

Engineering Procedure

SAEP-313

31 January, 2005

PLIDCO Split Sleeves

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Saudi Aramco DeskTop Standards

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1 Scope

This SAEP provides directions for use of PLIDCO Split Sleeves for the repair of leaking or ruptured pipelines and process lines. Any deviations to this instruction requires the approval of the Manager, Consulting Services Department, Dhahran.

2 Applicable Documents

Saudi Aramco Engineering Procedures

[SAEP-310](#)

Pipeline Repair and Maintenance

[SAEP-312](#)

Installation of Weld + Ends Coupling

3 Instructions

3.1 General

3.1.1 PLIDCO Split Sleeves are listed in the SAMS catalog in sizes 6 inches through 60 inches under stock numbers 02-560-XXX and 02-561-XXX.

3.1.2 When to Use

3.1.2.1 PLIDCO Split Sleeves are high in cost compared to other methods of pipeline repair. Therefore, their use should be restricted to those cases where speed of repair will provide sufficient economic justification. They are particularly attractive for permanent repair of small leaks (no cracking evident) which cannot be plugged readily and where downtime for draining oil from the line is excessive.

3.1.2.2 They can also be used for quick, temporary repairs without welding on urgently required pipelines and process lines within plant limits which at a future date can be removed from service for permanent repairs. However, sleeve pressure, temperature, and packing limitations must be considered when installing unwelded sleeves (e.g., paragraph 3.1.3.4) and the unwelded sleeve must be removed for permanent repair in approximately three months. In this case, the removed split sleeves can be checked by Consulting Services Department, and returned to stock if suitable for future use.

3.1.2.3 PLIDCO Split Sleeves shall NOT be used to connect two sections of pipe. For this purpose, weld+ends, flanges or butt welds shall be used. Refer to [SAEP-312](#) and [SAEP-310](#).

3.1.3 Limitations

3.1.3.1 Defect Types

PLIDCO Split Sleeves are used on blowouts or punctures which cannot be readily sealed by plugs or patches. They shall not be used for repair of a defect if less than 70% of the design minimum pipe wall thickness (around the total circumference) is left to resist axial forces, and they shall not be used for reinforcement of non-leaking defects such as gouges, corrosion lakes, etc. Reinforcement of non-leaking defects shall use standard repair sleeves in accordance with [SAEP-310](#).

3.1.3.2 Temperature

The manufacturer indicates an operating temperature rating for Viton packing of -26°C to 120°C, and for Silicone packing of -54°C to 232°C. During welding, Viton, Silicone, and Buna-N packing will deteriorate rapidly at elevated temperatures, therefore, metal temperatures in the packing area must not be allowed to rise above 232°C, 232°C, and 121°C respectively, during welding. The packing is located approximately 50 mm from the sleeve ends. Some PLIDCO sleeves in stock have Silicone packing which is more heat resistant, however, Silicone is not as resilient and durable for extended services, thus is not the preferred sealant material. Buna N packing is the PLIDCO standard packing. It has a temperature rating of -30°C to 121°C. See Table 1 for maximum interpass temperature for welding.

3.1.3.3 Pressure

The packing and bolts on standard sleeves are rated for 6895 kPa (1000 psi). Special sleeves for water injection systems are rated at 20684 kPa (3000 psi). During the welding operation, the packing softens. Table 1 identifies values which are considered to be safe during welding, if not limited by the requirements of [SAEP-310](#), or for maximum line pressure if repair is not welded.

Table 1 – Safe Welding Values

	Max. Interpass Temp.	Max. Line Press.
Viton:	232°C (450°F)	6895 kPa (1000 psi)
Silicone:	232°C (450°F)	6895 kPa (1000 psi)
Buna N:	121°C (250°F)	6895 kPa (1000 psi)

3.1.3.4 Requirement to Weld

Because of possible deterioration of the seal, permanent installations shall be welded. Buna N packing deteriorates quickly in hydrocarbons and welding is required immediately after installation.

3.1.3.5 Low Temperature Piping

If a Silicone Packing sleeve is used on LPG lines, it must be welded without delay after flow is restored. Unwelded sleeves on LPG lines are not allowed.

The minimum temperature at which welding is permitted on low temperature piping is 0°C. Consequently, the temperature of LPG/NGL piping must be checked prior to and during welded repairs. Alternatives other than welding shall be discussed with the Consulting Services Department (CSD) if the line temperature is less than 0°C.

3.1.3.6 Packing Service

Table 2 provides the recommended packing material to be employed for the type of service in which it will be used.

Table 2 – Recommended Packing Material

Service Fluid contains H ₂ S	Service Fluid contains Corr. Inhibitor	Recommended Packing
YES	YES	1. Viton GF (Peroxide Cured)
YES	NO	1. Viton (Peroxide or Amine Cured) 2. Buna-N
NO	YES	1. Viton GF
NO	NO	1. Viton 2. Buna-N

3.2 Preparation of Fitting and Pipe

- 3.2.1 Remove all coatings, rust, and scale from the pipe surface where the PLIDCO Split-Sleeve is to be assembled. Meticulously clean the area around the pipe where the seals will come in contact with the pipe, ensuring that the contact area is free of dents or pits in the seal area.

This may require weld reinforcements to be ground flush with the surface of the pipe. Any bulges in the pipe adjacent to the failure must be jacked in so that the sleeve can be installed without damage to the packing. Care must be exercised to prevent sections of the pipe from protruding inside of the pipe that would restrict flow of fluid and interfere with the scraping operation. Refer to [SAEP-310](#) for the requirements in regards to protrusions into the pipe wall.

- 3.2.2 All bolts and nuts on the sleeve must be cleaned and lubricated with a high pressure anti-galling lubricant such as SAMS 14-838-050 or 14-839-052. Measurements must be taken so that the sleeve is centered over the failure of the pipe. It is essential that the packing at both ends of the sleeve seats on an undistorted, clean area of the pipe.

3.3 Installation

- 3.3.1 Assemble halves of PLIDCO sleeve loosely around the pipe to one side of the leak. Slide the assembly over the leak to the proper position. Care should be exercised not to damage the packing when positioning the sleeve over the leak. The sleeve should be rotated either before or after sliding into position so that any sharp edges do not damage packing and that any bulges are centered in one of the halves.
- 3.3.2 Bolt tightening sequence starts at the center bolts of each half and works outward. Measurements of torque (N-m, Ft-lbs) should be taken during the tightening operation to ensure that side bolts are tightened uniformly. Tightening can be done with air-operated impact wrenches or with hand wrenches. However, hydraulic torque wrenches or stud tensioners are preferred, if available. Hand wrenches should be used if sparks from a rapidly spinning socket wrench would be a hazardous concern.
- 3.3.3 Bolts should be tightened in accordance with the torque value indicated in Table 3.

Table 3 – Torque Values

Bolt Dia.	Torque N-m	Torque Ft-Lb	Bolt Dia.	Torque N-m	Torque Ft-Lb
$\frac{3}{4}$	135	100	$1-\frac{3}{4}$	1957.5	1450
$\frac{7}{8}$	216	160	$1-\frac{7}{8}$	2430	1800
1	337.5	250	2	2970	2200
$1-\frac{1}{8}$	472.5	350	$2-\frac{1}{4}$	4185	3100
$1-\frac{1}{4}$	675	500	$2-\frac{1}{2}$	5805	4300
$1-\frac{3}{8}$	945	700	$2-\frac{3}{4}$	7695	5700

1- 1/2	1215	900	3	9990	7400
1- 5/8	1485	1100	3- 1/4	12825	9500
			3- 1/2	16200	12000

Commentary Note:

Torque values shown represent a coefficient of friction of .15. It is assumed that the studs and nuts are clean, free running, free of obvious surface flaws and lubricated with a light weight machine oil. The torque values are safe minimums and represent approximately 25,000 psi (172.4 MPa) bolt pre-stress.

- 3.3.4 After installation of the sleeve the pipeline pressure shall be increased slowly and steadily to the allowable operating pressure in accordance with Table 1. Surges should be avoided as much as possible.

3.4 Welding

3.4.1 General

All welding and safety requirements and procedures shall conform with [SAEP-310](#) "Pipeline Repair and Maintenance". This includes the requirements for use of low hydrogen electrodes, 5 mm minimum wall thickness in areas of welding, and maximum line pressure and minimum flow during welding. Refer to [SAEP-310](#). External coatings, (including FBE), rust, and scale shall be completely removed in the welding area. Welding on internally coated lines shall be in accordance with [SAEP-310](#), para. 3.3.

3.4.2 Specific Requirements in Welding PLIDCO Sleeves

3.4.2.1 Line pressure and flow requirements shall be in accordance with [SAEP-310](#) and shall be established at a stable rate for at least one half hour without leaks occurring prior to starting welding. It is essential that a combustible mixture does not exist in the repair area. Install a vent valve in the top of the sleeve to withdraw hot oil and vapours. Use a 25 mm or larger vent valve. Pipe the hydrocarbon fluid to a safe down wind location. Refer to [SAEP-310](#).

3.4.2.2 Welding interpass temperature shall be continuously monitored with a temperature indicating device (e.g., tempil stick, pyrometer) to ensure the pressure-temperature ratings of paragraph 3.1.3.3 are not exceeded. The interpass temperature check shall be done on the sleeve no further than 50 mm from the sleeve end.

3.4.2.3 Welding Technique

- 3.4.2.3.1 Sleeve Ends. Fillet weld the ends of the sleeve with at least 3 passes ensuring the minimum fillet weld leg size is equal to the pipe nominal wall thickness. Use 3.2 mm low-hydrogen electrodes, vertical up progression, with welders on each end working in opposite quadrants at the same time. The toes of the fillet weld shall blend smoothly into the pipe surface.
- 3.4.2.3.2 Sleeve Flanges. Use 3.2 mm low-hydrogen electrodes with 3 passes to ensure seal. In some cases, it may be necessary to hand bevel the flange edges to make room for 3 passes without excessive reinforcement.
- 3.4.2.3.3 Nuts and Stud Ends. Seal weld bottom of nuts and stud ends with 2 passes using 2.4 mm or 3.2 mm low-hydrogen electrodes. The studs and nuts shall be cleaned with solvent prior to welding. If sleeve is to be buried, torch cut the studs back to the weld and file or grind smooth to minimize coating and wrapping problems.

Revision Summary

31 January 2005	Revised the "Next Planned Update". Reaffirmed the contents of the document, and reissued with updated list of Committee members.
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