



**Technical Manual
for
Subsea
FlexJoint[®] Assembly**

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1 INTRODUCTION

1.1 GENERAL

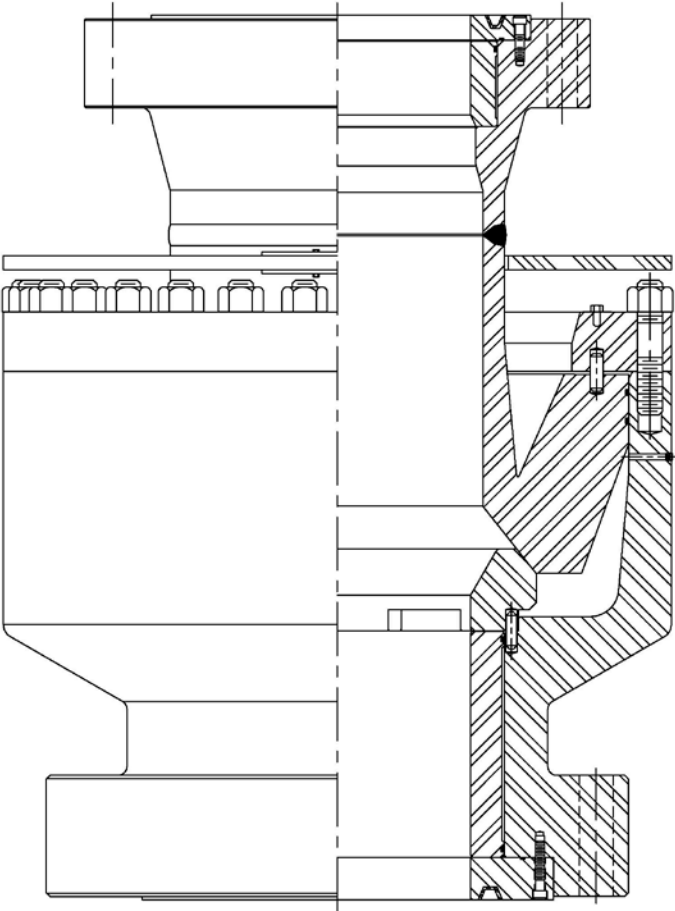
This manual provides the operating and maintenance information necessary to use and maintain the Subsea FlexJoint® Assembly (flexible joint) manufactured by Oil States Industries (OSI). OSI offers Subsea flexible joints for 600, 2,000, 2,500, 3,000, 3,500, 5,000, and 6,000 psi internal pressure applications in a variety of flanged configurations. This section provides a general description of the units and defines their operating parameters. Section 2 provides a list of tools and materials required for maintenance. Section 3 provides complete inspection and repair procedures. Information pertaining to storage and shipment is provided in Section 4 and Section 5 contains complete parts lists for the units.

1.2 DESCRIPTION

Subsea flexible joints are flexible couplings designed as a direct replacement for a standard ball joint and are used to couple the drilling riser to the Blowout Preventer (BOP) Stack. Refer to Figure 1-1. All units share a common design comprising of large diameter, spherical elastomeric bearings within a forged housing equipped with customer specified end connections. Materials used in the flexible joints consist of high-grade steels and various nitrile elastomers that offer a high resistance to oil well fluids. These elastomers also exhibit extremely long life under the conditions encountered during drilling and production operations. The OSI Subsea FlexJoint® Assembly was designed so that the flex element acts as the primary seal. This technology was vital to the success of capping the Macondo well.

The OSI FlexJoint® Assembly was able to overcome an over-rotation load case, high well bore temperatures, and extreme well bore pressures for an extended duration. The OSI FlexJoint® Assembly successfully acted as the critical seal in the final capping stack arrangement, even though the wellbore temperatures and pressures exceeded the nominal requirements. This sealing technology is only available with an industry and field proven OSI FlexJoint® Assembly. The major component of the flexible joint is the flex element assembly.

Figure 1-1
Typical Subsea
Flexible Joint



The flex element assembly is constructed using alternating layers of elastomer pads and spherically shaped metal reinforcements. It is molded with an approximately 3/8 inch (1 cm) thick elastomer coating. The flex element assembly is integrally bonded during the molding process to the nipple and back flange so that it forms, in addition to a bearing, the seal between the body and the nipple. The flex element assembly is secured within the body by a retainer flange fastened to the top of the body by various retainer studs and nuts (with the size and quantity depending on the internal pressure rating).

Due to the wear (keyseat) damage that typically occurs along the internal bore during drilling operations, each flexible joint can include replaceable wear components. These wear components protect the critical components within the flexible joint in order to extend the life of the unit. The replaceable wear components include ring groove inserts, wear sleeves, and a center wear ring with a tapered lead in angle.

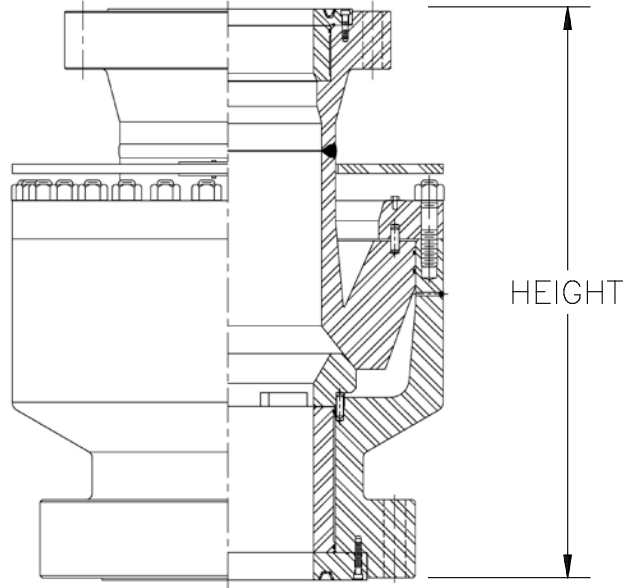
1.3 TECHNICAL CHARACTERISTICS

Each Subsea flexible joint permits cocking displacements up to ± 10 degrees. The flexible joints range from 47 to 62 inches (1.2 to 1.6 m) in diameter and weigh between 10,000 lbs to 30,000 lbs (4,536 to 13,606 kg). The length of the unit depends on the end connections selected as well as the pressure rating of the unit. Table 1.1 illustrates typical overall heights for the 2.0, 2.5, 3.0, 3.5, 5.0, and 6.0 ksi Subsea flexible joints with various end flanges and lists some of the end flanges available. Figure 1-2 illustrates a typical configuration. Table 1.2 provides the performance characteristics of the 2.0, 2.5, 3.0, 3.5, 5.0, and 6.0 ksi Subsea flexible joints.

NOTE:

Where differences exist between the US customary and metric values within this manual, the US customary value is the standard.

**Figure 1-2
Subsea Flexible Joint
Configuration**



**Table 1.1
Overall Heights ***

2.0 ksi Subsea Flexible Joint

Connection		Height			
Top (API)	Bottom (API)	13-5/8 in.	16-3/4 in.	18-3/4 in.	21-1/4 in.
2,000 Flange	2,000 Flange	—	—	—	48-3/4
5,000 Flange	5,000 Flange	56	55-3/4	60-1/4	61-1/4
10,000 Flange	10,000 Flange	60-1/4	56-1/2	64-3/4	—
15,000 Flange	15,000 Flange	62	65	68	—

2.5 ksi Subsea Flexible Joint

Connection		Height			
Top (API)	Bottom (API)	13-5/8 in.	16-3/4 in.	18-3/4 in.	21-1/4 in.
5,000 Flange	5,000 Flange	56	55-3/4	60-1/4	61-1/4
10,000 Flange	10,000 Flange	60-1/4	56-1/2	64-3/4	—
15,000 Flange	15,000 Flange	62	65	68	—

* Dimensions are based on applicable API 6B or 6BX type flanges.

3.0 ksi Subsea Flexible Joint

Connection		Height			
Top (API)	Bottom (API)	13-5/8 in.	16-3/4 in.	18-3/4 in.	21-1/4 in.
5,000 Flange	5,000 Flange	56	55-3/4	60-1/4	61-1/4
10,000 Flange	10,000 Flange	60-1/4	56-1/2	64-3/4	—
15,000 Flange	15,000 Flange	62	65	68	—

3.5 ksi Subsea Flexible Joint

Connection		Height			
Top (API)	Bottom (API)	13-5/8 in.	16-3/4 in.	18-3/4 in.	21-1/4 in.
5,000 Flange	10,000 Flange	—	NA	64	—
10,000 Flange	10,000 Flange	—	NA	67	—
10,000 Flange	15,000 Flange	—	NA	69	—
15,000 Flange	15,000 Flange	—	NA	71	—

5.0 ksi Subsea Flexible Joint

Connection		Height			
Top (API)	Bottom (API)	13-5/8 in.	16-3/4 in.	18-3/4 in.	21-1/4 in.
5,000 Flange	10,000 Flange	—	NA	71-1/4	—
10,000 Flange	10,000 Flange	—	NA	74-1/4	—
10,000 Flange	15,000 Flange	—	NA	76-1/4	—
15,000 Flange	15,000 Flange	—	NA	78-1/4	—

6.0 ksi Subsea Flexible Joint

Connection		Height			
Top (API)	Bottom (API)	13-5/8 in.	16-3/4 in.	18-3/4 in.	21-1/4 in.
5,000 Flange	10,000 Flange	—	—	—	—
10,000 Flange	10,000 Flange	—	NA	84-1/4	—
10,000 Flange	15,000 Flange	—	NA	86-1/4	—
15,000 Flange	15,000 Flange	—	NA	88-1/4	—

Table 1.2
Performance Characteristics

2.0 ksi Subsea Flexible Joint

Characteristic	Value
Bore Size:	13-5/8 in. (34.6 cm) 16-3/4 in. (42.5 cm) 18-3/4 in. (47.6 cm) 21-1/4 in. (54.0 cm)
Maximum Operating Pressure:	2,000 psi (137 bar)
Maximum Test Pressure:	3,000 psi (207 bar)
Maximum Operating Tension:	1,000,000 lbs (4,448 kN)
Maximum Tension (Flooded Riser):	2,000,000 lbs (8,896 kN)
Maximum Deflection:	±10 degrees
Angular Spring Rate:	34,210 ft-lb/deg (46.38 kNm/deg) @ 10 degrees rotation
Maximum Water Depth: (Based on 18 ppg mud)	4,000 ft (1220 m)
Maximum Outer Diameter:	47.00 in. (119 cm)
Estimated Final Weight:	10,000 lbs (4536 kg)

2.5 ksi Subsea Flexible Joint

Characteristic	Value
Bore Size:	13-5/8 in. (34.6 cm) 16-3/4 in. (42.5 cm) 18-3/4 in. (47.6 cm) 21-1/4 in. (54.0 cm)
Maximum Operating Pressure:	2,500 psi (172 bar)
Maximum Test Pressure:	3,750 psi (258 bar)
Maximum Operating Tension:	1,000,000 lbs (4,448 kN)
Maximum Tension (Flooded Riser):	2,000,000 lbs (8,896 kN)
Maximum Deflection:	±10 degrees
Angular Spring Rate:	34,210 ft-lb/deg (46.38 kNm/deg) @ 10 degrees rotation
Maximum Water Depth: (Based on 18 ppg mud)	5,000 ft (1524 m)
Maximum Outer Diameter:	47.00 in. (119 cm)
Estimated Final Weight:	10,000 lbs (4536 kg)

3.0 ksi Subsea Flexible Joint

Characteristic	Value
Bore Size:	13-5/8 in. (34.6 cm) 16-3/4 in. (42.5 cm) 18-3/4 in. (47.6 cm) 21-1/4 in. (54.0 cm)
Maximum Operating Pressure:	3,000 psi (207 bar)
Maximum Test Pressure:	4,500 psi (311 bar)
Maximum Operating Tension:	1,000,000 lbs (4,448 kN)
Maximum Tension (Flooded Riser):	2,000,000 lbs (8,896 kN)
Maximum Deflection:	±10 degrees
Angular Spring Rate:	34,210 ft-lb/deg (46.38 kNm/deg) @ 10 degrees rotation
Maximum Water Depth: (Based on 18 ppg mud)	6,000 ft (1829 m)
Maximum Outer Diameter:	48.50 in. (123 cm)
Estimated Final Weight:	14,000 lbs (6350 kg)

3.5 ksi Subsea Flexible Joint

Characteristic	Value
Bore Size:	16-3/4 in. (42.5 cm) 18-3/4 in. (47.6 cm)
Maximum Operating Pressure:	3,500 psi (241 bar)
Maximum Test Pressure:	5,250 psi (362 bar)
Maximum Operating Tension:	2,000,000 lbs (8,896 kN)
Maximum Tension (Flooded Riser):	2,500,000 lbs (11,121 kN)
Maximum Deflection:	±10 degrees
Angular Spring Rate:	41,640 ft-lb/deg (56.46 kNm/deg) @ 10 degrees rotation
Maximum Water Depth: (Based on 18 ppg mud)	7,000 ft (2133 m)
Maximum Outer Diameter:	56.00 in. (142 cm)
Estimated Final Weight:	20,000 lbs (9071 kg)

5.0 ksi Subsea Flexible Joint

Characteristic	Value
Bore Size:	16-3/4 in. (42.5 cm) 18-3/4 in. (47.6 cm)
Maximum Operating Pressure:	5,000 psi (345 bar)
Maximum Test Pressure:	7,500 psi (517 bar)
Maximum Operating Tension:	2,000,000 lbs (8,896 kN)
Maximum Tension (Flooded Riser):	2,500,000 lbs (11,121 kN)
Maximum Deflection:	±10 degrees
Angular Spring Rate:	68,730 ft-lb/deg (93.19 kNm/deg) @ 10 degrees rotation
Maximum Water Depth: (Based on 18 ppg mud)	10,000 ft (3048 m)
Maximum Outer Diameter:	58.00 in. (147 cm)
Estimated Final Weight:	25,000 lbs (11,340 kg)

6.0 ksi Subsea Flexible Joint

Characteristic	Value
Bore Size:	16-3/4 in. (42.5 cm) 18-3/4 in. (47.6 cm)
Maximum Operating Pressure:	6,000 psi (414 bar)
Maximum Test Pressure:	9,000 psi (621 bar)
Maximum Operating Tension:	3,000,000 lbs (13,345 kN)
Maximum Tension (Flooded Riser):	3,500,000 lbs (15,569 kN)
Maximum Deflection:	±10 degrees
Angular Spring Rate:	94,080 ft-lb/deg (127.56 kNm/deg) @ 10 degrees rotation
Maximum Water Depth: (Based on 18 ppg mud)	12,000 ft (3658 m)
Maximum Outer Diameter:	62.00 in. (158 cm)
Estimated Final Weight:	30,000 lbs (13,606 kg)

2 TOOLS AND MATERIALS REQUIRED

2.1 GENERAL

This section provides detailed information on the tools and materials required for maintenance of a Subsea flexible joint. In addition to the standard tools identified below, a crane is required for handling the unit and the various parts during inspection and maintenance. The minimum lift capacity of the crane should be checked against the estimated weights given in Table 1.2.

2.2 TOOLS AND MATERIALS

Table 2.1 lists the tools and materials required for maintenance of a Subsea flexible joint, and explains the intended purpose of each.

NOTE:

Equivalent tools or materials may be substituted for those listed as long as the intended purpose is achieved.

Table 2.1
Tools and Materials Required for Flexible Joint Maintenance

2.0 and 2.5 ksi Subsea Flexible Joints

Item	Purpose
Torque Wrench (2,000 ft-lb)	Torque Retainer Nuts
Torque Wrench (300 ft-lb)	Torque Ring Groove Insert Bolts
Capscrew Wrench (5/8 in.)	Remove Ring Groove Insert
2-3/4 Socket (hex)	Retainer Nuts
Eyebolt 1 in., 8-UNC	Lift Retainer Flange
Eye Nuts 1-1/4 in., 8-UN	Lift Flex Element Assembly and Body
Eyebolts 1/2 in., 13-UNC	Lift Wear Ring and Seal Ring Flange
Sling for Crane	Connect to Eyebolts
Grease, API SA2	Lube Bolts, Wear Ring
Grease, Alemite Multi-Purpose #2	Lube O-ring
Thread Lubricant	Lube Retainer Studs, Nuts
Trichloroethylene	Clean Metal
Methyl Ethyl Ketone (MEK)	Clean Rubber
Emery Cloth (400 grit or finer)	Refinish O-ring Groove

3.0 ksi Subsea Flexible Joints

Item	Purpose
Torque Wrench (3,500 ft-lb)	Torque Retainer Nuts
Torque Wrench (300 ft-lb)	Torque Ring Groove Insert Bolts
Capscrew Wrench (5/8 in.)	Remove Ring Groove Insert
3-1/8 Socket (hex)	Retainer Nuts
Eyebolt 1 in., 8-UNC	Lift Retainer Flange
Eye Nuts 1-1/4 in., 8-UN	Lift Flex Element Assembly and Body
Eyebolts 1/2 in., 13-UNC	Lift Wear Ring and Seal Ring Flange
Sling for Crane	Connect to Eyebolts
Grease, API SA2	Lube Bolts, Wear Ring
Grease, Alemite Multi-Purpose #2	Lube O-ring
Thread Lubricant	Lube Retainer Studs, Nuts
Trichloroethylene	Clean Metal
Methyl Ethyl Ketone (MEK)	Clean Rubber
Emery Cloth (400 grit or finer)	Refinish O-ring Groove

3.5 ksi Subsea Flexible Joints

Item	Purpose
Torque Wrench (8,000 ft-lb)	Torque Retainer Nuts
Torque Wrench (300 ft-lb)	Torque Ring Groove Insert Bolts
Capscrew Wrench (5/8 in.)	Remove Ring Groove Insert
4-1/4 Socket (hex)	Retainer Nuts
Eyebolt 1 in., 8-UNC	Lift Retainer Flange
Eye Nuts 1-1/4 in., 8-UN	Lift Flex Element Assembly and Body
Eyebolts 1/2 in., 13-UNC	Lift Wear Ring and Seal Ring Flange
Sling for Crane	Connect to Eyebolts
Grease, API SA2	Lube Bolts, Wear Ring
Grease, Alemite Multi-Purpose #2	Lube O-ring
Thread Lubricant	Lube Retainer Studs, Nuts
Trichloroethylene	Clean Metal
Methyl Ethyl Ketone (MEK)	Clean Rubber
Emery Cloth (400 grit or finer)	Refinish O-ring Groove

5.0 and 6.0 ksi Subsea Flexible Joints

Item	Purpose
Torque Wrench (12,500 ft-lb)	Torque Retainer Nuts
Torque Wrench (300 ft-lb)	Torque Ring Groove Insert Bolts
Capscrew Wrench (5/8 in.)	Remove Ring Groove Insert
4-5/8 Socket (hex)	Retainer Nuts
Eyebolt 1 in., 8-UNC	Lift Retainer Flange
Eye Nuts 1-1/4 in., 8-UN	Lift Flex Element Assembly and Body
Eyebolts 1/2 in., 13-UNC	Lift Wear Ring and Seal Ring Flange
Sling for Crane	Connect to Eyebolts
Grease, API SA2	Lube Bolts, Wear Ring
Grease, Alemite Multi-Purpose #2	Lube O-ring
Thread Lubricant	Lube Retainer Studs, Nuts
Trichloroethylene	Clean Metal
Methyl Ethyl Ketone (MEK)	Clean Rubber
Emery Cloth (400 grit or finer)	Refinish O-ring Groove



3 MAINTENANCE

3.1 GENERAL

This section presents complete procedures for installation and removal, disassembly, cleaning, inspection, and reassembly of each Subsea flexible joint. The procedures are directed toward identification and replacement of worn or damaged parts, since field repair of these parts is impractical. Maintenance procedures are essentially the same for each flexible joint size. However, there are options that may be present on any size of flexible joint. The various options are summarized below and procedures for each are presented as part of the maintenance process. When performing maintenance, select the appropriate procedure for the unit being worked on.

3.1.1 End Connections. Various end connections are available for the flexible joints. Generally, no maintenance is required for these other than replacement of worn or damaged studs or seal rings. This manual assumes that typical end connections are used. If your unit uses a different end connection, it may be necessary to adjust the size of eyebolts used for lifting the end connection or to make other minor adjustments in the procedures. Where special end connections are provided as specified by the customer, maintenance procedures are provided as a supplement to this manual.

3.1.2 Debris Shield. Two different types of debris shields are used on the flexible joints, depending on whether splitting the shield is required to clear the upper end connector.

3.1.3 Parts. Due to the difference in pressure ratings between the various models of flexible joints, certain parts are changed. When ordering replacements for wear components and similar parts, be sure you are referring to the parts list (Section 5) for your size unit or to the OSI unit serial number.

3.2 REMOVAL

The flexible joint should be removed from the stack and the riser following the operator's standard procedures. After the unit has been removed, it should be positioned upright in an area that is free of obstacles and permits easy access to all parts of the flexible joint.

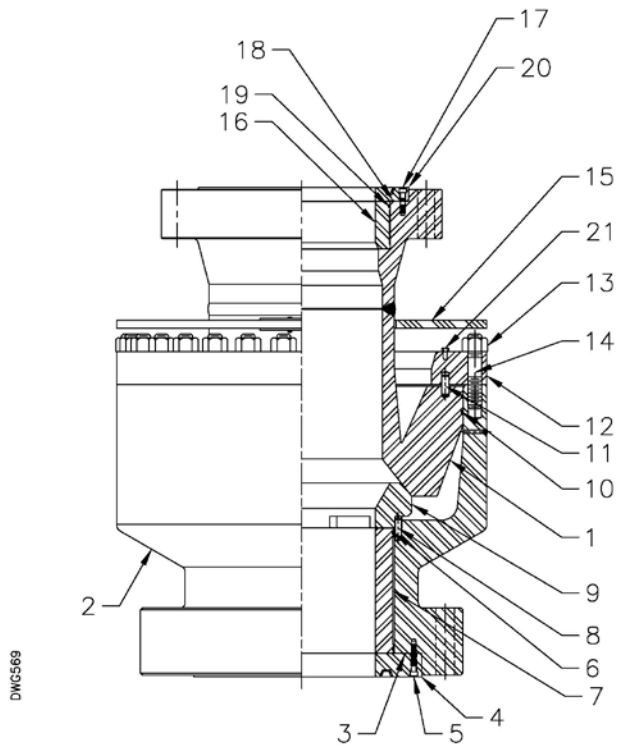
WARNING:

The flexible joint and its parts are extremely heavy. Never work in a position that places you under the unit or its parts when they are being lifted. Failure to follow the maintenance procedures or to observe this WARNING could result in injury or death.

3.3 FLEXIBLE JOINT DISASSEMBLY

Perform the following procedures, in sequence, to disassemble the flexible joint. The procedures are keyed (via the numbers in parenthesis) to the numerical list of components shown in Figure 3-1. It is recommended that, with the exception of the debris shield, if disassembly is started, the unit be completely disassembled and inspected for worn or damaged parts before reassembling.

**Figure 3-1
Subsea Flexible Joint
Components**



- | | |
|--------------------------------------|---------------------------------------|
| 1. Flex Element Assembly | 12. Retainer Flange |
| 2. Body | 13. Retainer Nut |
| 3. O-ring (Lower Ring Groove Insert) | 14. Retainer Stud |
| 4. Lower Ring Groove Insert | 15. Debris Shield |
| 5. Bolts (Lower Ring Groove Insert) | 16. Upper Wear Sleeve |
| 6. O-ring (Lower Wear Sleeve) | 17. Bolts (Upper Ring Groove Insert) |
| 7. Lower Wear Sleeve | 18. O-ring (Upper Ring Groove Insert) |
| 8. Center Wear Ring Pin | 19. O-ring (Upper Wear Sleeve) |
| 9. Center Wear Ring | 20. Upper Ring Groove Insert |
| 10. O-Ring (Flex Element) | 21. Identification Tag |
| 11. Anti-Rotation Pin | |

NOTE:

The upper and lower ring groove inserts and wear sleeves are an optional feature. If your unit does not have them, disregard these disassembly procedures.

3.3.1 Lower Ring Groove Insert and Wear Sleeve. Remove the lower ring groove insert (4) and the lower wear sleeve (7) as follows:

NOTE:

The flexible joint must be upside down (inverted) for this procedure.

1. Remove the lower ring groove insert bolts, Item (5) Figure 3-1.
2. Screw 1/2-13 eyebolts into the holes provided in the ring groove insert (4) and connect the crane hook to them using the sling.
3. Lift the ring groove insert out and set on a wooden pallet.
4. Remove the O-ring (3) from the ring groove insert. Discard the O-ring.
5. Screw 1/2-13 eyebolts into the lower wear sleeve (7). Connect the crane hook into them using the sling.
6. Lift out the lower wear sleeve and set on a wooden pallet.
7. Remove the O-rings (6) from the lower wear sleeve. Discard the O-rings.

3.3.2 Upper Ring Groove Insert and Wear Sleeve. Remove the upper ring groove insert (20) and the upper wear sleeve (16) as follows:

NOTE:

The flexible joint must be right side up for this procedure.

1. Remove the upper ring groove insert bolts, Item (17) Figure 3-1.
2. Screw 1/2-13 eyebolts into the holes provided in the ring groove insert (20) and connect the crane hook to them using the sling.
3. Lift the ring groove insert out and set on a wooden pallet.
4. Remove the O-ring (18) from the ring groove insert. Discard the O-ring.
5. Screw 1/2-13 eyebolts into the upper wear sleeve (16). Connect the crane hook into them using the sling.
6. Lift out the upper wear sleeve and set on a wooden pallet.
7. Remove the O-rings (19) from the upper wear sleeve. Discard the O-rings.

3.3.3 Debris Shield. Remove the debris shield (15) as follows:

1. Remove the screws and plate that secure the break in the debris shield (15).
2. Bend the debris shield (15) to clear the upper end connector and remove it.

3.3.4 Flex Element Assembly. Remove the flex element assembly (1) as follows:

CAUTION:

Be extremely careful when removing the assembly from the body to avoid damage to the O-rings.

1. Screw four eye nuts to studs equally spaced around the end connector or install four eyebolts, as applicable.
2. Position the crane and connect it to the eyebolts. Take up the slack in the crane cable, but do not apply tension yet.
3. Ensure that there is a locator mark on both the retainer flange (12) and body (2) to permit proper orientation when the assembly is reinstalled. If no marks are found, scribe opposing lines on the body (2) and retainer flange (12) to serve as a locator.

CAUTION:

Be careful while moving the flex element assembly not to damage the elastomer or elastomer to metal interfaces.

4. Remove the retainer nuts (13) from the retainer studs (14).
5. Use the crane to lift the flex element assembly (1) with the retainer flange (12) straight up out of the body (2). Swing the assembly clear of the body and cautiously remove the O-rings (10) from the flex element assembly. Discard the O-rings. Set the assembly and retainer flange down on a wooden pallet.
6. For those units with an end connector small enough to permit the retainer flange (12) to be removed, use four eyebolts through the retainer flange to lift the flange away from the flex element assembly. Otherwise, use the eyebolts to lift the retainer flange while performing step 7 below and then set it back in place.

-
7. Remove the two anti-rotation pins (11) from the flex element assembly.

3.3.5 Center Wear Ring. Remove the center wear ring (9) from the body (2) as follows:

1. Install four 1/2 inch eyebolts in the holes provided in the upper surface of the center wear ring (9).
2. Connect the crane sling to the eyebolts and lift the center wear ring (9) out of the body (2).
3. Ensure that the center wear ring pin (8) remained in the body. If it didn't, remove it from the underside of the center wear ring.
4. Set the center wear ring (9) down on a wooden pallet and disconnect the crane from the eyebolts.
5. Remove the center wear ring pin (8) from the body (2).

3.3.6 Retainer Studs. Damaged retainer studs (14) may be removed from the API flange or body by installing two nuts on a stud and then applying a torque to the bottom nut.

NOTE:

Do not remove undamaged retainer studs. Retainer studs should be removed as directed in 3.3.6 above only if obvious damage to the stud is apparent or the stud is improperly installed.

3.4 CLEANING AND INSPECTION

Cleaning and inspection of the parts within the flexible joint are described in the following subparagraphs. Always clean the part before performing the inspection. Replace all worn or damaged parts with new parts before reassembling the flexible joint.

OSI recommends that under normal operating conditions, the flexible joint should be disassembled and inspected for damage / wear every 5 years. In order to issue a new OSI Certificate of Conformance, a disassembly and inspection of critical areas and dimensional checks to verify conformance must be completed by an OSI facility per SP2U-0061. See Section 5.3 to contact the nearest OSI facility.

3.4.1 Cleaning.

WARNING:

The solvents used for cleaning the parts within the flexible joint are toxic. Avoid getting the solvents on your skin or breathing the fumes. Cleaning operations should be performed in a well-ventilated area.

Methyl Ethyl Ketone (MEK) is extremely flammable. Do not smoke or allow welding or other operations involving open flames or sparks nearby when it is being used.

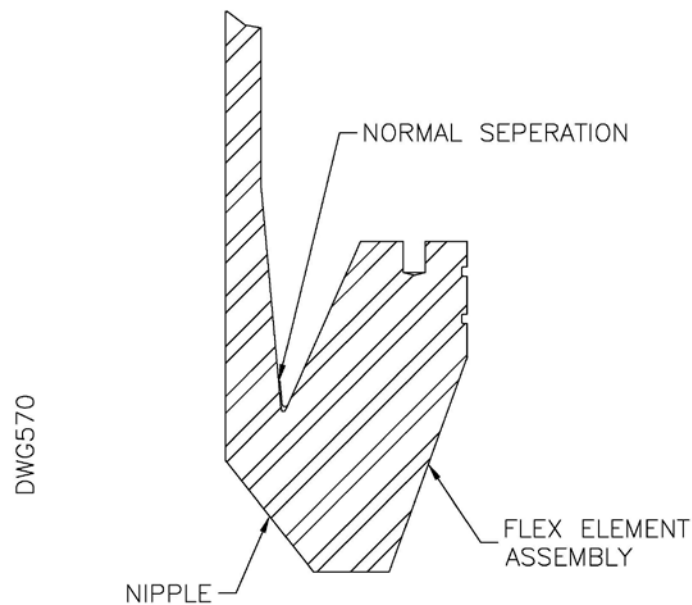
1. Clean all metal parts within the flexible joint with a clean rag soaked with Trichloroethylene or equivalent solvent. Be especially careful to remove all dirt and grease from the O-ring grooves, anti-rotation pins and their holes, mating surfaces, and threads of bolts, studs, and nuts.
2. Clean the elastomer of the flex element assembly (1) with a clean rag soaked in MEK.

3.4.2 Inspection.

NOTE:

The elastomer flashing usually separates from the nipple at the point indicated by Figure 3-2. This is normal when the flexible joint is deflected and should be no cause for concern.

**Figure 3-2
Flashing Separation**



1. Elastomer. Inspect the entire surface of the elastomer for abrasion or wear. Cuts or gouges in the elastomer that exceed 1/8 inch (3mm) in depth are cause for replacement of the flex element assembly (1).
2. Center Wear Ring (9), Upper (19) and Lower (7) Wear Sleeves. Inspect the components for signs of uneven or excessive wear. Replace the components if they are sufficiently scored, galled, or worn such that wear is occurring to the body (2) interior or flex element assembly (1).

-
3. Nipple. The extension protruding from the middle of the flex element assembly (1) is referred to as the nipple. Check the bearing surface of the nipple for excessive or uneven wear. Return the entire flexible joint to the manufacturer for repair or replacement if severe scoring, galling, or wear in excess of ¼ inch is found. Inspect the remainder of the nipple for cracks or other defects, paying particular attention to the weld area. Return the unit to the manufacturer for repair or replacement if cracks or other defects occur for reasons other than normal wear.
 4. Body. Inspect the body (2) for cracks, other defects, and particularly damage to the mating surfaces. Return the entire unit to the manufacturer if defects are found.
 5. Flex Element Back Flange. The integrally bonded heavy metal ring surrounding the flex element assembly (and containing the O-rings) is referred to as the back flange. Inspect the flange for damage to the O-ring grooves and mechanical damage to the mating surfaces. Minor damage to the O-ring grooves may be repaired by smoothing out the surface with #400 grit or finer emery cloth. Ensure that the grooves are completely clean before installing new O-rings.
 6. Threads. Inspect all threaded parts for damage to the thread. Minor thread damage may be repaired by using an appropriate tap or die to renew the threads. Bolts, studs, or nuts with excessive damage to the threads should be replaced. If interior threads are badly damaged, return the unit to the manufacturer for repair or replacement.
 7. Ring Groove Inserts. Inspect the ring groove inserts for damage to the mating surfaces or the O-ring groove. Minor damage to the O-ring groove may be repaired by smoothing out the surface with #400 grit or finer emery cloth. Ensure that the groove is completely clean before installing a new O-ring.

3.5 FLEXIBLE JOINT ASSEMBLY

Assembly of the flexible joint is essentially a reversal of the disassembly procedures. Perform the procedures outlined in the following paragraphs, being sure to observe the **WARNINGS** and **CAUTIONS** during reassembly of the flexible joint.

3.5.1 Retainer Studs. Retainer studs that have been removed should be installed as follows:

1. Ensure that both the retainer stud (14) and the threaded hole are clean.
2. Screw the retainer stud (14) into the body (2), using the double-nut method, to a height of:

2.0 ksi	2.5 ksi	3.0 ksi	3.5 ksi	5.0 ksi	6.0 ksi
7.0 ±0.1 in. (18 cm)	7.0 ±0.1 in. (18 cm)	7.7 ±0.1 in. (20 cm)	9.5 ±0.1 in. (24 cm)	10.5 ±0.1 in. (27 cm)	11.2 ±0.1 in. (28 cm)

NOTE:

Refer to API standards to determine the proper installed height for studs in the end connectors.

3.5.2 Center Wear Ring. Install the center wear ring (9) as outlined below:

1. Ensure that the holes for the center wear ring pin (8) in the body (2) and center wear ring (9) are completely clean.

CAUTION:

Be extremely careful when installing the center wear ring not to allow it to contact the O-ring mating surfaces at the top inside of the body. Damage to this area may require that the entire flexible joint be replaced.

2. Install the center wear ring pin (8) in the hole in the body (2).
3. Connect the crane sling to the eyebolts in the center wear ring (9) and set the center wear ring into the body (2) being careful to ensure that the center wear ring pin (8) mates with the hole in the bottom of the center wear ring.
4. Disconnect the crane sling from the eyebolts and remove the eyebolts.
5. Coat the exposed surfaces of the center wear ring with API #SA2 grease or equivalent.

3.5.3 Retainer Flange and Flex Element Assembly. Install the retainer flange (12) and the flex element assembly (1) as follows:

1. Install four eyebolts in the retainer flange (12) and connect the crane sling to them.

WARNING:

Be extremely careful when working under the assembly to ensure that it is not lowered while you are working on it. One person should be assigned to remain at the crane controls while you are working to prevent operation of the crane.

2. Raise the retainer flange (12) clear of the top of the flex element back flange and inspect the mating surfaces and anti-rotation pins (11) and holes.

-
3. Ensure that the holes for the anti-rotation pins (11) in both the retainer flange (12) and back flange are clean and then coat the anti-rotation pins with grease and install them in the back flange holes.
 4. Lower the retainer flange (12) onto the anti-rotation pins (11) being sure it lines up and completely seats on the pins.
 5. Remove the sling and eyebolts from the retainer flange (12).
 6. Connect the crane sling to the eye nuts or eyebolts in the end connector and raise and position the flex element assembly (1) over the body (2). Do not lower into place.
 7. Lubricate the new O-rings (10) heavily with Alemite multipurpose #2 grease or equivalent and install them in the O-ring grooves. Apply additional lubricant to the O-rings and metal surface after they are installed.
 8. Lubricate the retainer studs (14) on the body (2) liberally with thread lubricant or equivalent.

NOTE:

The torque tables in steps 12 and 13 are a guide to torque application depending on the thread lubricant used by the technician. The torque values provided are based on the friction coefficient of various lubricants available.

CAUTION:

Be extremely careful while installing the flex element assembly into the body, not to damage the O-rings or mar the mating surfaces. Damage to the body or flange surfaces may require replacement of the entire unit.

Figure 3-3
34 Bolt Torque Pattern
3.0 ksi Subsea Flexible Joint

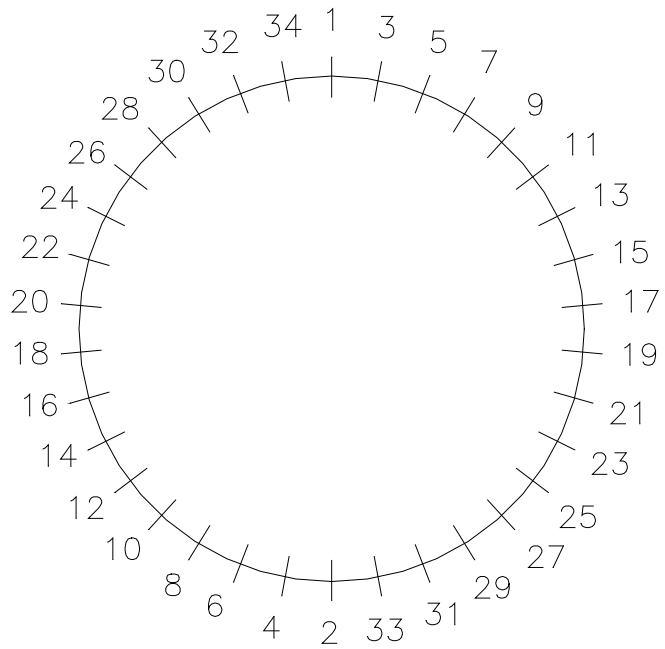


Figure 3-4
30 Bolt Torque Pattern
2.0 ksi Subsea Flexible Joint

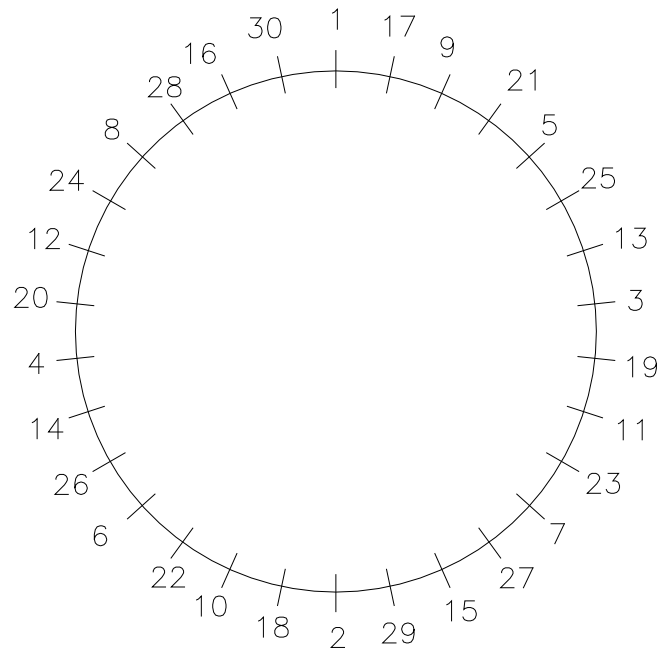


Figure 3-5
36 Bolt Torque Pattern
2.5 ksi Subsea Flexible Joint

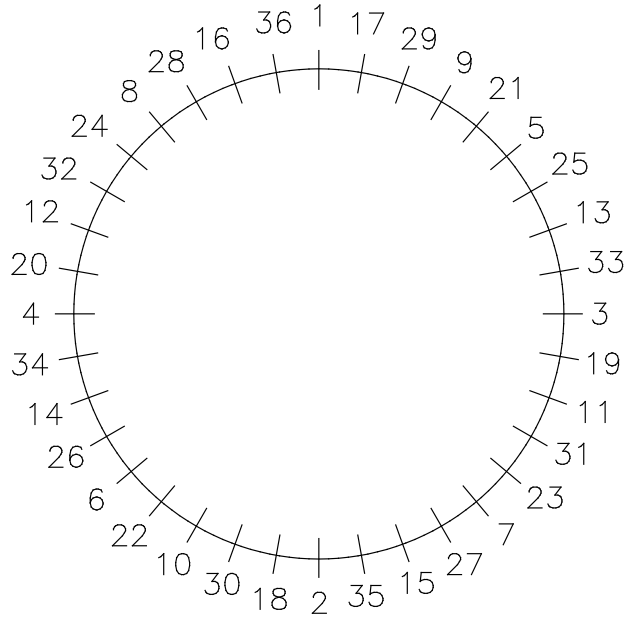


Figure 3-6
28 Bolt Torque Pattern
3.5, 5.0 ksi Subsea Flexible Joint

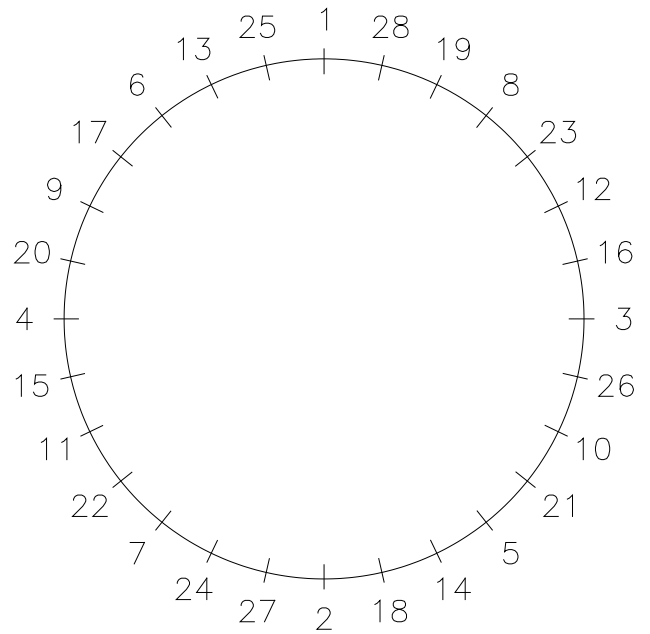
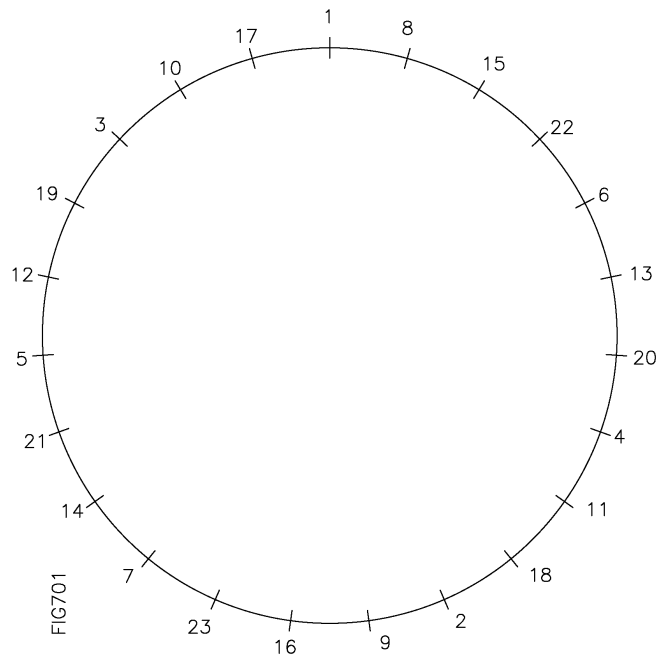


Figure 3-7
23 Bolt Torque Pattern
6.0 ksi Subsea Flexible Joint



9. Ensure that the flex element assembly (1) is properly oriented by lining up the locator lines scribed on the body (2) and retainer flange (12) and then lower the flex element assembly into the body until the retainer flange seats completely over the retainer studs (14).
10. Install the retainer nuts (13) on the retainer studs (14) and tighten them finger tight.
11. Refer to Figures 3-3 through 3-7 and torque each nut in the indicated order to the following values:

2.0 ksi	2.5 ksi	3.0 ksi	3.5 ksi	5.0 ksi	6.0 ksi
150 ft-lbs	150 ft-lbs	150 ft-lbs	150 ft-lbs	150 ft-lbs	150 ft-lbs

12. Torque each nut to the applicable value in Table 3.1, based on the thread lubricant used, in the order indicated in Figures 3-3 through 3-7.

Table 3.1
50 Percent Torque Applied

Flexible Joint	Friction Coefficients (Fc) for Thread Lubricants				
	Dry 0.2 Fc (ft-lbs)	MIL-L-24479B 0.08 Fc (ft-lbs)	0.15 Fc (ft-lbs)	0.10 Fc (ft-lbs)	0.06 Fc (ft-lbs)
2.0 ksi	2,000	850	1,550	1,060	670
2.5 ksi	2,000	850	1,550	1,060	670
3.0 ksi	3,075	1,200	2,325	1,600	1,005
3.5 ksi	7,600	3,300	6,200	4,210	2,615
5.0 ksi	10,000	4,300	8,100	5,500	3,400
6.0 ksi	20,000	8,500	16,000	10,800	6,650

13. Torque each nut to the applicable value in Table 3.2, based on the thread lubricant used, in the order indicated in Figures 3-3 through 3-7. Repeat the torque sequence to ensure even torquing.

Table 3.2
100 Percent Torque Applied

Flexible Joint	Friction Coefficients (Fc) for Thread Lubricants				
	Dry 0.2 Fc (ft-lbs)	MIL-L-24479B 0.08 Fc (ft-lbs)	0.15 Fc (ft-lbs)	0.10 Fc (ft-lbs)	0.06 Fc (ft-lbs)
2.0 ksi	4,000	1,700	3,100	2,120	1,340
2.5 ksi	4,000	1,700	3,100	2,120	1,340
3.0 ksi	6,150	2,400	4,650	3,200	2,010
3.5 ksi	15,200	6,600	12,400	8,420	5,230
5.0 ksi	20,000	8,600	16,200	11,000	6,800
6.0 ksi	40,000	17,000	32,000	21,600	13,300

14. Allow the unit to sit for at least one hour and then recheck the torque for the values given in Table 3.2. Torque any nuts that are below the specified value.
15. Inspect the unit to ensure that all mating surfaces are flush and for any other indications of improper assembly.

3.5.4 Debris Shield. Perform the following steps to reinstall the debris shield (15).

NOTE:

For debris shields that are not split, position the debris shield around the nipple and omit steps 1 and 2 below.

1. Bend the debris shield (15) so that it will clear the upper end connector and install around the nipple.
2. Install the plate to the debris shield (15) and secure it with the 10 screws.

3.5.5 Upper Wear Sleeve. Install the upper wear sleeve (16) as follows:

1. Lubricate the new O-ring (19) with Alemite multipurpose #2 grease or equivalent and install in the O-ring groove. Coat entire outside surface with grease.
2. Attach the crane to the 1/2-13 eyebolts in the upper wear sleeve (16).
3. Lift the upper wear sleeve (16) and lower into position.

3.5.6 Upper Ring Groove Insert. Install the upper ring groove insert (20) as follows:

1. Lubricate the new O-ring (18) with Alemite #2 multipurpose grease or equivalent and install in the O-ring groove.
2. Attach the crane to the 1/2-13 eyebolts. Lift the upper ring groove insert (20) and lower into position aligning the bolt holes in the body (2).

-
3. Install the upper ring groove insert bolts (17) and torque to 150 ft-lbs.

3.5.7 Lower Wear Sleeve. Install the lower wear sleeve (7) as follows:

NOTE:

The flexible joint must be upside down (inverted) for this procedure.

1. Lubricate the new O-rings (6) with Alemite multipurpose #2 grease or equivalent and install in the O-ring grooves. Coat entire outside surface with grease.
2. Attach the crane to the 1/2-13 eyebolts in the lower wear sleeve (7).
3. Lift the lower wear sleeve (7) and lower into position.

3.5.8 Lower Ring Groove Insert. Install the lower ring groove insert (4) as follows:

1. Lubricate the new O-ring (3) with Alemite #2 multipurpose grease or equivalent and install in the O-ring groove.
2. Attach the crane to the 1/2-13 eyebolts. Lift the lower ring groove insert (4) and lower into position aligning the bolt holes in the body (2).
3. Install the lower ring groove insert bolts (5) and torque to 150 ft-lbs.



4 PREPARATION FOR STORAGE OR SHIPMENT

4.1 GENERAL

This section presents information on the packing and preservation required to prepare the flexible joint for storage or shipment.

4.2 PRESERVATION

Prior to storing or shipping the flexible joint, the following steps should be taken to ensure that no deterioration occurs during storage.

4.2.1 Clean Metals. Clean the metal surfaces of the unit completely inside and out with Trichloroethylene or an equivalent solvent.

4.2.2 Coat. Coat the metal surfaces with a liberal coat of API #SA2 grease or equivalent.

4.2.3 Clean Elastomer. Clean the elastomer surfaces inside and out with Methyl Ethyl Ketone. (MEK)

4.2.4 Install Shield. Place a shield over the open end of the flexible joint and secure it in place.

4.2.5 Cover. If the unit will be exposed to direct sunlight, cover the entire unit to protect the elastomer from deterioration due to sunlight. The best option is an aluminum cover that completely protects the unit

from sunlight and rain, but any cover that is waterproof and shields the elastomer from the sun may be used.

4.3 PACKING

Packing of the flexible joint is limited to securing the unit to an appropriate pallet and ensuring that the steps required for preservation outlined in Section 4.2 have been accomplished.

4.4 STORAGE

The flexible joint should be stored in the vertical position in a cool, dry area where it is protected from moisture and sunlight. The temperature during storage should not be below -20°F (-29°C).

NOTE:

To protect the bottom sealing surfaces of the flexible joint, do not place the flexible joint on uneven surfaces such as rocks or steel as this may damage the sealing surfaces.

5 PARTS LIST

5.1 GENERAL

This section presents typical parts lists for each Subsea flexible joint. Coverage is limited to those items that may be replaced by usual maintenance procedures.

5.2 USING PARTS LIST

NOTE:

If the top assembly drawings for your flexible joint are available, refer to them to verify part numbers before ordering. If not, the top assembly drawing number is stamped on the flexible joint body. In addition, each individual part is stamped with the drawing number and serial number for that part.

To use the parts lists, first determine the model you have and turn to the parts list (Figures 5-1 through 5-8) for that model. Locate the part(s) you need and note the number of the part on the illustration. Find the corresponding part on the parts list and use the information provided to order parts. Each list provides the item number, name of the part, Oil States part number, and the quantity used in one flexible joint for all replacement parts.

5.3 ORDERING INFORMATION

Replacement parts for any member of the Subsea FlexJoint® Assembly family may be ordered from Oil States Industries at the addresses given below. Always include all of the following information when ordering parts.

1. Rig Name
2. Unit Size
3. Unit Serial Number
4. Part Name
5. Part Number
6. Quantity Required
7. Your Company Name
8. Address and Phone Number
9. Shipping Instructions

CONTACT INFORMATION:

North America

Special Products
Oil States Industries, Inc.
P. O. Box 670
1031 Commercial Blvd. North
Arlington, Texas 76001
Tel.+1 817 548 4200
Fax.+1 817 804 7198
specprod@oilstates.com

South America

Macaé, Brazil
Oil States Industries do Brasil Ltda.
Rua Professora Ivone Alves de Barcelos
No. 205
Novo Cavaleiros
CEP 27930-490
Macaé, RJ Brazil
Tel.+55 22 2763 4300
Fax.+55 22 2773 5625

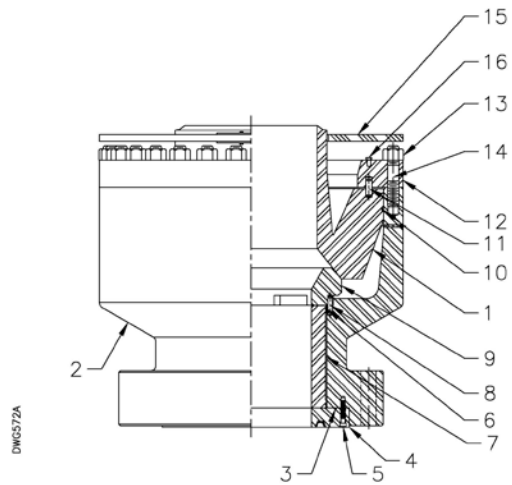
Europe

Oil States Heartlands
Broadfold Road
Bridge of Don
Aberdeen AB23 8EE
Scotland, UK
Tel. +44 1224 708 700
Fax. +44 1224 708 400

Asia

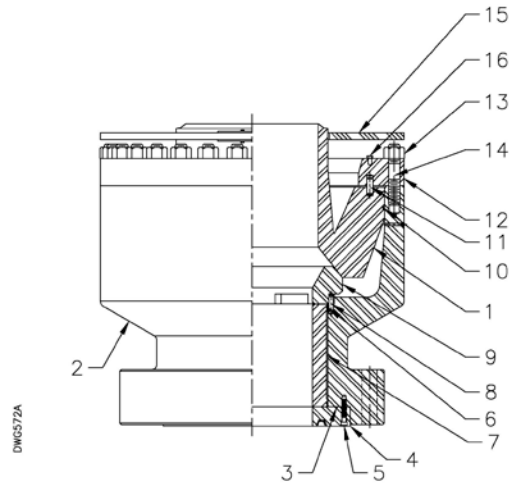
Oil States Industries (Asia) Pte Ltd.
42-H Penjuru Road
Singapore 609158
Tel.+65 6773 7555
Fax.+65 6773 7667
sales.singapore@oilstates.com

Figure 5-1
13-5/8 in. –5,000
2.0 ksi Subsea Flexible Joint Parts List



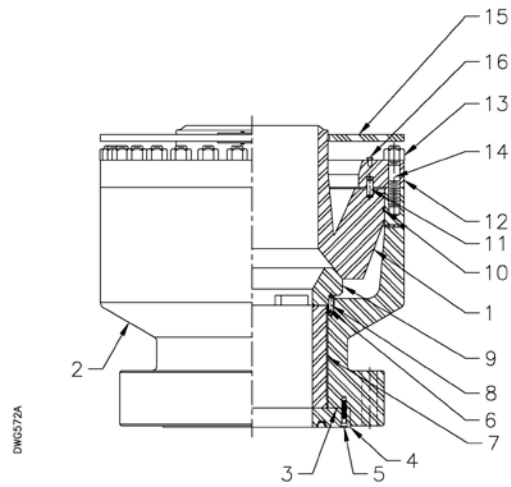
Item	Description	Part Number	Quantity Required
1	Flex Element Assembly	PD2343-1	1
2	Body	PD2344-1	1
3	O-ring (Ring Groove Insert)	PB2163-1	1
4	Lower Ring Groove Insert	PD2156-1	1
5	Bolt (Ring Groove Insert)	GR.8 S.H.C.S.	4
6	O-Ring (Wear Sleeve)	PB2164-6	2
7	Lower Wear Sleeve	PD2680-1	1
8	Center Wear Ring Pin	PB0982	1
9	Center Wear Ring	PD2230-1	1
10	O-ring (Flex Element)	PB0977	2
11	Anti-Rotation Pin	PB0849	2
12	Retainer Flange	PD2262-1	1
13	Retainer Nut	PB2265	30
14	Retainer Stud	PB2266	30
15	Debris Shield	PD3620-1	1
16	Identification Tag	PB12079-1	1

Figure 5-2
16-3/4 in. -5,000
2.0 ksi Subsea Flexible Joint Parts List



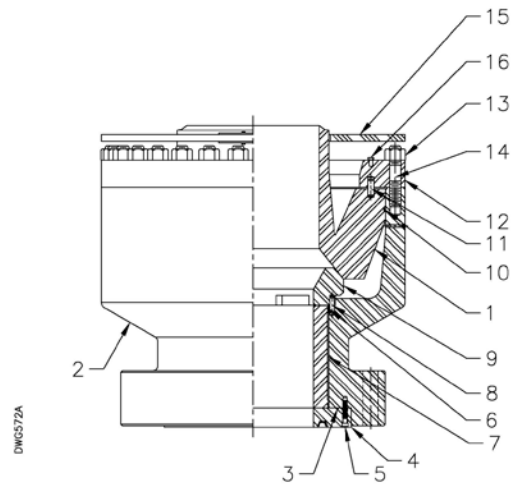
Item	Description	Part Number	Quantity Required
1	Flex Element Assembly	PD2343-1	1
2	Body	PD2344-4	1
3	O-ring (Ring Groove Insert)	PB2163-2	1
4	Lower Ring Groove Insert	PD2156-3	1
5	Bolt (Ring Groove Insert)	GR.8 S.H.C.S.	4
6	O-Ring (Wear Sleeve)	PB2164-2	2
7	Lower Wear Sleeve	PD2680-4	1
8	Center Wear Ring Pin	PB0982	1
9	Center Wear Ring	PD2230-2	1
10	O-ring (Flex Element)	PB0977	2
11	Anti-Rotation Pin	PB0849	2
12	Retainer Flange	PD2262-1	1
13	Retainer Nut	PB2265	30
14	Retainer Stud	PB2266	30
15	Debris Shield	PD3620-1	1
16	Identification Tag	PB12079-1	1

Figure 5-3
18-3/4 in. –5,000, 10,000, 15,000
2.0 ksi Subsea Flexible Joint Parts List



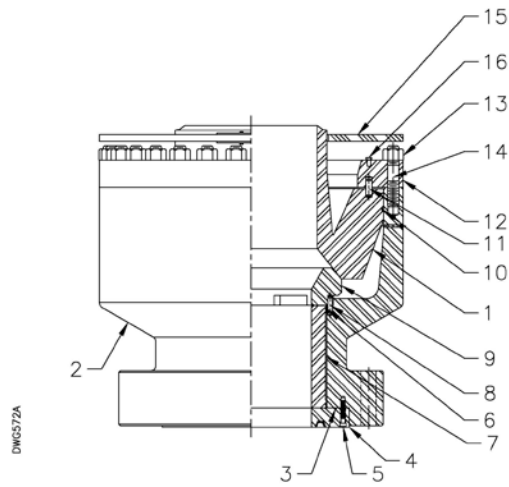
Item	Description	Part Number			Quantity Required
		5,000	10,000	15,000	
1	Flex Element Assembly	PD2343-1	PD2343-1	PD2343-1	1
2	Body	PD2344-5	PD2344-6	PD2344-11	1
3	O-ring (Ring Groove Insert)	PB2163-3	PB2163-3	PB2163-3	1
4	Lower Ring Groove Insert	PD2156-4	PD2156-5	PB2156-5	1
5	Bolt (Ring Groove Insert)	GR.8 S.H.C.S.	GR.8 S.H.C.S.	GR.8 S.H.C.S.	6
6	O-Ring (Wear Sleeve)	PB2164-3	PB2164-3	PB2164-3	2
7	Lower Wear Sleeve	PD2680-5	PD2680-6	PD2680-10	1
8	Center Wear Ring Pin	PB0982	PB0982	PB0982	1
9	Center Wear Ring	PD2229-1	PD2229-1	PD2229-1	1
10	O-ring (Flex Element)	PB0977	PB0977	PB0977	2
11	Anti-Rotation Pin	PB0849	PB0849	PB0849	2
12	Retainer Flange	PD2262-1	PD2262-1	PD2262-1	1
13	Retainer Nut	PB2265	PB2265	PB2265	30
14	Retainer Stud	PB2266	PB2266	PB2266	30
15	Debris Shield	PD3620-1	PD3620-1	PD3620-1	1
16	Identification Tag	PB12079-1	PB12079-1	PB12079-1	1

Figure 5-4
21-1/4 in. -5,000
2.0 ksi Subsea Flexible Joint Parts List



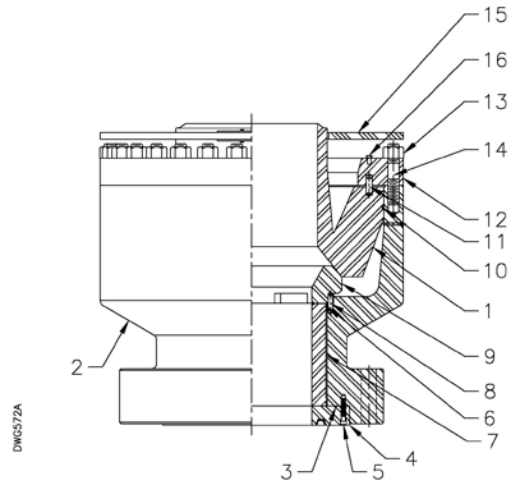
Item	Description	Part Number	Quantity Required
1	Flex Element Assembly	PD2343-2	1
2	Body	PD2344-8	1
3	O-ring (Ring Groove Insert)	PB2163-5	1
4	Lower Ring Groove Insert	PD2156-8	1
5	Bolt (Ring Groove Insert)	GR.8 S.H.C.S.	6
6	O-Ring (Wear Sleeve)	PB2164-5	2
7	Lower Wear Sleeve	PD6208-1	1
8	Center Wear Ring Pin	PB0982	1
9	Center Wear Ring	PD2229-2	1
10	O-ring (Flex Element)	PB0977	2
11	Anti-Rotation Pin	PB0849	2
12	Retainer Flange	PD2262-1	1
13	Retainer Nut	PB2265	30
14	Retainer Stud	PB2266	30
15	Debris Shield	PD3620-1	1
16	Identification Tag	PB12079-1	1

Figure 5-5
18-3/4 in. –5,000, 10,000, 15,000
2.5 ksi Subsea Flexible Joint Parts List



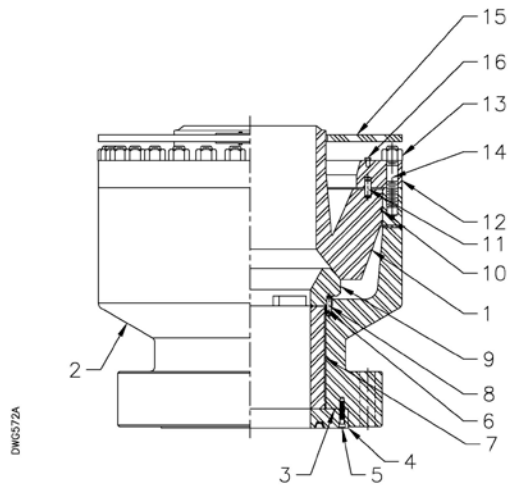
Item	Description	Part Number			Quantity Required
		5,000	10,000	15,000	
1	Flex Element Assembly	PD2343-1	PD2343-1	PD2343-1	1
2	Body	PD4269-4	PD4269-2	PD4269-1	1
3	O-ring (Ring Groove Insert)	PB2163-3	PB2163-3	PB2163-3	1
4	Lower Ring Groove Insert	PD2156-4	PD2156-5	PB2156-5	1
5	Bolt (Ring Groove Insert)	GR.8 S.H.C.S.	GR.8 S.H.C.S.	GR.8 S.H.C.S.	6
6	O-Ring (Wear Sleeve)	PB2164-3	PB2164-3	PB2164-3	2
7	Lower Wear Sleeve	PD2680-5	PD2680-6	PD2680-7	1
8	Center Wear Ring Pin	PB0982	PB0982	PB0982	1
9	Center Wear Ring	PD2229-1	PD2229-1	PD2229-1	1
10	O-ring (Flex Element)	PB0977	PB0977	PB0977	2
11	Anti-Rotation Pin	PB0849	PB0849	PB0849	2
12	Retainer Flange	PD4270	PD4270	PD4270	1
13	Retainer Studs	PB2266	PB2266	PB2266	36
14	Retainer Nuts	PB2265	PB2265	PB2265	36
15	Debris Shield	PD3620-1	PD3620-1	PD3620-1	1
16	Identification Tag	PB12079-1	PB12079-1	PB12079-1	1

Figure 5-6
18-3/4 in. –5,000, 10,000, 15,000
3.0 ksi Subsea Flexible Joint Parts List



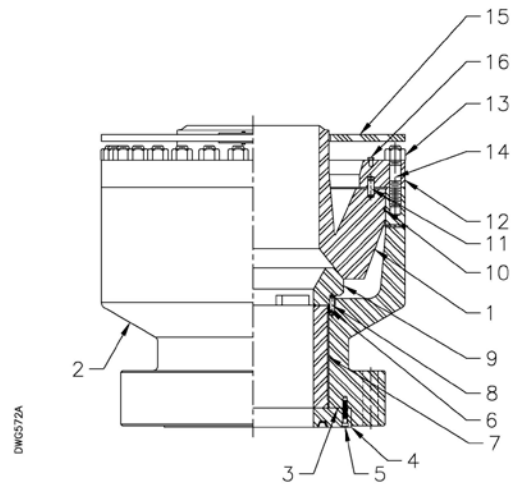
Item	Description	Part Number			Quantity Required
		5,000	10,000	15,000	
1	Flex Element Assembly	PD7376-1	PD7376-1	PD7376-1	1
2	Body	PD7375-1	PD7375-2	PD7375-3	1
3	O-ring (Ring Groove Insert)	PB2163-3	PB2163-3	PB2163-3	1
4	Lower Ring Groove Insert	PD2156-4	PD2156-5	PD2156-5	1
5	Bolt (Ring Groove Insert)	GR.8 S.H.C.S.	GR.8 S.H.C.S.	GR.8 S.H.C.S.	6
6	O-Ring (Wear Sleeve)	PB2164-3	PB2164-3	PB2164-3	2
7	Lower Wear Sleeve	PD2680-5	PD2680-6	PD2680-10	1
8	Center Wear Ring Pin	PB0982	PB0982	PB0982	2
9	Center Wear Ring	PD2229-1	PD2229-1	PD2229-1	1
10	O-ring (Flex Element)	PB0977	PB0977	PB0977	2
11	Anti-Rotation Pin	PB0849	PB0849	PB0849	2
12	Retainer Flange	PD7374	PD7374	PD7374	1
13	Retainer Studs	PB7379	PB7379	PB7379	34
14	Retainer Nuts	PB7380	PB7380	PB7380	34
15	Debris Shield	PD3620-1	PD3620-1	PD3620-1	1
16	Identification Tag	PB12079-1	PB12079-1	PB12079-1	1

Figure 5-7
18-3/4 in. –5,000, 10,000, 15,000
3.5 ksi Subsea Flexible Joint Parts List



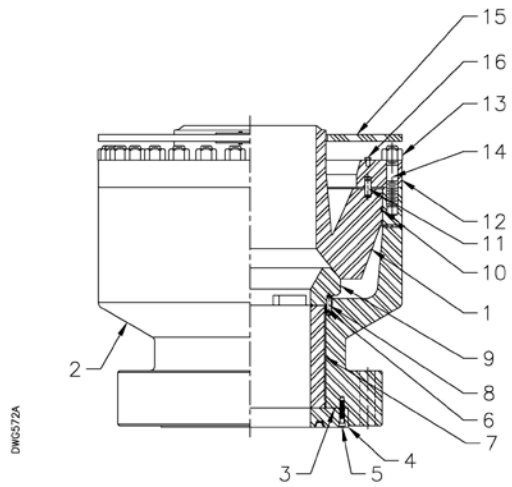
Item	Description	Part Number			Quantity Required
		5,000	10,000	15,000	
1	Flex Element Assembly	PD7282	PD7282	PD7282	1
2	Body	PD7277-1	PD7277-2	PD7277-3	1
3	O-ring (Ring Groove Insert)	PB2163-3	PB2163-3	PB2163-3	1
4	Lower Ring Groove Insert	PD2156-4	PD2156-5	PD2156-5	1
5	Bolt (Ring Groove Insert)	GR.8 S.H.C.S.	GR.8 S.H.C.S.	GR.8 S.H.C.S.	6
6	O-Ring (Wear Sleeve)	PB2164-3	PB2164-3	PB2164-3	2
7	Lower Wear Sleeve	PD7752	PD2680-7	PD2680-10	1
8	Center Wear Ring Pin	PB0982	PB0982	PB0982	2
9	Center Wear Ring	PD7278	PD7278	PD7278	1
10	O-ring (Flex Element)	PB7590	PB7590	PB7590	2
11	Anti-Rotation Pin	PB0849	PB0849	PB0849	2
12	Retainer Flange	PD7283	PD7283	PD7283	1
13	Retainer Studs	PB7329	PB7329	PB7329	28
14	Retainer Nuts	PB7330	PB7330	PB7330	28
15	Debris Shield	PD7492	PD7492	PD7492	1
16	Identification Tag	PB12079-1	PB12079-1	PB12079-1	1

Figure 5-8
18-3/4 in. –10,000, 15,000
5.0 ksi Subsea Flexible Joint Parts List



Item	Description	Part Number		Quantity Required
		10,000	15,000	
1	Flex Element Assembly	PD7672	PD7672	1
2	Body	PD7629-2	PD7629-1	1
3	O-ring (Ring Groove Insert)	PB2163-3	PB2163-3	2
4	Lower Ring Groove Insert	PD2156-5	PD2156-5	1
5	Bolt (Ring Groove Insert)	GR.8 S.H.C.S.	GR.8 S.H.C.S.	6
6	O-Ring (Wear Sleeve)	PB2164-3	PB2164-3	2
7	Lower Wear Sleeve	PD7791-2	PD7791-1	1
8	Center Wear Ring Pin	PB0982	PB0982	1
9	Center Wear Ring	PD7684	PD7684	1
10	O-ring (Flex Element)	PB7792	PB7792	2
11	Anti-Rotation Pin	PB0849	PB0849	2
12	Retainer Flange	PD7680	PD7680	1
13	Retainer Studs	PB7793	PB7793	28
14	Retainer Nuts	PB7794	PB7794	28
15	Debris Shield	PD7492-1	PD7492-1	1
16	Identification Tag	PB12079-1	PB12079-1	1

Figure 5-9
18-3/4 in. –10,000, 15,000
6.0 ksi Subsea Flexible Joint Parts List



Item	Description	Part Number		Quantity Required
		10,000	15,000	
1	Flex Element Assembly	PD8226	PD8226	1
2	Body	PD8227-2	PD8227-1	1
3	O-ring (Ring Groove Insert)	PB2163-3	PB2163-3	2
4	Lower Ring Groove Insert	PD2156-5	PD2156-5	1
5	Bolt (Ring Groove Insert)	GR.8 S.H.C.S.	GR.8 S.H.C.S.	6
6	O-Ring (Wear Sleeve)	PB2164-3	PB2164-3	2
7	Lower Wear Sleeve	PD8229-2	PD8229-1	1
8	Center Wear Ring Pin	PB0982	PB0982	1
9	Center Wear Ring	PD8228	PD8228	1
10	O-ring (Flex Element)	PB8231	PB8231	2
11	Anti-Rotation Pin	PB0849	PB0849	2
12	Retainer Flange	PD8230	PD8230	1
13	Retainer Studs	PB8232	PB8232	28
14	Retainer Nuts	PB8233	PB8233	28
15	Debris Shield	PD7492-2	PD7492-2	1
16	Identification Tag	PB12079-1	PB12079-1	1