CONSTRUCTION INSPECTORS'

HANDBOOK FOR

FIRE PROTECTION SYSTEMS

Distributed by

Fire Protection Engineering Branch Code 408
Atlantic Division
Naval Facilities Engineering Command
Building N-26, Naval Station
Norfolk, Virginia 23511-6287
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TABLE OF CONTENTS

FOREWARD

This handbook was prepared to assist construction inspectors in assuring that the Navy's fire protection systems are installed properly and in accordance with contract requirements. This handbook does not attempt to cover all types of fire protection systems or complex fire protection systems such as foam/water deluge systems, multiplex fire alarm systems, station fire alarm systems, or halon extinguishing systems. The systems covered within are those types most commonly and frequently installed. The handbook replaces the January 1978 Construction Representatives' Handbook for Fire Protection Systems. Any comments would be appreciated and should be forwarded to LANTNAVFACENGCOM, attention Code 408.

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Head, Fire Protection Engineering Branch
Engineering and Design Division

September 1987

SECTION 1

SUBMITTALS AND FINAL ACCEPTANCE INSPECTIONS

I. PROPER PROCEDURES

A. Navy Fire Protection Engineers must conduct inspections and tests of fire protection equipment prior to acceptance by the Officer in Charge of Construction as required by NAVFACINST 11320.17C. It should also be noted that all fire protection submittals shall be forwarded to Atlantic Division, Naval Facilities Engineering Command, Code 408 Fire Protection, Bldg. N-26, Naval Station, Norfolk, Virginia 23511-6287 for review and approval prior to the installation of equipment. This applies to all situations regardless of who did the design (A&E, LANTDIV or the station), except that PWC Norfolk projects shall be reviewed and inspected by the PWC Fire Protection Engineer. This has caused problems in the past because of submittals being forwarded to A&Es or Public Works for approval. It must be strongly emphasized that ALL FIRE PROTECTION SYSTEMS SUBMITTALS SHALL BE FORWARDED TO THE DIVISION FIRE PROTECTION ENGINEER FOR APPROVAL PRIOR TO THE INSTALLATION OF EQUIPMENT.

B. It is mandatory that submittals (shop drawings and descriptive data) be stamped "Approved" or "Approved as Noted" by Atlantic Division, Naval Facilities Engineering Command, Code 408 Fire Protection prior to commencing the fire protection system installation. A sample stamp that appears on "Approved" or "Approved as Noted" submittals is shown below. Inspectors should refer to the approved submittal package frequently during construction and preliminary inspections. The majority of punch list items found during final acceptance tests of newly installed fire protection systems can be avoided if the contractor installs the systems per the "Approved" shop drawings and descriptive data.

C. In a few special cases, ROICC or fire department personnel may be authorized to perform the final inspection and acceptance test. However, generally this test is performed by a LANTNAVFACENGCOM Code 408 Fire Protection Engineer. This authorization must be a written confirmation from LANTNAVFACENGCOM Code 408 to station ROICC. In such situations, it is essential that the appointed Fire Department personnel having approval authority be given all fire protection system data (Contract Drawings, Specifications, Amendments, Change Orders, Shop Drawings, Descriptive Data, etc.) prior to the final inspection and acceptance test.

D. One of the keys to a successful acceptance inspection is the recognition and correction of contract discrepancies prior to scheduling the final inspection and acceptance tests. Do not wait until all parties have arrived on site for the final inspection and acceptance test to bring up areas of conflict or differences of opinion in contract documentation interpretation. Requesting "on-the-spot" problem resolutions or interpretations at the time of the final inspection and acceptance test must be avoided. These conflicts must be resolved prior to the final inspection and acceptance test, thus preventing costly reinspections.

SECTION 2

AUTOMATIC FIRE SPRINKLER SYSTEMS

I. TYPES OF SYSTEMS

A. There are four basic types of sprinkler systems: (See figures 1a-1d)

1. Wet-pipe sprinkler systems are the most common type and the simplest. This system's piping has closed automatic sprinkler heads and is filled with water under pressure.

2. Dry-pipe systems are normally used in locations where pipes are subject to freezing. They are similar to the wet-pipe system except piping is filled with air under pressure, which holds closed a "dry-pipe valve". Actuation of a sprinkler head releases air pressure, thus permitting water pressure to open the "dry-pipe valve". Water is then released into the system and out of the open head.

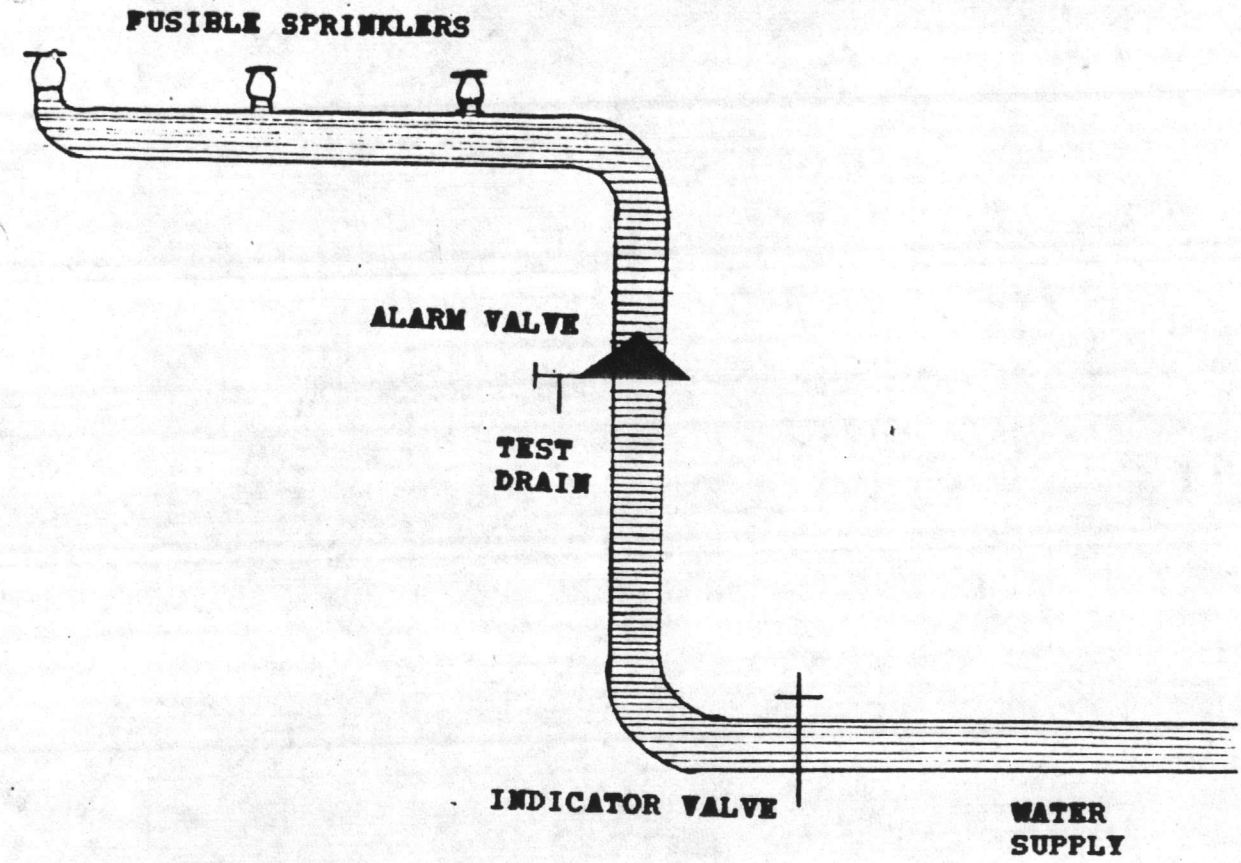
3. Deluge systems are used in areas such as hangars or special hazards or when large volumes of water delivered through all sprinkler heads is desirable. These systems utilize open sprinkler heads. The deluge valve is activated by a detection system installed throughout the protected area.

4. Pre-action systems employ closed sprinkler heads attached to piping containing air which may or may not be under pressure. The valve is activated by a fire detection system which is usually more sensitive than the sprinklers. Actuation of the detection systems opens the valve, permitting water to flow into the piping. Water will not be discharged from the sprinkler head until such time that the heat fuses the link and opens the sprinkler head.

B. All materials and equipment used in sprinkler systems will normally be of a make and type listed by Underwriters' Laboratories, Inc. (U.L.) or approved by Factory Mutual Engineering Corporation (FM). The following is a description of the most commonly used material and equipment.

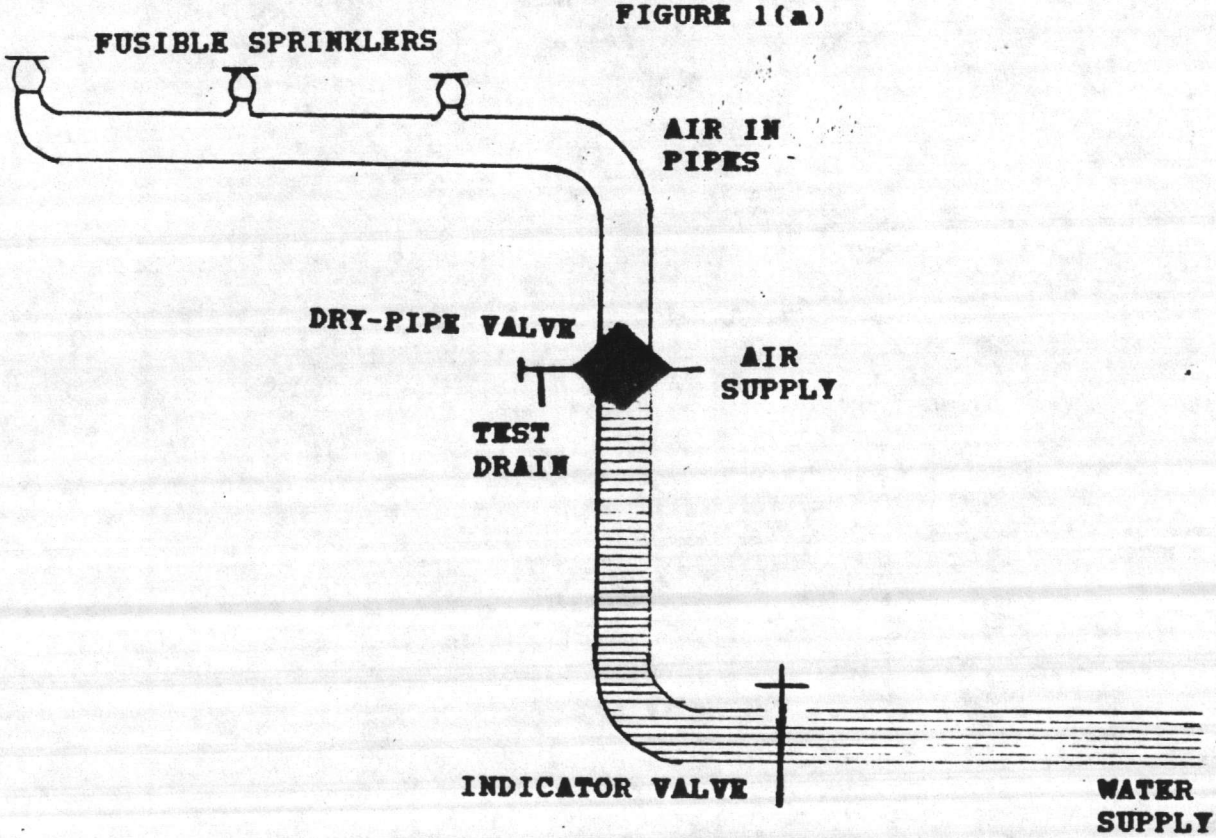
1. Piping. Pipe is usually black steel or wrought iron, even though copper is permitted. Schedule 40 pipe is generally used, particularly for pipe sizes 2" or less. Schedule 30 pipe is permitted for sizes 8 inches and larger. Schedule 10 pipe is sometimes specified for pipe sizes 2" and greater because of its light weight. Plain-end fittings with gripping/teeth-type mechanical couplings will not be permitted. Some common terms used to describe components of piping are:

(a) Risers: Vertical pipes supplying the sprinkler system.



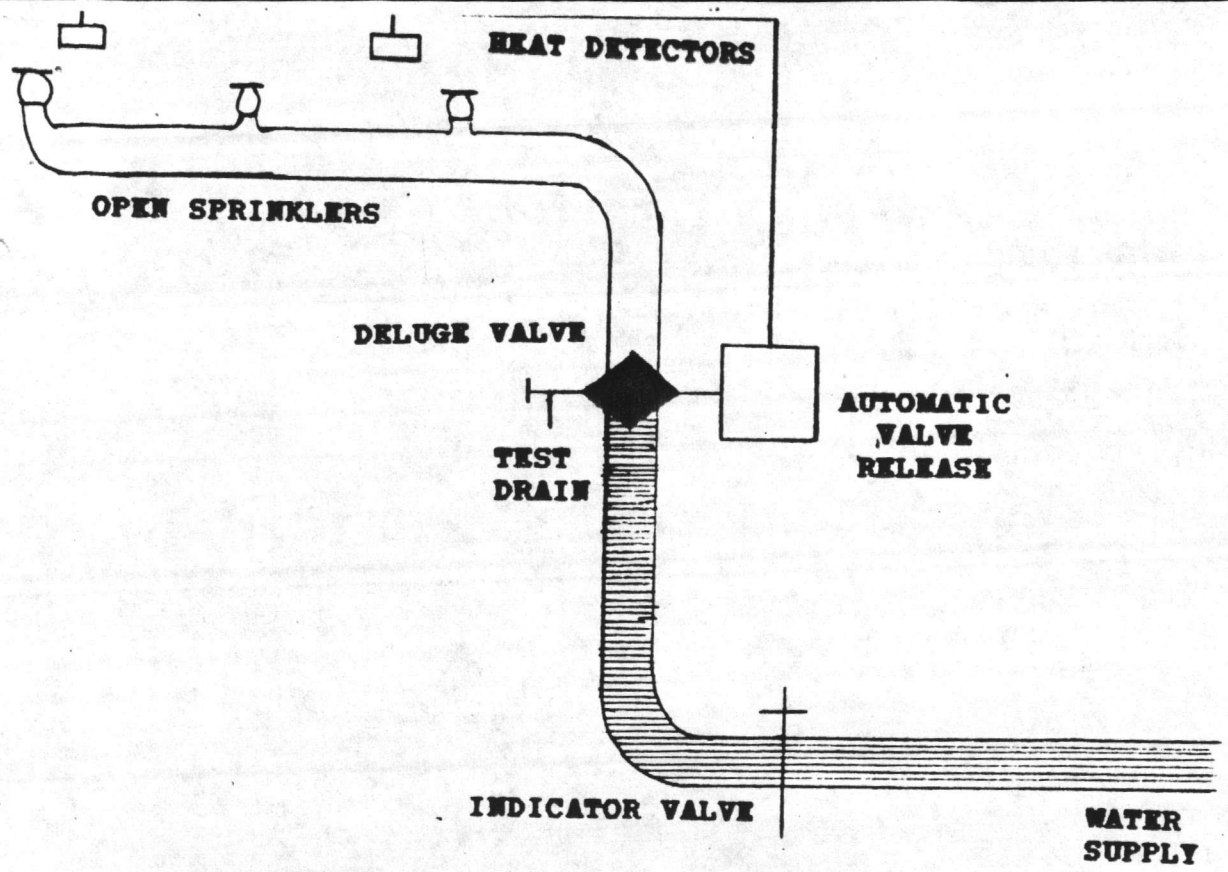
WET-PIPE SYSTEM

FIGURE 1(a)



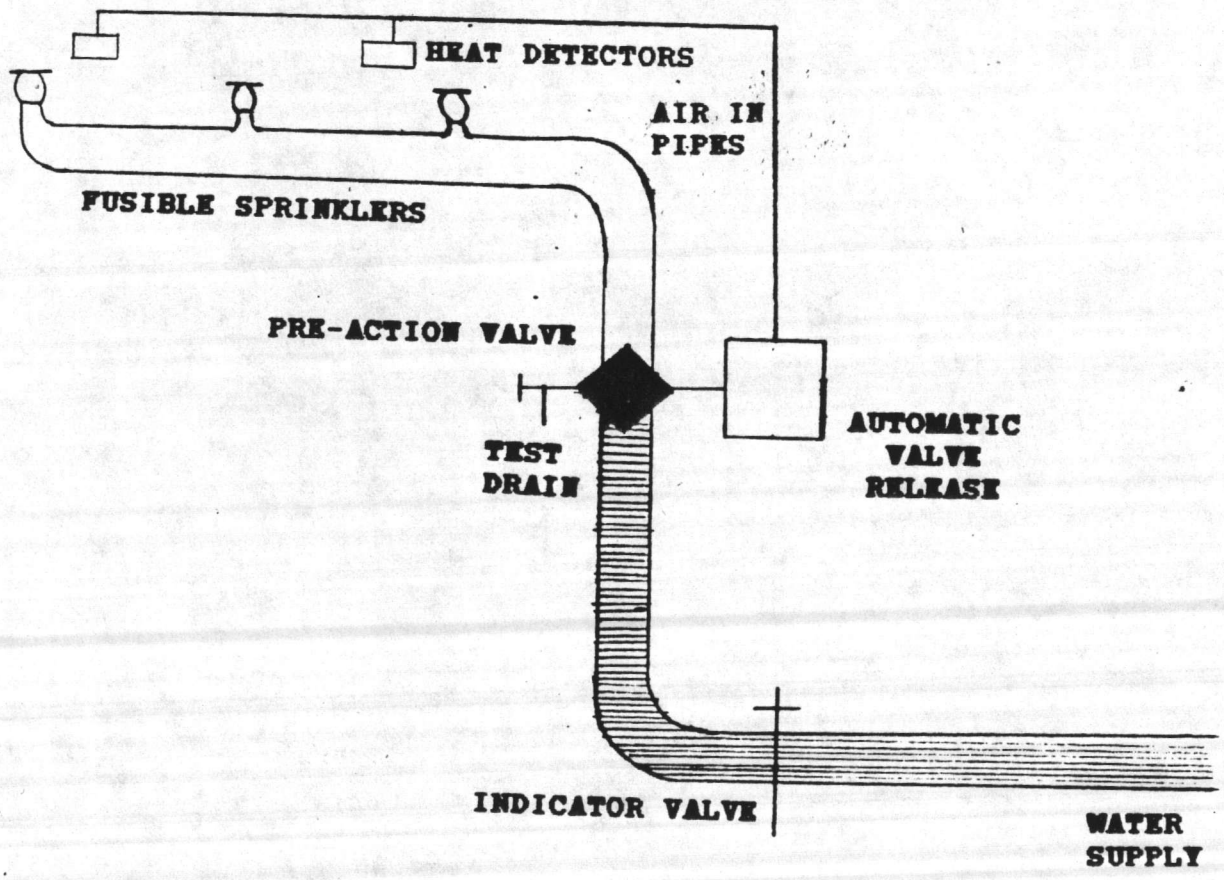
DRY-PIPE SYSTEM

FIGURE 1(b)



DELUGE SYSTEM

FIGURE 1(c)



PRE-ACTION SYSTEM

FIGURE 1(d)

(b) Feed Mains: Pipes supplying cross mains or risers.

(c) Cross Mains: Pipes directly supplying the lines on which the sprinkler heads are placed.

(d) Branch lines: Pipes to which the sprinkler heads are directly attached.

2. Fittings: Screwed, flanged, or rubber gasketed grooved-end pipe/fittings with mechanical coupling are usually used. Grooved-end is permitted only on pipe sizes 1-1/2 inches or larger. (Follow specification). Welded joints are used occasionally. Use of plain-end fittings with mechanical couplings that "bite" into the pipe will not be permitted. Also, all pipe size changes will be made using tapered reducing fittings.

3. Valves: All valves on connections to water supplies and in supply pipes to sprinkler systems should be outside screw and yoke (OS&Y) or approved indicator type. Check valves are usually straightway swing type installed in a vertical or horizontal position, although water check valves have been allowed. Ball-drip valves (used for fire department connection drainage) are typically required to be installed horizontally.

4. Hangars: Used to attach sprinkler piping to structural elements of building. See Figure A-3-15.1 of NFPA 13.

5. Sprinkler heads: Either of the upright or pendant design. Available in six temperature ranges with appropriate color coding. See table 3-16.6.1 of NFPA 13. The Navy normally uses intermediate ($212^{o}F$) temperature heads, which are color coded white.

6. Sprinkler Alarms: Any flow of water through the system equal to or greater than that from a single head will result in an alarm signal. The sprinkler alarm is normally arranged to activate the building evacuation alarm system, transmit a signal to the local fire department and sound a water motor gong. Common components used in alarm assemblies are:

(a) Water Motor Gong: An alarm bell mechanically operated by the flow of water through it. Usually located on the outside building wall near the sprinkler riser. Pipe sizes to the water motor gong must be at least 3/4 inch and be of a corrosion resistant material, usually galvanized pipe.

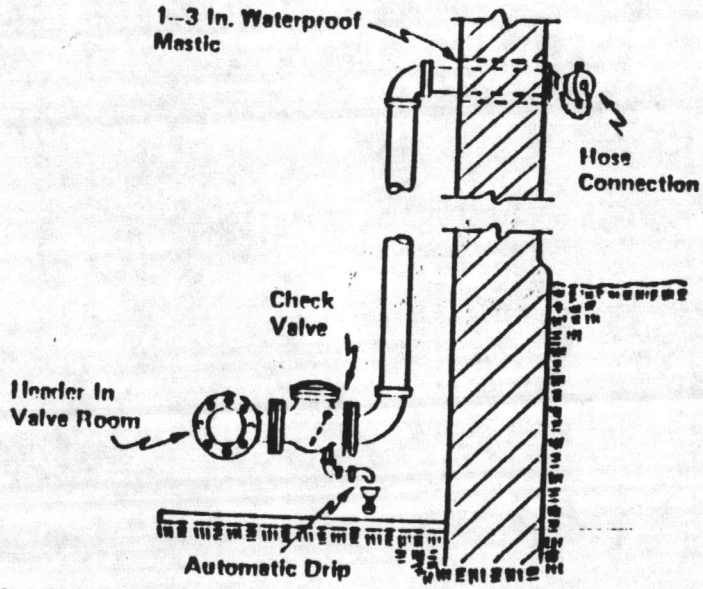
(b) Alarm Check Valve: Used in wet-pipe systems and located in sprinkler riser. Designed to give an alarm by opening upon the flow of water.

(c) Retard Chamber: Located in the alarm assembly and used to prevent needless alarms due to the water surges. Consists of a chamber which can hold 2 gallons or less.

(d) Excess Pressure Pump: Small capacity pump used to prevent needless alarms due to water surges (used infrequently).

(e) Pressure Switch: Located in water motor gong line and used to activate electrically operated alarm system upon flow of water. LANTDIV requires an adjustable retard mechanical diaphragm controlled water pressure type pressure switch in wet pipe systems. The normal waterflow pressure switch used in wet pipe sprinkler systems is a Potter WFSR-B or equivalent. A time delay of 20 to 40 seconds should be set by the sprinkler contractor during the prefinal inspection and acceptance tests.

7. Fire Department Connection: Usually a siamese connection with two 2.5 inch National Standard female hose threads with threaded caps and chains and equipped with a 4-inch check valve and piping connection. (See Figure 2)



For SI Units: 1 in. = 25.4 mm.

Fire Department Connection

Figure 2

II. PREPARATORY INSPECTION

A. Verify that the sprinkler contractor has submitted detailed working drawings and catalog cuts of equipment, and assure that these submittals have been reviewed and approved by the Fire Protection Engineering Branch. Check submittal for a signed approval stamp. If submittals are approved as noted check the notes which convey the approval.

B. Sprinkler System Underground Piping

1. Check depth of line to assure pipe is located below frost line, usually three feet, but four feet if below railroad track; specifications will most likely dictate.

2 Pipes should be cleaned when placed in the ground, and open ends plugged upon stopping work.

3. Pipes should bear throughout their length, and not be supported by their ends only.

4. Joints should be made tight.

5. All tees, caps, plugs and bends should be anchored.

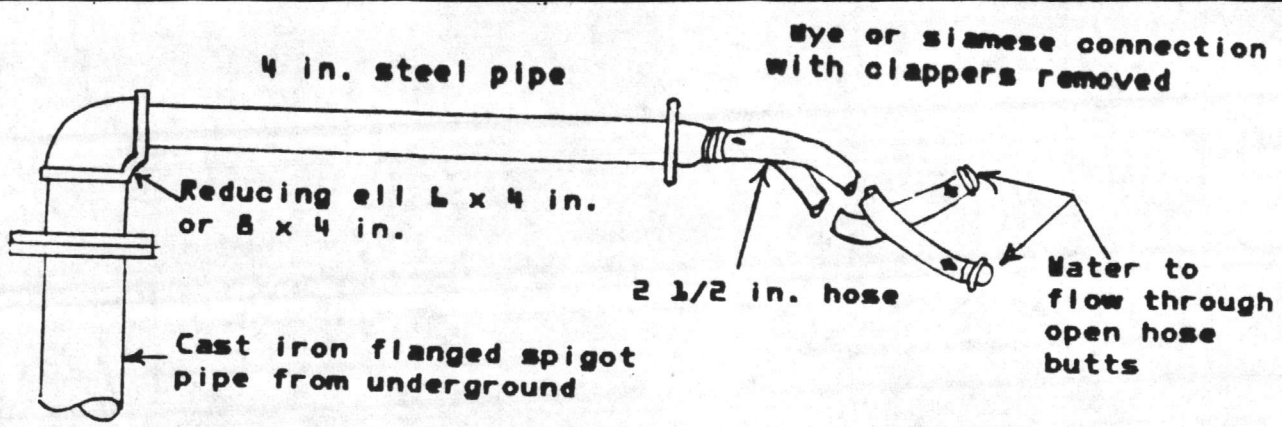
6. Piping should be hydrostatically tested at not less than 200 psi for two hours.

7. All valves should be tested to assure that they will fully open and close under water pressure.

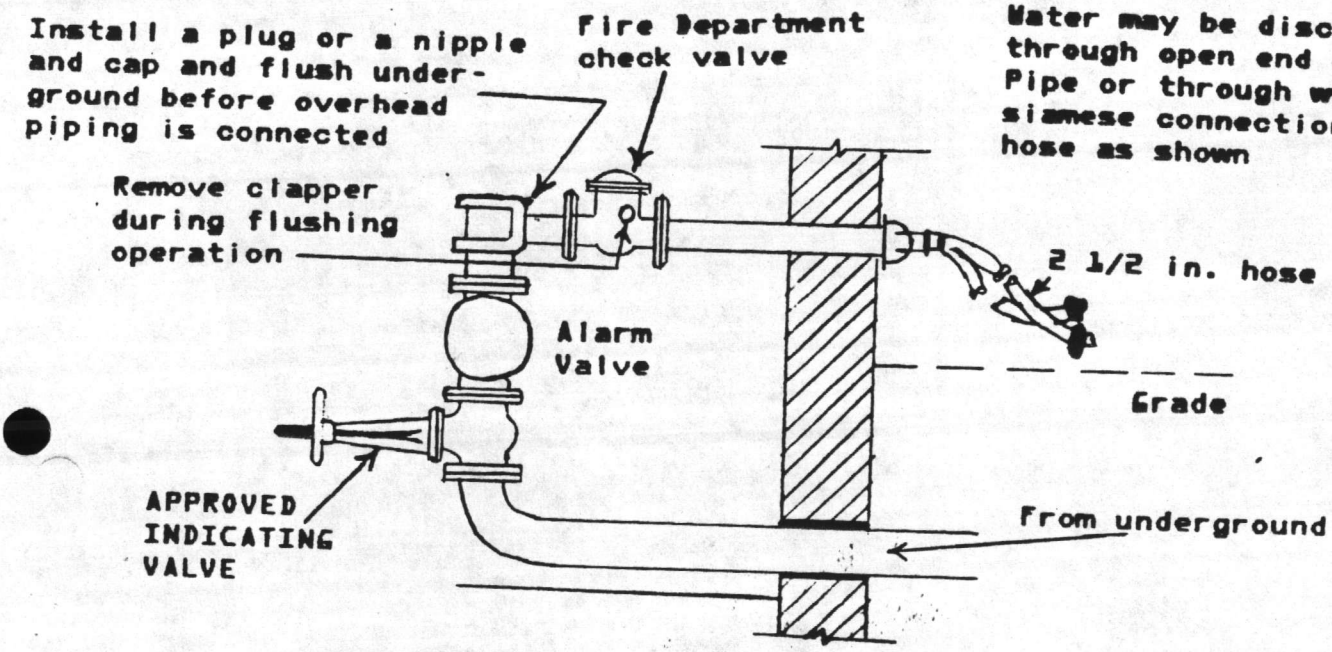
8. Thoroughly flush mains before the connection is made to the sprinkler system riser. (See figure 3 for Typical Flushing Methods). The following flows should be used:

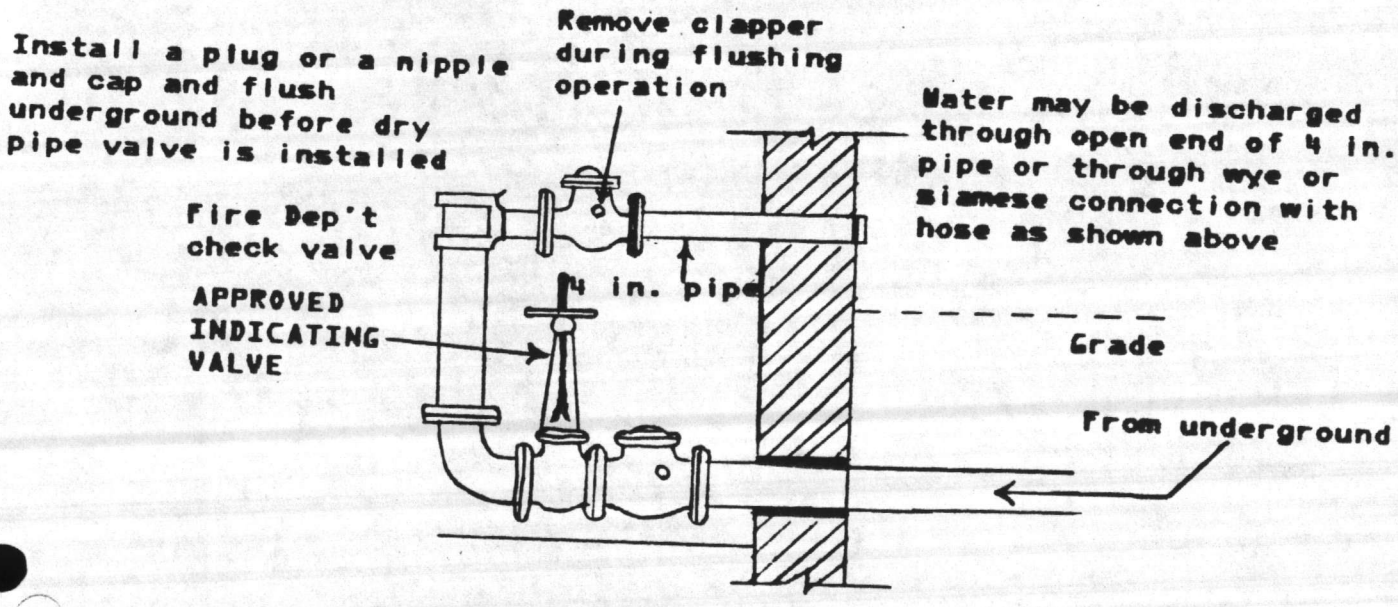
4"&6" -	750 gpm
8" -	1000 gpm
10" -	1500 gpm
12" -	2000 gpm

9. Underground sprinkler piping within five feet of the building shall be outside-coated AWWA C104 cement mortar lined AWS C151 ductile-iron pipe and AWWA C110 fittings. No joints are allowed under foundation walls. Piping must be braced with steel rods and a thrust block (see specifications).



Employing horizontal run of 4 in. pipe and reducing fitting near base of riser.





Employing fire department connections.

Figure 3--Methods of Flushing Water Supply Connections.

C. Interior Sprinkler Piping.

1. Ream piping to remove burrs and fins before being installed.

2. "Knock" clean all pipe before installation.

3. Use joint compound or pipe tape on threads.

4. All drains should discharge to the outside of the building.

5. Assure that pipe is painted according to specifications.

D. Sprinkler Heads.

1. Verify that sprinkler heads are installed in combustible concealed spaces in accordance with approved submittal drawings.

2. Check to assure that the specified temperature ratings are being provided, usually intermediate (212°F).

3. Verify that heads, hangers and piping are installed in accordance with approved submittal drawings and NFPA 13.

E. Pipe Size and Type.

Verify that all piping is sized and installed in accordance with the approved submittal drawings. This is extremely important, especially if the system is hydraulically calculated. Pipe should also be of the type specified and approved in the submittal. Note: pipe types might change, (i.e., 1.5 inches and larger may be grooved-end, smaller pipe will be schedule 40). Schedule 10 and schedule 30 pipe shall not be threaded (grooved-end only).

F. Floor and Wall Penetration.

The space around piping penetrating floors and fire walls should be filled with a nonhardening mastic. For floor penetrations, a collar extending three to six inches above the floor level should be provided and the space packed with fiberglass insulation sealed with applicable mastic material at each end. Pipe passing through walls and floors will be required to pass through a hot-dip galvanized steel pipe sleeve.

G. Hydrostatic Testing.

1. Sprinkler systems should be hydrostatically tested at 200 psi for two hours. Blank flange plates or other measures shall be used to prevent pressurizing on top of the differential dry-pipe alarm valve clapper and damaging the clapper seat. No leakage shall be permitted. Piping between the check valve in the fire department inlet pipe and the outside connection shall also be tested.

2. Dry-pipe and deluge systems, in addition to the above hydrostatic test, should be pumped up to 40 psi air pressure and allowed to stand for 24 hours. Air leakage should not exceed 1 1/2 psi during this time frame.

H. Other Tests. All components of the sprinkler system, including alarm system, should be operated to assure that they will function properly. Tests of deluge and pre-action type systems should include operation of all heat or smoke detection devices.

I. The following forms shall be filled out and submitted by the contractor prior to final acceptance testing:

1. "Contractors Material and Test Certificate for Aboveground Piping".

2. "Contractor's Material and Test Certificate for Underground Piping".

Note: It is recommended that information on these forms be verified and that all hydrostatic and air pressure tests be witnessed at some time during the test to ensure validity.

III. FINAL INSPECTION AND ACCEPTANCE TESTS. Upon completion of pre-final tests and inspections and verification that the system functions properly, the Division Fire Protection Engineer shall be requested to conduct a final inspection and acceptance test. A technical representative of the installing contractor and any interested parties should be notified to be present at the final inspection and tests. However, final inspection participants should be kept to minimum number of essential personnel.

IV. PROBLEM AREAS

A. Construction (lights, partitions, ducts, etc) obstructing sprinkler head discharge.

B. Excessive distance between sprinklers and ceiling (roof) or walls.

C. Painted sprinkler heads.

D. Pressure switch not connected to fire alarm system.

E. Lack of maintenance and operations manuals and as-built drawings (if required).

F. Sprinkler head temperature rating not increased near unit heaters.

G. 165°F heads versus 212°F minimum temperature heads.

H. Failure to provide 2-1/2 inch caps and chains on the fire department connection.

I. Lack of proper painting, pipe sleeves, and escutcheon plates.

J. Differences in sprinkler piping layout, head locations and equipment make/models used from that indicated in approved submittal data.

V. For procedures to be followed in the final acceptance test by the Division Fire Protection Engineer, see Appendix A.

CONTRACTOR'S MATERIAL & TEST CERTIFICATE FOR ABOVEGROUND PIPING

PROCEDURE

Upon completion of work, inspection and tests shall be made by the contractor's representative and witnessed by an owner's representative. All defects shall be corrected and system left in service before contractor's personnel finally leave the job.

A certificate shall be filled out and signed by both representatives. Copies shall be prepared for approving authorities, owners and contractor. It is understood the owner's representative's signature in no way prejudices any claim against contractor for faulty material, poor workmanship, or failure to comply with approving authority's requirements or local ordinances.

PROPERTY NAME | DATE

PROPERTY ADDRESS

PLANS

ACCEPTED BY APPROVING AUTHORITY('S) NAMES

ADDRESS

INSTALLATION CONFORMS TO ACCEPTED PLANS ☐ YES ☐ NO

EQUIPMENT USED IS APPROVED ☐ YES ☐ NO

IF NO, EXPLAIN DEVIATIONS

INSTRUCTIONS

HAS PERSON IN CHARGE OF FIRE EQUIPMENT BEEN INSTRUCTED AS TO LOCATION OF CONTROL VALVES AND CARE AND MAINTENANCE OF THIS NEW EQUIPMENT ☐ YES ☐ NO
IF NO, EXPLAIN

HAVE COPIES OF APPROPRIATE INSTRUCTIONS AND CARE AND MAINTENANCE CHARTS AND NFPA 13A BEEN LEFT ON PREMISES ☐ YES ☐ NO
IF NO, EXPLAIN

LOCATION OF SYSTEM

SUPPLIES BLDGS.

SPRINKLERS

MAKE	MODEL	YEAR OF MANUFACTURE	ORIFICE SIZE	QUANTITY	TEMPERATURE RATING

PIPE AND FITTINGS

PIPE CONFORMS TO _____ STANDARD ☐ YES ☐ NO

FITTINGS CONFORM TO _____ STANDARD ☐ YES ☐ NO

IF NO, EXPLAIN

ALARM VALVE OR FLOW INDICATOR

ALARM DEVICE			MAXIMUM TIME TO OPERATE THROUGH TEST PIPE	
TYPE	MAKE	MODEL	MIN.	SEC.

DRY PIPE OPERATING TEST

DRY VALVE			Q.O.D.		
MAKE	MODEL	SERIAL NO.	MAKE	MODEL	SERIAL NO.

	TIME TO TRIP THRU TEST PIPE*		WATER PRESSURE	AIR PRESSURE	TRIP POINT AIR PRESSURE	TIME WATER REACHED TEST OUTLET*		ALARM OPERATED PROPERLY	
	MIN.	SEC.	PSI	PSI	PSI	MIN.	SEC.	YES	NO
Without Q.O.D.									
With Q.O.D.									

IF NO, EXPLAIN

*MEASURED FROM TIME INSPECTOR'S TEST PIPE IS OPENED.

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(OVER)

DELUGE & PREACTION VALVES

OPERATION ☐ PNEUMATIC ☐ ELECTRIC ☐ HYDRAULIC

PIPING SUPERVISED ☐ YES ☐ NO | DETECTING MEDIA SUPERVISED ☐ YES ☐ NO

DOES VALVE OPERATE FROM THE MANUAL TRIP AND/OR REMOTE CONTROL STATIONS ☐ YES ☐ NO

IS THERE AN ACCESSIBLE FACILITY IN EACH CIRCUIT FOR TESTING ☐ YES ☐ NO | IF NO, EXPLAIN

MAKE	MODEL	DOES EACH CIRCUIT OPERATE SUPERVISION LOSS ALARM		DOES EACH CIRCUIT OPERATE VALVE RELEASE		MAXIMUM TIME TO OPERATE RELEASE	
		YES	NO	YES	NO	MIN.	SEC.

TEST DESCRIPTION

HYDROSTATIC: Hydrostatic tests shall be made at not less than 200 psi (13.6 bars) for two hours or 50 psi (3.4 bars) above static pressure in excess of 150 psi (10.2 bars) for two hours. Differential dry-pipe valve clappers shall be left open during test to prevent damage. All aboveground piping leakage shall be stopped.

FLUSHING: Flow the required rate until water is clear as indicated by no collection of foreign material in burlap bags at outlets such as hydrants and blow-offs. Flush at flows not less than 400 GPM (1514 L/min) for 4-inch pipe, 600 GPM (2271 L/min) for 5-inch pipe, 750 GPM (2839 L/min) for 6-inch pipe, 1000 GPM (3785 L/min) for 8-inch pipe, 1500 GPM (5678 L/min) for 10-inch pipe and 2000 GPM (7570 L/min) for 12-inch pipe. When supply cannot produce stipulated flow rates, obtain maximum available.

PNEUMATIC: Establish 40 psi (2.7 bars) air pressure and measure drop which shall not exceed 1-½ psi (0.1 bars) in 24 hours. Test pressure tanks at normal water level and air pressure and measure air pressure drop which shall not exceed 1-½ psi (0.1 bars) in 24 hours.

TESTS

ALL PIPING HYDROSTATICALLY TESTED AT _____ PSI FOR _____ HRS. | IF NO, STATE REASON

DRY PIPING PNEUMATICALLY TESTED ☐ YES ☐ NO

EQUIPMENT OPERATES PROPERLY ☐ YES ☐ NO

DRAIN TEST | READING OF GAGE LOCATED NEAR WATER SUPPLY TEST PIPE: STATIC PRESSURE: _____ PSI | RESIDUAL PRESSURE WITH VALVE IN TEST PIPE OPEN WIDE _____ PSI

Underground mains and lead in connections to system risers flushed before connection made to sprinkler piping.

VERIFIED BY COPY OF THE U FORM NO. 85B ☐ YES ☐ NO | OTHER EXPLAIN

FLUSHED BY INSTALLER OF UNDERGROUND SPRINKLER PIPING ☐ YES ☐ NO

BLANK TESTING GASKETS

NUMBER USED	LOCATIONS	NUMBER REMOVED

WELDING

WELDED PIPING ☐ YES ☐ NO

IF YES . . .

DO YOU CERTIFY AS THE SPRINKLER CONTRACTOR THAT WELDING PROCEDURES COMPLY WITH THE REQUIREMENTS OF AT LEAST AWS D10.9, LEVEL AR-3 ☐ YES ☐ NO

DO YOU CERTIFY THAT THE WELDING WAS PERFORMED BY WELDERS QUALIFIED IN COMPLIANCE WITH THE REQUIREMENTS OF AT LEAST AWS D10.9, LEVEL AR-3 ☐ YES ☐ NO

DO YOU CERTIFY THAT WELDING WAS CARRIED OUT IN COMPLIANCE WITH A DOCUMENTED QUALITY CONTROL PROCEDURE TO INSURE THAT ALL DISCS ARE RETRIEVED, THAT OPENINGS IN PIPING ARE SMOOTH, THAT SLAG AND OTHER WELDING RESIDUE ARE REMOVED, AND THAT THE INTERNAL DIAMETERS OF PIPING ARE NOT PENETRATED ☐ YES ☐ NO

HYDRAULIC DATA NAMEPLATE

NAMEPLATE PROVIDED ☐ YES ☐ NO | IF NO, EXPLAIN

REMARKS

DATE LEFT IN SERVICE WITH ALL CONTROL VALVES OPEN:

SIGNATURES

NAME OF SPRINKLER CONTRACTOR

TESTS WITNESSED BY

FOR PROPERTY OWNER (SIGNED) | TITLE | DATE

FOR SPRINKLER CONTRACTOR (SIGNED) | TITLE | DATE

ADDITIONAL EXPLANATION AND NOTES

Contractor's Material & Test Certificate for Aboveground Piping

CONTRACTOR'S MATERIAL & TEST CERTIFICATE FOR UNDERGROUND PIPING

PROCEDURE

Upon completion of work, inspection and tests shall be made by the contractor's representative and witnessed by an owner's representative. All defects shall be corrected and system left in service before contractor's personnel finally leave the job.

A certificate shall be filled out and signed by both representatives. Copies shall be prepared for approving authorities, owners and contractor. It is understood the owner's representative's signature in no way prejudices any claim against contractor for faulty material, poor workmanship, or failure to comply with approving authority's requirements or local ordinances.

PROPERTY NAME | DATE

PROPERTY ADDRESS

PLANS

ACCEPTED BY APPROVING AUTHORITY('S) NAMES

ADDRESS

INSTALLATION CONFORMS TO ACCEPTED PLANS ☐YES ☐NO

EQUIPMENT USED IS APPROVED ☐YES ☐NO

IF NO, STATE DEVIATIONS

INSTRUCTIONS

HAS PERSON IN CHARGE OF FIRE EQUIPMENT BEEN INSTRUCTED AS TO LOCATION OF CONTROL VALVES AND CARE AND MAINTENANCE OF THIS NEW EQUIPMENT ☐YES ☐NO

IF NO, EXPLAIN

HAVE COPIES OF APPROPRIATE INSTRUCTIONS AND CARE AND MAINTENANCE CHARTS BEEN LEFT ON PREMISES ☐YES ☐NO

IF NO, EXPLAIN

LOCATION

SUPPLIES BLDGS.

UNDERGROUND PIPES AND JOINTS

PIPE TYPES AND CLASS | TYPE JOINT

PIPE CONFORMS TO _____ STANDARD ☐YES ☐NO

FITTINGS CONFORM TO _____ STANDARD ☐YES ☐NO

IF NO, EXPLAIN

JOINTS NEEDING ANCHORAGE CLAMPED, STRAPPED, OR BLOCKED IN ACCORDANCE WITH _____ STANDARD ☐YES ☐NO

IF NO, EXPLAIN

TEST DESCRIPTION

FLUSHING. Flow the required rate until water is clear as indicated by no collection of foreign material in burlap bags at outlets such as hydrants and blow-offs. Flush at flows not less than 400 GPM (1514 L/min) for 4-inch pipe, 600 GPM (2271 L/min) for 5-inch pipe, 750 GPM (2839 L/min) for 6-inch pipe, 1000 GPM (3785 L/min) for 8-inch pipe, 1500 GPM (5678 L/min) for 10-inch pipe and 2000 GPM (7570 L/min) for 12-inch pipe. When supply cannot produce stipulated flow rates, obtain maximum available.

HYDROSTATIC. Hydrostatic tests shall be made at not less than 200 psi (13.8 bars) for two hours or 50 psi (3.4 bars) above static pressure in excess of 150 psi (10.3 bars) for two hours.

LEAKAGE. New pipe laid with rubber gasketed joints shall, if the workmanship is satisfactory, have little or no leakage at the joints. The amount of leakage at the joints shall not exceed 2 qts. per hr. (1.89 L/h) per 100 joints irrespective of pipe diameter. The leakage shall be distributed over all joints. If such leakage occurs at a few joints the installation shall be considered unsatisfactory and necessary repairs made. The amount of allowable leakage specified above may be increased by 1 fl oz per in. valve diameter per hour (30 mL/25 mm/h) for each metal seated valve isolating the test section. If dry barrel hydrants are tested with the main valve open, so the hydrants are under pressure, an additional 5 oz per minute (150 mL/min) leakage is permitted for each hydrant.

FLUSHING TESTS

NEW UNDERGROUND PIPING FLUSHED ACCORDING TO _____ STANDARD ☐YES ☐NO

BY (COMPANY)

IF NO, EXPLAIN

HOW FLUSHING FLOW WAS OBTAINED

☐PUBLIC WATER ☐TANK OR RESERVOIR ☐FIRE PUMP

THROUGH WHAT TYPE OPENING

☐HYDRANT BUTT. ☐OPEN PIPE

LEAD-INS FLUSHED ACCORDING TO _____ STANDARD ☐YES ☐NO

BY (COMPANY)

IF NO, EXPLAIN

HOW FLUSHING FLOW WAS OBTAINED

☐PUBLIC WATER ☐TANK OR RESERVOIR ☐FIRE PUMP

THROUGH WHAT TYPE OPENING

☐Y CONN. TO FLANGE & SPIGOT ☐OPEN PIPE

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(OVER)

HYDROSTATIC TEST	ALL NEW UNDERGROUND PIPING HYDROSTATICALLY TESTED AT _____ PSI FOR _____ HOURS	JOINTS COVERED ☐ YES ☐ NO
LEAKAGE TEST	TOTAL AMOUNT OF LEAKAGE MEASURED _____ GALS. _____ HOURS	
	ALLOWABLE LEAKAGE _____ GALS. _____ HOURS	
HYDRANTS	NUMBER INSTALLED / TYPE AND MAKE	ALL OPERATE SATISFACTORILY ☐ YES ☐ NO
CONTROL VALVES	WATER CONTROL VALVES LEFT WIDE OPEN ☐ YES ☐ NO IF NO, STATE REASON	
	HOSE THREADS OF FIRE DEPARTMENT CONNECTIONS AND HYDRANTS INTERCHANGEABLE WITH THOSE OF FIRE DEPARTMENT ANSWERING ALARM ☐ YES ☐ NO	
REMARKS	DATE LEFT IN SERVICE	
SIGNATURES	NAME OF INSTALLING CONTRACTOR	
	TESTS WITNESSED BY	
	FOR PROPERTY OWNER (SIGNED) / TITLE / DATE	
	FOR INSTALLING CONTRACTOR (SIGNED) / TITLE / DATE	
ADDITIONAL EXPLANATION AND NOTES		

Contractor's Material & Test Certificate for Underground Piping

SECTION 3

FIRE ALARM SYSTEM

I. MATERIALS

A. Description

1. Fire alarm systems are of two basic types - manual and automatic.

2. These systems can be arranged to perform one or a combination of the following basic functions:

   a. Notify occupants of a fire by audible and/or visual alarms
   b. Notify local fire department
   c. Monitor fire extinguishing system
   d. Actuate fire control equipment
   e. Shut down air handling units

B. Components

1. The most common components of fire alarm systems are as follows:

   a. Control Panel. Main component and normally contains all switches, relays, visual and audible indicating devices and all other components required for complete control, supervision, and testing of the alarm system. Also, connection to the exterior station fire alarm system is usually made through this panel.

   b. Annunciator Panel. This panel is normally used in larger facilities. It is a slave of the main control panel, and its purpose is to aid fire fighters in locating the area or zone in the building from which the signal originated. The annunciator panel may be integral with the main control panel, or it may be a separate unit.

   c. Master Box (coded transmitter). When the interior main control panel is activated, the master box is also activated and transmits a coded signal to the station's fire department. A radio transmitter performs the same function, but transmits using a radio frequency verses cables.

   d. Manual stations. Devices provided for the manual activation of the alarm system. Generally red in color and labeled "Fire". Manual stations are usually located at main exits and should have screw-type terminals.

   e. Heat detectors. Are usually fixed temperature and rate of rise. Are used to activate extinguishing systems or are installed in areas where automatic sprinklers can not be justified.

f. Smoke detectors. Are of the ionization or photoelectric type. Used to provide early fire detection and activate fire extinguishing and/or evacuation systems.

II. INSTALLATION

A. Most of the alarm system components are shown on the contract drawings. Number 14 AWG wiring is used for the interconnection of low voltage equipment and number 12 AWG wiring is used for 120 volt circuits.

III. PREPARATORY INSPECTION

A. Detailed wiring diagrams of the alarm system and equipment, along with catalog cuts and descriptive literature, must be submitted by the contractor for approval prior to installation. Submittals must be stamped and signed by the Atlantic Division Fire Protection Engineering Branch, Code 408.

B. All material should be new and delivered to the job site in manufacturer's original unopened containers. Verify that material is identical to approved catalog cuts and verify that all items are U.L. listed or FM approved. Check for the label on the equipment.

IV. PREFINAL INSPECTION AND TESTS

A. Verify that all equipment is properly located. Location of equipment is usually shown on the contract drawings.

B. Detectors. Heat and smoke detectors shall be located as shown on contract drawings and approved shop drawings. Verify that the firing voltage of each smoke detector is recorded.

C. Wiring. Check to verify that pigtail or "T" tap connections do not exist. Check to verify that alarm and signal circuits are identified. Verify circuit supervision by removing an alarm initiating device and checking for the appropriate trouble signal at the control panel. The correct way of wiring zone circuits in order to prevent "T" taps or pigtails is shown in Figure 4.

D. Acceptance Test. Upon completion of the system a complete preliminary test of all the system's functions should be conducted. If automatic detectors are installed, each one should be activated. Firing voltages of all smoke detectors shall be recorded. Upon completion of the preliminary tests, have smoke detectors cleaned and contact Fire Protection Engineering Branch to conduct the final acceptance tests..

V. PROBLEMS

A. The major problem with fire alarm system installations is improper wiring. Some of the more common deficiencies are as follows:

1. Wiring not identified.

2. Wrong size of wire installed.

3. Improper wiring preventing specified functions from being performed (i.e. trouble alarms, ring-back feature, city box disconnect).

4. Pigtail or "T" tap connections (defeats supervision function).

5. Each manual station does not have a separate screw terminal for each conductor.

6. Fire alarm devices are not on specified zone.

7. Lack of conductor identification and rigid plastic or painted metal zone labels.

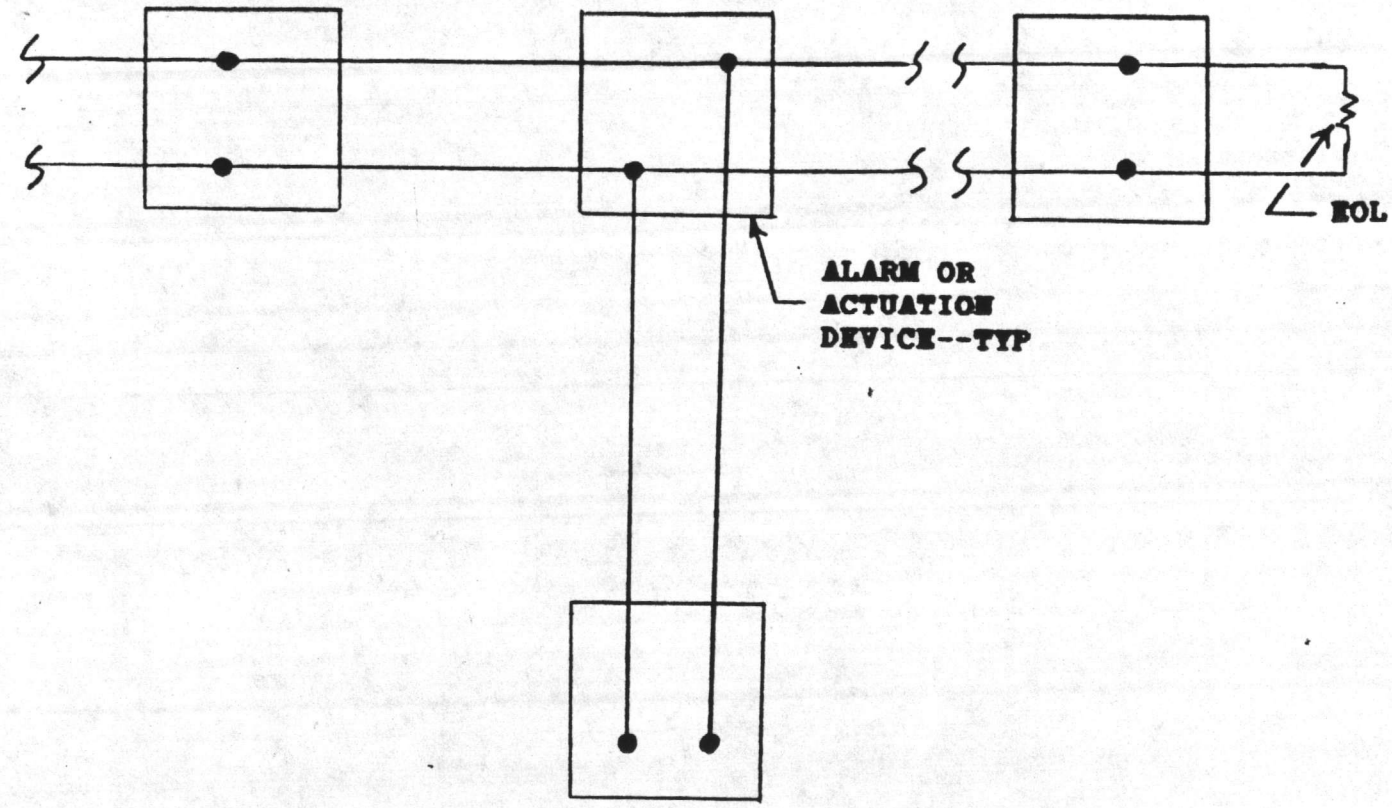
B. Ionization type detectors have not had their sensitivity properly adjusted by a factory representative and their settings properly recorded.

C. None or improper number of spare parts (i.e. keys, manual stations, smoke detectors heat detectors etc.). Also spare zones should contain actual zone module, not just an empty space for the spare zone module.

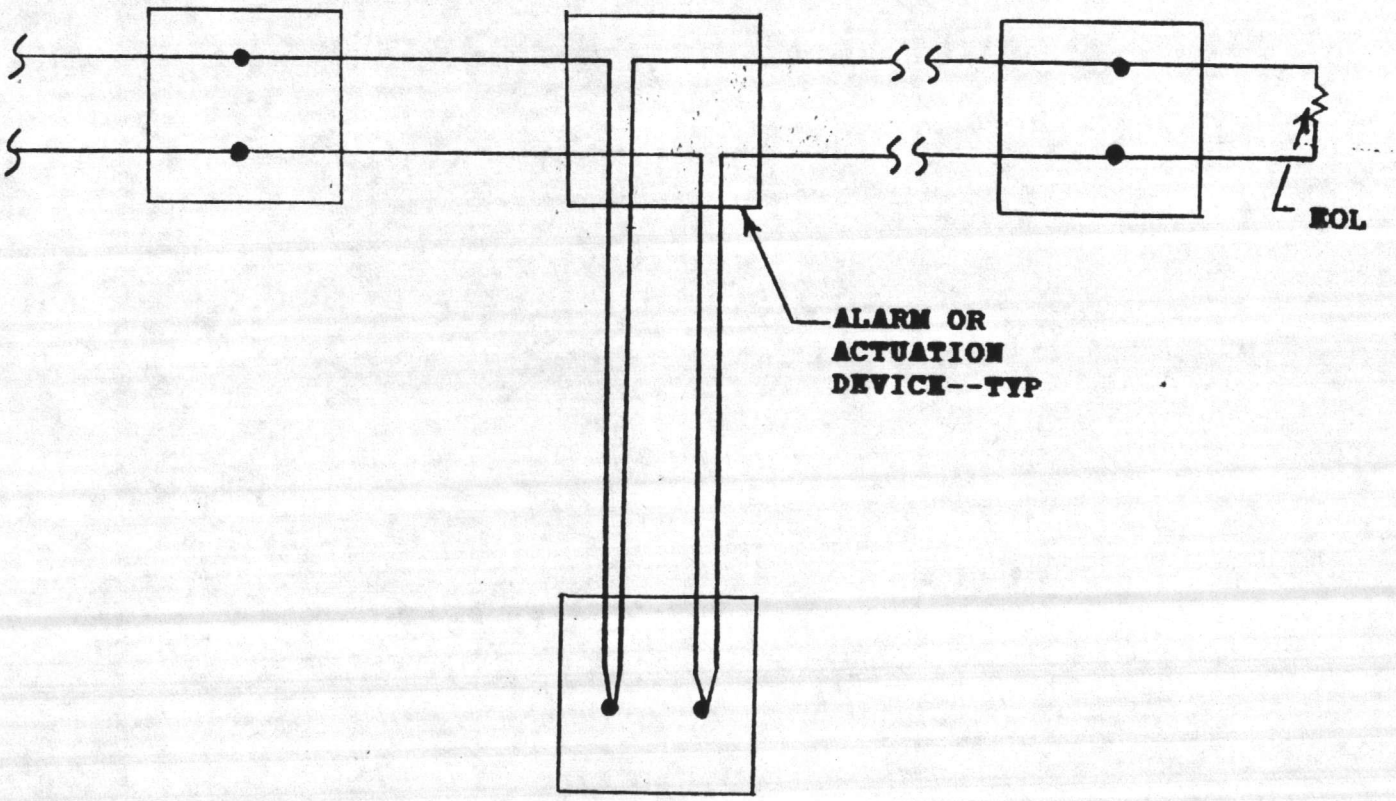
D. Smoke detectors have not been recently cleaned prior to final inspection and acceptance testing and have reduced sensitivities cause by construction dust/dirt.

VI. FINAL ACCEPTANCE TEST

For procedures to be followed in the final acceptance test by the Division Fire Protection Engineer, see Appendix B.



WRONG



CORRECT

FIGURE 4

SECTION 4

HIGH PRESSURE CARBON DIOXIDE SYSTEM

I. MATERIALS

A. The two basic types of systems are as follows:

1. Total flooding which consists of a fixed supply of carbon dioxide normally connected to fixed piping with nozzles arranged to discharge carbon dioxide into an enclosed space. Usually activated by manual pull stations.

2. Hand Hose Line consists of a fixed supply of carbon dioxide supplying hose line(s).

B. The basic components of the system are as follows:

1. Storage cylinders of usually 75 pound capacity with a protection cap for the valve. Cylinders are stored in steel racks, designed to hold cylinders securely in the upright position. The rack is designed to support a beam scale weight device to allow weighing cylinders in place. A main to reserve transfer switch may also be provided at the cylinders.

2. Flexible Connectors are used to connect the discharge heads to the manifold and should be capable of withstanding 5000 psi bursting pressure.

3. Manifolds and Piping. Manifolds are fabricated of zinc coated or cadmium plated pipe and fittings. Pipe is galvanized steel, Schedule 40 for 3/4 inch diameter and Schedule 80 for 1 inch diameter and larger. All fittings shall be class 300, hot-dipped galvanized and marked.

4. Pipe Sleeves are provided where walls and floors are penetrated.

5. Hose Reels contain 75 feet of 3/4 inch braid rubber covered hose on an approved reel and are equipped with a nonconductive discharge horn, playpipe and approved quick opening shut off valve.

6. Pneumatic Switches are provided just after the piping header and are connected to the building fire alarm system.

C. All equipment must be listed by U.L. Inc. or approved by Factory Mutual.

II. PREPARATORY INSPECTION

A. Verify that the contractor has submitted detailed working drawings, calculations and catalog cuts of equipment, and that these have been reviewed and approved by the Fire Protection Engineering Branch. Check the submittal for a signed "Approval Stamp".

B. All material shall be new, unless specified otherwise, and should be identical to the approved submittals. Check the material for a U.L. Inc. or FM label.

III. PREFINAL INSPECTION AND TESTS

A. After verification that working drawings and materials supplied are approved, the contractor can begin work. Check to verify that piping, nozzles and equipment are installed in accordance with approved submittals.

B. Piping

1. Check to see that piping is not restricted due to foreign matter or faulty fabrication.

2. Piping shall be securely supported.

3. Pipe shall be reamed and cleaned before assembly. After assembly, the piping system shall be blow out before nozzles for discharge devices are installed.

C. Fittings. Fittings shall be Class 300, hot-dipped galvanized. Identify Class 300 fittings by having #300 WSP or #2000 imprinted on fitting with the initials "MI" and the manufacturers initials.

D. Nozzles shall be located and directed in accordance with the approved shop drawings. Nozzles must be marked with proper size or code in accordance with approved shop drawings.

E. Hand hose lines shall be located as shown on the approved drawings.

F. Verify that valves are installed as approved on shop drawings. Valves shall be installed to give sufficient room for repair or removal without interfering with another pipe or valve.

G. Pre-final tests. Conduct a 150 psi pneumatic test and CO_2 preliminary discharge test as required by specifications. Upon verification that the system functions properly, the Fire Protection Engineering Branch should be contacted to schedule a final acceptance test. A representative of the installing contractor shall be present at the final acceptance test.

IV. PROBLEM AREAS

A. Listed below are some of the common deficiencies found in past final acceptance tests:

1. Ordinary (Class 150) fittings used in place of required class 300 fittings.

2. Systems are not leak-tight and leak during testing.

3. Installed nozzle sizes do not match those shown on approved shop drawings.

4. Required labels and instruction plates missing.

5. Required safety valves are not installed in accordance with approved shop drawings.

V. FINAL ACCEPTANCE TEST

For procedures to be followed in the final acceptance test by the Division Fire Protection Engineer, see Appendix C.

SECTION 5

PRE-ENGINEERED DRY CHEMICAL AND WET CHEMICAL

FIRE EXTINGUISHING SYSTEM

I. MATERIALS

A. Pre-Engineered system ("Package System") has predetermined flow rates, nozzle pressures, and quantities of dry or wet chemical. These systems have specific pipe size, maximum and minimum pipe lengths, flexible hose specifications, number of fittings and number and types of nozzles prescribed by a nationally recognized testing laboratory such as U.L. Inc. Systems are usually used to protect kitchen hoods, ducts and associated range-top hazards such as deep fat fryers, grills and charbroilers.

B. All equipment shall be listed by U.L. Inc. or approved by F.M.

C. Listed below are the basic components of the system:

1. Piping. Threaded pipe and fittings shall be galvanized malleable iron, galvanized steel, stainless steel, copper or brass. Black steel pipe with welded joints may be used. However, specification will dictate pipe types.

2. Nozzles shall be listed by U.L. Inc. or approved by F.M. for their specific application.

3. Operating devices are fusible links, manual stations and gas or electrical shut down devices.

II. PREPARATORY INSPECTION

A. Verify that the Contractor has submitted detailed working drawings and catalog cuts of equipment, and assure that these submittals have been reviewed and approved by the Atlantic Fire Protection Engineering Branch. Check submittal for signed "Approval Stamp".

B. All material shall be new and installed in accordance with the approved submittals. This is extremely important in pre-engineered systems.

III. PREFINAL INSPECTION AND TESTING

A. After verification that working drawings and materials supplied have been approved, the contractor can begin work.

B. Insure that all equipment is installed in accordance with approved shop drawings.

C. Upon completion of the prefinal inspection, contact the Fire Protection Engineering Branch to schedule the final acceptance test. A representative of the installing contractor shall be present at the final acceptance test.

IV. PROBLEM AREAS

A. Listed below are some of the common deficiencies noted at the time of the final acceptance tests.

1. Instruction and maintenance manuals not available.

2. Electrical or gas supply to kitchen cooking equipment is not arranged to shut-down upon activation of the system.

3. Exhaust fans do not start up or continue to run as required by the specification.

4. Piping is not properly supported and braced.

5. Grease covers missing from nozzles.

6. Remote manual release station is not provided or not installed in accordance with contract drawings.

V. FINAL ACCEPTANCE TEST

For procedures to be followed in the final acceptance test by the Atlantic Division Fire Protection Engineer, see Appendix D.

SECTION 6

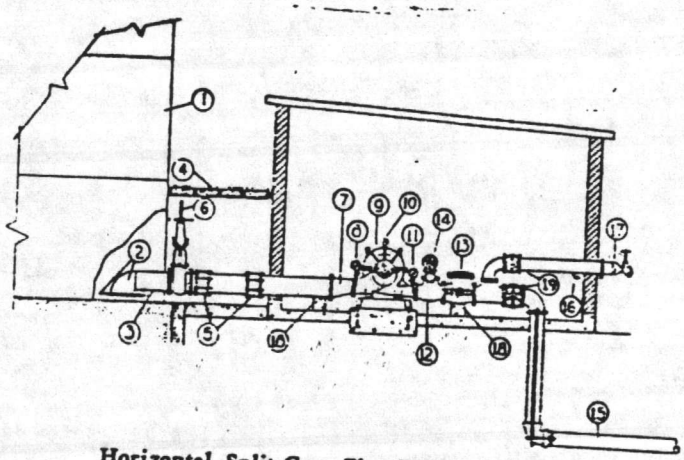
FIRE PUMPS

I. INTRODUCTION

Fire pumps are installed to provide increased water volume and pressure for fire fighting and fire protection systems, (i.e. automatic sprinkler systems, fire hydrants, standpipes etc.) They may take suction from water mains, ground level storage tank reservoirs, or from natural water bodies. Fire pumps are of centrifugal type and driven by an electric motor or a diesel engine. They are designed to deliver their rated capacity at a specified head pressure and should deliver 150% of rated capacity at not less than 65% of the rated pressure. For example, a 1000 gpm pump rated @ 100 psi must produce 1500 gpm @ 65 psi.

II. TYPES OF FIRE PUMPS

A. Horizontal fire pumps are of the split case or end suction design and are used where a water supply is obtainable under a positive head. Figure 5 shows the installation of a typical horizontal split-case fire pump.

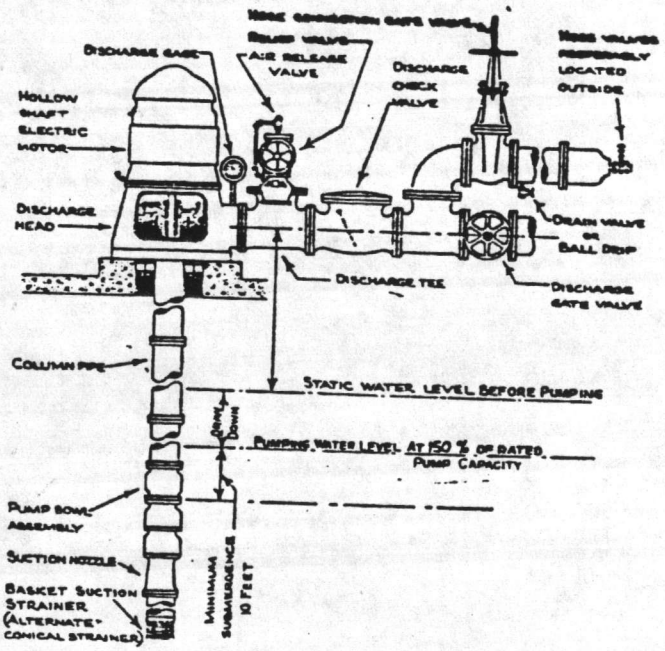


Horizontal Split-Case Fire Pump Installation with Water Supply under a Positive Head.

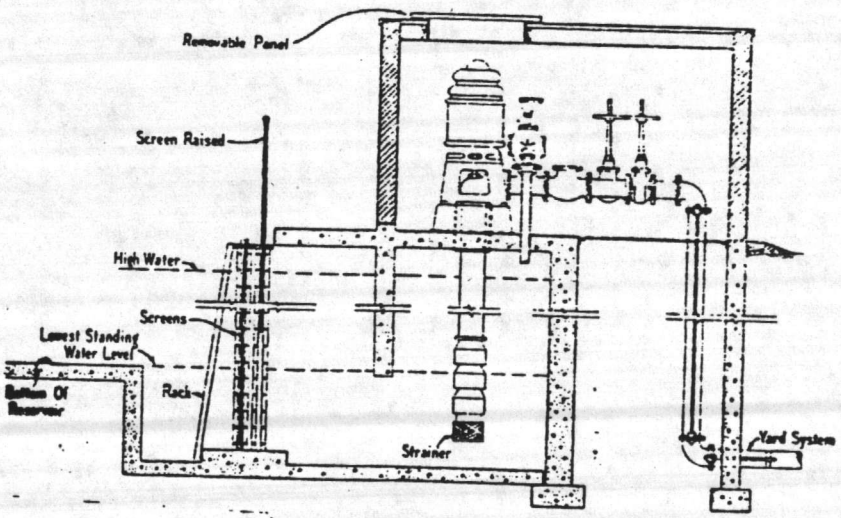
1. Above-Ground Suction Tank.
2. Entrance Elbow and 4 ft. x 4 ft. (1.2 m x 1.2 m) square vortex plate. Distance above bottom of tank—one-half diameter of suction pipe with a minimum of 6 in. (152 mm).
3. Suction Pipe.
4. Frostproof Casing.
5. Flexible Couplings for strain relief.
6. O.S. & Y. Gate Valve (see 3-3.4.6 and A-3-3.4.6).
7. Eccentric Reducer.
8. Suction Gage.
9. Horizontal Split-Case Fire Pump.
10. Automatic Air Release.
11. Discharge Gage.
12. Reducing Discharge Tee.
13. Discharge Check Valve.
14. Relief Valve (if required).
15. Discharge Pipe.
16. Drain Valve or Ball Drip.
17. Hose Valve Manifold with Hose Valves.
18. Pipe Supports.
19. Indicating Gate or Indicating Butterfly Valve.

FIGURE 5

B. Vertical shaft turbine-type fire pumps are used when the source of water is located below the pumps. This type of pump was originally used in drilled wells but is most effective in lifting water from lakes, streams, open sumps and other subsurface sources. These pumps are commonly found at fuel and ship piers. Figure 6 shows two typical installations of vertical shaft turbine-type fire pumps.



Vertical Shaft Turbine-Type Pump Installation in a Well.



Vertical Shaft Turbine-Type Pump — Installation in a Wet Pit.

FIGURE 6

III. FIRE PUMP COMPONENTS

A. Pumps will be of the centrifugal type of either the horizontal or vertical shaft design.

B. Relief valve should be provided between the pump and pump check valves to relieve excessive pressure on the water system. The relief valve should discharge through a cone to the exterior of the pump house or to the water storage reservoir.

C. A circulation relief valve of at least 3/4-inch in size should be provided for each pump to prevent the pump from overheating when operating with no discharge. This relief valve will not be required for engine driven pumps in which the engine cooling water is taken from the pump discharge.

D. Suction and discharge pressure gauges are required for horizontal pumps. A discharge pressure gauge only is required for vertical pumps.

E. A check valve is required on the discharge side of the pump.

F. Control valves of the OS&Y type should be provided on the suction side of the pump and on the supply side of the check valve to make the pump and check valve accessible for repair.

G. Piping within pump house will normally be specified to be steel pipe with flanged fittings only. Other types of fittings (i.e. welded, rubber gasketed, etc.) will normally not be permitted.

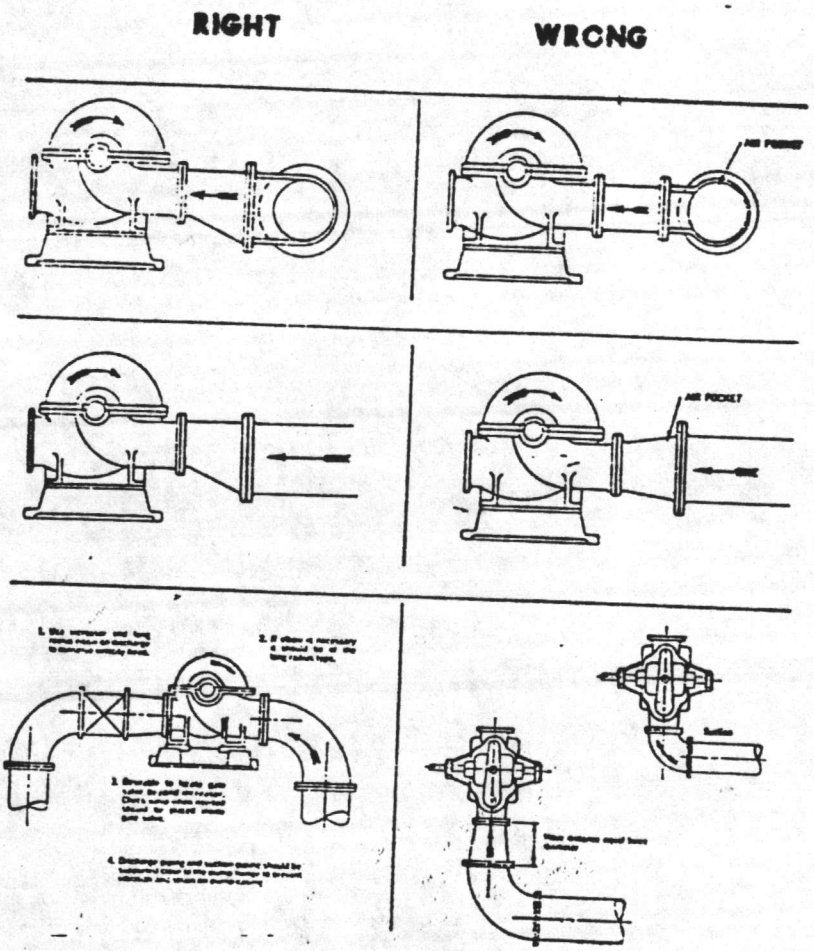
H. Test header with 2-1/2-inch hose valves should be provided on the exterior wall of the pump house. The number of 2-1/2-inch valve outlets will depend on the size of the pump.

I. Size of pump, pipe, and fittings should be as follows:

Pump Rating gpm L/min	Minimum Pipe Sizes (Nominal) Suction in.*	Discharge in.*	Relief Valve in.	Relief Valve Discharge in.	Meter Device in.	Number and Size of Hose Valves in.	Hose Header Supply in.
25 (95)	1	1	¾	1	1¼	1 – 1½	1
50 (189)	1½	1¼	1¼	1½	2	1 – 1½	1¼
100 (379)	2	2	1½	2	2½	2 – 1½	2
150 (568)	2½	2½	2	2½	3	1 – 2½	2½
200 (757)	3	3	2	2½	3	1 – 2½	2½
250 (946)	3½	3	2	2½	3½	1 – 2½	3
300 (1136)	4	4	2½	3½	4½	1 – 2½	3
400 (1514)	4	4	3	5	4	2 – 2½	4
450 (1703)	5	5	3	5	4	2 – 2½	4
500 (1892)	5	5	3	5	5	2 – 2½	4
750 (2839)	6	6	4	6	5	3 – 2½	6
1000 (3785)	8	6	4	8	6	4 – 2½	6
1250 (4731)	8	8	6	8	6	6 – 2½	8
1500 (5677)	8	8	6	8	8	6 – 2½	8
2000 (7570)	10	10	6	10	8	6 – 2½	8
2500 (9462)	10	10	6	10	8	8 – 2½	10
3000 (11 355)	12	12	8	12	8	12 – 2½	10
3500 (13 247)	12	12	8	12	10	12 – 2½	12
4000 (15 140)	14	12	8	14	10	16 – 2½	12
4500 (17 032)	16	14	8	14	10	16 – 2½	12
5000 (18 925)	16	14	8	14	10	20 – 2½	12

*Actual pump flange may be less than pump size.

K. Eccentric tapered reducers should be provided to prevent air pockets when pump suction pipe and pump suction flange are not of the same size. Figure 7 shows proper and improper methods of making the connection between the pipe and flange.



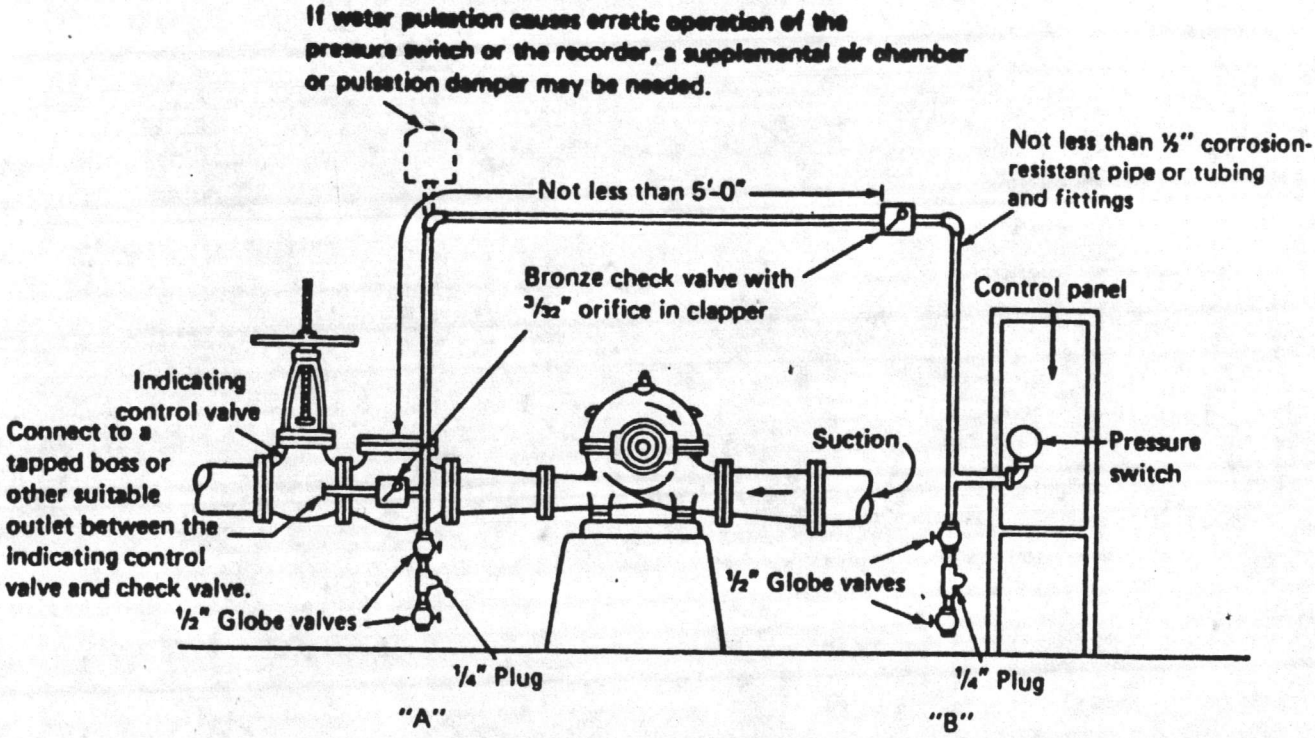
Right and Wrong Pump Suctions*

*Diagram reprinted from *Hydraulic Institute Standards for Centrifugal, Rotary and Reciprocating Pumps*; thirteenth edition — 1975. Copyright by the Hydraulic Institute, 1230 Keith Building, Cleveland, OH 44115.

FIGURE 7

L. Pumps will normally be specified for electric motor or diesel engine drive. When a diesel engine is specified, it should be provided with a closed circuit, heat exchanger type cooling system. The use of an ordinary vehicle type radiator cooling system is not acceptable.

M. Controllers for fire pumps should be approved for the type pump they are connected to. Normally pump controllers will start the fire pumps on loss of pressure in the system. However, pumps which supply deluge type sprinkler systems will normally be arranged to start upon operation of the deluge system.



Test Connection at "A" or "B"

If water is clean, ground-face unions with noncorrosive diaphrams drilled for 3/32" orifices may be used in place of the check valves

For SI Units: 1 in. = 25.4 mm; 1 ft = 0.3048 m.

Piping Connection for Each Automatic Pressure Switch (for Fire Pumps or Jockey Pumps).

NOTE: Solenoid drain valve used for engine driven fire pumps may be at "A," "B," or "inside of controller enclosure."

FIGURE 8

N. Jockey pumps of approximately 10 to 20 gpm capacity are normally provided to maintain pressure on the fire protection distribution system.

M. Figure 8 shows the typical connection between a pressure switch and the fire pump.

IV. CONSTRUCTION AND INSTALLATION

A. Verify that the contractor has submitted equipment lists covering all material he proposes to install, and that these have been approved by the Fire Protection Engineering Branch prior to installation. A signed approval stamp should be on each submittal.

B. After the submittals have been approved, the contractor may be permitted to begin work.

C. All materials should be checked to assure compliance with approved submittals and that the items required are "UL" listed or "FM" approved.

D. Frequent in-progress inspections must be conducted to assure that the plans are accurately followed and high quality workmanship is provided.

V. PREFINAL INSPECTION AND TESTS

A. After installation is completed, the contractor should test the pumps. Caution must be exercised throughout fire pump tests. The high pressures and flows generated by fire pumps may burst pipes, fittings and testing equipment producing hazardous situations. Personnel safety shall be a priority. The following minimum procedures should be accomplished:

(1) Fire Pumps

(a) Determine that pump is primed and casing is full of water. Interior wearing rings may be damaged by operation without water.

(b) Have the pump started, observing proper method of starting for various types of drivers.

(c) Observe bearings for signs of overheating.

(d) Observe alignment of pump and driver. Note tightness of foundation bolts.

(e) Observe stuffing boxes of pump. With water seal supplied with water, a small leak at stuffing box glands is necessary.

(f) Watch pressure gauges. Signs of suction leaks may be indicated by cavitation or knocking in pump. Gauge readings also may suggest that there are obstructions in the suction line, such as ice, or that foot valves or screens are clogged, or that well supply is inadequate, that foot valve should be lower or that intakes are insufficiently immersed.

(g) Churn pressure test is performed by closing all outlets, opening relief valve slightly, and noting pump pressure (for horizontal shaft pumps usually not over 120 per cent of rated pressure; for vertical shaft pumps, 140 per cent).

(h) If pump is arranged for automatic as well as manual starting, have the pump started by simulating an automatic starting condition such as a pressure drop caused by opening test header outlets on pump discharge.

(2) Electrically Driven Centrifugal Pumps: Electric pump controllers normally have detailed instructions given on the controller and these should be followed. Manual starting should be repeated a number of times at each test. Manual remote controls should be also given an operating test.

(3) Internal Combustion Engine Driven Pump: To start pump, have contractor follow manufacturer's instructions provided.

B. After prefinal tests have been conducted and proper functioning of the system has been verified the Atlantic Division Fire Protection Engineering Branch should be contacted to conduct a final inspection and acceptance test. At this time, full flow operational tests will be conducted. Representatives of the installing contractor, pump manufacturer, diesel mechanic (for diesel engines), etc., should be notified to be present at the final inspection and test.

C. PROBLEM AREAS NOTED IN PAST FIRE PUMP ACCEPTANCE INSPECTIONS

1. Pump alarms fail to work properly. (i.e. pump trouble, low fuel level, pump running, etc.).

2. Pumphouse pipe, fittings, and equipment not installed according to approved shop drawings.

3. Unapproved welded fittings and rubber gasketed fittings installed. (Current fire pump specifications only permit flanged fittings.)

VI. FINAL ACCEPTANCE TEST

For procedures to be followed in the final acceptance test by the Atlantic Division Fire Protection Engineer, see Appendix E.

SECTION 7

OTHER FIRE PROTECTION SYSTEMS/ITEMS

I. FIRE HYDRANTS

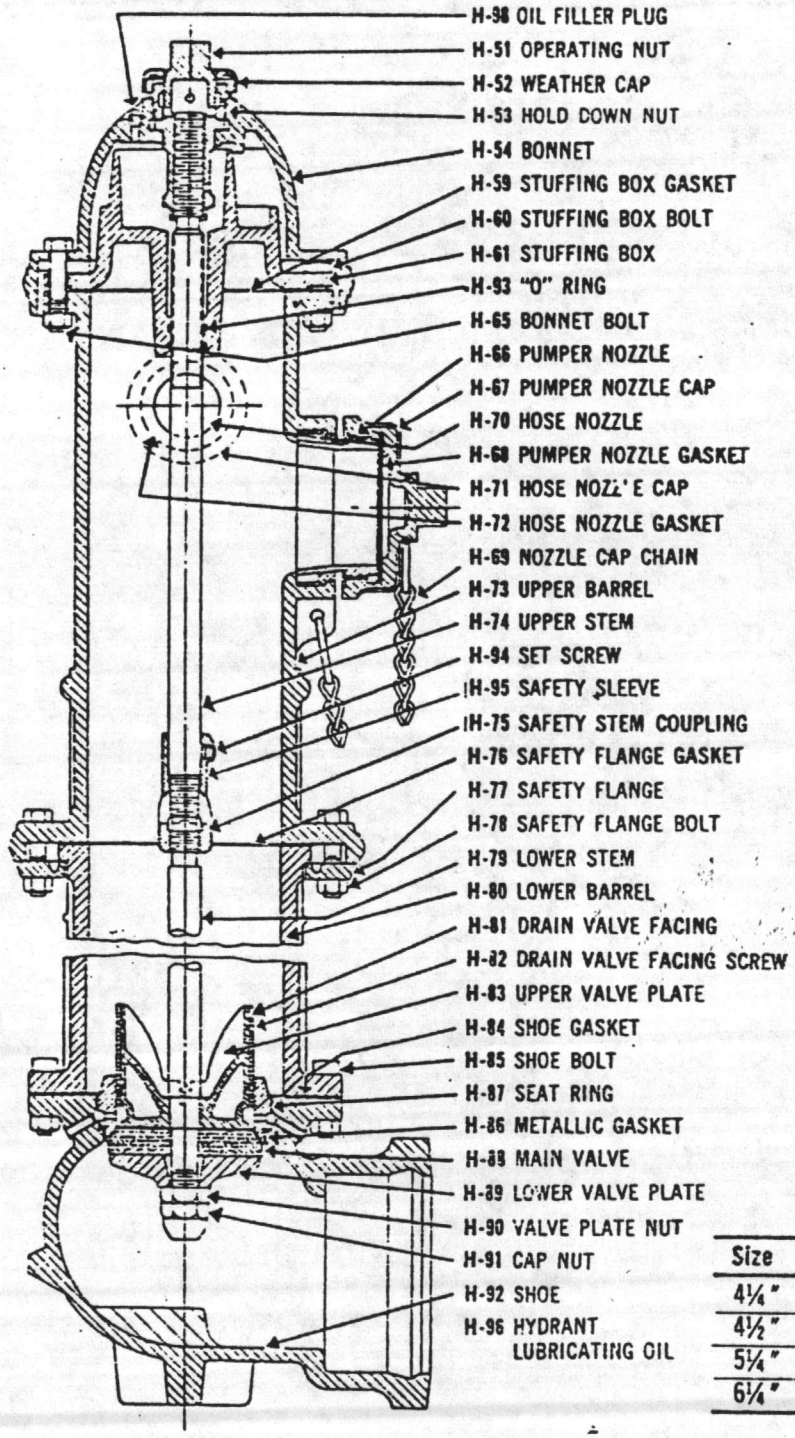
A. INTRODUCTION

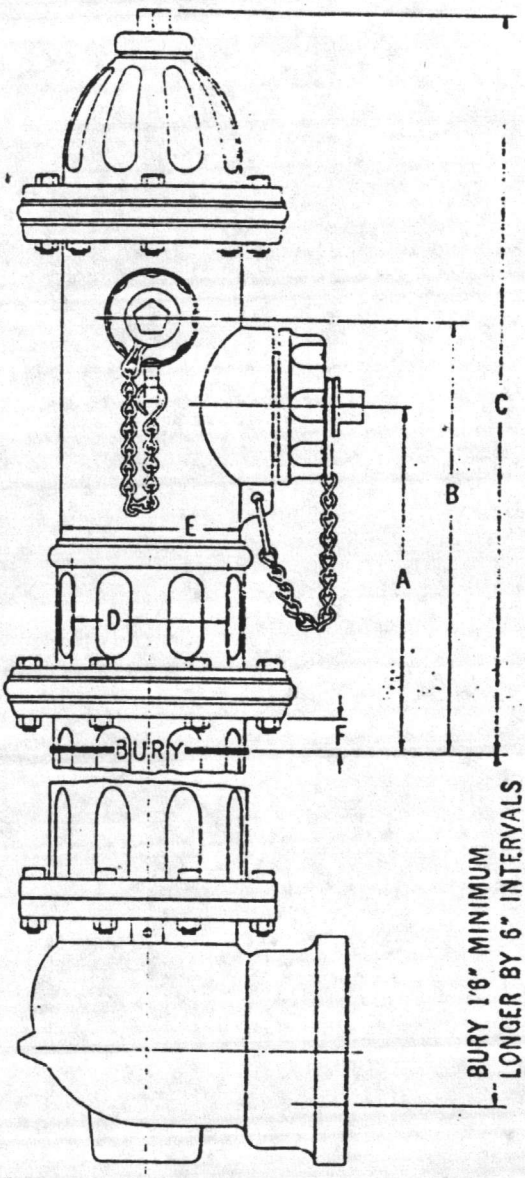
Fire hydrants are provided on water distribution systems as a means of supplying water to fire department apparatus for fire fighting operations. Hydrants are required to be spaced around buildings or facilities in a sufficient number to meet the predetermined maximum fire flow for the area. In general, at least one fire hydrant should be provided for each 750 gpm fire flow requirement, and with at least two fire hydrants provided within 500 feet of ang building. Fire hydrants should be installed to permit easy access by the fire department, between three and seven feet of the roadway edge or curb, with the hydrant 4-1/2 - inch pumper connection facing the roadway, and with a minimum distance of 18 inches from the ground to the center of the 4-1/2 inch pumper connection. A control or shutoff valve should be provided in the supply piping to the hydrant to permit maintenance of the hydrant without taking portions of the water supply system out of service.

B. TYPES OF HYDRANTS

(1) Wet-barrel hydrants (California type) are designed for use where there is no possibility of freezing. They normally have a valve of the compression type at each outlet but may have one such valve located in the bonnet that controls the flow of water to all outlets.

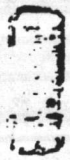
(2) Dry-barrel hydrants are the most commonly used hydrants. These hydrants are of the compression, gate of knuckle-joint types as determined by the valve mechanism located in the foot piece. To prevent freezing, any water in the hydrant should drain out at the bottom through a small drain valve that opens as the hydrant valve approaches the closed position. Normally new hydrants are specified to be of the AWWA "Improved Type". These hydrants are of a design which permits them to be broken off without serious damage to the hydrant and without flooding the street or area with water. A typical hydrant of this design is illustrated in Figure 9.





DIMENSIONAL DIAGRAM

Size	A	B	C	D	E	F
4¼"	16¾	21¼	35⅛	6½	7⅝	1⅓
4½"	16¾	21¼	35⅛	6½	7⅝	1⅜
5¼"	18	23	38⅓	7¼	8⅜	1⅝
6¼"	18¾	23¾	40¼	8½	9¾	2⅓



H-97 Cast Iron Breakable Safety Stem Coupling optional for H-95 Brass Safety Sleeve and H-75 Brass Safety Stem Coupling shown above.

FIGURE 9

C. CONSTRUCTION AND INSTALLATION

A. Hydrants and shutoff valves should be new unless otherwise specified and should meet the appropriate AWWA standards. Hydrants are not required to be listed by Underwriters' Laboratories, Inc.

B. Water mains supplying hydrants should be properly anchored and provided with thrust blocks at each bend, tee or plug. Thrust blocks should be sized in accordance with LANTDIV Plate WD-1.

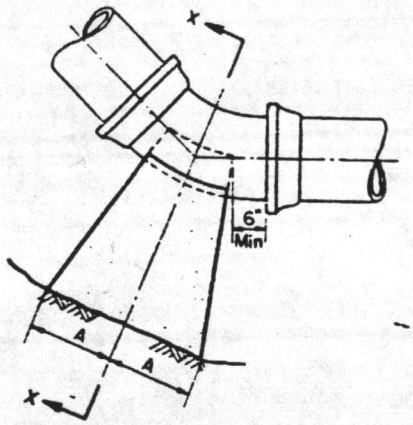
C. Size of supply pipe to the hydrants should be as indicated on the contract drawings. The minimum size is normally 6-inches.

D. The shutoff valve to the hydrant should be provided with a valve box and cover. The top of the box should be located slightly above grade.

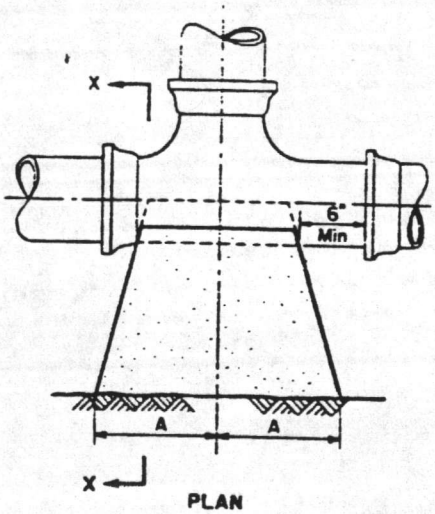
E. Fire hydrants should be installed in accordance with LANTDIV Plate WD-2. The pumper outlet should face the roadway and be 18-inches above grade from center. Chains should be provided for the caps.

F. The hose threads on the hydrant should be checked to assure that they are compatible with the fire department's hose connections. Normally, the hydrant outlets should have "National Standard hose threads" (NST). The station fire department can assist in determining this.

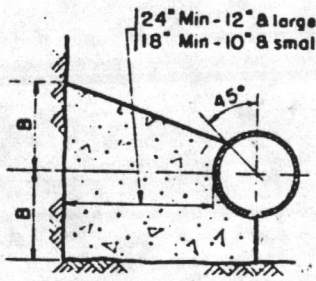
G. Each hydrant should be painted to comply with the Navy's Standard Color Code (NAVFAC P-309). Hydrants on potable water systems should be painted yellow. Hydrants on nonpotable water systems should be painted yellow with red bonnets.



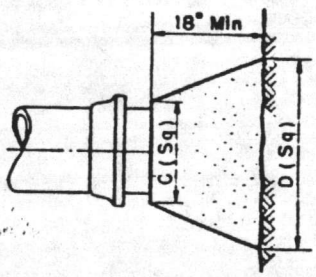
PLAN
BENDS



PLAN
TEES



SECTION X-X
BENDS & TEES



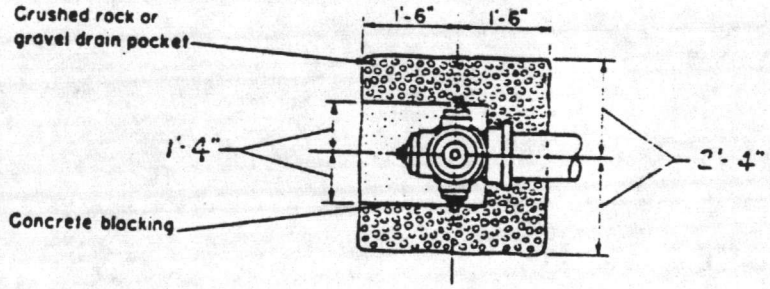
PLAN & ELEVATION
PLUGS

SIZE	1/4 BENDS		1/8 BENDS		1/16 BENDS		TEES		PLUGS	
	A	B	A	B	A	B	A	B	C	D
6"	16"	10"	9"	10"	6"	8"	10"	12"	10"	21"
8"	22"	13"	12"	13"	8"	10"	13"	16"	12"	29"
10"	26"	17"	14"	17"	10"	13"	16"	20"	14"	36"
12"	29"	21"	16"	21"	11"	16"	18"	24"	16"	41"
14"	35"	24"	19"	24"	12"	20"	22"	27"	18"	48"
16"	38"	27"	21"	27"	12"	24"	24"	30"	20"	54"

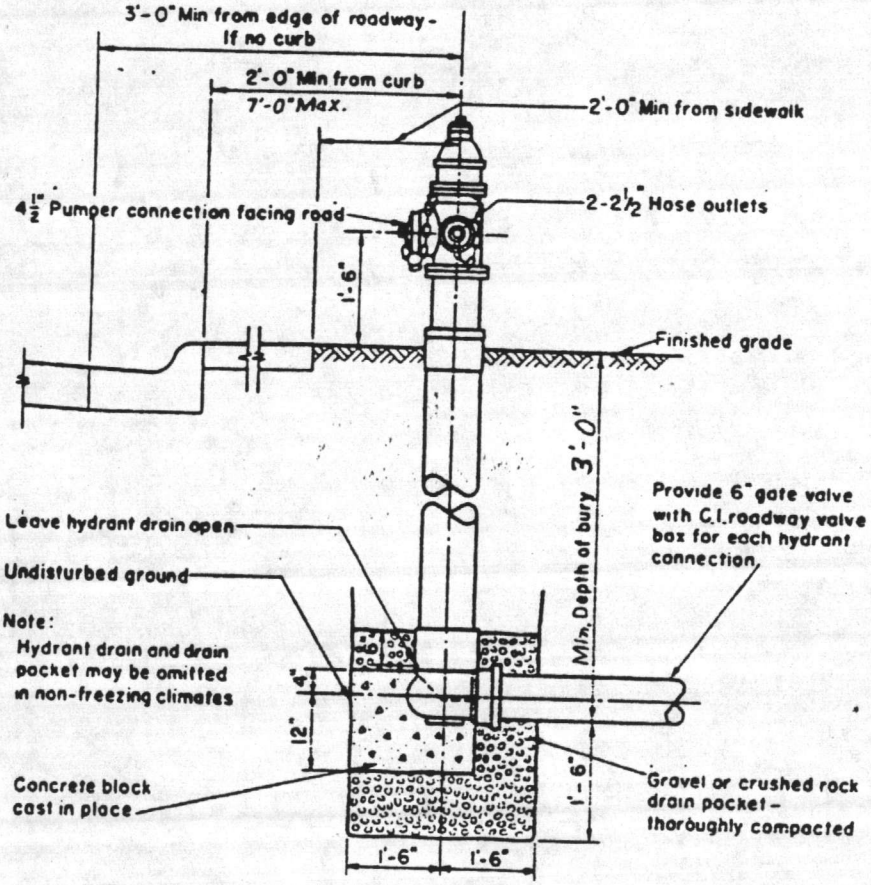
NOTE: Based on 100 p.s.i. static pressure plus A.W.W.A. water hammer
All bearing surfaces to be carried to undisturbed ground

STANDARD THRUST BLOCKS FOR WATER MAINS

LANTDIV PLATE WD-1



PLAN



SECTION

FIRE HYDRANT INSTALLATION

LANTDIV PLATE WD-2

II. STANDPIPES

A. INTRODUCTION

Standpipes are provided primarily to give outlets for large fire water hose streams in locations hard to reach with exterior type fire fighting equipment. They eliminate the need for carrying charged hose upstairs on high ladders. Naval standards require standpipe protection in all buildings over three stories high. Standpipe systems consist of the following basic parts: a riser located in each stairwell, a 2-1/2-inch hose connection and valve at each floor level and at least one standard two-way fire department siamese connection at the base.

B. TYPES OF STANDPIPES

(1) Most wet standpipes are system having supply valve open and under water pressure at all times.

(2) Most standpipe systems are normally dry, but arranged to admit water by manually or automatically opening a normally closed valve.

(3) Dry standpipes have no permanent water supply but are designed to be supplied with water by fire department apparatus. This type system is normally provided at new Naval facilities where standpipe systems are required.

C. SYSTEM COMPONENTS

(1) Piping will normally be black steel schedule 40 pipe designed to withstand a working pressure of not less than 175 psi. Screwed or flanged type fittings will normally be used.

(2) Gate and check valves must comply with specifications and installed at approved contract drawing locations. All valves shall open by counterclockwise rotation.

(3) Fire Department Connection: A connection through which the local fire department can pump water into the standpipe system. One or more fire department connections may be provided, usually siamese type connections, located on exterior walls. Refer to Section 1 on sprinkler systems for details on fire department connections.

D. CONSTRUCTION AND INSTALLATION

(1) Verification should be made that the contractor has submitted equipment lists covering all material he proposes to install, and that these lists have been approved by the Fire Protection Engineering Branch prior to installation. A signed approval stamp should be on each submittal.

(2) Check to assure that all material is new and identical to that called out on approved submittals. All items should be Underwriters' Laboratories, Inc. listed or Factory Mutual approved.

(3) Piping should be adequately supported and should not vibrate when standpipe is in use. Pipe passing through masonry or concrete walls or floors should be fitted with sleeves. Piping should not be cast directly in walls or floors.

(4) Hose connections should be properly identified. Riser hose connections should be provided with a conspicuous, permanently legible sign reading "Dry Standpipe for Fire Department Use Only". Fire department siamese connection should be designated by a sign having raised letters at least one inch in size, cast on a plate or fitting reading "Standpipe". If hose connection does not serve all of the building, an appropriate and durable sign should be attached indicating the portion of the building served.

(5) Assure that all required valves are installed. Quite often, required gate or check valves are not installed in the system. Frequently, the automatic drip valve, required between any outside hose connection and the check valve, is omitted.

(6) All hose coupling threads should be checked to assure that they conform to those used by the local fire department.

(7) Assure that all hose connections are located and arranged so that hose lines can be readily and conveniently attached to the inlets without interference from any nearby objects, including building walls, fences, posts, or other fire department connections. Roof manifold hose connections should be usable without having to lean over roof edge.

(8) The standpipe system is required to be hydrostatically tested at not less than 200 pounds per square inch pressure for a two hour period. Where standpipes are built in walls or partitions, tests should be made before they are covered or permanently concealed. Any leakage should be corrected.

III. HVAC

A. GENERAL

Air handling systems utilizing ducts involve the potential hazard of spreading fire, smoke, and hot gaseous products of combustion through the building or areas that they serve. This hazard can be minimized by providing suitable fire doors or fire dampers where ducts pass through fire walls, partitions or floors and by using air handling systems for smoke removal. Air handling, ventilation, and exhaust systems shall generally meet the design requirements of the following:

(1) NFPA 90A Air Conditioning and Ventilation Systems
(2) NFPA 90B Warm Air Heating and Air Conditioning Systems
(3) NFPA 91 Blower and Exhaust Systems
(4) NFPA 96 Commercial Cooking Equipment, Vapor Removal
(5) NFPA 101 Life Safety Code

B. SMOKE CONTROL/REMOVAL SYSTEMS

Smoke control combines barriers (walls, floors, doors, etc.) with fan-produced air flows and pressure differences. Smoke removal facilities are essential in windowless and multi-story buildings in order to avoid undue exposure of occupants and to permit fire fighting operations. Any air handling unit of 15,000 cfm or more serving multiple areas or located in an unsprinklered building, a hospital, school, or detention facility shall have duct smoke detectors. These detectors, at a minimum, shall shut down the respective air handling unit. Unsprinklered high rise buildings having floors that reach beyond fire department ladders shall have smoke control systems that permits the development of positive pressures in stair and elevator shafts and in non-fire floors and negative pressures (or lesser pressures) in areas involved in fire. These smoke control systems may be operated manually from a fire department control board or automatically where feasible.

C. FIRE AND SMOKE DAMPERS

Fire dampers shall be installed in ducts passing through a fire wall or partition required to have a 2-hour or greater fire resistance rating, and in ducts passing through any floor. Smoke dampers shall be provided when passing through required smoke partitions. All dampers shall meet the requirements of NFPA 90A. Fire and smoke dampers are shown on the contract drawings. There should be an access door located adjacent to each damper for maintenance and testing.

IV. FIRE WALLS/PARTITIONS AND ENCLOSURES

Fire walls, fire partitions, and fire enclosures are designed to prevent the spread of fire. Fire walls, partitions and enclosures should not be penetrated in such a way that their fire rating integrity is impaired. Plastic pipe shall not penetrate fire rated walls or floors. Doors in fire walls, partitions, or enclosures shall be U.L. listed fire doors with appropriate ratings.

V. FIRE DOORS

Although blank, unpierced firewalls are preferable, door openings, when necessary, shall be protected in accordance with NFPA 80, Fire Doors and Windows. All fire doors shall be in fire door frames and shall be listed by Underwriters' Laboratories, Inc. or approved by Factory Mutual.

VI. BUILDING CONSTRUCTION MATERIALS

A. INTERIOR FINISH

Interior finish is rated by flame spread and smoke developed ratings. Interior finish for all exits, patient rooms, and sleeping rooms shall have a flame spread of 25 or less and smoke developed of 50 or less when tested in accordance with ASTM E-84. Interior finish materials for all other areas shall not exceed 75 for flame spread and 100 for smoke developed ratings. All interior finish material should have proof of flame spread and smoke developed rating compliance (i.e. stamped, labeled, material data sheets, lab test reports, etc.). Many plastics comply with the flame spread but fail to comply with smoke developed criteria. Most wood paneling is unacceptable.

B. ROOFING MATERIALS

Roofing materials shall comply with specifications and shall be applied according to manufacturer's installation recommendations. Extreme caution must be exercised when using heating equipment and applying heated roofing materials. Fire extinguishers shall be on site. Fire department personnel should be notified and open flames and heated roofing materials shall be kept away from a wood, insulation, and other combustible materials. Materials should be completely cooled prior to workers leaving the work site. Many fires have occurred while installing roofing materials which require heating.

C. INSULATION

Insulation, like interior finish, is to be rated by flame spread and smoke developed ratings. A flame spread rating of 75 or less and a smoke developed rating of 150 or less is generally required for thermal and acoustical insulation. Insulation installed within wall assemblies may have an increased flame spread rating of 100, with no requirements for the smoke developed rating. All insulation should have proof of conformance.

APPENDIX A

FINAL ACCEPTANCE TESTS FOR AUTOMATIC SPRINKLER SYSTEMS

Receive (from Contractor)

A. Five copies of operating and maintenance instructions, catalog cuts, parts lists, wiring diagram and testing procedures.

Inspection

A. Check to see that valves are properly installed.

B. Check to see that all piping is properly installed in accordance with the approved shop drawings and NFPA 13 criteria.

C. Check to see that all sprinkler heads are of proper temperature rating and properly located in accordance with the approved shop drawings and NFPA 13 criteria.

D. Check to see that sprinkler heads are not painted.

E. Check to see that all main drains discharge to the outside of the building or to an interior drain that is capable of handling the full flow.

F. Check hanger locations.

G. Check to see that all piping is painted or properly identified.

H. Check wall and floor penetrations for escutcheon plates and sleeves. Check to see that they are properly sealed.

I. Check to see that all sprinkler piping is capable of being properly drained.

J. Check identification and instruction signs for valves, drains, inspector test valve, fire department connection, etc.

K. Check to insure that sprinkler heads are not obstructed by lights, insulation, ducts, walls, beams, etc.

L. Check to see if elevated temperature sprinkler heads are used near unit heaters and other heat sources as required by NFPA 13.

Testing

A. Pick up completed contractor's material & test certificates. Certificates and tests should have been verified and signed during prefinal tests.

B. All main control valves shall be opened and closed to insure that they are properly working.

C. Two inch drain and inspector's test valve shall be opened. Water motor gong shall ring within one minute after opening inspector's test valve.

D. Pressure switch and connection to building fire alarm system shall be tested.

E. Where smoke or heat detectors are used to activate the systems, each detector shall be activated to insure proper operation of the pre-action/deluge sprinkler valve. See Appendix B for testing the detectors.

F. Full discharge tests shall be conducted on all deluge systems.

G. Test excess pressure pumps, tamper switch, and other devices when they are provided.

APPENDIX B

FINAL ACCEPTANCE TEST FOR FIRE ALARM SYSTEM

A. Receive from Contractor: Five copies of operating instructions and maintenance manuals, as-built wiring and circuit diagrams, parts list with model number, and spare parts.

Inspection

A. Check location of all fire alarm devices.

B. Check for proper size wiring

C. Check for identification of conductors.

D. Check conduit penetrations of fire walls or partitions, ceilings and floors for proper sealing around the conduit.

E. Check panel door for circuit diagrams.

F. Check circuit breaker - red, separate, locked, labeled.

G. Check for proper power supply connection, usually ahead of main distribution panel.

H. Check Panel for:

1. Labels
2. Lamps
3. Switches
4. Fuses
5. All switches in locked section

Testing (Notify station fire department prior to testing)

A. Check supervision by disconnecting wire in fire alarm control panel for bells, pull stations and detectors. Every time a wire is removed from terminal, the panel should go into a trouble condition.

B. Turn off bell silence switch . In off position panel will go into trouble and sound trouble alarms. Everything else shows normal condition. Turn switch back on, then repeat for master box disconnect switch.

C. Place panel in trouble, silence trouble bell (buzzer) - the trouble light should remain on. Clear the trouble condition - the trouble buzzer should sound, until silence switch is placed in normal condition.

D. Disconnect AC power. Battery on light will be activated and trouble light and buzzer is activated. Restore AC power, no manual restoration of panel should be required and the panel should not sound an alarm.

E. Activate lamp test switch for annunciator panel.

F. Check each zone in panel for proper operation.

G. Pull stations.

1. Check to see that each conductor has its own screw terminal.

2. Remove wire from station; panel should go into trouble.

3. Check to see that stations are activating the proper zone lamp at the control panel.

H. Bells (Horns)

1. Remove bell and panel should go into trouble. Check wiring.

2. Place panel into alarm condition and check bells.

I. Detectors.

1. Remove wire to check supervision.

2. Remove detector head to check supervision.

3. Activate each detector.

J. Check operation of Master Box.

K. Check operation of all auxiliary contacts.

APPENDIX C

FINAL ACCEPTANCE TEST FOR HIGH PRESSURE CARBON DIOXIDE SYSTEMS

Receive (from contractor)

A. Five copies of operating and maintenance instructions, catalog cuts, parts list, wiring diagram, testing procedures and as-built drawings.

Inspection

A. Check piping, fittings, valves, hangers, nozzles, manual stations and cylinder locations.

B. Verify that proper signs are provided.

C. Check for proper storage rack, and verify that scale is provided.

Testing

A. Hand Hose Reels.

1. Check power supply for microswitch.

2. Disconnect discharge heads from cylinders.

3. Remove hand hose reel and check to see if control head was activated.

4. Replace hose reel and place cylinders on reserve.

5. Remove hose reel and check to see that control heads were activated.

6. Place control heads on one main carbon dioxide cylinder and one reserve cylinder and plug all openings on flexible hoses from manifold.

7. Remove hose fully from reel, check all fittings to assure that they are properly installed and tight.

8. Activate and discharge one full cylinder on both the main and reserve system, if required by specifications.

9. Discharge carbon dioxide into a safe area, preferably outside the building.

10. Replace cylinders and place the system into service.

B. Total Flooding

CAUTION: EXTREME CARE MUST BE TAKEN IN PERFORMING DISCHARGE TESTS OF TOTAL FLOODING CO_2 SYSTEMS. IN NO CIRCUMSTANCES SHALL SPACE BE OCCUPIED DURING TEST. IF THERE IS ANY DOUBT ABOUT THE SAFETY OF THE TEST TO BE PERFORMED, DO NOT PROCEED WITH THE TEST.

1. Disconnect control heads from cylinders.

2. Check area to be flooded for openings and possible leaks.

3. Activate detectors and manual releases to insure that the control heads are activated on both the main and the reserve system. See Appendix B for testing detectors. If graphic display is provided showing which underfloor detector activated, make sure it operates properly.

4. Place sampling tubes, if they are to be used, in area to be protected.

5. Discharge carbon dioxide into area to determine if proper concentrations are met and maintained. Check for underfloor leaks.

APPENDIX D

FINAL ACCEPTANCE TEST FOR DRY CHEMICAL EXTINGUISHING SYSTEM

Receive (from contractor)

A. Five copies of operating a maintenance instructions, catalog cuts, parts list, wiring diagram and testing procedures.

Inspection

A. Piping and nozzle locations, size and type.

B. Locations and temperature rating of fusible links. Location of nozzles and fusible links with cooking surfaces and duct.

C. Manual activation station/remote manual activation station.

D. Shunt trip breaker (electric)/solenoid valve (gas).

E. Wiring - size & type

F. Location of cylinder/control head (7' max off of floor)

G. Engraved plastic/metal signs for identifying manual/remote manual activation station and emergency operating instruction.

H. Protective covering for outside installation cylinder/equipment.

Testing

A. Test 1

1. Disarm cylinder

2. Replace fusible link with test link and cut to check:

   a. Activation of control head
   b. Signal to fire alarm system
   c. Shut down power for kitchen hood cooking equipment
   d. Fan start-up or continue running

3. Replace fusible link

4. Reset system

B. Test 2

1. In some situations it is preferred to perform a bag discharge test. In this test each nozzle is covered completely with a specially fabricated bag and the dry chemical is actually discharged. The bags contain the discharged dry chemical and can be hand weighed to check for even system distribution.

APPENDIX E

FINAL ACCEPTANCE TESTS FOR FIRE PUMP INSTALLATIONS

Receive (from contractor)

A. Five copies of operating and maintenance instructions, catalog cuts, parts list, wiring diagram and test procedures. In addition, contractor shall provide a copy of the "certified" pump test curve.

Inspection

A. Check contractor's submittal to verify that all equipment provided was approved by the Division Fire Protection Engineer.

B. Check to see that all required control valves are properly installed.

C. Check to see that piping and equipment is installed in accordance with the approved shop drawings and NFPA 20 criteria. Make certain that the layout of suction piping avoids the formation of air pockets.

D. Check to see that the relief valve discharges into an open pipe or into a cone or funnel secured to the valve outlet, or that the relief valve is provided with a means for detecting flow through the relief valve.

E. Verify that the pump and driver are securely mounted to a solid foundation such that proper alignment between the pump and the driver will be maintained.

F. Check to see that a clearance of not less than 1" is provided where piping passes through walls or floors. Verify the presence of pipe sleeves, where required by the specification.

G. Verify that the pump and driver contain all required instruments and controls, such as pressure gauges, air releases, relief valves, temperature gauges, governors, etc.

H. If the driver is a diesel engine, verify that proper clearance is maintained between the exhaust system and any combustible materials, and that the exhaust system discharges to a safe point outside of the pump enclosure.

Testing

A. All control valves shall be opened and closed to insure that they are properly working. Close the valve between the fire pump discharge and the system, and leave it shut until the completion of the acceptance test.

B. Check to see that the jockey pump maintains system pressure at the required level.

C. Manually start the fire pump, and verify that the pump cannot be shut down except by manually shutting it down. With the pump running, check for excessive noise, vibration, cavitation, etc. If the pump driver is a diesel engine, make sure, after operating the engine for a period of time, that the operating characteristics of the engine, such as oil temperature, coolant temperature, engine speed, etc. are within normal limits. If engine speed is different than the rated speed of the pump, adjust the governor until the engine is running at the rated speed of the pump. Note that the governor must maintain the engine speed within 10% of the rated pump speed over all pump operating conditions.

D. Reduce water pressure by discharging water through the test header. Loss of pressure shall cause the fire pump to automatically start. If controller is equipped for automatic shutdown after starting causes return to normal, verify that the pump runs for at least ten minutes after starting conditions return to normal.

E. The fire pump controller shall perform at least ten manual and ten automatic operations during the acceptance test.

F. If multiple pumps are provided, check that all sequential operations occur properly. Verify that failure of one pump will not affect subsequent operations of other pumps.

G. Verify that operation of the fire pump causes actuation of the "fire pump running" alarm.

H. Check to see that trouble conditions cause operation of the "fire pump trouble" alarm.

I. Verify that all control sequences required by the specification operate in an acceptable manner.

J. Before flowing water, make sure suitable drainage is available, so that localized flooding is avoided. WHEN FLOWING WATER, USE EXTRA CAUTION TO INSURE PERSONAL SAFETY OF ALL THOSE PARTICIPATING IN THE ACCEPTANCE TEST.

1) Close all hose valves and relief valves, then start the pump. Pump discharge should be 0 gpm at this time. Record the pump churn pressure (discharge pressure minus suction pressure). Adjust the relief valve so that discharge pressure is within acceptable limits.

2) Open up the hose valves, and adjust the flow until the pump discharge is equal to 100% of the rated pump capacity. Record the flow, engine speed and pump pressure (discharge pressure minus suction pressure).

3) Adjust the flow until the pump discharge is equal to 150% of the rated pump capacity. Record the flow, engine speed, and pump pressure.

4) Plot these three points on graph paper, and draw the pump curve. Compare this curve with the "certified" pump curve, and verify that any difference between the two is within acceptable limits.

5) After shutting down the pump, VERIFY THAT ALL VALVES ARE RETURNED TO THE NORMAL POSITION.

NOTE: Additional information can be obtained from NFPA 20, "Standard for the Installation of Centrifugal Fire Pumps".

3623 w/o Sprngl

1) ~~Dd~~ Foundation elevated for air handling unit and any area over 4ft wide 4.4.1.3.2.1
2) stairwell Heads 4.4.1.7.3.2
3) mezz ~~required sprinkler for lack of omission~~ 1-6
4) 60 x 60 x 9
5) Beam cooling
6) concealed space 4.4.1.7.1.1 ~~[redacted]~~
4.4.1.7.1.2