

I. General

1. Pipes with S Joint

- (1) Abbreviation symbol:
- (2) Pipe size: 20 in. to 104 in. (In this manual, pipes size 20 in. to 40 in. and 84 in. to 104 in. are omitted.)
- (3) Nominal pipe wall thickness: Class 1, 2 and 3
- (4) S joint: see Figure 1

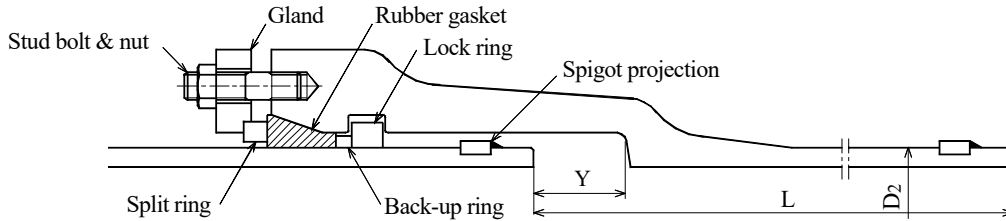


Figure 1 Pipe with S joint

- (5) Dimensions of pipe: see Figure 1 and Table 1

Table 1 Dimensions of pipes with S joint

Size (in.)	Outside diameter D_2 (in.)		Standard gap Y (in.)	Nominal laying length L
	Nominal	Tolerance		
44	45.04	+0.08 -0.16	3.15	19.69' (236.22")
48	49.06			
54	55.12			
60	61.18		2.95	13.12' (157.48") and 16.40' (196.85")
64	64.96			
66	66.97			
72	72.76			
80	81.14		3.15	

Note 1. In case that the converted circumferential diameter is not less than the minimum value in the above table, additional negative tolerance 0.04" on the outside diameter can be allowed.

Note 2. In this manual, units of feet and inches are expressed by (figure)' and (figure)" respectively.

2. Collar with S joint

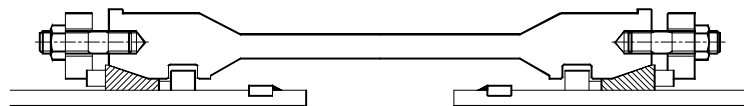


Figure 2 Collar with S joints

4. Accessories

1) Connecting pieces of lock ring

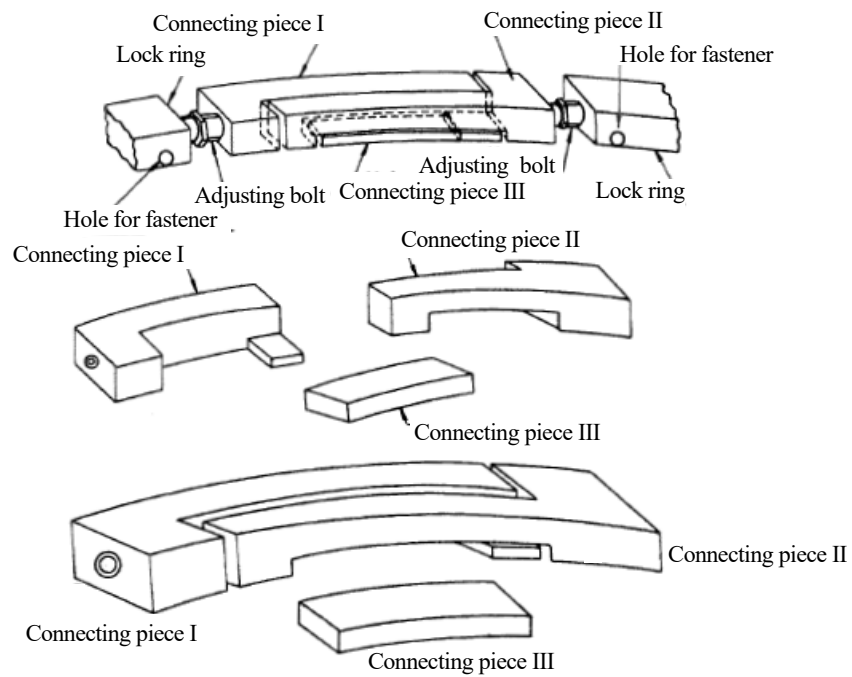


Figure 3 Connecting pieces of lock ring

2) Materials of accessories

- (1) Rubber gasket: SBR (EPDM)
- (2) Gland: Ductile iron
- (3) Split ring: Ductile iron
- (4) Stud bolt and nut: Stainless steel
- (5) Lock ring: Ductile iron
- (6) Connecting pieces and adjusting bolt: Stainless steel
- (7) Back-up ring: SBR (EPDM)

II. Jointing Procedure of Pipes

Assemble S joint strictly in accordance with this manual. If not, the assembled joint may leak or not be restrained.

To ensure the assembled joint, it is recommended checking the joint conditions with “Joint check sheet”.

1. Laying of pipe

Check the ovality of the spigot (see Table 1). If the spigot has an excessive ovality, correct it.

Locate the manufacturer's mark ⊗ on the socket end at the top then lay the pipe slowly in the trench.

Make the tapped bolt holes on the socket face symmetrical about the vertical center line.

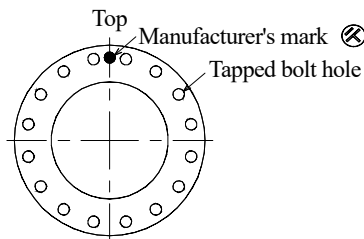


Figure 4 Position of manufacturer's mark

2. Cleaning of socket and spigot

Remove the oil, sand and other deposited foreign substances completely from the inside surface of socket and outside surface of spigot within the distance of about 24” from the spigot end.

3. Adjustment of lock ring connecting pieces

- 1) Screw one side of the adjusting bolt into the tapped hole on the end of the lock ring by only one thread then the other side into the tapped hole on the connecting piece I by only one thread (see Figure 5). In this case, make the direction of the hole for fastener on the lock ring and slot portion of connecting piece I same, and screw the reverse screw of the adjusting bolt into the connecting piece I.

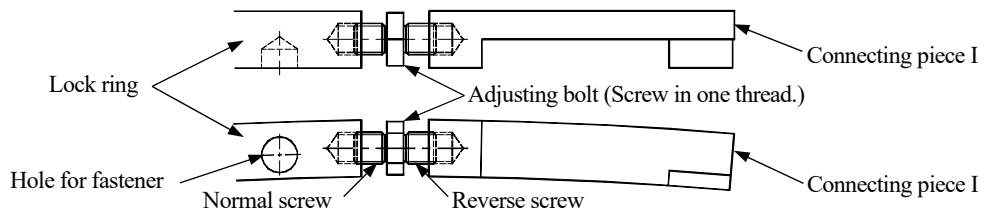


Figure 5 Connecting piece I and adjusting bolt of lock ring

- 2) Connect the lock ring and connecting piece II with adjusting bolt with the same manner as connecting piece I (see Figure 6).

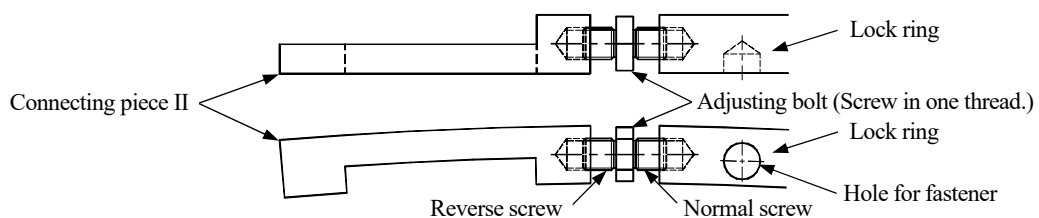
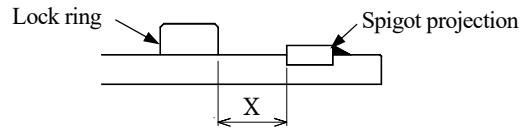


Figure 6 Connecting piece II and adjusting bolt of lock ring

- 3) Place the connecting piece I and II at the top and make the direction of the hole for fastener on the lock ring opposite to the spigot projection. Set the lock ring on the spigot of pipe at the distance X from the spigot projection as shown in Table 2.

Table 2 Position of lock ring on the spigot



Size (in.)	X (in.)
44 to 60	3.2
64 to 72	3.0
80	3.2

Contract the lock ring lightly with the fastener by fastening the nut by hand and fix it to the pipe. Make sure that the lock ring and spigot projection are in parallel around the pipe (see Figure 7).

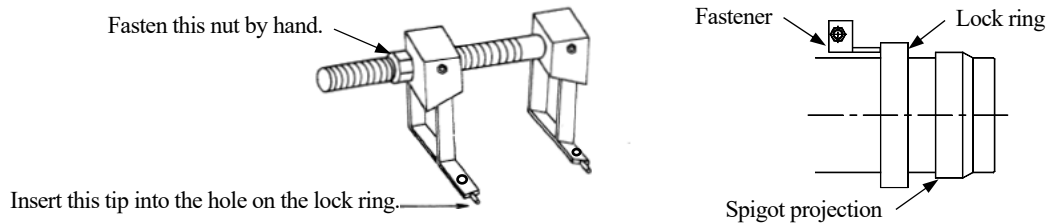


Figure 7 Lock ring fastener

- 4) Contract the lock ring by fastening the nut of fastener lightly with spanner until the lock ring touches the pipe surface. Place the connecting piece III into the space between the connecting piece I and II. Make the gap between connecting piece I and III about 0.06" to 0.08" by adjusting bolts. In this case, make the gap a and b between the lock ring and connecting piece I and II respectively almost same.

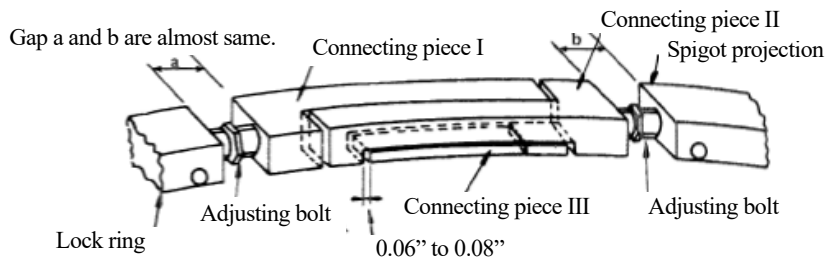


Figure 8 Adjustment of lock ring connecting pieces

- 5) Loosen and remove the fastener from the lock ring. Confirm that the lock ring contacts with the pipe all around the spigot. Check the gap between the lock ring and pipe outside surface with 0.04" thick gage. There shall be no gap of over 0.04" in a wide area along the circumference of the lock ring.
- 6) Take out the connecting piece III then remove the lock ring from the spigot. In this case, do not turn the connecting pieces around the adjusting bolts. Do not miss the connecting piece III.

4. Set of lock ring

- 1) Contract and insert the lock ring into the groove of socket inside. In this case, locate the connecting piece I and II at the top of the socket and do not turn them around the adjusting bolts.

2) Attach the expander between the connecting piece I and II then expand the lock ring so that whole lock ring is stored in the groove all around the socket (see Figure 9).

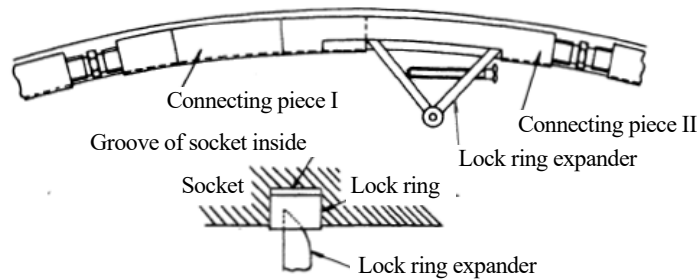


Figure 9 Expansion of lock ring with expander

5. Set of gland and split ring

Clean the gland and split ring and set them on the spigot (see Figure 10). In this case, locate the split portion of the split ring at the pipe bottom.

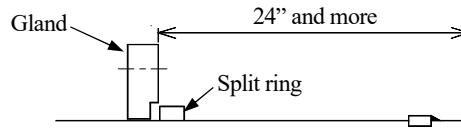


Figure 10 Set of gland and split ring on the spigot

6. Set of rubber gasket and back-up ring

1) Apply lubricant to the spigot outside and socket inside (see Figure 11).

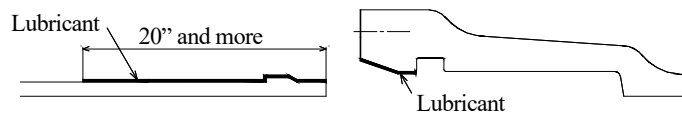


Figure 11 Application of lubricant

2) Confirm the indication mark of the joint type “S” on the backside of the rubber gasket. Clean the rubber gasket and back-up ring. Apply lubricant to the inside surface of the rubber gasket then set them on the spigot (see Figure 12). In this case, the reinforcement metal on the side of back-up ring is opposite side of the rubber gasket (see Figure 13).

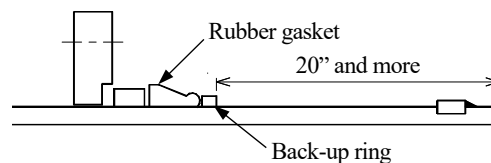


Figure 12 Set of rubber gasket and back-up ring

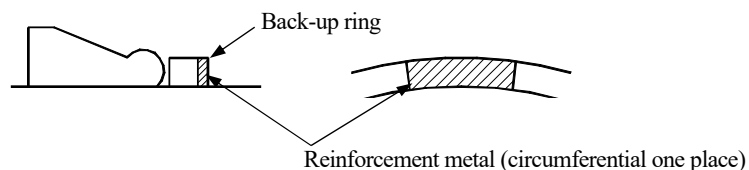
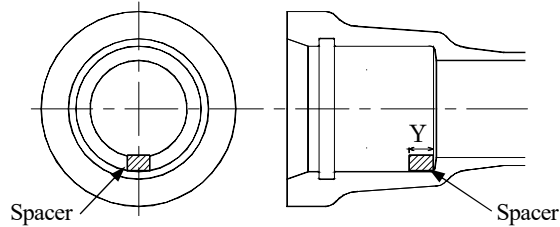


Figure 13 Reinforcement metal of back-up ring

7. Insertion of spigot into socket

- 1) Place the spacer, made of wood or steel, on the bottom of the socket inside (see Table 3).

Table 3 Spacer



Size (in.)	Y (in.)
44 to 60	3.15
64 to 72	2.95
80	3.15

- 2) Lift the pipe with crane then insert the spigot slowly into the socket until the spigot end touches the spacer. When the spigot has passed the lock ring, the expander falls automatically. If the spigot projection touches the lock ring and the pipe gets stuck in the socket, push the pipe by swinging side to side.

8. Contraction of lock ring

- 1) Rest the spigot projection on the socket bottom then contract the lock ring with the fastener at the top of pipe (see Figure 14).

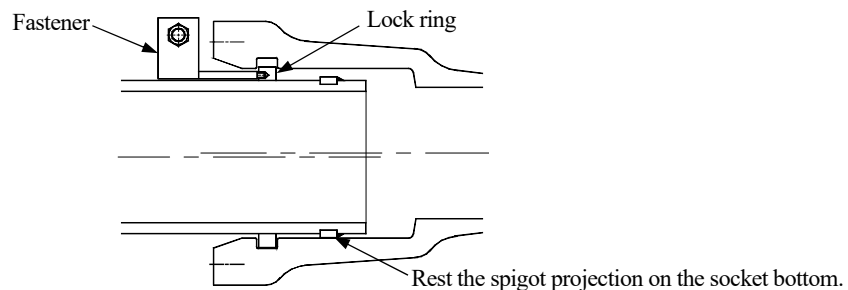


Figure 14 Contraction of lock ring

- 2) Put the connecting piece III on a thin steel plate then place it into the space between the connecting piece I and II (see Figure 15). Then remove the lock ring fastener.

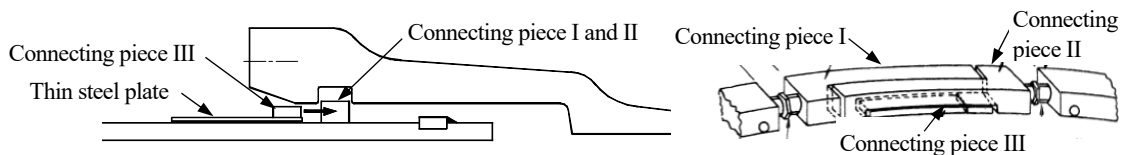


Figure 15 Set of connecting piece III

Check the gap between the lock ring and pipe outside surface. The lock ring, connecting piece I, II and III shall contact with the pipe surface all around the spigot and there shall be no gap of over 0.04" in a wide area between the pipe outside surface and the lock ring.

9. Insertion of back-up ring

Lift the spigot pipe with crane then align the socket pipe and spigot pipe so that the clearance between the socket inside and spigot outside is uniform all around the pipe. Insert the back-up ring into the clearance between the socket and spigot with suitable plate or rod until the back-up ring touches the lock ring all around the pipe by adjusting the clearance between the socket and spigot. Confirm that the back-up ring is not twisted.

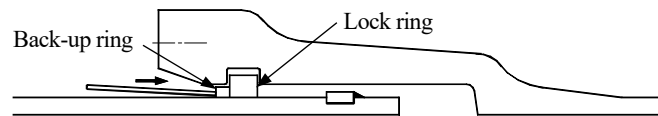


Figure 16 Insertion of back-up ring

10. Insertion of rubber gasket

- 1) Apply lubricant to the external surface of the rubber gasket. If previously applied lubricant to the spigot outside and socket inside dried, apply lubricant to them again.
- 2) Push the rubber gasket into the clearance between the socket and spigot. In this case, do not push the rubber gasket with sharp-edged tool like a chisel which will damage the rubber gasket.

11. Set of bolts

Make sure that there are no foreign materials on the thread portion of the bolt. Screw the whole shorter threads of the stud bolts into the tapped holes on the socket face.

12. Tightening of nuts

- 1) Place two wedges between the gland and pipe at the top to align the bolt holes on the gland with the bolts of the socket end (see Figure 17). In this case, never damage the threads of the bolts. Push the gland and split ring to the socket then fasten several nuts by hand.

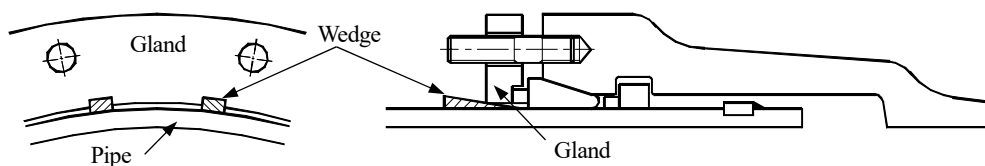


Figure 17 Alignment of gland and pipe

- 2) Mate the recession of gland with the split ring all around the pipe. In this case, make sure that split portion of the split ring is at the pipe bottom.

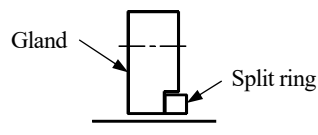


Figure 18 Gland and split ring

- 3) Attach the nut to each bolt then tighten the nuts little by little with ratchet wrench or spanner in accordance with the following steps so that the rubber gasket goes into the socket uniformly all around the spigot.

(1) At first, tighten the nuts at the top and bottom, then secondly at the both sides of pipe.

(2) Tighten the nuts on the diagonal symmetric positions alternately to make the gap between the gland and socket end uniform all around the socket (see Figure 19).

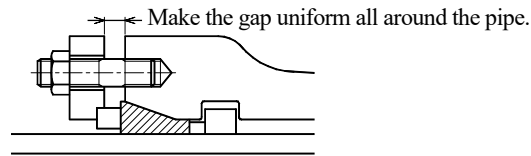


Figure 19 Tightening of nuts

4) Check the tightness of fastened bolts and nuts with torque wrench by the bolting torque shown in Table 4 once around the socket in accordance with the order shown in Figure 20. In this case, use calibrated torque wrench.

Table 4 Standard bolting torque

Size (in.)	Bolt size (mm)	Standard bolting torque (ft-lb)
44 to 80	M30	147.4

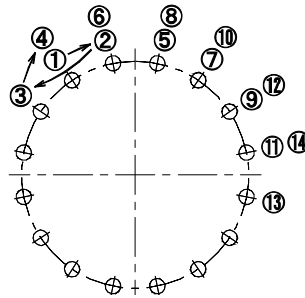


Figure 20 Bolting torque checking order

5) Take out the spacer and lock ring expander from the pipe inside.

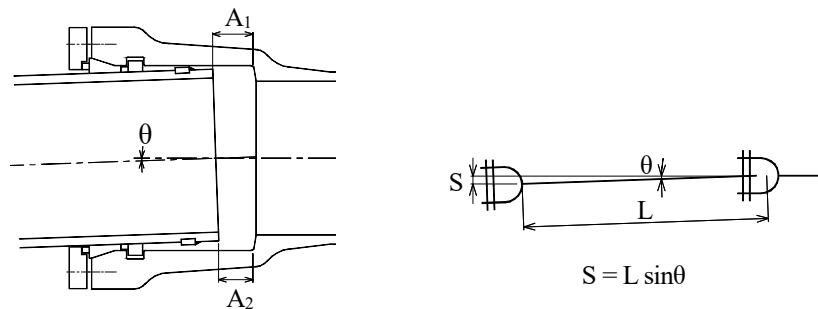
III. Joint with Deflection

- 1) Align the pipes in straight then assemble the joint in accordance with Section 1 to 12 3) of Clause II.
- 2) Fasten all nuts lightly then deflect the joint to the required angle within the allowable deflection angle shown in Table 7.

It is recommended deflecting the joint within a half of the allowable angle for future deflection after pipes are laid. Do not deflect the joint over the allowable angle in any case.

The deflected angle can be checked by measuring the longest and shortest distances between the spigot end and socket bottom at the inside of pipe (see Table 5).

Table 5 Allowable joint deflection angle and deflected joint



Size (in.)	Allowable deflection angle θ	$A_1 - A_2$ (in.)	Allowable offset S (in.) per one pipe		
			L=13.12'	L=16.40'	L=19.69'
44	1° 40'	1.30	-		6.69
48	1° 30'	1.30	-	-	5.90
54	1° 30'	1.46	-	-	5.90
60	1° 30'	1.61	-	-	5.90
64	1° 30'	1.69	3.93	5.11	-
66	1° 30'	1.77	3.93	5.11	-
72	1° 30'	1.89	3.93	5.11	-
80	1° 30'	2.13	3.93	5.11	-

- 3) Tighten the all nuts in accordance with Section 12 of Clause II.

IV. Installation Procedure of Collar

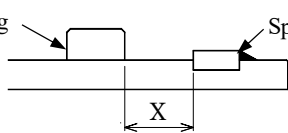
Installation procedure of collar differs depending on the pipe laying order as below.

1. Connection of two pipes laying in order to the same direction

Joint assembling procedure of collar is the same as that of pipes except for the position of the lock ring at adjustment of the connecting pieces which shall be as shown in Table 6.

Table 6 Position of lock ring at adjustment of connecting pieces for collar

Lock ring	Spigot projection
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Size (in.)	X (in.)
44 to 72	2.8
80	2.4

2. Connection of two pipes laid from opposite side

- 1) Adjust the length of the lock ring and connecting pieces for each spigot pipe to be connected.
- 2) Provide a white marking on each pipe at 40" apart from the spigot end.
- 3) Set the gland, split ring, rubber gasket and back-up ring on the spigot of each pipe to be connected.
- 4) Set the lock ring to the socket of collar to face the laid pipe but not the opposite side socket.
- 5) Expand the lock ring then pass the whole length of collar through the spigot (see Figure 21).

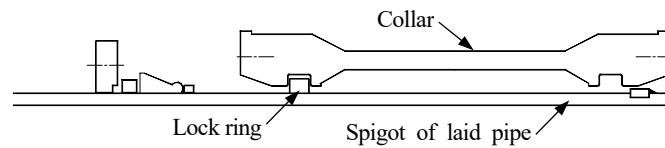
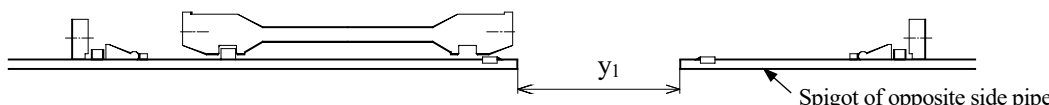


Figure 21 Set of collar on the spigot

- 6) Lay the opposite side pipe so that the distance between the spigots conforms to the value in Table 7 then mate the two spigots.

Table 7 Standard distance between the spigots in collar



Size (in.)	y_1 (in.)
44, 48	11.8
54	12.2
60	12.6
64, 66	12.8
72	13.0
80	13.2

- 7) Shift the collar to the opposite side pipe slightly then set the lock ring to the opposite side socket (see Figure 22).

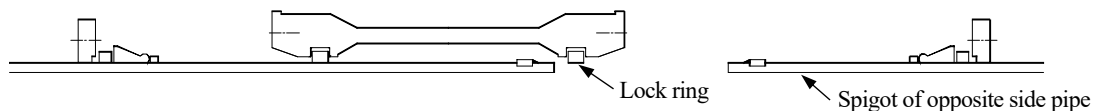


Figure 22 Set of lock ring to opposite side socket

- 8) Expand the lock ring with expander. Insert the stopper between the connecting piece I and II (see Figure 23) and remove the expander.

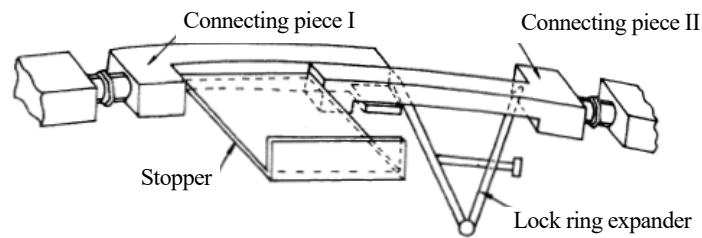


Figure 23 Lock ring stopper

- 9) Slide the collar to the opposite side pipe so that the midst of the collar is at the midst of the standard distance y_1 between the spigots. This is ensured by making the distance between the white marking and socket end of the collar on each spigot pipe same (see Figure 24).

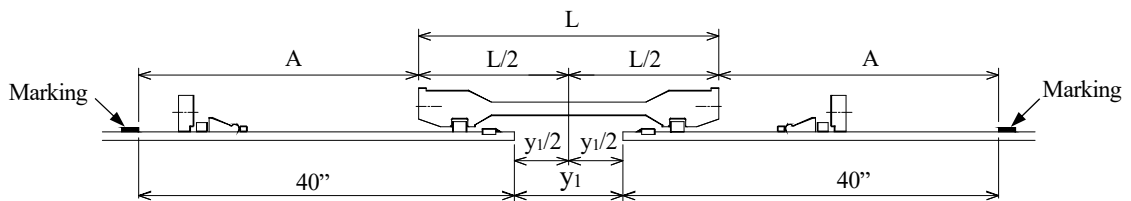


Figure 24 Correct position of collar

- 10) Assemble the joints with the same procedure as pipes.

V. Preparation of Cut Pipe Spigot for Size 64 in. and Smaller Pipes

When spigot of field-cut pipe is to be connected to the S socket of pipe, it is necessary to form the spigot projection by grooving the spigot end and setting the spigot ring in the groove (see Figure 25).

Formation of the spigot projection on site is limited to size 64 in. and smaller pipes. In case of size 66 in. and larger pipes, pipes cut into the required length are supplied by the pipe manufacturer.

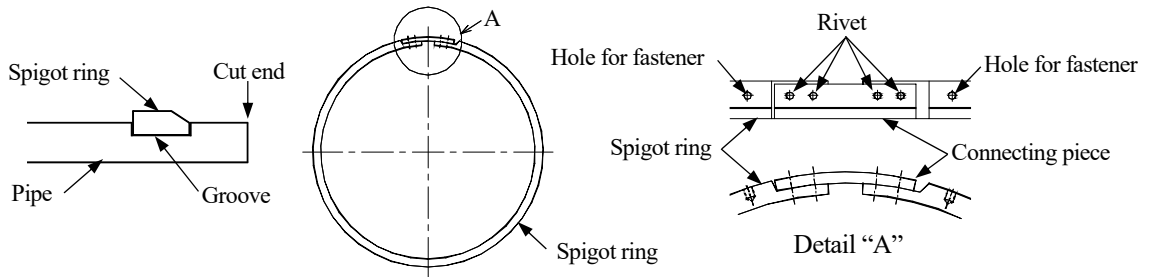


Figure 25 Spigot ring for spigot projection

1. Effective length of cut pipe

The nominal length of cut pipe shall be as shown in Figure 26.

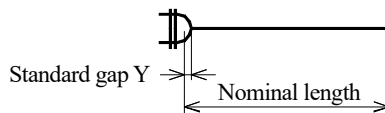


Figure 26 Effective length of cut pipe

Note. When cut pipe will be connected with S joint collar, decide the length of the cut pipe by taking the distance y_1 between the spigot ends in the collar into consideration.

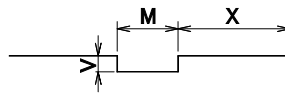
2. Pipe for cutting

Cut only the gauged pipe with Class 1 thickness. The gauged pipe, which outside diameter is suitable to joint along the pipe axis, can be identified by a white line marked around the socket neck.

3. Grooving of spigot

1) Cut the pipe into the required length with cutting machine then groove the spigot with grooving machine. The position and dimensions of the groove are shown in Table 8.

Table 8 Position and dimensions of groove



Size (in.)	V (in.)		M (in.)		X (in.)	
44, 48	0.20	+0.04	1.26	+0.06 -0.02	1.97	±0.16
54		-0.02			2.36	
60	0.24	+0.06	1.46		2.17	
64		-0.02				

- 2) Bevel the corner of the groove and the cut end of pipe with file or grinder.
- 3) Apply suitable coating to the exposed iron at the groove and cut end of the pipe. If cement mortar lining is damaged at the cut end, repair the damaged lining.

4. Set of spigot ring

- 1) Confirm that there are no foreign materials such as sand in the groove of the spigot.
- 2) Insert 1/4" x 0.4" long bolt into the hole on the jaw of the lock ring fastener. Set the spigot ring in the groove then insert the 1/4" bolts on the lock ring fastener into the holes on the spigot ring. Contract the spigot ring with the fastener and fix it to the groove of the spigot (see Figure 27).

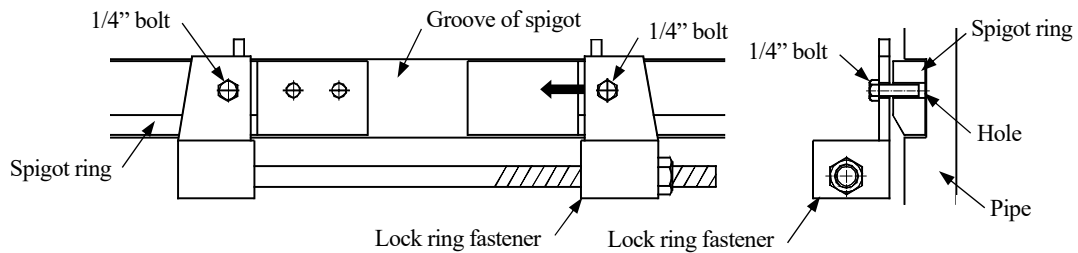


Figure 27 Set of spigot ring in the groove of spigot

- 3) Tamp the spigot ring lightly with plastic hammer until the tapered side touches the spigot end side wall of the groove (see Figure 28).

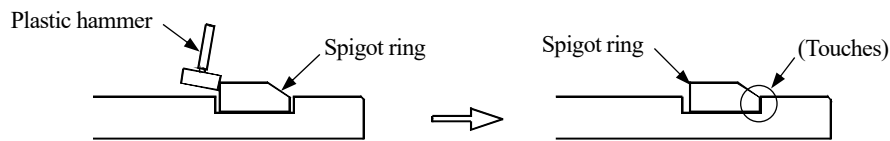


Figure 28 Correct position of spigot ring in the groove

- 4) Confirm by hand that the spigot ring does not move laterally and circumferentially. If moved, reset the spigot ring again.
- 5) Attach the connecting piece on the spigot ring by inserting the rivets into the holes of spigot ring and connecting piece (①, ② of Figure 29). Fix the spigot ring and connecting piece to the groove with vise. Mark the riveting positions on the spigot ring by drilling shallow holes with drilling machine through the holes of the connecting piece (③, ④ of Figure 29). Use 0.161" - 0.165" diameter drill.

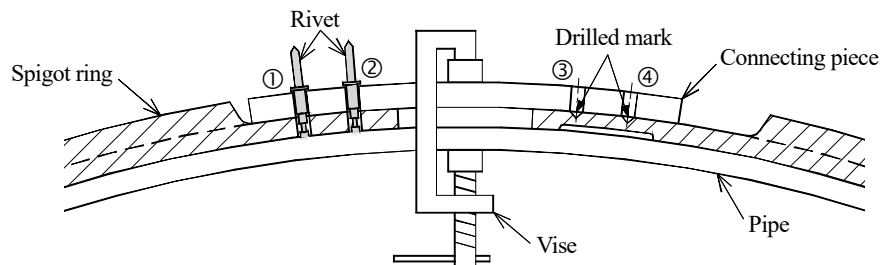


Figure 29 Set of spigot ring

- 6) Remove the vise then take out the spigot ring from the groove of spigot. Drill two penetrated holes on the spigot ring at the drilled mark (③ and ④ of Figure 29).

- 7) Confirm that there are no foreign materials such as sand in the groove of spigot and spigot ring.
Set the spigot ring in the groove of spigot then fix it to the groove by contracting with the fastener in accordance with above 2) to 4).
- 8) Align the drilled holes on the spigot ring and connecting piece then insert the rivets into the holes of spigot ring and connecting piece. Fix them with vise to the groove then rivet them in the order ①, ②, ③ and ④ of Figure 30.
- In this case, squeeze the handle of riveter not at once but in several times.

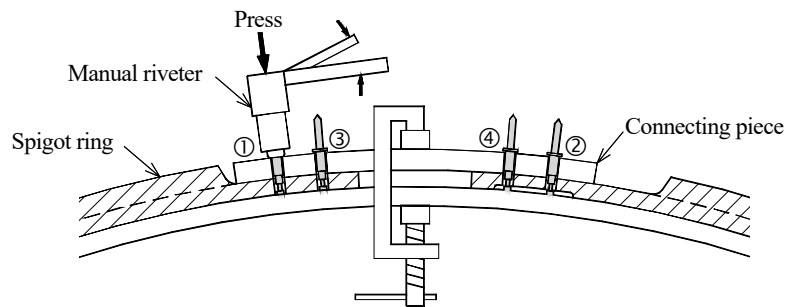


Figure 25 Riveting of spigot ring and connecting piece

- 9) Remove the vise then confirm by hand that the spigot ring does not move circumferentially and laterally. If moved, reset the spigot ring again.

VI. Disassembling of Joints

- 1) Loosen and remove all nuts.
- 2) Shift the gland and split ring about 20" far from the socket end.
- 3) Take out the rubber gasket and split ring by using flat-blade screwdriver with bent tip. In this case, never damage the threads of the bolts.
- 4) Contract the lock ring with the fastener then take out the connecting piece III.
- 5) Pull out the spigot until the spigot projection comes to the lock ring. Expand the lock ring with the fastener by hand. Hammer the wedge plates into the gap between the lock ring and spigot over the spigot projection at 6 to 8 places around the pipe.

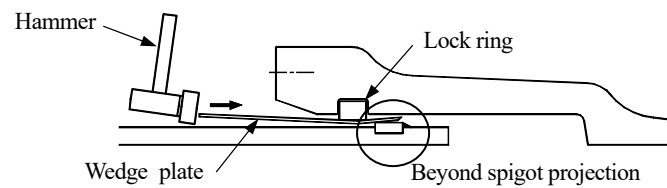


Figure 31 Wedge plate

- 6) Align the jointed pipes with crane. Pull out the lifted pipe slowly from the socket by swinging it.

Annex

Special Tools for S Joint Assembling/Disassembling and Pipe Cutting

Description		Quantity	Remark
1. Joint assembly			
(1)	Lock ring fastener	1	(Spanner by contractor)
(2)	Thickness gauge (0.04" thick)	1	
(3)	Lock ring expander	1	
(4)	Thin steel plate for connecting piece III insertion	1	(by contractor)
(5)	Torque wrench	1	174 ft-lb (M30) (by contractor)
(6)	Wedge for gland alignment	2	(by contractor)
(7)	Spacer	1	(by contractor)
(8)	Stopper for lock ring of collar	1	
(9)	Lubricant	-	(by contractor with brush)
2. Spigot projection formation of cut pipe			
(1)	Pipe cutting & grooving machine	1	(Power source by contractor)
(2)	Lock ring fastener	1	(Two 1/4" x 0.4" long bolts by contractor)
(3)	Vise	1	(by contractor)
(4)	Drilling machine	1	(by contractor with 0.16" dia. drill)
(5)	Manual riveter & rivets	1	4 rivets / connecting piece
(6)	Grinder or file	1	(by contractor)
(7)	Paint for cut pipe	1	(Brush by contractor)
3. Joint disassembly			
(1)	Wedge plate	8	