INSTALLATION OF DUCTILE-IRON WATER MAINS AND THEIR APPURTENANCES

All ductile iron pipe, valves, hydrants and fittings should be installed and tested in accordance with applicable AWWA and other industry standards. **It is the installer's obligation to know and understand all applicable standards and specifications and to follow them in all situations.** It is also the purchaser/installer's obligation and responsibility to make certain that all of its employees understand and follow these standards. Specific standards that are applicable include, but may not be limited to ANSI/AWWA C600-93, C500-86, C502-85, C503-88, C504-94, C509-87, C800-84, C504, C508, C111/A-21.11-85, and the considerations outlined in AWWA Manuals M17, M41, and M44. The Ductile Iron Pipe Research Association also publishes an installation guide for ductile iron pipe. This guide is available from McWane, Inc. Pipe Divisions, Ransom Industries, Inc. or directly from the Ductile Iron Pipe Research Association, located at 245 Riverchase Parkway East, Suite 0, Birmingham, AL 35244, Telephone 205/402-8700, FAX 205/402-8730.

The following guidelines apply to most installations of ductile iron pipe and appurtenances. **These guidelines are not intended as a substitute for the applicable standards and specifications, which should be followed in all instances.**

All pipe and appurtenances should be inspected carefully at the point of delivery for damage and other defects immediately before installation. Any lumps, blisters, excess coating or cement, or other foreign matter should be removed from the socket and plain ends of each pipe, and the outside of the plain end and the inside of the bell wiped clean and dry and be free from dirt, sand, grit, cement, excess coating or any other foreign material before the pipe is laid. Valves should be inspected for direction of opening, for consistency with other valves in the system, number of turns to open, freedom of operation, tightness of pressure-containing bolting and test plugs, tightness of the nuts and bolts, cleanliness of valve ports, end-joints, and especially seating surfaces, handling damage, and cracks. Hydrants shall be inspected for direction of opening, nozzle threading, operating nut and cap nut dimensions, tightness of pressure-containing bolting, cleanliness of inlet elbow, handling damage, and cracks. Any defective materials should be marked, repaired, or held for inspection by the owner.

Water and sewer mains shall be laid and maintained to lines and grades established by the plans and specifications for the project. Fittings, valves, tapped or bossed outlets, and hydrants must be installed at the required locations unless changes are approved in accordance with applicable specifications. Each joint should be inspected prior to backfilling to make certain the gasket has not been pushed or dislodged from the socket. This inspection can be accomplished visually with large diameter lines and by use of a feeler gauge with smaller diameter lines.

Figures 1, 2, and 3, on pages 14-16, generally describe the laying conditions for ductile iron pipe and the proper method of assembly of push-on joint and mechanical joint pipe. **However, the installer is responsible for making certain that the assembly complies with all applicable standards and specifications.**

Prior to installation of hydrants and valves, the direction of opening, operating nuts, hose nozzle threads and steamer nozzle threads must be checked to make certain they comply with the other hydrants in your city. We will not be responsible if advised of incorrect operating nuts and nozzle threads after installation. The hydrant should be opened and closed at least twice a year to insure proper operation and drainage. Store hydrant bottom inlet downward to prevent freezing. Check all bolts and nuts for tightness. Do not lift hydrant without use of slings.

Prior to conducting any pressure testing of pipe, the installed components should be properly backfilled. In particular, restrained-joint systems, which derive their stability from the interaction of the pipe and soil, should be backfilled prior to testing.

When testing valves, keep the valve closed when placing it in the trench. Do not backfill around valves before hydrostatic system test. Leave the valves exposed while the pipeline is being pressurized. Check to see that all valve joints and pressure containing bolting are tight. All appurtenances should be installed with appropriate thrust restraints. Generally, flanged valves are not recommended for buried service, as explained in AWWA C509-94. The improper installation of flanged valves can generate excessive stresses and cause valve failure.

Non-buried applications of push-on joint, mechanical joint, restrained joint, or ball and socket joint pipe, fittings, or valves, involve complex design and installation considerations. These applications include bridge crossings, installation on piers, etc. McWane, Inc. and Ransom Industries, Inc. do not make recommendations nor assume responsibility for

design or installation practices on such projects.

Applications involving flanged joint weld-on bosses also involve special design and installation considerations. Because this joint has no deflection capability, appurtenances attached in any direction must be completely immobilized to prevent overstressing the joint and joint failure due to thrust or other forces and pipeline settling. McWane, Inc. does not assume responsibility for design or installation practices in such applications. Flanged bosses should not be used at all in buried service, since complete immobilization is not generally possible.

When rubber-seated butterfly valves are used to isolate sections of line for test, it is important to realize that these valves are designed or factory adjusted to hold rated pressure only. Test pressures above valve-rated pressure may cause leakage past the rubber seat. In order to prevent time lost in searching for leaks, it is recommended that excavations for buried valves not be backfilled until after pressure tests have been made.

Seat leakage can result from foreign material in the line. If this occurs, open the valve 5-10° to obtain high-velocity flushing action, then close. Repeat several times to clear seats for tight shutoff. Seat leakage can result from a rotational shift position of the disc with relation to the body seat.

Before conducting any pressure testing, air must be expelled completely from the section of piping under test. If permanent air vents are not located at all high points, appropriate measures shall be taken to ensure that air can be expelled as the line is filled with water. All deadends shall be equipped with suitable blow-off or venting devices.

All pressure testing of lines should be done hydrostatically. Do not use air-pressure to test pressurized water or sewer lines. WARNING: THE USE OF AIR TO PRESSURE TEST A LINE, OR THE FAILURE TO REMOVE ALL AIR FROM A LINE PRIOR TO TESTING, CAN CAUSE EXPLOSIVE PRESSURES TO BUILD UP IN THE LINE THAT COULD CAUSE SERIOUS PERSONAL INJURY. NEVER USE COMPRESSED AIR TO PRESSURE TEST A LINE, AND ALWAYS MAKE CERTAIN THAT ALL AIR HAS BEEN REMOVED FROM THE LINE.

BEFORE APPLYING WATER PRESSURE

It may be acceptable to test gravity sewer lines with low pressure air (5 psi or less) if proper procedures and precautions are followed. Consult all applicable standards and the project engineer before conducting any such testing.

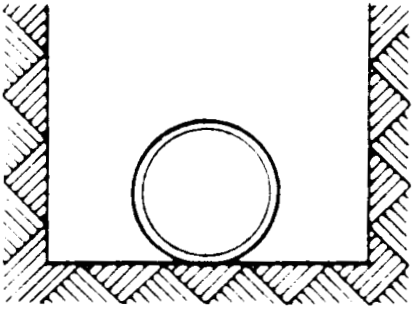
Before performing any maintenance or repairs on pipe, valve, or hydrant, and before cutting into a line, make certain that all pressure has been released. Take care to insure that the pressure has been cut off upstream from the work area, and that it has been relieved by opening downstream valves or hydrants, as necessary. WARNING: CUTTING INTO A PRESSURIZED LINE CAN CAUSE SERIOUS PERSONAL INJURY. Where circumstances require tapping into a pressurized line, use only tapping sleeves designed for this purpose and only in accordance with the manufacturers instructions and applicable safety standards.

When flushing or flow testing either wet- or dry-barrel fire hydrants, a rigid diverter should never be used. The rigid diverter consists of a pipe screwed onto the hydrant outlet, extending out to a desired length, and bending up to 90˚ to change the direction of the water flow before discharging full flow into the atmosphere.

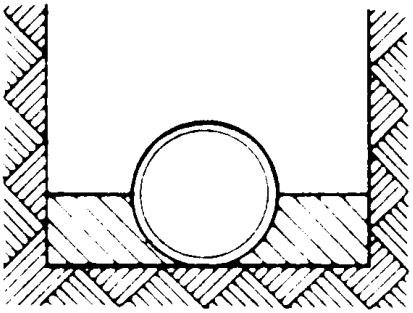
The water discharged from the diverter generates a pushing force (thrust) that could be very dangerous. The effect of this force is magnified by the distance from the outlet to the bend in the pipe, generating what can be a very tight torque on the hydrant due to the leverage. A rigid diverter can produce many hundreds of pounds of torque on the fire hydrant, potentially causing damage to the hydrant and connections leading to the hydrant. Maximum danger exists when the rigid diverter is installed in such a manner that the line pressure would create a sufficient torque to cause the hydrant head to unscrew from the standpipe, bury, or extension riser.

To prevent possible bodily injury, property damage or damage to the fire hydrant and its supporting structures, use only a diffuser or a flexible hose (properly restrained at the point of discharge) before flushing or flow testing.

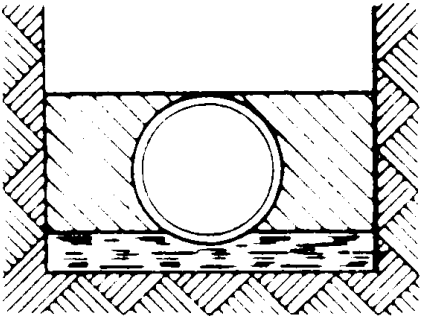
FIGURE 1-LAYING CONDITIONS FOR DUCTILE IRON PIPE



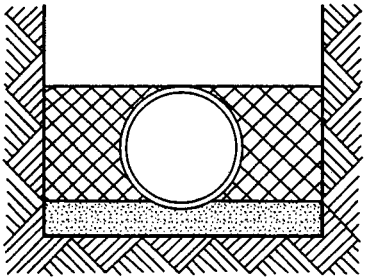
Type 1*
Flat-bottom trench.† Loose backfill.



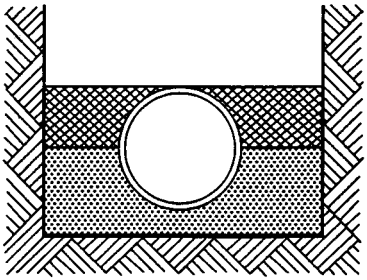
Type 2
Flat-bottom trench.† Backfill lightly consolidated to centerline of pipe.



Type 3
Pipe bedded in 4 in. (100 mm) minimum of loose soil.++
Backfill lightly consolidated to top of pipe.



Type 4
Pipe bedded in sand, gravel, or crushed stone to depth of 1/8 pipe diameter, 4 in. (100 mm) minimum. Backfill compacted to top of pipe. (Approximately 80 percent Standard Proctor, AASHTO T-99.)



Type 5
Pipe bedded in compacted granular material to centerline of pipe. Compacted granular or select material++ to top of pipe. (Approximately 90 percent Standard Proctor, AASHTO T-99.)

*For 14 in. (355-mm) and large pipe, consideration should be given to the use of laying conditions other than type 1.
†"Flat-bottom" is defined as undisturbed earth.
++"Loose soil" or "select material" is defined as native soil excavated from the trench, free of rocks, foreign materials, and frozen earth.

PUSH-ON JOINT DUCTILE IRON PIPE

INSTALLATION OF DUCTILE IRON WATER MAINS AND THEIR APPURTENANCES

SPIGOT STRIPE

The TYTON® Joint incorporates two spigot stripes painted on the plain end. The joint is fully assembled when the first stripe has disappeared inside the bell and the second stripe is approximately flush with the bell face.

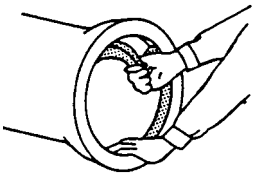
The FASTITE® Joint incorporates a single stripe painted on the plain end. The joint is fully assembled when the stripe disappears inside the bell.

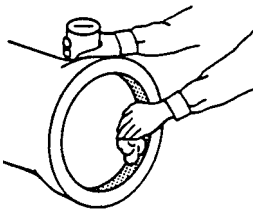
COLD WEATHER INSTALLATION

It is more difficult to position the gasket and assemble the joint in cold weather because of the stiffness of cold rubber. For ease of assembly, it is recommended that the gaskets be warmed up prior to placement in the bell. It should be noted that during cold weather it is far more difficult to effectively clean out the bell. Ice or frozen dirt in the gasket groove can prevent proper seating of the gasket.

LUBRICANT USAGE

PIPE SIZE	3	4	6	8	10	12	14	16	18	20	24	30	36
JOINTS PER LB. OF LUBRICANT	28	24	16	12	10	8	7	6	5	5	4	3	2.5





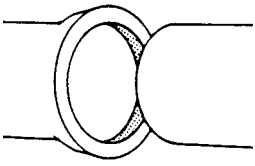
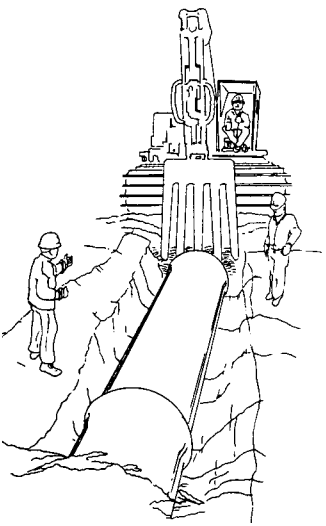


FIGURE 2 - PUSH-ON-JOINT ASSEMBLY

1. Thoroughly clean the groove and the bell socket of the pipe or fitting; also clean the plain end of the mating pipe. Using a gasket of the proper design for the joint to be assembled, make a small loop in the gasket and insert it in the socket, making sure the gasket faces the correct direction and that it is properly seated. Note: In cold weather, it is necessary to warm the gasket to facilitate insertion.

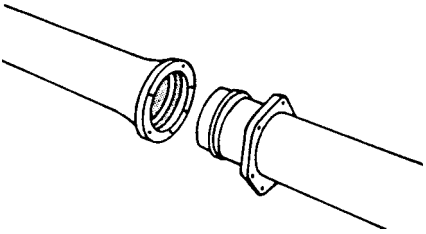
2. Apply lubricant to the gasket and plain end of the pipe in accordance with the pipe manufacturer's recommendations. Lubricant is furnished in sterile containers, and every effort should be made to protect against contamination of the container's contents. In some cases, manufacturer's recommendations on joint lubrication require that the gasket groove not be lubricated; in others, lubrication of the groove is necessary. It is important to follow the pipe manufacturer's instructions.

3. Be sure that the plain end is beveled; square or sharp edges may damage or dislodge the gasket and cause a leak. When pipe is cut in the field, bevel the plain end with a heavy file or grinder to remove all sharp edges. Push the plain end into the bell of the pipe. Keep the joint straight while pushing. Make deflection after the joint is assembled.



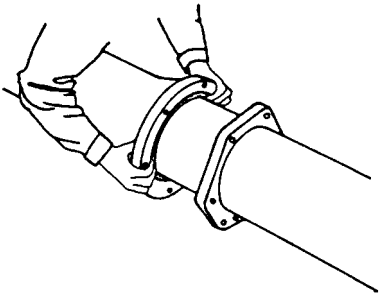
4. Small pipe can be pushed into the bell socket with a long bar. Large pipe requires additional power, such as a jack, lever puller, or backhoe. The supplier may provide a jack or lever puller on a rental basis. A timber header should be used between the pipe and jack or backhoe bucket to avoid damage to the pipe.

FIGURE 3 - MECHANICAL JOINT ASSEMBLY

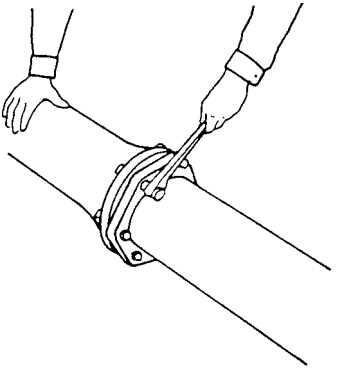


1. Clean the socket and the plain end. Lubrication and additional cleaning should be provided by brushing both the gasket and plain end with soapy water or an approved pipe lubricant meeting the requirements of ANSI/AWWA C111/A21.11, just prior to slipping the gasket onto the plain end for joint assembly. Place the gland on the plain end with the lip extension toward the plain end, followed by the gasket with the narrow edge of the gasket toward the plain end.

3. Push the gland toward the socket and center it around the pipe with the gland lip against the gasket. Insert bolts and hand tighten nuts. Make deflection after joint assembly but before tightening bolts.



2. Insert the pipe into the socket and press the gasket firmly and evenly into the gasket recess. Keep the joint straight during assembly.



4. Tighten the bolts to the normal range of bolt torque as indicated below while at all times maintaining approximately the same distance between the gland and the face of the flange at all points around the socket. This can be accomplished by partially tightening the bottom bolt first, then the top bolt, next the bolts at either side, finally the remaining bolts. The use of a torque-indicating wrench will facilitate this procedure. Repeat the process until all bolts are within the appropriate range of torque. MJ pipe not available above 24".

DO NOT OVERSTRESS BOLTS TO COMPENSATE FOR POOR INSTALLATION PROCEDURES

Pipe Size	Bolt Dia.	Nut Across Flats	Wrench Length	Torque Range Foot Pounds
3"	5/8"	1-1/16"	8"	45 TO 60
4"-24"	3/4"	1-1/4"	10"	75 TO 90
30"	1"	1-5/8"	14"	100 TO 120
36"	1"	1-5/8"	14"	100 TO 120

ASSEMBLY OF FIELD CUT PIPE

When pipe are cut in the field, the cut end may be readily conditioned so that it can be used to make up the next joint. The outside of the cut end should be beveled about 1/4-inch at an angle of about 30 degrees (Figure 1). This can be quite easily done with a coarse file or a portable grinder. The operation removes any sharp, rough edges which otherwise might injure the gasket.

When ductile iron pipe is to be cut in the field, the material should be ordered as "GAUGED FULL LENGTH". Pipe that is "gauged full length" is specially marked to avoid confusion. Ductile iron pipe selected for field cutting should also be field gauged in the location of the cut and found to be within the tolerances shown in Table 1. Full gauged pipe should not be cut any closer than 2 ft. of the face of the bell. In the field, a mechanical joint gland can be used as a gauging device.

Figure 1

Table 1. Suitable Pipe Diameters for Field Cuts and Restrained Joint Field Fabrication

Nominal Pipe Size In.	Min. Pipe Diameter In.	Max. Pipe Diameter In.	Min. Pipe Circumference In.	Max. Pipe Circumference In.
3	3.90	4.02	12-1/4	12-5/8
4	4.74	4.86	14-29/32	15-9/32
6	6.84	6.96	21-1/2	21-7/8
8	8.99	9.11	28-1/4	28-5/8
10	11.04	11.16	34-11/16	35-1/16
12	13.14	13.26	41-9/32	41-21/32
14	15.22	15.35	47-13/16	48-7/32
16	17.32	17.45	54-13/32	54-13/16
18	19.42	19.55	61	61-13/32
20	21.52	21.65	67-19/32	68
24	25.72	25.85	80-13/16	81-7/32
30	31.94	32.08	100-11/32	100-25/32
36	38.24	38.38	120-1/8	120-9/16
Above Table Based On ANSI/AWWA C151/A21.51 Guidelines For Push-On Joints.				

THE BACKHOE METHOD OF ASSEMBLY

A backhoe may be used to assemble pipe of intermediate and larger sizes. The plain end of the pipe should be carefully guided by hand into the bell of the previously assembled pipe. The bucket of the backhoe may then be used to push the pipe until fully seated. A timber header should be used between the pipe and backhoe bucket to avoid damage to the pipe.