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Standard

for

OUTSIDE PROTECTION

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National Fire Protection Association

International

The National Fire Protection Association was organized in 1896 to promote the science and improve the methods of fire protection. Its membership includes national and regional societies and associations (list on outside back cover) and twenty thousand individuals, corporations, and organizations. Anyone interested may become a member; the annual dues are $15.00. Full membership information is available on request.

This is one of a large number of publications on fire safety issued by the Association. All NFPA standards and recommended practices, including this text, are prepared by the technical committees of the NFPA and adopted at an Annual Meeting of the Association. They are intended to prescribe reasonable measures for minimizing losses of life and property by fire.

This text and most other NFPA standards and recommended practices are published in the **National Fire Codes,** a compilation of NFPA's official technical material, issued in seven clothbound volumes. Full information on the availability of these Codes and other NFPA publications can be secured from the Association.

Official NFPA Definitions

SHALL is intended to indicate requirements.

SHOULD is intended to indicate recommendations, or that which is advised but not required.

APPROVED refers to approval by the authority having jurisdiction.

Units of measurements used here are U. S. standard. 1 U. S. gallon = 0.83 Imperial gallons = 3.785 liters. One foot = 0.3048 meters. One inch = 25.40 millimeters. One pound per square inch = 0.06805 atmospheres = 2.307 feet of water.

Approved Equipment

The National Fire Protection Association does not "approve" individual items of fire protection equipment, materials or services. The suitability of devices and materials for installation under NFPA standards is indicated by the listing of nationally recognized testing laboratories, whose findings are customarily used as a guide to approval by agencies applying these standards. Underwriters' Laboratories, Inc., Underwriters' Laboratories of Canada, the Factory Mutual Laboratories and the American Gas Association (gas equipment) test devices and materials for use in accordance with the appropriate standards, and publish lists which are available on request.

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Outside Protection

NFPA No. 24 — 1962

This edition of the Standard for Outside Protection incorporates a revision adopted by the National Fire Protection Association on May 22, 1962, on recommendation of the Committee on Standpipes and Outside Protection. It supersedes the edition of 1959, and all prior editions.

In 1953, this Standard was extensively revised from prior editions, and incorporated the material on Hose Houses for Mill Yards formerly published in a separate Standard No. 25. Several important amendments were adopted in 1959.

NFPA Committee activity in this field dates from 1903 when the then Committee on Hose and Hydrants first presented specifications for Mill Yard Hose Houses. This Standard was revised and reissued in successive editions with enlarged scope. The material on Underground Piping was transferred from the Automatic Sprinkler Standards to the present Standard in 1920. These revisions were handled by several different Committees, predecessors of the present Committee on Standpipes and Outside Protection. For more complete summary of history, see 1953 edition of the Standard.

This standard has been adopted and published by the National Board of Fire Underwriters in NBFU No. 24.

AMENDMENT ADOPTED IN 1962

Paragraph 9601 was revised to recognize the fact that there is now more than one manufacturer of listed or approved mechanical joint retainer glands.

Contents

STANDARD FOR OUTSIDE PROTECTION.

NFPA No. 24

Foreword.

This Standard covers only the general details of yard piping supplying automatic sprinklers, open sprinklers, water spray systems, foam systems, yard hydrants, monitor nozzles, roof hydrants, or standpipes, with references also to houses and care and maintenance of fire hose.

The following NFPA standards should be consulted for specific information. These are published by the National Fire Protection Association in pamphlet form and also in the National Fire Codes and are available from the NFPA Office, 60 Batterymarch Street, Boston 10, Massachusetts. Many of them have also been published by the National Board of Fire Underwriters with the same designating numbers and can be acquired from the NBFU at 85 John Street, New York, New York. Certain items have also been published by the Canadian Underwriters' Association, 524 Coristine Building, Montreal, Quebec.

Centrifugal Fire Pumps	Standard	No.	20
Fire Department Hose Connections	"	"	23
Foam Extinguishing Systems	"	"	11
Sprinkler Systems	"	"	13
Standpipe and Hose Systems	"	"	14
Supervision and Care of Valves Controlling Water Supplies for Fire Protection	"	"	26
Water Tanks for Private Fire Protection Service	"	"	22
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Fire Hose Coupling Screw Threads	"	"	194
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Care of Fire Hose	"	"	198

The authority having jurisdiction should always be consulted before the installation of, or remodeling of, yard piping.

CHAPTER 1. GENERAL INFORMATION.

11. A layout plan shall be secured from or approved by the authority having jurisdiction in every case where new yard piping is contemplated.

12. The plan shall be drawn to scale and shall include all essential details such as:

(a) Size and location of all water supplies.

(b) Size and location of all piping, indicating where possible the class and type and depth of existing pipe, the class and type of new pipe to be installed and the depth to which it is to be buried.

(c) Size, type and location of valves. Indicate if located in pit or if operation is by post indicator or key wrench through a curb box. Indicate the size, type and location of meters, regulators and check valves.

(d) Size and location of hydrants, showing size and number of outlets and if outlets are to be equipped with independent gate valves. Indicate if hydrant house and equipment is to be provided and by whom.

(e) Sprinkler and standpipe risers and monitor nozzles to be supplied by the system.

(f) Location of fire department connection, if part of yard system, including detail of connection.

13. Piping should be laid so that the system can be extended with a minimum of expense. Possible future plant expansion should also be considered and the piping laid so that it will not be covered by buildings.

14. Installation work shall be done by fully experienced and responsible persons.

15. One or more framed plans of the complete system (kept corrected up to date) should be conspicuously posted for ready reference.

CHAPTER 2. WATER SUPPLIES.

21. Nature of Supply. The choice of water supplies shall be made in cooperation with the authority having jurisdiction.

22. Public Water System. (Applicable also to private reservoir and standpipe systems).

2200. One or more connections from a reliable public water system of good pressure and adequate capacity furnishes an ideal primary supply. A high static water pressure shall not, however, be the criterion by which the efficiency of the supply is determined.

2201. Adequacy of water supply shall be determined by flow tests or other reliable means. Where flow tests are made the flow in gallons per minute together with the static and residual pressures should be indicated on the plan.

2202. Street mains should be of ample size, in no case smaller than 6 inches. Dead-end mains should be avoided if possible by arranging for mains supplied from both directions.

2203. No pressure regulating valve shall be used in water supply except by special permission of the authority having jurisdiction. Where meters are used they shall be of an approved type.

2204. Where connections are made from public waterworks systems it may be necessary to guard against possible contamination of the public supply. The requirements of the public health authority should be determined and followed.

2205. Connections to public waterworks systems should be controlled, where feasible, by indicator post valves of a standard type and located not less than 40 feet from the buildings protected. If this cannot be done, the indicator post valves shall be placed where they will be readily accessible in case of fire and not liable to injury. (See Section 33 for details.) Where indicator post valves cannot readily be used, as in a city block, underground gate valves should conform to these provisions and their locations and direction of turning to open should be plainly marked on the buildings.

2206. Connections for domestic or standpipe use over 2 inches in size shall conform to paragraph 2205.

23. Pumps.

2300. A fire pump installation consisting of pump, driver and suction supply, when of adequate capacity and reliability, and properly located, makes a good secondary supply. An automatically controlled fire pump taking water from a water main of adequate volume, or taking draft under a head from a reliable storage of adequate capacity, may under certain conditions be accepted by the authority having jurisdiction as a single supply.

2301. Where a centrifugal pump is the only means of supplying water, the pump should be provided with supervisory service from an approved central station system or from an approved proprietary system or their substantial equivalent, which shall provide means for positive indication at the central office that the pump has operated normally. This arrangement is to be in addition to the supervision of power supply and other features that may be required by the authority having jurisdiction. These pumps should be operated at least monthly by the supervisory service representative, and at more frequent intervals where the authority having jurisdiction so requires.

NOTE: See sections dealing with sprinkler equipment supervisory and water flow alarm services in NFPA No. 71— Central Station Protective Signaling Systems, NFPA No. 72— Proprietary, Auxiliary, and Local Protective Signaling Systems, and in NFPA No. 72C— Remote Station Protective Signaling Systems. See also separately published NFPA standards No. 20— Installation and Operation of Centrifugal Fire Pumps, and No. 13— Sprinkler Systems.

24. Tanks.

2401. Gravity Tanks. The capacity and elevation shall be determined by the authority having jurisdiction. See NFPA No. 22— Water Tanks for Private Fire Protection.

2402. Pressure Tanks. When pressure tanks are to be used the authority having jurisdiction should be consulted. See NFPA No. 22—Water Tanks for Private Fire Protection.

25. Penstocks or Flumes, Rivers or Lakes.

2501. Water supply connections from penstocks, flumes, rivers, lakes, or reservoirs shall be arranged to avoid mud and sediment, and should be provided with approved double removable screens or approved strainers installed in an approved manner.

26. Fire Department Connections.

2600. A connection through which the public fire department can pump water into the sprinkler, standpipe or other system furnishing water for fire extinguishment makes a desirable auxiliary supply. For this purpose one or more fire department connections shall be provided in all cases except when permission of the authority having jurisdiction is obtained for their omission.

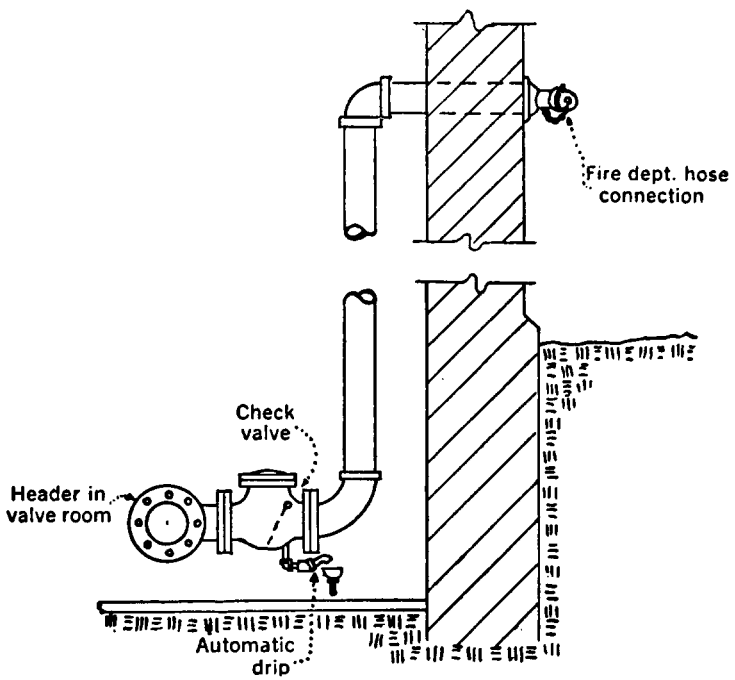


Fig. 26 Fire Department Hose Connection

2601. Fire department connections shall be properly supported.

2602. There shall be no shut-off valve in the fire department connection.

2603. An approved straightway check valve shall be installed in each fire department connection, located as near as practicable to the point where it joins the system.

2604. The pipe between the check valve and the outside hose coupling shall be equipped with an approved automatic drip, arranged to discharge to a proper place.

2605. Hose connections shall be approved type conforming to NFPA No. 23— Fire Department Hose Connections for Sprinkler and Standpipe Systems.

2606. Hose coupling threads shall conform to those used by the local fire department. (American) National Standard Fire-Hose Coupling Screw Threads shall be used whenever they will fit the local fire department hose threads. See NFPA No. 194— Fire Hose Coupling Screw Threads.

2607. Hose connections shall be equipped with standard caps, properly secured and arranged for easy removal by fire departments.

2608. Hose connections should be on the street side of building and shall be located to permit prompt and easy attachment of the hose.

2609. Hose connections shall be designated by a sign having raised letters at least one inch in size cast on a plate or fitting, reading for service designated: e.g. — "AUTO-SPKR." or "OPEN SPKR." or "STANDPIPE", etc.

CHAPTER 3. VALVES.

31. Types of Valves.

3101. All control valves shall be approved outside screw and yoke or other approved indicator pattern. Underground gate valves of approved pattern equipped with approved indicator posts meet this recommendation.

3102. Check valves shall be of an approved type.

32. Valves Controlling Water Supplies.

3201. At least one gate valve shall be installed in each source of water supply except fire department connections.

3202. Where there is more than one source of water supply, a check valve shall be installed in each connection, except that, where cushion tanks are used with automatic fire pumps, no check valve is required in the cushion tank connection.

3203. A gate valve should be installed on each side of each check valve, except that, in the discharge pipe from a pressure tank or a gravity tank of less than 15,000 gallons capacity, no gate valve need be installed on the tank side of the check valve.

3204. Where a gravity tank is located on a tower in the yard, the gate valve on the tank side of the check valve should be of O. S. & Y. type; the other should be either an O. S. & Y. valve or an indicator post valve. Where a gravity tank is located on a building both gate valves should be of the O. S. & Y. type; and all fittings inside the building, except the drain tee and heater connections, shall be under the control of a gate valve.

3205. When a pump, located in a combustible pump house or exposed to danger from fire or falling walls, or a tank, discharges into a yard main fed by another supply, either the check valve in the connection should be located in a pit or the gate should be of the indicator post type located a safe distance outside buildings.

3206. Check valves on tank or pump connections when located underground may be placed inside of buildings and at a safe distance from the tank riser or pump, except in

cases where the building is entirely of one fire area, when it is ordinarily considered satisfactory to locate the check valve overhead in the lowest level.

3207. All gate valves controlling water supplies for sprinklers should be located where readily accessible.

33. Indicator Post Valves.

3301. Every connection from the yard main to a building shall be provided with an indicator post valve, except where other arrangements are acceptable to the authority having jurisdiction.

3302. Indicator post valves should be located not less than 40 feet from buildings; but where necessary to place a valve close to a building, it should be located at a blank part of the wall.

3303. Indicator post valves shall be set with regard to the final grade line so that the top of the post will be about 36 inches above the ground.

3304. Post indicator valves may require protection against mechanical damage. This work should be promptly attended to if not included in the contract.

34. Valves in Pits.

3401. Where it is impracticable to provide an indicator post valve, valves may be placed in pits through permission of the authority having jurisdiction. The pit shall be in accordance with the provisions of NFPA No. 22— Water Tanks for Private Fire Protection.

3402. A wrench or crow-foot with a long handle should be provided for each valve, and kept in the pit where it can be reached from the yard level. The location of the valve should be clearly marked on neighboring buildings, and the cover of the pit should be kept free from dirt and snow at all times.

35. Sectional Valves.

3501. Large yard systems should have sectional controlling valves arranged to provide the maximum reliability of the various supplies.

3502. A valve should be provided on each bank where a main crosses water; it is also recommended that valves be installed to shut off sections of pipe under buildings. (See Paragraph 9301.)

36. Identifying and Securing.

3601. All control valves shall be plainly marked indicating the section or portion controlled. To assure that valves are kept open, it is essential to provide central station proprietary valve supervisory service and/or to secure the valves in the open position using an acceptable type of seal which must be destroyed before the valve can be closed. Weekly recorded inspections shall be made.

CHAPTER 4. HYDRANTS

41. Type of Hydrants.

4101. Hydrants shall meet the requirements of NFPA No. 29-C— Fire Hydrants for Private Fire Service, and have not less than a 6-inch connection with the mains. The number, size and arrangement of outlets, the size of main valve opening and the size of barrel shall be suitable for the protection to be provided and shall be approved by the authority having jurisdiction. Independent gate valves on 2½-inch outlets may be used. (See Chapter 5.) A hose house and equipment shall be provided at each hydrant unless well located portable hose reels and equipment are accepted by the authority having jurisdiction.

4102. Hydrants should be tested periodically for proper functioning in accordance with the requirements of the authority having jurisdiction but at least semi-annually.

42. Number and Location.

4201. A sufficient number of hydrants shall be installed to provide two streams for every part of the interior of each building not covered by standpipe protection and to provide hose stream protection for every exterior part of each building by the use of the lengths of hose normally attached to the hydrants. There shall be sufficient hydrants

to concentrate the required fire flow about any important building with no hose line exceeding 500 feet in length.

NOTE: Public hydrants when available on an acceptable public water system may be considered to comply with this requirement.

4202. For average conditions hydrants should be placed about fifty feet from the buildings protected. Where it is impossible to place them at this distance, they may be put nearer, provided they are set in locations where the chance of injury by falling walls is small, and from which men are not likely to be driven by smoke or heat. Usually in crowded mill yards they can be placed beside low buildings, near brick stair towers, or at angles formed by substantial brick walls which are not likely to fall.

43. Setting.

4301. Hydrants shall be set on flat stones or concrete slabs with about half a barrel of small stones (or equivalent) placed about the bottom to insure quick drainage from the drip. They shall not be placed near retaining walls where there is danger of frost through the wall.

4302. Where soil is of such a nature that the hydrants will not drain properly with the arrangement specified in Paragraph 4301, the hydrant drain shall be connected to a drain by not less than a 2-inch cast iron pipe; or some other means acceptable to the authority having jurisdiction shall be provided to keep the hydrant barrels clear of water.

4303. In setting hydrants due regard should be given to final grade line; centers of hose outlets should be about 18 inches above the floor of the hose house or 18 inches above ground.

4304. Hydrants shall be fastened to piping by standard clamps or be properly anchored. (See Fig. 96.)

4305. Hydrants may require protection against mechanical damage. This work shall be promptly attended to if not included in the sprinkler contract.

CHAPTER 5. HOSE HOUSES AND EQUIPMENT.

51. Location.

5101. A hose house should be located over the hydrant and arranged so that the hydrant will be as close to the front of the house as possible and still allow sufficient room back of the doors for the hose gates and attached hose.

52. Construction.

5201. Hose houses shall be of substantial construction on adequate foundations. The construction shall be such as to protect the hose from weather and vermin and designed so that hose lines can be quickly brought into use. Clearance shall be provided for proper operation of the hydrant wrench. Proper ventilation shall be provided. The exterior shall be painted or otherwise suitably protected against deterioration.

53. Size and Arrangement.

5301. Hose houses shall be of a size and arrangement to provide shelves or racks for the hose and equipment. For typical hose houses see Figures 53–1, 53–2 and 53–3. For other types of hose houses or equivalent enclosures consult the authority having jurisdiction.

54. Marking.

5401. Hose houses shall be plainly marked in large letters with the fire hydrant number or hose house number.

55. Equipment — General.

5501. Each hose house shall be equipped with —

- 2 — Underwriters' play pipes.
- 1 — pair play pipe brackets.
- 1 — fire axe.
- 1 — pair fire axe brackets.
- 1 — crowbar
- 1 — pair crowbar brackets.
- 1 — extra hydrant wrench (in addition to wrench on hydrant).
- 4 — coupling spanners.
- 2 — hose and ladder straps.
- 1 — Underwriters' play pipe holder

2 — 2½-in. hose washers (spares).

The above may be modified by the authority having jurisdiction depending upon the local conditions.

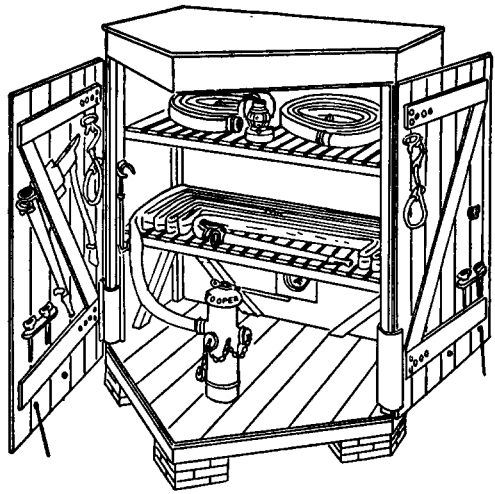


Fig. 53-1. Typical Wooden Hose House. For equipment details see Sections 55, 56, 57, and 58

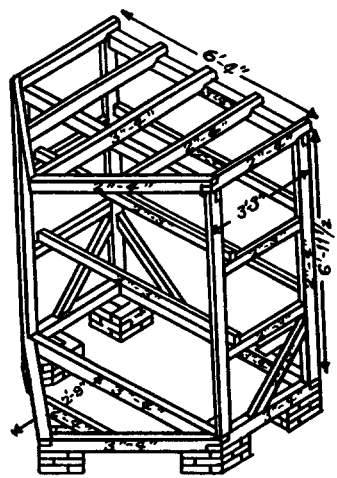


Fig. 53-2. Typical Wooden Hose House Framing Plan

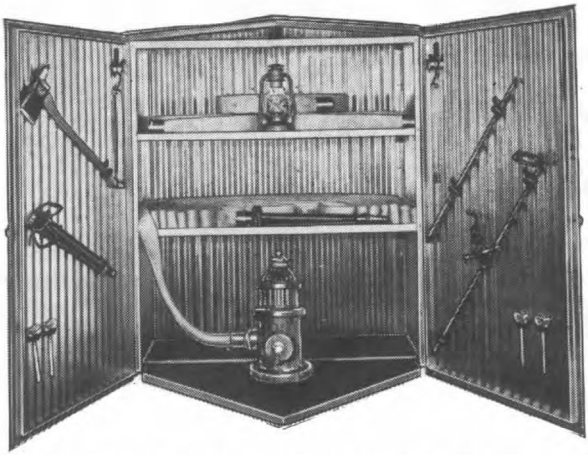


Fig. 53-3. Typical Metal Hose House

For equipment details see Sections 55-58

56. Hose.

5601. At least 100 feet and preferably 150 feet of approved 2½-inch woven jacket rubber-lined hose should always be attached to a hydrant outlet, and so arranged or laid, that a fire stream can be placed in action with minimum delay. The size and total amount of hose that should be maintained at any individual location will depend on local conditions and the authority having jurisdiction should be consulted.

57. Couplings.

5701. Couplings shall be of the same size and thread and directly interchangeable with those of the nearest fire department that would respond to an alarm, or where there is no fire department, couplings shall be interchangeable with those of the nearest plant that would be able to render practical assistance.

5702. Threads shall be in accordance with paragraph 2606. Where couplings are not interchangeable, proper adapters shall be provided in the hose houses.

5703. Where the fire department does not have double female couplings, it is an excellent practice to provide them with the hose equipment.

NOTE: These are for use during an emergency for connecting hose from hydrant to hydrant.

58. Nozzles.

5801. Nozzles shall be of approved type.

NOTE: Standard play pipes are smooth tapering tubes 30 inches long wound and painted, with a 1⅛-inch smooth bore nozzle. For use of other types of approved nozzles consult the authority having jurisdiction.

59. Domestic Service Use Prohibited.

5901. The use of hydrants and hose for purposes other than fire or fire drills shall be prohibited.

CHAPTER 6. FIRE HOSE CARE AND MAINTENANCE.

61. General. (See NFPA No. 198— Care of Fire Hose.)

6100. Woven jacket rubber-lined fire hose should preferably be kept in a cool, dry location such as a small, well-ventilated hose house with slatted shelves for good air circulation. Mildew will attack hose fabric if the hose is stored in a damp location. Hose jackets can be treated to retard mildew growth. Corrosive chemicals will weaken the fabric and cause the hose to fail. Gasoline, oils, or organic solvent will deteriorate the rubber lining. Continued exposure to high temperatures will cause the rubber lining to harden and crack. The useful life of woven jacket rubber-lined hose at inside hose connections in dry, well-ventilated rooms with ordinary temperatures will be about the same as yard hose, having the same maintenance.

6101. When hose is kept in a hose house at a hydrant, it is good practice to have two or three lengths connected together and attached to the hydrant ready for instant use. Where hose is folded on the shelves for easy removal, the folds should be as long as possible. Hose that is not connected to the hydrant should be kept in rolls, as this eliminates the many sharp bends and kinks which tend to crack the rubber lining when hose is folded. In rolling the hose, place the male coupling on the inside of the coil, using care to prevent sharp bends near this coupling.

6102. Fire hose should be reserved for fighting fires; for other uses, a separate supply of proper hose should be provided.

6103. The hose shall not be stored inside a main building, where it might be inaccessible in case of fire.

6104. Where hose may be subjected to acids, acid fumes, or other corrosive materials, as in chemical plants, the purchase of approved rubber-covered rubber-lined hose is advised. For plant yards containing rough surfaces that will cause heavy wear or where working pressures are above 150 pounds per square inch, double jacketed hose should be provided.

62. Testing Hose.

6201. Hose should be tested once a year. The test pressure shall be at least equivalent to the maximum static yard pressure or the highest fire pump shutoff pressure, whichever is greater, but in no case less than 150 pounds per square inch. These tests relieve stresses which are set up in the jacket and in the rubber lining when it is held in one position for a long time. Pressure used at date of test should be recorded on a card tacked on the hose house door. (See NFPA No. 196— Fire Hose.)

NOTE: The hydrostatic pressure test may be made as follows: A threaded cap with petcock or small valve for air outlet should be attached to one end of the hose line, with the other end connected to the fire or hydrostatic test pump if there is one available, or otherwise to the normal water supply. The hose shall be completely filled with water and the pressure applied gradually. Care should be taken to remove all the air from the hose before applying the test pressure, as a serious accident may result if the hose should burst or a coupling should disengage. The test pressure shall be maintained for at least one minute and then released. It is best to make these tests in warm weather to facilitate drying and prevent freezing the hose.

6202. All hose should not be removed from a hose house for testing at the same time because the time lost in returning it in case of a fire might allow the blaze to spread beyond control.

6203. Faulty hose shall be discarded and replaced promptly with new hose that meets requirements of NFPA No. 196— Fire Hose. Faulty hose should not be stored in hose houses.

63. Cleaning Hose.

6301. After fire hose has been tested, or used for other purposes, it shall be cleaned and dried. When the fabric has been oil-soaked, the oil can be removed by warm water and a good grade of washing soap. This soap should be rinsed off before the hose is dried.

64. Drying Hose.

6401. Before returning the hose to service it should be carefully drained and dried. This can be done by hanging

the hose vertically or by laying it on a dry area with a slope of about 2 feet in 50. Sectional slatted racks about 52 feet long are used for such drying. When drying hose, be careful that the water will not drain from the hose and drop on the jacket of other hose underneath.

6402. When the hose is returned to the hose house, any folds that are made in the hose should be arranged to come at a different point each time the hose is replaced. Whenever possible, hose that has been stored in rolls should be used to replace that which has been stored folded since the last test or use.

CHAPTER 7. HEAVY CALIBER HOSE STREAMS.

71. Use and Location.

7100. Where large amounts of combustible materials are located in yards, such as log piles, lumber, railway car storage, etc., it is necessary to provide a ready means of delivering large quantities of water at effective pressures. This can best be accomplished by installing permanent monitor nozzles on the ground around the piles, and occasionally where necessary on special trestles or on roofs of buildings. (See Fig. 71.) Portable deluge sets for use with siamesed hose lines are also valuable in many cases.

7101. The location of this apparatus, the size of piping supplying it, the arrangement of control valves and the necessary water supplies, all demand special consideration in each individual case and the authority having jurisdiction should be consulted.

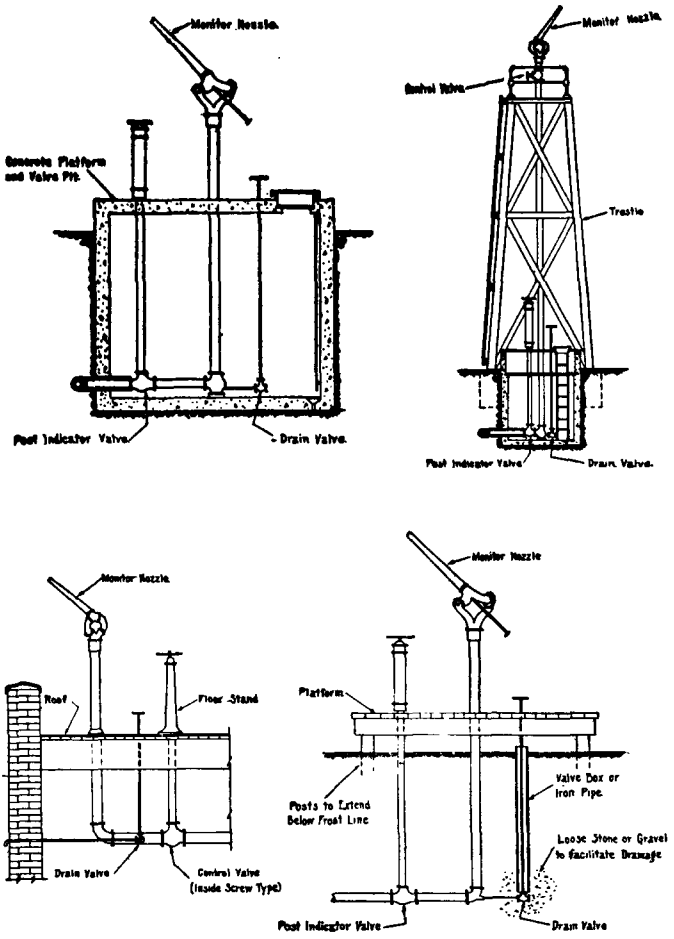


Fig. 71. Standard Monitor Nozzles.

Gear control nozzles are also satisfactory.

CHAPTER 8. UNDERGROUND PIPE AND FITTINGS.

81. Type and Weight of Pipe.

8101. Piping shall be approved asbestos cement, cast iron, reinforced concrete or steel or other approved pipe. See Paragraph 8106 for required coating and lining. (See A81 in Appendix for availability of specifications mentioned in this chapter.)

8102. The class of pipe used shall be determined through consideration of the maximum working pressures and the laying conditions under which the pipe is to be installed. For example, where pipe is to be installed for a maximum working pressure of 150 pounds per square inch, laid without blocks, on flat-bottomed trench, with tamped backfill, under five feet of cover, thickness Class 22 cast iron pipe should be provided in sizes 4-inch to 20-inch inclusive and thickness Class 23 for sizes 24-inch to 48-inch inclusive or Pressure Class 150 asbestos cement, reinforced concrete or steel pipe could be used.

For other laying conditions of cast iron pipe see Manual for the Computation of Strength and Thickness of Cast Iron Pipe (ASA-A21.1); Specifications for Cast Iron Pit Cast Pipe for Water or Other Liquids (A21.2); Specifications for Cast Iron Pipe Centrifugally Cast in Metal Molds for Water or Other Liquids (A21.6); or Specifications for Cast Iron Pipe Centrifugally Cast in Sand-Lined Molds for Water or Other Liquids (A21.8).

8103. Asbestos cement pipe shall conform to one of the following specifications and be installed in accordance with the manufacturer's instructions: —

a) American Water Works Association Tentative Standard Specifications for Asbestos-Cement Water Pipe (AWWA C400-53T).

b) Federal Specification for Pipe, Asbestos-Cement (SS-P-55/a, October 7, 1953).

8104. Cast iron pipe shall conform to one of the following specifications and be installed in accordance with the manufacturer's instructions:—

a) American Standard Specifications for Cast Iron Pit-Cast Pipe, for Water or other Liquids (ASA A21.2-1953; AWWA-C102-53).

b) American Standard Specifications for Cement Mortar Lining for Cast Iron Pipe and Fittings (ASA A21.4-1953; AWWA-C104-53).

c) American Standard Specifications for Cast Iron Pipe Centrifugally Cast in Metal Molds, for Water or Other Liquids (ASA A21.6-1953; AWWA C106-53).

d) American Standard Specification for Cast Iron Pipe Centrifugally Cast in Sand-Lined Molds, for Water or Other Liquids (ASA A21.8-1953; AWWA C106-53).

e) American Standard Specification for a Mechanical Joint for Cast Iron Pressure Pipe and Fittings (ASA A21.11-1953).

f) Federal Specification for Pipe, Cast Iron Bell and Spigot, Water (WW-P-421A, March 2, 1955).

8105. Steel pipe shall have a minimum thickness of .250 inches and conform to one of the following specifications and be installed in accordance with the manufacturer's instructions: —

a) Standard for Steel Pipe for Underground Water Service of Underwriters' Laboratories, Inc. (Underwriters' Laboratories, Inc., Subject 888).

Standard for Steel Water Pipe up to, but not including, 30 inches (AWWA C202-49).

8106. Steel pipe shall be coated and lined according to the following specifications: —

American Water Works Standard for Coal-Tar Enamel Protective Coatings for Steel Water Pipe (AWWA C203-57).

82. Fittings.

8201. Fittings shall have joints and pressure class ratings compatible with the pipe used.

8202. Fittings for cast iron pipe shall conform to one of the following specifications: —

a) American Standard Specifications for Short Body Cast Iron Fittings, 3-inch to 12-inch, for 250 psi (ASA 21.10).

b) American Water Works Association Standard Specifications for Cast Iron Pressure Fittings (AWWA C100-08).

c) American Standard for Cast Iron Pipe Flanges and Flanged Fittings, Class 125 (ASA-B16.1-1959).

83. Sizes of Pipe.

8301. No pipe smaller than 6 inches in diameter shall be installed underground in yard systems for mains, hydrant branches, or sprinkler risers.

8302. In moderately large plants a loop system is recommended because it provides water from several directions. In small plants a lesser amount of larger pipe may be installed which may be later extended to form a loop as the plant is enlarged.

8303. The size of the pipe supplying sprinkler systems and yard systems shall be determined by the authority having jurisdiction, due consideration being given to the construction and occupancy of the plant, to the volume and pressure of water required and to the adequacy of the supply.

8304. For purposes of computing friction loss in steel or unlined cast iron pipe, use 100 as the coefficient-C in Hazen & Williams formula; for cement-lined, reinforced concrete or asbestos-cement pipe, use 120.

NOTE: The coefficients specified above are commonly used in water works practice which uses nominal pipe sizes and makes no special allowance for fittings. The authority having jurisdiction may accept a coefficient of 140 for cement-lined, reinforced concrete or asbestos-cement pipe, where the design is based on actual internal pipe sizes with proper allowance for added friction loss in all fittings and design calculations on this basis are submitted for approval.

CHAPTER 9. RULES FOR LAYING PIPE.

91. Depth of Cover.

9101. The depth of cover over water pipes should be determined by the maximum depth of frost penetration in the locality where the pipe is laid, and in those locations where frost is not a factor, the depth of cover shall be not less than 2½ feet to prevent mechanical injury. Pipe under driveways shall be buried a minimum of 3 feet and under railroad tracks a minimum of 4 feet. Recommended depth of cover above the top of underground yard mains is indicated in Fig. 91.

9102. Depth of covering shall be measured from top of pipe to ground level and due consideration shall always be given to future or final grade and nature of soil.

NOTE: Greater depth is required in a loose gravelly soil (or in rock) than in compact, clayey soil. A safe rule to follow is to bury the top of pipe not less than one foot below the lowest frost line for the locality.

9103. As there is normally no circulation of water in private fire mains, they require greater depth of covering than do public mains.

92. Protection Against Freezing.

9201. Where it is impracticable to bury pipe it may be laid aboveground, provided the pipe is protected against freezing and mechanical injury, to the satisfaction of the authority having jurisdiction.

9202. Pipes should not be placed over raceways or near embankment walls, but if such an arrangement is unavoidable special attention shall be given to protection against frost.

9203. Where pipe is laid in raceways or shallow streams care shall be taken that there will be sufficient depth of running water between the pipe and the frost line during all seasons of frost; a safer method is to bury the pipe one foot or more under the bed of the waterway. Care shall also be taken to keep the pipe back from the banks a sufficient distance to avoid any danger of freezing through the side of the bank above the water line. Pipe shall be buried below frost line where entering the water.

93. Protection Against Breakage.

9301. Pipe should not be run under buildings or under heavy piles of iron, coal, etc. Where piping necessarily passes under a building, the foundation walls shall be arched over the pipe. (See paragraph 3502.)

9302. Special care is necessary in running pipes under railroad tracks, under roads carrying heavy trucking, under large piles of iron, under buildings having heavy machinery liable to fall and under buildings containing hammers or other machinery or having heavy trucking which will subject the buried pipes to shock or vibration. Where subject to such breakage, pipes should be run in a covered pipe trench or be otherwise properly guarded. (See Section 81.)

94. Care in Laying.

9401. Pipes shall be clean inside when put in trenches and open ends shall be plugged when work is stopped, to prevent stones rolling inside.

9402. Pipes shall bear throughout their length and not be supported by the bell ends only.

9403. If ground is soft, or of a quicksand nature, special provision must be made for supporting pipe. For ordinary conditions of soft ground, longitudinal wooden stringers with cross ties will give good results. A reinforced concrete mat 3 inches or 4 inches thick in the bottom of the trench has also been used with excellent results. In extreme cases the stringers and cross ties or concrete mat may have to be supported on piles.

95. Pipe Joints.

9501. Joints shall be made tight. Poured lead joints, properly caulked, have proved satisfactory. Special joint compounds may be used when approved by the authority having jurisdiction; such joints if employed shall be made by persons familiar with the particular material used.

9502. When using bell and spigot pipe or fittings changes in grade or direction should never be made by shifting the

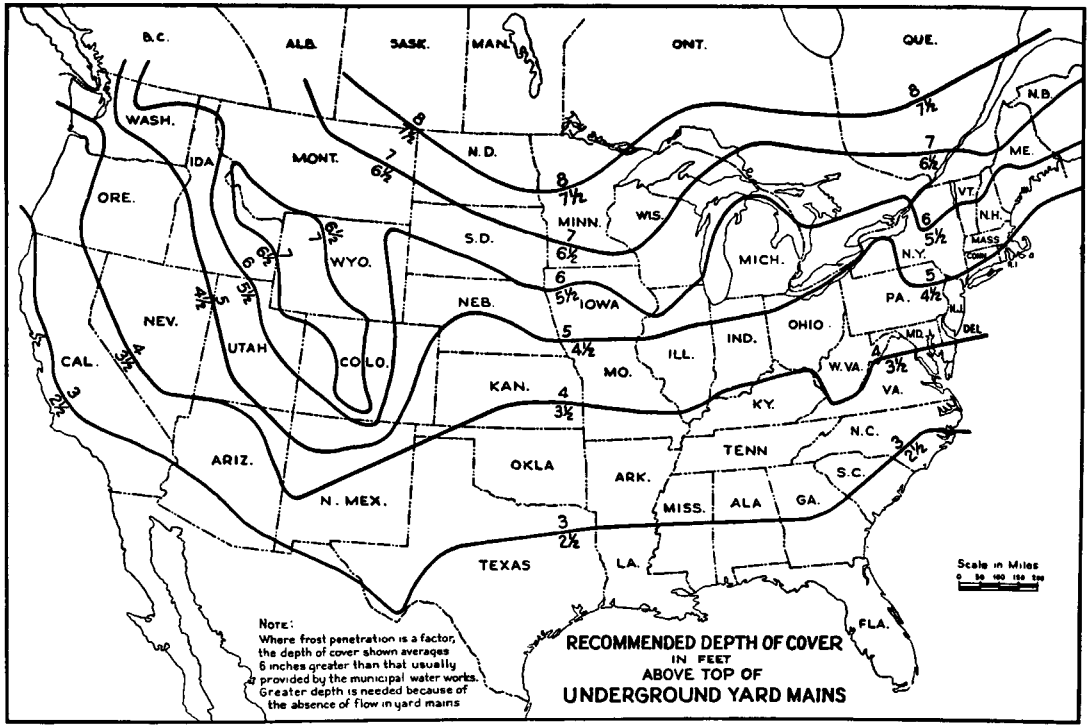

B.C.
ALB.
SASK.
MAN.
ONT.
QUE.
N.B.
ME.
VT.
N.H.
MASS
CONN
R.I.
N.Y.
WASH.
IDA.
MONT.
N.D.
MINN.
WIS.
MICH.
ORE.
S.D.
WYO.
NEB.
IOWA
PA.
N.J.
DEL.
MD.
NEV.
UTAH
COLO.
CAL.
IND.
OHIO
ILL.
W.VA.
KAN.
MO.
KY.
VA.
ARIZ.
N. MEX.
OKLA
ARK.
TENN
N.C.
S.C.
MISS.
ALA
GA.
TEXAS
LA.
FLA.
Scale in Miles
0 50 100 150 200
Note:
Where frost penetration is a factor, the depth of cover shown averages 6 inches greater than that usually provided by the municipal water works. Greater depth is needed because of the absence of flow in yard mains
RECOMMENDED DEPTH OF COVER
IN FEET
ABOVE TOP OF
UNDERGROUND YARD MAINS

Fig. 91

pipe in the joints, as uneven lead joints result and these are likely to leak. When using mechanical joint pipe or fittings, deflection shall not exceed that recommended by the manufacturer.

9503. Joints other than the bell and spigot type should be used only when approved.

96. Anchoring Fire Mains.

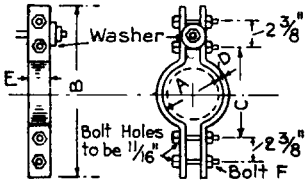
9601. When using "bell and spigot" pipe, all tees, plugs and bends should be anchored by means of tie-rods and pipe hydrant clamps as shown (Figs. 96–1, 2, 3, 4, 5, 6) or equal. When using "mechanical joint pipe," all tees and bends should be anchored by tie-rods as shown (Figs. 96–A, B, C, D, E, F) or equal, or with tie-rods and pipe-clamps as shown (Figs. 96–G to S) or equal. In lieu of these methods of anchoring, thrust blocks or fittings (mechanical joint retainer glands or equal) listed or approved by a nationally recognized testing laboratory for restraining joints, may be used. Thrust blocks as specified in paragraph 9606 are recommended for pipes larger than 12 inch.

9602. Dimensions are in inches unless otherwise indicated, and are for American Water Works Association standard fittings. Dimensions can be varied for other types of fittings. When ordering fittings specify lugs, if clamps and rods are to be used.

9603. After installation, rods and clamps should be thoroughly covered with asphalt to prevent corrosion.

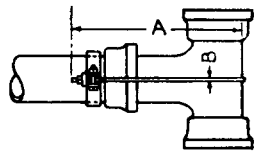
9604. Where asbestos-cement or steel pipes are installed thrust blocks shall be used.

9605. Down steep hills, mains shall be properly anchored to prevent slipping. A general rule is to anchor the pipe at the bottom of the hill, at any turns, and otherwise on straight runs about every forty-eight feet. The anchoring shall be done either to natural rock or by means of brick or concrete piers built on the downhill side of the bell. Bell ends shall be installed facing uphill.



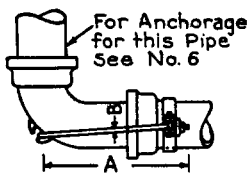
No. 1
PIPE CLAMP

Size	A	B	C	D	E	F
4	5	14 11/16	7 1/4	1/2	2	5/8 x 3 1/2
6	7 1/8	16 15/16	9 1/2	1/2	2	5/8 x 3 1/2
8	9 5/16	19 3/16	11 3/4	1/2	2	5/8 x 3 1/2
10	11 3/8	21 7/16	14	1/2	2	5/8 x 3 1/2
12	13 1/2	23 13/16	16 3/8	1/2	2	5/8 x 3 1/2



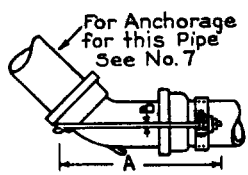
No. 2
TEE ANCHOR

Size	A	B
6	25 1/2	3/4
8	27 1/2	3/4



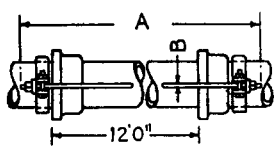
No. 3
1/4 BEND ANCHOR

Size	A	B
4	21	3/4
6	22 1/2	3/4
8	24 1/4	3/4
10	26	3/4
12	27 3/4	3/4



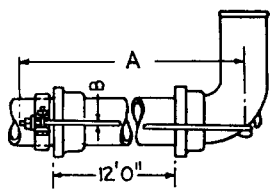
No. 4
1/8 BEND ANCHOR

Size	A	B
4	23 1/2	3/4
6	25	3/4
8	27	3/4
10	29	3/4
12	31	3/4



No. 5
PIPE ANCHOR

Size	A	B
6	13' 3"	3/4
8	13' 3"	3/4
10	13' 3"	3/4
12	13' 3"	3/4

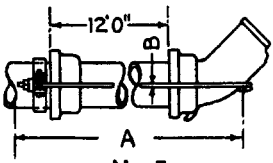


No. 6
1/4 BEND BELL ANCHOR

Size	A	B
4	13' 3"	3/4
6	13' 5"	3/4
8	13' 5"	3/4
10	13' 6 3/4"	3/4
12	13' 10"	3/4

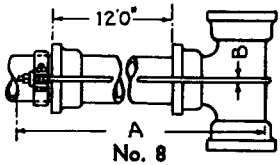
NOTE: In Nos. 5 and 6, if less than 12' 0" between joints, anchorage should extend to 2nd bell.

Fig. 96-1



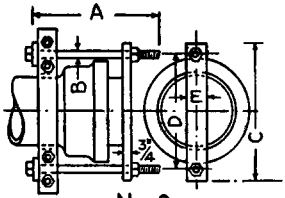
No. 7
1/8 BEND BELL ANCHOR

Size	A	B
4	13' 3"	¾
6	13' 5"	¾
8	13' 7"	¾
10	13' 9"	¾
12	13' 11"	¾



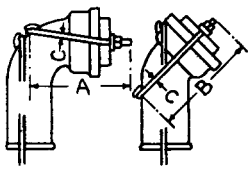
No. 8
TEE ANCHOR — BELL OUTLET

Size	A	B
4	13' 4½"	¾
6	13' 7"	¾
8	13' 9"	¾
10	14' 0"	¾
12	14' 2"	¾



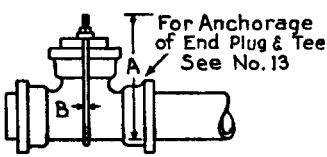
No. 9
PLUG CLAMP
BELL END PIPE

Size	A	B	C	D	E
4	13½	¾	12⅛	9¾	2
6	13½	¾	14⅜	12	2½
8	13½	¾	16⅝	14¼	2½
10	13½	¾	18⅞	16½	2½
12	13½	¾	21¼	18⅞	2½



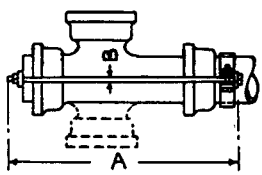
No. 10
PLUG CLAMP
BELL END 1/4 & 1/8 BENDS

Size	A	B	C
4	14½	14½	¾
6	15½	16½	¾
8	17	18½	¾
10	18¾	21	¾
12	20½	23	¾



No. 11
PLUG CLAMP
BELL OUTLET TEE

Size	A	B
4	18	¾
6	20½	¾
8	21	¾
10	24	¾
12	26	¾

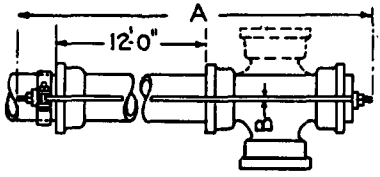


No. 12
SPIGOT TEE OR CROSS CLAMP

Size	A	B
6	35	¾
8	38	¾

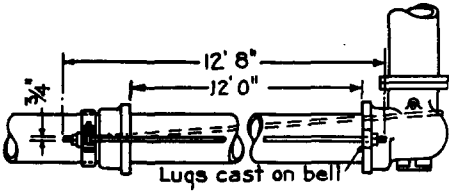
NOTE: In Nos. 7 and 8, if less than 12' 0" between joints, anchorage should extend to 2nd bell.

Fig. 96-2



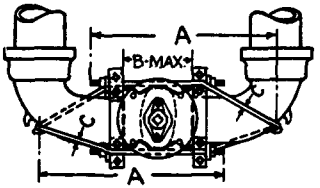
No. 13
BELL END TEE — PLUG ANCHOR

Size	A	B
4	14' 3"	¾
6	14' 8"	¾
8	14' 8"	¾
10	15' 3"	¾
12	15' 3"	¾



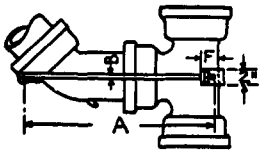
No. 14
HYDRANT ANCHOR
DIMENSIONS AS INDICATED

If hydrant not fitted with lugs, rod should be attached as per dotted lines (hyd. dimensions vary.)



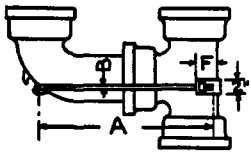
No. 15
¼ BEND (Spigot End) — INDICATOR POST ANCHOR

Size	A	B	C
4	2' 3"	12	¾
6	2' 5¼"	12¾	¾
8	2' 8¼"	14	¾



No. 16
BELL END TEE — ⅛ BEND ANCHOR

Size A	B	C	D	E	F
4 26	¾	12⅛	9¾	2½	1¾
6 29	¾	14⅜	12	3 9/16	2⅞
8 32	¾	16⅜	14¼	4⅝	3 15/16
10 35½	¾	18⅞	16½	5¾	4 9/16
12 38	¾	21¼	18⅞	6¾	6

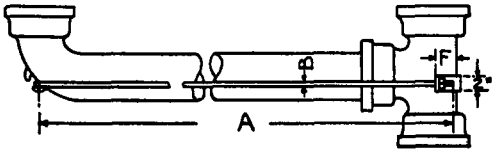


No. 17
BELL END TEE — ¼ BEND ANCHOR

Size	A	B
4	24	¾
6	26½	¾
8	29½	¾
10	33	¾
12	36	¾

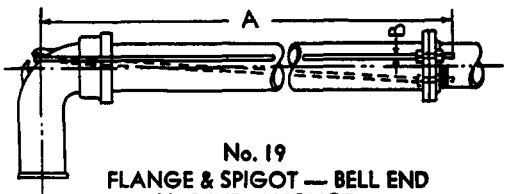
NOTE: In Nos. 13 & 14 if less than 12' 0" between joints, anchorage should extend to 2nd bell.

Fig. 96-3



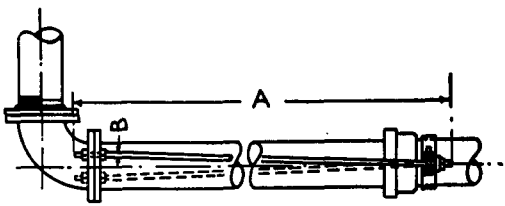
No. 18
BELL END TEE & LONG 1/4 BEND ANCHOR

Size	A	B
4	5' 8½"	¾
6	5' 10"	¾
8	5' 11½"	¾



No. 19
FLANGE & SPIGOT — BELL END 1/4 BEND ANCHOR

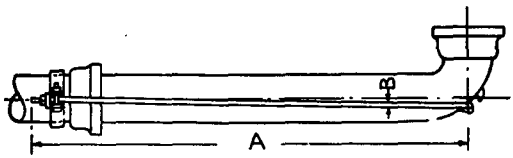
Size	A (6' 0" Flg. Spigot)	A (3' 0" Flg. Spigot)	B
4	6' 9"	3' 9"	¾
6	7' 0"	4' 0"	¾
8	7' 0"	4' 0"	¾
10	7' 4"	4' 4"	¾
12	7' 4"	4' 4"	¾



No. 20
FLANGE & SPIGOT — BELL END PIPE ANCHOR

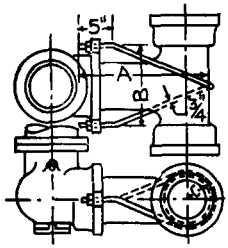
Size	A (6' 0" Flg. Spigot)	A (3' 0" Flg. Spigot)	B
4	6' 9¼"	3' 9¼"	¾
6	6' 9¼"	3' 9¼"	¾
8	6' 9¼"	3' 9¼"	¾
10	6' 9½"	3' 9½"	¾
12	6' 9½"	3' 9½"	¾

Fig. 96-4



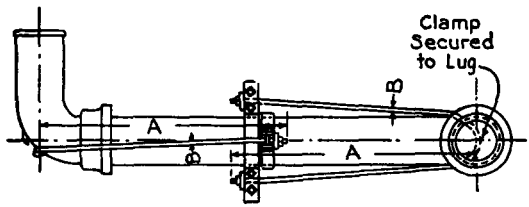
No. 21
BELL END PIPE — LONG SPIGOT
1/4 BEND ANCHOR

Size	A	B
4	5' 6½"	¾
6	5' 6½"	¾
8	5' 6½"	¾



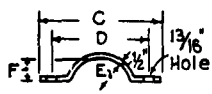
No. 22
SPIGOT TEE —
HYDRANT ANCHOR

Size	A	B	C
6 x 6 x 6	20	12	3 1/16
8 x 8 x 6	22	12	4 5/8



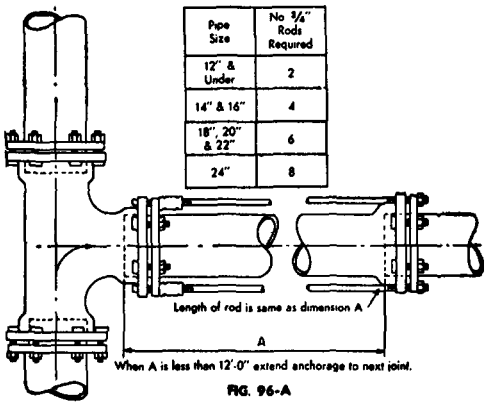
No. 23
LONG AND SHORT SPIGOT 1/4 BEND ANCHOR

Size	A	B
4	3' 2"	¾
6	3' 2"	¾
8	3' 2"	¾



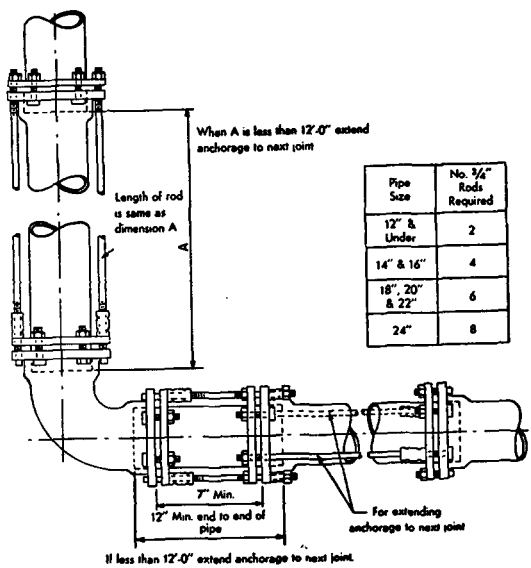
ANCHOR STRAP
For Nos. 16, 17 & 18
1/4 BEND ANCHOR

Fig. 96-5



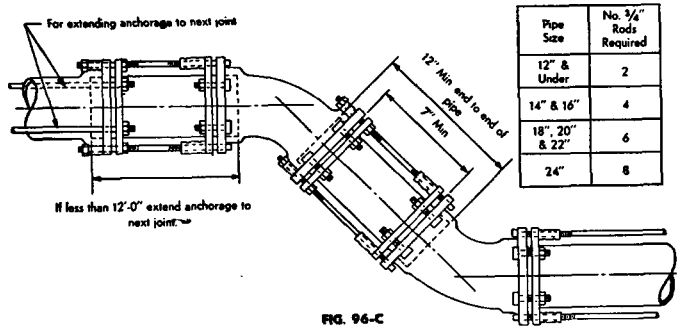
Pipe Size	No ¾" Rods Required
12" & Under	2
14" & 16"	4
18", 20" & 22"	6
24"	8

FIG. 96-A



Pipe Size	No. ¾" Rods Required
12" & Under	2
14" & 16"	4
18", 20" & 22"	6
24"	8

FIG. 96-B



Pipe Size	No. ¾" Rods Required
12" & Under	2
14" & 16"	4
18", 20" & 22"	6
24"	8

FIG. 96-C

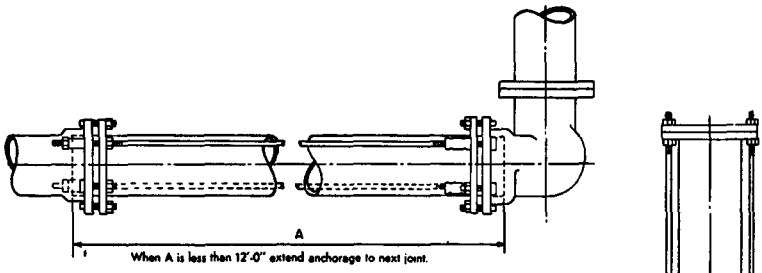


FIG. 96-E

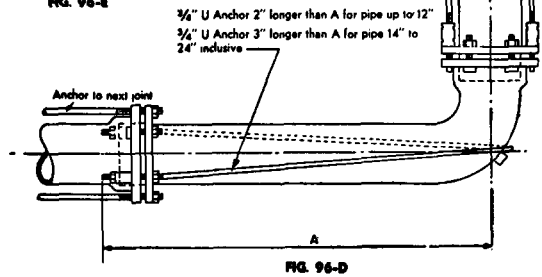


FIG. 96-D

Pipe Size	No. ¾" Rods Required
12" & Under	2
14" & 16"	4
18", 20" & 22"	6
24"	8

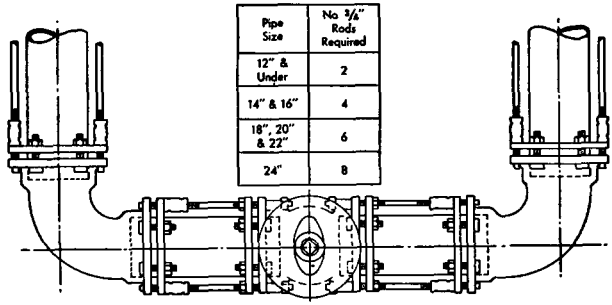


FIG. 96-F

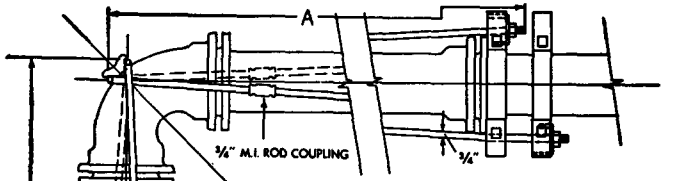


FIG. 96-G

M.J. ¼ BEND ANCHOR

NOTE: WHEN "A" IS LESS THAN 12'-0" EXTEND ANCHORAGE TO NEXT JOINT.

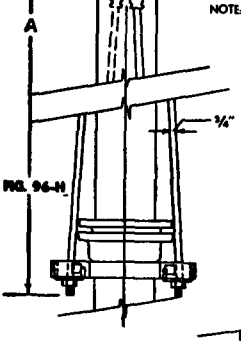


FIG. 96-H

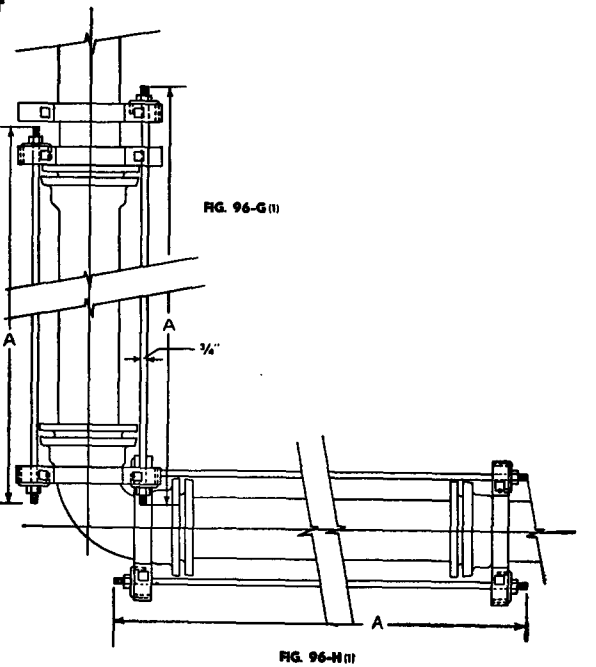


FIG. 96-G (1)

FIG. 96-H (1)

M.J. ¼ BEND ANCHOR

NOTE: WHEN "A" IS LESS THAN 12'-0" EXTEND ANCHORAGE TO NEXT JOINT.

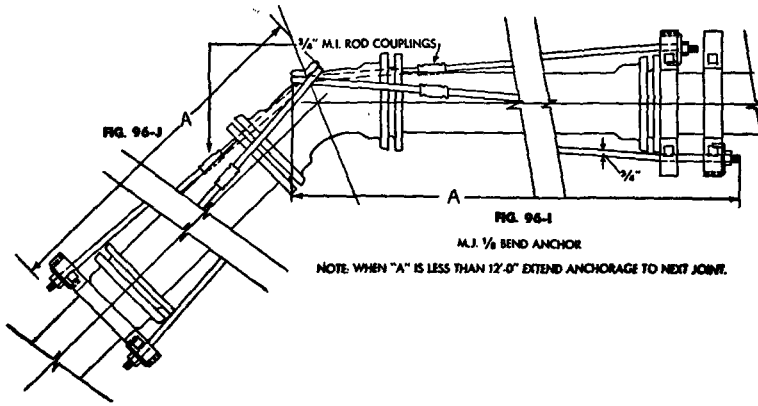


FIG. 96-J

FIG. 96-I

M.J. ⅛ BEND ANCHOR

NOTE: WHEN "A" IS LESS THAN 12'-0" EXTEND ANCHORAGE TO NEXT JOINT.

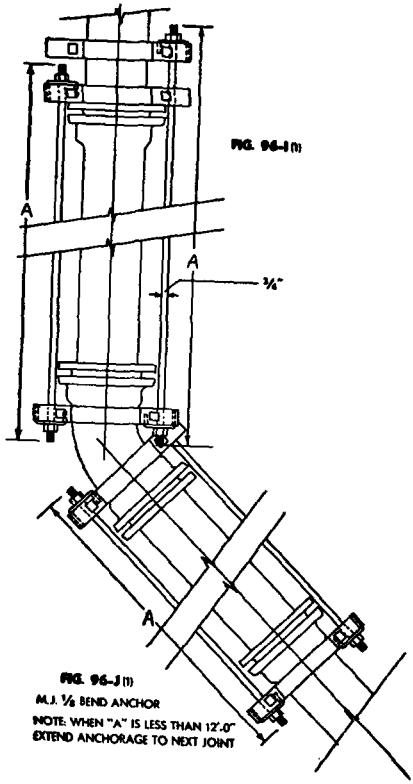


FIG. 96-J (1)

M.J. ⅛ BEND ANCHOR

NOTE: WHEN "A" IS LESS THAN 12'-0" EXTEND ANCHORAGE TO NEXT JOINT

FIG. 96-I (1)

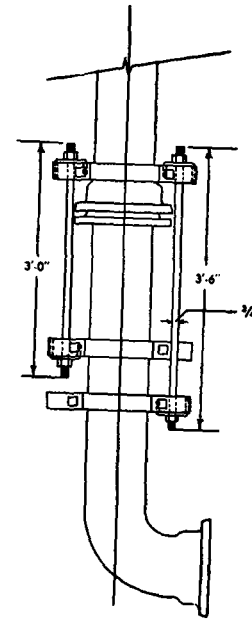


FIG. 96-K

LONG M J ¼ BEND ANCHOR

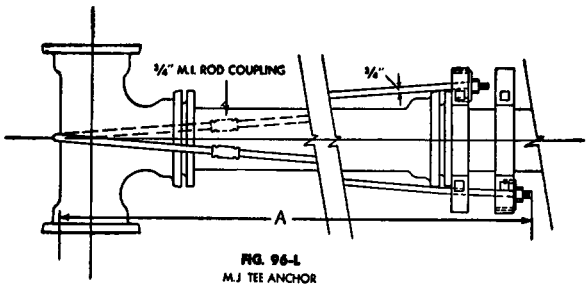


FIG. 96-L
M.J TEE ANCHOR
NOTE: WHEN "A" IS LESS THAN 12'-0" EXTEND ANCHORAGE TO NEXT JOINT.

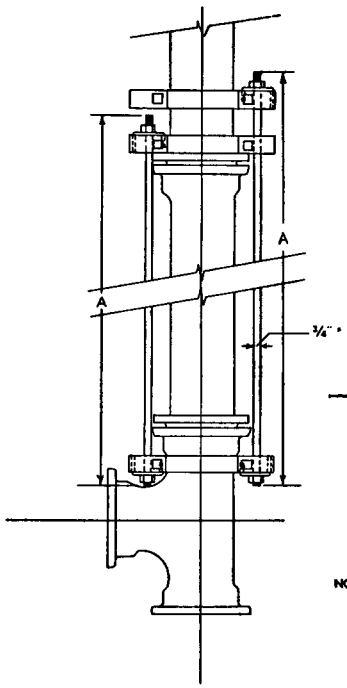


FIG. 96-M
M.J TEE ANCHOR
NOTE WHEN "A" IS LESS THAN 12' 0" EXTEND ANCHORAGE TO NEXT JOINT

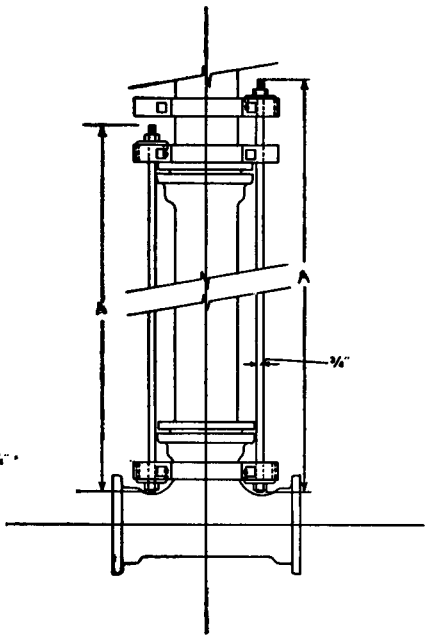


FIG. 96-L (1)
M.J. TEE ANCHOR
NOTE: WHEN "A" IS LESS THAN 12'-0" EXTEND ANCHORAGE TO NEXT JOINT

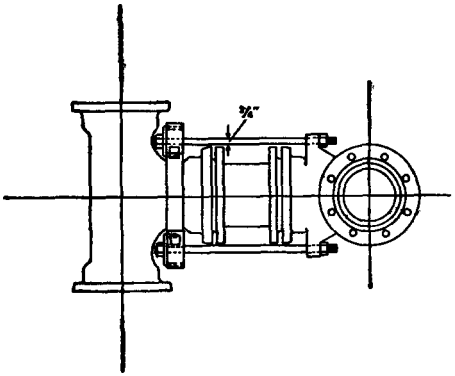


FIG. 96-N

M.J. TEE AND M.J. HYDRANT ANCHOR

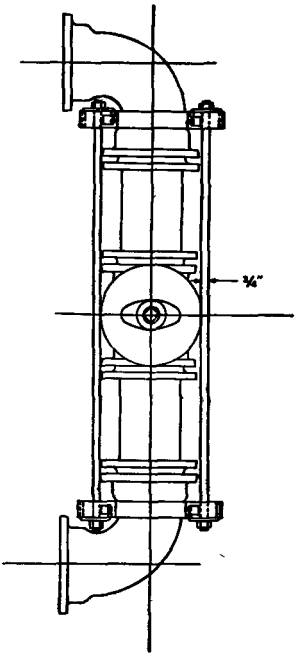
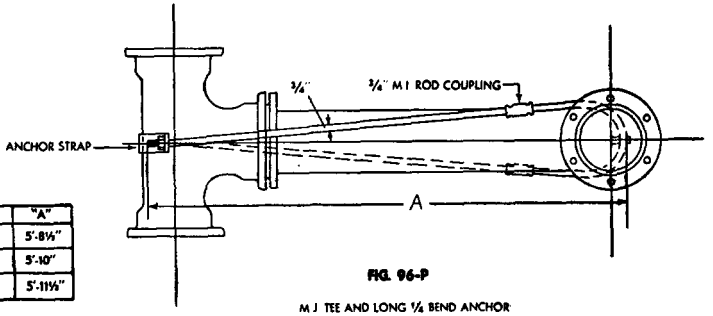


FIG. 96-O

M.J. ⅛ BEND AND M.J. INDICATOR POST ANCHOR



SIZE	"A"
4"	5'-8½"
6"	5'-10"
8"	5'-11½"

FIG. 96-P

M.J. TEE AND LONG ⅛ BEND ANCHOR