of NFPA 70.

B. Breakers in the panels feeding the control panel shall be fitted with suitable guard, such that the breaker cannot be turned off but fixed so the breaker can trip and requiring the removal of a screw to remove the guard. Separate breakers shall be provided for each control panel main power and trouble circuits. Breakers shall be lockable in ON position.

C. Conductors shall be copper and shall be of the type and AWG size to Authority Having Jurisdiction.

D. Provide adequate evacuation alarm devices for appropriate signal level throughout building.

E. Remote Indicators: Provide in an adjacent area where readily visible for all concealed detectors.

F. General smoke Detector spacing: Smoke detector spacing shall be in accordance with the listed spacing, the manufacturers recommendations and the requirements of NFPA 72E. Detectors shall not be located within five feet of a supply air register nor within twelve inches of a lighting fixture.

G. Duct smoke Detector Location:

1. Location shall be in accordance with the listed spacing, the manufacturers recommendations and the requirements of NFPA.

2. Coordinate installation of detectors with sheet metal installer for mounting; electrically connect and provide remote indicator lights (for duct smoke detectors) where the detector is located above a suspended ceiling or in an area which is not readily accessible. Coordinate interposing relay operation to shutdown fan system.

H. Visual Indicators: Locate to meet ADA requirements and be ceiling mounted.

I. Devices: Relays and other devices to be mounted in auxiliary panels are to be securely fastened to avoid false indications and failures due to shock or vibration.

J. Wiring:

1. Within sub-panels: Shall be arranged and routed to allow accessibility to equipment for adjustment and maintenance.

2. Terminals: Spade lugs with upset legs and insulation sleeves sized for the conductors.

3. Each conductor shall be identified as specified herein with wire markers at every splice and terminal point. Attach the wire markers within two inches of the wire termination. Mark both ends with alphanumeric wire markers.

4. Raceways carrying notification and Class A fire alarm signals shall have supply and return conductors installed in separate conduits. Paint coverplates of fire alarm J-boxes red. All raceways utilized for fire alarm shall be ¾” minimum EMT and “RED” in color. All wiring shall be in conduit.
5. Voltages shall not be mixed in any junction box, housing, or device, except those containing power supplies and control relays. Electrical metallic tubing conduit is acceptable in dry locations not enclosed in concrete or where not subject to mechanical damage. Conceal conduit in finished areas of new construction and wherever practicable in existing construction. The use of flexible conduit not exceeding a 6 foot length shall be permitted in initiating device circuits. Run conduit or tubing concealed unless specifically shown otherwise on the drawings. Shielded wiring shall be utilized where recommended by the manufacturer. For shielded wiring, the shield shall be grounded at only one point, that shall be in or adjacent to the FACP. Pigtail or T-tap connections to signal line circuits. Initiating device circuits, supervisory alarm circuits, and notification appliance circuits are prohibited. Color coding is required for circuits and shall be maintained throughout the circuit. Conductors used for the same functions shall be similarly color coded. Wiring shall conform to NFPA 70.

6. Conductor Terminations: Labeling of conductors at terminal blocks in terminal cabinets, and remote control units shall be provided at each conductor connection. Each conductor or cable shall have a shrink-wrap label to provide a unique and specific designation. Each terminal cabinet and fire alarm control unit shall contain a laminated drawing that indicates each conductor, its label, circuit, and terminal. The laminated drawing shall be neat, using 12 point lettering minimum size, and mounted within each cabinet, panel, or unit so that it does not interfere with the wiring or terminals. Maintain existing color code scheme where connecting to existing equipment.

3.02 TESTING

A. All test equipment, instruments, tools and labor required to conduct the system tests shall be furnished by the installing Contractor.

B. The Contractor shall use test instruments that bear valid calibration stamp showing date of calibration and the expiration date of the stamp. Calibration and accuracy of test instruments shall be certified by an independent testing laboratory having standards traceable to the National Institute of Standards and Technology.

C. In addition to the testing specified to be performed by the installing contractor, the installation shall be subject to test by the local Authority Having Jurisdiction.

3.03 AUXILIARY CONTROLS

A. Conductors and power supplies of sufficient size shall be installed to minimize voltage drop consistent with the proper operation of all devices. Destructive link smoke dampers shall not be connected to the fire alarm system. Fan shutdown control circuits, smoke removal control circuits supervised (subject to NFPA requirements) and may be incorporated into the fire alarm raceway system, except that limited energy circuits shall be routed separately from line voltage circuits as required by Code (NEC Article 760).

3.04 CERTIFICATION

A. Following the final acceptance testing, the manufacturer’s representative shall submit a letter to the Contracting Officer with a copy to the Construction Manager stating he has inspected the system installation and found it in compliance with the manufacturer’s installation standards and acceptable in all respects.

3.05 ACCEPTANCE TESTING
A. A written acceptance test procedure for testing the fire alarm system components and installation will be prepared by signal subcontractor in accordance with NFPA 72 and this specification. The signal subcontractor shall be responsible for the performance of the acceptance test procedure, demonstrating the functionality of the system and verifying the correct operation of all system components, circuits, and programming.

B. A program matrix shall be prepared by the signal subcontractor, referencing each alarm input to every output function affected as a result of an alarm condition on that input. In the case of outputs programmed using more complex logic functions involving ‘any’, ‘or’, ‘not’, ‘count’, ‘time’, and ‘timer’ statements; the complete output equation shall be referenced in the matrix.

C. A complete listing of all device labels for alphanumeric annunciator displays and logging printers shall be prepared prior to the acceptance test procedure.

D. The signal subcontractor’s acceptance inspector shall use the system As-Built drawings in combination with the documents specified herein, during the test procedure to verify operation as programmed. In conducting the acceptance test procedure, the acceptance inspector shall request demonstration of any or all input and/or output functions.

E. Class A system wiring shall be tested to demonstrate correct system response and correct subsequent system operation in the event of:

- Open loop
- Shorted loop
- Grounded loop
- Open communication link
- Shorted communication link
- Grounded communication link
- Open zone wiring
- Grounded zone wiring
- Open signal circuit wiring
- Shorted signal circuit wiring
- Grounded signal circuit wiring
- Initiating device removal
- Battery disconnected
- Primary power disconnected
- Connection to EMS system, where applicable

F. System evacuation alarm signaling shall be demonstrated as follows:

1. All signals actuate as programmed
2. Signal audibility

G. System indications shall be demonstrated as follows:

1. Correct message display for each alarm input
2. Correct annunciator light for each alarm input
3. System charging current shall be normal trickle charge for a full charged battery bank

3.06 DOCUMENTATION
A. System documentation shall be furnished to the Contracting Officer and Government and shall include but not be limited to the following:

1. The contractor shall maintain a set of drawings on site to record as-built construction. The drawings shall be updated on a daily basis and shall be available for review at all times. These drawings shall not be used for construction prints. As-built drawings shall show details of installation including conduit/cable locations, device locations, wire counts, equipment locations and such other details of construction required for a complete record of the construction. Upon completion of the construction the on-site as-built drawings shall be formally produced in a CAD format for turnover to the government as part of the required documentation package.

2. System operation, installation, maintenance and programming manuals.

3. System menu driven instructions for the alteration, addition or deletion of zones, modification, addition or deletion of zone messages and the modification, deletion or addition of logic modules as required for system operation.

3.07 MOUNTING HEIGHTS

A. Per ADA requirements, all mounting heights indicated are the distances from the finished floor level to the top of the device box:

<table>
<thead>
<tr>
<th>Device</th>
<th>Height</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manual Stations</td>
<td>48&quot;</td>
</tr>
<tr>
<td>Speaker/Strobes</td>
<td>Ceiling/wall 84&quot;</td>
</tr>
<tr>
<td>Control Panel</td>
<td>60&quot; (depending on control panel)</td>
</tr>
<tr>
<td>Annunciator</td>
<td>60&quot;</td>
</tr>
</tbody>
</table>

3.08 FIELD QUALITY CONTROL

A. Testing Procedures: Detailed test procedures, prepared and signed by a Registered Professional Engineer or a NICET Level 3 Fire Alarm Technician, and signed by representative of the installing company, for the fire detection and alarm system 60 days prior to performing system tests. Detailed test procedures shall list all components of the installed system such as initiating devices and circuits, notification appliances and circuits, signaling line devices and circuits, control devices/equipment, batteries, transmitting and receiving equipment, power sources/supply, annunciators, special hazard equipment, emergency communication equipment, interface equipment, Guard’s Tour equipment, and transient (surge) suppressors. Test procedures shall include sequence of testing, time estimate for each test, and sample test data forms. The test data forms shall be in a check-off format (pass/fail with space to add applicable test data) and shall be used for the preliminary testing and the acceptance testing. The test data forms shall record the test results and shall:

1. Identify the NFPA Class of all Initiating Device Circuits (IDC), Notification Appliance Circuits (NAC), Voice Notification System, and Signaling Line Circuits (SLC).

2. Identify each test required by NFPA 72 Test Methods and required test herein to be performed on each component, and describe how this test shall be performed.

3. Identify each component and circuit as to type, location within the facility, and unique identity within the installed system. Provide necessary floor plan sheets showing each component location, test location, and alphanumeric identity.

4. Identify all test equipment and personnel required to perform each test (including equipment necessary for testing smoke detectors using real smoke).
5. Provide space to identify the date and time of each test. Provide space to identify the names and signatures of the individuals conducting and witnessing each test.

B. Test States:

1. Preliminary Testing: Conduct preliminary tests to ensure that devices and circuits area functioning properly. Tests shall meet the requirements of paragraph entitled ‘Minimum System Tests’. After preliminary testing is complete, provide a letter certifying that the installation is complete and fully operable. The letter shall state that each initiating and indicating device was tested in place and functioned properly. The letter shall also state that panel functions were tested and operating properly. The letter shall include the names and titles of the witnesses to the preliminary tests. The Contractor and an authorized representative from each supplier of equipment shall be in attendance at the preliminary testing to make necessary adjustments.

2. Request for Formal Inspection and Tests: When tests have been completed and corrections made, submit a signed, dated certificate with a request for formal inspection and tests to the Contracting Offices Designated Representative (COR).

3. Final Testing: Notify the Contracting Officer in writing when the system is ready for final acceptance testing. Submit request for test at least 15 calendar days prior to the test date. The tests shall be performed in accordance with the approved test procedures in the presence of the Contracting Officer. The Contractor shall furnish instruments and personnel required for the tests. A final acceptance test will not be scheduled until the operation and maintenance (O&M) Manuals are furnished to the Contracting Officer and the following are provided at the job site:
   a. The systems manufacturer’s technical representative
   b. Marked-up red line drawings of the system as actually installed.
   c. Megger test results
   d. Loop resistance test results
   e. Complete program printout including input/output addresses

4. The final tests shall be witnessed by the Contracting Offices Designated Representative (COR). At this time, any and all required tests shall be repeated at their discretion. Following acceptance of the system, as-built drawings and O&M Manuals shall be delivered to the Contracting Officer for review and acceptance.

C. Minimum System Tests: Test the system in accordance with the procedures outlined in NFPA 72, IEC 60849, IEC 60268-16. The required tests are as follows:

1. Megger Tests: After wiring has been installed, and prior to making any connections to panels or devices, wiring shall be megger tested for insulation resistance, grounds, and/or shorts. Conductors with 300 volt rated insulation shall be tested at a minimum of 250 VDC. Conductors with 600 volt rated insulation shall be tested at a minimum of 500 VDC. The tests shall be witnessed by the Contracting Officer and test results recorded for use at the final acceptance test.
2. Loop Resistance Tests: Measure and record the resistance of each circuit with each pair of conductors in the circuit short-circuited at the farthest point from the circuit origin. The tests shall be witnessed by the Contracting Officer and test results recorded for use at the final acceptance test.

3. Verify the absence of unwanted voltages between circuit conductors and ground. The tests shall be accomplished at the preliminary test with results available at the final system test.

4. Verify that the control unit is in the normal condition as detailed in the manufacturer's O&M Manual.

5. Test each initiating and indicating device and circuit for proper operation and response at the control unit. Smoke sensors shall be tested in accordance with manufacturer's recommended calibrated test method. Use of magnets is prohibited. Testing of duct smoke detectors shall comply with the requirements of NFPA 72.

6. Test the system for specified functions in accordance with the contract drawings and specifications and the manufacturer's O&M Manual.

7. Test both primary power and secondary power. Verify, by test, the secondary power system is capable of operating the system for the time period and in the manner specified.

8. Determine that the system is operable under trouble conditions as specified.


10. Test the battery charger and batteries.

11. Verify that software control and data files have been entered or programmed into the FACP. Hard copy records of the software shall be provided to the Contracting Officer.

12. Verify that red-line drawings are accurate.

13. Measure the current in circuits to ensure there is the calculated spare capacity for the circuits.

14. Measure voltage readings for circuits to ensure that voltage drop is not excessive.

15. Disconnect the verification feature for smoke sensors during tests to minimize the amount of smoke needed to activate the sensor. Testing of smoke sensors shall be conducted using real smoke. The use of canned smoke is prohibited.

16. Measure the voltage drop at the most remote appliance (based on wire length) on each notification appliance circuit.

17. Audibility intelligibility testing of the voice evacuation notification system shall be accomplished in accordance with NFPA 72 for voice evacuation systems, IEC 60268-16, and ANSI S3.2.

18. Opening the circuit at not less than 10% of alarm initiating devices and notification appliances to test the wiring supervisory feature.

19. The Contractor shall demonstrate modem communications with remote sites as specified by the COR. Dial in capability shall also be demonstrated, using specified security.

20. The Contractor shall demonstrate fiber optic communications with remote sites as specified by the COR. Dial in capability shall also be demonstrated, using specified security.
3.09 DRAWINGS, MANUALS, TOOLS AND SPARE PARTS

A. Upon completion of the installation and prior to final inspection, the contractor shall furnish 'as-built' drawings as indicated above. In addition, the contractor shall furnish five (5) copies of a manual, including wiring diagrams, giving complete instructions for the operation, inspection, testing and maintenance of the system. Any special tools necessary for the maintenance of the equipment shall be furnished, as well as one spare set of fuses of each type and size required. As soon as practicable after approval of the list of equipment, the contractor shall furnish copies of spare parts data for each different item of equipment listed. The data shall include a complete list of parts and supplies with current unit prices.

3.10 INSTRUCTION OF GOVERNMENT EMPLOYEES

A. Equipment manufacturer shall provide one day on site and five days of technical training to the Government at the manufacturing facility. Training shall allow for classroom instruction as well as individual hands on programming, troubleshooting and diagnostics exercises. Room and travel costs shall be included for two Government personnel. Factory training shall occur within six months of system acceptance.

B. Instructor: Include in the project the services of an instructor, who shall have received specific training from the manufacturer for the training of other persons regarding the inspection, testing, and maintenance of the system provided. The instructor shall train the Government employees designated by the Contracting Officer, in the care, adjustment, maintenance, and operation of the fire alarm and fire detection/mass notification system.

C. Qualifications: Each instructor shall be thoroughly familiar with all parts of this installation. The instructor shall be trained in operating theory as well as in practical O&M work.

D. Required Instruction Time: Provide eight hours of instruction after final acceptance of the system. The instruction shall be given during regular working hours on such dates and times as are selected by the Contracting Officer. The instruction may be divided into two or more periods at the discretion of the Contracting Officer. The training shall allow for rescheduling for unforeseen maintenance and/or fire department responses.

END OF SECTION
PART 1-GENERAL

1.01 SUMMARY

A. This performance specification provides the minimum requirements for the Mass Notification / Life Safety System. The system shall include, but not limited to all design equipment, materials, labor, installation, documentation, testing and services necessary to furnish and install a complete, operational system to include but not limited to the following functions:

1. One-way voice communication notification system
2. ADA compliant visual notification system
3. Interface to the Fire Alarm System for fire signaling override when necessary
4. Interface to any site wide master station
5. UFC 4-021-01 Compliant Mass Notification/Life Safety System
6. Obtain the Authority Having Jurisdiction’s acceptance

B. Quantity or Placement of Devices: This specification makes no representation to the quantity or location of devices required to satisfy the Authority Having Jurisdiction. It is the responsibility of the Contractor to coordinate with the Authority Having Jurisdiction to ensure that the completed installation satisfies all requirements of the governing codes. Device Placements on prototype drawings on bid drawings are shown as one suggested layout. Final placement of devices is by AHJ.

C. Authority Having Jurisdiction: The Authority Having Jurisdiction for this project is to be determined by the Contractor.

1.02 ALTERNATES, MASS NOTIFICATION / LIFE SAFETY

A. Strict conformance to this specification is required to ensure that the installed and programmed system will function as designed, and will accommodate the future requirements and operations of the building. All specified operational features must be met without exception.

B. The authorized representative of the manufacturer of the major equipment shall be responsible for the satisfactory installation of the complete system.

C. All equipment and components shall be the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a protected premises protective signaling system. The authorized representative of the manufacturer of the major equipment, such as control panels, shall be responsible for the satisfactory installation of the complete system.

D. All control panel assemblies and connected field appliances shall be provided by the same system supplier, and shall be designed and tested to ensure that the system operates as specified. The system shall utilize independently addressed, microprocessor-based modules to activate the strobe circuits and for use as interface to the fire alarm signaling as detailed in this specification.
E. All equipment and components shall be installed in strict compliance with the manufacturer's recommendations.

F. The equipment to be supplied will be considered only if it meets all sections of the performance specification. Any deviations of system performance outlined in this specification will only be considered when the following requirements have been met:

G. A complete description of proposed alternate system performance methods with five (5) copies of working drawings thereof for approval by the Government, not less than ten (10) calendar days prior to the scheduled date for submission of bids.

H. The supplier shall furnish evidence that the proposed or alternate system performance is equal or superior to the system operation stated in the specification. Such evidence shall be submitted to and accepted by the Government, not less than ten (10) calendar days prior to the scheduled date for submission of bids.

I. The supplier shall submit a point-by-point statement of compliance for all sections in this specification. The statement of compliance shall consist of a list of all paragraphs within these sections. Where the proposed system complies fully with the paragraph, as written, placing the word "comply" opposite the paragraph number shall indicate such. Where the proposed system does not comply with the paragraph as written and the supplier feels the proposed system will accomplish the intent of the paragraph, a full description of the function as well as a full narrative description of how its proposal will meet its intent shall be provided. Any submission that does not include a point-by-point statement of compliance as described herein shall be disqualified. Where a full description is not provided, it shall be assumed that the proposed system does not comply.

J. The acceptability of any alternate proposed system shall be the sole decision of the Government or his authorized representative.

1.03 REFERENCES

A. Codes & Standards

1. The equipment and installation shall comply with the current provisions of the following codes and standards:

   NFPA 70 - 2005 National Electric Code®
   NFPA 72 - 2007 National Fire Alarm Code®
   UL 464 - Audible Signaling Appliances.
   UL 864 - Control Units for Fire Protective Signaling Systems.
   UL 1971 - Signaling Devices for the Hearing-Impaired.
   UL 1481 - Power Supplies for Fire Protective Signaling Systems.
   UL 1711 - Amplifiers for Fire Protective Signaling Systems.
   UL 1635 - Digital Alarm Communicator System Units

   Federal Codes and Regulations

   UFC 4-010-01 DOD Minimum Antiterrorism Standards for Buildings
   UFC 4-021-01 Design and O&M: Mass Notification Systems
1.04 SYSTEM DESCRIPTION

A. General, Mass Notification / Life Safety: The Contractor shall furnish all labor, services and testing materials necessary to furnish and install a complete, functional Mass Notification / Life Safety (fire alarm system). The System shall comply in respects with all pertinent codes, rules, regulations and laws of the Authority, and local jurisdiction. The System shall comply in all respects with the requirements of the specifications, manufacturer's recommendations and Underwriters Laboratories Inc. (ULI) listings.

B. It is further intended that upon completion of this work, the Government be provided with:

C. Complete information and drawings describing and depicting the entire system as installed, including all information necessary for maintaining, troubleshooting, and/or expanding the system at a future date.

D. Designs of attachments to building structure shall meet the requirements of UBC, Seismic Zone, or as directed by Authority Having Jurisdiction. Submit detailed mathematical analysis of the design.

E. Complete documentation of system testing.

F. Certification that the entire system has been inspected and tested, is installed entirely in accordance with the applicable codes, standards, manufacturer's recommendations and ULI listings, and is in proper working order. Contractor shall fill out the "Fire Alarm System Record of Completion" after testing the system as required by Chapter 10 of NFPA 72 - 2007 edition, and the requirements of Annex E.

G. Mass Notification System. Provide and install a new mass notification system consisting of:

1. The Autonomous Control Unit (ACU) shall be located with the central fire alarm control cabinet.

2. The combination Remote LCD annunciator with remote microphone / Local Operator Console shall be located at the main store entrance, also in security office, store manager office and as described in UFC 4-021-01.

3. Provide a combination multi-channel one-way voice communication system.

4. Booster Power Supplies, (BPS) to power the strobe lights shall be located, as needed for the number of mass notification strobes in the building. Each BPS shall provide supervision to the strobe lights and associated wiring as required by UL, and any fault shall be transmitted to the mass notification main control panel.

5. Provide audible appliances located throughout the building.

6. Provide synchronized Class A wired visual appliances located throughout the building.
7. Provide interface to the fire alarm control panel to shut down the fire alarm signals, both audible and visual, upon a mass notification alarm condition. During any mass notification alert message, the fire alarm horn/strobes shall be silenced so that the mass notification message can be heard throughout.

H. Mass Notification Autonomous Control Unit.

1. The Autonomous Control Unit (ACU) shall be located adjacent to the remote fire alarm annunciator and shall be multiplexed back to the main mass notification panel and provide the capability to page any level of the building individually as well as the ability to activate any one of 7 mass notification messages stored in the ASU portion of the mass notification panel.

2. The local Operator Console /Remote LCD annunciator with remote microphone shall be located per UFC 4-021-01. All locations shall be verified with the Authority Having Jurisdiction.

3. Provide a combination multi-channel one-way voice communication system having a minimum of eight (8) prerecorded mass notification event messages as well as the ability to page a manual message from the microphone in the local operator console.

4. Provide synchronized Class A wired amber visual appliances located throughout the building.

5. Provide textual signage located throughout the building as required by UFC 4-021-01.

6. Provide a connection to receive signals from and to transmit signals to the base mass notification system.

7. Provide a connection to the building public address system.

1.05 OPERATIONS

A. Upon manual initiation of any mass notification event:

1. The selected message shall be broadcast throughout the entire building. This message shall override any fire messages in progress or subsequent to the initiation of the mass notification message. The mass notification message shall continue until overridden by a manual page or the message broadcast is manually discontinued. This message shall also be fed into the building public address system.

2. The synchronized amber alert strobes shall be activated for the duration of the message.

3. The clear “fire” strobes shall be extinguished if flashing and prohibited while the mass notification event is active.

4. The textual signage shall indicate a mass notification event is in progress.

5. The panel / ACU shall indicate all applicable information associated with the event condition including: message active destination zones if applicable.

6. The remote annunciator / LOC LCD/LED’s associated with the event shall be illuminated.

7. It shall be possible to duplicate any ACU command/function from any LOC systems.
B. System Configuration:

1. All Mass Notification / Life Safety System equipment shall be arranged and programmed to provide, the notification of building occupants and to facilitate the safe evacuation of building occupants, as required.

2. Power Supply Audio: Standby power supply shall be an electrical battery with capacity to operate the system under maximum supervisory load for seventy-two (72) hours and capable of operating the system for fifteen (15) minutes of evacuation alarm on all devices, operating at maximum load. The system shall include a charging circuit to automatically maintain the electrical charge of the battery. The system shall automatically adjust the charging of the battery to compensate for temperature.

3. Display: The main display interface shall show the first and most recent highest priority system events without any operator intervention. All system events shall be directed to one of four message queues. Messages of different types shall never intermixed to eliminate operator confusion. A "Details" switch shall provide additional information about any device highlighted by the operator.

4. Notification Appliance Circuits: All notification appliance circuits shall be Class A (Style "Z"). All notification appliance circuits shall have a minimum circuit output rating of: 2 amps @ 24 vdc; 50 watts @ 25V audio, and 35 watts @ 70V audio. The notification circuits shall be power limited. Non-power limited circuits are not acceptable.

5. Network Wiring:

   a. The system supplied under this specification shall utilize node-to-node, direct-wired multi-priority peer-to-peer network operations. The system shall utilize independently addressed, output modules as described in this specification for triggering of the BPS units for the amber mass notification strobe lights. The peer-to-peer network shall contain multiple nodes consisting of the ACU, main controller, remote control panels, and LCD/LED (LOC) nodes. Each node is an equal, active functional node of the network, which is capable of making all local decisions and generating network tasks to other nodes in the event of node failure or communications failure between nodes.

   b. When a network is wired using a Class A configuration, a single break or short on the network wiring causes the system to isolate the fault, and network communication continues uninterrupted, without any loss of function. Should multiple wiring faults occur, the network re-configures into many sub-networks and continues to respond to alarm events from every panel that can transmit and receive network messages.

1.06 SUBMITTALS

A. The contractor shall purchase no equipment for the system specified herein until the Government has approved the project submittals in their entirety and has returned them to the contractor. It is the responsibility of the contractor to meet the entire intent and functional performance detailed in these specifications. Approved submittals shall only allow the contractor to proceed with the installation and shall not be construed to mean that the contractor has satisfied the requirements of these specifications. The contractor shall submit five (5) complete sets of documentation within 30 calendar days after award of purchase order.

B. Each submittal shall include a cover letter providing a list of each variation that the submittal may have from the requirements of the contract documents. In addition the Contractor shall provide specific notation on each shop drawing, sample, catalog cut, data sheet, installation manual, etc. submitted for review and approval, of each such variation.
C. All drawings and diagrams shall include the contractor's title block, complete with drawing title, contractor's name, address, date including revisions, and preparer's and reviewer's initials.

D. Product Data: Data sheets with the printed logo or trademark of the manufacturer for all equipment. Indicated in the documentation will be the type, size, rating, style, and catalog number for all items proposed to meet the system performance detailed in this specification. The proposed equipment shall be subject to the approval of the Government and Contracting Officer.

E. Shop Drawings: A complete set of shop drawings shall be supplied. The shop drawings shall be reproduced electronically in digital format. This package shall include but not be limited to:

1. Control panel wiring and interconnection schematics.
2. Complete point-to-point wiring diagrams.
3. Riser diagrams.
4. Complete floor plan drawing locating all system devices and 1/4' = 1'-0 scale plan and elevation of all equipment in the Fire Command Station. Including showing the placement of each individual item of fire alarm, security, and access control equipment as well as raceway size and routing, junction boxes, and conductor size, quantity, and color in each raceway.
5. Detailed system operational description. Any Specification differences and deviations shall be clearly noted and marked.
6. Complete system bill of material.
7. All drawings shall be reviewed and signed off by an individual having a minimum of a NICET III certification in fire protection engineering technology, subfield of fire alarm systems.
8. Quality Assurance/Control Submittals
9. Installer's Certification
10. The engineered systems distributor must be licensed in the state of project location and have been incorporated in the business in that state for a minimum of 5 years.
11. Submit a copy of the system supplier's training certification issued by the manufacturer of the integrated life safety system, and a copy of the installing technician's NICET certification.
12. Complete calculations shall be provided which show the electrical load on the following system components:
13. Each system power supply, including stand-alone booster supplies.
14. Each standby power supply (batteries).
15. Each notification appliance circuit.
16. Each auxiliary control circuit that draws power from any system power supply.
F. Close Out: Five (5) copies of the following documents shall be delivered to the Contracting Officer at the time of system acceptance. The close out submittals shall include:

1. Project specific operating manuals covering the installed integrated life safety system. The manual shall contain a detailed narrative description of the system architecture, inputs, notification signaling, auxiliary functions, annunciation, sequence of operations, expansion capability, application considerations and limitations. Manufacturer's data sheets and installation manuals/instructions for all equipment supplied. A generic or typical owner's instruction and operation manual shall not be acceptable to fulfill this requirement.

2. As-Built drawings consisting of: a scaled plan of each building showing the placement of each individual item of the Integrated Life Safety System equipment as well as raceway size and routing, junction boxes, and conductor size, quantity, and color in each raceway. All drawings must reflect point to point wiring, device address and programmed characteristics as verified in the presence of the Contracting Officer and/or the end user unless device addressing is electronically generated, and automatically graphically self-documented by the system.

3. All drawings shall be provided in standard .DXF format. A vellum plot of each sheet shall also be provided.

4. The application program listing for the system as installed at the time of acceptance by the Contracting Officer and/or local AHJ (disk, hard copy printout, and all required passwords).

5. Provide the name, address and telephone of the authorized factory representative.

6. A filled out Record of Completion similar to NFPA 72, 2007 edition figure 4.5.2.1.

7. Include a complete set of drawings in final record building drawings.

1.07 QUALITY ASSURANCE

A. The contractor shall have successfully installed similar system fire detection, evacuation voice and visual signaling control components on a previous project of comparable size and complexity. AAFES and the Government reserve the right to reject any control components for which evidence of a successful prior installation performed by the contractor cannot be provided.

B. The contractor shall have in-house engineering and project management capability consistent with the requirements of this project. Qualified and approved representatives of the system manufacturer shall perform the detailed engineering design of central and remote control equipment. Qualified and approved representatives of the system manufacturer shall produce all panel and equipment drawings and submittals, operating manuals. The contractor is responsible for retaining qualified and approved representative of those system manufacturers specified for detailed system design and documentation, coordination of system installation requirements, and final system testing and commissioning in accordance with these specifications.

1.08 WARRANTY AND MAINTENANCE

A. The Contractor shall supply the following spare parts:

1. Audible and visible devices - One (1) percent of the installed quantity of each type, but no less than two (2) devices.

2. Keys - A minimum of three (3) sets of keys shall be provided and appropriately identified.
B. Warranty:

1. The contractor shall warranty all materials, installation and workmanship for one (1) year from date of acceptance, unless otherwise specified. A copy of the manufacturer's warranty shall be provided with closeout documentation and included with the operation and installation manuals.

1.09 TRAINING

A. The System Supplier shall schedule and present a minimum of 8 hours of documented formalized instruction for the Contracting Officer, detailing the proper operation of the installed System.

B. The instruction shall be presented in an organized and professional manner by a person factory trained in the operation and maintenance of the equipment and who is also thoroughly familiar with the installation.

C. The instruction shall cover the schedule of maintenance required by NFPA 72 and any additional maintenance recommended by the system manufacturer.

D. Instruction shall be made available to the Local Municipal Fire Department if requested by the Local Authority Having Jurisdiction.

PART 2-PRODUCT

2.01 MANUFACTURER

A. All equipment and components shall be the manufacturer's most current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a protected premises protective signaling system. The authorized representative of the manufacturer of the major equipment, such as control panels, shall be responsible for the satisfactory installation of the complete system.

B. The contractor shall be experienced in the installation of UL listed fire alarm systems as the Mass Notification system shall be a fully supervised Class A wired voice and visual announcement system to provide full coverage both audibly and visually the entire project, to meet ADA and NFPA 72 installation for voice and visual evacuation systems.

C. The manufacturer of the system equipment shall be regularly involved in the design, manufacture, and distribution of all products specified in this document. These processes shall be monitored under a quality assurance program that meets the ISO 9000 requirements.

D. All System components shall be the cataloged products of a single supplier. All products shall be listed by the manufacturer for their intended purpose.

E. All control panel assemblies and connected field appliances shall be both designed and manufactured by the same company, and shall be tested and cross-listed as to ensure that a fully functioning is designed and installed. The system supplied under this specification shall be a microprocessor-based direct wired, multi-priority peer-to-peer networked system. The system shall utilize independently addressed, microprocessor-based smoke detectors, heat detectors, and modules as described in this specification.

2.02 PANEL COMPONENTS AND FUNCTIONS

A. Combination Mass Notification / Life Safety
1. The control panel shall be a multi-processor based networked system designed specifically for one-way emergency audio communications applications. The control panel shall be listed and approved for the application standard as listed under the General section.

2. The control panel shall include all required hardware, software and site-specific system programming to provide a complete and operational system. The control panel shall be designed such that interactions between any application can be configured, and modified using software provided by a single supplier. The control panel operational priority shall assure that mass notification takes priority over other life safety activities coordinated by the control panel.

3. The control panel /ACU shall include the following capacities:
   a. Support up to 2500 analog/addressable points.
   b. Provide an operator interface control/display that shall annunciate, command and control system functions.
   c. Provide an internal audible signal with different programmable patterns to distinguish between alarm, supervisory, trouble and monitor conditions.
   d. Provide system reports that provide detailed description of the status of system parameters for corrective action or for preventative maintenance programs. Reports shall be displayed by the operator interface or capable of being printed on a printer.
   e. Provide an authorized operator with the ability to operate or modify system functions like system time, date, passwords, holiday dates, restart the system and clear control panel event history file.
   f. Provide an authorized operator to perform test functions within the installed system.
   g. The control panel shall contain a standby power supply that automatically supplies electrical energy to the system upon primary power supply failure. The system shall include a charging circuit to automatically maintain the electrical charge of the battery.

B. Control Panel / Autonomous Control Unit:

1. The system shall be designed and equipped to receive, monitor, and annunciate signals from devices and circuits installed throughout the building. Standard LED annunciators may be combined in common enclosures provided that the groups of LED’s comprising each of the required annunciators are separated from one another (MN Event Messages, Detection, Supervisory, Status, and Security) and clearly labeled.

2. Manufacturers’ standard control switches shall be acceptable if they provide the required operation, including performance, supervision and position indication. If the manufacturers’ standard switches do not comply with these requirements, fabrication of custom manual controls acceptable to the Contracting Officer is required.

3. Activation of a mass notification event, receipt of alarm, trouble, and supervisory signals shall activate integral audible devices at the control panel(s) and at each remote annunciator device. The integral audible devices shall produce a sound output upon activation of not less than 85 dBA at 10 feet.
4. The annunciator shall contain the following system status indicators:

   a. 168 character Backlit Liquid Crystal Display
   b. System Normal Indicator
   c. System Common Alarm Indicator
   d. System Common Trouble Indicator
   e. System Common Supervisory Indicator
   f. System Ground Fault Indicator
   g. System Disabled Point(s) Indicator
   h. System Reset Switch with Indicator
   i. System Alarm Silence Switch with Indicator
   j. System Trouble Silence Switch with Indicator
   k. System Message Queue Scroll Switches.
   l. 10-Digit Keypad to Enable/Disable System and Functions.

5. The LED Annunciator/Switches shall provide manual initiation of mass notification event messages (8 minimum) and destination zones.

6. The LED Annunciator shall contain the following switches:

   a. Provide two-position switch to manually unlock all stairwell and exit doors.
   b. Provide switches for system by-pass functions. Actual switch function shall be determined by the Contracting Officer.
   c. Provide a one-way emergency voice communication system annunciator with the following design: This standard LED annunciator (LOC) shall incorporate the microphone for the one-way broadcasts, including all required zone select and manual override control switches to duplicate the functions of the ACU, in the event the ACU is not accessible. Marine Corps: Provide no more than one (LOC) if necessary in addition to the ACU. Locate the LOC as directed by the AHJ.
   d. The unit shall be fully supervised from the control panel. The housing shall contain a lock that is keyed identical to the fire alarm system for the building.
   e. Auxiliary Input Module shall be designed to be an outboard expansion module to either expand the number of optional remote microphone stations, or allow a telephone interface.
   f. Remote microphone station (PA) shall incorporate a Push-To-Talk (PTT) microphone, and controls to allow public address paging in the facility. The public address paging function shall not override any alarm or notification functions.

7. Audio:

   a. The system shall be capable of delivering multi-channel audio messages simultaneously over copper and/or fiber media. All audio messages and live pages shall originate at the one-way audio control unit. The one-way audio control unit shall store pre-recorded audio messages digitally. These messages shall be automatically directed to various areas in a facility under program control or to all areas of the building simultaneously. The system shall support remote cabinets with zoned amplifiers to receive, amplify and send messages through speakers over supervised circuits.
   b. The one-way emergency audio control shall provide control switches to select and direct Mass Notification Messages.
c. Manual page controls and destination switches shall be provided.

8. Audio Amplifiers (Multi-Channel): Provide as minimum one twenty (20) watt audio amplifier per paging zone. The system software shall be capable of selecting the required audio source signal for amplification. To enhance system survivability, each audio amplifier shall automatically provide a local 3-3-3 1000 Hz temporal pattern output upon loss of the audio communications with the one-way audio control unit, during an alarm condition. Audio amplifiers shall be power limited and protected from short circuits conditions on the audio circuit wiring. Each amplifier output shall include a dedicated, selectable 70 Vrms output. Provide a standby audio amplifier that will automatically sense the failure of a primary amplifier, and replace the function of the failed amplifier.

9. Power Supply:
   a. System power supply(s) shall provide multiple power limited 24 VDC output circuits as required by the panel.
   b. Upon failure of normal (AC) power, the affected portion(s) of the system shall automatically switch over to secondary power without losing any system functions.
   c. Each system power supply shall be individually supervised. Power supply trouble signals shall identify the specific supply and the nature of the trouble condition.
   d. All standby batteries shall be continuously monitored by the power supply. Battery and disconnection of battery power supply conditions shall immediately announced as battery trouble and identify the specific power supply affected.
   e. All system power supplies shall be capable of recharging their associated batteries, from a fully discharged condition to a capacity sufficient to allow the system to perform consistent with the requirements of this section, in 60 minutes maximum.
   f. All AC power connections shall be to the building's designated emergency electrical power circuit and shall meet the requirements of NFPA 72. The AC power circuit shall be installed in conduit raceway. The power circuit disconnect means shall be clearly labeled Mass Notification System CIRCUIT CONTROL and shall have a red marking. The location of the circuit disconnect shall be labeled permanently inside the each control panel the disconnect serves.

2.03 FIELD MOUNTED SYSTEM COMPONENTS

A. Low Profile Speaker-Strobe:
   1. Provide low profile wall mount speaker/strobes. The low profile speaker/strobe shall not extend more than 1" (2.5cm) past the finished wall surface, and provide a switch selectable audible output of 2W (90dBA), 1W (87dBA), 1/2W (84dBA), or 1/4W (81dBA) at 10 ft. when measured in reverberation room per UL-464.
   2. Strobes shall provide synchronized flash output that shall be switch selectable for output values of 15cd, 30cd, 75cd & 110cd. Wattage and candela settings shall be visible with the cover installed. When the cover is installed, no mounting hardware shall be visible. In and out screw terminals shall be provided for all wiring. The low profile speaker/strobes shall mount in a North American 4" x 2 1/8" square electrical box, without trims or extension rings.
   3. All “Alert” strobes shall be ceiling mounted, provided with amber lenses.
B. Speaker-Strobe Ceiling 8”:

1. Provide 8” ceiling mounted speaker/strobes. In and out screw terminals shall be provided for wiring. Speaker baffles shall be round or square, steel with white finish as required. Provide square surface mount boxes with matching white finish as required. Speakers shall provide 1/2w, 1w, 2w, and 4W power taps for use with 25V or 70V systems. At the 4-watt setting, the speaker shall provide a 94-dBA sound output a frequency of 1000 Hz. when measured in an anechoic chamber at 10 ft. Strobes shall provide synchronized flash outputs. Strobe output shall be determined as required by its specific location and application from a family of 15cd, 30cd, 75cd, and 110cd devices.

2. All “Alert” strobes shall be provided with amber lenses.

C. Speakers, Outside:

1. Provide 8” recessed weatherproof outside mounted re-entrant speaker and separate strobes at the locations shown on the drawings. Weatherproof boxes shall be provided for outdoor mounting. Speakers shall provide 2w, 4w, 8w, and 15w power taps for use with 70V systems. The re-entrant speakers shall utilize a high efficiency compression driver. Cone type drivers are not acceptable. At the 15-watt setting, the speaker shall provide a 102-dBA sound output over a frequency range of 400-4000 Hz. when measured in reverberation room per UL-1480. Strobes shall provide synchronized flash. Strobe output shall be determined as required by its specific location and application from a family of 15cd, 30cd, 75cd, & 110cd devices. Provide Bogen flush mount Model FMH15T speaker with SGHD8 grill and adaptor ring. Paint grill to match building color.

2. All “Alert” strobes shall be provided with amber lenses. Provide speaker/strobes with a 757A-WBW w/p box or equal.

D. Remote LED Text Display

1. An LED text display shall be provided at all public exit locations. The LED text display shall be at least two lines with a minimum of 20 characters per line. The size shall not exceed 16 inches length x 6 inches height x 3 inches deep. The text display shall as a minimum meet the following requirements: (Electrical mechanical room does not require a text sign.)

   a. Two lines of information for high priority messaging.
   b. Minimum of 20 characters per line (40 total) displayed.
   c. Text shall be no less than ½” in height and readable from 1 foot to 20 feet away.
   d. 32K character memory.
   e. RS232 or RS485 serial interface included.
   f. Display shall be wall or ceiling mounted.
   g. Mounting brackets for a convenient wall/cubicle mount.
   h. During non-emergency periods, date and time shall be displayed.
   i. All programming shall be accomplished from the mass notification network.
   j. No user programming shall be required.
E. Fiber Optic: The fiber optic transceiver shall be fully compatible with EIA standards for RS-232, RS-422 and RS485 at data rates from 0 (DC) to 2.1 mbps (200 kbps for RS-232) in the low speed mode or from 10 kbps to 10 mbps in the high-speed mode. The fiber optic transceiver shall be capable of simplex or full duplex asynchronous transmissions in both point-to-point systems and drop-and-repeat data networks. The fiber optic transceiver shall be user configurable for the protocol, speed and mode of operation required. The fiber optic transceiver shall be installed as a stand-alone or card cage unit. The fiber optic transceiver shall operate on either multi-mode or single-mode fiber optic cable. The fiber optic transceiver shall be supplied with optical connectors. Meet current Base standards. Verify fiber mode with Base.

PART 3-EXECUTION

3.01 INSTALLATION

A. The contractor shall provide all equipment, labor, materials, transportation and documentation required herein and on the drawings to install a complete and operable system to include all required testing and test documents. The installing contractor shall be UL listed as a fire alarm installer under category UUJS of the UL FIRE Protection Equipment Directory. The installation shall be under the direct supervision of a factory trained representative of the equipment manufacturer with a minimum of four years experience in the installation of similar systems. Qualifications of the installers and supervisor shall be provided to the Contracting Officer upon request.

B. All system wiring shall be approved for mass notification use and shall be installed in metallic conduit or raceway. All conduit penetrations through walls shall be sealed with appropriate fire resistant material. Conduit runs shall follow the building contours and shall be installed parallel or perpendicular to walls and ceilings. All conduit field bends shall be made by benders specifically designed for the purpose. All junction boxes shall be sized to accommodate the number of conductors installed in accordance with the NEC. Conduit wire fill shall not exceed 40 percent. Conductors for lighting, power or Class 1 circuits shall not be installed with mass notification conductors in any conduit, raceway or cable.

C. Signaling line, notification and Class A circuits shall have supply and return conductors installed in separate conduits.

D. Provide all wiring in conduit. Voltages shall not be mixed in any junction box, housing, or device, except those containing power supplies and control relays. Electrical metallic tubing conduit is acceptable in dry locations not enclosed in concrete or where not subject to mechanical damage. Conceal conduit in finished areas of new construction and wherever practicable in existing construction. The use of flexible conduit not exceeding a 6 foot length shall be permitted in initiating device circuits. Run conduit or tubing concealed unless specifically shown otherwise on the drawings. Shielded wiring shall be utilized where recommended by the manufacturer. For shielded wiring, the shield shall be grounded at only one point, that shall be in or adjacent to the FCP. Pigtail or T-tap connections to signal line circuits, initiating device circuits, supervisory alarm circuits, and notification appliance circuits are prohibited. Color coding is required for circuits and shall be maintained throughout the circuit. Conductors used for the same functions shall be similarly color coded. Wiring shall conform to NFPA 70.
E. Conductor Terminations: Labeling of conductors at terminal blocks in terminal cabinets, and remote control units shall be provided at each conductor connection. Each conductor or cable shall have a shrink-wrap label to provide a unique and specific designation. Each terminal cabinet and fire alarm control unit shall contain a laminated drawing that indicates each conductor, its label, circuit and terminal. The laminated drawing shall be neat, using 12 point lettering minimum size, and mounted within each cabinet, panel, or unit so that it does not interfere with the wiring or terminals. Maintain existing color code scheme where connecting to existing equipment.

3.02 AS-BUILT DRAWINGS

A. The contractor shall maintain a set of drawings on site to record as-built construction. The drawings shall be updated on a daily basis and shall be available for review at all times. These drawings shall not be used for construction prints. As-built drawings shall show details of installation including conduit/cable locations, device locations, wire counts, equipment locations and such other details of construction required for a complete record of the construction. Upon completion of the construction the on-site as-built drawings shall be formally produced in a CAD format for turnover to the government and contracting officer as part of the required documentation package.

3.03 CONNECTION OF NEW SYSTEM

A. The following new system connections shall be made during the last phase of construction, at the beginning of the preliminary tests. New system connections shall include:

1. Connection of new control modules to magnetically held smoke door (hold-open) devices.

2. Connection of new elevator recall smoke sensors to wiring and conduit.

3. Connection of new system transmitter to base fire reporting system.

B. Once these connections are made, system shall be left energized and new audio/visual devices deactivated. Report immediately to the Contracting Officer, coordination and field problems resulting from the connection of the above components.

3.04 FIRESTOPPING

A. Provide firestopping for holes at conduit penetrations through floor slabs, fire rated walls, partitions with fire rated doors, corridor walls, and vertical service shafts in accordance with Division 07.

3.05 PAINTING

A. Paint exposed electrical, fire alarm conduit, and surface metal raceway to match adjacent finishes in exposed areas. Paint junction boxes, conduit and surface metal raceways red in unfinished areas. Painting shall comply with Division 09.
3.06 FIELD QUALITY CONTROL

A. Testing Procedures: Detailed test procedures, prepared and signed by a Registered Professional Engineer or a NICET Level 3 Fire Alarm Technician, and signed by representative of the installing company, for the fire detection and alarm system 60 days prior to performing system tests. Detailed test procedures shall list all components of the installed system such as initiating devices and circuits, notification appliances and circuits, signaling line devices and circuits, control devices/equipment, batteries, transmitting and receiving equipment, power sources/supply, annunciators, special hazard equipment, emergency communication equipment, interface equipment, Guard’s Tour equipment, and transient (surge) suppressors. Test procedures shall include sequence of testing, time estimate for each test, and sample test data forms. The test data forms shall be in a check-off format (pass/fail with space to add applicable test data) and shall be used for the preliminary testing and the acceptance testing. The test data forms shall record the test results and shall:

1. Identify the NFPA Class of all Initiating Device Circuits (IDC), Notification Appliance Circuits (NAC), Voice Notification System, and Signaling Line Circuits (SLC).
2. Identify each test required by NFPA 72 Test Methods and required test herein to be performed on each component, and describe how this test shall be performed.
3. Identify each component and circuit as to type, location within the facility, and unique identity within the installed system. Provide necessary floor plan sheets showing each component location, test location, and alphanumeric identity.
4. Identify all test equipment and personnel required to perform each test (including equipment necessary for testing smoke detectors using real smoke).
5. Provide space to identify the date and time of each test. Provide space to identify the names and signatures of the individuals conducting and witnessing each test.

B. Test States:

1. Preliminary Testing: Conduct preliminary tests to ensure that devices and circuits area functioning properly. Tests shall meet the requirements of paragraph entitled ‘Minimum System Tests’. After preliminary testing is complete, provide a letter certifying that the installation is complete and fully operable. The letter shall state that each initiating and indicating device was tested in place and functioned properly. The letter shall also state that panel functions were tested and operating properly. The letter shall include the names and titles of the witnesses to the preliminary tests. The Contractor and an authorized representative from each supplier of equipment shall be in attendance at the preliminary testing to make necessary adjustments.

2. Request for Formal Inspection and Tests: When tests have been completed and corrections made, submit a signed, dated certificate with a request for formal inspection and tests to the Contracting Offices Designated Representative (COR).

C. Final Testing: Notify the Contracting Officer in writing when the system is ready for final acceptance testing. Submit request for test at least 15 calendar days prior to the test date. The tests shall be performed in accordance with the approved test procedures in the presence of the Contracting Officer. The Contractor shall furnish instruments and personnel required for the tests. A final acceptance test will not be scheduled until the operation and maintenance (O&M) Manuals are furnished to the Contracting Officer and the following are provided at the job site:

1. The systems manufacturer’s technical representative
2. Marked-up red line drawings of the system as actually installed.

3. Megger test results

4. Loop resistance test results

5. Complete program printout including input/output addresses

D. The final tests shall be witnessed by the Contracting Offices Designated Representative (COR). At this time, any and all required tests shall be repeated at their discretion. Following acceptance of the system, as-built drawings and O&M Manuals shall be delivered to the Contracting Officer for review and acceptance.

E. Minimum System Tests: Test the system in accordance with the procedures outlined in NFPA 72, IEC 60849, IEC 60268-16. The required tests are as follows:

1. Megger Tests: After wiring has been installed, and prior to making any connections to panels or devices, wiring shall be megger tested for insulation resistance, grounds, and/or shorts. Conductors with 300 volt rated insulation shall be tested at a minimum of 250 VDC. Conductors with 600 volt rated insulation shall be tested at a minimum of 500 VDC. The tests shall be witnessed by the Contracting Officer and test results recorded for use at the final acceptance test.

2. Loop Resistance Tests: Measure and record the resistance of each circuit with each pair of conductors in the circuit short-circuited at the farthest point from the circuit origin. The tests shall be witnessed by the Contracting Officer and test results recorded for use at the final acceptance test.

3. Verify the absence of unwanted voltages between circuit conductors and ground. The tests shall be accomplished at the preliminary test with results available at the final system test.

4. Verify that the control unit is in the normal condition as detailed in the manufacturer’s O&M Manual.

5. Test each initiating and indicating device and circuit for proper operation and response at the control unit. Smoke sensors shall be tested in accordance with manufacturer’s recommended calibrated test method. Use of magnets is prohibited. Testing of duct smoke detectors shall comply with the requirements of NFPA 72.

6. Test the system for specified functions in accordance with the contract drawings and specifications and the manufacturer’s O&M Manual.

7. Test both primary power and secondary power. Verify, by test, the secondary power system is capable of operating the system for the time period and in the manner specified.

8. Determine that the system is operable under trouble conditions as specified.


10. Test the battery charger and batteries.

11. Verify that software control and data files have been entered or programmed into the FACP. Hard copy records of the software shall be provided to the Contracting Officer.
12. Verify that red-line drawings are accurate.

13. Measure the current in circuits to ensure there is the calculated spare capacity for the circuits.

14. Measure voltage readings for circuits to ensure that voltage drop is not excessive.

15. Disconnect the verification feature for smoke sensors during tests to minimize the amount of smoke needed to activate the sensor. Testing of smoke sensors shall be conducted using real smoke. The use of canned smoke is prohibited.

16. Measure the voltage drop at the most remote appliance (based on wire length) on each notification appliance circuit.

17. Audibility intelligibility testing of the voice evacuation notification system shall be accomplished law NFPA 72 for voice evacuation systems, IEC 60268-16, and ANSI S3.2.

18. Opening the circuit at not less than 10% of alarm initiating devices and notification appliances to test the wiring supervisory feature.

19. The Contractor shall demonstrate modem communications with remote sites as specified by the COR. Dial in capability shall also be demonstrated, using specified security.

20. The Contractor shall demonstrate fiber optic communications with remote sites as specified by the COR. Dial in capability shall also be demonstrated, using specified security.

3.07 ARMY/AIR FORCE SPECIFIC REQUIREMENTS: VERIFY INTELLIGIBILITY BY MEASUREMENT AFTER INSTALLATION

A. Ensure that a CIS score greater than 0.8 is provided in each area where building occupants normally could be found. Note: Values of 0.75 through 0.84 will be rounded to 0.8.

B. Areas of the building provided with hard wall and ceiling surfaces (such as metal or concrete) that are found to cause excessive sound reflections may be permitted to have a CIS score less than 0.8 if approved by the DOD installation, and if building occupants in these areas can determine that a voice signal is being broadcast and they must walk no more than 10 m (33 ft) to find a location with CIS score of at least 0.8.

C. Areas of the building where occupants are not expected to be normally present are permitted to have a CIS score less than 0.8 if personnel can determine that a voice signal is being broadcast and they must walk no more than 15 m (50 ft) to a location with a CIS score of at least 0.8.

D. Measurements should be taken near the head level applicable for most personnel in the space under conditions (e.g. standing, sitting, sleeping, as appropriate).

E. Commercially available test instrumentation shall be used to measure intelligibility as specified by IEC 60849 and IEC 60268-16. The mean value of at least three readings shall be used to compute the intelligibility score at each test location.

Note: An STI score of 0.7 is considered equivalent to a CIS score of 0.7.
3.08 DRAWINGS, MANUALS, TOOLS AND SPARE PARTS

A. Upon completion of the installation and prior to final inspection, the contractor shall furnish ‘as-built’ drawings as indicated above. In addition, the contractor shall furnish five (5) copies of a manual, including wiring diagrams, giving complete instructions for the operation, inspection, testing and maintenance of the system. Any special tools necessary for the maintenance of the equipment shall be furnished, as well as one spare set of fuses of each type and size required. As soon as practicable after approval of the list of equipment, the contractor shall furnish copies of spare parts data for each different item of equipment listed. The data shall include a complete list of parts and supplies with current unit prices.

3.09 INSTRUCTION OF GOVERNMENT EMPLOYEES

A. Equipment manufacturer shall provide one day on site and five days of technical training to the Government at the manufacturing facility. Training shall allow for classroom instruction as well as individual hands on programming, troubleshooting and diagnostics exercises. Room and travel costs shall be included for two Government personnel. Factory training shall occur within six months of system acceptance.

B. Instructor: Include in the project the services of an instructor, who shall have received specific training from the manufacturer for the training of other persons regarding the inspection, testing, and maintenance of the system provided. The instructor shall train the Government employees designated by the Contracting Officer, in the care, adjustment, maintenance, and operation of the fire alarm and fire detection/mass notification system.

C. Qualifications: Each instructor shall be thoroughly familiar with all parts of this installation. The instructor shall be trained in operating theory as well as in practical O&M work.

D. Required Instruction Time: Provide eight hours of instruction after final acceptance of the system. The instruction shall be given during regular working hours on such dates and times as are selected by the Contracting Officer. The instruction may be divided into two or more periods at the discretion of the Contracting Officer. The training shall allow for rescheduling for unforeseen maintenance and/or fire department responses.

END OF SECTION
SECTION 31 10 00
SITE CLEARING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Protecting existing vegetation to remain.
B. Removing existing vegetation.
C. Clearing and grubbing.
D. Stripping, screening and stockpiling topsoil.
E. Removing above and below-grade site improvements.
F. Disconnecting, capping or sealing, and abandoning site utilities in place.
G. Temporary erosion- and sedimentation-control measures.

1.02 RELATED REQUIREMENTS

A. Section 01 50 00 - Temporary Facilities and Controls.
B. Section 31 20 00 - Earth Moving.

1.03 DEFINITIONS

A. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.
B. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.
C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil;
   1. Topsoil shall be reasonably free of subsoil, clay lumps, gravel, and other objects more than 1 inch in diameter; and free of weeds, roots, toxic materials, or other non-soil materials.
D. Vegetation: Trees, shrubs, groundcovers, grass, sod and other plants.

1.04 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads and other adjacent occupied or used facilities during site-clearing operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from EXCHANGE and authorities having jurisdiction.
   2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.
B. Utility Locator Service: Notify Call Before You Dig, 8-1-1 for area where Project is located before site clearing.
C. Do not commence site clearing operations until temporary erosion- and sedimentation-control, SWPPP Plan and plant-protection measures are in place.
D. Soil Striping, Handling, and Stockpiling: Perform only when the topsoil is dry or slightly moist.
E. Savable Improvements: Carefully remove items indicated to be salvaged and store on EXCHANGE premises where indicated.

1.05 SUBMITTALS

A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.
B. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.
C. NPDES Permit (National Pollution Discharge Eliminations Systems) with Associated SWPPP (Stormwater Pollution Prevention Plan) prepared for the site and implemented by the Contractor.

1.06 MATERIAL OWNERSHIP
A. Except for stripped topsoil and other soil materials indicated to be stockpiled or otherwise remain on EXCHANGE property, cleared materials shall become Contractor's property and shall be removed from Project site.

PART 2 PRODUCTS
2.01 MATERIALS
A. Topsoil: Stockpile screened topsoil quantities at a suitable location for future amendment process.
B. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.

PART 3 EXECUTION
3.01 PREPARATION
A. Protect and maintain benchmarks and survey control points from disturbance during construction.
B. Locate and clearly identify trees, shrubs, and other vegetation to remain. Protect existing site improvements to remain from damage during construction. Only remove vegetation identified by the Owner.
C. Restore damaged improvements to their original condition, as acceptable to Owner.

3.02 STORMWATER POLLUTION PREVENTION PLAN (SWPPP)
A. The Contractor shall provide a SWPPP for the project site.
B. Contractor shall review, sign, and implement all elements of the SWPPP during construction.

3.03 TREE PROTECTION
A. 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. Do not store construction materials, debris or excavated material within drip line of remaining trees.
2. Do not permit vehicles, equipment, or foot traffic within drip line of remaining trees.
B. Do not excavate within drip line of trees, unless otherwise indicated or approved by Contracting Officer.
C. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Contracting Officer.
D. Replace trees that cannot be repaired and restored to full-growth status, as determined by the qualified arborist.

3.04 TEMPORARY EROSION AND SEDIMENTATION CONTROL
A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties, according to requirements of authorities having jurisdiction. Utilize the Best Management Practices for silt fence, rock check dams, bio-filtration swales, temporary construction entrances and others shown on the SWPPP, Grading & Drainage Drawings, and erosion and sedimentation-control details shown on the Drawings, and as needed to ensure a stable site throughout the duration of the project.
B. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
C. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.
3.05 EXISTING UTILITIES

A. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place. Arrange with utility companies to shut off indicated utilities.

B. Locate, identify, and disconnect utilities indicated to be abandoned in place.

C. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by EXCHANGE or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
   1. Notify Contracting Officer not less than five (5) days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Contracting Officer written permission.

D. Excavate for and remove underground utilities indicated to be removed.

3.06 CLEARING AND GRUBBING

A. Remove obstructions, and other vegetation to permit installation of new construction. Do not remove vegetation indicated to remain or to be relocated.

B. Fill depressions caused by clearing and grubbing operations within future building, pavement and sidewalk areas with Structural Fill material unless further excavation or earthwork is indicated.
   1. Place fill material in horizontal layers not exceeding a loose depth of 6 inches at or near optimum moisture content and compact each layer to 95 percent of the modified proctor maximum density per ASTM D 1557.

C. Fill depressions caused by clearing and grubbing operations not in future building, pavement and sidewalk areas with suitable native material unless further excavation or earthwork is indicated.
   1. Place fill material in horizontal layers not exceeding a loose depth of 6 inches at or near optimum moisture content and compact each layer to 85 percent of the modified proctor maximum density per ASTM D 1557.

3.07 TOPSOIL STRIPPING, SCREENING AND STOCKPILING

A. Remove sod and grass before stripping.

B. Strip topsoil to whatever depths are encountered as directed by the Contracting Officer in a manner to prevent intermingling with underlying subsoil or other waste materials. Remove subsoil and non soil materials from topsoil, including clay lumps, gravel, and other objects more than 1 inch in diameter; trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

D. Limit height of topsoil stockpiles to 72 inches.
   1. Do not stockpile topsoil within drip line of remaining trees.
   2. Dispose of excess topsoil as specified for waste material disposal.

3.08 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

B. Remove slabs, paving, and aggregate base as indicated.

C. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.

3.09 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner’s property.
B. Separate recyclable materials produced during site clearing from other non-recyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION
SECTION 31 20 00
EARTH MOVING

PART 1  GENERAL

1.01  SECTION INCLUDES
A. Preparing subgrades for slabs on grade, pavements, curbs and gutters, walks, and sod.
B. Excavating and backfilling for buildings and structures.
C. Crushed aggregate base course for concrete pavements, curbs and gutters, and walks.
D. Excavating and backfilling trenches for utilities and pits for buried utility structures.

1.02  RELATED REQUIREMENTS
A. Section 01 50 00 - Temporary Facilities and Controls.
B. Divisions 22, 23, 26, and 33 for installing underground mechanical and electrical utilities and buried mechanical and electrical structures.
C. Section 31 10 10 - Site Clearing.
D. Section 32 13 00 - Concrete Paving.
E. Section 32 92 00 - Turf and Grasses.

1.03  DEFINITIONS
A. Backfill: Soil materials used to fill an excavation
B. Borrow: Satisfactory soil imported from off-site for use as fill or backfill.
C. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below crushed gravel base or topsoil materials.
D. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.
E. Structures: Building, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
F. Structural Fill: Soil placed or moved on site that will support any structural elements including pavements, concrete, sidewalks, and curbs.
G. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.
2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.
H. Trench Zone Backfill: Material used to fill a trench above the Pipe Bedding to subgrade, placed over pipe in a trench to subgrade elevation.
I. Pipe Bedding: Aggregate layer placed over the excavated trench bottom in a trench 4 inches below the pipe to 6 inches above the pipe, including haunches to support sides of pipe. Aggregate layer placed over the excavated trench bottom in a trench 6 inches below the pipe in areas of rock to 6 inches above the pipe, including haunches to support sides of pipe.
J. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. for bulk excavation or ¾ cu. yd. for footing, trench, and pit excavation.
1. Excavation of Footings, Trenches, and Pits: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch wide, maximum, short-tip-radius rock bucket; rated at not less than 138-hp flywheel power with bucket-curling force of not less than 28,700 lbf and stick-crowed force of not less than 18,400 lbf, measured according to SAE J-1179.
K. Crushed Aggregate Base: Aggregate layer placed between the subgrade and hot-mix asphalt paving or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

1.04 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from EXCHANGE and authorities having jurisdiction.
   2. Provide alternate routes around closed or obstructed traffic ways if required by EXCHANGE or authorities having jurisdiction.

B. Utility Locator Service: Notify "Call Before You Dig" 8-1-1 for area where Project is located before beginning earth moving operations.

C. Do not commence earth moving operations until temporary erosion- and sedimentation-control measures, specified in Section 01 50 00 - Temporary Facilities and Controls, and Section 31 10 00 - Site Clearing, are in place.

D. Do not commence earth moving operations until plant-protection measures specified in Section 31 10 00 - Site Clearing, are in place.

E. The following practices are prohibited within protection zones:
   1. Storage of construction materials, debris, or excavated material.
   2. Parking vehicles or equipment.
   3. Foot traffic.
   4. Erection of sheds or structures.
   5. Impoundment of water.
   6. Excavation or other digging unless otherwise indicated.
   7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
   8. Do not direct vehicle or equipment exhaust towards protection zones.
   9. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

F. Earth Moving is unclassified and shall include excavation, backfill and compaction of native material, structural fill and imported material and disposal of unsuitable material for the buildings, access roads, drainage, utility lines and all associated structures. It is the Contractor’s responsibility to protect all existing improvements to remain in place.

G. Surplus excavated material shall be removed from the site and disposed of legally by the Contractor at no additional cost to EXCHANGE. Surplus excavated material may be stockpiled on the site in locations and heights as determined by the Contracting Officer.

H. Existing Utilities: Locate existing underground utilities in areas of excavation work. If utilities are indicated to remain in place, provide adequate means of support and protection during earthwork operations.
   1. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Government and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.
   2. Do not interrupt existing utilities serving facilities occupied by Government or others, during occupied hours, except when permitted in writing by Contracting Officer, and then only after acceptable temporary utility services have been provided.
   3. Provide a minimum 72-hours notice to the Contracting Officer and receive written notice to proceed before interrupting any utility.

1.05 SUBMITTALS

A. Product Data: For each type of the following manufactured products required:
   1. Geotextiles.
2. Warning Tapes.

B. Samples for Verification: For the following products, in sizes indicated below:
2. Warning Tape: 12 inches long; of each color.

C. Qualification Data: For qualified testing agency.

D. Material Test Reports: For each on-site and borrow soil material proposed for fill, base, free draining aggregate, drain rock cover and backfill as follows:
1. Classification according to ASTM D 2487.
2. Laboratory compaction curve according to ASTM D 1557.

PART 2 PRODUCTS

2.01 SOIL MATERIALS

A. General:
1. Use native onsite borrow soil materials from Government designated areas and onsite excavations.
2. Provide import borrow soil materials when sufficient satisfactory soil materials are not available from excavations and designated borrow areas onsite.

B. Satisfactory materials: Satisfactory materials shall comprise any materials classified by ASTM D 2487 as GW, GP, GM, GP-GM, GW-GM, GC, GP-GC, GM-GC, SW, SP, SM, SW-SM, SP-SM.

C. Unsatisfactory Materials: Materials which do not comply with the requirements for satisfactory materials are unsatisfactory.
1. Unsatisfactory materials include man-made fills, trash, refuse, or backfills from previous construction. Unsatisfactory material also includes material classified as satisfactory which contains root and other organic matter, frozen material, and stones larger than 6 inches. The Contracting Officer shall be notified of any contaminated materials.

D. Unstable Materials: Unstable materials shall consist of materials too wet to properly support the utility pipe, conduit, or appurtenant structure.

E. Backfill and fill shall consist of satisfactory soil materials meeting the following requirements.
1. Passing the 1.5 inches Sieve: 100%
2. Passing the #40 Sieve: less than 5 times that passing the #200 sieve.
3. Passing the #200 Sieve: 35% or less.
4. Plasticity Index: 10 or less.

F. Bedding Material: Bedding shall consist of select native material of which 100% shall pass of 5/8-inch square opening in sieve, and shall be uniformly graded from coarse to fine with not more than 15% passing a No. 200 screen. Bedding material shall be free of topsoil or organic matter.

G. Select Bedding Material: Select granular material shall consist of well-graded sand, gravel, crushed gravel, crushed stone or crushed slag composed of hard, tough and durable particles, and shall contain no more than 10 percent by weight of material passing a No. 200 mesh sieve and no less than 95 percent by weight passing the 1 inch sieve. The maximum allowable aggregate size shall be 2 inches, or the maximum size recommended by the pipe manufacturer, whichever is smaller.

H. Liquid Limit and Plasticity Index: Liquid limit and plasticity index requirements shall apply to the completed course and shall also apply to any component that is blended to meet the required gradation. The portion of any component or of the completed course passing the No. 40 sieve shall be either non-elastic or have a liquid limit not greater than 25 and a plasticity index not greater than 5.

I. Silt Fencing: 3'-0" high, self-supporting polypropylene fabric specifically designed for the intended purpose.
1. Posts For Silt Fencing: Steel or minimum 1½” x 1½” wood.

J. Aggregate Base Course: The ABC shall consist of clean, sound, durable particles of crushed stone, crushed slag, crushed gravel, angular sand, or other approved material. ABC shall be free of lumps of clay, organic matter, and other objectionable materials or coatings. The portion retained on the 4.75 mm No. 4 sieve shall be known as coarse aggregate; that portion passing the 4.75 mm No. 4 sieve shall be known as fine aggregate.

1. Coarse Aggregate: Coarse aggregates shall be angular particles of uniform density. When the coarse aggregate is supplied from more than one source, aggregate from each source shall meet the specified requirements and shall be stockpiled separately.
   a. Crushed Gravel: Crushed gravel shall be manufactured by crushing gravels, and shall meet all the requirements specified below.
   b. Crushed Stone: Crushed stone shall consist of freshly mined quarry rock, and shall meet all the requirements specified below.
   c. Crushed Slag: Crushed slag shall be an air-cooled blast-furnace product having an air dry unit weight of not less than 1120 kg/cubic meter 70 pcf as determined by ASTM C 29>C 29M, and shall meet all the requirements specified below.

2. Aggregate Base Course Coarse Aggregates: ABC coarse aggregate shall not show more than 50 percent loss when subjected to the Los Angeles abrasion test in accordance with ASTM C 131. The amount of flat and elongated particles shall not exceed 30 percent. A flat particle is one having a ratio of width to thickness greater than 3; an elongated particle is one having a ratio of length to width greater than 3. In the portion retained on each sieve specified, the crushed aggregates shall contain at least 50 percent by weight of crushed pieces having two or more freshly fractured faces with the area of each face being at least equal to 75 percent of the smallest midsectional area of the piece. When two fractures are contiguous, the angle between planes of the fractures must be at least 30 degrees in order to count as two fractured faces. Crushed gravel shall be manufactured from gravel particles 50 percent of which, by weight, are retained on the maximum size sieve listed in TABLE 1.

3. Fine Aggregate: Fine aggregates shall be angular particles of uniform density. When the fine aggregate is supplied from more than one source, aggregate from each source shall meet the specified requirements.

4. Aggregate Base Course Fine Aggregate: ABC fine aggregate shall consist of screenings, angular sand, crushed recycled concrete fines, or other finely divided mineral matter processed or naturally combined with the coarse aggregate.

5. Gradation Requirements: The specified gradation requirements shall apply to the completed base course. The aggregates shall be continuously well graded within the limits specified in TABLE 1. Sieves shall conform to ASTM E11.

### TABLE I. GRADATION OF AGGREGATES

Percentage by Weight Passing Square-Mesh Sieve

<table>
<thead>
<tr>
<th>Sieve Designation</th>
<th>No. 1</th>
<th>No. 2</th>
<th>No. 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 inch</td>
<td>100</td>
<td>-----</td>
<td>-----</td>
</tr>
<tr>
<td>1-1/2 inch</td>
<td>70-100</td>
<td>100</td>
<td>-----</td>
</tr>
<tr>
<td>1 inch</td>
<td>45-80</td>
<td>60-100</td>
<td>100</td>
</tr>
<tr>
<td>1/2 inch</td>
<td>30-60</td>
<td>30-65</td>
<td>40-70</td>
</tr>
<tr>
<td>No. 4</td>
<td>20-50</td>
<td>20-50</td>
<td>20-50</td>
</tr>
<tr>
<td>No. 10</td>
<td>15-40</td>
<td>15-40</td>
<td>15-40</td>
</tr>
<tr>
<td>No. 40</td>
<td>5-25</td>
<td>5-25</td>
<td>5-25</td>
</tr>
<tr>
<td>No. 200</td>
<td>0-8</td>
<td>0-8</td>
<td>0-8</td>
</tr>
</tbody>
</table>

NOTE 1: Particles having diameters less than No. 200 Sieve shall not be in excess of 3 percent by weight of the total sample tested.
NOTE 2: The values are based on aggregates of uniform specific gravity. If materials from different sources are used for the coarse and fine aggregates, they shall be tested in accordance with ASTM C127 and ASTM C128 to determine their specific gravities. If the specific gravities vary by more than 10 percent, the percentages passing the various sieves shall be corrected as directed by the Contracting Officer.

2.02 GEOTEXTILES

A. Stabilization / Separation Geotextile Fabric for Paved Areas: Non woven geotextile stabilization /separation fabric placed over subgrade with the properties of US Fabrics, Inc. US 205, or approved equivalent.

2.03 ACCESSORIES

A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick. Tape shall have a minimum strength of 1750 psi lengthwise and 1500 psi crosswise. The tape shall be manufactured with integral wires, foil backing or other means to enable detection by a metal detector when the tape is buried up to 3 feet deep. The tape shall be of a tape specifically manufactured for marking and locating underground utilities. The metallic core of the tape shall be encased in a protective jacket or provided with other means to protect it from corrosion. Tape color shall be as specified below and shall bear a continuous printed inscription describing the specific utility.
   2. Yellow: Gas, oil, steam, and dangerous materials.
   3. Orange: Telephone and other communications.
   4. Blue: Water systems.
   5. Green: Sewer (sanitary and storm) systems.
   6. Purple: Irrigation systems.

PART 3 EXECUTION

3.01 PREPARATION

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

B. Protect and maintain erosion and sedimentation controls during earth moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.02 EXPLOSIVES

A. Explosives: Do not use explosives.

3.03 EXCAVATION, GENERAL

A. All excavation is unclassified except that defined as rock excavation. Rock excavation will be paid for by adjusting the contract sum according to unit prices included in the Contract Documents.

1. Unclassified excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock of unauthorized excavation.
   a. Intermittent drilling; ram hammering; or ripping of material not classified, as rock excavation is unclassified excavation.
3.04 EXCAVATION FOR STRUCTURES
   A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
      1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
      2. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended for bearing surface.
   B. Excavations at Edges of Tree- and Plant-Protection Zones:
      1. Excavate by hand to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.

3.05 EXCAVATION FOR WALKS AND PAVEMENTS
   A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.06 EXCAVATION FOR UTILITY TRENCHES
   A. Excavate trenches to indicated gradients, lines, depths, and elevations. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
   B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated. Provide 6 inches clearance each side of pipe or conduit.
   C. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.07 SUBGRADE INSPECTION
   A. Subgrade shall be tested by the EXCHANGE hired Testing Entity.
   B. If Testing Entity determines that unsatisfactory soil is present continue excavation and replace with compacted backfill or fill material as directed. Notify the Contracting Officer immediately.
   C. Proof-roll subgrade below pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Testing Entity, and replace with compacted Structural Fill, as directed.
   D. Authorized additional excavation and replacement material outside of fill areas will be paid for according to Contract provisions for Changes in the Work.
   E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Contracting Officer or Testing Entity without additional compensation.

3.08 UNAUTHORIZED EXCAVATION
   A. 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, with 28-day compressive strength of 2500 psi, may be used when approved by Architect. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.
3.09 STORAGE OF SOIL MATERIALS
A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.10 BACKFILL
A. Place and compact backfill in excavations promptly, but not before completing the following:
   1. Surveying locations of underground utilities for Record Documents.
   2. Testing and inspecting underground utilities.
   3. Removing concrete formwork.
   4. Removing trash and debris.
   5. Removing temporary shoring and bracing, and sheeting.
   6. Installing permanent or temporary horizontal bracing on horizontally supported walls.
B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.11 UTILITY TRENCH BACKFILL
A. Place backfill on subgrades free of mud, frost, snow, or ice.
B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
C. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Section 03 30 00 - Cast-in-Place Concrete.
D. Backfill voids with satisfactory soil while removing shoring and bracing.
E. Place and compact Pipe Bedding to a height of 6 inches over the pipe or conduit.
   1. Carefully compact under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
F. Place and compact Trench Zone Backfill to final subgrade elevation.
G. Provide 4-inch-thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase.
H. Install warning tape directly above utilities, 18 inches below finished grade along entire length of utility.

3.12 SOIL MOISTURE CONTROL
A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
   1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
   2. 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.

3.13 COMPACTATION OF SOIL BACKFILLS AND FILLS
A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D1557:
1. Under structures, building slabs, curbs, and pavements, scarify and recompact top 12 inches of existing subgrade and compact each layer of backfill or fill soil material to 98 percent.
2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material to 98 percent.
3. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 90 percent.
4. For utility trenches, compact each layer of Trench Backfill under pavements, concrete, curbs and sidewalks at 98 percent and Trench Backfill under turf or unpaved areas at 90 percent.

3.14 GRADING
A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
   1. Provide a smooth transition between adjacent existing grades and new grades.
   2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
   1. Turf or Unpaved Areas: Plus or minus 1 inch.
   2. Walks: Plus or minus ½ inch.
   3. Pavements: Plus or minus ½ inch.
C. Grading Inside Building Lines: Finish subgrade to a tolerance of ½ inch when tested with a 10-foot straightedge.

3.15 CRUSHED AGGREGATE BASE UNDER PAVEMENTS AND WALKS
A. Place Crushed Aggregate Base on subgrades free of mud, frost, snow, or ice.
B. On prepared subgrade, place Crushed Aggregate Base under pavements, curbs and gutters, and walks as follows:
   1. Install separation geotextile at locations where subgrade conditions require. Install geotextiles according to manufacturer's written instructions, overlapping sides and ends.
   2. Place Crushed Aggregate Base course under concrete pavement, curbs and gutters, and walks.
   3. Shape to required crown elevations and cross-slope grades.
   4. Place 6 inches or less in compacted thickness in a single layer.
   5. Compact Crushed Aggregate Base at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 98 percent of maximum dry unit weight according to ASTM D1557.
C. Pavement Shoulders: Place shoulders along edges of Crushed Aggregate Base to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each layer to not less than 98 percent of maximum dry unit weight according to ASTM D1557.

3.16 FIELD QUALITY CONTROL
A. Testing Agency: EXCHANGE will hire an independent, qualified geotechnical engineering testing agency to perform tests and inspections.
B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.
C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Contracting Officer.
D. Testing agency will test compaction of soils in place according to ASTM D1557. Tests will be performed at the following locations and frequencies:
   1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than three tests.
   2. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet or less of trench length, but no fewer than two tests.
   3. 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 materials to depth required; recompact and retest until specified compaction is obtained.

3.17 PROTECTION
   A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
   B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.
   C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.18 DISPOSAL OF SURPLUS SOIL
   A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it. All surplus material shall be hauled to a designated site on base.

END OF SECTION
SECTION 31 31 16
TERMITE CONTROL

PART 1  GENERAL
1.01  SECTION INCLUDES
A. Chemical soil treatment.

1.02  RELATED REQUIREMENTS
A. Section 03 30 00 - Cast-in-Place Concrete: Vapor barrier placement under concrete slab-on-grade.

1.03  REFERENCE STANDARDS

1.04  SUBMITTALS
A. See Section 01 33 00 - Submittals, for submittal procedures.
B. Product Data: Indicate toxicants to be used, composition by percentage, dilution schedule, intended application rate.
C. Test Reports: Indicate regulatory agency approval reports when required.
D. Manufacturer's Certificate: Certify that toxicants meet or exceed specified requirements.
E. Certificate of compliance from authority having jurisdiction indicating approval of toxicants.
F. Manufacturer's Application Instructions: Indicate caution requirement.
G. Record and document moisture content of soil before application.
H. Installer Qualifications: Company specializing in performing work of the type specified and with minimum three (3) years of documented experience.
I. Maintenance Data: Indicate re-treatment schedule.
J. Warranty: Submit warranty and ensure that forms have been completed in Owner's name.

1.05  QUALITY ASSURANCE
A. Installer Qualifications: Company specializing in performing this type of work and:
   1. Having minimum of three (3) years documented experience.
   2. Approved by manufacturer of treatment materials.
   3. Licensed in the State in which the Project is located.

1.06  WARRANTY
A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
B. Provide five year installer's warranty against damage to building caused by termites.
   1. Include coverage for repairs to building and to contents damaged due to building damage.
   2. Inspect annually and report in writing to Owner. Provide inspection service for 5 years from Date of Substantial Completion.

PART 2  PRODUCTS
2.01  CHEMICAL SOIL TREATMENT
A. Toxicant Chemical: EPA (Title 7, United States Code, 136 through 136y) approved; synthetically color dyed to permit visual identification of treated soil.
B. Diluent: Recommended by toxicant manufacturer.
C. Manufacturers:
4. Substitutions: See Section 01 60 00 - Product Requirements.

D. Mixes: Mix toxicant to manufacturer’s instructions.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that soil surfaces are unfrozen, sufficiently dry to absorb toxicant, and ready to receive treatment.

B. Verify final grading is complete.

3.02 APPLICATION - CHEMICAL TREATMENT

A. Comply with requirements of U.S. EPA and applicable state and local codes.

B. Spray apply or inject toxicant in accordance with manufacturer's instructions.

C. Apply toxicant at following locations:
   1. Under Slabs-on-Grade.
   2. At Both Sides of Foundation Surface.
   3. Soil Within 10 feet of Building Perimeter For a Depth of 2 feet.

D. Under slabs, apply toxicant immediately prior to installation of vapor barrier.

E. At foundation walls, apply toxicant immediately prior to finish grading work outside foundations.

F. Apply extra treatment to structure penetration surfaces such as pipe or ducts, and soil penetrations such as grounding rods or posts.

G. Re-treat disturbed treated soil with same toxicant as original treatment.

H. If inspection or testing identifies the presence of termites, re-treat soil and re-test.

3.03 PROTECTION

A. Do not permit soil grading over treated work.

   END OF SECTION
SECTION 32 13 00
CONCRETE PAVING

PART 1 GENERAL

1.01 DESCRIPTION
A. Furnish and install Portland cement concrete paving complete, in place. Extent of Portland
cement concrete paving is indicated on the Drawings and as specified herein.
B. This section includes:
   1. Concrete paving.
   2. Concrete curbs and gutters.
   3. Concrete walkways.

1.02 RELATED WORK:
A. Section 03 30 00 - Cast-in-Place Concrete.
B. Section 07 92 00 - Joint Sealants: Concrete paving joint sealants.
C. Section 31 20 00 - Earth Moving: Crushed stone base course beneath concrete pavements,
walks, curbs and gutters.
D. Section 32 17 23 - Pavement Markings.

1.03 SUBMITTALS
A. See Section 01 33 00 - Submittals, for submittal procedures.
B. Provide samples, manufacturer's product data, test reports, and materials' certifications as
required in referenced sections for concrete and joint fillers and sealers.

1.04 QUALITY ASSURANCE
A. Codes and Standards: Comply with local governing regulations if more stringent than herein
specified.
B. Accessibility Requirements: ADAAG and local requirements.
C. Construction Tolerance: 1/8-inch in 10 feet for grade and alignment of top of forms; 1/4-inch in
10 feet for vertical face on longitudinal axis.
D. Install concrete and joint patterns as detailed in the Drawings.
E. Testing: Owner will hire an independent testing laboratory or entity.

1.05 PROJECT CONDITIONS
A. Traffic Control: Maintain access for vehicular, pedestrian and emergency vehicle traffic as
required for other construction activities and existing facilities.
B. Coordinate signage and barriers to direct traffic flow around the work area for operations.
Review changes and movement of barriers as the work progresses with Contracting Officer.
Allow minimum of 3 days for paving to cure prior to allowing other than foot traffic on surface.

PART 2 PRODUCTS

2.01 MATERIALS
A. Base Course: #57 graded crushed stone aggregate.
   1. Base Course Compacted Thickness: 6 inches, unless otherwise indicated.
   2. Refer to Section 31 20 00 - Earth Moving, for further requirements.
B. Formwork Materials: Steel, wood, or other suitable material of size and strength to resist
movement during concrete placement and to retain horizontal and vertical alignment until
removal. Use straight forms, free of distortion and defects.
C. Use flexible spring steel forms to form radius bends as required.
D. Form release agent: Provide commercial formulation form-release agent that will not bond with,
stain, or adversely affect concrete surfaces and will not impair subsequent treatments of
concrete surfaces.
E. Calcium chloride shall not be used unless approved by the Contracting Officer.

F. Antisplalling Compound: Boiled linseed oil and mineral spirits, complying with AASHTO M-233.

G. Concrete: ASTM C150, Type 1 Portland cement; ASTM C33, normal weight aggregates; potable water.
   1. Design Mix: ASTM C94, 4000 psi, 28 days minimum compressive strength.
   2. Slump Limits: 8 inches minimum with superplasticizer, 3 inches otherwise.
   3. Air Content: 5% to 8%.
   4. Finish: Broom finish, perpendicular to direction of travel.

H. Bonding Compound: Polyvinyl acetate or acrylic base.


J. Reinforcing Bars: Deformed steel bars, ASTM A 615, Grade 60.

K. Joint Dowel Bars: Plain steel bars, ASTM A 615, Grade 60. Cut bars true to length with ends square and free of burrs.

L. Expansion and Isolation Joint Materials: ASTM D 1751 Asphalt Saturated Cellulosic Fiber.

M. Liquid-Membrane Forming and Sealing Curing Compound: Comply with ASTM C 309, Type 1, Class A unless other type acceptable to Contracting Officer. Moisture loss no more than 0.055 gr./sq. cm. when applied at 200 sq. ft./gal.

N. Epoxy Adhesive: ASTM C 881, 2-component material suitable for use on dry or damp surfaces. Provide material "Type," "Grade," and "Class" to suit project requirements.

PART 3 EXECUTION

3.01 BASE COURSE MATERIAL
   A. General: Base course consists of placing base course material, in layers of specified thickness, over prepared subgrade surface to support a pavement course.
   B. Refer to Section 31 20 00 for provision of 6 inch crushed stone base course to be provided beneath concrete pavements, walks, curbs and gutters.

3.02 SURFACE PREPARATION
   A. Remove loose material from compacted base course surface immediately before placing concrete.
   B. Proof-roll prepared base course surface to check for unstable areas and need for additional compaction. Do not begin paving work until such conditions have been corrected and are ready to receive paving.

3.03 FORM CONSTRUCTION
   A. Set forms to required grades and lines, braced and secured. Install forms to allow continuous progress of work and so that forms can remain in place at least 24 hours after concrete placement.
   B. Check completed formwork for grade and alignment to following tolerances:
      1. Top of forms not more than 1/8 inch in 10 feet.
      2. Vertical face on longitudinal axis, not more than 1/4 inch in 10 feet.
   C. Clean forms after each use and coat with form release agent as required to ensure separation from concrete without damage.
   D. Slope step treads at 1/4 inch per foot to drain.

3.04 REINFORCEMENT
   A. Locate, place, and support reinforcement as specified in Division 3 sections, unless otherwise indicated.
3.05 CONCRETE PLACEMENT

A. General: Comply with requirements of Division 3 sections for mixing and placing concrete, and as herein specified.

B. Do not place concrete until base course and forms have been checked for line and grade, and all free of all deleterious material. Moisten base course if required to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

C. Place concrete by methods that prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints. Use only square-faced shovels for hand spreading and consolidation.

D. Use bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

E. Deposit and spread concrete in a continuous operation between transverse joints as far as possible. If interrupted for more than 1/2 hour, place a construction joint.

F. Curbs and Gutters: Automatic machine may be used for curb and gutter placement at Contractor's option. If machine placement is to be used, submit revised mix design and laboratory test results that meet or exceed minimums specified. Machine placement must produce curbs and gutters to required cross-section, lines, grades, finish, and jointing as specified for formed concrete. If results are not acceptable, remove and replace with formed concrete as specified.

3.06 JOINTS

A. General: Construct construction, isolation, and expansion joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.

B. Joints: Locate and install contraction, construction, isolation, and expansion joints as indicated or required.

1. Provide control joints (CJ) as shown on drawings. If no control joints are shown provide at 5 feet on center each way. Coordinate with Contracting Officer for point of beginning and module prior to pouring.

2. Provide expansion joints (EJ) as shown on drawings. If no expansion joints are shown provide at 15 feet on center maximum each way.

C. When joining existing pavement place transverse joints to align with previously placed joints, unless otherwise indicated.

D. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour, unless pavement terminates at isolation or expansion joints.

1. Use epoxy bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

E. Isolation and Expansion Joints: Form isolation and expansion joints of pre-formed joint-filler strips abutting concrete curbs, catch basins manholes, inlets, structures, walks, other fixed objects, and where indicated.

1. Locate expansion joints at intervals of 15 feet, unless otherwise indicated.

2. Extend joint fillers full width and depth of joint.

3. Terminate joint filler ½ inch below finished surface.

4. Place top of joint filler below finished concrete surface and fill joint with sealant.

5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint–filler sections together.

6. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
F. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to the following radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.

3.07 CONCRETE FINISHING
A. After striking-off and consolidating concrete, smooth surface by screeding and floating. Adjust floating to compact surface and produce uniform texture.
B. After floating, test surface for trueness with a 10-ft. straightedge. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide a continuous smooth finish.
C. Work edges of slabs, gutters, back top edge of cut, and formed joints with an edging tool, and round to 1/2-inch radius, unless otherwise indicated. Eliminate tool marks on concrete surface.
D. After completion of floating and when excess moisture or surface sheen has disappeared, complete troweling and finish surface as follows:
   1. Broom finish by drawing a fine-hair broom across concrete surface perpendicular to line of traffic. Repeat operation if required to provide a fine line texture acceptable to Contracting Officer.
      a. On inclined slab surfaces, provide a coarse, non-slip finish by scoring surface with a stiff bristled broom, perpendicular to line of traffic.
E. Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point-up any minor honeycombed areas. Remove and replace areas or sections with major defects, as directed by Contracting Officer.

3.08 CURING
A. Protect and cure finished concrete paving in compliance with applicable requirements of Section 03 30 00. Use membrane-forming curing and sealing compound or approved moist curing methods.

3.09 WEATHER PLACEMENT CONDITIONS
A. Cold Weather Placing: Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306 and as herein specified.
   1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F, and not more than 80 deg F at point of placement.
   2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
   3. Do not use calcium chloride, salt and other materials containing antifreeze agents.
B. Hot Weather Placing: When hot weather conditions exist that would seriously impair quality and strength on concrete, place concrete in compliance with ACI 305 and as herein specified.
   1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 deg F. Mixing water may be chilled, or chopped ice may be used to control temperature provided water equivalent of ice is calculated in total amount of mixing water. Use of liquid nitrogen to cool concrete is Contractor’s option.
   2. Cover reinforcing steel with water soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.
   3. Fog spray forms, reinforcing steel and subgrade just before concrete is placed.
   4. Use water-reducing retarding admixture (Type D) when required by high temperatures, low humidity, or other adverse placing conditions.

3.10 REPAIRS AND PROTECTIONS
A. Repair or replace broken or defective concrete, as directed by Contracting Officer.
B. Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least 14 days after placement. When Construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

C. Sweep concrete pavement and wash free of stains, discolorations, dirt, and other foreign material just before final inspection.

3.11 FIELD QUALITY CONTROL

A. See Sections 03 30 00 and 01 40 00 for Field Quality Control testing.

END OF SECTION
SECTION 32 17 23
PAVEMENT MARKINGS

PART 1 GENERAL
1.01 SECTION INCLUDES
A. Markings for concrete pavement.

1.02 RELATED REQUIREMENTS
A. Section 32 13 00: Concrete Paving.
B. Work shall comply with local facility regulations and requirements of all governing authorities.

1.03 PROJECT CONDITIONS - TRAFFIC CONTROL
A. Maintain access for vehicular and pedestrian traffic as required for other construction activities.
B. Utilize flagmen, barricades, warning signs, and warning lights as required for safe working conditions.

PART 2 PRODUCTS
2.01 MATERIALS - PAINT
A. Type: Chlorinated rubber alkyd, FS TT-P-115, Type III, factory mixed, quick-drying, non-bleeding.
B. Colors: (Unless noted otherwise on plan)
   1. Lane Striping: Yellow
   2. Handicap Symbols: Blue or Per Local Code
   3. Parking Stall Stripping: White
   4. Directional Arrows and Wording at Entrances and Exits: White
   5. Directional Arrows in Parking Lot: White
   6. Stop Bars: White

PART 3 EXECUTION
3.01 PREPARATION
A. Sweep and clean surface as necessary to eliminate loose material, dust, oil, grease or other material or impurities that would hamper bonding of paint to surface.

3.02 APPLICATION
A. Apply paint at manufacturer's recommended rate with total minimum of 100 to 110 sq. ft./gal. Apply with mechanical equipment to produce uniform straight edges.
B. Painting of traffic markings shall consist of two (2) coats, one (1) applied as stated above and the other six (6) to seven (7) months after opening.

END OF SECTION
SECTION 32 91 13
SOIL PREPARATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Provide, install, and fine grade topsoil, as called out on plans and specifications. The work shall include, but is not limited to, the following:
   1. Placing topsoil, as indicated on planting plans and herein.
   2. Finishing and fine grading all soil surfaces of planting areas as indicated on the plans.
   3. Preparing soil in all planted areas as specified.
   4. Fertilizing and amending the topsoil as indicated on the plans and specifications.
   5. Disposing of excess soil and debris off the site as specified.

B. All scaled dimensions are approximate. Before proceeding with work, contractor shall verify all dimensions and quantities and shall immediately inform the Owner's Representative of any discrepancy between the information on the drawings and the actual conditions. Contractor shall refrain from doing any work until given approval to do so by the Owner's Representative. Proceeding with work in areas of discrepancy can nullify Contractor's ability to charge additional fees.

C. All material shall be subject to the inspection and approval of the Owner's Representative at any time and at any place. The Owner's Representative may require samples of material prior to approval.

1.02 RELATED REQUIREMENTS

A. Section 31 10 00 - Site Clearing.
B. Section 31 20 00 - Earth Moving.
C. Section 32 92 00 - Turf and Grasses.

1.03 SUBMITTALS

A. Submit cut sheets or reports for the following:
   1. Source of topsoil.
   2. Fertilizers.
   3. Lab results for topsoil and lab recommendations for soil amendments to bring the topsoil into conformance with the specifications.

B. Do not commence work until all items are approved.

PART 2 PRODUCTS

2.01 TOPSOIL

A. Topsoil shall be a well-graded soil of good uniform quality. It should be a natural, friable soil representative of productive soils in the vicinity of the project site. Topsoil shall be free of admixture of subsoil, foreign matter, objects larger than one inch in any dimension, toxic substances, weeds, and any material or substances that may be harmful to plant growth and shall have a pH value of not less than 5.0 nor more than 7.5.

B. If generated onsite, native topsoil meeting the requirements above shall be stripped, screened, and stockpiled in accordance with Section 31 10 00 - SITE CLEARING.

C. Amend topsoil according to recommendations of Soils Testing Laboratory for fertilizers and soil amendments, including pH adjusters required for meeting pH range, organic matter, and micronutrients.

2.02 SOIL CONDITIONERS

A. Coarse concrete sand, if used to condition the soil, per Section 2.01 above, shall meet the requirements of ASTM C33 Fine Aggregate, and shall be clean, sharp, free of limestone, shale, and slate particles and of toxic materials.
B. Organic soil amendment shall be a wood material, Compost Mix or Peat Moss with pH range of 5.5 to 8.0 partially decomposed, as per the following specifications:

1. Compost shall be mature, stable, weed free, and produced by aerobic decomposition of organic matter. Compost feedstock may include, but is not limited to: agricultural, food or industrial residuals; Class A biosolids as defined in the EPA CFR Title 40, Part 503; yard trimmings, or source-separated municipal solid waste. The product must not contain any visible refuse or other physical contaminants, substances toxic to plants, or over 5% sand, silt, clay or rock material by dry weight. The product shall possess no objectionable odors. The product must meet all applicable USEPA CFR, Title 40, Part 503 Standards for Class A biosolids. The moisture level shall be such that no visible water or dust is produced when handling the material. The organic matter content shall be between 35 and 65%, as determined by loss of ignition test method (ASTM D 2974), have a carbon:nitrogen ratio between 20:1 and 35:1, maximum electrical conductivity of 3 ohms/cm, moisture content range between 35 and 50%, free from viable weeds.

2.03 FERTILIZER
   A. Fertilizer shall be as recommended by Soils Testing Laboratory.

2.04 WEED CONTROL
   A. Prior to planting, apply an approved pre-emergent herbicide in accordance with Manufacturer's recommendations.
   B. Apply "Round-up" in accordance with manufacturer's recommendations.

2.05 WATER
   A. Water for dust control and clean-up shall be provided by the Contractor.
      1. Contractor may connect to Owner's existing water service facilities, at no cost.

PART 3 EXECUTION

3.01 GRADING, LEVELING AND CONTOURING
   A. The work covered here is to finish grade and level to correct local conditions.
   B. Topsoil, if needed, shall be added to bring landscaping areas up to specified levels, grades and contours.
   C. All shrub and tree planting areas shall be graded to within 2.0" of the top of adjacent curb or paving, except where otherwise noted. All turf areas shall be fine graded to within 1.5" of the top of adjacent curb or paving, except where otherwise noted. If topsoil is required to bring existing grades to these requirements then the contractor shall provide topsoil, either stockpiled or imported to meet these ends.
   D. Re-establish all surface drainage grades. Blend slopes into level areas.
   E. Do not mix soil if the soil or amendments are saturated.
   F. Soil mix will naturally compact by approximately 30%. Allow soil to naturally settle. Use of water by spraying or sprinkling is acceptable. Add additional soil mix until the desired grade is achieved when settled.

3.02 PLANTING PREPARATION
   A. All areas to be planted shall be cleaned, weeded and cross-ripped to a minimum depth of 12" (unless otherwise noted), and shall be loosed and friable.
   B. If required by the results of the lab testing agency, apply soil amendments at 6 cu. yards/1000 sq. ft. (2" layer) to all turf areas. Thoroughly incorporate the soil amendments with top 4" to 6" soil layer.
   C. Bring amended soil to finish grades and elevations shown on contract documents and within these specifications. Do not work soil under muddy conditions. No rocks 1" in diameter or larger shall be visible on the finish grades of turf areas and 2" in all shrub and tree beds and compact soil to 80% to 85% modified proctor.
3.03 WEED CONTROL
   A. Prior to construction, "Round-up," or an approved equal, may be applied per manufacturer’s recommendations to eradicate existing weeds.

3.04 SITE CLEANUP AND DUST CONTROL
   A. The Contractor shall cause all working forces at the site to maintain the site in a neat, orderly manner throughout the construction operations.
   B. The work shall be conducted in a manner that will control the dust. When ordered to provide dust control, the Contractor shall reduce the dusty conditions to the satisfaction of the Owner’s Representative.
   C. During construction, the Contractor shall remove all rubbish and debris as it is generated. Upon completion of the work, the Contractor shall remove all equipment and debris, and shall leave the site in a neat, clean condition; all to the satisfaction of the Owner’s Representative.

END OF SECTION
SECTION 32 92 00
TURF AND GRASSES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnish all material, equipment and labor required to sod areas as shown on plans and specified herein. The work shall include, but is not limited to, the following:
   1. Finishing and fine grading all soil surfaces of planting areas as indicated on the plans.
   2. Preparing soil in all planted areas as specified.
   3. Furnishing and installing sod as indicated on the plans and specifications.
   4. Fertilizing as indicated on the plans and specifications.
   5. Disposing of excess soil and debris off the site as specified.

B. All scaled dimensions are approximate. Before proceeding with work, Contractor shall verify all dimensions and quantities and shall immediately inform the Owner's Representative of any discrepancy between the information on the drawings and the actual conditions. Contractor shall refrain from doing any work until given approval to do so by the Owner's Representative. Proceeding with work in areas of discrepancy can nullify Contractor's ability to charge additional fees.

1.02 RELATED REQUIREMENTS

A. Section 31 10 00 - Site Clearing.
B. Section 31 20 00 - Earth Moving.
C. Section 32 91 13 - Soil Preparation.

1.03 REFERENCE STANDARDS

A. TPI (SPEC) - Guideline Specifications to Turfgrass Sodding; Turfgrass Producers International.

1.04 SUBMITTALS

A. Certification: Submit certification of grass species and location of sod source.

1.05 QUALITY ASSURANCE

A. Sod Producer: Company specializing in sod production and harvesting with minimum of five years experience, and certified by the state in which the project is located.

B. Protect existing landscaping and new landscaping to be installed from damage. Any damage occurring to existing vegetation shall be the responsibility of the Contractor and shall be repaired or replaced at the discretion of the Owner and at no additional cost to the Owner.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver sod on pallets. Protect exposed roots from dehydration.

B. Do not deliver more sod than can be laid within 24 hours.

1.07 WARRANTY

A. Sod shall be warranted for a period of one (1) year from the date of acceptance. Sod that dies or is in poor condition, as determined by the Owner's Representative, shall be replaced immediately with “in-kind” sod, at no additional cost to the Owner. Material to be replaced shall be replaced by the Contractor within 15 days of written notice from the Owner's Representative. Replacement sod material shall be warranted for the time remaining on the original plant warranty period.

PART 2 PRODUCTS

2.01 SOD

A. Sod: TPI, Certified Turfgrass Sod quality; cultivated grass sod; type indicated below; with strong fibrous root system, free of stones, burned or bare spots; containing no more than 5 weeds per 1000 sq ft. Minimum age of 18 months, with root development that will support its own weight without tearing, when suspended vertically by holding the upper two corners.
1. Grass Type: Match existing at site.

2.02 TURF FERTILIZER
   A. Provide turf fertilizer that is commercial grade, free flowing, uniform in composition, and conforms to applicable state and federal regulations.
   B. Granular fertilizer shall bear the manufacturer’s warranted statement of analysis. Granular fertilizer shall contain a minimum percentage of 16 nitrogen (of which 50% shall be organic), 16 available phosphoric acid, and 16 potash.

2.03 WEED CONTROL
   A. Apply "Round-up" per manufacturer’s recommendations prior to seeding.

2.04 WATER
   A. Water for installation, maintenance, and clean-up shall be provided by the Contractor.
      1. Contractor may connect to Owner's existing water service facilities, at no cost.

PART 3 EXECUTION

3.01 MATERIAL INSPECTION
   A. All material shall be subject to the inspection and approval of the Owner’s Representative at any time and at any place. The Owner’s Representative may require samples of material prior to approval.

3.02 GRADING, LEVELING, AND CONTOURING
   A. Prior to sodding, verify that the grade of the planting area preparation conforms to the plans and specifications.

3.03 SOD PLACEMENT OPERATIONS AND ESTABLISHMENT
   A. Harvest and Delivery: Harvest from the source and deliver to project site within 24 hours. Deliver only as much sod as can be installed in one day’s work.
   B. Soil surface adjacent to paved edges shall be located as per specifications. Fine grade all surfaces to be sodded. Roll all surfaces to compact soils and to expose all depression or surface irregularities. Correct all depression and irregularities.
   C. Distribute “starter” fertilizer per the recommended amounts per square footage onto the surface of the soil.
   D. Do not lay sod on dry soils. Lightly water soil prior to laying sod and let it dry to a non-sticking surface. Lay first strip of sod roll along a straight edge. Butt joints tightly to a peak and depress to a flat condition (Do not overlap edges). On second strip, laid next to the first, stagger the joints much like a brick running bond pattern. Use a sharp knife to cut sod to fit curves and around sprinkler heads.
   E. After laying a section of sod, roll lightly to eliminate irregularities and to form a good contact between the sod and soil. Heavy rollers shall be avoided based upon potential grooves being left in the final grade.
   F. Thoroughly irrigate the sod surface after a section is completed. Sod shall be kept moist at all times for at least the first ten days, depending on the temperature. After the sod is established, decrease the frequency of irrigation and increase the amount of the water per application.
   G. Landscape Contractor shall request approval for his/her sod installation from the Owner’s Representative.
   H. The Contractor shall work to establish each grass area of this contract for a minimum 45 days. The establishment period shall begin the day after approval of the laying of sod. If, upon inspection after 45 days, the grass is found to be in a healthy growing condition with no bare spots, then the Owner’s Representative will approve the ‘turf establishment period’ as complete. Noncompliance with the above conditions will extend the turf establishment period until approval is met. Grass maintenance, during the establishment period, shall include (but not be limited to): fertilizing, watering, weed control, and removal and replacement of dead grass areas as required.
I. Fertilization: Fertilize sodded areas with 16-16-16 at a rate of 5 lbs. per 1000 sf. at the 30th day and 60th day after approval of turf installation.

3.04 MAINTENANCE PERIOD
A. Provide landscape maintenance from the completion and acceptance of each new landscape area. The maintenance period shall be for 90 days and include the following: watering of landscape shrubs, trees and turf, re-fertilization, weeding, mowing, clean-up, edging, repairs of all washouts and gullies, replanting areas void of turf one square foot and larger in area, mowing the new lawn to 2 inches whenever the grass reaches 3 inches in height prior to final inspection and acceptance, and other necessary work of maintenance.

3.05 WEED CONTROL
A. Prior to construction, "Round-up," or an approved equal, may be applied per manufacturer’s recommendations to eradicate existing weeds.
B. During construction and establishment period, the contractor shall elect to apply the same as above or selective sprays or begin manual techniques to control weed growth and propagation.
C. Turf areas shall be weed free at the end of the establishment period.

3.06 SITE CLEANUP AND DUST CONTROL
A. The Contractor shall cause all working forces at the site to maintain the site in a neat, orderly manner throughout the construction operations.
B. The work shall be conducted in a manner that will control the dust. When ordered to provide dust control, the Contractor shall reduce the dusty conditions to the satisfaction of the Owner's Representative.
C. During construction, the Contractor shall remove all rubbish and debris as it is generated. Upon completion of the work, the Contractor shall remove all equipment, debris and shall leave the site in a neat, clean condition; all to the satisfaction of the Owner's Representative.

END OF SECTION