



**PLIDCO® FLANGE REPAIR
SPLIT+SLEEVE
INSTALLATION INSTRUCTIONS**

LANGUAGES:

CLICK ON LANGUAGE DESIRED

ENGLISH



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PLIDCO® FLANGE REPAIR SPLIT+SLEEVE INSTALLATION INSTRUCTIONS

!! WARNING!!

IMPROPER SELECTION OR USE OF THIS PRODUCT CAN RESULT IN EXPLOSION, FIRE, DEATH, PERSONAL INJURY, PROPERTY DAMAGE AND/OR HARM TO THE ENVIRONMENT.

Do not use or select a PLIDCO Flange Repair Split+Sleeve until all aspects of the application are thoroughly analyzed. Do not use the PLIDCO Flange Repair Split+Sleeve until you read and understand these installation instructions. If you have any questions, or encounter any difficulties using this product, please contact: PLIDCO 440-871-5700

READ CAREFULLY

The person in charge of the repair must be familiar with these instructions and communicate them to all personnel involved in the repair crew.

Safety Check List

Pipeline repairs can be made with the pipeline in operation or shutdown.

- Read and follow these instructions carefully. Follow your company's safety policy and applicable codes and standards. If the PLIDCO Flange Repair Split+Sleeve is to be installed underwater, be sure to read the *Underwater Installation* section.
- Whenever a PLIDCO product is modified in any form including adding a vent or changing seals by anyone other than the Engineering and Manufacturing Departments of The Pipe Line Development Company or a PLIDCO certified repacking company, the product warranty is voided. Products that are field modified do not have the benefit of the material traceability, procedural documentation, quality inspection and experienced workmanship that are employed by The Pipe Line Development Company.
- The PLIDCO Flange Repair Split+Sleeve should never be used to couple pipe unless sufficient end restraint is provided such as with a PLIDCO Clamp+Ring. The PLIDCO Flange Repair Split+Sleeve has no end restraint rating in its unwelded condition. If used to couple pipe without supplementary end restraint, the pipe could pull out of the fitting resulting in EXPLOSION, FIRE, DEATH, PERSONAL INJURY, PROPERTY DAMAGE, AND/OR HARM TO THE ENVIRONMENT.

- ❑ Observe the maximum allowable operating pressure (MAOP) and temperature on the label of the PLIDCO product. Do not exceed the MAOP or temperature as indicated on the unit.
- ❑ Be absolutely certain that the correct seal material has been selected for the intended use. Contact PLIDCO or an authorized PLIDCO distributor if there are any questions about the seal compatibility with the pipeline chemicals and temperatures.
- ❑ The PLIDCO Flange Repair Split+Sleeve may be operated at the full design pressure in its bolted (non-welded) state.
- ❑ When repairing an active leak, extreme care must be taken to guard personnel. Severe injury or death could result.
- ❑ During the *Pipe Preparation* and *Installation* procedures, those installing the PLIDCO Flange Repair Split+Sleeve must wear, at minimum, Z87+ safety eyewear and steel toe safety footwear.
- ❑ If the pipeline has been shut down, re-pressuring should be done with extreme caution. Re-pressuring should be accomplished slowly and steadily without surges that could vibrate the pipeline and fitting. Industry codes and standards are a good source of information on this subject. Except for testing purposes, do not exceed the design pressure of the PLIDCO Flange Repair Split+Sleeve. Personnel should not be allowed near the repair until the seal has been proven.

Pipe Preparation

1. Remove all coatings, rust and scale from the pipe surface where the circumferential seals of the PLIDCO Flange Repair Split+Sleeve will contact the pipe (see Figure 1). A near-white finish, as noted in SSPC-SP10 / NACE No.2, is preferred. The cleaner the pipe surface the more positive the seal.
2. Where the circumferential seals will contact any pipe welds, the welds in this vicinity must be ground flush with the outside diameter of the pipe.
3. Circumferential pipe welds within the circumferential seals do not need to be ground flush as long as the weld height does not exceed 3/16 inch (4.7 mm) within 1" of the seal. Welds inside the belly do not need to be ground. (see Figure 1).

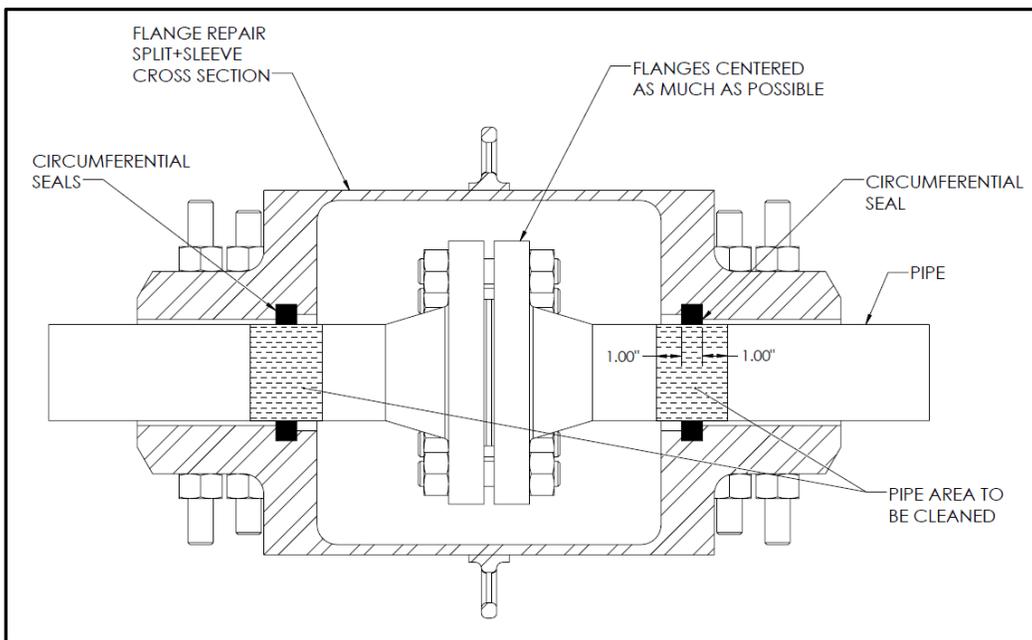


Figure 1

4. Pipe outside diameter tolerance is $\pm 1\%$ for 6-inch nominal pipe size and smaller. For pipe sizes larger than 6-inch nominal the tolerance is ± 0.06 inch (± 1.5 mm).
5. The seals can tolerate minor surface irregularities up to $\pm 1/32$ inch (0.8 mm) deep. The defective surfaces may be rendered suitable for sealing by applying a suitable epoxy such as Belzona 1161 and sanding or filing the surface to match the required outer diameter.
6. A PLIDCO Flange Repair Split+Sleeve is capable of sealing on out-of-round pipe up to approximately 5% ovality. This is based on the ability of the bolting to reshape the pipe. For very thick wall pipe the bolting may not be able to reshape the pipe. Badly out-of-round pipe may require repositioning the PLIDCO Split+Sleeve or using of a different length PLIDCO Flange Repair Split+Sleeve to ensure the circumferential seals are positioned on round pipe.
7. A PLIDCO Flange Repair Split+Sleeve is not capable of reshaping flattened or dented pipe.

Lifting & Handling

When not being moved or transported on a pallet, PLIDCO Flange Repair Split+Sleeves should always be lifted, transported, or installed using the installed lifting eyes as shown in Figures 2 & 3. All Flange Repair Split+Sleeves that exceed 50 lbs. per half or are too heavy to move and install by hand are provided with lifting eyes on each half. Longer fittings are provided with two lifting eyes as shown in Figure 3. If two lifting eyes per half are provided, both lifting eyes are required to lift the fitting. Chains, hooks, shackles, or straps suitable for the weight of the fitting(s) shall be used, and must be securely inserted through the lifting eyes.

The lifting eyes are designed to support the weight of a fully assembled Flange Repair Split+Sleeve. The lifting eyes are installed on both halves of the fitting, and should be used to maneuver or lower Flange Repair Split+Sleeve onto the pipeline.

Vertical installations or installations that require special rigging due to space, obstructions, or location may require additional lifting eyes to be added in locations other than shown in Figures 2 & 3. These can be added prior to ordering or sent back to a PLIDCO manufacturing facility to be added by PLIDCO personnel.

Note: Careless handling can damage the seals and GirderRings (seal retainers). Lifting devices such as chains, cables, or straps should never contact the seals or GirderRings. Never lift the fitting by inserting the forks from a fork lift inside of the fitting. Contact on the seals or GirderRings can result in the seals being pulled from their grooves. (See Figure 4)

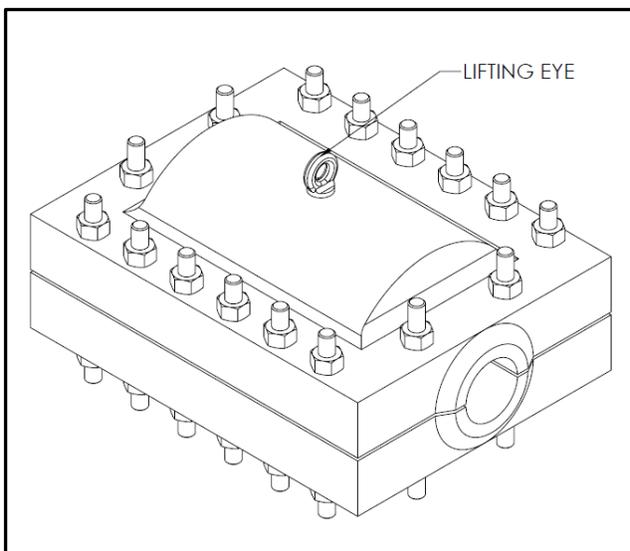


Figure 2

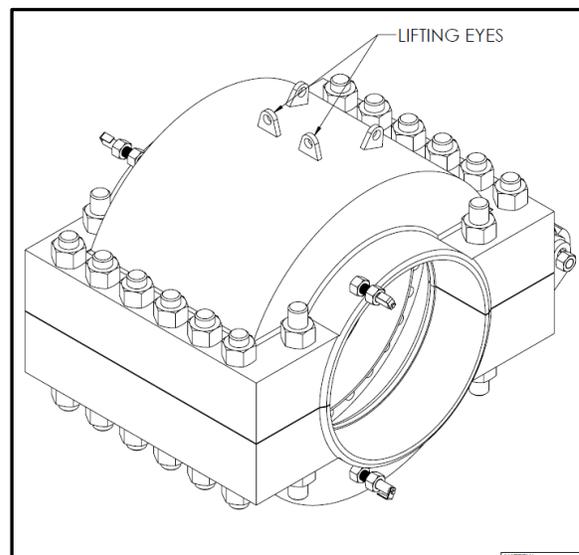


Figure 3

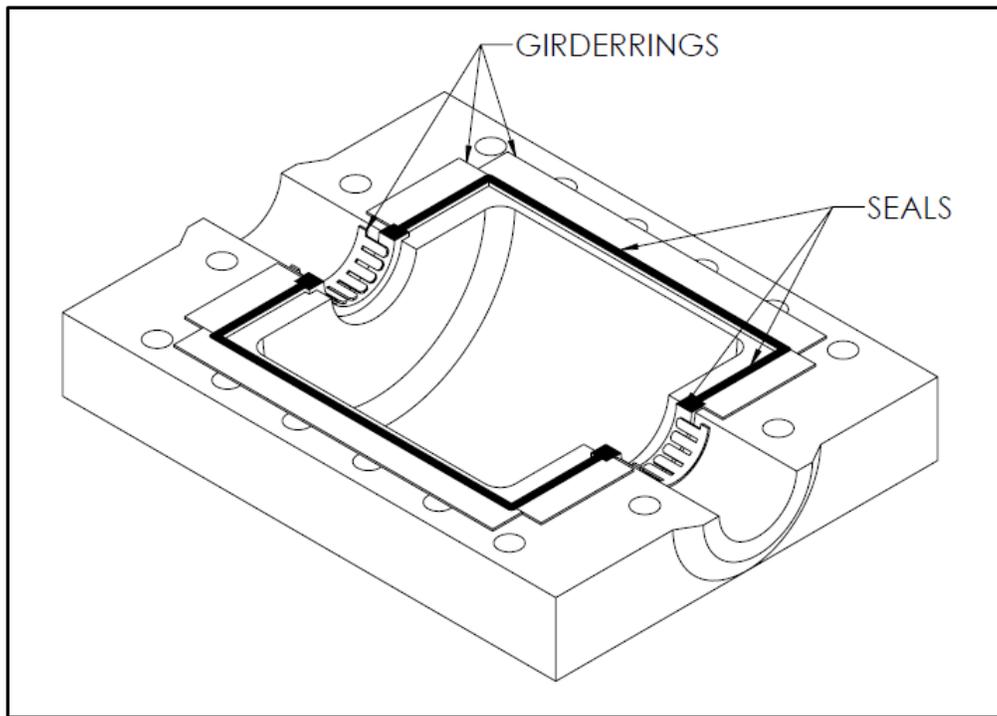


Figure 4

Installation

This section defines the general procedure for installation of a PLIDCO Flange Repair Split+Sleeve.

1. If the two sleeve halves were shipped as an assembled unit, it would have been shipped with spacers between the two halves to prevent damage to the longitudinal seals and ends of the circumferential seals. Typically, small diameter nuts are used for the spacers. The spacers must be removed and discarded before installing the PLIDCO Split+Sleeve. Failure to remove the spacers will prevent proper compression of the seals.
2. Coat all exposed surfaces of elastomer seals with a lubricant. Table 1 lists the lubricants that are recommended for the various seals. The customer must determine if the lubricant is compatible with the product in the pipeline. Lubricant is not recommended for underwater installations or braided packing. Refer to the section on Underwater Installations.

Petroleum based lubricants	= A	
Silicone based lubricants	= B	
Glycerin based lubricants	= C	
Super Lube® Grease (1)	= D	
		Temperature (2)
Buna-N	A, B, C, D	225°F (107°C)
Viton	A, B, C, D	250°F (121°C)
Silicone	C, D	300°F (149°C)
Neoprene	B, C, D	250°F (121°C)
Aflas	A, B, C, D	225°F (107°C)
Hycar	A, B, C, D	180°F (82°C)
1) Super Lube® Grease is a product of Synco Chemical Corporation. (www.super-lube.com)		
2) Temperature limit is for the seal material only and does not imply the pressure rating is necessarily applicable at this limit.		

Table 1: Approved Lubricants

3. Clean and lubricate all studs and nuts. Verify that each nut freely runs up and down each stud prior to installation.

Notes: Lubricant is not recommended for underwater installations.

The type of lubricant will dictate the torque value per the PLIDCO torque chart on the last page.

4. Assemble the Flange Repair Split+Sleeve around the pipe and flange set making sure the yellow painted ends are matched and that the fitting is centered over the flanges as much as possible. The seals should be at least 1" (25mm) away from any circumferential welds or any leaks. At no point should leak should be closer than ½" from the circumferential seals. Try to avoid having any leak spraying directly onto the longitudinal seals.
5. Torque the studs uniformly as indicated by the corresponding value per bolt size from the **PLIDCO Torque Chart** located on page 12 of these instructions. The best results are obtained by maintaining an equal gap all around the side bars while tightening the studs. Ensure there is full nut engagement by having a minimum of 1/4 inch (6.4 mm) of stud extending beyond the nut. The sequence for torquing the studs should follow the pattern shown Figure 5, and should be executed repeatedly as follows:
 - a. 1st time- Hand tight or 10% of the minimum torque value to bring the 2 halves together
 - b. 2nd time - 50% torque.
 - c. 3rd time- 100% torque.
 - d. Repeat the sequence at 100% torque until all the studs and nuts are unable to continue spinning.

Note: The torque values listed on the PLIDCO Torque Chart represent residual torque. The initial torque value may need to be slightly higher due to bolt relaxation. Applicable industry methods should be used to verify bolt preload. A rechecking of torque is recommended at 4 and 24 hours after installation.

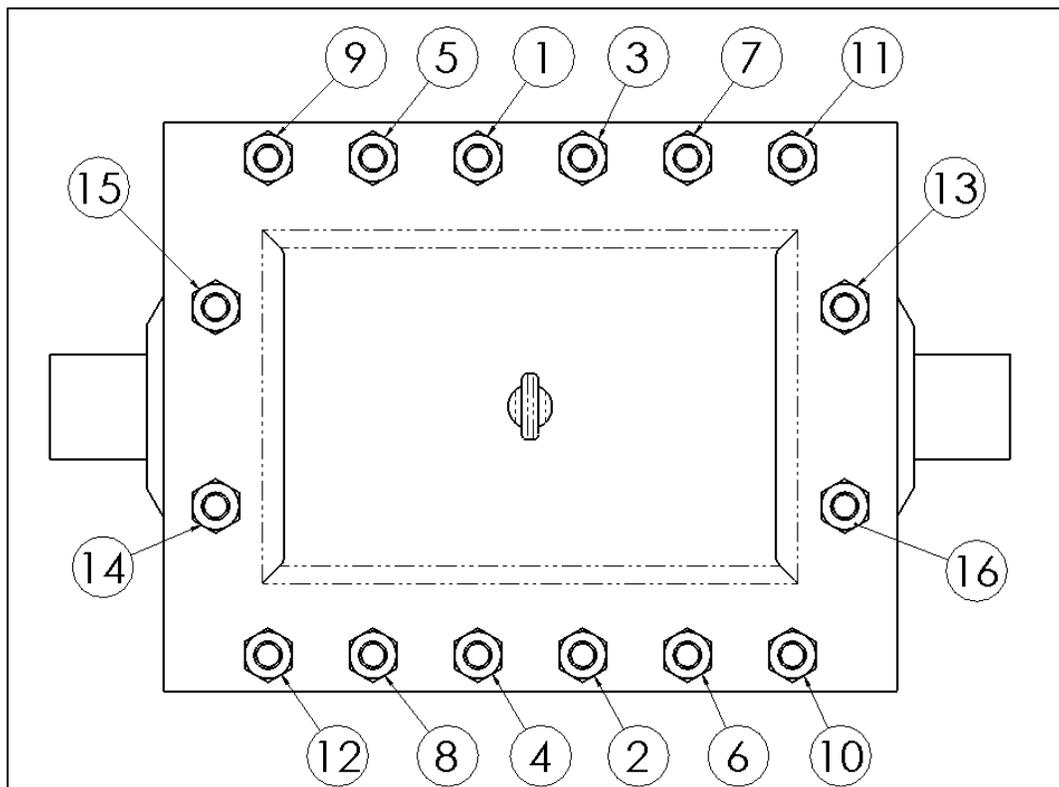


Figure 5

6. The side bars are gapped approximately 1/8 inch (3.2 mm) or less when the PLIDCO Flange Repair Split+Sleeve is fully tightened.
7. Verify that the leak has been contained by visually inspecting for leaks or performing a field hydrotest.
8. If the fitting was supplied with vents, verify that the plugs are snug. For all plugs that were removed during installation or for hydrotesting, new Teflon tape, thread sealant, or anaerobic thread sealant shall be reapplied to the threads.

Hinged Flange Repair Split+Sleeve Installation

This section defines the general procedure for Flange Repair Split+Sleeve Installation on a horizontal pipe. Vertical or angled pipe installations may require additional lifting devices, and/or a different hinge design and operation.

1. Orient the Flange Repair Split+Sleeve and remove all studs and nuts as shown in Figures 6 & 7.
2. Attach shackles to the lifting eyes. Smaller fittings typically only have lifting eyes in the center of the shell as shown in Figure 6. Larger diameter fittings have additional lifting eyes on an angle as shown in Figure 7. For larger diameter fittings, the angled lifting eyes are to be used during installation with hinges.

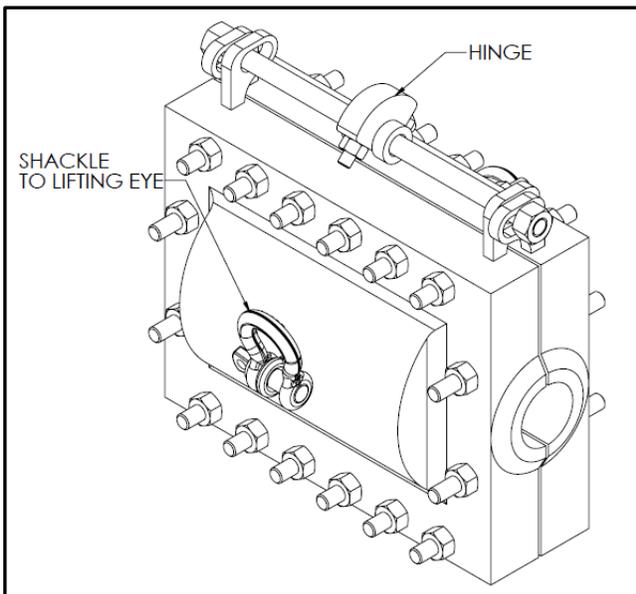


Figure 6

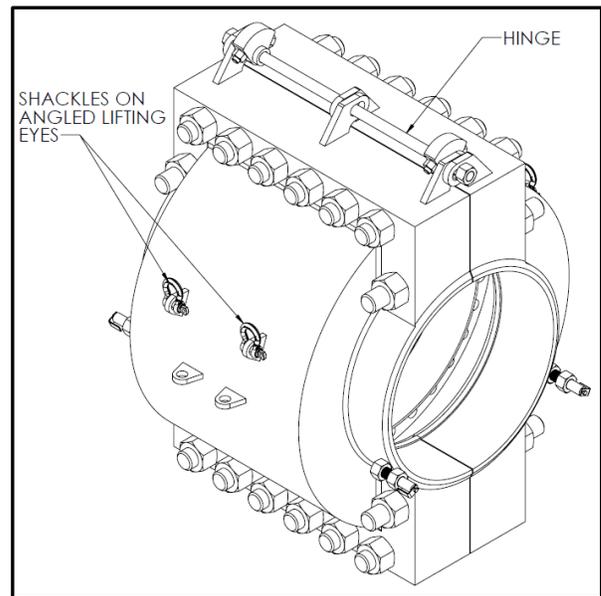


Figure 7

3. Attach properly sized rigging such as chains, cables, or straps to a single point crane attachment. The rigging should be sufficiently long enough that the rigging doesn't interfere with opening and closing of the fitting as shown in Figure 8.
4. Lift the fitting up from the single point crane attachment. The Flange Repair Split+Sleeve will open up as shown in Figure 8.
5. Position the fitting over the pipeline and slowly lower the fitting onto the pipeline as shown in Figure 8. The inside of the fitting should come in contact with the pipeline, and the fitting will start to close as it is lowered. Some fittings may require some additional side force to close the fitting around the pipe. Keep all body parts clear of the inside of the fitting at all times as the fitting is being lowered onto the pipe. This is to ensure safety in the event that the fitting slams closed rapidly.
6. Once the fitting is wrapped around the pipe, insert the studs through the bolt holes and thread on the nuts as shown in Figure 9. Proceed to tighten the studs and nuts per these installation instructions.

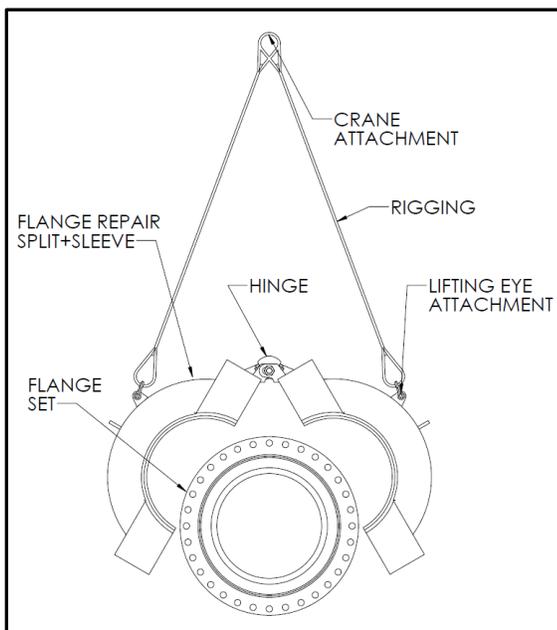


Figure 8

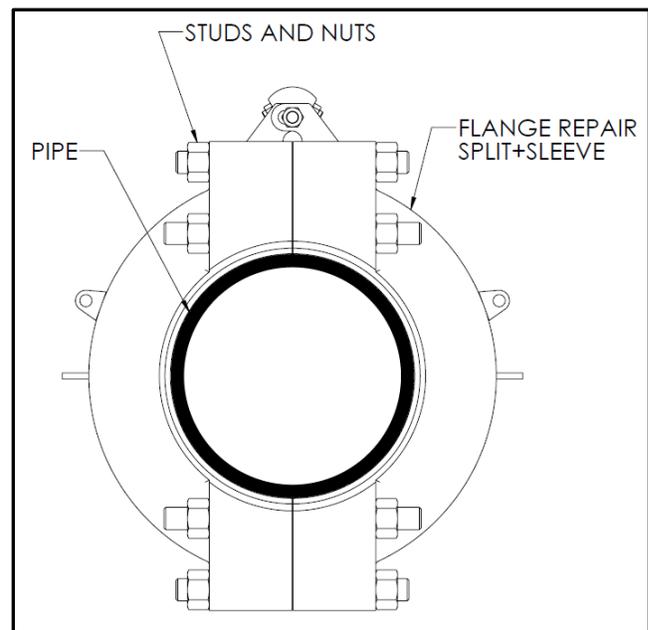


Figure 9

Sealant Injection

Sealant Injection is not required for a PLIDCO Flange Repair Split+Sleeve to achieve a leak tight seal provided the sleeve was installed with elastomer seals per this installation instruction, and the temperature and pressure of the pipeline are within the design limitations of the Flange Repair Split+Sleeve. However, PLIDCO Flange Repair Split+Sleeves are capable of being injected with sealant, grout, hardenable epoxy, or similar substance. Please note: *Flange Repair Split+Sleeves Installed with braided style packing such as Kevlar, Graphite, or Teflon require sealant injection in order to seal.*

In-order for standard Flange Repair Split+Sleeves to be injected with sealant, the fitting must come from the factory with a minimum of one vent in each half. For fittings without vents, please contact PLIDCO or an authorized representative for options to add vents on existing fittings.

The Flange Repair Split+Sleeve must be installed and fully tightened prior to injecting sealant.

Please see IP-033, *PLIDCO Sealant Injection Instructions*, for additional information for injecting sealant.

Re-pressuring and Field Testing

If the pipeline has been shut down, re-pressuring should be done with extreme caution. Re-pressuring should be accomplished slowly and steadily without surges that could vibrate the pipeline or produce a sudden impact load. Industry codes and standards are a good source of information on this subject.

Except for testing purposes, do not exceed the design pressure of the PLIDCO fitting. The PLIDCO fitting is designed to be tested up to 1½ times its design pressure. However, PLIDCO recommends following API Recommended Practice 2201, *Procedures for Welding or Hot Tapping on Equipment in Service*, Section 6.5. The test pressure should be at least equal to the operating pressure of the line or vessel, but not to exceed internal pressure by 10%. This is meant to avoid possible internal collapse of the pipe or vessel wall. However, if prevailing conditions could cause collapse of the pipe or pressure walls, the test pressure may be reduced. (See API Standard 510 Section 5.8 for pressure testing precautions.) Personnel should not be allowed near the repair until the seal has been proven.

Field Welding Instructions

Welding is not a requirement for the pressure sealing ability of the PLIDCO Flange Repair Split+Sleeve. The issue of welding is dependent on your company's requirements, applicable codes, and if longitudinal loads need to be carried by the PLIDCO Flange Repair Split+Sleeve.

!! WARNING!!

Failure to follow field welding instructions could result in explosion, fire, death, personal injury, property damage and/or harm to the environment.

All of the aspects for in-service welding of PLIDCO Flange Repair Split+Sleeves are not addressed by this document. ASME PCC-2, API 1104 Appendix B, ASME Section IX, PRCI L52047, PRCI Hot Tap® Model, and other industry information pertaining to in-service welding must be considered when planning in-service welding. Refer to IP-019, *Welding Considerations* for additional information.

It is recommended that the pipeline should be full and under flow.

Welders and weld procedures should be qualified in accordance with API Standard 1104, *Welding of Pipelines and Related Facilities*, Appendix B, *In-Service Welding*. We strongly recommend the use of a low hydrogen welding process such as GMAW or SMAW using low hydrogen electrodes (E-XX18) because of their high resistance to moisture pick-up and hydrogen cracking. These are also the preferred welding processes for seal welding the studs and nuts. SMAW electrodes must be absolutely dry.

Use weld material with equal or greater tensile strength than the pipe. Carefully control the size and shape of the circumferential fillet welds. The size of the fillet weld should be at least 1.4 times the wall thickness of the pipe. This assumes a 1.0 joint efficiency. You may need to select a different joint efficiency based on your level of inspection. Strive for a concave faced fillet weld, with streamlined blending into both members; avoid notches and undercuts. The smoother and more streamlined the weld, the greater the resistance to fatigue failure. The worst possible shape would be a heavy reinforced convex weld with an undercut. Improper weld shape can lead to rapid fatigue failure, which can cause leakage, rupture or an explosion with attendant serious consequences.

It is very important that the field welding procedure closely follow the essential variables of the qualified procedure so that the quality of the field weld is represented by the mechanical tests performed for the procedure qualification.

We do not recommend the use of thermal blankets for pre-heating. Thermal blankets can generate hot spots and reduce the ability of the PLIDCO Flange Repair Split+Sleeve to dissipate welding heat in the vicinity of the seals. We recommend a small torch, such as a cutting torch, being careful not to aim the flame directly into the gap between the PLIDCO Flange Repair Split+Sleeve and the pipe towards the seals. The flame from a preheat torch is helpful in burning off oils and other contaminants. Do not use a large torch, commonly called a rosebud, because of the difficulty controlling the size of the area being preheated.

Monitor the heat generated by welding or preheating, particularly near the area of the seals, by using temperature crayons or probe thermometers. If the heat generated approaches the temperature limit of the seal material, which is indicated on the label, welding should be discontinued or sequenced to another part of the fitting so that the affected area has a chance to cool.

Seal welding the grade B-7 studs of the PLIDCO Flange Repair Split+Sleeve is the most difficult phase of field welding. They are made of AISI 4140 steel with a high carbon equivalence. By using a low hydrogen welding process with preheat, the problem of hydrogen cracking and pinholes can be reduced. The preheat will dry out any moisture, oil dampness or thread lubricant that may be present in the weld area. If the stud lengths need to be cut back, allow at least 1/4 inch (6.4 mm) of stud beyond the nut for the fillet weld. Preheat the stud and nut, and then weld the nut to the stud. Check the preheat and then weld the nut to the sidebar.

WELDING AFTER A CONSIDERABLE TIME LAPSE AFTER THE INITIAL INTALLATION

PLIDCO recommends that if the PLIDCO Flange Repair Split+Sleeve is to be welded, the welding be completed as soon as possible after the installation; as conditions permit. Welding at a significantly later date relies heavily on whether proper installation procedures were followed and the compatibility of the elastomeric seals with the product in the pipeline.

After the installation of the PLIDCO Flange Repair Split+Sleeve there is no meaningful test that can be performed to determine the condition of the seals or the remaining service life the seals. There are many variables that can affect the condition of the seals which PLIDCO has no control.

If the PLIDCO Flange Repair Split+Sleeve is to be welded at a significant time lapse from the installation, the follow precautions should be followed:

1. The PLIDCO Flange Repair Split+Sleeve must be closely inspected for any leakage that may have developed.

2. The studs and nuts should be retightened per the recommended torque value.
3. If possible, the pressure in the line should be reduced.
4. Some flow in the line may still be required to dissipate the welding heat to prevent damage to the elastomeric seals.
5. Following the recommended welding practices as listed under Field Welding Instructions.

Welding Sequence

Caution should be observed so that welding does not overheat the seals. Sequence the welding so that the heat is not concentrated in one area. It will be necessary to re-torque the studs and nuts periodically during field welding because weld contraction causes them to loosen.

1. Fillet weld ends to pipe. (See Figure 10)
2. Seal Weld side openings.
3. Re-torque studs and nuts.
4. Seal weld nuts to studs.
5. Seal weld nuts to side bars.
6. Seal weld vent plugs, if applicable.

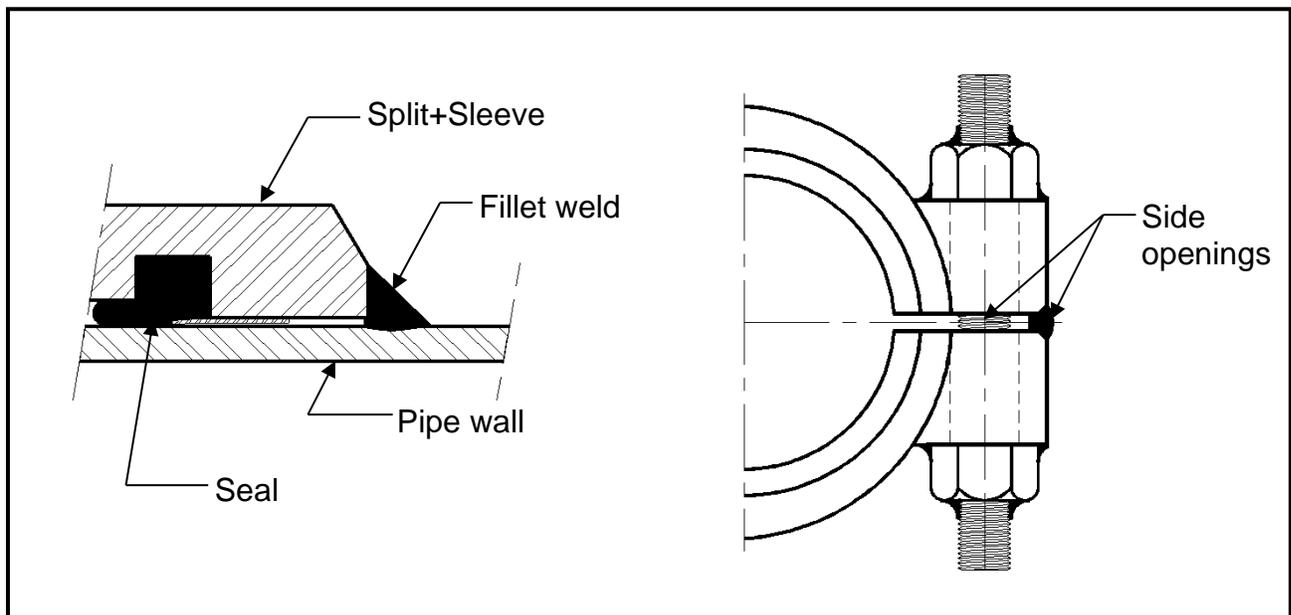


Figure 10

Storage Instructions

PLIDCO Flange Repair Split+Sleeves should be stored in a dry environment to prevent the unpainted surfaces from rusting. Storage temperatures should not exceed 120°F (49°C). Cover with dark polyethylene to keep the direct sunlight away from the packing. It is best to exclude contamination, light, ozones and radiation. Improperly stored PLIDCO Flange Repair Split+Sleeves can cause the seal material to become cracked and brittle and lose its ability to seal.

Traceability

PLIDCO Flange Repair Split+Sleeves, as with most PLIDCO products, have a unique serial number by which the fitting is fully traceable. Additionally, all elastomer seals have a unique batch number by which the seal material is traceable.

Recommended Inspection Schedule

1. After the pipeline is re-pressurized and field tested (see *Re-pressuring and Field Testing* for precautions) the torque values should be checked again 4 hours after installation. Then, the torque values should be checked again 24 hours after that.
2. It is recommended that if the product is not being welded, that torque striping be applied from the nuts to the sidebar of the PLIDCO Split+Sleeve so any loosening of the bolts can be visually seen during an inspection.
3. 6 months after installation it is recommended that a visual inspection occurs that checks for visible signs of leakage, bolt/nut loosening, and general wear or corrosion.
4. After the 6-month inspection occurs, a yearly visual inspection is recommended that checks for visible signs of leakage, bolt/nut loosening, and general wear or corrosion.

Underwater Installation

WARNING!

This warning is only applicable to a non-leaking, underwater installation. When assembling a PLIDCO Flange Repair Split+Sleeve product under water (or under any liquid) it is possible to build up thousands of pounds of pressure in the annulus between the fitting and the pipe. The pressure is caused by compressing the fluid trapped in the annulus as the two fitting halves are closed and tightened. For installations over a leak, pressure in the annulus equalizes with the pressure in the pipe. The pressure trapped in the annulus may have the following effects:

- The pressure rating of the split product is exceeded causing leakage or damage to the fitting.
- The pipe on which the fitting is installed is damaged.
- Personal injury or death due to subsequent removal of a vent plug.

RECOMMENDATIONS

The Pipe Line Development Company strongly recommends the following for non-leaking, underwater installations:

1. All fittings are supplied with vents.
2. Vents are open during installation.

Additionally, the Pipe Line Development Company recommends not using a lubricant on the seals or on the stud and nut threads. This is to prevent sand, gravel, or debris from sticking to the lubricant and possibly interfering with sealing and/or obtaining accurate torque reading on the stud bolts.

PLIDCO Torque Chart for Split+Sleeve

Nominal Diameter of Stud (inches) (see Note 2)	Wrench Opening Across Flats (inches)	Torque Values (see Note 1)	
		0.15 C _f	
		ft-lbs	Nm
		25,000 psi pre-stress	
5/8--11	1-1/16	56	76
3/4--10	1-1/4	98	133
7/8--9	1-7/16	156	212
1--8	1-5/8	233	316
1-1/8--8	1-13/16	342	464
1-1/4--8	2	480	651
1-3/8--8	2-3/16	651	883
1-1/2--8	2-3/8	857	1160
1-5/8--8	2-9/16	1110	1490
1-3/4--8	2-3/4	1390	1890
1-7/8--8	2-15/16	1730	2350
2--8	3-1/8	2120	2870
2-1/4--8	3-1/2	3050	4140
2-1/2--8	3-7/8	4230	5740
		23,000 psi pre-stress	
2-3/4--8	4-1/4	5220	7080
3--8	4-5/8	6890	9340
3-1/4--8	5	8800	11900
3-1/2--8	5-3/8	11000	15000
3-3/4--8	5-3/4	13600	18500
4--8	6-1/8	16600	22500
		18,800 psi pre-stress	
4-1/4--8	6-1/2	16300	22100
4-1/2--8	6-7/8	19400	26300
4-3/4--8	7-1/4	22900	31000
5--8	7-5/8	26700	36300
5-1/4--8	8	31000	42100
5-1/2--8	8-3/8	35700	48400
5-3/4--8	8-3/4	40900	55400
6--8	9-1/8	46500	63000

Studs: ASTM A193 Grade B7 - Nuts: ASTM A194 Grade 2H

Note 1: The torque values listed are residual torque value. This is the torque value and residual stress after bolt relaxation. The studs and nuts must be clean, free running, free of obvious flaws. The values listed assume that the nuts are properly lubricated with a lubricant having an approximate coefficient of friction (μ) 0.15 or k factor of 0.19 such as light weight machine oil. If a lower coefficient of friction lubricant is used, such as graphite, please contact PLIDCO's Engineering department for appropriate torque values.

Note 2: The second number is the pitch, which is shown in number of threads per inch.

Note 3: Use the pre-stress value shown for the applicable stud size if bolt tensioners are to be used and follow the bolt tensioner manufacturer's instructions.

Note 4: This chart is also to be used for all PTFE (Teflon) coated studs.