


I General

1. Overview of applicable joint type

1) Name: NS ductile iron pipe

Abbreviation: NS

Abbreviation symbol: 

2) Pipe size 20" to 40" (500mm to 1000mm)

3) Type and thickness of pipe

Straight pipe: S type (one type only)

Fittings: Collar (sleeve), bend, double-socket tee, reducer, short pipe, plug, etc.

Only one type of pipe thickness is available.

4) Nominal laying length of straight pipe

19.69 feet (19' 8 1/4"), (6 m)

5) Standards JWWA G 113, G114

2. NS Joint (20" - 40")

1) Structure

(1) Straight pipe

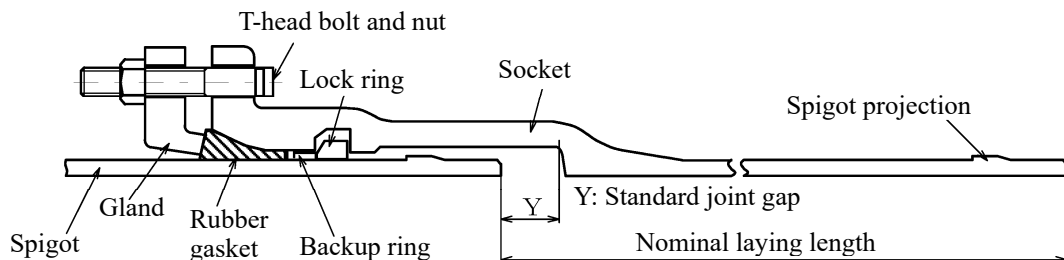


Figure 1 Straight pipe joint structure

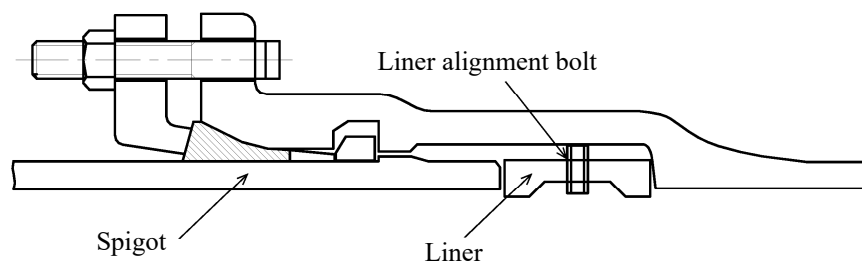


Figure 2 Joint structure of a straight pipe using a liner

(2) Fittings

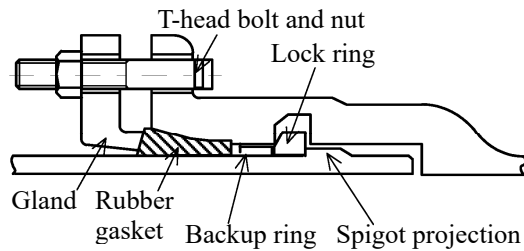


Figure 3 Fittings joint structure

2) Materials of Accessories

Table 1 Materials of Accessories

Name	Material
Rubber gasket	SBR (NBR, EPDM)
Gland	Ductile iron
T-head bolt and nut	Stainless steel
Backup ring	Polyamide resin (PA6)
Lock ring	Ductile iron
Liner	Ductile iron
Liner alignment bolt	Polyamide resin (PA6)
Spigot ring for cut pipe	Ductile iron
Liner holder, bolt, washer	Stainless steel

3. Standard performance

1) Expansion and contraction

Table 2 shows the expansion and contraction of the straight pipe and collar.

Table 2 Expansion and contraction of straight pipe and collar Unit: inches

Pipe size	For each straight pipe joint	For each collar	
		Expansion	Contraction
20"	±2.4"	2.4"	10.2"
24"	±2.4"	2.4"	10.2"
28"	±2.4"	2.4"	11.8"
32"	±2.4"	2.4"	12.0"
36"	±2.4"	2.4"	12.0"
40"	±2.4"	2.4"	12.2"

2) Allowable deflection angle

Table 3 lists the allowable deflection angles of the straight pipe and collar (on one side).

Table 3 Allowable deflection angles of straight pipe and collar (on one side).

Pipe size	Allowable deflection angle (Installation stage)	Maximum deflection angle
20"	3° 20'	7°
24"	2° 50'	7°
28"	2° 30'	7°
32"	2° 10'	7°
36"	2° 00'	7°
40"	1° 50'	7°

3) Pull-out resistance

Table 4 shows the pull-out resistance of the joint.

Table 4 Pull-out resistance

Pipe size	Pull-out resistance (lbf)
20"	340,000 (1500kN)
24"	408,000 (1800kN)
28"	476,000 (2100kN)
32"	544,000 (2400kN)
36"	612,000 (2700kN)
40"	680,000 (3000kN)

II. Straight pipe jointing procedure

Assemble NS joint strictly in accordance with this manual. To ensure the assembled joint, it is recommended checking the joint conditions with "Joint check sheet".

1. Pipe installation

Keeping the manufacturer's mark of the pipe facing upward, unload the pipe gently to the specified position, as shown in Figure 4. At that time, arrange the positions of the socket flange holes with reference to the center.

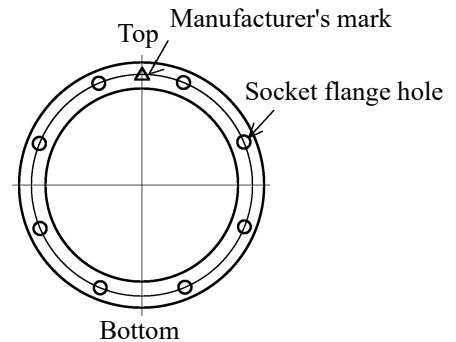


Figure 4 Pipe installation

2. Cleaning the pipe and checking for dimensions

Completely remove the oil, sand lubricant or other foreign substances deposited within a distance of approx. 2feet (60 cm) from the end surface of the spigot outer surface and those deposited on the inner surface of the socket. Measure the dimensions on the top, bottom, right and left of the spigot. If an ellipse has been detected, correct the ellipse.

3. Setting the lock ring

- (1) As illustrated in Figure 5, set the lock ring so that the tapered surface will be located on the side of the socket end face.

Further, when putting the lock ring into the socket groove, set the lock ring in a horizontal position so that the split portion of the lock ring comes to the front, and insert it into the socket. After that, turn it inside the socket so that the lock ring will be held in the groove. If it cannot be easily inserted in position, gently tap it with a plastic hammer.

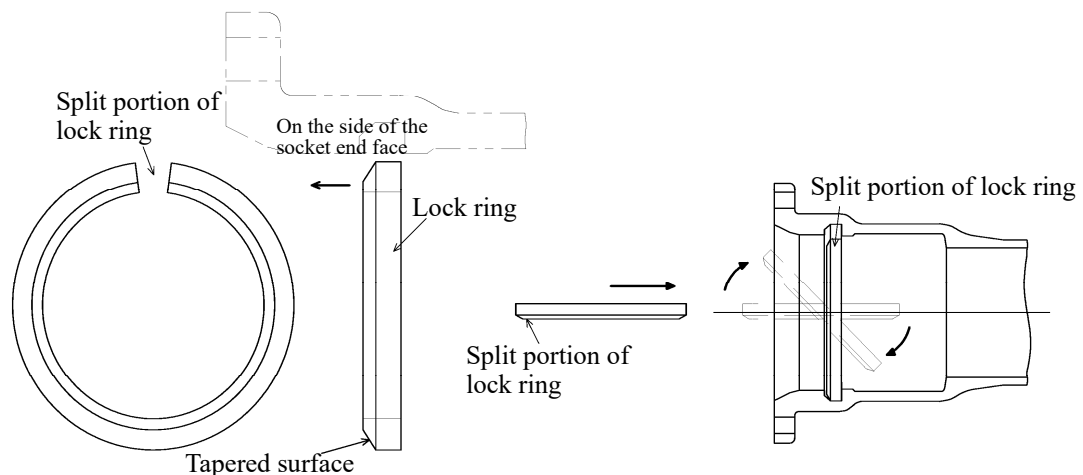


Figure 5 How to set the lock ring into socket



CAUTION

Do not put your hand or finger in the clearance between the pipes and lock ring during work. Otherwise, your hand or finger may be pinched and an accident may occur.



CAUTION

Set the lock ring correctly. Otherwise, the pull-out resistant function of the joint may be damaged.

- (2) As illustrated in Figure 6, use a lock ring expander to expand the ring so that the split portion of the lock ring will reach the dimension “s” (value as a guide) shown in Table 5.

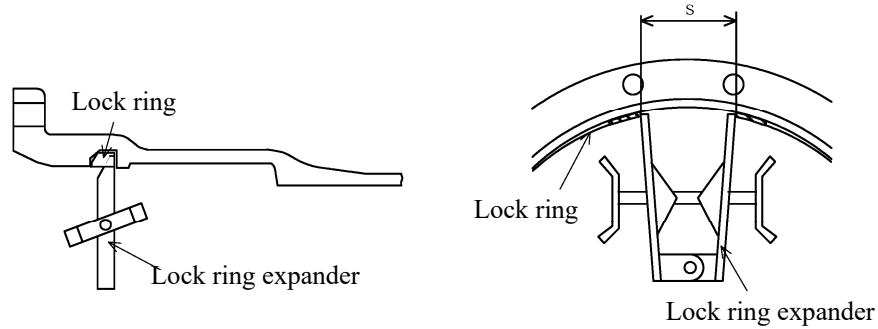


Figure 6 Installation of lock ring expander

Table 5 Dimension “s” (value as a guide)

Pipe size	Dimension “s”
20”	4.8” (122mm)
24”	4.8” (122mm)
28”	5.2” (132mm)
32”	6.02” (153mm)
36”	6.18” (157mm)
40”	6.38” (162mm)

- (3) As illustrated in Figure 7, the stopper width can be adjusted by the stopper interval adjusting screw. As illustrated in Figure 8, insert the stopper into the lock ring split portion by adjusting the stopper width, and remove the lock ring expander.

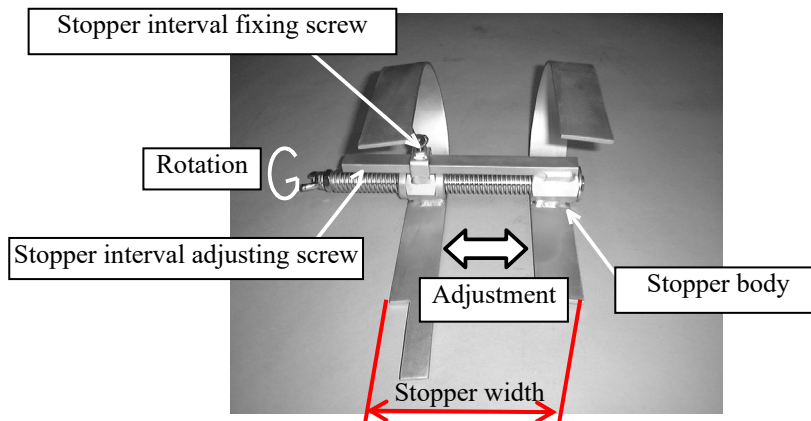


Figure 7 Stopper overview

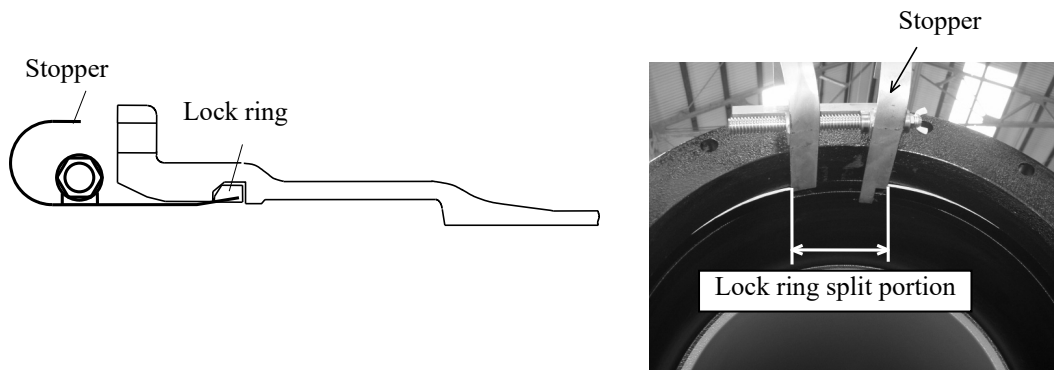


Figure 8 Stopper installation

If the spigot projection comes in contact with the lock ring and the spigot cannot be inserted even after the lock ring split portion has been expanded to the dimension "s", expand the lock ring split portion by further 0.2" (5 mm) and install the stopper in position.

4. Setting the Rubber gasket and back-up ring

- (1) Clean the Rubber gasket and set it to the spigot. At this time, confirm the indication mark (NS) of the rubber gasket and set it in the direction illustrated in Figure 9.
- (2) Clean the back-up ring and set the spigot to it. In this case, set it in the direction illustrated in Figure 9.

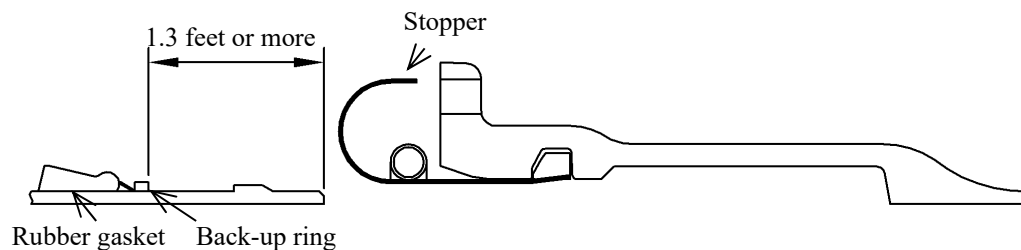


Figure 9 Joining part setting position

**CAUTION**

Confirm the orientation of the rubber gasket and back-up ring before setting them. Otherwise, water leakage may occur.

**CAUTION**

Use the rubber gasket and back-up ring conforming to the specified type of joining and normal diameter. Otherwise, water leakage may occur.

**CAUTION**

Do not use the rubber gasket that was once removed by disassembling the joint. Otherwise, water leakage may occur.

5. Lubrication

Apply lubricant to the socket interior from end face to socket groove. (See Figure 10.)

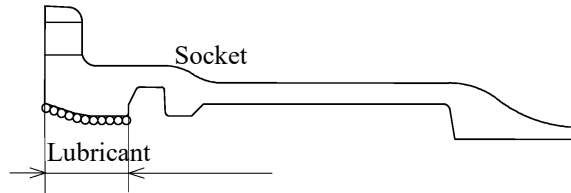


Figure 10 Application of lubricant

6. Alignment of socket and spigot

- (1) Lift the pipe with a crane. In this state, insert the spigot into the socket.
- (2) Slowly insert it so that the socket end face will be located within the width of the white line A of the two white lines indicated on the outside surface of the spigot (white line on the end face side of the spigot) (see Figure 11).
- (3) After the spigot has been inserted, pull out the stopper installed on the lock ring split portion. In this case, make sure that the lock ring holds the outer surface of the spigot. If the spigot comes in contact with the stopper during insertion of the spigot, the stopper may be removed. If the stopper has been removed, repeat the steps from 3. (2).

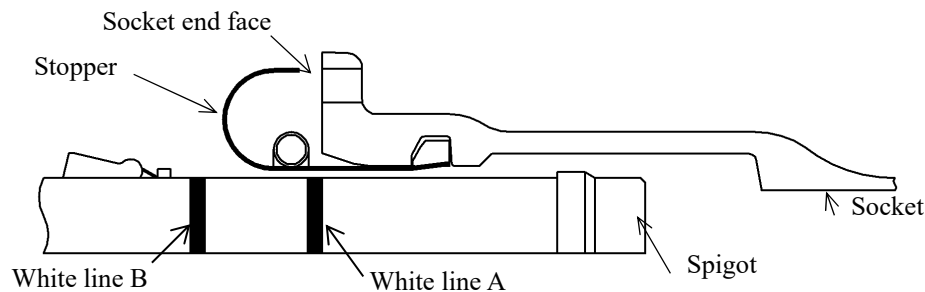


Figure 11 Spigot insertion

7. Back-up ring insertion

Carefully align the pipe so that the dimension between the inside of the socket end and outside of the spigot (clearance between the socket and spigot) will be uniform, as illustrated in Figure 12. Keep the pipe aligned until joining work is over. After having aligned the pipe, use an insertion rod to insert the back-up ring into the clearance between the socket and spigot until the back-up ring will contact the lock ring over the entire periphery, as illustrated in Figure 13.

(Reference) If alignment is difficult in the lifted position, apply a hydraulic jack to the bottom of the pipe. This is also an effective way for alignment.

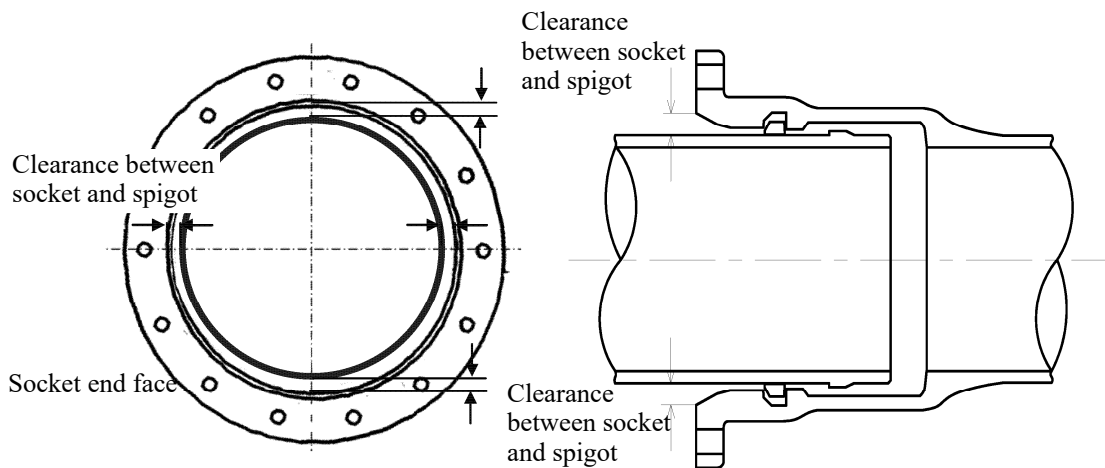


Figure 12 Pipe alignment

When inserting the back-up ring, take care of the following:

- ① Locate the lock ring cut portion between two red lines indicated on the back-up ring so that the cut portion of the back-up ring will not overlap the cut portion of the lock ring. (See Figure 13.)
- ② Make sure that the tapered surfaces of the cut portion of the back-up ring are facing each other. (See Figure 14.)

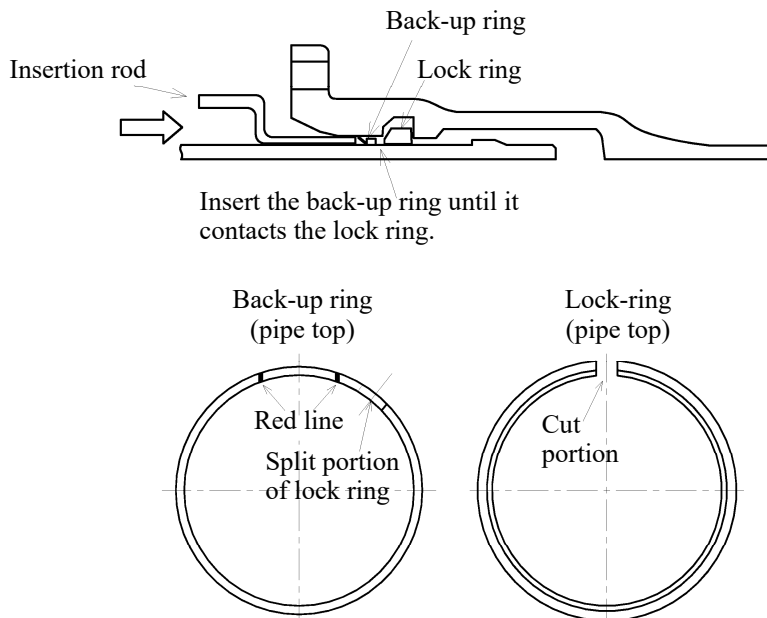


Figure 13 Back-up ring insertion

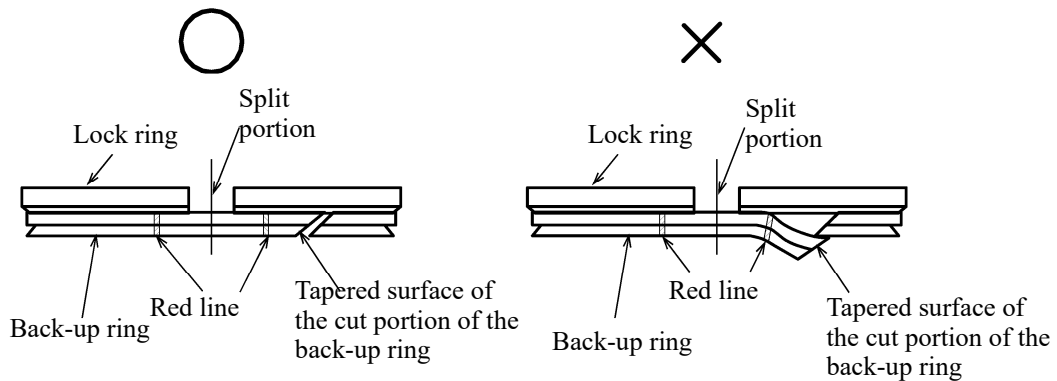


Figure 14 Checking the cut portion of the back-up ring

8. Rubber gasket insertion

- (1) Apply lubricant to the outer surface of the rubber gasket, outer surface of the spigot and inner surface of the socket. Figure 15 shows the range for lubricant application.

It should be noted that insertion of the rubber gasket may be difficult if the lubricant applied to the inner surface of the socket in step 7 has been dried. If so, apply lubricant again.
- (2) While maintaining the clearance between the socket and spigot uniform in the vertical and lateral directions, push the rubber gasket into the clearance between the socket and spigot.

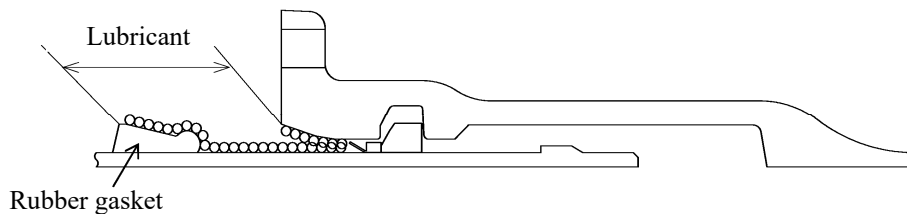


Figure 15 Application of lubricant

9. Setting the gland, T-head bolt and nut

(1) Setting the gland

As illustrated in Figure 16, arrange the split portions of the gland in the vertical direction (pipe top-bottom).

In the first place, pass a bolt into the bolt hole of the respective split portions and tighten the nut by hand so that they will be integral with the gland. After that, set all the bolts and nuts into the socket flanges and gland bolt holes.

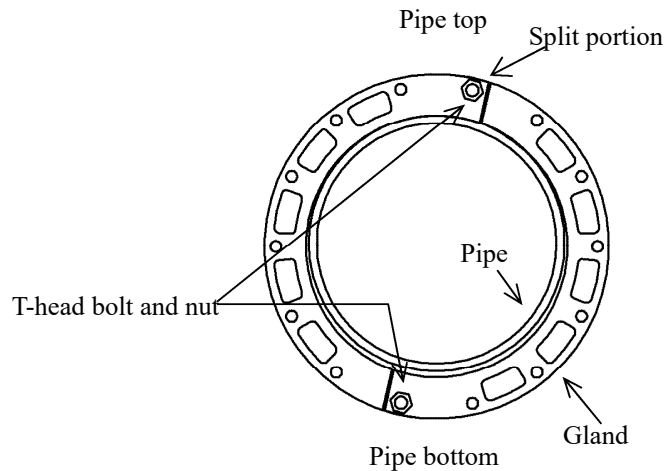


Figure 16 How to set the gland


CAUTION

When the gland is to be exchanged or set, check for safety. Otherwise, an accident such as fracture of the leg may occur when the gland has been dropped.


CAUTION

Make sure that the split portions of the gland are arranged in the vertical direction (pipe top-bottom). Otherwise, insertion of the rubber gasket may be partially insufficient, with the result that water leakage may occur.

(2) Gland alignment

As illustrated in Figure 17, set a wedge at two positions on the periphery of the gland split portions on the pipe top side and align the gland. After gland alignment, tighten all the bolts and nuts by hand.

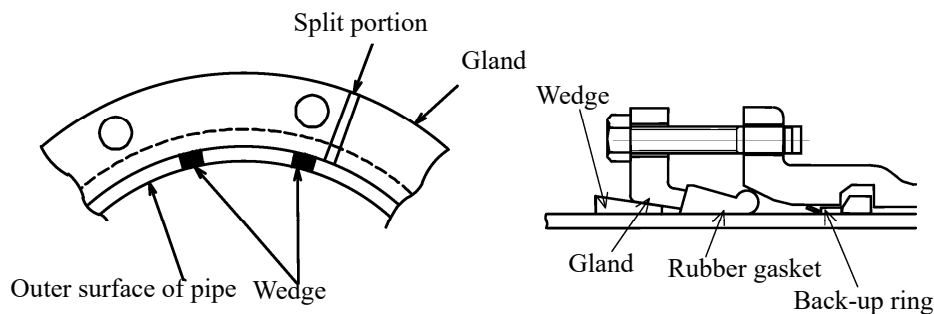


Figure 17 Gland alignment

10. Tightening

(1) Adjustment of standard joint gap and temporary nut tightening

Make adjustment so that the distance from the socket end face to the end face of the white line B will fall within the specified dimension range [2.8" to 3.1", (70 to 80 mm)], as illustrated in Figure 18. After that, as illustrated in Figure 19, use a ratchet wrench or spanner to tighten the nut little by little on the temporary basis until the round portion of the rubber gasket will be hidden behind the flange surface uniformly over the entire periphery.

Table 6 L₁-dimension

Pipe size	L ₁
20"	86.6" (220mm)
24"	86.6" (220mm)
28"	10.1" (257mm)
32"	10.4" (265mm)
36"	10.4" (265mm)
40"	10.6" (268mm)

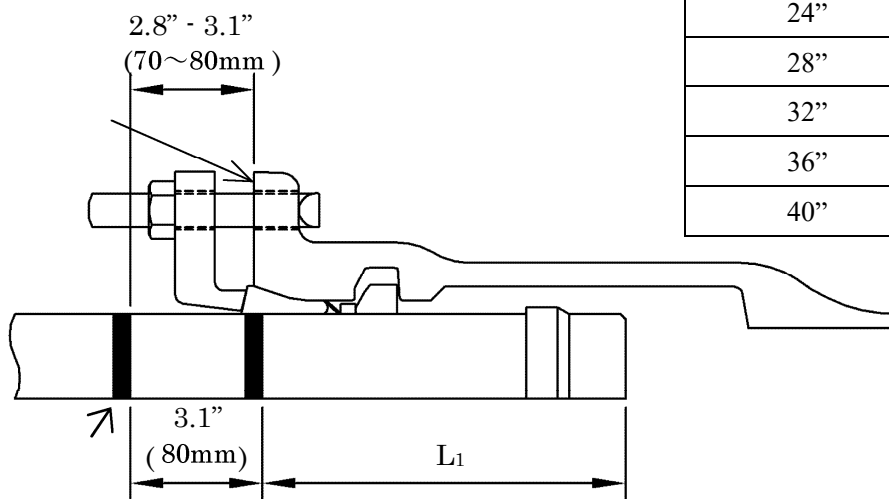


Figure 18 Standard joint gap

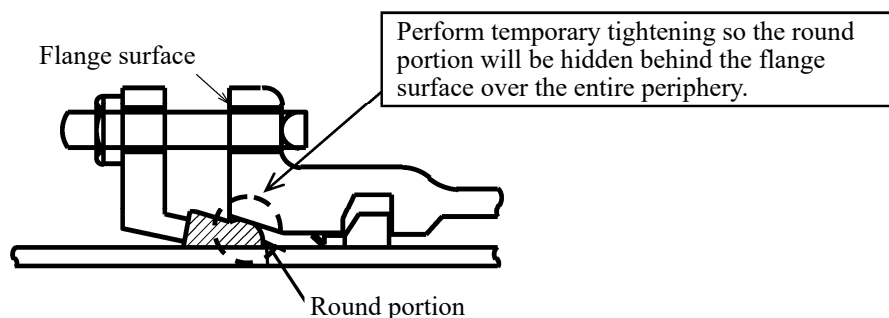


Figure 19 Temporary tightening and rubber gasket insertion

(2) Nut tightening

After temporary tightening, while making sure of the gland alignment, use a ratchet wrench or spanner to tighten the nuts so that the incoming/outgoing status of rubber gasket will be uniform.

- ① In the first place, tighten the nut located close to the gland split portion on the pipe bottom (the lower portion in Figure 20). Since the clearance between the socket and spigot tends to be comparatively small on the pipe bottom, tighten the nut in preference ("1st" in Figure 20).
- ② Secondly, tighten the T-head bolt and nut close to the split portion on the pipe top (on the top position in Figure 20).
- ③ Thirdly, tighten the nut on side of the pipe ("3rd" and "4th" in Figure 20).
- ④ After that, tighten the nuts on the almost symmetric positions alternately (tightening in a crisscross pattern). In this case, tighten the nut in preference where the space between the gland surface and socket end face is larger or where the rubber gasket is much protruded.

When tightening the nuts, take care of the following in particular:

- Tighten the nuts so that the incoming/outgoing state of the rubber gasket will be almost uniform over the entire periphery.
- Tighten the nuts so that the space between gland surface and socket end face will be almost uniform over the entire periphery. Take care in particular so that the split portions of the gland will not be bent.
- To ensure that uneven tightening will not occur, do not tighten the nut too much in one step. Tighten the nuts in several steps on a per-1/2 inches basis as a guide.

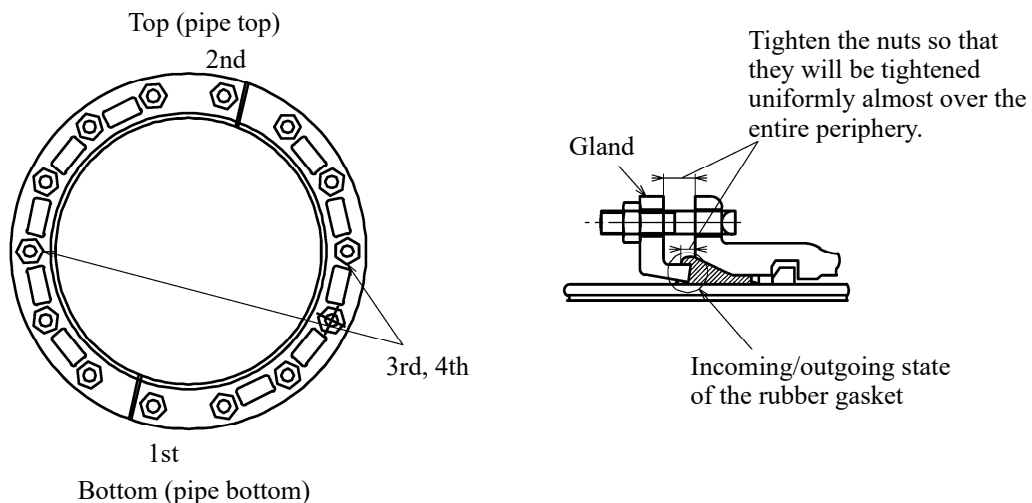


Figure 20 Tightening of bolts and nuts

(3) Additional tightening of nuts

Before the standard tightening torque shown in Table 7 has been reached, perform one additional tightening operation over the entire periphery by a torque wrench in conformity to the method of Figure 21, until the standard tightening torque is reached.



CAUTION

To manage the tightening torque, use a torque wrench that has passed the inspection.

Table 7 Standard tightening torque

Pipe size	Bolt diameter	Standard tightening torque (N·m)
20", 24"	M20mm	100 (73.7ft-lb)
28", 32"	M24mm	140 (103.2ft-lb)
36", 40"	M30mm	200 (147.4 ft-lb)

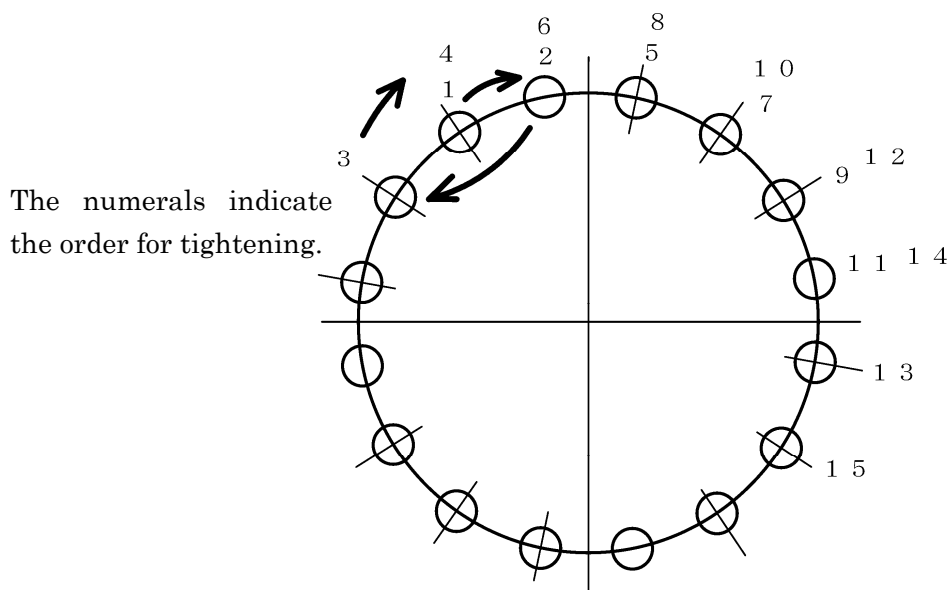


Figure 21 Method of additionally tightening nuts

(4) Confirming tightening torque

After performing one tightening operation over the entire periphery at the standard tightening torque, if the first nut for which tightening was started at the standard tightening torque (bolt 1 in Figure 21) can be moved by hand, tighten only the 1st and 2nd nuts again at the standard tightening torque.


CAUTION

After performing one tightening operation over the entire periphery at the standard tightening torque, if any nut other than the 1st or 2nd nut is tightened again at the standard tightening torque, the tightening torque will be too large.

11. Checking connection

After tightening the bolts and nuts, check the following items:

(1) Checking for uniform tightening of bolts and nuts

- ① As illustrated in Figure 22, measure the clearance between the gland and socket end face at four locations, and make sure that the difference between the maximum and minimum values does not exceed 0.2" (5 mm).
- ② If the difference between the maximum and minimum values on the same circumference in ① exceeds 0.2" (5 mm), disassemble, inspect and check the joint. Then make the parts joined again. In this case, replace the rubber gaskets and back-up rings by new ones.

(2) Checking the clearance from socket end face to white line

Measure the clearance X from socket end face to white line B. Make sure that the clearance falls within the specified dimension range [2.8" to 3.5" (70 to 89 mm)].

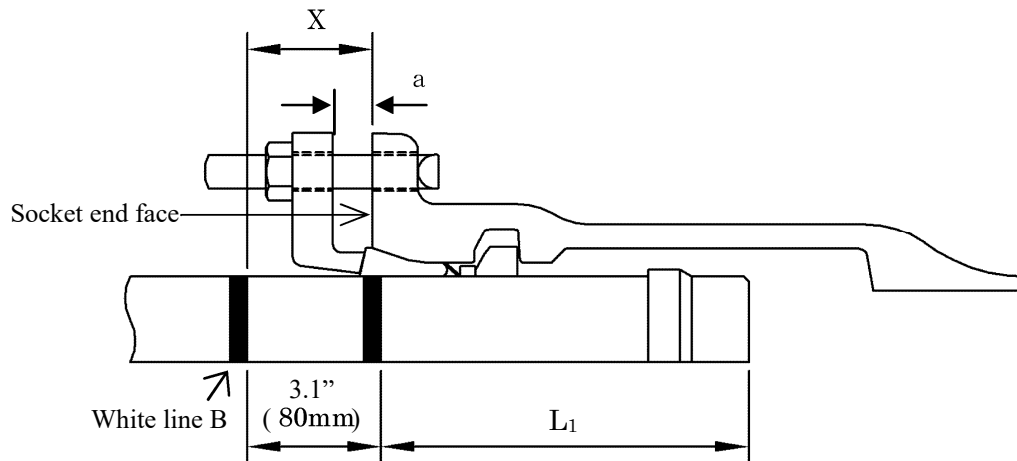


Figure 22 Measurement of clearance between socket end face and gland, and clearance between socket end face and white line

(3) Checking the incoming/outgoing state of rubber gasket

- ① As illustrated in Figure 23, check the incoming/outgoing state with reference to the socket end face of the rubber gasket at four locations. Make sure that there is no simultaneous presence of the states A and C or A, B and C on one and the same circumference.
- ② If there is a simultaneous presence of the states A and C or A, B and C in the incoming/outgoing state of the rubber gasket in the above description, disassemble the joint and then make the parts joined again.

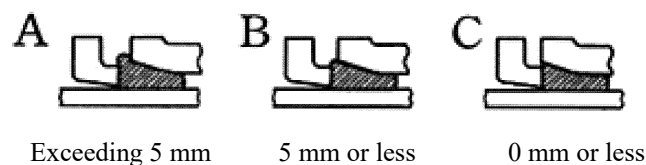


Figure 23 Incoming/outgoing state of rubber gasket

③ Curling of rubber gasket

Make sure that there is no abnormal state such as "the corner of a rubber gasket overriding the gland" or "local rise of rubber gasket" over the entire periphery, as illustrated in Figure 24.

The pipe bottom is particularly difficult to check, but must be checked by all means because a trouble tends to occur to this portion.

If the corner of a rubber gasket overrides the gland, or there is a local rise of rubber gasket, this shall be considered as abnormal. Disassemble the joint and then make the parts joined again. In this case, replace the rubber gasket and back-up ring by new ones.

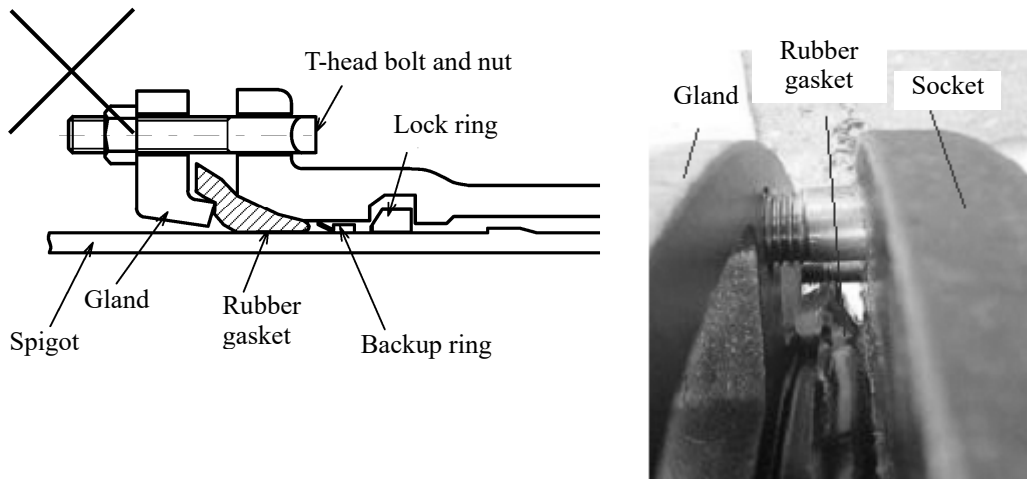


Figure 24 Overriding of rubber gasket (connection failure)

12. Fill in check sheet

The check sheet is used for quality management of ductile iron pipe joining. Fill in the check sheet shall be performed immediately when joining work has been done. (The check sheet is given by manufactures.)

End