Procedure for Field Welding of Restrained Joint Ductile Iron Pipe

Factory welded joints are made with Ni-Rod 44 welding wire with special welding equipment. The welds are superior to field welded joints because they have little effect on the microstructure of the ductile iron pipe. However, it is not feasible to field weld with this process. The following field welding procedure encompasses the recommendations of our own Research Department and Inco Alloys, Inc. who are recognized experts in ductile iron welding.

Griffin Pipe is not responsible for welding techniques other than the factory applied weld performed by our own people; therefore, Griffin Pipe Products Co. assumes no liability whatsoever for any problems resulting from the field welding of ductile iron restrained joint pipe.

Procedural Instructions:

1. All surfaces that are to be welded should be cleaned to expose only sound, unoxidized metal. There should be no foreign materials such as rust, dirt, scale, paint, or grease in the weldment area. Abrasive grinding, shot or grit blasting would be a suitable means of surface preparation to meet this requirement.

2. The Cor-Ten steel ring should be clamped securely on the pipe in the position specified by Griffin drawings shown on pages 2 and 3, and clamped tight to the pipe using the clamp loaned by Griffin Pipe. The ring must be square to the pipe.

3. The welding equipment should be an electrical welding machine capable of providing direct current, reverse polarity, and the welding amperage range of 70-95 amps.

4. Welding electrodes should be 1/8" diameter Inco Alloy Ni-Rod 44 for welding ductile iron.

5. Welding should be accomplished by the backhand method and a maintenance of a short arc length and an electrical current range of 70-95 amps. The electrode angles should be 60 degrees from the horizontal in the direction of travel, and 45 degrees from the horizontal directly into the fillet weld. Polarity should be reversed. The backhand method means the electrode is tilted in the direction of travel.

6. The Cor-Ten steel ring is tack-welded to the pipe first using three or four tack welds depending on the size of the pipe. Each tack would be 3/4" to 1" long. For pipe of 12" in size, it is usually best to make four tack welds. Unless the ring is secured by tacking before welding a continuous pass, it will expand out of position. The weld is always to be on the spigot side of the Cor-Ten ring.

7. After the tack welds are completed, the clamping fixture is to be removed and the first pass is finished by filling in the area between the tacks.

8. All rings should be welded with two passes. The first pass should be a buttering pass made only on the pipe adjacent to the restraining ring. The second pass should be a fillet weld that joins the ring to the previous pass. The finished weld must provide a weld fillet of a minimum of 3/8".

After each welding pass it is important that the weld be cleaned of slag before initiating the next pass.

In general, the reason for limiting the size of welding electrodes and welding current is to minimize the possibility of the development of cracks in the weld area.

When multiple welding passes are made this also tempers the brittle structure developed in the heat affected zone and results in a stronger, more reliable weld.

When welding is completed, the pipe should be allowed to cool slowly. Forced cooling of any kind should be avoided.

All welds should be made in a position as close to the flat position as possible. It is advisable that some means of rotating the pipe to accomplish this be provided.

It is very important to realize that ductile iron is much more sensitive to heat treatment than most steels which makes it necessary that this procedure be carefully followed.

If any problems such as cracks are encountered in the attempt to weld rings on ductile iron pipe, professional assistance should be sought before proceeding further.

All welds are to exhibit good fusion with no undercuts, no overlaps, no slag inclusions, and no cracks.

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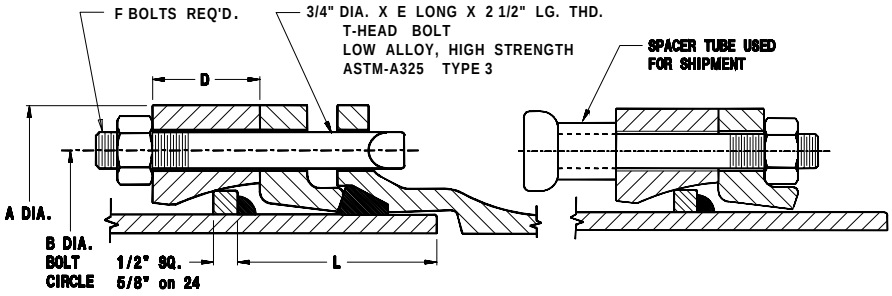
Bolt-Lok™ Restrained Joint Ductile Iron Pipe

4" Thru 24" MJ Flexible Restrained Joint GENERAL ASSEMBLY



Assembly Instructions

A special mechanical joint gland is used with this joint and should not be replaced or otherwise substituted. The special feature of this gland is that its rear face or surface is smooth so that it may, in cooperation with the restraining flange, move or slide radially to accommodate joint deflection.

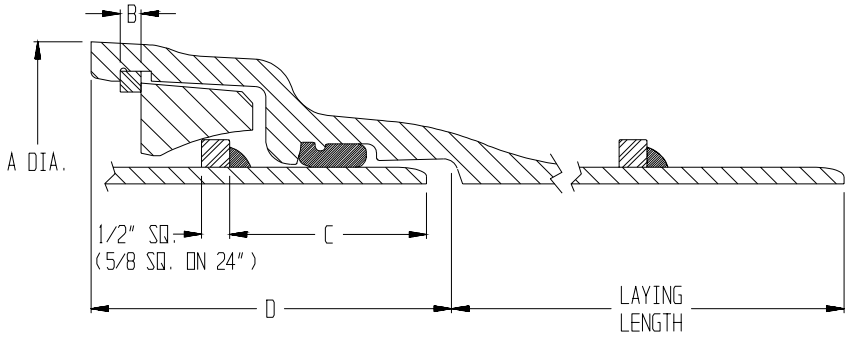
1. Clean bell and plain end. Lubricate both pipe end and gasket cavity with pipe joint lubricant. The joint area must be free of dirt.
2. Place gasket over spigot end and slide back to mechanical joint gland. Narrow end of gasket should face spigot end of pipe. Lubricate the gasket surface.
3. Insert spigot into socket, keeping pipe in straight alignment.
4. Insert T-head bolts through bell flange, mechanical joint gland and then restraining flange. Place nuts on T-head bolts and finger tighten.
5. Remove T-head bolts which hold mechanical gland to restraining flange and reinsert from opposite direction. Discard spacer which is only used for shipping. Place pipe in final deflected position.
6. Tighten nuts uniformly, maintaining mechanical joint gland parallel to mechanical joint socket flange during tightening. Tighten until torque of 120-150 foot-pounds has been reached.

Size	A Dia.	B Dia.	D	E	F	L	Defl. Angle
4	9.38	7.50	2.00	6	4	3¾	4°
6	11.38	9.50	2.00	6	6	4	4°
8	13.63	11.75	2.25	6	6	4	4°
10	15.88	14.00	2.25	6	8	4	4°
12	18.19	16.25	2.50	7	8	4	4°
14	20.50	18.75	2.50	7	10	5¼	3°
16	22.75	21.00	2.63	7	12	5¼	3°
18	25.75	23.25	2.63	7	12	5½	2½°
20	28.25	25.50	2.88	8	14	5¾	2½°
24	32.50	30.00	3.00	8	16	5¾	2°

Size	Rtg.	Min. Class	Rtg.
4	350	51	-
6 - 14	350	50	-
16	250	50	350
18	250	50	350
20	250	51	350
24	250	53	350

Snap-Lok™ Restrained Joint Ductile Iron Pipe

6" Thru 24" TYTON JOINT® Flexible Restrained Joint GENERAL ASSEMBLY



Assembly Instructions

1. All foreign matter in the socket must be removed, i.e., mud, sand, cinders, gravel, pebbles, trash, frozen material, etc. The gasket seat should be thoroughly inspected to be certain it is clean. Foreign matter in the gasket seat may cause a leak. ***Do not lubricate the inside of the bell.***

2. The gasket must be wiped clean with a clean cloth, flexed, and then placed into the socket with the rounded bulb end entering first. Looping the gasket in the initial insertion will facilitate seating the gasket heel evenly around the retainer seat. Smaller sizes require only one loop. With larger sizes it will be helpful to loop the gasket at the 12 o'clock and 6 o'clock positions. When installing TYTON JOINT pipe in subfreezing weather, the gaskets, prior to their use, must be kept at a temperature of at least 40°F by suitable means, such as storing in a heated area or keeping immersed in a tank of warm water. If the gaskets are kept in warm water, they should be dried before placing in the pipe socket.

3. The seating of the gasket may be facilitated by flexing the gasket at one or two points depending on size and then pressing the bulge or bulges out.

4. A thin film of pipe joint lubricant should be applied to the inside surface of gasket which will come in contact with plain end of the pipe.

5. Remove all packing material from pipe spigot. Clean dirt or foreign matter from the outside of restraining ring. Clean the plain end of pipe and grind or file sharp edges which may damage the gasket. Apply lubricant to beveled nose.

6. Place spigot end in companion bell and provide reasonably straight alignment. Push pipe straight home with aid of a bar or more powerful means. If assembly is not accomplished with the application of reasonable force by the methods indicated, the plain end of the pipe should be removed to check for the proper positioning of the gasket, adequate lubrication and removal of foreign matter in the joint.

7. Slide restraining ring fully into socket, exposing full depth of lock ring groove.

8. Insert lock ring into groove, placing gap into groove first. Ring may be forced into socket, if necessary. Lock ring should be back against restraining ring when in final position.

9. Cut wire tie allowing lock ring to expand into groove.

   To verify lock ring is fully expanded in groove, use a punch or screwdriver and hammer, and drive one end of lock ring around circumferentially until movement is noticed. Repeat in opposite direction.

   Place pipe in final deflected position.

Disassembly Instructions

With water pump pliers, grab ends of pins in lock ring and clamp until ends of lock ring are together.

Remove ring.

Attach sling to pipe and pull spigot out of socket. Restraining ring casting will be removed with pipe.

Size	A Dia.	B	C	D	Laying Lgth.*	Defl. Angl
6	11.44	.375	3.500	6.51	19'11"	4°
8	13.97	.375	4.000	7.19	19'10"	4°
10	16.44	.500	4.125	7.25	19'10"	4°
12	18.75	.500	4.250	7.50	19'10"	4°
14	20.96	.500	5.250	8.88	19'9"	3°
16	23.22	.500	5.250	8.95	19'8"	3°
18	25.72	.625	5.375	9.07	19'8"	3°
20	27.85	.625	6.000	9.88	19'7"	3°
24	32.54	.625	6.250	10.58	19'6"	3°

Dimensions in Inches

* SNAP-LOK and either SNAP-LOK, BOLT-LOK or plain spigot end.

Size	Rated Pressure psi
6	350
8	350
10	350
12	350
14	350
16	350
18	350
20	350
24	350

NOTE: In sizes 14" to 24", pressure rating is limited to the rating of the pipe barrell.

NI-ROD 44 Welding Electrode and NI-ROD Filler Metal 44

General Description

NI-ROD* 44 Welding Electrode and NI-ROD Filler Metal 44 are completely new products designed specifically to allow 100% joint efficiency in the common grades of ductile iron. However, the products are also useful for the welding of other high-strength cast irons. They use a metallurgically unique, nickel-iron-manganese system to provide both outstanding strength and ductility. The addition of manganese allows the reduction of carbon while still providing low residual shrinkage stresses.

NI-ROD 44 Welding Electrode is formulated with the utmost in flux coating and can be used with uncommon ease in all positions. Arc stability is excellent with both AC and DC modes, while overheating is not encountered. The flux coating is non-conductive which allows welding in deep, narrow areas without unwanted side-wall arcing.

NI-ROD Filler Metal 44 is a solid bare wire whose production is made possible by the discovery of a unique nickel-iron-manganese metallurgical system. It is designed for automatic and semi-automatic welding of ductile, malleable, and gray irons in all positions and at high deposition rates. Deposition rates as high as 18 lb/hr and travel speeds up to 50 in./min may be used in high-production robotics applications. NI-ROD Filler Metal 44 may be used with TIG (GTAW), MIG (GMAW) spray, pulsing-arc, and short-arc modes, and submerged arc processes. Direct current is used in all applications with straight polarity and constant current for TIG while reversed polarity with constant voltage is required for MIG and submerged arc. Argon shielding gas is used for TIG welding, argon and CO_2 can be used with MIG welding, and INCOFLUX 6 should be used with the submerged arc process.

Preheat and post heat treatments are not usually required, but may be advantageous for heavy-section fully restrained joints in low-ductility castings.

Recommended Amperage Ranges

Welding Electrode Diameter, in.	AC	DCRP
3/32	50 - 65	50 - 65
1/8	70 - 90	70 - 90
5/32	100 - 120	100 - 125
3/16	125 - 150	120 - 150

Applications

NI-ROD 44 Welding Electrode is used for welding of cast irons to themselves and other materials, for repairing worn or broken parts, and for salvaging defective castings where highest mechanical strength and ductility are required.

NI-ROD Filler Metal 44 offers high-speed, high-quality weldments made with 0.035 in., 0.045 in. and 0.062 in. diameter wires. It can be used with all robotics, automatic, and semi-automatic processes and in all positions. NI-ROD Filler Metal 44 provides the wetting and crack-resistant weldability that allows steel forgings and castings to be re-designed in less expensive ductile iron and still be automatically welded. Typical production-line applications would include drive shafts, hydraulic and pneumatic cylinders, and rolls. Large roll re-building can also be done with NI-ROD Filler Metal 44.

TIG welding with NI-ROD Filler Metal 44 can be used for root passes of pipe butt joints, small surface repairs, and intricate fabrications and repairs.

Nominal Chemical Composition (All-Weld-Metal)

NI-ROD 44 Welding Electrode

Ni 44
C 1.5
Mn 11
Fe 44

NI-ROD Filler Metal 44

Ni 44
C 0.3
Mn 11
Fe 45

Mechanical Properties

NI-ROD 44 Welding Electrode and NI-ROD Filler Metal 44 produce highest strength and ductility deposits while maintaining mechinability and color-match. The table below provides typical all-weld-metal mechanical properties:

Product	Tensile Strength ksi	Yield Strength ksi	Elongation %	Impact Strength ft-lb
NI-ROD 44 Welding Electrode	100	65	20	10
NI-ROD Filler Metal 44	100	65	35	8

Available Sizes

NI-ROD 44 Welding Electrode	
Diameter, in.	Length, in.
3/32	14
1/8	14
5/32	14
3/16	14

NI-ROD Filler Metal 44 is available in 30-pound spools in diameters of 0.035, 0.045, and 0.062 inch. 36-in. straight lengths in diameters of 0.062, 0.093, and 0.125 in. are also available.