# SPECIFICATIONS

# FOR

# NIAGARA FALLS, N.Y.
# BORDER PATROL STATION

## UNITED STATES IMMIGRATION AND NATURALIZATION SERVICE
## U.S. BORDER PARTROL
## NIAGARA FALLS, N.Y.

## DATE: May 2000

**FINAL**

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# DIVISION 1

# GENERAL REQUIREMENTS

# SECTION 01000

# STATEMENT OF WORK

## PART 1 - GENERAL

### 1.1 DESCRIPTION OF WORK:

The contractor shall provide all plant, labor, tools, equipment, appliances and materials and perform all work necessary to renovate and expand an existing 800 square foot building and four car garage constructed in the early 1960's. Construction is wood frame with brick veneer and wooden truss roofing system, residential construction. Also included is outside parking and landscaping. All work shall be in strict accordance with the specifications and drawings forming parts, thereof, subject to the terms and conditions of the contract. Completed facility will be utilized by the Border Patrol for Administrative and Operations activities.

### 1.2 LOCATION:

The work site is the Immigration and Naturalization Services (INS) Border Patrol Facilities at Niagara Falls, New York as indicated on the project drawings.

### 1.3 PRINCIPAL FEATURES:

The work to be performed includes the principal features listed below. This general outline of principal features does not in any way limit the responsibility of the contractor to perform all work and furnish all plant labor and material required by the specifications and drawings and to perform a complete and permanent job to adequately fulfill the intent of these specifications.

1.3.1 Removal of:

a. Asbestos containing material as indicated on Drawing A1 of this contract document.

b. Lead Based paint if encountered shall be removed in accordance with specification Section 02090.

1.3.2 Provisions of:

a. Renovation of approximately 1706 square feet and addition of approximately 274 square feet new area.

b. Construction will be residential type, slab on grade, wood or metal frame, brick veneer exterior walls. Building will be heated and air conditioned.

## 1.4 AUTHORITY

Except as noted below, the term "Contracting Officer" (CO) as used in this specification includes the authorized representative of the CO acting within the limits of his/her authority. With respect to all paragraphs of the specifications citing "approval by the Contracting Officer" and all paragraphs cited in Material Approval Submittals, of the solicitation, the term "Contracting Officer" means only those individuals properly appointed as CO within the Contracting Division; no other Government personnel has the authority to grant such approval.

## 1.5 TECHNICAL REPRESENTATIVE:

The Corp of Engineers is designated as the Contracting Officer's technical representative. Authority includes, but is not limited to the following specific functions of this contract:

a. Technical administration and inspection.

b. Recommending approval of shop drawings, samples and materials.

c. Testing materials not otherwise specified to be performed by the contractor or others.

d. Coordinating work operations.

## 1.6 COMPLYING WITH ENVIRONMENTAL REGULATIONS:

The contractor shall fully comply with all Federal and Local environmental laws.

## 1.7 HEALTH AND SAFETY PLAN:

Prior to commencing work, the contractor shall submit a health and safety plan for review by the Contracting Officer. The plan shall include worker's safety, confined spaces, OSHA training, handling of hazardous materials and other site safety considerations.

## 1.8 HAZARDOUS MATERIALS:

Any chemical to be used or stored during construction must be approved by the CO prior to the contractor bringing it on the work site. Material Safety Data Sheet will be provided along with methods of storing the hazardous materials and any hazardous waste.

## 1.9 AS-BUILT DRAWINGS:

On completion of work and before final inspection, the contractor shall neatly and clearly mark up two (2) sets of drawings, in red, to show all

variations or changes made to the construction designed. The drawings shall be delivered to the CO prior to final payment. If a choice of materials and/or methods has been permitted, the as-built drawings shall depict the construction actually provided. Representation of such variations shall conform to standard drafting practice and include short supplementary notes, legends and details as required to fully describe the actual conditions. Utilities shall be dimensioned from two known points or an existing permanent object, to the center line of the ditch. Legibility and clear portrayal of the as-built construction and marked prints shall be subject to review by the CO.

1.10 DATA BASE:

These specifications and accompanying drawings were prepared using data derived from the original construction drawings and from site visits. The construction shown shall not be construed as exact or complete nor are minor variations covered. It is recognized that site conditions referred to vary and that those building and site conditions ordinarily encountered and generally recognized as inherent in work of this character may include variations. The contractor shall be responsible for determining the exact conditions at the site and building and shall accept them as they exist at the time of contract award, regardless of whether or not the contractor visited the site prior to award. The contractor shall verify all measurements of existing conditions before ordering sized materials. If materials are ordered on the basis of what is shown on the construction drawings without verification of existing conditions, the contractor does so at his/her own risk.

1.11 INTERPRETATION OF THE DRAWINGS AND SPECIFICATIONS

1.11.1 It shall be understood that the specifications and drawings are complementary and are to be taken together for a complete interpretation of the work.

1.11.2 The contractor shall furnish construction completely, including accessories for all items installed.

1.11.3 The drawings of necessity utilize symbols and schematic diagrams to indicate various items of work. Neither of these have any dimensional significance nor do they delineate every item required for the intended installations. The work shall be installed, in accordance with the diagrammatic intent expressed on the electrical and mechanical drawings, and in conformity with the dimensions indicated on final architectural, civil and structural working drawings and on equipment shop drawings.

1.11.4 No interpretation shall be made from the limitations of symbols and diagrams that any elements necessary for complete work are excluded.

1.11.5 Certain details appear on the drawings which are specific with regard to the dimensioning and positioning of the work. These details are intended only for the purpose of establishing general

feasibility. They do not obviate field coordination for the indicated work.

1.11.6 Information as to the general construction of a facility shall be derived from existing structural and architectural drawings and specifications only as available at the Site Civil Engineering print room.

1.11.7 The use of words in the singular shall not be considered as limiting where other indications denote that more than one item is referred to.

## 1.12 EXISTING CONDITIONS:

These specifications and accompanying drawings were prepared using data derived from available original construction drawings and from site visits. The construction shown shall not be construed as exact or complete nor are minor variations covered. It is recognized that site conditions referred to vary and that those building and site conditions ordinarily encountered and generally recognized as inherent in work of this character may include variations. The contractor shall be responsible for determining the exact conditions at the site and building and shall accept them as they exist at the time of contract award, regardless of whether or not the contractor visited the site prior to award. The contractor shall verify all measurements of existing conditions before ordering sized materials. If materials are ordered on the basis of what is shown on the construction drawings without verification of existing conditions, the contractor does so at his/her own risk.

### 1.12.1 LOCATION OF UNDERGROUND UTILITY LINES:

The Contractor shall verify the exact location of all active underground utility lines in the path of excavation prior to excavating that portion of the work. The Contractor shall take adequate precautions to protect underground lines. When utility lines are encountered that are not on the drawings, the Contracting Officer shall be notified prior to further work in the area and the contractor shall also coordinate with the local utility companies. The Contractor shall notify the CO of any active utility lines which must be protected or relocated to support construction. Damage to active underground lines, as a result of Contractor operations, whether such lines are shown on the projects drawings or not, shall be repaired to the original condition at the Contractor’s expense at no additional cost to the government.

## 1.13 SPECIFICATION DIVISION:

These specifications are divided into several trade sections for convenience only and not to establish the units of work required of any trade. The contractor shall be responsible for the allocation of the work between appropriate trades.

**1.14 SUBMITTALS:**

Items shall be submitted after receipt of Notice to Proceed, within time limits prescribed in paragraph (Contractor Submittal Procedures) of the Special Contract Requirement (Section 00800) and in accordance with Section 01330, SUBMITTAL PROCEDURES. Materials or equipment shall not be installed until submissions have been approved by the CO. All submittals shall be verified by the contractor as being in full compliance with requirements of these project specifications and/or drawings. Submittals received without the contractor's certification will be returned, without action, for the contractor's certification and resubmittal. Partial submittals for approval of materials and/or equipment will not be accepted for review. The contractor shall be responsible for submitting for approval, at one time, all items of material and/or equipment that are part of a given system.

**1.15 PASS AND IDENTIFICATION:**

The contractor shall obtain the necessary passes and/or identification for entry into US Border Patrol Site for himself and all employees prior to commencement of work. All contractor employees shall be U.S. citizens or shall have a legal right to work in the United States. The Government reserves the right to refuse to issue a pass to any employee of the contractor for any reason deemed valid by the Government.

**1.16 SCHEDULE OF WORK:**

**1.16.1 Normal Schedule:**

Work shall be accomplished during the standard 8-hour day, 5-day week, Monday through Friday excluding Federal holidays. Deviations must be approved, in advance, by the CO.

**1.16.2 Changes:**

The contractor shall notify the CO two working days prior to moving to the work site to commence work and 36 hours prior to resumption of work at the site after an interruption of more than three (3) days.

**1.17 INSPECTION:**

Inspection of work by the Government will normally be accomplished along with the work as it progresses. At the discretion of the CO, inspection of various phases of work may be directed at their completion and prior to initiation of any further work. If phased inspection is directed, the contractor shall notify the CO at least one day prior to expected completion of that phase to be inspected.

**1.18 PRELIMINARY AND FINAL INSPECTIONS:**

The contractor shall request scheduling of the preliminary and final inspections in writing a minimum of five (5) work days in advance of project completion. The scheduling shall be coordinated with the CO.

**1.19 COORDINATION OF TRADES:**

The contract drawings are in part diagrammatic and show the general arrangement of work features and trades. The contractor must have competent personnel on the work site to coordinate all field work and shop drawings of the various trades prior to installation and/or submission of field or shop drawings for approval. The contractor shall allot spaces to the various trades prior to installation of the work. In spaces where all the various installations cannot be accommodated, the contractor shall notify the CO and submit suggestions for resolving the interference problems. The decision of the CO shall be final. The contractor shall be responsible for the coordination of drawings, when required, for completion of the work by the trades involved.

**1.20 UTILITIES:**

**1.20.1 Use of Utilities:**

All reasonable quantities of utility service will be made available to the contractor without charge. Any temporary lines and connections that may be required shall be installed, maintained and removed by the contractor at his expense and in a manner satisfactory to the CO. Removal shall be accomplished prior to final acceptance.

**1.21 PROJECT CLOSE OUT SUBMITTALS:**

At the completion of construction and before final payment, the contractor shall submit to the CO the following information, for record and operation purposes. Close out submittals shall be submitted as specified in the Sections of the specifications and as one (1) complete package.

a. As-Built drawings (2 set 24” x 36” and AutoCAD Release 14 diskette).

b. Operation and Maintenance Data/Manuals.

c. Guarantees, Warranties and Bonds.

d. Keys and keying schedule for all contractor provided locks and lockable items.

e. Spare parts and maintenance materials.

f. Deliver evidence of compliance with requirements of governing authorities.

g. Real Property Records.

1.22 DRAWINGS ACCOMPANYING SPECIFICATIONS:

Drawings accompanying the Specifications are the property of the Government and shall not be used for purposes other than those contemplated by the specifications.

1.23 BORDER PATROL REGULATIONS:

The contractor shall conform to all INS Regulations and Directives, as identified specifically at the pre-construction conference, that pertain to security, safety, traffic, fire and personnel clearances insofar as they apply to the contractors activities as directed by the CO. The contractor shall be responsible for providing and placing barricades, lighting and safety devices during construction activities.

1.24 COORDINATION OF WORK OPERATIONS:

The work to be performed under this contract is on an active installation of the U.S. Border Patrol Agency. The contractor shall coordinate work operations with the CO prior to starting work under this contract. The contractor shall have a superintendent who speaks, reads, writes and understands the English language to act for the contractor and to be available on the job site throughout each work day. Contractor will also use construction management personnel who can speak, write and understand English. The contractor shall have an employee on the site that is responsible for his quality control (QC) at all times. He shall designate his QC person to the CO at the pre-construction conference.

1.25 GOVERNMENT FURNISHED PROPERTY:

A list of the Government furnished property and materials, if applicable, will be provided to the contractor.

1.26 REAL PROPERTY RECORDS:

Within ten (10) workdays of construction completion, and prior to final payment, the Contractor shall submit the following to the Contracting Officer. The checklist shall include:

a. Real property installed equipment listing,

b. Letter of final inspection, and

c. List of discrepancies and drawings.

Once reviewed and final concurrence CO is received and all deficiencies have been corrected, final payment will be made. Should the checklist

be returned to the Contractor for corrections, the Contractor shall make the corrections and return the checklist within ten (10) workdays.

-- END OF SECTION 01000 --

DIVISION 1

GENERAL REQUIREMENTS

SECTION 01012

SPECIAL CONDITIONS

## PART 1 - GENERAL

### 1.1 CONTRACTOR PERFORMANCE REQUIREMENTS

#### 1.1.1 Staging Area:

The staging area will be limited to areas within the U.S. Border Patrol Station property line and will be assigned by the CO at the pre-construction conference. If the contractor has any dumpsters in the staging area, they shall be clearly marked with a sign "for private use only, not for use of site personnel". Dumpsters shall be emptied when contents mounds to height of sides. Upon completion of all work outlined in the contract drawings and specifications, the contractor shall remove from the confines of the Site, his construction materials and his equipment.

#### 1.1.2 Marking of Equipment, Trailers and Temporary Offices:

The contractor shall ensure that equipment and trucks used on the job, are conspicuously marked with both name and telephone number of owner or lessee. The letter size of the firm name shall be a minimum of 8" high with all lettering professionally and neatly prepared. All trailers, office and storage shall be kept in good condition.

#### 1.1.3 Cleanliness:

The contractor shall protect Government property and furnishings that may be in, or adjacent to, the work area with appropriate clean drop cloths, barricades, dust-stops, or other provisions as determined by, or approved by, the CO prior to starting work. The contractor shall remove all debris, tools, materials and equipment and other items when work is completed in each particular area.

#### 1.1.4 Daily Clean-Up:

Daily construction site and staging area clean-up shall be accomplished by the contractor. This clean-up shall include the placing of construction material and equipment in a neat and orderly arrangement on the site. Equipment and materials must not block access to existing facilities. Rubbish, debris,

rubble, and garbage shall be removed at the end of each work day. At the end of the work day, the contractor shall inspect the site and area to ensure that all paper, cardboard, demolition products and similar materials are removed to provide a litter-free appearance. On-Site access routes utilized by construction equipment and/or delivery vehicles shall be maintained free from clay or mud balls, clods, and mud. All grass areas in the contractors construction area or within ten feet of contractor construction areas or within ten feet of buildings or portions of buildings under construction shall be mowed and trimmed to maintain neat grassy areas of reasonable length, by the contractor. Grass height shall never be allowed to exceed 6 inches.

1.1.5 Equipment Left at Worksite:

Equipment may not be left at worksites if work is stopped for more than 24 hours. Such equipment must be taken back to the remote storage site unless specifically approved to remain by the Contracting Officer.

1.1.6 Construction Fencing

The contractor shall utilize and maintain existing site construction fencing system. The construction fence system consists of a chain link fence.

1.1.7 The Contractor's employees shall park in areas assigned by the CO. Contractor personnel must park in approved parking areas. Parking on the grass is not permitted. Contractor's vehicles will not be allowed to drive on grass to gain access to worksites unless specific routes are approved in advance. The contractor's employees shall park in the areas assigned by the CO.

1.1.8 Fuel Storage:

Gas or diesel fuels shall not be stored at the construction site without written approval from the CO.

1.1.9 Bench Mark

The coordinate point with elevation of 588.0 feet, marked with a nail on the existing storm drainage inlet on the south of the existing parking area, near the south property boundary shall be used as the reference bench mark.

## 1.2 HEALTH AND SAFETY PLAN:

Prior to commencing work, the contractor shall submit a health and safety plan for review by Contracting Officer (CO) in accordance with Section 01330, SUBMITTAL PROCEDURES. The plan will include worker's safety, confined spaces, OSHA training, handling of hazardous materials and other site safety considerations.

## 1.3 SITE ACCESS AND SECURITY PLAN:

The contractor shall develop and submit for the contracting officer's approval, a list of contractors who will perform work at the site.

Contractor personnel are allowed in the restricted area only if a valid contract is in effect. The general contractor shall monitor entrance to the work site.

The contractor's employees shall be restricted to areas within this scope of work: plus, access to the site as may be approved in the pre-construction conference with regard to work scheduling and material handling.

### 1.3.1 ACCESS TO CONSTRUCTION SITE:

The Government reserves the right to enter all work areas affected by this contract and to do any and all work deemed necessary to correct deficiencies found at any time during the duration of this contract including any and all time extensions thereto. Access to the construction site must be detailed in accordance with Border Patrol requirements.

## 1.4 WORK CLEARANCE REQUEST

### 1.4.1 Work Permits:

The contractor shall be responsible for obtaining all permits required for construction.

## 1.5 ACCIDENT PREVENTION:

The contractor shall comply with all local and Federal Occupational Safety and Health Standards.

### 1.5.1 Confined Spaces:

The contractor shall request that proper permits for access to the confined spaces during construction operations from the CO, in writing, a minimum of 10 work days prior to confined space entry. All permits shall be issued by site safety.

### 1.5.2 Occupational Safety and Health Act:

Contractors shall comply with OSHA Construction Industry Standards (29 CFR 1926), Publication V2206, and the portions of OSHA General Industry Safety and Health Standards (29 CFR 1910) that are applicable to construction.

### 1.5.3 Submittal:

The contractor shall prepare and submit for Government review, a site/contract-specific Health and Safety Plan in accordance

with Occupational Safety and Health Administration (OSHA) 29 CFR 1910.120.

1.5.4 Safety Plan:

The Plan shall establish a site/contract-specific program for medical surveillance, training, hazard assessment, work protection, site control, accident prevention and response to emergencies. Standard practices and procedures of industrial hygiene, occupational health and safety, and environmental protection shall be prescribed in the plan. The plan shall also include Material Safety Data Sheets (MSDS) for all hazardous materials associated with the contract, in accordance with Federal Standard 313A.

1.5.5 Plan Review:

This Plan must be reviewed by appropriate site agency and approved by the CO prior to the commencement of all on-site work.

1.6 FIRE PROTECTION: WELDING, BURNING AND CUTTING OPERATIONS.

All welding and burning operations shall be accomplished in strict compliance with the requirement outlined in the National Fire Protection Association Standard. Prior to starting welding, cutting, brazing, burning and/or any other flame or spark producing operations, the Contractor or subcontractor performing the work shall obtain a burning permit from the CO. A Copy of each permit shall be retained at the project site, until work for which the permit was issued is completed. The contractor or subcontractor shall provide required equipment, materials, shields, extinguishers, sand and other devices at each location where work of the type requiring a permit is conducted.

1.7 ENVIRONMENTAL PROTECTION:

The contractor shall provide and maintain environmental protection during the life of the contract as defined herein. Environmental protection shall be provided to correct conditions that might endanger the environment during normal construction operations. The contractor shall comply with all local and Federal laws.

1.7.1 Control and Disposal of Solid Wastes:

Wastes shall be placed in closed metal containers which are emptied on a regular schedule.

1.7.2 Disposal of Waste:

All waste shall be transported off Government property and disposal shall be in a manner that complies with Federal, State and local requirements. The Contractor shall provide the CO with a copy of the Local permit or license, which reflects such

agencies disposal authorization. The permit, or license, and the location of the disposal area, shall be provided to the CO prior to transporting materials off Government property. Waste shall be removed and transported in a manner that prevents spillage on streets or adjacent areas. Local regulation regarding hauling and disposal shall apply.

1.7.3 Definitions of Waste:

1.7.3.1 Sediment:

Earth that has been eroded and transported by runoff.

1.7.3.2 Solid Waste:

Discarded solid materials resulting from construction activities.

1.7.3.3 Rubbish:

A variety of combustible and non-combustible wastes such as paper, boxes, glass, metal and lumber scrap, tin cans and bones.

1.7.3.4 Debris:

Combustible and non-combustible wastes such as ashes and waste materials resulting from demolition and construction work.

1.7.3.5 Chemical Waste:

Petroleum products, bituminous materials, salts, acids, alkalis, herbicides, pesticides, organic chemicals and inorganic wastes.

1.7.3.6 Sanitary Wastes:

(1) Sewage: Waste which is considered as domestic sanitary sewage.

(2) Garbage: Refuse and scraps resulting from preparation of food.

1.7.3.7 Rubble:

Fill materials generated from non-reinforced concrete masonry, asphalt construction and natural earth resulting from excavation.

1.7.3.8 Landscaping Waste:

Trees, limbs, brush, stumps and other vegetation generated from the clearing and grubbing of natural areas.

1.7.4 Temporary Construction:

Upon completion and acceptance of the construction, the Contractor shall remove all temporary construction facilities such as work areas, structures, foundations of temporary structures, stockpiles of excess or waste materials, debris and other vestiges of construction, unless indicated otherwise on the project drawings. All disturbed areas shall be restored to pre-contract construction conditions, including grading, sodding and other restorations.

1.7.5 Erosion and Sediment Control Measures:

1.7.6 Burn Off:

Burn-off of ground cover will not be permitted.

1.7.6.1 Reduction of Exposure of Unprotected Erodible Soils:

Earthwork brought to final grade shall immediately be finished as indicated and specified. Side slopes and back slopes shall be protected immediately upon completion of rough grading. Earthwork shall be planned and conducted in such a manner as to minimize the duration of exposure of unprotected soils.

1.7.6.2 Temporary Protection of Erodible soils:

Temporary protection shall be provided on side and back slopes when rough grading is complete or when sufficient soil is exposed to require protection to prevent erosion. Protection shall be afforded by accelerated growth of permanent vegetation, temporary vegetation, mulching, or netting. Slopes too steep for stabilization by other means shall be stabilized by hydro-seeding, mulch anchored in place, covering with anchored netting sodding, or such combination of these and other methods as may be necessary for effective erosion control.

Methods as required shall be utilized to effectively control sedimentation and runoff; including, but not limited to, the following:

a. Mechanical Retardation and Control of Runoff:

The rate of runoff from the construction site shall be mechanically retarded and controlled. Diversion ditches shall be constructed to retard and divert runoff to protected drainage courses.

1.7.7 Hazardous Materials:

Any chemical to be used or stored during construction must be approved by the CO prior to the contractor bringing it on the Border Patrol Station Site. Material Safety Data Sheet shall

be provided along with methods of storing the hazardous materials and any hazardous waste.

## 1.8 LANDSCAPE PROTECTION:

Provide protection for all existing landscape features such as trees, shrubs, bushes, plantings and sod in and around the area of construction. No existing tree, shrubs, bushes, or other items shall be affected in any way, by contractor actions, unless required by specifications. Prior to any demolition or construction in proximity to any existing landscape feature, the feature shall be protected by fencing, barricades, temporary removal and/or other approved devices. When construction requires that heavy machinery work in close proximity to existing mature trees, the trees shall be protected with a strong 2″ x 4″ frame with 3/4″ plywood sheeting barricades or enclosure. No movement or operation of heavy equipment within a tree shadow area or drip line shall be permitted. Any features which require pruning or trimming in order to place new construction materials or to allow clearance for new materials or equipment, shall be pruned or trimmed in a workmanlike manner. All damaged items shall be replaced in kind with new, by the contractor.

## 1.9 TRENCHING AND EXCAVATION:

Excavation and related work shall be completed in scheduled phase between blocks or manholes for installations requiring testing. For excavations in which testing is not required, the trenches shall be backfilled at the end of the day except for the last 15 feet. Backfilling must be accomplished daily; established structures and plantings must be avoided; excavation shall not begin until material and equipment for the specified portion of the job is available on the site. Trenches or excavations which cut roads, parking lots, driveways and delivery routes shall be fully coordinated between the contractor and the Border Patrol agency. The contractor shall provide non-skid surface, steel road plates until the vehicle routes are permanently repaired. Excavations and the repair which will traverse completely across vehicle routes shall be scheduled in stages which allow crossing of vehicles until road plates and/or permanent repairs are in place.

## 1.10 BARRICADES:

Barricades are required in accordance with the quoted safety regulations. Each job site will be clearly identified by signs, and protected by barriers suitably marked by reflective materials, and illumination for easy sighting after dark.

## 1.11 SEVERE WEATHER WARNING REQUIREMENTS:

When a severe weather warning has been issued for the area in which construction is being performed, the contractor shall immediately take action to tie down, or otherwise secure, structures, materials, and equipment at the job site that could become missiles as a result of strong surface winds, thunderstorms, or other weather-related

conditions. This requirement is applicable twenty-four (24) hours a day, seven (7) days a week.

PART 2 ADDITIONAL DATA CONCERNING VARIOUS SUBMITTALS:

2.1 SHOP DRAWINGS:

Original drawings prepared by the contractor, subcontractors, subsubcontractors, distributors or other sources which graphically show relationships of various components of the work, schematic diagrams of systems, details of fabrication, layouts of particular elements, connections and other relational aspects of the work.

a. Present shop drawings in a clear and thorough manner.

b. Identify item covered by the shop drawing by reference to drawing number and detail or specification paragraph.

c. Submit four copies of all shop drawings.

2.2 MANUFACTURERS CATALOG CUTS/DATA:

Manufacturers catalog sheets, brochures, diagrams, schedules, performance charts, illustrations and other standard descriptive data which provide calculations, descriptions or documentation regarding the work.

a. Information should be standard data and/or information published by the manufacturer of the product.

b. The specific type, size, capacity and part number will be annotated on the manufacturers information.

c. Submit four copies of catalog cuts/data to the Contracting Officer.

2.3 SAMPLES:

Physical samples to illustrate materials, color, shape, construction, workmanship and to establish standards by which complete work is to be judged.

a. Office samples shall be of sufficient size and quantity to clearly illustrate the following:

(1). Functional characteristics of the product, with integrally-related parts and attachment devices.

(2). Color, textures and patterns.

(3). Method of installation or application.

(4). Submit four samples of each product to the Contracting Officer.

## 2.4 CERTIFICATES/CERTIFICATIONS:

Statement signed by responsible officials of a manufacturer of a product, system or material, attesting that the product, system or material meets specified requirements. The statement must be dated after the award of this contract, must name the project, and must list the specific requirements which are being certified.

a. Certificate/Certification will describe the item to be certified.

b. The name and address of the contractor shall be on the document.

c. Date(s) of certification and date of shipment if appropriate.

d. Submit four copies of Certificate/Certification to the Contracting Officer.

## 2.5 PERFORMANCE TEST REPORTS:

Reports of inspections or test, including analysis and interpretation of test results. Each report shall be properly identified. Test methods used shall be identified and test results shall be recorded.

Test reports shall identify the test made, the date of the test, the Contractor's name and address performing the tests, and the authorizing signature for certification of the validity of test methods and results.

Test results must be clear and readily understandable.

Submit four copies of the reports to the Contracting Officer.

## 2.6 INSTRUCTIONS:

Preprinted material describing installation of a product, system or material, including special notices and material safety data which provide calculations, descriptions or documentation regarding the work.

a. Instructions shall identify the equipment by make and model, the type of the instructions and reference the specification paragraph or drawing that the instruction covers.

b. The instruction shall be either a manufacturer's supplied item or if provided by Contractor, be neat and clear.

Submit four copies of the instruction(s) to the Contracting Officer.

## 2.7 OPERATION AND MAINTENANCE MANUALS:

Data which forms a part of an operation and maintenance manual shall be submitted in accordance with Section 01000 STATEMENT OF WORK, paragraph 1.21 "PROJECT CLOSE OUT SUBMITTALS."

Operation and maintenance manuals shall be information provided by the manufacturer of a product. It will include diagrams, schematics, parts lists and other data necessary to operate and maintain the equipment or product.

Submit four copies of the operation and maintenance manuals to the Contracting Officer.

## 2.8 WORK PLAN:

The work plan will be a detailed listing of work to be done and the sequence in which it will be accomplished. The work plan will indicate time frames and level of effort required for each task. The work plan shall indicate the effect of each phase on the following phase and the impact if not complete before starting the next action.

a. The work plan will be a detailed procedure for accomplishing the required task. The plan will identify Contractor responsibilities and methods of monitoring and control.

b. Submit four copies of the work plan to the Contracting Officer.

## 2.9 CONTRACTORS OPTIONS:

a. For products specified only by a reference standard, the Contractor shall select a product meeting that standard which is available from a commercial source.

b Where names of manufacturers products or equipment appear in these specifications and drawings, the products of other manufacturers will receive equal consideration. Items to be submitted as “equal” must meet the same noted specifications or acknowledged trade standard for quality, finish and/or operation. The Contractor is required to provide documentation that the substituted product meets the specification requirements.

-- END OF SECTION 01012 --

DIVISION

GENERAL REQUIREMENTS

SECTION 01060

SAFETY

## PART 1 GENERAL

### 1.1 REFERENCES

The publications listed below are referenced and the most current publication applies. The publications are referred to in the text by basic designation only.

### 1.2 GENERAL:

Worker 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.

### 1.3 SAFETY PROGRAM:

The contractor shall designate an employee responsible for overall supervision of accident prevention activities. Such duties shall include: (1) assuring applicable safety requirements are (a) communicated to the workers in a language they understand (reference EM 385-1-1, 3 Sep 1996, 01.A.04). It is the Contractor's responsibility to ascertain if there are workers on the job who do not speak and/or understand the English language. If such workers are employed by the prime contractor or subcontractors, at any tier, it is the prime contractor's responsibility to insure that all safety programs, signs, and tool box meetings are communicated to the workers in a language they understand, and that a bilingual employee is on site at all times. If the contractor contends that interpreters and/or bilingual signs are not required, certification must be provided which verifies that all workers (who native tongue is other than English) have a command of the English language sufficient to understand all direction, training and safety requirements, whether written or oral, and (b) incorporated in work methods, and (2) inspecting the work to ensure that safety measures 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 engineers 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.

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 procedure and safeguards necessary to eliminate the hazards or reduce the risk to an acceptable level.

a. Subsequent job-site safety meetings shall be held as follows:

(1) A safety meeting shall be held at least for 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 representatives.

(2) At least one safety meeting shall be conducted weekly, or whenever new crews begin work, by the appropriate field supervisors or foremen for al 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.

## 1.4 ACCIDENTS:

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

1.4.1 Accident Reporting, Eng Form 3394: Section I, Paragraph 01.D, of EM 385-1-1 and the Contract Clause entitled

ACCIDENT PREVENTION 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 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 24 hours. A written report on the above noted form shall be submitted 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 given 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 lost days 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.

1.5 OSHA Requirements

1.5.1 OSHA Log: A copy of the Contractor's OSHA Log of Injuries shall be forwarded monthly to the Contracting Officer.

1.5.2 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 take place upon completion of the OSHA inspection.

1.6 SUBMITTALS FOR GOVERNMENT APPROVAL: Submittal shall be in accordance with Section 01330 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 SECTION 01060 --

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SECTION 01330

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# SECTION 01330

# SUBMITTAL PROCEDURES

## PART 1 GENERAL

### 1.1 PAYMENT

No separate payment will be made for any requirements under this Section and all costs of implementation shall be included in the payment item(s) shown in Section 00010, "SOLICITATION, OFFER AND AWARD (SF 1442) AND BIDDING SCHEDULE."

### 1.2 SUBMITTALS

The submittals described below are further described in other sections of the specifications. Other requirements pertaining to submittals are included in the Special Contract Requirements. Submittals required by the Contract Clauses and other nontechnical parts of the contract are not included in this Section.

Data

Submittals which provide calculations, descriptions, or documentation regarding the work.

Drawings

Submittals which graphically show relationship of various components of the work, schematic diagrams of systems, details of fabrication,layouts of particular elements, connections, and other relational aspects of the work.

Instructions

Preprinted material describing installation of a product, system or material, including special notices and material safety data sheets, if any, concerning impedances, hazards, and safety precautions.

Schedules

Tabular lists showing location, features, or other pertinent information regarding products, materials, equipment, or components to be used in the work.

Statements

A document, required of the Contractor, or through the Contractor, from a supplier, installer, manufacturer, or other lower tier Contractor, the purpose of which is to confirm the quality or orderly progression of a portion of the work by documenting procedures, acceptability of methods or personnel, qualifications, or other verifications of quality.

Reports

Reports of inspections or tests, including analysis and interpretation of test results. Each report shall be properly identified. Test methods used shall be identified and test results shall be recorded.

Certificates

Statement signed by an official authorized to certify on behalf of the manufacturer of a product, system or material, attesting that the product, system or material meets specified requirements. The statement must be dated after the award of the contract, must state the Contractor's name and address, must name the project and location, and must list the specific requirements which are being certified.

Samples

Samples, including both fabricated and unfabricated physical examples of materials, products, and units of work as complete units or as portions of units of work.

Records

Documentation to record compliance with technical or administrative requirements.

Operation and Maintenance Manuals

Data which forms a part of an operation and maintenance manual.

## 1.3 SUBMITTAL CLASSIFICATION

Submittals are classified as follows:

### 1.3.1 Government Approved

Governmental approval is required for extensions of design, critical materials, deviations, equipment whose compatibility with the entire system must be checked, and other items as designated by the Contracting Officer. Within the terms of the Contract Clause (Section 00700) entitled "Specifications and Drawings for Construction," they are considered to be "shop drawings."

#### 1.3.1.1 Designated Reviewers

The organization designated to perform the review for approval for items requiring Government approval (GA) is identified by acronym in the REVIEWER column on the SUBMITTAL REGISTER, ENG FORM 4288. Following is a list of the acronyms used and their full description:

AOF = The Resident U.S. Army Corps of Engineers Area Office

EPD = Engineering and Planning Division, Buffalo District, U.S. Army Corps of Engineers

1.3.2 Information Only

All submittals not requiring Government approval will be for information only. They are not considered to be "shop drawings" within the terms of the Contract Clause referred to above.

1.4 APPROVED SUBMITTALS

The Contracting Officer's approval of submittals shall not be construed as a complete check, but will indicate only that the general method of construction, materials, detailing and other information are satisfactory. Approval will not relieve the Contractor of the responsibility for any error which may exist, as the Contractor under the CQC requirements of this contract is responsible for dimensions, the design of adequate connections and details, and the satisfactory construction of all work. After submittals have been approved by the Contracting Officer, no resubmittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a substitution is necessary.

1.5 DISAPPROVED SUBMITTALS

When a submittal is returned to the Contractor and marked "DISAPPROVED" or "APPROVED - SUBJECT TO CONDITIONS INDICATED", the Contractor shall make all corrections required by the Contracting Officer and promptly furnish a corrected submittal in the form and number of copies specified for the initial submittal. If the Contractor considers any correction indicated on the submittals to constitute a change to the contract, a notice in accordance with the Contract Clause (Section 00700) "Changes" shall be given promptly to the Contracting Officer.

1.6 WITHHOLDING OF PAYMENT

Payment for materials incorporated in the work will not be made if required approvals have not been obtained.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 GENERAL

The Contractor shall submit all items listed on the Submittal Register (ENG Form 4288) and specified in other sections of these specifications. The Contracting Officer may request submittals in addition to those listed when deemed necessary to adequately describe the work covered in the respective sections. Units of weights and measures used on all submittals shall be the same as those used in the contract drawings. Submittals shall be made in the respective number of copies and to the respective address set forth below. Each submittal shall be complete and in sufficient detail to allow ready determination of compliance with contract requirements. Prior to submittal, all items shall be checked and approved by the Contractor's Quality Control (CQC) representative and each item shall be stamped, signed, and dated by the CQC representative indicating action taken. Proposed deviations from the contract requirements shall be clearly identified. Submittals shall include items such as: Contractor's,

manufacturer's, or fabricator's drawings; descriptive literature including (but not limited to) catalog cuts, diagrams, operating charts or curves; test reports; test cylinders; samples; O&M manuals (including parts list); certifications; warranties; and other such required submittals. Submittals requiring Government approval shall be scheduled and made prior to the acquisition of the material or equipment covered thereby. Samples remaining upon completion of the work shall be picked up and disposed of in accordance with manufacturer's Material Safety Data Sheets (MSDS) and in compliance with existing laws and regulations.

## 3.2 SUBMITTAL REGISTER (ENG FORM 4288)

See list of attachments in Section 00100, "INSTRUCTIONS, CONDITIONS AND NOTICES TO BIDDERS" for Submittal Register, ENG Form 4288 listing items of equipment and materials for which submittals are required by the specifications; this list may not be all inclusive and additional submittals may be required. Columns "d" through "r" have been completed by the Government; the Contractor shall complete columns "a" and "s" through "u" and submit the forms (two (2) hard copies) to the Contracting Officer for approval within 10 calendar days after Notice to Proceed. The approved submittal register will become the scheduling document and will be used to control submittals throughout the life of the contract. The Submittal Register and the progress schedules shall be coordinated.

## 3.3 SCHEDULING

Submittals covering component items forming a system or items that are interrelated shall be scheduled to be coordinated and submitted concurrently. Certifications to be submitted with the pertinent drawings shall be so scheduled. Adequate time (a minimum of 10 calendar days exclusive of mailing time) shall be allowed and shown on the register for review and approval. No delay damages or time extensions will be allowed for time lost in late submittals.

## 3.4 TRANSMITTAL FORM (ENG FORM 4025)

The sample transmittal form (ENG Form 4025), listed as an attachment in Section 00100, shall be used for submitting both Government approved and information only submittals in accordance with the instructions on the reverse side of the form. These forms will be furnished to the Contractor, or may be copied from the attached form. This form shall be properly completed by filling out all the heading blank spaces and identifying each item submitted. Special care shall be exercised to ensure proper listing of the specification paragraph and/or sheet number of the contract drawings pertinent to the data submitted for each item.

## 3.5 SUBMITTAL PROCEDURE

Submittals shall be made as follows:

### 3.5.1 Procedures

Submittals shall be made as stipulated in paragraph "Contractor Submittal Procedures" of the SPECIAL CONTRACT REQUIREMENTS" (Section 00800) and as specified herein. Contractor shall forward four (4) copies of each submittal to the following Area Office:

U.S. ARMY CORPS OF ENGINEERS
New York-Pennsylvania Area Office
1776 Niagara Street
Buffalo, NY 14207-3199

### 3.5.2 Deviations

For submittals which include proposed deviations requested by the Contractor, the column "variation" of ENG Form 4025 shall be checked. The Contractor shall set forth in writing the reason for any deviations and annotate such deviations on the submittal. The Government reserves the right to rescind inadvertent approval of submittals containing unnoted deviations.

## 3.6 CONTROL OF SUBMITTALS

The Contractor shall carefully control his procurement operations to ensure that each individual submittal is made on or before the Contractor scheduled submittal date shown on the approved "Submittal Register."

## 3.7 GOVERNMENT APPROVED SUBMITTALS

Upon completion of review of submittals requiring Government approval, the submittals will be identified as having received approval by being so stamped and dated. The distribution of approved copies will be as specified in the Contract Clause (Section 00700) entitled "Specifications and Drawings for Construction."

### 3.7.1 Reservation of Rights

The Government reserves the right to require the Contractor to resubmit any item found not to comply with the contract. This does not relieve the Contractor from the obligation to furnish material conforming to the plans and specifications; will not prevent the Contracting Officer from requiring removal and replacement of nonconforming material incorporated in the work; and does not relieve the Contractor of the requirement to furnish samples for testing by the Government laboratory or for check testing by the Government in those instances where the technical specifications so prescribe.

## 3.8 INFORMATION ONLY SUBMITTALS

Normally submittals for information only will not be returned. Approval of the Contracting Officer is not required on information only submittals.

## 3.9 STAMPS

Stamps used by the Contractor on the submittal data to certify that the submittal meets contract requirements shall be similar to the following:

CONTRACTOR

(Firm Name)

_____ Approved

_____ Approved with corrections as noted on submittal data and/or attached sheets(s).

SIGNATURE: _____

TITLE: _____

DATE: _____

-- End of Section --

DIVISION 1

GENERAL REQUIREMENTS

SECTION 01440

# CONTRACTOR QUALITY CONTROL

## PART 1 GENERAL

### 1.1 REFERENCES (Not Applicable)

### 1.2 PAYMENT

Separate payment will not be made for providing and maintaining an effective Quality Control program, and all costs associated therewith shall be included in the applicable unit prices or lump-sum prices contained in the Bidding Schedule.

## PART 2 PRODUCTS (Not Applicable)

## PART 3 EXECUTION

### 3.1 GENERAL

The Contractor is responsible for quality control and shall establish and maintain an effective quality control system in compliance with the Inspection clauses of this contract. The quality control system shall consist of plans, procedures, and organization necessary to produce an end product which complies with the contract requirements. The system shall cover all construction operations, both onsite and offsite, and shall be keyed to the proposed construction sequence. The project superintendent will be held responsible for the quality of work on the job and is subject to removal by the Contracting Officer for non-compliance with quality requirements specified in the contract. The project superintendent in this context shall mean the individual with the responsibility for the overall management of the project including quality and production.

### 3.2 QUALITY CONTROL PLAN

#### 3.2.1 General

The plan shall identify personnel, procedures, control, instructions, records, and forms to be used. The Contractor shall submit the CQC Plan for review and acceptance within seven (7) calendar days after notice of contract award. Work shall not proceed until notice of approval.

#### 3.2.2 Content of the CQC Plan

The CQC Plan shall include, as a minimum, the following to cover all construction operations, both onsite and offsite, including work by subcontractors, fabricators, suppliers, and purchasing agents:

a. A description of the quality control organization, including a chart showing lines of authority. The staff shall include a CQC System Manager who shall report to the project superintendent.

b. A copy of the letter to the CQC System Manager signed by an authorized official of the firm which describes the responsibilities and delegates sufficient authorities to adequately perform the functions of the CQC System Manager, including authority to stop work which is not in compliance with the contract.

c. Procedures for scheduling, reviewing, certifying, and managing submittals, including those of subcontractors, offsite fabricators, suppliers, and purchasing agents. These procedures shall be in accordance with Section 01330 SUBMITTAL PROCEDURES.

## 3.3 COORDINATION MEETING

After award of the contract, but before physical start of construction, the Contractor shall meet with the Contracting Officer or Authorized Representative and discuss the Contractor's quality control system. During the meeting, a mutual understanding of the system details shall be developed, including the forms for recording the CQC operations, control activities, testing, and administration of the system.

## 3.4 QUALITY CONTROL ORGANIZATION

### 3.4.1 General

The requirements for the CQC organization are a CQC System Manager and sufficient number of additional qualified personnel to ensure contract compliance. The Contractor shall provide a CQC organization which shall be at the site at all times during progress of the work and with complete authority to take any action necessary to ensure compliance with the contract. All CQC staff members shall be subject to acceptance by the Contracting Officer.

### 3.4.2 CQC System Manager

The Contractor shall identify as CQC System Manager an individual within his organization at the site of the work who shall be responsible for overall management of CQC and have the authority to act in all CQC matters for the Contractor. The CQC System Manager shall be on the site at all times during construction and will be employed by the prime Contractor. The CQC System Manager shall be assigned as System Manager but may have duties as project superintendent in addition to quality control. An alternate for the CQC System Manager will be identified in the plan to serve in the event of the System Manager's absence. Period of absence may not exceed 1 week at any one time, and not more than 15 workdays during the contract period.

## 3.5 SUBMITTALS

Submittals shall be made as specified in Section 01330 SUBMITTAL PROCEDURES. The CQC organization shall be responsible for certifying that all submittals are in compliance with the contract requirements.

## 3.6 COMPLETION INSPECTION

### 3.6.1 Punch-Out Inspection

Near the completion of all work or any increment thereof established by a completion time indicated in the approved work schedule, or stated elsewhere in the specifications, the CQC System Manager shall conduct an inspection of the work and develop a "punch list" of items which do not conform to the approved drawings and specifications. Such a list of deficiencies shall be included in the CQC documentation, as required by paragraph DOCUMENTATION below, and shall include the estimated date by which the deficiencies will be corrected. The CQC System Manager or staff shall make a second inspection to ascertain that all deficiencies have been corrected. Once this is accomplished the Contractor shall notify the Contracting Officer that the facility is ready for the Contracting Officer "Pre-Final" inspection.

### 3.6.2 Pre-Final Inspection

The Contracting Officer will perform this inspection to verify that the facility is complete and ready to be occupied. A Contracting Officer "Pre-Final Punch List" may be developed as a result of this inspection. The Contractor's CQC System Manager shall ensure that all items on this list have been corrected and so notify the Contracting Officer so that a "Final" inspection with the customer can be scheduled. Any items noted on the "Pre-Final" inspection shall be corrected in a timely manner. These inspections and any deficiency corrections required by this paragraph will be accomplished within the time slated for completion of the entire work or any particular increment thereof if the project is divided into increments by separate completion dates.

### 3.6.3 Final Acceptance Inspection

The Contractor's Quality Control Inspection personnel, his superintendent or other primary management person and the contracting Officer's representative will be in attendance at this inspection. Additional Government personnel including, but not limited to, those from Immigration and Naturalization user groups may also be in attendance. The final acceptance inspection will be formally scheduled by the Contracting Officer based upon results of the Pre-Final inspection. Notice will be given to the Contracting Officer at least 14 days prior to the final acceptance inspection and must include the Contractor's assurance that all specific items previously identified to the Contractor as being unacceptable, along with all remaining work performed under the contract, will be complete and acceptable by the date scheduled for the final acceptance inspection. Failure of the Contractor to have all contract work acceptably complete for this inspection

will be cause for the Contracting Officer to bill the Contractor for the Government's additional inspection cost in accordance with the contract clause entitled "Inspection of Construction".

## 3.7 DOCUMENTATION

The Contractor shall maintain current records providing factual evidence that required quality control activities and/or tests have been performed. These records shall include the work of subcontractors and suppliers and shall be on an acceptable form.

These records shall indicate a description of trades working on the project; the number of personnel working; weather conditions encountered; and any delays encountered. These records shall cover both conforming and deficient features and shall include a statement that equipment and materials incorporated in the work and workmanship comply with the contract. The original and one copy of these records in report form shall be furnished to the Contracting Officer daily within 24 hours after the date(s) covered by the report, except that reports need not be submitted for days on which no work is performed. As a minimum, one report shall be prepared and submitted for every seven days of no work and on the last day of a no work period. All calendar days shall be accounted for throughout the life of the contract. The first report following a day of no work shall be for that day only. Reports shall be signed and dated by the CQC System Manager. The report from the CQC System Manager shall include copies of test reports and copies of reports prepared by all subordinate quality control personnel.

-- End of Section 01440 --

DIVISION 2

SITE

SECTION 02050

DEMOLITION

## PART 1 GENERAL

### 1.1 REFERENCES (Not Applicable)

### 1.2 GENERAL REQUIREMENTS

The work includes demolition, salvage of identified items and materials, and removal of resulting rubbish and debris. Rubbish and debris shall be removed from Government property daily, unless otherwise directed, to avoid accumulation at the demolition site. Materials that cannot be removed daily shall be stored in areas specified by the Contracting Officer. In the interest of occupational safety and health, the work shall be performed in accordance with Section 01012 SPECIAL CONDITIONS. In the interest of conservation, salvage shall be pursued to the maximum extent possible; salvaged items and materials shall be disposed of as specified.

### 1.3 SUBMITTALS

Government approval is required for submittals with a “GA” designation, submittals having and “FIO” designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

#### 1.3.1 Records “GA”

Work Plan

The procedures proposed for the accomplishment of the work. The procedures shall provide for safe conduct of the work, including procedures and methods to provide necessary supports, lateral bracing and shoring when required, careful removal and disposition of materials specified to be salvaged, protection of property which is to remain undisturbed, coordination with other work in progress, and timely disconnection of utility services. The procedures shall include a detailed description of the methods and equipment to be used for each operation, and the sequence of operations.

### 1.4 DUST CONTROL

The amount of dust resulting from demolition shall be controlled to prevent the spread of dust to occupied portions of the construction site and to avoid creation of a nuisance in the surrounding area. Use of water will not be permitted when it will result in, or create, hazardous or objectionable conditions such as ice, flooding and pollution.

## 1.5 PROTECTION

### 1.5.1 Protection of Personnel

During the demolition work the Contractor shall continuously evaluate the condition of the structure being demolished and take immediate action to protect all personnel working in and around the demolition site. No area, section, or component of floors, roofs, walls, columns, pilasters, or other structural element will be allowed to be left standing without sufficient bracing, shoring, or lateral support to prevent collapse or failure while workmen remove debris or perform other work in the immediate area.

Floors, roofs, walls, columns, pilasters, and other structural components that are designed and constructed to stand without lateral support or shoring, and are determined to be in stable condition, may be allowed to remain standing without additional bracing, shoring, of lateral support until demolished. The Contractor shall ensure that no elements determined to be unstable are left unsupported and shall be responsible for placing and securing bracing, shoring, or lateral supports as may be required as a result of any cutting, removal, or demolition work performed under this contract.

### 1.5.2 Protection of Existing Property

Before beginning any demolition work, the Contractor shall survey the site and examine the drawings and specifications to determine the extent of the work. The Contractor shall take necessary precautions to avoid damage to existing items to remain in place, to be reused, or to remain the property of the Government; any damaged items shall be repaired or replaced as approved by the Contracting Officer. The Contractor shall coordinate the work of this section with all other work and shall construct and maintain shoring, bracing, and supports as required. The Contractor shall ensure that structural elements are not overloaded and shall be responsible for increasing structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under this contract.

### 1.5.3 Protection From the Weather

The interior of buildings to remain and salvageable materials and equipment shall be protected from the weather at all times.

### 1.5.4 Protection of Trees

Trees within the project site which might be damaged during demolition and which are indicated to be left in place shall be protected by a 1.83 m(6 foot) high fence. The fence shall be securely erected a minimum of 1.5 m (5 feet) from the trunk of individual trees or follow the outer perimeter of branches or clumps of trees. Any tree designated to remain that is damaged during the work under this contract shall be replaced in kind or as approved by the Contracting Officer.

1.5.5 Environmental Protection

The work shall comply with the requirements of Section 01012.

## 1.6 BURNING

The use of burning at the project site for the disposal of refuse and debris is not permitted.

## 1.7 USE OF EXPLOSIVES

Use of explosives is not permitted.

## 1.8 AVAILABILITY OF WORK AREAS

The Contractor shall coordinate availability of work areas with the Contracting Officer prior to beginning work.

# PART 2 PRODUCTS (NOT APPLICABLE)

# PART 3 EXECUTION (NOT APPLICABLE)

-- End of Section 02050 --

DIVISION 2

SITE

SECTION 02080

ASBESTOS REMOVAL

## PART 1 GENERAL

### 1.1 APPLICABLE PUBLICATIONS:

The removal of asbestos materials shall be in accordance with all applicable Federal and State Laws, Codes and Regulations, including but not limited to following

1.1.1 Military specification (Mil Spec):

MIL-L-1940C Lumber and Plywood, Fire-Retardant Treated & Int Am-l

Each piece of treated material shall bear identification of the testing agency to indicate performance in accordance with such rating.

1.1.2 New Jersey State, Subchapter 8, Asbestos Hazard Abatement Subcode N.J.A.C. 5.23-8

1.1.3 Code of Federal Regulations (CFR) Publications:

29 CFR Access to Employee Exposure and Medical Records 1910.20

29 CFR Respiratory Protection 1910.134

29 CFR Specifications for Accident Prevention Signs and Tags 1910.145

29 CFR Occupational Exposure Asbestos, 1910.1001 Tremolite, Anthophyllite and Actinolite

29 CFR Hazard Communication 1910.1200

29 CFR Asbestos, Tremolite, Anthophyllite, and 1926.58 Actinolite

40 CFR General provisions Subpart A 61

40 CFR National Emission Standard for Asbestos Subpart M 61

40 CFR Standard for Waste Disposal for Manufacturing, Demolition, 61.152 Renovation, Spraying, and Fabrications Operations

40 CFR Guidelines for the Land Disposal of Solid Wastes 241

40 CFR 257 Criteria for Classification of Solid waste Disposal Facilities and Practices .

40 CFR 762 Asbestos Abatement Projects Rule

1.1.4 Federal Register (FR) publication:

52 FR 171 Asbestos Containing Material in Schools:

33470-3347l Announcement of Interim Laboratory Quality Assurance program

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

E 849-82 Safety and Health Requirements Relating to Occupational Exposure to Asbestos

1.1.6 American National standard Institute (ANSI) Publications

Z9.2-79 Fundamentals Governing the Design and Operation of Local Exhaust Systems

Z88.2-80 Practices for Respirator Protection

1.2 Definitions:

1.2.1 Amended Water:

Water containing a wetting agent or surfactant.

1.2.2 Asbestos:

The term asbestos includes chrysotile, amosite, crocidolite, tremolite, anthophyllite, and other forms.

1.2.3 Asbestos Control Area:

An area where asbestos removal operations are performed which is isolated by physical boundaries to prevent the spread of asbestos dust, fibers, or debris.

**1.2.4 Asbestos Fibers:**

This expression refers to asbestos fibers having baying an aspect ratio of 3:1 and longer than 5 micrometers.

**1.2.5 Area Monitoring:**

Sampling of asbestos fiber concentrations within the asbestos control area and outside the asbestos control area which is representative of the airborne concentrations of asbestos fibers which may reach the breathing zone.

**1.2.6 Friable Asbestos Material:**

Material that contains more than one percent asbestos by weight and that can be crumbled, pulverized, or reduced to powder by hand pressure when dry.

**1.2.7 Encapsulant (Sealant):**

A liquid material which can be applied to asbestos containing materials and which controls the possible release of asbestos fibers from the material either by creating a membrane over the surface (bridging encapsulant) or by penetrating into the material and binding its components together (penetrating encapsulant).

**1.2.8 Encapsulate:**

The act of applying a sealant to asbestos containing building materials to control the possible release of asbestos fiber into the ambient air.

**1.2.9 Glovebag Technique:**

A method with limited applications for removing small amounts of friable asbestos containing material from HVAC ducts short, piping runs, valves, joist, elbows, and other non-planner surfaces in a noncontained work area. The glovebag assembly is a manufactured or fabricated device consisting of a glovebag (typically constructed of 6-mil or greater transparent regulite plastic), two inward projecting longsleeve rubber gloves, one inward projecting water and sleeve, and internal tool pouch, and an attached, labeled receptacle for asbestos waste. The glovebag is constructed and installed in such manner that it surrounds the object or area to be decontaminated and contains all asbestos fibers released during the removalprocess. All workers who are permitted to use the glovebag technique must be highly trained, experienced, and skilled in this method.

**1.2.10 HEPA Filter Equipment:**

High efficiency particulate absolute filtered vacuuming equipment with a filter system capable of collecting and retaining asbestos fibers. Filters

shall be of 99.97 percent efficiency for retaining fibers of 0.3 microns or larger.

1.2.11 Nonfriable Asbestos Material:

Material that contains asbestos in which the fibers have been locked in by a bonding agent, coating, binder, or other material so that the asbestos is well bound and will not release fibers in excess of the asbestos control limit during any appropriate use, handling, demolition, storage, transportation, processing or disposal.

1.2.12 Personal Monitoring:

Sampling of asbestos fiber concentrations within the breathing zone of an employee.

1.2.13 Time Weighted Average (TWA):

Three samples are required to establish the 8 hour, time weighted average. The TWA is an 8 hour time weighted average airborne concentration of fibers, longer than 5 micrometers, per cubic centimeter of air.

1.2.14 Transite Removal Technique:

A method with limited application for removing nonfriable asbestos containing material from walls, ceilings and other special applications in noncontaminated work area. All workers who are permitted to use this technique must be highly trained, experienced and skilled in this method.

1.2.15 Asbestos Permissible Exposure Limit:

Determined by using the most current edition of the American Conference of Government Industrial Hygienist-Threshold limit values for chemical substances in the work environment.

1.3 Title to Materials:

All materials resulting from demolition work, except as specified otherwise, shall become the property of the contractor and shall be disposed of as specified herein.

1.4 Protection of Existing Work to Remain:

Perform demolition work without damage or contamination of adjacent work. Where such work is damaged or contaminated, it shall be restored to its original condition.

**1.5 Medical Requirement:**

**29 CFR 1926.58.**

**1.5.1 Medical Examinations:**

**Before exposure to airborne asbestos fibers, provide workers with a comprehensive medical examination. The content of the examination shall be consistent with 29 CFR 1926.58 (m) (2) (ii). This examination is not required if adequate records show the employee has been examined as required by 29 CFR 1926.58 within the past years. The same medical examination shall be given on an annual basis to employees engaged in an occupation involving potential exposure to asbestos fibers and within 30 calendar days before or after the termination of employment in such occupation. Specifically identify x-ray films of asbestos workers to the consulting radiologist, and mark medical record jackets with the word: "ASBESTOS." Interpretation aid classification of x-ray films shall be conducted in accordance with Appendix E, 29 CFR 1926.58.**

**1.5.2 Medical Records:**

**Maintain complete and accurate records as required by 29 CFR 1926.58 and 29 CFR 1910.20 of employees' medical examinations for a period of at least 30 years after termination of employment and make records of the required medical examinations available for inspection and copying to:**

**The Assistant Secretary of Labor for Occupational Safety and Health, The Director of the National Institute for Occupational Safety and Health (NIOSH), authorized representatives of either, and an employees' physician upon the request of the employee or former employee. Provide written documentation to Contracting Officer or the Contracting Officer Representative prior to beginning work that the medical examinations have been performed on the contractor employees.**

**1.6 Permits and Notifications:**

**Secure necessary permits in conjunction asbestos removal, hauling, and disposition and provide timely notification of such actions as may be required by federal, state, regional, and local authorities. Notify the Regional Office of the United States Environmental Protection Agency (USEPA) in accordance with 40 CFR 61 and provide copies of the notification to the Contracting Officer and the State Environmental Regulator Agencies.**

**1.7 Safety Compliance:**

**In addition to detailed requirements of this specification, comply with laws, ordinances, rules, and regulations of federal, state, regional, and local authorities regarding handling, storing, transporting, and disposing of asbestos waste materials. Comply with the applicable requirements of the current issue of 29 CFR 1926.58. Submit matters of interpretation of standards to the appropriate administrative agency for resolution before**

starting the work. Where the requirements of this specification and referenced documents vary, the most stringent requirement shall apply.

1.8 Respirator program:

Establish a respiratory program as required by ANSI Z88.2 and 29 CFR 1910.134.

1.9 Industrial Hygienist:

Conduct monitoring and training under the direction of an industrial hygienist certified by the American Board of Industrial Hygiene.

Part 2. MATERIALS:

2.1 Plastic Sheeting:

Polyethylene film .006" and .004" thick.

2.2 Tape:

3” wide duct tape.

2.3 Lumber:

Unless otherwise specified herein, all lumber shall be Standard Grade Douglas Fir or West Coast Hemlock or equivalent of sizes required for use. Lumber for framing and blocking shall be kiln dried and treated with fire retardant where used inside the existing building.

2.4 Plywood:

Plywood shall be C-D Exterior Grade 1/2" thickness, treated with fire retardant where used inside the existing building.

2.5 Rough hardware:

Rough hardware, including nails, screws, anchors, bolts, brackets, fittings and other devices shall be of proper type and size for the work performed. All shall develop full strength of members to which they attached.

2.6 Wetting Agent

Wetting Agent shall be 50% polyoxyethylene ester and 50% polyoxyethylene ether.

2.7 Encapsulant:

Must be approved by EPA for asbestos applications.

2.8 Glovebags:

6-mil thickness 5 minimum, as approved by EPA.

2.9 Plastic bags:

6 mil thickness minimum, as approved by EPA.

2.10 Drums:

Metal or fiber with sealable covers, as approved by EPA.

2.11 Dumpster or Skip:

Lockable and properly labeled, as required by EPA.

Part 3. SUBMITTALS:

3.1 Within fifteen (15) days after receipt of Notice to Proceed the following items shall be submitted to the Contracting Officer for approval.

3.1.1 Certificate of Compliance:

Submit manufacturers' certification that vacuums, ventilation equipment, and other equipment required to contain airborne asbestos fibers conform to ANSI Z9.2.

3.1.2 Asbestos plan:

Submit a detailed plan of the work procedures to be used in the removal and demolition of materials containing asbestos. The plan shall be prepared, signed and sealed, including certification number and date, by the certified industrial hygienist. Such plan shall include an asbestos control area, change rooms, layout of change rooms, of sequencing of asbestos related work, disposal plan type of wetting agent and asbestos sealer to be used, air monitoring, and a detailed description of the method to be employed in order to control pollution. This plan must be approved prior to the start of any asbestos work. The contractor and certified industrial hygienist shall meet with the Contracting Officer prior to beginning work, to discuss in detail the asbestos plan, including work procedures and safety precautions.

3.1.3 Testing Laboratory:

Submit the name, address, and telephone number of the testing laboratory selected for the monitoring, testing, and reporting of

airborne concentrations of asbestos fibers along with certification that persons counting the samples have been judged proficient by successful participation within the last year in the National Institute for Occupational Safety and Health (NIOSH) Proficiency Analytical Testing (PAT) Program.

3.1.4 Industrial Hygienist:

Submit the name, address, and telephone number of the industrial hygienist selected to prepare asbestos plan, direct monitoring and training, and a certification that the industrial hygienist is certified by the American Board of Industrial Hygiene, including certification number and date.

3.l.5 Training:

Submit certificates signed by each employee that the employee has received training in the proper handling of materials that contain asbestos; understands the health implications and risks involved, including the illnesses possible from exposure to airborne asbestos fibers; understands the use and limits of the respirator equipment to be used; and understands the results of monitoring of airborne quantities of asbestos as related to health and respiratory equipment. Submit copy of State Certification. Employees must be State certified.

3.1.6 License:

Submit copy of license as required by the provisions of the Asbestos Control and licensing Act, (P.L. 1984, C. 173).

3.1.7 Warning Sign:

Submit a copy of warning signs conforming to 29 CFR 19l0.145(d)(4) and 29 CFR 1926.58(k).

3.1.8 Regulations:

Maintain two copies of applicable Federal, State and local regulations. Post one copy of each at the work site. Keep on file in the Contractor's Office one copy of each. These regulations include a copy of the U.S. Environmental protection Agency Regulations for Asbestos, 40 CFR 61, Subpart M, and a copy of U.S. Department of Labor-OSHA Asbestos Regulations, 29 CFR 1926.58.

3.1.9 Sanitary Landfill:

Submit the name, address, and telephone number of the disposal site selected to properly dispose of asbestos contaminated material. Submit DEP registration for waste hauler. Submit landfill receipts for all asbestos waste disposed of.

**Part 4 AIR SAMPLING AND MONITORING:**

All air monitoring shall be conducted in accordance with 29 CFR 1926.58(f). The testing laboratory shall be employed by the contractor and approved by the Contracting Officer. The government reserves the right to test alongside the testing agent of the contractor, as deemed necessary by the Contracting Officer.

4.1 Throughout the entire work operation and following the cleaning operations the contractor shall conduct air sampling for monitoring of asbestos exposure levels. Contractor shall furnish to the Government complete record (certified by the testing laboratory) of all air monitoring tests and results as performed. Fiber count shall be reported to .01 digit on an air sample record form.

4.2 All testing shall be performed using NIOSH 7400 method or P CAM 239. All air samples will be analyzed utilizing phase contrast microscopy except for one clearance sample which will require Transmission Electron Microscopy Analysis.

4.3 Air monitoring shall be conducted according to methods prescribed in EPA report 560/5-85-024 “widely known as the ‘Purple Book’”.

4.4 If at any time the results of the air samples taken outside the work area rise above 0.2 fibers/CC or the initial air sample volume (whichever is greater), a confirmation asbestos fiber count will be required. If the confirmation count still exceeds the 0.2 fiber/CC or initial air sample volume limit, the work will stop immediately and clean down procedures will be required. "Outside the work area" shall be defined as outside the encapsulation or any air outside the glovebags to be used on piping.

4.5 For final air sampling, the area must be dry, and an “aggressive sampling" method must be employed. Procedures for aggressive sampling are as follows:

Before starting the sampling pumps, direct the exhaust from forced air equipment (such as 1 HP leaf blower) against all walls, ceilings, floors, ledges and other surfaces in the room. This should take at least 5 minutes per 1000 square feet of floor.

Place a 20" fan in the center of the room (1 fan/l0,000 cubic feet room space). Place the fan on slow speed and point it toward the ceiling.

Start the sampling pumps, pull a minimum volume of 3,054 liters per sample. Turn off the pump, and then the fans when sampling is complete. Clean shall be defined as having an air concentration of 0.01 fibers/CC.

4.6 Analyze one filter via NIOSH 7400 method (or P CAM 239) and one via TEM quantification method as described in EPA 560/5-85-024.

4.7 Documentation of air sampling must include as a minimum:

Calculations of minimum sample volume to achieve necessary detection limits; sampling times; sampling locations (with appropriate diagrams); evidence of periodic inspection of sampling equipment; documentation of pre and post calibration of equipment; detailed description of work conditions; description of worker protective devices; and a description of any atypical environmental conditions.

4.8 Documentation of sample analysis must include as a minimum:

Sample identification; total sample duration; sample flow rate; total air volume; total fibers counted (with work sheets); total fields counted; blank filter analysis; and fiber concentration in fibers per cubic centimeter. Analytical results must include calculation of detection limits as given in Appendix M of Environmental Protection Agency Publication EPA 560/5-85-024, June 1985; Guidance For Controlling Friable Asbestos Containing Materials Buildings: Quantification limit must be at least 0.01 fiber/CC for clearance and preliminary samples.

4.9 Monitoring results:

Fiber counting shall be completed and results reviewed by the industrial hygienist within 16 hours. The industrial hygienist shall notify the contractor and the Contracting Officer immediately of any exposures to asbestos fibers in excess of the acceptable limits. Submit a complete record of all monitoring results to the Contracting Officer within 3 working days, signed by the testing laboratory employee performing air monitoring, the employee that tested the sample, and the certified industrial hygienist.

Part 5 AIR MONITORING; PERSONNEL:

5.1 Throughout the entire work operation, the contractor shall conduct personnel air monitoring.

5.2 Laboratory approval and documentation procedures shall be required as for air sampling and monitoring.

5.3 All personnel samples must be taken at the breathing zones of persons who are performing maintenance tasks, as well as those persons who may potentially occupy the room (i.e., supervisory personnel, visitors). The filters must face downward within the sampling device. Enough samples must be taken to enable determination of an eight hour Time Weighted Average (TWA) for airborne fiber concentrations.

5.4 25% of the contractor’s employees must be sampled per workshift in each work area.

5.5 Personnel samples are required as follows:

5.5.1 Inside all masked and sealed areas, during a removal or encapsulation project.

5.5.2 Upon initiation of a maintenance procedure that involves the removal of encapsulation of asbestos containing materials. These measurements will be used to determine the protective clothing and respirators that will be required for the performance of such a maintenance procedure. Any changes to the maintenance procedure (i.e. amounts of asbestos removed, percentage of asbestos contained in the materials, etc.) will require a new series of measurements.

Part 6 PERSONNEL PROTECTION:

6.1 Prior to commencement of work, the workers shall be instructed, and shall be knowledgeable, in the areas described in Section 1, paragraph 5.4. In addition on-site training in the use of equipment and facilities unique to this job shall be performed. Emergency Evacuation and Evacuation Procedures to be followed in the event of compressor failure shall be included in worker training prior to commencement of work.

6.2 All respiratory protection shall be provided to workers in conjunction with a respiratory protection program which shall meet the requirements of 29 CFR 1910.134(b)(1) through (11) and 29 CFR 1926.58(h). This program shall be posted at the worksite.

6.3 Provide workers with personally issued and marked respiratory equipment approved by the National Institute for Occupational Safety and Health (NIOSH).

6.4 Respiratory protection shall be worn by all persons potentially exposed to asbestos from the initiation of the asbestos demolition project until all areas have been given clearance. Clearance shall be obtained by visual inspection and air monitoring.

6.5 All individuals entering the work area in the beginning of the asbestos removal work shall wear Type “C” air supplied respirators. Type “C” respirators shall be required until it has been determined by air samples, taken within the shrouded area, that the airborne fiber connection is less than 5 fibers/CC, which then permits air purifying respirators to be worn at all times. For areas where glovebag or transite abatement procedures will be the only ones used, the requirements for Type “C” respirators may be deleted and air purifying respirators will suffice.

6.6 Compressed air systems shall be designed to provide air volumes and pressures to accommodate respirator manufacturer's specifications. The compressed air systems shall have a receiver of adequate capacity to allow escape of all respirator wearers from contaminated areas in the event of compressor failure. Compressors must meet the requirements of 29 CFR 19l0.134(d). Compressors must have an in-line carbon monoxide monitor, and periodic inspection of the carbon monoxide monitor must be evidenced. Documentation of adequacy of compressed air system/respirator protection system must be retained on site. This documentation will include a list of compatible components with the maximum number and type of respirators that may be used with the system. Periodic testing of compressed air shall insure that systems provide air of sufficient quality.

6.7 Provide authorized visitors with suitable respirators and respirator fit testing and provide instructions on proper wear whenever they are required to enter the work area.

6.8 Provide workers with sufficient sets of protective full body clothing. Such clothing shall consist of full body coveralls and headgear. Provide eye protection and hard hats as required by applicable safety regulations. Disposable type protective clothing, headgear, and footwear may be provided.

6.9 Provide authorized visitors with suitable protective clothing, headgear, eye protection and footwear whenever they are required to enter the work area.

6.10 Provide and post, in the Equipment Room and the Clean Room, the decontamination and work procedures to be followed by workers.

Part 7. PREPARATION:

7.1 Site plan:

Prior to any removal of any asbestos containing material the contractor shall provide a site plan distinguishing how the asbestos control area and the decontamination unit (submitted Section 2, paragraph 3.1.2) will be setup for use at the work site. The exception to this section shall be if the glovebag technique is solely used or during transite removal in which case the contractor need not provide a personnel decontamination system.

7.1.1 Decontamination Unit:

Each area within the unit shall be clearly identified and separated from the other areas by plastic sheet doors or other acceptable air locks designed to minimize fiber or air transfer as people pass between areas. Decontamination area shall consist of the following:

7.1.2 Clean Room:

No asbestos contaminated clothing, respirators, equipment, etc., shall enter this room. This room shall be entered from the exterior. All persons entering the work area shall disrobe, change into approved working clothes and pick up respirators with new filters. Street clothing shall be stored in this room. The clean room shall be connected to the Shower Room with an approved air lock.

7.1.3 Shower Room shall be a contaminated area. Entrance to this room shall be through approved air locks on either side. The Shower Room shall have a shower and floor receptor. All shower water shall be retained in (6-mil minimum) plastic bags in drums or HEPA filtered and discharged to a sanitary sewer. These bags and drums shall be sealed and marked with the label as prescribed by the EPA Regulations. Access to the Clean Room or the Equipment Room shall be through the Shower Room.

7.1.4 Equipment Room shall be a contaminated area. Entrance to this room shall be through approved air locks on either side. All contaminated clothing, footgear, equipment, etc., shall be stored here. Access to the work area shall be through this room.

7.2 Sequence of entering or leaving the work area:

7.2.1 Contamination Sequence (entering from the exterior to the work area):

7.2.1.1 Worker (or any other person) shall enter the Clean Room and remove clothing, put on clean coveralls, head covering, gloves and respirator, pass through near air lock, Shower Room and far air lock and enter Equipment Room.

7.2.1.2 Upon entry into Equipment Room, worker shall put on foot gear and any additional clothing and/or equipment necessary for entry into the work area. When weather or building temperature requires clothing in addition to the coveralls, such clothing shall be put on over the coveralls, and shall remain in the contaminated areas.

7.2.1.3 Worker shall proceed through air lock to work area.

7.2.2 Decontamination Sequence (leaving the work area and passing through to the exterior):

7.2.2.1 Prior to leaving the work area for any reason, the worker shall remove all gross contamination and debris from the protective clothing. (In practice, one worker normally shall assist another.) The worker then proceeds through the air lock to the Equipment Room.

7.2.2.2 Upon entry into the Equipment Room, the worker shall remove all clothing except the respirator. Extra work clothing shall be stored in contaminated end of the unit. Disposable coveralls shall be placed in a bag for disposal with other material. The worker shall then proceed into the Shower Room. The respirator must be washed down while being worn prior to removal of contaminated clothing. Upon removal of the respirator, it shall be left in the shower area for processing by others.

7.2.2.3 After showering, the worker shall enter the Clean Room naked and shall dress in outside clothing or dress in coveralls for reentry into the contaminated area.

7.2.2.4 Contaminated respirators left in the Shower Room shall be picked up, cleaned, and wrapped by protected workers in a separate area of the Shower Room. Filters shall be removed when wet and disposed of in accordance with contaminated material disposal methods. The respirators shall be left in the clean area of the Shower Room and shall be removed by workers in clean overalls. (New filters shall be inserted in place in the respirator when unwrapped prior to reuse). The cleaners shall exit the contaminated area through the Shower Room in accordance with decontamination procedures.

7.2.2.5 All work footgear shall remain inside the contaminated area until completion of the job, and shall be thoroughly cleaned at this time or disposed of in accordance with contaminated material disposal methods.

7.2.2.6 There shall be no smoking, eating or drinking in any contaminated areas (Shower Room, Equipment Room and work area). Respirators shall be worn in all contaminated areas at all times.

7.3 Work Area Preparation:

7.3.1 Warning signs shall be provided and displayed in accordance with 29 CFR 1910.145 and 29 CFR 1926.58. Provide caution signs at all approaches to asbestos control areas. Locate signs at such a distance that personnel may read the sign and take the necessary protective steps required before entering the area. Provide labels and affix to all asbestos materials, scrap, waste, debris, and other products contaminated with asbestos.

7.3.2 Prior to the start of removal of friable asbestos material, the contractor shall clean with wet cloths or, if necessary, a vacuum equipped with High Efficiency Particulate Absolute (HEPA) filters, all items and equipment which can be removed without disturbing the asbestos material.

These items and equipment shall be removed from the work area and returned after the job has been completed and the work area has been decontaminated.

7.3.3 At the same time, the contractor shall clean all wall and floor surfaces not containing friable asbestos material and all non-removable items and equipment in the work area. Cleaning shall be done with clean, wet cloths and, if necessary, vacuums equipped with HEPA filters, as described in sub-paragraph 7.3.2 above.

7.3.4 Cloths used for cleaning shall be disposed of as asbestos contaminated waste.

7.3.5 Upon completion of surface cleaning, the contractor shall erect a protective envelope within the work area which shall isolate the work area for the duration of the work by completely sealing off all openings and fixtures in the work area including, but not limited to, heating and ventilating ducts, doorways, roof mounted smoke vents, built-in equipment and fixed lighting. The protective envelope shall be plastic sheeting taped in place where necessary or where stress may be applied to the protective envelope, a framework of lumber and/or plywood shall be erected to support the .006” thick plastic sheeting. The floor and wall surfaces in the work area shall be covered with plastic sheeting. Wall surfaces shall be covered with .004" minimum thickness plastic sheeting and all other surfaces shall be covered with .006" thick plastic sheeting. All plastic sheeting shall be taped securely in place. All joints shall be lapped and double taped to prevent water or other damage or contamination during removal of asbestos. All surfaces shall be constantly inspected to insure that the protective envelope remains intact. Any damage shall be immediately patched and double tape sealed to prevent contamination.

7.3.6 The contractor shall remove all heating, ventilation, and air-conditioning systems, filters, pack them in sealable plastic bags (6-mil minimum) for disposal as asbestos-containing waste. All filters will be replaced by the Government.

7.3.7 The contractor shall establish emergency and fire evacuation procedures from the work area.

7.3.8 The supply and return air system shall be shut down insofar as the work area located within the protective envelope is concerned. Air movement shall be kept to a minimum while the removal operation is in progress. Air supply and return systems shall remain shut down until after final cleanup and acceptance by the Government. All work shall be phased so that this objective is achieved.

7.3.9 Negative Air Pressure System:

Negative air pressure, systems must be installed and operated in accordance with ANSI Z9.2. The negative air pressure system shall be operated continuously, 24 hours a day, until the containment barrier and/or perimeter barrier of the asbestos control area is removed. Pressure differential recordings for each workday shall be reviewed by

the Industrial Hygienist and submitted to the Contracting Officer within 24 hours from the end of each workday. The Industrial Hygienist shall notify the contractor and the Contracting Officer immediately of any variance in the pressure differential which could cause exposure of adjacent unsealed areas to asbestos fiber concentrations in excess of 0.02 F/CC. If the fiber count within any occupied area or within the outside atmosphere exceeds 0.02 F/CC, this shall be considered a work suspension level and work shall be stopped until the problem can be identified and corrected.

## Part 8 METHODS OF ASBESTOS REMOVAL:

### 8.1 Method:

All friable asbestos material shall be removed by use of the "wet" method.

8.1.1 All water shall be "amended" by use of an additive "wetting agent". The wetting agent shall be 50% polyoxyethylene ester and 50% polyoxyethylene ether at a concentration of 1 ounce of wetting agent to 5 gallons of water.

8.l.2 The friable asbestos material shall be sprayed with a amended water. A fine, low pressure spray of this solution shall be applied to prevent fiber disturbance preceding the removal of the asbestos material. The asbestos material should be sufficiently saturated to prevent emission of airborne fibers in excess of the exposure limit as prescribed in the OSHA Regulations. The amended water shall be sprayed as many times and as often as necessary to ensure that the asbestos material is adequately wetted throughout (especially the asbestos nearest the substrate) to prevent dust emission.

8.1.3 Removal of the asbestos material shall be done in small sections by two-person teams. The wet material shall be packed and sealed into labeled 6-mil plastic bags held within metal or fiber drums prior to starting the next section to prevent the material from drying. Water-soaked fallen material shall not be left out of bags overnight or for more than four hours on hot days to prevent loss of its water content due to evaporation. All drums shall be sealed as soon as filled but not later than the, completion of each workday. Bags and drums shall be marked with the label prescribed by section 61.22(c) of the EPA Regulations. The outside containers shall be wet-cleaned or HEPA vacuumed before leaving the equipment area. All vacuum cleaners shall be equipped with HEPA filters.

8.1.4 When all asbestos removal is completed, the entire work area shall be thoroughly cleaned with amended water. All equipment to be reused such as ladders, scaffolding, staged platforms, scrapers, vacuums, etc., shall be thoroughly cleaned with amended water. All reusable equipment, except for scaffolding, shall be removed from the work and equipment areas. All disposable equipment such as brushes, pails,

brooms, mops, etc., shall be packed and sealed into plastic bags (6-mil minimum) and placed and sealed into metal or fiber drums. The bags and drums shall be sealed and marked with the label as prescribed by the EPA Regulations. All bags and drums shall be wet-cleaned or HEPA vacuumed before being taken from the Equipment Room.

8.1.5 When asbestos removal is completed and all surfaces are dry. Apply one (1) coat of approved encapsulate sealer following the manufacturer's recommendations for applications to all surfaces where asbestos was removed.

Part 9. REMOVAL PROCEDURE (PIPING, GLOVEBAG):

9.1 The contractor shall rope off area at least 50 feet on all sides of glovebag work location to restrict personnel movement near the site during the removal process. Proper caution signs shall be utilized, and posted at each perimeter (N, S, E and W).

9.2 Workers performing glovebag work shall wear disposable gear (full body coveralls, head covers, and footwear) and approved air purify respirators throughout the procedure. Subsequent personal sampling shall be conducted. All personal sampling shall be conducted in accordance with 29 CFR 1926.58.

9.3 All removal tools required shall be placed in glovebag tool pouch prior to attachment to pipe. The contractor shall then place glovebag around pipe, and seal edges to the pipe.

9.4 The contractor shall install wand of sprayer through glovebag water sleeve and seal by taping the end of the sleeve around the wand.

9.5 The contractor shall insure that the 6-mil plastic bag attached to the glovebag has some type of support at the bottom to prevent separation due to the weight of the wet debris falling from the above compartment.

9.6 The contractor shall spray all insulation within the glovebag with an amended water spray prior to removing any insulation. The insulation shall then be removed and dropped into the attached containment bag while continually spraying with amended water. When all insulation is removed, the pipe shall be thoroughly washed and rubbed clean. All visible debris and dust must be removed.

9.6.1 At locations where the insulation rests directly on pipe hangers or supports, the contractor shall re-support the pipe by placing wood blocks of approximately the same thickness as the removed insulation between the pipe and hanger.

9.7 When piping is clean, the contractor shall thoroughly dampen all raw edges of insulation, wash tools with water wand, wash inside of glovebag to insure all asbestos fibers are evacuated to the attached plastic trash bag, and then remove water wand and deflate the glovebag with a HEPA vacuum.

9.8 The contractor shall carefully seal the glovebag, and then place it in a properly labeled 6-mil. bag prior to disposal.

9.9 All piping, after glovebagging procedure is complete and surfaces are dry, shall be sprayed with one (1) coat of approved encapsulate sealer following manufacturer's recommendations for applications.

9.10 All workers associated with the glovebagging procedure shall be required to remove and dispose of protective clothing and respirator cartridges prior to leaving roped off area.

Part 10. REMOVAL PROCEDURES FOR TRANSITE:

10.1 The contractor shall rope off an area at least 50 feet on all sides of the transite work location to restrict personnel movement near the site during the removal process. Proper caution signs shall be utilized, and posted at each perimeter (N, S, E and W).

10.2 Workers performing transite work shall wear disposable gear (full body coveralls, head covers, and footwear) and approved air purifying respirators throughout the procedure. Subsequent personal sampling shall be conducted. All personal sampling shall be conducted in accordance with 29 CFR 1910.1001.

10.3 Workers shall carefully remove the transite without cutting, sawing, or drilling the material.

10.4 The removed transite shall be hand placed onto a double layer of 6-mil plastic. Place only enough transite material on plastic to fill a disposal bag three quarters full. Wrap the transite material in the doublelayer of plastic and then place the plastic and transite into a properly labeled 6-mil bag prior to disposal.

10.5 All workers associated with the transite procedure shall be required to remove and dispose of protective clothing and respirator cartridges prior to leaving roped off area.

Part 11. DAMAGE BY CONTRACTOR:

Contractor shall be responsible for all damage caused by or during the abatement process. Contractor shall make every effort to restore the damaged areas to their original condition subject to approval by the Contracting Officer. Any repair work will be done at no cost to the Government. This does not mean that the insulating material is to be replaced, only that substance is to be encapsulated.

Part 12. FINAL CLEAN-UP OF THE WORK AREAS:

12.1 Following the cleanup there shall be a settling period of 24 hours. During this period, there shall be no entry, activity or ventilation within the protective envelope.

12.2 Upon completion of the 24 hour settling period, the contractor shall clean all surfaces in the work area, including all scaffolding with

amended water or with HEPA filter vacuums. HEPA filtered vacuums shall not be used on wet material. Upon completion of the cleaning of the work areas and scaffolding, the contractor shall wait another 24 hours to allow for settlement of dust, then wet-clean or HEPA vacuum all surfaces in the work area again (including all scaffolding).

12.3 After completion of the third cleaning, the contractor shall perform the following:

12.3.1 Complete visual inspection of the work area to insure that the work area is dustfree.

12.3.2 Air monitoring testing shall be done under aggressive conditions within 48 hours to determine the amount of asbestos in the air.

12.3.3 If the test results exceed the allowable limits, the clean-up and testing shall be repeated at no additional cost to the Government until compliance is achieved.

12.4 The maximum allowable limits of concentration of asbestos fibers shall not exceed .01 f/CC TWA (.01 fibers per cubic centimeter time weight average) as a clearance level.

12.5 After the work area is found to be in compliance with the requirements specified herein, the contractor shall:

12.5.1 Remove all scaffolding, ladders and other such equipment.

12.5.2 Unseal all doorways.

12.5.3 The decontamination areas shall be dismantled, all non-contaminated materials removed from the site, and all plastic sheeting (whether contaminated or not) shall be disposed.

12.5.4 Dispose of all plastic sheeting by carefully removing it, rolling it up keeping the contaminated side inside and disposing of it by packing and sealing it into (6-mil minimum) plastic bags and drums, sealed and marked with the label as prescribed by the EPA Regulations.

12.5.5 Upon removal of the protective envelope, the floor shall be completely wet-cleaned or HEPA vacuumed.

Part 13. RE-ESTABLISHMENT OF OBJECTS AND SYSTEMS:

13.1 When cleanup is completed:

13.1.1 Relocate objects moved to temporary locations in the course of the work to their proper positions.

13.1.2 Re-secure mounted objects removed in the course of the work in their former positions.

13.2 Reestablish HVAC, mechanical, and electrical systems.

## Part 14. DISPOSITION OF CONTAMINATED MATERIALS:

### 14.1 Drums:

All drums shall be sealed and marked with the label prescribed by EPA Regulations. A lockable and properly labeled dumpster or skip may be utilized in place of the drums for storage and transporting asbestos waste.

### 14.2 Transportation:

Contractor shall transport all sealed drums to the previously approved sanitary landfill disposal site and shall deposit the asbestos contaminated materials. All transportation shall be done by a DEP registered waste hauler.

14.2.1 Upon arrival at the disposal site, the drum shall be unsealed and undamaged plastic bags shall be removed and deposited in the fill. If a bag is damaged, it shall remain in the drum, the drum resealed, and the entire contaminated drum shall be buried in the fill. The drums shall not be used for any other purpose except for transporting asbestos-contaminated materials. The drums may be reused for subsequent asbestos removal projects. All drums containing contaminated water shall remain sealed and be buried in the fill.

### 14.3 Disposal Area:

The contractor shall have the disposal site operator submit a letter attesting to each individual day's disposal. These letters shall be submitted to:

The New Jersey Department of Environmental Protection, Office of Solid Waste Administration, John Fitch Plaza, Trenton, New Jersey 08625

Copies of these letters shall be forwarded to the Contracting Officer. The contents of the letters shall conform to the following:

"On (Date) , (Number of) yards / or (Number of) tons of asbestos-containing waste was received from (Name of Contractor) and was promptly and properly disposed of at this site."

-- END OF SECTION 02080 --

**DIVISION 2**

**SITE WORK**

**SECTION 02090**

**LEAD BASED PAINT REMOVAL AND DISPOSAL**

**PART I - GENERAL**

**1.01 REFERENCES: The publication listed below, current as for the date of this solicitation, form a part of this specification to the extend referenced. The publications are referred to in the text by the basic designation only.**

**A. Air Force Lead Exposure Hazard Management Guide, AL/OE-TR-1993-0175, Sections VI, VII, and VIII.**

**B. Occupational Safety and Health (29 CFR 1910 and 1926):**

**1. 29 CFR 1926.62 Lead Safety and Health Regulations for Construction**

**2. 29 CFR 1910.1025 Occupational, Safety and Health Standards; Lead**

**3. 1926.20, "General Safety and Health Provisions"**

**4. 1926.21, "Safety Training and Education"**

**5. 1926.25, "Housekeeping"**

**6. 1926.28, "Personal Protective Equipment"**

**7. 1926.33, "Access to Employee Exposure and Medical Records"**

**8. 1926.51(f), "Washing Facilities"**

**9. 1926.55, "Gases, Vapors, Fumes, Dusts, and Mists"**

**10. 1926.57, "Ventilation"**

**11. 1926.59, "Hazard Communication"**

**12. 1926.103, "Respiratory Protection"**

**1.02 SCOPE OF WORK:**

**A. Principal Features: Samples taken of painted surfaces which interface with this work effort have levels of lead below the HUD and EPA "abatement" action level of 0.50% by weight. However, some levels are above 0.06% by weight and therefore require appropriate OSHA worker protection measures.**

B. Description of Work: The contractor shall provide trained personnel, tools, equipment, appliances and materials, and perform all work necessary to perform air monitoring in accordance with requirements in this specification and all local, state, and federal law, codes, and regulations for the subject project area on McGuire Air Force Base.

C. Scope of Responsibilities: The Contractor shall be responsible for providing an independent Certified Industrial Hygienist (CIH) to perform air monitoring during work and determine the pre-existing and final conditions of lead dust in the facility.

D. Definitions:

1. Action Level: Employee exposure , without regard to use of respirators, to an airborne concentration of lead of 30 micrograms per cubic meter of air (30 ug/m3) averaged over an 8-hour period. As used in this specification, 30 ug/m3 refers to the Action Level.

2. Air Monitoring: The process of collecting samples of air and analyzing them to determine the amount of lead present. The goal of air monitoring is to determine the mass of lead present per cubic centimeter of air.

3. Certified Industrial Hygienist (CIH): Industrial Hygienist employed by the Contractor is certified by the American Board of Industrial Hygiene in comprehensive practice.

4. Lead Permissible Exposure Limit (PEL): 50 micrograms per cubic meter (ug/m3) of air as an 8 hour time weighted average.

5. Personnel Monitoring: Sampling of airborne lead concentration within the breathing zone of an employee.

E. Pre-Performance Conference:

1. The Contractor shall attend a pre-performance conference scheduled by the Contracting Officer. This meeting shall also be attended by the independent CIH. At this meeting the Contractor shall present in detail the following for approval:

a. A written plan for preparation of the work site which ensures worker and occupant safety.

b. A written description of the types and quantities of protective clothing and approved respirators to be used.

c. A written delineation of responsibility of work site isolation, e.g., barrier construction, signs, security.

**1.03 GENERAL REQUIREMENTS:**

**A. Regulation Compliance**

**1. US Department of Labor Occupational Safety and Health Administration (OSHA) Lead Regulations CFR Title 29, Part 1910, Section 1025 and Part 1926.62.**

**B. Documentation and Submittals: The Contractor shall provide the Project Manager with detailed written documents for each item listed below 30 days after award of contract and a minimum of 30 days before beginning work.**

**1. Items listed in paragraph 1.02.E.1.**

**2. Qualifications of CIH: The Contractor shall submit name, address, and telephone number of the CIH selected to perform responsibilities outlined in this specification. Provide previous experience of the CIH. Submit proper documentation that the Industrial Hygienist is certified by the American Board of Industrial Hygiene in comprehensive practice, including certification number and date of certification.**

**3. Testing Laboratory Qualifications: the Contractor must select a laboratory responsible for analyzing and reporting worker exposures to airborne concentrations of lead and lead concentrations in site soils if necessary. Proper documentation that persons performing the analyses have been judged proficient by successful participation within the last year in the National Institute for Occupational Safety and Health (NIOSH) Proficiency Analytical Testing (PAT) Program will be included in the final project report or earlier if requested. The laboratory shall be accredited by the American Industrial Hygiene Association (AIHA), through its Environmental Lead Laboratory Accreditation Committee's Environmental Lead Proficiency Analytical Testing Program (ELPAT). Provide AIHA and ELPAT documentation along with date of accreditation/reaccreditation.**

**4. Air Sampling: Air sampling results shall be submitted by the Contractor to the CCI within five working days. These results must be signed by the Industrial Hygienist that performed the sampling.**

**5. Records: The Contractor shall provide the Project Manager with a copy of their medical monitoring program. At a minimum, the medical monitoring program shall comply with OSHA 29 CFR 1926.62. The Contractor shall provide the Project Manager with photocopies of test results.**

**C. Documentation at Pre-Performance Conference: The Contractor shall furnish documentation to the Contracting Officer at the pre-performance conference, that the firm and its employees are familiar with the following regulations of the US Department of Labor, Occupational Safety and Health Administration (OSHA).**

1. OSHA regulations, namely: Section 1910.1025. and 1926.62.

PART 2 - PRODUCTS

2.1 SPECIFIC REQUIREMENTS:

A. Protective Clothing and Equipment for Lead Abatement:

1. The Contractor shall provide approved respirators and protective clothing, when required, to all workers and to official representatives of McGuire AFB, CO and CCI representatives who may inspect the job site (where required).

2. Protective clothing, when required, may consist of disposable full body coveralls, with hoods and booties attached. Separate disposable head covers and foot covering may be substituted if disposable coveralls without hoods and booties are used. Additional clothing shall include boots and gloves. Eye protection and hard hats shall be available as appropriate. In the event that airborne lead concentrations are above 50 $ug/m^3$, contractors may choose between three (3) types of respiratory protection as specified. In order of increasing effectiveness, they are:

a. Full face respirators equipped with dual cartridge air purifying high-efficiency filters and certified by the National Institute for Occupational Safety and Health (NIOSH) or Mine Safety and Health Administration (MSHA) for use in atmospheres containing lead dusts and fumes.

b. Power air purifying respirators certified by NIOSH/MSHA for use in atmospheres containing lead dusts and fumes.

c. Type “C” supplied-air respirators, operated in a pressure-demand mode and certified by NIOSH/MSHA.

3. The Contractor shall require that all persons entering the work area shall wear an approved respirator when specified for the phase of work and protective clothing. There shall be no exceptions to this rule.

PART 3 - EXECUTION

3.1 Testing: An independent Certified Industrial Hygienist (CIH) shall certify in writing that the inside and outside lead control area air monitoring samples are less than 30 $ug/m^3$ micrograms per cubic meter of air, or if above 50 $ug/m^3$, appropriate respiratory protection for the employees was provided and the work procedures were performed in accordance with 29 CFR 1910.1025.

-- END OF SECTION 02090 --

DIVISION 2

SITEWORK

SECTION 02110A

CLEARING AND GRUBBING

## PART 1 GENERAL

### 1.1 REFERENCES (Not Applicable)

### 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

1.2.1 Records "FIO"

1.2.1.1 Materials

Written permission to dispose of such products on private property shall be filed with Contracting Officer.

## PART 2 PRODUCTS (Not Applicable)

## PART 3 EXECUTION

### 3.1 CLEARING

Clearing shall consist of the felling, trimming, and cutting of trees into sections and the satisfactory disposal of the trees and other vegetation designated for removal, including down timber, snags, brush, and rubbish occurring in the areas to be cleared. Trees and vegetation to be left standing shall be protected from damage incident to clearing, grubbing, and construction operations. Clearing shall also include the removal and disposal of structures that obtrude, encroach upon, or otherwise obstruct the work.

### 3.2 GRUBBING

Stumps, roots, logs and other organic or metallic debris not suitable for foundation purposes, shall be removed to a depth of not less than 0.5 meters (18 inches) below the original surface level in areas indicated. Depressions made by grubbing shall be filled and graded to conform with the adjacent surface.

## 3.3 DISPOSAL OF MATERIALS

Refuse from the clearing and grubbing operations shall be disposed off site in accordance with local laws and regulations.

## 3.4 USE OF SILT FENCING

Excavation for building will include a silt fencing scheme around the periphery of the excavation to preclude the transport of silt off the excavation: The silt fencing shall be commercially available fine mesh fabric fence at least 0.4 meter (18 inches) high supported every 3 m (10 feet) by 50 x 50 (2″ x 2″) wooden posts. The contractor shall submit the silt fence FIO to the CO.

-- End of Section 02110A --

DIVISION 2

SITE

SECTION 02210A

# GRADING AND RIPRAP PLACEMENT

## PART 1 GENERAL

### 1.1 REFERENCES

The publications listed below are referenced and the most current publication applies. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|---|---|
| ASTM D 1556 | Density and Unit Weight of Soil in Place by the Sand-Cone Method |
| ASTM D 1557 | Laboratory Compaction Characteristics of Soil Using Modified Effort(56,000 ft-lbf/cu. ft. (2,700 kN-m/cu. m.)) |
| ASTM D 2487 | Classification of Soils for Engineering Purposes (Unified Soil Classification System) |

### 1.2 DEFINITIONS

#### 1.2.1 Satisfactory Materials

Materials classified in ASTM D 2487 as GW, GP, and SW, and free from roots and other organic matter, trash, debris, and frozen materials and stones larger than 6 inches in any dimension are satisfactory.

#### 1.2.2 Unsatisfactory Materials

Materials which do not comply with the requirements for satisfactory materials are unsatisfactory. Materials classified in ASTM D 2487 as, Pt, OH, and OL are unsatisfactory. Unsatisfactory materials also include man-made fills, refuse, or backfills from previous construction.

#### 1.2.3 Cohesionless and Cohesive Materials

Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Cohesionless materials include materials classified in ASTM D 2487 as GW, GP, SW, and SP. Materials classified as GM and SM will be identified as cohesionless only when the fines have a plasticity index of zero.

1.2.4 Degree of Compaction

Degree of compaction is a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557 abbreviated below as a percent of laboratory maximum density.

1.2.5 Topsoil

Material obtained from excavations, suitable for topsoils.

## 1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

1.3.1 Reports

Field Testing Control

Copies of all laboratory and field test reports to the Contracting Officer within 24 hours of the completion of the test.

# PART 2 PRODUCTS

## 2.1 RIPRAP

Riprap shall consist of sound and durable stone, cobbles, spalls, or broken concrete. The material shall have a maximum size of 100 mm (4 inches) and be reasonably well-graded between the maximum size stone permitted and 75 mm (3 inch) stone, with not more than five percent by weight smaller than the 75 mm (3 inch) size. The least dimension of a stone shall be considered its size.

# PART 3 EXECUTION

## 3.1 CONSERVATION OF TOPSOIL

Where indicated, topsoil shall be removed to a depth of 300 mm (12 inches) without contamination with subsoil and stockpiled convenient to areas for later application or at locations specified. Topsoil shall be removed to full depth and shall be stored separate from other excavated materials and piled free of roots, stones, and other undesirable materials. Any surplus of topsoil from excavations and grading shall be removed from the site.

## 3.2 EXCAVATION

Excavation of every description, regardless of material encountered, within the grading limits of the project shall be performed to the lines and grades indicated. Satisfactory excavation material shall be transported to and placed in fill areas within the limits of the work. All unsatisfactory material and surplus material shall be removed from site. In the event that it is necessary to remove unsatisfactory material to a depth greater than specified, the Contracting Officer shall be notified. Excavations carried below the depths indicated, without specific directions, shall, except as otherwise specified, be refilled to the proper grade with satisfactory material as directed.

All additional work of this nature shall be at the Contractor's expense. Excavation and filling shall be performed in a manner and sequence that will provide drainage at all times. Excavations shall be kept free from water.

## 3.3 DITCHES, GUTTERS, AND CHANNEL CHANGES

Ditches, gutters, and channel changes shall be cut accurately to the cross sections and grades indicated. Care shall be taken not to excavate ditches and gutters below the grades indicated. Excessive ditch and gutter excavation shall be backfilled to grade with satisfactory, thoroughly compacted material or with suitable stone or as directed. All ditches and gutters excavated under this section shall be maintained until final acceptance of the work. No excavated material shall be deposited closer to the edges of the ditches than indicated and in no case less than 900 mm. (3 feet.)

## 3.4 BACKFILL ADJACENT TO STRUCTURES

Backfill adjacent to structures shall be placed and compacted uniformly in such manner as to prevent wedging action or eccentric loading upon or against the structures. Slopes bounding or within areas to be backfilled shall be stepped or serrated to prevent sliding of the fill. Backfill for storm drains and subdrains, including the bedding and backfill for structures other than culverts and drains, shall conform to the additional requirements in other applicable sections.

## 3.5 PREPARATION OF GROUND SURFACE FOR FILL

All vegetation, such as roots, brush, heavy sods, heavy growth of grass, and all decayed vegetable matter, rubbish, and other unsatisfactory material within the area upon which fill is to be placed, shall be removed before the fill is started. In no case will unsatisfactory material remain in or under the fill area. Sloped ground surfaces steeper than one vertical to four horizontal on which fill is to be placed shall be plowed, stepped, or broken up, as directed, in such manner that the fill material will bond with the existing surface. Prepared surfaces on which compacted fill is to be placed shall be wetted or dried as may be required to obtain the specified moisture content and density.

## 3.6 FILLS AND EMBANKMENTS

Fills and embankments shall be constructed at the locations and to lines and grades indicated. Stones having a dimension greater than 100 mm (4 inches) shall not be permitted in the upper 150 mm (6 inches) of fill or embankment. The material shall be placed in successive horizontal layers of 300 mm (12 inches) in loose depth for the full width of the cross section and shall be compacted as specified. Each layer shall be compacted before the overlaying lift is placed. Moisture content of the fill or backfill material shall be adjusted as required, to within plus or minus 5 percent of optimum moisture content as determined from laboratory tests specified in paragraph DEFINITIONS.

## 3.7 COMPACTION

Except for paved areas, each layer of the fill or embankment shall be compacted to at least 95 percent of laboratory maximum density

## 3.8 FINISHED EXCAVATION, FILLS, AND EMBANKMENTS

All areas covered by the project shall be uniformly smooth-graded, compacted, and free from irregular surface changes. The degree of finish shall be that ordinarily obtainable from blade-grader operations, except as otherwise specified. Ditches and gutters shall be finished to permit adequate drainage. The surface of areas to be turfed shall be finished to a smoothness suitable for the application of turfing materials. For subgrade areas to be paved, the following shall be accomplished as required:

(a) soft or otherwise unsatisfactory material shall be replaced with satisfactory excavated material or other approved materials;

(b) rock encountered in the cut sections shall be excavated to a depth of 6 inches below finished grade for the subgrade;

(c) low areas resulting from removal of unsatisfactory material or from excavation of rock shall be brought up to required grade with satisfactory materials, and the entire subgrade shall be shaped to line, grade, and cross section and shall be compacted as specified. The surface of embankments or excavated areas for road construction or other areas on which a base course or pavement is to be placed shall vary not more than 15 mm (0.05 foot) from the established grade and approved cross section. Surfaces other than those that are to be paved shall be finished not more than 45 mm (0.15 foot) above or below the established grade or approved cross section.

## 3.9 PLACING TOPSOIL

On areas to receive topsoil, the compacted subgrade soil shall be scarified to a 50 mm (2 inch) depth for bonding of topsoil with subsoil. Topsoil then shall be spread evenly to a thickness of 100 mm (4 inches) and graded to the elevations and slopes shown. Topsoil shall not be spread when frozen or excessively wet or dry. Material required for topsoil in excess of that produced by excavation within the grading limits shall be obtained from [off-site areas] [areas indicated].

## 3.10 RIPRAP PLACEMENT

The approved riprap shall be dumped in a manner to produce a reasonably solid mass within the limits shown in the plans. Any appreciable variation in size distribution or thickness shall be corrected by redistributing the riprap.

## 3.11 FIELD TESTING CONTROL

Testing shall be the responsibility of the Contractor and shall be performed by an approved commercial testing laboratory or by the Contractor subject to approval. Field density and moisture content tests shall be performed on every 450 square meters (5000 square feet)

of each lift placed. Field in-place density shall be determined in accordance with ASTM D 1556.

## 3.12 PROTECTION

Newly graded areas shall be protected from traffic and from erosion, and any settlement or washing away that may occur from any cause, prior to acceptance, shall be repaired and grades reestablished to the required elevations and slopes. All work shall be conducted in accordance with the environmental protection requirements of the contract.

-- End of Section 02210A--

DIVISION 2

SITE

SECTION 02221

# EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS

## PART 1 GENERAL

### 1.1 REFERENCES

The publications listed below are referenced and the most current publication applies. The publications are referred to in the text by basic designation only.

#### 1.1.1 AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|---|---|
| ASTM D 1556 | Density and Unit Weight of Soil in Place by the Sand-Cone Method |
| ASTM D 1557 | Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu.m.)) |
| ASTM D 2216 | Laboratory Determination of Water (Moisture) Content of Soil, and Rock |
| ASTM D 2487 | Classification of Soils for Engineering Purposes (Unified Soil Classification System) |

### 1.2 DEFINITIONS

#### 1.2.1 Degree of Compaction

Degree of compaction required is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557 abbreviated hereinafter as percent laboratory maximum density.

### 1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

#### 1.3.1 Reports "FIO"

Field Density Tests; Testing of Backfill Materials;.

Copies of all laboratory and field test reports within 24 hours of the completion of the test.

## PART 2 PRODUCTS

### 2.1 MATERIALS

#### 2.1.1 Satisfactory Materials

Satisfactory materials include materials classified in ASTM D 2487 as GW, GP, SP, and SW, and shall be free of trash, debris, roots or other organic matter, or stones larger than 75 mm (3 inches) in any dimension.

#### 2.1.2 Unsatisfactory Materials

Unsatisfactory materials include materials classified in ASTM D 2487 as PT, OH, and OL, and any other materials not defined as satisfactory.

#### 2.1.3 Cohesionless and Cohesive Materials

Cohesionless materials include materials classified in ASTM D 2487 as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesionless only when the fines are nonplastic.

### 2.2 CAPILLARY WATER BARRIER

Capillary Water Barrier shall consist of clean, crushed, nonporous rock, crushed gravel, or uncrushed gravel. The maximum particle size shall be 37.5 mm (1-1/2 inches) and no more than 2 percent by weight shall pass the 4.75 mm (No. 4) size sieve.

## PART 3 EXECUTION

### 3.1 CLEARING AND GRUBBING

Clearing and grubbing is specified in Section 02110 CLEARING AND GRUBBING.

### 3.2 TOPSOIL

Topsoil shall be stripped to a depth as shown on the drawings below existing grade within the designated excavations and grading lines and deposited in storage piles for later use. Excess topsoil shall be disposed as specified for excess excavated material.

### 3.3 EXCAVATION

Excavation shall conform to the dimensions and elevations indicated for each building, structure, and footing except as specified hereinafter, and shall include trenching for utility and foundation drainage systems

to a point 1.5 m (5 feet) beyond the building line of each building and structure, excavation for outside grease interceptors, underground fuel tanks, and all work incidental thereto. Excavation shall extend a sufficient distance from walls and footings to allow for placing and removal of forms. Excavations below indicated depths will not be permitted except to remove unsatisfactory material. Unsatisfactory material encountered below the grades shown shall be removed as directed and replaced with satisfactory material. Satisfactory material removed below the depths indicated without specific direction of the Contracting Officer shall be replaced at no additional cost to the Government to the indicated excavation grade with satisfactory materials, except that concrete footings shall be increased in thickness to the bottom of the overdepth excavations and over-break in rock excavation. Satisfactory material shall be placed and compacted as specified in paragraph FILLING AND BACKFILLING. Determination of elevations and measurements of approved overdepth excavation of unsatisfactory material below grades indicated shall be done under the direction of the Contracting Officer.

## 3.4 DRAINAGE AND DEWATERING

### 3.4.1 Drainage

Surface water shall be directed away from excavation and construction sites so as to prevent erosion and undermining of foundations. Diversion ditches, dikes and grading shall be provided and maintained as necessary during construction. Excavated slopes and backfill surfaces shall be protected to prevent erosion and sloughing. Excavation shall be performed so that the site and the area immediately surrounding the site and affecting operations at the site shall be continually and effectively drained.

### 3.4.2 Dewatering

Groundwater flowing toward or into excavations shall be controlled to prevent sloughing of excavation slopes and walls, boils, uplift and heave in the excavation and to eliminate interference with orderly progress of construction. French drains, sumps, ditches or trenches will not be permitted within 900 mm (3 feet) of the foundation of any structure, except with specific written approval, and after specific contractual provisions for restoration of the foundation area have been made. Control measures shall be taken by the time the excavation reaches the water level in order to maintain the integrity of the in situ material.

## 3.5 SHORING

Shoring, including sheet piling, shall be furnished and installed as necessary to protect workmen, banks, adjacent paving, structures, and utilities. Shoring, bracing, and sheeting shall be removed as excavations are backfilled, in a manner to prevent caving.

## 3.6 CLASSIFICATION OF EXCAVATION

Excavation will be unclassified regardless of the nature of material encountered.

## 3.7 BLASTING

Blasting will not be permitted.

## 3.8 UTILITY AND DRAIN TRENCHES

Trenches for underground utilities systems and drain lines shall be excavated to the required alignments and depths. The bottoms of trenches shall be graded to secure the required slope and shall be tamped if necessary to provide a firm pipe bed. Recesses shall be excavated to accommodate bells and joints so that pipe will be uniformly supported for the entire length. Rock, where encountered, shall be excavated to a depth of at least 150 mm (6 inches) below the bottom of the pipe, and the overdepth shall be backfilled with satisfactory material placed and compacted in conformance with paragraph FILLING AND BACKFILLING.

## 3.9 BORROW

Where satisfactory materials are not available in sufficient quantity from required excavations, approved materials shall be obtained.

## 3.10 EXCAVATED MATERIALS

Satisfactory excavated material required for fill or backfill shall be placed in the proper section of the permanent work required under this section or shall be separately stockpiled if it cannot be readily placed. Satisfactory material in excess of that required for the permanent work and all unsatisfactory material shall be disposed of as specified in Section 02210A CLEARING AND GRUBBING.

## 3.11 FINAL GRADE OF SURFACES TO SUPPORT CONCRETE

Excavation to final grade shall not be made until just before concrete is to be placed. For pile foundations, the excavation shall be stopped at an elevation of from 150 to 300 mm (6 to 12) inches above the bottom of the footing before driving piles. After pile driving has been completed, the remainder of the excavation shall be completed to the elevations shown. Only excavation methods that will leave the foundation rock in a solid and unshattered condition shall be used. Approximately level surfaces shall be roughened, and sloped surfaces shall be cut as indicated into rough steps or benches to provide a satisfactory bond. Shales shall be protected from slaking or other erosion resulting from ponding or flow of water.

## 3.12 SUBGRADE PREPARATION

Unsatisfactory material in surfaces to receive fill or in excavated areas shall be removed and replaced with satisfactory materials. The surface shall be scarified to a depth of 150 mm (6 inches) before the fill is started. Sloped surfaces steeper than 1 vertical to 4 horizontal shall be plowed, stepped, benched, or broken up so that the fill material will bond with the existing material. When subgrades are less than the specified density, the ground surface shall be broken up to a minimum depth of 150 mm, (6 inches,) pulverized, and compacted to the specified density. When the subgrade is part fill and part excavation or natural ground, the excavated or natural ground portion shall be scarified to a depth of 300 mm (12 inches) and compacted as specified for the adjacent fill. Material shall not be placed on surfaces that are muddy, frozen, or contain frost. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, or other approved equipment well suited to the soil being compacted. Material shall be moistened or aerated as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used. Minimum subgrade density shall be as specified in paragraph FILLING AND BACKFILLING.

## 3.13 FILLING AND BACKFILLING

Satisfactory materials shall be used in bringing fills and backfills to the lines and grades indicated and for replacing unsatisfactory materials. Satisfactory materials shall be placed in horizontal layers not exceeding 200 mm (8 inches) in loose thickness, or 150 mm (6 inches) when hand-operated compactors are used. After placing, each layer shall be plowed, disked, or otherwise broken up, moistened or aerated as necessary, thoroughly mixed and compacted as specified. Backfilling shall not begin until construction below finish grade has been approved, underground utilities systems have been inspected, tested and approved, forms removed, and the excavation cleaned of trash and debris. Backfill shall be brought to indicated finish grade and shall include backfill for outside grease interceptors and underground fuel tanks. Backfill shall not be placed in wet or frozen areas. Where pipe is coated or wrapped for protection against corrosion, the backfill material up to an elevation 600 mm (2 feet) above sewer lines and 300 mm (1 foot) above other utility lines shall be free from stones larger than 25.4 mm (1 inch) in any dimension. Heavy equipment for spreading and compacting backfill shall not be operated closer to foundation or retaining walls than a distance equal to the height of backfill above the top of footing; the area remaining shall be compacted in layers not more than 100 mm (4 inches) in compacted thickness with power-driven hand tampers suitable for the material being compacted. Backfill shall be placed carefully around pipes or tanks to avoid damage to coatings, wrappings, or tanks. Backfill shall not be placed against foundation walls prior to 7 days after completion of the walls. As far as practicable, backfill shall be brought up evenly on each side of the wall and sloped to drain away from the wall. Each layer of fill and backfill shall be compacted to not less than the percentage of maximum density specified below:

| | Percent Laboratory maximum density | |
|---|---|---|
| | Cohesive material | Cohesionless material |
| Fill, embankment, and backfill | | |
| Under structures, building slabs, steps, paved areas, around footings, and in trenches | 90 | 95 |
| Under sidewalks and grassed areas | 85 | 90 |
| Subgrade | | |
| Under building slabs, steps, and paved areas, top 300 mm | 90 | 95 |
| Under sidewalks, top 150 mm | 85 | 90 |

| | Percent Laboratory maximum density | |
|---|---|---|
| | Cohesive material | Cohesionless material |
| Fill, embankment, and backfill | | |
| Under structures, building slabs, steps, paved areas, around footings, and in trenches | 90 | 95 |
| Under sidewalks and grassed areas | 85 | 90 |
| Subgrade | | |
| Under building slabs, steps, and paved areas, top 12 inches | 90 | 95 |
| Under sidewalks, top 6 inches | 85 | 90 |

Approved compacted subgrades that are disturbed by the Contractor's operations or adverse weather shall be scarified and compacted as specified herein before to the required density prior to further construction thereon. Recompaction over underground utilities and heating lines shall be by hand tamping.

## 3.14 TESTING

Testing shall be the responsibility of the Contractor and shall be performed at no additional cost to the Government. Testing shall be performed by an approved commercial testing laboratory or may be performed by the Contractor subject to approval. Field in-place density shall be determined in accordance with ASTM D 1556.

### 3.14.1 In-Place Densities

#### 3.14.1.1 In-Place Density of Subgrades

One test per 139 square meters (1500 square foot) or fraction thereof.

#### 3.14.1.2 In-Place Density of Fills and Backfills

One test per 139 square meters (1500 square foot) or fraction thereof of each lift for fill or backfill areas compacted by other than hand or hand-operated machines.

### 3.14.2 Moisture Content

In the stockpile, excavation or borrow areas, a minimum of two tests per day per type of material or source of materials being placed is required during stable weather conditions. During unstable weather, tests shall be made as dictated by local conditions and approved moisture content shall be tested in accordance with ASTM D 2216.

### 3.14.3 Optimum Moisture and Laboratory Maximum Density

Tests shall be made for each type material or source of material including borrow material to determine the optimum moisture and laboratory maximum density values. One representative test per 76 cubic meters (100 cubic yards) of fill and backfill, or when any change in material occurs which may affect the optimum moisture content or laboratory maximum density will be made.

## 3.15 CAPILLARY WATER BARRIER

Capillary water barrier under concrete floor and area-way slabs on grade shall be placed directly on the subgrade and shall be compacted with a minimum of two passes of a hand-operated plate-type vibratory compactor.

## 3.16 GRADING

Areas within 1.5 m (5 feet) outside of each building and structure line shall be constructed true-to-grade, shaped to drain, and shall be maintained free of trash and debris until final inspection has been completed and the work has been accepted.

## 3.17 SPREADING TOPSOIL

Areas outside the building lines from which topsoil has been removed shall be topsoiled. The surface shall be free of materials that would hinder planting or maintenance operations. The subgrade shall be pulverized to a depth of 50 mm (2 inches) by disking or plowing for the bonding of topsoil with the subsoil. Topsoil shall then be uniformly spread, graded, and compacted to the thickness, elevations, slopes shown, and left free of surface irregularities. Topsoil shall be compacted by one pass of a cultipacker, roller, or other approved equipment weighing 1.46 kN/m to 2.34 kN/m (100 to 160 pounds per linear foot) of roller. Topsoil shall not be placed when the subgrade is frozen, excessively wet, extremely dry, or in a condition otherwise detrimental to seeding, planting, or proper grading.

## 3.18 PROTECTION

Settlement or washing that occurs in graded, topsoiled, or backfilled areas prior to acceptance of the work shall be repaired and grades reestablished to the required elevations and slopes.

-- End of Section 02221 --

DIVISION 2

SITEWORK

SECTION 02222

# EXCAVATION, TRENCHING, AND BACKFILLING UTILITIES

## PART 1 GENERAL

### 1.1 REFERENCES

#### 1.1.1 AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|---|---|
| ASTM D 422 | Particle-Size Analysis of Soils |
| ASTM D 1556 | Density and Unit Weight of Soil in Place by the Sand-Cone Method |
| ASTM D 1557 | Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu. m.) |
| ASTM D 2487 | Classification of Soils for Engineering Purposes (Unified Soil Classification System |
| ASTM D 3017 | Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth) |

### 1.2 DEFINITIONS

#### 1.2.1 Degree of Compaction

Degree of compaction shall be expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557.

### 1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

#### 1.3.1 Reports "FIO"

Field Density Tests;

Testing of Backfill Materials;

Copies of all laboratory and field test reports within 24 hours of the completion of the test.

## PART 2 PRODUCTS

### 2.1 MATERIALS

#### 2.1.1 Satisfactory Materials

Satisfactory materials shall consist of any material classified by ASTM D 2487 as GW, GP, SP, and SW.

#### 2.1.2 Unsatisfactory Materials

Unsatisfactory materials shall be materials that do not comply with the requirements for satisfactory materials. Unsatisfactory materials include but are not limited to those materials containing roots and other organic matter, trash, debris, frozen materials and stones larger than 75 millimeters, ( 3 inches,) and materials classified in ASTM D 2487, uses class v series PT, OH, and OL. Unsatisfactory materials also include man-made fills, refuse, or backfills from previous construction.

#### 2.1.3 Unyielding Material

Unyielding material shall consist of rock and gravelly soils with stones greater than 75 millimeters (3 inches) in any dimension or as defined by the pipe manufacturer, whichever is smaller.

#### 2.1.4 Unstable Material

Unstable material shall consist of materials too wet to properly support the utility pipe, conduit, or appurtenant structure.

#### 2.1.5 GRANULAR PIPE BEDDING

Granular pipe bedding shall consist of well-graded sand, gravel, crushed gravel, crushed stone or crushed slag composed of hard, tough and durable particles, and shall contain not more than 10 percent by weight of material passing a No. 200 mesh sieve and no less than 100 percent by weight passing the l/2 inch sieve. The maximum allowable aggregate size shall be 1/2 inch. Maximum Plasticity Index of six Gradation as follows:

| Sieve size | Percent Passing |
|---|---|
| No. 4 | 100 |
| No. 8 | 55-85 |
| No. 40 | 10-30 |

#### 2.1.6 SELECT PIPE BEDDING

Select pipe bedding shall consist of granular pipe bedding or satisfactory materials free from rocks 1/2 inch or larger in any dimension or free from rocks of such size as recommended by the pipe manufacturer, whichever is smaller.

| Sieve Size | Percent Passing |
|---|---|
| 1 ½ in. | 100 |
| ½ in. | 45-75 |
| No. 40 | 10-25 |

2.1.7 PLASTIC MARKING TAPE

Plastic marking tape shall be acid and alkali-resistant polyethylene film, 6 inches wide with minimum thickness of 0.004 inch. Tape shall have a minimum strength of 1750 psi lengthwise and 1500 psi crosswise. The tape shall be manufactured with integral wires, foil backing or other means to enable detection by a metal detector when the tape is buried up to 3 feet deep. The tape shall be of a type specifically manufactured for marking and locating underground utilities. The metallic core of the tape shall be encased in a protective jacket or provided with other means to protect it from corrosion. Tape color shall be red and shall bear a continuous printed inscription of "ELECTRIC."

## PART 3 EXECUTION

### 3.1 EXCAVATION

Excavation shall be performed to place the top of conduit at a minimum of thirty (30) inches below finished grade. Rock excavation shall include removal and disposition of material defined as rock in paragraph MATERIALS. Earth excavation shall include removal and disposal of material not classified as rock excavation. During excavation, material satisfactory for backfilling shall be stockpiled in an orderly manner at a distance from the banks of the trench equal to 1/2 the depth of the excavation, but in no instance closer than 2 feet. Excavated material not required or not satisfactory for backfill shall be removed from the site. Grading shall be done as may be necessary to prevent surface water from flowing into the excavation, and any water accumulating therein shall be removed to maintain the stability of the bottom and sides of the excavation. Unauthorized overexcavation shall be backfilled in accordance with paragraph BACKFILLING AND COMPACTION at no additional cost to the Government.

3.1.1 Conservation Of Topsoil

Topsoil shall be removed to a depth of 6 inches without contamination with subsoil and stockpiled convenient to areas for later application or at locations specified. Topsoil shall be removed to full depth and shall be stored separate from other excavated materials and piled free of roots, stones, and other undesirable materials. Any surplus of topsoil from excavations and grading shall be removed from the site.

### 3.1.2 Trench Excavation

The trench shall be excavated as recommended by the manufacturer of the pipe to be installed and must meet OSHA requirements. Trench walls below the top of the pipe shall be sloped, or made vertical, and of such width as recommended in the manufacturer's installation manual. Where no manufacturer's installation manual is available, trench walls shall be made vertical. Trench walls more than 0.9 meters (3 feet) high shall be shored, cut back to a stable slope, or provided with equivalent means of protection for employees who may be exposed to moving ground or cave in. Vertical trench walls more than 0.9 meters (3 feet) high shall be shored. Trench walls which are cut back shall be excavated to at least the angle of repose of the soil. Special attention shall be given to slopes which may be adversely affected by weather or moisture content. The trench width below the top of pipe shall not exceed 600 mm (24 inches) plus pipe outside diameter (O.D.).

#### 3.1.2.A Bottom Preparation

The bottoms of trenches shall be accurately graded to provide uniform bearing and support for the bottom quadrant of each section of the pipe. Bell holes shall be excavated to the necessary size at each joint or coupling to eliminate point bearing. Stones of 1/2 inches or greater in any dimension, or as recommended by the pipe manufacturer, whichever is smaller, shall be removed to avoid point bearing.

#### 3.1.2.B Removal of Unstable Material

Where unstable material is encountered in the bottom of the trench, such material shall be removed to the depth directed and replaced to the proper grade with select granular material as provided in paragraph BACKFILLING AND COMPACTION. When removal of unstable material is required due to the fault or neglect of the Contractor in his performance of the work, the resulting material shall be excavated and replaced by the Contractor without additional cost to the Government.

#### 3.1.2.C Stockpiles

Stockpiles shall be kept in a neat and well drained condition, giving due consideration to drainage at all times. The ground surface at stockpile locations shall be cleared, grubbed, and sealed by rubber-tired equipment, excavated satisfactory and unsatisfactory materials shall be separately stockpiled. Stockpiles of satisfactory materials shall be protected from contamination which may destroy the quality and fitness of the stockpiled material. If the Contractor fails to protect the stockpiles, and any material becomes unsatisfactory, such material shall be removed and replaced with satisfactory material from approved sources at no additional cost to the Government.

## 3.2 BACKFILLING AND COMPACTION

Backfill material shall consist of satisfactory material, select granular material, or initial backfill material as required. Backfill shall be placed in layers not exceeding 150 mm (6 inches) loose thickness for compaction by hand operated machine compactors, and 200 mm (8 inches) loose thickness for other than hand operated machines, unless otherwise specified. Each layer shall be compacted to at least 95 percent maximum density for cohesionless soils and 90 percent maximum density for cohesive soils, unless otherwise specified.

### 3.2.1 Trench Backfill

Trenches shall be backfilled to the grade shown. The trench shall not be backfilled until all specified tests are performed.

#### 3.2.1.1 Bedding and Initial Backfill

Provide select pipe bedding or granular pipe as shown on plans material for bedding, consisting of SE, SP, SM sand as classified in accordance with ASTM D 2487. Initial backfill material shall be placed and compacted with approved tampers to a height of at least one foot above the utility pipe or conduit. The backfill shall be brought up evenly on both sides of the pipe for the full length of the pipe. Care shall be taken to ensure thorough compaction of the fill under the haunches of the pipe.

#### 3.2.1.2 Backfill twelve inches above the crown

The remainder of the trench, except for roadways, shall be filled with satisfactory material, as shown on drawings and defined above.

## 3.3 SPECIAL REQUIREMENTS

Special requirements for both excavation and backfill relating to the specific utilities are as follows:

### 3.3.1 Water Lines

Trenches shall be of a depth to provide a minimum cover of 1.20 meters (4 feet) from the existing ground surface, or from the indicated finished grade, whichever is lower, to the top of the pipe.

### 3.3.2 Plastic Marking Tape

Warning tapes shall be installed directly above the pipe, at a depth of 300 millimeters (12 inches) below finished grade unless otherwise shown.

## 3.4 TESTING

Testing shall be the responsibility of the Contractor and shall be performed at no additional cost to the Government.

### 3.4.1 Testing Facilities

Tests shall be performed by an approved commercial testing laboratory or may be tested by facilities furnished by the Contractor. No work requiring testing will be permitted until the facilities have been inspected and approved by the Contracting Officer. The first inspection shall be at the expense of the Government. Cost incurred for any subsequent inspection required because of failure of the first inspection will be charged to the Contractor.

### 3.4.2 Testing of Backfill Materials

Characteristics of backfill materials shall be determined in accordance with particle size analysis of soils ASTM D 422 and moisture-density relations of soils ASTM D 1557. A minimum of one particle size analysis and one moisture-density relation test shall be performed on each different type of material used for bedding and backfill.

### 3.4.3 Field Density Tests

Tests shall be performed in sufficient numbers to ensure that the specified density is being obtained. A minimum of one field density test per lift of backfill for every 150 meters (450 feet) of installation shall be performed. One moisture density relationship shall be determined for every 1500 cubic meters (1500 cubic yards) of material used. Field in-place density shall be determined in accordance with ASTM D 1556. The calibration curves furnished with the moisture gauges shall be checked along with density calibration checks as described in ASTM D 3017. The calibration checks of both the density and moisture gauges shall be made at the beginning of a job, on each different type of material encountered, at intervals as directed by the Contracting Officer. Copies of calibration curves, results of calibration tests, and field and laboratory density tests shall be furnished to the Contracting Officer. Trenches improperly compacted shall be reopened to the depth directed, then refilled and compacted to the density specified at no additional cost to the Government.

-- End of Section 02222 --

DIVISION 2

CONCRETE

SECTION 02511

# CONCRETE FOR SIDEWALKS, CURBS, AND GUTTERS

## PART 1 GENERAL

### 1.1 REFERENCES

The publications listed below are referenced and the most current publication applies. The publications are referenced to in the text by basic designation only.

#### 1.1.1 AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 182 Hydraulic Cement Concrete

#### 1.1.2 AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 31 Making and Curing Concrete Test Specimens in the Field

ASTM C 94 Ready Mixed Concrete

ASTM C 171 Sheet Materials for Curing Concrete

ASTM C 172 Sampling Freshly Mixed Concrete

ASTM C 173 Air Content of Freshly Mixed Concrete by the Volumetric Method

ASTM C 231 Air Content of Freshly Mixed Concrete by the Pressure Method

ASTM C 309 Liquid Membrane Forming Compounds for Curing Concrete

ASTM D 1752 Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

## 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

### 1.2.1 Certificates/Certifications "FIO"

Cement, pozzolan, and ground iron blast-furnace slag will be accepted on the basis of manufacturer's certification of compliance, accompanied by mill test reports attesting that the materials meet the requirements of the specification under which it is furnished. No cement, pozzolan, or slag shall be used until notice of acceptance has been given by the Contracting Officer. Cement, pozzolan, and slag may be subjected to check testing by the Government from samples obtained at the mill, at transfer points, or at the project site.

### 1.2.2 Performance Test Reports "GA"

Copies of all field quality control and laboratory test reports within 24 hours of completion of the test.

### 1.2.3 Statements "FIO"

Copies of certified delivery tickets for all concrete used in the construction.

## 1.3 GENERAL REQUIREMENTS

### 1.3.1 Strength Requirements

Structural concrete for all work shall have a 28-day compressive strength of 4000 pounds per square inch and a 28-day flexural strength 4000 pounds per square inch. Concrete made with high-early strength cement shall have a 7-day strength equal to the specified 28-day strength for concrete made with Type II portland cement.

### 1.3.2 Air Entrainment

All concrete shall contain from 4 to 7 percent total air.

### 1.3.3 Special Properties

Concrete may contain other admixtures, such as water reducers, superplasticizers, or set retarding agents to provide special properties to the concrete, if approved.

### 1.3.4 Slump

Slump shall be within 1 to 3 inches. Where use of superplasticizers are approved to produce flowing concrete this slump requirement does not apply.

## 1.4 WEATHER LIMITATIONS

### 1.4.1 Placing During Cold Weather

Concrete placement shall be discontinued when the air temperature reaches 40 degrees F and is falling. Placement may begin when the air temperature reaches 35 degrees F and is rising. Provisions shall be made to protect the concrete from freezing during the specified curing period. If necessary to place concrete when the temperature of the air, aggregates, or water is below 35 degrees F, placement shall be approved in writing. Approval shall be contingent upon full conformance with the following provisions. The underlying material shall be prepared and protected so that it is entirely free of frost when the concrete is deposited.

Mixing water and aggregates shall be heated as necessary to result in the temperature of the in-place concrete being between 50 and 85 degrees F.

Methods and equipment for heating shall be approved. The aggregates shall be free of ice, snow, and frozen lumps before entering the mixer. Covering and other means shall have the capability of producing the required product, meeting grade controls, thickness control and smoothness requirements as specified. Use of the equipment shall be discontinued if it produces unsatisfactory results. The Contracting Officer shall have access at all times to the plant and equipment to ensure proper operation and compliance with specifications.

# PART 2 PRODUCTS

## 2.1 CONCRETE

Concrete shall conform to the applicable requirements of ASTM C 94. Maximum size of aggregate shall be 1-1/2 inches.

### 2.1.1 Air Content

Mixtures shall have air content by volume of concrete of 5 to 7 percent, based on measurements made immediately after discharge from the mixer.

### 2.1.2 Slump shall be 1 to 3 inches.

## 2.2 CURING MATERIALS

Curing materials shall be burlap, impervious sheets, or membrane-forming compounds.

### 2.2.1 Impervious Sheet Materials

Impervious sheet materials shall conform to ASTM C 171, type optional, except that polyethylene film, if used, shall be white opaque.

2.2.2 Burlap

Burlap shall conform to AASHTO M 182.

2.2.3 White Pigmented Membrane Forming Curing Compound

White pigmented membrane-forming curing compound shall conform to ASTM C 309, Type 2.

## 2.3 EMBEDDED ITEMS

Embedded items shall be expansion joints installed at intervals to match the original sidewalk.

## 2.4 CONCRETE PROTECTION MATERIALS

Concrete protection materials shall be a linseed oil mixture of equal parts, by volume, of linseed oil and either mineral spirits, naphtha, or turpentine. At the option of the contractor, commercially prepared linseed oil mixtures, formulated specifically for application to concrete to provide protection against the action of deicing chemicals may be used, except that emulsified mixtures are not acceptable.

## 2.5 JOINT FILLER STRIPS

2.5.1 Contraction Joint Filler for Curb and Gutter and Sidewalk

Contraction joint filler for curb and gutter shall consist of hard pressed fiberboard.

## 2.6 FORMS

Wood forms shall be surfaced plank, 2 inch nominal thickness, straight and free from warp, twist, loose knots, splits or other defects. Wood forms shall have a nominal length of 10 feet. Radius bends may be formed with 3/4 inch boards, laminated to the required thickness. Steel forms shall be channel formed sections with a flat top surface and with welded braces at each end and at not less than two intermediate points. Ends of steel forms shall be interlocking and self-aligning. Steel forms shall include flexible forms for radius forming, corner forms, form spreaders, and fillers. Steel forms shall have a nominal length of 10 feet with a minimum of two welded stake pockets per form. Stake pins shall be solid steel rods with chamfered heads and pointed tips designed for use with steel forms.

2.6.1 Sidewalk Forms

Sidewalk forms shall be of a height equal to the full depth of the finished sidewalk.

### 2.6.2 Curb and Gutter Forms

Curb and gutter outside forms shall have a height equal to the full depth of the curb or gutter. The inside form of curb shall have batter as indicated and shall be securely fastened to and supported by the outside form. Rigid forms shall be provided for curb returns, except that benders or thin plank forms may be used for curb or curb returns with a radius of 10 feet or more, where grade changes occur in the return, or where the central angle is such that a rigid form with a central angle of 90 degrees cannot be used. Back forms for curb returns may be made of 1-1/2 inch benders, for the full height of the curb, cleated together.

## PART 3 EXECUTION

## 3.1 SUBGRADE PREPARATION

Subgrade shall be placed and compacted to conform with applicable requirements of Section 02222.

### 3.1.1 Sidewalk Subgrade

The subgrade shall be tested for grade and cross section with a template extending the full width of the sidewalk and supported between side forms.

### 3.1.2 Curb and Gutter Subgrade

The subgrade shall be tested for grade and cross section by means of a template extending the full width of the curb and gutter. The subgrade shall match the surrounding subgrade.

### 3.1.3 Maintenance of Subgrade

The subgrade shall be maintained in a smooth, compacted condition in conformity with the required section and established grade until the concrete is placed. The subgrade shall be in a moist condition when concrete is placed. The subgrade shall be prepared and protected so as to produce a subgrade free from frost when the concrete is deposited.

## 3.2 FORM SETTING

Forms shall be carefully set to the indicated alignment, grade and dimensions. Forms shall be held rigidly in place by a minimum of three stakes per form placed at intervals not to exceed 4 feet. Corners, deep sections, and radius bends shall have additional stakes and braces, as required. Clamps, spreaders, and braces shall be used where required to insure rigidity in the forms. Forms shall be removed without injuring the concrete. Bars or heavy tools shall not be used against the

concrete in removing the forms. Any concrete found defective after form removal shall be promptly and satisfactorily repaired. Forms shall be cleaned and coated with form oil each time before concrete is placed. Wood forms may, instead, be thoroughly wetted with water before concrete is placed, except that with probable freezing temperatures, oiling is mandatory.

### 3.2.1 Sidewalks

Forms for sidewalks shall be set with the upper edge true to line and grade with an allowable tolerance of 1/8 inch in any 10 foot long section. After forms are set, grade and alignment shall be checked with a 10 foot straightedge. Forms shall have a transverse slope of 1/4-inch per foot with the low side adjacent to the roadway. Side forms shall not be removed for 12 hours after finishing has been completed.

### 3.3.3 Edge and Joint Finishing

All slab edges, including those at formed joints, shall be finished carefully with an edger having a radius of 1/8 inch. Transverse joints shall be edged before brooming, and the brooming shall eliminate the flat surface left by the surface face of the edger. Corners and edges which have crumbled and areas which lack sufficient mortar for proper finishing shall be cleaned and filled solidly with a properly proportioned mortar mixture and then finished.

### 3.3.4 Surface and Thickness Tolerances

Finished surfaces shall not vary more than 5/16 inch from the testing edge of a 10 foot straightedge. Permissible deficiency in section thickness will be up to 1/4 inch.

## 3.4 CURB AND GUTTER CONCRETE PLACEMENT AND FINISHING

### 3.4.1 Formed Curb and Gutter

Concrete shall be placed to the section required in a single lift. Consolidation shall be achieved by using approved mechanical vibrators.

### 3.4.2 Concrete Finishing

Exposed surfaces shall be floated and finished with a smooth wood float until true to grade and section and uniform in texture. Floated surfaces shall then be brushed with a fine-hair brush with longitudinal strokes. The edges of the gutter and top of the curb shall be rounded with an edging tool to a radius of 1/2 inch. Immediately after removing the front curb form, the face of the curb shall be rubbed with a wood or concrete rubbing block and water until blemishes, form marks, and tool marks have been removed. The front curb surface, while still wet, shall be brushed in the same manner as the gutter and curb top. The top

surface of gutter and entrance shall be finished to grade with a wood float.

## 3.5 SIDEWALK JOINTS

Sidewalk joints shall be constructed to divide the surface into rectangular areas. Transverse contraction joints shall be spaced at a distance equal to the sidewalk width or to match the existing sidewalk joint spacing on centers, whichever is less, and shall be continuous across the slab. Transverse expansion joints shall be installed at sidewalk returns and opposite expansion joints in adjoining curbs. Where the sidewalk is not in contact with the curb, transverse expansion joints shall be installed as indicated. Expansion joints shall be formed about structures and features which project through or into the sidewalk pavement, using joint filler to match the existing sidewalk.

### 3.5.1 Contraction Joints

The contraction joints shall be formed in the fresh concrete by cutting a groove in the top portion of the slab to a depth of at least one-fourth of the sidewalk slab thickness, using a jointer to cut the groove, or by sawing a groove in the hardened concrete with a power-driven saw, unless otherwise approved. Sawed joints shall be constructed by sawing a groove in the concrete with a 1/8-inch blade to the depth indicated. An ample supply of saw blades shall be available on the job before concrete placement is started, and at least one standby sawing unit in good working order shall be available at the job site at all times during the sawing operations.

### 3.5.2 Expansion Joints

Expansion-joint filler shall not be required between curbs that abut the sidewalk longitudinally. Joint filler in expansion joints surrounding structures and features within the sidewalk shall consist of preformed filler material conforming to ASTM D 1752.

Expansion joints shall be formed with 1/2 inch joint filler strips. Joint filler shall be placed with top edge 1/4 inch below the surface and shall beheld in place with steel pins or other devices to prevent warping of the filler during floating and finishing. Immediately after finishing operations are completed, joint edges shall be rounded with an edging tool having a radius of 1/8 inch, and concrete over the joint filler shall be removed. At the end of the curing period, expansion joints shall be carefully cleaned and filled with joint sealer.

## 3.6 CURB AND GUTTER JOINTS

Curb and gutter joints shall be constructed at right angles to the line of curb and gutter.

### 3.6.1 Contraction Joints

Contraction joints shall be constructed directly opposite contraction joints in abutting Portland cement concrete pavements and spaced so that monolithic sections between curb returns will not be less than 5 feet nor greater than 15 feet in length. Contraction joints shall be constructed by means of 1/8-inch thick separators and of a section conforming to the cross section of the curb and gutter. Separators shall be removed as soon as practicable after concrete has set sufficiently to preserve the width and shape of the joint and prior to finishing.

### 3.6.2 Expansion Joints

Intervals between expansion joints of curb and combination curb and gutters adjacent to flexible pavements will not be less than 30 feet nor greater than 120 feet.

Expansion joints shall be formed by means of preformed expansion joint filler material cut and shaped to the cross section of curb and gutter. Expansion joints shall be provided in curb and gutter directly opposite expansion joints of abutting Portland cement concrete pavement, and shall be of the same type and thickness as joints in the pavement. Where curb and gutter do not abut portland cement concrete pavement, expansion joints at least 1/2 inch in width shall be provided at intervals to match existing curb and gutter. Expansion joints shall be provided in nonreinforced concrete gutter to match existing curb and gutter. Expansion joints and the top 1-inch depth of curb and gutter contraction joints shall be sealed with joint sealer. The joint opening shall be thoroughly cleaned before the sealing material is placed. Sealing shall be done so that the material will not be spilled on exposed surfaces of the concrete. Concrete at the joint shall be surface dry and atmospheric and concrete temperatures shall be above 50 degrees Fat the time of application of joint sealing material. Excess material on exposed surfaces of the concrete shall be removed immediately and concrete surfaces cleaned.

## 3.7 CURING AND PROTECTION

### 3.7.1 General Requirements

Concrete shall be protected against loss of moisture and rapid temperature changes for at least 7 days from the beginning of the curing operation. Unhardened concrete shall be protected from rain and flowing water. All equipment needed for adequate curing and protection of the concrete shall be on hand and ready for use before actual concrete placement begins. Protection shall be provided as necessary to prevent cracking of the pavement due to temperature changes during the curing period.

#### 3.7.1.1 Mat Method

The entire exposed surface shall be covered with two or more layers of burlap. Mats shall overlap each other at least 6 inches. The mat shall be thoroughly wetted with water prior to placing on concrete surface and shall be kept continuously in a saturated condition and in intimate contact with concrete for not less than 7 days.

3.7.1.2 Impervious Sheeting Method

The entire exposed surface shall be wetted with a fine spray of water and then covered with impervious sheeting material. Sheets shall be laid directly on the concrete surface with the light-colored side up and overlapped 12 inches when a continuous sheet is not used. The curing medium shall not be less than 18 inches wider than the concrete surface to be cured, and shall be securely weighted down by heavy wood planks, or a bank of moist earth placed along edges and laps in the sheets. Sheets shall be satisfactorily repaired or replaced if torn or otherwise damaged during curing. The curing medium shall remain on the concrete surface to be cured for not less than 7 days.

3.7.1.3 Membrane Curing Method

A uniform coating of white-pigmented membrane-curing compound shall be applied to the entire exposed surface of the concrete as soon after finishing as the free water has disappeared from the finished surface. Formed surfaces shall be coated immediately after the forms are removed and in no case longer than 1 hour after drying has occurred, the surface of the concrete shall be moistened with a fine spray of water and the curing compound applied as soon as the free water disappears. Curing compound shall be applied in two coats by hand-operated pressure sprayers at a coverage of approximately 200 square feet per gallon. for both coats. The second coat shall be applied in a direction approximately at right angles to the direction of application of the first coat. The compound shall form a uniform, continuous, coherent film that will not check, crack, or peel and shall be free from pinholes or other imperfections. If pinholes, abrasion, or other discontinuities exist, an additional coat shall be applied to the affected areas within 30 minutes. Concrete surfaces that are subjected to heavy rainfall within 3 hours after the curing compound has been applied shall be resprayed by the method and at the coverage specified above. Areas where the curing compound is damaged by subsequent construction operations within the curing period shall be resprayed. Necessary precautions shall betaken to insure that the concrete is properly cured at sawed joints, and that no curing compound enters the joints. The top of the joint opening and the joint groove at exposed edges shall be tightly sealed before the concrete in the region of the joint is resprayed with curing compound. The method used for sealing the joint groove shall prevent loss of moisture from the joint during the entire specified curing period. Approved standby facilities for curing concrete pavement shall be provided at a location accessible to the job site for use in the event of mechanical failure of the spraying equipment or other conditions that might prevent correct application of the membrane-curing compound at the

proper time. Concrete surfaces to which membrane-curing compounds have been applied shall be adequately protected during the entire curing period from pedestrian and vehicular traffic, except as required for joint-sawing operations and surface tests, and from any other possible damage to the continuity of the membrane.

### 3.7.2 Backfilling

After curing, debris shall be removed and the area adjoining the concrete shall be backfilled, graded, and compacted to conform to the surrounding area in accordance with lines and grades indicated.

### 3.7.3 Protection

Completed concrete shall be protected from damage until accepted. The Contractor shall repair damaged concrete and clean concrete discolored during construction. Concrete that is damaged shall be removed and reconstructed for the entire length between regularly scheduled joints. Refinishing the damaged portion will not be acceptable. Removed damaged portions shall be disposed of as directed.

### 3.7.4 Protective Coating

Protection against urea, sodium chloride, and calcium chloride used for deicing purposes is not required for concrete that will be in place for a cumulative time of 6 weeks at a continuous minimum temperature of 40 degrees F, excluding the curing time. Otherwise, concrete which will be exposed to deicing chemicals shall be given protective coating after the curing period. Concrete which is to receive protective coating in accordance with ACI Committee Report 515 and manufacturer’s instructions shall be moist cured to eliminate the need for removing a curing membrane prior to application of the protective coating. provides a detailed discussion of protective coating for concrete. Coated surfaces shall be protected from vehicular and pedestrian traffic until dry.

#### 3.7.4.1 Precautions

Protective coating shall not be heated by direct application of flame or electrical heaters and shall be protected from exposure to open flame, sparks, and fire adjacent to open containers or applicators. Material shall not be applied at temperatures lower than 50 degrees F.

## 3.8 FIELD QUALITY CONTROL

### 3.8.1 General Requirements

The Contractor shall perform the inspection and tests described and meet the specified requirements for inspection details and

frequency of testing. Based upon the results of these inspections and tests, the Contractor shall take the action and submit reports as required below, and any additional tests to ensure that the requirements of these specifications are met.

### 3.8.2 Concrete Testing

#### 3.8.2.1 Strength Testing

The Contractor shall provide molded concrete specimens for strength tests. Samples of concrete placed each day shall be taken not less than once a day nor less than once for every 250 cubic yards of concrete. The samples for strength tests shall be taken in accordance with ASTM C 172. Cylinders for acceptance shall be molded in conformance with ASTM C 31 by an approved testing laboratory. Each strength test result shall be the average of two test cylinders from the same concrete sample tested at 28 days, unless otherwise specified or approved. Concrete specified on the basis of compressive strength will be considered satisfactory if the averages of all sets of three consecutive strength test results equal or exceed the specified strength, and no individual strength test result falls below the specified strength by more than 500 psi.

#### 3.8.2.2 Air Content

Air content shall be determined in accordance with ASTM C 173 or ASTM C 231. ASTM C 231 shall be used with concretes and mortars made with relatively dense natural aggregates. Two tests for air content shall be made on randomly selected batches of each class of concrete placed during each shift. Additional tests shall be made when excessive variation in concrete workability is reported by the placing foreman or the Government inspector. If results are out of tolerance or when excessive crumbling or slumping is noticed along the edges of slip-formed concrete, the placing foreman shall be notified and he shall take appropriate action.

-- END OF SECTION 02511 --

DIVISION 2

SITEWORK

SECTION 02513

# ASPHALTIC CONCRETE PAVING - GENERAL

## PART 1 GENERAL

### 1.1 RELATED DOCUMENTS

All applicable provisions of the Subcontractor Agreement shall govern the work under this section.

### 1.2 WORK INCLUDED

1.2.1. This section of the specifications covers the control and general conduct of asphalt paving.

1.2.2. All work shall be constructed using materials and methods in accordance with the drawings, New York State Department of Transportation (N.Y.S.D.O.T.)and referenced technical standards.

1.2.3. Provide all labor, materials, necessary equipment and services to complete the Asphaltic Concrete Paving work, as indicated on the drawings, as specified herein or both, except as for items specifically indicated as "NIC ITEMS".

1.2.4. Including, but not necessarily limited to the following:

1.2.4.1 Preparation of subgrade.

1.2.4.2 Installation and compaction of base course.

1.2.4.3 Spreading of asphalt surface course.

### 1.3 RELATED WORK

1.3.1. Section 02050 - Demolition

1.3.2. Section 02511 – Concrete for Sidewalks, Curbs and Gutters

### 1.4 TRAFFIC CONTROL

The CONTRACTOR shall provide and maintain access to and from all properties along the line of his work. The CONTRACTOR shall also provide temporary bypasses and maintain them in a safe and usable condition whenever detouring of traffic to parallel routes cannot be done without hardship or excessive increases in travel by the public.

## 1.5 SPECIAL SUBGRADE CONDITIONS

When special subgrade conditions are encountered for which these "Asphaltic Concrete Paving Specifications" are not applicable, portions of these specifications shall be deleted or revised to provide a properly finished paved surface. A requested revision or deletion of the specifications shall be accompanied with reports and laboratory tests on existing field conditions. Any change from these "Asphaltic Concrete Paving Specifications" shall be approved by the CONTRACTING OFFICER and shall be in effect only for a specified area or paving project.

## 1.6 QUALITY ASSURANCE

### 1.6.1 Standard Specifications

1.6.1.1 Work and materials shall conform to all applicable requirements of New York State Department of Transportation (N.Y.D.O.T.)

### 1.6.2 American Society for Testing and Materials.

1.6.2.1 ASTM 3515-80 “Standard Specification for Hot-Mixed, Job Laid, Bituminous Paving mixtures.”

## 1.7 SUBMITTALS

1.7.1. Provide copies of materials, notarized certificates of compliance signed by material producer and CONTRACTOR, certifying that each material item complies with, or exceeds, specified requirements.

## 1.8 JOB CONDITIONS

1.8.1. Apply prime and tack coats when ambient temperature is above 50 degrees, and when temperature has not been below 35 degrees for 12 hours immediately prior to application. Do not apply when base is wet or contains an excess of moisture.

1.8.2. Construct asphalt concrete surface course only when atmospheric temperature is above 40 degrees, and when base is dry. Base course may be placed when air temperature is above 30 degrees, and rising.

## 1.9 LOCATIONS, LAYOUT AND GRADES

1.9.1. Locate and layout paved areas with reference to benchmarks, property lines or buildings according to the drawings and as accepted by the CONTRACTING OFFICER.

1.9.2. Determine locations of paved edges line from surveyor's permanent reference monuments and information on the drawings.

1.9.3. Where permanent reference monuments are not available, obtain proper line locations from authorities having jurisdiction.

1.9.4. Establish and maintain required lines and elevations.

## PART 2 PRODUCTS

### 2.1 FILL AND BASE COURSE

All fill shall be clean rock and sand (maximum rock size = 1 inch) and comply with N.Y.D.O.T specifications.

### 2.2 PRIME COAT

2.2.1 Prime coat shall be Grade RC-70, cut-back asphalt.

2.2.2. Prime coat shall have full compatibility with surface treatment asphalt.

2.2.3. The bituminous material shall conform to the requirements of the New York State Department of Transportation (N.Y.D.O.T.)

2.2.4. The sand for cover shall be clean dry sand.

### 2.3 TACK COAT

The bituminous material to be used for the tack coat shall conform to the requirements of New York State Department of Transportation (N.Y.D.O.T.)

### 2.4 ASPHALT

2.4.1. The asphaltic concrete surface course shall be in accordance with New York State Department of Transportation (N.Y.D.O.T)requirements.

## PART 3 EXECUTION

### 3.1 BARRICADES

3.1.1. Provide substantial temporary barricades around all areas of operation and maintain until work under this section is completed and approved.

3.1.2. Install temporary traffic markers, signals, and signs as per New York State Department of Transportation (N.Y.D.O.T.).

3.1.2.1. Eliminate potentially hazardous conditions.

3.1.2.2. Maintain adequate traffic patterns free of conflict with work under this Contract.

## 3.2 PREPARATION OF SUBGRADE

3.2.1. All work shall be in accordance with New York State Department of Transportation (N.Y.D.O.T.)standards and regulations.

## 3.3 CONSTRUCTION OF BASE COURSE

3.3.1. All work shall be in accordance with New York State Department of Transportation (N.Y.D.O.T.)standards and regulations.

## 3.4. BITUMINOUS TACK COAT

3.4.1. All work shall be in accordance with New York State Department of Transportation (N.Y.D.O.T.)standards and regulations.

## 3.5 ASPHALTIC CONCRETE WEARING SURFACE COURSE

3.5.1 All work shall be in accordance with New York State Department of Transportation (N.Y.D.O.T.)standards and regulations.

## 3.6 ABUTTING EXISTING PAVING

Meet elevation of existing paving and structures, facilities and utilities where applicable by feathering the thickness of the new surface course for not more than one (1) foot in the periphery of the structure, facility or utility. Do not cover access covers, manhole tops, water meters or other similar devices.

## 3.7 PAVEMENT EDGES

Make edges of paved area conform to details and sections as shown on drawings.

## 3.8 FIELD QUALITY CONTROL

3.8.1. Test in place asphalt concrete course for compliance with requirements for thickness and surface smoothness. Repair or remove and replace unacceptable paving as directed by GOVERNMENT Representative and CONTRACTING OFFICER.

3.8.1.1. In-place compacted thickness will not be acceptable if exceeding following allowable variation from required thickness:

3.8.1.1.1. <u>Base Course:</u> Not greater than 1/2" of specified thickness.

3.8.1.1.2. <u>Surface Course:</u> Not greater than 1/4" of specified thickness.

3.8.1.2. Test finished surface of each asphalt concrete course for smoothness, using 10' straight edge applied parallel with, and at right angles to centerline of paved area. Surfaces will

not be acceptable if exceeding the following tolerances for smoothness.

3.8.1.2.1. Base Course Surface: 1/4".

3.8.1.2.2. Wearing Course Surface: 1/8".

3.8.2. Check surface area at intervals as directed by the CONTRACTING OFFICER.

3.8.3 Finish grade shall be within ±0.05 feet of the grades indicated on the plans.

## 3.9 CLEAN UP

3.9.1. Remove all debris and excess material immediately from project site.

3.9.2. Take down all barricades and temporary traffic markers, signals and signs only after all work included in this section is finished and inspected, and only after so directed by the CONTRACTING OFFICER.

3.9.3. Leave project area clean, orderly and free of any hazardous conditions.

-- END OF SECTION 02513 --

DIVISION 2

SITE

SECTION 02660

WATER DISTRIBUTION SYSTEM

## PART 1 GENERAL

### 1.1 REFERENCES

The publications listed below are referenced and the most current publication applies. The publications are referenced to in the text by basic designation only.

#### 1.1.1 AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|---|---|
| ASTM A 36 | Carbon Structural Steel |
| ASTM D 2241 | Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series) |
| ASTM F 477 | Elastomeric Seals (Gaskets) for Joining Plastic Pipe |

#### 1.1.2 AMERICAN WATER WORKS ASSOCIATION (AWWA)

| | |
|---|---|
| AWWA C104 | Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water |
| AWWA C110 | Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In., for Water and Other Liquids |
| AWWA C111 | Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings |
| AWWA C153 | Ductile-Iron Compact Fittings, 3 In. Through 16 In., for Water and Other Liquids |
| AWWA C200 | Fabricated Electrically Welded Steel Pipe |
| AWWA C502 | Dry-Barrel Fire Hydrants |
| AWWA C651 | Disinfecting Water Mains |
| AWWA C900 | Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In., for Water Distribution |
| AWWA M23 | Manual: PVC Pipe - Design and Installation |

1.1.3 ASBESTOS CEMENT PIPE PRODUCERS ASSOCIATION (ACPPA)

ACPPA-01 Recommended Work Practices for A/C Pipe

1.1.4 MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-80 Bronze Gate, Globe, Angle and Check Valves

1.1.5 NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 24 Installation of Private Fire Service Mains and Their Appurtenances

NFPA 49 Hazardous Chemicals Data

NFPA 325M Fire Hazard Properties of Flammable Liquids, Gases, and Volatile Solids

NFPA 704 Identification of the Fire Hazards of Materials

1.1.6 NSF INTERNATIONAL (NSF)

NSF Std 14 Plastics Piping System Components and Related Materials

## 1.2 PIPING

This section covers water supply and connections to existing water lines. The Contractor shall have a copy of the manufacturer's recommendations for each material or procedure to be utilized available at the construction site at all times.

### 1.2.1 Service Lines

Piping for water service lines shall be ASTM 2241 SDR 26 polyvinyl chloride (PVC).

### 1.2.2 Supply Lines 3 Inches or Larger

Piping for water supply lines 3 inches or larger shall be ASTM 2241 SDR 26 polyvinyl chloride (PVC) plastic.

### 1.2.3 PVC Pipe Components

All PVC plastic piping system components intended for transportation of potable water shall comply with NSF Std 14 and shall be legibly marked with their symbol.

1.2.4 Excavation, Trenching, and Backfilling

Excavation, trenching, and backfilling shall be in accordance with the applicable provisions of Section 02222 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS, except as modified herein.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

1.3.1 Manufacturers Catalog Cuts/Data "FIO"

Manufacturers catalog cuts on all piping, specials, and appurtenances specified in this section shall be provided.

1.3.2 Certificates/Certifications "FIO"

Manufacturer's Representative

The name and qualifications of the manufacturer's representative and written certification from the manufacturer that the representative is technically qualified in all phases of PVC pipe laying and jointing and experienced to supervise the work and train the Contractor's field installers, prior to commencing installation.

Installation

a. Statement signed by the manufacturer's field representative certifying that the Contractor's personnel are capable of properly installing the pipe on the project.

1.3.3 Performance Test Reports "GA"

Test results from commercial laboratory verifying bacteriological disinfection of all water lines following acceptance of installation by the Government designated representative.

1.3.4 Instructions "GA"

The manufacturer's installation recommendations for each material or procedure to be utilized.

1.3.5 Statements "GA"

Waste Water Disposal Method

The method proposed for disposal of waste water from hydrostatic tests and disinfection, prior to performing hydrostatic tests.

Satisfactory Installation

A statement signed by the principal officer of the contracting firm stating that the installation is satisfactory and in accordance with the contract drawings and specifications and the manufacturer's prescribed procedures and techniques, upon completion of the project and before final acceptance.

## 1.4 HANDLING

Pipe and accessories shall be handled so as to ensure delivery to the trench in sound, undamaged condition. Pipe shall be carried into position and not dragged. Use of pinch bars and tongs for aligning or turning pipe will be permitted only on the bare ends of the pipe. The interior of pipe and accessories shall be thoroughly cleaned of foreign matter before being lowered into the trench and shall be kept clean during laying operations by plugging or other approved method. Before installation, the pipe shall be inspected for defects. Material found to be defective before or after laying shall be replaced with sound material without additional expense to the Government. Rubber gaskets that are not to be installed immediately shall be stored in a cool and dark place.

### 1.4.1 PVC Pipe and Fittings

Polyvinyl Chloride (PVC) pipe and fittings shall be handled and stored in accordance with the manufacturer's recommendations. Storage facilities shall be classified and marked in accordance with NFPA 704, with classification as indicated in NFPA 49 and NFPA 325M.

# PART 2 PRODUCTS

## 2.1 PIPE

Pipe shall conform to the respective specifications and other requirements specified below.

### 2.1.1 PVC Pipe

Pipe, couplings and fittings shall conform to conforming to ASTM D 2241, SDR 26 pipe dimensions, and AWWA C900, Class 150, elastomeric-gasket joint, unless otherwise shown or specified. The polyvinyl chloride (PVC) pipe shall be DR-14 per AWWA C 900.

## 2.2 FITTINGS AND SPECIALS

### 2.2.1 Ductile and Gray Iron Fittings

a. Fittings and specials shall be iron, bell end in accordance with AWWA C110, 150 psi pressure rating unless otherwise shown or specified, except that profile of bell may have special dimensions as required by the pipe manufacturer; or may be fittings and specials of the same material as the pipe with elastomeric gaskets, all in conformance with AWWA C900. Iron fittings and specials shall be cement-mortar lined (standard thickness) in accordance with AWWA C104.

Rubber gaskets for iron fittings shall conform to AWWA C111. Fittings shall be bell and spigot or plain end pipe, or as applicable. Ductile iron compact fittings shall be in accordance with AWWA C153.

## 2.3 JOINTS

### 2.3.1 Plastic Pipe

#### 2.3.1.1 Polyvinyl Chloride Pipe

Joints, fittings, and couplings shall be as specified for PVC pressure-rated pipe. Joints connecting pipe of differing materials shall be made in accordance with the manufacturer's recommendations as approved by the Contracting Officer. Pipe bells shall consist of an integral wall section with a factory installed, solid cross section elastomeric ring which meets the requirements of ASTM F 477. The bell section shall be designed to be at least as hydrostatically strong as the pipe wall and meet the requirements of AWWA C900.

## 2.4 VALVES

### 2.4.1 Gate Valves

Gate valves shall be designed for a working pressure of not less than 150 psi. Valve connections shall be as required for the piping in which they are installed. Valves shall have a clear waterway equal to the full nominal diameter of the valve, and shall be opened by turning counterclockwise. The operating nut or wheel shall have an arrow, cast in the metal, indicating the direction of opening.

2.4.1.1 Valves smaller than 3 inches shall be all bronze and shall conform to MSS SP-80, Type 1, Class 150.

2.4.1.2 Resilient-Seated Gate Valves: Gate valves shall be resilient-seated gate valves and shall conform to AWWA C509. Valves shall be supplied with mechanical joint fittings. An approved valve box shall be provided for all buried valves as shown in the contract drawings.

## 2.5 VALVE BOXES

Valve boxes shall be cast iron or concrete, except that concrete boxes may be installed only in locations not subjected to vehicular traffic. Cast-iron boxes shall be extension type with slide-type adjustment and with flared base. The minimum thickness of metal shall be 3/16 inch. Concrete boxes shall be the standard product of a manufacturer of precast concrete equipment. The word "WATER" shall be cast in the cover. The box length shall adapt, without full extension, to the depth of cover required over the pipe at the valve location.

## PART 3 EXECUTION

### 3.1 INSTALLATION

#### 3.1.1 Cutting of Pipe

Cutting of pipe shall be done in a neat and workmanlike manner without damage to the pipe. Unless otherwise recommended by the manufacturer and authorized by the Contracting Officer, cutting shall be done with an approved type mechanical cutter. Wheel cutter shall be used when practicable. Squeeze type mechanical cutters shall not be used.

#### 3.1.2 CONNECTIONS TO EXISTING MAINS

Where connections are required between new work and existing water mains, the connections shall be made in a thorough and workmanlike manner, using proper specials and fittings to suit the actual conditions. In case a connection is made to an existing fitting in the line, the Contractor shall schedule his work so that digging an locating the existing fittings can be completed prior to starting trench work on the line. Cut-ins into lines shall be done at a time approved by the Construction Contracting Inspector (CCI). The Contractor shall verify the dimensions of all pipe before special fittings

##### 3.1.2.1 Tapping Sleeves and Valves

For all “wet” (live) taps into existing asbestos cement pipe iron pipe, and PVC pipe, tapping sleeves and valves shall be used. The tapping sleeves shall be with mechanical joints, cast iron bolts and flanged outlet for connection to the tapping valve. The Contractor shall verify type of existing main before ordering sleeve. The tapping valve shall have an inlet flange to match the sleeve and a mechanical joint outlet for matching connection to water main pipe. Tapping valve shall be rated for 200 psi working pressure, open counter-clockwise with non-rising stem and have O-ring seals.

##### 3.1.2.2 Valve Markers

All valve locations shall be marked with a 4” x 4” x 6’ concrete post, stamped “V.” Markers shall be located just inside R/W line behind the valve, or as directed by the CCI.

##### 3.1.2.3 Joints For Dissimilar Pipe

Joints between dissimilar buried pipe shall be made with flexible mechanical compression joint coupling with No. 305 stainless steel bands, or a concrete closure collar as directed by the CCI. Install couplings in strict accordance with the manufacturer’s recommendations. Use concrete collars only when approved by the CCI, and then only to make connections between

dissimilar pipe when standard rubber gasketed joints or flexible couplings are impractical. Before the closure collars are poured, wash the pipe to remove all loose material and soil from the surface on which the concrete will be placed. Wet nonmetallic pipe thoroughly prior to pouring the collars. Wrap and securely fasten a light gauge of sheet metal or building felt around the pipe to insure that no concrete shall enter the line. Place reinforcement as required. Make entire collar in one pour using 3000 psi concrete and extend a minimum of 12” on each side of the joint. The minimum thickness around the outside diameter of the pipe shall be 6”. No collar shall be poured in water. After the collars are poured and have taken their initial set, cure by covering with well moistened earth.

### 3.1.3 Adjacent Facilities

#### 3.1.3.1 Sewer Lines

Where the location of the water pipe is not clearly defined in dimensions on the drawings, the water pipe shall not be laid closer horizontally than 10 feet from a sewer except where the bottom of the water pipe will be at least 12 inches above the top of the sewer pipe, in which case the water pipe shall not be laid closer horizontally than 6 feet from the sewer. Where water lines cross under gravity-flow sewer lines, the sewer pipe for a distance of at least 10 feet each side of the crossing shall be fully encased in concrete or shall be made of pressure pipe with no joint located within 3 feet horizontally of the crossing. Water lines shall in all cases cross above sewage force mains or inverted siphons and shall be not less than 2 feet above the sewer main. Joints in the sewer main, closer horizontally than 3 feet to the crossing, shall be encased in concrete.

#### 3.1.3.2 Water Lines

Water lines shall not be laid in the same trench with sewer lines, gas lines, fuel lines, or electric wiring.

#### 3.1.3.3 Casing Pipe

Water pipe shall be encased in a sleeve of rigid conduit for the lengths shown. The pipe sleeve shall be steel, manufactured in accordance with AWWA C200, ASTM A 36, diameter 20 inches, with a minimum wall thickness of 3/8”. A minimum clearance of at least 2 inches between the inner wall of the sleeve and the maximum outside diameter of the sleeved pipe and joints shall be provided. Suitable pipe support shall be provided as shown for the water pipe through the casing pipe.

#### 3.1.3.4 Structures

Where water pipe is required to be installed within 3 feet of existing structures, the water pipe shall be sleeved as required in Paragraph "Casing Pipe". The Contractor shall take proper precautions during installation of the water pipe and sleeve to

ensure that there will be no damage to the structures and no settlement or movement of foundations or footings.

### 3.1.4 Joint Deflection

#### 3.1.4.1 PVC Pipe

Maximum offset in alignment between adjacent pipe joints shall be as recommended by the manufacturer and approved by the Contracting Officer, but in no case shall it exceed 3 degrees.

### 3.1.5 Placing and Laying

Pipe and accessories shall be carefully lowered into the trench by means of derrick, ropes, belt slings, or other authorized equipment. Under no circumstances shall any of the water-line materials be dropped or dumped into the trench. Except where necessary in making connections with other lines or as authorized by the Contracting Officer, pipe shall be laid with the bells facing in the direction of laying. The full length of each section of pipe shall rest solidly upon the pipe bed, with recesses excavated to accommodate bells, couplings, and joints. Pipe that has the grade or joint disturbed after laying shall be taken up and relaid. Pipe shall not be laid in water or when trench conditions are unsuitable for the work. Water shall be kept out of the trench until joints are complete. When work is not in progress, open ends of pipe, fittings, and valves shall be securely closed so that no trench water, earth, or other substance will enter the pipes or fittings. Pipe ends left for future connections shall be valved, plugged, or capped, and anchored as approved by the Government designated representative.

#### 3.1.5.1 Plastic Pipe Installation

PVC pipe shall be installed in accordance with AWWA M23 and the manufacturer’s instructions.

#### 3.1.5.2 Connections

Where connections are made between new work and existing mains, the connections shall be made by using specials and fittings to suit the actual conditions. When made under pressure, these connections shall be installed using standard methods as approved by the Contracting Officer. Connections to existing asbestos-cement pipe shall be made in accordance with ACPPA-01.

### 3.1.6 Jointing

#### 3.1.6.1 Polyvinyl Chloride (PVC) Plastic Pipe

a. Joints shall be elastomeric-gasket as specified in AWWA C900.

3.1.6.2 Connections

Connections between different types of pipe and accessories shall be made with transition fittings approved by the Contracting Officer.

3.1.7 Service Lines

Service lines shall include the pipeline connecting building piping to water distribution lines to the connections with the building service at a point outside the building where such building service exists. Where building services are not installed, the Contractor shall terminate the service lines at a point designated by the Contracting Officer. Such service lines shall be closed with plugs or caps. All service stops and valves shall be provided with service boxes.

3.1.8 Setting of, Meters, Valves and Valve Boxes

3.1.8.1 Valves

After delivery, valves, shall be drained to prevent freezing and shall have the interiors cleaned of all foreign matter before installation. Stuffing boxes shall be tightened and valves shall be fully opened and fully closed to ensure that all parts are in working condition. Valves and valve boxes shall be installed where shown or specified, and shall be set plumb. Valve boxes shall be centered on the valves. Boxes shall be installed over each outside gate valve unless otherwise shown. Where feasible, valves shall be located outside the area of roads and streets. Valves shall be set upon a slab of concrete not less than 4 inches thick and 15 inches square resting upon undisturbed earth.

3.1.8.2 Service Boxes

Where water lines are located below paved streets having curbs, the boxes shall be installed directly back of the curbs. Where no curbing exists, service boxes shall be installed in accessible locations, beyond the limits of street surfacing, walks and driveways.

3.1.9 Thrust Restraint

Plugs, caps, tees and bends deflecting 11-1/4 degrees or more, either vertically or horizontally, on waterlines 4 inches in diameter or larger, and fire hydrants shall be provided with thrust restraints as shown on drawings. Valves shall be securely anchored or shall be provided with thrust restraints to prevent movement. Thrust restraints shall be thrust blocks.

3.1.9.1 Thrust Blocks

Thrust blocking shall be concrete of a mix not leaner than: 1 cement, 2-1/2 sand, 5 gravel; and having a compressive strength of not less than 2,000 psi after 28 days. Blocking shall be placed

between solid ground and the hydrant or fitting to be anchored. Unless otherwise indicated or directed, the base and thrust bearing sides of thrust blocks shall be poured directly against undisturbed earth. The sides of thrust blocks not subject to thrust may be poured against forms. The area of bearing shall be as shown or as directed. Blocking shall be placed so that the fitting joints will be accessible for repair. Steel rods and clamps, protected by galvanizing or by coating with bituminous paint, shall be used to anchor vertical down bends into gravity thrust blocks.

## 3.2 HYDROSTATIC TESTS

Where any section of a water line is provided with concrete thrust blocking for fitting or hydrants, the hydrostatic tests shall not be made until at least 5 days after installation of the concrete thrust blocking, unless otherwise approved.

### 3.2.1 Pressure Test

After the pipe is laid, the joints completed, fire hydrants permanently installed, and the trench partially backfilled leaving the joints exposed for examination, the newly laid piping or any valved section of piping shall, unless otherwise specified, be subjected for 1 hour to a hydrostatic pressure test of 200 psi. Each valve shall be opened and closed several times during the test. Exposed pipe, joints, fittings, hydrants, and valves shall be carefully examined during the partially open trench test. Joints showing visible leakage shall be replaced or remade as necessary. Cracked or defective pipe, joints, fittings, hydrants and valves, discovered in consequence of this pressure test shall be removed and replaced with sound material, and the test shall be repeated until the test results are satisfactory. The requirement for the joints to remain exposed for the hydrostatic tests may be waived by the Contracting Officer when one or more of the following conditions is encountered:

3.2.1.1 Wet or unstable soil conditions in the trench.

3.2.1.2 Compliance would require maintaining barricades and walkways around and across an open trench in a heavily used area that would require continuous surveillance to assure safe conditions.

3.2.1.3 Maintaining the trench in an open condition would delay completion of the contract.

The Contractor may request a waiver, setting forth in writing the reasons for the request and stating the alternative procedure proposed to comply with the required hydrostatic tests. Backfill placed prior to the tests shall be placed in accordance with the requirements of Section 02222 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS.

3.2.2 Leakage Test

Leakage test shall be conducted after the pressure tests have been satisfactorily completed. The duration of each leakage test shall be at least 2 hours, and during the test the water line shall be subjected to not less than 200 psi pressure. Water supply lines designated on the drawings shall be subjected to a pressure equal to 200 psi. Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved or approved section thereof, necessary to maintain pressure within 5 psi of the specified leakage test pressure after the pipe has been filled with water and the air expelled. No piping installation will be accepted if leakage exceeds the allowable leakage which is determined by the following formula:

L = 0.0001351ND*(square root of P)

L = Allowable leakage in gallons per hour

N = Number of joints in the length of pipeline tested

D = Nominal diameter of the pipe in inches

P = Average test pressure during the leakage test, in psi gauge

Should any test of pipe disclose leakage greater than that calculated by the above formula, the defective joints shall be located and repaired until the leakage is within the specified allowance, without additional cost to the Government.

3.2.3 Time for Making Test

Except for joint material setting or where concrete thrust blocks necessitate a 5-day delay, pipelines jointed with rubber gaskets, mechanical or push-on joints, or couplings may be subjected to hydrostatic pressure, inspected, and tested for leakage at any time after partial completion of backfill.

3.2.4 Concurrent Hydrostatic Tests

The Contractor may elect to conduct the hydrostatic tests using either or both of the following procedures. Regardless of the sequence of tests employed, the results of pressure tests, leakage tests, and disinfection shall be satisfactory as specified. All replacement, repair or retesting required shall be accomplished by the Contractor at no additional cost to the Government.

3.2.4.1 Pressure test and leakage test may be conducted concurrently.

3.2.4.2 Hydrostatic tests and disinfection may be conducted concurrently, using the water treated for disinfection to accomplish the hydrostatic tests. If water is lost when treated for disinfection and air is admitted to the unit being tested, or if any repair procedure results in contamination of the unit, disinfection shall be reaccomplished.

## 3.3 DISINFECTION

### 3.3.1 Bacteriological Disinfection

Before acceptance of potable water operation, each unit of completed waterline shall be disinfected as prescribed by AWWA C651. Polyvinyl Chloride (PVC) pipe lines shall be chlorinated using only the above specified chlorinating material in solution. In no case will the agent be introduced into the line in a dry solid state. The treated water shall be retained in the pipe long enough to destroy all non-spore-forming bacteria. Except where a shorter period is approved, the retention time shall be at least 24 hours and shall produce not less than 25 ppm of free chlorine residual throughout the line at the end of the retention period. All valves on the lines being disinfected shall be opened and closed several times during the contact period. The line shall then be flushed with clean water until the residual chlorine is reduced to less than 1.0 ppm. During the flushing period, each fire hydrant on the line shall be opened and closed several times. Personnel from the Contractor's commercial laboratory shall take at least 3 water samples from different points, approved by the Contracting Officer, in proper sterilized containers and perform a bacterial examination in accordance with state approved methods. The commercial laboratory must be certified by the state's approving authority for examination of potable water. The disinfection shall be repeated until tests indicate the absence of pollution for at least 2 full days. The unit will not be accepted until satisfactory bacteriological results have been obtained.

## 3.4 CLEANUP

Upon completion of the installation of water lines, and appurtenances, all debris and surplus materials resulting from the work shall be removed by the contractor.

-- END OF SECTION 02660 --

DIVISION 2

SITEWORK

SECTION 02980

TOPSOIL AND SEEDING

## PART 1 GENERAL

### 1.1 WORK INCLUDED

A. The furnishing of topsoil, fertilizer, seed, and mulch: the preparation of the subgrade and the placing of the topsoil, fertilizer, seed and mulch.

B. The maintenance required until acceptance.

### 1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 02222-Trenching, Backfilling and Compacting

### 1.3 SUBMITTALS

A. The Contractor shall submit the location of source and data for off- site topsoil.

B. Analysis of the seed.

C. Should hydroseeder be used,the Contractor shall submit all data including material and application rates.

## PART 2 PRODUCTS

### 2.1 MATERIALS

A. Topsoil shall be unfrozen friable clayey loam free from clay lumps, stones, roots, sticks, stumps, brush or foreign objects.

B. Fertilizer shall be a standard quality commercial carrier of available plant food elements. A complete prepared and packaged material containing a minimum of 10 percent nitrogen, 10 percent phosphoric acid and 10 percent potash.

1. Each bag of fertilizer shall bear the manufacturer’s guaranteed statement of analysis.

C. Seed mixtures shall be of commercial stock of the current season’s crop and shall be delivered in unopened containers bearing the guaranteed analysis of the mix.

1. All seed shall meet the New York State standards of germination and purity.

D. Seed Mixtures:

| Specia | Lawn Areas* | Unmaintainded Areas* |
|---|---|---|
| 3% Kentucky Bluegrass | 50 | 40 |
| Creeping Red Fescue | 30 | 30 |
| Manhattan or Pennfine Ryegrass | 20 | 30 |

* % by weight

E. Mulch shall be stalks of oats, wheat, rye or other approved crops which are free from noxious weeds.

## PART 3 EXECUTION

### 3.1 INSTALLATION

A. The topsoil, fertilizer, and seeding will be accomplished one week after excavation. This one week period is during planting season, if work is outside of the planting season, this one week shall begin from the start of the planting season.

B. The area to receive topsoil shall be graded to a depth of not less than 4 inches or as specified, below the proposed finished surface. If the depth of topsoil existing prior to construction was greater than 4 inches, the topsoil shall be replaced not less than the greater depth.

1. All debris and inorganic material shall be removed and the surface loosened for a depth of 2 inches prior to the placing of the topsoil.

2. The topsoil shall not be placed until the subgrade is in suitable condition and shall be free of excessive moisture and frost.

C. Satisfactory topsoil removed from the excavations shall be placed on repared subgrade to the depth required.

1. In event the topsoil removed during excavation is unsatisfactory or inadequate to obtain the required finished grades, the Contractor shall furnish the required quantity of satisfactory topsoil from approved sources off site.

2. All topsoil shall be free from stones, roots, sticks, stumps, brush or foreign objects.

3. The finished surfaced shall conform to the lines and grades of the area before disturbed or as shown on the Contractor Drawings. Any irregularities shall be corrected before the placement of fertilizer and seed.

D. The fertilizer shall be applied uniformly at a rate as recommended by the manufacturer.

1. Following the application of the fertilizer and prior to application of the seed, the topsoil shall be scarified to a

least 2 inches with a disc or other suitable method traveling across the slope if possible.

E. When the topsoil surface has been fine graded, the seed mixture shall be uniformly applied upon the prepared surface with a mechanical spreader at a rate of not less than 5 pounds per 1000 square feet.

1. The seed shall be raked lightly into the surface and rolled with a light hand lawn roller.

2. Seeding and mulching shall not be done during windy weather.

F. The mulch shall be hand or machine spread to form a continuos blanket over the seed bed, approximately 2 inches uniform thickness at loose measurement. Excessive amounts or bunching of mulch will not be permitted.

1. Mulch shall be anchored by an acceptable method.

2. Unless otherwise specified, mulch shall be left in place and allowed to disintegrate.

3. Any anchorage or mulch that has not disintegrate at time of first mowing, shall be removed. Anchors may be or driven flush with ground surface.

G. Seeded areas shall be watered as often as required to obtain germination and to obtain and maintain a satisfactory sod growth. Watering shall be in a such a manner as to prevent washing out of seed.

H. Hydroseeding may be accepted as an alternative method of applying fertilizer, seed and mulch. The Contractor must submit all data regarding materials and application rates to the Contracting Officer for review.

I. Contractor shall investigate and adjust the soil condition as necessary to ensure successful germination and growth of selected plant material.

## 3.2 MAINTENANCE

A. All lawn areas shall be mowed by the Contractor before the new grass reaches a height of 4 inches.

1. Underground Conduit and Ductbank

a. Following the establishment of a good stand of grass and the first mowing, the Contractor’s obligation shall end except for the repair of settlement or damage.

2. Plants and Similar Projects

a. The Contractor shall maintain the newly seeded areas in good condition until acceptance, including regular mowing to a height of 2 inches.

--END OF SECTION 02980--

DIVISION 3

CONCRETE

SECTION 03300

# CONCRETE FOR BUILDING CONSTRUCTION

## PART 1 GENERAL

### 1.1 REFERENCES

The publications below are referenced and the most current publication applies. The publications are referenced to in the text by basic designation only.

| | |
|---|---|
| 1.1.1 | ACI INTERNATIONAL (ACI) |
| ACI 301 | Specifications for Structural Concrete for Buildings |
| ACI 318/318R | Building Code Requirements for Structural Concrete and Commentary |
| 1.1.2 | AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) |
| ASTM A 82 | Standard Specification for Cold-Drawn Steel Wire for Concrete Reinforcement |
| ASTM A 185 | Standard Specification for Steel Welded Wire for Concrete Reinforcement |
| ASTM A 615 | Deformed and Plain Billet Steel Bars for Concrete Reinforcement |
| ASTM C 94 | Ready Mixed Concrete |
| ASTM C 171 | Standard Specification for Sheet Materials for Curing Concrete |
| ASTM C 260 | Standard Specification for Air-Entraining Admixtures for Concrete |
| ASTM C 309 | Liquid Membrane Forming Compounds for Curing Concrete |
| ASTM C 494 | Standard Specification for Air-Entraining Admixtures |
| ASTM C 920 | Elastomeric Joint Sealants |

ASTM D 1751 Preformed Expansion Joint Filler for Concrete Paving and Structural Construction

## 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

A. Certificates of Compliance "FIO"

Cement, pozzolan, and ground iron blast-furnace slag will be accepted on the basis of manufacturer's certification of compliance, attesting that the materials meet the requirements of the specification under which it is furnished. No cement, pozzolan, or slag shall be used until notice of acceptance has been given by the Project Manager.

B. Concrete Reinforcement System "GA"

Detail drawings showing reinforcing steel replacement, schedules, sizes, grades, and splicing and bending details. Drawings shall show support details including types, sizes and spacing.

C. Reinforcing Steel "GA"

Certified copies of mill reports attesting that the reinforcing steel furnished meets the requirements specified, prior to the installation of reinforcing steel.

## 1.3 GENERAL REQUIREMENTS

A. Strength Requirements

Structural concrete for all work shall have a 28-day compressive strength of 26.67 mpa or 4000 pounds per square inch.

B. Air Entrainment

All concrete shall contain from 4 to 7 percent total air.

C. Special Properties

Concrete may contain other admixtures, such as water reducers, superplasticizers, or set retarding agents to provide special properties to the concrete, if approved. Admixtures shall conform with ASTM C-494 included in the referenced ACI-301 publication.

D. Slump

Slump shall be within the following limits:

| Structural Element | *Slump in mm | |
|---|---|---|
| | Minimum | Maximum |
| Walls, columns and beams | 50 | 100 |
| Foundation walls, substructure walls, footings, pavement, and slabs | 25 | 75 |
| Any structural concrete approved for placement by pumping | None | 150 |

## PART 2 PRODUCTS

### 2.1 CONCRETE MATERIALS:

Concrete shall conform to ASTM C 94; type I or II.

### 2.2 EMBEDDED ITEMS

Embedded items shall be of the size and type indicated or as needed for the application. Dovetail slots shall be galvanized steel.

### 2.3 FORM MATERIALS

Forms for concrete surfaces shall be metal, plywood, or hardboard capable of producing the required surface without adverse effect on the concrete. Form coating shall be nonstaining form oil or form release agent that will not adversely affect the concrete surfaces or impair subsequent applications to the concrete. (See article 2.2 above.) Form ties shall be metal, factory-fabricated, removable or snap-off type that will not leave holes less than 6 mm (1/4 inch) nor more than 25 mm (1 inch) deep and not more than 25 mm (1 inch) in diameter.

### 2.4 REINFORCEMENT

Bar reinforcement shall be deformed, Grade 60 billet steel conforming to ASTM A 615. Mesh reinforcement shall be welded steel wire fabric with wires at right angles to each other, meeting ASTM A-185. Tie wire and used wire for reinforcement, shall meet ASTM A 82 designation.

## 2.5 WELDED WIRE FABRIC

Welded wire fabric shall conform to ASTM A 185 OR ASTM A 497.

## 2.6 WATER

Water shall be clean and free of oil, salt, acid, alkali or other substances deleterious to concrete.

## 2.7 Admixtures

A. Retarder, ASTM C 494, Type B

B. Water Reducer if used shall be ASTM C 494 types A,D or E

C. Calcium chloride shall not be used in this project.

## 2.8 Joint Sealants:

A. Horizontal Surfaces ASTM D-1190

B. Vertical Surfaces ASTM C-920, Type M, Grade NS, Class 25, use T.

C. Expansion Joint Filler: ASTM D-1751 or ASTM D 1752.

## 2.9 Curing Materials.

A. Impervious sheet materials shall conform to ASTM C 171, type optional; waterproof paper, polyethylene coated burlap, except that polyethylene film, if used, shall be white opaque.

B. Membrane-forming curing compounds shall be white pigmented compounds, Type 2, free of paraffin or petroleum, conforming to ASTM C-309-89. Do not use where finished appearance is important. Use only where appropriate.

# PART 3 EXECUTION

## 3.1 PREPARATION OF SURFACES

Surfaces to receive concrete shall be clean and free from frost, ice, mud, and water. Conduit and other similar items shall be in place and clean of any deleterious substance. Surfaces shall be moist but without free water when the concrete is placed.

## 3.2 FORMWORK

Formwork shall be leaked-proof, properly aligned, and adequately supported to produce concrete conforming accurately to the indicated shapes, lines, dimensions, and with surfaces free of offsets, waviness, or bulges. Where surfaces are to be exposed or painted, panels shall be of uniform sizes, using smaller panels only where required by openings, joints or for closure. Unless otherwise shown, exposed external corners shall be chamfered, beveled or rounded by moldings placed in the forms. Form surfaces shall be thoroughly cleaned and coated before each use.

Forms shall be removed at a time and in a manner that will not injure the concrete.

## 3.3 INSTALLATION OF REINFORCEMENT

Reinforcement shall be fabricated to shapes and dimensions shown and shall conform to the requirements of ACI 318/318R. Reinforcement shall be cold bent unless otherwise authorized. Bars shall not be bent after embedment in concrete.

Safety caps shall be placed on all exposed ends of vertical concrete reinforcement bars that pose a danger to life safety. Wire tie ends shall face away from the forms.

### A. Placement

Reinforcement shall be free from loose rust and scale, dirt, oil, or other deleterious coating that could reduce bond with the concrete. Reinforcement shall be placed in accordance with ACI 318/318R at locations shown plus or minus one bar diameter. Reinforcement shall be as indicated through construction or contraction joints. Concrete coverage shall be as indicated or as required by ACI 318/318R.

### B. Splicing

Splices of reinforcement shall conform to ACI 318/318R and shall be made only as required or indicated. Splicing shall be by lapping. Lapped bars shall be placed in contact and securely tied or spaced transversely apart to permit the embedment of the entire surface of each bar in concrete. Lapped bars shall not be spaced farther apart than one-fifth the required length of lap or 150 mm. (6 inches.)

## 3.4 INSTALLATION OF EMBEDDED ITEMS

Embedded items shall be free from oil, loose scale or rust, and paint. Embedded items shall be installed at the locations indicated and required to serve the intended purpose. Voids in sleeves, slots and inserts shall be filled with readily removable material to prevent the entry of concrete.

## 3.5 WELDED-WIRE FABRIC

Welded-wire fabric shall be placed in slabs as indicated. Fabric placed in slabs on grade shall be continuous between expansion, construction, and contraction joints. Fabric placement at joints shall be as indicated. Lap splices shall be made in such a way that the overlapped area equals the distance between the outermost crosswires plus 50 mm. (2 inches.) Laps shall be staggered to avoid continuous laps in either direction. Fabric shall be wired or clipped together at laps at intervals not to exceed 1.22 m. (4 feet.) Fabric shall be positioned by the use of supports.

## 3.6 DOWELS

Dowels shall be installed in slabs on grade at locations indicated and at right angles to joint being doweled. Dowels shall be accurately positioned and aligned parallel to the finished concrete surface before concrete placement. Dowels shall be rigidly supported during concrete placement.

## 3.7 BATCHING, MIXING AND TRANSPORTING CONCRETE

The work shall conform to ACI ASTM C-94 included in the referenced ACI-301 publication, except as otherwise specified.

## 3.8 CONCRETE PLACEMENT

Concrete shall be handled from mixer to forms in a continuous manner until the approved unit of operation is completed. Adequate scaffolding, ramps and walkways shall be provided so that personnel and equipment are not supported by in-place reinforcement. Placing will not be permitted when the sun, heat, wind, or limitations of facilities furnished by the Contractor prevent proper consolidation, finishing or curing. Concrete shall be deposited as close as possible to its final position in the forms, and there shall be no vertical drop greater than 2.4 meters (8 feet) except where suitable equipment is provided to prevent segregation and where specifically authorized.

## 3.9 CONSOLIDATION

Consolidation shall conform to ACI 309 - “Recommend Practice for Consolidation of Concrete”, included in above referenced publication, (ACI-301), latest revision, for each specific application. Immediately after placing, each layer of concrete shall be consolidated by internal vibrators. Vibrators shall be inserted vertically at uniform spacing over the area of placement. The distance between insertions shall be approximately 1-1/2 times the radius of action of the vibrator so that the area being vibrated will not overlap the adjacent just-vibrated area. Vibrators shall not be used to transport concrete within the forms.

## 3.10 WEATHER LIMITATIONS

Special protection measures, approved by the Project Director, shall be used if freezing temperatures are anticipated before the expiration of the specified curing period. The temperature of the concrete placed during warm weather shall not exceed 30 degrees C (85 degrees F) except where an approved retarder is used. The mixing water and/or aggregates shall be cooled, if necessary, to maintain a satisfactory placing temperature. In no case shall the placing temperature exceed 35 degrees C. ( 95 degrees F.).

## 3.11 CONSTRUCTION JOINTS

Construction joints shall be located as indicated or approved. Where concrete work is interrupted by weather, end of work shift or other

similar type of delay, location and type of construction joint shall be subject to approval of the Project Manager.

## 3.12 FINISHING CONCRETE

### A. Formed Surfaces

Fins and loose material shall be removed. Unsound concrete, voids over 13 mm (1/2 inch) in diameter, and tie-rod bolt holes shall be cut back to solid concrete, reamed, brush-coated with cement grout, and filled solid with a stiff portland cement and sand mortar mix. Patchwork shall finish flush with adjoining concrete surfaces in texture and color. Patchwork shall be cured for 72 hours.

## 3.13 CURING AND PROTECTION

### A. General

Immediately after placement, concrete shall be protected from premature drying in extremes temperatures, rapid temperature change, mechanical injury and injury from rain and flowing water. Concrete operations shall take place only when it is known that ambient and form temperature will be above 10 degrees for the first 3 days and at a temperature above 0 degrees C (32 degrees F) for the remainder of the specified curing period, by weather condition as permitted and appropriate thermal protection covering.

### B. Moist Curing

Concrete to be moist-cured shall be maintained continuously wet for the entire curing period. If water or curing materials used stains or discolors concrete surfaces, which are to be permanently exposed, the concrete surfaces shall be cleaned. When wooden forms are left in place during curing, they shall be kept wet at all times. If the forms are removed before the end of the curing period, curing shall be carried out as on unformed surfaces, using suitable materials. Horizontal surfaces shall be cured by ponding, by covering with a 50 mm (2 inch) minimum thickness of continuously saturated sand, or by covering with waterproof paper, polyethylene sheet, polyethylene-coated burlap or saturated burlap, as specified in section 2.2 above.

### C. Membrane Curing

Membrane curing shall not be used on surfaces that are to receive any subsequent treatment depending on adhesion or bonding to the concrete. Do not use ASTM C-309-89 Type B curing compound where the concrete surface is going to receive paint, bituminous roofing or adhesives for resilient flooring. The curing compound selected shall be compatible with any subsequent paint, roofing, waterproofing or flooring specified. Membrane curing compound shall not be used on surfaces that are maintained at curing temperatures with free steam. Curing compound shall be applied

to formed surfaces immediately after the forms are removed and prior to any patching or other surface treatment except the cleaning of loose sand, mortar, and debris from the surface. Surfaces shall be thoroughly moistened with water and the curing compound shall be applied to slab surfaces as soon as the bleeding water has disappeared, with the tops of joints being temporarily sealed to prevent entry of the compound and to prevent moisture loss during the curing period. Compound shall be applied in a one-coat continuous operation by mechanical spraying equipment, at a uniform coverage in accordance with the manufacturer's printed instructions. Concrete surfaces, which have been subjected to rainfall within 3 hours after curing compound has been applied, shall be resprayed by the method and at the coverage specified. On surfaces permanently exposed to view, the surface shall be shaded from direct rays of the sun for the duration of the curing period. Horizontal surfaces coated with curing compound shall be kept free of foot and vehicular traffic, and from other sources of abrasion and contamination during the curing period.

**-- END OF SECTION 03300--**

DIVISION 4

MASONRY

SECTION 04200A

CONCRETE MASONRY UNITS

## PART 1 GENERAL

### 1.1 REFERENCES

The publications listed below are referenced and the most current publication applies. The publications are referenced to in the text by basic designation only.

| | |
|---|---|
| 1.1.2 | ACI INTERNATIONAL (ACI) |
| ACI SP-66 | ACI DETAILING MANUAL |
| 1.1.3 | AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) |
| ASTM A 82 | Steel Wire, Plain, for Concrete Reinforcement |
| ASTM A 153 | Zinc Coating (Hot-Dip) on Iron and Steel Hardware |
| ASTM A 615 | Deformed and Plain Billet-Steel Bars for Concrete Reinforcement |
| ASTM C 55 | Concrete Building Brick |
| ASTM C 90 | Load Beaning Concrete Masonry Units |
| ASTM C 91 | Masonry Cement |
| ASTM C 129 | Nonloadbearing Concrete Masonry Units |
| ASTM C 270 | Mortar for Unit Masonry |
| ASTM C 476 | Grout for Masonry |
| ASTM D 494 | Chemical Admixtures for Concrete |
| ASTM C 641 | Staining Materials in Lightweight Concrete Aggregates |

ASTM C 2000 Rubber products in automotive applications

ASTM D 2240 Rubber property – Durometer Hardness

## 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

### 1.2.1 Data "FIO"

Concrete Masonry Units

Manufacturer's descriptive data.

### 1.2.2 Drawings "GA"

Masonry Work.

Drawings including wall openings greater than one masonry unit in area. No approval will be given to the shop drawings until the Contractor certifies that all openings, including those for mechanical and electrical service, are shown. If, during construction, additional masonry openings are required, the approved shop drawings shall be resubmitted with the additional openings shown along with the proposed changes. Location of these additional openings shall be clearly highlighted. Reinforcement bending shall conform to the requirements of ACI SP-66.

### 1.2.3 Reports Masonry Cement. Fire-rated CMU. "FIO"

Test reports from an approved independent laboratory. Test reports on a previously tested material shall be certified as the same as that proposed for use in this project.

### 1.2.4 Certificates "FIO"

Concrete Brick. Concrete Masonry Units CMU. Control Joint Keys. Anchors, Ties, and Bar Positioners;. Expansion-Joint Materials. Joint Reinforcement. Reinforcing Steel Bars and Rods;. Masonry Cement; FIO. Mortar Coloring; . Precast Concrete Items;. Mortar Admixtures;. Grout Admixtures;.

Certificates of compliance stating that the materials meet the specified requirements.

### 1.2.5 Samples "GA"

Anchors, Ties, and Bar Positions.

Two of each type used.

Expansion-Joint Material.

One piece of each type used.

Joint Reinforcement.

One piece of each type used, including corner and wall intersection pieces, showing at least two cross wires.

## 1.3 DELIVERY, HANDLING AND STORAGE

Materials shall be delivered, handled, stored, and protected to avoid chipping, breakage, and contact with soil or contaminating material.

### 1.3.1 Masonry Units

Concrete masonry units shall be covered or protected from inclement weather and shall conform to the moisture content as specified in ASTM C 90 when delivered to the jobsite. In addition, prefaced concrete units shall be stored with their finish surfaces covered.

### 1.3.2 Reinforcement, Anchors, and Ties

Steel reinforcing bars, coated anchors, ties, and joint reinforcement shall be stored above the ground. Steel reinforcing bars and uncoated ties shall be free of loose mill scale and rust.

### 1.3.3 Cementitious Materials, Sand and Aggregates

Cementitious and other packaged materials shall be delivered in unopened containers, plainly marked and labeled with manufacturers' names and brands. Cementitious material shall be stored in dry, weathertight enclosures or be completely covered. Cement shall be handled in a manner that will prevent the inclusion of foreign materials and damage by water or dampness. Sand and aggregates shall be stored in a manner to prevent contamination or segregation.

# PART 2 PRODUCTS

## 2.1 GENERAL REQUIREMENTS

The source of materials which will affect the appearance of the finished work shall not be changed after the work has started except with Contracting Officer's approval.

## 2.2 CONCRETE BRICK

Concrete brick shall conform to ASTM C 55, Type I, Grade N. Concrete brick may be used where necessary for filling out in concrete masonry unit construction.

## 2.3 CONCRETE MASONRY UNITS (CMU)

Hollow and solid concrete masonry units shall conform to ASTM C 129, Type I, Lightweight Grade S-1 on interior 6” and 8” thick walls and normal weight Grade “N-1”, ASTM-C-90 (load bearing) on 8” thick exterior walls. Cement shall have a low alkali content and be of one brand.

### 2.3.1 Aggregates

Lightweight aggregates and blends of lightweight and heavier aggregates in proportions used in producing the units, shall comply with the following requirements when tested for stain-producing iron compounds in accordance with ASTM C 641: by visual classification method, the iron stain deposited on the filter paper shall not exceed the "light stain" classification.

### 2.3.2 Kinds and Shapes

Units shall be modular in size and shall include closer, jamb, header, lintel, and bond beam units and special shapes and sizes to complete the work as indicated. In exposed interior masonry surfaces, units having a bullnose shall be used for vertical external corners except at door, window, and louver jambs. Radius of the bullnose shall be 25 mm (1 inch.) Units used in exposed masonry surfaces in any one building shall have a uniform fine to medium texture and a uniform color.

### 2.3.3 Fire-Rated CMU Walls

Concrete masonry units used in fire-rated construction shown on the drawings shall be correspond to the U.L. number certified for the fire rating indicated.

### 2.3.4 Coloring

Concrete masonry units color shall be selected from manufacturers standard color range. Final selection shall be determined by the Government’s designated representative.

## 2.4 PRECAST CONCRETE ITEMS

Trim, lintels, copings, splashblocks and door sills, shall be factory-made units from a plant regularly engaged in producing precast concrete units. Unless otherwise specified, units shall have a smooth dense finish. Prior to use, each item shall be wetted and inspected for crazing. Items showing evidence of dusting, spalling, crazing, or having surfaces treated with a protective coating will be rejected.

## 2.5 MORTAR

Mortar shall be Type N in accordance with the proportion specification of ASTM C 270; Type N cement-lime mortar proportions shall be 1 part cement, 1 part lime and 6 parts aggregate; when masonry cement ASTM C 91 is used the maximum air content shall be limited to 12 percent and

performance equal to cement-lime mortar shall be verified. Mortar for prefaced concrete masonry unit wainscots shall contain aggregates with 100 percent passing the (No. 8) sieve and 95 percent passing the (No. 16) sieve. Pointing mortar in showers and kitchens shall contain ammonium stearate, or aluminum tri-stearate, or calcium stearate in amount equal to 3 percent by weight of cement used. Cement shall have a low alkali content and be of one brand. Aggregates shall be from one source.

## 2.6 GROUT

Grout shall conform to ASTM C 476. Cement used in grout shall have a low alkali content. Grout slump shall be between 8 and 10 inches. Grout shall be used subject to the limitations of Table III. Proportions shall not be changed and materials with different physical or chemical characteristics shall not be used in grout for the work unless additional evidence is furnished that the grout meet the specified requirements.

### 2.6.1 Admixtures

Accelerating admixture shall be non-corrosive, contain less than 0.2 percent chlorides, and conform to ASTM C 494, Type C.

### 2.6.2 Grout Barriers

Grout barriers for vertical cores shall consist of fine mesh wire, fiberglass, or expanded metal.

## 2.7 ANCHORS, TIES, AND BAR POSITIONERS

Anchors and ties shall be fabricated without drips or crimps and shall be zinc-coated in accordance with ASTM A 153, Class B-2. Steel wire used for anchors and ties shall be fabricated from steel wire conforming to ASTM A 82. Anchors and ties shall be sized to provide a minimum of (5/8 inch) mortar cover from either face.

### 2.7.1 Wire Mesh Ties

Wire mesh for tying 100 mm (4 inch) thick concrete masonry unit partitions to other intersecting masonry partitions shall be 13 mm (1/2 inch) mesh of minimum 16 gauge steel wire. Minimum lengths shall be not less than 300 mm. (12 inches.)

### 2.7.2 Adjustable Anchors

Adjustable anchors shall be (3/16 inch) diameter steel wire, triangular-shaped. Anchors attached to steel shall be (5/16 inch) diameter steel bars placed to provide (1/16 inch) play between flexible anchors and structural steel members. Spacers shall be welded to rods and columns. Equivalent welded-on steel anchor rods or shapes standard with the flexible-anchor manufacturer may be furnished when approved. Welds shall be cleaned and given one coat of zinc-rich touch up paint.

### 2.7.3 Bar Positioners

Bar positioners, used to prevent displacement of reinforcing bars during the course of construction, shall be factory fabricated from 9 gauge steel wire or equivalent, and coated with a hot-dip galvanized finish. Not more than one wire shall cross the cell.

## 2.8 JOINT REINFORCEMENT

Joint reinforcement shall be factory fabricated from steel wire conforming to ASTM A 82, welded construction. Tack welding will not be acceptable in reinforcement used for wall ties. Wire shall have zinc coating conforming to ASTM A 153, Class B-2. All wires shall be a minimum of 9 gauge. Reinforcement shall be ladder type design, having one longitudinal wire in the mortar bed of each face shell for hollow units and one wire for solid units. Joint reinforcement shall be placed a minimum of 16 mm (5/8 inch) cover from either face. The distance between crosswires shall not exceed 400 mm (16 inches). Joint reinforcement for straight runs shall be furnished in flat sections not less than 3 m (10 feet) long. Joint reinforcement shall be provided with factory formed corners and intersections. If approved for use, joint reinforcement may be furnished with adjustable wall tie features.

## 2.9 REINFORCING STEEL BARS AND RODS

Reinforcing steel bars and rods shall conform to ASTM A 615, Grade 60.

## 2.10 CONTROL JOINT KEYS

Control joint keys shall be a factory fabricated solid section of natural or synthetic rubber (or combination thereof) conforming to ASTM D 2000 or polyvinyl chloride conforming to ASTM D 2287. The material shall be resistant to oils and solvents. The control joint key shall be provided with a solid shear section not less than 16 mm (5/8 inch) thick and 10 mm (3/8 inch) thick flanges, with a tolerance of plus or minus 2 mm (1/16 inch). The control joint key shall fit neatly, but without forcing, in masonry unit jamb sash grooves. The control joint key shall be flexible at a temperature of minus 34 degrees C (minus 30 degrees F) after five hours exposure, and shall have a durometer hardness of not less than 70 when tested in accordance with ASTM D 2240.

## 2.11 EXPANSION-JOINT MATERIALS

Backer rod and sealant shall be adequate to accommodate joint compression equal to 50 percent of the width of the joint. The backer rod shall be compressible rod stock of polyethylene foam, polyurethane foam, butyl rubber foam, or other flexible, nonabsorptive material as recommended by the sealant manufacturer. Sealant shall conform to Section 07920 JOINT SEALING.

## 2.12 FLASHING

Flashing shall be as specified in Section 07600 SHEET METALWORK, GENERAL.

# PART 3 EXECUTION

## 3.1 ENVIRONMENTAL REQUIREMENTS

### 3.1.1 Hot Weather Installation

The following precautions shall be taken if masonry is erected when the ambient air temperature is more than 37 degrees C (99 degrees F) in the shade and the relative humidity is less than 50 percent. All masonry materials shall be shaded from direct sunlight; mortar beds shall be spread no more than 1.2 m (4 feet) ahead of masonry; masonry units shall be set within one minute of spreading mortar; and after erection, masonry shall be protected from direct exposure to wind and sun for 48 hours.

## 3.2 LAYING MASONRY UNITS

Masonry units shall be laid in running bond pattern to match grouted cells. Each unit shall be adjusted to its final position while mortar is still soft and plastic. Units that have been disturbed after the mortar has stiffened shall be removed, cleaned, and relaid with fresh mortar. Air spaces, cavities, chases, expansion joints, and spaces to be grouted shall be kept free from mortar and other debris. Units used in exposed masonry surfaces shall be free from chipped edges or other imperfections detracting from the appearance of the finished work. Vertical joints shall be kept plumb. Units being laid and surfaces to receive units shall be free of water film. Solid units shall be laid in a nonfurrowed full bed of mortar. Units shall be shoved into place so that the vertical joints are tight. Vertical joints of the vertical face shells of concrete masonry units, except where indicated at control, expansion, and isolation joints, shall be completely filled with mortar. Mortar will be permitted to protrude up to 13 mm (1/2 inch) into the space or cells to be grouted. Means shall be provided to prevent mortar from dropping into the space below. Collar joints shall be filled with mortar or grout during the laying of the facing wythe, and filling shall not lag the laying of the facing wythe by more than 200 mm. (8 inches.)

### 3.2.1 Surface Preparation

Surfaces upon which masonry is placed shall be cleaned of laitance, dust, dirt, oil, organic matter, or other foreign materials and shall be slightly roughened to provide a surface texture with a depth of at least 3 mm. (1/8 inch.) Sandblasting shall be used, if necessary, to remove laitance from pores and to expose the aggregate.

### 3.2.2 Forms and Shores

Forms and shores shall be sufficiently rigid to prevent deflections which may result in cracking or other damage to supported masonry and sufficiently tight to prevent leakage of mortar and grout. Supporting forms and shores shall not be removed in less than 10 days.

### 3.2.3 Concrete Masonry Units

Units in piers, pilasters, columns, starting courses on footings, solid foundation walls, lintels, and beams, and where cells are to be filled with grout shall be full bedded in mortar under both face shells and webs. Other units shall be full bedded under both face shells. Head joints shall be filled solidly with mortar for a distance in from the face of the unit not less than the thickness of the face shell. Foundation walls below grade shall be grouted solid. Jamb units shall be of the shapes and sizes to conform with wall units. Solid units may be incorporated in the masonry work where necessary to fill out at corners, gable slopes, and elsewhere as approved. Double walls shall be stiffened at wall-mounted plumbing fixtures by use of strap anchors, two above each fixture and two below each fixture, located to avoid pipe runs, and extending from center to center of the double wall. Walls and partitions shall be adequately reinforced for support of wall-hung plumbing fixtures when chair carriers are not specified.

### 3.2.4 Tolerances

Masonry shall be laid plumb, true to line, with courses level. Bond pattern shall be kept plumb throughout. Corners shall be square unless noted otherwise. Except for walls constructed of prefaced concrete masonry units, masonry shall be laid within the following tolerances (plus or minus unless otherwise noted):

**TABLE II**

**TOLERANCES**

| Variation from the plumb in the lines and surfaces of columns, walls and arise | |
|---|---|
| In adjacent masonry units | 1/8 inch |
| In 10 feet | 1/4 inch |
| **Variation from the plumb for external corners expansion joints, and other conspicuous lines** | |
| In 20 feet | 1/4 inch |
| In 40 feet | 1/2 inch |

| Variation from the level for exposed lintels, sills, parapets, horizontal grooves, and other conspicuous | |
|---|---|
| In 20 feet | 1/4 inch |
| In 40 feet or more | 1/2 inch |
| **Variation from level for bed joints and top surfaces bearing walls:** | |
| In 10 feet | 1/4 inch |
| In 40 feet or more | 1/2 inch |
| **Variation from horizontal lines** | |
| In 10 feet | 1/4 inch |
| In 20 feet | 3/8 inch |
| In 40 feet or more | 1/2 inch |

### 3.2.5 Cutting and Fitting

Full units of the proper size shall be used wherever possible, in lieu of cut units. Cutting and fitting, including that required to accommodate the work of others, shall be done by masonry mechanics using power masonry saws. Concrete masonry units may be wet or dry cut. Wet cut units, before being placed in the work, shall be dried to the same surface-dry appearance as uncut units being laid in the wall. Cut edges shall be clean, true and sharp. Openings in the masonry shall be made carefully so that wall plates, cover plates or escutcheon required by the installation will completely conceal the openings and will have bottoms parallel with the masonry bed joints. Reinforced masonry lintels shall be provided above openings over 300 mm (12 inches) wide for pipes, ducts, cable trays, and other wall penetrations, unless steel sleeves are used.

### 3.2.6 Jointing

Joints shall be tooled when the mortar is thumbprint hard. Horizontal joints shall be tooled last. Joints shall be brushed to remove all loose and excess mortar. Mortar joints shall be finished as follows:

#### 3.2.6.1 Flush Joints

Joints in concealed masonry surfaces and joints at electrical outlet boxes in wet areas shall be flush cut. Flush cut joints shall be made by cutting off the mortar flush with the face of the wall. Joints in unparged masonry walls below grade shall be pointed tight. Flush joints for architectural units, such as

fluted units, shall completely fill both the head and bed joints.

3.2.6.2 Tooled Joints

Joints in exposed exterior and interior masonry surfaces shall be tooled slightly concave. Joints shall be tooled with a jointer slightly larger than the joint width so that complete contact is made along the edges of the unit. Tooling shall be performed so that the mortar is compressed and the joint surface is sealed.

3.2.6.3 Door and Window Frame Joints

On the exposed interior side of exterior frames, joints between frames and abutting masonry walls shall be raked to a depth of 10 mm. (3/8 inch.) On the exterior side of exterior frames, joints between frames and abutting masonry walls shall be raked to a depth of 10 mm. (3/8 inch.)

3.2.7 Joint Widths

Joint widths shall be as follows:

3.2.7.1 Concrete Masonry Units

Concrete masonry units shall have 10 mm (3/8 inch)joints, except for prefaced concrete masonry units.

3.2.7.2 Prefaced Concrete Masonry Units

Prefaced concrete masonry units shall have a joint width of 10 mm (3/8 inch) wide on unfaced side and not less than 5 mm (3/16 inch) nor more than 6 mm (1/4 inch) wide on prefaced side.

3.2.8 Embedded Items

Spaces around built-in items shall be filled with mortar. Openings around flush-mount electrical outlet boxes in wet locations shall be pointed with mortar. Anchors, ties, wall plugs, accessories, flashing, pipe sleeves and other items required to be built-in shall be embedded as the masonry work progresses. Anchors, ties and joint reinforcement shall be fully embedded in the mortar. Cells receiving anchor bolts and cells of the first course below bearing plates shall be filled with grout.

3.2.9 Unfinished Work

Unfinished work shall be stepped back for joining with new work. Toothing may be resorted to only when specifically approved. Loose mortar shall be removed and the exposed joints shall be thoroughly cleaned before laying new work.

### 3.2.10 Masonry Wall Intersections

Each course shall be masonry bonded at corners and elsewhere as shown. Masonry walls shall be anchored or tied together at corners and intersections with bond beam reinforcement and prefabricated corner or tee pieces of joint reinforcement as shown.

### 3.2.11 Partitions

Partitions shall be continuous from floor to underside of floor or roof deck where shown. Openings in firewalls around joists or other structural members shall be filled as indicated or approved. Where suspended ceilings on both sides of partitions are indicated, the partitions other than those shown to be continuous may be stopped approximately 100 mm (4 inches) above the ceiling level. An isolation joint shall be placed in the intersection between partitions and structural or exterior walls as shown. Interior partitions having 100 mm (4 inch) nominal thick units shall be tied to intersecting partitions of 100 mm (4 inch) units, 125 mm (5 inches) into partitions of 150 mm (6 inch) units, and 175 (7 inches) into partitions of 200 mm (8 inch) or thicker units. Cells within vertical plane of ties shall be filled solid with grout for full height or partition or solid masonry units may be used. Interior partitions having masonry walls over 100 mm (4 inches) thick shall be tied together with joint reinforcement. Partitions containing joint reinforcement shall be provided with prefabricated pieces at corners and intersections or partitions.

## 3.3 MORTAR

Mortar shall be mixed in a mechanically operated mortar mixer for at least 3 minutes, but not more than 5 minutes. Measurement of ingredients for mortar shall be by volume. Ingredients not in containers, such as sand, shall be accurately measured by the use of measuring boxes. Water shall be mixed with the dry ingredients in sufficient amount to provide a workable mixture which will adhere to the vertical surfaces of masonry units. Mortar that has stiffened because of loss of water through evaporation shall be retempered by adding water to restore the proper consistency and workability. Mortar that has reached its initial set or that has not been used within 2-1/2 hours after mixing shall be discarded.

## 3.4 REINFORCING STEEL

Reinforcement shall be cleaned of loose, flaky rust, scale, grease, mortar, grout, or other coating which might destroy or reduce its bond prior to placing grout. Reinforcement shall be placed prior to grouting. Unless otherwise indicated, vertical wall reinforcement shall extend to within 50 mm (2 inches) of tops of walls.

### 3.4.1 Positioning Bars

Vertical bars shall be accurately placed within the cells at the positions indicated on the drawings. A minimum clearance of 13 mm (1/2 inch) shall be maintained between the bars and masonry units. Minimum clearance between parallel bars shall be one diameter of the reinforcement. Vertical reinforcing may be held in place using bar positioners located near the ends of each bar and at intermediate intervals of not more than 192 diameters of the reinforcement. Column and pilaster ties shall be wired in position around the vertical steel. Ties shall be in contact with the vertical reinforcement and shall not be placed in horizontal bed joints.

### 3.4.2 Splices

Bars shall be lapped a minimum of 48 diameters of the reinforcement. Welded or mechanical connections shall develop at least 125 percent of the specified yield strength of the reinforcement.

## 3.5 JOINT REINFORCEMENT

Joint reinforcement shall be installed at 400 mm (16 inches) on center or as indicated. Reinforcement shall be lapped not less than 150 mm. (6 inches.) Prefabricated sections shall be installed at corners and wall intersections. The longitudinal wires of joint reinforcement shall be placed to provide not less than 16 mm (5/8 inch) cover to either face of the unit.

## 3.6 PLACING GROUT

Cells containing reinforcing bars shall be filled with grout. Hollow masonry units in walls or partitions supporting plumbing, heating, or other mechanical fixtures, voids at door and window jambs, and other indicated spaces shall be filled solid with grout. Cells under lintel bearings on each side of openings shall be filled solid with grout for full height of openings. Walls below grade, lintels, and bond beams shall be filled solid with grout. Units other than open end units may require grouting each course to preclude voids in the units. Grout not in place within 1-1/2 hours after water is first added to the batch shall be discarded. Sufficient time shall be allowed between grout lifts to preclude displacement or cracking of face shells of masonry units. If blowouts, flowouts, misalignment, or cracking of face shells should occur during construction, the wall shall be torn down and rebuilt.

### 3.6.1 Vertical Grout Barriers for Fully Grouted Walls

Grout barriers shall be provided not more than 10 m (30 feet) apart, or as required, to limit the horizontal flow of grout for each pour.

3.6.2 Horizontal Grout Barriers

Grout barriers shall be embedded in mortar below cells of hollow units receiving grout.

3.6.3 Grout Holes and Cleanouts

3.6.3.1 Grout Holes

Grouting holes shall be provided in slabs, spandrel beams, and other in-place overhead construction. Holes shall be located over vertical reinforcing bars or as required to facilitate grout fill in bond beams. Additional openings spaced not more than 400 mm (16 inches) on centers shall be provided where grouting of all hollow unit masonry is indicated. Openings shall not be less than 100 mm (4 inches) in diameter or 75 by 100 mm (3 by 4 inches) in horizontal dimensions. Upon completion of grouting operations, grouting holes shall be plugged and finished to match surrounding surfaces.

3.6.3.2 Cleanouts for Hollow Unit Masonry Construction

Cleanout holes shall be provided at the bottom of every pour in cores containing vertical reinforcement when the height of the grout pour exceeds 1.5 m. (5 feet.) Where all cells are to be grouted, cleanout courses shall be constructed using bond beam units in an inverted position to permit cleaning of all cells. Cleanout holes shall be provided at a maximum spacing of 800 mm (32 inches) where all cells are to be filled with grout. A new series of cleanouts shall be established if grouting operations are stopped for more than 4 hours. Cleanouts shall not be less than 75 by 100 mm (3- by 4-inch) openings cut from one face shell. Manufacturer's standard cutout units may be used at the Contractor's option. Cleanout holes shall not be closed until masonry work, reinforcement, and final cleaning of the grout spaces have been completed and inspected. For walls which will be exposed to view, cleanout holes shall be closed in an approved manner to match surrounding masonry.

3.6.4 Grouting Equipment

3.6.4.1 Grout Pumps

Pumping through aluminum tubes will not be permitted. Pumps shall be operated to produce a continuous stream of grout without air pockets, segregation, or contamination. Upon completion of each day's pumping, waste materials and debris shall be removed from the equipment, and disposed off site.

3.6.4.2 Vibrators

Internal vibrators shall maintain a speed of not less than 5,000 impulses per minute when submerged in the grout. At least one spare vibrator shall be maintained at the site at all times. Vibrators shall be applied at uniformly spaced points not

further apart than the visible effectiveness of the machine. Duration of vibration shall be limited to time necessary to produce satisfactory consolidation without causing segregation.

### 3.6.5 Grout Placement

Masonry shall be laid to the top of a pour before placing grout. Grout shall not be placed in two-wythe solid unit masonry cavity until mortar joints have set for at least 3 days during hot weather and 5 days during cold damp weather. Grout shall not be placed in hollow unit masonry until mortar joints have set for at least 24 hours. Grout shall be placed using a hand bucket, concrete hopper, or grout pump to completely fill the grout spaces without segregation of the aggregates. Vibrators shall not be inserted into lower pours that are in a semi-solidified state. The height of grout pours and type of grout used shall be limited by the dimensions of grout spaces as indicated in Table III. Low-lift grout methods may be used on pours up to and including 1.5 m (5 feet) in height. High-lift grout methods shall be used on pours exceeding 1.5 m (5 feet) in height.

#### 3.6.5.1 Low-Lift Method

Grout shall be placed at a rate that will not cause displacement of the masonry due to hydrostatic pressure of the grout. Mortar protruding more than 13 mm (1/2 inch) into the grout space shall be removed before beginning the grouting operation. Grout pours 300 mm (12 inches) or less in height shall be consolidated by mechanical vibration or by puddling. Grout pours over 300 mm (12 inches) in height shall be consolidated by mechanical vibration and reconsolidated by mechanical vibration after initial water loss and settlement has occurred. Low-lift grout shall be used subject to the limitations of Table III.

#### 3.6.5.2 High-Lift Method

Mortar droppings shall be cleaned from the bottom of the grout space and from reinforcing steel. Mortar protruding more than 6 mm (1/4 inch) into the grout space shall be removed by dislodging the projections with a rod or stick as the work progresses. CMU units shall not be pre-wetted. The individual lifts of grout shall be limited to 1.2 m (4 feet) in height. The first lift of grout shall be placed to a uniform height within the pour section and vibrated thoroughly to fill all voids. This first vibration shall follow immediately behind the pouring of the grout using an approved mechanical vibrator. After a waiting period sufficient to permit the grout to become plastic, but before it has taken any set, the succeeding lift shall be poured and vibrated 300 to 450 mm (12 to 18 inches) into the preceding lift. If the placing of the succeeding lift is going to be delayed beyond the period of workability of the preceding, each lift shall be reconsolidated by reworking with a second vibrator as soon as the grout has taken its settlement shrinkage. The waiting, pouring, and reconsolidation steps shall be repeated until the top of the pour is reached. The top lift shall be reconsolidated after the required waiting period.

The high-lift grouting of any section of wall between vertical grout barriers shall be completed to the top of a pour in one working day unless a new series of cleanout holes is established and the resulting horizontal construction joint cleaned. High-lift grout shall be used subject to the limitations in Table III.

TABLE III

POUR HEIGHT AND TYPE OF GROUT FOR VARIOUS GROUT SPACE DIMENSIONS

| | | | Minimum Dimensions of the Total Clear Areas Within Grout Spaces and Cells (in.) (1,2) | |
|---|---|---|---|---|
| Maximum Grout Pour Height (feet) (4) | Grout Type | Grouting Procedure | Multiwythe Masonry (3) | Hollow unit Masonry |
| 1 | Fine | Low Lift | 3/4 | 1-1/2 x 2 |
| 5 | Fine | Low Lift | 2 | 2 x 3 |
| 8 | Fine | High Lift | 2 | 2 x 3 |
| 12 | Fine | High Lift | 2-1/2 | 2-1/2 x 3 |
| 24 | Fine | High Lift | 3 | 3 x 3 |
| 1 | Coarse | Low Lift | 1-1/2 | 1-1/2 x 3 |
| 5 | Coarse | Low Lift | 2 | 2-1/2 x 3 |
| 8 | Coarse | High Lift | 2 | 3 x 3 |
| 12 | Coarse | High Lift | 2-1/2 | 3 x 3 |
| 24 | Coarse | High Lift | 3 | 3 x 4 |

Notes:

(1) The actual grout space or cell dimension must be larger than the sum of the following items:

a) The required minimum dimensions of total clear areas given in the table above;

b) The width of any mortar projections within the space;

c) The horizontal projections of the diameters of the horizontal reinforcing bars within a cross section of the grout space or cell.

(2) The minimum dimensions of the total clear areas shall be made up of one or more open areas, with at least one area being 20 mm (3/4 inch) or greater in width.

(3) For grouting spaces between masonry wythes.

(4) Where only cells of hollow masonry units containing reinforcement are grouted, the maximum height of the pour shall not exceed the distance between horizontal bond beams.

## 3.7 BOND BEAMS

Bond beams shall be filled with grout and reinforced as indicated on the drawings. Grout barriers shall be installed under bond beam units to retain the grout as required. Where splices are required for continuity, reinforcement shall be lapped 48 bar diameters. A minimum clearance of 13 mm (1/2 inch) shall be maintained between reinforcement and interior faces of units.

## 3.8 CONTROL JOINTS

Control joints shall be provided as indicated and shall be constructed by using special control-joint units in accordance with the details shown on the drawings. Sash jamb units shall have a 19 by 19 mm (3/4 by 3/4 inch) groove near the center at end of each unit. The vertical mortar joint at control joint locations shall be continuous, including through all bond beams. This shall be accomplished by utilizing half blocks in alternating courses on each side of the joint. The control joint key shall be interrupted in courses containing continuous bond beam steel. In single wythe exterior masonry walls, the exterior control joints shall be raked to a depth of 20 mm; (3/4 inch;) backer rod and sealant shall be installed in accordance with Section 07920 JOINT SEALING. Exposed interior control joints shall be raked to a depth of 6 mm. (1/4 inch.) Concealed control joints shall be flush cut.

## 3.9 CONCRETE MASONRY VENEER JOINTS

Concrete masonry veneer joints shall be provided and constructed as shown on the drawings. Joints shall be kept free of mortar and other debris.

## 3.10 LINTELS

### 3.10.1 Precast Concrete and Steel Lintels

Precast concrete and steel lintels shall be as shown on the drawings. Lintels shall be set in a full bed of mortar with faces plumb and true. Steel and precast lintels shall have a minimum bearing length of 200 mm (8 inches) unless otherwise indicated on the drawings.

## 3.11 SILLS AND COPINGS

Sills and copings shall be set in a full bed of mortar with faces plumb and true.

## 3.12 ANCHORAGE TO STRUCTURAL STEEL

Masonry shall be anchored to vertical structural steel framing with adjustable steel wire anchors spaced not over 400 mm (16 inches) on centers vertically, and if applicable, not over 600 mm (24 inches) on centers horizontally.

## 3.13 PARGING

The outside face of below-grade exterior concrete-masonry unit walls enclosing usable rooms and spaces shall be parged with type S mortar. Parging shall not be less than 13 mm (1/2 inch) thick troweled to a smooth dense surface so as to provide a continuous unbroken shield from top of footings to a line 150 mm (6 inches) below adjacent finish grade, unless otherwise indicated. Parging shall be coved at junction of wall and footing. Parging shall be damp-cured for 48 hours or more before backfilling. Parging shall be protected from freezing temperatures until hardened.

## 3.14 SPLASH BLOCKS

Splash blocks shall be located as shown.

## 3.15 POINTING AND CLEANING

After mortar joints have attained their initial set, but prior to hardening, mortar and grout daubs or splashings shall be completely removed from masonry-unit surfaces that will be exposed or painted. Before completion of the work, defects in joints of masonry to be exposed or painted shall be raked out as necessary, filled with mortar, and tooled to match existing joints. Immediately after grout work is completed, scum and stains which have percolated through the masonry work shall be removed using a high pressure stream of water and a stiff bristled brush. Masonry surfaces shall not be cleaned, other than removing excess surface mortar, until mortar in joints has hardened. Masonry surfaces shall be left clean, free of mortar daubs, dirt, stain, and discoloration, including scum from cleaning operations, and with tight mortar joints throughout. Metal tools and metal brushes shall not be used for cleaning. Prefaced concrete masonry unit surfaces shall be cleaned with soap powder and clean water applied with stiff fiber brushes. Excess mortar shall be removed with wood paddles. Metal cleaning tools, metal brushes, abrasive powders, and acid solutions shall not be used. At the completion of cleaning operations, the surfaces shall be rinsed with clean water. In areas of traffic within the building, a barricade of wood supported by framing lumber shall be erected to protect the units. In other areas, a heavy kraft-type building paper shall be taped over the units until final acceptance.

## 3.16 PROTECTION

Facing materials shall be protected against staining. Top of walls shall be covered with nonstaining waterproof covering or membrane when work is not in progress. Covering of the top of the unfinished walls shall continue until the wall is waterproofed with a complete roof or

parapet system. Covering shall extend a minimum of 600 mm (2 feet) down on each side of the wall and shall be held securely in place. Before starting or resuming, top surface of masonry in place shall be cleaned of loose mortar and foreign material.

-- END OF SECTION 04200A --

DIVISION 4

MASONRY

SECTION 04200B

BRICK MASONRY

## PART 1 GENERAL

### 1.1 REFERENCES

The publications listed below are referenced and the most current publication applies. The publications are referred to in the text by basic designation only.

#### 1.1.1 AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|---|---|
| ASTM A 82 | Steel Wire, Plain, for Concrete Reinforcement |
| ASTM A 153 | Zinc Coating (Hot-Dip) on Iron and Steel Hardware |
| ASTM C 62 | Building Brick (Solid Masonry Units Made from Clay or Shale) |
| ASTM C 216 | Facing Brick (Solid Masonry Units Made from Clay or Shale) |
| ASTM C 270 | Mortar for Unit Masonry |
| ASTM C 494 | Chemical Admixtures for Concrete |

### 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

1.2.1 Data "FIO"

Clay or Shale Brick

Manufacturer's descriptive data.

1.2.2 Statements "FIO"

Cold Weather Installation.

Cold weather construction procedures.

1.2.3 Reports "FIO"

Masonry Cement

Test reports from an approved independent laboratory. Test reports on a previously tested material shall be certified as the same as that proposed for use in this project.

1.2.4 Certificates "FIO"

Clay or Shale Brick; Anchors and Ties; Expansion-Joint Materials; Joint Reinforcement Masonry Cement;. Mortar Coloring; Insulation; Precast Concrete Items; Mortar Admixtures;

Certificates of compliance stating that the materials meet the specified requirements.

1.2.5 Samples "GA"

Clay or Shale Brick

Color samples of three stretcher units and one unit for each type of special shape. Units shall show the full range of color and texture.

Anchors and Ties

Two of each type used.

Expansion-Joint Material

One piece of each type used.

Joint Reinforcement

One piece of each type used, including corner and wall intersection pieces, showing at least two cross wires.

1.3 DELIVERY, HANDLING, AND STORAGE

Materials shall be delivered, handled, stored, and protected to avoid chipping, breakage, and contact with soil or contaminating material.

1.3.1 Reinforcement, Anchors, and Ties

Coated anchors, ties, and joint reinforcement shall be stored above the ground. Uncoated ties shall be free of loose mill scale and rust.

1.3.2 Cementitious Materials, Sand and Aggregates

Cementitious and other packaged materials shall be delivered in unopened containers, plainly marked and labeled with manufacturers' names and brands. Cementitious material shall be stored in dry, weathertight enclosures or be completely covered. Cement shall be handled in a manner that will prevent the inclusion of foreign

materials and damage by water or dampness. Sand and aggregates shall be stored in a manner to prevent contamination or segregation.

## PART 2 PRODUCTS

### 2.1 GENERAL REQUIREMENTS

The source of materials which will affect the appearance of the finished work shall not be changed after the work has started except with Contracting Officer's approval.

### 2.2 CLAY OR SHALE BRICK

Color range and texture of clay or shale brick shall be as indicated to match existing brickwork and shall conform to the approved sample. Grade SW shall be used for brick in contact with earth or grade and for all exterior work. Clay or shale brick units shall be delivered factory-blended to provide a uniform appearance and color range in the completed wall.

#### 2.2.1 Solid Clay or Shale Brick

Solid clay or shale shall conform to ASTM C 62 and ASTM C 216. Brick size shall be 64 modular and the nominal size of the brick used shall be 64mm (2 1/2_inches) thick, 102 mm (4 inches) wide, and 203 mm (8 inches) long. Minimum compressive strength of the brick shall be 55.20 MPa (8,000 psi).

### 2.3 PRECAST CONCRETE ITEMS

Trim, copings, splash blocks and door sills shall be factory-made units from a plant regularly engaged in producing precast concrete units. Unless otherwise specified, units shall have a smooth dense finish. Prior to use, each item shall be wetted and inspected for crazing. Items showing evidence of dusting, spalling, crazing, or having surfaces treated with a protective coating will be rejected.

### 2.4 MORTAR

Mortar shall be Type N in accordance with the proportion specification of ASTM C 270. Type N cement-lime mortar proportions shall be 1 part cement, 1part lime and 6 parts aggregate; when masonry cement ASTM C 91 is used the maximum air content shall be limited to 12 percent and performance equal to cement-lime mortar shall be verified. Cement shall have a low alkali content and be of one brand. Aggregates shall be from one source.

#### 2.4.1 Admixtures

In cold weather, a non-chloride based accelerating admixture may be used subject to approval. Accelerating admixture shall be non-corrosive, shall contain less than 0.2 percent chlorides, and shall conform to ASTM C 494, Type C.

### 2.4.2 Coloring

Mortar coloring shall be added to the mortar used for exposed masonry surfaces to produce a uniform color matching the existing mortar joints. Mortar coloring shall not exceed 3 percent of the weight of cement for carbon black and 10 percent of the weight of cement for all other pigments. Mortar coloring shall be chemically inert, of finely ground limeproof pigment, and furnished in accurately pre-measured and packaged units that can be added to a measured amount of cement.

## 2.5 ANCHORS AND TIES

Anchors and ties shall be fabricated without drips or crimps and shall be zinc-coated in accordance with ASTM A 153, Class B-2. Steel wire used for anchors and ties shall be fabricated from steel wire conforming to ASTM A 82. Anchors and ties shall be sized to provide a minimum of 16 mm (5/8 inch) mortar cover from either face.

### 2.5.1 Wall Ties

Wall ties shall be rectangular-shaped fabricated of 5 mm (3/16 inch) diameter zinc-coated steel wire. Rectangular wall ties shall be no less than 100 mm (4 inches) wide. Wall ties may also be of a continuous type conforming to paragraph JOINT REINFORCEMENT. Adjustable type wall ties, if approved for use, shall consist of two essentially U-shaped elements fabricated of 5 mm (3/16 inch)diameter zinc-coated steel wire. Adjustable ties shall be of the double pintle to eye type and shall allow a maximum of 13 mm (1/2 inch)eccentricity between each element of the tie. Play between pintle and eye opening shall be not more than 2 mm (1/16 inch). The pintle and eye elements shall be formed so that both can be in the same plane.

### 2.5.2 Dovetail Anchors

Dovetail anchors shall be of the flexible wire type, 5 mm (3/16 inch)diameter zinc-coated steel wire, triangular shaped, and attached to a 12 gauge or heavier steel dovetail section. These anchors shall be used for anchorage of veneer wythes or composite-wall facings extending over the face of concrete columns, beams,or walls. Cells within vertical planes of these anchors shall be filled solid with grout for full height of walls or partitions, or solid units may be used. Dovetail slots are specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

### 2.5.3 Adjustable Anchors

Adjustable anchors shall be 5 mm (3/16 inch)diameter steel wire, triangular-shaped. Anchors attached to steel shall be 8 mm (5/16 inch) diameter steel bars placed to provide 2 mm(1/16 inch) play between flexible anchors and structural steel members. Spacers shall be welded to rods and columns. Equivalent welded-on steel anchor rods or shapes standard with the flexible-anchor manufacturer may be furnished when approved. Welds shall be cleaned and given one coat of zinc-rich touch up paint.

## 2.6 JOINT REINFORCEMENT

Joint reinforcement shall be factory fabricated from steel wire conforming to ASTM A 82, welded construction. Tack welding will not be acceptable in reinforcement used for wall ties. Wire shall have zinc coating conforming to ASTM A 153, Class B-2. All wires shall be a minimum of 9 gauge. Reinforcement shall be ladder type design, having one longitudinal wire in the mortar bed of each face shell for hollow units and one wire for solid units. Joint reinforcement shall be placed a minimum of 16 mm (5/8 inch) cover from either face. The distance between crosswires shall not exceed 400 mm (16 inches). Joint reinforcement for straight runs shall be furnished in flat sections not less than 3 m (10 feet)long. Joint reinforcement shall be provided with factory formed corners and intersections. If approved for use, joint reinforcement may be furnished with adjustable wall tie features.

## 2.7 EXPANSION-JOINT MATERIALS

Backer rod and sealant shall be adequate to accommodate joint compression equal to 50 percent of the width of the joint. The backer rod shall be compressible rod stock of polyethylene foam, polyurethane foam, butyl rubber foam, or other flexible, nonabsorptive material as recommended by the sealant manufacturer. Sealant shall conform to Section 07920 JOINT SEALING.

## 2.8 INSULATION

### 2.8.1 Air Space

The cavity space shall allow for a minimum air space of 20 mm (3/4 inch).

## 2.9 FLASHING

Flashing shall be as specified in Section 07600 SHEET METALWORK, GENERAL.

# PART 3 EXECUTION

## 3.1 ENVIRONMENTAL REQUIREMENTS

### 3.1.1 Hot Weather Installation

The following precautions shall be taken if masonry is erected when the ambient air temperature is more than 37 degrees C (99 degrees F) in the shade and the relative humidity is less than 50 percent. All masonry materials shall be shaded from direct sunlight; mortar beds shall be spread no more than 1.2 m (4 feet) ahead of masonry; masonry units shall be set within one minute of spreading mortar; and after erection, masonry shall be protected from direct exposure to wind and sun for 48 hours.

### 3.1.2 Cold Weather Installation

Before erecting masonry when ambient temperature or mean daily air temperature falls below 4 degrees C, (40 degrees F), a written statement of proposed cold weather construction procedures shall be submitted for approval. The following precautions shall be taken during all cold weather erection.

#### 3.1.2.1 Preparation

Ice or snow formed on the masonry bed shall be thawed by the application of heat. Heat shall be applied carefully until the top surface of the masonry is dry to the touch. Sections of masonry deemed frozen and damaged shall be removed before continuing construction of those sections.

a. Air Temperature 4 to 0 degrees C. (40 to 32 Degrees F). Sand or mixing water shall be heated to produce mortar temperatures between 4 degrees C and 49 degrees C. (40 degrees F and 120 degrees F).

b. Air Temperature 0 to minus 4 degrees C. (32 to 25 Degrees F). Sand and mixing water shall be heated to produce mortar temperatures between 4 degrees C and 49 degrees C. (40 degrees F and 120 degrees F). Temperature of mortar on boards shall be maintained above freezing.

c. Air Temperature minus 4 to minus 7 degrees C. (25 to 20 Degrees F). Sand and mixing water shall be heated to provide mortar temperatures between 4 degrees C and 49 degrees C. (40 degrees F and 120 degrees F). Temperature of mortar on boards shall be maintained above freezing. Sources of heat shall be used on both sides of walls unde construction. Windbreaks shall be employed when wind is in excess of 24 km/hour. (15 mph).

d. Air Temperature minus 7 degrees C (20 Degrees F) and Below.Sand and mixing water shall be heated to provide mortar temperatures between 4 degrees C and 49 degrees C. (40 degrees F and 120 degrees F). Enclosure and auxiliary heat shall be provided to maintain air temperature above 0 degrees C. (32 degrees F). Temperature of units when laid shall not be less than minus 7 degrees C. (20 degrees F).

#### 3.1.2.2 Completed Masonry and Masonry Not Being Worked On

a. Mean daily air temperature 4 degrees C to 0 degrees C. (40 degrees F to 32 degrees F). Masonry shall be protected from rain or snow for 24 hours by covering with weather-resistive membrane.

b. Mean daily air temperature 0 degrees C to minus 4 degrees C. (32 degrees F to 25 degrees F). Masonry shall be completely covered with weather-resistant membrane for 24 hours.

c. Mean Daily Air Temperature minus 4 degrees C to minus 7 degrees.C. (25 Degrees F to 20 Degrees F). Masonry shall be completely covered with insulating blankets or equally protected for 24 hours.

d. Mean Daily Temperature minus 7 degrees C 20 Degrees F and Below. Masonry temperature shall be maintained above 0 degrees C (32 degrees F) for 24 hours by enclosure and supplementary heat, by electric heating blankets, infrared heat lamps, or other approved methods.

## 3.2 LAYING MASONRY UNITS

Masonry units shall be laid in running bond pattern. Facing courses shall be level with back-up courses, unless the use of adjustable ties has been approved in which case the tolerances shall be plus or minus 13 mm. (1/2 inch). Each unit shall be adjusted to its final position while mortar is still soft and plastic. Units that have been disturbed after the mortar has stiffened shall be removed, cleaned, and relaid with fresh mortar. Units used in exposed masonry surfaces shall be free from chipped edges or other imperfections detracting from the appearance of the finished work. Vertical joints shall be kept plumb. Units being laid and surfaces to receive units shall be free of water film and frost. Mortar for veneer wythes shall be beveled and sloped toward the center of the wythe from the cavity side. Units shall be shoved into place so that the vertical joints are tight. Vertical joints of brick, except where indicated at control, expansion, and isolation joints, shall be completely filled with mortar. Mortar will be permitted to protrude up to 13 mm 1/2 inch into the space or cells to be grouted. Means shall be provided to prevent mortar from dropping into the space below. In double wythe construction, the inner wythe may be brought up not more than 400 mm (16 inches) ahead of the outer wythe. Collar joints shall be filled with mortar or grout during the laying of the facing wythe, and filling shall not lag the laying of the facing wythe by more than 200mm. (8 inches).

### 3.2.1 Surface Preparation

Surfaces upon which masonry is placed shall be cleaned of laitance, dust, dirt, oil, organic matter, or other foreign materials and shall be slightly roughened to provide a surface texture with a depth of at least 3 mm. (1/8 inch).

### 3.2.2 Forms and Shores

Forms and shores shall be sufficiently rigid to prevent deflections which may result in cracking or other damage to supported masonry and sufficiently tight to prevent leakage of mortar and grout. Supporting forms and shores shall not be removed in less than 10 days.

### 3.2.3 Clay or Shale Brick Units

Brick facing shall be laid with the better face exposed. Brick shall be laid in running bond with each course bonded at corners, unless otherwise indicated. Molded brick shall be laid with the frog side down. Brick that is cored, recessed, or has other deformations may be used in sills, treads, soldier courses, except where deformations will be exposed to view. Wetting of clay, shale brick, or hollow brick units having an initial rate of absorption of more than 0.155 gm per minute per square cm (1 gm per minute per square inch) of bed surface shall be in conformance with ASTM C 67. The method of wetting shall ensure that each unit is nearly saturated but surface dry when laid.

### 3.2.4 Tolerances

Masonry shall be laid plumb, true to line, with courses level. Bond pattern shall be kept plumb throughout. Corners shall be square unless noted otherwise. Masonry shall be laid within the following tolerances (plus or minus unless otherwise noted):

**TABLE II**

**TOLERANCES**

| | |
|---|---|
| **Variation from the plumb in the line and surfaces of columns, walls and arises.** | |
| In adjacent masonry units | 3 mm |
| In 3m | 6 mm |
| **Variations from horizontal lines** | |
| In 3 m | 6 mm |
| **Variations in thickness of walls** | |
| Minus | 6 mm |
| Plus | 13 mm |

**TABLE II**

**TOLERANCES**

| | |
|---|---|
| **Variation from the plumb in the lines and surfaces of columns, walls and arises.** | |
| **In adjacent masonry units** | **1/8 inch** |
| **In 10 feet** | **1/4 inch** |
| **Variations from horizontal lines** | |
| **In 10 feet** | **1/4 inch** |
| **Variations in thickness of walls** | |
| **Minus** | **1/4 inch** |
| **Plus** | **1/2 inch** |

**3.2.5 Cutting and Fitting**

**Full units of the proper size shall be used wherever possible, in lieu of cut units. Cutting and fitting, including that required to accommodate the work of others, shall be done by masonry mechanics using power masonry saws. Cut edges shall be clean, true and sharp. Openings in the masonry shall be made carefully so that wall plates, cover plates or escutcheons required by the installation will completely conceal the openings and will have bottoms parallel with the masonry bed joints. Steel lintels shall be provided above openings over 300 mm (12 inches) wide for pipes, ducts, cable trays, and other wall penetrations, unless steel sleeves are used.**

**3.2.6 Jointing**

**Joints shall be tooled when the mortar is thumbprint hard. Horizontal joints shall be tooled last. Joints shall be brushed to remove all loose and excess mortar. Mortar joints shall be finished as follows:**

**3.2.6.1 Flush Joints**

**Joints in concealed masonry surfaces and joints at electrical outlet boxes in wet areas shall be flush cut. Flush cut joints shall be made by cutting off the mortar flush with the face of the wall. Joints in unparged masonry walls below grade shall be pointed tight. Flush joints for architectural units, such as fluted units, shall completely fill both the head and bed joints.**

3.2.6.2 Tooled Joints

Joints in exposed exterior and interior masonry surfaces shall be tooled slightly concave. Joints shall be tooled with a jointer slightly larger than the joint width so that complete contact is made along the edges of the unit. Tooling shall be performed so that the mortar is compressed and the joint surface is sealed.

3.2.6.3 Door and Window Frame Joints

On the exposed interior side of exterior frames, joints between frames and abutting masonry walls shall be raked to a depth of 10 mm. (3/8 inch). On the exterior side of exterior frames, joints between frames and abutting masonry walls shall be raked to a depth of 10 mm. (3/8 inch).

3.2.7 Joint Widths

Brick joint widths shall be the difference between the actual and nominal dimensions of the brick in either height or length. Brick expansion joint widths shall be as shown.

3.2.8 Embedded Items

Spaces around built-in items shall be filled with mortar. Openings around flush-mount electrical outlet boxes in wet locations shall be pointed with mortar. Anchors, ties, wall plugs, accessories, flashing, pipe sleeves and other items required to be built-in shall be embedded as the masonry work progresses. Anchors, ties and joint reinforcement shall be fully embedded in the mortar.

3.2.9 Unfinished Work

Unfinished work shall be stepped back for joining with new work. Toothing may be resorted to only when specifically approved. Loose mortar shall be removed and the exposed joints shall be thoroughly cleaned before laying new work.

3.2.10 Masonry Wall Intersections

Each course shall be masonry bonded at corners and elsewhere as shown. Masonry walls shall be anchored or tied together at corners and intersections with bond beam reinforcement and prefabricated corner or tee pieces of joint reinforcement as shown.

Partitions shall be continuous from floor to underside of floor or roof deck where shown. Openings in firewalls around joists or other structural members shall be filled as indicated or approved. Where suspended ceilings on both sides of partitions are indicated, the partitions other than those shown to be continuous may be stopped approximately 100 mm (4 inches) 4 inches above the ceiling level. An isolation joint shall be placed in the intersection between partitions and structural or exterior walls as shown. Partitions containing joint reinforcement shall be provided with prefabricated pieces at corners and intersections or partitions.

## 3.3 ANCHORED VENER CONSTRUCTION

The inner and outer wythes shall be completely separated by a continuous airspace as shown on the drawings. Both the inner and the outer wythes shall be laid up together except when adjustable joint reinforcement assemblies are approved for use. When both wythes are not brought up together, through-wall flashings shall be protected from the damage until they are fully enclosed in the wall. The airspace between the wythes shall be kept clear and free of mortar dropping by temporary wood strips laid on the wall ties and carefully lifted out before placing the next row of ties. A coarse gravel or drainage depth of 100 mm (4 inches) of coarse aggregate or 250 mm (10 inches) of drainage material to keep mortar from plugging the weep holes.

## 3.4 WEEP HOLES

Weep holes shall be provided not more than 600 mm (24 inches) on centers in mortar joints of the exterior wythes above wall flashing, over foundations, bond beams, and any other horizontal interruptions of the cavity. Weep holes shall be formed by placing short lengths of well-greased No. 10. 8 mm (5/16 in.) nominal diameter, braided cotton sash cord in the motar an withdrawing the cords after the wall has been completed. Other approved methods may be used for providing weep holes. Weep holes shall be kept free of mortar and other obstructions.

## 3.5 COMPOSITE WALLS

Masonry wythes shall be tied together with joint reinforcement or with unit wall ties. Facing shall be anchored to concrete backing with wire dovetail anchors set in slot built in the face of the concrete as specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. The facing wythe shall be anchored or tied to the backup at a maximum spacing of 400 mm (16 inches) on center vertically and 600 mm (24 inches) on center horizontally. Until ties shall be spaced not over 400 mm (16 inches) apart vertically, staggered in alternate course. Ties shall be laid not closer than 16 mm (5/8 inch) to either masonry face. Ties shall not extend through control joints. Collar joints between masonry facing and masonry backup shall be filled solidly with grout.

## 3.6 MORTAR

Mortar shall be mixed in a mechanically operated mortar for at least 3 minutes, but not more than 5 minutes. Measurement of ingredients for mortar shall be by volume. Ingredients not in containers, such as sand, shall be accurately measured by the use of measuring boxes. Water shall be mixed with the dry ingredients in sufficient amount to provide a workable mixture, which will adhere to the vertical surfaces of masonry units. Mortar that has stiffened because of loss of water through evaporation shall be retempered by adding water to restore the proper consistency and workability. Mortar that has reached its initial set or that has not been used within 2 1/12 hours after mixing shall be discharged.

## 3.7 JOINT REINFORCEMENT

Joint reinforcement shall be installed at 400 mm (16 inches) on center or as indicated. Reinforcement shall be lapped not less than 150 mm. (6 inches). Prefabricated sections shall be installed at corners and wall intersections. The longitudinal wires of joint reinforcement shall be placed to provide not less than 16-mm (5/8-inch) cover to either face of the unit.

## 3.8 BRICK EXPANSION JOINTS

Brick expansion joints shall be provided and constructed as shown on the drawings. Joints shall be kept free of mortar and other debris.

## 3.9 LINTELS

Steel lintels shall be as shown on the drawings. Lintels shall be set in a full bed of mortar with faces plumb and true. Steel lintels shall have a minimum bearing length of 200 mm (8 inches) unless otherwise indicated on the drawings.

## 3.10 SILLS AND COPINGS

Sills and copings shall be set in a full bed of mortar with faces plumb and true.

## 3.11 POINTING AND CLEANING

After mortar joints have attained their initial set, but prior to hardening, mortar and grout daubs or splashings shall be completely removed from masonry-unit surfaces that will be exposed or painted. Before completion of the work, defects in joints of masonry to be exposed or painted shall be raked out as necessary, filled with mortar, and tooled to match existing joints. Immediately after grout work is completed, scum and stains which have percolated through the masonry work shall be removed using a high pressure stream of water and a stiff bristled brush. Masonry surfaces shall not be cleaned, other than removing excess surface mortar, until mortar in joints has hardened. Masonry surfaces shall be left clean, free of mortar daubs, dirt, stain, and discoloration, including scum from cleaning operations, and with tight mortar joints throughout. Metal tools and metal brushes shall not be used for cleaning.

## 3.12 Clay or Shale Brick Surfaces

Exposed clay or shale brick masonry surfaces shall be cleaned as necessary to obtain surfaces free of stain, dirt, mortar and grout daubs, efflorescence, and discoloration or scum from cleaning operations. The exposed masonry surfaces shall be water-soaked and then cleaned with a solution proportioned 30 milliliters (1/2 cup) trisodium phosphate and 30 milliliters (1/2 cup) laundry detergent to 11 liters (one gallon) of water or cleaned with a proprietary masonry cleaning agent specifically recommended for the color and texture by the clay products manufacturer. The solution shall be applied with stiff fiber brushes, followed immediately by thorough rinsing with clean water. Proprietary cleaning

agents shall be used in conformance with the cleaning product manufacturer's printed recommendations. Efflorescence shall be removed in conformance with the brick manufacturer's recommendations.

## 3.13 PROTECTION

Facing materials shall be protected against staining. Top of walls shall be covered with nonstaining waterproof covering or membrane when work is not in progress. Covering of the top of the unfinished walls shall continue until the wall is waterproofed with a complete roof or parapet system. Covering shall extend a minimum of 600 mm (2 feet) down on each side of the wall and shall be held securely in place. Before starting or resuming, top surface of masonry in place shall be cleaned of loose mortar and foreign material.

-- End of Section 04200B --

DIVISION 5

METALS

SECTION 05400

COLD-FORMED METAL FRAMING

## PART 1 GENERAL

### 1.1 REFERENCES

The publications listed below are referenced and the most current publication applies. The publications are referred to in the text by the basic designation only.

#### 1.1.1 AMERICAN IRON AND STEEL INSTITUTE (AISI)

| | |
|---|---|
| AISI SG-673 | Cold-Formed Steel Design Manual |

#### 1.1.2 AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|---|---|
| ASTM A 446 | Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process |

#### 1.1.3 AMERICAN WELDING SOCIETY, INC. (AWS)

| | |
|---|---|
| AWS D1.3 | Structural Welding Code – Sheet Steel |

#### 1.1.4 FEDERAL SPECIFICATIONS (FS)

| | |
|---|---|
| FS TT-P-664 | Primer Coating, Alkyd, Corrosion-Inhibiting, Lead and Chromate Free, VOC-Compliant |

### 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

1.2.1 Manufacturer's Catalog Data "GA"

a. Studs

1.2.2 Drawings "GA"

a. Framing drawings

1.2.2.1 Drawing Requirements "GA"

Submit framing drawings to show sizes, thicknesses, layout, material designations, methods of installation, and accessories. Drawings shall be signed and sealed by a Professional Engineer licensed in the State of New York.

1.2.3 Design Data "GA"

a. Metal framing calculations

1.2.3.1 Data Required "GA"

Submit metal framing calculations to verify sizes, gages, and spacing of members and connections. Show methods and practices used in installation. Calculations shall be signed and sealed by a Professional Engineer licensed in the State of New York.

## 1.3 DELIVERY, STORAGE, AND HANDLING

Deliver materials to job site and store in adequately ventilated, dry locations. Storage area shall permit easy access for inspection and handling. If necessary to store materials outside, stack off the ground, support on a level platform, and protect from the weather as approved. Handle materials to prevent damage. Replace damaged items with new, as directed by the Contracting Officer.

## 1.4 LOAD-BEARING COLD-FORMED METAL FRAMING

Include top and bottom tracks, bracing, fastenings, and other accessories necessary for complete installation. Framing members shall have the structural properties indicated. Where physical structural properties are not indicated, they shall be as necessary to withstand all imposed loads. Design framing in accordance with AISI SG-673. Non-load-bearing metal framing, furring, and ceiling suspension systems are specified in Section 09250A, "Gypsum Wallboard."

## 1.5 MAXIMUM DEFLECTION

a. Exterior Studs:

| Deflection Criteria | Exterior Finish |
|---|---|
| L/240 or L/360 | Synthetic Plaster, Metal Panels |
| L/360 | Cement Plaster, Wood Veneer |
| L/600 | Brick Veneer, Stone Panels |

Wall deflections shall be computed on the basis that studs withstand all lateral forces independent of any composite action from sheathing materials. Studs abutting windows or louvers shall also be designed not to exceed 1/4 inch maximum deflection.

# PART 2 PRODUCTS

## 2.1 STUDS

2.1.1 Studs of 1.5 mm 16 Gage (0.0598 Inch) and Heavier

Galvanized steel, ASTM A 446

2.1.2 Studs of 1.2 mm 18 Gage (0.0478 Inch) and Lighter

Studs of 1.2 mm 18 Gage (0.0478 Inch) and Lighter, Track, and Accessories (All Gages): Galvanized steel, ASTM A 446.

2.1.3 Sizes, Gages, Section Modulus, and Other Structural Properties

Studs shall be stamped with manufacturer's name, initials, or logo, an ICBO number, material thickness and yield strength. Size and gage as indicated.

## 2.2 PAINT

Ungalvanized steel, if used, shall be thoroughly cleaned, phosphate treated, and coated with corrosion-inhibiting primer, FS TT-P-664.

## 2.3 PLASTIC GROMMETS

Supply plastic grommets, recommended by stud manufacturer, to protect electrical wires. Prevent metal to metal contact for plumbing pipes.

# PART 3 EXECUTION

## 3.1 FASTENING

Fasten framing members together by welding or by using self-drilling or self-tapping screws. Welding shall conform to AWS D1.3 welding procedure. Electrodes and screw connections shall be as required and indicated in the design calculations. Do not field weld materials lighter than 1.2 mm 18 gage.

## 3.2 TRACKS

Provide accurately aligned runners at top and bottom of partitions. Anchor tracks as indicated in design calculations. Butt weld joints in tracks or splice with stud inserts. Fasteners shall be at least 75 mm (3 inches) from the edge of concrete slabs.

## 3.3 STUDS

Cut studs square and set with firm bearing against webs of top and bottom tracks. Position studs vertically in tracks and space as indicated in design. Do not splice studs. Provide at least two studs at jambs of doors and other openings 600 mm (2 feet) wide or larger. Provide jack studs over openings, as necessary, to maintain indicated stud spacing. Provide tripled studs at corners, positioned to receive interior and exterior finishes. Fasten studs to top and bottom tracks by welding or screwing both flanges to the tracks. In curtain wall construction, provide for vertical movement where studs connect to the structural frame. Provide horizontal bracing in accordance with the design calculations and AISI SG-673, consisting of, as a minimum, runner channel cut to fit between and welded to the studs or hot- or cold-

rolled steel channels inserted through cutouts in web of each stud and secured to studs with welded clip angles. Bracing shall be not less than the following:

| LOAD | HEIGHT | BRACING |
|---|---|---|
| Wind load only | Up to 3000 mm | One row at mid-height |
| | Over 3000 mm | Rows 1500 mm o.c. maximum |
| Axial load | Up to 3000 mm | Two rows at 1/3 points |
| | Over 3000 mm | Rows 900 mm o.c. maximum |

| LOAD | HEIGHT | BRACING |
|---|---|---|
| Wind load only | Up to 10 feet | One row at mid-height |
| | Over 10 feet | Rows 5'-0" o.c. maximum |
| Axial load | Up to 10 feet | Two rows at 1/3 points |
| | Over 10 feet | Rows 3'-4" o.c. maximum |

## 3.4 ERECTION TOLERANCES

a. Framing members which will be covered by finishes such as wallboard, plaster, or ceramic tile set in a mortar setting bed, shall be within the following limits:

(1) Layout of walls and partitions: 6 mm (1/4 inch) from intended position;

(2) Plates and runners: 6 mm in 2400 mm (1/4 inch in 8 feet) from a straight line;

(3) Studs: 6 mm in 2400 mm (1/4 inch in 8 feet) out of plumb, not cumulative; and

(4) Face of framing members: 6 mm in 2400 mm (1/4 inch in 8 feet) from a true plane.

-- End of Section 05400--

DIVISION 6

WOOD AND PLASTICS

SECTION 06100A

# ROUGH CARPENTRY, ORIENTED STRAND BOARD AND PREFABICATED ROOF TRUSSES

## PART 1 GENERAL

### 1.1 REFERENCES

The publications listed below are referenced and the most current publication applies. The publications are referred to in the text by basic designation only.

| | |
|---|---|
| 1.1.1 | AMERICAN PLYWOOD ASSOCIATION (APA) |
| APA E445 | Performance Standards and Policies for Structural-Use Panels |
| APA N-211 | Standards for Wall Bracing |
| 1.1.2 | DEPARTMENT OF COMMERCE (DOC) |
| DOC PS 1 | Construction and Industrial Plywood |
| 1.1.3 | NORTHEASTERN LUMBER MANUFACTURERS ASSOCIATION (NELMA) |
| NELMA-01 | Standard Grading Rules for Northeastern Lumber |
| 1.1.4 | SOUTHERN PINE INSPECTION BUREAU (SPIB) |
| SPIB-1001 | Standard Grading Rules for Southern Pine Lumber |
| 1.1.5 | Truss Plate Institute |
| QST-88 | Quality Standards for Metal Plates Connected Wood Trusses |

### 1.2 DELIVERY AND STORAGE

Materials shall be delivered to the site in undamaged condition, stored off ground in fully covered, well ventilated areas, and protected from extreme changes in temperature and humidity.

## 1.3 SUBMITTALS

Government approval is required for submittals with a “GA” designation, submittals having an “FIO” designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

### 1.3.1 Shop Drawings “GA”

Details drawings and structural calculations for the prefabricated roof trusses signed and sealed by a professional engineer licensed in the state of New York.

# PART 2 PRODUCTS

## 2.1 LUMBER AND SHEATHING

### 2.1.1 Grading and Marking

Materials shall bear the grademark, stamp or other identifying marks indicating grades of material and rules or standard under which produced.

### 2.1.2 Sizes

Sizes shall conform to requirements of the rules or standards under which produced. Unless otherwise specified, lumber shall be surfaced on four sides. Size references, unless otherwise specified, are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the standard under which the product is produced.

### 2.1.3 Treatment

Items requiring treatment shall be as shown.

#### 2.1.3.1 Lumber and Timbers

Lumber and timbers shall be treated with waterborne preservatives to a retention level as follows:

a. 4 kg per cubic meter (0.25 pcf) intended for above ground use.

b. 6.4 kg per cubic meter (0.40 pcf) intended for ground contact and fresh water use.

#### 2.1.3.2 Plywood

a. Plywood for roof decking and wall panels shall be stamped with the APA seal as rated structural 1 sheathing. Exposure 1, 5/8” minimum thickness, and span rating for 40 pounds per sq. ft. shall be visible.

b. Plywood shall be treated with waterborne preservatives to a retention level as follows:

1. 4 kg per cubic meter (0.25 pcf) intended for above ground use.

2. 6.4 kg per cubic meter (0.40 pcf) intended for ground contact and fresh water use.

2.1.3.3 Oriented Strand Board

a. Oriented Strand Board for roof decking and shear wall shall be stamped with APA seal as rated structural 1 sheathing, exposure 1. Thickness as shown on plans, 5/8" minimum and span rating shall be visible for 40 pounds per sq.ft. of live load.

b. OSB Sheathing shall conform to the National Evaluation report NER-108 and the APA Performance rated Standard…

2.1.3.4 Prefabricated Roof Trusses

The prefabricated roof trusses shall be designed by the fabricator according to industry standards and for the loading and conditions indicated in the contract documents.

2.1.4 Subflooring

2.1.4.1 Wood

Species and grade shall be in accordance with TABLE I at the end of this section, 25 mm (1 inch) thick, center-matched, shiplapped, or square edge.

2.1.5 Miscellaneous Wood Members

Members shall include bridging, corner bracing, furring, grounds, and nailing strips. Members shall be in accordance with TABLE I for the species used. Sizes shall be as follows unless otherwise shown:

TABLE I

| Member | Size (inch) |
|---|---|
| Furring | 1 by 3. |
| Grounds | Plaster thickness by 1-1/2. |
| Nailing strips | 1 by 3 when used as shingle base or interior finish, otherwise 2 inch stock. |

## 2.2 ACCESSORIES AND NAILS

Accessories and nails shall be the type, size, and finish best suited for intended use unless indicated otherwise.

# PART 3 EXECUTION

## 3.1 INSTALLATION OF MISCELLANEOUS WOOD MEMBERS

### 3.1.1 Sheathing OSB or Plywood

a. Roof Decking OSB or Plywood shall be installed conforming to the manufacturer's standards structural diagrams and shear walls. Fastening shall visibly relate to the recommended spacing and rated shear capacities in manufacturer's literature.

### 3.1.2 Roof Truss Installation

Erector shall have specialized experience in the erection of prefabrication roof trusses for a period at least 3 years and shall be certified. Trusses must be securely braced and anchored both during election and after permanent installation in accordance with the "Commentary and Recommendations for Handling, Installing and Bracing Metal Plate Connected Woods Trusses (HIB-91) as published by the Truss Plate Institute.

### 3.1.3 Wood Grounds

Wood grounds shall be provided as necessary for attachment of trim, finish, and other work to plaster. Grounds shall be run in lengths as long as practicable, butt jointed, and rigidly secured in place.

### 3.1.4 Furring Strips

Furring strips shall be provided at the locations shown. Furring strips shall be installed at 400 mm (16 inches) on center unless otherwise shown, run in lengths as long as practicable, butt jointed and rigidly secured in place.

-- END OF SECTION 06100A --

DIVISION 6

WOOD AND PLASTICS

SECTION 06200

FINISH CARPENTRY

## PART 1 GENERAL

### 1.1 REFERENCES

The publications listed below are referenced and the most current publication applies. The publications are referred to in the text by basic designation only.

| | |
|---|---|
| 1.1.1 | AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) |
| ASTM D 1435 | Outdoor Weathering of Plastics |
| ASTM F 547 | Definitions of Terms Relating to Nails for Use with Wood and Wood-Base Materials |
| 1.1.2 | AMERICAN WOOD-PRESERVERS' ASSOCIATION (AWPA) |
| AWPA C9 | Plywood - Preservative Treatment by Pressure Processes |
| AWPA M4 | Standard for the Care of Preservative-Treated Wood Products |
| AWPA P5 | Standards for Waterborne Preservatives |
| 1.1.3 | DEPARTMENT OF COMMERCE (DOC) |
| DOC PS 1 | Voluntary Product Standard - Construction and Industrial Plywood |
| DOC PS 2 | Performance Standard for Wood-based Structural-Use Panels |
| 1.1.4 | SOUTHERN PINE INSPECTION BUREAU (SPIB) |
| SPIB-1001 | Standard Grading Rules for Southern Pine Lumber |
| 1.1.5 | WOOD MOULDING AND MILLWORK PRODUCERS ASSOCIATION (WMMPA) |
| WMMPA WM 6 | Industry Standard for Non-Pressure Treating of Wood Millwork |

### 1.2 SUBMITTALS

1.3.1 Shop Drawings

Details drawings and structural calculations for the prefabricated roof trusses signed and sealed by a professional engineer licensed in the state of New York.

PART 2 PRODUCTS

2.1 LUMBER AND SHEATHING

2.1.1 Grading and Marking

Materials shall bear the grademark, stamp or other identifying marks indicating grades of material and rules or standard under which produced.

2.1.2 Sizes

Sizes shall conform to requirements of the rules or standards under which produced. Unless otherwise specified, lumber shall be surfaced on four sides. Size references, unless otherwise specified, are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the standard under which the product is produced.

1.2.1 Data "GA"

Wood Items, Siding, and Trim;

Manufacturer's printed data indicating the usage of engineered or recycled wood products, and environmentally safe preservatives.

1.2.2 Drawings "GA"

Finish Carpentry; "GA"

Drawings showing fabricated items and special mill and woodwork items. Drawings shall indicate materials and details of construction, methods of fastening, erection, and installation.

1.2.3 Samples

Siding;. Moldings;. Fascias and Trim;.

Samples shall be of sufficient size to show patterns, color ranges, and types, as applicable, of the material proposed to be used.

1.3 DELIVERY AND STORAGE

Materials shall be delivered to the site in undamaged condition, stored off ground in fully covered, well-ventilated areas, and protected from extreme changes in temperature and humidity.

## PART 2 PRODUCTS

### 2.1 WOOD ITEMS, SIDING, AND TRIM

The Contractor shall furnish products which optimize design by reducing the amount of wood used (engineered wood), or recycled wood products, and preservatives without arsenic or chromium when the products and methods are competitive in price or directed by the Contracting Officer.

#### 2.1.1 Grading and Marking

Materials shall bear the grademark, stamp or other identifying marks indicating grades of material and rules or standards under which produced. Such identifying marks on a material shall be in accordance with the rule or standard under which the material is produced, including requirements for qualifications and authority of the inspection organization, usage of authorized identification, and information included in the identification. The inspection agency for lumber shall be certified by the Board of Review, American Lumber Standards Committee, to grade the species used. Except for plywood, structural-use panels, and lumber, bundle marking will be permitted in lieu of marking each individual piece. Surfaces that are to be architecturally exposed to view shall not bear grademarks, stamps, or other types of identifying marks.

#### 2.1.2 Sizes and Patterns

Lumber sizes and patterns shall conform to rules or standards under which produced. Unless otherwise specified, lumber shall be surfaced on four sides. Sizes and patterns for materials other than lumber shall conform to requirements of the rules or standards under which produced. Size references, unless otherwise specified, are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the standard under which the product is produced.

#### 2.1.3 Moisture Content

The maximum moisture content of untreated trim and wood siding shall be 15 percent at the time of delivery to the jobsite and when installed. Moisture content of all other material shall be in accordance with the standard under which the product is produced.

#### 2.1.4 Preservative Treatment

##### 2.1.4.1 Plywood

Plywood shall be treated in accordance with AWPA C9 with waterborne preservatives listed in AWPA P5 to a retention level as follows:

a. 4 kg per cubic meter (0.25 pcf) (0.25 pcf) intended for above ground use.

b. 6.4 kg per cubic meter (0.4 pcf) (0.4 pcf) intended for ground contact and fresh water use.

2.1.4.2 Exterior Wood Molding and Millwork

Exterior wood molding and millwork within 455 mm (18 inches) of soil, in contact with water or concrete shall be preservative-treated in accordance with WMMPA WM 6. Exposed areas of treated wood that are cut or drilled after treatment shall receive a field treatment in accordance with AWPA M4. Items of all-heart material of cedar, cypress, or redwood will not require preservative treatment, except when in direct contact with soil.

2.1.5 Siding

Horizontal siding shall be wood.

2.1.5.1 Horizontal Wood Siding

Wood siding shall be Western Cedar, grade Clear A with vertical grain. Siding shall be horizontal bevel type, nominal 12mm (1/2 inch thick), 200 mm (8 inches) wide, maximum practical lengths, smooth face. Wood siding shall be prestained 2 coats 100% acrylic solid, color shall be selected by owner’s designated representative.

2.1.6 Soffits

2.1.6.1 Plywood

Plywood soffits shall be plywood, DOC PS 1, exterior type, Grade A-C rated siding, 9 mm (11/32 inch) thick for 600 mm (24 inch) on centers maximum span with all edges supported.

2.1.7 Fascias and Trim

2.1.7.1 Wood

Fascias and trim, including exterior door and window casing, shall be species and grade listed in TABLE I at the end of this section. Sizes shall be as indicated.

2.1.8 Moldings

Moldings shall be of the pattern indicated and shall be of a grade compatible with the finish specified.

2.1.9 Woodwork Items

2.1.10 Utility Shelving

Utility shelving shall be a suitable species equal to or exceeding requirements of plywood, interior type, Grade A-B, 13 mm (1/2 inch) thick, any species group.

## 2.2 NAILS

Nails shall be the size and type best suited for the purpose and shall conform to ASTM F 547. Nails shall be hot-dip galvanized or aluminum when used on exterior work. For siding, length of nails shall be sufficient to extend 40 mm (1-1/2 inches) into supports, including wood sheathing over framing. Screws for use where nailing is impractical shall be size best suited for purpose.

# PART 3 EXECUTION

## 3.1 GENERAL

### 3.1.1 Installation of Siding

Siding shall be accurately fitted and positioned without springing or otherwise forcing siding in place. Siding to have a paint finish shall have nails driven flush.

### 3.1.2 Horizontal Siding

End joints shall be made over framing members and be so alternated that at least two boards will be between joints on the same support. Shorter pieces shall be uniformly distributed throughout each area. Starter strips shall be provided as necessary to establish proper slant for siding. Ends of siding shall be predrilled if necessary to prevent splitting when
nailed. Horizontal bevel siding shall be overlapped and nailed into each support in accordance with approved recommendations of the siding manufacturer.

## 3.2 SOFFITS

### 3.2.1 Wood

Panels shall be applied with edges at joints spaced in accordance with manufacturer's instructions and with all edges backed with framing members. Panels shall be nailed 10 mm (3/8 inch) from edges at 150 mm (6 inches) on center and at intermediate supports at 300 mm (12 inches) on center. Panels shall be installed using the maximum practical lengths.

## 3.3 FASCIAS AND EXTERIOR TRIM

Exposed surfaces and square edges shall be machine sanded, caulked, and constructed to exclude water. Joints of built-up items, in addition to nailing, shall be glued as necessary for weather-resistant construction. End joints in built-up members shall be well distributed. Joints in flat work shall be shouldered. Backs of wide-faced miters shall be held together with metal rings and glue. Fascias and other flat members shall be in maximum practicable lengths. Cornices shall be braced, blocked, and rigidly anchored for support and protection of vertical joints.

## 3.4 MOLDING AND INTERIOR TRIM

Molding and interior trim shall be installed straight, plumb, level and with closely fitted joints. Exposed surfaces shall be machine sanded at the mill. Molded work shall be coped at returns and interior angles and mitered at external corners. Intersections of flatwork shall be shouldered to ease any inherent changes in plane. Window and door trim shall be provided in single lengths. Blind nailing shall be used to the extent practicable, and face nailing shall be set and stopped with a nonstaining putty to match the finish applied. Screws shall be used for attachment to metal; setting and stopping of screws shall be of the same quality as required where nails are used.

## 3.5 WOODWORK ITEMS

### 3.5.1 Shelving

Shelving shall be anchored to supporting construction. Unless otherwise indicated, shelves shall be supported by wall-supported brackets not more than 600 mm (24 inches) on center or as required to limit deflection to 6 mm (1/4 inch) between supports with a load of 525 N per meter. (35 lb per lineal foot.) Adjustable shelf hardware shall be steel standards, channel shaped, with 25 mm (1 inch) adjustment slots and brackets designed for attachment to standards.

Table I. SPECIES AND GRADE TABLES

| Grading Rules | Species | Choice | Clear | C Sheet | C and Better |
|---|---|---|---|---|---|
| NELMA-01 | Eastern cedar | | X | | |
| | Eastern Hemlock | | X | | |
| | Taramack | | | | X |
| | Eastern W. Pine | | | | X |
| | Northern Pine | | | X | X |
| | Eastern Spruce | | X | | |
| | Balsam Fir | | | | |
| SCMA-01 | Cyrpess | | | X | |
| SPIB-1001 | Southern Pine | | | | X |

NOTE 1: Except as specified in NOTE 2 below, exterior trim shall be any of the species listed above. Interior trim shall be any one of the species listed above and the highest grade of the species for stain or natural finish and one grade below highest grade of species for paint finish.

NOTE 2: Southern Yellow Pine and Tamarack shall not be used where painting is required and may be used on exterior work only when approved and stained with a preservative type stain.

-- End of Section 06200 --

DIVISION 7

THERMAL AND MOISTURE PROTECTION

SECTION 07212

MINERAL FIBER BLANKET INSULATION

## PART 1 GENERAL

### 1.1 REFERENCES

The publications listed below are referenced and the most current publication applies. The publications are referred to in the text by the basic designation only.

| | |
|---|---|
| 1.1.1 | AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) |
| ASTM C 665. | Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing |
| ASTM C 930. | Potential Health and Safety Concerns Associated with Thermal Insulation Materials and Accessories |
| ASTM D 3833. | Water Vapor Transmission of Pressure-Sensitive Tapes |
| ASTM E 84. | Surface Burning Characteristics of Building Materials |
| ASTM E 96. | Water Vapor Transmission of Materials |
| ASTM E 136 | Behavior of Materials in a Vertical Tube Furnace at 750 Degrees C |
| 1.1.2 | CODE OF FEDERAL REGULATIONS (CFR) |
| 29 CFR 1910.134 | Respiratory Protection |
| 1.1.3 | NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) |
| NFPA 54 | National Fuel Gas Code |
| NFPA 70 | National Electrical Code |
| NFPA 211 | Chimneys, Fireplaces, Vents, and Solid Fuel Burning Appliances |

### 1.2 SUBMITTALS

Government approval is required for submittals with a “GA” designation, submittals having an “FIO” designation are for information only. The following shall be submitted in accordance with section 01330 "Submittal Procedures."

1.2.1 Manufacturer's Catalog Data "GA"

a. Blanket insulation

b. Sill sealer insulation

c. Vapor retarder

d. Pressure sensitive tape

e. Accessories

1.2.2 Instructions "FIO"

a. Blanket Insulation

## 1.3 DELIVERY, STORAGE, AND HANDLING

### 1.3.1 Delivery

Deliver materials to site in original sealed wrapping bearing manufacturer's name and brand designation, specification number, type, grade, R-value, and class. Store and handle to protect from damage. Do not allow insulation materials to become wet, soiled, crushed, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storing, and protecting of materials before and during installation.

### 1.3.2 Storage

Inspect materials delivered to the site for damage; unload and store out of weather in manufacturer's original packaging. Store only in dry locations, not subject to open flames or sparks, and easily accessible for inspection and handling.

## 1.4 SAFETY PRECAUTIONS

### 1.4.1 Respirators

Provide installers with dust/mist respirators, training in their use, and protective clothing, all approved by National Institute for Occupational Safety and Health (NIOSH)/Mine Safety and Health Administration (MSHA) in accordance with 29 CFR 1910.134.

### 1.4.2 Smoking

Do not smoke during installation of blanket thermal insulation.

### 1.4.3 Other Safety Concerns

Consider other safety concerns and measures as outlined in ASTM C 930.

## PART 2 PRODUCTS

### 2.1 BLANKET INSULATION

ASTM C 665, Type II, blankets with non-reflecting coverings Class A, membrane-faced surface with a flame spread of 25 or less and a smoke developed rating of 150 or less when tested in accordance with ASTM E 84.

#### 2.1.1 Thermal Resistance Value (R-VALUE)

As indicated on contract documents.

#### 2.1.2 Recycled Materials

Provide Thermal Insulation containing recycled materials to the extent practicable, provided the material meets all other requirements of this section. The minimum required recycled materials content by weight are:

Fiberglass: 20 to 25 percent glass cullet.

#### 2.1.3 Prohibited Materials

Do not provide asbestos-containing materials.

### 2.2 SILL SEALER INSULATION

ASTM C 665, Type I.

### 2.3 BLOCKING

Wood, metal, unfaced mineral fiber blankets in accordance with ASTM C 665, Type I, or other approved materials. Use only non-combustible materials meeting the requirements of ASTM E 136 for blocking around chimneys and heat producing devices.

### 2.4 VAPOR RETARDER

Membrane with the following properties:

Water Vapor Permeance: ASTM E 96: [5.72 x 10-8] g/Pa.s.m2 (1 perm)
Maximum Flame Spread: ASTM E 84: 25

### 2.5 PRESSURE SENSITIVE TAPE

As recommended by the vapor retarder manufacturer and having a water vapor permeance rating of 5.72 x 10-8 g/Pa.s.m2 (one perm) or less when tested in accordance with ASTM D 3833.

### 2.6 ACCESSORIES

2.6.1 Adhesive

As recommended by the insulation manufacturer.

2.6.2 Mechanical Fasteners

Corrosion resistant fasteners as recommended by the insulation manufacturer.

## PART 3 EXECUTION

### 3.1 EXISTING CONDITIONS

Before installing insulation, ensure that areas that will be in contact with the insulation are dry and free of projections which could cause voids, compressed insulation, or punctured vapor retarders. If moisture or other conditions are found that do not allow the workmanlike installation of the insulation, do not proceed but notify Contracting Officer of such conditions.

### 3.2 PREPARATION

3.2.1 Blocking at Attic Vents and Access Doors

Prior to installation of insulation, install permanent blocking to prevent insulation from slipping over, clogging, or restricting air flow through soffit vents at eaves. Install permanent blocking to maintain accessibility to equipment or controls that require maintenance or adjustment.

3.2.2 Blocking Around Heat Producing Devices

Install non-combustible blocking around heat producing devices to provide the following clearances:

a. Recessed lighting fixtures, including wiring compartments, ballasts, and other heat producing devices, unless these are certified by the manufacturer for installation surrounded by insulation: 75 mm (3 inches) from outside face of fixtures and devices or as required by NFPA 70 and, if insulation is to be placed above fixture or device, 600 mm (24 inches) above fixture.

b. Vents and vent connectors used for venting the products of combustion, flues, and chimneys other than masonry chimneys: Minimum clearances as required by NFPA 211.

c. Gas Fired Appliances: Clearances as required in NFPA 54. Blocking around flues and chimneys is not required when insulation blanket, including any attached vapor retarder, passed ASTM E 136, in addition to meeting all other requirements stipulated in Part 2. Blocking is also not required if the chimneys are certified by the manufacturer for use in contact with insulating materials.

## 3.3 INSTALLATION

### 3.3.1 Blanket Insulation

Install and handle insulation in accordance with manufacturer's Instructions. Keep material dry and free of extraneous materials. Ensure personal protective clothing and respiratory equipment is used as required. Observe safe work practices.

#### 3.3.1.1 Electrical wiring

Do not install insulation in a manner that would sandwich electrical wiring between two layers of insulation.

#### 3.3.1.2 Continuity of Insulation

Install blanket insulation to butt tightly against adjoining blankets and to studs, rafters, joists, sill plates, headers and any obstructions. Provide continuity and integrity of insulation at corners, wall to ceiling joints, roof, and floor. Avoid creating thermal bridges.

#### 3.3.1.3 Installation at Bridging and Cross Bracing

Insulate at bridging and cross bracing by splitting blanket vertically at center and packing one half into each opening. Butt insulation at bridging and cross bracing; fill in bridged area with loose or scrap insulation.

#### 3.3.1.4 Cold Climate Requirement

Place insulation to the outside of pipes.

#### 3.3.1.5 Insulation Blanket with Affixed Vapor Retarder

Locate vapor retarder as indicated. Do not install blankets with affixed vapor retarders unless so specified. Unless the insulation manufacturer's instructions specifically recommend not to staple the flanges of the vapor retarder facing, staple flanges of vapor retarder at 150 mm (6 inch) intervals flush with face or set in the side of truss, joist, or stud. Avoid gaps and bulges in insulation and "fishmouth" in vapor retarders. Overlap both flanges when using face method. Seal joints and edges of vapor retarder with pressure sensitive tape. Stuff pieces of insulation into small cracks between trusses, joists, studs and other framing, such as at attic access doors, door and window heads, jambs, and sills, band joists, and headers. Cover these insulated cracks with vapor retarder material and tape all joints with pressure sensitive tape to provide air and vapor tightness.

#### 3.3.1.6 Sizing of Blankets

Provide only full width blankets when insulating between trusses, joists, or studs. Size width of blankets for a snug fit where trusses, joists or studs are irregularly spaced.

3.3.1.7 Special Requirements for Ceilings

Place insulation under electrical wiring occurring across joists. Pack insulation into narrowly spaced framing. Do not block flow of air through soffit vents.

3.3.1.8 Installation of Sill Sealer

Size sill sealer insulation and place insulation over top of masonry or concrete perimeter walls or concrete perimeter floor slab on grade. Fasten sill plate over insulation.

3.3.1.9 Special Requirements for Floors

Hold insulation in place with corrosion resistant wire mesh, wire fasteners, or wire lacing.

3.3.1.10 Access Panels and Doors

Affix blanket insulation to access panels greater than one square foot and access doors in insulated floors and ceilings. Use insulation with same R-Value as that for floor or ceiling.

- - End of Section 07212 - -

DIVISION 7

THERMAL AND MOISTURE PROTECTION

SECTION 07270

FIRESTOPPING

## PART 1 GENERAL

### 1.1 REFERENCES

The publications listed below are referenced and the most current publication applies. The publications are referred to in the text by basic designation only.

| | |
|---|---|
| 1.1.1 | AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) |
| ASTM E 84 | Surface Burning Characteristics of Building Materials |
| ASTM E 814 | Fire Tests of Through-Penetration Fire Stops |
| 1.1.2 | UNDERWRITERS LABORATORIES (UL) |
| UL-05 | Fire Resistance Directory |
| UL 723 | Test for Surface Burning Characteristics of Building Materials |
| UL 1479 | Fire Tests of Through-Penetration Firestops |

### 1.2 SUBMITTALS

Government approval is required for submittals with a “GA” designation, submittals having an “FIO” designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

1.2.1 Drawings “GA”

Firestopping Materials.

Detail drawings including manufacturer's descriptive data, typical details, installation instructions and the fire-test data and/or report as appropriate for the fire resistance rated construction and location. Submittal shall indicate the firestopping material to be provided for each type of application. When more than 5 penetrations are to receive firestopping, drawings shall indicate location and type of application.

1.2.2 Certificates "GA"

Firestopping Materials.

Certificates attesting that firestopping material complies with the specified requirements. The label or listing of the Underwriters Laboratories will be acceptable evidence. In lieu of the label or listing, a written certificate may be submitted from an approved, nationally recognized testing agency equipped to perform such services, stating that the items have been tested and conform to the specified requirements and testing methods.

Installer Qualifications. "GA"

Manufacturer's certification stating that each installer is qualified and trained to install the specified firestopping material.

Inspection.

Manufacturer's representative certification stating that firestopping work has been inspected and found to be applied according to the manufacturer's recommendations and the specified requirements.

## 1.3 GENERAL REQUIREMENTS

Firestopping shall consist of furnishing and installing a material or a combination of materials to form an effective barrier against the spread of flame, smoke and gases, and maintain the integrity of fire resistance rated walls, partitions, floors, and ceiling-floor assemblies, including through-penetrations and construction joints. Through-penetrations include the annular space around pipes, tubes, conduit, wires, cables and vents. Construction joints include those used to accommodate expansion, contraction, wind, or seismic movement; firestopping material shall not interfere with the required movement of the joint.

## 1.4 STORAGE AND DELIVERY

Materials shall be delivered in the original unopened packages or containers showing name of the manufacturer and the brand name. Materials shall be stored off the ground and shall be protected from damage and exposure to elements. Damaged or deteriorated materials shall be removed from the site.

## 1.5 INSPECTION

A representative of the manufacturer shall be on the site during the initial firestopping applications and periodically during the application period to ensure that preparations are adequate, that surfaces are clean and suitable for application, and that materials are applied according to the manufacturer's recommendations and the contract requirements.

## 1.6 INSTALLER QUALIFICATIONS

Each installer of firestopping material shall be trained and have a minimum of 3 years experience in the installation of firestopping of the type specified.

# PART 2 PRODUCTS

## 2.1 FIRESTOPPING MATERIALS

Firestopping materials shall consist of commercially manufactured products complying with the following minimum requirements:

### 2.1.1 Fire Hazard Classification

Material shall have a flame spread of 25 or less, and a smoke developed rating of 50 or less, when tested in accordance with ASTM E 84 or UL 723. Material shall be an approved firestopping material as listed in UL-05.

### 2.1.2 Toxicity

Material shall be nontoxic to humans at all stages of application.

### 2.1.3 Fire Resistance Rating

Firestopping will not be required to have a greater fire resistance rating than that of the assembly in which it is being placed.

#### 2.1.3.1 Through-Penetrations

Firestopping materials for through-penetrations, as described in paragraph GENERAL REQUIREMENTS, shall provide "F" and "T" fire resistance ratings in accordance with ASTM E 814 or UL 1479, except that T Ratings are not required for penetrations smaller than or equal to a 100 mm (4 inch) nominal pipe or 0.01 square meter (16 square inches) in overall cross sectional area. Fire resistance ratings shall be the following:

a. Penetrations of Fire Resistance Rated Walls and Partitions: F Rating = 2 hours, T Rating = 1 hour.

b. Penetrations of Fire Resistance Rated Floors and Ceiling-Floor Assemblies; F Rating = 1 hour, T Rating = 1 hour.

#### 2.1.3.2 Construction Joints and Gaps

Fire resistance ratings of construction joints, as described in paragraph GENERAL REQUIREMENTS, and gaps such as those between floor slabs or roof decks and curtain walls shall be as follows: construction joints in walls, 2 hours; gaps between floor slabs and curtain walls, 1 hour; gaps between top of the walls and the bottom or roof decks, 2 hours.

## PART 3 EXECUTION

### 3.1 PREPARATION

Areas to receive firestopping shall be free of dirt, grease, oil, or loose materials which may affect the fitting or fire resistance of the firestopping system.

### 3.2 INSTALLATION

Firestopping material shall completely fill void spaces regardless of geometric configuration, subject to tolerance established by the manufacturer. Firestopping for filling floor voids 100 mm (4 inches) or more in any direction shall be capable of supporting the same load as the floor is designed to support or shall be protected by a permanent barrier to prevent loading or traffic in the firestopped area. Firestopping shall be installed in accordance with manufacturer's written instructions. Firestopping shall be provided in the following locations, except in floor slabs on grade:

a. Penetrations of duct, conduit, tubing, cable and pipe through floors and through fire-resistance rated walls, partitions, and ceiling-floor assemblies.

b. Penetrations of vertical shafts such as pipe chases, elevator shafts, and utility chutes.

c. Gaps at the intersection of floor slabs and curtain walls, including inside of hollow curtain walls at the floor slab.

d. Gaps at perimeter of fire-resistance rated walls and partitions, such as between the top of the walls and the bottom of roof decks.

e. Construction joints in floors and fire rated walls and partitions.

f. Other locations where required to maintain fire resistance rating of the construction.

### 3.3 INSPECTION

Firestopped areas shall not be covered or enclosed until inspection is complete and approved. A manufacturer's representative shall inspect the applications initially and periodically during the work to assure that the completed work has been accomplished according to the manufacturer's written instructions and the specified requirements.

-- END OF SECTION 07270 --

DIVISION 7

THERMAL AND MOISTURE PROTECTION

SECTION 07311

ROOFING, STRIP SHINGLES

## PART 1 GENERAL

### 1.1 REFERENCES

The publications listed below are referenced and the most current publication applies. The publications are referred to in the text by basic designation only.

#### 1.1.1 AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|---|---|
| ASTM D 226 | Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing |
| ASTM D 1970 | Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection |
| ASTM D 3018 | Class A Asphalt Shingles Surfaced With Mineral Granules |
| ASTM D 3161 | Wind-Resistance of Asphalt Shingles (Fan-Induced Method) |
| ASTM D 3462 | Asphalt Shingles Made From Glass Felt and Surfaced with Mineral Granules |
| ASTM E 108 | Fire Tests of Roof Coverings |

### 1.2 SUBMITTALS

Government approval is required for submittals with a “GA” designation, submittals having an “FIO” designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

#### 1.2.1 Data “GA”

Roofing System

Manufacturer's catalog data, description of underlayment, shingles, fasteners, and flashing. Manufacturer's instructions, annotated or supplemented by the Contractor to indicate configuration and method for installing the underlayment, shingles, and flashing, and for waterproofing of joints where flashings change direction. The number, spacing and orientation of fasteners shall be specified.

1.2.2 Samples "GA"

Finishes

Samples of materials and products requiring color or finish selection.

## 1.3 DELIVERY AND STORAGE OF MATERIALS

Materials shall be delivered in manufacturer's unopened bundles and containers with the manufacturer's brand and name marked clearly thereon. Shingles shall be stored in accordance with manufacturer's printed instructions. Roll goods shall be stored on end in an upright position. Immediately before laying, roofing felt shall be stored for 24 hours in an area maintained at a temperature not lower than 10 degrees C. (50 degrees F.).

## 1.4 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period shall be provided. Shingles shall be warranted to a 25 years period.

# PART 2 PRODUCTS

## 2.1 MATERIALS

Materials shall conform to the following requirements:

2.1.1 Metal Drip Edges

Metal drip edges shall be minimum 0.47 mm (28 gauge)galvanized steel or an equivalent non-corrosive non-staining material.

2.1.2 Underlayment

Organic felt; ASTM D 226, Type I. Modified bitumen; ASTM D 1970.

2.1.3 Nails

In accordance with shingle manufacturer's printed instructions.

2.1.4 Ridge Vents

Ridge vents shall be continuous low profile residential type with integral insect screening material. Ridge vents shall be fully compatible with selected shingles.

2.1.5 Shingles

Shingles shall be approximately 300 by 900 mm (12 by 36 inches) in dimension and dimensional or "slate line" design. Shingles shall have self-sealing adhesive strips and shall meet a wind velocity rating of 100 km/h (60 mph) plus or minus 5 percent in accordance with ASTM D 3161. Shingles shall be fungus resistant. Glass felt

shingles shall comply with ASTM D 3018 and ASTM D 3462 Type I, Class A and shall weigh not less than 102 kg (225 lbs.).

## 2.2 COLOR

The Government's designated representative shall select shingle color from the manufacturer's standard colors.

# PART 3 EXECUTION

## 3.1 PREPARATION OF SURFACES

The construction of any bay or section of roof decking shall be completed before roofing work is started. Roof surfaces shall be smooth, firm, dry, and free from loose boards, large cracks, and projecting ends that might damage the roofing. Vents and other projections through roofs shall be properly flashed and secured in position, and projecting nails shall be driven firmly home.

## 3.2 APPLICATION OF ROOFING

### 3.2.1 Flashings

Metal flashings shall conform to Section 07600 SHEET METALWORK, GENERAL. Metal flashings shall be provided at the intersections of roofs and adjoining walls and at projections through the deck such as chimneys and vent stacks. Valley flashing may be of the open, closed cut, or woven type.

### 3.2.2 Metal Drip Edges

Metal drip edges shall be provided along the eaves and rakes. The metal drip edge shall be applied directly over the underlayment along the rakes and directly on the wood deck at the eaves. Metal drip edges shall extend back from the edge of the deck not less than 75 mm (3 inches) and shall be secured with compatible nails spaced not more than 250 mm (10 inches) on center along the inner edge.

### 3.2.3 Underlayment

Before any shingles are applied, a single layer of asphalt-saturated-felt underlayment shall be applied to the roof deck sheathing. In areas subject to ice damming, a self adhering modified bitumen membrane underlayment shall be applied starting from the eaves to a point 600 mm (24 inches) inside the inside wall line.

### 3.2.4 Ridge Vents

Ridge Vents shall be applied in accordance with the manufacturer's instructions. Proper installation of the vents may require field cutting of the installed roof deck sheathing and underlayment to achieve the required ventilation.

### 3.2.5 Shingles

Shingles shall be applied in accordance with the manufacturer's printed instructions as they appear on the bundle wrapping.

-- End of Section 07311 --

DIVISION 7

THERMAL AND MOISTURE PROTECTION

SECTION 07600A

SHEET METALWORK, GENERAL

## PART 1 GENERAL

### 1.1 REFERENCES

The publications listed below are referenced and the most current publication applies. The publications are referred to in the text by basic designation only.

1.1.1 SHEET METAL AND AIR CONDITIONING CONTRACTORS NATIONAL ASSOCIATION (SMACNA)

SMACNA-02 Architectural Sheet Metal Manual

### 1.2 GENERAL REQUIREMENTS

Sheet metalwork shall be accomplished to form weathertight construction without waves, warps, buckles, fastening stresses or distortion, and shall allow for expansion and contraction.

#### 1.2.1 Coordination

Cutting, fitting, drilling, and other operations in connection with sheet metal required to accommodate the work of other trades shall be performed by sheet metal mechanics. Installation of sheet metal items used in conjunction with roofing shall be coordinated with roofing work to permit continuous roofing operations.

### 1.3 DELIVERY, STORAGE, AND HANDLING

Materials shall be adequately packaged and protected during shipment and shall be inspected for damage, dampness, and wet-storage stains upon delivery to the jobsite. Materials shall be clearly labeled as to type and manufacturer. Sheet metal items shall be carefully handled to avoid damage. Materials shall be stored in dry, ventilated areas until immediately before installation.

## PART 2 PRODUCTS

### 2.1 MATERIALS

Lead, lead-coated metal, and galvanized steel shall not be used. Any metal listed by SMACNA-02 for a particular item may be used, unless otherwise specified or indicated. Materials shall conform to the requirements specified below and to the thicknesses and configurations established in SMACNA-02. Different items need not be of the same metal, except that if copper is selected for any exposed item, all exposed items shall be copper.

## PART 3 EXECUTION

### 3.1 GENERAL

Items such as flashings shall be fabricated in conformance with SMACNA-02 and as indicated. Unless otherwise specified or indicated, exposed edges shall be folded back to form a 13 mm (1/2 inch) hem on the concealed side; and bottom edges of exposed vertical surfaces shall be angled to form drips.

-- END OF SECTION 07600A --

DIVISION 7

THERMAL AND MOISTURE PROTECTION

SECTION 07920A

CAULKING AND SEALANTS

## PART 1 GENERAL

### 1.1 REFERENCES

The publications listed below are referenced and the most current publication applies. The publications are referred to in the text by basic designation only.

| | |
|---|---|
| 1.1.1 | AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA) |
| AAMA 800-86 | Voluntary Specifications and Test Methods for Sealants |
| 1.1.2 | AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) |
| ASTM C 834 | Latex Ceiling Compounds |
| 1.1.3 | FEDERAL SPECIFICATIONS (FS) |
| FS TT-C-00598 | Caulking Compound, Oil and Resin Base Type (for Building Construction) |
| FS TT-S-00227 | Sealing Compound: Elastomeric Type, Multi Component (for Caulking, Sealing, and Glazing in Buildings and Other Structures) |
| FS TT-S-00230 | Sealing Compound: Elastomeric Type, Single Component (for Caulking, Sealing, and Glazing in Buildings and Other Structures) |
| FS TT-S-001657 | Sealing Compound, Single Component, Butyl Rubber Based, Solvent Release Type (for Buildings and Other Types of Construction) |

### 1.2 GENERAL REQUIREMENTS

Caulking and sealants shall be provided in joints as indicated or specified. The joint design, shape, and spacing shall be as indicated. Mixing shall be in accordance with instructions provided by the manufacturer of the sealants.

## 1.3 SUBMITTALS

Government approval is required for submittals with a “GA” designation, submittals having an “FIO” designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

### 1.2.1 Data “FIO”

Materials.

Manufacturer's descriptive data including backstop material, primer and sealer. Descriptive data for elastomeric sealants shall include shelf life, curing time, and mixing instructions for two component sealants.

### 1.2.2 Certificates “F10”

Materials

Certificates of compliance stating that the caulking and sealants conform to the specified requirements. Certificates shall include laboratory test reports showing that the caulking and sealants have been tested within the last 12 months.

## 1.4 ENVIRONMENTAL REQUIREMENTS

The ambient temperature shall be within the limits of 4 degrees C to 32 degrees C (40 to 90 degrees F) when the caulking and sealants are applied.

## 1.5 DELIVERY AND STORAGE

Materials shall be delivered to the job in the manufacturer's original unopened containers. Caulking compound or components outdated as indicated by shelf life shall not be used. Materials shall be carefully handled and stored to prevent inclusion of foreign materials or exposure to temperatures exceeding 90 degrees F. Sealant tape shall be handled and stored in a manner that will not deform the tape.

# PART 2 PRODUCTS

## 2.1 MATERIALS

### 2.1.1 No. 1 Caulking Compound

No. 1 caulking compound shall conform to FS TT-C-00598, Type I.

### 2.1.2 No. 2 Sealant

No. 2 sealant shall be a two-component, elastomeric-type compound conforming to FS TT-S-00227, Type II, Class A. The compound shall be supplied in pre-measured kit form for on-the-job mixing.

2.1.3 No. 3 Sealant

No. 3 sealant shall be a single-component conforming to FS TT-S-001657, Type I or II.

2.1.4 No. 4 Sealant

No. 4 sealant shall be a one-component, elastomeric-type compound conforming to FS TT-S-00230, Type II, Class A.

2.1.5 No. 6 Sealant

No. 6 sealant shall be a one-component latex sealing compound conforming to ASTM C 834.

2.1.6 No. 7 Sealant

No. 7 sealant shall be a polyisobutylene-based or isoprene-isobutylene-based pressure-sensitive tape or bead as specified or shown, conforming to Section 807.1 of AAMA 800-86.

2.1.7 No. 10 Sealant

No. 10 sealant shall be treated-type foamed-urethane strip saturated with a butylene waterproofing material or asphalt-impregnated foamed-polyurethane strip and shall be capable of sealing out moisture and weather when compressed to the extent recommended by the manufacturer for the capability of the joint. The sealant shall be furnished in the proper width to obtain the degree of compression required when installed in the joint.

2.1.8 Acoustical Sealant

Synthetic rubber or polymeric-based material shall be nonhardening type with lasting resilience and able to absorb normal movement without adhesive failure.

## 2.2 SEALER

Sealer for use with No. 1 caulking compound shall be aluminum paint.

## 2.3 PRIMER

Primer for No. 2, 3, or 4 sealant shall be as recommended by the sealant manufacturer.

## 2.4 BACKSTOP MATERIAL

Backstop materials shall be as recommended by the sealant manufacturer.

## 2.5 BOND-PREVENTIVE MATERIALS

Bond-preventive materials shall be pressure-sensitive adhesive polyethylene tape, aluminum foil or wax paper. At the option of the Contractor, backstop material with bond breaking characteristics may be installed in lieu of bond-preventive materials specified.

# PART 3 EXECUTION

## 3.1 SURFACE PREPARATION

### 3.1.1 General

The surfaces of joints to be sealed shall be dry. Oil, grease, dirt, chalk, particles of mortar, dust, loose rust, loose mill scale, and other foreign substances shall be removed from all joint surfaces to be sealed. Oil and grease shall be removed with solvent and surfaces shall be wiped with clean cloths.

### 3.1.2 Concrete and Masonry Surfaces

Where surfaces have been treated with curing compounds, oil, or other such materials, the materials shall be removed by sandblasting or wire brushing. Laitance, efflorescence and loose mortar shall be removed from the joint cavity.

### 3.1.3 Steel Surfaces

Steel surfaces to be in contact with sealant shall be sandblasted or, if sandblasting would not be practical or would damage adjacent finish work, the metal shall be scraped and wire brushed to remove loose mill scale. Protective coatings on steel surfaces shall be removed by sandblasting or by a solvent that leaves no residue.

### 3.1.4 Aluminum Surface

Aluminum surfaces of windows and door frames in contact with sealants shall be cleaned of temporary protective coatings. When masking tape is used for a protective cover, the tape and any residual adhesive shall be removed just prior to applying the sealant. Solvents used to remove protective coating shall be as recommended by the manufacturer of the aluminum work and shall be nonstaining.

## 3.2 APPLICATION

### 3.2.1 Paper Masking Tape

Paper masking tape shall be placed on the finish surface on one or both sides of a joint cavity to protect adjacent finish surfaces from primer or compound smears. Masking tape shall be removed within 10 minutes after joint has been filled and tooled.

### 3.2.2 Bond-Preventive Materials

Bond-preventive materials for Nos. 2, 3, and 4 sealant shall be installed on the bottom of the joint cavity and other surfaces indicated to prevent the sealant from adhering to the surfaces covered by the bond-preventive materials. The materials shall be carefully applied to avoid contamination of adjoining surfaces or breaking bond with surfaces other than those covered by the bond-preventive materials.

### 3.2.3 Backstops

The back or bottom of joints constructed deeper than indicated shall be packed tightly with backstop material to provide a joint of the depth indicated. Where necessary to provide a backstop for caulking compound, the joint shall be packed tightly with rope yarn.

### 3.2.4 Primer

Primer shall be used on concrete masonry units, wood, or other porous surfaces in accordance with instructions furnished with the sealant. Primer shall be applied to the joint surfaces to be sealed. Surfaces adjacent to joints shall not receive primer.

### 3.2.5 Caulk and Sealant

Caulk and sealant shall be applied as recommended by the manufacturer.

## 3.3 CLEANING

The surfaces adjoining the caulked and sealed joints shall be cleaned of smears and other soiling resulting from the caulking and sealing application as work progresses.

-- END OF SECTION 07920A --

DIVISION 8

DOORS AND WINDOWS

SECTION 08110A

STEEL DOORS AND FRAMES

## PART 1 GENERAL

### 1.1 REFERENCES

The publications listed below are referenced and the most current publication applies. The publications are referred to in the text by basic designation only.

| | |
|---|---|
| 1.1.1 | AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) |
| ASTM C 236 | Steady-State Thermal Performance of Building Assemblies by Means of a Guarded Hot Box |
| ASTM C 976 | Thermal Performance of Building Assemblies by Means of a Calibrated Hot Box |
| ASTM D 2863 | Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index) |
| ASTM E 152 | Fire Tests of Door Assemblies |
| ASTM E 283 | Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen |
| 1.1.2 | DOOR AND HARDWARE INSTITUTE (DHI) |
| DHI-A115.IG | Installation Guide for Doors and Hardware |
| 1.1.3 | NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM) |
| NAAMM HMMA 862 | Hollow Metal Manual; Section: Guide Specifications for Commercial Security Hollow Metal Doors and Frames |

1.1.4 NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

| | |
|---|---|
| NFPA 80 | Fire Doors and Windows |
| NFPA 80A | Protection of Buildings from Exterior Fire Exposures |
| NFPA 101 | Safety to Life from Fire in Buildings and Structures |

1.1.5 STEEL DOOR INSTITUTE (SDOI)

| | |
|---|---|
| SDOI SDI-100 | Standard Steel Doors and Frames |
| SDOI SDI-107 | Hardware on Steel Doors (Reinforcement - Application) |

## 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation, submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

1.2.1 Certificates "GA"

Fire Rated Doors. Thermal Insulated Doors. Security Doors.

a. Certification of Oversized Fire Doors: Certificates of compliance in accordance with the requirements of ASTM E 152 for fire doors exceeding the sizes for which label service is available.

b. Certification of Security Door Rating:

Certification or test report for doors shall show compliance with the specified requirements. The certification, or test report, shall list the parameters and the type of hardware and perimeter seals used to achieve the rating.

1.2.2 Samples "GA"

Steel Doors and Frames.

Manufacturer's standard color samples of factory applied finishes.

## 1.3 DELIVERY AND STORAGE

Materials shall be delivered to the site and shall be stored in an upright position in accordance with DHI-A115.IG.

## 1.4 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period shall be provided.

# PART 2 PRODUCTS

## 2.1 DOORS AND FRAMES

Doors and frames shall be factory fabricated in accordance with SDOI SDI-100 and the additional requirements specified herein. Door grade shall be heavy duty (Grade II). Doors and frames shall be prepared to receive hardware conforming to the templates and information provided under Section 08700 BUILDERS' HARDWARE. Frames shall be welded type located as shown A1+A2. Door frames shall be furnished with a minimum of three jamb anchors and one floor anchor per jamb. Anchors shall be not less than 1.2 mm (18 gauge) steel or 4.5 mm (7 gauge) diameter wire. For wall conditions that do not allow the use of a floor anchor, an additional jamb anchor shall be provided. Rubber silencers shall be furnished for installation into factory predrilled holes in door frames. Exterior doors shall have top edges closed flush and sealed against water penetration.

## 2.2 FIRE RATED DOORS

Fire rated door assemblies shall bear the listing identification label of a nationally recognized testing laboratory qualified to perform tests of fire door assemblies in accordance with ASTM E 152 and having a listing for the tested assemblies. The fire resistance rating shall be as shown. Listing identification labels shall be permanently applied by a method which results in their destruction should they be removed.

## 2.3 SECURITY DOORS

Security type doors and frames shall be factory fabricated in accordance with NAAMM HMMA 862 and the additional requirements specified herein. Doors and frames shall be galvanized 1.7 mm (14 gauge) construction. Doors shall have 1.7 mm (14 gauge) steel plate on both sides, and be internally reinforced vertically with continuous 1.0 mm (20 gauge) steel stiffeners spaced 150 mm (6 inches) on center. Doors shall be fully welded construction with no visible seams or joints. Door thickness shall be 44.5 mm (1-3/4 inches). Exterior doors shall be insulated to provide a thermal conductance (U-value) not to exceed 2.33 W/ sq m times K (0.41 btu/hr times sq f times f) (0.41 btu/hr times sq f times f) when tested as an operational assembly in accordance with ASTM C 236 or ASTM C 976. Doors with cellular plastic cores shall have a minimum oxygen index rating of 22 percent when tested in accordance with ASTM D 2863. Door frames shall be all welded type, with double rabbet jamb profile. At meeting stiles, an astragal shall be provided by extending the face panel of the active leaf not less than 16 mm (5/8 inch) across the gap between the two leaves. Astragal shall be flush with the face panel of the inactive leaf.

## 2.4 WEATHERSTRIPPING

Unless otherwise specified in Section 08700 BUILDERS' HARDWARE, weatherstripping shall be as follows: Weatherstripping for head and jamb shall be manufacturer's standard elastomeric type. Air leakage rate of weatherstripping shall not exceed 0.31 l/s per linear meter (0.20 cfm per linear foot) of crack when tested in accordance with ASTM E 283 at standard test conditions.

## 2.5 SIDELIGHT PANELS

Panels for sidelight shall be constructed in accordance with SDOI SDI-100. Panels shall be nonremovable from the outside of exterior doors or the unsecure side of interior doors.

## 2.6 LOUVERS

Doors shall be provided with louver sections. Louvers shall be sightproof type inserted into the door. Inserted louvers shall be stationary. Louvers shall be nonremovable from the outside of exterior doors or the unsecure side of interior doors. Insect screens shall be a removable type with 18 by 16 mesh aluminum or bronze cloth.

## 2.7 GLAZING

Glazing shall be as specified in Section 08810 GLASS AND GLAZING. Removable glazing beads shall be screw-on or snap-on type.

## 2.8 FACTORY FINISH

Doors and frames shall be phosphatized, primed, and finished with an electrostatic baked on enamel or polyester base factory finish paint system. Color shall be in accordance with Section 09915 COLOR SCHEDULE.

# PART 3 EXECUTION

## 3.1 INSTALLATION

Installation shall be in accordance with DHI-A115.IG. Preparation for surface applied hardware shall be in accordance with SDOI SDI-107. Rubber silencers shall be installed in door frames after finish painting has been completed; adhesively applied silencers are not acceptable. Installation and operational characteristics of fire doors shall be in accordance with NFPA 80, NFPA 80A and NFPA 101. Hollow metal door frames shall be solid grouted in masonry walls.

## 3.2 FIELD PAINTED FINISH

Steel doors and frames shall be field painted in accordance with Section 09900 PAINTING, GENERAL. Weatherstrips shall be protected from paint. Color shall be as selected by Government designated representative.

-- END OF SECTION 08110A --

DIVISION 8

DOORS AND WINDOWS

SECTION 08210

WOOD DOORS

## PART 1 GENERAL

### 1.1 REFERENCES

The publications listed below are referenced and the most current publication applies. The publications are referred to in the text by basic designation only.

| | |
|---|---|
| 1.1.1 | AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) |
| ASTM E 283 | Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen |
| 1.1.2 | ARCHITECTURAL WOODWORK INSTITUTE (AWI) |
| AWI-02 | Architectural Woodwork Quality Standards, Guide Specifications and Quality Certification Program |
| 1.1.3 | NATIONAL WOOD WINDOW & DOOR ASSOCIATION (NWWDA) |
| NWWDA I.S. 1-A | Architectural Wood Flush Doors |
| NWWDA I.S. 4 | Water-Repellent Preservative Non-Pressure Treatment for Millwork |

### 1.2 GENERAL REQUIREMENTS

#### 1.2.1 Standard Products

Doors shall be of the type, size, and design indicated on the drawings, and shall be the standard products of manufacturers regularly engaged in the manufacture of wood doors.

#### 1.2.2 Marking

Each door shall bear a stamp, brand, or other identifying mark indicating quality and construction of the door. The identifying mark or a separate certification shall include identification of the standard on which construction of the door is based, identity of the manufacturing plant, identification of the standard under which preservative treatment, if used, was made, and identification of the doors having a Type I glue bond.

## 1.3 SUBMITTALS

Government approval is required for submittals with “GA” designation, submittals having an “FIO” designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

### 1.3.1 Drawings “GA”

Wood Doors

Drawings indicating the location of each door, elevation of each type of door, details of construction, marks to be used to identify the doors, and location and extent of hardware blocking. Drawings shall include catalog cuts or descriptive data for doors, weatherstripping, flashing, and thresholds to be used.

### 1.3.2 Instructions “FIO”

## 1.4 STORAGE

Doors shall be stored in fully covered areas and protected from damage and from extremes in temperature and humidity. Doors shall be stored on supports to prevent warping or twisting, and to provide ventilation. Factory cartons or wrappers shall be kept intact until installation.

## 1.5 HARDWARE

Hardware, including weatherstripping and thresholds, is specified in Section 08700 BUILDERS' HARDWARE.

## 1.6 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period shall be provided.

# PART 2 PRODUCTS

## 2.1 GENERAL FABRICATION REQUIREMENTS

### 2.1.1 Edge Sealing

Wood end-grain exposed at edges of doors shall be sealed prior to shipment.

### 2.1.2 Preservative Treatment

Exterior softwood doors shall be water-repellent preservative treated in accordance with NWWDA I.S. 4.

### 2.1.3 Adhesives

Adhesives shall be in accordance with NWWDA I.S. 1-A, requirements for Type I Bond Doors (waterproof) for exterior doors and

requirements for Type II Bond Doors (water-repellent) for interior doors. Adhesive for doors to receive a transparent finish shall be nonstaining. Adhesives shall contain no formaldehydes.

2.1.4 Prefitting

Doors shall be furnished prefitted or unfitted at the option of the Contractor.

## 2.2 FLUSH DOORS

Flush wood doors shall be solid core as shown and shall conform to NWWDA I.S. 1-A, except for the one year acclimatization requirement in paragraph T-2, which shall not apply. Wood doors shall be [5-ply] construction with faces, stiles, and rails bonded to the cores.

2.2.1 Core Construction

2.2.1.1 Solid Cores

Door construction shall be glued wood block core with vertical and horizontal edges bonded to the core.

2.2.2 Face Panels

2.2.2.1 Natural Finished Wood Veneer Doors

Veneer doors to receive natural finish shall be Premium Grade, book matched birch veneer in accordance with NWWDA I.S. 1-A. Vertical stile strips shall be selected to provide edges of compatible species. Door finish shall be in accordance with paragraph FINISHING FIELD FINISHING.

2.2.2.2 Painted Wood Veneer Doors

Veneer doors to receive paint finish shall be Economy Grade in accordance with NWWDA I.S. 1-A. Door finish shall be in accordance with paragraph FIELD FINISHING.

## 2.3 Natural Finished Doors

Doors to receive natural finish shall be Premium Grade in accordance with AWI-02. Finish shall be in accordance with paragraph FIELD FINISHING.

# PART 3 EXECUTION

## 3.1 INSTALLATION OF DOORS

3.1.1 General Use Doors

Doors shall be fit, hung, and trimmed as required. Door shall have a clearance of 3 mm 1/8 inch at the sides and top and shall have a bottom clearance of 6 mm 1/4 inch over thresholds and 13 mm 1/2 inch at other locations unless otherwise shown. The lock edge or both edges of doors shall be beveled at the rate of 3 mm 1/8 inch in 50

mm 2 inches. Cuts made on the job shall be sealed immediately after cutting, using a clear varnish or sealer. Bottom of doors shall be undercut to allow clear door swing over carpeted areas. Vertical edges of doors which have not been rounded or beveled at the factory shall be eased when the doors are installed.

## 3.2 FIELD FINISHING

Doors to receive field finishing, whether paint or natural finish, shall be factory primed or sealed, as required, and then shall be finished in accordance with Section 09900 PAINTING, GENERAL. Factory applied sealer shall not prevent doors from accepting field stain and finish. Color shall be as selected by the government's designated representative. Field touch-up of factory finishes shall be in accordance with manufacturers instructions.

-- End of Section 08210--

DIVISION 8

DOORS AND WINDOWS

SECTION 08520A

ALUMINUM WINDOWS

## PART 1 GENERAL

### 1.1 REFERENCES

The publications listed below are referenced and the most current publication applies. The publications are referred to in the text by basic designation only.

| | |
|---|---|
| 1.1.2. | ALUMINUM ASSOCIATION (AA) |
| AA DAF-45 | Designation System for Aluminum Finishes |
| 1.1.3. | AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA) |
| AAMA 101 | Voluntary Specifications for Aluminum and Poly(Vinyl Chloride) (PVC) Prime Windows and Glass Doors |
| AAMA 1503.1 | Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections |
| 1.1.4. | NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) |
| NFPA 101 | Safety to Life from Fire in Buildings and Structures |

### 1.2 WINDOW PERFORMANCE

Aluminum windows shall meet the structural test pressures, air infiltration, and water penetration amounts established by AAMA 101 for each window type specified.

#### 1.2.1 Thermal Performance

Thermal transmittance for thermally broken aluminum windows with insulating glass shall not exceed R-Value Class 0.59 m/W (R3.33) when tested in accordance with AAMA 1503.1.

#### 1.2.2 Life Safety Criteria

Windows shall conform to NFPA 101 Life Safety Code when rescue and/or second means of escape are indicated.

## 1.3 SUBMITTALS

Government approval is required for submittals with a “GA” designation, submittals having an “FIO” designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

### 1.3.1 Data “GA”

Aluminum Windows.

Manufacturer's descriptive data, catalog cut sheets, installation, and cleaning instructions.

## 1.4 QUALIFICATIONS

Window manufacturer shall specialize in designing and manufacturing the type of aluminum windows specified in this section, and shall have a minimum of 5 years of documented successful experience.

## 1.5 DELIVERY AND STORAGE

Aluminum windows shall be delivered to project site and stored in accordance with manufacturer's recommendations.

## 1.6 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period shall be provided.

# PART 2 PRODUCTS

## 2.1 ALUMINUM WINDOW TYPES

Aluminum windows shall consist of complete units including sash, glass, frame, weatherstripping, and hardware. Windows shall conform to AAMA 101 and shall be labeled with the AAMA label. Windows shall be double-glazed.

### 2.1.1 Fixed Windows

Aluminum fixed windows shall conform to AAMA 101.

### 2.1.2 Projected Windows

Aluminum projected windows shall conform to AAMA 101.

## 2.2 INSECT SCREENS

Insect screens shall be aluminum window manufacturer's standard design, and shall be provided where scheduled on drawings.

## 2.3 GLASS AND GLAZING

Aluminum windows shall be designed for inside glazing, field glazing, and for glass types scheduled on drawings and specified in Section 08810 GLASS AND GLAZING.

## 2.4 FINISH

### 2.4.1 Anodized Aluminum Finish

Exposed surfaces of aluminum windows shall be finished with anodic coating conforming to AA DAF-45: Architectural Class I, color anodic coating.

### 2.4.2 Color

Color shall be selected from manufacturer’s standard anodic coatings.

# PART 3 EXECUTION

## 3.1 INSTALLATION

Aluminum windows shall be installed and cleaned in accordance with manufacturer's published instructions. The completed window installation shall be watertight and in accordance with Section 07920 JOINT SEALING. Glass and glazing shall be installed in accordance with Section 08810 GLASS AND GLAZING.

-- End of Section 08520A --

DIVISION 8

DOORS AND WINDOWS

SECTION 08700A

BUILDERS' HARDWARE

## PART 1 GENERAL

### 1.1 REFERENCES

The publications listed below are referenced and the most current publication applies. The publications are referred to in the text by basic designation only.

| | |
|---|---|
| 1.1.1 | AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) |
| ASTM E 283 | Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences Across the Specimen |
| 1.1.2 | BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA) |
| BHMA A156.1 | Butts and Hinges |
| BHMA A156.2 | Bored and Preassembled Locks and Latches |
| BHMA A156.4 | Door Controls - Closers |
| BHMA A156.5 | Auxiliary Locks & Associated Products |
| BHMA A156.6 | Architectural Door Trim |
| BHMA A156.7 | Template Hinge Dimensions |
| BHMA A156.8 | Door Controls - Overhead Holders |
| BHMA A156.13 | Mortise Locks and Latches |
| BHMA A156.15 | Closer Holder Release Devices |
| BHMA A156.16 | Auxiliary Hardware |
| BHMA A156.18 | Materials and Finishes |
| BHMA A156.21 | Thresholds |

| | |
|---|---|
| 1.1.3 | DOOR AND HARDWARE INSTITUTE (DHI) |
| DHI-02 | Installation Guide for Doors and Hardware |
| DHI-04 | Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames |
| DHI-05 | Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames |
| DHI A115-W | Wood Door Hardware Standards (INCL A115-W1 Thru A1115-W9) |
| 1.1.4 | FEDERAL STANDARDS (FED-STD) |
| FED-STD 795 | (Basic) Uniform Federal Accessibility Standards |
| 1.1.5 | National Fire Protection Association (NFPA) |
| NFPA 80 | Fire Doors and Windows |

## 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation, submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

### 1.2.1 Data. "GA"

Manufacturer's descriptive data, technical literature, catalog cuts, and installation instructions for hardware and accessories. Spare parts data for locksets, exit devices, closers, after approval of the detail drawings, and not later than 1 month prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.

## 1.3 DELIVERY, STORAGE, AND HANDLING

Hardware shall be delivered to the project site in the manufacturer's original packages. Each article of hardware shall be individually packaged in the manufacturer's standard commercial carton or container, and shall be properly marked or labeled to be readily identifiable with the approved hardware schedule.

## 1.4 SPECIAL TOOLS

Special tools, such as those supplied by the manufacturer, shall be provided as required to adjust hardware items.

## PART 2 PRODUCTS

### 2.1 GENERAL HARDWARE REQUIREMENTS

Hardware shall conform to the requirements specified herein and the HARDWARE SETS listing at the end of this section. Hardware items providing accessibility and usability for physically handicapped shall comply with FED-STD 795.

### 2.2 TEMPLATES

Templates of hinges shall conform to BHMA A156.7.

### 2.3 HINGES

Hinges shall conform to BHMA A156.1. Hinges used on metal doors and frames shall also conform to BHMA A156.7.

#### 2.3.1 Hinges for Reverse Bevel Doors with Locks

Hinges for reverse bevel doors with locks shall have pins that are made nonremovable by means such as a set screw in the barrel, or safety stud, when the door is in the closed position.

#### 2.3.2 Contractor's Option

Hinges with antifriction bearings may be furnished in lieu of ball bearing hinges, except where prohibited for fire doors by the requirements of NFPA 80.

### 2.4 LOCKS AND LATCHES

Locksets, latchsets and deadlocks shall be manufactured by Best to coordinate with existing base keying system. Knob diameter shall be 54 to 57 mm. (2-l/8 to 2-l/4 inches.)

#### 2.4.1 Bored Lock and Latchsets

Bored lock, latchsets, and strikes shall be series 4000 and shall conform to BHMA A156.2, Grade 1.

#### 2.4.2 Auxiliary Locks and Associated Products

Bored and mortise deadlocks and latchsets, and rim locks, shall conform to BHMA A156.5.

#### 2.4.3 Lock Cylinders Mortise, Rim and Bored

Lock cylinders shall comply with BHMA A156.5. Lock cylinder shall have not less than seven pins. Cylinders shall have key removable type cores. A grand master keying system shall be provided, as an

extension of the existing keying system. Construction interchangeable cores shall be provided. Disassembly of knob or lockset shall not be required to remove core from lockset.

### 2.4.4 Lock Trimlock

Lock TrimLock trim shall be cast, forged, or heavy wrought construction of commercial plain design. In addition to meeting the test requirement of BHMA A156.2 or BHMA A156.13, knobs, lever handles, roses, and escutcheons shall be 1.27 mm (0.050 inch) thick, if unreinforced. If reinforced, the outer shell shall be 0.89 mm (0.035 inch) thick and the combined thickness shall be 1.78 mm (0.070 inch) except that knob shanks shall be 1.52 mm (0.060 inch) thick.

## 2.5 KEYING

Locks shall be keyed in sets or subsets as scheduled. Change keys for locks shall be stamped with change number and the inscription "U.S. Property - Do Not Duplicate." Keys shall be supplied as follows:

| | |
|---|---|
| Locks: | 2 change keys each lock. |
| Master keyed sets: | 6 keys each set. |
| Grand master keys: | 6 total. |
| Construction keys: | 6 total. |
| Blank keys: | 6 total. |

The keys shall be furnished to the Contracting Officer arranged for key control system storage in sets or subsets as scheduled.

## 2.6 DOOR CLOSING DEVICES

Door closing devices shall conform to BHMA A156.4, Grade 1. Closing devices shall be products of one manufacturer for each type specified.

Surface type closers shall be Grade 1, Series C02000 Full Cover with options PT-4H, Size 1 or 2 through Size 6, and PT-4D with back check position valve. Closers for doors close to a wall shall be of narrow projection so as not to strike the wall at the 90-degree open position.

## 2.7 DOOR CONTROLS - OVERHEAD HOLDERS

Door controls - overhead holders shall conform to BHMA A156.8.

## 2.8 ARCHITECTURAL DOOR TRIM

Architectural door trim shall conform to BHMA A156.6.

### 2.8.1 Door Protection Plates

2.8.1.1 Kick Plates

Kick plates shall be Category J100, stainless steel. Width of plates shall be 50 mm (2 inches) less than door width for single doors and 1 inch less for pairs of doors. Height shall be 250 mm (10 inches). Edges of metal plates shall be beveled.

2.8.2 Combination Push-Pull Plates

Combination push-pull plates shall be Category J300, 1.27 mm (0.050 inch) thick minimum stainless steel beveled four edges. (6”X 6” min. size)

## 2.9 AUXILIARY HARDWARE

Auxiliary hardware, consisting of flush bolts and door stops, shall conform to BHMA A156.16. Lever extension flush bolts shall be Type L14081.

## 2.10 MISCELLANEOUS

2.10.1 Metal Thresholds

Thresholds shall conform to BHMA A156.21. Thresholds for exterior doors shall be extruded aluminum of the type indicated and shall provide proper clearance and an effective seal with specified weather stripping. Air leakage rate of weatherstripping shall not exceed 0.775 L/s per lineal meter (0.5 cubic feet per minute per lineal foot) of crack when tested in accordance with ASTM E 283 at standard test conditions.

2.10.2 Rain Drips

Extruded aluminum, not less than 1.78 mm (0.07 inch) thick, bronze anodized. Door sill rain drips shall be 38 mm to 44 mm (1-1/2 inches to 1-3/4 inches) high by 16 mm (5/8 inch) projection. Overhead rain drips shall be approximately 38 mm (1-1/2 inches) high by 63 mm (2-1/2 inches) projection and shall extend 50 mm (2 inches) on either side of the door opening width.

2.10.3 Aluminum Housed Type Weatherseals

Weatherseals of the type indicated shall consist of extruded aluminum retainers not less than 1.78 mm (0.07 inch) wall thickness with vinyl, neoprene, silicone rubber, polyurethane or vinyl brush inserts. Aluminum shall be bronze anodized. Weatherseal material shall be of an industrial/commercial grade. Air leakage rate of weatherstripping shall not exceed 0.775 L/s per lineal meter (0.5 cubic foot per minute per lineal foot) of crack when tested in accordance with ASTM E 283 at standard test conditions.

2.10.4 Gasketing

Gasketing shall be a compression type seal, silicon based, self-adhesive product for use on steel door frames with steel doors. Color shall be bronze. Air leakage rate of weatherstripping shall not exceed 0.775 L/s per lineal meter (0.5 cubic feet per minute per lineal foot) of crack when tested in accordance with ASTM E 283 at standard test conditions.

### 2.10.5 Key Control Storage System

Key control storage system shall conform to BHMA A156.5, and shall be properly labeled for key identification.

## 2.11 FASTENINGS

Fastenings of proper type, size, quantity, and finish shall be supplied with each article of hardware.

## 2.12 FINISHES

Unless otherwise specified, finishes shall conform to those identified in BHMA A156.18. Where painting of primed surfaces is required, painting is specified in Section 09900 PAINTING, GENERAL. All finishes shall be as selected by user.

# PART 3 EXECUTION

## 3.1 APPLICATION

Hardware shall be located in accordance with DHI-04 and DHI-05. When approved, slight variations in locations or dimensions will be permitted. Application shall be in accordance with DHI-02 or DHI A115-W.

### 3.1.1 Key Control Storage Systems

Key control storage system shall furnished to the Contracting Officer.

### 3.1.2 Weatherseals

Weatherseals shall be located as indicated, snug to door face and fastened in place with color matched metal screws after door and frames have been finish painted. Screw spacing shall be as recommended by manufacturer.

### 3.1.3 Gasketing

Gasketing shall be installed at the inside edge of the hinge and head and latch sides of door frame. Frames shall be toleranced for a 3 mm (1/8 inch) clearance between door and frame. Frames shall be treated with tape primer prior to installation.

## 3.2 OPERATIONAL TESTS

Prior to acceptance of any electrical hardware system, an operational test shall be performed to determine if devices are operating as intended by the specifications. Wiring shall be tested for correct voltage, current carrying capacity, and proper grounding. Stray voltages in lock wiring shall be eliminated to prevent locking devices from releasing in critical situations.

## 3.3 FINISH HARDWARE DATA SHEET

### 3.3.1 Acceptable Manufactures:

| | |
|---|---|
| Butts and Hinges: | Soss, or approved equal. Manufacturer specified is for quality only. |
| Locks: | Best, or approved equal. Manufacturer specified is for quality only. |
| Kickplates/Crashplates: | Ives, or approved equal. Manufacturer specified is for quality only. |
| Overhead Closers: | LCN, or approved equal. Manufacturer specified is for quality only. |
| Door Trim Units: | Ives, or approved equal. Manufacturer specified is for quality only. |
| Door Stripping & Seals: | Pemko, or approved equal. Manufacturer specified is for quality only. |
| Thresholds: | Pemko, or approved equal. Manufacturer specified is for quality only. |

## 3.4 HARDWARE SETS

SEE ARCHITECTURAL DRAWINGS

-- END OF SECTION 08700A --

DIVISION 8

DOORS AND WINDOWS

SECTION 08810A

GLASS AND GLAZING

## PART 1 GENERAL

### 1.1 REFERENCES

The publications listed below are referenced and the most current publication applies. The publications are referred to in the text by basic designation only.

#### 1.1.1 AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|---|---|
| ASTM C 1036 | Flat Glass |
| ASTM C 1048 | Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass |
| ASTM E 773 | Seal Durability of Sealed Insulating Glass Units |
| ASTM E 774 | Sealed Insulating Glass Units |

#### 1.1.2 CODE OF FEDERAL REGULATIONS (CFR)

| | |
|---|---|
| 16 CFR 1201 | Safety Standard for Architectural Glazing Materials |

#### 1.1.3 GLASS ASSOCIATION OF NORTH AMERICA (GANA)

| | |
|---|---|
| GANA-01 | Glazing Manual |

### 1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

#### 1.2.1 Data

Manufacturer's descriptive product data, handling and storage recommendations, installation instructions, and cleaning instructions for glass and glazing accessories.

## 1.3 DELIVERY, STORAGE AND HANDLING

Glass and glazing materials shall be delivered to the site in the manufacturer's unopened containers. Materials shall be stored indoors in accordance with manufacturer's instructions.

## 1.4 PROJECT/SITE CONDITIONS

Glazing work shall not be started until outdoor temperature is above 5 degrees C (40 degrees F) and rising, unless approved by Contracting Officer.

## 1.5 WARRANTY

Manufacturer shall warrant the insulating glass to be free of fogging or film formation on the internal glass surfaces caused by failure of the hermetic seal and the monolithic reflective glass to be free of peeling or deteriorating of coating for a period of 10 years after Date of Substantial Completion.

# PART 2 PRODUCTS

## 2.1 INSULATING GLASS

Insulating glass shall be Class A preassembled units of dual-seal construction consisting of lites of glass separated by an aluminum spacer and dehydrated space conforming to ASTM E 773 and ASTM E 774.

### 2.1.1 Low-E Insulating Glass

Interior and exterior glass panes for Low-E insulating units shall be Type I annealed flat glass, Class 1-clear with anti-reflective low-emissivity coating on No. 2 surface (inside surface of exterior pane), Quality q3 - glazing select, conforming to ASTM C 1036.

## 2.2 HEAT-TREATED GLASS

Heat-treated glass shall conform to the following requirements.

### 2.2.1 Tempered Glass

Tempered glass shall be kind FT fully tempered transparent flat type, Class 1-clear, Condition A uncoated surface, Quality q3 - glazing select, conforming to ASTM C 1048. Color shall be clear. For all doors and interior windows.

## 2.3 MIRRORS

### 2.3.1 Glass Mirrors

Glass for one-way mirrors shall be Type I transparent flat type, Class 1 clear, Glazing Quality q1, 6 mm (1/4 inch) thick conforming to ASTM C 1036. in toilet rooms.

## 2.4 GLAZING ACCESSORIES

Glazing accessories, compounds, and sealants shall be type suitable for the application and shall be in accordance with manufacturer's instructions.

# PART 3 EXECUTION

## 3.1 INSTALLATION

Glass and glazing work and cleaning shall be performed in accordance with GANA-01, NFPA 80 and glass manufacturer's instructions.

-- END OF SECTION 08810A --

DIVISION 8

DOORS AND WINDOWS

SECTION 08840

PLASTIC GLAZING

## PART 1 GENERAL

### 1.1 REFERENCES

The publications listed below are referenced and the most current publication applies. The publications are referred to in the text by basic designation only.

| | |
|---|---|
| 1.1.1. | AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI) |
| ANSI Z97.1 | Safety Glazing Materials Used in Buildings |
| 1.1.2. | AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) |
| ASTM C 669 | Glazing Compounds for Back Bedding and Face Glazing of Metal Sash |
| ASTM C 920 | Elastomeric Joint Sealants |

### 1.2 GENERAL REQUIREMENTS

Plastic glazing shall be provided in the locations indicated. Glazing may be performed in the shop or in the field using plastic sheets of the thickness specified.

### 1.3 SUBMITTALS

Government approval is required for submittals with a “GA” designation, submittals having and “FIO” designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

1.3.1 Data “FIO”

Glazing Materials. Cleaning.

Data composed of catalog cuts, brochures, cleaning directions, and compatible cleaning agents.

1.3.2 Instructions “FIO”

Installation.

Manufacturer's installation instructions.

1.3.3 Certificates "FIO"

Glazing Materials.

Certificates stating that the plastic sheets and glazing material meet the specified requirements.

1.3.4 Samples "FIO"

Plastic Sheets. Glazing Compound.
Glazing Tape. Sealant.

## 1.4 DELIVERY AND STORAGE

Glazing compounds, sealants and primers shall be delivered to the site in the manufacturer's unopened containers. Plastic sheets shall be stored in safe, dry locations and shall not be unpacked until needed for installation.

## 1.5 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period shall be provided.

# PART 2 PRODUCTS

## 2.1 MATERIALS

2.1.1 Plastic Sheets

2.1.1.1 Polycarbonate Plastic Sheets

Polycarbonate plastic sheets shall conform to ANSI Z97.1, clear and smooth on both sides ultraviolet stabilized, scratch resistant,12.7 mm (1/2 in) thick.

2.1.2 Glazing Compound

Nonhardening glazing compound shall conform to ASTM C 669, gray or neutral color for glazing in wood, steel, or color finished aluminum, and aluminum color for glazing in natural colored aluminum.

2.1.3 Glazing Tape

Glazing tape shall be fully-cured synthetic rubber, or plastic composition; and shall be unreinforced, 100 percent solid, resilient, nonsagging, nonstaining, and noncrazing. The tape shall be pressure sensitive. The tape shall be capable of sealing out moisture, air, and dust when compressed to the extent recommended by the glazing tape manufacturer for the extensibility requirements of the joint. The tape shall be furnished in the proper width and depth for the particular application in order to obtain the required

degree of compression when installed in the joint. The tape shall withstand temperatures of minus 40 degrees C (minus 40 degrees F) up to 71 degrees C (160 degrees F) without bleeding, cracking, flowing, or showing signs of deterioration.

### 2.1.4 Sealant

Sealant shall conform to ASTM C 920, Grade NS, Class 25 Use G. Sealant shall be gray or neutral color for glazing in wood, steel, or color finished aluminum, and aluminum color for glazing in natural color aluminum.

### 2.1.5 Sealant Backstop Material

Sealant backstop shall be a material that will not adversely affect or bond with sealant. Shape and dimensions shall be as recommended by the plastic sheet manufacturer for the particular application.

### 2.1.6 Sealant Primer

Sealant primer shall be as recommended by the sealant manufacturer.

### 2.1.7 Glazing Accessories

Glazing accessories shall be as required to supplement the items to be glazed including glazing points and spacer shims. Ferrous metal accessories shall have a finish that will not stain or corrode while in service. Spacer shims shall be of material and of dimensions recommended by the plastic sheet manufacturer.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Glazing shall be performed in accordance with the approved installation instructions of the plastic sheet manufacturer.

### 3.2 CLEANING

The plastic surfaces shall be clean and free of smears, spatters, scratches, and other defacement at the time the work is accepted. Cleaning shall be in accordance with the plastic sheet manufacturer's recommendation.

-- End of Section 08840 --

DIVISON 9

FINISHES

SECTION 09250A

GYPSUM WALLBOARD

## PART 1 GENERAL

### 1.1 REFERENCES

The publications listed below are referenced and the most current publication applies. The publications are referred to in the text by basic designation only.

| | |
|---|---|
| 1.1.1 | AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) |
| ASTM A 580 | Stainless and Heat Resisting Steel Wire |
| ASTM A 853 | Steel Wire, Carbon, for General Use |
| ASTM C 36 | Gypsum Wallboard |
| ASTM C 475 | Joint Compound and Joint Tape for Finishing Gypsum Board |
| ASTM C 557 | Adhesive for Fastening Gypsum Wall Board to Wood Framing |
| ASTM C 630 | Water - Resistant Gypsum Backing Board |
| ASTM C 645 | Bearing Steel Studs, Runners (Track), and Rigid Furring Channels for Screw Application of Gypsum Board |
| ASTM C 754 | Installation of Steel Framing Members to Receive Screw-Attached Gypsum |
| ASTM C 840 | Application and Finishing of Gypsum Board |
| ASTM C 955 | Load-Bearing (Transverse and Axial) Steel Studs, Runners, and Bracing or Bridging for Screw Application of Gypsum Board and Metal Plaster Bases |
| ASTM C 1002 | Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases |
| 1.1.2 | FACTORY MUTUAL ENGINEERING AND RESEARCH (FM) |
| FM P8016 | Specification Tested Products Guide |

1.1.3 GYPSUM ASSOCIATION (GA)

GA 600 Fire Resistance Design Manual

1.1.4 UNDERWRITERS LABORATORIES (UL)

UL-05 Fire Resistance Directory

## 1.2 SUBMITTALS

Government approval is required for submittals with a “GA” designation, submittals having an “FIO” designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

### 1.2.1 Drawings “GA”

Steel Framing. Control Joints. Fire-Resistant Assemblies.

Drawings and installation details for ceiling framing, furring, special wall framing, and framed openings in walls and ceilings.

### 1.2.2 Certificates “FIO”

Gypsum Wallboard. Water-Resistant Gypsum Board. Steel Framing.

Certificates stating that the steel framing and gypsum wallboard meet the specified requirements.

## 1.3 DELIVERY, STORAGE AND HANDLING

Materials shall be delivered in original containers bearing the name of manufacturer, contents, and brand name. Materials shall be stored in accordance with manufacturer's printed instructions.

## 1.4 ENVIRONMENTAL CONDITIONS

Environmental conditions for application and finishing of gypsum board shall be in accordance with ASTM C 840.

# PART 2 MATERIALS

## 2.1 NON-LOADBEARING STUD WALLS

### 2.1.1 Studs

Studs for non-loadbearing walls shall conform to ASTM C 645. Studs shall be 1.214 mm thick (18 gauge) steel, C-shaped, punched web for utility access, G60 hot-dip galvanized.

2.1.2 Runner Tracks

Floor and ceiling runner tracks shall conform to ASTM C 645. Tracks shall be, U-shaped with minimum 22 mm (7/8 inch) flanges, unpunched web, gauge to match studs, G60 hot-dip galvanized.

## 2.2 LOADBEARING STUD WALLS

2.2.1 Studs

Studs for loadbearing walls shall conform to ASTM C 955. Studs shall be, C-shaped with minimum 32 mm (1-1/4 inch) high flanges, punched web for utility access, 1.519 mm thick (16 gauge) steel, G60 hot-dip galvanized.

2.2.2 Runner Tracks

Floor and ceiling runner tracks shall conform to ASTM C 955. Runners shall be, U-shaped with minimum 22 mm (7/8 inch) flanges, unpunched web, thickness (gauge) to match studs, G60 hot-dip galvanized.

2.2.3 Bridging

Bridging for loadbearing walls shall conform to ASTM C 955. Bridging shall be minimum 19 by 19 mm (3/4 by 3/4 inch) cold-rolled steel channel with weld attachment clips at each stud or V-bar type weld or screw attached to each stud flange.

## 2.3 SUSPENDED CEILING FRAMING

Main carrying channels and cross furring members for suspended gypsum board ceilings shall conform to ASTM C 645. Carrying channels shall be formed from 1.519 mm thick (16 gauge) cold-rolled steel, hot-dipped galvanized, 38 by 19 mm. (1-1/2 by 3/4 inch.) Furring members shall be cold-rolled steel, hot-dip galvanized, 19 by 19 mm. (3/4 by 3/4 inch.)

## 2.4 GYPSUM BOARD

Gypsum board shall have square-cut ends, tapered or beveled edges and shall be maximum possible length.

2.4.1 Standard Gypsum Board

Regular gypsum board shall conform to ASTM C 36, and shall be 1200 mm (48 inches) wide.

2.4.2 Fire-Rated Gypsum Board

Fire-rated gypsum board shall conform to ASTM C 36, and shall be Type X, 1200 mm (48 inches) wide.

2.4.3 Water-Resistant Gypsum Board

Water-resistant gypsum board shall conform to ASTM C 630, regular, and shall be 1200 mm (48 inch) width.

## 2.5 ACCESSORIES

### 2.5.1 Taping and Embedding Compound

Taping and embedding compound shall conform to ASTM C 475.

### 2.5.2 Finishing or Topping Compound

Finishing or topping compound shall conform to ASTM C 475.

### 2.5.3 All-Purpose Compound

All-purpose compound shall be compatible with tape and substrate.

### 2.5.4 Joint Tape

Joint tape shall conform to ASTM C 475 and shall be as recommended by gypsum board manufacturer.

### 2.5.5 Screws

Screws shall conform to ASTM C 1002. Screws shall be, Type G for gypsum board to gypsum board, Type S for wood or light-gauge steel framing.

### 2.5.6 Adhesives

Adhesives shall conform to ASTM C 557.

### 2.5.7 Hangers

Suspended ceiling runner channel hangers shall be soft, annealed steel wire not less than 4 mm (0.1620 inch) nominal diameter, conforming to ASTM A 853.

### 2.5.8 Fastenings

Tie wire, clips, rings, and other fastenings shall be corrosion-resisting steel conforming to ASTM A 580, composition 302, 304, or 316, Condition A, except vertical surfaces not incorporated in ceiling construction may be erected with soft, annealed steel conforming to ASTM A 853.

# PART 3 EXECUTION

## 3.1 INTERIOR WALL FRAMING

Steel framing and furring members shall be installed in accordance with ASTM C 754.

## 3.2 SUSPENDED CEILING FRAMING

Suspended ceiling system framing shall be installed in accordance with ASTM C 754.

## 3.3 APPLICATION OF GYPSUM BOARD

Gypsum board shall be installed in accordance with ASTM C 840 and as specified.

## 3.4 TAPING AND FINISHING

Gypsum board taping and finishing shall be performed in accordance with ASTM C 840.

## 3.5 FIRE-RESISTANT ASSEMBLIES

Gypsum wallboard for fire-rated assemblies shall be in accordance with UL-05, FM P8016 or GA 600 for the design number indicated on drawings.

## 3.6 PATCHING

Surface defects and damage shall be corrected as required to leave gypsum board ready to receive finish as specified.

-- END OF SECTION 09250A --

DIVISION 9

SPECIALTIES

SECTION 09310A

CERAMIC TILE

## PART 1 GENERAL

### 1.1 REFERENCES

The publications listed below are referenced and the most current publication applies. The publications are referred to in the text by basic designation only.

| | |
|---|---|
| 1.1.1 | AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI) |
| ANSI A108.11 | Interior Installation of Cementitious Backup Units |
| ANSI A118.4 | Latex-Portland Cement Mortar |
| ANSI A118.6 | Ceramic Tile Grout |
| ANSI A118.9 | Test Methods and Specifications for Cementitious Backer Units |
| ANSI A118-10 | Waterproofing Membrane |
| ANSI A137.1 | Ceramic Tile |
| 1.1.2 | TILE COUNCIL OF AMERICA (TCA) |
| TCA-01 | Handbook for Ceramic Tile Installation |

### 1.2 SUBMITTALS

Government approval is required for submittals with a “GA” designation, submittals having an “FIO” designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

1.2.1 Data “FIO”

Tile. Mortar, Grout, and Adhesive.

Manufacturer's catalog data, preprinted installation and cleaning instructions.

1.2.2 Samples "GA"

Tile. Accessories. Marble Thresholds.

Samples of sufficient size to show color range, pattern, type and joints.

1.3 DELIVERY AND STORAGE

Materials shall be delivered to the project site in manufacturer's original unopened containers. Materials shall be kept dry, protected from weather, and stored under cover.

1.4 ENVIRONMENTAL REQUIREMENTS

Ceramic tile work shall not be performed unless the substrate and ambient temperature is at least 10 degrees C (50 degrees F) and rising. Temperature shall be maintained above 10 degrees C (50 degrees F) while the work is being performed and for at least 7 days after completion.

1.5 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1-year period shall be provided.

PART 2 PRODUCTS

2.1 Tile shall be standard grade conforming to ANSI A137.1. Containers shall be grade sealed. Floor tile shall have a minimum static coefficient of friction of 0.5. Tile shall be Class III as rated by the manufacturer for abrasion resistance as related to foot traffic.

2.1.1 Glazed Wall Tile

Glazed wall tile and trim shall be cushion edged with bright or matte glaze as chosen by the Government designated representative. Tile shall be as shown.

2.2 MORTAR, GROUT, AND ADHESIVE

Mortar, grout, and adhesive shall conform to the following:

2.2.1 Latex modified Portland Cement Mortar

ANSI A118.4

2.2.2 Ceramic Tile Grout

ANSI A118.6.

2.3 CEMENTITIOUS BACKER BOARD

Cementitious backer units shall comply with ANSI A118.9.

## 2.4 MARBLE THRESHOLDS

Marble thresholds shall have a fine sand-rubbed finish and shall be white in color.

# PART 3 EXECUTION

## 3.1 GENERAL INSTALLATION REQUIREMENTS

Tile work shall not be started until roughing in for mechanical and electrical work has been completed and tested, and built-in items requiring membrane waterproofing have been installed. Floor tile installation shall not be started in spaces requiring wall tile until after wall tile has been installed. Tile bases and coves shall be solidly backed with mortar.

## 3.2 INSTALLATION OF WALL TILE

Wall tile shall be installed in accordance with manufacturer’s instructions and the Handbook for Ceramic Tile Council of America requirements for thin set tile.

## 3.3 INSTALLATION OF FLOOR TILE

Floor tile shall be installed in accordance with manufacturer’s instructions the Handbook for Ceramic Tile Council of America requirement for thin set tile.

## 3.4 WATERPROOFING

Shower pans are specified in Section 15400B PLUMBING, FIXTURES.

Waterproofing under concrete fill for showerpans and ceramic tile installation shall conform to the requirements of ANSI 118.10 and Tile Council of America Method F122.

## 3.5 CEMENTITIOUS BACKER BOARD INSTALLATION

Cementitious backer units shall be installed in accordance with ANSI A108.11.

## 3.6 CONTROL JOINTS

Joints shall be formed as indicated and sealed as specified in Section 07920A CAULKING AND SEALANTS.

## 3.7 CLEANING AND PROTECTING

Upon completion, tile surfaces and grout shall be cleaned in accordance with manufacturer's approved cleaning instructions. Tiled floor areas shall be covered with building paper before foot traffic is permitted

over the finished tile floors. Board walkways shall be laid on tiled floors that are to be continuously used as passageways by workmen.

-- END OF SECTION 09310A --

DIVISION 9

FINISHES

SECTION 09650A

RESILIENT FLOORING

## PART 1 GENERAL

### 1.1 REFERENCES

The publications listed below are referenced and the most current publication applies. The publications are referred to in the text by basic designation only.

#### 1.1.1 AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM F 1066 Vinyl Composition Floor tile

### 1.2 SUBMITTALS

Government approval is required for submittals with a “GA” designation, submittals having an “FIO” designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

#### 1.2.1 Data “FIO”

Resilient Flooring and Accessories.

Manufacturer's descriptive data and installation instructions. Cleaning and maintenance instructions shall be included.

#### 1.2.2 Samples “GA”

Resilient Flooring and Accessories.

Three samples of each indicated color and type of flooring an base. Sample size shall be minimum 75 mm by 125 mm. (3 inches by 5 inches.)

### 1.3 DELIVERY AND STORAGE

Materials shall be delivered to the building site in original unopened containers and shall be stored according to manufacturer's recommendations.

## 1.4 ENVIRONMENTAL REQUIREMENTS

Areas to receive resilient flooring shall be maintained at a temperature above 21 degrees C (70 degrees F) for 2 days before application, during application and 2 days after application. A minimum temperature of 13 degrees C (55 degrees F) shall be maintained thereafter.

## 1.5 SCHEDULING

Resilient flooring application shall be scheduled after the completion of other work which would damage the finished surface of the flooring.

# PART 2 PRODUCTS

## 2.1 VINYL-COMPOSITION TILE

Vinyl-composition tile shall conform to ASTM F 1066, Class 2, (through pattern title), Composition 1, asbestos-free, and shall be 300 mm square (12 inches square) and 3.2 mm (1/8 inch) thick. Tile shall have the color and pattern uniformly distributed throughout the thickness of the tile. Flooring in any one continuous area shall be from the same lot and shall have the same shade and pattern.

## 2.2 RESILIENT BASE

Base shall be vinyl type, straight (installed with carpet) and coved (installed with resilient flooring). Base shall be 100 mm (4 inches) high minimum 3 mm (1/8 inch) thick. Job Formed corners shall be furnished.

## 2.3 EDGE STRIP

Edge strip shall be vinyl, 25 mm (1 inch) wide, and of thickness to match the flooring.

## 2.4 ADHESIVE

Adhesive for flooring and wall base shall be as recommended by the flooring manufacturer.

# PART 3 EXECUTION

## 3.1 INSTALLATION

Flooring and accessories shall be installed in accordance with manufacturer's instructions.

-- END OF SECTION 09650A --

DIVISION 9

FINISHES

SECTION 09680A

CARPET

## PART 1 GENERAL

### 1.1 REFERENCES

The publications listed below are referenced and the most current publication applies. The publications are referred to in the text by basic designation only.

| | |
|---|---|
| 1.1.1 | AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC) |
| AATCC 134 | Test Method: Elastrostatic Propensity of Carpets |
| 1.1.2 | AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) |
| ASTM D 418 | Pile Yarn Floor Covering Construction |
| ASTM D 1335 | Tuft Bind of Pile Floor Coverings |
| 1.1.3 | CODE OF FEDERAL REGULATIONS (CFR) |
| 16 CFR 1630 | Standard for the Surface Flammability of Carpet and Rugs |
| 1.1.4 | GERMANY INSTITUTE FOR STANDARDIZATION (DEUTSCHES INSTITUTE FUR NORMUNG) (DIN) |
| DIN 54318 | Machine Made Textile Floor Coverings; Determination of Dimensional Changes Due to the Effects of Varied Water and Heat Conditions; Identical with ISO 2551 Edition 1981 |

### 1.2 SUBMITTALS

Government approval is required for submittals with a “GA” designation, submittals having an “FIO” designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

1.2.1 Data “FIO”

Carpet and Accessories.

For each type of carpet material and installation accessory required, catalog data and printed documentation stating physical characteristics, durability, resistance to fading and flame

resistance characteristics, installation and maintenance instructions.

1.2.2 Certificates. "FIO"

Carpet and Accessories.

Certificates of compliance from a laboratory accredited by the National Laboratory Accreditation Program of the National Institute of Standards and Technology attesting that each type of carpet and carpet with cushion material conforms to the standards specified.

1.2.3 Samples. "GA"

Carpet and Accessories.

a. Carpet: Two "Production Quality" samples 675 by 450 mm (27 by 18 inches) of each carpet proposed for use, showing quality, pattern, and color specified.

b. Vinyl Moldings: Two pieces of each type at least 300 mm. (12 inches long.)

## 1.3 REGULATORY REQUIREMENTS

Carpet and adhesive shall bear the Carpet and Rug Institute (CRI) Indoor Air Quality (IAQ) label.

## 1.4 DELIVERY AND STORAGE

Materials shall be delivered and stored in accordance with manufacturer's recommendations.

## 1.5 ENVIRONMENTAL REQUIREMENTS

Areas in which carpeting is to be installed shall be maintained in accordance with manufacturer's recommendation.

## 1.6 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1-year period shall be provided.

## 1.7 EXTRA MATERIAL

Extra Material from same dye lot consisting uncut carpet tiles shall be provided for future maintenance. A minimum of 5 percent of total square meters (square yards) of each carpet type, pattern, and color shall be provided.

## PART 2 PRODUCTS

### 2.1 CARPET TYPE C1

Carpet shall be first quality modular tile 457 x 457 mm (18 x 18 inches) square with 0.15 percent growth/shrink rate in accordance with DIN 54318. Pile type shall be level - loop. Pile fiber shall be soil hiding and static control branded commercial nylon continuous filament with a pile or wire height of 4.0 mm. (0.156 inch.)

a. Gauge shall be 1 mm/10 mm. (1 inch/10 inch.)

b. Stitches and Tufts shall be 0.155 per square mm. (100 ends per square inch.)

c. Surface Pile Yarn Weight, shall be 1.79 kg per square meter. (24 ounces per square yard.) This does not include weight of backings. Weight of actual surface yarn exposed to wear above carpet backing shall be determined in accordance with ASTM D 418.

d. Pile Density shall be 6968 as determined using the formula below.

Density = (W)(36)/T

W is pile yarn weight in ounces per square yard, and T is pile thickness in inches. Pile thickness shall be determined in accordance with ASTM D 418.

e. Dye method shall be solution dyed.

f. Primary backing materials shall be synthetic hardback. Secondary backing to suit project requirements shall be those customarily used and accepted by the trade for each type of carpet, except when a special unitary back designed for gluedown is provided.

g. Pattern, texture, and color shall be as indicated on drawing Finish Schedule.

#### 2.1.1 Performance Requirements

a. Static Control: Static control shall be provided to permanently control static buildup to less than 2.0 kV when tested at 20 percent relative humidity and 21 degrees C (70 degrees F) in accordance with AATCC 134.

b. Flammability and Critical Radiant Flux Requirements: Carpet shall comply with 16 CFR 1630. Carpet in corridors and exits shall have a minimum average critical radiant flux of 0.22 watts per square centimeter when tested in accordance with ASTM E 618.

c. Tuft bind shall be a minimum 40 N (9 pound) average force for loop pile when tested in accordance with ASTM D 1335.

2.1.2 Additional Performance Characteristics

Nontoxic antimicrobial treatment shall be guaranteed by the carpet manufacturer to last the life of the carpet.

## 2.2 ADHESIVES AND CONCRETE PRIMER

Adhesives and concrete primers for installation of carpet shall be waterproof, nonflammable, meet local air-quality standards, and shall be as recommended by the carpet manufacturer. Release adhesive for modular tile carpet shall be as recommended by the carpet manufacturer.

## 2.3 MOLDING

Vinyl molding shall be heavy-duty and designed for the type of carpet being installed. Color shall be as selected from manufacturer’s standard range.

## 2.4 TAPE

Tape for seams shall be as recommended by the Carpet manufacturer for the type of seam used in installation.

## 2.5 COLOR, TEXTURE, AND PATTERN

Color, texture, and pattern shall be as selected by the Government’s designated representative.

# PART 3 EXECUTION

## 3.1 MOISTURE AND ALKALINITY TEST

Concrete slab shall be tested for moisture content and excessive alkalinity in accordance with CRI 104. The moisture content shall not exceed a hygrometer reading of 65 percent.

## 3.2 PREPARATION OF CONCRETE SUBFLOOR

Installation of the carpeting shall not commence until concrete substrate is at least 90 days old. The concrete surfaces shall be prepared in accordance with instructions of the carpet manufacturer. Type of concrete sealer, when required, shall be compatible with the carpet.

## 3.3 INSTALLATION

Installation shall be in accordance with the manufacturer's instructions and CRI 104. Edges of carpet meeting hard surface flooring shall be protected with molding. Installation shall be in accordance with the molding manufacturer’s instructions

## 3.3 MODULAR TILE INSTATLLATION

Modular tiles shall be installed with release adhesive and shall be snugly jointed together. Tiles shall be laid in an alternating pattern with accessibility to the subfloor where required.

## 3.4 CLEANING AND PROTECTION

Soiled spots and adhesive shall be removed from the face of the carpet with appropriate spot remover. Carpet shall be vacuumed clean and shall be protected from soiling and damage with heavy, reinforced, nonstaining kraft paper, plywood, or hardboard sheets. Edges of kraft paper protection shall be lapped and secured to provide a continuous cover. Traffic shall be restricted for at least 45 hours.

## 3.5 REMNANTS

Remnants from the installation, consisting of pieces more than 600mm (2 feet) in dimension with more than 0.6 square meters (6 square feet) total, shall be provided.

-- END OF SECTION 09680A --

DIVISION 9

FINISHES

SECTION 09900

PAINTING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This section includes surface preparation, painting, and finishing of exposed interior items and surfaces.

1. Surface preparation, priming, and finish coats specified in this section are in addition to shop priming and surface treatment specified under other sections.

B. Paint exposed surfaces whether or not colors are designated in “schedules”, except where a surface or material is specifically indicated not be painted or is to remain natural. Where an item or surface is not specifically mentioned, paint the same as similar adjacent materials of surfaces. If color or finish is not designated, the Contracting Officer will select from standard colors or finishes available.

1. Painting includes field painting exposed bare and covered pipes and ducts (including color coding), hangars, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment.

C. Painting is not required on prefinished items, finished metal surfaces, concealed surfaces, operating parts, and labels.

1. Prefinished items not to be painted include the following factory-finished components:

a. Metal toilet enclosures.

b. Acoustic materials.

c. Architectural woodwork and casework.

d. Ornamental metal work, unless specifically indicated on drawings.

e. Mechanical and electrical equipment.

f. Light fixtures.

g. Distribution cabinets.

2. Concealed surfaces not to be painted include wall or ceiling surfaces in the following generally in accessible areas:

a. Foundation spaces.

b. Furred areas.

c. Control space.

d. Pipe spaces.

e. Attic shafts.

3. Finished metal surfaces not to be painted include:

a. Anodized aluminum.

b. Stainless steel. c. Chromium plate.

4. Operating parts not be painted include moving parts of operating equipment such as the following:

a. Valve and damper operations

b. Linkages.

c. Sensing devices.

d. Motor and fan shafts.

D. Related Sections:The following sections contain requirements that relate to this section:

1. Shop Priming Structural Steel:Division 5

2. Shop Priming Ferrous Metal:Division 5

3. Shop Priming Steel Doors and Frames: Division 8

1.2 REFERENCES

A. The publications listed below are referenced, and the most current publications. The publications are referred to in the text by basic designation only.

1. FS TT-E-509 -- Federal Specification for Interior Semigloss Odorless Alkyd Enamel.

2. FS TT-P-543 -- Federal Specification for Interior Enamel Undercoat.

3. FS TT-P-641 -- Federal Specification for Galvanized Metal Primer

4. FS TT-P-650 -- Federal Specification for Interior Latex-Based White Primer.

5. FS TT-P-664 -- Federal Specification for Synthetic Rust-Inhibiting Primer.

6. FS TT-S-300 -- Federal Specification for Cut Shellac.

7. FS TT-S-711 -- Federal Specification for Oil-Type Interior Wood Stain.

8. FS TT-V-86 -- Federal Specification for Oil Rubbing Varnish.

## 1.3 DEFINITIONS

A. "Paint" includes coating systems materials, primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate, or finished coats.

## 1.4 SUBMITTALS

A. Product Data: Manufacturer's technical information, label analysis, and application instructions for each material proposed for use.

1. List each material and cross-reference the specific coating and finish system and application. Identify each material by the manufacturer's catalog number and general classification.

B. Samples for verification purposes: Provide samples of each color and material to be applied, with texture to simulate actual conditions, on representative samples of the actual substrate. Define each separate cost, including block fillers and primers. Use representative colors when preparing samples for review. Resubmit until required sheen, color, and texture are achieved.

1. Provide a list of material and application for each coat of each sample. Label each sample as to location and application.

2. Submit samples on the following substratesfor the Government's review of color and texture only:

a. Painted wood: Provide two 12- by 12-inch samples of each color and materialson hardboard.

b. Stained or Natural Wood: Provide two 4- by 8- inch samples of natural and stained wood finish n actual wood surfaces.

c. Ferrous Metal: Provide two 4-inch-square samples of flat metal and two 8-inch-long samples of solid metal for each color and finish.

## 1.5 QUALITY ASSURANCE

A. Single-Source Responsibility: Provide primers and undercoat paint produced by the same manufacturer as the finish coats. B. Coordination of Work: Review other sections in which primers are provided to ensure compatibility of the total systems for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

B. Coordination of Work: Review other sections in which primers are provided to ensure compatibility of the total systems for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

1. Notify the Contracting Officer of problems anticipated using the materials specified.

C. Material Quality: Provide the manufacturer's best quality trade sale paint material of the various coating types specified. Paint material containers not displaying manufacturer's product identification will not be acceptable.

1. Proprietary names used to designate colors or material are not intended to imply that products named are required or to exclude equal products of other manufacturers.

2. Federal specifications establish a minimum quality level for paint materials, except where other product identification is used. Provide written certification from the manufacturer that materials provided meets or exceed these criteria.

## 1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the job site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:

1. Product name and title of material.

2. Product description (generic classification or binder type).

3. Federal specification number, if applicable.

4. Manufacturer's stock number, if applicable.

5. Contents by volume, for pigment and vehicle constituents.

6. Thinning instructions.

7. Application instructions.

8. Color name and number.

B. Store materials not in uses in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain containers used in storage in a clean condition, free of foreign materials or residue.

1. Protect from freezing. Keep storage are neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards results from handling, mixing, and application.

## 1.7 JOB CONDITIONS

A. Apply water-based paints only when the temperature of surfaces to be painted and surround air temperature are between 50 deg F (10 deg C) and 90 deg F (32 deg C).

B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45 deg F (7 deg C) and 95 deg F (35 deg C).

C. Do not apply paint in snow, rain, fog, or mist, when the relative humidity exceeds 85 percent, at temperatures less than 5 deg F (3 deg C0 above the dew point, or to damp or wet surfaces.

1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by the manufacturer during application and drying periods.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide products of one of the following:

1. M. A. Bruder & Sons, Inc. (MAB), or approved equal. Manufacturer specified is for quality only.

## 2.2 PRIMERS

A. Latex-Based Interior White Primer: Latex-based primer coating used on interior gypsum drywall under a flat latex paint or an alkyd semigloss enamel.

1. MAB:Rich-Lux Prime Fast, or approved equal. Manufacturer specified is for quality only.

B. Synthetic, Rust-Inhibiting Primer: Quick-drying, rust-inhibiting primer for priming ferrous metal on the exterior under full-gloss and flat alkyd enamel and on the interior under flat latex paint or odorless alkyd semigloss or alkyd gloss enamels:

1. MAB:Rust-O-Lastic Red Metal Primer, or approved equal. Manufacturer specified is for quality only.

C. Galvanized Metal Primer: Primer used to prime interior zinc-coat (galvanized) metal surfaces:

1. Pittsburgh: 6-215/216 Speedhide Galvanized Steel Primer, or approved equal. Manufacturer specified is for quality only.

## 2.3 UNDERCOAT MATERIALS

A. Interior Enamel Undercoat: Ready-mixed enamel for use as an undercoat over a primer on ferrous or zinc-coated metal under an interior alkyd semigloss enamel or a full-gloss alkyd enamel:

1. MAB:Rich-Lux Velvet, or approved equal. Manufacturer specified is for quality only.

## 2.4 INTERIOR FINISH PAINT MATERIAL

A. Interior semigloss Odorless Alkyd Enamel: Low-odor, semigloss, alkyd enamel for use over a primer an undercoat on concrete, masonry (including concrete masonry block), plaster, wood, and hardboard and both ferrous and zinc-coated (galvanized) metal surfaces and over a primer on gypsum drywall:

1. MAB:Fresh Kote Semi-Gloss, or approved equal. Manufacturer specified is for quality only.

B. Cut Shellac:Quick-drying, rosin-free, clear, general-purpose shellac varnish for use on the interior over stained and natural-finished woodwork for a clear finish.

1. MAB:Minit DRI Sanding sealer, or approved equal. Manufacturer specified is for quality only.

C. Oil Rubbing Varnish: Clear, oil-type rubbing varnish for use on interior stained or natural-finished woodwork.

1. MAB:Rich-Lux Urethane Wood Finish, Satin, or approved equal. Manufacturer specified is for quality only.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine substrates and conditions under which painting will be performed for compliance with requirements for application of paint. Do not begin paint applications until unsatisfactory conditions have been corrected.

1. Start of painting will be construed as the applicator’s acceptance of surfaces and conditions within a particular area.

## 3.2 PREPARATION

A. General Procedures: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items in place that are not to be painted, or provide surface-applied protection prior to surface preparation and painting. Remove these items if necessary for complete painting of the items and adjacent surfaces. Following completion of painting operations

in each space or area, have items re-installed by workers skilled in the trades involved.

1. Clean surfaces before applying paint or surface treatments. Remove oil and grease prior to cleaning. Schedule cleaning and painting so that dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

B. Surface Preparation: Clean and prepare surfaces to be painted in accordance with the manufacturer's instructions for each particular substrate condition an as specified.

1. Provide barrier coats over incompatible primers or remove and reprime. Notify Contracting Officer in writing of problems anticipated with using the specified finish-coat material with substrates primed by others.

2. Cementitious Materials: Prepare concrete, concrete masonry block, and cement plaster surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.

   a. Use abrasive blast-cleaning methods if recommended by the paint manufacturer.

   b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause blistering and burning of finish paint, correct this condition before application. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's printed directions.

3. Wood: Clean surfaces of dirt, oil, an other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.

   a. Scrape and clean small, dry, seasoned knots and apply a thin coat of white shellac or other recommended knot sealer before application of primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.

   b. Prime, stain, or seal woo to be painted immediately upon delivery. Prime edges, ends, faces, undersides, and backsides of wood, including cabinets, counters, cases, and paneling.

   c. When transparent finish is required, backprime with spar varnish. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately upon delivery.

4. Ferrous Metals: Clean nongalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with recommendations of the Steel Structures Painting Council.

   a. Blast steel surfaces clean as recommended by the paint system manufacturer and in accordance with requirements of SSPC specification SSPC-SP-10.

   b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.

   c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by the paint manufacturer, and touch up with the same primer as the shop coat.

5. Galvanized Surfaces: Clean galvanized surfaces with non-petroleum-based solvents so that the surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

C. Materials Preparation: Carefully mix and prepare paint materials in accordance with manufacturer’s directions.

1. Maintain containers used in mixing and application of paint in a clean condition, free of foreign materials and residue.

2. Stir material before application to produce a mixture of uniform density; stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.

3. Use only thinners approved by the paint manufacturer, and only within recommended limits.

## 3.3 APPLICATION

A. Apply paint in accordance with manufacturer’s directions. Use applicators and techniques best suited and for substrate and type of material being applied.

B. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of durable paint film.

C. Paint colors, surface treatments, and finishes are indicated in “schedules”.

D. Provide finish coats so that are compatible with primers used.

E. The number or coats and film thickness required is the same regardless of the application method. Do not apply succeeding coats until he previous coat has cured as recommended by the

manufacturer. Sand between applications where sending is required to produce and even smooth surface in accordance with the manufacturer's directions.

F. Apply additional costs when undercoats, stains, or other conditions show through final cost of paint until paint film is of uniform finish, color, and appearance. Give special attention to ensure that surfaces, including edges, corners, crevices, welds, and exposed fasteners, receive a dry film thickness equivalent to that of flat surfaces.

G. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers, covers for finned tubed radiation, grilles, and similar components are in place. Extend coatings in these areas as required to maintain the system integrity and provide desired protections.

H. Paint surface behind moveable equipment and furniture same as similar exposed surfaces. Paint surfaces behind permanently fixed equipment or furniture with prime coat only before final installation of equipment.

I. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, nonspecular black paint. J. Paint back sides of access panels and removable or hinged covered to match exposed surfaces.

K. Finish exterior doors on tops, bottoms, and side edges same as exterior faces.

L. Sand lightly between each succeeding enamel or varnish coat.

M. Omit primer on metal surfaces that have been shop primed and touch up painted.

N. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surfaces deterioration.

1. Allow sufficient time between successive coats to permit proper drying. Do not recoat until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure and where application of another coat of paint does not cause lifting or less of adhesion of the undercoat.

O. Minimum Coating Thickness: Apply materials at not leas s than the manufacturer's recommended spreading rate. Provide a total dry film, thickness of the entire system as recommended by the manufacturer.

P. Mechanical and Electrical Work: Painting mechanical and electrical work is limited to items exposed in mechanical equipment rooms and in occupied spaces.

Q. Prime Coats: Before application of finish coats, apply a prime coat of material as recommended by the manufacturer to material that is required to be painted or finished and has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction posts or unsealed area in first coat appears, to assure a finish coat with no burn through or other defects due to insufficient sealing

R. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

S. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, cloudiness, color irregularity, runs, brush marks, orange peel, nail holes, or other surface imperfections.

1. Provide satin finish for final coats.

T. Completed Work: Match approved samples for color, texture, and coverage, Remove, refinish, or repaint work not in compliance with specified requirements.

## 3.4 FIELD QUALITY CONTROL

A. The Government reserves the right to invoke the following test procedure at any time and as often as the Government deems necessary during the period when paint is being applied.

1. The Contractor will engage the services of an independent testing laboratory to sample the paint material being used. Samples of material delivered to the project will be taken, identified, sealed, and certified in the presence of the contractor.

## 3.5 CLEANING

A. Cleanup: At the end of each work day, remover empty cans, rags, rubbish, and other discarded paint materials from the site.

1. Upon completion of painting, clean glass and paint spattered surfaces. Remove spattered paint by washing and scraping, using care not to scratch or damage adjacent finished surfaces.

## 3.6 PROTECTION

A. Protect work or other trades, whether to be painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as acceptable to Contracting Officer.

B. Provide “wet paint” signs to protect newly painted finishes. Remove temporary protective wrappings provided by others for protection of their work after completion of painting operations.

## 3.7 INTERIOR PAINT SCHEDULE

A. General: Provide the following paint systems for the various substrates, as indicated.

B. Gypsum Drywall Systems:

1. Odorless Semigloss Alkyd Enamel Finish: 3 coats with total dry film thickness not less than 2. 5 miles.

   a. Primer:Interior Latex-based white Primer (FS TT-P-650)

   b. First Coat:Interior Semigloss Odorless Alkyd Enamel (FS TT-E-509)

   c. Second Coat:Interior Semigloss Odorless Alkyd Enamel (FS TT-E-509).

C. Stained Woodwork:

1. Stained Varnish Rubbed Finish: 3 finish coats over stain plus filler on open-grain wood. Wipe filler before applying first varnish coat.

   a. Stain Coat:Oil-Type Interior wood Stain (FS TT-S-711)

   b. First Coat:Cut Shellac (FS TT-S-300)

   c. Second Coat:Oil Rubbing Varnish (FS TT-V-86).

   d. Third Coat:Oil Rubbing Varnish (FS TT-V-86).

D. Natural-Finish Woodwork:

1. Rubbed Varnish Finish: 2 finish coats over shellac plus filler on open-grain wood.

   a. First Coat:Cut Shellac (FS TT-S-300).

   b. Second Coat:Oil Rubbing Varnish (FS TT-V-86).

   c. Third Coat:Oil Rubbing Varnish (FS TT-V-86).

E. Ferrous Metal:

1. Semigloss Enamel Finish: 2 coats over primer with total dry film thickness not less than 2. 5 mils.

   a. Primer:Synthetic rust-Inhibiting Primer (FS TT-P-664)

b. Undercoat:Interior Enamel Undercoat (FS TT-E-543)

c. Finish Coat:Interior Semigloss Odorless Alkyd Enamel (FS TT-E-509)

F. Zinc-Coated Metal:

1. Semigloss Finish: 2 coats over primer, with total dry film thickness not less than 2. 5 mils.

a. Primer:Galvanized Metal Primer (FS TT-P-641).

b. Undercoat:Interior Enamel Undercoat (FS TT-E-543)

c. Finish Coat:Interior Semigloss Odorless Alkyd Enamel (FS TT-E-509).

-- END OF SECTION 09900 --

DIVISION 10

SPECIALITIES

SECTION 10160

TOILET PARTITIONS

## PART 1 GENERAL

### 1.1 REFERENCES

The publications listed below are referenced and the most current publication applies. The publications are referred to in the text by basic designation only.

| | |
|---|---|
| 1.1.1 | CODE OF FEDERAL REGULATIONS (CFR) |
| 36 CFR 1191 | Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities |
| 1.1.2 | FEDERAL SPECIFICATIONS (FS) |
| FS RR-P-1352 | Partitions, Toilet, Complete |
| 1.1.3 | FEDERAL STANDARDS (FED-STD) |
| FED-STD 795 | Uniform Federal Accessibility Standards |

### 1.2 SYSTEM DESCRIPTION

Toilet partition system, including toilet enclosures, room entrance screens, and urinal screens, shall be a complete and usable system of panels, hardware, and support components. The partition system shall be provided by a single manufacturer and shall be a standard product as shown in the most recent catalog data. The partition system shall comply with FED-STD 795 and 36 CFR 1191 for areas as shown.

### 1.3 SUBMITTALS

Governemnt approval is required for submittals with a “GA” designation, submittals having an “FIO” designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

1.3.1 Data “FIO”

Toilet Partition System.

Manufacturer's technical data and catalog cuts including installation and cleaning instructions.

1.3.2 Drawings "GA"

Toilet Partition System.

Drawings showing plans, elevations, details of construction, hardware, reinforcing, fittings, mountings, and anchoring.

1.3.3 Samples "GA"

Toilet Partition System.

Manufacturer's standard color charts and color samples.

## 1.4 DELIVERY, STORAGE, AND HANDLING

Components shall be delivered to the jobsite in the manufacturer's original packaging with the brand, item identification, and project reference clearly marked. Components shall be stored in a dry location that is adequately ventilated and free from dust, water, or other contaminants and shall have easy access for inspection and handling.

## 1.5 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period shall be provided.

# PART 2 PRODUCTS

## 2.1 TOILET ENCLOSURES

Toilet enclosures shall conform to FS RR-P-1352, Type I, Style A. Width, length and height of toilet enclosures shall be as shown. Finish surface of panels shall be stainless steel Finish 3. Panels indicated to receive toilet paper holders or grab bars as specified in Section 10800 TOILET ACCESSORIES shall be reinforced for the reception of the items required. Grab bars shall comply with FED-STD 795 and 36 CFR 1191.

## 2.2 URINAL SCREENS

Urinal screens shall conform to FS RR-P-1352, Type III, Style D. Finish surface of screens shall be stainless steel Finish 3. Width and height of urinal screens shall be as shown.

## 2.3 HARDWARE

Hardware for the toilet partition system shall conform to FS RR-P-1352 for the specified type and style of partitions. Hardware finish shall be highly resistant to alkalies, urine, and other common toilet room acids.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Toilet partitions shall be installed straight and plumb in accordance with approved manufacturer's instructions with horizontal lines level and rigidly anchored to the supporting construction. Where indicated, anchorage to walls shall be by through-bolting. Drilling and cutting for installation of anchors shall be at locations that will be concealed in the finished work.

### 3.2 ADJUSTING AND CLEANING

Doors shall have a uniform vertical edge clearance of approximately 5 mm (3/16 inch) and shall rest open at approximately 30 degrees when unlatched. Baked enamel finish shall be touched up with the same color of paint that was used for the finish. Toilet partitions shall be cleaned in accordance with approved manufacturer's instructions and shall be protected from damage until accepted.

-- END OF SECTION 10160 --

DIVISION 10

SPECIALTIES

SECTION 10500

LOCKERS

## PART 1 - GENERAL

### 1.1 DESCRIPTION

Staff lockers

### 1.2 QUALITY ASSURANCE

Products of manufacturers regularly engaged in manufacturing lockers of type specified and shown.

### 1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation, submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

#### 1.3.1 Drawings "GA"

Lockers.

Lockers, showing details of construction, fastenings and methods of anchorage specified, and items of hardware and accessories. Drawings shall include catalog cuts, manufacturer's descriptive data and installation instructions, templates, and key list, showing lock and key number, and locker number.

#### 1.3.2 Samples "GA"

Lockers.

Six inch square metal panel of lockers, showing color. One plate for each color.

### 1.4 APPLICABLE PUBLICATIONS

Publications listed below are referenced and the most current publication. Publications are referenced in text by basic designation only.

| | |
|---|---|
| 1.4.1 | FEDERAL SPECIFICATIONS (FED. SPEC.) |
| AA-L-00486H(1) | Lockers, Clothing, Steel NOTICE 1 |
| FF-B-588C(1) | Bolt, Toggle; And Expansion Sleeve, Screw |
| FF-S-325 | Shield, Expansion; Nail, Expansion; And Nail |
| INT AMD 3 | Drive Screw (Devices, Anchoring, Masonry) |
| 1.4.2 | MILITARY SPECIFICATIONS: |
| MIL-W-28581B | Wardrobes: Clothing, Composite Wood and Metal |

1.5 DELIVERY, STORAGE AND HANDLING

A. Do not store outside. Protect from damage.

B. Handle to prevent damage to lockers or building components.

PART 2 - PRODUCTS

2.1 STAFF LOCKERS

A. Conform to Fed. Spec. AA-L-00486, modified for size.

1. Delete federal stock numbers required in identification marking paragraph of Federal Specifications.

2. Reproduction sample is not required.

B. Size:

1. Type I (single tier):

a. Identified as A: 381 mm (15-inches) wide, 457 mm (18-inches) deep, 1981 mm (78-inches) high with base panels.

C. Provide sloping tops and adjustable legs.

D. Provide flush filler plates or base panel of not less than 1.5 mm (0.0598-inch) thick sheet steel between legs at exposed fronts and ends of lockers.

E. Furnish lockers as shown on plans, with a common sloping top.

F. Do not expose bolts on front of lockers.

G. Sloping Tops: Filler Plates, and Closures

1. Fabricate 1.2 mm (0.0478-inch) thick sheet steel.

2. Height of slope approximately one-third the depth of the locker.

3. Fasten sloping tops with oval-head sheet metal screws inserted from interior including flush closures on exposed ends of sloping tops.

4. Where ceilings interfere with installation of sloping tops, omit sloping tops and provide flat steel filler plates.

5. Closures for openings larger than 6 mm (1/4-inch) wide between lockers and adjacent walls; either flat steel closure strips, scribed to required contours, 1 mm or (0.0359-inch) thick machined formed fillers with returns.

6. Finish same color as lockers.

H. Spaces:

1. Where lockers are fastened to walls, provide spacers, permanently mounted on lockers for fasteners.

2. Thickness of spacers required to fill space between back of locker and wall face.

3. Designed so wall face or back of locker is not deformed when fastener is tightened.

## 2.2 FASTENERS

A. For securing lockers to adjoining construction; toggle or expansion bolts, 6 mm (1/4-inch) in diameter, or other appropriate size and type of fastenings as required for each specific type installation.

B. Use toggle bolts, Fed. Spec. FF-B-588, in hollow masonry and frame construction.

C. Use expansion bolts, Fed. Spec. FF-S-325 in solid masonry or concrete. Do not use lead, fiber or plastic shield.

D. Where type, size, or spacing of anchorage is not shown or specified, show on shop drawings proposed fastenings and method of installation.

## 2.3 LOCKS, KEYING AND NUMBERING

A. Locks:

1. Lockers:

a. Flat key type, key lock differently and into one master key set.

b. Provide two keys for each locker and two master keys.

c. Provide locks and keys with an identifying number stamped on back of lock and on corresponding keys. Use different numbers for each locker.

d. Number lockers consecutively within a space or room.

2. Marking of Locks and Keys:

a. Name of manufacturer, or trademark by which manufacture can readily be identified, legibly marked on each lock, and key change number marked on the exposed face of the lock.

b. Key change numbers stamped on each key.

c. Key change numbers provide sufficient information for replacement of key by manufacturer.

d. Attach identification tags to keys.

B. Keying:

1. Locks key differently.

2. Provide two keys per lock and six master keys.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

A. Assemble lockers as specified by manufacturer.

B. Show in presence of Contracting Officer that keys for each unit and master keys operate locks as specified.

C. Touch-up any abraded or damaged finish with matching paint.

D. Clean or repair all dirt or stains.

E. Remove any protective wrappings from lockers and components.

F. Lockers:

1. Closures: Secure closures with sheet metal screws to tubular or channel members of units, or with bolts where exposed on inside.

2. Filler Plates: Secure filler plates to top members unless otherwise shown. Secure filler plates more than six inches in width to top edge and fasten by screws to a continuous 25 by 25 mm (1 by 1-inch), 1 mm (0.0747-inch) thick steel angle secured to ceiling with toggle bolts.

3. Base: Install filler plates at locker base over leg.

4. Tops: Install sloping tops or filler plates as specified.

## 3.2 ANCHORAGE

A. To Walls: Except as otherwise shown, anchor lockers through back near top and bottom with 5 mm (3/16-inch) toggle bolt in hollow construction.

1. Do not anchor to wood grounds.

2. Fastenings and anchorage for lockers to metal stud partitions: Use toggle bolts or as shown.

## 3.3 ADJUSTING

A. Adjust lockers so doors and drawers operate without binding and do not require force over two pounds to close and lock in position.

B. Adjust locks to operate freely without dead bolt binding or bearing against sides of strike.

-- END OF SECTION 10500 --

DIVISION 10

SPECIALTIES

SECTION 10522

FIRE EXTINGUISHER CABINETS

## PART 1 GENERAL

### 1.1 DESCRIPTION

This section covers recessed fire extinguisher cabinets.

### 1.2 RELATED WORK

A. Acrylic glazing: Section 08810, GLASS AND GLAZING.

B. Field Painting: Section 09900, PAINTING.

### 1.3 SUBMITTALS

A. Submit in accordance with Section 01330, SUBMITTAL PROCEDURES.

B. Manufacturer's Literature and Data: Fire extinguisher cabinet including installation instruction and rough opening required.

## PART 2 PRODUCTS

### 2.1 FIRE EXTINGUISHER CABINET

Recessed type with flat trim of size and design shown.

### 2.2 FABRICATION

A. Form body of cabinet from 0.9 mm (0.0359 inch) thick sheet steel.

B. Fabricate door and trim from 1.2 mm (0.0478 inch) thick sheet steel with all face joints fully welded and ground smooth.

1. Glaze doors with 6 mm (1/4 inch) thick G-19, clear acrylic sheet.

2. Design doors to open 180 degrees.

3. Provide continuous hinge, pull handle, and adjustable roller catch.

### 2.3 FINISH

A. Finish interior of cabinet body with baked-on semigloss white enamel.

B. Finish door, frame with manufacturer's standard baked-on prime coat suitable for field painting.

**PART 3 EXECUTION**

A. Install fire extinguisher cabinets in prepared openings and secure in accordance with manufacturer's instructions.

B. Install cabinet so that bottom of cabinet is 975 mm (39 inches) above finished floor.

**-- END OF SECTION 10522 --**

DIVISION 10

SPECIALTIES

SECTION 10800A

TOILET ACCESSORIES

## PART 1 GENERAL

### 1.1 REFERENCES

The publications listed below are referenced and the most current publication applies. The publications are referred to in the text by basic designation only.

1.1.1 AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 1036 Flat Glass

1.1.2 COMMERCIAL ITEM DESCRIPTIONS (CID)

CID A 2380 Dispenser, Paper Towel

CID A 2398 Curtain, Shower and Window (Metric SI)

### 1.2 SUBMITTALS

Government approval is required for submittals with a “GA” designation, submittals having an “FIO” designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

1.2.1 Data “FIO”

Finishes. Accessory Items.

Manufacturer's descriptive data and catalog cuts indicating materials of construction, fasteners proposed for use for each type of wall construction, mounting instructions, and operation instructions.

### 1.3 DELIVERY, STORAGE, AND HANDLING

Toilet accessories shall be wrapped for shipment and storage, delivered to the jobsite in manufacturer's original packaging and stored in a clean, dry area protected from construction damage and vandalism.

## PART 2 PRODUCTS

### 2.1 MANUFACTURED UNITS

Toilet accessories shall be provided where shown on plans. Porcelain type, tile-wall accessories are specified in Section 09310 CERAMIC TILE. Each accessory item shall be complete with the necessary mounting plates.

#### 2.1.1 Anchors and Fasteners

Anchors and fasteners shall be capable of developing a restraining force commensurate with the strength of the accessory to be mounted and shall be suited for use with the supporting construction. Exposed fasteners shall be of tamperproof design and shall be finished to match the accessory.

#### 2.1.2 Finishes

Except where noted otherwise, finishes on metal shall be provided as follows:

| Metal | Finish |
|---|---|
| Stainless steel | No. 4 satin finish |

### 2.2 ACCESSORY ITEMS

Accessory items shall conform to the requirements specified below. Sizes shall be as shown on plans.

#### 2.2.1 Facial Tissue Dispenser (FTD)

Facial tissue dispenser shall be recessed mounted, Type 304 stainless steel face, satin finish. Face of recessed dispenser shall be secured by friction with suitable spring steel clips. Dispenser shall have a minimum capacity of 300 two-ply tissues.

#### 2.2.2 Grab Bar (GB)

Grab bar shall be 1.3 mm (18 gauge), 32 mm (1-1/4 inches) OD Type 304 stainless steel. Concealed mounting flange shall have set screw mounting holes concealed on the lip of the flange. Grab bar shall have peened non-slip surface. Installed bars shall be capable of withstanding a 2.225 kN (500 pound) vertical load without obvious permanent deformation. Space between wall and grab bar shall be 38 mm (1/2 inch.)

#### 2.2.3 Glass Mirrors

Glass for mirrors shall be Type I transparent flat type, Class 1-clear. Glazing Quality q1 6 mm (1/4 inch) thick conforming to ASTM C 1036. Glass color shall be clear. Glass shall be coated on one surface with silver coating, copper protective coating, and mirror backing paint. Silver coating shall be highly adhesive pure silver coating of a thickness which shall provide

reflectivity of 83 percent or more of incident light when viewed through 6 mm (1/4 inch) thick glass, and shall be free of pinholes or other defects. Copper protective coating shall be pure bright reflective copper, homogeneous without sludge, pinholes or other defects, and shall be of proper thickness to prevent "adhesion pull" by mirror backing paint. Mirror backing paint shall consist of two coats of special scratch and abrasion-resistant paint and shall be baked in uniform thickness to provide a protection for silver and copper coatings which will permit normal cutting and edge fabrication.

2.2.4 Mirror, Tilt (MT)

Tilt mirror shall be surface mounted and shall provide full visibility for person in a wheelchair. Mirror shall have fixed tilt, extending at least 100 mm (4 inches) from the wall at the top and tapering to 25 mm (1 inch) at the bottom. Glass for mirrors shall conform to ASTM C 1036 and paragraph Glass Mirrors.

2.2.5 Paper Towel Dispenser (PTD)

Paper towel dispenser shall conform to CID A-A-2380, Type I, shall be constructed of not less than 0.683 mm (0.269 inch) Type 304 stainless steel, and shall be recessed mounted. Dispenser shall have a towel compartment and a liquid soap dispenser. Locking mechanism shall be tumbler key lock.

2.2.6 Combination Paper Towel Dispenser/Waste Receptacle Units (PTDWR)

Dispenser/receptacle shall be recessed semi-recessed and shall have a capacity of 400 sheets of C-fold, single-fold, or quarter-fold towel. Waste receptacle shall be designed to be locked in unit and removable for service. Locking mechanism shall be tumbler key lock concealed tumbler key lock. Waste receptacle shall have a capacity of 12 gallons. Unit shall be fabricated of 0.8 mm (0.30 inch) stainless steel welded construction with a satin finish. Waste receptacle that accepts reusable liner standard for unit manufacturer shall be provided.

2.2.7 Sanitary Napkin Disposer (SND)

Sanitary napkin disposal shall be constructed of Type 304 stainless steel with removable leak-proof receptacle for disposable liners. Fifty disposable liners of the type standard with the manufacturer shall be provided. Receptacle shall be retained in cabinet by tumbler lock. Disposer shall be provided with a door for inserting disposed napkins, and shall be recessed.

2.2.8 Sanitary Napkin and Tampon Dispenser (SNTD)

Sanitary napkin and tampon dispenser shall be recessed. Dispenser, including door shall be Type 304 stainless steel and shall dispense both napkins and tampons with a minimum capacity of 20 each. Dispensing mechanism shall be for complimentary coin operation. Coin mechanisms shall be field changeable by adjusting pins for new coin designation. Coin mechanisms shall have minimum

denominations of 25 cents. Doors shall be hung with a full-length corrosion-resistant steel piano hinge and secured with a tumbler lock. Keys for coin box shall be different from the door keys.

2.2.9 Shower Curtain (SC)

Shower curtain shall conform to CID A-A-2398, Style I.

2.2.10 Shower Curtain Rods (SCR)

Shower curtain rods shall be Type 304 stainless steel 32 mm (1-1/4 inch) OD by 1.24 mm (0.049 inch) minimum straight.

2.2.11 Soap Dispenser (SD)

Soap dispenser shall be surface mounted, liquid type consisting of a vertical Type 304 stainless steel tank with holding capacity of 1.2 L (40 fluid ounces) with a corrosion-resistant all-purpose valve that dispenses liquid soaps, lotions, detergents and antiseptic soaps, shall contain a swap feed mechanism and an agitator and shall have a minimum capacity of 0.94 L (32 ounces).

2.2.12 Soap Holder (SH)

Soap holder shall be recessed Type 304 stainless steel. Separate supports shall be stainless steel.

2.2.13 Soap and Grab Bar Combination, Recessed (SGR)Soap and grab bar combination shall be recessed type and shall be Type 304 stainless steel, satin finish.

2.2.14 Towel Pin (TP)

Towel pin shall have concealed wall fastenings, and a pin integral with or permanently fastened to wall flange. Maximum projection shall be 100 mm (4 inches).

2.2.15 Toilet Tissue Dispenser (TTD)

Toilet tissue holder shall be Type II - surface mounted with two rolls of tissue stacked vertically. Cabinet shall be stainless steel, satin finish.

2.2.16 Waste Receptacle (WR)

Waste receptacle shall be Type 304 stainless steel, designed for recessed mounting. Reuseable liner, of the type standard with the receptacle manufacturer, shall be provided. Capacity shall be as shown. Receptacles with push doors and doors for access to the waste compartment shall have continuous hinges.

2.2.17 Toilet Seat Cover Dispenser (TSCD)

Toilet seat cover dispensers shall be stainless steel and be partition mounted. Dispenser shall have a minimum capacity of 500 seat covers. Dual access dispensers shall have a minimum capacity of 500 seat covers. Dual access dispensers shall have a minimum capacity of 500 seat covers per side. Combination seat cover dispenser, sanitary napkin disposal and/or toilet tissue dispenser shall meet the requirements of this paragraph as well as paragraph Sanitary Napkin Disposer (SND) and paragraph Toilet Tissue Dispenser (TTD) as applicable.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Toilet accessories shall be securely fastened to the supporting construction in accordance with the manufacturer's approved instructions.

### 3.2 SCHEDULE

Schedule shall be as shown on drawings.

-- END OF SECTION 10800A --

DIVISION 12

FURNISHINGS

SECTION 12390A

CABINETS AND COUNTERTOPS

## PART 1 GENERAL

### 1.1 REFERENCES

The publications listed below are referenced and the most current publication applies. The publications are referred to in the text by basic designation only.

1.1.1 BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

BHMA A156.9 Cabinet Hardware

1.1.2 KITCHEN CABINET MANUFACTURERS ASSOCIATION (KCMA)

KCMA A161.1 Recommended Performance & Construction Standards for Kitchen and Vanity Cabinets

1.1.3 NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA LD 3 High-Pressure Decorative Laminates

### 1.2 DESIGN

Cabinets shall be wood, factory-fabricated and finished in the manufacturer's standard sizes as indicated. Cabinets shall be constructed as specified and shall meet the requirements of KCMA A161.1. Fastenings shall permit removal and replacement of individual units without affecting the remainder of the installation. Drawers shall be removable and shall be equipped with position stops to avoid accidental complete withdrawals.

### 1.3 SUBMITTALS

Government approval is required for submittals with a “GA” designation, submittals having an “FIO” designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

1.3.1 Data “FIO”

Cabinets and Countertops.

Manufacturer's printed data, catalog cuts, and installation instructions.

1.3.2 Samples "GA"

Cabinets and Countertops.

Complete minimum size cabinets may be furnished as samples. Mock-up units are not acceptable. Samples shall be of sufficient size to show color pattern and method of assembly.

a. Counter top and backsplash - One section, containing both.

b. Door and drawer front - One of each, with hardware mounted.

c. Melamine plastic color samples shall be approximately 50 mm by 75 mm (2" x 3") size.

d. Stain/color samples shall be approximately 50 mm by 75 mm (2" x 3") size.

## 1.4 DELIVERY AND STORAGE

Cabinets shall be delivered to the jobsite wrapped in a protective covering. Cabinets shall be stored as recommended by manufacturer.

# PART 2 PRODUCTS

## 2.1 CABINETS

Wall and base cabinets shall be of the same construction and same outside appearance. Door design shall be selected from vendors standard styles. Corner cabinets shall be equipped with full circle shelves as indicated. Shelves shall be fixed or fully adjustable as indicated. Adjustable shelves shall be capable of adjusting on approximately 31 mm (1-1/4 inch) increments. Shelves shall be minimum 13 mm (1/2 inch) thick plywood or minimum 13 mm (1/2 inch) thick 20 kg (45 pound) density particle board. Drawer fronts shall be minimum 16 mm (5/8 inch) thick, 20 kg (45 pound) density particle board core.

### 2.1.1 Frame Type Cabinets

Cabinets shall be constructed with frame fronts and solid ends, or frame construction throughout. Frame members shall be 19 mm (3\4 inch) thick by 38 mm (1-1\2 inch) wide; kiln-dried hardwood, glued together, and shall be either mortised and tenoned, dovetailed or doweled, nailed, stapled or screwed. Backs of wall cabinets shall be 3 mm (1\8 inch) thick plywood or tempered hardboard. Backs of base and tall cabinets shall be 9 mm (3\8 inch) thick hardwood plywood or 9 mm (3\8 inch) thick, 20 kg (45 pound) density particle board. Bottoms of cabinets shall be minimum 9 mm (3\8 inch) thick plywood sound grade. Cabinet ends shall be 16 mm (5\8 inch) thick, 20 kg (45 pound) density particle board core.

2.1.2 Frameless Type Cabinets

Cabinets shall be of frameless design and shall be constructed of minimum 16 mm (5\8 inch) thick, 20 kg (45 pound) density particle board end and floor panels. Cabinet back shall be constructed of minimum 5 mm (3/16-inch) thick, 20 kg (45 pound) density particle board.

## 2.2 COUNTERTOPS AND BACKSPLASH

Countertop and backsplash shall be constructed of 19 mm (3/4 inch) thick plywood and shall be fully formed type. Cove type shall be a single unit with self-edging and plastic laminate coved at the juncture of the countertop and backsplash. Fully formed type or square edge shall be a unit with shaped edges using wood nose molding at counter edge. Backsplash shall be not less than 88 mm (3-1/2 inches) high. End splashes constructed of 19 mm (3/4 inch) plywood or 19 mm (3/4 inch) thick, 20 kg (45 pound) density particle board core shall be supplied. Sink rims shall be corrosion resistant steel clamping type.

## 2.3 FINISH

2.3.1 Cabinet Finish

Cabinets shall be provided with a standard factory-applied durable finish. Exposed exterior surfaces shall be hardwood or grade A-A hardwood veneer with natural stain and sprayed on polyurethane finish. Colors shall be selected from manufacturer's standard.

2.3.2 Melamine Laminated Finish on Cabinets

Cabinet backs and shelves shall be finished with a melamine laminate on the exposed side. Laminate shall conform to the requirements of NEMA LD 3 and laminate adhesive shall be contact type applied to both surfaces. Design, color, and finish shall be selected from manufacturer's standard.

2.3.3 Melamine Laminates on Countertops

Continuous sheets of longest lengths practicable shall be provided. When the countertop and backsplash are two separate units, GP50 plastic laminate shall be used. When the countertop and backsplash are one unit, PF42 plastic laminate shall be used. Plastic laminate shall conform to the requirements of NEMA LD 3 and plastic laminate adhesive shall be contact type applied to both surfaces. Design, color, and finish shall be selected from manufacturer's standard.

2.3.4 Backer Sheets

Backer Sheets of plastic laminate, shall conform to NEMA LD 3, Grade BK20 and shall be applied to the underside of all core material. Design, color, and finish shall be selected from manufacturer's standard.

## 2.4 HARDWARE

Hardware shall conform to BHMA A156.9, shall be suitable for kitchen cabinet use and shall be selected from manufacturer’s standard.

# PART 3 EXECUTION

## 3.1 INSTALLATION

Cabinets shall be installed in accordance with manufacturer's instructions. The inner edge of sink cut-outs in laminated plastic tops shall be painted with a coat of semigloss enamel paint and sink flanges shall be set in a bed of sealant.

-- END OF SECTION 12390A --

DIVISION 15

MECHANICAL

SECTION 15250

MECHANICAL INSULATION

## PART 1 GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes pipe, duct, and equipment insulation.

### 1.3 DEFINITIONS

A. Hot Surfaces: Normal operating temperatures of 100 deg F (38 deg C) or higher.

B. Dual-Temperature Surfaces: Normal operating temperatures that vary from hot to cold.

C. Cold Surfaces: Normal operating temperatures less than 75 deg F (24 deg C).

D. Thermal resistivity is designated by an r-value that represents the reciprocal of thermal conductivity (k-value). Thermal conductivity is the rate of heat flow through a homogenous material exactly 1 inch (25.4 mm) thick. Thermal resistivity (r-value) is expressed by the temperature difference in degrees Fahrenheit (Kelvins) between the two exposed faces required to cause 1 BTU per hour (1 Watt) to flow through 1 square foot (1 square meter) at mean temperatures indicated.

E. Thermal Conductivity (k-value): Measure of heat flow through a material at a given temperature difference; conductivity is expressed in units of Btu x inch/h x sq. ft. x deg F (W x m/sq. m x K).

F. Density: Is expressed in pcf (kg/cu. m).

### 1.4 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product data for each type of mechanical insulation identifying k-value, thickness, and accessories.

C. Material certificates, signed by the manufacturer, certifying that materials comply with specified requirements where laboratory test reports cannot be obtained.

D. Material test reports prepared by a qualified independent testing laboratory. Certify insulation meets specified requirements.

## 1.5 QUALITY ASSURANCE

A. Fire Performance Characteristics: Conform to the following characteristics for insulation including facings, cements, and adhesives, when tested according to ASTM E 84, by UL or other testing or inspecting organization acceptable to the authority having jurisdiction. Label insulation with appropriate markings of testing laboratory.

1. Interior Insulation: Flame spread rating of 25 or less and a smoke developed rating of 50 or less.

2. Exterior Insulation: Flame spread rating of 75 or less and a smoke developed rating of 150 or less.

## 1.6 SEQUENCING AND SCHEDULING

A. Schedule insulation application after testing of piping and duct systems.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Glass Fiber:

a. CertainTeed Corporation.

b. Knauf Fiberglass GmbH.

c. Schuller.

d. Owens-Corning Fiberglas Corporation.

e. USG Interiors, Inc. - Thermafiber Division.

2. Flexible Elastomeric Cellular:

a. Armstrong World Industries, Inc.

b. Halstead Industrial Products.

c. IMCOA.

d. Rubatex Corporation.

## 2.2 GLASS FIBER

A. Material: Inorganic glass fibers, bonded with a thermosetting resin.

B. Jacket: All-purpose, factory-applied, laminated glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil having self-sealing lap.

C. Board: , semi-rigid jacketed board.

1. Thermal Conductivity: 0.26 Btu x inch/h x sq. ft. x deg F (0.037 W x m/sq. m x K) average maximum, at 75 deg F (24 deg C) mean temperature.

2. Density: 1.2 pcf (19.2 kg/cu. m) average minimum.

D. Blanket: , jacketed flexible blankets.

1. Thermal Conductivity: 0.32 Btu x inch/h x sq. ft. x deg F (0.046 W x m/sq. m x K) average maximum, at 75 deg F (24 deg C) mean temperature.

E. Preformed Pipe Insulation: , rigid pipe insulation, jacketed.

1. Thermal Conductivity: 0.26 Btu x inch/h x sq. ft. x deg F (0.037 W x m/sq. m x K) average maximum at 75 deg F (24 deg C) mean temperature.

2. Density: 1.0 pcf (16.0 kg/cu. m) average minimum.

F. Adhesive: Produced under the UL Classification and Follow-up service.

1. Type: Non-flammable, solvent-based.

2. Service Temperature Range: Minus 20 to 180 deg F (Minus 29 to 82 deg C).

G. Vapor Barrier Coating: Waterproof coating recommended by insulation manufacturer for outside service.

## 2.3 FLEXIBLE ELASTOMERIC CELLULAR

A. Material: Flexible expanded closed-cell structure with smooth skin on both sides.

1. Tubular Materials: ASTM C 534, Type I.

2. Sheet Materials: ASTM C 534, Type II.

B. Thermal Conductivity: 0.30 Btu x inch/h x sq. ft. x deg F (0.043 W x m/sq. m x K) average maximum at 75 deg F (24 deg C).

C. Coating: Water based latex enamel coating recommended by insulation manufacturer.

## 2.4 ADHESIVES

A. Flexible Elastomeric Cellular Insulation Adhesive: Solvent-based, contact adhesive recommended by insulation manufacturer.

B. Lagging Adhesive: non-flammable adhesive in the following Classes and Grades:

1. Class 1, Grade A for bonding glass cloth and tape to unfaced glass fiber insulation, sealing edges of glass fiber insulation, and bonding lagging cloth to unfaced glass fiber insulation.

2. Class 2, Grade A for bonding glass fiber insulation to metal surfaces.

## 2.5 JACKETS

A. General: except as otherwise indicated.

B. Foil and Paper Jacket: Laminated glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil.

1. Water Vapor Permeance: 0.02 perm (1.2 ng/Pa/s/sq. m) maximum.

2. Puncture Resistance: 50 beach units minimum.

C. PVC Jacketing: High-impact, ultra-violet-resistant PVC, 20 mils (0.50 mm) thick, roll stock ready for shop or field cutting and forming to indicated sizes.

1. Adhesive: As recommended by insulation manufacturer.

D. PVC Fitting Covers: Factory-fabricated fitting covers manufactured from 20 mil (0.50 mm) thick, high-impact, ultra-violet-resistant PVC.

1. Adhesive: As recommended by insulation manufacturer.

## 2.6 ACCESSORIES AND ATTACHMENTS

A. Glass Cloth and Tape: Woven glass fiber fabrics, plain weave, presized a minimum of 8 ounces per sq. yd. (272 gm per sq. m).

1. Tape Width: 4 inches (102 mm).
2. Cloth Standard: MIL-C-20079H, Type I.
3. Tape Standard: MIL-C-20079H, Type II.

B. Bands: 3/4 inch (19 mm) wide, in one of the following materials compatible with jacket:

1. Stainless Steel: Type 304, 0.020 inch (0.5 mm) thick.
2. Galvanized Steel: 0.005 inch (0.13 mm) thick.
3. Aluminum: 0.007 inch (0.18 mm) thick.
4. Brass: 0.01 inch (0.25 mm) thick.
5. Nickel-Copper Alloy: 0.005 inch (0.13 mm) thick.

C. Wire: 14 gage (1.6 mm) nickel copper alloy, 16 gage (1.6 mm), soft-annealed stainless steel, or 16 gage (1.6 mm), soft-annealed galvanized steel.

D. Corner Angles: 28 gage (0.3 mm), 1 inch by 1 inch (25 mm by 25 mm) aluminum, adhered to 2 inches by 2 inches (50 mm by 50 mm) kraft paper.

E. Anchor Pins: Capable of supporting 20 pounds (9 kg) each. Provide anchor pins and speed washers of sizes and diameters as recommended by the manufacturer for insulation type and thickness.

## 2.7 SEALING COMPOUNDS

A. Vapor Barrier Compound: Water-based, fire-resistive composition.

1. Water Vapor Permeance: 0.08 perm (4.6 ng/Pa/s/sq. m) maximum.
2. Temperature Range: Minus 20 to 180 deg F (Minus 29 to 82 deg C).

B. Weatherproof Sealant: Flexible-elastomer-based, vapor-barrier sealant designed to seal metal joints.

1. Water Vapor Permeance: 0.02 perm (1.2 ng/Pa/s/sq. m) maximum.
2. Temperature Range: Minus 50 to 250 deg F (Minus 46 to 121 deg C).
3. Color: Aluminum.

# PART 3 - EXECUTION

## 3.1 PREPARATION

A. Surface Preparation: Clean, dry, and remove foreign materials such as rust, scale, and dirt.

B. Mix insulating cements with clean potable water. Mix insulating cements contacting stainless-steel surfaces with demineralized water.

1. Follow cement manufacturer's printed instructions for mixing and portions.

## 3.2 INSTALLATION, GENERAL

A. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each mechanical system.

B. Select accessories compatible with materials suitable for the service. Select accessories that do not corrode, soften, or otherwise attack the insulation or jacket in either the wet or dry state.

C. Install vapor barriers on insulated pipes, ducts, and equipment having surface operating temperatures below 60 deg F (16 deg C).

D. Apply insulation material, accessories, and finishes according to the manufacturer's printed instructions.

E. Install insulation with smooth, straight, and even surfaces.

F. Seal joints and seams to maintain vapor barrier on insulation requiring a vapor barrier.

G. Seal penetrations for hangers, supports, anchors, and other projections in insulation requiring a vapor barrier.

H. Seal Ends: Except for flexible elastomeric insulation, taper ends at 45 degree angle and seal with lagging adhesive. Cut ends of flexible elastomeric cellular insulation square and seal with adhesive.

I. Apply adhesives and coatings at manufacturer's recommended coverage-per-gallon rate.

J. Keep insulation materials dry during application and finishing.

## 3.3 PIPE INSULATION INSTALLATION, GENERAL

A. Tightly butt longitudinal seams and end joints. Bond with adhesive.

B. Stagger joints on double layers of insulation.

C. Apply insulation continuously over fittings, valves, and specialties, except as otherwise indicated.

D. Apply insulation with a minimum number of joints.

E. Apply insulation with integral jackets as follows:
   1. Pull jacket tight and smooth.
   2. Cover circumferential joints with butt strips, at least 3 inches (76 mm) wide, and of same material as insulation jacket. Secure with adhesive and outward clinching staples along both edges of butt strip and space 4 inches (100 mm) on center.
   3. Longitudinal Seams: Overlap seams at least 1-1/2 inches

(40 mm). Apply insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap.

Staple laps with outward clinching staples along edge at 4 inches (100 mm) on center.

4. Exception: Do not staple longitudinal laps on insulation applied to piping systems with surface temperatures at or below 35 deg F (1.7 deg C).
5. Vapor Barrier Coatings: Where vapor barriers are indicated, apply on seams and joints, over staples, and at ends butt to flanges, unions, valves, and fittings.
6. At penetrations in jackets for thermometers and pressure gages, fill and seal voids with vapor barrier coating.
7. Repair damaged insulation jackets, except metal jackets, by applying jacket material around damaged jacket. Adhere, staple, and seal. Extend patch at least 2 inches (50 mm) in both directions beyond damaged insulation jacket and around the entire circumference of the pipe.

F. Exterior Wall Penetrations: For penetrations of below grade exterior walls, extend metal jacket for exterior insulation through penetration to a point 2 inches (50 mm) from interior surface of wall inside the building. Seal ends of metal jacket with vapor barrier coating. Secure metal jacket ends with metal band. At point where insulation metal jacket contacts mechanical sleeve seal, insert cellular glass preformed pipe insulation to allow sleeve seal tightening against metal jacket. Tighten and seal sleeve to jacket to form a watertight seal.

G. Interior Walls and Partitions Penetrations: Apply insulation continuously through walls and partitions, except fire-rated walls and partitions. Apply an aluminum jacket with factory-applied moisture barrier over insulation. Extend 2 inches (50 mm) from both surfaces of wall or partition. Secure aluminum jacket with metal bands at both ends. Seal ends of jacket with vapor barrier coating. Seal around penetration with joint sealer. Refer to Division 7 Section "Joint Sealants."

H. Fire-Rated Walls and Partitions Penetrations: Terminate insulation at penetrations through fire-rated walls and partitions. Seal insulation ends with vapor barrier coating. Seal around penetration with firestopping or fire-resistant joint sealer. Refer to Division 7 for firestopping and fire-resistant joint sealers.

I. Flanges, Fittings, and Valves - Interior Exposed and Concealed: Coat pipe insulation ends with vapor barrier coating. Apply premolded, precut, or field-fabricated segments of insulation around flanges, unions, valves, and fittings. Make joints tight. Bond with adhesive.

1. Use same material and thickness as adjacent pipe insulation.
2. Overlap nesting insulation by 2 inches (50 mm) or 1-pipe diameter, which ever is greater.
3. Apply materials with adhesive, fill voids with mineral fiber

insulating cement. Secure with wire or tape.

4. Insulate elbows and tees smaller than 3 inches (DN 75) pipe size with premolded insulation.
5. Insulate elbows and tees 3 inches (DN 75) and larger with premolded insulation or insulation material segments. Use at least 3 segments for each elbow.
6. Cover insulation, except for metal jacketed insulation, with PVC fitting covers and seal circumferential joints with butt strips.
7. Cover insulation, except for metal jacketed insulation, with 2 layers of lagging adhesive to a minimum thickness of 1/16 inch (1.6 mm). Install glass cloth between layers. Overlap adjacent insulation by 2 inches (50 mm) in both directions from joint with glass cloth and lagging adhesive.

J. Hangers and Anchors: Apply insulation continuously through hangers and around anchor attachments. and seal insulation ends.

1. Inserts and Shields: Cover hanger inserts and shields with jacket material matching adjacent pipe insulation.

## 3.4 GLASS FIBER PIPE INSULATION INSTALLATION

A. Bond insulation to pipe with lagging adhesive.

B. Seal exposed ends with lagging adhesive.

C. Seal seams and joints with vapor barrier compound.

## 3.5 FLEXIBLE ELASTOMERIC CELLULAR PIPE INSULATION INSTALLATION

A. Slip insulation on the pipe before making connections wherever possible. Seal joints with adhesive. Where the slip-on technique is not possible, cut one side longitudinally and apply to the pipe. Seal seams and joints with adhesive.

B. Valves, Fittings, and Flanges: Cut insulation segments from pipe or sheet insulation. Bond to valve, fitting, and flange and seal joints with adhesive.

1. Miter cut materials to cover soldered elbows and tees.
2. Fabricate sleeve fitting covers from flexible elastomeric cellular insulation for screwed valves, fittings, and specialties. Miter cut materials. Overlap adjoining pipe insulation.

## 3.6 DUCT INSULATION

A. Install block and board insulation as follows:

1. Adhesive and Band Attachment: Secure block and board insulation tight and smooth with at least 50 percent coverage of adhesive. Install bands spaced 12 inches (300 mm) apart. Protect insulation under bands and at exterior corners with metal corner angles. Fill joints, seams, and chipped edges

with vapor barrier compound.

2. Speed Washers Attachment: Secure insulation tight and smooth with speed washers and welded pins. Space anchor pins 18 inches (450 mm) apart each way and 3 inches (75 mm) from insulation joints. Apply vapor barrier coating compound to insulation in contact, open joints, breaks, punctures, and voids in insulation.

B. Blanket Insulation: Install tight and smooth. Secure to ducts having long sides or diameters as follows:

1. Smaller Than 24 Inches (610 mm): Bonding adhesive applied in 6 inches (150 mm) wide transverse strips on 12 inches (300 mm) centers.
2. 24 Inches (610 mm) and Larger: Anchor pins spaced 12 inches (300 mm) apart each way. Apply bonding adhesive to prevent sagging of the insulation.
3. Overlap joints 3 inches (75 mm).
4. Seal joints, breaks, and punctures with vapor barrier compound.

## 3.7 JACKETS

A. Foil and Paper Jackets (FP): Install jackets drawn tight. Install lap or butt strips at joints with material same as jacket. Secure with adhesive. Install jackets with 1-1/2 inches (40 mm) laps at longitudinal joints and 3 inch (75 mm) wide butt strips at end joints.

1. Seal openings, punctures, and breaks in vapor barrier jackets and exposed insulation with vapor barrier compound.

## 3.8 APPLICATIONS

A. General: Materials and thicknesses are specified in schedules at the end of this Section.

B. Interior, Exposed Piping Systems: Unless otherwise indicated, insulate the following piping systems:

1. Domestic cold water.
2. Refrigerant suction.

C. Interior, Concealed Piping Systems: Unless otherwise indicated, insulate the following piping systems:

1. Domestic cold water.
2. Refrigerant suction.

D. Exterior, Exposed Piping Systems: Unless otherwise indicated, insulate the following piping systems:

1. Refrigerant suction.

E. Duct Systems: Unless otherwise indicated, insulate the following duct systems:

1. Interior concealed supply, and outside air ductwork.
2. Interior exposed supply air ductwork.
3. Exterior exposed supply and return ductwork.

## 3.9 PIPE INSULATION SCHEDULES

A. General: Abbreviations used in the following schedules include:

1. Field-Applied Jackets: P = PVC, K = Foil and Paper, A= Aluminum, SS = Stainless Steel.
2. Pipe Sizes: NPS = Nominal Pipe Size (DN = Nominal Dimension).

B. Domestic Cold Water All Sizes (Interior): 1/2 inch (13 mm) thick glass fiber, cellular glass, or flexible elastomeric insulation. Field-applied jacket is not required.

INTERIOR REFRIGERANT SUCTION AND EXPOSED AND CONCEALED

| PIPE SIZES (NPS) | MATERIALS | THICKNESS IN INCHES | VAPOR BARRIER REQ'D | FIELD-APPLIED JACKET |
|---|---|---|---|---|
| 1/2 TO 1-1/4 | FLEXIBLE ELASTOMERIC | 3/4 | YES | NONE |

EXTERIOR REFRIGERANT SUCTION EXPOSED AND CONCEALED

| PIPE SIZES (NPS) | MATERIALS | THICKNESS IN INCHES | VAPOR BARRIER REQ'D | FIELD-APPLIED JACKET |
|---|---|---|---|---|
| 1/2 TO 1-1/4” | FLEXIBLE ELASTOMERIC | 3/4 | YES | NONE |

DOMESTIC HOT WATER EXPOSED AND CONCEALED

| PIPE SIZES (NPS) | MATERIALS | THICKNESS IN INCHES | VAPOR BARRIER REQ'D | FIELD-APPLIED JACKET |
|---|---|---|---|---|
| 1/2 TO 4 | GLASS FIBER | 1 | NO | NONE |

## 3.10 DUCT SYSTEMS INSULATION SCHEDULE

INTERIOR CONCEALED HVAC SUPPLY DUCTS

| MATERIAL | FORM | THICKNESS IN INCHES | VAPOR BARRIER REQ'D | FIELD-APPLIED JACKET |
|---|---|---|---|---|
| GLASS FIBER | BLANKET | 1-1/2 | YES | NONE |

INTERIOR EXPOSED HVAC SUPPLY DUCTS AND PLENUMS

| MATERIAL | FORM | THICKNESS IN INCHES | VAPOR BARRIER REQ'D | FIELD-APPLIED JACKET |
|---|---|---|---|---|
| GLASS FIBER | BOARD - RECT. | 1-1/2 | YES | NONE |
| GLASS FIBER | PIPE - ROUND | 1-1/2 | YES | NONE |

-- END OF SECTION 15250 --

DIVISION 15

MECHANICAL

SECTION 15330

# WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION

## PART 1 GENERAL

### 1.1 REFERENCES

The publications listed below are referenced and the most current publication applies. The publications are referred to in the text by basic designation only.

#### 1.1.1 AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|---|---|
| ASTM A 47 | Ferritic Malleable Iron Castings |
| ASTM A 53 | Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless |
| ASTM A 135 | Electric-Resistance-Welded Steel Pipe |
| ASTM A 183 | Carbon Steel Tract Bolts and Nuts |
| ASTM A 536 | Ductile Iron Castings |
| ASTM A 795 | Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use |
| ASTM F 442 | Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR) |

#### 1.1.2 AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

| | |
|---|---|
| ASME B16.1 | Cast Iron Pipe Flanges and Flanged Fittings |
| ASME B16.3 | Malleable Iron Threaded Fittings |
| ASME B16.4 | Cast Iron Threaded Fittings |
| ASME B16.9 | Factory-Made Wrought Steel Buttwelding Fittings |
| ASME B16.11 | Forged Fittings, Socket-Welding and Threaded |
| ASME B16.18 | Cast Copper Alloy Solder Joint Pressure Fittings |
| ASME B16.21 | Nonmetallic Flat Gaskets for Pipe Flanges |
| ASME B16.22 | Wrought Copper and Copper Alloy Solder Joint Pressure Fittings |

| | |
|---|---|
| ASME B18.2.1 | Square and Hex Bolts and Screws (Inch Series) |
| ASME B18.2.2 | Square and Hex Nuts (Inch Series) |
| 1.1.3 | AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE) |
| ASSE 1015 | Double Check Backflow Prevention Assembly |
| 1.1.4 | FACTORY MUTUAL ENGINEERING AND RESEARCH (FM) |
| FM P7825 | Approval Guide |
| 1.1.5 | MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS) |
| MSS SP-71 | Cast Iron Swing Check Valves, Flanges and Threaded Ends |
| 1.1.6 | NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) |
| NFPA 13 | Installation of Sprinkler Systems NFPA 13R (1994) Installation of Sprinkler Systems in Residential Occupancies Up to and Including Four Stories in Height. |
| NFPA 24 | Installation of Private Fire Service Mains and Their Appurtenances |
| NFPA 231C | Rack Storage of Materials |
| NFPA 1963 | Fire Hose Connections |

1.1.7 NATIONAL INSTITUTE FOR CERTIFICATION IN ENGINEERING TECHNOLOGIES (NICET)

| | |
|---|---|
| NICET 1014 | Detail Manual for Certification in the Field of Fire Protection Engineering Technology (Field 003) Automatic Sprinkler System Layout |

1.1.8 UNDERWRITERS LABORATORIES (UL)

| | |
|---|---|
| UL-04 | Fire Protection Equipment Directory |
| UL 668 | Hose Valves For Fire Protection Service |

## 1.2 GENERAL REQUIREMENTS

Wet pipe sprinkler system shall be provided in areas indicated on the drawings. The sprinkler system shall provide fire sprinkler protection for the entire area. Except as modified herein, the system shall be designed and installed in accordance with NFPA 13. Pipe sizes which are not indicated on drawings shall be determined by hydraulic calculation.

1.2.1 Hydraulic Design

The system shall be hydraulically designed to discharge a minimum density of .10 gpm per square foot of floor area. The minimum pipe size for branch lines in gridded systems shall be 25 mm (1 inch). Hydraulic calculations shall be in accordance with the Area/Density Method of NFPA 13.

1.2.1.1 Basis for Calculations

Water supply shall be presumed available at the point of connection to existing. Hydraulic calculations shall be based upon the Hazen-Williams formula with a "C" value of 120 for steel piping, 150 for copper tubing, 140 for new cement- lined ductile-iron piping.

1.2.2.1 Sprinkler Spacing

Sprinklers shall be uniformly spaced on branch lines. Maximum spacing per sprinkler shall not exceed 225 square feet. Limits specified in NFPA 13 for light hazard occupancy.

1.3 SUBMITTALS

Submittals related to system configuration, hydraulic calculations, and equipment selection, including manufacturer's catalog data, working drawings, connection drawings, control diagrams and certificates shall be submitted concurrently as a complete package. The package will be reviewed by the Contracting Officer’s Fire Protection Engineer.

Government approval is required for submittals with a “GA” designation, submittals having an “FIO” designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

1.3.1 Data “GA”

Sprinkler System Equipment.

Manufacturer's Catalog Data for each separate piece of equipment proposed for use in the system. Data shall indicate the name of the manufacturer of each item of equipment, with data highlighted to indicate model, size, options, etc. proposed for installation. In addition, a complete equipment list which includes equipment description, model number and quantity shall be provided.

Hydraulic Calculations. “GA”

Hydraulic calculations, including a drawing showing hydraulic reference points and pipe segments.

Spare Parts.

Spare parts data shall be included for each different item of material and equipment specified. The data shall include a complete list of parts and supplies, with current unit prices and source of

supply, and a list of parts recommended by the manufacturer to be replaced after 1 year and 3 years of service. A list of special tools and test equipment required for maintenance and testing of the products supplied by the Contractor shall be included.

1.3.2 Drawings "GA"

Sprinkler System Shop Drawings.

Detail drawings conforming to the requirements established for working plans as prescribed in NFPA 13. Drawings shall include plan and elevation views which establish that the equipment will fit the allotted spaces with clearance for installation and maintenance. Each set of drawings shall include the following:

a. Descriptive index of drawings in the submittal with drawings listed in sequence by drawing number. A legend identifying device symbols, nomenclature, and conventions used.

b. Floor plans drawn to a scale not less than 1:100 (1/8" = 1'-0") which clearly show locations of sprinklers, risers, pipe hangers, seismic separation assemblies, sway bracing, inspector's test connections, drains, and other applicable details necessary to clearly describe the proposed arrangement. Each type of fitting used and the locations of bushings, reducing couplings, and welded joints shall be indicated.

c. Actual center-to-center dimensions between sprinklers on branch lines and between branch lines; from end sprinklers to adjacent walls; from walls to branch lines; from sprinkler feed mains, cross-mains and branch lines to finished floor and roof or ceiling. A detail shall show the dimension from the sprinkler and sprinkler deflector to the ceiling in finished areas.

d. Longitudinal and transverse building sections showing typical branch line and cross-main pipe routing as well as elevation of each typical sprinkler above finished floor.

e. Details of each type of riser assembly; pipe hanger; sway bracing for earthquake protection, and restraint of underground water main at point-of-entry into the building, and electrical devices and interconnecting wiring.

1.3.2.1 As-Built Drawings. "GA"

As-built drawings, no later than 14 working days after completion of the Final Tests. The sprinkler system shop drawings shall be updated to reflect as-built conditions after work is completed and shall be on reproducible full-size mylar film.

1.3.3 Instructions "GA"

Test Procedures.

Proposed test procedures for piping hydrostatic test, testing of alarms, at least 14 days prior to the start of related testing.

1.3.4 Schedules "GA"

Preliminary Tests.

A schedule of preliminary tests, at least 14 days prior to the proposed start of the tests.

Final Test. "GA"

Upon successful completion of tests specified under PRELIMINARY TESTS, written notification shall be given to the Contracting Officer of the date for the final acceptance test. Notification shall be provided at least 14 days prior to the proposed start of the test. Notification shall include a copy of the Contractor's Material & Test Certificates.

1.3.5 Statements "GA"

Installer Qualifications.

Qualifications of the sprinkler installer.

Submittal Preparer's Qualifications.

The name and documentation of certification of the individual who will prepare the submittals, prior to the submittal of the drawings and hydraulic calculations.

1.3.6. Certificates "FIO"

Contractor's Material & Test Certificates.

Certificates, as specified in NFPA 13, shall be completed and signed by the Contractor's Representative performing required tests for both underground and aboveground piping.

1.3.7 Operation and Maintenance Manuals "GA"

Sprinkler System.

Manuals shall be in loose-leaf binder format and grouped by technical sections consisting of manufacturer's standard brochures, schematics, printed instructions, general operating procedures, and safety precautions. The manuals shall list routine maintenance procedures possible breakdowns, and repairs, and troubleshooting guide. This shall include procedures and instructions pertaining to frequency of preventive maintenance, inspection, adjustment, lubrication and cleaning necessary to minimize corrective maintenance and repair.

1.4 HYDRAULIC CALCULATIONS

Hydraulic calculations shall be as outlined in NFPA 13 except that calculations shall be performed by computer using software specifically

designed for fire protection system design. Software which uses k-factors for typical branch lines is not acceptable. Calculations shall be taken back to the water supply source unless water supply data is otherwise indicated. Calculations shall substantiate that the design area indicated is the hydraulically most demanding. Water supply curves and system requirements shall be plotted on semi-logarithmic graph paper so as to present a summary of the complete hydraulic calculation. A summary sheet listing sprinklers in the design area and their respective hydraulic reference points, elevations, actual discharge pressures and actual flows shall be provided. Elevations of hydraulic reference points (nodes) shall be indicated. Documentation shall identify each pipe individually and the nodes connected thereto. The diameter, length, flow, velocity, friction loss, number and type fittings, total friction loss in the pipe, equivalent pipe length and Hazen-Williams coefficient shall be indicated for each pipe. For gridded systems, calculations shall show peaking of demand area friction loss to verify that the hydraulically most demanding area is being used. Also for gridded systems, a flow diagram indicating the quantity and direction of flows shall be included. A drawing showing hydraulic reference points (nodes) and pipe designations used in the calculations shall be included and shall be independent of shop drawings.

## 1.5 SUBMITTAL PREPARER'S QUALIFICATIONS

The sprinkler system submittals, including as-built drawings, shall be prepared by an individual who is either a registered professional engineer or who is certified as a Level III IV Technician by National Institute for Certification in Engineering Technologies (NICET) in the Automatic Sprinkler System Layout subfield of Fire Protection Engineering Technology in accordance with NICET 1014.

## 1.6 INSTALLER QUALIFICATIONS

The installer shall be experienced and regularly engaged in the installation of the type and complexity of system included in this project. A statement prior to submittal of any other data or drawings, that the proposed sprinkler system installer is regularly engaged in the installation of the type and complexity of system included in this project shall be provided. In addition, data identifying the location of at least three systems recently installed by the proposed installer which are comparable to the system specified shall be submitted. Contractor shall certify that each system has performed satisfactorily, in the manner intended, for a period of not less than 6 months.

## 1.7 REGULATORY REQUIREMENTS

Compliance with referenced NFPA standards is mandatory. This includes advisory provisions listed in the appendices of such standards, as though the word "shall" had been substituted for the word "should" wherever it appears. Applicable material and installation standards referenced in Appendix A of NFPA 13 and NFPA 24 shall be considered mandatory the same as if such referenced standards were specifically listed in this specification. In the event of a conflict between specific provisions of this specification and applicable NFPA standards, this specification shall govern. All requirements that exceed the minimum requirements of NFPA 13 shall be incorporated into the design.

Reference to "authority having jurisdiction" shall be interpreted to mean the Contracting Officer.

## 1.8 DELIVERY AND STORAGE

Equipment placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt and dust or other contaminants.

# PART 2 PRODUCTS

## 2.1 GENERAL EQUIPMENT REQUIREMENTS

### 2.1.1 Standard Products

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

### 2.1.2 Requirements for Fire Protection Service

Equipment and materials shall have been tested by Underwriters Laboratories, Inc. and listed in UL-04 or approved by Factory Mutual and listed in FM P7825. Where the terms "listed" or "approved" appear in this specification, such shall mean listed in UL-04 or FM P7825.

### 2.1.3 Nameplates

Major components of equipment shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate permanently affixed to the item of equipment.

## 2.2 ABOVEGROUND PIPING SYSTEMS

Above ground piping shall be steel.

### 2.2.1 Steel Piping System

#### 2.2.1.1 Steel Pipe

Except as modified herein, steel pipe shall be black galvanized as permitted by NFPA 13 and shall conform to applicable provisions of ASTM A 795, ASTM A 53, or ASTM A 135. Pipe in which threads or grooves are cut shall be Schedule 40. Pipe shall be marked with the name of the manufacturer, kind of pipe, and ASTM designation.

#### 2.2.1.2 Fittings for Non-Grooved Steel Pipe

Fittings shall be cast iron conforming to ASME B16.4, steel conforming to ASME B16.9 or ASME B16.11, or malleable iron conforming to ASME B16.3. Steel press fittings shall be approved for fire protection systems. Galvanized fittings shall be used for piping systems or portions of piping systems utilizing galvanized piping. Fittings into which sprinklers, drop nipples or riser

nipples sprigs are screwed shall be threaded type. Plain-end fittings with mechanical couplings, fittings which use steel gripping devices to bite into the pipe and segmented welded fittings shall not be used.

2.2.1.3 Flanges

Flanges shall conform to NFPA 13 and ASME B16.1. Gaskets shall be non- asbestos compressed material in accordance with ASME B16.21, 1.6 mm (1/16 inch) thick, and full face or self-centering flat ring type. Bolts shall be squarehead conforming to ASME B18.2.1 and nuts shall be hexagon type conforming to ASME B18.2.2.

2.2.2 Pipe Hangers

Hangers shall be listed in UL-04 or FM P7825 and of the type suitable for the application, construction, and pipe type and sized involved.

2.2.3 Valves

2.2.3.1 Control Valve and Gate Valve

Manually operated sprinkler control valve and gate valve shall be outside stem and yoke (OS&Y) type and shall be listed in UL-01 or FM P7825.

2.2.3.2 Check Valve

Check valve 50 mm (2 inches) hand larger shall be listed in UL-01 or FM P7825. Check valves 100 mm (4 inches) and larger shall be of the swing type with flanged cast iron body and flanged inspection plates, shall have a clear waterway and shall meet the requirements of MSS SP-71, for Type 3 or 4.

## 2.3 ALARM CHECK VALVE ASSEMBLY

Assembly shall include an alarm check valve, standard trim piping, pressure gauges, bypass, retarding chamber, testing valves, main drain, and other components as required for a fully operational system.

## 2.4 WATER MOTOR ALARM ASSEMBLY

Assembly shall include a body housing, impeller or pelton wheel, drive shaft, striker assembly, gong, wall plate and related components necessary for complete operation. Minimum 20 mm (3/4 inch) galvanized piping shall be provided between the housing and the alarm check valve. Drain piping from the body housing shall be minimum 25 mm (1 inch) galvanized and shall be arranged to drain to the outside of the building. Piping shall be galvanized both on the inside and outside surfaces.

## 2.5 ALARM INITIATING AND SUPERVISORY DEVICES

2.5.1 Sprinkler Waterflow Indicator Switch, Vane Type

Switch shall be vane type with a pipe saddle and cast aluminum housing. The electro-mechanical device shall include a flexible, low-density polyethylene paddle conforming to the inside diameter of the fire protection pipe. The device shall sense water movements and be capable of detecting a sustained flow of 38 L/min (10 gpm) or greater. The device shall contain a retard device adjustable from 0 to 90 seconds to reduce the possibility of false alarms caused by transient flow surges. The switch shall include two SPDT (Form C) contacts, and shall be equipped with a silicone rubber gasket to assure positive water seal and a dustproof cover and gasket to seal the mechanism from dirt and moisture.

### 2.5.2 Sprinkler Pressure (Waterflow) Alarm Switch

Pressure switch shall include a metal housing with a neoprene diaphragm, SPDT snap action switches and a 15 mm (1/2 inch) NPT male pipe thread. The switch shall have a maximum service pressure rating of 1207 kPa (175 psi). There shall be two SPDT (Form C) contacts factory adjusted to operate at 28 to 55 kPa. (4 to 8 psi.)

The switch shall be capable of being mounted in any position in the alarm line trim piping of the alarm check valve.

### 2.5.3 Valve Supervisory (Tamper) Switch

Switch shall be suitable for mounting to the type of control valve to be supervised open. The switch shall be tamper resistant and contain one set of SPDT (Form C) contacts arranged to transfer upon removal of the housing cover or closure of the valve of more than two rotations of the valve stem.

## 2.6 FIRE DEPARTMENT CONNECTION

Fire department connection shall be flush type with cast brass body, matching wall escutcheon lettered "Auto Spkr" with a chromium plated finish. The connection shall have two inlets with individual self-closing clappers, caps with drip drains and chains. Female inlets shall have 65 mm (2-1/2 inch) diameter American National Fire Hose Connection Screw Threads (NH) per NFPA 1963.

## 2.7 SPRINKLERS

Sprinklers shall be used in accordance with their listed spacing limitations. Temperature classification shall be ordinary as indicated. Sprinklers in high heat areas including attic spaces or in close proximity to unit heaters shall have temperature classification in accordance with NFPA 13.

### 2.7.1 Pendent Sprinkler

Pendent sprinkler shall be of the fusible strut or glass bulb type, recessed quick-response type with nominal 12.7 mm (1/2

inch)) or 13.5 mm (17/32 inch) orifice. Pendent sprinklers shall have a polished chrome or white enamel finish.

## 2.8 ACCESSORIES

### 2.8.1 Sprinkler Cabinet

Spare sprinklers shall be provided in accordance with NFPA 13 and shall be packed in a suitable metal or plastic cabinet. Spare sprinklers shall be representative of, and in proportion to, the number of each type and temperature rating of the sprinklers installed. At least one wrench of each type required shall be provided.

### 2.8.2 Pendent Sprinkler Escutcheon

Escutcheon shall be one-piece metallic type with a depth of less than 20 mm (3/4 inch) and suitable for installation on pendent sprinklers. The escutcheon shall have a factory finish that matches the pendent sprinkler heads.

### 2.8.3 Pipe Escutcheon

Escutcheon shall be polished chromium-plated zinc alloy, or polished chromium-plated copper alloy. Escutcheons shall be either one-piece or split-pattern, held in place by internal spring tension or set screw.

### 2.8.4 Sprinkler Guard

Guard shall be a steel wire cage designed to encase the sprinkler and protect it from mechanical damage. Guards shall be provided on sprinklers located as indicated.

### 2.8.5 Identification Sign

Valve identification sign shall be minimum 150 mm wide x 50 mm high (6 inches wide x 2 inches high) with enamel baked finish on minimum 1.214 mm (18 gauge) steel or 0.6 mm (0.024 inch) aluminum with red letters on a white background or white letters on red background. Wording of sign shall include, but not be limited to "main drain," "auxiliary drain," "inspector's test," "alarm test," "alarm line," and similar wording as required to identify operational components.

## 2.9 DOUBLE-CHECK VALVE BACKFLOW PREVENTION ASSEMBLY

Double-check backflow prevention assembly shall comply with ASSE 1015. The assembly shall have a bronze, cast-iron or stainless steel body with flanged ends. The assembly shall include OS&Y shutoff valves on the inlet and outlet, 2-positive-seating check valve for continuous pressure application, and four test cocks. Assemblies shall be rated for working pressure of 1034 kPa (150

psi.) The maximum pressure loss shall be 40 kPa (6 psi) at a flow rate equal to the sprinkler water demand, at the location of the assembly.

## PART 3 EXECUTION

### 3.1 INSTALLATION REQUIREMENTS

The installation shall be in accordance with the applicable provisions of NFPA 13, NFPA 24 and publications referenced therein. Installation of in-rack sprinklers shall comply with applicable provisions of NFPA 231C.

### 3.2 ABOVEGROUND PIPING INSTALLATION

Piping shall be run straight and bear evenly on hangers and supports.

#### 3.2.1 Piping in Exposed Areas

Exposed piping shall be installed so as not to diminish exit access widths, corridors or equipment access. Exposed horizontal piping, including drain piping, shall be installed to provide maximum headroom.

#### 3.2.2 Piping in Finished Areas

In areas with suspended or dropped ceilings and in areas with concealed spaces above the ceiling, piping shall be concealed above ceilings. Piping shall be inspected, tested and approved before being concealed. Risers and similar vertical runs of piping in finished areas shall be concealed.

#### 3.2.3 Pendent Sprinklers

Drop nipples to pendent sprinklers shall consist of minimum 25 mm (1 inch) pipe with a reducing coupling into which the sprinkler shall be threaded. Hangers shall be provided on arm-overs to drop nipples supplying pendent sprinklers when the arm-over exceeds 300 mm. (12 inches.) Where sprinklers are installed below suspended or dropped ceilings, drop nipples shall be cut such that sprinkler ceiling plates or escutcheons are of a uniform depth throughout the finished space. The outlet of the reducing coupling shall not extend more than 25 mm (1 inch) below the underside of the ceiling. On pendent sprinklers installed below suspended or dropped ceilings, the distance from the sprinkler deflector to the underside of the ceiling shall not exceed 100 mm. (4 inches.)

##### 3.2.3.1 Pendent Sprinkler Locations

Pendent sprinklers in suspended ceilings shall be a minimum of 150 mm (6 inches) from ceiling grid.

#### 3.2.4 Pipe Joints

Pipe joints shall conform to NFPA 13, except as modified herein. Not more than four threads shall show after joint is made up.

Welded joints will be permitted, only if welding operations are performed as required by NFPA 13 at the Contractor's fabrication shop, not at the project construction site. Flanged joints shall be provided where indicated or required by NFPA 13. Grooved pipe and fittings shall be prepared in accordance with the manufacturer's latest published specification according to pipe material, wall thickness and size. Grooved couplings and fittings shall be from the same manufacturer.

### 3.2.5 Reducers

Reductions in pipe sizes shall be made with one-piece tapered reducing fittings. The use of grooved-end or rubber-gasketed reducing couplings will not be permitted. When standard fittings of the required size are not manufactured, single bushings of the face type will be permitted. Where used, face bushings shall be installed with the outer face flush with the face of the fitting opening being reduced. Bushings shall not be used in elbow fittings, in more than one outlet of a tee, in more than two outlets of a cross, or where the reduction in size is less than 15 mm (1/2 inch.)

### 3.2.6 Pipe Penetrations

Cutting structural members for passage of pipes or for pipe-hanger fastenings will not be permitted. Pipes that must penetrate concrete or masonry walls or concrete floors shall be core-drilled and provided with pipe sleeves. Each sleeve shall be Schedule 40 galvanized steel, ductile iron or cast iron pipe and shall extend through its respective wall or floor and be cut flush with each wall surface. Sleeves shall provide required clearance between the pipe and the sleeve per NFPA 13. The space between the sleeve and the pipe shall be firmly packed with mineral wool insulation. Where pipes pass through fire walls, fire partitions, or floors, a fire seal shall be placed between the pipe and sleeve in accordance with Section 07270 FIRESTOPPING. In penetrations which are not fire-rated or not a floor penetration, the space between the sleeve and the pipe shall be sealed at both ends with plastic waterproof cement which will dry to a firm but pliable mass or with a mechanically adjustable segmented elastomer seal.

### 3.2.7 Escutcheons

Escutcheons shall be provided for pipe penetration of ceilings and walls. Escutcheons shall be securely fastened to the pipe at surfaces through which piping passes.

### 3.2.8 Inspector's Test Connection

Unless otherwise indicated, test connection shall consist of 25 mm (1 inch) pipe connected to the remote branch line; a test valve located approximately 2 meters (7 feet) above the floor; a smooth bore brass outlet equivalent to the smallest orifice sprinkler used in the system; and a painted metal identification sign affixed to the valve with the words "Inspector's Test." The discharge orifice shall be located outside the building wall

directed so as not to cause damage to adjacent construction or landscaping during full flow discharge.

### 3.2.9 Drains

Main drain piping shall be provided to discharge at the location indicated. Auxiliary drains shall be provided as required by NFPA 13 except that drain valves shall be used where drain plugs are otherwise permitted. Where branch lines terminate at low points and form trapped sections, such branch lines shall be manifolded to a common drain line.

### 3.2.10 Installation of Fire Department Connection

Connection shall be mounted on the exterior wall approximately 900 mm (3 feet) above finished grade as shown. The piping between the connection and the check valve shall be provided with an automatic drip in accordance with NFPA 13 and arranged to drain to the outside.

### 3.2.11 Identification Signs

Signs shall be affixed to each control valve, inspector test valve, main drain, auxiliary drain, test valve, and similar valves as appropriate or as required by NFPA 13. Hydraulic design data nameplates shall be permanently affixed to each sprinkler riser as specified in NFPA 13.

## 3.3 ELECTRICAL WORK

Alarm signal wiring connected to the building fire alarm control system shall be in accordance with Section 16721 FIRE DETECTION AND ALARM SYSTEM. All wiring for supervisory and alarm circuits shall be #14 AWG solid copper installed in metallic tubing or conduit. Wiring color code shall remain uniform throughout the system.

## 3.4 FIELD PAINTING AND FINISHING

Field painting and finishing are specified in Section 09900 PAINTING, GENERAL.

## 3.5 PRELIMINARY TESTS

### 3.5.1 Aboveground Piping

#### 3.5.1.1 Hydrostatic Testing

Aboveground piping shall be hydrostatically tested in accordance with NFPA 13 at not less than 1400 kPa (200 psi) in excess of maximum system operating pressure and shall maintain that pressure without loss for 2 hours. There shall be no drop in gauge pressure or visible leakage when the system is subjected to the hydrostatic

test. The test pressure shall be read from a gauge located at the low elevation point of the system or portion being tested.

### 3.5.2 Testing of Alarm Devices

Each alarm switch shall be tested by flowing water through the inspector's test connection. Each water-operated alarm devices shall be tested to verify proper operation.

### 3.5.3 Main Drain Flow Test

Following flushing of the underground piping, a main drain test shall be made to verify the adequacy of the water supply. Static and residual pressures shall be recorded on the certificate specified in paragraph SUBMITTALS. In addition, a main drain test shall be conducted each time after a main control valve is shut and opened.

## 3.6 FINAL ACCEPTANCE TEST

A technician employed by the installing Contractor shall be present for the final tests and shall provide a complete demonstration of the operation of the system. This shall include operation of control valves and flowing of inspector's test connections to verify operation of associated waterflow alarm switches. After operation of control valves has been completed, the main drain test shall be repeated to assure that control valves are in the open position. In addition, the representative shall have available copies of as-built drawings and certificates of tests previously conducted. The installation shall not be considered accepted until identified discrepancies have been corrected and test documentation is properly completed and received.

-- END OF SECTION 15330 --

DIVISION 15

MECHANICAL

SECTION 15400A

PLUMBING PIPING

## PART 1 GENERAL

### 1.1 SUMMARY

A. This Section includes plumbing piping systems to a point 5 feet outside the building. Systems include the following:

1. Potable water distribution, including cold and hot water supply.

2. Drainage and vent systems, including sanitary and storm.

B. Related Sections: The following sections contain requirements that relate to this Section:

1. Division 15 Section "Plumbing Fixtures" for plumbing system components.

### 1.2 SYSTEM PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing piping systems with the following minimum working pressure ratings, except where indicated otherwise:

1. Water Distribution Systems, Above Ground: 125 psig.

2. Soil, Waste, and Vent Systems: 10-foot head of water.

### 1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Coordination drawings, drawn accurately to scale and coordinating penetrations.

### 1.4 QUALITY ASSURANCE

A. Comply with the provisions of ASME B31.9 "Building Services Piping" for materials, products, and installation.

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

## PART 2 PRODUCTS

### 2.1 PIPES AND TUBES

A. General: The application of the following pipe, tube, and fitting materials and joining methods required for plumbing piping systems are indicated in Part 3 Article "Pipe and Fittings Applications."

B. Hard Copper Tube: ASTM B 88, Types K, L, and M, water tube, drawn temper.

C. Soft Copper Tube: ASTM B 88, Types K and L, water tube, annealed temper.

D. Copper Drainage Tube: ASTM B 306, Type DWV, drawn temper.

E. Steel Pipe: ASTM A 53, Type S, Grade A, Schedule 40, seamless, galvanized, Thread end.

1. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53 or ASTM A 106, Schedule 40, seamless, galvanized, carbon-steel pipe.

F. PVC Pipe Pipe: ASTM D 2665 Plastic drain, waste, and vent pipe fitting.

### 2.2 PIPE FITTINGS AND TUBE FITTINGS

A. Wrought-Copper, Solder-Joint Pressure Fittings: ASME B16.22.

B. Cast-Copper-Alloy, Solder-Joint Pressure Fittings: ASME B16.18.

C. Wrought-Copper, Solder-Joint, DWV Drainage Fittings: ASME B16.29.

D. Mechanically Formed Outlets: Manufacturer's standard written procedure for forming tee-branch outlet from pipe and tube.

E. Cast-Copper-Alloy, Solder-Joint, DWV Drainage Fittings: ASME B16.23.

F. Bronze Flanges: ASME B16.24, Classes 150 and 300.

G. Copper Unions: ASME B16.18, cast-copper-alloy body, hexagonal stock, with ball-and-socket joint, metal-to-metal seating surfaces, and solder-joint, threaded, or solder-joint and threaded ends.

1. Threaded Ends: Threads conforming to ASME B1.20.1.

H. Malleable-Iron Unions: ASME B16.39, Classes 150 and 300, hexagonal stock, with ball-and-socket joint, metal-to-metal bronze seating surfaces, and female threaded ends having threads conforming to ASME B1.20.1.

I. Galvanized, Cast-Iron Threaded Fittings: ASME B16.4, Classes 125 and 250, standard pattern, with threads conforming to ASME B1.20.1.

J. Galvanized, Cast-Iron Threaded Drainage Fittings: ASME B16.12, recessed drainage pattern, with threads conforming to ASME B1.20.1.

K. Steel Pipe, Grooved-End Fittings: ASTM A 47 malleable-iron, ASTM A 106 steel, or ASTM A 536 ductile-iron, galvanized, grooved-end fittings designed to accept couplings for grooved or shouldered joints.

## 2.3 JOINING MATERIALS

A. Pipe Flange Gasket Materials: Suitable for the chemical and thermal conditions of the piping system contents.

B. Flange Bolts and Nuts: carbon steel, except where other material is indicated.

C. Plastic Pipe Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, except where other type or material is indicated.

D. Solder Filler Metal:

1. Alloy Sn95 or Alloy Sn94: Tin (approximately 95 percent) and silver (approximately 5 percent), having 0.10 percent lead content.

2. Alloy E: Tin (approximately 95 percent) and copper (approximately 5 percent), having 0.10 percent maximum lead content.

3. Alloy HA: Tin-antimony-silver-copper-zinc, having 0.10 percent maximum lead content.

4. Alloy HB: Tin-antimony-silver-copper-nickel, having 0.10 percent maximum lead content.

5. Alloy Sb5: Tin (95 percent) and antimony (5 percent), having 0.20 percent maximum lead content.

E. Brazing Filler Metals:

1. BCuP Series: Copper-phosphorus alloys.

2. BAg1: Silver alloy.

F. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

G. Solvent Cements: Manufacturer's standard solvents.

H. Plastic Pipe Seals: elastomeric gasket.

I. Flanged, Ductile-Iron Pipe Gasket, Bolts, and Nuts: rubber gasket, carbon steel bolts and nuts.

J. Couplings: Iron body sleeve assembly, fabricated to match outside diameters of plain-end pressure pipes.

1. Sleeve: Class B, gray iron.

2. Followers: ductile iron.

3. Gaskets: Rubber.

4. Finish: Enamel paint.

## 2.4 VALVES

A. Gate Valves, 2 Inches and Smaller: Class 150, body and union bonnet of cast bronze; with threaded or solder ends, solid disc, copper-silicon alloy stem, brass packing gland, "Teflon" impregnated packing, and malleable iron handwheel. Do not use solder end valves for hot water heating or steam piping applications.

# PART 3 EXECUTION

## 3.1 PIPE AND FITTINGS APPLICATIONS

A. General: Use pipe, tube, fittings, and joining methods for piping systems according to the following applications.

B. Water distribution piping above ground: Use the following:

1. 2 inches and small: Hard copper tube, Type L; wrought-copper or cast-copper-alloy pressure fittings; copper unions; bronze flanges; and solder joints with Alloy Sn95 solder.

C. Water distribution piping below ground: Use the following:

1. 2 inches and small: Soft copper tube, Type K, cast copper-alloy pressure fittings; copper unions; bronze flanges; and solder joints with Alloy Sn95 solder.

D. Soil, Waste, and Vent Piping Above and Below Ground: Use the following:

1. 4 inches and small: ASTM D2665 solvent weld PVC pipe and fitting. and solvent cement.

## 3.2 VALVE APPLICATIONS

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

1. Shutoff Duty: Use gate, ball, or butterfly valves.

2. Throttling Duty: Use globe, ball, or butterfly valves.

## 3.3 PIPING INSTALLATION, GENERAL

A. General: Install piping as described below, except where system Sections specify otherwise. Individual piping system specification Sections in Division 15 specify piping installation requirements unique to the piping system.

B. General Locations and Arrangements: Drawings (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, except where deviations to layout are approved on coordination drawings.

C. Install piping at indicated slope.

D. Install components having pressure rating equal to or greater than system operating pressure.

E. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.

F. Install piping free of sags and bends.

G. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, except where indicated.

H. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.

I. Install piping to allow application of insulation plus 1-inch (25-mm) clearance around insulation.

J. Locate groups of pipes parallel to each other, spaced to permit valve servicing.

K. Install fittings for changes in direction and branch connections.

L. Install couplings according to manufacturer's printed instructions.

M. Install pipe escutcheons for pipe penetrations of concrete and masonry walls, wall board partitions, and suspended ceilings according to the following:

1. Chrome-Plated Piping: Cast-brass, one-piece, with set-screw, and polished chrome-plated finish. Use split-casting escutcheons, where required, for existing piping.

2. Uninsulated Piping Wall Escutcheons: Cast-brass or stamped-steel, with set-screw.

3. Uninsulated Piping Floor Plates in Utility Areas: Cast-iron floor plates.

4. Insulated Piping: Cast-brass or stamped-steel, with concealed hinge, spring clips, and chrome-plated finish.

5. Piping in Utility Areas: Cast-brass or stamped-steel, with set-screw or spring clips.

N. Sleeves are not required for core drilled holes.

O. Permanent sleeves are not required for holes formed by PE plastic (removable) sleeves.

P. Install sleeves for pipes passing through concrete and masonry walls, concrete floor and roof slabs, and where indicated.

Q. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, concrete floor and roof slabs, and where indicated.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring where specified.

2. Build sleeves into new walls and slabs as work progresses.

3. Install large enough sleeves to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

a. Steel Pipe Sleeves: For pipes smaller than 6 inches.

b. Steel Sheet-Metal Sleeves: For pipes 6 inches and larger that penetrate gypsum-board partitions.

c. Cast-Iron Sleeve Fittings: For floors having membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.

1. Seal space outside of sleeve fittings with nonshrink, nonmetallic grout.

4. Except for below-grade wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants.

R. Fire Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestopping sealant material.

S. Verify final equipment locations for roughing in.

T. Refer to equipment specifications in other Sections for roughing-in requirements.

U. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping system Sections.

1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

3. Soldered Joints: Construct joints according to AWS "Soldering Manual," Chapter 22 "The Soldering of Pipe and Tube."

4. Brazed Joints: Construct joints according to AWS "Brazing Manual" in the "Pipe and Tube" chapter.

5. Threaded Joints: Thread pipe with tapered pipe threads. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full inside diameter. Join pipe fittings and valves as follows:

   a. Note the internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.

   b. Apply appropriate tape or thread compound to external pipe threads (except where dry seal threading is specified).

   c. Align threads at point of assembly.

   d. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.

   e. Damaged Threads: Do not use pipe or pipe fittings having threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

6. Welded Joints: Construct joints according to AWS "Recommended Practices and Procedures for Welding Low Carbon Steel Pipe" using qualified processes and welding operators according to the "Quality Assurance" Article.

7. Flanged Joints: Align flange surfaces parallel. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.

8. Plastic Pipe and Fitting Solvent-Cement Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels.

9. Plastic Pipe and Fitting Heat-Fusion Joints: Prepare pipe and fittings and join with heat-fusion equipment according to manufacturer's printed instructions.

   1. Plain-End Pipe and Fittings: Butt joining.

2. Plain-End Pipe and Socket-Type Fittings: Socket joining.

## 3.4 WATER DISTRIBUTION PIPING INSTALLATION

A. Install piping level without pitch.

## 3.5 DRAINAGE, WASTE AND VENT INSTALLATION

A. Horizontal Drainage Piping: 1/4 inch per foot (2 percent).

B. Vent Piping: 1/8 inch per foot (1 percent).

C. Provide pipe sleeves at all horizontal wall penetrations above and below grade.

D. Provide pipe sleeves for all slab penetrations above grade.

## 3.6 INSTALLATION OF VALVES

A. Sectional Valves: Install sectional valves close to main on each branch and riser serving 2 or more plumbing fixtures or equipment connections and where indicated. Use gate or ball valves for sectional valves 2 inches and smaller.

B. Shutoff Valves: Install shutoff valves on inlet to each plumbing equipment item, on each supply to each plumbing fixture not having stops on supplies, and elsewhere as indicated. For shutoff valves 2 inches and smaller, use gate or ball valves; for shutoff valves 2-1/2 inches and larger, use gate or butterfly valves.

## 3.7 HANGERS AND SUPPORTS INSTALLATION

A. Conform to table below for maximum spacing of supports:

| Pipe Material | Horizontal In Feet | Vertical In Feet |
|---|---|---|
| Copper Tubing 1-1/4" and Smaller | 6 | 10 |
| PVC Pipe | 12 | 15 |

B. Pipe Attachments: Install the following:

1. Riser Clamps: MSS Type 8 or Type 42 for vertical runs.

2. Adjustable Steel Clevis Hangers: MSS Type 1 for individual straight horizontal runs 100 feet and less.

## 3.8 FIELD QUALITY CONTROL

A. Inspect water distribution piping as follows:

1. Do not enclose, cover, or put into operation water distribution piping system until it has been inspected and approved by the authority having jurisdiction.

B. Test water distribution piping as follows:

1. Test for leaks and defects in new water distribution piping systems and parts of existing systems 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 system tested.

C. Leave uncovered and unconcealed in new, altered, extended, or replaced water distribution piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved for testing.

D. Cap and subject the piping system to a static water pressure of 50 psig above the operating pressure without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for 4 hours. Leaks and loss in test pressure constitute defects that must be repaired.

E. Repair leaks and defects with new materials and retest system or portion thereof until satisfactory results are obtained.

F. Prepare reports for tests and required corrective action.

G. Inspect drainage piping as follows:

1. Do not enclose, cover, or put into operation drainage and vent piping system until it has been inspected and approved by the authority having jurisdiction.

-- END OF SECTION 15400A --

DIVISION 15

MECHANICAL

SECTION 15400B

PLUMBING, FIXTURES

## PART 1 GENERAL

### 1.1 REFERENCES

The publications listed below are referenced and the most current publication applies. The publications are referred to in the text by basic designation only.

#### 1.1.1 AIR CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

| | |
|---|---|
| ARI 1010 | Drinking Fountains and Self-Contained, Mechanically-Refrigerated Drinking-Water Coolers |

#### 1.1.2 AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

| | |
|---|---|
| ANSI A117.1 | Providing Accessibility and Usability for Physically Handicapped People |

#### 1.1.3 AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|---|---|
| ASTM D 2235 | Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings |
| ASTM D 2564 | Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems |
| ASTM D 2855 | Making Solvent-Cemented Joints Poly(Vinyl Chloride) (PVC) Pipe and Fittings |
| ASTM D 3138 | Solvent Cements for Transition Joints Between Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Non-pressure Piping Components |
| ASTM D 3139 | Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals |
| ASTM D 3212 | Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals |
| ASTM F 493 | Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings |

1.1.4 AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

| | |
|---|---|
| ASME A112.6.1M | Supports for Off-the-Floor Plumbing Fixtures for Public Use |
| ASME A112.21.1M | Floor Drains |
| ASME B1.20.1 | Pipe Threads, General Purpose (Inch) |
| ASME B16.21 | Nonmetallic Flat Gaskets for Pipe Flanges |

1.1.5 AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

| | |
|---|---|
| ASSE 1012 | Backflow Preventers with Intermediate Atmospheric Vent |
| ASSE 1037 | Pressurized Flushing Devices for Plumbing Fixtures |

1.1.6 AMERICAN WATER WORKS ASSOCIATION (AWWA)

| | |
|---|---|
| AWWA C606 | Grooved and Shouldered Joints |

1.1.7 COMMERCIAL ITEM DESCRIPTION (CID)

| | |
|---|---|
| CID A-A-238 | Seat, Water Closet |

1.1.8 FEDERAL SPECIFICATIONS (FS)

| | |
|---|---|
| FS QQ C 40 | Caulking: Lead Wool and Lead Pig |
| FS TT P 1536 | Plumbing Fixture Setting Compound |
| FS QQ C 40 | Caulking: Lead Wool and Lead Pig |
| FS TT P 1536 | Plumbing Fixture Setting Compound |
| FS WW C 440 | Clamps, Hose, (Low-Pressure) |
| FS WW P 541/GEN | Plumbing Fixtures |
| FS WW P 541/1 | Plumbing Fixtures (Water Closets) |
| FS WW P 541/2 | Plumbing Fixtures (Urinals) |
| FS WW P 541/4 | Plumbing Fixtures (Lavatories) |
| FS WW P 541/5 | Plumbing Fixtures (Sinks, Kitchen, Service, and Laundry Trays) |
| FS WW P 541/6 | Plumbing Fixtures (Drinking Fountains) |

1.1.9 MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

| | |
|---|---|
| MSS SP-73 | Brazing Joints for Copper and Copper Alloy Pressure Fittings |

1.1.10 MILITARY SPECIFICATIONS (MS)

| | |
|---|---|
| MS MIL G 15840 | Garbage Disposal Machines, Commercial and Household |
| MS MIL T 27730 | Tape, Antiseize, Polytetrafluoroethylene, With Dispenser |

1.1.11 NATIONAL ASSOCIATION OF PLUMBING-HEATING-COOLING CONTRACTORS (NAPHCC)

| | |
|---|---|
| NAPHCC 01 | National Standard Plumbing Code |

1.1.12 NATIONAL SANITATION FOUNDATION (NSF)

| | |
|---|---|
| NSF Std 14 | Plastic Piping Components and Related Materials |

1.1.13 UNDERWRITERS LABORATORIES (UL)

| | |
|---|---|
| UL 430 | Waste Disposers |

## 1.2 GENERAL REQUIREMENTS

### 1.2.1 Standard Products

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products. Items of equipment shall essentially duplicate equipment that has been in satisfactory use at least 2 years prior to bid opening.

### 1.2.2 Verification of Dimensions

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

### 1.2.3 Code

All plumbing work shall be in accordance with NAPHCC-01, unless otherwise stated.

## 1.3 SUBMITTALS

Government approval is required for submittals with a “GA” designation, submittals having an “FIO” designation are for information only. The

following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURS:

1.3.1 Reports "FIO"

Tests, Flushing and Sterilization

Test reports in booklet from showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, completion and testing of the installed system. Each test report shall indicate the final position of controls.

1.3.2 Certificates "FIO"

Where materials or equipment are specified to comply with requirements of AGA, or ASME, proof of such compliance. The label or listing of the specified agency will be acceptable evidence. In lieu of the label or listing, a written certificate may be submitted from an approved, nationally recognized testing organization equipped to perform such services, stating that the items have been tested and conform to the requirements and testing methods of the specified agency. Where equipment if specified to conform to requirements of the ASME Boiler and Pressure Vessel Code, the design, fabrication, and installation shall conform to the code.

1.3.3 Bolts "FIO"

Written certification that the bolts furnished comply with the requirements of this specification, provided by the bolt manufacturer. The certification shall include illustrations of product-required markings, the date of manufacture, and the number of each type of bolt to be furnished based on this certification.

1.4 ELECTRICAL WORK

Electrical work shall be as specified in Section 16415C ELECTRICAL WORK, INTERIOR

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Pipe

Pipe fittings shall be compatible with the applicable pipe materials. Pipe threads (except dry seal) shall conform to ASME B1.20.1. Grooved pipe couplings and fittings shall be of the same manufacturer. Material or equipment containing lead shall not be used in any potable water system.

couplings and fittings shall be of the same manufacturer. Material or equipment containing lead shall not be used in any potable water system.

2.1.2 Hubless Pipe

Huless cast-iron soil pipe shall not be installed under concrete floor slabs.

2.1.3 Plastic Pipe

Plastic pipe shall be installed under concrete floor slabs, or in air plenums. Plastic pipe, fittings, and solvent cement shall meet NSF Std 14 and be NSF listed for the service intended. Plastic pipe, fittings, and solvent cement used for potable hot and cold water service shall bear the NSF seal NSF-PW. Polypropylene pipe shall conform to dimensional requirements for Schedule 40, Iron Pipe Size.

2.1.4 Pipe Joint Materials

Joints and gaskets materials shall conform to the following:

a. Caulking Lead: FS QQ-C-40, Type I.

b. Nonmetallic Flange Gaskets for Flanges: ASME B16.21.

c. Metal Solder: ASTM B 32, 95-5, tin-antimony.

d. PTFE Tape, for use with Threaded Metal or Plastic Pipe: MS MIL-T-27730.

e. Rubber Gaskets for Grooved Pipe: ASTM D 2000, designation M2CA615A15B44F17Z, maximum temperature 110 degrees C (230 degrees F).

f. Flexible Elastomeric Seals: ASTM D 3139 or ASTM D 3212.

g. Solvent Cement for Transition Joints between ABS and PVC Nonpressure Piping Components: ASTM D 3138.

h. Plastic Solvent Cement for ABS Plastic Pipe: ASTM D 2235.

i. Plastic Solvent Cement for PVC Plastic Pipe: ASTM D 2564 and ASTM D 2855.

j. Plastic Solvent Cement for CPVC Plastic Pipe: ASTM F 493.

2.1.5 Miscellaneous Materials

Miscellaneous materials shall conform to the following:

a. Hose Clamps: FS WW-C-440.

b. Supports for Off-The-Floor Plumbing Fixtures: ASME A112.6.1M.

c. Plumbing Fixture Setting Compound: FS TT-P-1536, Type II.

### 2.1.6 Pipe Insulation Material

Insulation shall be as specified in Section 15250 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

## 2.2 VALVES

Valves shall be provided on supplies to equipment and fixtures.

## 2.3 FIXTURES

Fixtures shall be water conservation type, in accordance with the National Standard Plumbing Code. Fixtures for use by the physically handicapped shall be in accordance with ANSI A117.1. Vitreous china, nonabsorbent, hard-burned, and vitrified throughout the body shall be provided. Porcelain enameled ware shall have specially selected, clear white, acid-resisting enamel coating evenly applied on surfaces. No fixture will be accepted that shows cracks, crazes, blisters, thin spots, or other flaws. Fixtures shall be equipped with appurtenances such as traps, faucets, stop valves, and drain fittings. Each fixture and piece of equipment requiring connections to the drainage system, except grease interceptors, shall be equipped with a trap. Brass expansion or toggle bolts capped with acorn nuts shall be provided for supports, and polished chromium-plated pipe, valves, and fittings shall be provided where exposed to view. Fixtures with the supply discharge below the rim shall be equipped with backflow preventers. Internal parts of flush valves, shower mixing valves, shower head face plates, pop-up stoppers of lavatory waste drains, and pop-up stoppers and overflow tees and shoes of bathtub waste drains may contain acetal resin, fluorocarbon, nylon, acrylonitrile-butadiene-styrene (ABS) or other plastic material, if the material has provided satisfactory service under actual commercial or industrial operating conditions for not less than 2 years. Plastic in contact with hot water shall be suitable for 82 degrees C (180 degrees F) water temperature. Plumbing fixtures shall be as indicated in Plumbing Fixture Schedule attached at the end of this section of the specifications.

### 2.3.1 Lavatories

Enameled cast-iron lavatories shall be provided with two cast-iron or steel brackets secured to the underside of the apron and drilled for bolting to the wall in a manner similar to the hanger plate. Exposed brackets shall be porcelain enameled.

## 2.4 BACKFLOW PREVENTERS

Backflow preventers with intermediate atmospheric vent shall be in accordance with ASSE 1012.

## 2.5 DRAINS

### 2.5.1 Floor Drains

Floor drains shall conform to ASME A112.21.1M. Drains installed in connection with waterproofed floors shall be equipped with bolted-type device to securely clamp flashing.

## 2.6 TRAPS

Unless otherwise specified herein, traps shall be copper-alloy adjustable tube type with slip joint inlet and swivel. Traps shall be without a cleanout. Tubes shall be 20-gauge or more copper alloy. Inlets shall have rubber washer and copper alloy nuts for slip joints above the discharge level. Swivel joints shall be below the discharge level and shall be of metal-to-metal or metal-to-plastic type as required for the application. Nuts shall have flats for wrench grip. Outlets shall have internal pipe thread, except that when required for the application, the outlets shall have sockets for solder-joint connections. The depth of the water seal shall be not less than 50 mm (2 inches). The interior diameter shall be not more than 3.2 mm (1/8 inch) over or under the nominal size, and interior surfaces shall be reasonably smooth throughout. A copper alloy "P" trap assembly consisting of an adjustable "P" trap and treaded trap wall nipple with cast brass wall flange shall be provided for lavatories. The assembly shall be a standard manufactured unit and may have a rubber-gasketed swivel joint.

## 2.7 WATER HAMMER ARRESTER

Water hammer arrester shall conform to ASME A112.26.1M, ASSE1010, or PDI WH-201, bellows or piston type with pressurized cushioning chamber. Size are based on water supply units,ASME A112.26.1M sizes “A” through “F” and PDI WH-201 sizes “A” through “F”.

## 2.8 CLEANOUTS

Cast iron floor cleanout with adjustable housing, bronze closure plug and round scoriated nickle bronzed cover secure with vandal proof screws.

# PART 3 EXECUTION

## 3.1 FIXTURES AND FIXTURE TRIMMINGS

Angle stops, straight stops, stops integral with the faucets, or concealed type of lock-shield, and loose-key pattern stops for supplies with threaded, sweat or solvent weld inlets, shall be furnished and installed with fixtures. Where connections between copper tubing and faucets are made by rubber compression fittings, a beading tool shall be used to mechanically deform the tubing above the compression fitting. Exposed traps and supply pipes for fixtures and equipment shall be connected to the rough piping systems at the wall, unless otherwise specified under the item. Floor and wall escutcheons shall be as specified. Drain lines and hot water lines of fixtures for handicapped personnel shall be insulated and do not require polished chrome finish.

Plumbing fixtures and accessories shall be installed within the space shown.

### 3.1.1 Fixture Connections

Where space limitations prohibit standard fittings in conjunction with the cast-iron floor flange, special short-radius fittings shall be provided. Connections between earthenware fixtures and flanges on soil pipe shall be made gastight and watertight with a closet-setting compound or neoprene gasket and seal. Use of natural rubber gaskets or putty will not be permitted. Fixtures with outlet flanges shall be set the proper distance from floor or wall to make a first-class joint with the closet-setting compound or gasket and fixture used.

### 3.1.2 Flush Valves

Flush valves shall be secured to prevent movement by anchoring the long finished top spud connecting tube to wall adjacent to valve with approved metal bracket. Flush valves for water closets shall be installed 28 inches above the floor. Bumpers for water closet seats shall be installed on the wall.

### 3.1.3 Height of Fixture Rims Above Floor

Lavatories shall be mounted with rim 863.6 mm (34 inches) above finished floor. Wall-hung drinking fountains, and water coolers shall be installed with rim 854 mm (33 5/8 inches) above floor. Wall-hung service sinks shall be mounted with rim 654 mm (25 3/4 inches) above the floor. Installation of fixtures for use by the physically handicapped shall be in accordance with ANSI A117.1.

### 3.1.4 Fixture Supports

Fixture supports for off-the-floor lavatories, urinals, water closets, and other fixtures of similar size, design, and use, shall be of the chair-carrier type. The carrier shall provide the necessary means of mounting the fixture, with a foot or feet to anchor the assembly to the floor slab. Adjustability shall be provided to locate the fixture at the desired height and in proper relation to the wall. Support plates, in lieu of chair carrier, shall be fastened to the wall structure only where it is not possible to anchor a floor-mounted chair carrier to the floor slab.

#### 3.1.4.1 Support for Solid Masonry Construction

Chair carrier shall be anchored to the floor slab. Where a floor-anchored chair carrier cannot be used, a suitable wall plate shall be imbedded in the masonry wall.

#### 3.1.4.2 Wall-Mounted Water Closet Gasket

Where wall-mounted water closets are provided, reinforced wax, treated felt, or neoprene gaskets shall be provided. The type of gasket furnished shall be as recommended by the chair-carrier manufacturer.

### 3.1.5 Backflow Prevention Devices

No plumbing fixture, equipment, or pipe connection shall be installed that will provide a cross connection or interconnection between a potable water supply and any source of nonpotable water. The backflow prevention device shall be installed where indicated and located so that no part of the device will be submerged. Access shall be provided for maintenance and testing. Each device shall be a standard commercial unit.

### 3.1.6 Access Panels

Access panels shall be provided provided for concealed valves and controls, or any item requiring inspection or maintenance. Access panels shall be of sufficient size and located so that the concealed items may be serviced, maintained, or replaced.

### 3.1.7 Traps

Each trap shall be placed as near the fixture as possible, and no fixture shall be double-trapped. Traps installed on cast-iron soil pipe shall be cast iron. Traps installed on steel pipe or copper tubing shall be recess-drainage pattern, or brass-tube type. Traps for acid-resisting waste shall be of the same material as the pipe.

## 3.2 ESCUTCHEONS

Escutcheons shall be provided at finished surfaces where bare or insulated piping, exposed to view, passes through floors, walls, or ceilings, except in boiler, utility, or equipment rooms. Escutcheons shall be fastened securely to pipe or pipe covering and shall be satin-finish, corrosion-resisting steel, polished chromium-plated zinc alloy, or polished chromium-plated copper alloy. Escutcheons shall be either one-piece or split-pattern, held in place by internal spring tension or setscrew.

## 3.3 TESTS, FLUSHING, AND STERILIZATION

The plumbing system shall be tested in accordance with NAPHCC-01.

## 3.4 PLUMBING FIXTURE SCHEDULE

P-1A WATER CLOSET HANDICAPPED:

Siphon-jet, elongated bowl, top supply spud, FS WW-P-541/GEN and FS WW-P-541/1, SPN SJEB225, wall mounted. Mounting height PER ANSI A117.1.

Basis of design: American Standard, CADET 1.6, MODEL NO. 3043.102, COLOR - WHITE

Floor flange shall be copper alloy, cast iron, or plastic.

Gasket shall be wax type.

Seat - CID A-A-238, Type A, white plastic, elongated, open front.

Flush Valve - ASSE 1037, (SPN 1a3.5), large diaphragm type with non-hold-open feature, backcheck angle control stop, and vacuum breaker. Minimum upper chamber inside diameter of not less than 66.7 mm (2-5/8 inches) at the point where the diaphragm is sealed between the upper and lower chambers.

P-1B LAV. TOILET COMBYS:

Basic of design: Acorn Penal- ware model 1418-AR-2-BP-2-FV-P4.

Fixture shall be fabricated from 14 gage, type 304 stainless steel. Construction shall be seamless welded an exposed surfaces shall have a stain finish. Countertop shall have and air-circulation, self-draining soap dish. Toilet shall be blowout jet type with an elongated bowl, a self-draining flushing rim, and an integral contoured seat with a sanitary high polish finish. Toilet trap shall pass a 2-5/8″ diameter ball and be fully enclosed. Cabinet interior is sound-deadened with-resistant material. Fixture shall be furnished with necessary fasteners for proper installation.

P-2 URINAL:

Wall hung, with integral trap and extended shields, FS WW-P-541/2 siphon jet. Top supply connection, back outlet.

Basis of design:: American Standard, LYNBROOK 1.5, MODEL NO. 6531.09, COLOR - WHITE.

Flush Valve - (SPN 1a1.5). All other features are the same as the Flush Valve for P-1.

P-3B LAVATORY, WALL HUNG

Manufacturer standard sink depth, FS WW-P-541, vitreous china wall hung. Mounting height per ANSI A117.1. Basic of design: American Standard, Lucerne Wall Hung Model 355.012.

Color: White

Basis of design: American Standard, Horizon Countertop Model No. 3301.025 Color - White.

Faucet - Faucets shall be single control, mixing type. Faucets shall have metal replaceable cartridge control unit or metal cartridge units with diaphragm which can be replaced without special tools. Valves and handles shall be copper alloy. Connection between valve and spout for center-set faucet shall be of rigid metal tubing.

Handles - Lever type. Cast, formed, or drop forged copper alloy.

Drains - Pop-up drain shall include stopper, lift rods, jam nut, washer, and tail piece. See paragraph FIXTURES for optional plastic accessories.

Drain Assembly – Plug, cup strainer, crossbars, jam nuts, washers, couplings, stopper, etc. shall be copper alloy, or stainless steel.

P-4C KITCHEN SINK:

FS WW-P-541/5, ledge back with holes for faucet and spout 7 in. double bowl 812.8 by 533.4 mm (33 x 22 in) stainless steel.

Basis of design: Elkay Celebrity, CR Series, Model No. CR-3322, 3-hole.

Faucet and Spout - Cast or wrought copper alloy. Aerator shall have internal threads.

Handle - Cast copper alloy, wrought copper alloy, or stainless steel. Single lever type.

Drain Assembly - Plug, cup strainer, crossbars, jam nuts, washers, couplings, stopper, etc. shall be copper alloy or stainless steel.

P-6A FLOOR DRAINS: Specified in Section 2.5.1

P-7 WATER COOLER DRINKING FOUNTAINS:

Water cooler drinking fountains shall be self-contained, conform to ARI 1010, use one of the halogenated fluorocarbons as a refrigerant, have a capacity to deliver 30.2 liters per hour (8 gph) of water at 10 degrees C (50 degrees F) with an inlet water temperature of 27 degrees C (80 degrees F) while residing in a room environment of 32 degrees C (90 degrees F), have self-closing valves. Self-closing valves shall have automatic stream regulators, have flow control capability, have a push button actuation or have a cross-shaped index metal turn handle without a hood. All exposed surfaces of stainless steel shall have No. 4 general polish finish. Spouts shall provided a flow of water at least 100 mm (4 inches) high so as to allow the insertion of a cup or glass under the flow of water. Handicapped - Handicapped units shall be surface wall-mounted. The dimensions shall be 482.6 mm (19 inches) wide, 508.0 mm (20 inches) deep, with a back height of 152.4 mm to 203.2 mm (6 to 8 inches). The unit shall clear the floor or ground by at least 203.2 mm (8 inches). The clear knee space shall exist between the bottom of the bowl and the floor or ground of at least 685.0 mm (27 inches) and between the front edge of the bowl and the body of the unit of at least 203.2 mm (8 inches). An 203.2-mm (8-inch) wide clear space shall exist on both sides of the unit. The spout height shall be no more than 915-mm (36 inches) above the floor or ground to the outlet. The spout shall be at the front of the unit and direct the water flow in a trajectory that is parallel or nearly parallel to the front of the unit. The bowl shall be made of corrosion resisting steel. The unit shall be for interior installation. Basis of design: Elkay, Model No. EBFSA-4.

P-8 WALL HYDRANT

Manufacturers standard cast bronze box type for installation in masonry wall.

- END OF SECTION 15400B --

DIVISION 15

MECHANICAL

SECTION 15400C

PLUMBING, WATER HEATER

## PART 1 GENERAL

### 1.1 REFERENCES

The publications listed below are referenced and the most current publication applies. The publications are referred to in the text by basic designation only.

| | |
|---|---|
| 1.1.1 | AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI) |
| ANSI Z21.10.1 | Gas Water Heaters Volume I: Storage Water Heaters with Input Ratings of 75,000 Btu Per Hour or Less |
| ANSI Z21.10.3 | Gas Water Heaters Vol III; Storage, with Input Rating Above 75,000 Btu Per Hour, Circulating and Instantaneous Water Heaters |
| ANSI Z21.22 | Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems |
| 1.1.2 | AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE) |
| ASHRAE 90A | Energy Conservation in New Building Design |
| 1.1.3 | AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME) |
| ASME-13 | Boiler and Pressure Vessel Code; Section IV, Heating Boilers |
| ASME B40.1 | Gauges - Pressure Indicating Dial Type - Elastic Element |
| ASME CSD-1 | Controls and Safety Devices for Automatically Fired Boilers |
| 1.1.4 | AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE) |
| ASSE 1005 | Water Heater Drain Valves - 3/4-Inch Iron Pipe Size |
| 1.1.5 | CODE OF FEDERAL REGULATIONS (CFR) |
| CFR 21 Part 175 | Indirect Food Additives: Adhesives and Components of Coatings |
| 1.1.6 | MILITARY SPECIFICATIONS (MS) |
| MS MIL-H-12322 | Heater, Water, Steam- Hot-Water Heated |

| | |
|---|---|
| MS MIL-T-12295 | Tanks, Hot Water Storage |
| 1.1.7 | NATIONAL ASSOCIATION OF PLUMBING-HEATING-COOLING CONTRACTORS (NAPHCC) |
| NAPHCC-01 | National Standard Plumbing Code |
| 1.1.8 | NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) |
| NFPA 31 | Installation of Oil Burning Equipment |
| NFPA 54 | National Fuel Gas Code |
| 1.1.9 | SCIENTIFIC APPARATUS MAKERS ASSOCIATION (SAMA) |
| SAMA Z236.1 | General Purpose Lab Use for Liquid-in-Glass Thermometers |
| 1.1.10 | UNDERWRITERS LABORATORIES (UL) |
| UL 174 | Household Electric Storage-Tank Water Heaters |

## 1.2 GENERAL REQUIREMENTS

### 1.2.1 Standard Products

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products. Items of equipment shall essentially duplicate equipment that has been in satisfactory use at least 2 years prior to bid opening.

### 1.2.2 Verification of Dimensions

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

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All plumbing work shall be in accordance with NAPHCC-01, unless otherwise stated.

## 1.3 SUBMITTALS

Government approval is required for submittals with a “GA” designation, submittals having an “FIO” designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

### 1.3.1 Reports “FIO”

Tests, Flushing and Sterilization

Tests reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, completion and testing of the installed system. Each test report shall indicate the final position of controls.

1.3.2 Certificates "FIO"

Materials and Equipment

Where materials or equipment are specified to comply with requirements of AGA, or ASME, proof of such compliance. The label or listing of the specified agency will be acceptable evidence. In lieu of the label or listing, a written certificate may be submitted from an approved, nationally recognized testing organization equipped to perform such services, stating that the items have been tested and conform to the requirements and testing methods of the specified agency. Where equipment if specified to conform to requirements of the ASME Boiler and Pressure Vessel Code, the design, fabrication, and installation shall conform to the code.

Bolts

Written certification that the bolts furnished comply with requirements of this specification, provided by the bolt manufacturer. The certification shall include illustrations of product-required markings, the date of manufacture, and the number of each type of bolt to be furnished based on this certification.

1.3.3 Operation and Maintenance Manuals "GA"

Plumbing System

Six copies of the operation manual outlining the step-by-step procedures required for system startup, operation and shutdown. The manual shall include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and their basic operating features. Six copies of the maintenance manual listing routine maintenance procedures, possible breakdowns and repairs. The manual shall include piping and equipment layout and simplified wiring and control diagrams of the system as installed.

## 1.4 ELECTRICAL WORK

Electrical work shall be as specified in Section 16415C ELECTRICAL WORK, INTERIOR.

# PART 2 PRODUCTS

## 2.1 MATERIALS

a. Gauges - Pressure and Vacuum Indicating Dial Type - Elastic Element: ASME B40.1.

b. Thermometers: SAMA Z236.1.

## 2.2 VALVES

Water Heater Drain Valves ASSE 1005

Temperature and Pressure Relief Valves ANSI Z21.22 for Hot Water Supply Systems and ASME-13

Temperature and Pressure Relief Valves ASME CSD-1 Safety for Automatically Fired Hot Water Boilers Code No., Part CW, Article 5

## 2.3 WATER HEATER

Water heater types and capacities shall be as indicated.

### 2.3.1 Gas-Fired Type

Gas-fired water heaters shall conform to ANSI Z21.10.3 for heaters with input greater than 22 kW (75,000 Btu per hour).

### 2.3.2 Phenolic Resin Coatings

The phenolic resin coil coating system shall be a product specifically intended for use on steel, copper, copper alloy, and stainless steel water heating coils. All coating components shall be capable of withstanding dry heat temperatures up to 204 degrees C (400 degrees F). All coating material shall meet the requirements of CFR 21 Part 175. The coating system shall consist of the following three components:

#### 2.3.2.1 Wash Primer

The wash primer shall be composed of a combination of polyvinyl butyral and a heat hardening phenolic resin. The weight per liter (gallon) shall be between 0.8388 kg per liter (7.0 lbs. per gallon) and 0.8867 kg per liter (7.4 lbs. per gallon).

#### 2.3.2.2 Pigmented Base Coat

The pigmented baking phenolic base coat shall consist of heat hardening phenolic resins, suitable pigments of the earth type, and softening agents. It shall not contain drying oils or cellulose material. The weight per gallon shall be between 1.2 kg per liter (10.3 lbs/gallon) and 1.3 kg per liter (10.7 lbs/gallon). The non-volatile solids content shall be between 60 percent and 64 percent by weight.

#### 2.3.2.3 Clear Top Coat

The clear non-pigmented baking phenolic top coat shall have a weight per liters (gallon) of between 1.0 kg per liter (8.65 lbs/gallon) and 1.1 kg per liter (8.95 lbs/gallon). The non-volatile solids content shall be between 48 percent and 52 percent by weight.

## PART 3 EXECUTION

### 3.1 DISSIMILAR PIPE MATERIALS

Connections to water heaters shall be made with dielectric unions or flanges. Connecting joints between plastic and metallic pipe shall be made with transition fitting for the specific purpose.

### 3.2 RELIEF VALVES

No other valves shall be installed between the relief valve and the water heater. The relief valve shall be installed where the valve actuator comes in contact with the hottest water in the heater. Whenever possible, the valve shall be installed directly in a tapping in the tank or heater. When heaters are not provided with a relief valve tapping, the valve shall be installed in the hot-water outlet piping. A discharge pipe the size of the valve outlet shall be connected to the valve outlet and terminated at a safe location. A vacuum relief valve shall be provided on the cold water supply line to the hot-water storage tank or water heater and mounted within 150 mm (6 inches) above the top of the tank or water heater.

### 3.3 INSTALLATION OF GAS-FIRED-WATER HEATER

Installation shall conform to NFPA 54 for gas fired water heater.

### 3.4 PHENOLIC RESIN APPLICATION PROCESS

The phenolic resin coating shall be applied at either the coil or coating manufacturer's factory.

-- END OF SECTION 15400C --

DIVISION 15

MECHANICAL

SECTION 15488

NATURAL GAS PIPING

## PART 1 GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes piping, specialties, and accessories for natural gas systems within the building and to the gas meters.

B. Approximate values of natural gas that will be supplied for these systems are the following:

1. Heating Value: 1000 Btu/cu. ft.
2. Specific Gravity: 0.6.

### 1.3 DEFINITIONS

A. Low-Pressure Natural Gas Piping System: Operating at pressure of 0.5 psig or less.

### 1.4 SYSTEM PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure Ratings: Except where otherwise indicated, the following are minimum pressure requirements.

1. Low-Pressure Natural Gas Piping Systems: 2 psig.

### 1.5 SUBMITTALS

A. General: Submit the following according to Conditions of Contract and Division 1 Specification Sections.

B. Coordination drawings for natural gas piping systems, including required clearances and relationship to other services that serve the same work areas.

C. Test reports specified in "Field Quality Control" Article in Part 3.

### 1.6 QUALITY ASSURANCE

A. Comply with NFPA 54 "National Fuel Gas Code" for gas piping materials and components; installations; and inspection, testing, and purging.

B. Product Options: Natural gas systems equipment, specialties, and accessories are based on specific types, manufacturers, and models indicated. Equipment and other components having equal performance characteristics by other manufacturers may be considered, provided deviations in dimensions, operation, and other characteristics do not change design concept or intended performance as judged by the Architect. The burden of proof of equality of products is on the Contractor. Refer to Division 1 Section "Product Substitutions."

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

1. Low-Pressure Gas Stops:

   Hammond Valve Corp.
   Jomar International, Ltd.
   Lancaster by National Meter Parts, Inc.
   A.Y. McDonald Mfg. Co.
   Rockford-Eclipse Div., Eclipse, Inc.

2. Gas Valves, 2 Inches and Smaller:

   Homestead by Olson Technologies, Inc.
   Lancaster by National Meter Parts, Inc.
   Lunkenheimer Co.
   A.Y. McDonald Mfg. Co.
   Milliken Valve Co., Inc.
   Mueller Co., A Grinnell Co.
   Mueller Steam Specialty Div., Core Industries, Inc.
   Nordstrum Valves, Inc.
   Resun by J.M. Huber Corp., Equipment Div.
   Rockford-Eclipse Div., Eclipse, Inc.

### 2.2 PIPES AND TUBES

A. General: Refer to "Pipe Applications" Article in Part 3 for identification of systems where the following materials are used.

1. Steel Pipe: ASTM A 53, Type E, Electric-Resistance Welded or Type S, Seamless, Grade B, Schedule 40, black.

### 2.3 PIPE AND TUBE FITTINGS

A. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern, with threads conforming to ASME B1.20.1.

B. Unions: ASME B16.39, Class 150, black malleable iron; female pattern; brass-to-iron seat; ground joint.

C. Cast-Iron Fittings: ASME B16.1, Classes 125 and 250.

D. Steel Fittings: ASME B16.9, wrought steel, butt-welding type; and ASME B16.11, forged steel.

## 2.4 JOINING MATERIALS

A. Joint Compound and Tape: Suitable for natural gas.

B. Gasket Material: Thickness, material, and type suitable for natural gas.

## 2.5 VALVES

A. Manual Valves: Conform to standards listed, or where appropriate, valves according to ANSI Z21.15 and ANSI Z21.15a.

B. Low-Pressure Gas Stops, 2 Inches and Smaller: AGA-certified design for 2 psig or less natural gas, with AGA stamp, plug or ball type, bronze body and bronze plug or chrome-plated brass ball. Include flat head, square head, or lever handle and threaded ends.

C. Gas Valves, 2 Inches and Smaller: Valves may be any one of the following types:

1. ASME B16.33, 150 psi WOG, bronze body, bronze plug, straightaway pattern, square head, tapered-plug type, with threaded ends.

## 2.6 PIPING SPECIALTIES

A. Flexible Connectors: ANSI Z21.24 or ANSI Z21.24a, copper alloy.

B. Strainers: Y pattern, full size of connecting piping. Include Type 304 stainless-steel screens with 3/64-inch perforations except where other screens are indicated.

1. Pressure Rating: 125 psig minimum steam or 175 psig WOG working pressure except where otherwise indicated.
2. Sizes 2 Inches and Smaller: Bronze body, with female threaded ends.
3. Sizes 2-1/2 Inches and Larger: Cast-iron body, with flanged ends.
4. Screwed screen retainer with centered blowdown and pipe plug.

# PART 3 EXECUTION

## 3.1 PIPE APPLICATIONS

A. General: Flanges, unions, transition and special fittings, and valves with pressure ratings same or higher than system pressure rating may be used in applications below, except where specified otherwise.

B. Low-Pressure Natural Gas Systems, above Ground within Building: Use the following:

1. 2 Inches and Smaller: Steel pipe, malleable-iron, threaded fittings, and threaded joints.

## 3.2 VALVE APPLICATIONS

A. Use low-pressure gas stops, tapered plug or ball type, for shutoff to appliances with 2-inch or smaller low-pressure gas supply.

## 3.3 JOINT CONSTRUCTION

A. Use materials suitable for natural gas service.

## 3.4 PIPING INSTALLATIONS

A. Drips and Sediment Traps: Install drips at points where condensate may collect. Locate where readily accessible to permit cleaning and emptying. Do not install where condensate would be subject to freezing.

B. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use minimum-length nipple of 3 pipe diameters, but not less than 3 inches long, and same size as connected pipe. Install with space between bottom of drip and floor for removal of plug or cap.

C. Install gas piping at a uniform grade of 1/4 inch in 15 feet, upward toward risers. Install piping upward from service risers to meters, service regulator when meter is not provided, and equipment.

D. Make reductions in pipe sizes using eccentric reducer fittings installed with the level side down.

E. Connect branch piping from top or side of horizontal piping.

F. Install unions in pipes 2 inches and smaller, adjacent to each valve, at final connection to each piece of equipment, and elsewhere as indicated. Unions are not required on flanged devices.

G. Install dielectric fittings (unions and flanges) with 1 ferrous and 1 brass or bronze-end connections, separated by insulating material, where piping of dissimilar metals are joined.

H. Install dielectric fittings (unions and flanges) with 2 ferrous end connections, separated by insulating material, at outlet from gas meter and, where indicated, for ferrous piping.

I. Anchor piping to ensure proper direction of piping expansion and contraction. Install expansion joints, expansion loops, and pipe guides as required.

## 3.5 HANGER AND SUPPORT INSTALLATION

A. Install hangers for horizontal piping with following maximum spacing and minimum rod sizes:

| Nominal Pipe Size (Inches) | Steel Pipe Max. Span (Feet) | Min. Rod Dia. (Inches) |
|---|---|---|
| 1/2 | 6 | 3/8 |
| 3/4 | 8 | 3/8 |
| 1 | 8 | 3/8 |

| | | |
|---|---|---|
| 1-1/4 | 9 | 3/8 |
| 1-1/2 to 2 | 10 | 3/8 |

## 3.6 VALVE INSTALLATION

A. Install valves in accessible locations, protected from physical damage. Tag valves with a metal tag attached with a metal chain indicating the piping systems supplied.

B. Install a gas valve upstream of each gas pressure regulator. Where two gas pressure regulators are installed in series in a single gas line, a manual valve is not required at the second regulator.

## 3.7 TERMINAL EQUIPMENT CONNECTIONS

A. Install a gas valve upstream and within 6 feet of each gas-utilizing appliance. Install a union or flanged connection downstream from the valve to permit removal of controls.

B. Sediment Traps: Install tee fittings forming drips, as close as practical to gas appliance inlets. Cap or plug bottom outlet.

## 3.8 FIELD QUALITY CONTROL

A. Inspect, test, and purge natural gas systems according to NFPA 54, Part 4 "Gas Piping Inspection, Testing, and Purging" and local gas utility requirements.

B. Repair leaks and defects with new materials, and retest system until satisfactory results are obtained.

C. Report test results promptly and in writing to the Architect and the authority having jurisdiction.

D. Verify capacities and pressure ratings of regulators, valves, and specialties.

E. Verify correct pressure settings for pressure regulators.

F. Verify that specified piping tests are complete.

## 3.9 ADJUSTING

A. Adjust controls and safety devices. Replace damaged and malfunctioning controls and safety devices.

-- END OF SECTION 15488 --

DIVISION 15

MECHANICAL

SECTION 15530

REFRIGERANT PIPING

## PART 1 GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes refrigerant piping used for air conditioning applications. This Section includes:

Pipes, tubing, fittings, and specialties.
Special duty valves.
Refrigerants.

1.3 Related Sections: The following sections contain requirements that relate to this section:

A. Division 15, Section "Mechanical Insulation" for pipe insulation.

### 1.4 SUBMITTALS

A. Product data for the following products:

Each type valve specified.
Each type refrigerant piping specialty specified.

B. Shop Drawings showing layout of refrigerant piping, specialties, and fittings including, but not necessarily limited to, pipe and tube sizes, valve arrangements and locations, slopes of horizontal runs, wall and floor penetrations, and equipment connection details. Show interface and spatial relationship between piping and proximate to equipment.

C. Brazer's Certificates signed by Contractor certifying that brazers comply with requirements specified under "Quality Assurance" below.

D. Maintenance data for refrigerant valves and piping specialties.

### 1.5 QUALITY ASSURANCE

A. Qualify brazing processes and brazing operators in accordance with ASME "Boiler and Pressure Vessel Code," Section IX, "Welding and Brazing Qualifications".

B. Regulatory Requirements: Comply with provisions of the following codes:

ANSI B31.5: ASME Code for Pressure Piping - Refrigerant Piping.

ANSI/ASHRAE Standard 15: Safety Code for Mechanical Refrigeration.
BOCA Basic National Mechanical Code.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

Refrigerant Valves and Specialties:
Alco Controls Div, Emerson Electric.
Danfoss Electronics, Inc.
EATON Corporation, Control Div.
Henry Valve Company.
Parker-Hannifin Corporation, Refrigeration and Air Conditioning Division.
Sporlan Valve Company.

### 2.2 PIPE AND TUBING MATERIALS

A. General: Refer to Part 3, Article "PIPE APPLICATION" for identification of systems where the below specified pipe and fitting materials are used.

B. Copper Tubing: ASTM B 280, Type ACR, hard-drawn straight lengths, and soft-annealed coils, seamless copper tubing. Tubing shall be factory cleaned, ready for installation, and have ends capped to protect cleanliness of pipe interiors prior to shipping.

### 2.3 FITTINGS

A. Wrought-Copper Fittings: ANSI B16.22, streamlined pattern.

### 2.4 JOINING MATERIALS

A. Brazing Filler Metals: AWS A5.8, Classification BAg-1 (Silver).

### 2.5 VALVES

A. General: Complete valve assembly shall be UL-listed and designed to conform to ARI 760.

B. Solenoid Valves: 250 deg.F temperature rating, 400 psig working pressure; forged brass, with Teflon valve seat, two-way straight through pattern, and solder end connections. Provide manual operator to open valve. Furnish complete with NEMA 1 solenoid enclosure with 1/2 inch conduit adapter, and 24 volt, 60 Hz. normally closed holding coil.

C. Thermal Expansion Valves: thermostatic adjustable, modulating type; size as required for specific evaporator requirements, and factory set for proper evaporator superheat requirements. Valves shall have copper fittings for solder end connections; complete with sensing bulb, a distributor having a side connection for hot gas bypass line, and an external equalizer line.

### 2.6 REFRIGERANT PIPING SPECIALTIES

A. General: Complete refrigerant piping specialty assembly shall be UL-listed and designed to conform to ARI 760.

B. Moisture/liquid Indicators: 500 psig maximum operation pressure, 200 deg.F maximum operating temperature; forged brass body, with replaceable polished optical viewing window, and solder end connections.

C. Filter-driers: 500 psig maximum operation pressure; steel shell, flange ring, and spring, ductile iron cover plate with steel capscrews, and wrought copper fittings for solder end connections. Furnish complete with replaceable filter-drier core kit, including gaskets, as follows: High capacity desiccant sieves to provide micronic filtration and extra drying capacity.

## 2.7 REFRIGERANT

A. Refrigerant No. 22, in accordance with ASHRAE Standard.

# PART 3 EXECUTION

## 3.1 EXAMINATION

A. Examine rough-in for refrigerant piping systems to verify actual locations of piping connections prior to installation.

## 3.2 PIPE APPLICATIONS

A. Use Type L, or Type ACR drawn copper tubing with wrought copper fittings and brazed joints above ground, within building. Use Type K, annealed temper copper tubing for 2 inch and smaller without joints, below ground and within slabs. Mechanical fittings (crimp or flair) are not permitted. If other than Type ACR tubing is used, clean and protect inside of tubing as specified in Article "CLEANING" below.

## 3.3 PIPING INSTALLATIONS

A. General: Install refrigerant piping in accordance with ASHRAE Standard 15 - "The Safety Code for Mechanical Refrigeration."

B. Install piping in as short and direct arrangement as possible to minimize pressure drop.

C. Install piping for minimum number of joints using as few elbows and other fitting as possible.

D. Arrange piping to allow normal inspection and servicing of compressor and other equipment. Install valves and specialties in accessible locations to allow for servicing and inspection.

E. Provide adequate clearance between pipe and adjacent walls and hanger, or between pipes for insulation installation. Use sleeves through floors, walls, or ceilings, sized to permit installation of full thickness insulation.

F. Insulate suction lines. Liquid line are not required to be insulated, except where they are installed adjacent and clamped to suction lines, where both liquid and suction lines shall be insulated as a unit.

1. Do not install insulation until system testing has been completed and all leaks have been eliminated.

G. Install copper tubing in rigid or flexible conduit in locations where copper tubing will be exposed to mechanical injury.

H. Use fittings for all changes in direction and all branch connections.

I. Install exposed piping at right angles or parallel to building walls. Diagonal runs are not permitted, unless expressly indicated.

J. Install piping free of sags or bends and with ample space between piping to permit proper insulation applications.

K. Conceal all pipe installations in walls, pipe chases, utility spaces, above ceilings, below grade or floors, unless indicated to be exposed to view.

L. Install piping tight to slabs, beams, joists, columns, walls, and other permanent elements of the building. Provide space to permit insulation applications, with 1 inch clearance outside the insulation. Allow sufficient space above removable ceiling panels to allow for panel removal.

M. Exterior Wall Penetrations: Seal pipe penetrations through exterior walls using sleeves and mechanical sleeve seals. Pipe sleeves smaller than 6 inch shall be steel; pipe sleeves 6 inch and larger shall be sheet metal.

N. Install strainers immediately ahead of each expansion valve, solenoid valve, hot gas bypass valve, compressor suction valve, and as required to protect refrigerant piping system components.

O. Install moisture/liquid indicators in liquid lines between filter/driers and thermostatic expansion valves and in liquid line to receiver.

## 3.4 PIPE JOINT CONSTRUCTION

A. Brazed Joints: Comply with the procedures contained in the AWS "Brazing Manual."

WARNING: Some filler metals contain compounds which produce highly toxic fumes when heated. Avoid breathing fumes. Provide adequate ventilation.

CAUTION: When solenoid valves are being installed, remove the coil to prevent damage. When sight glasses are being installed, remove the glass. Remove stems, seats, and packing of valves, and accessible internal parts of refrigerant specialties before brazing. Do no apply heat near the bulb of the expansion valve.

B. Heat joints using oxy-acetylene torch. Heat to proper and uniform brazing temperature.

## 3.5 VALVE INSTALLATIONS

A. General: Install refrigerant valves where indicated, and in accordance with manufacturer's instructions.

## 3.6 EQUIPMENT CONNECTIONS

A. The Drawings indicate the general arrangement of piping, fittings, and

specialties.

B. Install piping adjacent to machine to allow servicing and maintenance.

## 3.7 FIELD QUALITY CONTROL

A. Inspect, test, and perform corrective action of refrigerant piping in accordance with ASME Code B31.5, Chapter VI.

B. Repair leaking joints using new materials, and retest for leaks.

## 3.8 CLEANING

A. Before installation of copper tubing other than Type ACR tubing, clean the tubing and fitting using following cleaning procedure:

## 3.9 ADJUSTING AND CLEANING

A. Adjust controls and safeties. Replace damaged or malfunctioning controls and equipment with new materials and products.

## 3.10 COMMISSIONING

A. Charge system using the following procedure:

B. Install core in filter dryer after leak test but before evacuation.

C. Evacuate refrigerant system with vacuum pump; until temperature of 35 deg F is indicated on vacuum dehydration indicator.

D. During evacuation, apply heat to pockets, elbows, and low spots in piping.

E. Maintain vacuum on system for minimum of 5 hours after closing valve between vacuum pump and system.

F. Break vacuum with refrigerant gas, allow pressure to build up to 2 psi.

G. Complete charging of system, using new filter dryer core in charging line. Provide full operating charge.

-- END OF SECTION 15530 --

DIVISION 15

MECHANICAL

SECTION 15566B

DUCTWORK

## PART 1 GENERAL

### 1.1 REFERENCES

The publications listed below are referenced and the most current publication applies. The publications are referred to in the text by basic designation only.

#### 1.1.1 AIR DIFFUSION COUNCIL (ADC)

ADC 1062:GRD Test Codes for Grilles, Registers, and Diffusers

#### 1.1.2 AIR MOVEMENT AND CONTROL ASSOCIATION (AMCA)

AMCA 500 Test Method for Louvers, Dampers and Shutters

#### 1.1.3 NORTH AMERICAN INSULATION MANUFACTURERS ASSOCIATION (NAIMA)

NAIMA-01 Fibrous Glass Duct Construction Standards

#### 1.1.4 NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 90A Installation of Air Conditioning and Ventilating Systems

#### 1.1.5 SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA-05 Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems

SMACNA-06 HVAC Duct Construction Standards - Metal and Flexible

SMACNA-10 HVAC Air Duct Leakage Test Manual

#### 1.1.6 UNDERWRITERS LABORATORIES (UL)

UL-01 Building Materials Directory

| | |
|---|---|
| UL-03 | Electrical Construction Materials Directory |
| UL-05 | Fire Resistance Directory |
| UL 181 | Factory-Made Air Ducts and Connectors |
| UL 214 | Tests for Flame-Propagation of Fabrics and Films |
| UL 555 | Fire Dampers |

## 1.2 COORDINATION OF TRADES

Ductwork, piping offsets, fittings, and accessories shall be furnished as required to provide a complete installation and to eliminate interference with other construction.

## 1.3 DELIVERY AND STORAGE

All equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants.

## 1.4 SUBMITTALS

Government approval is required for submittals with a “GA” designation, submittals having an “FIO” designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

### 1.4.1 Ductwork Components Data “GA”

Manufacturer’s catalog data shall be included with the detail drawings for all ductwork components. The data shall be highlighted to show model, size, options, etc., that are intended for consideration. Data shall be adequate to demonstrate compliance with contract requirements.

### 1.4.2 Drawings “GA”

Ductwork Layout

Drawings shall consist of ductwork layout showing the location of all supports and hangers, typical hanger details, gauge reinforcement, reinforcement spacing rigidity classification, and static pressure and seal classifications in accordance with SMACNA standards; and piping layout showing the location of all guides and anchors, the load imposed on each support or anchor, and typical support details. Drawings shall include any information required to demonstrate that the system has been coordinated and will properly function as a unit and shall show equipment relationship to other parts of the work, including clearances required for operation and maintenance.

## PART 2 PRODUCTS

### 2.1 STANDARD PRODUCTS

Components shall be standard products of a manufacturer regularly engaged in the manufacturing of products which are of a similar material, design and workmanship. The standard products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year experience shall include applications of components under similar circumstances and of similar size. The 2 years must be satisfactorily completed by a product which has been sold or is offered for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures. Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation, for not less than 6000 hours exclusive of the manufacture's factory tests, can be shown. The equipment items shall be supported by a service organization.

### 2.2 ASBESTOS PROHIBITION

Asbestos and asbestos-containing products shall not be used.

### 2.3 NAMEPLATES

All equipment shall have a nameplate that identifies the manufacturer's name, address, type or style, model or serial number, and catalog number.

### 2.4 DUCTWORK COMPONENTS

#### 2.4.1 Metal Ductwork

All aspects of metal ductwork construction, including all fittings and components, shall comply with SMACNA-06 unless otherwise specified. Elbows shall be radius type with a centerline radius of 1-1/2 times the width or diameter of the duct where space permits. Otherwise, elbows having a minimum radius equal to the width or diameter of the duct or square elbows with factory fabricated turning vanes may be used. Static pressure Class 125, 150, and 500 Pa (1/2, 1, and 2 inch w.g.) ductwork shall meet the requirements of Seal Class C. Sealants shall conform to fire hazard classification specified in Section 15250 THERMAL INSULATION FOR MECHANICAL SYSTEMS. Pressure sensitive tape shall not be used as a sealant. Spiral lock seam duct, and flat oval shall be made with duct sealant and locked with not less than 3 equally spaced drive screws or other approved methods indicated in SMACNA-06. The sealant shall be applied to the exposed male part of the fitting collar so that the sealer will be on the inside of the joint and fully protected by the metal of the duct fitting. One brush coat of the sealant shall be applied over the outside of the joint to at least 50 mm (2 inch) band width covering all screw heads and joint gap. Dents in the male portion of the slip fitting collar will not be acceptable.

2.4.1.1 Transitions

Diverging air flow transitions shall be made with each side pitched out a maximum of 15 degrees, for an included angle of 30 degrees. Transitions for coverging air flow shall be made with each side pitched in a maximum of 30 degrees, for an included angle of 60 degrees, or shall be as indicated. Factory-fabricated reducing fittings for systems using round duct sections when formed to the shape of the ASME short flow nozzle, need not comply with the maximum angles specified.

2.4.1.2 Insulated Nonmetallic Flexible Duct Runouts

Flexible duct runouts shall be used only where indicated. Runout length shall be as shown on the drawings, but shall not exceed 3 m. (10 feet.) Runouts shall be preinsulated, factory fabricated, and shall comply with NFPA 90A and UL 181. Either field or factory applied vapor barrier shall be provided. Where coil induction or high velocity units are supplied with vertical air inlets, a streamlined and vaned and mitered elbow transition piece shall be provided for connection to the flexible duct or hose. The last elbow to these units, other than the vertical air inlet type, shall be a die-stamped elbow and not a flexible connector. Insulated flexible connectors may be used as runouts. The insulated material and vapor barrier shall conform to the requirements of Section 15250 THERMAL INSULATION FOR MECHANICAL SYSTEMS. The insulation material surface shall not be exposed to the air stream.

2.4.1.3 General Service Duct Connectors

A flexible duct connector approximately 150 mm (6 inches) in width shall be provided where sheet metal connections are made to fans or where ducts of dissimilar metals are connected. For round/oval ducts, the flexible material shall be secured by stainless steel or zinc-coated, iron clinch-type draw bands. For rectangular ducts, the flexible material locked to metal collars shall be installed using normal duct construction methods. The composite connector system shall comply with UL 214 and be classified as "flame-retarded fabrics" in UL-01.

2.4.2 Ductwork Accessories

2.4.2.1 Duct Access Doors

Access doors shall be provided in ductwork where indicated and at all air flow measuring primaries, automatic dampers, fire dampers, coils, thermostats, and other apparatus requiring service and inspection in the duct system, and unless otherwise shown, shall conform to SMACNA-06. Access doors shall be provided upstream and downstream of air flow measuring primaries cooling coils. Doors shall be minimum 375 by 450 mm (15 by 18 inches), unless otherwise shown. Where duct size will not accommodate this size door, the doors shall be made as large as practicable. Doors 600 by 600 mm (24 by 24 inches) larger shall

be provided with fasteners operable from both sides. Doors in insulated ducts shall be the insulated type.

2.4.2.2 Splitters and Manual Balancing Dampers

Splitters and manual balancing dampers shall be furnished with accessible operating mechanisms. Where operators occur in finished portions of the building, operators shall be chromium plated with all exposed edges rounded. Splitters shall be operated by quadrant operators or 5 mm (3/16 inch) rod brought through the side of the duct with locking setscrew and bushing. Two rods are required on splitters over 200 mm (8 inches). Manual volume control dampers shall be operated by locking-type quadrant operators. Dampers and splitters shall be 2 gauges heavier than the duct in which installed. Unless otherwise indicated, multileaf dampers shall be opposed blade type with maximum blade width of 300 mm (12 inches). Access doors or panels shall be provided for all concealed damper operators and locking setscrews. Unless otherwise indicated, the locking-type quadrant operators for dampers, when installed on ducts to be thermally insulated, shall be provided with stand-off mounting brackets, bases, or adapters to provide clearance between the duct surface and the operators not less than the thickness of the insulation. Stand-off mounting items shall be integral with the operator or standard accessory of the damper manufacturer. Volume dampers shall be provided where indicated.

2.4.2.3 Air Deflectors and Branch Connections

Air deflectors shall be provided at duct mounted supply outlets, at takeoff or extension collars to supply outlets, at duct branch takeoff connections, and at 90 degree elbows, as well as at locations as indicated on the drawings or otherwise specified. Conical branch connections or 45 degree entry connections may be used in lieu of deflectors or extractors for branch connections. All air deflectors, except those installed in 90 degree elbows, shall be provided with an approved means of adjustment. Adjustment shall be made from easily accessible means inside the duct or from an adjustment with sturdy lock on the face of the duct. When installed on ducts to be thermally insulated, external adjustments shall be provided with stand-off mounting brackets integral with the adjustment device, to provide clearance between the duct surface and the adjustment device not less than the thickness of the thermal insulation. Air deflectors shall be factory-fabricated units consisting of curved turning vanes or louver blades designed to provide uniform air distribution and change of direction with minimum turbulence or pressure loss. Air deflectors shall be factory or field assembled. Blade air deflectors, also called blade air extractors, shall be approved factory fabricated units consisting of equalizing grid and adjustable blade and lock. Adjustment shall be easily made from the face of the diffuser or by position adjustment and lock external to the duct. Stand-off brackets shall be provided on insulated ducts and are described herein . Fixed air deflectors, also called turning vanes, shall be provided in all 90 degree elbows.

2.4.3 Diffusers, Registers, and Grilles

Units shall be factory-fabricated of steel, corrosion-resistant steel, or aluminum and shall distribute the specified quantity of air evenly over space intended without causing noticeable drafts, air movement faster than 60.25 m/s (50 fpm) in occupied zone, or dead spots anywhere in the conditioned area. Outlets for diffusion, spread, throw, and noise level shall be as required for specified performance. Performance shall be certified in accordance with ADC 1062:GRD. Inlets and outlets shall be sound rated and certified in accordance with ADC 1062:GRD. Sound power level shall be as indicated. Diffusers and registers shall be provided with volume damper with accessible operator, unless otherwise indicated; or if standard with the manufacturer, an automatically controlled device will be acceptable. Volume dampers shall be opposed blade type for all diffusers and registers. Where the inlet and outlet openings are located less than 2 meters (7 feet) above the floor, they shall be protected by a grille or screen in accordance with NFPA 90A.

2.4.3.1 Diffusers

Diffuser types shall be as indicated. Ceiling mounted units shall be furnished with antismudge devices, unless the diffuser unit minimizes ceiling smudging through design features. Diffusers shall be provided with air deflectors of the type indicated. Air handling troffers or combination light and ceiling diffusers shall conform to the requirements of UL-03 for the interchangeable use as cooled or heated air supply diffusers or return air units. Ceiling mounted units shall be installed with rims tight against ceiling. Sponge rubber gaskets shall be provided between ceiling and surface mounted diffusers for air leakage control. Suitable trim shall be provided for flush mounted diffusers. Duct collar connecting the duct to diffuser shall be airtight and shall not interfere with volume controller. Return or exhaust units shall be similar to supply diffusers.

2.4.3.2 Registers and Grilles

Units shall be four-way directional-control type, except that return and exhaust registers may be fixed horizontal or vertical louver type similar in appearance to the supply register face. Registers shall be provided with sponge-rubber gasket between flanges and wall or ceiling. Return and exhaust registers shall be located 150 mm (6 inches) above the floor unless otherwise indicated. Four-way directional control may be achieved by a grille face which can be rotated in 4 positions or by adjustment of horizontal and vertical vanes. Grilles shall be as specified for registers, without volume control damper.

2.4.5 Louvers

Louvers shall be furnished for installation in exterior walls which are directly connected by ductwork to air handling equipment. Louver blades shall be fabricated from anodized aluminum or galvanized steel sheets, and shall be provided with a

frame of galvanized steel or aluminum structural shapes. Sheet metal thickness and fabrication shall conform to SMACNA-06. Blades shall be accurately fitted and secured to frames. Edges of louver blades shall be folded or beaded for rigidity and baffled to exclude driving rain. Louver shall be provided with bird screen. Louvers shall bear AMCA Certified Ratings Seal for air performance and water penetration ratings as described in AMCA 500.

## PART 3 EXECUTION

### 3.1 INSULATION

Work shall be installed as shown and in accordance with the manufacturer's diagrams and recommendations.

#### 3.1.1 Flexible Connectors

Preinsulated flexible connectors and flexible duct shall be attached to other components in accordance with the latest printed instructions of the manufacturer to ensure a vapor tight joint. Hangers, when required to suspend the connectors, shall be of the type recommended by the connector or duct manufacturer and shall be provided at the intervals recommended.

#### 3.1.2 Sleeved and Framed Openings

Space between the sleeved or framed opening and the duct or the duct insulation shall be packed as specified in Section 07270 FIRESTOPPING for fire rated penetrations. For nonfire rated penetrations, the space shall be packed as specified in Section 07920 JOINT SEALING.

#### 3.1.3 Metal Ductwork

Installation shall be in accordance with SMACNA-06 unless otherwise indicated. Duct supports for sheet metal ductwork shall be in accordance with SMACNA-06, unless otherwise specified. Friction beam clamps indicated in SMACNA-06 shall not be used. Risers on high velocity ducts shall be anchored in the center of the vertical run to allow ends of riser to move due to thermal expansion. Supports on the risers shall allow free vertical movement of the duct. Supports shall be attached only to structural framing members and concrete slabs. Supports shall not be anchored to metal decking unless a means is provided and approved for preventing the anchor from puncturing the metal decking. Where supports are required between structural framing members, suitable intermediate metal framing shall be provided. Where C-clamps are used, retainer clips shall be provided.

### 3.1.4 Insulation

Thickness and application of insulation materials for ductwork, piping, and equipment shall be in accordance with Section 15250 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

## 3.2 CLEANING

Ducts, plenums, and casings shall be thoroughly cleaned of all debris and blown free of all small particles of rubbish and dust and then shall be vacuum cleaned before installing outlet faces. New filters shall be installed in all air systems that are part of the work specified herein after cleaning is complete.

## 3.3 TESTING, ADJUSTING, AND BALANCING

The Contractor shall test, adjust, and balance the system in accordance with Section 15990, TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS. Fire and smoke damper operation shall be adjusted during testing, adjusting and balancing.

-- END OF SECTION 15566B --

DIVISION 15

MECHANCIAL

SECTION 15610

GAS FURNACE

## PART 1 GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes furnaces and accessories complete with the controls.

B. This Section includes furnaces and accessories with the following additional components:

1. Direct-expansion cooling coils.
2. Air cleaners.

C. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 15 Section “Condensing Units” for condensing units used with cooling coils provided in furnaces.

### 1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Products Data for each furnace including rated capacities of selected models, weights (shipping, installed, and operating), furnished specialties, and accessories. Include plan and elevation views of units, minimum clearances, and data on ratings and capacities.

C. Wiring diagrams detailing wiring for power and control systems and differentiating between manufacturer-installed and field-installed wiring.

D. Maintenance data for each furnace to include in the operation and maintenance manual specified in Division 1.

## 1.2 QUALITY ASSURANCE

A. Electrical Component Standard: Provide components that comply with NFPA 70 and that are listed and label by UL where available.

B. Listing and Labeling: Provide electrically operated fixtures specified in this Section that are listed and labeled.

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

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

## 1.3 WARRANTY

A. General Warranty: The special warranty specified in this Articles shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made be the Contractor under requirements of the Contract Documents.

B. Manufacturer’s Special Warranty on Furnace: Submit a written warranty signed by manufacturer agreeing to replace components within specified warranty period indicated below. Warranty covers failure due to normal conditions of use.

1. Warranty Period: Manufacturer’s standard but not less than 5 years after date of installation.

## 1.4 EXTRA MATERIALS

A. Furnish extra materials described below that much products installed, are packaged with protective covering for storage, and are identified with labels describing contents.

1. Disposable Air Filters: Furnish 2 complete sets.
2. Fan Belts: Furnish one set for each furnace fan.

# PART 2 – PRODUCTS

## 2.1 FURNACES, GENERAL

A. Description: Factory assembled, piped, wired, and tested.

B. Configuration: Upflow.

C. Cabinet: Steel with foil-faced, glass-fiber, interior insulation. Lift-out panels and all other items requiring access for maintenance.

D. Finish of External Casings and Cabinets: Baked enamel over corrosion-resistant-treated surface.

E. Fan: Centrifugal, factory balanced, resilient mounted.

F. Fan Motors: Energy-efficient type. Totally enclosed, with internal thermal protection and permanent lubrication.

## 2.2 GAS-FIRED FURNACES, CONDENSING

A. Comply with AGA Z21.47, "Gas-Fired Central Furnaces", and NEPA 54, "National Fuel Gas Code.

1. AGA Approval: Bear label of American Gas Association.
2. Type of Gas: Natural.

B. Efficiency: 93 percent AFUE, minimum.

C. Heat Exchanger: Aluminized-steel welded construction with aluminum-finned, stainless-steel tube condensing coil.

D. Burner Controls: Solid state; control gas valve and ignition.

1. Gas Value: 100 percent safety gas shutoff; 24-V combining pressure regulation and manual shutoff.

2. Ignition: Electronic pilot ignition, with electric spark igniter.

E. Automatic Controls: Solid-state board delays fan start and fan shutdown.

## 2.3 CONTROLS

A. Controls: Include components required for satisfactory operation of furnaces and auxiliary equipment in all seasons.

B. Control Transformer: 24 VAC output, factory installed, and wired in furnace.

C. Thermostat: 24 VAC, 2-stage, adjustable, heating-cooling wall mounting unit with fan ON-AUTOMATIC selector.

D. Relays: As required to achieve specified operation.

E. Wire and Cable: Specified in Division 16 Section "Wire and Cables".

## 2.4 AIR FILTERS

A. Filters: 1-inch – (25-mm-) thick, disposable, fiberglass type in sheet metal rack.

## 2.5 COOLING FEATURES

A. Evaporator Coil: Conform to ARI 210/240, "Unitary Air Conditioning and Air Source Heat Pump Equipment." Match size with furnace. Match remote condensing unit specified in Division 15 Section "Condensing Units" with type, capacity, pressure-drop

ratings, restricted distributor, or expansion valve. Include condensate drain pan with accessible drain outlet.

B. Evaporate Coil Enclosure: As required to suit furnace and cooling coil. Steel cabinet with access panel and flanges for integral mounting at or on furnace cabinet.

C. Refrigerant Line Kits: Annealed-copper suction ad liquid lines factory cleaned, dried, pressurized, and sealed: with insulated suction line and flared fittings at evaporator end; no fitting at condenser end; length as required.

## PART 3 EXECUTION

### 3.1 INSTALLATION

A. Install furnaces and accessories according to manufacturer's written instructions.

B. Connect condensate drain pans using copper tubing, ASTM B 88, Type M (ASTM B 88M, Type C) with streamline drainage fittings and soldered joints or PVC drainage piping. Extend to nearest equipment drain or floor drain. Construct vented, deep trap at connection to drain pan and install cleanouts at changes in direction. Terminate to suit local code requirements, except where stricter methods are indicated.

C. Base-Mounted Units: Secure units to substrate. Provide optional bottom closure base where installation conditions require.

D. Control: Install thermostats at mounting height of 60 inches (1500 mm) above floor.

E. Control Wiring: Install control wiring as specified in Division 16 Section "Wires and Cables".

F. Connect ducts according to Division Section "Metal Ducts".

G. Identify furnaces and connections according to Division Section "Basic Mechanical Materials and Methods."

H. Identify furnaces and connections according to Division 15 Section "Mechanical Identification."

### 3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties. Specific connection requirements are as follows:

1. Install piping adjacent to machine to allow service and maintenance.

2. Gas Piping: Connect ASTM-A53 Black Steel gas piping to boiler, full size of boiler gas train inlet, and provide union with sufficient clearance for burner removal and service.

3. Refrigerant Tubing: Connect ASTM-B280 refrigerant tubing to coils and condensing units.

B. Electrical: Conform to applicable requirements of Division 16 Sections.

C. Connect motors and components to wiring systems and to ground as indicated and instructed by manufacturer. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

## 3.3 ADJUSTING AND CLEANING

A. Set controls, and other adjustments for optimum heating performance and efficiency. Adjust heat distribution features, including shutters, dampers, and relays, to provide optimum heating performance and system efficiency.

B. After completing system installation, inspect furnaces and associated components. Repair scratches and mars if finish to match original finish. Clean unit internally using methods and material recommended by manufacturer.

## 3.4 COMMISSIONING

A. Startup Services: Provide startup service, as specified below.

1. Start each furnace and operate controls.

2. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.

3. Test functions, operations, control sequences, and protective features. Adjust to ensure operation is as specified.

B. Correct deficiencies identified by test and observations and retest until specified requirements are met.

-- END OF SECTION 15610 --

DIVISION 15

MECHANICAL

SECTION 15671

AIR COOLED CONDENSING UNIT

## PART 1 GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes the following:

1. Air-cooled condensing units.

B. Related Sections include the following:

1. Division 15 Section “Gas Furnace”.

### 1.3 SUBMITTALS

A. Products Data: Include rated capacities; shipping, installed, and Operating weights; dimensions; required clearances; methods for assembling components; furnished specialties; accessories; and installation and startup instructions for each model indicated.

B. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring.

C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

D. Maintenance Data: For each condensing unit to include in the maintenance manuals specified in Division 1.

1. Include a parts list for each condensing unit, control, and accessory; troubleshooting maintenance guide; and servicing and preventive maintenance procedures and schedule.

E. Warranties: Special warranties specified in this Section.

## 1.4 QUALITY ASSURANCE

A. Listing and Label: Provide electrically operated equipment specified in this Section that is listed and labeled.

1. The Terms “Listed” and “Labeled”: As defined in NFPA 70, Article 100.

2. Listing and Labeling Agency Qualifications: A “Nationally Recognized Testing Laboratory” as defined in OSHA Regulation 1910.7.

A. Fabricate and label refrigeration system according to ASHRAE 15, “Safety Code for Mechanical Refrigeration”.

B. Comply with NFPA 710.

C. Comply with UL 303, “Refrigeration and Air-Conditioning Condensing and Compressor Units”.

## 1.5 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Warranty: A written warranty, executed by Contractor and signed by manufacturer, agreeing to replace components that fail in material and workmanship within the specified warranty period, provided manufacturer’s written instructions for installation, operation, and maintenance have been followed.

1. Warranty Period: Manufacturers standard, but not less than 5 years from date of Substantial Completion.

# PART 2 – PRODUCTS

## 2.1 CONDENSING UNITS, AIR COOLED, 1 TO 5 TONS (3.5 TO 17.6 KW)

A. Description: Factory assembled and tested, air cooled; consisting of compressors, condenser coils, fans, motors, refrigerant reservoirs, and operating controls.

B. Compressor: Hermetically sealed and isolated for vibration. Include thermal – and current-sensitive overload devices, start capacitor, relay, contactor, high-pressure switch and low-pressure switch..

C. Condenser: Copper-Tube aluminum-fin coil with liquid subcooler.

D. Refrigerant Components: Refrigerant circuit components shall include liquid line and suction line shutoff valves. System charged of refrigerant R-22 and compressor oil.

E. Condenser Fan: Direct-drive, aluminum propeller fan; with permanently lubricated fan motor with thermal-overload protection.

F. Accessories include the following:

1. Crankcase heater.

2. Automatic reset timer to prevent compressor rapid cycle.

3. Polyethylene mounting base to provide a permanent foundation.

G. Casing: Steel, finished with baked enamel; with removable panels for access to control, weep holes for water drainage, and mounting holes in base. Mount service valves, fittings, and gage ports on exterior of casing.

## 2.2 SOURCE QUALITY CONTROL

A. Verification of Performance: Rated condensing units according to ARI 210/240.

B. Verification of Performance: Rated condensing units according to ARI 340/360.

1. Coefficient of Performance: Equal to or greater than prescribed by ASHRAE 90.1, “Energy Efficient Design of New Building except Low-Rise Residential Buildings”.

C. Testing Requirements: Factory test sound-power level ratings according to ARI 270.

# PART 3 – EXECUTION

## 3.1 INSTALLATION

A. Install condensing units according to manufacturer’s written instructions.

B. Install units level and plumb, firmly anchored in locations indicated; maintain manufacturer’s recommended clearances.

C. Install ground-mounded units on 4-inch- (100-mm-) thick, reinforced concrete base, 4 inches (100 mm) larger than condensing unit each side. Concrete, reinforcement, and formwork requirements are specified in Division 3. Coordinate installation of anchoring devices.

## 3.2 CONNECTS

A. Connect refrigerant piping to air-cooled condensing units; maintain required access to unit. Install furnished field-mounted accessories.

B. Ground equipment.

1. Tighten electrical connectors and terminal according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

## 3.3 FIELD QUALITY CONTROL

A. Leak Test: After installation, charge systems with refrigerant and oil and test for leaks. Repair leaks and replace lost refrigerant and oil.

B. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation, product capability, and compliance with requirements.

1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units with new units and retest.

## 3.4 CLEANING

A. After completing system installation, including outlet fitting and devices, inspect exposed finish. Clean units to remove dirt and construction debris and repair damaged finishes.

## 3.5 COMMISSIONING

A. Verify that units are installed and connected according the Contract Documents.

B. Complete installation and startup checks according to manufacturer's written instructions and do the following:

1. Inspect for physical damage to unit casing.

2. Verify that access doors move freely and are weathertight.

3. Clean units and inspect for construction debris.

4. Check that all bolts and screws are tight.

5. Adjust vibration isolation and flexible connections.

6. Verify that control are connected and operational.

C. Lubricate bearings on fans.

D. Verify that fan wheel is rotating in the correct direction and is not vibrating or binding.

E. Start unit according to manufacturer's written instruction.

1. Complete manufacturer's starting checklist.

F. Check operation of condenser capacity control device.

G. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.

H. After startup and performance test, lubricate bearings.

## 3.6 DEMOSTRATION

A. Startup Services: Engage a factory-authorized service representative to train Owner's maintenance personnel as specified below:

1. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.

-- END OF SECTION 15671 --

DIVISION 15

MECHANICAL

SECTION 15850

FANS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes the following types of air-handling units:

1. Inline centrifugal fans.

### 1.2 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections:

B. Product data for selected models, including specialties, accessories, and the following:

1. Motor ratings and electrical characteristics plus motor and fan accessories.

2. Materials thickness and finishes, including color charts.

3. Dampers, including housings, linkages, and operators.

C. Shop drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, required clearances, components, and location and size of field connections.

D. Wiring diagrams that detail power, signal, and control wiring. Differentiate between manufacturer-installed wiring and field-installed wiring.

E. Maintenance data for air-handling units, for inclusion in Operating and Maintenance Manual specified in Division 1.

### 1.3 QUALITY ASSURANCE

A. UL Compliance: Fans shall be designed, manufactured, and tested in accordance with UL 705 "Power Ventilators."

B. UL Compliance: Fans and components shall be UL listed and labeled.

C. Nationally Recognized Testing Laboratory and NEMA Compliance (NRTL): Fans and components shall be NRTL listed and labeled. The term "NRTL" shall be as defined in OSHA Regulation 1910.7.

D. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

E. Electrical Component Standard: Components and installation shall comply with NFPA 70 "National Electrical Code."

## 1.4 SEQUENCING AND SCHEDULING

A. Coordinate the size and location of structural support members.

# PART 2 - PRODUCTS

## 2.1 SOURCE QUALITY CONTROL

A. Testing Requirements: The following factory tests are required:

1. Sound Power Level Ratings: Comply with AMCA Standard 301 "Method for Calculating Fan Sound Ratings From Laboratory Test Data." Test fans in accordance with AMCA Standard 300 "Test Code for Sound Rating." Fans shall be licensed to bear the AMCA Certified Sound Ratings Seal.

2. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings in accordance with AMCA Standard 210/ASHRAE Standard 51 - Laboratory Methods of Testing Fans for Rating.

## 2.2 FANS, GENERAL

A. General: Provide fans that are factory fabricated and assembled, factory tested, and factory finished, with indicated capacities and characteristics.

B. Fans and Shafts: Statically and dynamically balanced and designed for continuous operation at the maximum rated fan speed and motor horsepower.

C. Bearings: Provide type indicated, having a median life "Rating Life" (AFBMA L(50)) of 200,000, calculated in accordance with AFBMA Standard 9 for ball bearings and AFBMA Standard 11 for roller bearings.

D. Factory Finish: The following finishes are required:

1. Sheet Metal Parts: Prime coating prior to final assembly.

2. Exterior Surfaces: Baked-enamel finish coat after assembly.

## 2.3 INLINE CENTRIFUGAL FANS

A. General Description: Inline, direct-driven, centrifugal fans consisting of housing, wheel, inlet and discharge collars, fan shaft, bearings, drive assembly, motor and disconnect switch, mounting brackets, and accessories.

B. Housing: rigid structural members and formed galvanized steel panels, square inlet and outlet collars for duct connection, and support bracket adaptable to floor, side wall, or ceiling mounting. Two access panels perpendicular to the motor mounted panel for

inspection and servicing.

C. Direct-Drive Units: Motor encased in housing and factory-wired to disconnect located on outside of fan housing.

D. Fan wheel: Aluminum, backward inclined, centrifugal type, wheel shall be statically and dynamically balanced. Wheel shall have a wheel cone matched to the inlet cone for precise running.

E. Accessories: The following accessories are required as indicated:

1. Volume Control Damper: Manual operated with quadrant lock, located in fan outlet.

2. Companion Flanges: For inlet and outlet duct connections.

3. Speed Control: Variable speed switch with on-off control and speed control for 100 to 50 percent of fan air delivery.

## 2.4 MOTORS

A. Torque Characteristics: Sufficient to accelerate the driven loads satisfactorily.

B. Motor Sizes: Minimum sizes and electrical characteristics as indicated. If not indicated, large enough so that the driven load will not require the motor to operate in the service factor range.

C. Temperature Rating: 50 deg C maximum temperature rise at 40 deg C ambient for continuous duty at full load (Class A Insulation).

D. Service Factor: 1.15 for polyphase motors and 1.35 for single-phase motors.

E. Motor Construction: NEMA Standard MG 1, general purpose, continuous duty, Design B. Provide permanent-split capacitor classification motors for shaft-mounted fans.

1. Bearings: Permanently lubricated bearing.

2. Enclosure Type: The following features are required:

a. Open dripproof motors where satisfactorily housed or remotely located during operation.

3. Overload protection: Built-in, automatic reset, thermal overload protection.

4. Noise rating: Quiet.

5. Efficiency: Energy-efficient motors shall have a minimum efficiency as scheduled in accordance with IEEE Standard 112, Test Method B. If efficiency not specified, motors shall have a higher efficiency than "average standard industry motors" in accordance with IEEE Standard 112, Test Method B.

7. Nameplate: Indicate the full identification of manufacturer, ratings, characteristics, construction, and special features.

F. Starters, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 16.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances, housekeeping pads, and other conditions affecting performance of fans.

B. Do not proceed until unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION, GENERAL

A. Install fans level and plumb, in accordance with manufacturer's written instructions. Support units as described below.

1. Suspended Units: Suspend units from structural steel support frame using threaded steel rods and vibration isolation.

### 3.3 CONNECTIONS

A. Duct installations and connections are specified in other Division 15 sections. Make final duct connections with flexible connections.

B. Electrical Connections: The following requirements apply:

1. Electrical power wiring is specified in Division 16.

2. Temperature control wiring and interlock wiring are specified in Division 15 Section "Control Systems."

3. Grounding: Connect unit components to ground in accordance with the National Electrical Code.

### 3.4 ADJUSTING, CLEANING, AND PROTECTING

A. Adjust damper linkages for proper damper operation.

B. Clean unit cabinet interiors to remove foreign material and construction dirt and dust. Vacuum clean fan wheel and cabinet.

### 3.5 COMMISSIONING

A. Final Checks Before Start-Up: Perform the following operations and checks before start-up:

1. Verify unit is secure on mountings and supporting devices and that connections for ductwork, and electrical are complete. Verify proper thermal overload protection is installed in motors, starters, and disconnects.

2. Perform cleaning and adjusting specified in this Section.

3. Verify manual and automatic volume control and that fire and

smoke dampers in connected ductwork systems are in the full-open position.

B. Starting procedures for fans:

1. Energize motor; verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated RPM.

2. Measure and record motor electrical values for voltage and amperage.

C. Refer to Division 15 Section "Testing, Adjusting, and Balancing" for procedures for air-handling-system testing, adjusting, and balancing.

## 3.6 DEMONSTRATION

A. Demonstration Services: Arrange and pay for a factory-authorized service representative to train Owner's maintenance personnel on the following:

1. Procedures and schedules related to start-up and shutdown, troubleshooting, servicing, preventative maintenance, and how to obtain replacement parts.

-- END OF SECTION 15850 --

DIVISION 15

MECHANICAL

SECTION 15950

# HEATING, VENTILATING AND AIR CONDITIONING (HVAC) CONTROL SYSTEMS

## PART 1 GENERAL

### 1.1 REFERENCES

The publications listed below are referenced and the most current publication applies. The publications are referenced to in the text by basic designation only.

A. AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

| | |
|---|---|
| ASME B40.1 | Gauges – Pressure Indicating Dial Type - Elastic Element |

B. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

| | |
|---|---|
| NFPA 90A | Installation of Air Conditioning and Ventilating Systems |

C. UNDERWRITERS LABORATORIES (UL)

| | |
|---|---|
| UL 268A | Smoke Detectors for Duct Application |

### 1.2 GENERAL REQUIREMENTS

A. Standard Products

Material and equipment shall be standard products of a manufacturer regularly engaged in the manufacturing of such products which are of a similar material, design and workmanship. The standard products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening.

### 1.3 SUBMITTALS

Government approval is required for submittals with a “GA” designation, submittals having an “FIO” designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTALS:

A. Shop Drawings "GA"

Drawings of HVAC control system shall include: a list of symbols; drawings for each HVAC control system using abbreviations, symbols, nomenclature and identifiers as shown on the contract drawings.

Drawings for the HVAC control system shall include a schematic, a ladder diagram, an equipment schedule as shown, a wiring diagram, and a list of equipment with manufacturer and model number, and an HVAC control-system sequence of operation.

The wiring diagram shall show the interconnection of HVAC control conductors and to the identified terminals of starters and packaged equipment, with all necessary jumpers and ground connections. The wiring diagram shall show the labels of all conductors. All sources of power required for HVAC control systems and for packaged-equipment control systems shall be identified back to the panelboard circuit breaker number, HVAC system control panel, magnetic starter, or packaged control equipment circuit. Each power supply and transformer not integral to a controller, starter, or packaged equipment shall be shown. The connected volt-ampere load and the power supply volt-ampere rating shall be shown.

B. Manufacturers Catalog Cuts/Data "FIO"

Manufacturer's equipment data, product specific catalog cuts. Catalog cuts shall be in booklet form indexed by device type. Where multiple components are shown on a catalog cut, the application-specific component shall be marked.

C. Performance Test Reports "FIO"

Six copies of the site testing, commissioning, and balancing procedures. The site testing procedures shall identify each item to be tested and shall clearly describe each test. The test procedures shall include a list of the test equipment to be used for site testing, manufacturer and model number, and the date of calibration and accuracy of calibration within 6 months of the test date. Six copies of the site testing data. Original copies of all data produced during site testing, including results of each test procedure, after approval of the site tests. Six copies of the performance verification test plans and procedures. The test plan and procedures for the performance verification test, indexed and in booklet form, 60 days before scheduled test dates. Six copies of the performance verification test report, after completion of a successful test. Documentation of test results for the entire HVAC control system, complete and in booklet form and indexed, within 30 days after each test.

## 1.4 DELIVERY AND STORAGE

Products shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, and other contaminants, within the storage-condition limits published by the equipment manufacturer.

## PART 2 PRODUCTS

### 2.1 GENERAL EQUIPMENT REQUIREMENTS

A. Electrical and Electronic Devices

All electrical and electronic devices shall have a NEMA 1 enclosure in accordance with NEMA 250 unless otherwise shown.

### 2.2 MATERIALS

A. Wiring

1. Terminal Blocks

Terminal blocks shall be insulated, modular, feed-through, clamp style with recessed captive screw-type clamping mechanism, shall be suitable for rail mounting, and shall have end plates and partition plates for separation or shall have enclosed sides.

2. Control Wiring for 24-Volt Circuits

Control wiring for 24-volt circuits shall be 18 AWG minimum stranded copper, and shall be rated for 300-volt service.

3. Wiring for 120-Volt Circuits

Wiring for 120-volt circuits shall be 18 AWG minimum stranded copper, and shall be rated for 600-volt service.

### 2.3 THERMOSTATS

A. General

Thermostat ranges shall be selected so that the setpoint is adjustable without tools between plus or minus 10 degrees F of the setpoint shown. Thermostats shall be electric or low-voltage electronic.

### 2.4 MANUAL EMERGENCY FAN SHUTOFF SWITCHES

Manual emergency fan shutdown switches shall be provided for air distribution fan in accordance with NFPA 90A. Switches shall be the manual-reset type. Switches shall be located and mounted in an accessible manner, approximately 1.2 m (48 inches) above the finished floor. Switches shall be properly identified in etched rigid plastic placards.

## PART 3 EXECUTION

### 3.1 GENERAL INSTALLATION CRITERIA

The HVAC control system shall be completely installed and ready for operation, as specified and shown. Dielectric isolation shall be provided where dissimilar metals are used for connection and support.

Penetrations through and mounting holes in the building exterior shall be made watertight.

A. Device-Mounting Criteria

Devices mounted in or ductwork, on building surfaces, in mechanical/electrical spaces, or in occupied space ceilings shall be installed in accordance with manufacturers' recommendations and as shown. Control devices to be installed ductwork shall be provided with all required gaskets, flanges, thermal compounds, insulation, piping, fittings, and manual valves for shutoff, equalization, purging, and calibration.

B. Wiring Criteria

Wiring, including low-voltage wiring, shall be installed in metallic raceways. Wiring shall be installed without splices between control devices and HVAC units. Other electrical work shall be as specified in Section 16415 ELECTRICAL WORK, INTERIOR and as shown.

## 3.2 CONTROL-SYSTEM INSTALLATION

A. Room-Instrument Mounting

Room instruments shall be mounted so that their sensing elements are 1.5 m (5 feet) above the finished floor unless otherwise shown. Temperature setpoint device shall be recess mounted.

## 3.3 CONTROL SEQUENCES OF OPERATION

A. Sequence of Operation as indicated on contract drawings.

## 3.4 TESTING, COMMISSIONING, AND BALANCING

A. Site Testing

The Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform all site testing, calibration, adjusting and commissioning. The tests shall not be conducted during scheduled seasonal off-periods of base heating and cooling systems. Wiring shall be tested for continuity and for ground, open, and short circuits. The Contractor shall obtain written Government approval of the specific site-testing procedures prior to any test. Written notification of any planned site-testing, commissioning or tuning shall be given to the Government at least 14 calendar days prior to any test.

B. Control System Calibration, Adjustments, and Commissioning

All instrumentation and controls shall be calibrated and the specified accuracy shall be verified using test equipment with calibration traceable to NIST standards. Mechanical control

devices shall be adjusted to operate as specified. Control system commissioning shall be performed for each HVAC system.

C. Performance Verification Test

The Contractor shall demonstrate compliance of the HVAC control system with the contract documents. Using test plans and procedures previously approved by the Government, the Contractor shall demonstrate all physical and functional requirements of the project. The performance verification test procedures shall explain, step-by-step, the actions and expected results that will demonstrate that the control systems perform in accordance with the sequences of operation. The performance verification test shall not be started until after receipt by the Contractor of written permission by the Government, based on the Contractor's written certification of successful completion of Contractor site testing as specified.

D. Coordination with HVAC System Balancing

The Contractor shall tune the HVAC control system after all air-system minimum damper positions set and a report has been issued. Commissioning, except for tuning of controllers, may be performed prior to or simultaneous with HVAC system balancing.

-- END OF SECTION 15950 --

DIVISION 15

MECHANICAL

SECTION 15990

# TESTING, ADJUSTING AND BALANCING OF HVAC SYSTEMS

## PART 1 GENERAL

### 1.1 REFERENCES

The publications listed below are referenced and the most current publication applies. The publications are referred to in the text by basic designation only.

| | |
|---|---|
| 1.1.1 | AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI) |
| ANSI S1.4 | Sound Level Meters |
| ANSI S1.11 | Octave-Band and Fractional-Octave-Band Analog and Digital Filters |
| 1.1.2 | AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR CONDITIONING ENGINEERS (ASHRAE) |
| ASHRAE 111 | Practices for Measurement, Testing, Adjusting, and Balancing of Building Heating, Ventilation, Air-Conditioning and Refrigeration Systems |
| 1.1.3 | ASSOCIATED AIR BALANCE COUNCIL (AABC) |
| AABC MN-1 | National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems |
| 1.1.4 | NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB) |
| NEBB-01 | Procedural Standards for Testing Adjusting Balancing of Environmental Systems |
| 1.1.5 | NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) |
| NFPA 90A | Installation of Air Conditioning and Ventilating Systems |

1.1.6 SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA-07 HVAC Systems – Testing, Adjusting and Balancing

## 1.2 GENERAL REQUIREMENTS

The Contractor shall select AABC MN-1, NEBB-01, SMACNA-07 or ASHRAE 111 as the standard for providing testing, adjusting and balancing of air and water systems. The selected standard shall be used throughout the project. Testing, adjusting, and balancing shall be accomplished by a firm certified for testing and balancing by Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB). Prior to testing, adjusting, and balancing, the Contractor shall verify that the systems have been installed and are operating as specified. Approved detail drawings and all other data required for each system and/or component to be tested shall be made available at the jobsite during the entire testing, adjusting and balancing effort. The Contractor shall verify that all balancing devices are properly installed to permit testing, adjusting and balancing and that all duct leakage tests have been completed prior to testing, adjusting and balancing. The Contracting Officer shall be notified in writing of all equipment, components, or balancing devices, that are damaged, incorrectly installed, or missing, as well as any design deficiencies that will prevent proper testing, adjusting, and balancing. Testing, adjusting, and balancing shall not commence until approved by the Contracting Officer. Instrumentation accuracy shall be in accordance with the standard selected in this paragraph. Sound level measuring equipment shall be rated in accordance with ANSI S1.4 and ANSI S1.11.

## 1.3 INSTRUMENT ACCURACY REQUIREMENTS

All instrumentation shall be checked for accuracy before beginning testing, adjusting and balancing procedures. Instrument accuracy shall be in accordance with the standard selected in paragraph GENERAL REQUIREMENTS. Checks may be carried out against similar equipment maintained specifically for checking purposes or by the manufacturer or a recognized testing facility. All instrumentation used for testing shall be calibrated within 6 months of use. Pitot tubes and U-tube manometers do not require checking. In no case shall the instrumentation accuracy be less than specified by the instrument manufacturer. Any instrument falling out of calibration during the process of balancing and testing shall be recalibrated or removed from the site and replaced by a properly calibrated instrument. No instruments shall be allowed to remain on-site that are not in calibration.

## 1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation, submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

1.4.1 Reports "GA"

Testing and Balancing

Three copies of a preliminary report, 30 days before balancing commences. The report shall be organized by specific systems and shall clearly identify each item of equipment to be tested, adjusted, and balanced. The appropriate test procedures and measurements to be taken for each item of equipment shall be listed. Instrument calibration records shall be provided on forms shown in AABC MN-1 or SMACNA-07. Manufacturer's specified accuracy shall be shown. The report shall include floor plans showing all measurement locations and types of measurements to be made. All related data necessary for testing, balancing, and adjusting, including fan curves and pump curves, shall be included. A system readiness checklist, similar to that shown in SMACNA-07, shall be included. The report shall contain a listing of the deficiencies of all systems to be tested, adjusted and balanced and the corrective action taken. The report shall contain a schedule for the testing and balancing. Six copies of the final report on forms shown in AABC MN-1 or SMACNA-07, 30 days after completion of the test and balance operation. Data shall be in a hard bound cover identifying the project name, location, date of submittal, name of Contractor, and a general title indicating the specific area and type of work, and shall be signed by a registered professional engineer, employed by the test and balance firm, who has a minimum of 2 years experience in testing, adjusting and balancing work. The final report shall include a summary describing test methods, test results, and major corrective actions taken. The report shall include as-tested floor plans showing all measurement locations and types of measurements made. The air handling unit data shall include a static pressure profile diagram, and pitot tube traverses where possible. Air distribution data shall include coded drawings which show the exact location of each air outlet. All instruments that are recalibrated and brought back onto the jobsite after being found to be out of calibration shall have recalibration records submitted on forms shown in AABC MN-1 or SMACNA-07.

1.4.2 Certificates "GA"

Qualification

Qualification data, 90 days prior to testing and balancing operations. The test and balance firm shall be certified by the Associated Air Balance Council (AABC) or the National Environmental Balancing Bureau (NEBB). The lead balancing technician shall be qualified by AABC or NEBB and his qualification data shall include past experience on at least five similar projects.

## PART 2 PRODUCTS (Not Applicable)

## PART 3 EXECUTION

### 3.1 TESTING AND BALANCING

#### 3.1.1 General

The facility shall be essentially complete with final ceiling, walls, windows, doors and partitions in place. Doors and windows surrounding each area to be balanced shall be closed during testing and balancing operations. Air systems shall be complete and operable with balancing dampers, ducting, diffusers, returns, flow control boxes and control components in place. Exhaust fans shall be operational. Hydronic systems shall be complete and operable with balancing valves, flow meters, coils, pumps, piping and control components in place. All measurements and adjustments shall be made using procedures described in standard selected in paragraph GENERAL REQUIREMENTS. Air motion and distribution from air terminals shall be as shown. Smoke tests may be used to demonstrate proper air distribution from air terminals. All data including deficiencies encountered and corrective action taken shall be recorded. If a system cannot be adjusted to meet the design requirements, the Contractor shall promptly notify the Contracting Officer in writing.

#### 3.1.2 Air Systems

Clean filters shall be installed at the beginning of the testing, adjusting, and balancing effort. Each system shall be adjusted until all flow quantities are within plus ten percent and minus zero percent. Dampers shall be checked for tight shutoff. Air leakage around dampers shall be verified. Face and bypass dampers shall be set for air flow through coils. Fire and smoke dampers shall be open. Fans shall be checked for correct direction of rotation and proper speed shall be verified. Fire and smoke dampers shall be tested at system design air flow to ensure proper closure in accordance with NFPA 90A and manufacturer's instructions prior to building occupancy.

##### 3.1.2.1 General Balancing Methods

In addition to the requirements for specific systems, flows in supply, exhaust and return air systems shall be balanced using the methods in standard selected in paragraph GENERAL REQUIREMENTS. Throttling losses shall be limited. Air flow adjustments shall be made by first adjusting the fan speed to meet the design flow conditions. Flows and pressures shall be checked in all main risers and supply ducts at all supply, exhaust and return fan discharges. All flows shall be recorded before and after each adjustment.

3.1.2.2 Specific Systems

All special or additional procedures for testing and balancing shall be in accordance with the applicable requirements of the standard selected in paragraph GENERAL REQUIREMENTS. If a system has diversity, only the required quantity of wide open terminals shall be used to meet the design air flow.

3.1.3 Marking of Setting

Following final acceptance of certified reports by the Contracting Officer, the setting of all HVAC adjustment devices including valves, splitters, and dampers shall be permanently marked by the testing and balancing engineer so that adjustment can be restored if disturbed at any time.

3.1.4 Marking of Test Ports

The testing and balancing engineer shall permanently and legibly mark and identify the location points of the duct test ports. If the ductwork has exterior insulation, these markings shall be made on the exterior side of the ductwork insulation. All penetrations through ductwork and ductwork insulation shall be properly sealed to prevent air leakage or loss of vapor barrier.

3.1.5 Sound Level Testing

After the systems are properly tested, adjusted and balanced, sound levels shall be checked in accordance with the applicable provisions of AABC MN-1. Octave-band analysis and noise-criteria curve data shall be recorded on forms shown in AABC MN-1. All occupied areas including offices, corridors and shall be verified to be within the sound levels shown or as specified. Any areas not meeting the requirements of AABC MN-1 or the specifications or drawings shall be clearly indicated on the form and an explanation of all discrepancies shall be provided in test report.

3.2 CONTROL SYSTEMS

Testing, adjusting, and balancing of the systems shall be coordinated with the control system installation. All control components shall be verified to be properly installed and operating as specified before proceeding with testing, adjusting, and balancing. Verification shall be in accordance with AABC MN-1.

-- End of Section 15990 --

DIVISION 16

ELECTRICAL

SECTION 16370B

# ELECTRICAL WIRING, EXTERIOR, AERIAL

## PART 1 GENERAL

### 1.1 REFERENCES

The publications listed below are referenced and the most current publication applies. The publications are referred to in the text by basic designation only.

| | |
|---|---|
| 1.1.2. | AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) |
| ASTM B 1 | Hard-Drawn Copper Wire |
| ASTM B 8 | Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft |
| 1.1.3. | INSTITUTE OF ELECTRICAL AND ELECTRONIC ENGINEERS (IEEE) |
| IEEE C2 | National Electrical Safety Code |
| IEEE Std 404 | Cable Joints for Use with Extruded Dielectric Cable Rated 5000 V Through 46 000V and Cable Joints for Use with Laminated Dielectric Cable Rated 2500 V Through 500 000V |
| 1.1.4. | INSULATED CABLE ENGINEERING ASSOCIATION (ICEA) |
| ICEA S-70-547 | Weather Resistant Polyolefin Covered Wire and Cable |
| 1.1.5. | NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA) |
| NEMA WC 8 | Ethylene-Propylene-Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy |
| 1.1.6. | NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) |
| NFPA 70 | National Electrical Code |
| 1.1.7. | UNDERWRITERS LABORATORIES (UL) |
| UL 486A | Wire Connectors and Soldering Lugs for Use with Copper Conductors |

### 1.2 SERVICE CONDITIONS

Items provided under this section shall be specifically suitable for the service conditions.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation, submittal having an "FIO" designation are information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

### 1.3.1. Data "FIO"

Manufacturer's Catalog

Catalog cuts, brochures, circulars, specifications, product data, and printed information in sufficient detail and scope to verify compliance with the requirements of the contract documents.

### 1.3.2. Drawings "GA"

As-Built Drawings.

The as-built drawings shall be a record of the construction as installed. The drawings shall include the information shown on the contract drawings as well as deviations, modifications, and changes from the contract drawings, however minor. The as-built drawings shall be kept at the job site and updated daily. The as-built drawings shall be a full sized set of prints marked to reflect deviations, modifications, and changes. The as-built drawing shall be complete and show the location, size, dimensions, part identification, and other information. Upon completion of the work, the Contractor shall submit three full sized sets of the marked prints.

Test Reports. "GA"

Six copies of the information described below in 215.9 by 279.4 mm (8-1/2 by 11 inch) binders having a minimum of 5 rings, and including a separate section for each test. Sections shall be separated by heavy plastic dividers with tabs.

a. A list of equipment used, with calibration certifications.

b. A copy of measurements taken.

c. The dates of testing.

d. The equipment and values to be verified.

e. The condition specified for the test.

f. The test results, signed and dated.

g. A description of adjustments made.

1.3.3. Certificates "GA"

Material and Equipment.

Where materials or equipment are specified to conform to the standards of the Underwriters Laboratories (UL) or to be constructed or tested, or both, in accordance with the standards of the American National Standards Institute (ANSI), the Institute of Electrical and Electronic Engineers (IEEE), or the National Electrical Manufacturers Association (NEMA), the Contractor shall submit proof that the items provided under this section of the specifications conform to such requirements. The label of, or listing by, UL will be acceptable as evidence that the items conform thereto. Either a certification or a published catalog specification data statement, to the effect that the item is in accordance with the referenced ANSI or IEEE standard, will be acceptable as evidence that the item conforms thereto. A similar certification or published catalog specification data statement to the effect that the item is in accordance with the referenced NEMA standard, by a company listed as a member company of NEMA, will be acceptable as evidence that the item conforms thereto. In lieu of such certification or published data, the Contractor may submit a certificate from a recognized testing agency equipped and competent to perform such services, stating that the items have been tested and that they conform to the requirements listed, including methods of testing of the specified agencies.

## 1.4 DELIVERY, STORAGE, AND HANDLING

Stored items shall be protected from the environment in accordance with the manufacturer's published instructions.

# PART 2 PRODUCTS

## 2.1 GENERAL REQUIREMENTS

Products shall conform to the following requirements: Items of the same classification shall be identical including equipment, assemblies, parts, and components.

## 2.2 STANDARD PRODUCTS

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

## 2.3 CORROSION PROTECTION

2.3.1 Aluminum Materials

Aluminum shall not be used.

### 2.3.2 Equipment

Equipment and component items, not hot-dip galvanized or porcelain enamel finished, shall be provided with corrosion-resistant finishes. Cut edges or otherwise damaged surfaces of hot-dip galvanized sheet steel or mill galvanized sheet steel shall be coated with a zinc rich paint conforming to the manufacturer's standard.

## 2.4 CONDUCTORS, CONNECTORS, AND SPLICES

Local practices shall be followed in the selection of conductor composition. Conductor types shall not be mixed on any project, unless specifically indicated.

### 2.4.1 Copper Conductors

Hard-drawn-copper conductors shall comply with ASTM B 1 and ASTM B8 as appropriate for the conductor size.

### 2.4.2 Connectors and Splices

Connectors and splices shall be of copper alloys for copper conductors. Aluminum-composition and aluminum-composition to copper shall comply with UL 486B, and copper-to-copper shall comply with UL 486A.

## 2.5 LOW-VOLTAGE LINES

Low-voltage line conductors shall be of the neutral-supported secondary and service drop type with weather-resistant polyolefin-covered type conforming to ICEA S-70-547. Neutral-supported secondary and service drop conductors shall be insulated copper with bare hard-drawn-copper or copper clad steel neutrals. Conductors on secondary racks may be provided in lieu of neutral-supported cable for pole line circuits where necessary clearances are available.

# PART 3 EXECUTION

## 3.1 GENERAL INSTALLATION REQUIREMENTS

Wiring and aerial conductors shall be installed and energized in accordance with the manufacturer's published instructions. Secondary circuits installed in conduit on poles shall conform to the requirements of Section 16415C ELECTRICAL WORK, INTERIOR.

### 3.1.1 Conformance to Codes

The installation shall comply with the requirements and recommendations of IEEE C2 for [light] loading districts, Grade B construction. No reduction in clearance shall be made. The installation shall also comply with the applicable parts of NFPA 70.

### 3.1.2 Verification of Dimensions

The Contractor shall become familiar with details of the work, shall verify dimensions in the field, and shall notify the Contracting Officer of any discrepancy before performing any work.

## 3.2 CONDUCTOR INSTALLATION

### 3.2.1 Line Conductors

Unless otherwise indicated, conductors shall be installed in accordance with manufacturer's approved tables of sags and tensions. Proper care shall be taken in handling and stringing conductors to avoid abrasions, sharp bends, cuts, kinks, or any possibility of damage to insulation or conductors. Conductors shall be paid out with the free end of conductors fixed and cable reels portable, except where terrain or obstructions make this method unfeasible. Bend radius for any insulated conductor shall not be less than the applicable NEMA specification recommendation. Conductors shall not be drawn over rough or rocky ground, nor around sharp bends. When installed by machine power, conductors shall be drawn from a mounted reel through stringing sheaves in straight lines clear of obstructions. Initial sag and tension shall be checked by the Contractor, in accordance with the manufacturer's approved sag and tension charts, within the elapsed time after installation, as recommended by the manufacturer.

### 3.2.2 Connectors and Splices

Connectors and splices shall be mechanically and electrically secure under tension and shall be of the nonbolted compression type. The tensile strength of any splice shall be not less than the rated breaking strength of the conductor. Splice materials, sleeves, fittings, and connectors shall be noncorrosive and shall not adversely affect conductors. Low-voltage connectors for copper conductors shall be of the solderless pressure type. Noninsulated connectors shall be smoothly taped to provide a waterproof insulation equivalent to the original insulation, when installed on insulated conductors.

### 3.2.3 Conductor-To-Insulator Attachments

Conductors shall be attached to insulators by means of clamps, shoes, or tie wires, in accordance with the type of insulator. For insulators requiring conductor tie-wire attachments, tie-wire sizes shall be as indicated in TABLE II.

TABLE 11

TIE-WIRE REQUIREMENTS

| CONDUCTOR Copper (AWG) | TIE WIRE Soft-Drawn Copper (AWG) |
|---|---|
| 6 | 8 |
| 4 and 2 | 6 |
| 1 through 3/0 | 4 |
| 4/0 and larger | 2 |
| **AAC, AAAC, or ACSR (AWG)** | **AAAC OR AAC (AWG)** |
| Any size | 6 or 4 |

3.2.4 Low-Voltage Insulated Cables

Low-voltage cables shall be supported on clevis fittings using spool insulators. Dead-end clevis fittings and suspension insulators shall be provided where required for adequate strength. Dead-end construction shall provide a strength exceeding the rated breaking strength of the neutral messenger. Clevis attachments shall be provided with not less than 15.9 mm (5/8 inch) 5/8 inch through-bolts. Secondary racks may be used when installed on wood poles and where the span length does not exceed 61 (200 feet). Secondary racks shall be two-, three-, or four-wire, complete with spool insulators. Racks shall meet strength and deflection requirements for heavy-duty steel racks, and shall be either galvanized steel or aluminum alloy. Tops of insulator saddles shall be rounded and smooth to avoid damage to conductor insulation. Each insulator shall be held in place with a 15.9 mm (5/8 inch) button-head bolt equipped with a nonferrous cotter pin, or equivalent, at the bottom. Racks for dead-ending four No. 4/0 AWG or four larger conductors shall be attached to poles with three 15.9 mm (5/8 inch) through-bolts. Other secondary racks shall be attached to poles with at least two 15.9 mm (5/8 inch) through-bolts. Minimum vertical spacing between conductors shall not be less than 200 mm (8 inches).

## 3.3 CONNECTIONS TO UTILITY LINES

The Contractor shall coordinate the work with the Contracting Officer and the Utility Company shall provide for final connections to the utility electric lines.

## 3.4 CONNECTIONS TO BUILDINGS

### 3.4.1 Aerial Services

Connections to buildings shall be made at approximately the point indicated and shall be connected to the service entrance conductors. Supports at buildings shall be adequate to withstand required pulls; supports shall not be rated less than 4450 N (1000 pounds). Drip loops shall be formed on conductors at entrances to buildings, cabinets, or conduits. Service-entrance conduits with termination fittings and conductors within the building, including sufficient slack for connection to aerial service cables, shall conform to the requirements of Section 16415C ELECTRICAL WORK, INTERIOR WIRING.

## 3.5 FIELD TESTING

### 3.5.1 General

The Contractor shall perform all tests and inspections recommended by the manufacturer unless specifically waived by the Contracting Officer. The Contractor shall maintain a written record of tests which includes date, test performed, personnel involved, devices tested, serial number and name of test equipment, and test results. Field reports will be signed and dated by the Contractor.

### 3.5.2 Safety

The Contractor shall provide and use safety devices such as rubber gloves, protective barriers, and danger signs to protect and warn personnel in the test vicinity. The Contractor shall replace any devices or equipment which are damaged due to improper test procedures or handling.

### 3.5.3 Low-Voltage Cable Test

For underground secondary or service laterals from overhead lines, the low-voltage cable, complete with splices, shall be tested for insulation resistance after the cables are installed, in their final configuration, ready for connection to the equipment, and prior to energization. The test voltage shall be 500 volts dc, applied for one minute between each conductor and ground and between all possible combinations of conductors in the same trench, duct, or cable, with all other conductors in the same trench, duct, or conduit. The minimum value of insulation shall be:

R in megohms = (rated voltage in kV + 1) x 304.800/(length of cable in meters)

R in megohms = (rated voltage in kV + 1) x 1000/(length of cable in feet)

Each cable failing this test shall be repaired or replaced. The repaired cable shall then be retested until failures have been eliminated.

### 3.5.4 Pre-Energization Services

The following services shall be performed subsequent to testing but prior to the initial energization. The equipment shall be inspected to ensure that installation is in compliance with the recommendations of the manufacturer and as shown on the detail drawings. Terminations of conductors at major equipment shall be inspected to ensure the adequacy of connections. Bare and insulated conductors between such terminations shall be inspected to detect possible damage during installation. If factory tests were not performed on completed assemblies, tests shall be performed after the installation of completed assemblies. Components shall be inspected for damage caused during installation or shipment and to ensure that packaging materials have been removed.

### 3.5.5 Operating Tests

After the installation is completed, and at such time as the Contracting Officer may direct, the Contractor shall conduct operating tests. The equipment shall be demonstrated to operate in accordance with the specified requirements.

- End of Section 16370B –

DIVISION 16

ELECTRICAL

SECTION 16415A

ELECTRICAL WORK, INTERIOR - MOTORS

## PART 1 GENERAL

### 1.1 REFERENCES

The publications listed below are referenced and the most current publication applies. The publications are referenced to in the text by basic designation only.

1.1.1 AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 709 Laminated Thermosetting Materials

1.1.2 NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 2 Industrial Control Devices, Controllers and Assemblies

1.1.3 NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 National Electrical Code

### 1.2 GENERAL

1.2.1 Rules

The installation shall conform to the requirements of NFPA 70 and NFPA 101, unless more stringent requirements are indicated herein or shown.

1.2.2 Coordination

The drawings indicate the extent and the general location and arrangement of equipment, conduit, and wiring. The Contractor shall become familiar with all details of the work and verify all dimensions in the field so that the outlets and equipment shall be properly located and readily accessible. Equipment and materials shall be located to avoid interference with mechanical or structural features. If any conflicts occur necessitating departures from the drawings, details of and reasons for departures shall be submitted and approved prior to implementing any change.

1.2.3 Special Environments

1.2.3.1 Weatherproof Locations

Wiring, fixtures, and equipment in designated locations shall conform to NFPA 70 requirements for installation in damp or wet locations.

1.2.4 Standard Products

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

1.2.5 Identification Nameplates

Major items of electrical equipment and major components shall be permanently marked with an identification name to identify the equipment by type or function and specific unit number as indicated. Designation of motors shall coincide with their designation in the motor control center or panel. Unless otherwise specified, all identification nameplates shall be made of laminated plastic in accordance with ASTM D 709 with black outer layers and a white core. Edges shall be chamfered. Plates shall be fastened with black-finished round-head drive screws, except motors, or approved nonadhesive metal fasteners. When the nameplate is to be installed on an irregular-shaped object, the Contractor shall devise an approved support suitable for the application and ensure the proper installation of the supports and nameplates. In all instances, the nameplate shall be installed in a conspicuous location. At the option of the Contractor, the equipment manufacturer's standard embossed nameplate material with black paint-filled letters may be furnished in lieu of laminated plastic. The front of each panelboard and starter, shall have a nameplate to indicate the phase letter, corresponding color and arrangement of the phase conductors. The following equipment, as a minimum, shall be provided with identification nameplates:

| Minimum 1/4 Inch High Letters | Minimum 1/8 Inch High Letters |
|---|---|
| Starters | Control Power Transformers |
| Safety Switches | Control Devices |
| Equipment Enclosures | Instrument Transformers |
| Motors | |

1.2.6 As Built Drawings

The contractor shall furnish as required documentation within the performance period time frame. Following the project final inspection, or immediately following, before submission of final invoice, contractor shall furnish 2 sets of as built drawings to the Contacting Officer.

## 1.3 SUBMITTALS

Government approval is required for submittals with a “GA” designation, submittals having an “FIO” designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

### 1.3.1 Reports “FIO”

Materials and Equipment

The label or listing of the Underwriters Laboratories, Inc., shall be accepted as evidence that the materials or equipment conform to the applicable standards of that agency. In lieu of this label or listing, a statement from a nationally recognized, adequately equipped testing agency indicating that the items have been tested in accordance with required procedures and that the materials and equipment comply with all contract requirements will be accepted. However, materials and equipment installed in hazardous locations must bear the UL label unless the data submitted from other testing agency is specifically approved in writing by the Contracting Officer. Materials and equipment shall be approved based on the manufacturer's published data. For other than equipment and materials specified to conform to UL publications, a manufacturer's statement indicating complete compliance with the applicable Federal Specification, or standard of the American Society for Testing and Materials, National Electrical Manufacturers Association, or other commercial standard, is acceptable.

## 1.4 WORKMANSHIP

Materials and equipment shall be installed in accordance with recommendations of the manufacturer and as shown.

# PART 2 PRODUCTS

## 2.1 MATERIALS AND EQUIPMENT

Materials and equipment shall conform to the respective publications and other requirements specified below. Materials and equipment not listed below shall be as specified elsewhere in this section.

### 2.1.1 Motors, AC, Fractional and Integral

Motors, ac, fractional and integral kilowatt (horsepower) 373.0 kW (500 Hp) and smaller shall conform to NEMA MG 1 and UL 1004 for motors.

#### 2.1.1.1 Rating

The kilowatt (horsepower) rating of motors should be limited to no more than 125 percent of the maximum load being served unless a NEMA standard size does not fall within this range. In this case, the next larger NEMA standard motor size should be used.

2.1.1.2 Motor Efficiencies

Permanently wired polyphase motors of 1 hp or more shall meet the minimum full-load efficiencies as indicated in the following table, and as specified in this specification. Motors of 1 hp or more with open, dripproof or totally enclosed fan cooled enclosures shall be high efficiency type, unless otherwise indicated. Motors provided as an integral part of motor driven equipment are excluded from this requirement if a minimum seasonal or overall efficiency requirement is indicated for that equipment by the provisions of another section.

Minimum Motor Efficiencies

| HP | Std. Efficiency | High Efficiency |
|---|---|---|
| 1 | 77.0 | 85.5 |
| 1.5 | 78.5 | 85.5 |
| 2 | 78.5 | 85.5 |

## PART 3 EXECUTION

### 3.1 MOTORS

Motors shall be as specified in Paragraph MATERIALS AND EQUIPMENT for motors, ac, fractional and integral horsepower 500 Hp and smaller), whether or not motors are separately provided or included in equipment assemblies specified in other sections of these specifications. Each motor shall conform to the HP and voltage ratings indicated, and shall have a service-factor and other characteristics that are essential to the proper application and performance of the motors under conditions shown or specified. Unless otherwise specified, all motors shall have open frames, and continuous-duty classification based on a 40-degree C ambient temperature reference. Polyphase motors shall be squirrel-cage type, having normal-starting-torque and low starting-current characteristics, unless other characteristics are specified in other sections of these specifications or shown on contract drawings. The Contractor shall be responsible for selecting the actual horsepower ratings and other motor requirements necessary for the applications indicated. When electrically driven equipment furnished under other sections of these specifications materially differs from the design, the Contractor shall make the necessary adjustments to the wiring, disconnect devices and branch-circuit protection to accommodate the equipment actually installed.

### 3.2 MOTOR CONTROL

Each motor or group of motors requiring a single control and not controlled from a motor-control center shall be provided under other sections of these specifications with a suitable controller and devices that will perform the functions as specified for the respective motors. Each motor of 1/8 hp or larger shall be provided with thermal-overload protection. Polyphase motors shall

have overload protection in each ungrounded conductor. The overload-protection device shall be provided either integral with the motor or controller, or shall be mounted in a separate enclosure. Unless otherwise specified, the protective device shall be of the manually reset type. Single- or double-pole tumbler switches specifically designed for alternating-current operation only may be used as manual controllers for single-phase motors having a current rating not in excess of 80 percent of the switch rating. Automatic control devices such as thermostats, float or pressure switches may control the starting and stopping of motors directly, provided the devices used are designed for that purpose and have an adequate horsepower rating. When the automatic-control device does not have such a rating, a magnetic starter shall be used, with the automatic-control device actuating the pilot-control circuit. When combination manual- and automatic-control is specified and the automatic-control device operates the motor directly, a double-throw, three-position tumbler or rotary switch shall be provided for the manual control; when the automatic-control device actuates the pilot control circuit of a magnetic starter, the latter shall be provided with a three-position selector switch marked MANUAL-OFF-AUTOMATIC. Connections to the selector switch shall be such that only the normal automatic regulatory control devices will be bypassed when the switch is in the Manual position; all safety control devices, such as low- or high-pressure cutouts, high-temperature cutouts, and motor-overload protective devices, shall be connected in the motor-control circuit in both the Manual and the Automatic positions of the selector switch. Control circuit connections to any MANUAL-OFF-AUTOMATIC switch or to more than one automatic regulatory control device shall be made in accordance with wiring diagram approved by the Contracting Officer unless such diagram is included on the drawings. All controls shall be 120 volts or less unless otherwise indicated.

### 3.2.3 Contacts

Contacts in miscellaneous control devices such as float switches, pressure switches, and auxiliary relays shall have current and voltage ratings in accordance with NEMA ICS 2 for rating designation B300.

## 3.3 MOTOR-DISCONNECT MEANS

Each motor shall be provided with a disconnecting means when required by NFPA 70 even though not indicated. For single-phase motors, a single-or double-pole toggle switch, rated only for alternating current, will be acceptable for capacities less than 30 amperes, provided the ampere rating of the switch is at least 125 percent of the motor rating. Switches shall disconnect all ungrounded conductors.

## 3.4 EQUIPMENT CONNECTIONS

All wiring not furnished and installed under other sections of the specifications for the connection of electrical equipment as indicated on the drawings shall be furnished and installed under this section of the specifications. Flexible conduits 1.8 meters (6 feet) or less in length shall be provided to all electrical

equipment subject to periodic removal, vibration, or movement and for all motors. All motors shall be provided with separate grounding conductors. Liquid-tight conduits shall be used in damp or wet locations.

### 3.4.1 Motors and Motor Control

Control equipment furnished under this section of the specifications, and shown on the drawings, shall be connected under this section of the specifications unless shown or specified otherwise. Except as otherwise specifically noted, automatic-control wiring, signaling, and protective devices are not included in this section of the specifications, but shall be furnished and installed under other sections of the specifications. Control wiring not shown on the drawings shall be furnished under the other sections of the specifications.

## 3.5 PAINTING AND FINISHING

Field-applied paint on exposed surfaces shall be provided under Section 09900 PAINTING, GENERAL.

## 3.6 REPAIR OF EXISTING WORK

The work shall be carefully laid out in advance, and where cutting, channeling, chasing, or drilling of floors, walls, partitions, ceiling, or other surfaces is necessary for the proper installation, support, or anchorage of the conduit, raceways, or other electrical work, this work shall be carefully done, and any damage to building, piping, or equipment shall be repaired by skilled mechanics of the trades involved, at no additional cost to the Government.

## 3.7 TESTS

After the interior-wiring-system installation is completed, and at such time as the Contracting Officer may direct, the Contractor shall conduct an operating test for approval. The equipment shall be demonstrated to operate in accordance with the requirements of this specification. Continuity test shall be conducted on the telephone wiring system. The test shall be performed in the presence of the Contracting Officer. The Contractor shall furnish all instruments and personnel required for the tests, and the Government will furnish the necessary electric power. No part of the electrical distribution system shall be energized prior to the resistance testing of that systems ground rods and submission of test results to the Contracting Officer. Test reports shall indicate the location of the rod and the resistance and the soil conditions at the time the test was performed.

-- END OF SECTION 16415A --

DIVISION 16

ELECTRICAL

SECTION 16415B

# ELECTRICAL WORK, INTERIOR - LAMPS AND LIGHTING

## PART 1 GENERAL

### 1.1 REFERENCES

The publications listed below are referenced and the most current publication applies. The publications are referenced to in the text by basic designation only.

| | |
|---|---|
| 1.1.1 | AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI) |
| ANSI C82.1 | C82.1a; C82.1b; C82.1c; R 1992 Ballast's for Fluorescent Lamps Specifications |
| ANSI C82.4 | Ballast's for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type) |
| 1.1.2 | CODE OF FEDERAL REGULATIONS (CFR) |
| 47 CFR 18 | Rules and Regulations: Industrial, Scientific, and Medical Equipment |
| 1.1.3 | INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE) |
| IEEE C62.41 | Surge Voltages in Low-Voltage AC Power Circuits |
| 1.1.4 | NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA) |
| NEMA LE 4 | Recessed Luminaires, Ceiling Compatibility |
| 1.1.5 | NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) |
| NFPA 70 | National Electrical Code |
| NFPA 101 | Safety to Life from Fire in Buildings and Structures |
| 1.1.6 | UNDERWRITERS LABORATORIES (UL) |
| UL-03 | Electrical Construction Materials Directory |
| UL 542 | Lampholders, Starters, and Starter Holders for Fluorescent Lamps |
| UL 924 | Emergency Lighting and Power Equipment |

| | |
|---|---|
| UL 935 | Fluorescent-Lamp Ballast's |
| UL 1029 | High-Intensity-Discharge Lamp Ballast's |
| UL 1570 | Fluorescent Lighting Fixtures |
| UL 1572 | High Intensity Discharge Lighting Fixtures |

## 1.2 GENERAL

### 1.2.1 Rules

The installation shall conform to the requirements of NFPA 70 and NFPA 101, unless more stringent requirements are indicated herein or shown.

### 1.2.2 Coordination

The drawings indicate the extent and the general location and arrangement of equipment, conduit, and wiring. The Contractor shall become familiar with all details of the work and verify all dimensions in the field. Lighting fixtures, outlets, and other equipment and materials shall be located to avoid interference with mechanical or structural features; otherwise, lighting fixtures shall be symmetrically located according to the room arrangement when uniform illumination is required, or asymmetrically located to suit conditions fixed by design and shown. Lighting fixtures shall not be supported from sheet metal roof decks. If any conflicts occur necessitating departures from the drawings, details of and reasons for departures shall be submitted and approved prior to implementing any change.

### 1.2.3 Special Environments

#### 1.2.3.1 Weatherproof Locations

Wiring, fixtures, and equipment in designated locations shall conform to NFPA 70 requirements for installation in damp or wet locations.

### 1.2.4 Standard Products

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

1.2.5 As Built Drawings

The contractor shall furnish as required documentation within the performance period time frame. Following the project final inspection, or immediately following, before submission of final invoice, contractor shall furnish 2 sets of as built drawings to the Contacting Officer.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation, submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

1.3.1 Reports "FIO"

Materials and Equipment.

The label or listing of the Underwriters Laboratories, Inc., shall be accepted as evidence that the materials or equipment conform to the applicable standards of that agency. In lieu of this label or listing, a statement from a nationally recognized, adequately equipped testing agency indicating that the items have been tested in accordance with required procedures and that the materials and equipment comply with all contract requirements will be accepted.

## 1.4 WORKMANSHIP

Materials and equipment shall be installed in accordance with recommendations of the manufacturer and as shown.

# PART 2 PRODUCTS

## 2.1 GENERAL REQUIREMENTS

Fixtures, accessories and components, including ballast's, lampholders, lamps, starters and starter holders, shall conform to industry standards specified below.

2.1.1 Fixture, Auxiliary or Emergency

UL 924.

2.1.2 Fluorescent

a. Fixture: NEMA LE 4 for ceiling compatibility of surface fixtures and UL 1570. Fixtures shall be plainly marked for proper lamp and ballast type to identify lamp diameter, wattage, color and start type. Markings shall be readily visible to service personnel, but not visible from normal viewing angles.

b. Ballast's:

(1) Electronic Ballast. Electronic ballast's shall consist of a rectifier, high frequency inverter, and power control and regulation circuitry. The ballast's shall be UL listed, Class P, with a Class A sound rating and shall contain no PCBs. Ballast's shall meet 47 CFR 18 for electromagnetic interference and shall not interfere with the operation of other electrical equipment. Design shall withstand line transients per IEEE C62.41, Category A. Unless otherwise indicated, the minimum number of ballast's shall be used to serve each individual fixture, using one, two, three or four lamp ballast's. A single ballast may be used to serve multiple fixtures if they are continuous mounted, factory manufactured for that installation with an integral wireway and are identically controlled.

(a) Light output regulation shall be plus or minus 10 percent.

(b) Voltage input regulation shall be plus or minus 10 percent.

(c) Lamp current crest factor shall be no more than 1.7.

(d) Ballast factor shall be not less than 85 percent nor more than 100 percent, unless otherwise indicated.

(e) A 60 Hz filter shall be provided. Flicker shall be no more than 15 percent with any lamp suitable for the ballast.

(f) Ballast case temperature shall not exceed 25 degree Celsius rise above 40 degree Celsius ambient, when tested in accordance with UL 935.

(g) Input current third harmonic shall not exceed 32 percent total harmonic distortion or 27.5 percent of the third triplens.

(h) Power factor shall not be less than 0.9.

(i) Ballast's shall operate at a frequency of 20 KHz or more.

(j) Operating filament voltage shall be 2.5 to 4.5 volts.

(k) Warranty. Three year full warranty including a $10 labor allowance.

(l) Ballast Efficacy Factor (BEF) shall be in accordance with the following Table. Ballast's and lamps shall be matching rapid start or instant start as indicated on the following Table. If 32W-F32-T8 lamps and ballast's are used, they must be either all rapid start or all instant start.

ELECTRONIC FLUORESCENT BALLAST EFFICACY FACTORS*

| LAMP TYPE | TYPE OF STARTER & LAMP | NOMINAL OPERATIONAL INPUT VOLTAGE | NUMBER OF LAMPS | MIN. BALLAST EFFICACY FACTOR |
|---|---|---|---|---|
| 32W F32 T8 | rapid or instant start | 120 | 1 | 2.4 |
| | | | 2 | 1.4 |
| | | | 3 | 1.0 |
| | | | 4 | 0.8 |

*For ballast's not specifically designed for use with dimming controls

The BEF is calculated using the formula:
BEF = Ballast Factor (in percent) / Power Input
where Power Input = Total Wattage of Combined Lamps and Ballast's

c. Lampholders, Starters, and Starter Holders: UL 542.

2.1.3 High-Intensity-Discharge

a. Fixture: NEMA LE 4 for ceiling compatibility of recessed fixtures and UL 1572.

b. Ballast's: ANSI C82.4 for multiple supply types and UL 1029.

## PART 3 EXECUTION

### 3.1 WIRING METHODS

Unless otherwise indicated, wiring shall consist of insulated conductors installed in rigid aluminum or rigid zinc-coated steel

conduit, rigid plastic conduit, electrical metallic and/or nonmetallic tubing, or intermediate metal conduit. Nonmetallic-sheathed cables or metallic-armored cables may be installed in areas permitted by NFPA 70.

### 3.1.1 Sizes

Sizes shall be not less than indicated. Branch-circuit conductors shall be not smaller than No. 12 AWG. Conductors for branch circuits of 120 volts more than 30 meters (100 feet) long and of 277 volts more than 70 meters (230 feet) long, from panel to load center, shall be no smaller than No. 10 AWG.

## 3.2 LAMPS AND LIGHTING FIXTURES

Ballasted fixtures shall have ballast's which are compatible with the specific type and rating of lamps indicated and shall comply with the applicable provisions of the publications referenced.

### 3.2.1 Lamps

Lamps of the type, wattage, and voltage rating indicated shall be delivered to the project in the original cartons and installed in the fixtures just prior to the completion of the project.

#### 3.2.1.1 Fluorescent

Fluorescent lamps for magnetic ballast's shall have standard cool-white color characteristics and shall be of a type that will not require starter switches. Lamps shall be of the rapid-start type unless otherwise shown or approved. Fluorescent lamps for electronic ballast's shall be as indicated.

#### 3.2.1.2 High-Intensity-Discharge

High-intensity-discharge lamps shall be the metal halide type unless otherwise indicated, shown, or approved.

### 3.2.2 Fixtures

Fixtures shall be as shown on the lighting fixture schedule. Fixtures of similar designs and equivalent energy efficiency, light-distribution and brightness characteristics, and of equal finish and quality will be acceptable if approved. In suspended acoustical ceilings with fluorescent fixtures, the fluorescent emergency light fixtures shall be furnished with self-contained battery packs.

3.2.2.1 Accessories

Accessories such as straps, mounting plates, nipples, or brackets shall be provided for proper installation. Open type fluorescent fixtures with exposed lamps shall have a wire-basket type guard.

3.2.2.2 Suspended Fixtures

Suspended fixtures shall be provided with swivel hangers in order to ensure a plumb installation. Pendants, rods or chains 1.2 meters (4 feet) or longer, excluding fixture, shall be braced to limit swinging. Bracing shall be 3 directional, 120 degrees apart. Single-unit suspended fluorescent fixtures shall have twin-stem hangers. Multiple-unit or continuous-row fluorescent units shall have a tubing or stem for wiring at one point, and a tubing or rod suspension provided for each length of chassis including one at each end. Maximum distance between adjacent tubing or stems shall be 3 meters. (10 feet.) Rods shall be of not 3/16 inch diameter. Flexible raceway shall be installed to each fixture from an overhead junction box. Fixture to fixture wiring installation is allowed only when fixtures are installed end to end in a continuous run.

3.2.2.3 Ceiling Fixtures

Ceiling fixtures shall be coordinated with and suitable for installation in, on, or from the suspended ceiling provided under other sections of these specifications. Installation and support of fixtures shall be in accordance with the NFPA 70 and manufacturer's recommendations. Where seismic requirements are specified herein, fixtures shall be supported as shown or specified. Recessed fixtures shall have adjustable fittings to permit alignment with ceiling panels. Recessed fixtures installed in fire-resistive type of suspended ceiling construction shall have the same fire rating as the ceiling or shall be provided with fireproofing boxes having materials of the same fire rating as the ceiling panels, in conformance with UL-03. Surface-mounted fixtures shall be suitable for fastening to the structural support for ceiling panels.

3.2.2.4 Sockets

Sockets of industrial, strip, and other open type fluorescent fixtures shall be of the type requiring a forced movement along the longitudinal axis of the lamp for insertion and removal of the lamp.

### 3.2.3 Emergency Light Sets

Emergency light sets shall conform to UL 924 with the number of heads as indicated. Sets shall be permanently connected to the wiring system by conductors installed in short lengths of flexible conduit.

## 3.3 REPAIR OF EXISTING WORK

The work shall be laid out in advance, and where cutting, channeling, chasing, or drilling of floors, walls, partitions, ceiling, or other surfaces is necessary for the proper installation, support, or anchorage of the conduit, raceways, or other electrical work, damage to building, piping, or equipment shall be repaired by mechanics of the trades involved, at no additional cost to the Government.

## 3.4 TESTS

After the interior-wiring-system installation is completed, and at such time as the Contracting Officer may direct, the Contractor shall conduct an operating test for approval. The equipment shall be demonstrated to operate in accordance with the requirements of this specification.

-- END OF SECTION 16415B --

DIVISION 16

ELECTRICAL

SECTION 16415C

# ELECTRICAL WORK, INTERIOR - WIRING

## PART 1 GENERAL

### 1.1 REFERENCES

The publications listed below are referenced and the most current publication applies. The publications are referenced to in the text by basic designation only.

#### 1.1.2. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|---|---|
| STM D 709 | Laminated Thermosetting Materials |

#### 1.1.3. NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

| | |
|---|---|
| NEMA 250 | Enclosures for Electrical Equipment (1000 Volts Maximum) |
| NEMA AB 1 | Molded Case Circuit Breakers and Molded Case Switches |
| NEMA FU 1 | Low Voltage Cartridge Fuses |
| NEMA ICS 6 | Enclosures for Industrial Control and Systems |
| NEMA OS 1 | Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports |
| NEMA PB 1 | Panelboards |
| NEMA WD 1 | General Requirements for Wiring Devices |
| NEMA WD 6 | Wiring Devices - Dimensional Requirements |

#### 1.1.4. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

| | |
|---|---|
| NFPA 70 | National Electrical Code |
| NFPA 101 | Safety to Life from Fire in Buildings and Structures |

#### 1.1.5. UNDERWRITERS LABORATORIES (UL)

| | |
|---|---|
| UL 1 | Rev thru Jan 1995 Flexible Metal Conduit |
| UL 5 | Surface Metal Raceways and Fittings |
| UL 6 | Rigid Metal Conduit |

| | |
|---|---|
| UL 20 | General-Use Snap Switches |
| UL 44 | Rubber-Insulated Wires and Cables |
| UL 50 | Enclosures for Electrical Equipment |
| UL 67 | Panelboards |
| UL 83 | Thermoplastic-Insulated Wires and Cables |
| UL 98 | Enclosed and Dead-Front Switches |
| UL 198G | Fuses for Supplementary Overcurrent Protection |
| UL 360 | Liquid-Tight Flexible Steel Conduit |
| UL 486A | Wire Connectors and Soldering Lugs for Use with Copper Conductors |
| UL 486C | Splicing Wire Connectors |
| UL 489 | Molded-Case Circuit Breakers and Circuit-Breaker Enclosures |
| UL 510 | Insulating Tape |
| UL 512 | Fuseholders |
| UL 514A | Metallic Outlet Boxes |
| UL 514B | Fittings for Conduit and Outlet Boxes |
| UL 797 | Electrical Metallic Tubing |
| UL 857 | Busways and Associated Fittings |
| UL 869A | Reference Standard for Service Equipment |
| UL 891 | Dead-Front Switchboards |
| UL 943 | Ground-Fault Circuit Interrupters |
| UL 1660 | Liquid-Tight Flexible Nonmetallic Conduit |

## 1.2 GENERAL

### 1.2.1 Rules

The installation shall conform to the requirements of NFPA 70 and NFPA 101, unless more stringent requirements are indicated herein or shown.

### 1.2.2 Coordination

The drawings indicate the extent and the general location and arrangement of equipment, conduit, and wiring. The Contractor shall become familiar with all details of the

work and verify all dimensions in the field so that the outlets and equipment shall be properly located and readily accessible. Lighting fixtures, outlets, and other equipment and materials shall be located to avoid interference with mechanical or structural features; otherwise, lighting fixtures shall be symmetrically located according to the room arrangement when uniform illumination is required, or asymmetrically located to suit conditions fixed by design and shown. Raceways, junction and outlet boxes, and lighting fixtures shall not be supported from sheet metal roof decks. If any conflicts occur necessitating departures from the drawings, details of and reasons for departures shall be submitted and approved prior to implementing any change. The Electrical Contractor shall coordinate the electrical work with HVAC and electrical drawings and provide all power related wiring even if they are not shown on electrical drawings.

### 1.2.3 Special Environments

#### 1.2.3.1 Weatherproof Locations

Wiring, fixtures, and equipment in designated locations shall conform to NFPA 70 requirements for installation in damp or wet locations.

### 1.2.4 Standard Products

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

### 1.2.5 Identification Nameplates

Major items of electrical equipment and major components shall be permanently marked with an identification name to identify the equipment by type or function and specific unit number as indicated. Unless otherwise specified, all identification nameplates shall be made of laminated plastic in accordance with ASTM D 709, with black outer layers and a white core. Edges shall be chamfered. Plates shall be fastened with black-finished round-head drive screws, except motors, or approved nonadhesive metal fasteners. When the nameplate is to be installed on an irregular-shaped object, the Contractor shall devise an approved support suitable for the application and ensure the proper installation of the supports and nameplates. In all instances, the nameplate shall be installed in a conspicuous location. At the option of the Contractor, the equipment manufacturer's standard embossed nameplate material with black paint-filled letters may be furnished in lieu of laminated plastic. The front of each panelboard and starter, shall have a nameplate to indicate the phase letter, corresponding color and arrangement of the phase conductors. The following

equipment, as a minimum, shall be provided with identification nameplates:

| Minimum 1/4 Inch High Letters | Minimum 1/8 Inch High Letters |
|---|---|
| Panelboards | Control Power Transformers |
| Starters | Control Devices |
| Safety Switches | |
| Equipment Enclosures | |

1.2.6 As Built Drawings

Following the project completion or turnover, within 30 days the Contractor shall furnish 2 sets of as built drawings to the Contracting Officer.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation, submittal having an "FIO" designation are information only. The following shall be submitted in accordance with Section 01300 SUBMITTAL PROCEDURES:

1.3.1 Reports

Materials and Equipment

The label or listing of the Underwriters Laboratories, Inc., shall be accepted as evidence that the materials or equipment conform to the applicable standards of that agency. In lieu of this label or listing, a statement from a nationally recognized, adequately equipped testing agency indicating that the items have been tested in accordance with required procedures and that the materials and equipment comply with all contract requirements will be accepted. However, materials and equipment installed in hazardous locations must bear the UL label unless the data submitted from other testing agency is specifically approved in writing by the Contracting Officer. Materials and equipment shall be approved based on the manufacturer's published data.

For other than equipment and materials specified to conform to UL publications, a manufacturer's statement indicating complete compliance with the applicable Federal Specification, or standard of the American Society for Testing and Materials, National Electrical Manufacturers Association, or other commercial standard, is acceptable.

## 1.4 WORKMANSHIP

Materials and equipment shall be installed in accordance with recommendations of the manufacturer and as shown.

# PART 2 PRODUCTS

## 2.1 MATERIALS AND EQUIPMENT

Materials and equipment shall conform to the respective publications and other requirements specified below. Materials and equipment not listed below shall be as specified elsewhere in this section.

### 2.1.1 Busways

UL 857. Busses shall be copper. Enclosures shall be steel. Short-circuit ratings, except as indicated, shall be in accordance with NEMA BU 1.

### 2.1.2 Cables and Wires

Conductors in cables shall be annealed copper. Intermixing of copper and aluminum conductors in these sizes is not permitted. Design is based on copper conductors and aluminum conductors shall have an ampacity not less than that of the indicated copper conductors. Cables shall be single-conductor type, unless otherwise indicated. Cables and wires shall conform to UL 44 for rubber-insulated type; UL 83 for the thermoplastic-insulated type. The following types shall be provided.

#### 2.1.2.1 Service Entrance Cable

Type SE.

#### 2.1.2.2 Grounding Cables

Grounding cables shall be bare or shall have green low-voltage insulation.

### 2.1.3 Cabinets for Communications

UL 50. Cabinets shall have boxes constructed of zinc-coated sheet steel. Cabinets shall be constructed with interior dimensions not less than those indicated. Trim shall be fitted with hinged door and flush catch. Doors shall provide maximum-size openings to the box interiors. Boxes shall be provided with a 15 mm (5/8 inch) plywood back board having a two-coat insulating varnish finish.

### 2.1.4 Circuit Breakers

Circuit breakers shall have voltage, current and interrupting ratings as indicated.

#### 2.1.4.1 Molded-Case and Insulated-Case Circuit Breakers

NEMA AB 1 and UL 489 for circuit breakers.

a. Molded-Case Circuit Breakers: Single-pole breakers shall be full module size; two poles shall not be installed in a single module. Multipole breakers shall

be of the common-trip type having a single operating handle, but for sizes of 100 amperes or less may consist of single-pole breakers permanently factory assembled into a multipole unit having an internal, mechanical, nontamperable common-trip mechanism and external handle ties.

2.1.5 Conduit and Tubing

2.1.5.1 Electrical, Zinc-Coated Steel Metallic Tubing (EMT) UL 797.

2.1.5.2 Flexible Conduit, Steel and Plastic
General-purpose type, UL 1; liquid tight, UL 360, and UL 1660

2.1.5.3 Rigid Metal Conduit UL 6.

2.1.5.4 Surface Metal Electrical Raceways and Fittings

UL 5.

2.1.6 Conduit and Device Boxes and Fittings

2.1.6.1 Boxes, Metallic Outlet

NEMA OS 1 and UL 514A.

2.1.6.2 Boxes, Switch (Enclosed), Surface-Mounted

UL 98.

2.1.6.3 Fittings for Conduit and Outlet Boxes

UL 514B.

2.1.7 Connectors, Wire Pressure

2.1.7.1 Copper Conductors

UL 486A.

2.1.8 Enclosures

NEMA ICS 6 or NEMA 250, unless otherwise specified.

2.1.8.1 Cabinets and Boxes, Volume Greater Than 0.00164 Cubic Meters (100 Cubic Inches)

UL 50, hot-dip, zinc-coated, if sheet steel.

2.1.9 Circuit Breaker

UL 489.

2.1.10 Fuses and Fuseholders

2.1.10.1 Fuses, Low Voltage Cartridge Type

NEMA FU 1.

2.1.10.2 Fuses for Supplementary Overcurrent Protection

UL 198G.

2.1.10.3 Fuseholders

UL 512.

2.1.11 Panelboards

Dead-front construction, NEMA PB 1 and UL 67.

2.1.12 Receptacles

2.1.12.1 General Grade

NEMA WD 1.

2.1.12.2 Ground Fault Interrupters

UL 943, Class A or B.

2.1.13 Service Equipment

UL 869A.

2.1.14 Splice, Conductor

UL 486C.

2.1.15 Snap Switches

UL 20.

2.1.16 Tapes

2.1.16.1 Plastic Tape

UL 510.

2.1.16.2 Rubber Tape

UL 510.

2.1.17 Wiring Devices

NEMA WD 1 for general-purpose wiring devices, and NEMA WD 6 for dimensional requirements of wiring devices.

## PART 3 EXECUTION

### 3.1 WIRING METHODS

Unless otherwise indicated, wiring shall consist of insulated conductors installed in rigid zinc-coated steel conduit, electrical metallic tubing.

3.1.1 Conduit and Tubing Systems

Conduit and tubing systems shall be installed as indicated. Conduit sizes shown are based on use of copper conductors with insulation types as described in paragraph WIRING METHODS. Minimum size of raceways shall be 1/2 inch. Only metal conduits will be permitted when conduits are required for shielding or other special purposes indicated, or when required by conformance to NFPA 70. Electrical metallic tubing may be installed only within buildings. Electrical metallic tubing may be installed in concrete and grout in dry locations. Electrical metallic tubing installed in concrete or grout shall be provided with concrete tight fittings. EMT shall not be installed in damp or wet locations, or the air space of exterior masonry cavity walls. Bushings, manufactured fittings or boxes providing equivalent means of protection shall be installed on the ends of all conduits and shall be of the insulating type, where required by NFPA 70. Only UL listed adapters shall be used to connect EMT to rigid metal conduit, cast boxes, and conduit bodies. Penetrations of above grade floor slabs, time-rated partitions and fire walls shall be firestopped in accordance with Section 07270 FIRESTOPPING. Raceways shall not be installed under the firepits of boilers and furnaces and shall be kept 150 mm (6 inches) away from parallel runs of flues, steam pipes and hot-water pipes. Raceways shall be concealed within finished walls, ceilings, and floors unless otherwise shown. Raceways crossing structural expansion joints shall be provided with suitable expansion fittings or other suitable means to compensate for the building expansion and contraction and to provide for continuity of grounding.

3.1.1.3 Exposed Raceways

Exposed raceways shall be installed parallel or perpendicular to walls, structural members, or intersections of vertical planes and ceilings. Raceways under raised floors and above accessible ceilings shall be considered as exposed installations in accordance with NFPA 70 definitions.

3.1.1.4 Changes in Direction of Runs

Changes in direction of runs shall be made with symmetrical bends or cast metal fittings. Field made bends and offsets shall be made with an approved hickey or conduit bending machine. Crushed or deformed raceways shall not be installed. Trapped raceways in damp and wet locations shall be avoided where possible. Care shall be taken to prevent the lodgment of plaster, dirt, or trash in raceways, boxes, fittings and equipment during the course of construction.

Clogged raceways shall be entirely freed of obstructions or shall be replaced.

3.1.1.5 Supports

Metallic conduits and tubing shall be securely and rigidly fastened in place at intervals of not more than 3 meters (10 feet) and within 900 mm (3 feet) of boxes, cabinets, and fittings, with approved pipe straps, wall brackets, conduit clamps, conduit hangers, threaded C-clamps, or ceiling trapeze. C-clamps or beam clamps shall have strap or rod-type retainers. Rigid plastic conduits (if permitted as a wiring method) shall be supported as indicated above, except that they will be supported at intervals as indicated in NFPA 70. Loads and supports shall be coordinated with supporting structure to prevent damage or deformation to the structures, but no load shall be applied to joist bridging. Fastenings shall be by wood screws or screw-type nails to wood; by toggle bolts on hollow masonry units; by expansion bolts on concrete or brick; by machine screws, welded threaded studs, heat treated or spring steel-tension clamps on steel work. Nail-type nylon anchors or threaded studs driven in by a powder charge and provided with lock washers and nuts may be used in lieu of expansion bolts or machine screws. Raceways or pipe straps shall not be welded to steel structures. Holes cut to a depth of more than 40 mm (1-1/2 inches) in reinforced concrete beams or to a depth of more than 20 mm (3/4 inch) in concrete joists shall avoid cutting the main reinforcing bars. Holes not used shall be filled. In partitions of light steel construction, sheet-metal screws may be used. Conduit shall not be supported using wire or nylon ties. Raceways shall be installed as a complete system and be independently supported from the structure. Upper raceways shall not be the support of lower raceways. Supporting means will not be shared between electrical raceways and mechanical piping or ducts and shall not be fastened to hung ceiling supports. Conduits shall be fastened to all sheet-metal boxes and cabinets with two locknuts where required by the NFPA 70, where insulating bushings are used, and where bushings cannot be brought into firm contact with the box; otherwise, a single locknut and bushing may be used. Threadless fittings for electrical metallic tubing shall be of a type approved for the conditions encountered. A pull wire shall be inserted in each empty raceway in which wiring is to be installed by others if the raceway is more than 15 meters (50 feet) in length and contains more than the equivalent of two 90-degree bends, or where the raceway is more than 45 meters (150 feet) in length. The pull wire shall be of No. 14 AWG zinc-coated steel, or of plastic having not less than 200 pound per square inch tensile strength. Not less than 10 inches of slack shall be left at each end of the pull wire. Additional support for horizontal runs is not required when EMT rests on steel stud cutouts.

3.1.1.6 Communications Raceways

Communications raceways indicated shall be installed in accordance with the previous requirements for conduit and tubing and with the additional requirements that no length of run shall exceed 15 meters (50 feet) for 15 mm (1/2 inch) and 20 mm (3/4 inch) sizes, and 30 meters (100 feet) for 25 mm (1 inch) or larger sizes, and shall not contain more than two 90-degree bends or the equivalent. Additional pull or junction boxes shall be installed to comply with these limitations whether or not indicated. Inside radii of bends in conduits of 1 inch size or larger shall be not less than ten times the nominal diameter.

3.1.6.1 Sizes

All sizes are based on copper conductors, unless otherwise indicated. Sizes shall be not less than indicated. Branch-circuit conductors shall be not smaller than No. 12 AWG. Conductors for branch circuits of 120 volts more than 30 meters (100 feet) long, from panel to load center, shall be no smaller than No. 10 AWG. Class 1 remote control and signal circuit conductors shall be not less than No. 14 AWG. Class 2 remote control and signal circuit conductors shall be not less than No. 16 AWG. The conductor sizes are based on the use of THHN insulation for conductors smaller than No. 1/0 AWG and THHN insulation for conductors No. 1/0 and larger, except where otherwise indicated. Higher temperature rated conductors will be permitted, if the UL tested temperature ratings for which the equipment in the circuit is marked are not exceeded. Conductor sizes for nonlinear loads shall be based on the use of minimum 75 degrees C insulated conductors for branch circuits and feeders.

3.1.6.2 Power Conductor Identification

All phase conductors shall be identified by color-coding. The color of the insulation on phases A, B, and C respectively (for three phase) or phases A and B respectively (for single phase) of different voltage systems shall be as follows:

120/208 volt, 3-phase: Black, red, and blue.

120/240 volt, single/phase: Black and red.

Conductor phase and voltage identification shall be made by color-coded insulation for all conductors smaller than No. 6 AWG. For conductors No. 6 AWG and larger, identification shall be made by color-coded insulation, or conductors with black insulation may be furnished and identified by the use of half-lapped bands of colored electrical tape wrapped around the insulation for a minimum of 75 mm (3 inches) of length near the end, or other method as submitted by the Contractor and approved by the Contracting Officer. Conductor identification shall be provided within each enclosure where a tap, splice, or termination is made. Phase identification by a particular color shall be

maintained continuously for the length of a circuit, including junctions.

3.1.6.3 Control Conductor Identification

Control circuit conductor identification shall be made by color-coded insulated conductors, plastic-coated self-sticking printed markers, permanently attached stamped metal foil markers, or equivalent means as approved. Control circuit terminals of equipment shall be properly identified. Terminal and conductor identification shall match that shown on approved detail drawings. Hand lettering or marking is not acceptable.

## 3.2 BOXES AND SUPPORTS

Boxes shall be provided in the wiring or raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures. Boxes for metallic raceways, 4 by 4 inch nominal size and smaller, shall be of the cast-metal hub type when located in normally wet locations, when flush and surface mounted on outside of exterior surfaces, or when located in hazardous areas. Large size boxes shall be as shown. Boxes in other locations shall be sheet steel. In partitions of light steel construction bar hangers with 25 mm (1 inch) long studs, mounted between metal wall studs or metal stud "C" brackets snapped on and tab-locked to metal wall studs, shall be used to secure boxes to the building structure. When "C" brackets are used, additional box support shall be provided on the side of the box opposite the brackets. The edges of boxes for electrical devices shall be flush with the finished surfaces in gypsum and plasterboard installations. Boxes for mounting lighting fixtures shall be not less than 4 inches square except smaller boxes may be installed as required by fixture configuration, as approved. Boxes installed for concealed wiring shall be provided with suitable extension rings or plaster covers, as required. The bottom of boxes installed in masonry-block walls for concealed wiring shall be flush with the top of a block to minimize cutting of blocks, and boxes shall be located horizontally to avoid cutting webs of block. Unless otherwise indicated, boxes for wall switches shall be mounted 1.2 meters (48 inches) above finished floors. Switch and outlet boxes on opposite sides of fire rated walls shall be separated by a minimum horizontal distance of 600 mm. (24 inches.) Cast-metal boxes installed in wet locations and boxes installed flush with the outside of exterior surfaces shall be gasketed. Separate boxes shall be provided for flush or recessed fixtures when required by the fixture terminal operating temperature, and fixtures shall be readily removable for access to the boxes unless ceiling access panels are provided. Boxes and supports shall be fastened to wood with wood screws or screw-type nails of equal holding strength, with bolts and metal expansion shields on concrete or brick, with toggle bolts on hollow masonry units, and with machine screws or welded studs on steel work. Threaded studs driven in by powder charge and provided with lockwashers and nuts, or nail-type nylon anchors may be used in lieu of expansion shields, or machine screws. In open overhead spaces, cast-metal boxes threaded to raceways need not be separately supported except

where used for fixture support; cast-metal boxes having threadless connectors and sheet metal boxes shall be supported directly from the building structure or by bar hangers. Hangers shall not be fastened to or supported from joist bridging. Cast-metal boxes with 3/32 inch wall thickness are acceptable. Where bar hangers are used, the bar shall be attached to raceways on opposite sides of the box and the raceway shall be supported with an approved type fastener not more than 600 mm (24 inches) from the box. Penetration of more than 1-1/2 inches into reinforced-concrete beams or more than 3/4 inch into reinforced-concrete joists shall avoid cutting any main reinforcing steel.

### 3.2.1 Boxes for Use with Raceway Systems

Boxes for use with raceway systems shall be not less than 1-1/2 inches deep except where shallower boxes required by structural conditions are approved. Sheetmetal boxes for other than lighting fixtures shall be not less than 4 inches square except that 4 by 2 inch boxes may be used where only one raceway enters the outlet. Contractor shall size the telephone outlet boxes as required by the number, size and type of outlets specified and as required by the outlets furnished by the Contractor.

### 3.2.2 Pull Boxes

Pull boxes of not less than the minimum size required by NFPA 70 shall be constructed of galvanized sheet steel, except where cast-metal boxes are required in locations specified above. Boxes shall be furnished with screw-fastened covers. Where several feeders pass through a common pull box, the feeders shall be tagged to indicate clearly the electrical characteristics, circuit number, and panel designation.

## 3.3 DEVICE PLATES

One-piece type device plates shall be provided for all outlets and fittings. Plates on unfinished walls and on fittings shall be of zinc-coated sheet steel, cast-metal, or impact resistant plastic having rounded or beveled edges. Plates on finished walls shall be of steel with baked enamel finish or impact-resistant plastic and shall be ivory. Screws shall be of metal with countersunk heads, in a color to match the finish of the plate. Plates shall be installed with all four edges in continuous contact with finished wall surfaces without the use of mats or similar devices. Plaster fillings will not be permitted. Plates shall be installed with an alignment tolerance of 1.6 mm (1/16 inch). The use of sectional-type device plates will not be permitted. Plates installed in wet locations shall be gasket and provided with a hinged, gasket cover, unless otherwise specified.

## 3.4 RECEPTACLES

### 3.4.1 Single and Duplex

Single and duplex receptacles shall be rated 20 amperes, 125 volts, two-pole, three-wire, grounding type with polarized parallel slots. Bodies shall be of ivory to match color of switch handles in the same room or to harmonize with the color of the respective wall, and supported by mounting strap having plaster ears. Contact arrangement shall be such that contact is made on two sides of an inserted blade. Receptacle shall be side- or back-wired with two screws per terminal. The third grounding pole shall be connected to the metal mounting yoke. Switched receptacles shall be the same as other receptacles specified except that the ungrounded pole of each suitable receptacle shall be provided with a separate terminal. Only the top receptacle of a duplex receptacle shall be wired for switching application. Receptacles with ground fault circuit interrupters shall have the current rating as indicated, and shall be UL Class A type unless otherwise shown. Ground fault circuit protection shall be provided as required by NFPA 70 and as indicated on the drawings.

### 3.4.2 Weatherproof Applications

Weatherproof receptacles shall be suitable for the environment, damp or wet applicable, and the housings shall be labeled to identify the allowable use. Receptacles shall be marked in accordance with UL 514A for the type of use indicated; "Damp Locations", "Wet Locations", "Wet Location Only when Cover Closed". Assemblies shall be installed in accordance with the manufacturers recommendations.

#### 3.4.2.1 Damp Locations

Receptacles in damp locations shall be mounted in an outlet box with a gasket, weatherproof, cast-metal cover plate (device plate, box cover) and a gasket cap (hood, receptacle cover) over each receptacle opening. The cap shall be either a screw-on type permanently attached to the cover by a short length of bead chain or shall be a flap type attached to the cover with a spring loaded hinge.

#### 3.4.2.2 Wet Locations

Receptacles in wet locations must be installed in an assembly rated for such use whether the plug is inserted or withdrawn, unless otherwise indicated. In a duplex installation, the receptacle cover shall be configured to shield the connections whether one or both receptacles are in use.

### 3.4.3 Receptacles, 15-Ampere, 250-Volt

Receptacles, 15-ampere, 250-volt, shall be duplex two-pole, three-wire, grounding type with bodies of ivory phenolic compound supported by mounting yoke having plaster ears. The third grounding pole shall be connected to the metal

yoke. Each receptacle shall be provided with a mating cord-grip plug.

## 3.5 WALL SWITCHES

Wall switches shall be of the totally enclosed tumbler type. The wall switch handle and switch plate color shall harmonize with the color of the respective wall. Wiring terminals shall be of the screw type or of the solderless pressure type having suitable conductor-release arrangement. Not more than two switches shall be installed in a single-gang position. Switches shall be rated 20-ampere 120 -volt for use on alternating current only.

## 3.6 SERVICE EQUIPMENT

Service-disconnecting means shall be of the fusible safety switch type as indicated with external handle for manual operation. When service disconnecting means is a part of an assembly, the assembly shall be listed as suitable for service entrance equipment. Enclosures shall be sheet metal with hinged cover for surface mounting unless otherwise indicated.

## 3.7 PANELBOARDS

Circuit breakers and switches used as a motor disconnecting means, and not in sight of the motor and the driven machinery location, shall be capable of being locked in the open position. Door locks shall be keyed alike. Nameplates shall be as approved. Directories shall be typed to indicate loads served by each circuit and mounted in a holder behind a clear protective covering. Busses shall be copper.

### 3.7.1 Panelboards

Panelboards shall be circuit breaker equipped as indicated on the drawings. Multipole fusible switches shall be of the hinged-door type; single pole fusible switches shall be of the tumbler switch and fuse type. Switches serving as a motor disconnect means shall be of the tumbler switch and fuse type. Switches serving as motor disconnect means shall be horsepower rated in conformance with UL 98.

## 3.8 FUSES

Equipment provided under this contract shall be provided with a complete set of properly rated fuses when the equipment manufacturer utilize fuses in the manufacture of the equipment, or if current-limiting fuses are required to be installed to limit the ampere-interrupting-capacity of circuit breakers or equipment to less than the maximum available fault current at the location of the equipment to be installed. Fuses shall have a voltage rating of not less than the phase-to-phase circuit voltage, and

shall have the time-current characteristics required for effective power system coordination.

## 3.9 EQUIPMENT CONNECTIONS

All wiring not furnished and installed under other sections of the specifications for the connection of electrical equipment as indicated on the drawings shall be furnished and installed under this section of the specifications. Connections shall comply with the applicable requirements of paragraph WIRING METHODS. Flexible conduits 1.8 meters (6 feet) or less in length shall be provided to all electrical equipment subject to periodic removal, vibration, or movement and for all motors. All motors shall be provided with separate grounding conductors. Liquid-tight conduits shall be used in damp or wet locations.

## 3.10 PAINTING AND FINISHING

Field-applied paint on exposed surfaces shall be provided under Section 09900 PAINTING, GENERAL.

## 3.11 TESTS

After the interior-wiring-system installation is completed, and at such time as the Contracting Officer may direct, the Contractor shall conduct an operating test for approval. The equipment shall be demonstrated to operate in accordance with the requirements of this specification. Continuity test shall be conducted on the telephone wiring system. The test shall be performed in the presence of the Contracting Officer. The Contractor shall furnish all instruments and personnel required for the tests, and the Government will furnish the necessary electric power. No part of the electrical distribution system shall be energized prior to the resistance testing of that systems ground rods and submission of test results to the Contracting Officer. Test reports shall indicate the location of the rod and the resistance and the soil conditions at the time the test was performed.

-- END OF SECTION 16415C --

DIVISION 16

ELECTRICAL

SECTION 16415D

# ELECTRICAL WORK, INTERIOR - GROUNDING

## PART 1 GENERAL

### 1.1 REFERENCES

The publications listed below are referenced and the most current publication applies. The publications are referred to in the text by basic designation only.

| | |
|---|---|
| 1.1.2. | AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI) |
| ANSI C135.30 | Zinc-Coated Ferrous Ground Rods for Overhead or Underground Line Construction |
| 1.1.3. | INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE) |
| IEEE Std 81 | Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System (Part 1) |
| 1.1.4. | NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) |
| NFPA 70 | National Electrical Code |
| NFPA 101 | Safety to Life from Fire in Buildings and Structures |
| 1.1.5. | UNDERWRITERS LABORATORIES (UL) |
| UL 467 | Grounding and Bonding Equipment |

### 1.2 GENERAL

#### 1.2.1 Rules

The installation shall conform to the requirements of NFPA 70 and NFPA 101, unless more stringent requirements are indicated herein or shown.

#### 1.2.2 Coordination

The drawings indicate the extent and the general location and arrangement of equipment, conduit, and wiring. The Contractor shall become familiar with all details of the work and verify all dimensions in the field so that the outlets and equipment shall be properly located and readily accessible. If any conflicts occur necessitating departures

from the drawings, details of and reasons for departures shall be submitted and approved prior to implementing any change.

1.2.3 Standard Products

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

1.2.4 As Built Drawings

Following the project completion or turnover, within 30 days the Contractor shall furnish 2 sets of as built drawings to the Contracting Officer.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation, submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

1.3.1 Reports "FIO"

Materials and Equipment

The label or listing of the Underwriters Laboratories, Inc., shall be accepted as evidence that the materials or equipment conform to the applicable standards of that agency. In lieu of this label or listing, a statement from a nationally recognized, adequately equipped testing agency indicating that the items have been tested in accordance with required procedures and that the materials and equipment comply with all contract requirements will be accepted. However, materials and equipment installed in hazardous locations must bear the UL label unless the data submitted from other testing agency is specifically approved in writing by the Contracting Officer.

## 1.4 WORKMANSHIP

Materials and equipment shall be installed in accordance with recommendations of the manufacturer and as shown.

# PART 2 PRODUCTS

## 2.1 GROUND RODS

Ground rods shall be of copper-clad steel conforming to UL 467 zinc-coated steel conforming to ANSI C135.30 not less than 3/4 inch in diameter by 10 feet in length of the sectional type driven full length into the earth.

## PART 3 EXECUTION

### 3.1 GROUNDING

Grounding shall be in conformance with NFPA 70, the contract drawings, and the following specifications.

#### 3.1.1 Ground Rods

The resistance to ground shall be measured using the fall-of-potential method described in IEEE Std 81. The maximum resistance of a driven ground shall not exceed 25 ohms under normally dry conditions. If this resistance cannot be obtained with a single rod, additional rods not less than 1.8 meters (6 feet) on centers, or if sectional type rods are used, additional sections may be coupled and driven with the first rod. In high-ground-resistance, UL listed chemically charged ground rods may be used. If the resultant resistance exceeds 25 ohms measured not less than 48 hours after rainfall, the Contracting Officer shall be notified immediately. Connections below grade shall be fusion welded. Connections above grade shall be fusion welded or shall use UL 467 approved connectors.

#### 3.1.2 Grounding Conductors

A green ground wire shall be furnished regardless of the type of conduit. All equipment grounding conductors, including metallic raceway systems used as such, shall be bonded or joined together in each wiring box or equipment enclosure. Metallic raceways and grounding conductors shall be checked to assure that they are wired or bonded into a common junction. Metallic boxes and enclosures, if used, shall also be bonded to these grounding conductors by an approved means per NFPA 70. When boxes for receptacles, switches, or other utilization devices are installed, any designated grounding terminal on these devices shall also be bonded to the equipment grounding conductor junction with a short jumper.

### 3.3 TESTS

No part of the electrical distribution system shall be energized prior to the resistance testing of that system's ground rods. Test reports shall indicate the location of the rod and the resistance and the soil conditions at the time the test was performed.

-- END OF SECTION 16415D --

DIVISION 16

ELECTRICAL

SECTION 16670

# LIGHTNING PROTECTION SYSTEM

## PART 1 GENERAL

### 1.1 REFERENCES

The publications listed below are referenced and the most current publication applies. The publications are referenced to in the text by basic designation only.

#### 1.1.1 AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C135.30 Zinc-Coated Ferrous Ground Rods for Overhead or Underground Line Construction

#### 1.1.2 NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 National Electrical Code

NFPA 780 Lightning Protection Code

#### 1.1.3 UNDERWRITERS LABORATORIES (UL)

UL-03 Electrical Construction Materials Directory

UL 96 Lightning Protection Components

UL 96A Installation Requirements for Lightning Protection Systems

UL 467 Grounding and Bonding Equipment

UL 486A Wire Connectors and Soldering Lugs for Use with Copper Conductors

### 1.2 GENERAL REQUIREMENTS

#### 1.2.1 Verification of Dimensions

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work. No departures shall be made without the prior approval of the Contracting Officer.

#### 1.2.2 System Requirements

The system furnished under this specification shall consist of the standard products of a manufacturer regularly engaged in the

production of lightning protection systems and shall be the manufacturer's latest UL approved design. The lightning protection system shall conform to NFPA 70 and NFPA 780, UL 96 and UL 96A, except where requirements in excess thereof are specified herein.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation, submittals having and "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

### 1.3.1 Drawings "GA"

Lightning Protection System

Detail drawings consisting of a complete list of material, including manufacturer's descriptive and technical literature, catalog cuts, drawings, and installation instructions. Detail drawings shall demonstrate that the system has been coordinated and will function as a unit. Drawings shall show proposed layout and mounting and relationship to other parts of the work.

### 1.3.2 Certificates "FIO"

Materials and Equipment

Where material or equipment is specified to comply with requirements of UL, proof of such compliance. The label of or listing in UL-03 will be acceptable evidence. In lieu of the label or listing, a written certificate from an approved nationally recognized testing organization equipped to perform such services, stating that the items have been tested and conform to the requirements and testing methods of Underwriters Laboratories may be submitted. A letter of findings shall be submitted certifying UL inspection of lightning protection systems provided on Building 723.

# PART 2 PRODUCTS

## 2.1 MATERIALS

### 2.1.1 General Requirements

No combination of materials shall be used that form an electrolytic couple of such nature that corrosion is accelerated in the presence of moisture unless moisture is permanently excluded from the junction of such metals. Where unusual conditions exist which would cause corrosion of conductors, conductors with protective coatings or oversize conductors shall be used. Where a mechanical hazard is involved, the conductor size shall be increased to compensate for the hazard or the conductors shall be protected by covering them with molding or tubing made of wood or nonmagnetic material. When metallic conduit or tubing is

used, the conductor shall be electrically connected at the upper and lower ends.

2.1.2 Main and Secondary Conductors

Conductors shall be in accordance with NFPA 780 and UL 96 for Class I, Class II, or Class II modified materials as applicable.

2.1.2.1 Copper

Copper conductors used on nonmetallic stacks shall weigh not less than 375 pounds per thousand feet, and the size of any wire in the cable shall be not less than No. 15 AWG. The thickness of any web or ribbon used on stacks shall be not less than No. 12 AWG. Counterpoise shall be copper conductors not smaller than No. 1/0 AWG.

2.1.2.2 Aluminum

Aluminum shall not contact the earth nor shall it be used in any other manner that will contribute to rapid deterioration of the metal. Appropriate precautions shall be observed at connections with dissimilar metals. Aluminum conductors for bonding and interconnecting metallic bodies to the main cable shall be at least equivalent to strength and cross-sectional area of a No. 4 AWG aluminum wire. If perforated strips are used, the strips shall be as much wider than solid strips, as the diameter of the perforations. Aluminum strip for connecting exposed water pipes shall be not less than No. 12 AWG in thickness and at least 1-1/2 inches wide.

2.1.3 Air Terminals

Terminals shall be in accordance with UL 96 and NFPA 780. The tip of air terminals on buildings used for manufacturing, processing, handling, or storing explosives, ammunition, or explosive ingredients shall be a minimum of 2 feet above the ridge parapet, ventilator or perimeter. On open or hooded vents emitting explosive dusts or vapors under natural or forced draft, air terminals shall be a minimum of 5 feet above the opening. On open stacks emitting explosive dusts, gases, or vapor under forced draft, air terminals shall extend a minimum of 15 feet above vent opening. Air terminals more than 24 inches in length shall be supported by a suitable brace, with guides, not less than one-half the height of the terminal.

2.1.4 Ground Rods

Rods made of copper-clad steel shall conform to UL 467 and galvanized ferrous rods shall conform to ANSI C135.30. Ground rods shall be not less than 3/4 inch in diameter and 10 feet in length. Ground rods of copper-clad steel, stainless steel, galvanized ferrous, and solid copper shall not be mixed on the job.

2.1.5 Clamp-Type Connectors

Connectors for splicing conductors shall conform to UL 96, class as applicable, and UL 486A, Class 2, style and size as required for the installation.

2.1.6 Lightning Protection Components

Lightning protection components, such as bonding plates, air terminal supports, chimney bands, clips, and fasteners shall conform to UL 96, classes as applicable.

PART 3 EXECUTION

3.1 INTEGRAL SYSTEM

3.1.1 General Requirements

The lightning protection system shall consist of air terminals, roof conductors, down conductors, ground connections, and grounds, electrically interconnected to form the shortest distance to ground. All conductors on the structures shall be exposed except where conductors are in protective sleeves exposed on the outside walls. Secondary conductors shall interconnect with grounded metallic parts within the building. Interconnections made within side-flash distances shall be at or above the level of the grounded metallic parts.

3.1.1.1 Air Terminals

Air terminal design and support shall be in accordance with NFPA 780. Terminals shall be rigidly connected to, and made electrically continuous with, roof conductors by means of pressure connectors or crimped joints of T-shaped malleable metal and connected to the air terminal by a dowel or threaded fitting. Air terminals at the ends of the structure shall be set not more than 2 feet from the ends of the ridge or edges and corners of roofs. Spacing of air terminals 2 feet in height on ridges, parapets, and around the perimeter of buildings with flat roofs shall not exceed 25 feet. In specific instances where it is necessary to exceed this spacing, the specified height of air terminals shall be increased not less than 2 inches for each foot of increase over 25 feet. On large, flat or gently sloping roofs, as defined in NFPA 780, air terminals shall be placed at points of the intersection of imaginary lines dividing the surface into rectangles having sides not exceeding 50 feet in length. Air terminals shall be secured against overturning either by attachment to the object to be protected or by means of a substantial tripod or other braces permanently and rigidly attached to the building or structure. Metal projections and metal parts of buildings, smokestacks, and other metal objects that do not contain hazardous materials and that may be struck but not appreciably damaged by lightning, need not be provided with air terminals. However, these metal objects

shall be bonded to the lightning conductor through a metal conductor of the same unit weight per length as the main conductor. Where metal ventilators are installed, air terminals shall be mounted thereon, where practicable. Any air terminal erected by necessity adjacent to a metal ventilator shall be bonded to the ventilator near the top and bottom thereof. Where nonmetallic spires, steeples, or ventilators are present, air terminals shall be mounted thereon or to the side. In addition, where spires or steeples project more than 10 feet above the building, the conductor between the air terminal and metal roof shall be continued to the nearest down conductor and securely connected thereto.

3.1.1.2 Roof Conductors

Roof conductors shall be connected directly to the roof or ridge roll. Sharp bends or turns in conductors shall be avoided. Necessary turns shall have a radius of not less than 8 inches. Conductors shall preserve a downward or horizontal course and shall be rigidly fastened every 3 feet along the roof and down the building to ground. Metal ventilators shall be rigidly connected to the roof conductor at three places. All connections shall be electrically continuous. Roof conductors shall be coursed along the contours of flat roofs, ridges, parapets, and edges; and where necessary, over flat surfaces, in such a way as to join each air terminal to all the rest. Roof conductors surrounding tank tops, decks, flat surfaces, and flat roofs shall be connected to form a closed loop.

3.1.1.3 Down Conductors

Down conductors shall be electrically continuous from air terminals and roof conductors to grounding electrodes. Down conductors shall be coursed over extreme outer portions of the building, such as corners, with consideration given to the location of ground connections and air terminals. Each building or structure shall have not less than two down conductors located as widely separated as practicable, at diagonally opposite corners. On rectangular structures having gable, hip, or gambrel roofs more than 110 feet long, there shall be at least one additional down conductor for each additional 50 feet of length or fraction thereof. On rectangular structures having French, flat, or sawtooth roofs exceeding 250 feet in perimeter, there shall be at least one additional down conductor for each 100 feet of perimeter or fraction thereof. On an L- or T-shaped structure, there shall be at least one additional down conductor; on an H-shaped structure, at least two additional down conductors; and on a wing-built structure, at least one additional down conductor for each wing. On irregularly shaped structures, the total number of down conductors shall be sufficient to make the average distance between them along the perimeter not greater than 100 feet. On structures exceeding 50 feet in height, there shall be at least one additional down conductor for each additional 60 feet of height or fraction thereof, except that this application will not

cause down conductors to be placed about the perimeter of the structure at intervals of less than 50 feet. Additional down conductors shall be installed when necessary to avoid "dead ends" or branch conductors ending at air terminals, except where the air terminal is on a roof below the main protected level and the "dead end" or branch conductor is less than 16 feet in length and maintains a horizontal or downward coursing. Down conductors shall be equally and symmetrically spaced about the perimeter of the structure. Down conductors shall be protected where necessary, to prevent mechanical injury to the conductor.

3.1.1.4 Interconnection of Metallic Parts

Metal doors, windows, and gutters shall be connected directly to the grounds or down conductors using not smaller than No. 6 copper conductor, or equivalent. Conductors placed where there is probability of unusual wear, mechanical injury, or corrosion shall be of greater electrical capacity than would normally be used, or shall be protected. The ground connection to metal doors and windows shall be by means of mechanical ties under pressure, or equivalent.

3.1.1.5 Ground Connections

Ground connections comprising continuations of down conductors from the structure to the grounding electrode shall securely connect the down conductor and ground in a manner to ensure electrical continuity between the two. All connections shall be of the clamp type. There shall be a ground connection for each down conductor. Metal water pipes and other large underground metallic objects shall be bonded together with all grounding mediums. Ground connections shall be protected from mechanical injury. In making ground connections, advantage shall be taken of all permanently moist places where practicable, although such places shall be avoided if the area is wet with waste water that contains chemical substances, especially those corrosive to metal.

3.1.1.6 Grounding Electrodes

A grounding electrode shall be provided for each down conductor located as shown. A driven ground shall extend into the earth for a distance of not less than 10 feet. Ground rods shall be set not less than 3 feet, nor more than 8 feet, from the structures foundation. The complete installation shall have a total resistance to ground of not more than 5 ohms [if a counterpoise is not used]. Ground rods shall be tested individually prior to connection to the system and the system as a whole shall be tested not less than 24 hours after rainfall. When the resistance of the complete installation exceeds the specified value or two ground rods individually exceed 25 ohms, the Contracting Officer will be notified immediately. A counterpoise, where required, shall be of No. 1/0 copper cable or equivalent material having suitable resistance to corrosion and shall be laid around the perimeter of the structure in a trench not less than 2 feet deep at a distance

not less than 3 feet nor more than 8 feet from the nearest point of the structure. All connections between ground connectors and grounds or counterpoise, and between counterpoise and grounds shall be electrically continuous. Where so indicated on the drawings, an alternate method for grounding electrodes in shallow soil shall be provided by digging trenches radially from the building. The lower ends of the down conductors [or their equivalent in the form of metal strips or wires] are then buried in the trenches.

## 3.2 INSPECTION

The lightning protection system will be inspected by the Contracting Officer to determine conformance with the requirements of this specification. No part of the system shall be concealed until so authorized by the Contracting Officer.

-- END OF SECTION 16670 --

DIVISION 16

ELECTRICAL

SECTION 16721

FIRE DETECTION AND ALARM SYSTEM

## PART 1 GENERAL

### 1.1 REFERENCES

The publications listed below are referenced and the most current publication applies. The publications are referenced to in the text by basic designation only.

| | |
|---|---|
| 1.1.1 | American National Standards Institute (ANSI) |
| C135.30 | Zinc-Coated Ferrous Ground Rods for Overhead or Underground Line Construction |
| 1.1.2 | INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE) |
| IEEE C62.41 | Surge Voltages in Low-Voltage AC Power Circuits |
| 1.1.3 | NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) |
| NFPA 70 | National Electrical Code |
| NFPA 72 | National Fire Alarm Code |
| NFPA 90A | Installation of Air Conditioning and Ventilating Systems |
| 1.1.4 | UNDERWRITERS LABORATORIES (UL) |
| UL-04 | Fire Protection Equipment Directory |
| UL 6 | Rigid Metal Conduit |
| UL 38 | Manually Actuated Signaling Boxes for Use with Fire-Protective Signaling Systems |
| UL 268 | Smoke Detectors for Fire Protective Signaling Systems |
| UL 464 | Audible Signal Appliances |
| UL 467 | Grounding and Bonding Equipment |
| UL 521 | Heat Detectors for Fire Protective Signaling Systems |
| UL 864 | Control Units for Fire-Protective Signaling Systems |

## 1.2 GENERAL REQUIREMENTS

### 1.2.1 Standard Products

Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products and shall be items that have been in satisfactory use for at least 5 years prior to bid opening. Equipment shall be supported by a service organization that can provide service within 24 hours.

### 1.2.2 Nameplates

Major components of equipment shall have the manufacturer's name, address, type or style, voltage and current rating, and catalog number on a noncorrosive and nonheat-sensitive plate which is securely attached to the equipment.

### 1.2.3 Keys and Locks

Locks shall be keyed alike.

### 1.2.4 Tags

Tags with stamped identification number shall be furnished for keys and locks.

### 1.2.5 Verification of Dimensions

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

### 1.2.6 Compliance

The fire detection and internal alarm system and the central reporting system shall be configured in accordance with NFPA 72. The equipment furnished shall be compatible and be UL listed or FM approved or approved or listed by a nationally recognized testing laboratory in accordance with the applicable NFPA standards.

### 1.2.7 Manufacturer's Services

Services of a manufacturer's representative who is experienced in the installation, adjustment, testing, and operation of the equipment specified shall be provided. The representative shall supervise the installation, adjustment, and testing of the equipment.

## 1.3 SYSTEM DESIGN

### 1.3.1 Operation

The fire alarm and detection system shall be a complete, supervised fire alarm system. The system shall be activated into the alarm mode by actuation of any alarm initiating device. The system shall remain in the alarm mode until initiating device is reset and the fire alarm control panel is reset and restored to

normal. Alarm initiating devices shall be connected to signal line circuits SLC, Style 6, in accordance with NFPA 72. Alarm indicating appliances shall be connected to indicating appliance circuits (IAC), Style Z in accordance with NFPA 72. A two-loop conduit system shall be provided so that if any one conduit and all conductors contained in that conduit are severed all IDC, IAC, or SLC on that circuit shall remain functional. A two-loop system is not applicable to the central fire alarm communication center from the local panels. All textual, audible, and visual appliances and systems shall comply with NFPA 72. Addressable system shall be microcomputer based with a minimum word size of eight bits.

a. Sufficient memory shall be provided to perform as specified and as shown for addressable system.

b. Individual identity of each addressable device shall be provided for the following conditions:

   Alarm.

   Trouble.

   Open.

   Short.

   Appliances missing/failed

Remote detector - sensitivity adjustment from the panel for smoke detectors.

c. All addressable devices shall have the capability of individually being disabled or enabled from the panel.

1.3.2 Operational Features

The system shall have the following operating features:

a. Electrical supervision of alarm SLC and IAC. Smoke detectors shall have combined alarm initiating and power circuits.

b. Electrical supervision of the primary power (ac) supply, battery voltage, placement of alarm zone module (card, PC board) within the control panel, and transmitter tripping circuit integrity.

c. Trouble buzzer and trouble lamp (light emitting diode or neon light) to activate upon a single break, open, or ground fault condition which prevents the required normal operation of the system. The trouble signal shall also operate upon loss of primary power (ac) supply, low battery voltage, removal of alarm zone module (card, PC board), and disconnection of the circuit used for transmitting alarm signals off-premises. A trouble alarm silence switch shall

be provided which will silence the trouble buzzer, but will not extinguish the trouble indicator lamp. After the system returns to normal operating conditions, the trouble buzzer shall again sound until the silencing switch returns to normal position, unless automatic trouble reset is provided.

d. Transmitter disconnect switch to allow testing and maintenance of the system without activating the transmitter but shall provide a trouble signal when disconnected and a restoration signal when reconnected.

e. Evacuation alarm silencing switch or switches which, when activated, will silence alarm devices, but will not affect the zone indicating lamp nor the operation of the transmitter. This switch shall be over-ridden upon activation of a subsequent alarm from an unalarmed zone and the alarm devices will be activated.

f. Electrical supervision of circuits used for supervisory signal services. Supervision shall detect any open, short, or ground.

g. Confirmation or verification modules used on smoke detection initiating circuits. The modules shall interrupt the transmission of an alarm signal to the system control panel for a factory set period. This interruption period shall be adjustable from 1 to 60 seconds and be factory set at 20 seconds. Immediately following the interruption period, a confirmation period shall be in effect during which time an alarm signal if present will be sent immediately to the control panel. All fire alarm devices other than smoke detectors shall be prohibited on circuits controlled by confirmation or verification modules.

h. Zones for alarm SLC shall be as follows:

1.3.3 Alarm Functions

An alarm condition on a circuit shall automatically initiate the following functions:

a. Transmission of signals over the station radio fire reporting system. The signal shall be common for all zones.

b. Visual indications of the alarmed zones on the fire alarm control panel annunciator and on the remote annunciator.

c. Continuous sounding of alarm notification appliances throughout the building.

d. Operation of the smoke control system.

e. Deactivation of the air handling units throughout the building.

1.3.4 Primary Power

Operating power shall be provided as required by paragraph Power Supply for the System. Transfer from normal to emergency power or restoration from emergency to normal power shall be fully automatic and not cause transmission of a false alarm. Loss of ac power shall not prevent transmission of a signal via the fire reporting system upon operation of any initiating circuit.

1.3.5 Battery Backup Power

Battery backup power shall be through use of rechargeable, sealed-type storage batteries and battery charger.

## 1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation, submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

1.4.1 Data "FIO"

Battery

Substantiating battery calculations for supervisory and alarm power requirements. Ampere-hour requirements for each system component and each panel component, and the battery recharging period shall be included.

Voltage Drop

Voltage drop calculations for signaling appliance circuits to indicate that sufficient voltage is available for proper appliance operation.

Spare Parts "GA"

Spare parts data for each different item of material and equipment specified, not later than 1 month prior to the date of beneficial occupancy. Data shall include a complete list of parts and supplies with the current unit prices and source of supply and a list of the parts recommended by the manufacturer to be replaced after 3 years of service.

Qualifications "GA"

Qualifications, with verification of experience and license number, of a Registered Professional Engineer with at least 4 years of current experience in the design of the fire protection and detection systems. This engineer must perform the various specification items required by this section to be performed by a registered Professional Engineer.

1.4.2 Drawings "FIO"

Fire Alarm Reporting System

Detail drawings, signed by the Registered Professional Engineer, consisting of a complete list of equipment and material, including manufacturer's descriptive and technical literature, catalog cuts, and installation instructions. Note that the contract drawings show layouts based on typical detectors. The contractor shall check the layout based on the actual detectors to be installed and make any necessary revisions in the detail drawings. The detail drawings shall also contain complete wiring and schematic diagrams for the equipment furnished, equipment layout, and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Detailed point-to-point wiring diagram, signed by the Registered Professional Engineer, showing all points of connection. Diagram shall include connections between system devices, appliances, control panels, supervised devices, and all equipment that is activated or controlled by the panel.

1.4.3 Instructions "FIO"

Fire Alarm Reporting System

Six copies of operating instructions outlining step-by-step procedures required for system startup, operation, and shutdown. The instructions shall include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and their basic operating features. Six copies of maintenance instructions listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guide. The instructions shall include conduit layout, equipment layout and simplified wiring, and control diagrams of the system as installed. Instructions shall be approved prior to training.

Training "GA"

Lesson plans and training data, in manual format, for the training courses.

1.4.4 Statements "GA"

Test Procedures

Detailed test procedures, signed by the Registered Professional Engineer, for the fire detection and alarm system 60 days prior to performing system tests.

1.4.5 Reports "GA"

Testing

Test reports in booklet form showing all field tests performed to prove compliance with the specified performance criteria, upon

completion and testing of the installed system. Each test report shall document all readings, test results and indicate the final position of controls.

1.4.6 Certificates "GA"

Equipment

Certified copies of current approvals or listings issued by UL, FM or other nationally recognized testing laboratory, showing compliance with specified NFPA standards.

Installer

The Contractor shall provide documentation demonstrating that its fire detection and alarm system installer has been regularly engaged in the installation of fire detection and alarm systems meeting NFPA standards for a minimum of three years immediately preceding commencement of this contract. Such documentation shall specifically include proof of satisfactory performance on at least three projects similar to that required by these specifications, including the names and telephone numbers of using agency points of contact for each of these projects. Documentation shall indicate the type of each system installed and include a written certificate that each system has performed satisfactorily in the manner specified for a period of not less than 12 months following completion. All such data shall be submitted 30 days prior to commencement of installation for approval of the Contracting Officer. Listing of the installer under "Protective Signaling Services - Local, Auxiliary, Remote Station Proprietary (UUJS)" of UL-04 shall be accepted as equivalent proof of compliance with the foregoing experience requirements.

## 1.5 DELIVERY AND STORAGE

All equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variation, dirt and dust, and any other contaminants.

## 1.6 CENTRAL MONITORING

The control panel shall incorporate a built-in digital communicator transmitter which is UL listed to communicate fire & security event information to a UL listed central station monitoring service. One year of monitoring service shall be provided by the system supplier at no additional charge. After expiration of the first year of monitoring service, the Government reserves the option to seek renewal of monitoring through the original supplier or with another UL listed central station service. Two phone lines shall be provided at the control panel in accordance with NFPA 72 Chapter 4.

On site annunciation of system alarm & trouble events will be accomplished via an alphanumeric keypad. Each device location & event will be displayed on the keypad with a plain English description.

Multiple alphanumeric keypads shall be used. System silence & reset shall be accomplished at any of the system keypads.

## PART 2 PRODUCTS

### 2.1 GENERAL REQUIREMENTS

#### 2.1.1 Materials and Equipment

Units of the same type of equipment shall be products of a single manufacturer. All material and equipment shall be new and currently in production. Each major component of equipment shall have the manufacturer's model and serial number in a conspicuous place.

#### 2.1.2 Equipment

Fire Alarm System shall be supplied by

a. Radionics (D9412)

b. Edwards Technology

c. Simplex

d. or approved equal.

### 2.2 STORAGE BATTERIES

Storage Batteries shall be provided and shall be the sealed, nickel-cadmium type requiring no additional water. The batteries shall have ample capacity, with primary power disconnected, to operate the fire alarm system for a period of 48 hours. Following this period of operation via batteries, the batteries shall have ample capacity to operate all components of the system, including all alarm signaling devices in the total alarm mode for a minimum period of 30 minutes. Batteries shall be sized to deliver 50 percent more ampere/hours based on a 48 hour discharged rate than required for the calculated capacities. Battery cabinet shall be a separate compartment within the control panel. Batteries in the control panel shall be located at the bottom of the panel. Battery shall be provided with overcurrent protection in accordance with NFPA 72.

### 2.3 BATTERY CHARGER

Battery charger shall be completely automatic, with high/low charging rate, capable of restoring the batteries from full discharge to full charge within 12 hours. A separate ammeter shall be provided for indicating rate of charge. A separate voltmeter shall be provided to indicate the state of the battery charge. A pilot light indicating when batteries are manually placed on a high rate of charge shall be provided as part of the unit assembly if a high rate switch is provided. Charger shall be located in control panel.

## 2.4 MANUAL FIRE ALARM STATIONS

Manual fire alarm stations shall conform to the applicable requirements of UL 38. Manual stations shall be connected into alarm-initiating circuits. Stations shall be installed on surface mounted outlet boxes. Stations shall be single action type. Stations shall be finished in red, with raised letter operating instructions of contrasting color. Stations requiring the breaking of glass or plastic panels for operation are not acceptable. Stations employing glass or fiber rods are not acceptable. The use of a key or wrench shall be required to reset the station. Gravity or mercury switches are not acceptable. Switches and contacts shall be rated for the voltage and current upon which they operate. Stations shall have a separate screw terminal for each conductor. Surface mounted boxes shall be painted the same color as the fire alarm manual stations.

## 2.5 FIRE DETECTING DEVICES

Fire detecting devices shall comply with the applicable requirements of NFPA 72, NFPA 90A, UL 268, and UL 521. The detectors shall be provided as indicated. Detector base shall have screw terminals for making connections. No solder connections will be allowed. Detectors shall be connected into alarm initiating circuits. Detectors located in concealed locations (above ceiling, etc.) shall have a remote visible indicator lamp. Installed devices shall conform to the classification of the area.

### 2.5.1 Heat Detectors

Heat detectors shall be designed for detection of fire by combination compensation fixed temperature and rate-of-rise principle. Heat detectors shall be rated for a minimum of 15.2 m (50 foot) spacing (smooth-ceiling rated) in accordance with UL 521. Detectors located in areas subject to moisture, exterior atmospheric conditions or hazardous locations as defined by NFPA 70, shall be types approved for such locations. Heat detectors located in attic spaces or similar concealed spaces below the roof shall be intermediate temperature rated.

#### 2.5.1.1 Combination Fixed-Temperature and Rate-of-Rise Detectors

Detectors shall be designed for surface outlet box mounting and supported independently of wiring connections. Contacts shall be self-resetting after response to rate-of-rise principle. Under fixed temperature actuation, the detector shall have a permanent external indication which is readily visible. Detector units located in boiler rooms, showers, or other areas subject to abnormal temperature changes shall operate on fixed temperature principle only. Rating for fixed temperature portion shall be 57.2 degrees C (135 degrees F) in temperature conditioned spaces.

### 2.5.2 Smoke Detectors

Detectors shall be designed for detection of abnormal smoke densities. Smoke detectors shall be photoelectric type.

Detectors shall contain a visible indicator lamp that shows when the unit is in alarm condition. Detectors shall not be adversely affected by vibration or pressure. Detectors shall be the plug-in type in which the detector base contains terminals for making all wiring connections.

2.5.2.1 Photoelectric Detectors

Detectors shall operate on a light scattering concept using an LED light source. Failure of the LED shall not cause an alarm condition. Detectors shall be factory set for sensitivity and shall require no field adjustments of any kind. Detectors shall have an obscuration rating between 2.4 and 10 percent per foot when tested in accordance with UL 268.

2.5.2.2 Duct Detectors

Duct detectors are provided under Section 15950 Heating, Ventilation, and Air Conditioning HVAC Control Systems.

## 2.6 NOTIFICATION APPLIANCES

Audible appliances shall be heavy duty and conform to the applicable requirements of UL 464. Devices shall be connected into alarm indicating circuits and shall have a separate screw terminal for each conductor. Devices shall have manufacturer’s standard finish and color.

### 2.6.1 Alarm Horns

Horns shall be surface mounted, with the matching mounting back box surface mounted single projector, grill and vibrating type suitable for use in an electrically supervised circuit. Horns shall produce a minimum sound rating of at least 100 dBA at 3.048 m (10 feet). Horns used in exterior locations shall be specifically listed or approved for outdoor use and be provided with metal housing and protective grills.

### 2.6.2 Visual Notification Appliances

Visual notification appliances shall have high intensity optic lens and flash tubes. Strobes shall flash at approximately 1 flash per second and a minimum of 1 candela (8,000 peak candle power). Strobe shall be surface mounted.

### 2.6.3 Combination Audible/Visual Notification Appliances

Combination audible/visual notification appliances shall provide the same requirements as individual units except they shall mount as a unit in standard backboxes. All units shall be factory assembled. Any other audible indicating appliance employed in the fire alarm systems shall be approved by the authority having jurisdiction.

## 2.7 FIRE DETECTION AND ALARM SYSTEM PERIPHERAL EQUIPMENT

### 2.7.1 Ground Rods

Ground rods shall be of zinc-coated steel conforming to ANSI C135.30 not less than 19.1 mm (3/4 inch) in diameter by 3.1 m (10 feet) in length.

### 2.7.2 Conduit

Conduit and fittings shall comply with UL 6.

### 2.7.3 Wiring

Wiring for 120V ac power shall be No. 12 AWG minimum. Wiring for low voltage dc circuits shall be No. 16 AWG minimum. Power wiring (over 28 volts) and control wiring shall be isolated. All wiring shall conform to NFPA 70. System field wiring shall be solid copper and installed in metallic conduit. All conductors shall be color coded. Conductors used for the same functions shall be similarly color coded. Wiring code color shall remain uniform throughout the circuit. Pigtail or T-tap connections to alarm initiating, supervisory circuits, and alarm indicating circuits are prohibited. T-tapping using screw terminal blocks is allowed for addressable systems. The system shall be a 4-wire system.

### 2.7.4 Special Tools and Spare Parts

Special tools necessary for the maintenance of the equipment shall be furnished. Two spare fuses of each type and size required and five spare lamps and LED's of each type shall be furnished. Two percent of the total number of each different type of detector, but no less than two each, shall be furnished. Fuses and lamps shall be mounted in the fire alarm panel.`

# PART 3 EXECUTION

## 3.1 INSTALLATION

All work shall be installed as shown and in accordance with the manufacturer's diagrams and recommendations, unless otherwise specified.

### 3.1.1 Power Supply for the System

A single dedicated circuit connection for supplying power to the fire alarm system shall be provided. The primary power shall be supplied as shown on the drawings. The power supply shall be equipped with a locking mechanism and marked "FIRE ALARM CIRCUIT CONTROL".

### 3.1.2 Wiring

Conduit size for wiring shall be in accordance with NFPA 70. Wiring for the fire alarm system shall not be installed in conduits, junction boxes, or outlet boxes with conductors of

lighting and power systems. No more than one conductor shall be installed under any screw terminal. All circuit conductors entering or leaving any mounting box, outlet box enclosure or cabinet shall be connected to screw terminals with each terminal marked in accordance with the wiring diagram. Connections and splices shall be made using screw terminal blocks. The use of wire nut type connectors are prohibited in the system. Wiring within any control equipment shall be readily accessible without removing any component parts. The fire alarm equipment manufacturer's representative shall be present for the connection of wiring to the control panel.

### 3.1.3 Control Panel

The control panel and its assorted components shall be mounted so that no part of the enclosing cabinet is less than 300 mm (12 inches) nor more than 2 m (78 inches) above the finished floor. All manually operable controls shall be between 900 mm (36 inches) to 1.1 m (42 inches) above the finished floor. Panel shall be installed to comply with the requirements of UL 864.

### 3.1.4 Detectors

Detectors shall be installed in accordance with NFPA 72. Detectors shall be at least 300 mm (12 inches) from any part of any lighting fixture. Detectors shall be located at least 900 mm (3 feet) from diffusers of air handling systems. Each detector shall be provided with appropriate mounting hardware as required by its mounting location. Detectors which mount in free space shall be mounted directly to the end of the stubbed down rigid conduit drop. Conduit drops shall be firmly secured to minimize detector sway. Where length of conduit drop from ceiling or wall surface exceeds 900 mm, (3 feet,) sway bracing shall be provided.

### 3.1.5 Notification Appliances

Notification appliances shall be mounted a minimum of 2.4 m (8 feet) above the finished floor unless limited by ceiling height or otherwise indicated.

## 3.2 OVERVOLTAGE AND SURGE PROTECTION

All equipment connected to alternating current circuits shall be protected from surges per IEEE C62.41 and NFPA 70. All cables and conductors which serve as communications links, except fiber optics, shall have surge protection circuits installed at each end. Fuses shall not be used for surge protection.

## 3.3 GROUNDING

Grounding shall be provided to building ground or ground rods shall be driven. Maximum impedance to ground shall be 25 ohms. Ground rods shall not protrude more than 150 mm (6 inches) above grade.

## 3.4 TESTING

The Contractor shall notify the Contracting Officer 30 days before the preliminary and acceptance tests are to be conducted. The tests shall be performed in accordance with the approved test procedures in the presence of the Contracting Officer. The control panel manufacturer's representative shall be present to supervise all tests. The Contractor shall furnish all instruments and personnel required for the tests.

### 3.4.1 Preliminary Tests

Upon completion of the installation, the system shall be subjected to functional and operational performance tests including tests of each installed initiating and notification appliance. Tests shall include the meggering of all system conductors to determine that the system is free from grounded, shorted, or open circuits. The megger test shall be conducted prior to the installation of fire alarm equipment. If deficiencies are found, corrections shall be made and the system shall be retested to assure that it is functional.

### 3.4.2 Acceptance Test

Testing shall be in accordance with NFPA 72. The recommended tests in NFPA 72 shall be considered mandatory and shall verify that all previous deficiencies have been corrected. The test shall include the following:

a. Test of each function of the control panel.

b. Test of each circuit in both trouble and normal modes.

c. Tests of alarm initiating devices in both normal and trouble conditions.

d. Tests of each control circuit and device.

e. Tests of each alarm notification appliance.

f. Tests of the battery charger and batteries.

g. Complete operational tests under emergency power supply.

h. Visual inspection of all wiring connections.

i. Opening the circuit at each alarm initiating device and notification appliance to test the wiring supervisory feature.

j. Ground fault

k. Short circuit faults

l. Stray voltage

m. Loop resistance

## 3.5 TRAINING

Training course shall be provided for the operations and maintenance staff. The course shall be conducted in the building where the system is installed or as designated by the Contracting Officer. The training period shall consist of 3 training days (8 hours per day) and shall start after the system is functionally completed but prior to final acceptance tests. The instructions shall cover all of the items contained in the operating and maintenance instructions.

-- END OF SECTION 16721 --

DIVISION 16

ELECTRICAL

SECTION 16725

INTRUSION DETECTION SYSTEMS

## PART 1 GENERAL

### 1.1 REFERENCES

The publications listed below are referenced and the most current publication applies. The publications are referenced to in the text by basic designation only.

| | |
|---|---|
| 1.1.1 | AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI) |
| ANSI C2 | National Electrical Safety Code |
| 1.1.2 | DEPARTMENT OF DEFENSE (DOD) |
| DOD 3235.1 | Test & Evaluation of System Reliability Availability and Maintainability - A Primer |
| 1.1.3 | INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE) |
| IEEE C62.41 | Surge Voltages in Low-Voltage AC Power Circuits |
| IEEE Std 100 | IEEE Standard Dictionary of Electrical and Electronics Terms |
| IEEE Std 142 | IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems |
| 1.1.4 | MILITARY HANDBOOKS (MIL-HDBK) |
| MIL-HDBK 759 | Human Factors Engineering Design For Army Materiel |
| 1.1.5 | NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA) |
| NEMA ICS 1 | Industrial Controls and Systems |
| 1.1.6 | NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) |
| NFPA 70 | National Electrical Code |

1.1.7 UNDERWRITERS LABORATORIES (UL)

UL 6 Rigid Metal Conduit

UL 796 Printed-Wiring Boards

## 1.2 SYSTEM DESCRIPTION

### 1.2.1 General

The Contractor shall configure the Intrusion Detection System (IDS) as described and shown including Government Furnished Equipment. All computing devices, as defined in 47 CFR 15, shall be certified to comply with the requirements for Class A computing devices and labeled as set forth in 47 CFR 15. The system shall provide operator interaction and dynamic process manipulation, including overall system supervision, and control. Alarm data shall be obtained from local processors which are located within the protected zone.

### 1.2.2 Overall System Reliability Requirement

The system, including all components and appurtenances, shall be configured and installed to yield a mean time between failure (MTBF), as defined in IEEE Std 100, of at least 2000 hours continuous operation. Mean time between failure shall be calculated based on the configuration specified in paragraph Overall System Reliability Calculations.

### 1.2.3 Alarm Classifications

#### 1.2.3.1 Intrusion Alarm

The annunciation of an alarm resulting from the detection of a specified target and which represents an attempt to intrude into the protected area.

#### 1.2.3.2 Nuisance Alarm

The annunciation of an alarm resulting from the detection of an alarm stimuli but which does not represent an attempt to intrude into the protected area.

#### 1.2.3.3 Environmental Alarm

The annunciation of an alarm resulting from environmental conditions which exceed those specified.

#### 1.2.3.4 False Alarm

The annunciation of an alarm when there is no alarm stimuli.

### 1.2.4 Probability of Detection

Each zone shall have a continuous probability of detection greater than 90 percent and shall be demonstrated with a confidence level of 95 percent. This probability of detection equates to 49 successful detection’s out of 50 tests or 96 successful detections

out of 100 tests. A false alarm rate of less than 1 false alarm per sensor per 5 days shall be provided at this probability of detection.

1.2.5 Standard Intruder

The system shall be able to detect an intruder dressed in a long-sleeve shirt, slacks, and shoes unless environmental conditions at the site require protective clothing.

1.2.6 Standard Intruder Movement

Movement of the standard intruder is defined as any movement; such as walking, running, crawling, rolling, and jumping. The system shall detect a standard intruder moving through a protected zone in the most advantageous manner for the intruder.

1.2.7 Electrical Requirements

Electrically powered IDS equipment shall operate on 120 or 240 volt 60 Hz AC sources as shown. Equipment shall be able to tolerate variations in the voltage source of plus or minus 10 percent, and variations in the line frequency of plus or minus 2 percent with no degradation of performance.

1.2.8 Power Line Surge Protection

Equipment connected to alternating current circuits shall be protected from power line surges. Equipment protection shall withstand surge test waveforms described in IEEE C62.41. Fuses shall not be used for surge protection.

1.2.9 Sensor Wiring and Communication Circuit Surge Protection

Inputs shall be protected against surges induced on sensor wiring. Outputs shall be protected against surges induced on control and sensor wiring installed outdoors and as shown. All communications equipment shall be protected against surges induced on any communications circuit. All cables and conductors, except fiber optics, which serve as communications circuits from the controller to field equipment, and between field equipment, shall have surge protection circuits installed at each end. Protection shall be furnished at equipment. Fuses shall not be used for surge protection. The inputs and outputs shall be tested in both normal mode and common mode using the following two waveforms:

a. A 10 microsecond rise time by 1000 microsecond pulse width waveform with a peak voltage of 1500 volts and a peak current of 60 amperes.

b. An 8 microsecond rise time by 20 microsecond pulse width waveform with a peak voltage of 1000 volts and a peak current of 500 amperes.

1.2.10 Power Line Conditioners

A power line conditioner shall be furnished for the local processor. The power line conditioners shall be of the ferro-resonant design, with no moving parts and no tap switching, while electrically isolating the secondary from the power line side. The power line conditioners shall be sized for 125 percent of the actual connected kVA load. Characteristics of the power line conditioners shall be as follows:

a. At 85 percent load, the output voltage shall not deviate by more than plus or minus 1 percent of nominal when the input voltage fluctuates between minus 20 percent to plus 10 percent of nominal.

b. During load changes of zero to full load, the output voltage shall not deviate by more than plus or minus 3 percent of nominal. Full correction of load switching disturbances shall be accomplished within 5 cycles, and 95 percent correction shall be accomplished within 2 cycles of the onset of the disturbance.

c. Total harmonic distortion shall not exceed 3-1/2 percent at full load.

1.2.11 System Reaction

1.2.11.1 System Response

All alarms shall be annunciated on the controller displays within 1 second of their occurring at a local processor. This response time shall be maintained during system heavy load.

1.2.11.2 System Heavy Load Definition

System heavy load conditions are defined as the occurrence of alarms at a rate of 10 alarms per second. For the purpose of system heavy load definition, the system shall consist only of all console equipment and all local processors required by the design. The system heavy load conditions as specified shall have 50 percent of the alarms occurring at a single local processor with the remaining alarms distributed among the remaining local processors. The alarm printer shall continue to print out all occurrences, including time of occurrence, to the nearest second.

1.2.12 Environmental Conditions

1.2.12.1 Interior, Controlled Environment

All system components having controlled environments shall be rated for continuous operation under ambient environmental conditions of 1.7 to 48.9 degrees C (35 to 120 degrees F) (35 to 120 degrees F) dry bulb and 20 to 90 percent relative humidity, noncondensing.

### 1.2.13 System Capacity

The system shall monitor and control the number of inputs and outputs shown and shall include an expansion capability of a minimum of 25 percent.

## 1.3 TESTING

### 1.3.1 General

The Contractor shall perform predelivery testing, site testing, and adjustment of the completed intrusion detection system. The Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform all testing. Written notification of planned testing shall be given to the Government at least 14 days prior to the test, and in no case shall notice be given until after the Contractor has received written approval of the specific test procedures.

### 1.3.2 Test Procedures and Reports

Test procedures shall explain in detail, step-by-step actions and expected results demonstrating compliance with the requirements of the specification. Test reports shall be used to document results of the tests. Reports shall be delivered to the Government within 7 days after completion of each test.

## 1.4 TRAINING

### 1.4.1 General

The Contractor shall conduct training courses for designated personnel in the maintenance and operation of the IDS as specified. The training shall be oriented to the specific system being installed under this contract. Training manuals shall be delivered for each trainee with two additional copies delivered for archiving at the project site. The manuals shall include an agenda, defined objectives for each lesson, and a detailed description of the subject matter for each lesson. The Contractor shall furnish all audio-visual equipment and all other training materials and supplies. Where the Contractor presents portions of the course by audio-visual material, copies of the audio-visual material shall be delivered to the Government, either as a part of the printed training manuals or on the same media as that used during the training sessions. A training day is defined as 8 hours of classroom instruction, including two 15 minute breaks and excluding lunchtime, Monday through Friday, during the daytime shift in effect at the training facility. For guidance in planning the required instruction, the Contractor should assume that attendees will have a high school education or equivalent, and are familiar with intrusion detection systems. Approval of the planned training schedule shall be obtained from the Government at least 30 days prior to the training.

## 1.5 EXPERIENCE

The contractor shall submit written proof that the following experience requirements are being met.

### 1.5.1 Hardware Manufacturer Experience

All system components shall be produced by manufacturers who have been regularly engaged in the production of intrusion detection system components of the types to be installed for at least 5 years.

### 1.5.2 Software Manufacturer Experience

All system and application software shall be produced by manufacturers who have been regularly engaged in the production of intrusion detection system and application software of similar type and complexity as the specified system for at least 2 years.

### 1.5.3 System Installer Experience

The system shall be installed by a contractor who has been regularly engaged in the installation of intrusion detection systems of similar type and complexity as the specified system for at least 2 years.

## 1.6 MAINTENANCE AND SERVICE

### 1.6.1 General Requirements

The Contractor shall provide all services required and equipment necessary to maintain the entire intrusion detection system in an operational state as specified for a period of 1 year after formal written acceptance of the system, and shall provide all necessary material required for performing scheduled adjustments or other nonscheduled work.

### 1.6.2 Description of Work

The adjustment and repair of intrusion detection system includes all computer equipment, software updates, communications transmission equipment and DTM, local processors, and all new IDS sensors and support equipment. Responsibility shall be limited to Contractor installed equipment. The contractor shall provide the manufacturer's required adjustments and all other work necessary.

### 1.6.3 Personnel

Service personnel shall be certified in the maintenance and repair of similar types of equipment and qualified to accomplish all work promptly and satisfactorily. The Government shall be advised in writing of the name of the designated service representative, and of any change in personnel.

1.6.4 Schedule of Work

The Contractor shall perform two minor inspections at 6 month intervals (or more often if required by the manufacturer), and two major inspections offset equally between the minor inspections to effect quarterly inspection of alternating magnitude.

1.6.4.1 Scheduled Work

This work shall be performed during regular working hours, Monday through Friday, excluding federal holidays.

1.6.5 Emergency Service

The Government will initiate service calls when the intrusion detection system is not functioning properly. Qualified personnel shall be available to provide service to the complete intrusion detection system. The Government shall be furnished with a telephone number where the service supervisor can be reached at all times. Service personnel shall be at site within 2 hours after receiving a request for service. The intrusion detection system shall be restored to proper operating condition within 2 hours after service personnel arrive on site.

1.6.6 Operation

Performance of scheduled adjustments and repair shall verify operation of the intrusion detection system as demonstrated by the applicable tests of the performance verification test.

1.6.7 Work Requests

The Contractor shall separately record each service call request, as received. The form shall include the serial number identifying the component involved, its location, date and time the call was received, specific nature of trouble, names of service personnel assigned to the task, instructions describing what has to be done, the amount and nature of the materials to be used, the time and date work started, and the time and date of completion. The Contractor shall deliver a record of the work performed within 5 days after work is accomplished.

1.6.8 System Modifications

The Contractor shall make any recommendations for system modification in writing to the Government. No system modifications, shall be made without prior approval of the Government. Any modifications made to the system shall be incorporated into the operations and maintenance manuals, and other documentation affected.

1.6.9 Software

The Contractor shall provide all software updates and verify operation in the system. These updates shall be accomplished in a timely manner, fully coordinated with intrusion detection system operators, and shall be incorporated into the operations and maintenance manuals, and software documentation. There shall be at least one scheduled update near the end of the first year's warranty period, at which time the Contractor shall install and validate the latest released version of the Contractor's software.

## 1.7 CENTRAL MONITORING

The control panel shall incorporate a built-in digital communicator transmitter which is UL listed to communicate fire & security event information to a UL listed central station monitoring service. One year of monitoring service shall be provided by the system supplier at no additional charge. After expiration of the first year of monitoring service, the Government reserves the option to seek renewal of monitoring through the original supplier or with another UL listed central station service. Two phone lines shall be provided at the control panel in accordance with NFPA 72 Chapter 4.

On site annunciation of system alarm & trouble events will be accomplished via an alphanumeric keypad. Each device location & event will be displayed on the keypad with a plain English description. Multiple alphanumeric keypads shall be used. System silence & reset shall be accomplished at any of the system keypads.

# PART 2 PRODUCTS

## 2.1 GENERAL REQUIREMENTS

2.1.1 Materials and Equipment

Units of the same type of equipment shall be products of a single manufacturer. All material and equipment shall be new and currently in production. Each major component of equipment shall have the manufacturer's model and serial number in a conspicuous place.

2.1.2 Equipment

IDS shall be supplied by

a. Radionics (D9124)

b. Honeywell

c. ADT

d. or approved equal.

2.1.3 Alarm Output

The alarm output of each sensor shall be a single pole double throw (SPDT) contact rated for a minimum of 0.25 A at 24 volts DC.

2.1.4 Indicator Lights

Indicator lights used throughout the system shall be light emitting diodes (LED) or long life incandescent lamps. The indicator lights used shall be visible from a distance of 9.1 meters (30 feet) in an area illuminated to 800 lx. (75 foot candles.) The indicator lights shall conform to the following color coding:

a. RED shall be used to alert an operator that a zone is in alarm and that the alarm has been acknowledged.

b. FLASHING RED shall be used to alert an operator that a zone has gone into an alarm or that primary power has failed.

c. YELLOW shall be used to advise an operator that a zone is in access.

d. GREEN shall be used to indicate that a zone is secure or that power is on.

2.2 INTERIOR SENSORS

2.2.1 Balanced Magnetic Switch (BMS)

The BMS shall detect a 6.4 mm (1/4 in.) of separating relative movement between the magnet and the switch housing. Upon detecting such movement, it shall transmit an alarm signal to the alarm annunciation system.

2.2.1.1 BMS Subassemblies

The BMS shall consist of a switch assembly and an actuating magnetic assembly. The switch mechanism shall be of the balanced magnetic type. Each switch shall be provided with an overcurrent protective device, rated to limit current to 80 percent of the switch capacity. Switches shall be rated for a minimum lifetime of one million operations. The magnet assembly shall house the actuating magnet.

2.2.1.2 Housing

The housings of surface mounted switches and magnets shall be made of nonferrous metal and shall be weatherproof. The housings of recess mounted switches and magnets shall be made of nonferrous metal or plastic.

2.2.1.3 Remote Test

A remote test capability shall be provided. The remote test shall be initiated when commanded by the alarm annunciation system. The remote test shall activate the sensor's switch

mechanism causing an alarm signal to be transmitted to the alarm annunciation system. The remote test shall simulate the movement of the actuating magnet relative to the switch subassembly.

2.2.2 Glass Break Sensor

The glass break sensor shall detect high frequency vibrations generated by the breaking of glass while ignoring all other mechanical vibrations. An alarm signal shall be transmitted upon detecting such frequencies to the alarm annunciation system.

2.2.2.1 Sensor Element

The sensor element shall consist of piezoelectric crystals. The sensor element housing shall be designed to be mounted directly to the glass surface being protected. The detection pattern of a sensor element shall be circular with at least a 1.5 meter (5 foot) radius on a continuous pane of glass. A factory installed hookup cable of not less than 1.8 meters (6 feet) shall be included with each sensor. The sensor element shall not exceed 2600 square mm (4 square inches) in mounting area. The sensor element shall be equipped with a light emitting diode (LED) activation indicator. The activation indicator shall light when the sensor responds to the high frequencies associated with breaking glass. The LED shall be held on until it is turned off manually at the location of the sensor signal processor or by command from the alarm annunciation system.

2.2.2.2 Sensor Signal Processor

The sensor signal processor shall process the signals from the sensor element(s) and provide the alarm signal to the alarm annunciation system. The sensitivity of the sensor shall be adjustable by controls within the sensor signal processor. The controls shall not be accessible when the sensor signal processor housing is in place. The sensor signal processor may be integral with the sensor or may be a separate assembly.

2.2.2.3 Glass Break Simulator

The Contractor shall provide a device that can induce frequencies into the protected pane of glass that will simulate breaking glass to the sensor element without causing damage to the pane of glass.

2.2.3 Duress Alarm Switches

Duress alarm switches shall provide the means for an individual to covertly notify the alarm annunciation system that a duress situation exists.

2.2.3.1 Pushbutton

Latching pushbutton duress alarms shall be designed to be activated by depressing a pushbutton located on the duress switch housing. No visible or audible alarm or noise shall emanate from the switch. The switch shall lock in the activated

position until manually reset with a key. The switch housing shall shroud the activating button to prevent accidental activation. Switches shall be rated for a minimum lifetime of 50,000 operations.

### 2.2.4 Passive Infrared Motion Sensor

The passive infrared motion sensor shall detect changes in the ambient level of infrared emissions caused by the movement of a standard intruder within the sensor's field of view. Upon detecting such changes, the sensor shall transmit an alarm signal to the alarm annunciation system. The sensor shall detect a change in temperature of no more than 1.1 degrees C(2.0 degrees F), and shall detect a standard intruder traveling within the sensor's detection pattern at a speed of 0.091 to 2.29 meters (0.3 to 7.5 feet) per second across two adjacent segments of the field of view. Emissions monitored by the sensor shall be in the 8 to 14 micron range. The sensor shall be adjustable to obtain the coverage pattern shown. The sensor shall be equipped with a temperature compensation circuit.

#### 2.2.4.1 Test Indicator

The passive infrared motion sensor shall be equipped with an LED walk test indicator. The walk test indicator shall not be visible during normal operations. When visible, the walk test indicator shall light when the sensor detects an intruder. The sensor shall either be equipped with a manual control, located within the sensor's housing, to enable/disable the test indicator or the test indicator shall be located within the sensor such that it can only be seen when the housing is open/removed.

#### 2.2.4.2 Remote Test

A remote test capability shall be provided. The remote test hardware may be integral to the sensor or a separate piece of equipment. The remote test shall be initiated when commanded by the alarm annunciation system. The remote test shall excite the sensing element and associated electronics causing an alarm signal to be transmitted to the alarm annunciation system. The sensor stimulation generated by the remote test hardware shall simulate a standard intruder moving within the sensor's detection pattern.

## 2.3 WIRE AND CABLE

### 2.3.1 General

The Contractor shall provide all wire and cable not indicated as Government furnished equipment. All wiring shall meet NFPA 70 standards.

### 2.3.2 Above Ground Sensor Wiring

Sensor wiring shall be 20 AWG minimum, twisted and shielded, 2, 3, 4, or 6 pairs to match hardware. Multiconductor wire shall have an outer jacket of PVC.

## PART 3 EXECUTION

## 3.1 GENERAL

The Contractor shall install all system components, including Government furnished equipment, and appurtenances in accordance with the manufacturer's instructions, ANSI C2 and as shown, and shall furnish all necessary interconnections, services, and adjustments required for a complete and operable system as specified and shown.

### 3.1.1 Installation

All wiring, including low voltage wiring outside boxes, and similar enclosures, shall be cable as specified in Section(s) 16415C. Electric metallic tubing (EMT), armored cable, nonmetallic sheathed cable, or flexible conduit will not be permitted except where specifically shown. DTM shall not be pulled into conduits or placed in raceways, compartments, outlet boxes, junction boxes, or similar fittings with other building wiring. Flexible cords or cord connections shall not be used to supply power to any components of the intrusion detection system, except where specifically noted herein. All other electrical work shall be as specified in Section(s) 16415D and as shown. Grounding shall be installed as necessary to preclude ground loops, noise, and surges from adversely affecting system operation.

### 3.1.2 Enclosure Penetrations

All enclosure penetrations shall be from the bottom unless the system design requires penetrations from other directions. All penetrations on exterior enclosures shall be sealed with an approved sealant as recommended by the cable manufacturer to preclude the entry of water.

### 3.1.3 Installation - Software

The Contractor shall load all software as specified and required for an operational intrusion detection system, including databases and all specified programs.

## 3.2 SYSTEM STARTUP

The Contractor shall not apply power to the intrusion detection system until the following items have been completed:

a. Intrusion detection system equipment items and DTM have been set up in accordance with manufacturer's instructions.

b. A visual inspection of the intrusion detection system has been conducted to ensure that defective equipment items have not been installed and that there are no loose connections.

c. System wiring has been tested and verified as correctly connected as indicated.

d. All system grounding and transient protection systems have been verified as properly installed and connected as indicated.

e. Power supplies to be connected to the intrusion detection system have been verified as the correct voltage, phasing, and frequency as indicated.

f. Satisfaction of the above requirements shall not relieve the Contractor of responsibility for incorrect installation, defective equipment items, or collateral damage as a result of Contractor work/equipment.

## 3.3 SUPPLEMENTAL CONTRACTOR QUALITY CONTROL

The following requirements supplement the contractor quality control requirements specified elsewhere in the contract. The contractor shall provide the services of technical representatives who are thoroughly familiar with all components and installation procedures of the installed IDS; and are approved by the Contracting Officer. These representatives will be present on the job site during the preparatory and initial phases of quality control to provide technical assistance. These representatives shall also be available on an as needed basis to provide assistance with follow-up phases of quality control. These technical representatives shall participate in the testing and validation of the system and shall provide certification that their respective system portions meet its contractual requirements.

## 3.4 SITE TESTING

### 3.4.1 General

The Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform all site testing. The Government will witness all performance verification and endurance testing. Written permission shall be obtained from the Government before proceeding with the next phase of testing. Original copies of all data produced during performance verification and endurance testing shall be turned over to the Government at the conclusion of each phase of testing prior to Government approval of the test.

### 3.4.2 Contractor's Field Testing

The Contractor shall calibrate and test all equipment, place the integrated system in service, and test the integrated system. Ground rods installed by the Contractor shall be tested as specified in IEEE Std 142. The Contractor shall deliver a report describing results of functional tests, diagnostics, and calibrations including written certification to the Government that the installed complete system has been calibrated, tested,

and is ready to begin performance verification testing. The report shall also include a copy of the approved performance verification test procedure.

3.4.3 Performance Verification Test

The Contractor shall demonstrate that the completed IDS complies with the contract requirements. Using approved test procedures, all physical and functional requirements of the project shall be demonstrated and shown. The performance verification test, as specified, shall not be started until receipt by the Contractor of written permission from the Government, based on the Contractor's written request. This shall include certification of successful completion of testing as specified in paragraph Contractor's Field Testing, and upon successful completion of training as specified. The Government may terminate testing at any time when the system fails to perform as specified. Upon termination of testing by the Government or by the Contractor, the Contractor shall commence an assessment period. Upon successful completion of the performance verification test, the Contractor shall deliver test reports and other documentation, as specified, to the Government prior to commencing the endurance test.

3.4.4 Endurance Test

a. General: The Contractor shall demonstrate the specified probability of detection and false alarm rate requirements of the completed system. The endurance test shall be conducted in phases as specified. The endurance test shall not be started until the Government notifies the Contractor, in writing, that the performance verification test is satisfactorily completed, training as specified has been completed, and correction of all outstanding deficiencies has been satisfactorily completed. Upon successful completion of the endurance test, the Contractor shall deliver test reports and other documentation as specified to the Government prior to acceptance of the system.

b. Exclusions: The Contractor will not be held responsible for failures in system performance resulting from the following:

(1) An outage of the main power in excess of the capability of any backup power source, provided that the automatic initiation of all backup sources was accomplished and that automatic shutdown and restart of the IDS performed as specified.

(2) Failure of a Government furnished communications link, provided that the failure was not due to Contractor furnished equipment, installation, or software.

(3) Failure of existing Government owned equipment, provided that the failure was not due to Contractor furnished equipment, installation, or software.

(4) The occurrence of specified nuisance alarms.

(5) The occurrence of specified environmental alarms.

-- END OF SECTION 16725--

DIVISION 16

ELECTRICAL

SECTION 16741

TELECOMMUNICATIONS SYSTEM

## PART 1 - GENERAL

### 1.1 REFERENCES:

The publications listed below are referenced and the most current publication applies. The publications are referenced to in the text by basic designation only.

1.1.1 Air Force Command, Control, Communications, and Computer Agency (AFC4A):

| | |
|---|---|
| AFC4A Technical Bulletin TB 95-03 | Air Force Standards for Computer Telecommunications System Wiring |

1.1.2 American National Standards Institute (ANSI)/ Insulated Cable Engineer Association (ICEA):

| | |
|---|---|
| ANSI/ICEA S-80-576 | (September 1988) Standard for Telecommunications Wire and Cable for Wiring of Premises |
| EIA/TIA 568A | (Jul 91) Wire and Cable |
| EIA/TIA 569 | Commercial Building Standards for Telecommunication Pathways and Spaces |

1.1.3 Underwriters Laboratories (UL):

| | |
|---|---|
| UL CMR | Riser Cable |

1.1.4 National Fire Protection Association (NFPA):

| | |
|---|---|
| NFPA 70 | National Electric Code (NEC) |

### 1.2 DESCRIPTION OF WORK:

Installation of a telecommunications system within the designated parts of the building. This system will support voice, data, and local area network (LAN) connectivity for the facility. Work includes all wiring, cables, outlets, conduits, and mounting devices necessary for a system complete and ready for use. The cable will extend from the distribution frame to all parts of the building.

## 1.3 AS-BUILT DRAWINGS:

Following the project or turnover, within 30 days, the contractor shall furnish 2 complete sets of system drawings showing a complete schematic of the system and the physical runs of all wiring. These drawings should be turned over to the 305 Communications Squadron, Telephone Section via the CCI.

## 1.4 WORKMANSHIP:

Material and equipment shall be installed in accordance with the specifications listed in Section 1.1 and the manufacturers recommended practices.

# PART 2 - PRODUCTS

## 2.1 GENERAL:

All materials installed as part of this system shall be compatible and shall conform to industry specifications.

## 2.2 INSIDE WIRE AND CABLE:

All inside wiring and cables shall be UL listed and provided in accordance with EIA/TIA-568A and 569. No wire or cable shall be sized smaller than 24 AWG and shall be installed in accordance with AFC4A TB 95-03. House distribution cable shall consist of inside station wiring with one 4-pair cable terminated on each jack (three 4-pair cables for a triplex outlet). The cable for the voice and data jacks will be Level 3. The cable for the LAN jacks will be Level 5. These cables will connect each user outlet to its respective distribution frame. Each voice and data cable shall terminate on 66 type terminal blocks at the distribution frame. Each LAN cable shall terminate on EIA/TIA 568A certified, 110 type patch panels at the distribution frame. Each cable will be numbered to correspond to the outlet. If easy access is not available (suspended ceilings), cables shall be run in conduits, cable troughs, or on cable racks. All cables shall be of the proper type for installation in the particular environment they are to be used in, i.e. have the proper fire rating in accordance with the current NEC/NFPA 70.

## 2.3 TELECOMMUNICATIONS OUTLETS:

Outlets housing modular jacks shall be provided for this effort. As a minimum, one outlet should be provided on each wall that is less than 12 feet long. If a wall is more than 12 feet long, one outlet shall be provided every 8 feet. If the facility is to be furnished with modular office furniture, the outlet locations should be matched to the furniture design. Outlets shall be provided in the following configurations as appropriate:

A. Single outlet housing one 4-pair Level 3 jack.

B. Single outlet housing one 4-pair Level 5 jack.

C. Duplex outlet housing two 4-pair Level 3 jacks.

D. Duplex outlet housing one 4-pair Level 3 jack and one 4-pair Level 5 jack.

E. Triplex outlet housing two 4-pair Level 3 jacks and one 4-pair Level 5 jack.

F. Single 4-pair Level 3 jack suitable for mounting one or two line wall phones.

All jacks used to terminate Level 5 cables must be certified as EIA/TIA 568A & 569 compliant. Each jack shall be an 8 position, 8 wire modular jack. Both flush mount and surface mount outlets shall be provided as appropriate. Flush mounted types shall be suitable for mounting in standard electrical outlet boxes (preferred method). Surface mounted types shall be suitable for mounting on walls and baseboards. Where modular furniture is to be used, outlets suitable for mounting in modular raceways shall be provided. Each outlet will be labeled to show its relationship with the cables terminated on it, and each jack will be labeled to indicate it's use, i.e. voice, data, and LAN. If an outdoor outlet is necessary it will be corrosion resistant and weatherproof and designed to mate with a standard 4-wire modular plug.

## 2.4 CABLE SUPPORT:

All indoor cable and wiring shall be supported every 36 inches or less utilizing industry recognized and approved hardware such as cable straps, hangers, steel messenger cables, D-rings, racks, etc. Cable and wiring shall be self supporting and not rely on or be supported by other pipes, cables, or conduits. Cables will not be supported by a suspended ceiling or any of its components. Cables entering or leaving a conduit or duct shall be supported in a manner in which the cable is not stressed at the edge or rim of the conduit. Indoor conduit shall be firmly anchored and supported, and installed in accordance with the NEC.

## 2.5 TERMINAL BLOCKS AND TELECOMMUNICATIONS CLOSETS:

The EIA 1/2T1A 568 Terminal block and the 66 TYPE Connector Block shall be located in a lockable room reserved for use by the telecommunications system. This room shall provide adequate space for mounting and maintenance of equipment to support the telephone, data, LAN, and alarm systems. This room shall have minimum of one duplex electrical outlet on each wall and have adequate lighting. It shall be free of any electromagnetic fields and shall not be susceptible to water damage. The connector block shall be centrally located so that no cable run from the terminal block to the user outlet is more than 90 meters. Otherwise an additional telecommunications closet must be added to insure that no cable run exceeds 90 meters. The terminal block shall be mounted on a 3/4 inch plywood backboard. This backboard shall be painted with an insulating paint and sized to allow for future expansion of the telecommunications system. The terminal block will be divided into two separate fields. All Level 3 cables will terminate in one field and all Level 5 cables will terminate in a separate field.

## PART 3 - EXECUTION

### 3.1 QUALIFICATIONS:

All work done under this section shall be performed by and all equipment shall be furnished and installed by a certified telecommunications contractor. With the exception of furnishing and installing conduit, electrical boxes, and pullwires, this work shall not be done by the electrical contractor. The contractor shall have the following qualifications in Telecommunications Systems installation:

A. Contractor shall have a minimum of 3 years experience in the application, installation, and testing of the specified systems and equipment.

B. All supervisors and installers assigned to the installation of Level 5 cables and their associated hardware shall have certification that they are qualified to install and test the provided equipment and materials. General electrical trade staff (electricians) shall not be used for the installation of the premises distribution system cables and associated hardware.

C. All installers assigned to the installation of this system or any of its components shall have a minimum of 3 years experience in the installation of the telecommunications system components.

### 3.2 INSTALLATION AND TESTING:

A. The contractor shall install the communications and distribution system in accordance with manufacturers specifications and industry standards and procedures. All components and elements shall be properly identified and marked.

B. The contractor shall provide the 305 Communications Squadron, Commercial Communications Office, a complete “as installed” drawing and cable records for the complete communications cabling and distribution system.

C. All cables will be tested for the following: Continuity, shorts, opens, grounds, and crosses. In addition all Level 5 cables will be tested to insure compliance with EIA/TIA 568A standards. Test results will be provided to the same office as in paragraph 4.2.

-- END OF SECTION 16741 --