WYATT
FIRE PROTECTION, INC.
9095 S.W. Burnham
Tigard, OR 97223
(503) 684-2928

BANK BLOCK 2ND FLOOR

DECEMBER 14TH, 2020

WYATT
FIRE PROTECTION, INC.
9095 S.W. Burnham
Tigard, OR 97223

WARRANTY LETTER

December 14th, 2020

Johnson Project Solutions, Inc.
919 SW Taylor St, Suite 800
Portland, OR 97205

Project Name: Bank Block 2nd Floor

Location: 309 SW 6th Ave, 2nd Floor
Portland, OR 97204

The fire sprinkler system work performed by Wyatt Fire Protection, Inc. at Bank Block 2nd Floor, located at 309 SW 6th Ave, 2nd Floor, Portland, OR 97204 is guaranteed for one year, from 12/1/20 to 12/1/21, for all workmanship and against material failure.

Sincerely,

Ken Sutherland

Ken Sutherland, Vice President
WYATT FIRE PROTECTION, INC.
KS/lb

WYATT
FIRE PROTECTION, INC.
9095 S.W. Burnham
Tigard, OR 97223

BANK BLOCK 2ND

309 SW 6TH AVE, 2ND FLR

PORTLAND, OR 97204

May 19, 2020

EXPIRES: 12/31/2020

FIRE PROTECTION
EQUIPMENT SUBMITTAL

Series TY-FRB, 5.6 K-factor Upright, Pendent, and Recessed Pendent Sprinklers Quick Response, Standard Coverage

General Description

The TYCO Series TY-FRB, 5.6 K-factor, Upright (TY313) and Pendent (TY323) Sprinklers described in this data sheet are quick response, standard coverage, decorative 3 mm glass bulb-type spray sprinklers designed for use in light or ordinary hazard, commercial occupancies such as banks, hotels, and shopping malls.

The recessed version of the Series TY-FRB Pendent Sprinkler, where applicable, is intended for use in areas with a finished ceiling. This recessed pendent sprinkler uses one of the following:

- A two-piece Style 15 Recessed Escutcheon with recessed adjustment up to 5/8 in. (15,9 mm) from the flush pendent position.
- A two-piece Style 20 Recessed Escutcheon with recessed adjustment up to 1/2 in. (12,7 mm) from the flush pendent position.

The adjustment provided by the Recessed Escutcheon reduces the accuracy to which the fixed pipe drops to the sprinklers must be cut.

Intermediate level versions of Series TY-FRB Sprinklers are described in Technical Data Sheet TFP357. Sprinkler guards and shields are described in Technical Data Sheet TFP780.

IMPORTANT

Refer to Technical Data Sheet TFP2300 for warnings pertaining to regulatory and health information.

Always refer to Technical Data Sheet TFP700 for the "INSTALLER WARNING" that provides cautions with respect to handling and installation of sprinkler systems and components. Improper handling and installation can permanently damage a sprinkler system or its components and cause the sprinkler to fail to operate in a fire situation or cause it to operate prematurely.

NOTICE

The TYCO Series TY-FRB Sprinklers described herein must be installed and maintained in compliance with this document, as well as with the applicable standards of the National Fire Protection Association, in addition to the standards of any other authorities having jurisdiction. Failure to do so may impair the performance of these devices.

The owner is responsible for maintaining their fire protection system and devices in proper operating condition. Contact the installing contractor or product manufacturer with any questions.

Sprinkler Identification Number (SIN)

TY313 . . . . Upright 5.6K, 1/2 in. NPT
TY323 . . . .Pendent 5.6K, 1/2 in. NPT

Technical Data

Approvals
Refer to Table A

Maximum Working Pressure
175 psi (12.1 bar)
250 psi (17.2 bar)*

* The maximum working pressure of 250 psi (17.2 bar) only applies to the listing by Underwriters Laboratories, Inc. (UL).

Discharge Coefficient
K=5.6 GPM/psi$^{1/2}$ (80,6 LPM/bar$^{1/2}$)

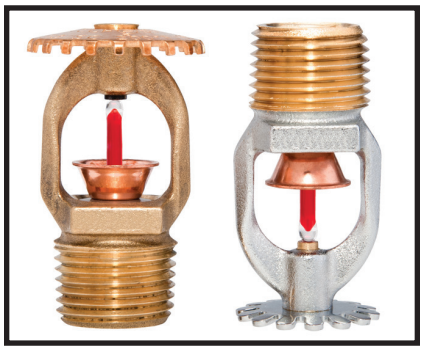
Temperature Rating
Refer to Table A

Finishes
Sprinkler: Refer to Table B

Recessed Escutcheon: White Coated, Black Coated, Chrome Plated, or Brass Plated

Physical Characteristics

Frame	Bronze
Button	Brass/Copper
Sealing Assembly	Stainless Steel w/TEFLON
Bulb	Glass
Compression Screw	Bronze
Deflector	Bronze



Operation

The glass bulb contains a fluid which expands when exposed to heat. When the rated temperature is reached, the fluid expands sufficiently to shatter the glass bulb, allowing the sprinkler to activate and water to flow.

Design Criteria

The TYCO Series TY-FRB, 5.6 K-factor, Upright (TY313) and Pendent (TY323) Sprinklers are intended for fire protection systems designed in accordance with the standard installation rules recognized by the applicable Listing or Approval agency (such as, UL Listing is based on the requirements of NFPA 13, and FM Approval is based on the requirements of FM's Loss Prevention Data Sheets). Only the Style 15 or Style 20 Recessed Escutcheon is to be used for recessed pendent installations.

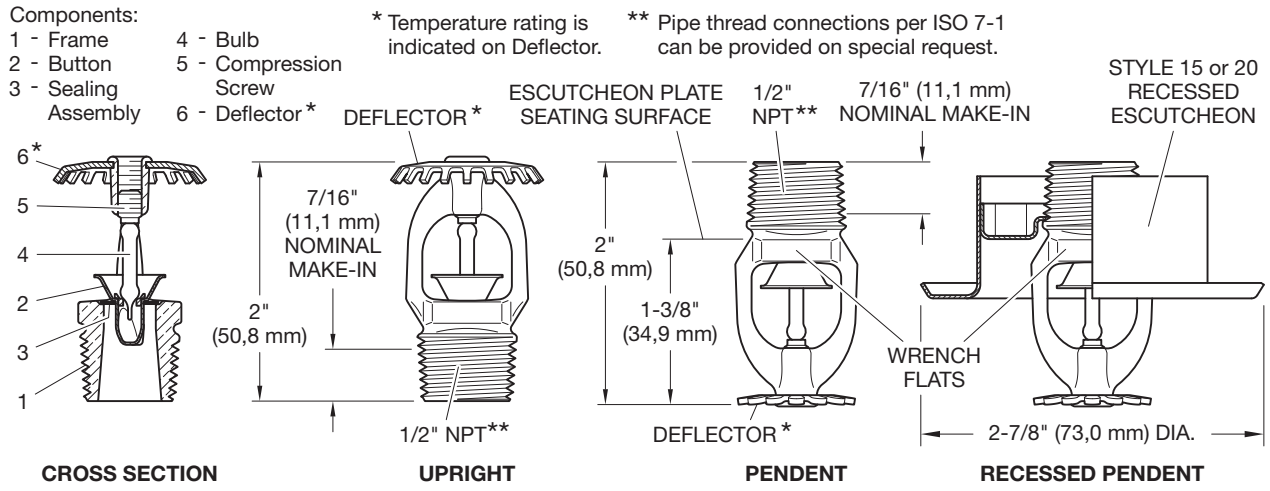


FIGURE 1
SERIES TY-FRB UPRIGHT (TY313) AND PENDENT (TY323) SPRINKLERS
5.6 K-FACTOR, 1/2 INCH NPT, QUICK RESPONSE

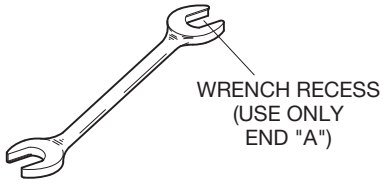


FIGURE 2
W-TYPE 6
SPRINKLER WRENCH

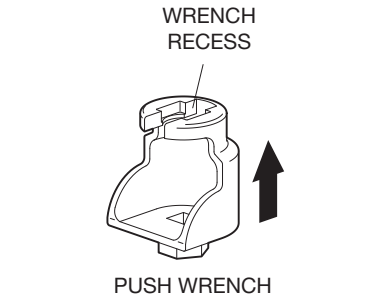


FIGURE 3
W-TYPE 7 RECESSED
SPRINKLER WRENCH

Installation

The TYCO Series TY-FRB, 5.6 K-factor, Upright (TY313) and Pendent (TY323) Sprinklers must be installed in accordance with this section.

General Instructions
Do not install any bulb-type sprinkler if the bulb is cracked or there is a loss of liquid from the bulb. With the sprinkler held horizontally, a small air bubble should be present. The diameter of the air bubble is approximately 1/16 in. (1,6 mm) for the 135°F (57°C) and 3/32 in. (2,4 mm) for the 286°F (141°C) temperature ratings.

A leak-tight 1/2 in. NPT sprinkler joint should be obtained by applying a minimum to maximum torque of 7 to 14 lb-ft (9,5 to 19,0 N·m). Higher levels of torque can distort the sprinkler Inlet with consequent leakage or impairment of the sprinkler.

Do not attempt to compensate for insufficient adjustment in the Escutcheon Plate by under- or over-tightening the sprinkler. Re-adjust the position of the sprinkler fitting to suit.

Upright and Pendent Sprinklers
The Series TY-FRB Upright and Pendent Sprinklers must be installed in accordance with the following instructions.

Step 1. Install Pendent sprinklers in the pendent position. Install upright sprinklers in the upright position.

Step 2. With pipe-thread sealant applied to the pipe threads, hand-tighten the sprinkler into the sprinkler fitting.

Step 3. Tighten the sprinkler into the sprinkler fitting using only the W-Type 6 Sprinkler Wrench (Figure 2). With reference to Figure 1, apply the W-Type 6 Sprinkler Wrench to the wrench flats. Torque sprinklers 7 to 14 lb-ft (9,5 to 19,0 N·m).

Recessed Pendent Sprinklers
The Series TY-FRB Recessed Pendent Sprinklers must be installed in accordance with the following instructions.

Step A. After installing the Style 15 or Style 20 Mounting Plate over the sprinkler threads, and with pipe-thread sealant applied to the pipe threads, hand-tighten the sprinkler into the sprinkler fitting.

Step B. Tighten the sprinkler into the sprinkler fitting using only the W-Type 7 Recessed Sprinkler Wrench (Figure 3). With reference to Figure 1, apply the W-Type 7 Recessed Sprinkler Wrench to the sprinkler wrench flats. Torque sprinklers 7 to 14 lb-ft (9,5 to 19,0 N·m).

Step C. After ceiling installation and finishing, slide on the Style 15 or Style 20 Closure over the Series TY-FRB Sprinkler and push the Closure over the Mounting Plate until its flange comes in contact with the ceiling.

Care and Maintenance

The TYCO Series TY-FRB, 5.6 K-factor, Upright (TY313) and Pendent (TY323) Sprinklers must be maintained and serviced in accordance with this section.

Before closing a fire protection system main control valve for maintenance work on the fire protection system that it controls, obtain permission to shut down the affected fire protection systems from the proper authorities and notify all personnel who may be affected by this action.

Absence of the outer piece of an escutcheon, which is used to cover a clearance hole, can delay sprinkler operation in a fire situation.

The owner must assure that the sprinklers are not used for hanging any objects and that the sprinklers are only cleaned by means of gently dusting with a feather duster; otherwise, non-operation in the event of a fire or inadvertent operation may result.

Sprinklers which are found to be leaking or exhibiting visible signs of corrosion must be replaced.

Automatic sprinklers must never be painted, plated, coated, or otherwise altered after leaving the factory. Modified sprinklers must be replaced. Sprinklers that have been exposed to corrosive products of combustion, but have not operated, should be replaced if they cannot be completely cleaned by wiping the sprinkler with a cloth or by brushing it with a soft bristle brush.

Care must be exercised to avoid damage to the sprinklers before, during, and after installation. Sprinklers damaged by dropping, striking, wrench twist/slippage, or the like, must be replaced. Also, replace any sprinkler that has a cracked bulb or that has lost liquid from its bulb. (Ref. Installation Section.)

The owner is responsible for the inspection, testing, and maintenance of their fire protection system and devices in compliance with this document, as well as with the applicable standards of the National Fire Protection Association (e.g., NFPA 25), in addition to the standards of any other authorities having jurisdiction. Contact the installing contractor or product manufacturer with any questions.

Automatic sprinkler systems are recommended to be inspected, tested, and maintained by a qualified Inspection Service in accordance with local requirements and/or national codes.

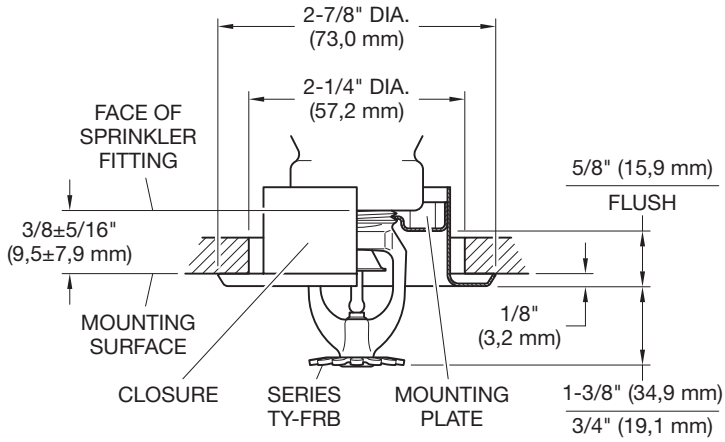


FIGURE 4
SERIES TY-FRB RECESSED PENDENT SPRINKLER ASSEMBLY (TY323) WITH TWO PIECE 5/8 INCH TOTAL ADJUSTMENT STYLE 15 RECESSED ESCUTCHEON

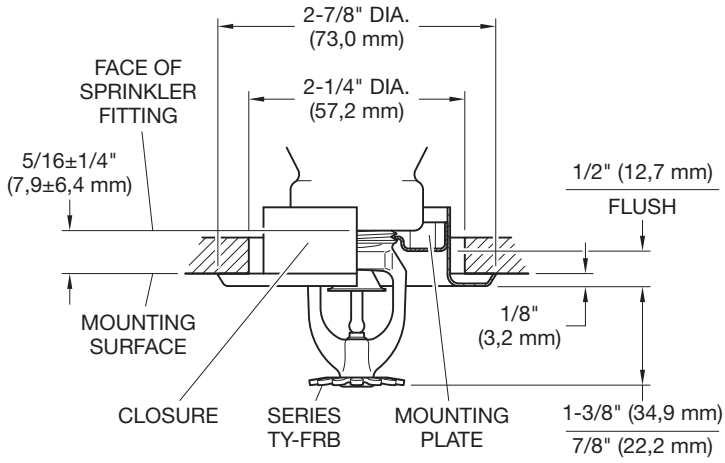


FIGURE 5
SERIES TY-FRB RECESSED PENDENT SPRINKLER ASSEMBLY (TY323) WITH TWO PIECE 1/2 INCH TOTAL ADJUSTMENT STYLE 20 RECESSED ESCUTCHEON

Limited Warranty

For warranty terms and conditions, visit www.tyco-fire.com.

Ordering Procedure

Contact your local distributor for availability. When placing an order, indicate the full product name and Part Number (P/N).

Sprinkler Assemblies with NPT Thread Connections
Specify: Series TY-FRB Upright or Pendent (specify) Sprinkler, SIN (specify), K=5.6, Quick Response, (specify) temperature rating, (specify) finish, P/N (specify, refer to Table A).

Recessed Escutcheon
Specify: Style 15 Recessed Escutcheon with (specify*) finish, P/N (specify*)

Specify: Style 20 Recessed Escutcheon with (specify*) finish, P/N (specify*)

* Refer to Technical Data Sheet TFP770

Sprinkler Wrench
Specify: W-Type 6 Sprinkler Wrench, P/N 56-000-6-387

Specify: W-Type 7 Sprinkler Wrench, P/N 56-850-4-001

K FACTOR	TYPE	TEMPERATURE	SPRINKLER FINISH (See Note 7) BULB LIQUID COLOR	NATURAL BRASS	CHROME PLATED	POLYESTER[c]
5.6 1/2 in. NPT	UPRIGHT (TY313) and PENDENT (TY323)	135°F (57°C)	Orange	1, 2, 3, 4, 5, 6		
		155°F (68°C)	Red			
		175°F (79°C)	Yellow			
		200°F (93°C)	Green			
		286°F (141°C)	Blue			
	RECESSED PENDENT (TY323) Figures 4[a] and 5[b]	135°F (57°C)	Orange	1, 2, 3, 4		
		155°F (68°C)	Red			
		175°F (79°C)	Yellow			
		200°F (93°C)	Green			

Notes:
1. Listed by Underwriters Laboratories, Inc., (UL) as Quick Response Sprinklers.
2. Listed by Underwriters Laboratories, Inc., for use in Canada (C-UL) as Quick Response Sprinklers.
3. Approved by Factory Mutual Research Corporation (FM) as Quick Response Sprinklers.
4. Approved by the City of New York under MEA 354-01-E.
5. VdS Approved (For details, contact Johnson Controls, Enschede, Netherlands, Tel. 31-53-428-4444/Fax 31-54-428-3377.)
6. Approved by the Loss Prevention Certification Board (LPCB Ref. No. 094a/06) as Quick Response Sprinklers.
7. Where Polyester Coated Sprinklers are noted to be UL and C-UL Listed, the sprinklers are UL and C-UL Listed as Corrosion-Resistant Sprinklers.

a. Installed with Style 15 (1/2 in. NPT) 5/8 in. Total Adjustment Recessed Escutcheon, as applicable.
b. Installed with Style 20 (1/2 in. NPT) 1/2 in. Total Adjustment Recessed Escutcheon, as applicable.
c. Frame and Deflector only. Listings and approvals apply to color (Special Order).

TABLE A
LABORATORY LISTINGS AND APPROVALS FOR
5.6 K-FACTOR SPRINKLERS

P/N[a] 77 – XXX – X – XXX

		SIN
370	5.6K UPRIGHT (1/2 in.NPT)	TY313
371	5.6K PENDENT (1/2 in.NPT)	TY323

Notes:
a. Use suffix "I" for ISO 7-1 connection; for example, 77-370-4-175-I

	SPRINKLER FINISH
1	NATURAL BRASS
3	PURE WHITE (RAL9010)[a] POLYESTER
4	SIGNAL WHITE (RAL9003) POLYESTER
5	JET BLACK (RAL9005) POLYESTER
9	CHROME PLATED

Notes:
a. Eastern Hemisphere sales only

	TEMPERATURE RATINGS
135	135°F (57°C)
155	155°F (68°C)
175	175°F (79°C)
200	200°F (93°C)
286	286°F (141°C)

TABLE B
SERIES TY-FRB UPRIGHT AND PENDENT SPRINKLERS
PART NUMBER SELECTION

1400 Pennbrook Parkway, Lansdale, PA 19446 | Telephone +1-215-362-0700

Eddy Flow

The Cost Effective Replacement for Schedule 10

Realizing the growing need of fire protection systems in commercial and residential construction, Bull Moose Tube has added Eddy Flow to its comprehensive line of sprinkler pipe products.

Eddy Flow is a specially engineered replacement for schedule 10, offering better flow characteristics while providing design flexibility. This product is FM approved, as well as UL listed (for U.S. and Canada) for roll grooving and welding for use in fire protection systems with a working pressure of 300 psi or less. Please check with appropriate sources for up-to-date listings and approval information.

As an added benefit, it is more economical to use than schedule 10 due to reduced delivery costs and ease of handling. Furthermore, Eddy Flow's larger ID provides an opportunity for downsizing and further cost savings.

COMPARISON

		INSIDE DIAMETER			C.R.R.*	
Nominal Pipe Size (in)	O.D. (in)	Eddy Flow (in)	Schedule 10 (in)	Schedule 40 (in)	Eddy Flow	Schedule 40
1 1/4	1.660	1.530	1.442	1.380	1.98	1.00
1 1/2	1.900	1.728	1.682	1.610	3.44	1.00
2	2.375	2.203	2.157	2.067	2.78	1.00
2 1/2	2.875	2.705	2.635	2.469	1.66	1.00
3	3.500	3.334	3.260	3.068	1.00	1.00
4	4.500	4.310	4.260	4.026	1.00	1.00

** Corrosion Resistance Ratio*

BENEFITS

- ***Dual Certified to ASTM A135 and A795.***
- ***FM Approved for roll grooved, and welded, and plain-end application in wet systems.***
- ***UL Listed (for U.S. and Canada) for joining by welding or by listed rubber gasketed fittings for use in wet, dry, preaction, and deluge type sprinkler systems.***
- ***UL Listed (for US and Canada) and FM Approved for use with Victaulic® FIT® Fittings in plain end applications.***
- ***Lightweight - saves shipping costs, and offers easier handling.***
- ***Can be used with roll grooved couplings or welded outlets for pressures up to 300 psi.***
- ***Floor stock available in various lengths produced in Casa Grande (AZ), Gerald (MO), and Masury (OH). Also can be ordered in custom lengths..***
- ***Can be used for wet and dry* systems.***

** Eddy Flow can be hot dipped galvanized to meet FM's requirement for dry systems.*

PIPE PREPARATION

For proper operation, all pipe surfaces should be cleaned prior to installation. In order to provide a leak-tight seat for the gasket, pipe surfaces should be free from indentations and projections from the end of the pipe to the groove. All loose paint, scale, dirt, chips, grease, and rust must be removed prior to installation. Failure to take these important steps may result in improper coupling assembly, causing leakage. Also, check the manufacturer's instructions for the specific fitting used.

BULL MOOSE TUBE COMPANY
A CAPARO company

1819 Clarkson Road
Chesterfield, MO 63017
(800) 325-4467
FAX: (636) 537-2645
www.bullmoosetube.com
e-mail:sales@bullmoosetube.com

For additional information, contact your salesperson today at (800) 325-4467 or (636) 537-2600 in the USA, or from Canada call (800) 882-4666

c UL us LISTED

FM APPROVED

Eddythread 40

A Lightweight Schedule 40 Replacement Pipe That Has a Corrosion Resistance Ratio of 1.0

Bull Moose Tube Company has been making pipe for a long time and is recognized as a producer of quality pipe products. Eddythread 40 is designed with the same thoroughness as our other fine pipe products and now our customers have an option to buy a carefully designed replacement for Schedule 40 that:

- Has a Corrosion Resistance Ratio of 1.0
- Has a Pressure Rating of 300 psi
- Is Lighter Weight Than Schedule 40
- Is Approved by Factory Mutual and Listed by Underwriters Laboratories
- Is Produced in Accordance to ASTM A-135 and A-795
- Can be Used With Standard Schedule 40 Threaded Fittings, Couplings and Valves
- Is Produced From Steel With Excellent Properties of Strength and Threadability
- Can be Used in Wet, Dry, Preaction, and Deluge Type Sprinkler Systems*
- Offers Lower Freight Costs

EDDYTHREAD 40 SPECIFICATIONS

NOMINAL PIPE SIZE (in)	WEIGHT (lbs/ft)	I.D. (in)	BUNDLE SIZE
1	1.461	1.083	70
1 1/4	2.070	1.418	51
1 1/2	2.547	1.654	44
2	3.308	2.123	30

CORROSION RESISTANCE RATIOS

NOMINAL PIPE SIZE (in)	SCHEDULE 40	EDDYTHREAD 40
1	1.00	1.00
1 1/4	1.00	1.00
1 1/2	1.00	1.00
2	1.00	1.00

** Eddythread 40 can be hot dipped galvanized to meet FM's requirement for dry systems*

BULL MOOSE TUBE COMPANY
A CAPARO company

1819 Clarkson Road
Chesterfield, MO 63017
(800) 325-4467
FAX: (636) 537-2645
www.bullmoosetube.com
e-mail:sales@bullmoosetube.com

For additional information, contact your salesperson today at (800) 325-4467 or (636) 537-2600 in the USA, or from Canada call (800) 882-4666

Victaulic® FireLock™ Fittings

10.03

1.0 PRODUCT DESCRIPTION

Available Sizes

- 1 ¼ – 8"/DN32 – DN200

Maximum Working Pressure

- Pressure ratings for Victaulic FireLock™ Fittings conform to the ratings of Victaulic FireLock EZ™ Style 009N couplings (refer to publication 10.64 for more information).

Application

- FireLock™ fittings are designed for use exclusively with Victaulic couplings that have been Listed or Approved for Fire Protection Services. Use of other couplings or flange adapters may result in bolt pad interference.
- Connects pipe, provides change in direction and adapts sizes or components

Pipe Materials

- Carbon steel

2.0 CERTIFICATION/LISTINGS

EN 10311
Regulation (EU)
No. 305/2011

3.0 SPECIFICATIONS – MATERIAL

Fitting: Ductile iron conforming to ASTM A536, Grade 65-45-12.

Fitting Coating:

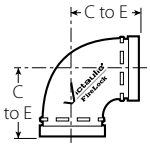
- ☐ Orange enamel.
- ☐ Red enamel in Europe, Middle East, Africa, and India.
- ☐ Optional: Hot dipped galvanized.

ALWAYS REFER TO ANY NOTIFICATIONS AT THE END OF THIS DOCUMENT REGARDING PRODUCT INSTALLATION, MAINTENANCE OR SUPPORT.

System No.		Location	
Submitted By		Date	

Spec Section		Paragraph	
Approved		Date	

4.0 DIMENSIONS



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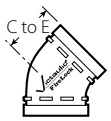

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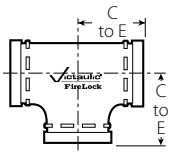


No. 002

No. 006

Nominal Size inches DN	Actual Outside Diameter inches mm	No. 001 90° Elbow C to E inches mm	No. 001 90° Elbow Approximate Weight Each lb kg	No. 003 45° Elbow C to E inches mm	No. 003 45° Elbow Approximate Weight Each lb kg	No. 002 Straight Tee C to E inches mm	No. 002 Straight Tee Approximate Weight Each lb kg	No. 006 Cap T inches mm	No. 006 Cap Approximate Weight Each lb kg
1 ¼ DN32	1.660 42.4	— —	— —	— —	— —	— —	— —	0.82 21	0.3 0.1
1 ½ DN40	1.900 48.3	— —	— —	— —	— —	— —	— —	0.82 21	0.4 0.2
2 DN50	2.375 60.3	2.75 70	1.7 0.8	2.00 51	1.8 0.8	2.75 70	2.4 1.1	0.88 22	0.6 0.3
2 ½	2.875 73.0	3.00 76	3.1 1.4	2.25 57	2.2 1.0	3.00 76	3.6 1.6	0.88 22	1.0 0.5
DN65	3.000 76.1	3.00 76	3.30 1.5	2.25 57	2.4 1.1	3.00 76	3.8 1.7	—	—
3 DN80	3.500 88.9	3.38 86	4.0 1.8	2.50 64	3.1 1.4	3.38 86	5.3 2.4	0.88 22	1.2 0.5
	4.250 108.0	4.00 102	5.7 2.6	3.00 76	5.1 2.3	4.00 102	7.5 3.4	—	—
4 DN100	4.500 114.3	4.00 102	6.7 3.0	3.00 76	5.6 2.5	4.00 102	8.7 3.9	1.00 25	2.4 1.1
5	5.563 141.3	4.88 124	12.6 5.7	3.25 83	8.3 3.8	4.88 124	15.7 7.1	1.00 25	4.1 1.9
DN125	5.500 139.7	4.88 124	12.4 5.6	3.25 82.6	8.2 3.7	4.88 124	15.4 6.9	—	—
	6.250 158.8	5.50 140	12.6 5.7	3.50 89	9.2 4.2	5.50 140	17.9 8.0	—	—
6 DN150	6.625 168.3	5.50 140	18.3 8.3	3.50 89	11.7 5.3	5.50 140	22.7 10.3	1.00 25	5.9 2.7
	6.500 165.1	5.43 140	17.6 7.9	3.50 89	11.4 5.2	5.50 140	22.0 9.9	—	—
8 DN200	8.625 219.1	6.81 173	25.5 11.6	4.25 108	20.4 9.3	6.94 176	38.7 17.6	1.13 29	12.7 5.8
	8.515 216.3	6.81 173	23.1 10.5	— —	— —	6.94 176	33.6 15.2	— —	— —

5.0 PERFORMANCE

Flow Data

Size		Frictional Resistance Equivalent of Straight Pipe[1]			
		Elbows		No. 002 Straight Tee	
Nominal Size inches DN	Actual Outside Diameter inches mm	No. 001 90° Elbow feet meters	No. 003 45° Elbow feet meters	Branch feet meters	Run feet meters
1 ¼ DN32	1.660 42.4	— —	— —	— —	— —
1 ½ DN40	1.900 48.3	— —	— —	— —	— —
2 DN50	2.375 60.3	3.5 1.1	1.8 0.5	8.5 2.6	3.5 1.1
2 ½	2.875 73.0	4.3 1.3	2.2 0.7	10.8 3.3	4.3 1.3
DN65	3.000 76.1	4.5 1.4	2.3 0.7	11.0 3.4	4.5 1.4
3 DN80	3.500 88.9	5.0 1.5	2.6 0.8	13.0 4.0	5.0 1.5
	4.250 108.0	6.4 2.0	3.2 0.9	15.3 4.7	6.4 2.0
4 DN100	4.500 114.3	6.8 2.1	3.4 1.0	16.0 4.9	6.8 2.1
5	5.563 141.3	8.5 2.6	4.2 1.3	21.0 6.4	8.5 2.6
DN125	5.500 139.7	8.3 2.5	4.1 1.3	20.6 6.3	8.3 2.5
	6.250 158.8	9.4 2.9	4.9 1.5	25.0 7.6	9.6 2.9
6 DN150	6.625 168.3	10.0 3.0	5.0 1.5	25.0 7.6	10.0 3.0
	6.500 165.1	9.8 3.0	4.9 1.5	24.5 7.5	9.8 3.0
8 DN200	8.625 219.1	13.0 4.0	5.0 1.5	33.0 10.1	13.0 4.0
	8.515 216.3	13.0 4.0	— —	33.0 10.1	13.0 4.0

[1] The flow data listed is based upon the pressure drop of Schedule 40 pipe.

6.0 NOTIFICATIONS

General Notes

NOTE: When assembling FireLock EZ™ couplings onto end caps, take additional care to make certain the end cap is fully seated against the gasket end stop. For FireLock EZ™ Style 009N/009H couplings, use FireLock™ No. 006 end caps containing the “EZ” marking on the inside face or No. 60 end caps containing the “QV EZ” marking on the inside face. Non-Victaulic end cap products shall not be used with Style 009/009V/009H/009N couplings.

7.0 REFERENCE MATERIALS

10.64: Victaulic® FireLock™ Rigid Coupling Style 009N

10.02: Victaulic® FireLock™ Rigid Coupling Style 005H with Vic-Plus™ Gasket System

29.01: Victaulic® Terms and Conditions of Sale

Ductile Iron Threaded Fittings

SMITH-COOPER®
INTERNATIONAL

Ductile Iron Threaded Fittings

Specifications

- SCI branded ductile iron threaded fittings are UL Listed and FM Approved at 500 psi
- Rated to 300 WSP
- Ductile iron castings conform to ASTM A536
- Fitting dimensions conform to ASME B16.3
- Bushings and plugs conform to ASME B16.14
- Fittings are 100% air tested
- NPT threads on all fittings conform to ASME B1.20.1
- Independent lab verification that fittings meet applicable chemical & physical properties
- Manufacturing facilities are ISO 9001:2008 and ISO 14001

c UL US LISTED

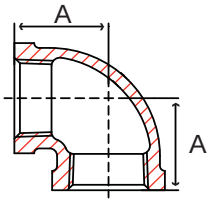
FM APPROVED

Temperature Degrees F	Working Pressure, Nonshock psiG 300# Class Threaded Fittings
-20 to 100	500
150	500
200	480
250	460
300	440
350	420
400	400
450	380
500	360
550	340
600	320
650	300

c UL us LISTED

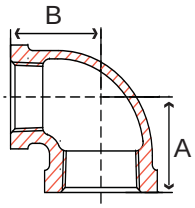
FM APPROVED

Fig. 35E 3 – 90° Elbow



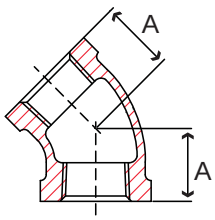
Size in	Part Number	A in	Packing Inner	Packing Master	Weight lb
1/2	35E 3004	1.13	100	200	0.2
3/4	35E 3006	1.31	70	140	0.3
1	35E 3010	1.50	40	80	0.5
1-1/4	35E 3012	1.75	25	50	0.8
1-1/2	35E 3014	1.94	18	36	1.1
2	35E 3020	2.25	10	20	1.8
2-1/2	35E 3024	2.70	4	8	3.2

Fig. 35RE3 – 90° Reducing Elbow



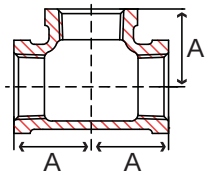
Size in	Part Number	A in	B in	Packing Inner	Packing Master	Weight lb
3/4 x 1/2	35RE3006004	1.20	1.22	80	160	0.3
1 x 1/2	35RE3010004	1.26	1.36	70	140	0.4
1 x 3/4	35RE3010006	1.38	1.45	50	100	0.4
1-1/4 x 1/2	35RE3012004	1.34	1.53	35	70	0.5
1-1/4 x 3/4	35RE3012006	1.45	1.63	35	70	0.6
1-1/4 x 1	35RE3012010	1.58	1.67	30	60	0.7
1-1/2 x 1/2	35RE3014004	1.52	1.75	30	60	0.6
1-1/2 x 3/4	35RE3014006	1.52	1.75	25	50	0.7
1-1/2 x 1	35RE3014010	1.65	1.80	20	40	0.8
1-1/2 x 1-1/4	35RE3014012	1.82	1.88	18	36	1.0
2 x 1/2	35RE3020004	1.60	1.97	18	36	1.0
2 x 3/4	35RE3020006	1.60	1.97	18	36	1.0
2 x 1	35RE3020010	1.73	2.02	16	32	1.2
2 x 1-1/4	35RE3020012	1.90	2.10	12	24	1.3
2 x 1-1/2	35RE3020014	2.02	2.16	10	20	1.5
2-1/2 x 1-1/2	35RE3024014	2.16	2.51	6	12	2.2
2-1/2 x 2	35RE3024020	2.39	2.60	6	12	2.5

Fig. 35F 3 – 45° Elbow



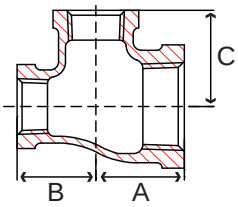
Size in	Part Number	A in	Packing Inner	Packing Master	Weight lb
1/2	35F 3004	0.88	150	300	0.2
3/4	35F 3006	0.98	80	160	0.3
1	35F 3010	1.13	40	80	0.5
1-1/4	35F 3012	1.29	25	50	0.7
1-1/2	35F 3014	1.44	20	40	1.0
2	35F 3020	1.69	10	20	1.6
2-1/2	35F 3024	1.95	4	8	2.7

Fig. 35T 3 – Tee



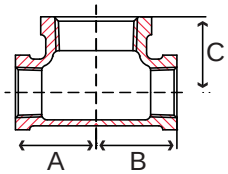
Size in	Part Number	A in	Packing Inner	Packing Master	Weight lb
1/2	35T 3004	1.13	80	160	0.3
3/4	35T 3006	1.31	30	60	0.5
1	35T 3010	1.50	25	50	0.7
1-1/4	35T 3012	1.75	10	20	1.1
1-1/2	35T 3014	1.94	10	20	1.5
2	35T 3020	2.25	6	12	2.4
2-1/2	35T 3024	2.70	4	8	4.3

Fig. 35RT3 – Reducing Tee



Size in	Part Number	A in	B in	C in	Packing Inner	Packing Master	Weight lb
3/4 x 1/2	35RT3006004	1.20	1.20	1.22	60	120	0.4
1 x 1/2	35RT3010004	1.26	1.26	1.36	30	60	0.6
1 x 1/2 x 1	35RT3010004010	1.50	1.36	1.50	30	60	0.6
1 x 3/4	35RT3010006	1.38	1.38	1.45	25	50	0.6
1 x 3/4 x 3/4	35RT3010006006	1.38	1.31	1.45	35	70	0.6
1 x 3/4 x 1	35RT3010006010	1.50	1.45	1.50	25	50	0.7
1-1/4 x 1/2	35RT3012004	1.34	1.34	1.53	20	40	0.8
1-1/4 x 1/2 x 1-1/4	35RT3012004012	1.75	1.53	1.75	25	50	0.9
1-1/4 x 3/4	35RT3012006	1.45	1.45	1.62	15	30	0.9
1-1/4 x 3/4 x 1-1/4	35RT3012006012	1.75	1.62	1.75	20	40	1.0
1-1/4 x 1	35RT3012010	1.58	1.58	1.67	15	30	1.0
1-1/4 x 1 x 1/2	35RT3012010004	1.34	1.26	1.53	25	50	0.7
1-1/4 x 1 x 3/4	35RT3012010006	1.45	1.38	1.63	20	40	0.8
1-1/4 x 1 x 1	35RT3012010010	1.58	1.50	1.69	20	40	0.9
1-1/4 x 1 x 1-1/4	35RT3012010012	1.75	1.69	1.75	15	30	1.0
1-1/2 x 1/2	35RT3014004	1.41	1.41	1.66	16	32	1.0
1-1/2 x 1/2 x 1-1/4	35RT3014004012	1.81	1.56	1.88	24	48	1.1
1-1/2 x 1/2 x 1-1/2	35RT3014004014	1.94	1.66	1.94	12	24	1.2
1-1/2 x 3/4	35RT3014006	1.52	1.52	1.75	16	32	1.1
1-1/2 x 3/4 x 1-1/4	35RT3014006012	1.94	1.66	1.88	20	40	1.1
1-1/2 x 3/4 x 1-1/2	35RT3014006014	1.94	1.75	1.94	18	36	1.2
1-1/2 x 1	35RT3014010	1.65	1.65	1.80	12	24	1.2
1-1/2 x 1 x 1/2	35RT3014010004	1.44	1.25	1.69	20	40	0.8
1-1/2 x 1 x 3/4	35RT3014010006	1.50	1.44	1.75	16	32	0.9
1-1/2 x 1 x 1	35RT3014010010	1.65	1.50	1.80	16	32	1.0
1-1/2 x 1 x 1-1/4	35RT3014010012	1.82	1.67	1.88	12	24	1.2
1-1/2 x 1 x 1-1/2	35RT3014010014	1.94	1.80	1.94	12	24	1.3
1-1/2 x 1-1/4	35RT3014012	1.82	1.82	1.88	12	24	1.4
1-1/2 x 1-1/4 x 1/2	35RT3014012004	1.41	1.34	1.66	16	32	0.9
1-1/2 x 1-1/4 x 3/4	35RT3014012006	1.52	1.45	1.75	16	32	1.0
1-1/2 x 1-1/4 x 1	35RT3014012010	1.65	1.58	1.80	16	32	1.1
1-1/2 x 1-1/4 x 1-1/4	35RT3014012012	1.82	1.75	1.88	14	28	1.3
1-1/2 x 1-1/4 x 1-1/2	35RT3014012014	1.94	1.88	1.94	14	28	1.4
2 x 1/2	35RT3020004	1.49	1.49	1.88	10	20	1.5
2 x 3/4	35RT3020006	1.60	1.60	1.97	10	20	1.6
2 x 1	35RT3020010	1.73	1.73	2.02	8	16	1.7
2 x 1 x 2	35RT3020010020	2.25	2.02	2.25	8	16	1.9
2 x 1-1/4	35RT3020012	1.90	1.90	2.10	8	16	1.9
2 x 1-1/4 x 2	35RT3020012020	2.25	2.10	2.25	8	16	2.0
2 x 1-1/2	35RT3020014	2.02	2.02	2.16	8	16	2.1
2 x 1-1/2 x 1/2	35RT3020014004	1.49	1.41	1.88	10	20	1.3
2 x 1-1/2 x 3/4	35RT3020014006	1.60	1.52	1.97	10	20	1.4
2 x 1-1/2 x 1	35RT3020014010	1.73	1.65	2.02	8	16	1.5
2 x 1-1/2 x 1-1/4	35RT3020014012	1.90	1.82	2.10	8	16	1.7
2 x 1-1/2 x 1-1/2	35RT3020014014	2.02	1.94	2.16	8	16	1.8

Fig. 35BT3 – Bull Head Tee



Size in	Part Number	A in	B in	C in	Packing Inner	Packing Master	Weight lb
3/4 x 1	35BT3006010	1.45	1.45	1.37	30	60	0.6
1 x 1-1/4	35BT3010012	1.67	1.67	1.58	20	40	0.9
1 x 1-1/2	35BT3010014	1.80	1.80	1.65	15	30	1.0
1-1/4 x 1 x 1-1/2	35BT3012010014	1.88	1.80	1.82	15	30	1.2
1-1/4 x 1-1/2	35BT3012014	1.88	1.88	1.82	15	30	1.3
1-1/4 x 2	35BT3012020	2.10	2.10	1.90	10	20	1.6
1-1/2 x 1-1/4 x 2	35BT3014012020	2.16	2.10	2.02	10	20	1.8
1-1/2 x 2	35BT3014020	2.16	2.16	2.02	8	16	1.8

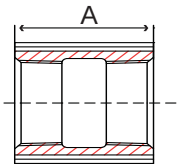


Fig. 35CP3 – Straight Coupling with Ribs

Size in	Part Number	A in	Packing		Weight lb
			Inner	Master	
1/2	35CP3004	1.38	200	400	0.1
3/4	35CP3006	1.63	100	200	0.2
1	35CP3010	1.75	60	120	0.4
1-1/4	35CP3012	2.00	35	70	0.5
1-1/2	35CP3014	2.19	25	50	0.7
2	35CP3020	2.62	15	30	1.2
2-1/2	35CP3024	3.00	9	18	2.2

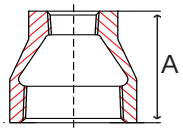


Fig. 35RC3 – Hex Reducing Coupling

Size in	Part Number	A in	Packing		Weight lb
			Inner	Master	
1 x 1/2	35RC3010004	1.69	80	160	0.3
1 x 3/4	35RC3010006	1.69	60	120	0.4
1-1/4 x 3/4	35RC3012006	2.06	40	80	0.6
2 x 1 (not hex)	35RC3020010	2.81	20	40	1.0

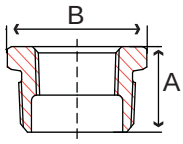


Fig. 35HB3 – Hex Bushing

Size in	Part Number	A in	Packing		Weight lb
			Inner	Master	
1 x 1/2	35HB3010004	1.06	180	360	0.2
1 x 3/4	35HB3010006	1.06	180	360	0.1
1-1/4 x 1	35HB3012010	1.19	90	180	0.2
1-1/2 x 1	35HB3014010	1.25	75	150	0.4
1-1/2 x 1-1/4	35HB3014012	1.25	75	150	0.3
2 x 1	35HB3020010	1.38	40	80	0.6
2 x 1-1/4	35HB3020012	1.38	40	80	0.6
2 x 1-1/2	35HB3020014	1.38	40	80	0.6

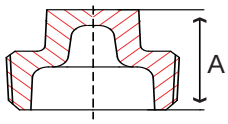


Fig. 35SP3 – Square Head Plug

Size in	Part Number	A in	Packing		Weight lb
			Inner	Master	
1/2	35SP3004	0.94	600	1200	0.07
3/4	35SP3006	1.12	350	700	0.1
1	35SP3010	1.25	200	400	0.1
1-1/4	35SP3012	1.37	100	200	0.3
1-1/2	35SP3014	1.44	80	160	0.4
2	35SP3020	1.50	45	90	0.6

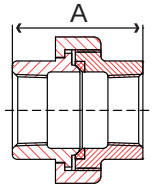


Fig. 35U 3 – Union with Brass Seat

Size in	Part Number	A in	Packing		Weight lb
			Inner	Master	
1	35U 3010	2.19	20	40	1.0
1-1/4	35U 3012	2.50	15	30	1.2
1-1/2	35U 3014	2.62	10	20	1.7
2	35U 3020	3.12	6	12	2.4

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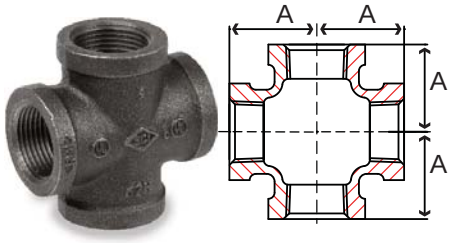
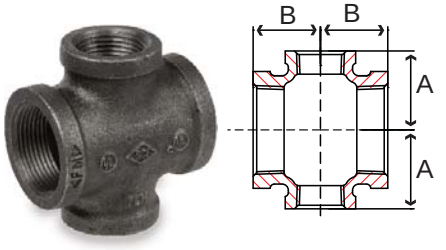
Fig. 35X 3 – Cross



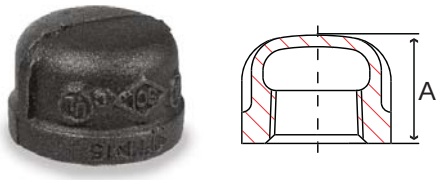
Size in	Part Number	A in	Packing		Weight lb
			Inner	Master	
1	35X 3010	1.50	20	40	0.9
1-1/4	35X 3012	1.75	12	24	1.4
1-1/2	35X 3014	1.94	8	16	1.8
2	35X 3020	2.25	6	12	2.8

Fig. 35RX3 – Reducing Cross



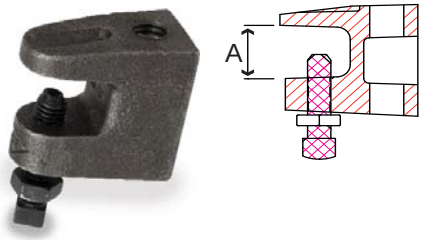
Size in	Part Number	A in	B in	Packing		Weight lb
				Inner	Master	
1-1/4 x 1	35RX3012010	1.67	1.58	15	30	1.2
1-1/2 x 1	35RX3014010	1.80	1.65	12	24	1.4
2 x 1	35RX3020010	2.02	1.73	8	16	2.0

Fig. 35C 3 – Cap



Size in	Part Number	A in	Packing		Weight lb
			Inner	Master	
1/2	35C 3004	0.87	300	600	0.1
3/4	35C 3006	0.97	200	400	0.1
1	35C 3010	1.16	110	220	0.2
1-1/4	35C 3012	1.28	70	140	0.4
1-1/2	35C 3014	1.33	50	100	0.5
2	35C 3020	1.45	25	50	0.8
2-1/2	35C 3024	1.70	18	36	1.6

Fig. 35BC3 – Beam Clamp



Size in	Part Number	A in	Packing		Weight lb
			Inner	Master	
3/8	35BC3003	0.75	100	200	0.3
1/2	35BC3004	0.75	80	160	0.5

Fig. 909 - No-Thread Swivel Sway Brace Attachment

TOLCO

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Size Range: 1" (25mm) bracing pipe. For brace pipe sizes larger than 1" (25mm), use Fig. 980. Available with holes for 3⁄8"-16 thru 3⁄4"-10 fastener attachment.

Material: Steel, hardened cone point set bolt

Function: The structural component of a sway and seismic bracing system.

Features: This product's design incorporates a concentric attachment opening which is critical to the performance of structural seismic connections. NFPA 13 indicates clearly that fastener table load values are based only on concentric loading. No threading of the bracing pipe is required. Open design allows for easy inspection of pipe engagement.

Application Note: Fig. 909 is used in conjunction with the Fig. 1000, Fig. 1001, Fig. 4A or Fig. 4L or other approved TOLCO attachment to pipe, and joined together with bracing pipe. Sway brace assemblies are intended to be installed in accordance with NFPA 13. The required type, number and size of fasteners used for the structure attachment fitting shall be in accordance with NFPA 13.

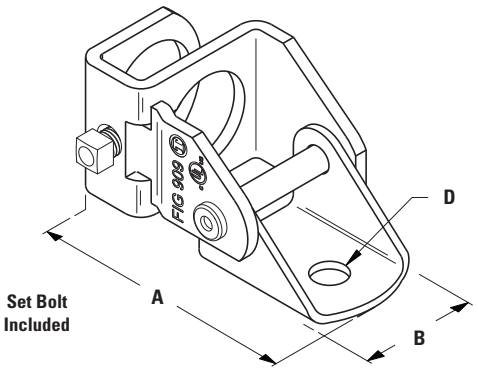
Approvals: Underwriters Laboratories Listed in the USA **(UL)** and Canada **(cUL)**.

Installation Instructions: Fig. 909 is the structural or transitional attachment component of a longitudinal or lateral sway brace assembly. It is intended to be combined with the "bracing pipe" and TOLCO "braced pipe" attachment, Fig. 1000, 1001, 4A, or other approved TOLCO attachment to pipe to form a complete bracing assembly. NFPA 13 guidelines should be followed.

To Install: Place the Fig. 909 onto the bracing pipe. Tighten the set bolt until the head bottoms out on surface. Attachment can pivot for adjustment to proper brace angle.

Finish: Plain or Electro-Galvanized. Contact B-Line for alternative finishes and materials.

Order By: Figure number, fastener attachment size and finish.



Part Number	Mounting Hole D in.	(mm)	Brace Pipe Size in.	(mm)	A in.	(mm)	B in.	(mm)	Max. Design Load lbs.	(kN)	Approx. Wt./100 lbs.	(kg)
909-1/2 *	17/32"	(13.5)	1"	(25)	6"	(152.4)	1 5/8"	(41.3)	2015	(8.96)	91	(41.3)
909-5/8	11/16"	(17.5)	1"	(25)	6"	(152.4)	1 5/8"	(41.3)	2015	(8.96)	90	(40.8)
909-3/4	13/16"	(20.6)	1"	(25)	6"	(152.4)	1 5/8"	(41.3)	2015	(8.96)	89	(40.4)

Other hole sizes are available, consult factory.
* Standard size.

Eaton's B-Line Business seismic bracing components are designed to be compatible only with other B-Line bracing components, resulting in a listed seismic bracing assembly. B-Line's warranty for seismic bracing components will be the warranty provided in B-Line's standard terms and conditions of sale made available by B-Line, except that, in addition to the other exclusions from B-Line's warranty, Eaton's B-line Business makes no warranty relating to B-Line's seismic bracing components that are combined with products not provided by Eaton's B-Line Business.

All dimensions in charts and on drawings are in inches. Dimensions shown in parentheses are in millimeters unless otherwise specified.

Fig. 4L - Longitudinal "In-Line" Sway Brace Attachment

Size Range: 2" (50mm) through 8" (200mm) IPS.

Material: Steel

Function: For bracing pipe against sway and seismic disturbance.

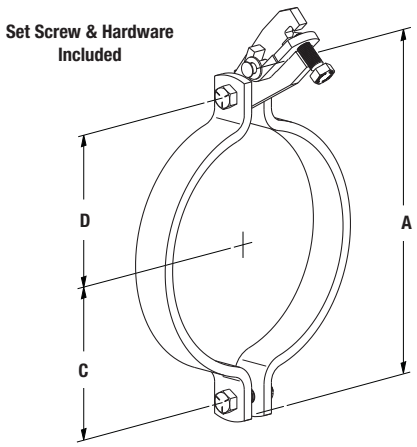
Approvals: Underwriters Laboratories Listed in the USA **(UL)** and Canada **(cUL)** 2 1/2" (65mm) through 8" (200mm) pipe. Approved by Factory Mutual Engineering **(FM)**, 2" (50mm) through 8" (200mm) pipe.

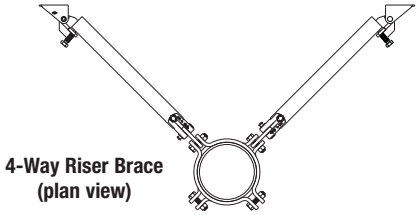
Installation Instructions: Fig. 4L is the "braced pipe" attachment component of a longitudinal sway brace assembly. It is intended to be combined with the "bracing pipe" and TOLCO structural attachment component to form a complete bracing assembly. NFPA 13 and/or OSHPD guidelines should be followed.

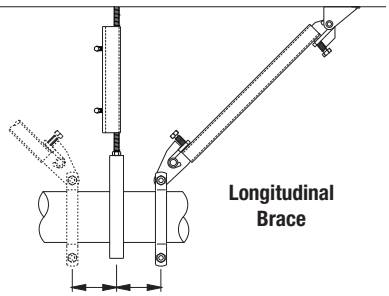
To Install: Place the Fig. 4L over the pipe to be braced and tighten bolts. Then engage "bracing pipe" into jaw opening and tighten set screw until head snaps off. Jaw attachment can pivot for adjustment to proper brace angle.

Finish: Plain. Contact B-Line for alternative finishes and materials.

Order By: Figure number, pipe size and finish.







Part No.	Pipe Size in.	Pipe Size (mm)	A in.	A (mm)	C in.	C (mm)	D in.	D (mm)	Bolt Size	Max. Rec. Load (cULuc) lbs.	Max. Rec. Load (cULuc) (kN)	*Max. Design Load (FM) lbs.	*Max. Design Load (FM) (kN)	Approx. Wt./100 lbs.	Approx. Wt./100 (kg)
4L-2	2"	(50)	5 3/8"	(136.5)	2 1/16"	(52.4)	2 1/16"	(52.4)	1/2"-13	2015	(8.96)	--	(--)	247	(112.0)
4L-2 1/2	2 1/2"	(65)	6 7/16"	(163.5)	2 1/2"	(63.5)	2 3/4"	(69.8)	1/2"-13	2015	(8.96)	3000	(13.34)	253	(114.7)
4L-3	3"	(80)	7"	(177.8)	2 3/4"	(69.8)	3 1/16"	(77.8)	1/2"-13	2015	(8.96)	1550	(6.89)	268	(121.5)
4L-4	4"	(100)	8 1/2"	(215.9)	3 3/8"	(85.7)	3 11/16"	(93.7)	1/2"-13	2015	(8.96)	1550	(6.89)	348	(157.8)
4L-5	5"	(125)	9 3/4"	(247.6)	3 7/8"	(98.4)	4 3/8"	(111.1)	1/2"-13	2015	(8.96)	1450	(6.45)	380	(172.3)
4L-6	6"	(150)	11 1/2"	(292.1)	5"	(127.0)	5 1/8"	(130.2)	1/2"-13	2015	(8.96)	1450	(6.45)	640	(290.3)
4L-8	8"	(200)	13 1/4"	(336.5)	5 5/8"	(142.8)	5 5/8"	(142.9)	1/2"-13	2015	(8.96)	1450	(6.45)	728	(330.2)

Part No.	Pipe Size in.	Pipe Size (mm)	Max. Rec. Load (cULuc) lbs./(kN)	*Max. Design Load (FM) 30-44° lbs./(kN)	45-59° lbs./(kN	60°-74° lbs./(kN)	75°-90° lbs./(kN)
4L-2	2"	(50)	2015 (8.96)	--	--	--	--
4L-2 1/2	2 1/2"	(65)	2015 (8.96)	1030 (4.58)	1180 (5.24)	1420 (6.31)	1590 (7.07)
4L-3	3"	(80)	2015 (8.96)	1030 (4.58)	1180 (5.24)	1420 (6.31)	1590 (7.07)
4L-4	4"	(100)	2015 (8.96)	530 (2.36)	730 (3.25)	890 (3.96)	990 (4.40)
4L-5	5"	(125)	2015 (8.96)	530 (2.36)	730 (3.25)	890 (3.96)	990 (4.40)
4L-6	6"	(150)	2015 (8.96)	530 (2.36)	730 (3.25)	890 (3.96)	990 (4.40)
4L-8	8"	(200)	2015 (8.96)	490 (2.18)	680 (3.02)	830 (3.69)	930 (4.13)

* The loads listed are axial loads on the brace. The horizontal load capacity, H, of the brace is: H = F x sin ?, where ? the installation angle measured from the vertical. FM approved when used with 1", 1¼", 1½" or 2" Sch. 40 brace pipe.

Eaton's B-Line Business seismic bracing components are designed to be compatible only with other B-Line bracing components, resulting in a listed seismic bracing assembly. B-Line's warranty for seismic bracing components will be the warranty provided in B-Line's standard terms and conditions of sale made available by B-Line, except that, in addition to the other exclusions from B-Line's warranty, Eaton's B-line Business makes no warranty relating to B-Line's seismic bracing components that are combined with products not provided by Eaton's B-Line Business.

All dimensions in charts and on drawings are in inches. Dimensions shown in parentheses are in millimeters unless otherwise specified.

Fig. 4LA - Longitudinal "In-Line" Sway Brace Attachment

Size Range: 1" (25mm) through 12" (300mm) IPS.

Material: Steel

Function: For bracing pipe against sway and seismic disturbance.

Approvals: Approved by Factory Mutual Engineering **(FM)**, 1" (25mm) through 12" (300mm) pipe.

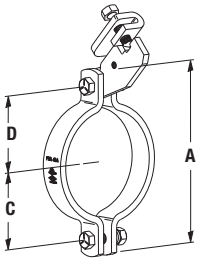
Installation Instructions: Fig. 4LA can be used as the system attachment component of a longitudinal or lateral brace assembly. It is intended to be combined with the "bracing member" and TOLCO transitional attachment and structural attachment to form a complete bracing assembly. For fire sprinkler applications NFPA 13 guidelines should be followed.

To Install: Place the Fig. 4LA pipe clamp component over the pipe to be braced and tighten down the break-off nuts until the hex head portion breaks off to verify correct installation torque. Next engage brace member (pipe or strut) with jaw component and tighten break-off head bolt until the hex head breaks off to verify correct installation torque. Pivot jaw for correct angle and attach to structure using TOLCO brand transitional attachment and structural attachment.

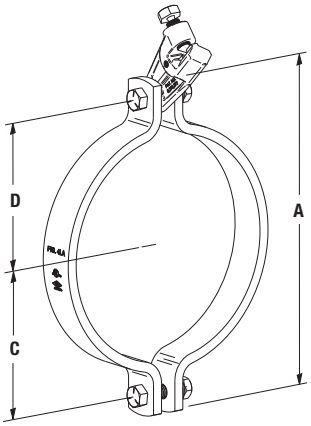
Finish: Plain or Electro-Galvanized. Contact B-Line for alternative finishes and materials.

Order By: Figure number, pipe size and finish.

4LA-1 thru 4LA-4



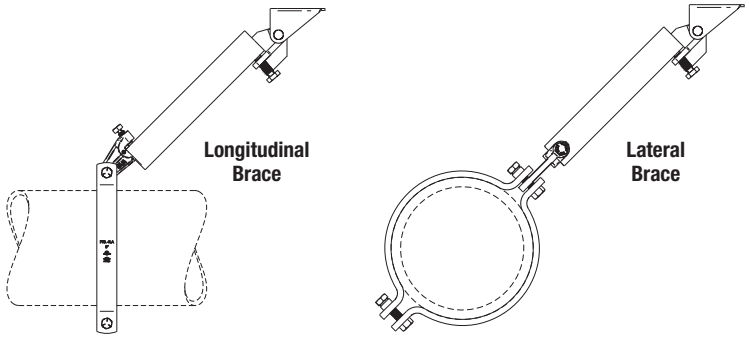
4LA-5 thru 4LA-12



Part No.	Pipe Size in.	Pipe Size (mm)	A in.	A (mm)	C in.	C (mm)	D in.	D (mm)	Bolt Size	Approx. Wt./100 lbs.	Approx. Wt./100 (kg)
4LA-1	1"	(25)	3 19/32"	(91.2)	1 5/16"	(33.5)	1 5/16"	(33.5)	3/8"-16	119	(54.0)
4LA-1 1/4	1 1/4"	(32)	3 29/32"	(99.3)	1 3/8"	(35.3)	1 3/8"	(35.3)	3/8"-16	123	(55.8)
4LA-1 1/2	1 1/2"	(40)	4 5/32"	(105.7)	1 1/2"	(38.5)	1 1/2"	(38.5)	3/8"-16	127	(57.6)
4LA-2	2"	(50)	5 11/32"	(135.6)	2 1/32"	(51.9)	2 1/16"	(51.9)	3/8"-16	142	(64.4)
4LA-2 1/2	2 1/2"	(65)	5 27/32"	(148.7)	2 5/16"	(58.5)	2 5/16"	(58.5)	3/8"-16	173	(78.5)
4LA-3	3"	(80)	6 1/2"	(164.9)	2 5/8"	(66.6)	2 5/8"	(66.6)	3/8"-16	187	(84.8)
4LA-3 1/2	3 1/2"	(90)	7.407"	(188.1)	2 7/8"	(73.1)	2 7/8"	(73.1)	3/8"-16	198	(89.8)
4LA-4	4"	(100)	7 13/32"	(190.8)	3 1/8"	(79.5)	3 1/8"	(79.5)	3/8"-16	209	(94.8)
4LA-5	5"	(125)	8 3/4"	(222.3)	3 5/8"	(92.1)	3 5/8"	(92.1)	1/2"-13	298	(135.2)
4LA-6	6"	(150)	10 5/8"	(269.9)	4 9/16"	(115.9)	4 9/16"	(115.9)	1/2"-13	521	(236.3)
4LA-8	8"	(200)	12 13/16"	(325.5)	5 9/16"	(143.7)	5 21/32"	(143.7)	1/2"-13	629	(285.3)
4LA-10	10"	(250)	16 1/2"	(419.1)	7 1/4"	(184.2)	7 1/4"	(184.2)	1/2"-13	1320	(598.7)
4LA-12	12"	(300)	18 1/2"	(469.9)	8 1/4"	(209.6)	8 1/4"	(209.6)	1/2"-13	1496	(678.6)

Eaton's B-Line Business seismic bracing components are designed to be compatible only with other B-Line bracing components, resulting in a listed seismic bracing assembly. B-Line's warranty for seismic bracing components will be the warranty provided in B-Line's standard terms and conditions of sale made available by B-Line, except that, in addition to the other exclusions from B-Line's warranty, Eaton's B-line Business makes no warranty relating to B-Line's seismic bracing components that are combined with products not provided by Eaton's B-Line Business.

Fig. 4LA - Longitudinal "In-Line" Sway Brace Attachment cont.



Longitudinal Loads			FM Max. Design Load								Max. Rec.	
Part No.	Pipe Size in.	(mm)	30°-44° lbs.	(kN)	45°-59° lbs.	(kN)	60°-74° lbs.	(kN)	75°-90° lbs.	(kN)	Load lbs.	(kN)
4LA-1	1"	(25)	680	(3.02)	970	(4.31)	1190	(5.29)	1320	(5.87)	1000	(4.45)
4LA-1 1/4	1 1/4"	(32)	680	(3.02)	970	(4.31)	1190	(5.29)	1320	(5.87)	1000	(4.45)
4LA-1 1/2	1 1/2"	(40)	680	(3.02)	970	(4.31)	1190	(5.29)	1320	(5.87)	1000	(4.45)
4LA-2	2"	(50)	680	(3.02)	860	(3.82)	1030	(4.58)	1150	(5.11)	1000	(4.45)
4LA-2 ½	2 1/2"	(65)	680	(3.02)	970	(4.31)	1190	(5.29)	1320	(5.87)	1000	(4.45)
4LA-3	3"	(80)	680	(3.02)	970	(4.31)	1190	(5.29)	1320	(5.87)	1000	(4.45)
4LA-3 ½	3 1/2"	(90)	680	(3.02)	970	(4.31)	1190	(5.29)	1320	(5.87)	1000	(4.45)
4LA-4	4"	(100)	680	(3.02)	970	(4.31)	1190	(5.29)	1320	(5.87)	1000	(4.45)
4LA-5	5"	(125)	-	-	-	-	-	-	-	-	1600	(7.11)
4LA-6	6"	(150)	1620	(7.20)	2,260	(10.05)	2010	(8.94)	2220	(9.87)	1600	(7.11)
4LA-8	8"	(200)	1620	(7.20)	1,660	(7.38)	1570	(6.98)	1740	(7.74)	2015	(8.96)
4LA-10	10"	(250)	1620	(7.20)	1,660	(7.38)	1570	(6.98)	1740	(7.74)	2765	(12.30)
4LA-12	12"	(300)	1620	(7.20)	1,660	(7.38)	1570	(6.98)	1740	(7.74)	-	-

Lateral Loads			FM Max. Design Load								Max. Rec.	
Part No.	Pipe Size in.	(mm)	30°-44° lbs.	(kN)	45°-59° lbs.	(kN)	60°-74° lbs.	(kN)	75°-90° lbs.	(kN)	Load lbs.	(kN)
4LA-1	1"	(25)	680	(3.02)	970	(4.31)	1190	(5.29)	1320	(5.87)	1000	(4.45)
4LA-1 1/4	1 1/4"	(32)	680	(3.02)	970	(4.31)	1190	(5.29)	1320	(5.87)	1000	(4.45)
4LA-1 1/2	1 1/2"	(40)	680	(3.02)	970	(4.31)	1190	(5.29)	1320	(5.87)	1000	(4.45)
4LA-2	2"	(50)	680	(3.02)	970	(4.31)	1190	(5.29)	1320	(5.87)	1000	(4.45)
4LA-2 ½	2 1/2"	(65)	680	(3.02)	970	(4.31)	1190	(5.29)	1320	(5.87)	1000	(4.45)
4LA-3	3"	(80)	680	(3.02)	970	(4.31)	1190	(5.29)	1320	(5.87)	1000	(4.45)
4LA-3 ½	3 1/2"	(90)	680	(3.02)	970	(4.31)	1190	(5.29)	1320	(5.87)	1000	(4.45)
4LA-4	4"	(100)	680	(3.02)	970	(4.31)	1190	(5.29)	1320	(5.87)	1000	(4.45)
4LA-5	5"	(125)	-	-	-	-	-	-	-	-	1600	(7.11)
4LA-6	6"	(150)	1620	(7.20)	2,300	(10.23)	2820	(12.54)	3140	(13.96)	1600	(7.11)
4LA-8	8"	(200)	1620	(7.20)	2,300	(10.23)	2820	(12.54)	3140	(13.96)	2015	(8.96)
4LA-10	10"	(250)	1620	(7.20)	2,300	(10.23)	2820	(12.54)	3140	(13.96)	2765	(12.30)
4LA-12	12"	(300)	1620	(7.20)	2,300	(10.23)	2820	(12.54)	3140	(13.96)	-	-

Eaton's B-Line Business seismic bracing components are designed to be compatible only with other B-Line bracing components, resulting in a listed seismic bracing assembly. B-Line's warranty for seismic bracing components will be the warranty provided in B-Line's standard terms and conditions of sale made available by B-Line, except that, in addition to the other exclusions from B-Line's warranty, Eaton's B-line Business makes no warranty relating to B-Line's seismic bracing components that are combined with products not provided by Eaton's B-Line Business.

All dimensions in charts and on drawings are in inches. Dimensions shown in parentheses are in millimeters unless otherwise specified.

Fig. 1000 - "Fast Clamp" Sway Brace Attachment

Component of State of California OSHPD Approved Seismic Restraints System

Size Range — Pipe size to be braced: 1" thru 6" Schedule 10 thru 40 IPS.* Pipe size used for bracing: 1" and 1¼" Schedule 40 IPS.

* Additionally **(UL)** approved for use to brace Schedule 7 sprinkler pipe up to 4" (maximum horizontal design load 655 lbs.) Torque requirement 6 — 8 ft. lbs.

Material — Carbon Steel

Function — For bracing pipe against sway and seismic disturbance. The pipe attachment component of a sway brace system: Fig. 1000 is used in conjunction with a TOLCO Fig. 900 Series Fitting and joined together with bracing pipe per NFPA 13* or TOLCO OSHPD Approved Seismic Manual, forming a complete sway brace assembly.

Features — Field adjustable, making critical pre-engineering of bracing pipe unnecessary. Unique design requires no threading of bracing pipe. Can be used as a component of a 4-way riser brace. Can be used as longitudinal brace with Fig. 907. Comes assembled and individually packaged with illustrated installation instructions — sizes are clearly marked. Steel leaf spring insert provided to assure installer and inspector necessary minimum torque has been achieved.

Installation — The Fig. 1000 is the "braced pipe" attachment component of a lateral sway brace assembly. It is intended to be combined with the "bracing pipe" and TOLCO structural attachment component, Fig. 980, 910 or 909 to form a complete bracing assembly. Follow NFPA 13 and/or OSHPD guidelines.

To Install — Place the Fig. 1000 over the pipe to be braced, insert bracing pipe through opening leaving a minimum of 1" extension. Brace pipe can be installed on top or bottom of pipe to be braced. Tighten hex nuts until leaf spring is flat. It is recommended that the brace angle be adjusted before hex nuts are fully tightened.

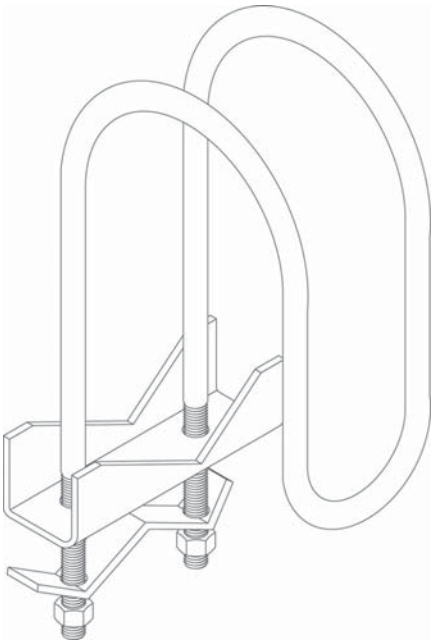
Approvals — Underwriters Laboratories Listed in the USA **(UL)** and Canada **(cUL)**. Approved by Factory Mutual Engineering **(FM)**. Included in our Seismic Restraints Catalog approved by the State of California Office of Statewide Health Planning and Development **(OSHPD)**. For additional load, spacing and placement information relating to OSHPD projects, please refer to the TOLCO Seismic Restraint Systems Guidelines.

Application Note — Position Fast Clamp and tighten two hex nuts until leaf spring flattens. A minimum of 1" pipe extension beyond the Fig. 1000 is recommended.

Finish — Plain

Note — Available in Electro-Galvanized and HDG finish or Stainless Steel materials.

Order By — Order first by pipe size to be braced, followed by pipe size used for bracing, figure number and finish.

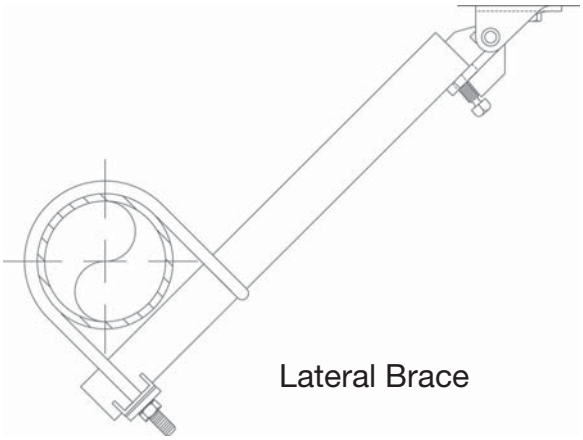


c UL US LISTED

FM APPROVED

Maximum Design Load
1" thru 4" pipe size — 2015 lbs.
6" size — 1265 lbs.

FM Approved Design Loads*
1" - 2½" - 600 lbs.
3" - 4" - 700 lbs.



Lateral Brace

TOLCO® brand bracing components are desgined to be compatible **ONLY** with other TOLCO® brand bracing components, resulting in a Listed seismic bracing assembly. **DISCLAIMER** — NIBCO does **NOT** warrant against the failure of TOLCO® brand bracing components, in the instance that such TOLCO® brand bracing components are used in combination with products, parts or systems which are not manufactured or sold under the TOLCO® brand. NIBCO shall **NOT** be liable under any circumstance for any direct or indirect, incidental or consequential damages of any kind, including but not limited to loss of business or profit, where non-TOLCO brand bracing components have been, or are used.

1

General Information

1-1 Scope. This recommended practice provides for the inspection, testing, and maintenance of sprinkler systems.

Because this publication is a recommended practice, it is advisory only. Unlike a standard, which specifies regulations, this document provides guidance only and the word *shall*, which indicates a requirement, is not used. Regulations governing the installation of the components of sprinkler systems are found in the appropriate standards. It is the feeling of many that requirements for adequate maintenance of automatic sprinkler systems should be mandatory rather than advisory. Unfortunately, the multiplicity of conditions which actually exist in the field would make the application of a mandatory standard in all instances difficult, if not impossible, and thereby render it meaningless. It is, therefore, felt that the guidance provided by the recommended practice is more appropriate. Further this guidance is considered so important to the proper operation of the system that a copy of this recommended practice is required to be furnished to the owner of the sprinkler system by 1-5.2 of NFPA 13.

1-2 Purpose. The purpose of this recommended practice is to provide guidance for inspection, testing, and maintenance of sprinkler systems.

The responsibility for properly maintaining a sprinkler system is the obligation of the owner(s) of the property. Suggestions as to details for proper maintenance by the owner are expanded in Section 1-5.

1-3 Definitions.

Antifreeze System. A system employing automatic sprinklers attached to a piping system containing an antifreeze solution and connected to a water supply. The antifreeze solution, followed by water, discharges immediately from sprinklers opened by a fire.

See Section 5-5 of NFPA 13, *Installation of Sprinkler Systems.*

Approved. Means "acceptable to the authority having jurisdiction."

NOTE: The National Fire Protection Association does not approve, inspect or certify any installations, procedures, equipment or materials nor does it approve or evaluate testing laboratories. In determining the acceptability of installations or procedures, equipment or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure or use. The authority having jurisdiction may also refer to the listings or labeling practices of an organization concerned with product evaluations which is in a position to determine compliance with appropriate standards for the current production of listed items.

Authority Having Jurisdiction. The "authority having jurisdiction" is the organization, office, or individual responsible for "approving" equipment, an installation, or a procedure.

NOTE: The phrase "authority having jurisdiction" is used in NFPA documents in a broad manner since jurisdictions and "approval" agencies vary as do their responsibilities. Where public safety is primary, the "authority having jurisdiction" may be a federal, state, local, or other regional department or individual such as a fire chief, fire marshal, chief of a fire prevention bureau, labor department, health department, building official, electrical inspector, or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the "authority having jurisdiction." In many circumstances the property owner or his designated agent assumes the role of the "authority having jurisdiction"; at government installations, the commanding officer or departmental official may be the "authority having jurisdiction."

Butterfly Valve. An indicating-type control valve incorporating wafer-type body with gear-operated, quarter-turn disc in the waterway.

Cold Weather Valve. An indicating-type valve for the control of 10 sprinklers or less in a wet system protecting an area subject to freezing. The valve is normally closed and the system drained during freezing weather.

Control Valve. A valve that may be opened or closed to regulate the flow of water to all or part of a sprinkler system.

See 3-9.2 of NFPA 13, *Standard for the Installation of Sprinkler Systems.*

Deluge System. A system employing open sprinklers installed in a water supply through a valve that is opened by the operation of a fire detection system installed in the same areas as the sprinklers. When this valve opens, water flows into the piping system and discharges from all sprinklers attached thereto.

See Section 5-3 of NFPA 13, *Standard for the Installation of Sprinkler Systems.*

Dry-Pipe System. A system employing automatic sprinklers installed in a piping system containing air or nitrogen under pressure, the release of which, as from the opening of a sprinkler, permits the water pressure to open a valve known as a dry-pipe valve. The water then flows into the piping system and out the opened sprinklers.

See Section 5-2 of NFPA 13, *Standard for the Installation of Sprinkler Systems.*

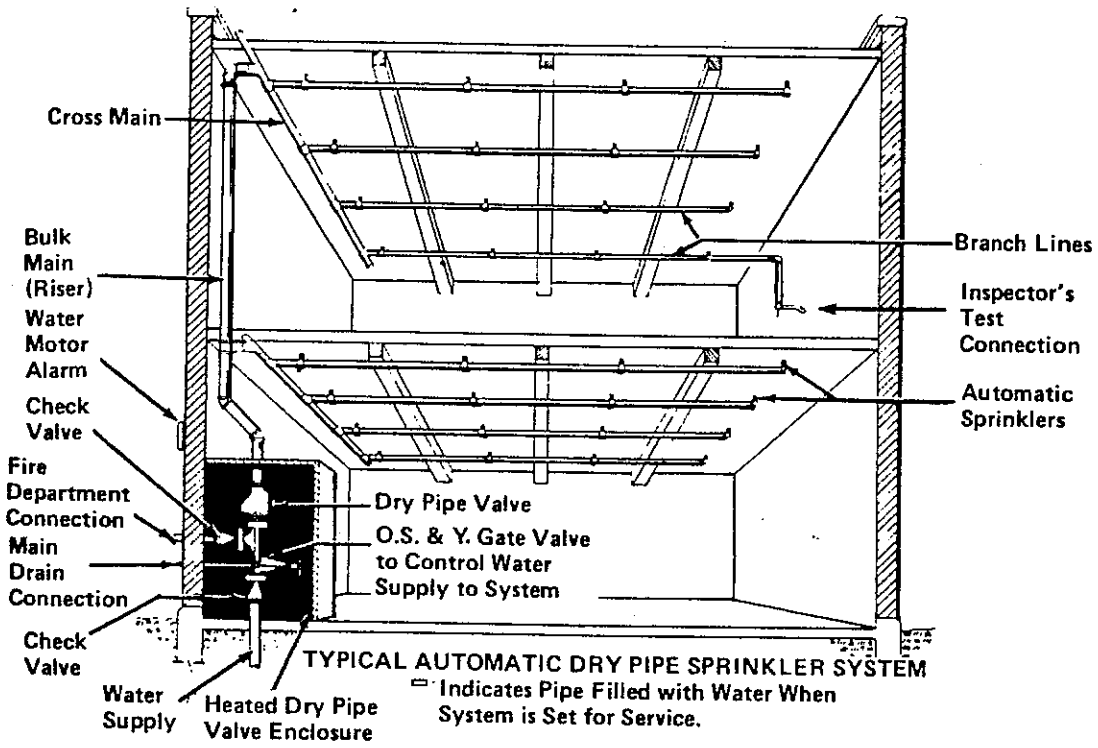


Figure 1-3(a) Dry-pipe System.

Emergency Impairment. A condition wherein a sprinkler system or a portion thereof is out of order due to an unexpected occurrence such as a ruptured pipe, operated sprinkler, interruption of water supply to the system, etc.

Indicator Post. A control extending above ground or through a wall for operating sprinkler control valves. A target or indicator visible through an opening in the post shows whether the valve is open or shut.

Inspection. A visual examination of a sprinkler system or portion thereof to verify that it appears to be in operating condition and is free from physical damage.

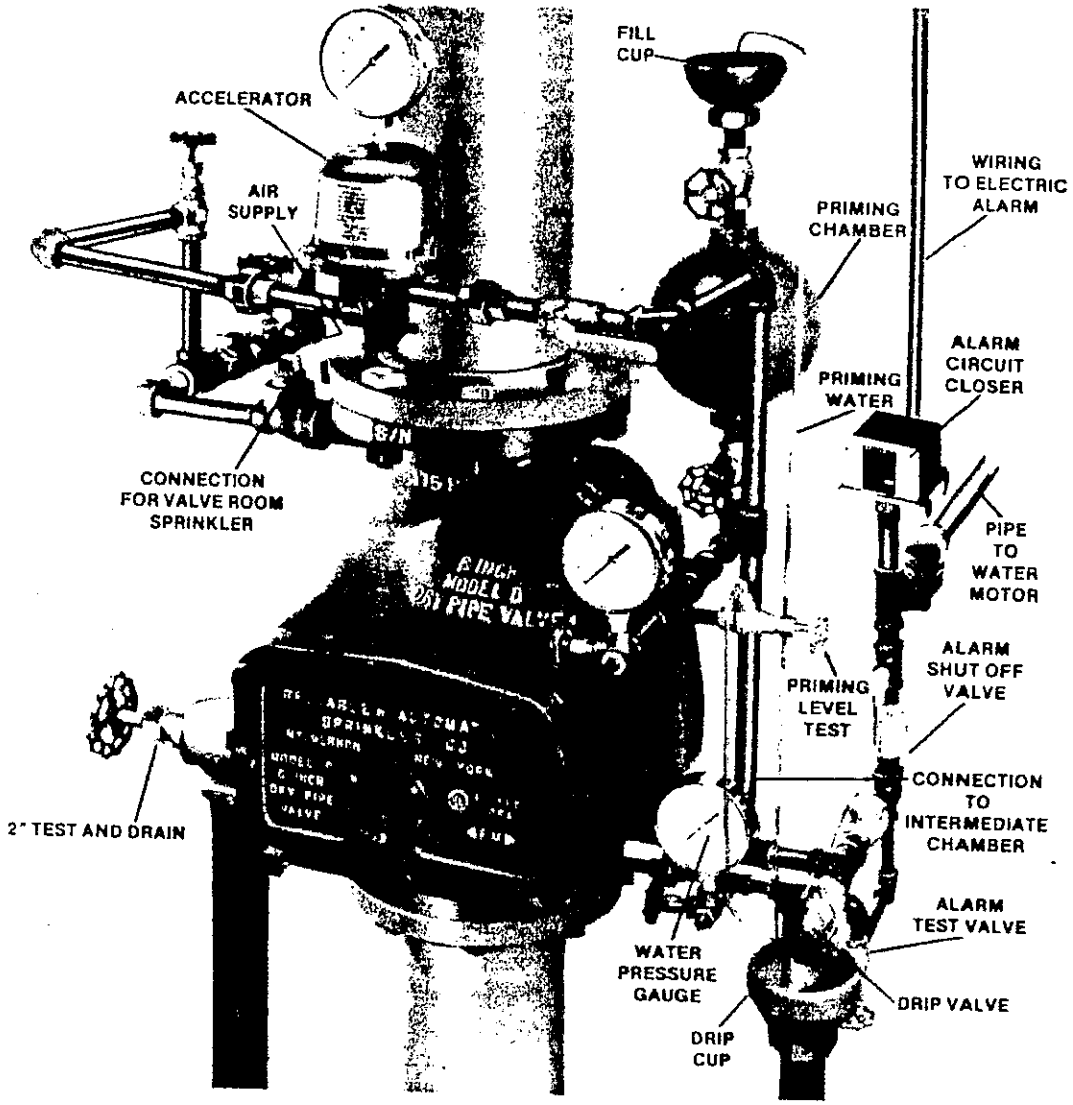


Figure 1-3(b) Typical Dry-pipe Valve with Trimmings.

Listed. Equipment or materials included in a list published by an organization acceptable to the "authority having jurisdiction" and concerned with product evaluation, that maintains periodic inspection of production of listed equipment or materials and whose listing states either that the equipment or material meets appropriate standards or has been tested and found suitable for use in a specified manner.

NOTE: The means for identifying listed equipment may vary for each organization concerned with product evaluation, some of which do not recognize equipment as listed unless it is also labeled. The "authority having jurisdiction" should utilize the system employed by the listing organization to identify a listed product.

Locks and Chains. Heavy-duty locks and chains sufficiently durable to resist any cutting device less than heavy-duty bolt cutters.

Maintenance. Work performed to keep equipment operable, or to make repairs.

Outside Screw and Yoke (O. S. & Y.) Valve. A gate valve with a rising stem that indicates if the valve is open or closed.

Preaction System. A closed sprinkler system containing air that may or may not be under pressure, with a supplemental fire detection system installed in the same areas as the sprinklers. Actuation of the fire detection system opens a valve that permits water to flow into the sprinkler piping and to be discharged from any sprinklers that may be open.

See 5-3.6 of NFPA 13, *Standard for the Installation of Sprinkler Systems.*

Preplanned Impairment. A condition where a sprinkler system or a portion thereof is out of service due to work that has been planned in advance such as revisions to the water supply or sprinkler system piping.

Qualified Inspection Service. A service program provided by a fire protection contractor and/or owner's representative in which all of the Chapter 7 provisions are included.

Quick-Opening Device. A listed device such as an accelerator or an exhauster used to cause a dry-pipe valve to operate more rapidly.

See 5-2.4 of NFPA 13, *Standard for the Installation of Sprinkler Systems.*

Roadway Box. A sleeve providing access to an underground control valve.

Seals. The use of small-diameter wire that is threaded and knotted within a lead seal. Alternately, plastic devices are available for the same purpose.

The closing of the seal makes it impossible to turn a valve unless the seal is broken. The broken seal indicates that the valve may have been moved from its normal position.

Should. Indicates a recommendation or that which is advised but not required.

Sprinkler System. A sprinkler system, for fire protection purposes, is an integrated system of underground and overhead piping designed in accordance with fire protection engineering standards. The installation includes a water supply such as a gravity tank, fire pump, reservoir or pressure tank, and/or connection by underground piping to a city main. The portion of the

sprinkler system aboveground is a network of specially sized or hydraulically designated piping installed in a building, structure or area, generally overhead, and to which sprinklers are connected in a systematic pattern. The system includes a controlling valve and a device for actuating an alarm when the system is in operation. The system is usually activated by heat from a fire and discharges water over the fire area.

Tamper Switch. An electrical device for control-valve supervision which initiates an alarm when the control valve is moved from the normal position.

Testing. Conducting periodic physical checks on the sprinkler system such as water flow tests, alarm tests, or dry-pipe valve trip tests.

Waterflow Alarm. A listed device so constructed and installed that any flow of water from a sprinkler system equal to or greater than that from a single automatic sprinkler will result in an alarm signal.

See Section 3-12 of NFPA 13, ***Standard for the Installation of Sprinkler Systems.***

Wet-Pipe System. A system employing automatic sprinklers installed in a piping system containing water and connected to a water supply. Water discharges immediately from sprinklers opened by a fire.

See Section 5-1 of NFPA 13, ***Standard for the Installation of Sprinkler Systems.***

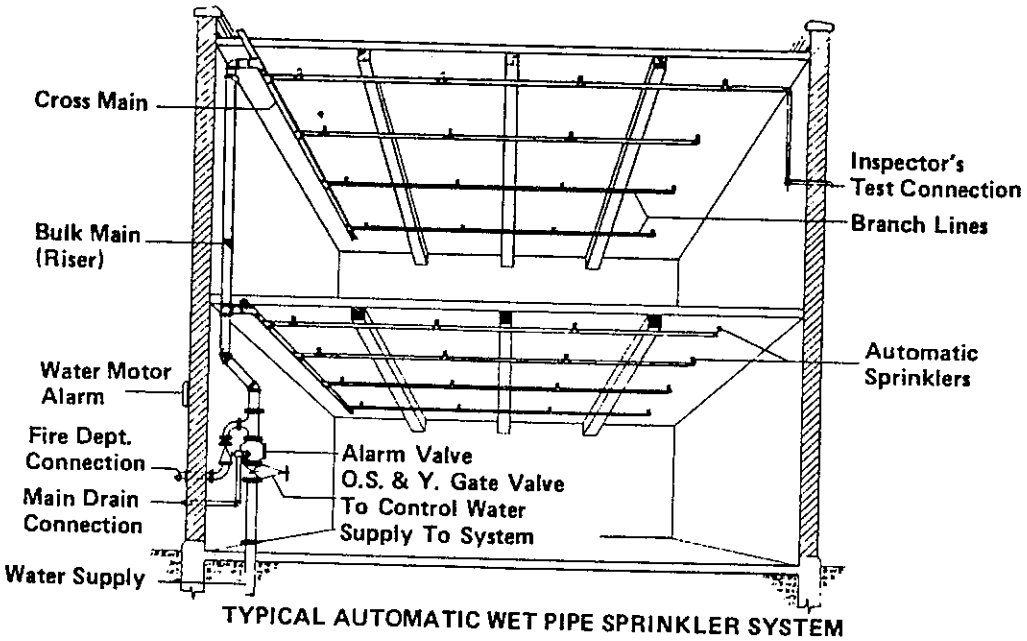


Figure 1-3(c) Wet-pipe System.

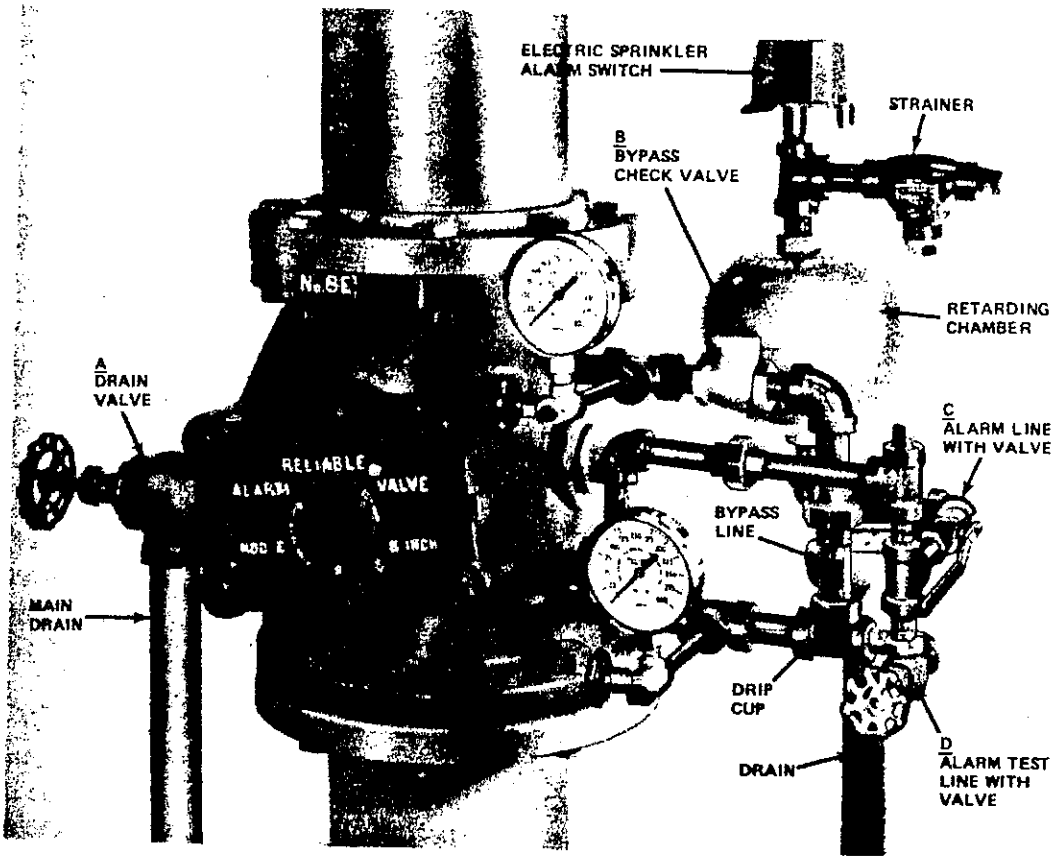


Figure 1-3(d) Typical Alarm Valve and Trimmings.

1-4 Units. Metric units of measurement in this recommended practice are in accordance with the modernized metric system known as the International System of Units (SI). Two units (liter and bar), outside of but recognized by SI, are commonly used in international fire protection. These units are listed in Table 1-4 with conversion factors.

Table 1-4

Name of Unit	Unit Symbol	Conversion Factor
liter	L	1 gal = 3.785 L
cubic decimeter	dm^3	1 gal = 3.785 dm^3
pascal	Pa	1 psi = 6894.757 Pa
bar	bar	1 psi = 0.0689 bar
bar	bar	1 bar = 10^5 Pa

For additional conversions and information see ASTM E380, *Standard for Metric Practice.*

1-4.1 If a value for measurement as given in this recommended practice is followed by an equivalent value in other units, the first stated is to be regarded as the requirement. A given equivalent value may be approximate.

1-4.2 The conversion procedure for the SI units has been to multiply the quantity by the conversion factor and then round the result to the appropriate number of significant digits.

1-5 Responsibility of the Owner or Occupant.

1-5.1 The responsibility for properly maintaining a sprinkler system is the obligation of the owners of the property.

By means of periodic tests, the equipment is shown to be in good operating condition or any defects or impairments are revealed. Such tests are made, however, at the owner's responsibility and risk. Intelligent cooperation in the performance of these tests shows evidence of the owner's interest in property conservation.

1-5.2 Automatic sprinkler systems installed in accordance with NFPA standards require a minimum of inspection, testing, and maintenance; however, deterioration or impairment may result from neglect. Definite provision for periodic competent attention is a prime requirement if the system is to serve its purpose effectively.

1-5.3 Arrangements should be made to keep all stock piles, racks, and other possible obstructions the proper distance below sprinklers. [The minimum recommended distance below sprinkler deflectors at the ceiling is 18 in. (457 mm). The minimum recommended distance below sprinkler deflectors in racks can be found in NFPA 231, *Standard for General Storage*; NFPA 231C, *Standard for Rack Storage*; and NFPA 231D, *Standard on Storage of Rubber Tires*.]

1-5.4 A competent and reliable employee should be given the responsibility of regularly inspecting, testing, and maintaining the system and reporting any troubles or defects to his employer. This employee should have proper instruction and training and a general understanding of the mechanical requirements of operation.

1-5.5 Support personnel should be trained in inspection, testing, and maintenance and be fully capable of taking over the functions at any time when the authorized individual is unavailable.

1-5.6 Public Fire Department.

1-5.6.1 It is advisable to notify the fire department of the installation of automatic sprinkler equipment so that it may become familiar with the system. The fire department should know the extent of the protection and the location and arrangement of the control valves and the connections for fire department use.

The fire department should also be notified if the system or a major portion of it is temporarily taken out of service. This notification allows the fire department to preplan in the event

of any emergency and also provides it an opportunity for making suggestions for provision of emergency or temporary water supplies during the impairment period.

1-5.7 Security Personnel.

1-5.7.1 Instruct security personnel in the following:

(a) Location and use of control valves, drain valves, and alarm devices.

(b) Prompt transmittal of a fire alarm to a fire department or brigade, before attempting to extinguish the fire.

(c) Proper notification in case of fire or impairment of sprinkler equipment.

(d) Daily visual inspection of all sprinkler control valves on the guard's first round to ascertain that they are open.

(e) Proper notification immediately of any valve found closed.

(f) Proper notification when sprinkler alarms operate, to determine the cause of water flow.

(g) Do not close sprinkler control valves until it has definitely been established that there is no fire.

(h) During cold weather, verify that windows or other openings are closed and that proper temperature is being maintained to prevent freezing.

The importance of inspection to ascertain that all sprinkler control valves are open cannot be overemphasized. Closed valves are by far the greatest cause of sprinkler system failure. It is also important that security personnel not close valves until it has been established that a fire has been completely extinguished. There have been a significant number of large losses where the sprinkler valve was prematurely closed, either because of concern regarding water damage or because the party closing the valve incorrectly thought the fire had been extinguished. When closed valves are found with no detectable reason for their being closed, security personnel should be especially alert for possible arson attempts.

1-6 Sprinkler Inspection Service.

1-6.1 The level of reliability of the protection offered by an automatic sprinkler system is promoted when there is a qualified inspection service. Qualified inspection service should include:

(a) Four visits per year, at regular intervals.

(b) All services indicated in summary Table 7-3.

(c) The completion of a report form with copies furnished to the property owner. (*See Chapter 7, Report of Inspection, Exhibit I.*)

1-6.2 The outside inspection services are an adjunct to, and are not intended to replace, the owners' obligations.

2

Water Supplies

2-1 General. The source and quantity of water is of fundamental importance. To ensure the continued existence of proper flow, it is necessary that periodic inspections and tests be conducted by qualified personnel.

2-2 Gravity Tanks and Suction Tanks. (*See NFPA 22, Standard for Water Tanks for Private Fire Protection.*)

2-2.1 Monthly inspections should be made to check the maintenance of water at the proper level in the tank.

Constant maintenance of a full supply of water in gravity tanks is necessary not only to ensure proper performance of the sprinkler system in the event of a fire, but to prevent shrinkage of wooden tanks and minimize corrosion of steel tanks.

2-2.2 Heating devices should be kept in order and the water temperature in the tank should be checked daily during freezing weather to maintain a minimum temperature of 40°F (4°C).

2-2.3 The tank roof should be kept tight and in good repair, with the hatches fastened closed and the frostproof casing of the tank riser in good repair.

2-2.4 Ice should not be allowed to form on any part of the tank structure. The prevention of freezing in the riser or the formation of ice in the tank itself is extremely important. Freezing in the riser of an elevated tank may obstruct the flow of water from the tank. The formation of a layer of ice on the water of elevated or suction tanks also may impede or prevent the flow from the tank. The formation of heavy icicles through leaking of the tank is dangerous as tank collapse may ensue or people may be endangered by falling icicles.

2-2.5 The bases of the tower columns should be kept free from dirt and rubbish that would permit the accumulation of moisture with consequent corrosion. The tops of foundation piers should always be at least 6 in. (152 mm) above the ground level.

Coal or ashes or combustible material of any kind should not be piled near the columns as this may cause failure of the steelwork due to fire,

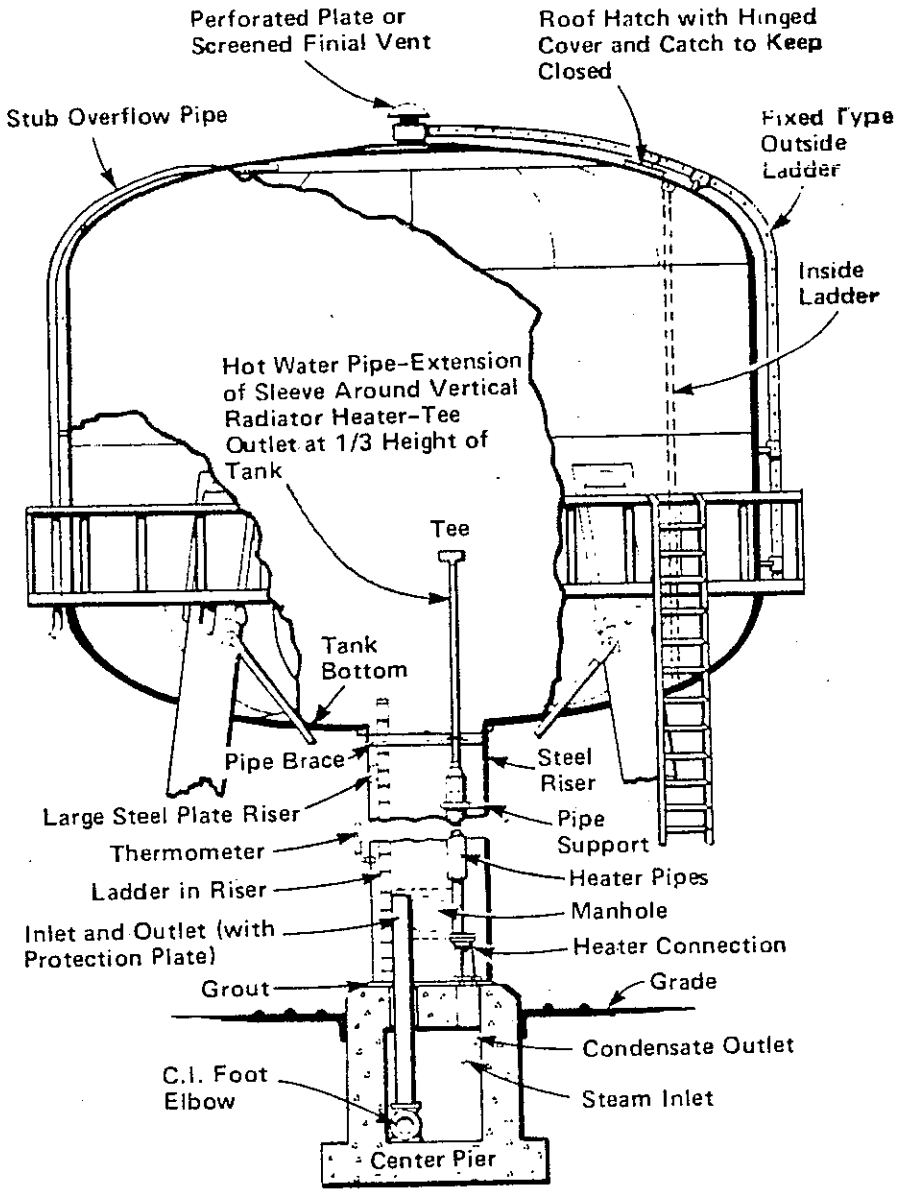


Figure 2.1. Typical gravity tank installation.

heating, or corrosion. The tank site should be kept cleared of weeds, brush, and grass.

2-2.6 Before repainting, the surface should be thoroughly dried and all loose paint, rust, scale, and other surface contamination should be removed. After proper surface preparation, the original paint system should be restored. It may be necessary or economical to repaint the entire inside surface. On the exterior, normal maintenance will involve local patching and periodic application of one complete finish coat when the preceding has weathered thin or for improved appearance after patching.

The painters should not allow any scrapings or other foreign material to fall down the riser or outlet. If the opening is covered for protection, only a

few sheets of paper tied over the end of the settling-basin-stub should be used. The paper should be removed upon the completion of the job.

For detailed information refer to NFPA 22, *Standard for Water Tanks for Private Fire Protection,* Care and Maintenance Section.

2-2.7 Necessary periodic emptying of steel tanks for repainting can be minimized by use of a cathodic corrosion prevention system that counteracts the natural electrolytic action that is the basis for most corrosion. Such a system needs periodic attention to the condition of suspended electrodes. If chemical water additives are used to inhibit corrosion, semi-annual chemical analysis of the water should be made. (*See also NFPA 22, Standard for Water Tanks for Private Fire Protection, Section A-2-7.13.*)

If cathodic protection is maintained in a steel tank, the tank should be cleaned out sufficiently often to prevent sediment and scale entering the discharge pipe.

2-2.8 The authority having jurisdiction should always be notified in advance when and for how long the tank is to be out of service.

2-3 Pressure Tanks. (*See NFPA 22, Standard for Water Tanks for Private Fire Protection.*)

2-3.1 Pressure tanks should be inspected regularly, checking the water level and air pressure monthly.

2-3.2 The interior of pressure tanks should be inspected carefully at three-year intervals to determine if corrosion is taking place and if repainting or repairing is needed. When necessary, they should be thoroughly scraped and wire brushed and repainted with an approved metal-protective paint.

2-3.3 Applicable safety codes should be consulted with respect to the maintenance and testing of pressure tanks.

2-3.4 The tank should be pressure tested at intervals as required by the ASME, *Non-Fired Pressure Vessel Code.*

2-3.5 Sight gage valves should be kept closed except when a test for water level is being made.

By keeping these valves closed, the water and air in the tank are isolated from the sight glass, so that breaking of the glass will not affect the volume of water nor the pressure available for fire protection.

2-3.6 The tank and its supports should be examined and painted as recommended for gravity tanks.

2-3.7 The heat within the tank enclosure should be checked daily during cold weather to maintain a 40°F (4°C) room temperature.

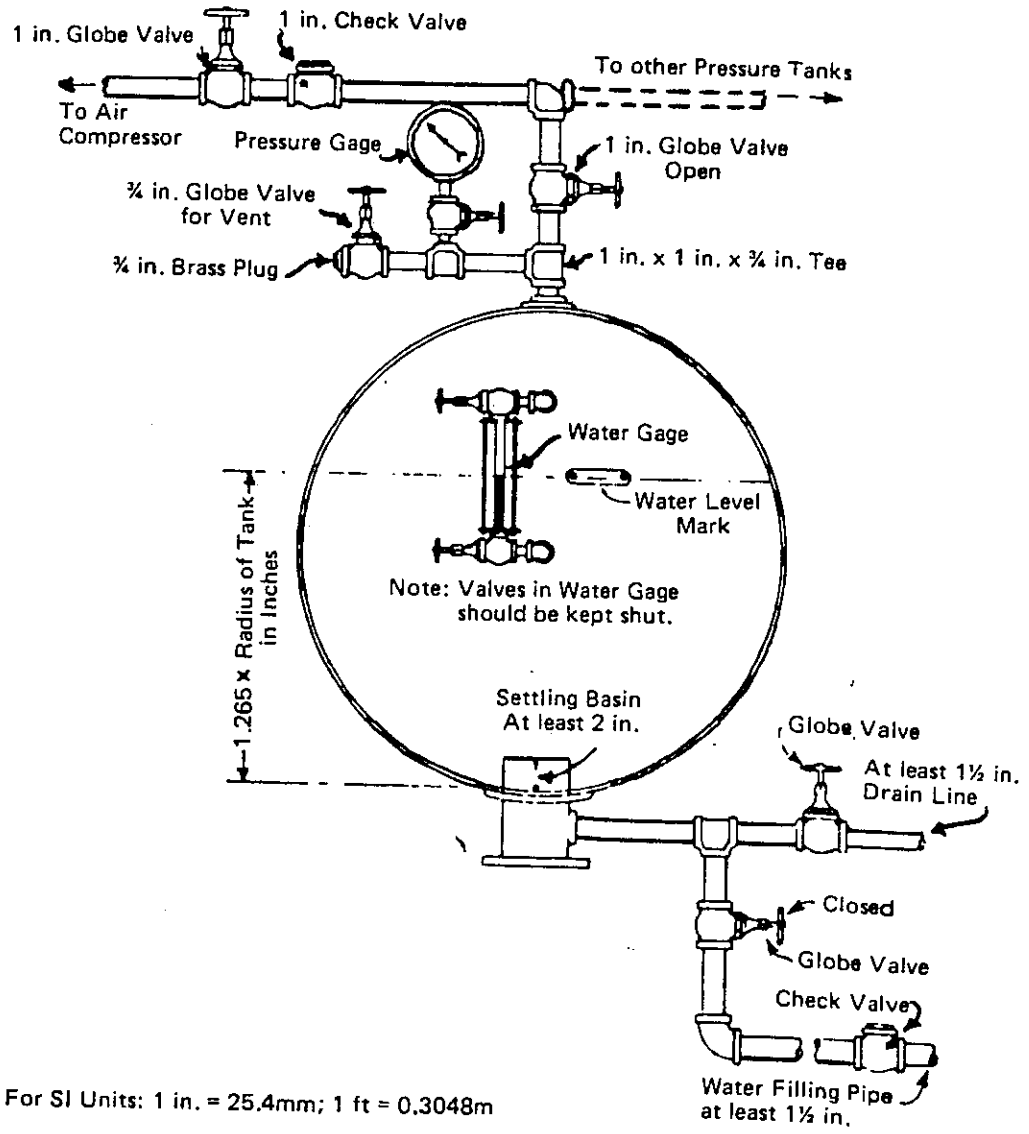


Figure 2.2. Typical connection to pressure tanks.

2-4 Fire Pumps. (*See NFPA 20, Standard for Installation of Centrifugal Fire Pumps and NFPA 21, Standard for the Operation and Maintenance of National Standard Steam Fire Pumps.*)

2-4.1 General.

2-4.1.1 The pump room should be kept clean and accessible at all times. The fire pump, driver, and controller should be protected against possible interruption of service through damage caused by explosion, fire, flood, earthquake, rodents, insects, windstorm, freezing, vandalism, and other adverse conditions.

2-4.1.2 The suction pipes, intakes, foot valves, and screens of fire pumps should be examined frequently to make sure that they are free from any obstruction. Mud, gravel, leaves, and other foreign material entering the suction pipe may cause damage to the pump or obstruction of the piping of

the sprinkler system. The formation of ice may also impair the operation of the pump.

NOTE: Horizontal pumps should be provided with water under a positive head.

2-4.1.3 Suitable means should be provided for maintaining the temperature of a pump room or pump house, where required, above 40°F (4°C). Where pumps are driven by internal combustion engines the temperature of the pump room, pump house, or area where engines are installed should never be less than the minimum recommended by the engine manufacturer.

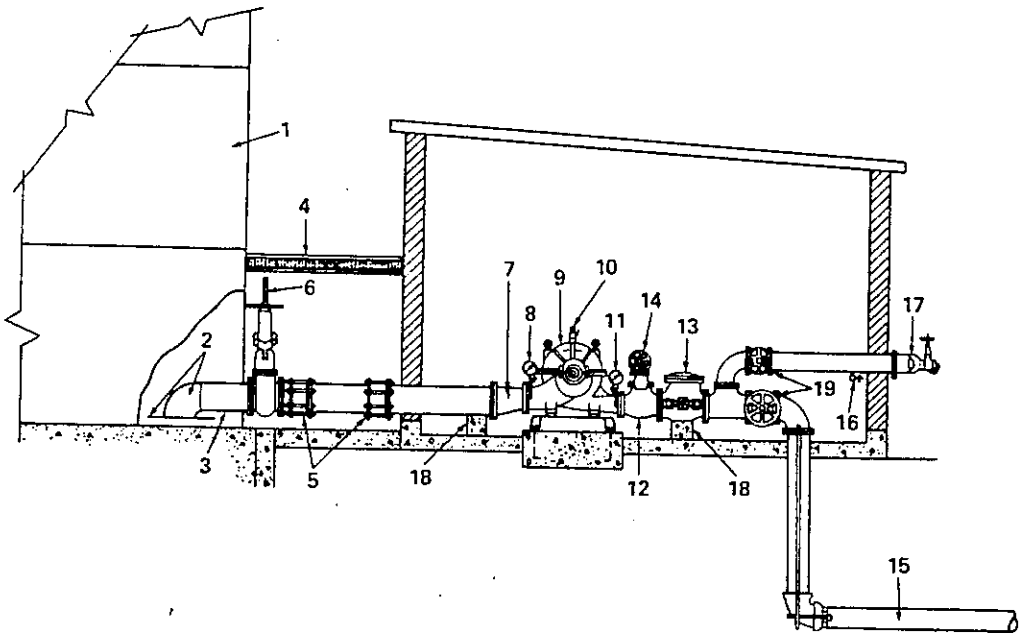


Figure 2.3. Horizontal split case fire pump installation with the water supply under a positive head: 1) aboveground suction tank; 2) entrance elbow; 3) suction pipe; 4) frostproof casing; 5) flexible couplings for strain relief; 6) O.S. & Y. gate valve; 7) eccentric reducer; 8) suction gage; 9) horizontal 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.

2-4.1.4 Pump rooms and pump houses should be dry and free of condensate. Accumulation of water in the steam pump supply line or drainage equipment may be dangerous and should be avoided. Where condensate is a problem some heat should be provided.

2-4.1.5 Fire pumps should be operated only in connection with fire protection service and not for plant use.

2-4.1.6 Oil in internal combustion engine pumps should be changed in accordance with manufacturer's instructions, but not less than annually.

2-4.1.7 Storage batteries should be tested frequently to determine the condition of battery cells and the amount of charge in the battery. Only distilled water should be used in battery cells. The plates should be kept submerged at all times.

2-4.1.8 Fuel storage tanks should be kept full at all times.

2-4.2 Periodic Operation and Testing.

2-4.2.1 The pump should be operated every week at rated speed. Inspect the condition of the pump, bearings, stuffing boxes, suction pipe strainers, and the various other details pertaining to the driver and control equipment. The examination should be extended to include the condition and reliability of the electric power supply and, if the pump is engine driven, the storage batteries, lubrication system, and oil and fuel supplies.

Exception: Electric motor driven fire pumps should be tested monthly.

The packing glands of horizontal shaft centrifugal pumps are part of the pump's lubrication system and should drip slowly when the pump is in operation.

2-4.2.2 When automatically controlled pumping units are to be tested weekly by manual means, at least one start should be accomplished by reducing the water pressure either with the test drain on the pressure sensing line or with a larger flow from the system.

The pressure switch in the control panel that activates the pump automatically is connected to the system through small diameter, noncorrosive piping. The test drain valve will be found in that piping.

2-4.2.3 If the driver has an internal combustion engine, it should be run for at least 30 minutes to bring it up to normal running temperature and to make sure it is running smoothly at rated speed. Automatically controlled equipment should be arranged to automatically start the engine with the initiating means being a solenoid valve drain on the pressure control line.

2-4.2.4 Steam pumps should be operated until water is discharged freely from the relief valve. Regular inspections should be made: checking the maintenance of ample pressure; proper supply of lubricating oil; operative condition of relief valve and level of water in the priming tank.

2-4.2.5 A yearly flow test should be made to ensure that neither pump nor suction pipe is obstructed and the pump is operating properly. When the water supply is from a public service main, pump operation should not reduce the suction head at the pump below the pressure allowed by the local authority. At this time both the static and pumping water level of vertical shaft pumps should be determined.

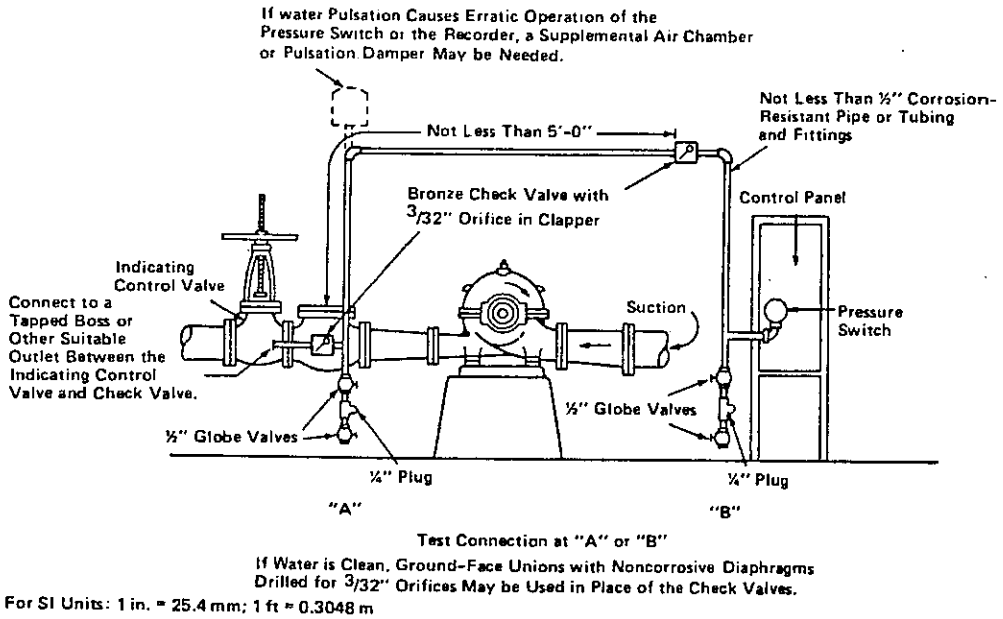


Figure 2.4. Piping connection for each automatic pressure switch for fire pumps or jockey pumps. Solenoid drain valve used for engine-driven pumps may be at "A," "B," or inside of controller enclosure.

Arrangements must be made for the safe discharge and disposal of the large volume of water.

2-5 Hydrants. (*See NFPA 24, Standard for Private Fire Service Mains and Their Appurtenances.*)

2-5.1 Inspection of Hydrants.

(a) Public hydrants near the building should be observed for any signs of damage or vandalism.

(b) Private hydrants should be inspected monthly to verify that they are visible and readily accessible with caps in place.

2-5.2 Maintenance.

(a) Lubricate private hydrants twice yearly.

(b) Private hydrants should be serviced as recommended by manufacturers.

2-5.3 Testing. At least annually, private hydrants should be opened and closed to ensure proper water flow and drainage.

2-6 Riser Flow Tests.

2-6.1 Water flow tests should be made quarterly from water supply test pipes (main drain valves).

Test at the main drain valves includes noting of pressure gage readings with unrestricted flow of water with the drain valve wide open, as compared with the reading with the drain valve closed. If the readings vary materially from those previously established or from normal readings, the condition should be investigated. These tests are intended to show whether or not the normal water supply is available on the system and to indicate the possible presence of closed valves or other obstructions in the supply pipe.

NOTE: Water flow test of a system having a direct connnection to central station or fire department should be made only after proper notice is given to the signal receiving station.

See Figure 2-9.1 of NFPA 13, *Standard for the Installation of Sprinkler Systems.*

2-7 Control Valves. (*See NFPA 26, Recommended Practices for the Supervision of Valves Controlling Water Supplies for Fire Protection.*)

2-7.1 General.

2-7.1.1 Valves should be numbered and each should have a sign indicating the portion of the system it controls.

2-7.1.2 A valve seal and tag system should be used in connection with the supervision and maintenance of a sprinkler system.

2-7.1.3 Each control valve in the sprinkler system should be secured in its normal or open position by means of a seal, lock, or tamper switch.

2-7.1.4 All control valves of the sprinkler system should be inspected at regular intervals.

(a) Sealed valves — weekly

(b) Locked valves and valves with tamper switches — monthly.

Paragraphs 2-7.1.3 and 2-7.1.4 are the most important in the entire recommended practice. Closed valves are the greatest cause of sprinkler system failure. A conscientiously applied program of securing control valves in the open position in combination with a regular inspection procedure will minimize the likelihood of such an occurrence.

2-7.1.5 If a normally open sprinkler valve is closed, thus shutting off any part of the system, the owner or manager of the property should be notified immediately so that the owner may follow his normal valve supervision procedure, including notifying the authority having jurisdiction. (*See Chapter 6, Impairments.*)

2-7.1.6 Valves should be kept in normal position and the sprinkler system in service to the greatest extent possible during alterations and repairs.

When alterations or repairs would otherwise take a system out of service for more than a few hours, the portion of the system being modified should be blanked off and the remainder of the system retained in service. Whenever possible, the portion of the system being modified should be returned to service at the completion of each day's work.

When the alteration or repair isolates the system from its supply, a temporary supply, such as connecting the opened main drain valve to an opened hydrant with fire hose, should be provided when possible.

2-7.1.7 After any alterations or repairs, an inspection should be made to ensure that the valves are in the fully open position, properly sealed, locked, or equipped with a tamper switch, and the system is in commission.

2-7.1.8 Valve stems should be oiled or greased at least once a year. At this time, completely close and reopen the valve to test its operation and distribute the lubricant.

2-7.2 Valve Inspection Report.

2-7.2.1 A valve inspection report should show that the valves are:

(a) In normal open or closed position

(b) Properly sealed, locked, or equipped with a tamper switch

(c) In good operating condition

(d) Readily accessible

(e) Provided with wrenches where required.

2-7.3 Indicator Post.

2-7.3.1 Quarterly, each post indicator valve should be opened until spring or torsion is felt in the rod, indicating that the rod has not become detached from the valve. Valves should be backed one-quarter turn from the wide open position to prevent jamming.

2-7.4 Underground Gate Valves with Roadway Boxes.

2-7.4.1 Quarterly, each valve should be operated with a T-handle wrench to verify that it is in the open position.

2-7.4.2 The location of each such valve should be clearly indicated by a sign on a nearby wall or by a marker. The sign should also indicate direction of valve opening, clockwise or counterclockwise.

2-7.4.3 The roadway box for the valve should always be readily accessible, and the cover should be kept in place.

2-8 Fire Department Connections.

See Section 2-7 of NFPA 13, *Standard for the Installation of Sprinkler Systems.*

2-8.1 Fire department connections should be visible and accessible at all times. They should be inspected monthly.

2-8.2 Caps or plugs should be in place, threads in good condition, ball drip or drain in working order, and check valve not leaking. Prior to replacing caps or plugs, ensure that waterway is clear of foreign material.

2-9 Hose and Hose Stations. (*See NFPA 1962, Standard for the Care, Use and Maintenance of Fire Hose Including Connections and Nozzles.*)

See NFPA 14, *Standard for the Installation of Standpipe and Hose Systems.*

2-9.1 Hose stations should be inspected monthly to ensure that all equipment is in place and in good condition. Hose racks or reels and nozzles should be checked for obvious signs of mechanical damage. Hose station control valves should be checked for signs of leakage.

2-9.2 Hose including gaskets should be removed and re-racked at least annually.

3
Automatic Sprinklers

See Section 3-11 of NFPA 13, *Standard for the Installation of Sprinkler Systems.*

3-1 General.

3-1.1 Sprinklers should be visually checked regularly. Sprinklers should be free from corrosion, foreign material, and paint, and not bent or damaged.

3-1.2 The standard sprinkler is the type manufactured since 1953, incorporating a uniform, hemispherical discharge pattern. Water is discharged in all directions below the plane of the deflector. Little or no water is discharged upward to wet the ceiling. Sprinkler deflectors are stamped as follows:

Upright Sprinkler Marked SSU

Pendent Sprinkler Marked SSP

3-1.3 The old-style sprinkler is the type manufactured before 1953. It discharges approximately 40 percent of the water upward to the ceiling. It can be installed in either the upright or pendent position.

3-1.4 Only listed sprinklers may be used. Sprinklers may not be altered in any respect nor have any type of ornamentation, paint, or coatings applied after shipment from the place of manufacture.

3-1.5 Corrosion-resistant or specially coated sprinklers are installed in locations where chemicals, moisture, or other corrosive vapors exist.

3-1.6 Temperature Ratings.

3-1.6.1 The standard temperature rating of automatic sprinklers is shown in Table 3-1.6.1. Automatic sprinklers are manufactured with their frame arms colored in accordance with color code designated in Table 3-1.6.1.

Table 3-1.6.1 is shown on page 428.

3-1.6.2 When higher temperature sprinklers are necessary to meet extraordinary conditions, special sprinklers rated as high as 650°F (343°C) are available and may be used.

Table 3-1.6.1

Temperature Ratings, Classifications, and Color Codings

Maximum Ceiling Temperature		Temperature Rating		Temperature Classification	Color Code
°F	°C	°F	°C		
100	38	135 to 170	57 to 77	Ordinary	Uncolored
150	66	175 to 225	79 to 107	Intermediate	White
225	107	250 to 300	121 to 149	High	Blue
300	149	325 to 375	163 to 191	Extra-High	Red
375	191	400 to 475	204 to 246	Very Extra-High	Green
475	246	500 to 575	260 to 302	Ultra-High	Orange

3-1.6.3 Information regarding the highest temperature that may be encountered in any location in a particular installation should be obtained by use of a thermometer, which should be hung for several days in the questionable location under the normal ambient temperature condition.

3-2 Replacement Sprinklers.

3-2.1 Care should be taken to ensure that replacement sprinklers have the proper characteristics for the location:

(a) Style

(b) Orifice size

(c) Temperature rating

(d) Coating, if any

(e) Deflector type (upright, pendent, sidewall, etc.).

Advances in technology have produced fast-acting sprinkler operating elements. The sensitivity of such elements is important to the operation of the appropriate number of sprinklers in a compartment *(as defined in 7-4.4.3 of NFPA 13)*. Therefore, residential sprinklers in a compartment must be of the same manufacturer and have the same heat-response elements (including temperature rating). This must be considered when providing replacement sprinklers.

Standard upright or pendent sprinklers having the characteristics indicated in 3-2.1 in common may be used interchangeably regardless of model or manufacturer. The listing specifications of other types of sprinklers should be checked if the use

of a replacement sprinkler of a different model or manufacturer is contemplated. The five characteristics listed materially affect the operation of the sprinkler and, therefore, its ability to extinguish a particular fire. Orifice size is of particular importance, especially when replacing other than ½-in. (13-mm) orifices (when replacing either large or small orifice sprinklers), due to the considerably different hydraulic and discharge characteristics. Replacement of sprinklers with improper temperature rating could result in premature opening where the higher temperature sprinkler was originally specified or installed, due to exposure to some particular heat source such as a unit heater, boiler, etc. This is also important when replacing sprinklers in storage occupancies where higher temperature sprinklers may have been specified to reduce the number of sprinklers opening in the event of fire in this type of high-heat-release exposure.

In recent years, special sprinklers having protection areas or distances between sprinklers different from those specified for standard sprinklers in NFPA 13 have been listed. Extreme care must be taken to ensure that such sprinklers are replaced with sprinklers having comparable characteristics.

3-2.2 Standard sprinklers manufactured after 1952 may be used to replace old-style sprinklers manufactured prior to 1953.

Exception: Piers and wharves. See 3-11.2.8.1 of NFPA 13, Installation of Sprinkler Systems.

Old-style sprinklers are used for the protection of fur vaults. (*See 4-4.16 of NFPA 13, Standard for the Installation of Sprinkler Systems.*)

3-2.3 Old-style sprinklers may be used to replace existing old-style sprinklers.

3-2.4 Old-style sprinklers should not be used to replace standard sprinklers without a complete engineering review of the system.

Because of their improved discharge characteristics, standard sprinklers are installed to protect a greater coverage area per sprinkler than was permitted for the old-style sprinklers. Therefore, old-style sprinklers installed in systems designed for standard sprinklers will not provide adequate coverage.

3-2.5 Secondhand sprinklers should not be used.

3-3 Automatic Sprinkler Replacement and Testing Program.

3-3.1 Representative samples of solder-type sprinklers with temperature classification of Extra High (325°F)(163°C) or greater that are exposed on a semicontinuous to continuous maximum allowable ambient temperature condition should be tested at 5-year intervals for operation by a testing laboratory acceptable to the authority having jurisdiction.

The fusing element in 360°F (182°C) solder-type sprinklers will, if exposed to temperatures approaching the fusing element's rating, gradually change its melting point.

3-3.1.1 A representative sample of sprinklers should normally consist of a minimum of two per floor or individual riser, and in any case not less than four, or 1 percent of the number of sprinklers per individual sprinkler system, whichever is greater.

3-3.2 All automatic sprinklers should be replaced when painted, corroded, damaged, or loaded with foreign materials, or when representative samples fail to meet test requirements.

3-3.3 When sprinklers have been in service for 50 years, representative samples should be submitted to a testing laboratory acceptable to the authority having jurisdiction for operational testing. Test procedure should be repeated at 10-year intervals.

3-3.3.1 Sprinklers made previous to 1920 should be replaced.

3-3.4 When residential or quick response sprinklers have been in service for 20 years, representative samples should be submitted to a testing laboratory acceptable to the authority having jurisdiction for operational testing and checks on sensitivity. Test procedures should be repeated at 10-year intervals.

The more conservative recommendations for residential and quick-response sprinklers is because of their newness and their lighter components when compared to standard sprinklers.

3-4 Sprinkler Guards. Sprinklers so located as to be subject to mechanical injury should be protected with approved sprinkler guards.

Generally, sprinklers that are located closer than 7 ft (2.1 m) from the floor are considered to be subject to mechanical injury, and guards should be considered in these cases. Also, sprinklers located under the rakes of stairwells at lower levels should be provided with guards. Guards are also important in storage locations and for sprinklers installed in storage racks.

3-5 Stock of Spare Sprinklers.

3-5.1 A supply of spare sprinklers (never less than six) should be stored in a cabinet on the premises for replacement purposes. The cabinet should be so located that it will not be exposed to moisture, dust, corrosion, or a temperature exceeding 100°F (38°C).

3-5.1.1 The stock of spare sprinklers should be as follows:

(a) For buildings having not over 300 sprinklers - not less than 6 sprinklers

(b) For buildings having 300 to 1,000 sprinklers - not less than 12 sprinklers

(c) For buildings having over 1,000 sprinklers - not less than 24 sprinklers

(d) Stock of spare sprinklers should include all types and ratings installed.

The stock of spare sprinklers required is a minimum. Spare sprinklers of all types and ratings installed should be available. For an occupancy with a variety of types and ratings of sprinklers installed, the stock of spare sprinklers should be increased above the minimum.

3-5.1.2 A special sprinkler wrench should be provided and kept in the cabinet, to be used in the removal and installation of sprinklers. Other types of wrenches may damage the sprinklers.

3-5.1.3 Automatic sprinklers and fusible links protecting commercial-type cooking equipment and their associated ventilation systems should be inspected twice yearly and replaced annually.

Bulb-type sprinklers and bulb-type spray nozzles showing no build-up of grease or other material need not be replaced.

3-5.1.4 Sprinklers protecting spraying areas should be clean and protected against overspray residue so that they will operate quickly in the event of fire. If covered, polyethylene or cellophane bags having a thickness of 0.003 in. (0.076 mm) or less, or thin paper bags, should be used. Coverings should be replaced or heads cleaned frequently so that heavy deposits or residue do not accumulate. If not covered, the sprinklers should be replaced annually.

4

Sprinkler System Components

4-1 General.

4-1.1 The sprinkler contractor provides instructional literature describing operation and proper maintenance of fire protection devices. This instructional literature should be posted near the system riser.

4-2 Piping.

See Section 3-1 of NFPA 13, *Standard for the Installation of Sprinkler Systems.*

4-2.1 General Provisions. Piping should be kept in good condition and free from mechanical injury. Sprinkler piping should not be used for support of ladders, stock, or other material.

4-2.2 When the piping is subject to corrosive atmosphere, a protective coating that resists corrosion should be provided and maintained in proper condition.

4-2.3 When the age or service conditions of the sprinkler equipment warrant, an internal examination of the piping should be made. When it is necessary to flush a part or all of the piping system, this work should be done by sprinkler contractors or other qualified workers.

4-3 Hangers.

See Section 3-10 of NFPA 13, *Standard for the Installation of Sprinkler Systems.*

4-3.1 Hangers should be kept in good repair. Broken or loose hangers should be replaced or refastened.

4-3.2 Broken or loose hangers may put undue strain on piping and fittings, cause breaks, and interfere with proper drainage.

4-4 Gages.

See 2-9.2 of NFPA 13, *Standard for the Installation of Sprinkler Systems.*

4-4.1 Gages on wet-pipe sprinkler systems should be checked monthly to ensure that normal water supply pressure is being maintained. Gages on dry, preaction, and deluge systems should be inspected weekly to ensure that normal air and water pressures are being maintained.

A pressure reading on the gage on the system side of an alarm valve in excess of the pressure recorded on the gage on the supply side of the valve is normal, as the highest pressure from the supply will get trapped in the system. Equal gage readings could indicate a leak in the system. If there are no visible leaks, it is a good possibility that the alarm valve itself is leaking or that pressure has been recently drained from the system side of the alarm check valve, as would occur during alarm tests. [*See Figure 1-3(d).*]

4-4.2 Gages should be checked with an inspector's gage every five years.

4-5 Water Flow Alarm Devices.

See 3-12.3 of NFPA 13, ***Standard for the Installation of Sprinkler Systems.***

4-5.1 Water-flow alarm devices include mechanical water motor gongs, vane-type water flow devices, and pressure switches that provide audible and/or visual signals.

4-5.2 Valves controlling water supply to alarm devices should be sealed or locked in the normally open position.

4-5.3 Water-flow alarm devices should be tested at least quarterly, weather permitting.

4-6 Notification to Supervisory Service.

4-6.1 To avoid false alarms where supervisory service is provided, including proprietary, remote alarm receiving facility, or fire department, the central station should always be notified before operating any valve or otherwise disturbing the sprinkler system.

4-7 Wet Systems—Alarm Valves.

4-7.1 Test alarms quarterly by opening the inspector's test connection.

Exception: Where weather conditions or other circumstances prohibit using the inspector's test connection, the by-pass test connection may be used.

4-7.2 Cold weather valves should be closed at the approach of freezing weather. Drain the piping in the area subject to freezing. The drain valves on

the exposed piping should be left slightly open. (Automatic protection should be restored when danger of freezing is past.)

NOTE: To provide year-round protection, it is recommended that cold weather valves be replaced with dry-pipe valves or antifreeze systems.

One manufacturer refers to its 2-in. (51-mm) dry-pipe valve as being a cold weather valve. This section refers only to manually operated control valves.

4-7.3 The freezing point of solutions in antifreeze systems should be checked annually by measuring the specific gravity with a hydrometer, and adjusting the solutions if necessary. The use of antifreeze solutions should be in conformity with any state or local health regulations.

See Figures 5-5.3.3(a), 5-5.3.3(b), 5-5.4, and A-5-5.3.3 of NFPA 13, *Standard for the Installation of Sprinkler Systems.*

4-7.4 Buildings should be inspected to verify that windows, skylights, doors, ventilators, and other openings and closures will not unduly expose sprinkler piping to freezing. Blind spaces, unused attics, stair towers, low spaces under buildings and roof houses are often subject to freezing.

4-8 Dry Systems—Dry Valves, Accelerators, Exhausters.

See Section 5-2 of NFPA 13, *Standard for the Installation of Sprinkler Systems.*

4-8.1 Dry-pipe systems should not be converted to wet-pipe during warm weather. This will cause corrosion and accumulation of foreign matter in the pipe system and loss of alarm service.

4-8.2 Inspection and Maintenance.

4-8.2.1 The priming water should be inspected quarterly and maintained at the proper level as recommended by the dry valve manufacturer.

4-8.2.2 Grease or other sealing material must not be used on seats of dry-pipe valves. Force should not be used in attempting to make dry valves tight.

4-8.2.3 Test water flow and low air pressure alarms and perform a water-flow test through the main drain connection quarterly.

A valved bypass is provided in the dry-pipe valve trim to facilitate waterflow alarm tests. It should be utilized when the alarms are to be tested without a trip test of the dry-pipe valve. [*See Figure 1-3(b).*]

4-8.2.4 The air or nitrogen pressure on each dry-pipe system should be checked at least once a week and maintained as per manufacturer's instructions. All leakage resulting in pressure loss greater than 10 psi (0.7 bar) per week should be repaired.

4-8.2.5 The dry-pipe valve enclosure should be maintained at a minimum temperature of 40°F (4°C).

4-8.2.6 Before and during freezing weather, all low-point drains on dry-pipe systems should be drained as frequently as required to remove all moisture. This process should be repeated daily until all condensate has been removed. The freezing of a small amount of water in the system piping may cause rupture of the sprinkler system resulting in extensive damage to the sprinkler system and water damage to the building and contents. Drum drip assemblies should be in a warm area or in a heated enclosure, when practical.

See Figure 3-6.3.3 of NFPA 13, *Standard for the Installation of Sprinkler Systems.*

The dry-pipe valve need not be tripped for moisture to enter a dry-pipe system. It will condense out of the air pressurizing the piping. When draining drum drips, the normally open top valve is closed to isolate the drum drip from the system.

4-8.3 Trip Tests.

4-8.3.1 Trip tests of each dry-pipe valve, including quick-opening devices, if any, should be done in the spring to allow all condensate to drain from the system piping. At this time, thoroughly clean the dry-pipe valve, renew parts as required, and reset the valve.

4-8.3.2 Each dry-pipe valve should be trip tested with the control valve partially open, and cleaned and reset at least once each year during warm weather. The shutoff valve should be kept open at least far enough to permit full flow of water at good pressure through the main drain when it is fully opened.

4-8.3.3 Before any dry-pipe valve is tripped or tested, the water supply line to it should be thoroughly flushed. The main drain below the valve should be opened wide, and water at full pressure should be discharged long enough to clear the pipe of any accumulation of scale or foreign material. If there is a hydrant on the supply line, this hydrant should be flushed before the main drain is opened.

4-8.3.4 Caution. The tripping of dry-pipe valves with throttled water supplies will not completely operate some models that require a high rate of flow to complete movement of the clapper assemblies.

4-8.3.5 All dry-pipe valves should have a tag or card attached showing the date on which the valve was last tripped and showing the name of the person and the organization making the test. Separate records of initial air and water pressures, tripping time and tripping air pressure, and dry-pipe valve operating condition should be kept for comparison with previous test records.

4-8.4 Trip Test Full Flow. Each dry-pipe valve should be trip tested with control valve wide open at least once every three years or when the system is altered. This test should be conducted by opening the inspector's test pipe. The test should be terminated when the dry-pipe valve has tripped and clean water is flowing at the inspector's test connection.

A full flow trip test is recommended only once every three years with a restricted flow trip test the other two years because, while full flow tests must be periodically conducted, they have some undesirable side effects. The high-velocity flow will tend to draw foreign material into the system, and the wetting of the pipe wall will result in the development of scale. There is also the problem of draining all the water from the system.

4-9 Air Compressor.

4-9.1 An air compressor should be lubricated only if recommended by the manufacturer and in accordance with his instructions. The motor unit should be kept dirt free. Filters and strainers should be cleaned as required. Crystals in air dryers should be replaced when color changes indicate they have absorbed moisture.

4-10 Air Maintenance Device.

4-10.1 Strainers, filters, and restriction orifices should be cleaned as required. If regulator is provided with a drain cock, periodically remove condensation.

4-11 Quick-Opening Devices (Accelerator or Exhauster).

See 5-2.4 of NFPA 13, *Standard for the Installation of Sprinkler Systems.*

4-11.1 The quick-opening device should be tested at least twice a year.

The manufacturer's instructions for testing and resetting the device should be carefully followed. If the device does not operate properly when

tested, the dry-pipe system should be kept in service and the device repaired or replaced immediately. Repair parts or a replacement device should be obtained from the original manufacturer.

4-12 Deluge, Preaction, and Automatic On-Off Preaction Systems.

See Section 5-3 of NFPA 13, *Standard for the Installation of Sprinkler Systems.*

4-12.1 Complete charts are furnished by the installing company, showing the proper method of operating and testing these systems. Only competent mechanics fully instructed with respect to the details and operation of such systems should be employed in their repair and adjustment. It is highly advisable for the owner to arrange with the installing company for at least annual inspection and testing of the equipment.

4-12.2 In preaction systems when it is necessary to repair the actuating system, as distinguished from the piping system itself, the water may be turned into the sprinkler piping, and automatic sprinkler protection thus maintained without alarm service, provided there is no danger of freezing.

4-12.3 Test detection systems semiannually and alarms quarterly according to the procedures suggested by the manufacturer.

5

Flushing

5-1 Flushing.

5-1.1 For effective control and extinguishment of fire, automatic sprinklers should receive an unobstructed flow of water. Although the overall performance record of automatic sprinklers has been very satisfactory, there have been numerous instances of impaired efficiency because sprinkler piping or sprinklers were plugged with pipe scale, mud, stones, or other foreign material. If the first sprinklers to open in a fire are plugged, the fire in that area will not be extinguished, an excessive number of sprinklers will operate causing increased water damage, and possibly the fire will spread out of control.

5-2 Types of Obstruction Material.

5-2.1 Obstructions may consist of compacted fine materials, such as rust, mud, or sand. Pipe scale is found more frequently in dry-pipe than in wet systems. Dry-pipe systems that have been maintained wet or dry alternately over a period of years are particularly susceptible to the accumulation of scale. Also, in systems continuously dry, condensation of moisture in the air supply may result in the formation of a hard scale along the bottom of the piping. When sprinklers open, the scale is broken loose and carried along the pipe, plugging some of the sprinklers or forming obstructions at the fittings.

5-2.2 Stones of various sizes, cinders, cast-iron pipe tubercles, chips of wood, or other coarse materials may be found. Sprinkler piping is sometimes partially obstructed by such objects as pieces of wood, paint brushes, broken pump valves or springs, or excess materials from improperly poured pipe joints. Materials may be sucked from the bottom of streams or reservoirs by fire pumps with poorly arranged or inadequately screened intakes and forced into the system. Sometimes floods damage intakes. Other materials may be permitted to enter by careless workers during installation or extensions of mains.

5-3 Preventing Entrance of Obstructive Material. The following measures should be taken to assure, as far as possible, that sprinkler systems are clear of obstructive foreign matter and will remain unobstructed.

5-3.1 Take care when installing underground mains, both public and private, to prevent entrance of stones, soil, or other foreign material. As

assurance that such material has not entered newly installed sprinkler systems from underground mains, installers are required as a condition of acceptance to flush all newly installed mains before connecting the inside piping. Private fire service mains should also be flushed after repairs or when breaks have occurred in public mains.

5-3.2 Screen pump suction supplies and maintain screens in good condition. Equip connections from penstocks with strainers or grids, unless the penstock inlets themselves are so equipped.

5-3.3 Keep dry-pipe systems on air the year round, instead of alternately on air or water, to inhibit formation of rust and scale.

5-3.4 Use extreme care when cleaning tanks and open reservoirs to prevent material from entering piping. Materials removed from the interior of gravity tanks during cleaning should not be permitted to enter the discharge pipe.

5-4 Conditions Showing Need for Investigation. Although precautions for preventing entrance of obstructive materials are generally followed at well-maintained premises, evidence based on fire experience and hundreds of flushing investigations shows that some sprinkler systems are obstructed to an extent that would seriously impair their effectiveness during a fire.

5-4.1 Conditions that may indicate the need of investigation include the following:

(a) Defective intake screens for fire pumps taking suction from streams and reservoirs.

(b) Discharge of obstructive material during routine water tests.

(c) Foreign material in fire pumps, in dry-pipe valves, or in check valves.

(d) Heavy discoloration of water during drain tests or plugging of inspector's test connections.

(e) Plugging of sprinklers.

(f) Plugged piping in sprinkler systems dismantled during building alterations.

(g) Failure to flush underground mains following installations or repairs.

(h) A record of broken public mains in the vicinity.

(i) Abnormally frequent tripping of dry-pipe valve.

5-4.2 Sprinkler systems should be examined internally at periodic intervals for obstructions. Where unfavorable conditions such as those itemized

above are found, the system should be examined at five-year intervals after installation or possibly sooner. Where conditions are favorable, dry-pipe systems should be examined at ten-year intervals after installation.

5-4.3 Dry-pipe systems found obstructed should be flushed and reexamined at intervals of not more than five years.

5-5 Precautions. When sprinkler systems are to be shut off for investigation or for flushing, take all the precautions outlined earlier. To prevent accidental water damage, control valves should be shut tight and the system completely drained before sprinkler fittings are removed or pipes disconnected. Cover stock and machinery susceptible to water damage, and provide equipment for mopping up any accidental discharge of water.

5-5.1 Large quantities of water are required for effective flushing by the hydraulic method, and it is important to plan in advance the most convenient methods of disposal.

5-6 Investigation Procedure.

5-6.1 From the plan of the fire protection system, determine the sources of water supply, age of mains and sprinkler systems, types of systems, and general piping arrangement.

5-6.2 Examine the fire pump suction supply and screening arrangements. If needed, have the suction cleaned before using the pump in tests and flushing operations. Gravity tanks should be inspected internally, except steel tanks recently cleaned and painted. If possible, have the tank drained and determine whether there is loose scale on the shell or sludge or other obstruction on the tank bottom. Cleaning and repainting may be required, particularly if not done within five years.

5-7 Test—Flushing Mains.

5-7.1 Use hydrants near the ends of mains for flow tests to determine whether mains contain obstructive material. If such material is found, mains should be thoroughly flushed before investigating sprinkler systems. Connect two lengths of 2½-in. hose to the hydrant. Attach burlap bags to free ends of the hose from which the nozzles have been removed to collect any material flushed out, and flow water long enough to determine condition of the main being investigated. If there are several sources of water supply, investigate each independently, avoiding any unnecessary interruptions to sprinkler protection. On extensive layouts repeat the tests at several hydrants to determine general conditions.

5-8 Testing Sprinkler Systems.

5-8.1 Investigate the dry systems first. Tests on several carefully selected, representative systems usually are sufficient to indicate general conditions throughout the premises. When preliminary investigations indicate consid-

erable obstructive material, this would justify investigating all systems (both wet and dry) before outlining needed flushing operations.

5-8.2 In selecting specific systems or pipes for investigation, consider:

(a) Pipes found obstructed during a fire or during maintenance work

(b) Systems adjacent to points of recent repair to yard mains, particularly if hydrant flow shows material in the main

(c) Pipes involving long horizontal runs of feed and cross mains. Obstructions are most likely to be found in the most remote branch lines at the end of the longest cross main from the longest feed main, particularly if the branch lines are lower than part of the feed main, as under a deck or platform.

5-8.3 Tests should include flows through 2½-in. fire hose directly from cross mains [*see Figures 5-8.3(a) and 5-8.3(b)*] and flows through 1½-in. hose from representative branch lines.

5-8.4 The fire pump should be operated for the large volume flows, as maximum pressure is desirable. Burlap bags should be used to collect dislodged material as is done in the investigation of yard mains, and each flow should be continued long enough to show the condition of the piping interior. After a test, leave all valves open and locked or sealed.

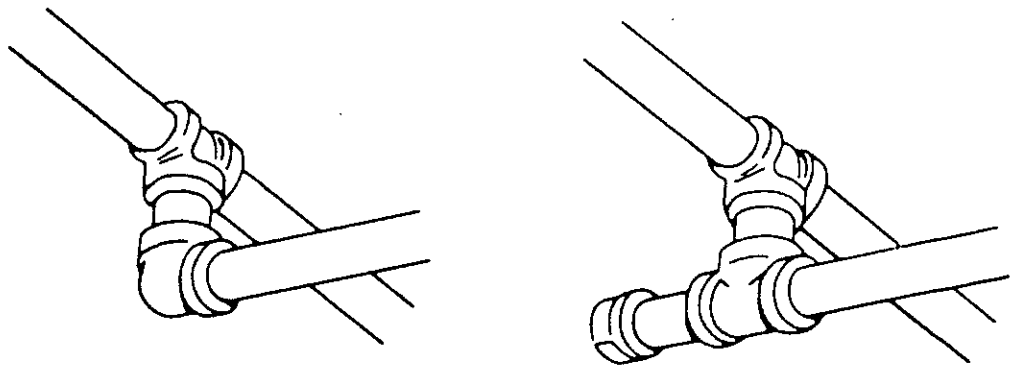


Figure 5-8.3(a) Replacement of Elbow at End of Cross Main with a Flushing Connection Consisting of a 2-in. Nipple and Cap.

5-9 Dry-Pipe Systems.

5-9.1 Having selected the test points of a dry-pipe system, close the main control valve and release air from the system. Check the piping visually with a flashlight while it is being dismantled. Attach hose valves and 1½-in. hose to ends of branch lines to be tested, shut these valves, and have air pressure restored on the system and the control valve reopened. Open the hose valve on the end branch line allowing the system to trip in simulation of normal

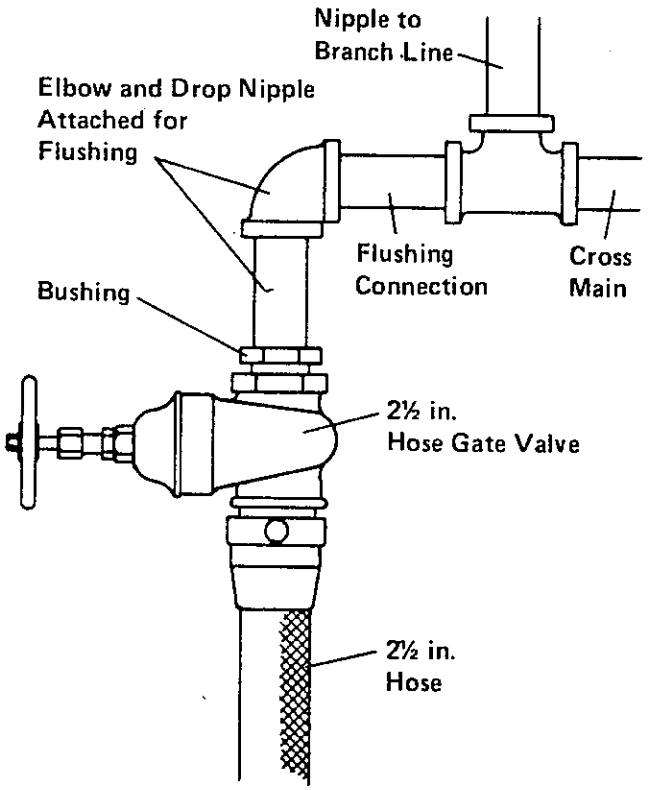


Figure 5-8.3(b) Connection of 2½-in. Hose Gate Valve with 2-in. Bushing, and Nipple and Elbow to 2-in. Cross Main.

action. If this test plugs the hose or piping, the extent of plugging should be noted and cleared from the branch line before proceeding with further tests.

5-9.2 After flowing the small end line, shut its hose valve and test the feed or cross main by discharging water through a 2½-in. fire hose, collecting any foreign material in a burlap bag.

5-9.3 After the test, the dry-pipe valve should be internally cleaned and reset in the normal manner. Its control valve should be opened, sealed, and a drain test made.

5-10 Wet Systems.

5-10.1 Testing of wet systems is similar to that of dry systems except that the system must be drained after closing the control valve to permit installation of hose valves for the test. Slowly reopen the control valve and make a small hose flow as prescribed for the branch line, followed by the 2½-in. hose flow for the cross main.

5-10.2 In any case, if lines become plugged during the tests, piping must be dismantled and cleaned, the extent of plugging noted, and a clear flow obtained from the branch line before proceeding further.

5-10.3 Make similar tests on representative systems to indicate the general condition of the wet systems throughout the installation, keeping a detailed record of what is done.

5-11 Outside Sprinklers for Protection Against Exposure Fires.

5-11.1 Outside or open sprinkler equipment should be flow tested once each year during warm weather. Before making flow tests, proper precautions should be taken to prevent damage from water discharge. Flow tests will determine that the sprinklers and the system piping are in good condition and free of obstructions. Obstructed sprinklers or piping should be cleared immediately.

5-12 Flushing Procedure.

5-12.1 If investigation indicates the presence of sufficient material to obstruct sprinklers, a complete flushing program should be carried out. The work should be done by qualified competent personnel. The source of the obstructing material should be determined and steps taken to prevent further entrance of such material. This entails such work as inspection and cleaning of pump suction screening facilities or cleaning of private reservoirs. If recently laid public mains appear to be the source of the obstructing material, waterwork authorities should be requested to flush their system. For recommendations and procedures for cleaning pump suctions see NFPA 20, *Standard for the Installation of Centrifugal Fire Pumps.*

5-13 Private Fire Service Mains.

5-13.1 Mains should be thoroughly flushed before flushing any interior piping. Flush piping through hydrants at dead ends of the system or through blowoff valves, allowing the water to run until clear. If the water is supplied from more than one direction or from a looped system, close divisional valves to produce a high velocity flow through each single line. A velocity of at least 6 ft per second (1.8 m/s) is necessary for cleaning the pipe and for lifting foreign material to an aboveground flushing outlet. Use the flow specified in Table 5-13.1 for the size of the main under investigation.

Table 5-13.1 Waterflow Recommended for Flushing Piping

Size of Pipe	Flow	
In.	gpm	(L/min)
4	400	(1514)
6	750	(2839)
8	1000	(3785)
10	1500	(5678)
12	2000	(7570)

5-13.2 Connections from main to sprinkler riser should be flushed. Although flow through a short open-ended 2-in. drain may create sufficient velocity in a 6-in. main to move small obstructing material, the restricted waterway of the globe valve usually found on a sprinkler drain may not allow stones and other large objects to pass. If presence of large size material is suspected, a larger outlet will be needed to pass such material and to create the 750-gpm (2839-L/min) flow necessary to move it. Fire department connections on sprinkler risers can be used as flushing outlets by removing the clappers. Mains can also be flushed through a temporary siamese fitting attached to the riser connection before the sprinkler system is installed (*see Figure 5-13.2*).

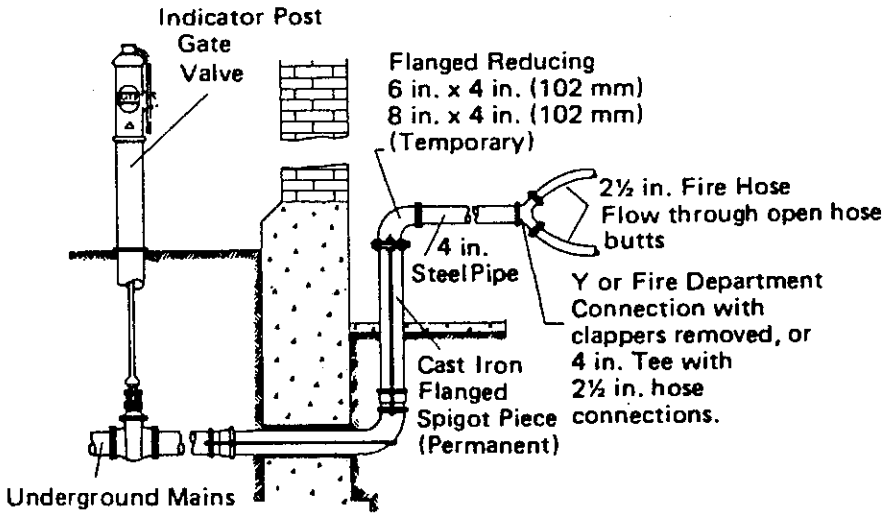


Figure 5-13.2 Arrangement for Flushing Branches from Underground Mains to Sprinkler Risers.

5-13.3 Sprinkler Piping.

5-13.3.1 Two methods are commonly used for flushing sprinkler piping: (a) the hydraulic method and (b) the hydropneumatic method.

(a) The hydraulic method consists of flowing water progressively from the mains, sprinkler risers, feed mains, cross mains, and finally the branch lines in the same direction in which it would flow during a fire.

(b) The hydropneumatic method utilizes special equipment and compressed air to blow a charge of approximately 30 gal (114 L) of water from the ends of branch lines back into feed mains and down the riser, washing the foreign material out of an opening at the base of the riser.

The hydraulic method of flushing gridded systems is explained in 5-13.4.8. This recommended practice does not address hydropneumatic flushing of gridded systems, as there has not yet been enough experience to establish a preferred procedure.

5-13.3.2 The choice of method depends on conditions at the individual premises. If examination indicates the presence of loose sand, mud, or moderate amounts of pipe scale, the piping can generally be satisfactorily flushed by the hydraulic method. Where the material is more difficult to remove and available water pressures are too low for effective scouring action, the hydropneumatic method is generally more satisfactory.

5-13.3.3 In some cases, where obstructive material is solidly packed or adheres tightly to the walls of the piping, the pipe will have to be dismantled and cleaned by rodding or other positive means.

5-13.3.4 Successful flushing by either the hydraulic or hydropneumatic method is dependent on establishing sufficient velocity of flow in the respective pipes to remove silt, scale, and other obstructive material. With the hydropneumatic method, this is accomplished by the air pressure behind the charge of water.

5-13.3.5 When flushing a branch line through the end pipe, sufficient water should be discharged to scour the largest pipe in the branch line. Lower rates of flow may reduce the efficiency of the flushing operation. To establish the recommended flow, remove small end piping and connect hose to larger section, if necessary.

5-13.3.6 To determine that the piping is clear after it has been flushed, representative branch lines and cross mains should be investigated, using both visual examination and sample flushings.

5-13.3.7 Whenever any section of piping is found severely or completely obstructed with packed material, such as hard scale, cinders, or gravel, the piping will usually have to be disassembled to remove the material.

5-13.3.8 Where pipe scale indicates internal or external corrosion, a section of the pipe affected should be thoroughly cleaned to determine if the walls of the pipe have seriously weakened.

5-13.4 Hydraulic Method. After the mains have been thoroughly cleared, flush risers, feed mains, cross mains, and finally the branch lines. Following this sequence will prevent drawing obstructing material into the interior piping.

5-13.4.1 Water should be turned into dry-pipe systems for one to two days before flushing, if possible, to soften pipe scale and deposits. When alarm is turned off due to this procedure, consideration should be given to providing watch service during the unattended hours. To flush risers, feed mains, and cross mains, attach 2½-in. hose gate valves to the extreme ends of these lines [*see Figure 5-8.3(b)*.] Such valves usually can be procured from the manifold of fire pumps or hose standpipes. As an alternative, an adapter with 2½-in. hose thread and standard pipe thread can be used with a regular gate valve. A length of fire hose without a nozzle should be attached to the

flushing connection. To prevent kinking of the hose and to obtain maximum flow, an elbow should usually be installed between the end of the sprinkler pipe and the hose gate valve. Attach the valve and hose so that no excessive strain will be placed on the threaded pipe and fittings. Support hose lines properly.

5-13.4.2 Where feed and cross mains and risers contain pipe 4, 5, and 6 in. in size, it may be necessary to use a fire department connection with two hose connections to obtain sufficient flow to scour this larger pipe.

5-13.4.3 In multistory buildings, systems should be flushed by starting at the lowest story and working up. Branch line flushing in any story may follow immediately the flushing of feed and cross mains in that story, allowing one story to be completed at a time.

5-13.4.4 Where a repetition of the trouble is probable, leave a 2-in. capped nipple at the ends of the cross mains for flushing piping. Sprinkler installation rules require that a flushing connection be provided at the end of each cross main terminating in 1¼-in. or larger pipe.

5-13.4.5 Flush branch lines after feed and cross mains have been thoroughly cleared. This will avoid drawing obstructing material from these pipes into the branches. Equip the ends of several branch lines with gate valves, and flush individual lines of the group consecutively. This will eliminate the need for shutting off and draining the sprinkler system to change a single hose line. The hose should be 1½ in. and as short as practicable. Branch lines may be flushed in any order that will expedite the work.

5-13.4.6 Branch lines may also be flushed through pipe 1½ in. or larger extending through a convenient window. If pipe is used, 45° elbows should be provided at the ends of branch lines. When flushing branch lines, hammering the pipes is an effective method of moving obstructions.

5-13.4.7 All pendent sprinklers should be removed and cleaned of obstructions.

5-13.4.8 Flushing Gridded Sprinkler Systems. All new gridded sprinkler systems should be arranged so that they can be thoroughly flushed. Figure 5-13.4.8 should be used as a guide. Other arrangements accomplishing the same results are acceptable.

In the case of a system such as in Figure 5-13.4.8, the flushing procedure is as follows:

(a) Disconnect all branch lines close to the secondary cross main, and cap or valve all open ends supplied by the primary cross main. Visually examine the interior of each branch line connected to the secondary cross main and plug or cap.

(b) Flush the primary cross main, first one end, then the other.

(c) Flush each branch line independently.

(d) Flush the secondary cross main from an auxiliary water source.

(e) Reconnect branch lines.

(f) Flush the secondary cross main, first one end, then the other.

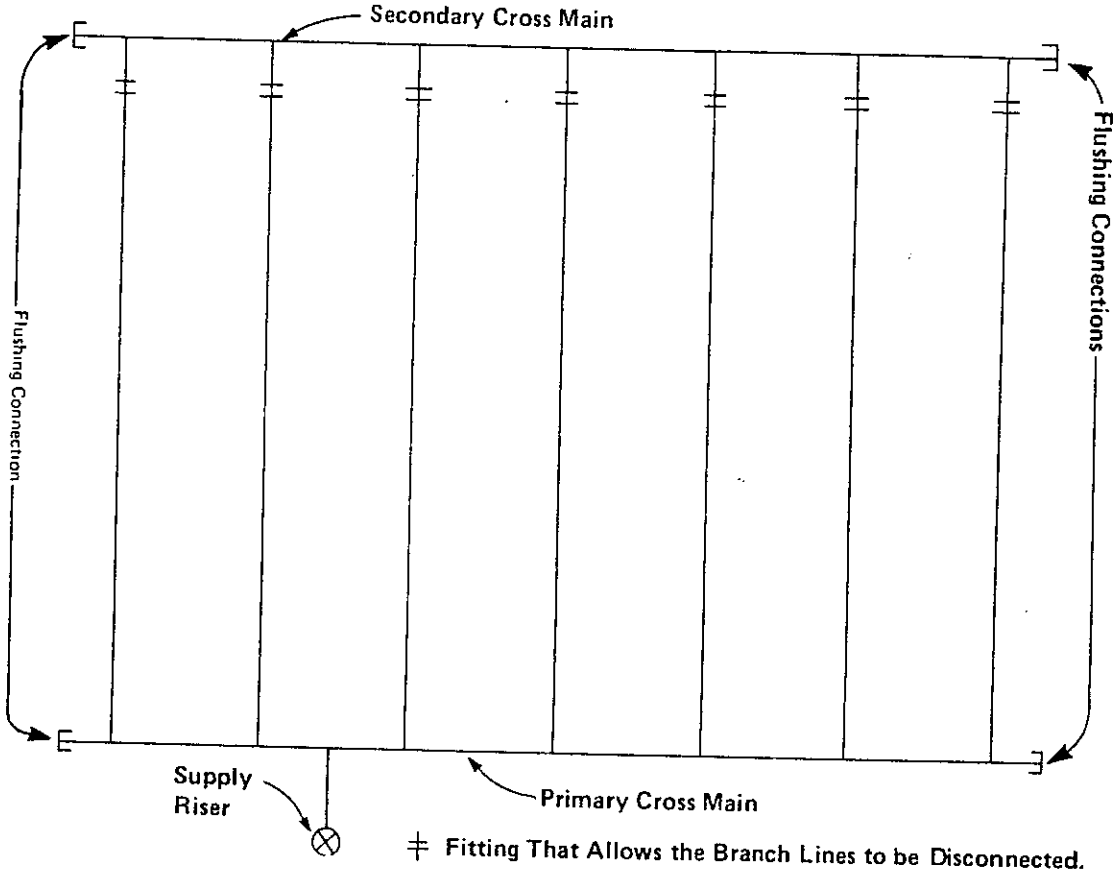


Figure 5-13.4.8

5-13.5 Hydropneumatic Method. The apparatus used for hydropneumatic flushing consists of a hydropneumatic machine, a source of compressed air, 1-in. (25-mm) air supply hose, 1½-in. hose for connecting to the sprinkler system, and 2½-in. hose.

5-13.5.1 The hydropneumatic machine (*see Figure 5-13.5.1*) consists of a 30-gal (114-L) water tank mounted over a 25-cu ft [(185-gal) (700-L)] compressed air tank. The compressed air tank is connected to the top of the water tank through a 2-in. lubricated plug cock. The bottom of the water tank is connected through hose to a suitable water supply. The compressed air tank is connected through suitable air hose to either the plant air system or a separate air compressor.

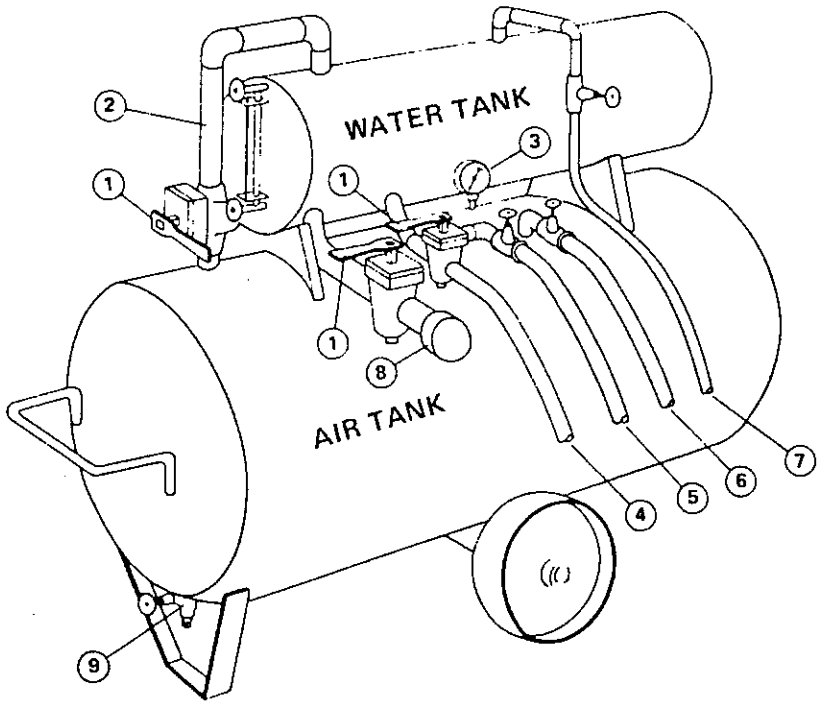


Figure 5-13.5.1 Hydropneumatic Machine.

1. Lubricated plug cocks.
2. Pipe connection between air and water tanks. This connection is open when flushing sprinkler system.
3. Air pressure gage.
4. 1-in. (25-mm) rubber hose (air type). Used to flush sprinkler branch lines.
5. Hose connected to source of water. Used to fill water tank.
6. Hose connected to ample source of compressed air. Used to supply air tank.
7. Water tank overflow hose.
8. 2½-in. pipe connection. When flushing large interior piping, connect woven jacket fire hose here and close 1-in. (25-mm) plug cock hose connection (4) used for flushing sprinkler branch lines.
9. Air tank drain valve.

5-13.5.2 To flush the sprinkler piping, the water tank is filled with water, the pressure raised to 100 psi (6.90 bars) in the compressed air tank, and the plug cock between tanks opened to put air pressure on the water. The water tank is connected by hose to the sprinkler pipe to be flushed. Then the lubricated plug cock on the discharge outlet at the bottom of the water tank is snapped open, permitting the water to be "blown" through the hose and sprinkler pipe by the compressed air. The water tank and air tank should be recharged after each blow.

5-13.5.3 Outlets for discharging water and obstructing material from the sprinkler system must be arranged. With the clappers of dry-pipe valves and alarm check valves on their seats and cover plates removed, sheet metal fittings can be used for connection to 2½-in. hose lines or for discharge into a drum. [Maximum capacity per blow is about 30 gal (114 L).] If the main riser drain is to be used, the drain valve should be removed and a direct hose

connection made. For wet-pipe systems with no alarm check valves, the riser should be taken apart just below the drain opening and a plate inserted to prevent foreign material from dropping to the base of the riser. Where dismantling of a section of the riser for this purpose is impractical, the hydropneumatic method should not be used.

5-13.5.4 Before starting a flushing job, each sprinkler system to be cleaned should be studied and a schematic plan prepared showing the order of the blows.

5-13.5.5 Hydropneumatic Method of Flushing Branch Lines. With the mains already flushed or known to be clear, the branch sprinkler lines should next be flushed. The order of cleaning individual branch lines must be carefully laid out if an effective job is to be done. In general, flush the branch lines starting with the line closest to the riser and work toward the dead end of the cross main (*see Figure 5-13.5.5*).

The order of flushing the branch lines is shown by the circled numerals. In this example the southeast quadrant is flushed first, then the southwest, next the northeast, and last the northwest.

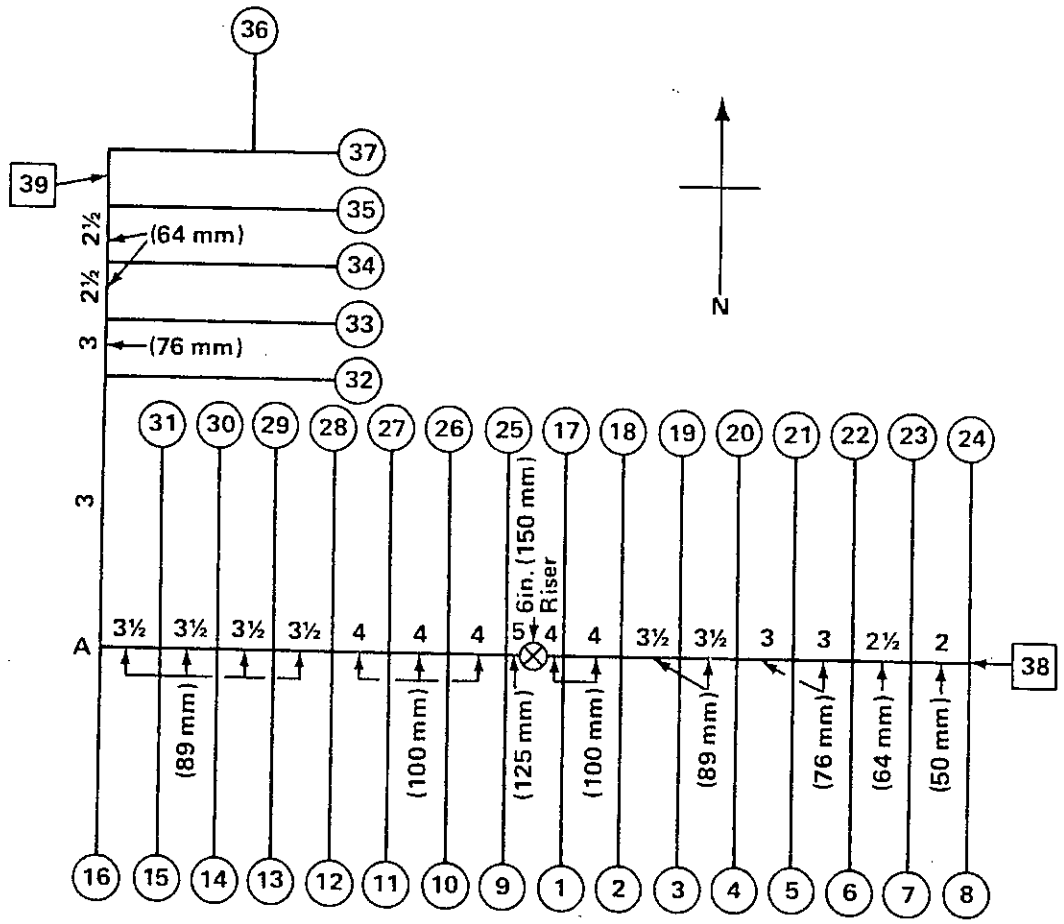


Figure 5-13.5.5 Schematic Diagram of Sprinkler System Showing Sequence to be Followed when Hydropneumatic Method is to be Used.

5-13.5.5.1 Air hose 1 in. (25 mm) in diameter is used to connect the machine with the end of the branch line being flushed. This hose should be as short as practicable. When the blow is made, the air pressure should be allowed to drop to 85 psi (5.9 bars) before the valve is closed. The resulting short slug of water will have less friction loss and a high velocity and hence do a more effective cleaning job than if the full 30 gal (114 L) of water is used. One blow is made for each branch line.

5-13.5.6 Hydropneumatic Method of Flushing Large Interior Piping. When flushing cross mains, completely fill the water tank and raise the pressure in the air receiver to 100 psi (6.9 bars). Connect the machine to the end of the cross main to be flushed with not over 50 ft (15.2 m) of 2½-in. hose. After opening the valve, allow air pressure in the machine to drop to zero. Two to six blows are necessary at each location, depending on the size and length of the main.

5-13.5.6.1 In Figure 5-13.5.5, the numerals in squares indicate the location and order of the cross main blows. Since the last branch line blows were west of the riser, clean the cross main east of the riser first. Where large cross mains are to be cleaned, it is suggested, if practical, to make one blow at 38, one at 39, the next at 38, then at 39; alternating in this manner until the required number of blows has been made at each location.

5-13.5.6.2 Cross mains are best flushed by introducing the blow at a point where water moving through the piping will make the least number of right-angle bends. In Figure 5-13.5.5, blows at 39 should be adequate to flush the cross mains back to the riser. Do not attempt to clean the cross mains from A to the riser by backing out branch line 16 and connecting the hose to the open side of the tee. If this were done, a considerable portion of the blow would pass northward up the 3-in. pipe list supplying branches 32 to 37, and the portion passing eastward to the riser could be ineffective. When the size, length, and condition of cross mains require blowing from a location corresponding to A, the connection should be made directly to the cross main corresponding to the 3½-in. pipe so that the entire flow would travel to the riser.

5-13.5.6.3 When flushing through a tee, always flush the run of tee after flushing the branch. Note the location of blows 35, 36, and 37 in Figure 5-13.5.5.

5-13.5.6.4 When flushing feed mains, arrange the work so that the water will pass through a minimum of right-angle bends.

5-13.5.6.5 The importance of doing a thorough flushing job should be strongly emphasized to those in charge of the work. In a number of instances, sprinklers in systems that had supposedly been flushed clear became plugged during a subsequent fire, permitting it to get out of control and cause serious damage.

6

Impairments

6-1 General. Valves controlling the water supply to all or part of a sprinkler system should be electrically supervised, or sealed, locked, or equipped with tamper switches and should be inspected frequently because of their importance to fire protection. The closing of control valves without proper authorization or preparation can seriously jeopardize operations. If sprinkler systems, fire hydrants, ground storage tanks, gravity tanks, fire pumps, etc. are impaired, the consequences may result in loss of life and damage to property. It is essential that adequate measures are taken during a fire protection impairment to ensure that the increased risks are minimized.

6-2 Impairment Coordinator. A representative of the building owner, manager, or tenant should be assigned to coordinate all impairments and restoration of protection.

6-3 Preplanned Impairment Programs.

6-3.1 All preplanned impairments should be authorized by the Coordinator. Before authorization is given, he should be responsible for verifying that the following is accomplished:

(a) Determine the exact extent of the intended impairment.

(b) Inspect the area or buildings to be involved and determine the increased risks.

(c) Submit recommendations to management. Consideration should be given to the need for temporary protection, termination of all hazardous operations, and frequent inspections of the area involved with 24-hour per day watchman service.

(d) Notify the fire department.

(e) Notify the insurance carrier, the alarm company, and other appropriate authority and implement Tag Impairment System (if such system is in use).

(f) Notify the supervisors in the areas to be affected.

6-3.2 When all impaired equipment is restored to normal working order, the following should be accomplished:

(a) Verify that all control valves are fully opened and locked, sealed, or equipped with a tamper switch.

(b) Conduct a main drain and alarm test on each sprinkler riser affected.

(c) Maintain as large a portion of the system in service as possible.

(d) Advise supervisors that protection has been restored.

(e) Advise the fire department that protection has been restored.

(f) Advise the insurance carrier, the alarm company, and other appropriate authorities that protection has been restored.

6-4 Emergency Impairments. Emergency impairments include sprinkler leakage, frozen or ruptured piping, equipment failure, etc. When this occurs, appropriate emergency action should be taken. The Coordinator should be contacted, and he should proceed to the extent possible to implement the preplanned impairment program including the restoration of sprinkler protection.

6-5 Restoring Systems to Service after Disuse.

6-5.1 Occasionally, automatic sprinkler systems in idle or vacant properties are shut off and drained. When the equipment in such properties is restored to service, it is recommended that such work be performed by a responsible and experienced sprinkler contractor. In such cases, the following procedures are recommended:

6-5.1.1 All lines of sprinkler piping should be traced from the extremities of the system to the main connections with a careful check for blank gaskets in flanges, closed valves, corroded or damaged sprinklers or piping, insecure or missing hangers, and insufficient support. Proper repairs or adjustments should be made and needed extensions or alterations of the equipment should be completed.

6-5.1.2 Air should be used to test the system for leaks before turning on the water. Water should be admitted slowly to the system, with proper precautions against damage by escape of water from previously undiscovered defects. When the system has been filled under normal service pressure, drain valve tests should be made to detect any closed valve that possibly could have been overlooked. All available test pipes then should be flushed, and where such pipes are not provided in accordance with the present standards, the proper equipment should be installed.

6-5.1.3 Where the sprinkler system has been long out of service, damaged by freezing, or subject to extensive repairs or alterations, the entire system

should be hydrostatically tested in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems*. Special care should be taken to detect any sprinklers showing leaks and to make replacements where necessary.

6-5.1.4 Dry-pipe valves, quick-opening devices, alarm valves and all alarm connections should be examined, put in proper condition and tested. Fire pumps, pressure and gravity tanks, reservoirs, and other water supply equipment should receive proper attention before being placed in service. Each supply should be tested separately.

6-5.1.5 An investigation for obstruction or stoppage in the sprinkler system piping should be made. (*See Chapter 5.*)

6-5.1.6 All control valves should be operated from closed to fully open position and should be left sealed, locked, or equipped with a tamper switch.

6-6 Sprinkler System Alterations.

6-6.1 Alterations will usually involve an impairment to all or part of the sprinkler system. Any alteration to a sprinkler system should be done in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems*, or other applicable NFPA standards.

7

Fire Records

7-1 Protection Records.

7-1.1 In all businesses, it is desirable to keep records of inspection, testing, and maintenance of protection equipment. The exact program for any building or set of buildings should be tailored to a specific plan for the particular building, considering occupancy, types of protection, alarms provided, etc. In the development of a fire protection record plan, it is advisable to consider advice from various sources including the:

Authority Having Jurisdiction (Rating Bureaus, Fire Prevention Bureaus, Fire Marshals, etc.)

Manufacturers of Various Devices

Fire Insurance Companies

Independent Fire Protection Consultants

Sprinkler Contractors

Other Applicable NFPA Codes as outlined in the Appendix.

7-1.2 An individual within the organization should be designated (Protection Record Administrator) to implement inspection, testing, and maintenance programs. Some firms may elect to do the basic functions themselves and contract the more technically involved operations.

7-1.3 The person in charge should consider the use of master control records, including a copy of the manufacturer's instructions covering all devices.

7-2 Valve Tag Systems.

7-2.1 Closed valves have caused over 30 percent of all sprinkler system failures. Adoption of the valve tag systems should visually highlight and minimize this significant cause of unsatisfactory sprinkler system performance. (*See Figure 7-2.1.*)

Figure 7-2.1 is shown on page 458.

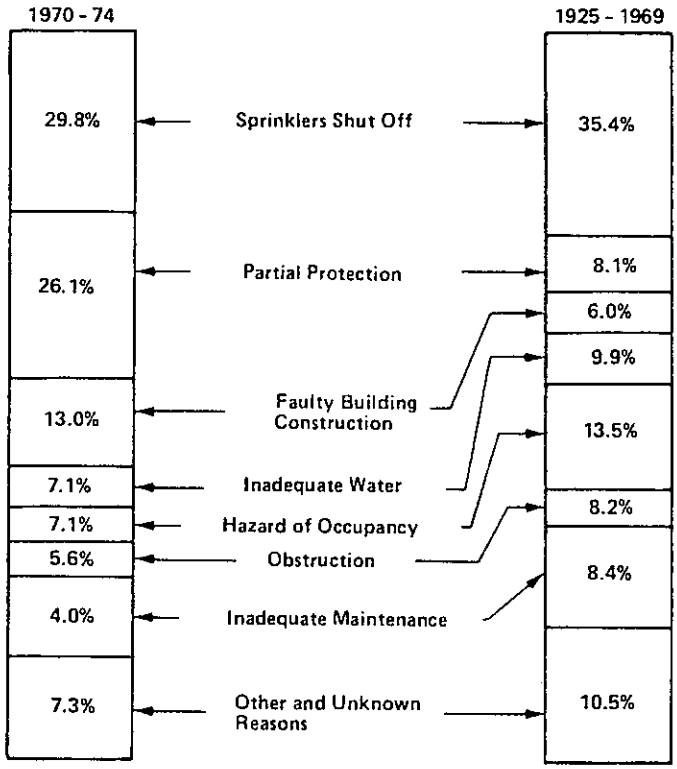


Figure 7-2.1 Reasons for Unsatisfactory Sprinkler System Performance.

7-2.2 Tag Impairment System. This system usually includes a three-part tag that is easily identifiable. One part is tied to a valve to be closed temporarily. The second part is sent to the authority having jurisdiction. The third part is displayed in the protection record administrator's office and sent to the authority having jurisdiction when protection is restored.

7-2.3 Valve Record Tag System. A tag on each valve indicating date sealed or locked, and date and results of maintenance procedures, should be provided. This provides a chronological record of valve maintenance.

7-3 Inspection Records. Inspection and maintenance records of the following activities should be kept by the protection record administrator:

As pointed out in the commentary to 3-3.4, because of the new technology that has resulted in smaller, faster responding operating elements used in residential and other quick-response sprinklers, there is a need to monitor the field performance of these sprinklers. Since sensitivity is crucial to the performance of these sprinklers, it will be important to know if there has been a deterioration in such sensitivity over the years. This is another reason for the recommendation to test a sample of these types of sprinklers after a 20-year interval.

Table 7-3

Summary: Minimum Inspection, Testing and Maintenance

Records–Inspection = Visual Observation
Testing = Handling Equipment, etc.
Maintenance = Periodic Servicing and Repair

For Guidance on Specific Valves, Pumps, Hydrants, etc. Refer to the Manufacturer's Instructions

Parts	Activity	Frequency	Section Number
Flushing Piping	Test	5 years	5.4.2
Fire Department Connections	Inspection	Monthly	2.8
Control Valves	Inspection	Weekly-Sealed	2-7.1.4
	Inspection	Monthly-Locked	2-7.1.4
	Inspection	Monthly-Tamper Switch	2-7.1.4
	Maintenance	Yearly	2-7.1.8
Indicator Post Valve	Test	Quarterly	2-7.3.1
Valves in Roadway Boxes	Test	Quarterly	2-7.4.1
Main Drain	Flow Test	Quarterly	2-6.1
Open Sprinklers	Test	Annual	5-11.1
Pressure Gage	Calibration Test	5 years	4-4.2
Sprinklers	Test	50 years	3-3.3
Sprinklers—High Temp.	Test	5 years	3-3.1
Sprinklers—Residential	Test	20 years	3-3.4
Water Flow Alarms	Test	Quarterly	4-5.3 4-7.1 4-12.3
Preaction/Deluge Detection Systems	Test	Semiannually	4-12.3
Preaction/Deluge Systems	Test	Annually	4-12.1

(continued)

Table 7-3 (Continued)

Parts	Activity	Frequency	Section Number
Hydrants	Inspection	Monthly	2-5.1
	Test (Open and Close)	Annually	2-5.3
	Maintenance	Semi-annually	2-5.2
Antifreeze Solution	Test	Annually	4-7.3
Cold Weather Valves	Open and Close Valves	Fall, Close; Spring, Open	4-7.2
Dry/Preaction/Deluge systems			
Air Pressure and Water Pressure	Inspection	Weekly	4-8.2.4
Enclosure	Inspection	Daily-Cold Weather	4-8.2.5
Priming Water Level	Inspection	Quarterly	4-8.2.1
Low-Point Drains	Test	Fall	4-8.2.6
Dry-Pipe Valves	Trip Test	Annual-Sprigng	1-6.1 4-8.3.1
Dry-Pipe Valves	Full Flow Trip	3 years-Spring	4-8.4
Quick Opening Devices	Test	Semi-annually	4-11.1
Gravity Tank			
Water Level	Inspection	Monthly	2-2.1
Heat	Inspection	Daily-Cold Weather	2-2.2
Condition	Inspection	Biannual	NFPA 22
Pressure Tank			
Water Level & Pressure	Inspection	Monthly	2-3.1
Heat Enclosures	Inspection	Daily-Cold Weather	2-3.7
Condition	Inspection	3 years	2-3.2
Pump	Test Flow	Annually	2-4.2.5
Engine Drive	Test Operate	Weekly	2-4.2.1
Motor Drive	Test Operate	Monthly	2-4.2.1
Steam Drive	Test Operate	Weekly	NFPA 21

Exhibit I Report of Inspection

Owner's Section (To be answered by Owner or Occupant)

A. Explain any occupancy hazard changes since the previous inspection.

B. Describe fire protection modifications made since last inspection.

C. Describe any fires since last inspection.

D. When was the system piping last checked for stoppage, corrosion, or foreign material?

E. When was the dry-piping system last checked for proper pitch?

F. Are dry valves adequately protected from freezing?

Inspector's Section (All responses reference current inspection)

1. General

a. Is the building occupied?

b. Are all systems in service?

c. Is there a minimum of 18 in. (457 mm) clearance between the top of the storage and the sprinkler deflector?

d. In areas protected by a wet system, does the building appear to be properly heated in all areas, including blind attics and perimeter areas, where accessible? Do all exterior openings appear to be protected against freezing?

e. Does the hand hose on the sprinker system appear to be satisfactory?

2. Control Valves (*See Item 14.*)

a. Are all sprinkler system control valves and all other valves in the appropriate open or closed position?

b. Are all control valves in the open position and locked, sealed, or equipped with a tamper switch?

3. Water Supplies (*See Item 15.*)

a. Was a water flow test of the main drain made at the sprinkler riser?

4. Tanks, Pumps, Fire Department Connections

a. Are fire pumps, gravity tanks, reservoirs, and pressure tanks in good condition and properly maintained?

b. Are fire department connections in satisfactory condition, couplings free, caps in place, and check valves tight? Are they accessible and visible?

5. Wet Systems (*See Item 13.*)

a. Are cold weather valves (O.S.&Y.) in the appropriate open or closed position?

b. Have antifreeze system solutions been tested?

c. Were the antifreeze test results satisfactory?

6. Dry Systems (*See Items 10 to 14.*)

a. Is the dry valve in service?

b. Are the air pressure and priming water level in accordance with the manufacturer's instructions?

c. Has the operation of the air or nitrogen supply been tested? Is it in service?

d. Were low points drained during this inspection?

e. Did quick-opening devices operate satisfactorily?

f. Did the dry valve trip properly during the trip pressure test?

g. Did the heating equipment in the dry-pipe valve room operate at the time of inspection?

7. Special Systems—as defined in Section 1-3 (*See Item 16.*)

a. Did the deluge or preaction valves operate properly during testing?

b. Did the heat-responsive devices operate properly during testing?

c. Did the supervisory devices operate during testing?

8. Alarms

a. Did water motor and gong test satisfactorily?

b. Did electric alarm test satisfactorily?

c. Did supervisory alarm service test satisfactorily?

9. Sprinklers

a. Are all sprinklers free from corrosion, loading, or obstruction to spray discharge?

b. Are sprinklers over 50 years old, thus requiring sample testing?

c. Is stock of spare sprinklers available?

d. Does the exterior condition of the sprinkler system appear to be satisfactory?

e. Are sprinklers of proper temperature ratings for their locations?

10. Date dry-pipe valve trip tested (control valve partially open)

_____

(See Trip Test Table that follows.)

11. Date dry-pipe valve trip tested (control valve fully open)

_____

(See Trip Test Table that follows.)

12. Date quick-opening device tested

_____

(See Trip Test Table that follows.)

13. Date deluge or preaction valve tested

_____

(See Trip Test Table that follows.)

14. Review Control Valve Maintenance

_____

(See Control Valve Maintenance Table that follows.)

DRY PIPE OPERATING TEST

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

	TIME TO TRIP THRU TEST CONNECTION*		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

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.

Control Valve Maintenance Table

Control Valves	Number	Type	Open	Secured	Closed	Explain Abnormal Signs	Condition
City Connection Control Valve							
Tank Control Valves							
Pump Control Valves							
Sectional Control Valves							
System Control Valves							
Other Control Valves							

15. Water Flow Test at Sprinkler Riser

Water Supply Source		City	Tank	Pump
Date	Test Pipe Location	Size Test Pipe	Static Pressure	Residual (Flow) Pressure
Last Water Flow Test				
This Water Flow Test				

16. Heat Responsive Devices

Test Method _____

_____

Type of Equipment _____

Manufacturer _____

Test Results:

Valve No. A B C D E F Valve No. A B C D E F

Valve No. A B C D E F Valve No. A B C D E F

Valve No. A B C D E F Valve No. A B C D E F

Valve No. A B C D E F Valve No. A B C D E F

Auxiliary Equipment: No.? ____ Type? ____ Location? ____ Test Result? ____

17. Explain any "No" answers and comments. _____

_____

_____

_____

_____

18. Adjustments or corrections made during this inspection: _____

_____

_____

_____

_____

19. Although these comments are not the result of an engineering review, the following desirable improvements are recommended:

_____

_____

_____

_____

Signature: _____

Date: _____