

TECHNICAL SPECIFICATIONS

FIRE PROTECTION

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FIRE PROTECTION GENERAL REQUIREMENTS

PART 1 – GENERAL

1.1 INTENT

It is the intent of this Specification to define the standards of components system forming part of the Fire Protection System Installation. All work carried out shall conform to these standards and shall include all components required by Statutory Authorities.

1.2 QUALIFICATIONS OF CONTRACTORS

The Contractor shall submit with the bid data for approval. The Contractor for the fire protection installation shall be qualified Fire Protection Contractor, regularly engaged in the installation of Automatic Fire Sprinkler System (AFSS) and other fire protection equipment.

The Contractor shall submit the following:

1. Contractor's organizational chart and name of personnel.
2. Financial statement
3. List of fire protection projects that have been completed and contract amount.
4. Company profile

Indicate the type and design of each system and certify that each system has performed satisfactorily in the manner intended for a period of not less than 18 months.

1.3 DESCRIPTION OF WORK

The work includes providing new fire extinguishing systems for the proposed Building which includes furnishing all labour, materials, and services necessary or incidental to the complete installation, testing, adjusting, training and placing into service of the several systems of fire protection as shown on drawings. Where incidental equipment or appurtenances are required, and not listed as shown, same shall be furnished as required for a complete fire protection system. The equipment, materials installation, workmanship, inspection and testing shall be in strict accordance with the required advisory provisions of National Fire Protection Association Standards, Fire Code of the Philippines and National Building Code except as modified herein.

The Contractor shall be responsible for coordinating his work with the various trades as necessary to avoid conflicts and to insure the installation of all work within the available space.

The Contractor is required to refer to all architectural and other trades, possible interference and conditions affecting his work.

Requirement for Portable Fire Extinguisher, Standpipe system and Automatic Fire Sprinkler shall comply with the local Fire Department Policy.

1.4 SUBMITTALS:

Submit shop drawings, manufacturer's data and certificates for equipment, materials and finish, and pertinent details for each system as specified in each individual section, and obtain

approval from the Consultant before procurement, fabrication, or delivery to the job site. Approval of submittal shall not relieve the Contractor of the responsibility of inspecting such material or equipment for defects or non-conforming with the specifications. Partial submittals are not acceptable and will be returned without review. Submittals shall include the manufacturer's name, trade name, catalogue model or number, nameplate data, size, layout dimensions, capacity, project specification and paragraph reference, applicable, industry, and technical society publication references, years of satisfactory service, and other information necessary to establish contract compliance of each item the Contractor proposes to provide. Photographs of existing installations and data submitted in lieu of catalogue data are not acceptable and will be returned without approval.

- A. Shop Drawings: Drawings shall include floor plans, sectional views, wiring diagrams, and installation details of equipment, and equipment spaces identifying and indicating proposed location, layout and arrangement of items of equipment, control panels, accessories, piping, and other items that must be shown to assure a coordinated installation. Drawings shall indicate adequate clearance for operation, maintenance, and replacements of operating equipment devices. If equipment is disapproved, drawings shall be revised to show acceptable equipment and be resubmitted.
- B. Manufacturer's Data: Submittals for each manufactured item shall be of manufacturer's descriptive literature of catalogued products, equipment drawings, diagrams, performance and characteristic curves, and catalogue cuts.
- C. Manufacturer's Installation Instructions: Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.

Design Data to include sway bracing and hydraulic calculations

Preliminary Testing

Testing and Commissioning Procedure

Final Acceptance Test Report

Certificate of Inspection by Fire Protection Project-In-Charge

1.5 OPERATION AND MAINTENANCE MANUAL.

Furnish an operation and maintenance manual as required for each item of equipment as specified in each individual section. Furnish 5 copies of the manual bound in hardback binders or an approved equivalent. Furnish one complete manual to the Consultant for review and approval within 90 calendar days after the equipment is approved, but at least 60 calendar days prior to field acceptance testing of the equipment or system. Furnish the remaining manuals at least 60 calendar days before the contract is completed. Inscribe the following identification on the cover: the words OPERATION AND MAINTENANCE MANUAL, the name and location of the equipment or the building and the name of the Contractor. The manual shall include the names, addresses, and telephone numbers of each contractor installing equipment, and of the local representatives for each item of equipment. The manual shall have a table of contents and be assembled to conform to the table of contents with the tab sheets placed before instructions covering the subject. The instructions shall be legible and easily read, with large sheets of drawings folded in. The manual shall include: wiring and control diagrams with data to explain detailed operation and control of each item of equipment, a control sequence describing start-up, operation and shutdown, description of the function of each principal item of equipment; the procedure for starting; the procedure for operating; shutdown instructions; installation instructions; maintenance instructions; lubrication schedule including type, grade, temperature range, and frequency; safety precautions, diagrams, and illustrations; test procedures performance data and parts list. The parts list for equipment shall indicate the sources of supply, recommended spare parts, and the

service organization which is reasonably convenient to the project site. The manual shall have complete information on the equipment, controls, accessories, and associated appurtenances provided.

POSTED OPERATING INSTRUCTIONS:

Furnish approved operating instructions for each system and principal item of equipment as specified in each individual section for the use of the operation and maintenance personnel. The operating instructions shall include wiring diagrams, control diagrams, and control sequence for each principal item of equipment. Operating instructions shall be printed or engraved, and shall be framed under glass or in approved laminated plastic and posted where directed. Operating instructions shall be attached to or posted adjacent to each principal item of equipment and include directions for start-up, proper adjustment, operating lubrication, shutdown, safety precautions, procedure in the event of equipment failure, and other areas as recommended by the manufacturer of each item of equipment.

1.6 DELIVERY AND STORAGE:

Equipment and materials shall be handled, stored, and protected to prevent damage before and during installation in accordance with the manufacturer's recommendations. Damaged or defective items shall be replaced.

1.7 STANDARDS PRODUCTS/SERVICE AVAILABILITY:

- A. Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products, which are of similar material, design and workmanship. The standard products shall have been in satisfactory commercial or industrial use for two (2) years prior to bid opening.
- B. Service Support: The equipment items shall be supported by service organizations. The Contractor shall submit a certified list of qualified permanent service organizations for support of the equipment which includes their addresses and qualifications. These service organizations shall be reasonably convenient to the equipment installation and able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.
- C. Manufacturer's Nameplate: Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

1.8 SAFETY REQUIREMENTS:

- A. Belts, pulleys, chains, gears, couplings, projecting setscrews, keys, rotating parts, and other power transmission apparatus, located so that any person can come in close proximity thereto, shall be fully located or properly guarded. Points of operation, ingoing nip points, and machinery producing flying chips and sparks shall be guarded.

1.9 AS-BUILT DRAWING:

After completion, but before final acceptance of the work, furnish a complete set of as-built drawings of each system for record and occupancy permit purposes. The Contractor Professional Engineer shall sign the as-built drawing in applying for occupancy permit.

PART 2 – EXECUTION

- 2.1. Fire Protection Contractor shall employ on the job at all times a competent superintendent responsible for the progress and execution of work. Equipment,

materials and Workmanship shall be of high quality conforming to standard practice as stipulated by NFPA.

- 2.2. The Consultant shall witness the formal test and approve all system before they are accepted by the Owner.
- 2.3. All equipment and installation shall be guaranteed for one (1) year from the date of acceptance against failure of components resulting from normal use or factory defects. Any parts of the system or equipment that becomes defective during the term of guarantee shall be repaired or replaced by the Contractor at his own expense.

***** END OF SECTION *****

DIVISION 21 – FIRE SUPPRESSION

SECTION 21 13 13

WET PIPE SPRINKLER SYSTEMS FIRE PROTECTION

PART 1 – GENERAL

1.1. SPRINKLER SYSTEM DESIGN

Except as modified herein, design automatic wet pipe fire sprinkler system in accordance with the required and advisory provisions of NFPA 13. Locate sprinklers in a consistent pattern with ceiling grid, lights, and air supply diffusers. All devices and equipment for fire protection service shall be UL Listed and FM Approve for use in wet pipe sprinkler system. Provide seismic protection for the sprinkler system.

1.1.1. Location of Sprinklers

Sprinklers in relation to the ceiling and the spacing of sprinkler shall not exceed that permitted by NFPA 13 for light and ordinary hazard occupancy. Uniformly space sprinklers on the branch piping. Sprinkler shall provide coverage throughout 100 percent of the building. This includes, but is not limited to, telephone rooms, electrical equipment rooms, boiler rooms, switchgear rooms, transformer rooms, and other electrical spaces. Coverage per sprinkler shall be in accordance with NFPA 13, but shall not exceed 225 ft² for light hazard occupancies & 130 ft² for Ordinary hazard.

1.1.2. Water Distribution

Distribution shall be uniform throughout the area in which the sprinklers will open. Discharge from individual sprinklers in hydraulically most remote area shall be between 100 percent and 120 percent of the specified density.

1.1.3. Density of Application of Water

Size pipe to provide the specified density when the system is discharging the specified total maximum required flow. Application to horizontal surfaces below the sprinkler shall be 0.10 gpm per sq. ft for areas classified as light hazard and 0.15 gpm per sq. ft for

areas classified as ordinary hazard group 1 and 0.20 gpm per sq. ft. for areas classified as ordinary hazard group 2.

1.1.4.Sprinkler Discharge Area

Area shall be the hydraulically most remote 1,500 sq. ft.

1.1.5.Inside Hose Allowance

Add an allowance for interior hose stream of 100gpm.

For sprinkler systems in residential occupancies, which are designed to NFPA13 R standards, paragraphs which address hydraulic design and sprinkler spacing must be edited according to NFPA13 R requirements.

1.1.6.Hydraulic Design

For sprinkler systems in residential occupancies, which are designed to NFPA 13 R standards, paragraphs which address hydraulic design and sprinkler spacing must be edited according to NFPA13 R requirements.

Discharge density for non-storage occupancies must be in accordance with UFC 3-600-01. Specific densities must be listed on the drawings or noted in the specification when drawings are not provided.

Stating "comply with UFC3-600-01 is not acceptable.

Hazard classification of miscellaneous storage must comply with NFPA 13. Discharge density for the hazard classification must comply with UFC3-600-01.

Hydraulically design the system to discharge a minimum density of 0.1 gpm/square feet over the hydraulically most demanding 1500 square feet of floor area for light hazard and 0.15 gpm/ft² for ordinary hazard group 1 and 0.2 gpm/ft² for ordinary hazard group 2. Hydraulic calculations shall be in accordance with the Area/Density Method of NFPA 13.

1.1.6.1. Basis for Calculations

Perform a fire hydrant flow test prior to shop drawing submittal in accordance with NFPA 291. Results must include hydrant elevations relative to the building and hydrant number/identifiers for the tested hydrants, including which were flowed, which had a gauge. This information must be presented in a tabular form if multiple hydrants were flowed. The results must be included with the hydraulic calculations.

Hydraulic calculations must be based on flow test noted in this paragraph, unless Fire Protection Engineer and approved by Contracting Officer. Hydraulic calculations must be based upon the Hazen-Williams formula with a "C" value noted in NFPA 13 for piping, and for existing underground piping. Hydraulic calculations must be based on operation of the fire pump(s) provided in Section 21 30 00 FIRE PUMPS. The minimum residual pressure in a service lateral (lead-in) at the design flow rate 150 percent of the fire pump rated flow must be 20 psi at the suction side of the fire pump.

1.1.6.2. Hydraulic Calculations

- a. Water supply curves and system requirements must be plotted on semi-logarithmic graph ($N^{1.85}$) paper so as to present a summary of the complete hydraulic calculation.
- b. Provide a summary sheet listing sprinklers in the design area and their respective hydraulic reference points, elevations, minimum discharge pressures and minimum flows. Elevations of hydraulic reference points (nodes) must be indicated.
- c. Documentation must identify each pipe individually and the nodes connected thereto. Indicate the diameter, length, flow, velocity, friction loss, number and type fittings, total friction loss in the pipe, equivalent pipe length and Hazen-Williams coefficient for each pipe.
- d. Where the sprinkler system is supplied by interconnected risers, the sprinkler system must be hydraulically calculated using the hydraulically most demanding single riser. The calculations must not assume the simultaneous use of more than one riser.
- e. All calculations must include the backflow preventer manufacturer's stated friction loss at the design flow or 12 psi for reduced pressure and 8 psi for double check backflow preventer, whichever is greater.
- f. All calculations must be performed back to the actual location of the flow test, taking into account the direction of flow in the service main at the test location.
- g. For gridded systems, calculations must show peaking of demand area friction loss to verify that the hydraulically most demanding area is being used. A flow diagram indicating the quantity and direction of flows must be included.

1.1.6.3 Sprinkler Coverage

Sprinklers must be uniformly spaced on branch lines. Provide coverage throughout 100 percent of the building. This includes, but is not limited to, telephone rooms, electrical equipment rooms (regardless of the fire resistance rating of the enclosure), boiler rooms, switch gear rooms, transformer rooms, attached electrical vaults and other electrical and mechanical spaces. Coverage per sprinkler must be in accordance with NFPA 13. Provide sprinklers below all obstructions in accordance with NFPA 13.

Exceptions are as follows:

- a. Sprinklers may be omitted from small rooms which are exempted for specific occupancies in accordance with NFPA 101.

- b. Facilities that are designed in accordance with NFPA 13R.

1.2. QUALITY ASSURANCE

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. In the event of a conflict between specific provisions of this specification and applicable NFPA standards, this specification shall govern. Reference to "authority having jurisdiction" shall be interpreted to mean the Local Fire Marshall/Officer.

1.2.1. Pre-construction Submittals

Within 36 days of contract award but no less than 14 days prior to commencing work on site, the prime Contractor must submit the following for review and approval. SD-02, SD-03 and SD-05 submittals received prior to the review and approval of the qualifications will be returned Disapproved without Review.

1.2.2. Fire Protection Specialist

Perform work specified in this section under the supervision of and certified by the Fire Protection Project-In-Charge, who is an individual registered professional mechanical engineer. The Fire Protection Project-In-Charge shall prepare a list of the fire protection related submittals from the Contract Submittal Register that relate to the successful installation of the sprinkler systems(s). The submittals identified on this list shall be accompanied by a letter of approval signed and dated by the Fire Protection Project-In-Charge when submitted to the Government. The Fire Protection Project-In-Charge shall be regularly engaged in the design and installation of the type and complexity of system specified in the contract documents, and shall have served in a similar capacity for at least three systems that have performed in the manner intended for a period of not less than 6 months.

1.2.3. Sprinkler System Installer

The Sprinkler System Installer shall be regularly engaged in the installation of the type and complexity of system specified in the contract documents, and shall served a similar capacity for at least three systems that have performed in the manner intended for a period of not less than 6 months. Installation drawings, shop drawing and as-built drawings shall be prepared.

1.2.4. Shop Drawings

Shop Drawings shall conform to the requirements established for working plans as prescribed in NFPA 13. Drawings shall include plan and elevation views demonstrating that the equipment will fit the allotted spaces with clearance for installation and maintenance. Each set of drawings shall include the following:

- a. A descriptive index with drawings listed in sequence by number. A legend sheet identifying device symbols, nomenclature, and conventions used in the package.
- b. Floor plans drawn to a scale not less than 1:100 1/8- inch equals 1-foot clearly showing locations of devices, equipment, risers, and other details required to clearly describe the proposed arrangement.

- 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 must show the dimension from the sprinkler and sprinkler deflector to the ceiling in finished areas.
- d. Longitudinal and transverse building sections showing typical branchline and cross main pipe routing, elevation of each typical sprinkler above finished floor and elevation of "cloud" or false ceilings in relation to the building ceilings.
- e. Plan and elevation views which establish that the equipment will fit the allotted spaces with clearance for installation and maintenance.
- f. Riser layout drawings drawn to a scale of not less than 1:25 1/2- inch equals 1-foot to show details of each system component, clearances between each other and from other equipment and construction in the room.
- g. 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. The dimension from the edge of vertical piping to the nearest adjacent wall(s) must be indicated on the drawings when vertical piping is located in stairs or other portions of the means of egress.
- h. Details of each type of pipe hanger [, seismic bracing/restraint] and related components.
- i. Include fire pump curve with shop drawings and hydraulic calculations.

1.3. DELIVERY, STORAGE, AND HANDLING

Protect all equipment delivered and placed in storage from the weather, excessive humidity and temperature variations, dirt and dust, or other contaminants. All pipes must be either capped or plugged until installed.

1.4. EXTRA MATERIALS

Submit spare parts data 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.

1.5. SPRINKLER SYSTEM DESIGNER

The sprinkler system designer must be certified as a Level [III]

[IV] Technician by National Institute for Certification in Engineering Technologies (NICET) in the Water-Based Systems Layout subfield of Fire Protection Engineering Technology in accordance with NICET 1014-7.

1.6. SPRINKLER SYSTEM INSTALLER

The sprinkler system installer must be regularly engaged in the installation of the type and complexity of system specified in the contract documents, and must have served in a similar capacity for at least three systems that have performed in the manner intended for a period of not less than 6 months.

1.7. REGULATORY REQUIREMENTS

Equipment and material must be listed or approved. Listed or approved, as used in this Section, means listed, labeled or approved by a Nationally Recognized Testing Laboratory (NRTL) such as UL Fire Prot Dir or FMAPP GUIDE. The omission of these terms under the description of an item or equipment described must not be construed as waiving this requirement. All listings or approvals by testing laboratories must be from an existing ANSI or UL published standard.

PART 2 – PRODUCTS

1.1. STANDARD PRODUCTS

Provide materials and equipment which are standard products of a manufacturer regularly engaged in the manufacture of such products and that essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

1.2. NAMEPLATES

Major components of equipment must have the manufacturer's name, address, type or style, model or serial number, catalog number, date of installation, installing Contractor's name and address, and the contract number provided on a new name plate permanently affixed to the item or equipment. Name plates must be etched metal or plastic, permanently attached by screws to control units, panels or adjacent walls.

1.3. IDENTIFICATION AND MARKING

Pipe and fitting markings must include name or identifying symbol of manufacturer and nominal size. Pipe must be marked with ASTM designation. Valves and equipment markings must have name or identifying symbol of manufacturer, specific model number, nominal size, name of device, arrow indicating direction of flow, and position of installation (horizontal or vertical), except if valve can be installed in either position. Markings must be included on the body casting or on an etched or stamped metal name plate permanently on the valve or cover plate.

1.4. PRESSURE RATINGS

Valves, fittings, couplings, alarm switches, and similar devices must be rated for the maximum working pressures that can be experienced in the system, but in no case less than 250 psi.

1.5. REQUIREMENTS FOR FIRE PROTECTION SERVICE

Provide Materials and Equipment that have been tested by Underwriters Laboratories, Inc. and are listed in UL Fire Prot Dir or approved by Factory Mutual and listed in FM P7825a and FM P7825b. Where the terms "listed" or "approved" appear in this specification, such shall mean listed in UL Fire Prot Dir or FM P7825a and FM P7825b

1.6. UNDERGROUND PIPING COMPONENTS

1.6.1. Pipe

Pipe shall comply with NFPA 24. Minimum pipe size shall be 150 mm 6 inches. Piping shall be listed for fire protection service and comply with AWWA standards. Underground piping shall be equipped with corrosion protection.

1.6.2. Buried Utility Warning and Identification Tape

Provide detectable magnetic plastic tape manufactured specifically for warning and identification of buried piping. Tape shall be detectable by an electronic detection instrument. Provide tape in rolls 80mm minimum width, color coded for the utility involved with warning and identification imprinted in bold block letters continuously and repeatedly over the entire tape length. Warning and identification shall read "CAUTION BURIED WATER PIPING BELOW" or similar wording. Use permanent code and letter colouring unaffected by moisture and other substances contained in trench backfill material.

1.6.3. Fittings and Gasket

Fittings must be ductile-iron conforming to AWWA C110/A21.10 with cement mortar lining conforming to AWWA C104/A21.4. Gaskets must be suitable in design and size for the pipe with which such gaskets are to be used. Gaskets for ductile-iron pipe joints must conform to AWWA C111/A21.11.

1.6.4. Gate Valve and Indicator Post

Installation must comply with NFPA 24. Gate valves for use with indicator post must conform to UL 262. Indicator posts must conform to UL 789. Provide each indicator post with one coat of primer and two coats of red enamel paint.

1.6.5. Valve Boxes

Except where indicator posts are provided, for each buried valve, provide a cast-iron, ductile-iron, or plastic valve box of a suitable size. Plastic boxes must be constructed of a crylonitrile-butadiene-styrene (ABS) or inorganic fiber-reinforced black polyolefin. Provide cast-iron, ductile-iron, or plastic cover for valve box with the word "WATER" cast on the cover. The minimum box shaft diameter must be 5.25 inches. Coat cast-iron and ductile-iron boxes with bituminous paint applied to a minimum dry-film thickness of 10 mils.

1.7. ABOVEGROUND PIPING COMPONENTS

Except as modified herein, steel pipe must be black as permitted by NFPA 13 and conform to the applicable provisions of ASTM A53/A53M, ASTM A135/A135M or ASTM A153/A153M. Steel pipe must be minimum Schedule 40 for sizes 2 inches and above, welded or mechanical groove connections. ERW steel pipe sch.40, steel piping with wall thickness not less than Schedule 40. Grooved pipe must be cut-grooved.

1.7.1. Steel Piping Components

1.7.1.1. Steel Pipe

Except as modified herein, steel pipe shall be B.I. or galvanized where indicated as permitted by NFPA 13 and shall conform to applicable provisions of ASTM A

795/A 795M, ASTM A 53/A 53M, or ASTM A 135/A 135M. Pipe in which threads or grooves are cut or rolled formed shall be Schedule 40 or shall be listed by Underwriters' Laboratories to have a corrosion resistance ratio (CRR) of 1.0 or greater after threads or grooves are cut or rolled formed. Pipe shall be marked with the name of the manufacturer, kind of pipe, and ASTM designation.

1.7.1.2. Fittings

Fittings must be welded, threaded, or grooved-end type. Threaded fittings must be cast-iron conforming to ASME B16.4, malleable-iron conforming to ASME B16.3 or ductile-iron conforming to ASTM A536. Plain-end fittings with mechanical couplings, fittings that use steel gripping devices to bite into the pipe, steel press fittings and field welded fittings are not permitted. Fittings, mechanical couplings, and rubber gaskets must be supplied by the same manufacturer. Threaded fittings must use Teflon tape or manufacturer's approved joint compound. Saddle tees using rubber gasketed fittings are permitted only when connecting to existing piping for additions or modifications. Saddle tees must use a connection method that completely wraps around the pipe. Reducing couplings are not permitted except as allowed by NFPA 13.

1.7.1.3. Grooved Mechanical Joints and Fittings

Joints and fittings must be designed for not less than 175 psi service and the product of the same manufacturer. Field welded fittings must not be used. Fitting and coupling housing must be malleable-iron conforming to ASTM A47/A47M, Grade 32510; ductile-iron conforming to ASTM A536, Grade 65-45-12. Rubber gasketed grooved-end pipe and fittings with mechanical couplings are permitted in pipe sizes 50 mm 2 inches and larger. Gasket must be the flush type that fills the entire cavity between the fitting and the pipe. Nuts and bolts must be heat-treated steel conforming to ASTM A183 and must be cadmium-plated or zinc-electroplated.

1.7.1.4. Flanges

Flanges shall conform to NFPA 13 and ASME B16.1. Gaskets shall be non-asbestos compressed material in accordance with ASME B16.21, 1/16 inch thick, and full face or self-centred flat ring type. Flanges matching valve facing, either raised face (RF) or flat face (FF), socket weld type, matching flanges according to ANSI, DIN or JIS standards.

1.7.1.5. Bolts, Nut, and Washers

Bolts shall conform to ASTM A 449, Type 1 and shall extend no less than three full threads beyond the nut with bolts tightened to the required torque. Nuts shall be hexagon type conforming to ASME B18.2.2. Washers shall meet the requirements of ASTM F 436. Flat circular washers shall be provided under all bolt heads and nuts.

1.7.2. Valves

1.7.2.1. 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 Bld Mat Dir or FM P7825a and FM P7825b.

1.7.2.2. Check Valve

Check valve 2 inches and larger shall be listed in UL Bld Mat Dir or FM P7825a and FM P7825b. Check valves 4 inches and larger shall be of the swing type with flanged cast iron body and flanged inspection plate, shall have a clear waterway and shall meet the requirements of MSS SP-71, for Type 3 or 4.

1.7.2.3. Hose Valve

Valve shall comply with UL 668 and shall have a minimum rating of 300 psi. Valve shall be non-rising stem, all bronze, 90 degree angle type, with 2-1/2 inch American National Standard Fire Hose Screw Thread (NH) male outlet in accordance with NFPA 1963. Hose valve shall be provided with 2-1/2 to 1-1/2 inch reducer. Hose valves shall be equipped with lugged cap with drip drain, cap gasket and chain. Valve finish shall be polished brass.

1.8. FIRE DEPARTMENT CONNECTION

Fire department connection must be flush type with cast-brass body; matching [wall] escutcheon lettered "Auto Spkr" with a polished-brass finish. The connection must have individual self-closing clappers, caps with drip drains and chains.] Female inlets must have 2 1/2-inch (65mm), American National Fire Hose Connection Screw Threads (NH) per NFPA 1963. Comply with UL 405.

1.9. BACKFLOW PREVENTER TEST CONNECTION

Test connection must consist of a series of listed hose valves with 65-mm 2 1/2-inch National Standard male hose threads with cap and chain.

1.10. VALVE SUPERVISORY (TAMPER) SWITCH

Switch must be integral to the control valve or suitable for mounting to the type of control valve to be supervised open. The switch must be tamper resistant and contain 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.

1.11. SPRINKLER ALARM SWITCH

Vane or pressure-type flow switch(es). Connection of switch must be by the fire alarm installer]. Vane type alarm actuating devices must have mechanical diaphragm controlled retard device adjustable from 10 to 60 seconds and must instantly recycle. Flow switches for elevator power shunt must not have a retard feature.

1.12. ALARM CHECK VALVE ASSEMBLY

Provide variable pressure type 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

1.13. WATERFLOW ALARM

Mechanically operated, exterior-mounted, water motor alarm assembly shall be provided and installed in accordance with NFPA 13. Water motor alarm 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 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 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.

1.14. ALARM INITIATING AND SUPERVISORY DEVICES

1.14.1. Sprinkler Water flow 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 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 be tamper resistant and contain two SPDT (Form C) contacts arranged to transfer upon removal of the housing cover, 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.

1.14.2. Sprinkler Pressure (Water flow) Alarm Switch

Pressure switch shall include a metal housing with a neoprene diaphragm, SPDT snap action switches and a 1/2 inch NPT male pipe thread. The switch shall have a maximum service pressure rating of 175 psi. There shall be two SPDT (Form C) contacts factory adjusted to operate at 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.

1.14.3. 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. OS&Y valves with tamper switch or Butterfly valves with FACP interfacing modules.

1.15. FIRE DEPARTMENT CONNECTION

Fire department connection shall be flush type with cast brass body matching wall escutcheon lettered "Auto Spkr" with a polished brass finish. The connection shall have two inlets with individual self-closing clappers, caps with drip drains and chains. Female inlets shall have 2-1/2 inch diameter American National Fire Hose Connection Screw Threads (NH) per NFPA 1963.

1.16. SPRINKLERS

Provide nominal 0.50 inch or 0.75 inch orifice sprinklers. Sprinklers with internal O-rings shall not be used. Sprinklers shall be used in accordance with their listed coverage limitations. Temperature classification shall be 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.

1.16.1. Pendent Sprinkler

Pendent sprinkler shall be of the fusible strut or glass bulb type, recessed type with nominal 1/2 inch or 17/32 inch orifice. Pendent sprinklers shall have a polished chrome finish.

1.16.2. Upright Sprinkler

Upright sprinkler shall have a nominal 1/2 inch or 3/4 inch orifice.

1.17. DISINFECTING MATERIALS

1.17.1. Liquid Chlorine

Liquid chlorine shall conform to AWWA B301.

1.17.2. Hypochlorites

Calcium hypochlorite and sodium hypochlorite shall conform to AWWA B300.

1.18. ACCESSORIES

1.18.1. 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.

1.18.2. Pendent Sprinkler Escutcheon

Escutcheon shall be one-piece metallic type with a depth of less than 3/4 inch and suitable for installation on pendent sprinklers. The escutcheon shall have a factory finish that matches the pendent sprinkler heads.

1.18.3. 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.

1.18.4. 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.

1.18.5. Identification Sign

Valve identification sign shall be minimum 6 inches wide by 2 inches high with enamel baked finish on minimum 18 gauge steel or 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.

PART 3 – EXECUTION

3.1. VERIFYING ACTUAL FIELD CONDITIONS

Before commencing work, examine all adjoining work on which the contractor's work that is dependent for perfect workmanship according to the intent of this specification section, and report to the Contracting Officer's Representative a condition that prevents performance of first class work. No "waiver of responsibility" for incomplete, inadequate or defective adjoining work will be considered unless notice has been filed before submittal of a proposal.

3.2. FIELD MEASUREMENTS

After becoming familiar with all details of the work, verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing the work.

3.3. INSTALLATION REQUIREMENTS

The installation must be in accordance with the applicable provisions of NFPA 13, NFPA 24 and publications referenced therein. Installation of in-rack sprinklers must comply with applicable provisions of NFPA 13. Locate sprinklers in a

consistent pattern with ceiling grid, lights, and air supply diffusers. Install sprinkler system over and under ducts, piping and platforms when such equipment can negatively affect or disrupt the sprinkler discharge pattern and coverage.

- a. Piping offsets, fittings, and other accessories required must be furnished to provide a complete installation and to eliminate interference with other construction.
- b. Wherever the contractor's work interconnects with work of other trades the Contractor must coordinate with other Contractors to insure all Contractors have the information necessary so that they may properly install all necessary connections and equipment. Identify all work items needing access dampers and similar equipment that are concealed above hung ceilings by permanent color coded pins/tabs in the ceiling directly below the item.
- c. Provide required supports and hangers for piping, conduit, and equipment so that loading will not exceed allowable loadings of structure. Submittal of a bid must be a deemed representation that the contractor submitting such bid has a certain allowable loadings and has included in his estimates the costs associated in furnishing required supports.

3.4. INSPECTION BY FIRE PROTECTION SPECIALIST

The Fire Protection Specialist shall: 1) inspect the sprinkler system periodically during the installation to assure that the sprinkler system is being provided and installed in accordance with the contract requirements, 2) witness the preliminary and final tests, and sign the test results, 3) after completion of the system inspections and a successful final test, certify in writing that the system has been installed in accordance with the contract requirements. Any discrepancy shall be brought to the attention of the Contracting Officer in writing, no later than three working days after the discrepancy is discovered.

3.5. ABOVEGROUND PIPING INSTALLATION

3.5.1. Protection of Piping against Earthquake Damage

Seismically protect the system piping against damage from earthquakes. This requirement is not subject to determination under NFPA 13. Install the seismic protection of the system piping in accordance with UFC 3-310-04, NFPA 13 and Annex A. Include the required features identified therein that are applicable to the specific piping system.

3.5.2. Piping in Exposed Areas

Install exposed piping without diminishing exit access widths, corridors or equipment access. Exposed horizontal piping, including drain piping, shall be installed to provide maximum headroom.

3.5.3. 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.

3.5.4. Pendent Sprinklers

Drop nipples to pendent sprinklers shall consist of minimum 1 inch pipe with a reducing coupling into which the sprinkler shall be threaded. Hangers shall be provided on arm-over's to drop nipples supplying pendent sprinklers when the arm-over exceeds 12 inches for steel pipe or 6 inches for copper tubing. 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 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 4 inches. Recessed pendent sprinklers shall be installed such that the distance from the sprinkler deflector to the underside of the ceiling shall not exceed the manufacturer's listed range and shall be of uniform depth throughout the finished area. Pendent sprinklers in suspended ceilings shall be a minimum of 6 inches from ceiling grid.

3.5.5. 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, fittings and grooving tools shall be products of the same manufacturer. For copper tubing, pipe and groove dimensions shall comply with the tolerances specified by the coupling manufacturer. The diameter of grooves made in the field shall be measured using a "go/no-go" gauge, vernier or dial caliper, narrow-land micrometer, or other method specifically approved by the coupling manufacturer for the intended application. Groove width and dimension of groove from end of pipe shall be measured and recorded for each change in grooving tool setup to verify compliance with coupling manufacturer's tolerances. Grooved joints shall not be used in concealed locations, such as behind solid walls or ceilings, unless an access panel is shown on the drawings for servicing or adjusting the joint.

3.5.6. 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 1/2 inch.

3.5.7. 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 penetrate fire walls, fire partitions, or floors, pipes shall be fire stopped. In penetrations that 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 that will dry to a firm but pliable mass or with a mechanically adjustable segmented elastomeric seal.

3.5.8. 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.

3.5.9. Inspector's Test Connection

Unless otherwise indicated, test connection shall consist of 1 inch pipe connected to the remote branch line; a test valve located approximately 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.

3.5.10. Drains

Main drain piping shall be provided to discharge at the location indicated. Auxiliary drains shall be provided as required by NFPA 13.

3.5.11. Installation of Fire Department Connection

Connection shall be mounted on the exterior wall approximately 3 feet above finished grade. 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.

3.5.12. 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.

3.6. UNDERGROUND PIPING INSTALLATION

The fire protection water main shall be laid, and joints anchored, in accordance with NFPA 24. Minimum depth of cover shall be 3 feet. The supply line shall terminate inside the building with a flanged piece, the bottom of which shall be set not less than 6 inches above the finished floor. A blind flange shall be installed temporarily on top of the flanged piece to prevent the entrance of foreign matter into the supply line. A concrete thrust block shall be provided at the elbow where the pipe turns up toward the floor. In addition, joints shall be anchored in accordance with NFPA 24 using pipe clamps and steel rods from the elbow to the flange above the floor and from the elbow to a pipe clamp in the horizontal run of pipe. Buried steel components shall be provided with a corrosion protective coating in accordance with AWWA C203. Piping more than 5 feet outside the building walls shall meet the requirements of Water Distribution.

3.7. EARTHWORK

All excavations shall be restored so its surface contour blends in with the surrounding area. Areas of roadways and pavement shall be excavated and restored. The bottom of the trench shall be dry or sufficient drained so that there is no standing water before the support and bedding layers are placed and compacted. The bedding layer must be sufficiently drained so that there is no standing water on the bedding layer before the pipe is installed. The depth of the trench shall be dug deep enough to provide a minimum ground cover above the top of the pipe. Ground bed of at least 150mm in depth below the bottom of the pipe. The width of the trench should be wide enough to allow room for jointing. A bedding layer of clean sand 150mm in depth is required for all trenches. The sand shall be free of debris and rocks and compacted to at least 70% relative density in accordance with ASTM D4253 and ASTM D4254.

The minimum ground cover requirements shall be 900 mm minimum. If it is impossible to achieve the minimum cover as specified, piping shall be protected by a reinforced concrete slab.

3.8. DISINFECTION

After all system components are installed and hydrostatic test(s) are completed, the entire sprinkler system shall be disinfected. Flush all sprinkler system piping with potable water until any entrained dirt and other foreign materials have been removed before introducing chlorinating material. Remove the flushing fitting of each cross main and of each grid branch line and then back-flush through the sprinkler main drain.

- a. The water chlorination procedure shall be in accordance with AWWA C651 and AWWA C652. Feed either a hypochlorite solution (using a hypo chlorinator) or liquid
- b. Chlorine (using a solution-fed chlorinator and booster pump) into the system at a constant rate of 50 parts per million (ppm) until the entire system is filled.
- c. Monitor the chlorine residual level in the water at six hour intervals for a period of 24 hours. If the residual chlorine is below 25 ppm in any interval sampled, flush all piping and repeat the chlorination procedure. Open and close each valve in the system several times during this 24 hour period to ensure its proper disinfection. Following the 24-hour period, verify that no less than 25 ppm chlorine residual remains in the system. After the chlorine residual level is successfully maintained at or above 25 ppm for a 24 hour period, flush the system with water from the distribution system until the residual chlorine is reduced to less than one ppm.
- d. Take additional samples of water at locations specified by the Contracting Officer in disinfected containers for bacterial examination. Test these samples in an approved laboratory for total coli form organisms (coli form bacteria, fecal coli form, streptococcal, and other bacteria) in accordance with EPA Standard Method SM9223, Total Coli forms-PA Test.
- e. Disinfection shall be repeated until tests indicate the absence of coli form organisms (zero mean coli form density per 100 milliliters) in two separate test samples taken 24 hours apart. The system will not be accepted until satisfactory bacteriological results have been obtained.

3.9. PIPE COLOR CODE MARKING

The sprinkler pipes shall painted with one coat of primer and two coats of fire red enamel paint.

3.10. PRELIMINARY TESTS

The system, including the underground water mains, and the aboveground piping and system components, shall be tested to assure that equipment and components function as intended. The underground and above ground interior piping systems and attached appurtenances subjected to system working pressure shall be tested in accordance with NFPA 13 and NFPA 24. Upon completion of specified tests, complete certificates as specified in paragraph SUBMITTALS.

3.10.1. Underground Piping

3.10.1.1. Flushing

Underground piping shall be flushed in accordance with NFPA 24. This includes the requirement to flush the lead-in connection to the fire protection system at a flow rate not less than the calculated maximum water demand rate of the system.

3.10.1.2. Hydrostatic Testing

New underground piping shall be hydrostatically tested in accordance with NFPA 24. The allowable leakage shall be measured at the specified test pressure by pumping from a calibrated container. The amount of leakage at the joints shall not exceed 2 quarts per hour per 100 gaskets or joints, regardless of pipe diameter.

3.10.2. Aboveground Piping

3.10.2.1. Hydrostatic Testing

Aboveground piping shall be hydrostatically tested in accordance with NFPA 13 at not less than 200 psi or 50 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.

3.10.2.2. Backflow Prevention Assembly Forward Flow Test

Each backflow prevention assembly shall be tested at system flow demand, including all applicable hose streams, as specified in NFPA 13. Provide all equipment and instruments necessary to conduct a complete forward flow test, including 2.5 inch diameter hoses, play pipe nozzles, calibrated pressure gauges, pitot tube gauge, plus all necessary supports to safely secure hoses and nozzles during the test. At the system demand flow, the pressure readings and pressure drop (friction) across the assembly shall be recorded. Provide a metal placard on the backflow prevention assembly that lists the pressure readings both upstream and downstream of the assembly, total pressure drop, and the system test flow rate. The pressure drop shall be compared to the manufacturer's data.

3.10.3. 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.

3.10.4. 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.

3.11. FINAL ACCEPTANCE TEST

Begin the Final Acceptance Test only when the Preliminary Test Report has been approved. The Fire Protection Engineer-In charge shall conduct the Final Acceptance Test 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 water flow 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. Submit the Final Acceptance Test Report as specified in the Submittals paragraph.

***** END OF SECTION *****

DIVISION 21 – FIRE SUPPRESSION

SECTION 21 30 00

FIRE PUMPS

PART I - GENERAL

- 1.1 Except as modified in this section or on the drawings, install fire pumps in conformance with NFPA 20, NFPA 70, and NFPA 72. In the event of a conflict between specific provisions of this specification and applicable NFPA standards, this specification governs. Devices and equipment for fire protection service must be UL Listed & FM Approved.

1.2 SEQUENCING

1.2.1 PrimaryFirePump

Primary fire pump shall automatically operate when the pressure drops to 110 psi. Pumps shall continue to run until shut down manually. The fire pump shall automatically stop operating when the system pressure reaches 125 psi and after the fire pump has operated for the minimum pump run time specified herein or has reached its cut-out pressure set on the controller.

1.2.2 Pressure Maintenance Pump-(Jockey Pump)

Pressure maintenance pump shall operate when the system pressure drops to 115 psi. Pump shall automatically stop when the system pressure reaches 125 psi and after the pump has operated for the minimum pump run time specified herein. Pump is mainly used to build up system pressure.

1.3 FIRE PUMP INSTALLATION RELATED MATERIALS

The Fire Protection Specialist shall prepare a list of the submittals, from the Contract Submittal Register, that relate to the successful installation of the fire pump(s), no later than 7 days after the approval of the Fire Protection Specialist and the Manufacturer's Representative. The submittals identified on this list shall be accompanied by a letter of approval signed and dated by the Fire Protection Specialist when submitted

1.4 QUALITY ASSURANCE

1.4.1 Fire Protection Specialist

Work specified in this section shall be performed under the supervision of and certified by the Fire Protection Specialist. Submit the name and documentation of certification of the proposed Fire Protection Specialists. The Fire Protection Specialist shall be an individual who is a registered professional engineer and a Full Member of the Society of Fire Protection Engineers or who is certified as a Level 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 1014-7. The Fire Protection Specialist shall be regularly engaged in the design and installation of the type and complexity of system specified in the Contract documents, and shall have served in a similar capacity for at least three systems that have performed in the manner intended for a period of not less than 6 months.

1.4.2 Qualifications of Welder

Submit certificates of each welder's qualifications prior to site welding; certifications shall not be more than one year old.

1.4.3 Qualifications of Installer

Prior to installation, submit data for approval showing that the Contractor has successfully installed fire pumps and associated equipment of the same type and design as specified herein, or that he has a firm contractual agreement with a subcontractor having such required experience. The data shall include the names and locations of at least two installations where the Contractor or the subcontractor referred to above, has installed such systems. Indicate the type and design of each system and certify that each system has performed satisfactorily in the manner intended for a period of not less than 18 months.

1.4.4 Preliminary Test Certification

When preliminary tests have been completed and corrections made, submit a signed and dated certificate with a request for a formal inspection and tests.

1.4.5 Final Test Certification

Concurrent with the Final Acceptance Test Report, submit certification by the Fire Protection Specialist that the fire pump installation is in accordance with the contract requirements, including signed approval of the Preliminary and Final Acceptance Test Reports. Submit data for approval showing the name and certification of all involved individuals with such qualifications at or prior to submittal of drawings.

1.4.6 Manufacturers Representative

Work specified in this section shall be performed under the supervision of and certified by a representative of the fire pump manufacturer. Submit the name and documentation of certification of the proposed Manufacturer's Representative, concurrent with submittal of the Fire Protection Specialist Qualifications. The Manufacturer's Representative shall be regularly engaged in the installation of the type and complexity of fire pump(s) specified in the Contract documents, and shall

have served in a similar capacity for at least three systems that have performed in the manner intended for a period of not less than 6 months.

1.5 DELIVERY, STORAGE AND HANDLING

Protect all equipment delivered and placed in storage from the weather, excessive humidity and temperature variations, dirt and dust, or other contaminants. Additionally, all pipes shall be either capped or plugged until installed.

1.6 EXTRA MATERIALS

Submit Spare Parts data for each different item of equipment and material 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. Include a list of special tools and test equipment required for maintenance and testing of the products supplied by the Contractor.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- a. 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.
- b. All equipment shall have a nameplate that identifies the manufacturer's name, address, type or style, model or serial number, contract number and accepted date; capacity or size; system in which installed and system which it controls and catalog number. Pumps and motors shall have standard nameplates securely affixed in a conspicuous place and easy to read. Fire pump shall have nameplates and markings in accordance with UL 448. Electric motor nameplates shall provide the minimum information required by NFPA 70.

2.2 FIRE PUMP

- a. Fire pump shall be electric motor driven as primary pump with supply of emergency power from generator as secondary power supply. Fire pump shall furnish not less than 150 percent of rated flow capacity at not less than 65 percent of rated net pressure. Pump shall be Vertical Turbine type equipped with all standard accessories. Pump shall be automatic start and manual stop. Pump shall conform to the requirements of UL 448.
- b. Submit manufacturer's catalog data included with the Fire Pump Installation Drawings for each separate piece of equipment proposed for use in the system. Catalog data shall indicate the name of the manufacturer of each item of equipment, with data annotated to indicate model to be provided. In addition, a complete equipment list that includes equipment description, model number and quantity shall be provided. Catalog data for material and equipment shall include, but not be limited to, the following:
 1. Fire pumps, drivers and controllers including manufacturer's certified shop test characteristic curve for each pump. Shop test curve may be submitted after approval of catalog data but shall be submitted prior to the final tests.

2. Pressure maintenance pump and controller.
3. Piping components.
4. Valves, including gate, check, globe and relief valves.
5. Gauges.
6. Hose valve manifold test header and hose valves.
7. Flowmeter.
8. Restrictive orifice union.
9. Associated devices and equipment.

- c. All equipment shall have a name plate that identifies the manufacturer's name, address, type or style, model or serial number, [contract number and accepted date; capacity or size; system in which installed and system which it controls] and catalog number. Pumps and motors shall have standard nameplates securely affixed in a conspicuous place and easy to read. Fire pump shall have nameplates and markings in accordance with UL 448. Diesel driver shall have nameplate and markings in accordance with UL 1247. Electric motor nameplates shall provide the minimum information required by NFPA 70, Section 430-7.

2.3 FIRE PUMP

Fire pump shall be vertical turbine, electric motor driven. Each pump capacity shall be rated at 300 gpm with a rated net pressure of 140 psi. Fire pump shall furnish not less than 150 percent of rated flow capacity at not less than 65 percent of rated net pressure. Pump shall be centrifugal water lubricated, vertical shaft turbine fire pump. Pump shall be automatic start and manual stop.

2.4 REQUIREMENTS FOR FIRE PROTECTION SERVICE

2.4.1 General Requirements

Materials and Equipment shall have been tested by Underwriters Laboratories, Inc. and listed in UL Fire Prot Dir or approved by Factory Mutual and listed in FM P7825a and FM P7825b. Where the terms "listed" or "approved" appear in this specification, such shall mean listed in UL Fire Prot Dir or FM P7825a and FM P7825b.

2.4.2 Alarms

NOTE: Power for alarms must be from a source other than the engine starting batteries and shall not exceed 125 volts. Power shall not be supplied from the same circuit supplying power to the fire pump controllers or from an emergency circuit.

Provide audible and visual alarms as required by NFPA 20 on the controller. Provide remote supervision as required by NFPA 20, in accordance with NFPA 72. Provide remote alarm devices located at where shown. Alarm signal shall be activated upon the following conditions: fire pump controller has operated into a pump running condition; pump controller main switch has been turned to OFF or to MANUAL position. Exterior alarm devices shall be weatherproof type. Provide alarm silencing switch and

red signal lamp, with signal lamp arranged to come on when switch is placed in OFF position.

2.5 ABOVE GROUND PIPING COMPONENTS

2.5.1 Pipe Sizes 65mm Ø and Larger

2.5.1.1 Pipe

Piping shall be Electric Resistance Welded, Grade A or Grade B in accordance with ASTM A 53/A 53M, Schedule 40, Grade A or B, black steel pipe. Steel pipe shall be joined by means of flanges welded to the pipe. Mechanical grooved joint is acceptable method for seismic considerations only. Suction piping shall be galvanized in accordance with NFPA 20. Pipe riser of size 150mm and larger in diameter shall be seamless type in accordance with ASTM A53 Grade A or B, schedule 80, black steel pipe.

2.5.1.2 Grooved Mechanical Joints and Fittings

Joints and fittings shall be designed for not less than 175 psi service and shall be the product of the same manufacturer. Fitting and coupling houses shall be malleable iron conforming to ASTM A 47/A 47M, Grade 32510; ductile iron conforming to ASTM A 536, Grade 65-45-12. Gasket shall be the flush type that fills the entire cavity between the fitting and the pipe. Nuts and bolts shall be alloy steel conforming to ASTM A193/A193M and ASTM A194/A194M respectively.

2.5.1.3 Flanges

Flanges shall be ASME B16.5, raised face finished, Class 150 flanges. Flanges shall be provided at valves connections to equipment, and where indicated.

2.5.1.4 Gaskets

Gaskets shall be AWWA C111/A21.11, cloth inserted red rubber gaskets.

2.5.1.5 Bolts

Bolts shall be ASTM A 193/A 193M, Grade B7. Bolts shall extend no less than three full threads beyond the nut with bolts tightened to the required torque.

2.5.1.6 Nuts

Nuts shall be ASTM A 194/A 194M, Grade B7.

Washers shall meet the requirements of ASTM F 436. Flat circular washers shall be provided under all bolt heads and nuts.

2.5.2 Piping Sizes 50mm and Smaller

2.5.2.1 Steel Pipe

Steel piping shall be ASTM A53/A53M, Schedule 40, Grade A or Grade B, electric resistance welding, black steel pipe with threaded end connections. Fittings shall be ASME B16.3, Class 150, zinc-coated threaded fittings. Unions shall be ASME B16.39, Class 150, zinc-coated unions.

2.5.3 Pipe Hangers and Supports

Pipe hangers and support shall be MSS SP-58 and or MSS SP-69, UL listed UL Fire Prot Dir or FM approved FM P7825a and FM P7825b and shall be fixed or adjustable type. Finish of rods, nuts, washers, hangers, and supports shall be zinc-plated after fabrication.

2.5.4 Valves

Valves shall be UL listed UL Fire Prot Dir or FM approved FM P7825a and FM P7825b for fire protection service. Valves shall have flange or threaded end connections.

2.5.4.1 Gate Valves and Control Valves

Gate valves and control valves shall be outside screw and yoke (O.S.&Y.) type which open by counterclockwise rotation.

2.5.4.2 Tamper Switch

The suction control valves, the discharge control valves, valves to test header and flow meter, and the by-pass control valves shall be equipped with valve tamper switches for monitoring by the fire alarm system.

2.5.4.3 Check Valve

Check valve shall be clear open, swing type check valve with flange or threaded inspection plate.

2.5.4.4 Relief Valve

Relief valve shall be pilot operated or spring operated type conforming to NFPA 20. A means of detecting water motion in the relief lines shall be provided where the discharge is not visible within the pump house.

2.5.4.5 Circulating Relief Valve

An adjustable circulating relief valve shall be provided for each fire pump in accordance with NFPA 20.

2.5.4.6 Suction Pressure Regulating Valve

Suction pressure regulating valve shall be FM approved FM P7825a and FM P7825b. Suction pressure shall be monitored through a pressure line to the controlling mechanism of the regulating valve. Valve shall be arranged in accordance with the manufacturer's recommendations.

2.5.5 Hose Valve Manifold Test Header

Construct header of steel pipe. Provide ASME B16.5, Class 150 flanged inlet connection to hose valve manifold assembly. Provide approved bronze hose gate valve with 65mm Ø National Standard male hose threads with cap and chain; locate 3 feet above grade in the horizontal position for each test header outlet. Welding shall be metallic arc process in accordance with ASME B31.1.

2.5.6 Pipe Sleeves

A pipe sleeve shall be provided at each location where piping passes entirely through walls, roofs, and floors, including pipe entering buildings from the exterior. Secure sleeves in position and location during construction. Provide sleeves of sufficient length to pass through entire thickness of walls and floors. Provide 25mm minimum clearance between exterior of piping or pipe insulation, and interior of sleeve or core-drilled hole. Firmly pack space with mineral wool insulation. Seal space at both ends of the sleeve or core-drilled hole with plastic waterproof cement which will dry to a firm but pliable mass, or provide a mechanically adjustable segmented elastomeric seal. In fire walls and fire floors, a fire seal shall be provided between the pipe and the sleeve in accordance with Fire stopping.

- a. Sleeves in Masonry and Concrete Walls, Roofs, and Floors: Provide hot-dip galvanized steel or black steel pipe sleeves. Core drilling of masonry and concrete may be provided in lieu of pipe sleeves provided that cavities in the core-drilled hole be completely grouted smooth.
- b. Sleeves in Other Than Masonry and Concrete Walls, Roofs, and Floors: Provide galvanized steel sheet pipe not less than 0.90 psf.

2.5.7 Escutcheon Plates

Provide one-piece or split-hinge metal plates for piping entering floors, walls, and ceilings in exposed areas. Provide polished stainless steel or chromium-plated finish on

copper alloy plates in finished spaces. Provide paint finish on plates in unfinished spaces. Plates shall be secured in place.

2.6 DISINFECTING MATERIALS

2.6.1 Liquid Chlorine

Liquid chlorine shall conform to AWWA B301.

2.7 ELECTRIC MOTOR DRIVER

Motors, controllers, contactors, and disconnects shall be provided with their respective pieces of equipment, as specified herein and shall have electrical connections. Controllers and contactors shall have a maximum of 120-volt control circuits, and auxiliary contacts for use with the controls furnished. When motors and equipment furnished are larger than sizes indicated, the cost of providing additional electrical service and related work shall be included under this section. Motor shall conform to NEMA MG 1 Design B type. Integral size motors shall be the premium efficiency type in accordance with NEMA MG 1. Motor horsepower shall be of sufficient size so that the nameplate horsepower rating will not be exceeded throughout the entire published pump characteristic curve. The motor and fire pump controller shall be fully compatible.

2.8 FIRE PUMP CONTROLLER

Controller shall be the automatic type and UL listed UL Fire Prot Dir or FM approved FM P7825a and FM P7825b for fire pump service. Pump shall be arranged for automatic start and stop, and manual push-button stop. Automatic stopping shall be accomplished only after all starting causes have returned to normal and after a minimum pump run time has elapsed. Controllers shall be completely terminally wired, ready for field connections, and mounted in a NEMA Type 2 drip-proof or NEMA Type 4 watertight and dust tight enclosure arranged so that controller current carrying parts will not be less than 300mm above the floor. Controller shall be provided with voltage surge arresters installed in accordance with NFPA 20. Controller shall be equipped with a bourdon tube pressure switch or a solid state pressure switch with independent high and low adjustments, automatic starting relay actuated from normally closed contacts, visual alarm lamps and supervisory power light. Controller shall be equipped with a thermostat switch with adjustable setting to monitor the pump room temperature and to provide an alarm when temperature falls below 40 degrees F. The controller shall be factory-equipped with a heater operated by thermostat to prevent moisture in the cabinet.

2.8.1 Controller for Electric Motor Driven Fire Pump

Controller shall be electronic soft start, auto-transformer, wye-delta, closed circuit transition starting type. Controller and transfer switch shall have a short circuit rating as indicated. An automatic transfer switch (ATS) shall be provided for each fire pump. The ATS shall comply with NFPA 20 and shall be specifically listed for fire pump service. The ATS shall transfer source of power to the alternate source upon loss of normal power. Controller shall monitor pump running, loss of a phase or line power, phase reversal, low reservoir and pump room temperature. Alarms shall be individually displayed in front of panel by lighting of visual lamps. Each lamp shall be labeled with rigid etched plastic labels. Controller shall be equipped with terminals for remote monitoring of pump running, pump power supply trouble (loss of power or phase and phase reversal), and pump room trouble (pump room temperature and low reservoir level, and for remote start. Limited service fire pump controllers are not permitted, except for fire pumps driven by electric motors rated less than 15 hp. Controller shall be equipped with a 7-day electric pressure recorder with 24-hour spring wound back-up. The pressure recorder shall provide a read-out of the system pressure, time, and date. Controller shall require the pumps to run for ten minutes for pumps with driver motors under 200 horsepower and for 15 minutes for pumps with motors 200 horsepower and greater, prior to automatic shutdown. The controller shall be equipped with an externally operable isolating switch which manually operates the motor circuit. Means shall be provided in the controller for measuring

current for all motor circuit conductors.

2.9 PRESSURE SENSING LINE

A completely separate pressure sensing line shall be provided for each fire pump and for the jockey pump. The sensing line shall be arranged in accordance with Figure A-7-5.2.1 of NFPA 20. The sensing line shall be 1/2 inch H58 brass tubing complying with ASTM B 135. The sensing line shall be equipped with two restrictive orifice unions each. Restrictive orifice unions shall be ground-face unions with brass restricted diaphragms drilled for a 3/32 inch. Restrictive orifice unions shall be mounted in the horizontal position, not less than 5 feet apart on the sensing line. Two test connections shall be provided for each sensing line. Test connections shall consist of two brass 1/2 inch globe valves and 1/4 inch gauge connection tee arranged in accordance with NFPA 20. One of the test connections shall be equipped with a 0 to 300 psi water oil-filled gauge. Sensing line shall be connected to the pump discharge piping between the discharge piping control valve and the check valve.

2.10 PRESSURE MAINTENANCE PUMP

2.10.1 General

Pressure maintenance pump shall be electric motor driven, submersible, and centrifugal type, with a rated discharge of 1 to 5 percent of the main pump capacity. Pump shall draft from the suction supply side of the suction pipe gate valve of the fire pump or as indicated and shall discharge into the system at the downstream side of the pump discharge gate valve. An approved indicating gate valve of the outside screw and yoke (O.S.&Y.) type shall be provided in the maintenance pump discharge and suction piping. Oil-filled water pressure gauge and approved check valve in the maintenance pump discharge piping shall be provided. Check valve shall be swing type with removable inspection plate.

2.10.2 Pressure Maintenance Pump Controller

Pressure maintenance pump controller shall be arranged for automatic and manual starting and stopping and equipped with a "manual-off-automatic" switch. The controller shall be completely prewired, ready for field connections, and wall-mounted in a NEMA Type 2 drip-proof enclosure. The controller shall be equipped with a bourdon tube pressure switch or a solid state pressure switch with independent high and low adjustments for automatic starting and stopping. A sensing line shall be provided connected to the pressure maintenance pump discharge piping between the control valve and the check valve. The sensing line shall conform to paragraph, PRESSURE SENSING LINE. The sensing line shall be completely separate from the fire pump sensing lines. An adjustable run timer shall be provided to prevent frequent starting and stopping of the pump motor. The run timer shall be set for 2 minutes.

2.10.3 Steel pipe

ASTM A 53/A 53M, hot-dipped zinc-coated, Schedule 40, threaded fitting connections, shall be ASME B16.3, zinc-coated, threaded malleable iron fittings. Unions shall be ASME B16.39 zinc-coated, threaded unions.

2.11 PUMP BASE PLATE AND PAD

A common base plate shall be provided for each horizontal-shaft fire pump for mounting pump and driver unit. The base plate shall be constructed of cast iron with raised lip tapped for drainage or welded steel shapes with suitable drainage. Each base plate for the horizontal fire pumps shall be provided with a 25mm galvanized steel drain line piped to the nearest floor drain. For vertical shaft pumps, pump head shall be provided with a cast-iron base plate and shall serve as the sole plate for mounting the discharge head assembly. Pump units and bases shall

be mounted on a raised 100mm or 150mm reinforced concrete pad that is an integral part of the reinforced concrete floor.

2.12 HOSE VALVE MANIFOLD TEST HEADER

Hose valve test header shall be connected by ASME B16.5, Class 150 flange inlet connection. Hose valves shall be UL listed UL Fire Prot Dir or FM approved FM P7825a and FM P7825b bronze hose gate valves with 65mm American National Fire Hose Connection Screw Standard Threads (NH) in accordance with NFPA 1963. The number of valves shall be in accordance with NFPA 20. Each hose valve shall be equipped with a cap and chain, and located no more than 3 feet and no less than 2 feet above grade.

2.13 FLOW METER

Meter shall be UL listed UL Fire Prot Dir or FM approved FM P7825a and FM P7825b as flow meters for fire pump installation with direct flow readout device. Flow meter shall be capable of metering any water flow quantities between 50 percent and 150 percent of the rated flow of the pumps. The flow meter shall be arranged in accordance with Figure A-2-14.2.1 of NFPA 20. The meter throttle valve and the meter control valves shall be O.S.&Y. valves. Automatic air release shall be provided if flow meter test discharge is piped to the pump suction and forms a closed-loop meter arrangement as defined in Figure A-2-14.2.1 of NFPA 20. Meter shall be of the venture, annular probe or orifice plate type.

2.14 JOINTS AND FITTINGS FOR COPPER TUBE

Wrought copper and bronze solder-joint pressure fittings shall conform to ASME B16.22 and ASTM B75/B75M. Cast copper alloy solder-joint pressure fittings shall conform to ASME B16.18. Cast copper alloy fittings for flared copper tube shall conform to ASME B16.26 and ASTM B62. Brass or bronze adapters for brazed tubing may be used for connecting tubing to flange and to threaded ends of valves and equipment. Extracted brazed tee joints produced with an acceptable tool and installed as recommended by the manufacturer may be used. Grooved mechanical joints and fittings shall be designed for not less than 125 psig service and shall be the product of the same manufacturer. Grooved fitting and mechanical coupling housing shall be ductile iron conforming to ASTM A536. Gaskets for use in grooved joints shall be molded synthetic polymer of pressure responsive design and shall conform to ASTM D2000 for circulating medium up to 239 degrees F. Grooved joints shall conform to AWWA C606. Coupling nuts and bolts for use in grooved joints shall be steel and shall conform to ASTM A183.

PART 3 – EXECUTION

3.1 EXAMINATION

After becoming familiar with all details of the work, verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing the work.

3.2 FIRE PUMP INSTALLATION RELATED SUBMITTALS

The Fire Protection Engineer shall prepare a list of submittals, from the Contract Submittal Register, that relate to the successful installation of the fire pump(s). The submittals identified on this list shall be accompanied by a letter of approval signed and dated by the Fire Protection Consultant when submitted to the Government.

3.3 INSPECTION BY FIRE PROTECTION CONSULTANT

The Fire Protection Engineer shall periodically perform a thorough inspection of the fire pump installation, including visual observation of the pump while running, to assure that the installation conforms to the contract requirements. There shall be no excessive vibration, leaks (oil or water), unusual noises, overheating, or other potential problems. Inspection shall include piping and equipment clearance, access, supports, and guards. Any discrepancy shall be brought to the attention of the Contracting Officer in writing, no later than three working days after the discrepancy is discovered. The Fire Protection Engineer shall witness the preliminary and final acceptance tests and, after completion of the inspections and a successful final acceptance test, shall sign test results and certify in writing that the installation the fire pump installation is in accordance with the contract requirements.

3.4 INSTALLATION

Equipment, materials, workmanship, fabrication, assembly, erection, installation, examination, inspection and testing shall be in accordance NFPA20, except as modified herein. In addition, the fire pump and engine shall be installed in accordance with the written instructions of the manufacturer.

3.5 INSTALLATION DRAWING

Submit Fire Pump Installation Drawings consisting of a detailed plan view, detailed elevations and sections of the pump room, equipment and piping, drawn to a scale of not less than 1:20 1/2 inch = 1 foot. Drawings shall indicate equipment, piping, and associated pump equipment to scale.

Indicate all clearance, such as those between piping and equipment; between equipment and walls, ceiling and floors; and for electrical working distance clearance around all electrical equipment. Include a legend identifying all symbols, nomenclatures, and abbreviations. Indicate a complete piping and equipment layout including elevations and/or section views of the following:

- a. Fire pumps, controllers, piping, valves, and associated equipment.
- b. Sensing line for each pump including the pressure maintenance pump.
- c. Pipe hangers and sway bracing including support.
- d. A one-line schematic diagram indicating layout and sizes of all piping, devices, valves and fittings.
- e. A complete point-to-point connection drawing of the pump power, control and alarm systems, as well as interior wiring schematics of each controller.

3.6 INSTALLATION REQUIREMENTS

Carefully remove materials so as not to damage material which is to remain. Replace existing work damaged by the Contractor's operations with new work of the same construction. Equipment, materials, workmanship, fabrication, assembly, erection, installation, examination, inspection and testing shall be in accordance NFPA 20, except as modified herein. In addition, the fire pump and engine shall be installed in accordance with the written instructions of the manufacturer.

3.7 PUMP ROOM CONFIGURATION

Provide detail plan view of the pump room including elevations and sections showing the fire pumps, associated equipment, and piping. Submit working drawings on sheets

not smaller than A1 24 by 36 inches; include data for the proper installation of each system. Show piping schematic of pumps, devices, valves, pipe, and fittings. Show point to point electrical wiring diagrams. Show piping layout and sensing piping arrangement. Show engine fuel and cooling system. Include:

- a. Pumps,drivers,andcontrollers
- b. Hosevalvemanifoldtestheader
- c. Circuitdiagramsforpumps
- d. Wiringdiagramsofeachcontroller

3.8 ACCESSORIES

Tank supports, piping offsets, fittings, and any other accessories required shall be furnished as specified to provide a complete installation and to eliminate interference with other construction.

3.9 PIPE AND FITTINGS

Piping shall be inspected, tested and approved before burying, covering, or concealing. Fittings shall be provided for changes in direction of piping and for all connections. Changes in piping sizes shall be made using tapered reducing pipe fittings. Bushings shall not be used. Photograph all piping prior to burying, covering, or concealing.

3.5.1 Cleaning of Piping

Interior and ends of piping shall be clean and free of any water or foreign material. Piping shall be kept clean during installation by means of plugs or other approved methods. When work is not in progress, open ends of the piping shall be securely closed so that no water or foreign matter will enter the pipes or fittings. Piping shall be inspected before placing in position.

3.5.2 Threaded Connections

Jointing compound for pipe threads shall be polytetrafluoroethylene (PTFE) pipe thread tape conforming to ASTM D 3308 Teflon pipe thread paste and shall be applied to male threads only. Exposed ferrous pipe threads shall be provided with one coat of zinc molybdate primer applied to a minimum of dry film thickness of 1 mil.

3.5.3 Pipe Hangers and Supports

Additional hangers and supports shall be provided for concentrated loads in aboveground piping, such as for valves and risers.

3.5.3.1 Vertical Piping

Piping shall be supported at each floor, at not more than 10 foot intervals.

3.5.3.2 Horizontal Piping

Horizontal piping supports shall be spaced as follows:

MAXIMUM SPACING (FEET)										
Nominal Pipe Size inches	1 and Under	1.25	1.5	2	2.5	3	3.5	4	5	6+
Copper Tube		7	8							
Steel Pipe	7	8	9	10	11	12	13	14	16	17

3.5.4 Underground Piping

Installation of underground piping and fittings shall conform to NFPA 24. Joints shall be anchored in accordance with NFPA 24. Concrete thrust block shall be provided at elbow where pipe turns up towards floor, and the pipe riser shall be restrained with steel rods from the elbow to the flange above the floor. After installation in accordance with NFPA 24, rods and nuts shall be thoroughly cleaned and coated with asphalt or other corrosion-retard material approved by the Contracting Officer. Minimum depth of cover shall be 3 feet.

3.5.5 Grooved Mechanical Joint

Grooves shall be prepared according to the coupling manufacturer's instructions. Grooved fittings, couplings, and grooving tools shall be products of the same manufacturer. Pipe and groove dimensions shall comply with the tolerances specified by the coupling manufacturer. The diameter of grooves made in the field shall be measured using a "go/no-go" gauge, vernier or dial caliper, narrow-land micrometer, or other method specifically approved by the coupling manufacturer for the intended application. Groove width and dimension of groove from end of pipe shall be measured for each change in grooving tool setup to verify compliance with coupling manufacturer's tolerances. Grooved joints shall not be used in concealed locations, such as behind solid walls or ceilings, unless an access panel is shown on the drawings for servicing or adjusting the joint.

3.6 ELECTRICAL WORK

Electric motor and controls shall be in accordance with NFPA 20, NFPA 72 and NFPA 70, unless more stringent requirements are specified herein or are indicated on the drawings. Electrical wiring and associated equipment shall be provided in accordance with NFPA 20. Provide wiring in rigid metal conduit or intermediate metal conduit, except electrical metallic tubing conduit may be provided in dry locations not enclosed in concrete or where not subject to mechanical damage.

3.7 PIPE COLOR CODE MARKING

Color code marking of piping shall be in accordance with current code.

3.8 FLUSHING

The fire pump suction and discharge piping shall be flushed at 150 percent of rated capacity of each pump. Where the pump installation consists of more than one pump, the flushing shall be the total quantity of water flowing when all pumps are discharging at 120 or 150 percent of their

rated capacities. The new pumps may be used to attain the required flushing volume. No underground piping shall be flushed by using the fire pumps. Flushing operations shall continue until water is clear, but not less than 10 minutes. Submit a signed and dated flushing certificate before requesting field testing.

3.9 FIELD TESTS

Submit, at least 2 weeks before starting field tests, system diagrams that show the layout of equipment, piping, and storage units, and typed condensed sequence of operation, wiring and control diagrams, and operation manuals explaining preventative maintenance procedures, methods of checking the system for normal, safe operation, and procedures for safely starting and stopping the system shall be framed under glass or laminated plastic. After approval, these items shall be posted where directed.

3.9.1 Hydrostatic Test

Piping shall be hydrostatically tested at 225 psig for a period of 2-hours, or at least 50 psi in excess of the maximum pressure, when the maximum pressure in the system is in excess of 175 psi in accordance with NFPA 20.

3.9.2 Preliminary Tests

The Fire Protection Engineer shall take all readings and measurements. The Manufacturer's Representative, a representative of the fire pump controller manufacturer, shall witness the complete operational testing of the fire pump and drivers. The fire pump controller manufacturer's representative shall each be an experienced technician employed by the respective manufacturers and capable of demonstrating operation of all features of respective components including trouble alarms and operating features. Fire pumps, drivers and equipment shall be thoroughly inspected and tested to insure that the system is correct, complete, and ready for operation. Tests shall ensure that pumps are operating at rated capacity, pressure and speed. Tests shall include manual starting and running to ensure proper operation and to detect leakage or other abnormal conditions, flow testing, automatic start testing, testing of automatic settings, sequence of operation check, test of required accessories; test of pump alarms devices and supervisory signals, test of pump cooling, operational test of relief valves, and test of automatic power transfer, if provided. Pumps shall run without abnormal noise, vibration or heating. If any component or system was found to be defective, inoperative, or not in compliance with the contract requirements during the tests and inspection, the corrections shall be made and the entire preliminary test shall be repeated.

3.9.3 Final Acceptance Test

The Fire Protection Engineer shall take all readings and measurements. The Manufacturer's Representative, and the fire pump controller manufacturer's representative, shall also witness for the final tests. The Contractor shall be responsible for repairing any damage caused by hose streams or other aspects of the test. The final acceptance test shall include the following:

3.9.3.1 Flow Tests

Flow tests using the test header, hoses and play pipe nozzles shall be conducted. Flow tests shall be performed at chum (no flow), 75, 100, 125 and 150 percent capacity for each pump and at full capacity of the pump installation. Flow readings shall be taken from each nozzle by means of a calibrated pitot tube with gauge or other approved measuring equipment. Rpm, suction pressure and discharge pressure reading shall be taken as part of each flow test.

3.9.3.2 Starting Tests

Pumps shall be tested for automatic starting and sequential starting. Setting of the pressure switches shall be tested when pumps are operated by pressure drop. Tests may be performed by operating the test connection on the pressure sensing lines. As a minimum, each pump shall be started automatically 10 times and manually 10 times, in accordance with NFPA 20. The fire pumps shall be operated for a period of a least 10 minutes for each of the starts. Pressure settings that include automatic starting and stopping of the fire pumps shall be indicated on an etched plastic placard, attached to the corresponding pump controller.

3.9.3.3 Alarms

All pump alarms, both local and remote, shall be tested.

3.9.3.4 Test Documentation

The Manufacturer's Representative shall supply a copy of the manufacturer's certified curve for each fire pump at the time of the test. The Fire Protection Engineer shall record all test results and plot curve of each pump performance during the test. Complete pump acceptance test data of each fire pump shall be recorded. The pump acceptance test data shall be on forms that give the detail pump information such as that which is indicated in Figure A-11-2.6.3(f) of NFPA 20. All test data records shall be submitted in a three ring binder.

***** END OF SECTION *****

SECTION 10 44 16

FIRE EXTINGUISHER

PART 1 - GENERAL

1.1 SUMMARY

Section includes portable, hand-carried Type fire extinguishers including mounting brackets for fire extinguishers.

1.2 SUBMITTALS

- a. **Product Data:** For each type of product indicated. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.
- b. **Operation and Maintenance Data:** For fire extinguishers to include in maintenance manuals.
- c. **Warranty:** Sample of special warranty.

1.3 QUALITY ASSURANCE

- a. **NFPA Compliance:** Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- b. **Fire Extinguishers:** Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
 - 1. Provide fire extinguishers approved, listed, and labeled by FMG.
- c. **Pre-installation Conference:**
 - 1. Review methods and procedures related to fire extinguishers including, but not limited to, the following:
 - a. Schedules and coordination requirements.

1.4 WARRANTY

- a. **Special Warranty:** Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Hydrostatic test in first subparagraph below is required every 5 years for water, AFFF, FFFP, dry-chemical-in-stainless-steel-shell, carbon dioxide, and wet-chemical fire extinguishers; every 12 years for other dry-chemical, dry-powder, and halogenated-agent fire extinguishers.
 - b. Failure of hydrostatic test according to NFPA 10.
 - c. Faulty operation of valves or release levers.
 - d. Verify available warranties and warranty periods for fire extinguishers with manufacturers listed in Part 2 articles. NFPA 10 requires that stored-pressure, portable fire extinguishers subject to hydrostatic tests every 12 years be subject to NFPA 10's maintenance procedures.
- b. **Warranty Period:** Guarantee that Fire Extinguishers are free of defects in materials, fabrication, finish, and installation and that they will remain so for a period of not less than one (1) year after substantial completion. Submit the manufacturer's warranty with inspection tag.

1.5 DELIVERY, STORAGE, AND HANDLING

- a. Protect materials from weather, soil, and damage during delivery, storage, and construction. Deliver materials in their original packages, containers, or bundles bearing the brand name and the name and type of the material.
- b. Provide the following equipment samples: One of each type of fire extinguisher being installed; one full-sized sample of each type of cabinet being installed; three samples of wall brackets and accessories of each type being used. Use approved samples for installation, with proper identification and storage.

PART 2 – PRODUCTS

2.1. FABRICATION DRAWINGS

Submit fabrication drawings consisting of fabrication and assembly details performed in the factory and product data for the following items: Fire Extinguishers; Accessories, cabinets, Wall Brackets.

2.2. WATER MIST

Water Mist extinguishers are primarily for Class A fires, although they are also safe for use in Class C fires.

2.3. DRY POWDER

Dry Powder extinguishers are for Class D or combustible metal fires only.

2.4. CLEAN AGENT

Newer Clean Agent extinguishers have replaced former halogenated extinguishers with less ozone depleting halo carbon agents, for Class B and C fires, with some larger units available for use on Class A, B, and C fires.

2.5. WET CHEMICAL

Wet Chemical extinguishers are primarily for cooking media fires (high temperature oils and fats) (some may also be used on Class A fires in commercial kitchens).

2.6. DRY CHEMICAL

Dry Chemical extinguishers can be used on Class A, B, and C fires (all the above elements) (not recommended for computers or sensitive electrical equipment - use clean agent or Carbon Dioxide).

2.7. CARBON DIOXIDE

Carbon Dioxide extinguisher can be used on Class B and C fires (flammable liquids and gases, live electrical equipment).

2.8. WATER AND FOAM

- a. Water extinguishers are for Class A fires only (paper, wood, cloth).
- b. Foam extinguishers are for Class A and B fires only (common combustibles, flammable liquids and gases).

2.9. MATERIAL

Provide corrosion-resistant steel extinguisher shell.

2.10 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- a. Fire Extinguishers: Type, size, and capacity for each fire protection cabinet mounting bracket indicated.
 1. Valves: Manufacturer's standard.
 2. Handles and Levers: Manufacturer's standard.
 3. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B inspections, maintenance, and recharging.
- b. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 4-A:80-B:C, 10-lb (4.5-kg)) nominal capacity, with monoammonium phosphate-based dry chemical in -steel cylinder.
- c. Carbon Dioxide Portable Fire Extinguisher 10lb (4.5kg) nominal capacity in steel cylinder.

2.11 WHEELED TYPE FIRE EXTINGUISHER

- a. Wheeled Fire Extinguisher: Type, size and capacity for location indicated, complete with carriage
Carriage: Fabricated from enameled-steel pipe, complete with hanger assembly, long-range nozzle, hose, and semipneumatic solid-rubber tires.
Hose: 100 feet (30.4m)
- b. Multipurpose Dry-Chemical Type: UL-rated 30-A:160-B:C, 50-lb (23-kg)] nominal capacity, with monoammonium phosphate-based dry chemical in steel container.

2.12 MOUNTING BRACKETS

- a. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.
- b. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by ARCHITECT.
 1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
Orientation: Horizontal.

PART 3 – EXECUTION

3.1. INSTALLATION

- 3.1.1. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
- 3.1.2. For Class A light-hazard occupancies, such as office buildings, use a Class A extinguisher within a 75 foot travel distance with one unit of 1A rating for every 3,000 square feet of floor area; ordinary hazard occupancies such as warehouses and department stores: 75 foot travel distance with one unit of 2A rating for every 3,000 square feet; and extra hazard occupancies such as wood working and spray painting locations: 75 foot travel distance with one unit of 3A rating for every 3,000 square feet.
- 3.1.3. For Class B light-hazard occupancies, use a Class B extinguisher within 50 foot travel distance with one unit of 4B rating; ordinary hazard occupancies: 1 50 foot travel distance with one unit of 8B rating; extra hazard occupancies: 15 meter 50 foot travel distance with one unit of 12B rating. For deep-layer flammable-liquid fire hazards such as dip tanks, one unit of Class B extinguishing potential is required for each 0.1 square foot of the largest individual hazard unless an approved automatic system is installed.
- 3.1.4. Class C extinguishers, where there are electrical hazards, are distributed on the same basis as Class B extinguishers.
- 3.1.5. Mounting Brackets: 54 inches (1372 mm) above finished floor to top of fire extinguisher. Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

3.2. PROTECTION

3.2.1. Repairing

Remove and replace damaged and unacceptable portions of completed work with new work at no additional cost to the Government.

3.2.2. Cleaning

Clean all surfaces of the work, and adjacent surfaces which are soiled as a result of the work. Remove from the site all construction equipment, tools, surplus materials and rubbish resulting from the work.

***** END OF SECTION *****

