
USACE / NAVFAC / AFCEA UFGS-13935N (September 1999)

Preparing Activity: NAVFAC Replacing without revision
NFGS of same number and date

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated 22 December 2004

SECTION TABLE OF CONTENTS

DIVISION 13 - SPECIAL CONSTRUCTION

SECTION 13935N

DRY-PIPE FIRE SPRINKLER SYSTEMS

09/99

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SYSTEM DESCRIPTION
- 1.3 SPRINKLER SYSTEM DESIGN
 - 1.3.1 Location of Sprinkler Heads
 - 1.3.2 Water Distribution
 - 1.3.3 Density of Application of Water
 - 1.3.4 Sprinkler Design Area
 - 1.3.5 Outside Hose Allowances
 - 1.3.6 Friction Losses
 - 1.3.7 Water Supply
 - 1.3.8 Detail Drawing
 - 1.3.9 Detail Drawings
- 1.4 SUBMITTALS
- 1.5 QUALITY ASSURANCE
 - 1.5.1 Qualifications of Installer

PART 2 PRODUCTS

- 2.1 ABOVEGROUND PIPING SYSTEMS
 - 2.1.1 Sprinkler Piping
 - 2.1.2 Sprinkler Heads
 - 2.1.3 Cabinet
 - 2.1.4 Dry Pipe Valves
 - 2.1.5 Water Motor Alarms
 - 2.1.6 Pressure Switch
 - 2.1.7 Low Air Pressure Supervisory Switch
 - 2.1.8 Tank Mounted Air Compressor
 - 2.1.9 Pipe Hangers and Supports
 - 2.1.10 Valves
 - 2.1.10.1 Backflow Preventers
 - 2.1.10.2 Valve Supervision
 - 2.1.11 Identification Signs
 - 2.1.12 Inspector's Test Connection
 - 2.1.13 Main Drains

- 2.1.14 Fire Department Connections
- 2.2 BURIED WATER PIPING SYSTEMS
 - 2.2.1 Pipe and Fittings
 - 2.2.2 Valves
 - 2.2.3 Post Indicator Valves
 - 2.2.4 Valve Boxes
 - 2.2.5 Buried Utility Warning and Identification Tape
- 2.3 PIPE SLEEVES
- 2.4 ESCUTCHEON PLATES

PART 3 EXECUTION

- 3.1 INSTALLATION
 - 3.1.1 Electrical Work
 - 3.1.2 Disinfection
 - 3.1.3 Connections to Existing Water Supply Systems
 - 3.1.4 Buried Piping System
 - 3.1.5 Field Painting
 - 3.1.5.1 Systems in Finished Areas
 - 3.1.5.2 Systems in Unfinished Areas
- 3.2 FIELD QUALITY CONTROL
 - 3.2.1 Preliminary Tests
 - 3.2.2 Formal Tests and Inspections
- 3.3 SCHEDULE

-- End of Section Table of Contents --

USACE / NAVFAC / AFCEA UFGS-13935N (September 1999)

Preparing Activity: NAVFAC Replacing without revision
NFGS of same number and date

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated 22 December 2004

SECTION 13935N

DRY-PIPE FIRE SPRINKLER SYSTEMS 09/99

NOTE: This guide specification covers the requirements for automatic dry-pipe fire extinguishing sprinkler systems for unheated areas subject to freezing.

Comments and suggestions on this guide specification are welcome and should be directed to the technical proponent of the specification. A listing of technical proponents, including their organization designation and telephone number, is on the Internet.

Recommended changes to a UFGS should be submitted as a Criteria Change Request (CCR).

Use of electronic communication is encouraged.

Brackets are used in the text to indicate designer choices or locations where text must be supplied by the designer.

NOTE: System requirements must conform to Unified Facilities Criteria (UFC) Fire Protection Engineering for Facilities and NFPA 13, "Installation of Sprinkler Systems."

NOTE: If there are questions concerning system design, consult with the Engineering Field Division, Naval Facilities Engineering Command, Fire Protection Engineer.

NOTE: Following information shall be shown on project drawings:

1. Location and detail of each sprinkler system supply riser, dry pipe valve, water motor alarm,

fire department inlet connection, pressure or flow switch, fused disconnect switch, and associated electrical connections.

2. Location where each sprinkler system begins including connection to water distribution system piping.

3. Location of sprinkler system control valves, post indicator valves, or wall indicator valves.

4. Area of sprinkler system coverage when system is protecting partial areas.

5. Details of anchoring piping, including pipe clamps and tie rods, or mechanical retainer glands.

6. Indicate existing sprinkler piping layout and sprinkler heads on project drawings only if existing sprinkler system is being modified and such layout is necessary for clarity.

PART 1 GENERAL

1.1 REFERENCES

NOTE: Issue (date) of references included in project specifications need not be more current than provided by the latest guide specification. Use of SpecsIntact automated reference checking is recommended for projects based on older guide specifications.

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

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C651 (1999) Disinfecting Water Mains

ASME INTERNATIONAL (ASME)

ASME A17.1 (2004) Handbook on Safety Code for Elevators and Escalators

FM GLOBAL (FM)

FM P7825 (2003) Approval Guide

FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH (FCCCHR)

FCCCHR List (continuously updated) List of Approved Backflow Prevention Assemblies

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

MSS SP-58 (2002) Pipe Hangers and Supports -
Materials, Design and Manufacture

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 13 (2002) Installation of Sprinkler Systems

NFPA 24 (2002) Installation of Private Fire
Service Mains and Their Appurtenances

NFPA 70 (2005) National Electrical Code

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC Paint 25 (1997; R 2000) Zinc Oxide, Alkyd, Linseed
Oil Primer for Use Over Hand Cleaned
Steel, Type I and Type II

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS TT-E-489 (Rev J; Notice 1)) Enamel, Alkyd, Gloss,
Low Voc Content

FS TT-P-664 (Rev D) Primer Coating, Alkyd,
Corrosion-Inhibiting, Lead and Chromate
Free, VOC-Compliant

UNDERWRITERS LABORATORIES (UL)

UL 262 (2004) Gate Valves for Fire-Protection
Service

UL 789 (2004) Indicator Posts for Fire-Protection
Service

UL Fire Prot Dir (2004) Fire Protection Equipment Directory

1.2 SYSTEM DESCRIPTION

Design [and provide] [new] [and] [modify existing] automatic dry pipe fire
extinguishing sprinkler systems for complete fire protection coverage
throughout [_____].

1.3 SPRINKLER SYSTEM DESIGN

**NOTE: Use hydraulic calculations for all new
systems over 93 sq. m 1000 sq ft. Use hydraulic
calculations or pipe schedules for new installations
less than 93 sq. m 1000 sq ft, and for additions to
existing pipe schedule systems. When hydraulic
calculations are not included, delete paragraphs
entitled "Water Distribution," "Density of
Application of Water," "Sprinkler Discharge Area,"
"Outside Hose Allowance," "Friction Losses," and
"Water Supply." Earthquake protection is required**

for buildings in seismic zones 3 and 4, and only
essential and high risk buildings in seismic zone 2.

Design automatic dry pipe fire extinguishing sprinkler systems in accordance with the required and advisory provisions of NFPA 13, [by pipe schedules] [or] [hydraulic calculations using the area/density method for uniform distribution of water over the design area] for [ordinary] [extra] hazard occupancy. Each system shall include materials, accessories, and equipment inside and outside the building to provide each system complete and ready for use. Design and provide each system to give full consideration to blind spaces, piping, electrical equipment, ducts, and other construction and equipment in accordance with detailed working drawings to be submitted for approval. Locate sprinkler heads in a consistent pattern with ceiling grid, lights, and air supply diffusers. Devices and equipment for fire protection service shall be UL Fire Prot Dir listed or FM P7825 approved for use in dry pipe sprinkler systems. [Design systems for earthquake protection.]

1.3.1 Location of Sprinkler Heads

Spacing of sprinklers and position and orientation of sprinklers in relation to the ceiling, walls, and obstructions shall conform to NFPA 13 for ordinary hazard occupancy; except for discharge density greater than 136 ml/s per sq meter 0.20 gpm per sq ft the spacing of sprinkler heads shall not exceed that for extra hazard occupancy. Uniformly space sprinklers on the branch piping.

1.3.2 Water Distribution

Distribution shall be uniform throughout the area in which the sprinkler heads will open. Discharge from individual sprinklers in the hydraulically most remote area shall be not less than 100 percent of the specified density.

1.3.3 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 sprinklers shall be [_____] L/m per sq meter gpm per sq ft.

**NOTE: Sprinkler designers shall use the criteria
from MIL-HDBK-1008 and not NFPA 13.**

1.3.4 Sprinkler Design Area

Area shall be the hydraulically most remote [_____] sq meter ft area as defined in NFPA 13.

1.3.5 Outside Hose Allowances

Hydraulic calculations shall include an allowance of [_____] L/m gpm for outside hose streams.

1.3.6 Friction Losses

Calculate losses in piping in accordance with the Hazen-Williams formula with 'C' value of 100 for steel piping, 150 for copper tubing, and 140 for cement-lined ductile-iron piping. Velocity in the sprinkler piping shall be limited to a maximum of .0061 km/s 20 ft/sec.

1.3.7 Water Supply

Base hydraulic calculations on a static pressure of [_____] kPa (gage) psig with [_____] L/m gpm available at a residual pressure of [_____] kPa (gage) psig at the [junction with the water distribution piping system.] [base of the sprinkler piping riser.] [Include discharge from fire pump[s] provided in Section 13920 FIRE PUMPS in the hydraulic calculations. Provide [35] [_____] kPa [5] [_____] psi cushion between total calculated demand and the water supply.]

1.3.8 Detail Drawing

Prepare A1 841 x 594 mm 24 by 36 inch detail working drawings of sprinkler heads and piping system layout in accordance with NFPA 13, "Working Drawings (Plans)." Show data essential for proper installation of each system. Show details, plan view, elevations, and sections of the systems supply and piping. Show piping schematic of systems supply, devices, valves, pipe, and fittings. Show point to point electrical wiring diagrams. Show location and orientation of sprinkler heads in relation to obstructions. [Submit drawings signed by a registered fire protection engineer.]

1.3.9 Detail Drawings

After completion, but before final acceptance, submit complete set of as-built drawings of each system for record purposes. Submit A1 841 x 594 mm 24 by 36 inch drawings on reproducible mylar film with title block similar to full size contract drawings. Furnish the as-built (record) working drawings in addition to as-built contract drawings required by Division 1, "General Requirements."

1.4 SUBMITTALS

NOTE: Submittals must be limited to those necessary for adequate quality control. The importance of an item in the project should be one of the primary factors in determining if a submittal for the item should be required.

A "G" following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G"

designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy projects.

Submittal items not designated with a "G" are considered as being for information only for Army projects and for Contractor Quality Control approval for Navy projects.

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.] [for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

[The [_____] Division, Naval Facilities Engineering Command, Fire Protection Engineer, will review and approve all submittals in this section requiring Government approval.]

[The [_____] Division, Naval Facilities Engineering Command, Fire Protection Engineer delegates the authority to the Quality Control (QC) Representative's U.S. Registered Fire Protection Engineer for review and approval of submittals required by this section. Submit to the [_____] Division, Naval Facilities Engineering Command, Fire Protection Engineer one set of all approved submittals and drawings immediately after approval but no more later than 15 working days prior to final inspection.]

SD-02 Shop Drawings

Sprinkler heads and piping system layout; G

Electrical wiring diagrams; G

SD-03 Product Data

Piping; G

Valves, including gate, check, and globe; G

Water motor alarms; G

Sprinkler heads; G

Pipe hangers and supports; G

Fire department connections; G

Low air pressure supervisory switch; G

Dry pipe valves; G

Air compressor; G

Mechanical couplings; G

Backflow Preventers; G

Pressure Switch; G

Annotate descriptive data to show the specific model, type, and size of each item.

SD-05 Design Data

NOTE: When a sprinkler system is designed using the
pipe schedule method, delete the paragraph entitled
"SD-05 Design Data."

Sprinkler system design; G

[Submit computer program generated hydraulic calculations to substantiate compliance with hydraulic design requirements. Calculations generated by computer program shall include the name, address, and telephone number of the software manufacturer.]

SD-06 Test Reports

Preliminary tests on piping system; G

SD-07 Certificates

Qualifications of installer; G

SD-10 Operation and Maintenance Data

Dry pipe valves, Data Package 3; G

Air compressor, Data Package 3; G

Submit in accordance with Section 01781 OPERATION AND MAINTENANCE DATA.

SD-11 Closeout Submittals

As-built drawings of each system; G

1.5 QUALITY ASSURANCE

1.5.1 Qualifications of Installer

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

NOTE: For projects administered by the Pacific
Division, Naval Facilities Engineering Command and
Engineering Field Activity Cheasapeake, include the
following optional paragraph requiring the minimum
qualification of a NICET Level-III technician for
preparation of all fire protection system drawings.

[Qualifications of System Technician: Installation drawings, shop drawing and as-built drawings shall be prepared, by or under the supervision of, an individual who is experienced with the types of works specified herein, and is currently certified by the National Institute for Certification in Engineering Technologies (NICET) as an engineering technician with minimum Level-III certification in automatic sprinkler system program. Contractor shall submit data for approval showing the name and certification of all involved individuals with such qualifications at or prior to submittal of drawings.]

PART 2 PRODUCTS

2.1 ABOVEGROUND PIPING SYSTEMS

Provide fittings for changes in direction of piping and for connections. [Make changes in piping sizes through tapered reducing pipe fittings; bushings will not be permitted.] Perform welding in the shop; field welding will not be permitted. Conceal piping in areas with [suspended ceiling] [and] [_____].

2.1.1 Sprinkler Piping

NFPA 13, except as modified herein. [Steel piping shall be Schedule [10] [or] [40] for sizes less than 200 mm 8 inches, and may be Schedule [10] [30] [or] [40] for sizes 8 inches 65 mm and larger.] Fittings into which sprinkler heads, sprinkler head riser nipples, or drop nipples are threaded shall be welded, threaded, or grooved-end type. Plain-end fittings with mechanical couplings and fittings which use steel gripping devices to bite into the pipe when pressure is applied will not be permitted. Rubber gasketed grooved-end pipe and fittings with mechanical couplings shall be permitted in pipe sizes 40 mm 1.5 inches and larger. Fittings shall be UL Fire Prot Dir listed or FM P7825 approved for use in dry pipe sprinkler systems. Fittings, mechanical couplings, and rubber gaskets shall be supplied by the same manufacturer. Steel piping with wall thickness less than Schedule 30 shall not be threaded. Steel piping shall be galvanized. [Sprinkler pipe and fittings shall be metal.]

2.1.2 Sprinkler Heads

Provide nominal 15 mm 0.50 inch [or 20 mm 0.53 inch] orifice [standard] [quick] [_____] response sprinkler heads. No o-rings will be permitted in sprinkler heads. Release element of each head shall be of the [ordinary] [intermediate] [_____] temperature rating or higher as suitable for the specific application. Provide polished stainless steel ceiling plates or chromium-plated finish on copper alloy ceiling plates, and chromium-plated pendent sprinklers below suspended ceilings. [Provide corrosion-resistant sprinkler heads and sprinkler head guards as required by NFPA 13.] Automatic sprinklers installed in the pendent position shall be of the dry-pendent type [except that standard pendent sprinklers may be installed

on return bends when both the sprinklers and the return bends are located in a heated area].

2.1.3 Cabinet

Provide metal cabinet with extra sprinkler heads and sprinkler head wrench adjacent to each dry pipe valve. The number and types of extra sprinkler heads shall be as specified in NFPA 13.

2.1.4 Dry Pipe Valves

Provide valve complete with accessories and appurtenances for the proper operation of the system.

2.1.5 Water Motor Alarms

Provide alarms of the approved weatherproof and guarded type, to sound locally on the flow of water in each corresponding sprinkler system. Mount alarms on the outside of the outer walls of each building at a location as directed. Provide separate drain piping directly to exterior of building.

2.1.6 Pressure Switch

Provide switch with circuit opener or closer for the automatic transmittal of an alarm over the facility fire alarm system. Connection of switch shall be under Section [13851N EXTERIOR FIRE ALARM SYSTEM] [13852N INTERIOR FIRE DETECTION AND ALARM SYSTEM]. Do not install a shutoff valve in the piping between the dry pipe valve and any pressure switch.

2.1.7 Low Air Pressure Supervisory Switch

Provide switch for each sprinkler system and connect to building fire alarm system to activate the system supervisory alarm when air pressure in system drops halfway from the normal pressure to the tripping point. Connection of switch shall be under Section [13852N INTERIOR FIRE DETECTION AND ALARM SYSTEM] [____]. Provide a bleeder valve in the air line ahead of the switch for testing operation of the switch. The valve shall be normally open. Closing the valve shall shut off the air supply to the switch and exhaust the pressure between the switch and valve.

2.1.8 Tank Mounted Air Compressor

Provide an approved, automatic type, electric motor-driven air compressor including pressure switch, air piping, and [____] [38 liter] [10 gallon] minimum capacity tank. Compressor shall have a minimum capacity capable of charging the complete sprinkler system to normal system air pressure within 30 minutes. Provide an approved automatic air maintenance device for each system.

2.1.9 Pipe Hangers and Supports

Provide in accordance with NFPA 13. Attach to steel joists with MSS SP-58, Type 19 or 23 clamps and retaining straps. Attach to Steel W or S beams with Type 21, 28, 29, or 30 clamps. Attach to steel angles and vertical web steel channels with Type 20 clamp with beam clamp channel adapter. Attach to horizontal web steel channel and wood with drilled hole on centerline and double nut and washer. Attach to concrete with Type 18 insert or drilled expansion anchor.

2.1.10 Valves

NFPA 13. Provide valves of types approved for fire service. Valves shall open by counterclockwise rotation. Provide [a rising stem] [an OS&Y] [a wall indicator] valve beneath each dry pipe valve. [Check valves shall be [flanged] clear opening swing-check type valves with flanged inspection and access cover plate for sizes [100] [200] mm [4] [8] inches [_____] and larger.] [Provide OS&Y gate valve in piping to sprinklers protecting elevator hoistways, machine rooms, and machinery spaces in accordance with ASME A17.1.]

2.1.10.1 Backflow Preventers

Provide double check valve assembly backflow preventer with OS&Y gate valve backflow preventer with OS&Y gate valve on both ends. Each check valve shall have a drain. Backflow prevention assemblies shall have current "Certificate of Approval" from the Foundation For Cross Connection Control and Hydraulic Research FCCCHR List. Listing of the specific make, model, design, and size in the FCCCHR List shall be acceptable as the required documentation. Provide downstream of the backflow prevention assembly listed hose valves with 2.5 inch 64 mm National standard male hose threads with cap and chain. Provide one valve for each 250 gpm 16 l/s of system demand or fraction thereof. Provide a permanent sign in accordance with paragraph entitled "Identification Signs" which reads, "Test Valve."

2.1.10.2 Valve Supervision

Provide supervision of each control valve against closure and tampering in accordance with NFPA 13. [Provide switch with SPDT (Form C) dry contacts for the automatic transmittal of a supervisory signal over the facility fire alarm system; minimum switch contact rating shall be 2.5 amperes at 24 VDC. A supervisory signal shall be initiated during the first two revolutions of the hand wheel, or during the first 1/5th of travel distance of the valve stem, from the full open position. Connection of the switch shall be under Section [13852N INTERIOR FIRE DETECTION AND ALARM SYSTEM] [13855N ANALOG / ADDRESSABLE INTERIOR FIRE ALARM SYSTEM].] [Provide breakaway key operated locks and steel chains to secure all control valves against unauthorized closure or tampering.]

2.1.11 Identification Signs

NFPA 13. Attach properly lettered and approved metal signs to each valve and alarm device. [Permanently affix hydraulic design information sign to the riser of each system.] For pipe schedule systems, provide a hydraulic design information sign stating: This is a [light] [ordinary] [extra] hazard pipe schedule system.

2.1.12 Inspector's Test Connection

Provide test connections approximately 2 meters 6 feet above the floor for each sprinkler system or portion of each sprinkler system equipped with an alarm device; locate at the hydraulically most remote part of each system. Provide test connection piping to a location where the discharge will be readily visible and where water may be discharged without property damage. Provide discharge orifice of same size as corresponding sprinkler orifice. Provide a precast concrete splash block under each exterior discharge orifice.

2.1.13 Main Drains

Provide separate drain piping [to discharge at safe points outside each building] [to sight cones attached to drains of adequate size to readily receive the full flow from each drain under maximum pressure.] [The penetration of the exterior wall shall be no greater than [0.61 meters] [2.0 feet] [above finished grade.]] Provide auxiliary drains as required by NFPA 13. Provide precast concrete splash blocks under each exterior drain discharge.

NOTE: Contact the fire department legally obligated to protect the facility to find out what their specific requirements are.

2.1.14 Fire Department Connections

Provide [100] [_____] mm [4] [_____] inches single [Storz] [_____] type connections approximately one meter 3 feet above finish grade, of the approved two-way type with 65 mm 2.5 inch National standard female hose threads with brass caps, chain, and identifying fire department connection escutcheon plate.

2.2 BURIED WATER PIPING SYSTEMS

NOTE: Minimum depth of cover must comply with NFPA 24 for the specific area of the project.

2.2.1 Pipe and Fittings

Provide outside-coated, cement-mortar lined, ductile-iron pipe, and fittings conforming to NFPA 24 for piping under the building and outside of building walls. Anchor joints in accordance with NFPA 24. Provide concrete thrust block at the elbow where the pipe turns up toward the floor, and restrain the pipe riser with steel rods from the elbow to the flange above the floor. Minimum pipe size shall be 150 mm 6 inches. Minimum depth of cover shall be [_____] [one meter] [3 feet] at finish grade. [Piping beyond 1.50 meters 5 feet outside of building walls shall be provided under Section 02510N WATER DISTRIBUTION.]

2.2.2 Valves

Provide as required by NFPA 24. Gate valves shall conform to UL 262 and shall open by counterclockwise rotation.

2.2.3 Post Indicator Valves

Provide with operating nut located about one meter 3 feet above finish grade. Gate valves for use with indicator post shall conform to UL 262. Indicator posts shall conform to UL 789. Provide each indicator post with one coat of primer and two coats of red enamel paint.

2.2.4 Valve Boxes

Except where indicator posts are provided, for each buried valve, provide cast-iron, ductile-iron, or plastic valve box of a suitable size. Plastic

boxes shall be constructed of acrylonitrile 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 shall be 133 mm 5.25 inches. Coat cast-iron and ductile-iron boxes with bituminous paint applied to a minimum dry-film thickness of 0.254 mm 10 mils.

2.2.5 Buried Utility Warning and Identification Tape

Provide detectable aluminum foil plastic backed tape or 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, 80 mm 3 inches minimum width, color coded for the utility involved with warning and identification imprinted in bold black letters continuously and repeatedly over entire tape length. Warning and identification shall read "CAUTION BURIED WATER PIPING BELOW" or similar wording. Use permanent code and letter coloring unaffected by moisture and other substances contained in trench backfill material.

2.3 PIPE SLEEVES

Provide where piping passes entirely through walls, floors, and roofs. Secure sleeves in position and location during construction. Provide sleeves of sufficient length to pass through entire thickness of walls, floors, and roofs. Provide 25 mm one inch minimum clearance between exterior of piping 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, seal both ends of pipe sleeves or core-drilled holes with UL listed fill, void, or cavity material.

- a. Sleeves in Masonry and Concrete Walls, Floors, and Roofs: Provide hot-dip galvanized steel, ductile-iron, or cast-iron sleeves. Core drilling of masonry and concrete may be provided in lieu of pipe sleeves when cavities in the core-drilled hole are grouted smooth.
- b. Sleeves in Other Than Masonry and Concrete Walls, Floors, and Roofs: Provide 26 gage galvanized steel sheet.

2.4 ESCUTCHEON PLATES

Provide split hinge metal plates for piping entering walls, floors, and ceilings in exposed spaces. Provide polished stainless steel plates or chromium-plated finish on copper alloy plates in finished spaces. Provide paint finish on metal plates in unfinished spaces.

PART 3 EXECUTION

3.1 INSTALLATION

Installation, workmanship, fabrication, assembly, erection, examination, inspection, and testing shall be in accordance with NFPA 13, except as modified herein. Install piping straight and true to bear evenly on hangers and supports. Do not hang piping from plaster ceilings. Keep the interior and ends of new piping and existing piping affected by Contractor's operations thoroughly cleaned of water and foreign matter. Keep piping systems clean during installation by means of plugs or other

approved methods. When work is not in progress, securely close open ends of piping to prevent entry of water and foreign matter. Inspect piping before placing into position. Provide Teflon pipe thread paste on male threads.

3.1.1 Electrical Work

Provide electrical work associated with this section under Section 16402 INTERIOR DISTRIBUTION SYSTEM, except for control [and fire alarm] wiring. [Provide fire alarm system under Section 13852N INTERIOR FIRE DETECTION AND ALARM SYSTEM.] Provide control [and fire alarm] wiring, [including connections to fire alarm systems,] under this section in accordance with NFPA 70. Provide wiring in rigid metal conduit or intermediate metal conduit, except electrical metallic tubing conduit may be used in dry locations not enclosed in concrete or where not subject to mechanical damage.

3.1.2 Disinfection

Disinfect the new water piping and existing water piping affected by Contractor's operations up to the [bottom flange of the dry pipe valve] [backflow prevention device] in accordance with AWWA C651. Fill piping systems with solution containing minimum of 50 milligram per kilogram (mg/kg) [_____] parts per million (ppm) of available chlorine and allow solution to stand for minimum of 24 hours. Flush solution from the systems with domestic water until maximum residual chlorine content is within the range of 0.2 to 0.5 mg/kg [_____] ppm, or the residual chlorine content of domestic water supply. Obtain at least two consecutive satisfactory bacteriological samples from new water piping, analyze by a certified laboratory, and submit results prior to the new water piping being placed into service. Disinfection of systems supplied by nonpotable water is not required.

3.1.3 Connections to Existing Water Supply Systems

Use tapping or drilling machine valve and mechanical joint type sleeves for connections to be made under pressure. Bolt sleeves around the main piping; bolt valve to the branch connection. Open valve, attach drilling machine, make tap, close valve, and remove drilling machine, all without interruption of service. Notify the Contracting Officer in writing at least [_____] [15] days prior to connection date; receive approval before any service is interrupted. Furnish materials required to make connections into existing water supply systems, and perform excavating, backfilling, and other incidental labor as required. [Furnish] [Government will furnish only] the labor and the tapping or drilling machine for making the actual connections to existing systems. [All piping shall be photographed prior to burying, covering, or concealing.]

3.1.4 Buried Piping System

Bury tape with the printed side up at a depth of 305 mm 12 inches below the top surface of earth or the top surface of the subgrade under pavements.

3.1.5 Field Painting

[Painting of sprinkler systems above suspended ceilings and in crawl spaces is not required.] Clean, prime, and paint new sprinkler system piping, valves, hangers, accessories, and miscellaneous metal work as specified [in Section 09900 PAINTS AND COATINGS] [and] [herein]. Clean surfaces prior to

painting. Immediately after cleaning, prime metal surfaces with FS TT-P-664 or SSPC Paint 25 metal primer applied to a minimum dry film thickness of 0.04 mm 1.5 mils. Exercise care to avoid painting sprinkler heads and operating devices. Upon completion of painting, remove materials which were used to protect sprinkler heads and operating devices which have been inadvertently painted and provide new clean sprinkler heads and operating devices of the proper type. Finish primed surfaces as follows:

3.1.5.1 Systems in Finished Areas

Finished areas are defined as areas where walls or ceilings are painted or are constructed of a prefinished material. Paint primed surfaces with two coats of paint to match adjacent surfaces, except paint valves and operating accessories with two coats of gloss red enamel. [Provide piping with 50 mm 2 inch wide red bands spaced at maximum 6 meter 20 feet intervals throughout the piping system. Bands shall be gloss red enamel or self-adhering plastic.]

[3.1.5.2 Systems in Unfinished Areas

Paint piping in valve rooms, [and] mechanical rooms, [and] [attics] [and] [crawl spaces] with FS TT-E-489 gloss red enamel applied to a minimum dry film thickness of 0.04 mm 1.6 mils.

]3.2 FIELD QUALITY CONTROL

Perform test to determine compliance with the specified requirements in the presence of the Contracting Officer. Test, inspect, and approve piping before covering or concealing.

3.2.1 Preliminary Tests

Hydrostatically test each system at 345 kPa (gage) 50 psig above normal system static pressure or 1379 kPa (gage) 200 psig, whichever is greater, for a 2-hour period with no leakage or reduction in pressure. Flush piping with potable water and air test each system in accordance with NFPA 13. Piping above suspended ceilings shall be tested, inspected, and approved before installation of ceilings. Test the alarms and other devices. Test the water flow alarms by flowing water through the inspector's test connection. Water shall be delivered to the system test connection in not more than 60 seconds, starting at the normal air pressure on the system and at the time of a fully opened inspection test connection. When tests have been completed and corrections made, submit a signed and dated certificate, similar to that specified in NFPA 13.

3.2.2 Formal Tests and Inspections

Do not submit a request for formal test and inspection until the preliminary test and corrections are completed and approved. Submit a written request for formal inspection at least [_____] [15] days prior to inspection date. An experienced technician regularly employed by the system installer shall be present during the inspection. At this inspection, repeat any or all of the required tests as directed. Correct defects in work provided by the Contractor, and make additional tests until the systems comply with contract requirements. Furnish appliances, equipment, [water,] electricity, instruments, connecting devices, and personnel for the tests. [The Government will furnish water for the tests.] The [_____] Division, Naval Facilities Engineering Command, Fire Protection Engineer, will witness formal tests and approve systems before

they are accepted.

3.3 SCHEDULE

Some metric measurements in this section are based on mathematical conversion of inch-pound measurement, and not on metric measurement commonly agreed to by the manufacturers or other parties. The inch-pound and metric measurements shown are as follows:

<u>Products</u>	<u>Inch-Pound</u>	<u>Metric</u>
Sprinkler Heads Orifice	0.50 inch	15 mm
	0.53 inch	20 mm
Air Compressor Tank Capacity	10 gallons	38 liters
Identification Tape Width	3 inches	80 mm

-- End of Section --