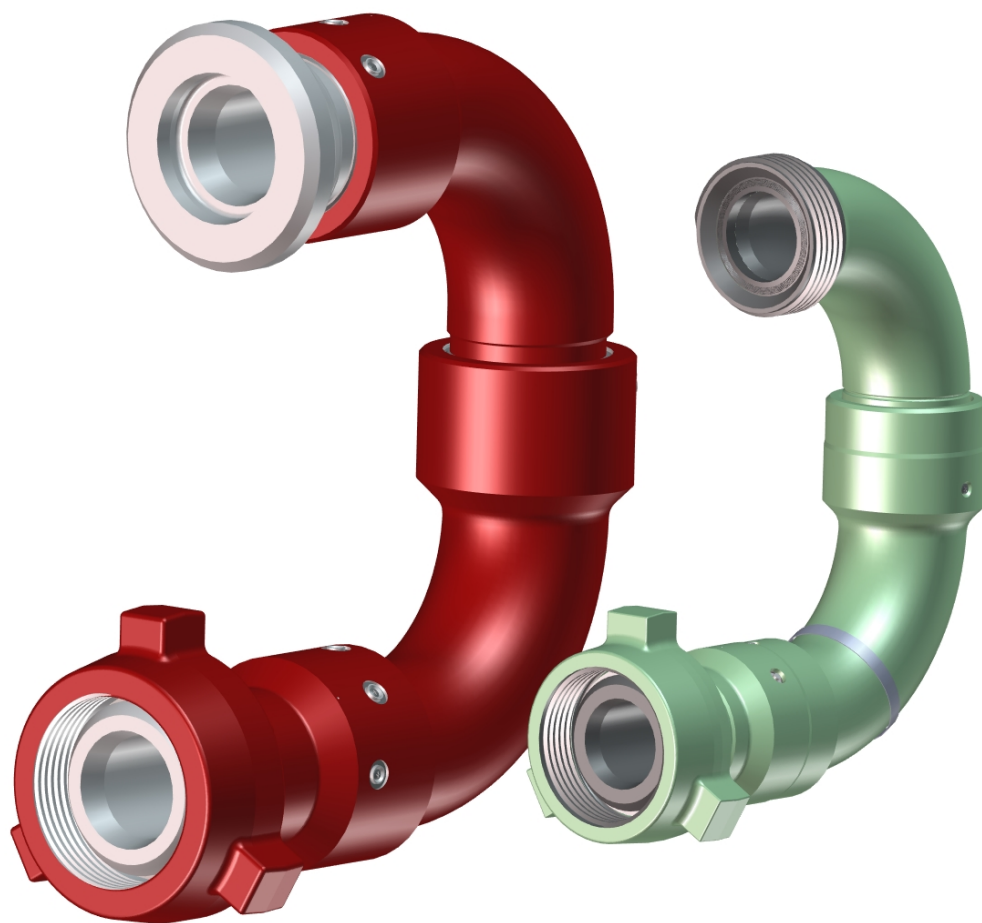


Swivels (Standard H₂S Service)
Operation Instruction and Service Manual



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Revision C

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SPM™ PRODUCT SAFETY GUIDE

WARNING: IMPORTANT SAFETY INFORMATION ENCLOSED. READ THIS OPERATING AND MAINTENANCE INSTRUCTIONS MANUAL BEFORE OPERATING PRODUCT.

WARNING: THIS INFORMATION MUST BE AVAILABLE TO ALL PERSONNEL THAT WILL OPERATE AND MAINTAIN EQUIPMENT. FAILURE TO READ, UNDERSTAND AND FOLLOW THE OPERATING AND MAINTENANCE INSTRUCTIONS MANUAL COULD RESULT IN SEVERE PERSONNEL INJURY OR DEATH!

Most SPM™ products generate, control or direct pressurized fluids; therefore, it is critical that those who work with these products be thoroughly trained in their proper application and safe handling. It is also critical that these products be used and maintained properly!!

WARNING: MISUSE, SIDE LOADING, IMPROPER MAINTENANCE, OR DISASSEMBLY UNDER PRESSURE CAN CAUSE SERIOUS INJURY OR DEATH!

The following information is given in good faith and should aid in the safe use of your SPM™ products. This information is not meant to replace existing Company's safety policies or practices.

Personal Responsibilities:

1. When working on SPM™ flow control products proper Protective Personnel Equipment (PPE) such as safety glasses, approved safety shoes and hard hat must be worn.
2. Personnel should never hammer on any component when pressure is present. Hammering on any part or component may also cause foreign material or steel slugs to become airborne.
3. Do not lift any swivel that weighs in excess of 40 pounds. Use a lifting device if assemblies are to be used above head or when weight exceeds 40 lbs.
4. Proper leg lifting should be used when lifting. Back lifts should be avoided.
5. It is a personal responsibility to use the proper tools when servicing the Swivel. It is a personal responsibility to be knowledgeable and trained in the use and handling of tools for all maintenance of the SPM™ Swivels.
6. Hot surface may be present; it is a person's own responsibility to protect against burn injury.

On Location:

1. Each SPM™ Swivel is clearly marked with a maximum pressure rating and type (Standard / H₂S). This pressure must not be exceeded, or **SERIOUS INJURY OR DEATH CAN OCCUR!**
2. Storage and transportation of swivel joints should be done in a safe manner. Do not transport any assembly that may become dislodged and cause an accident.
3. Welding, brazing, or heating any part of the SPM™ Swivel is prohibited. If accessories must be attached, consult SPM Oil & Gas factory prior to installation.
4. A complete visual inspection of the SPM™ Swivel must be made prior to each use. Any leaking seals, damaged components, or improperly tightened parts must be remedied prior to using.
5. Any repairs or service (even routine maintenance) performed on the SPM™ Swivel must be performed by a trained service technician who is qualified to work on SPM™ Swivels. All such service and repairs must be supervised by qualified management personnel or returned to SPM Oil & Gas for service. **Only SPM™ replacement parts should be utilized.** Failure to do so may result in loss of warranty as well as **SERIOUS INJURY OR DEATH!**
6. Swivels require maintenance. Swivel sections must be greased and free to rotate without binding. Any swivel that is excessively hard to rotate while hooking up or breaking down should be repaired before use. Swivels that leak at low or high pressure should be repaired or replaced.
7. Swivels are designed for ease of hook-up and minimal line movement. Using SPM™ Swivels for continuous rotation under pressure is strictly prohibited. Swivels are not designed for continuous rotation, even at very low pressure.
8. Swivel sections must not be pressured beyond their rated working pressure in field service or field testing.
9. Swivels are not designed for side loading. Loading that will induce a bending moment into the ball races is prohibited. To prevent the above, a five-point movement is recommended at all turns. This will allow the swivel to accommodate the free movement of the lines.
10. It may be necessary to use a single swivel to tie treating line to a well head, or other devices above ground level. In this situation, the hookup line from swivel to ground should be placed at an angle of 45° or greater. This will prevent side loading of the assembly.
11. Always make sure the swivel hookup is done in such a manner to ensure that threaded connections do not unscrew during operation.
12. Monitor the condition of Swivels used in an area where a permanent hookup is required. Frame flexing or structure movements must not place swivels in an improper side loaded condition.
13. Do not hammer or tamper with any SPM™ swivel when pressure is present.

Special Precautions:

1. Modifications to or unauthorized repair of any part of a SPM™ Swivel or use of components not qualified by SPM Oil & Gas can lead to damage or failure and **SERIOUS INJURY OR DEATH!**
2. All SPM™ threaded components are right hand threaded unless specifically designated otherwise. Any turning counterclockwise will unscrew the assembly. Ensure all threaded components are assembled to the correct torque value (if necessary) as directed per Section III, Maintenance and Repair.
3. All products should be properly cleaned, greased, or oiled after each use and inspected prior to each use.
4. Each union connection is clearly marked with a pressure code (i.e. "1502", 15,000 PSI). This pressure must not be exceeded. This code should also be used with mating unions. Improper mating can result in failures. All union connections used must match (according to size, pressure rating, etc.). These connections must also match the service of the designated string they are installed in.

**SINCE SWIVELS MAY BE REPAINTED IN DIFFERENT COLORS
FOR VARIOUS APPLICATIONS, DO NOT USE FACTORY COLOR AS PRIMARY
MEANS OF IDENTIFICATION.**

**WARNING: OBSERVE ALL INSTRUCTIONS, CAUTIONS AND WARNINGS AS NOTED IN THIS
MANUAL. FAILURE TO DO SO CAN LEAD TO EQUIPMENT DAMAGE AND SERIOUS BODILY
INJURY, DEATH, OR PROPERTY DAMAGE.**

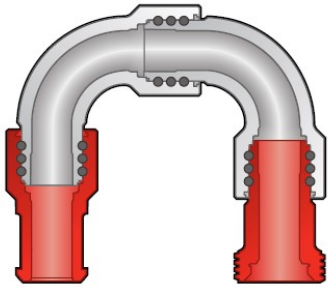
TABLE OF CONTENTS

SPM™ PRODUCT SAFETY GUIDE	2
TABLE OF CONTENTS	5
SECTION I: GENERAL INFORMATION	6
SWIVEL ASSEMBLIES & REBUILD KITS:	6
PRODUCT DESCRIPTION:	11
SWIVEL APPLICATIONS:	12
IDENTIFICATION FEATURES (ON SWIVEL BODY)	12
GENERAL DESCRIPTION OF SWIVEL OPERATION:	13
END CONNECTION OPTIONS:	14
PRESSURE/ TEMPERATURE RATINGS:	14
SECTION II: INSTALLATION AND OPERATION	15
INSTALLATION:	15
SECTION III: MAINTENANCE AND REPAIR	17
REQUIRED TOOLS:	18
MAINTENANCE REQUIREMENTS:	19
SPECIAL PRECAUTIONS:	20
INSPECTION – REPAIR – TESTING:	21
GREASE REQUIREMENTS	21
TYPICAL STANDARD SERVICE SWIVEL - BILL OF MATERIAL (BOM):	22
EXPLODED VIEW	23
TYPICAL H ₂ S SWIVEL - BILL OF MATERIAL (BOM)	24
PREVENTATIVE MAINTENANCE – DISASSEMBLY:	26
PREVENTATIVE MAINTENANCE- INSPECTING COMPONENTS:	30
PREVENTATIVE MAINTENANCE - REPLACEMENT AND ASSEMBLY:	31
SECTION IV: SERVICE AND SUPPORT	43
SERVICE CENTER ORDER INFORMATION:	43

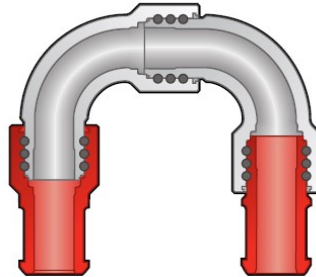
SECTION I: General Information

Swivel Assemblies & Rebuild Kits:

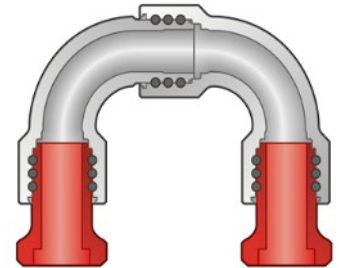
STYLE 10 SWIVELS



Style 10 - MxF



Style 10 - MxM



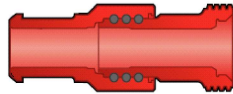
Style 10 Safety Iron™

FB1 – Specifics indicates will accept 2.5" Frac Ball

FB2 – Specifics indicates will accept 3.5" Frac Ball

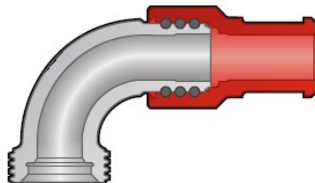
STYLE 10 SWIVEL													
Size	End Connection	Pressure Rating	Service Type	Part Number	Specifics	Part Kit	Seal Kit	Ball Kit	Plug Kit	Total # of Balls	Ball Size	# Races	# Balls per Race
2"													
2"	1502M X 1502F	15,000	STD	2A17135	BUNA	4L17126	4L17130	4L17131	4L17136	216	3/8"	9	24
2"	1502M X 1502M	15,000	STD	2A17205	BUNA	4L17126	4L17130	4L17131	4L17136	216	3/8"	9	24
2"	15K SI X 15K SI	15,000	STD	2A17893	BUNA	4L17126	4L17130	4L17131	4L17136	216	3/8"	9	24
2"	1502M X 1502F	10,000	H2S	2A17171	VITON	4L17193	4L17194	4L17196	4L17195	252	5/16"	9	28
2"	1502M X 1502M	10,000	H2S	2A17277	VITON	4L17193	4L17194	4L17196	4L17195	252	5/16"	9	28
3"													
3"	1502M X 1502F	15,000	STD	2A17920	FB1, BUNA	4L17660	4L17265	4L17303	4L17136	315	3/8"	9	35
3"	1502M X 1502M	15,000	STD	2A28766	FB1, BUNA	4L17660	4L17265	4L17303	4L17136	315	3/8"	9	35
3"	15K SI X 15K SI	15,000	STD	2A17945	FB1, BUNA	4L17660	4L17265	4L17303	4L17136	315	3/8"	9	35
3"	1502M X 1502F	10,000	H2S	2A17986	FB1, VITON	4L17305	4L17307		4L17308	297	3/8"	9	33
3"	1502M X 1502M	10,000	H2S	2A17278	FB1, VITON	4L17305	4L17307		4L17308	297	3/8"	9	33
4"													
4"	1002M X 1002F	10,000	STD	2A17925	FB2, VITON	4L17721				288	1/2"	9	32
4"	1002M X 1002M	10,000	STD	2A17929	FB2, BUNA	4L17721				288	1/2"	9	32
4"	10K SI X 10K SI	10,000	STD	2A29809	FB2, BUNA	4L17721				288	1/2"	9	32
4"	1502M X 1502F	15,000	STD	2A17765	BUNA	4L17785		4L17789	4L17787	234	5/8"	9	26
4"	1502M X 1502M	15,000	STD	2A17737	BUNA	4L17785		4L17789	4L17787	234	5/8"	9	26
4"	15K SI X 15K SI	15,000	STD	2A17894	BUNA	4L17785		4L17789	4L17787	234	5/8"	9	26

STYLE 20 SWIVELS



STYLE 20 SWIVEL													
Size	End Connection	Pressure Rating	Service Type	Part Number	Specifics	Part Kit	Seal Kit	Ball Kit	Plug Kit	Total # of Balls	Ball Size	# Races	# Balls per Race
2"													
2"	1502M X 1502F	15,000	STD	2A17271	BUNA	4L17126	4L17130	4L17131	4L17136	72	3/8"	3	24
2"	1502M X 1502F	10,000	H2S	2A17282	VITON	4L17193	4L17194	4L17196	4L17195	84	5/16"	3	28
3"													
3"	1502M X 1502F	15,000	STD	2A17671	FB1, BUNA	4L17660	4L17265	4L17303	4L17136	105	3/8"	3	35
3"	15K SI X 15K SI	15,000	STD	2A29299	FB1, BUNA	4L17660	4L17265	4L17303	4L17136	105	3/8"	3	35

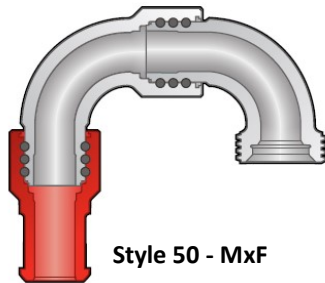
STYLE 30 SWIVELS



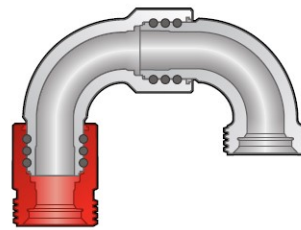
STYLE 30 SWIVEL													
Size	End Connection	Pressure Rating	Service Type	Part Number	Specifics	Part Kit	Seal Kit	Ball Kit	Plug Kit	Total # of Balls	Ball Size	# Races	# Balls per Race
2"													
2"	1502M X 1502F	15,000	STD	2A17297	BUNA	4L17126	4L17130	4L17131	4L17136	105	3/8"	3	35
2"	1502M X 1502F	10,000	H2S	2A17298	VITON	4L17193	4L17194	4L17196	4L17195	84	5/16"	3	28
3"													
3"	1502M X 1502F	15,000	STD	2A17947	FB1, BUNA	4L17660	4L17265	4L17303	4L17136	105	3/8"	3	35

FB1 – Specifics indicates will accept 2.5" Frac Ball
FB2 – Specifics indicates will accept 3.5" Frac Ball

STYLE 50 SWIVELS



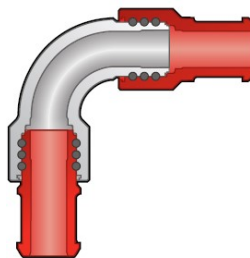
Style 50 - MxF



Style 50 - FxF

STYLE 50 SWIVEL													
Size	End Connection	Pressure Rating	Service Type	Part Number	Specifics	Part Kit	Seal Kit	Ball Kit	Plug Kit	Total # of Balls	Ball Size	# Races	# Balls per Race
2"													
2"	1502M X 1502F	15,000	STD	2A17139	BUNA	4L17126	4L17130	4L17131	4L17136	144	3/8"	6	24
2"	1502F X 1502F	15,000	STD	2A17213	BUNA	4L17126	4L17130	4L17131	4L17136	144	3/8"	6	24
2"	1502M X 1502F	10,000	H2S	2A17170	VITON	4L17193	4L17194	4L17196	4L17195	168	5/16"	6	28
2"	1502F X 1502F	10,000	H2S	2A17279	VITON	4L17193	4L17194	4L17196	4L17195	168	5/16"	6	28
3"													
3"	1502M X 1502F	15,000	STD	2A17922	FB1, BUNA	4L17660	4L17265	4L17303	4L17136	210	3/8"	6	35
3"	1502F X 1502F	10,000	STD	2A17980	FB1, VITON	4L17660	4L17265	4L17303	4L17136	198	3/8"	6	33
3"	1502M X 1502F	10,000	H2S	2A17981	FB1, VITON	4L17305	4L17307	4L17308	4L17308	198	3/8"	6	33
4"													
4"	1002M X 1002F	10,000	STD	2A17926	FB2, BUNA	4L17721				192	1/2"	6	32
4"	1502M X 1502F	15,000	STD	2A17567	BUNA	4L17785		4L17789	4L17787	156	5/8"	6	26

STYLE 60 SWIVELS

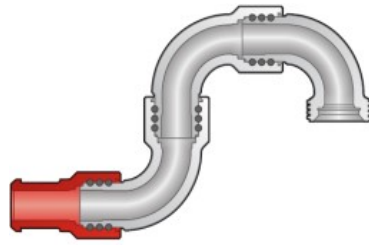


Style 60 - MxM

STYLE 60 SWIVEL													
Size	End Connection	Pressure Rating	Service Type	Part Number	Specifics	Part Kit	Seal Kit	Ball Kit	Plug Kit	Total # of Balls	Ball Size	# Races	# Balls per Race
2"													
2"	1502M X 1502M	15,000	STD	2A17193	BUNA	4L17126	4L17130	4L17131	4L17136	144	3/8"	6	24
2"	1502M X 1502F	15,000	STD	2A17494	BUNA	4L17126	4L17130	4L17131	4L17136	144	3/8"	6	24
3"													
3"	1502M X 1502M	15,000	STD	2A17953	FB1, BUNA	4L17660	4L17265	4L17303	4L17136	210	3/8"	6	35
3"	1502M X 1502F	15,000	STD	2A17970	FB1, BUNA	4L17660	4L17265	4L17303	4L17136	210	3/8"	6	35
3"	15K SI X 15K SI	15,000	STD	2A17939	FB1, BUNA	4L17660	4L17265	4L17303	4L17136	210	3/8"	6	35

FB1 – Specifics indicates will accept 2.5" Frac Ball
FB2 – Specifics indicates will accept 3.5" Frac Ball

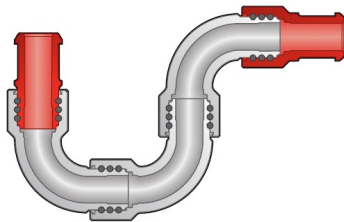
STYLE 80 SWIVELS



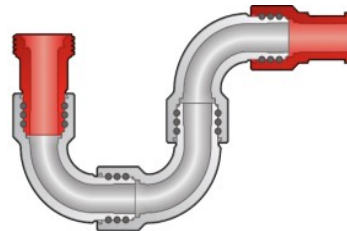
Style 80 - MxF

STYLE 80 SWIVEL													
Size	End Connection	Pressure Rating	Service Type	Part Number	Specifics	Part Kit	Seal Kit	Ball Kit	Plug Kit	Total # of Balls	Ball Size	# Races	# Balls per Race
2"													
2"	1502M X 1502F	15,000	STD	2A17289	BUNA	4L17126	4L17130	4L17131	4L17136	216	3/8"	9	24
3"													
3"	1502M X 1502F	15,000	STD	2A17934	FB1, BUNA	4L17660	4L17265	4L17303	4L17136	315	3/8"	9	35

STYLE 100 SWIVELS



Style 100 - MxM



Style 100 - MxF

STYLE 100 SWIVEL													
Size	End Connection	Pressure Rating	Service Type	Part Number	Specifics	Part Kit	Seal Kit	Ball Kit	Plug Kit	Total # of Balls	Ball Size	# Races	# Balls per Race
2"													
2"	1502M X 1502M	15,000	STD	2A17274	BUNA	4L17126	4L17130	4L17131	4L17136	216	3/8"	9	24
2"	1502M X 1502F	15,000	STD	2A17272	BUNA	4L17126	4L17130	4L17131	4L17136	288	3/8"	12	24
2"	1502M X 1502F	10,000	H2S	2A17285	VITON	4L17193	4L17194	4L17196	4L17195	336	5/16"	12	28
3"													
3"	1502M X 1502M	15,000	STD	2A17937	FB1, BUNA	4L17660	4L17265	4L17303	4L17136	315	3/8"	12	35
3"	1502M X 1502F	15,000	STD	2A17955	FB1, BUNA	4L17660	4L17265	4L17303	4L17136	315	3/8"	12	35
3"	1502M X 1502F	15,000	STD	2A17979	FB1, BUNA	4L17660	4L17265	4L17303	4L17136	315	3/8"	12	35
3"	1502M X 1502F	10,000	H2S	2A17982	FB1, VITON	4L17305	4L17307	4L17308	4L17308	396	3/8"	12	33

FB1 – Specifics indicates will accept 2.5" Frac Ball

FB2 – Specifics indicates will accept 3.5" Frac Ball

2" 1502 HOSE LOOP ASSEMBLIES

2" 1502 HOSE LOOP ASSEMBLIES						
Size	End Connection	Pressure Rating	Service Type	Length	Part Number	Specifics
2"						
2"	1502M X 1502F	15,000	STD	8' 7"	2A17581	Circulating, Buna
2"	1502M X 1502F	15,000	STD	9' 6"	2A17229	Circulating, Buna
2"	1502M X 1502F	10,000	H2S	9' 6"	2A17230	Circulating, H2S

Product Description:

Standard Service Swivels

SPM™ Swivel Joints are manufactured from high quality alloy steels especially suited to handle a wide variety of oilfield fluids including cement, fracturing fluids, drill mud, crude oil, and most other abrasive well treating fluids and materials. SPM™ Swivels are available in ten different styles for 360-degree rotation in one through four planes as shown on Page 7 thru 10.

Featuring metal elbows and couplings integrated with heavy duty ball bearings, SPM™ Swivels provide the necessary flexibility to allow high pressure rigid piping assemblies to be used in most applications.

Available in 2", 3" and 4" sizes and rated to non-shock cold working pressures up to 15,000 psi, the SPM™ Swivel provides many traditional and improved features and benefits.

Standard Design features include:

- Three rows of bearings in hardened and ground races to better handle heavy loads.
- Long radius configuration to minimize cavitation by flowing medium.
- Uniform wall thickness throughout for a longer life and more uniform flow of fluids, including slurries and abrasives.
- Elastomer packing for service up to 350°F (Contact Engineering for additional information).
- Safety Iron® or Hammer Union connections for reliable performance.

H₂S Service Swivels

Available in 2" and 3" sizes and rated up to 10,000 psi, the SPM™ Long Radius Sour Gas Swivel Joint is designed to conform to NACE MR0175 and API Standard RP-14E.

Although lime green has been identified as the color code for Sour Gas SPM™ products, parts can be repainted per customer's specification. Rating identification will always need to be verified per rating on nameplate. Refer to pages 6 thru 9 to identify the H₂S Swivel configurations.

H₂S Swivel Design features include:

- Three ball race bearing sets in 2" and 3" swivels. Balls are heavy duty drill bit type, and races are protected by removable heavy-duty stainless-steel race liners. Ball and race area are sealed and isolated from both working medium and ambient conditions.
- Primary and secondary seals are made from fluoroelastomer polymer, especially suited for exposure to sour gas.
- End connections available with SPM™ Sour Gas Hammer Unions.

WARNING: ENSURE THAT THE SWIVEL IS RATED FOR THE INDICATED PURPOSE. STANDARD SERVICE AND H₂S SERVICE SWIVELS CAN NOT BE INTERCHANGED

Contact your SPM™ Oil & Gas representative for advice about sour gas service applications.

Swivel Applications:

The benefits of utilizing swivels in a flow line include:

- a.) Piping may be conveniently routed around fixed objects.
- b.) Eliminates the need for exact alignment in lines.
- c.) Provides convenient folding features for storage.
- d.) Safer applications by avoiding rigid make-up.
- e.) May dampen piping vibration if plane of rotation is aligned with plane of vibration.

Swivels must be installed and maintained properly to perform as expected. When followed correctly, the information in this manual can both increase the working life of the swivel and greatly reduce any risks involved during operation.

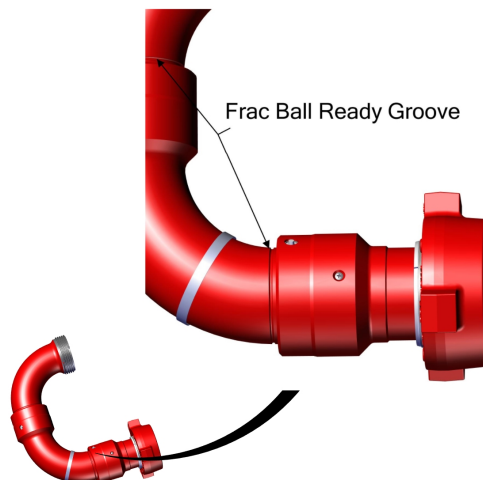
The SPM™ Swivels are manufactured in 2", 3" and 4" inch sizes. SPM™ Swivels are available for both standard service and for sour gas (H₂S) environments.

SPM™ Swivels are available in various max pressure ranges up to 15,000 psi. They are intended for well service applications such as acidizing, cementing, and fracturing and designed for slick water Frac fluids gels, mud, nitrogen (N₂/Gas) or CO₂.

Manufactured to SPM™ Oil & Gas stringent Quality Assurance System, the Standard Service components are made from the appropriate heat treated, low alloy steels. Sour Gas components are made in accordance with American Petroleum Institute (API), Standard RP14-E, and National Association of Corrosion Engineers (NACE), std. MR0175.

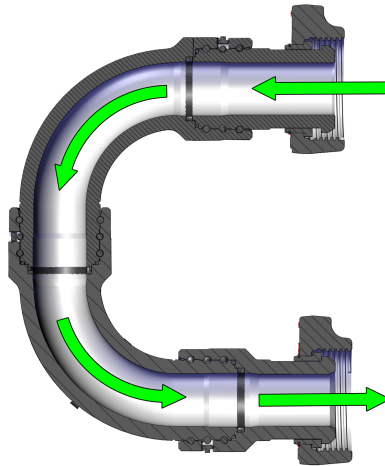
Identification features (On Swivel Body)

Select SPM™ swivel assemblies referenced in Section I: General Information, are identified as "Frac Ball Ready". This indicates that these assemblies are tested to ensure passage of the specified frac ball diameter. Each Frac Ball Ready Swivel assembly includes the visual indicator referenced below. This feature allows for quick confirmation regarding the capability of the swivel. Failure of the swivel to include this visual feature indicates that the swivel has not verified to pass a specific frac ball diameter.



General Description of Swivel Operation:

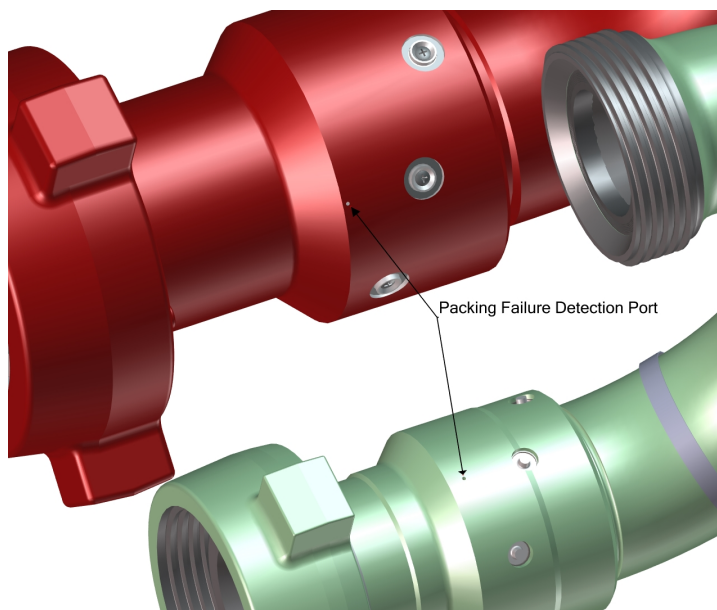
SPM™'s swivel joint has uniform ball bearing requirements for all bearing races. The swivel joint has a male and female connector that coaxially interconnects and rotates relative to each other while still maintaining a high-pressure seal. Each connector has three bearing races to form three sets of bearing races, each of which supports the same number of ball bearings. The circumference of the main set of races may be enlarged by less than the diameter of one ball, so it is impossible to add another ball to the coupled male and female connectors of the swivel joint.



Packing Failure Detection (Standard and H2S Models)

All SPM™ Long Radius Sour Gas Swivel Joints are furnished with a vent port between the primary seal (packing) and the secondary seal (backup) as shown below. This is intended to reduce the danger of high-pressure fluid entering the ball race area when the primary seal fails. In addition, any visible leaking at this feature serves as a visible indicator that the primary packing requires replacement.

It is extremely important to monitor the port for any venting of work fluid. Immediately repair the assembly when leakage is detected.



End Connection Options:

SPM™ Swivels are available with SPM™ Wing Union and Safety Iron® end connections. The data-band or wing nut will indicate the cold working pressure allowable for each assembly.

Wing union connections on the swivel are interchangeable with other union connections of the same size and pressure rating. **Caution must be taken to avoid mixing different ratings of wing connections.** These connections must also match the service of the designated string in which they are installed. Distraction or inability to observe good judgment may result in damage to components and create a life-threatening situation. Always verify working pressure ratings of each connection before use.

WARNING: OBSERVE ALL INSTRUCTIONS, CAUTIONS AND WARNINGS AS NOTED IN THIS MANUAL. FAILURE TO DO SO CAN LEAD TO EQUIPMENT DAMAGE AND PERSONAL INJURY OR DEATH!

Pressure/ Temperature Ratings:

Pressure

SPM™ Swivel Joints are rated for non-shock cold working pressures up to 15,000 PSI depending on style. Various pressure ratings are dependent upon product construction and end connectors. This information is provided on data-bands, which are permanently attached to the swivel assembly. Although color coding has been used to identify pressure ratings of product, it should not be used as the primary means. Parts can be repainted. Always verify rating on Swivel Assembly. Pages 6 thru 9 list the maximum working pressure of SPM™ Swivels.

These pressures are never to be exceeded in the field. Certified testing at the factory subjects the new product to a onetime test of 1.5 times the rated working pressure.

Field or customer-controlled tests should be conducted with experienced personnel. Maximum working pressure should never be exceeded. Deviation from this procedure requires SPM™ Engineering approval.

Temperature

The maximum recommended operating temperature for SPM™ Swivel Joints is limited to the capability of the polymer seals to withstand elevated temperatures while maintaining seal integrity under pressure.

The accepted limit for the standard nitrile material is 230°F (110°C); H₂S fluoroelastomer polymer limit is 350°F (176 °C). Third party testing has shown that there is a rapid drop-off in seal life, when caustic fluids are handled at temperatures leading up to 160°F (71°C). Generally, chemical attack, gas absorption, compression set, or tearing is accelerated in these conditions. A more careful monitoring of swivel condition is recommended when approaching the limits of the operating envelope in temperature, pressure, and erosive conditions.

Minimum operating temperature of -22°F (-30°C) is acceptable for the Nitrile, Viton and fluoroelastomer seal materials. Structural members of Standard and H₂S swivel assemblies are be certified to meet required impact values at temperatures to -22°F (-30°C).

SECTION II: Installation and Operation

Installation:

The following information is given in good faith and should aid the safe use of your SPM™ products. This information is not meant to replace any existing Company's safety policies or practices, which should be strictly followed.

SPM™ Swivels can be installed in various locations throughout the job site. Swivels can be installed on many areas such as connections to the wellhead of a fracturing site, ground iron between the Frac Trucks and Manifold Trailer, and Flow Back Systems.

SPM™ Swivel Joints are intended for installation where limited rotation or oscillation is present. Bearing, bearing race, and seal life will be reduced as rotary motion or flexing is increased at high pressures.

Insufficient number of swivels or improper make-up for a given installation can also induce unacceptable loads on the entire piping leading to early failure of seals or accelerated wear and tear on the product.

SPM™ recommends the use of a Style 50 (2 swivels) or Style 10 (3 swivels) at each piping connection when different elevations are present. Fewer swivels than featured in the Style 50 may lead to restrictions in some degrees of freedom.

Pulsation from pumping systems will reduce life of seals. The user is encouraged to properly tune their pump system to minimize problems such as cavitation and pressure spikes.

The user should recognize that the swivels and associated piping may very well become damaged if driven over by vehicles and equipment. This should be avoided.

Caustic and corrosive fluids will cause deterioration of internal surfaces including structural and seal members, leading to early seal failure and de-rating of structural components. The use of inhibitors in the service fluid along with routine flushing of components after each job will retard the effect of wear and tear on the product.

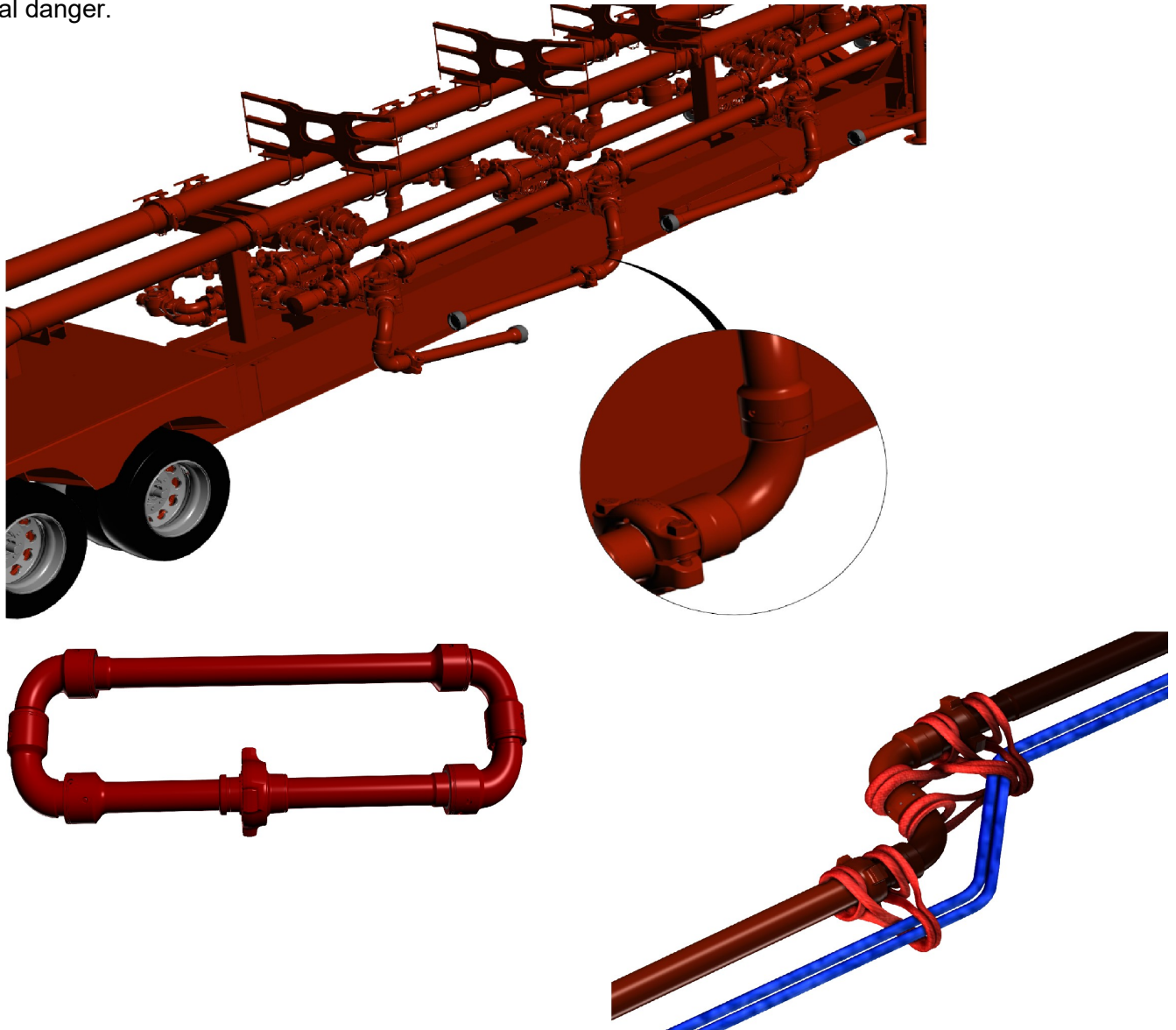
Internal friction in the Swivel is proportional to the working pressure and may vary significantly from one swivel to the next. Swivel torque must be considered when installing the components in an assembly.

Installation (Cont.):

! WARNING: OBSERVE ALL INSTRUCTIONS, CAUTIONS AND WARNINGS AS NOTED IN THIS MANUAL. FAILURE TO DO SO CAN LEAD TO EQUIPMENT DAMAGE AND PERSONNEL INJURY OR DEATH!

Care must be taken when installing the SPM™ Swivel so that a hammer never strikes the Swivel body. The body is not intended for severe forces, such as a hammer blow, and there is the danger that the valve could crack under such circumstances. This increases the chance of premature failure and could cause serious injury or death.


Do not attempt to work on or repair any equipment that is connected to a SPM™ Swivel that has high pressure flow. Failure to do so could put operators in extremely hazardous situations without them being aware of the potential danger.



SECTION III: Maintenance and Repair

 **WARNING:** OBSERVE INSTRUCTIONS, CAUTIONS, AND WARNINGS AS NOTED IN THIS MANUAL. FAILURE TO DO SO CAN LEAD TO EQUIPMENT DAMAGE, PERSONNEL INJURY, OR LOSS OF LIFE.

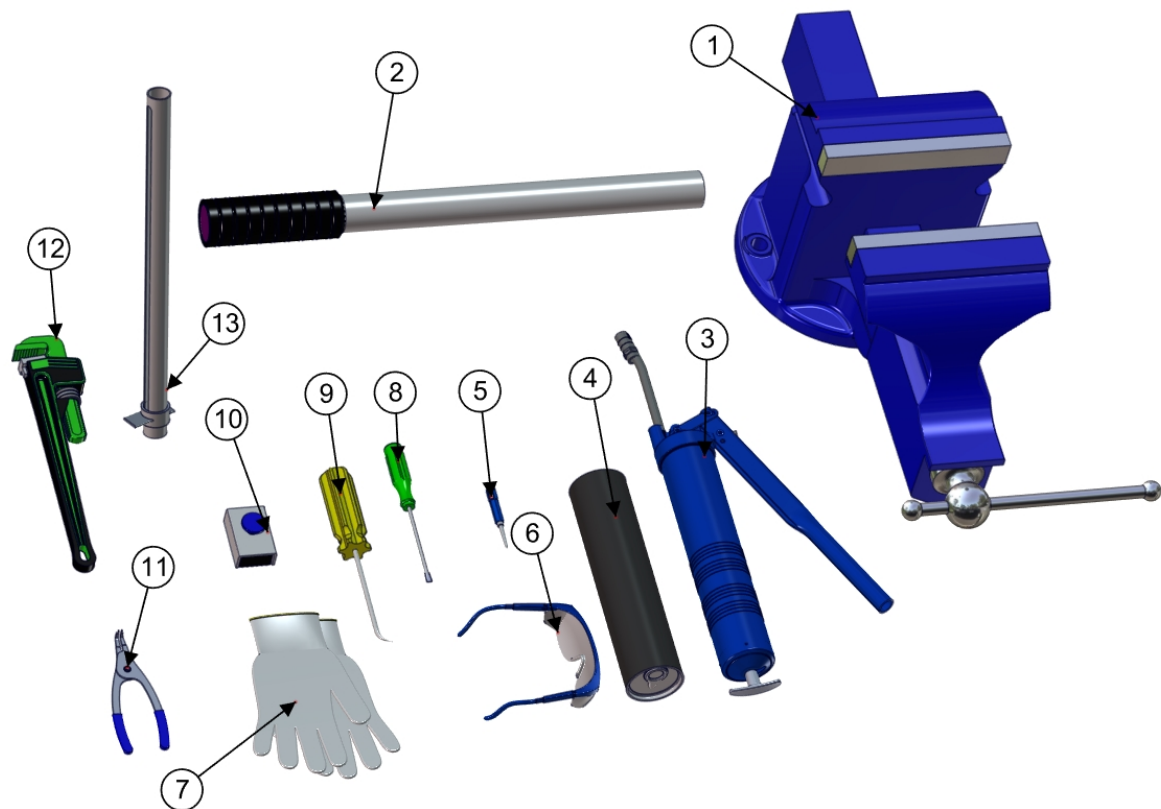
 **WARNING:** DISASSEMBLY UNDER PRESSURE CAN CAUSE **SERIOUS INJURY OR DEATH!**

 **WARNING:** OBSERVE ALL INSTRUCTIONS, CAUTIONS AND WARNINGS AS NOTED IN THIS MANUAL. FAILURE TO DO SO CAN LEAD TO EQUIPMENT DAMAGE, PERSONNEL INJURY OR LOSS OF LIFE.

ALWAYS REMEMBER:

1. Always wear PPE (personal protective equipment).
2. Only qualified technicians should perform maintenance on SPM™ products.
3. Always use SPM™ supplied new parts kit for reassembly.
4. Clean all components thoroughly prior to reassembly.
5. Use only SPM™ Swivel parts on SPM™ Swivels.

Required Tools:



ID	Description
1	Vise
2	Leverage arm (Optional)
3	Grease Gun
4	Grease (SPM™ PN: P45305)
5	Punch
6	Safety Glasses
7	Protective Gloves
8	Screwdriver
9	Pick or awl
10	Magnet
11	Truarc pliers (spring clip pliers)
12	Pipe Wrench
13	Ball Loading Tool

Maintenance Requirements:

SPM™ Swivels are made from high quality materials selected to provide the best service to the customer. However, the application of this product subjects it to handling fluids which are by their very nature corrosive and abrasive and operate at high velocities, and usually at high pressures. Some fluids may also require being conveyed at elevated temperatures. Combinations of any/or all of these conditions will hasten the deterioration of internal surfaces including seals and seal surfaces.

Without the benefit of scheduled maintenance to routinely service and inspect the condition of components, premature failure of parts can occur, leading to unnecessary material replacement along with the danger of injury to personnel. Proper knowledge and application of the swivel is necessary for safe operation.

It is recommended that a routine program include, at the very least, (1) inspection of structural members (i.e. straights and elbows) to detect wall thickness loss; (2) routine replacement of packing and seals; (3) regular scheduled lubrication.

Even the most well engineered product can quickly be eroded by the aggressive proppants, and high flow rates used in the industry. Due to this, SPM™ has developed a list of guidelines designed to maximize the life of swivel assemblies during challenging well service applications.

1. All flow line iron, including piping; plug valves, swivels, and check valves should be sized such that the fluid velocity does not exceed 42 ft. per second. This is critical, since erosion rate is a function of fluid velocity cubed. Exceeding the flow rate will rapidly erode the product.
2. A second flow line is required if a single line will not pass the necessary flow rate without exceeding the maximum flow velocity
3. The second flow line must originate at the manifold trailer and continue to the wellhead. At no point, can both lines converge before they terminate at the wellhead.
4. The terminal connection at the wellhead should employ a frac head. This item has increased erosion allowance compared to conventional wyes and will offer longer life.
5. Highly abrasive proppants (such as sintered bauxite) may cause erosion when used at the maximum allowable flow velocity. This will require that the fluid velocity be reduced by adding an additional line (or using larger iron).

IMPORTANT:

WARNING: STRUCTURAL MEMBERS WHO'S WALL THICKNESSES FALL BELOW THE MIN LISTED IN THE WALL THICKNESS CHART MUST BE REMOVED FROM SERVICE. WALL THICKNESS MAY BE MEASURED BY MECHANICAL, SONIC, OR VISUAL MEANS
(Contact Engineering for Min. Wall Chart)

WELDING, BRAZING OR HEATING CHECK VALVES IS PROHIBITED. Material Damage will occur.

Maintenance Requirements:

All internal components of SPM™ Swivel assemblies will be replaced during recertification. The replacement parts kits allow for a quality rebuild. Below is a summary:

- Each kit contains all necessary components to rebuild the SPM™ swivel.
- All components are designed for long life (see material specifications below).
- All components offer DNV Type Approval and PED (CE) certification for all pressure bearing kit components.



Special Precautions:

- Welding, brazing or heating swivels is prohibited. Material damage will occur.
- Do not restrain free movement of SPM™ swivels. Damage will occur, which could result in injury or death.
- If swivels are used with acid services, they should be washed with fresh water as soon as possible. After washing, it is recommended to be submersed in light oil for 5 minutes.
- Never alternate a swivel's service. Acid service should never be followed by cold temperature service. When acid etching or erosion is present, replace the swivel.
- When installing union end swivels, proper mating is required. Each union connection is clearly marked with a pressure code (i.e. "1502" 15,000 PSI). This pressure must not be exceeded. This code should also be used with mating unions. Improper mating can result in failures. All union connections used must match (according to size, pressure rating, etc.). These connections must also match the service of the designated string they are installed in.

Inspection – Repair – Testing:

- Swivels should be thoroughly inspected, serviced and/or repaired, at least every six (6) months. While assembly is torn down, a visual inspection for wear, corrosion, or erosion should be performed. In areas of high use, this type of inspection should be more frequent. Always visually inspect prior to each use.
- Replace the swivel if the wall thickness is less than the minimum allowable value published by SPM™.
- If the swivel leaks, it should be removed from service for immediate repair or replacement. Fluids may leak into the ball race cavity. This area is highly susceptible to problems caused by caustic or acid type fluids. If the ball races show indications of acid contamination, replace the unit.
- Use only SPM™ repair kits when repairing units. Follow detailed redressing instructions enclosed with each kit.
- Pressure testing should be done with cold water. Personnel should wear proper safety equipment and avoid any area of danger while pressure is present. Prior to any pressure testing, all air must be evacuated from the system. Failure to do so could result in **PERSONAL INJURY OR DEATH!**
- Weld repair is prohibited for swivels.

Grease Requirements

SPM™ swivels are engineered such that they only require lubrication of the ball races after 6 months of operation. For most applications, this lubrication will be completed during the 6 month inspection and re-kitting of the swivel; resulting in no additional lubrication requirements for the end-user. Longer term applications, such as offshore may require scheduling of lubrication activities on a 6 month basis.

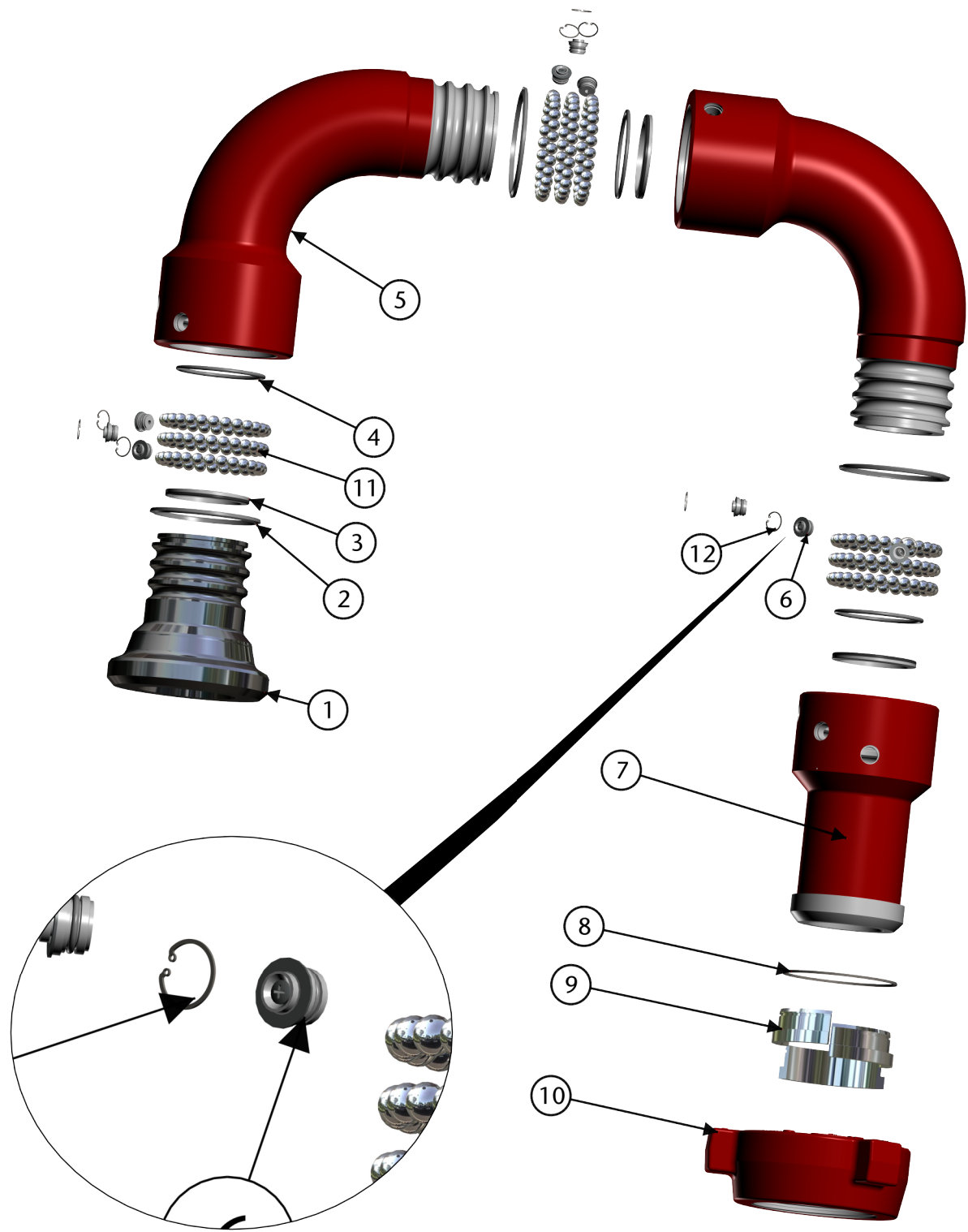
Note: Lubrication of the SPM™ swivels must be completed using SPM™ PN: P45305 grease.

This grease has been specifically formulated to provide superior performance while resisting hardening, and or separation of the thickening agent. The use of any alternative grease will result in decreased performance and increased risk of corrosion in the ball races.

Typical Standard Service Swivel - Bill of Material (BOM):

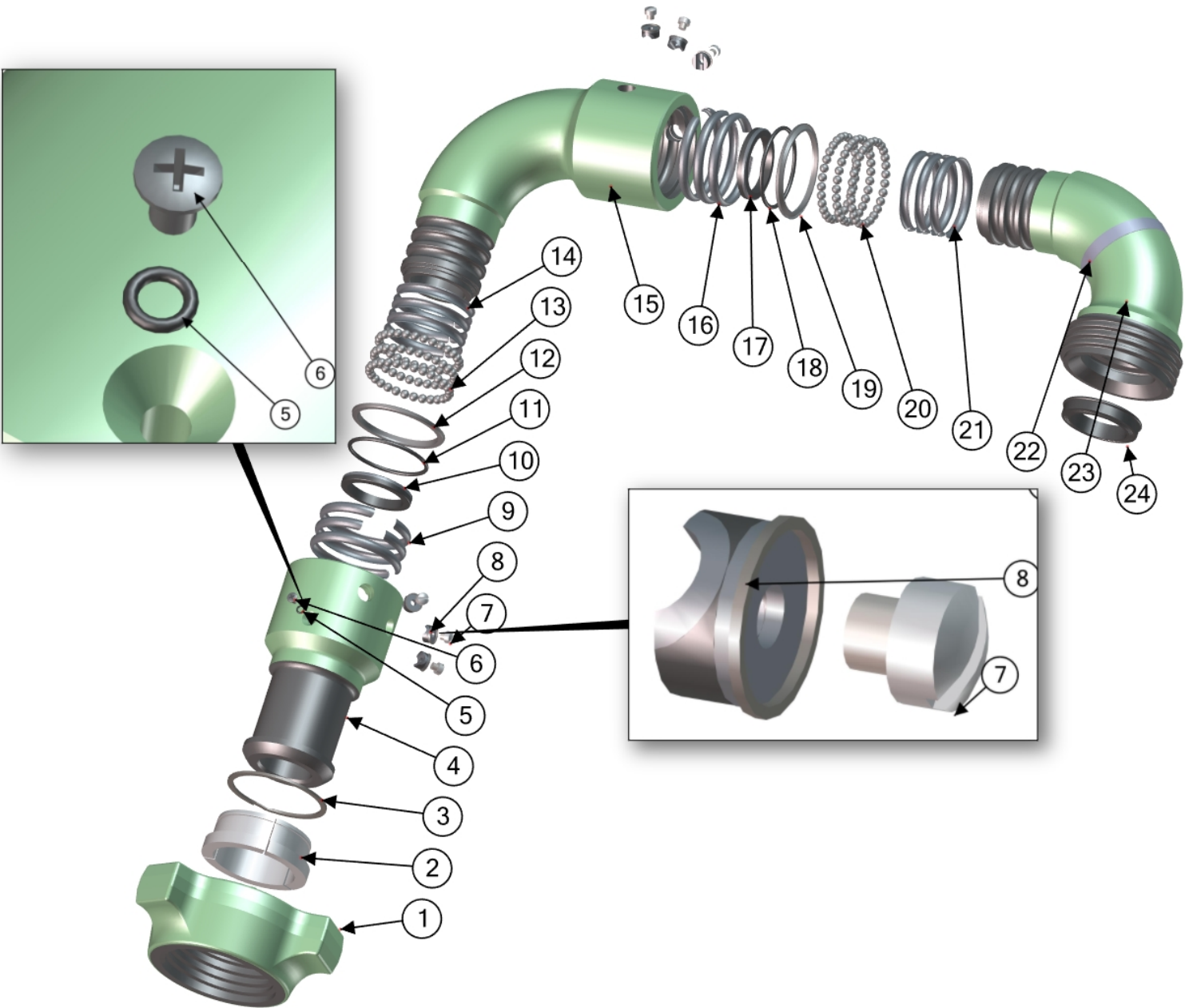
Standard Swivel	
BOM ID	DESCRIPTION
1	COUPLING/SAFETY IRON/MALE BALL RACE
2	SWIVEL DUST SEAL
3	SWIVEL SEAL RING
4	SWIVEL O RING
5	SWIVEL ELBOW MALE/FEMALE BALL RACE
6	BALL PLUG ASSEMBLY
7	SWIVEL COUPLING//FEMALE BALL RACE
8	RETAINER RING
9	RETAINER SEGMENTS
10	WING NUT
11	BEARINGS
12	RETAINER RING

Exploded View



Typical H₂S Swivel - Bill of Material (BOM)

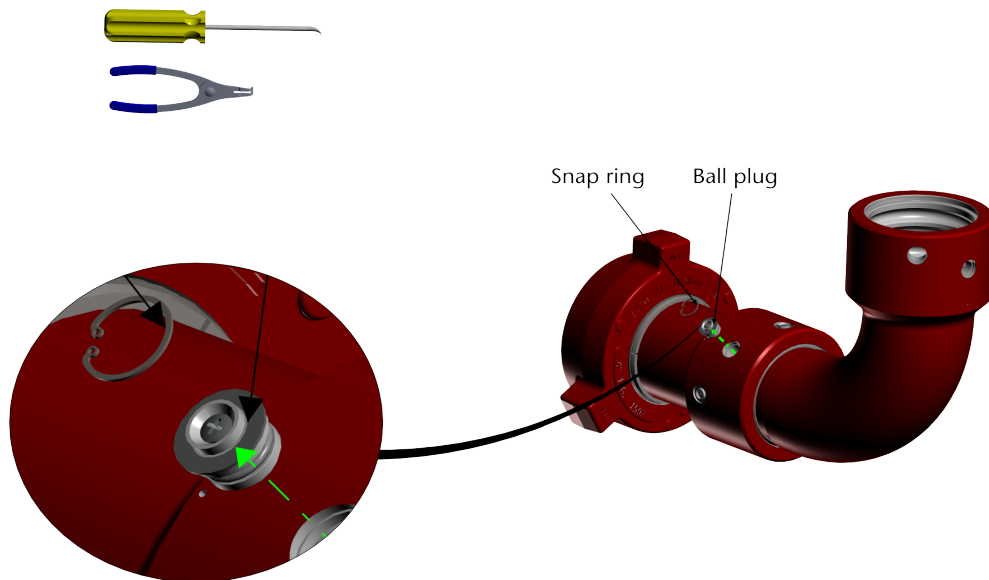
H2S Swivel	
BOM ID	DESCRIPTION
1	WING NUT
2	RETAINER SEGMENTS
3	RETAINER RING
4	SWIVEL ELBOW MALE X FEMALE BALL RACE
5	LUBE PLUG O-RING
6	LUBE PLUG
7	RETAINER RING BOLT
8	RETAINER RING
9	H2S FEMALE BALL RACE INSERTS
10	SWIVEL SEAL RING
11	SWIVEL O RING
12	SWIVEL DUST SEAL
13	BEARINGS
14	H2S MALE BALL RACE INSERTS
15	SWIVEL ELBOW MALE X FEMALE BALL RACE
16	H2S FEMALE BALL RACE INSERTS
17	SWIVEL SEAL RING
18	SWIVEL O RING
19	SWIVEL DUST SEAL
20	BEARINGS
21	H2S MALE BALL RACE INSERTS
22	DATA BAND
23	SWIVEL ELBOW MALE BALL RACE
24	SEAL RING



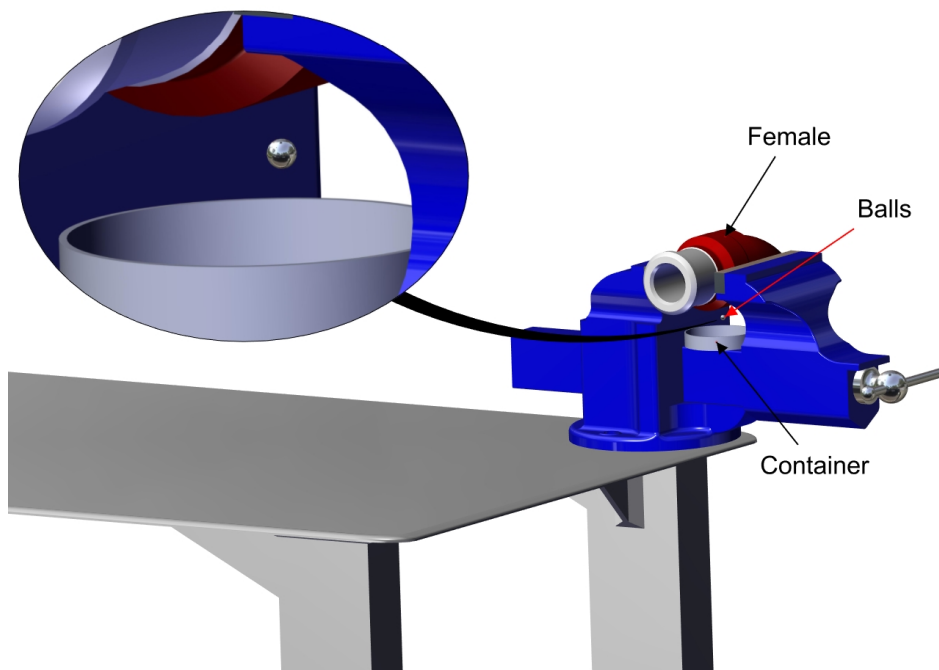
Preventative Maintenance – Disassembly:

WARNING: MAKE SURE THAT THERE IS NO PRESSURE ON THE SWIVEL!

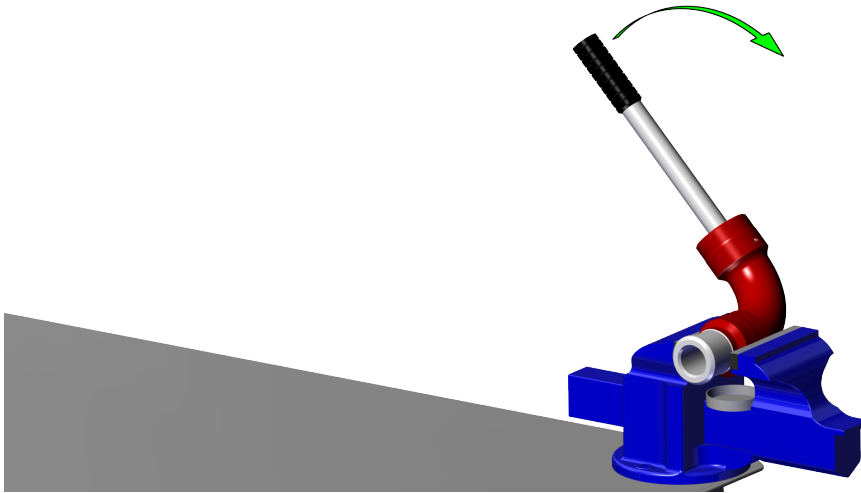
1. Using Truarc pliers, remove snap rings holding plugs in place. Remove ball plugs using pick or awl.



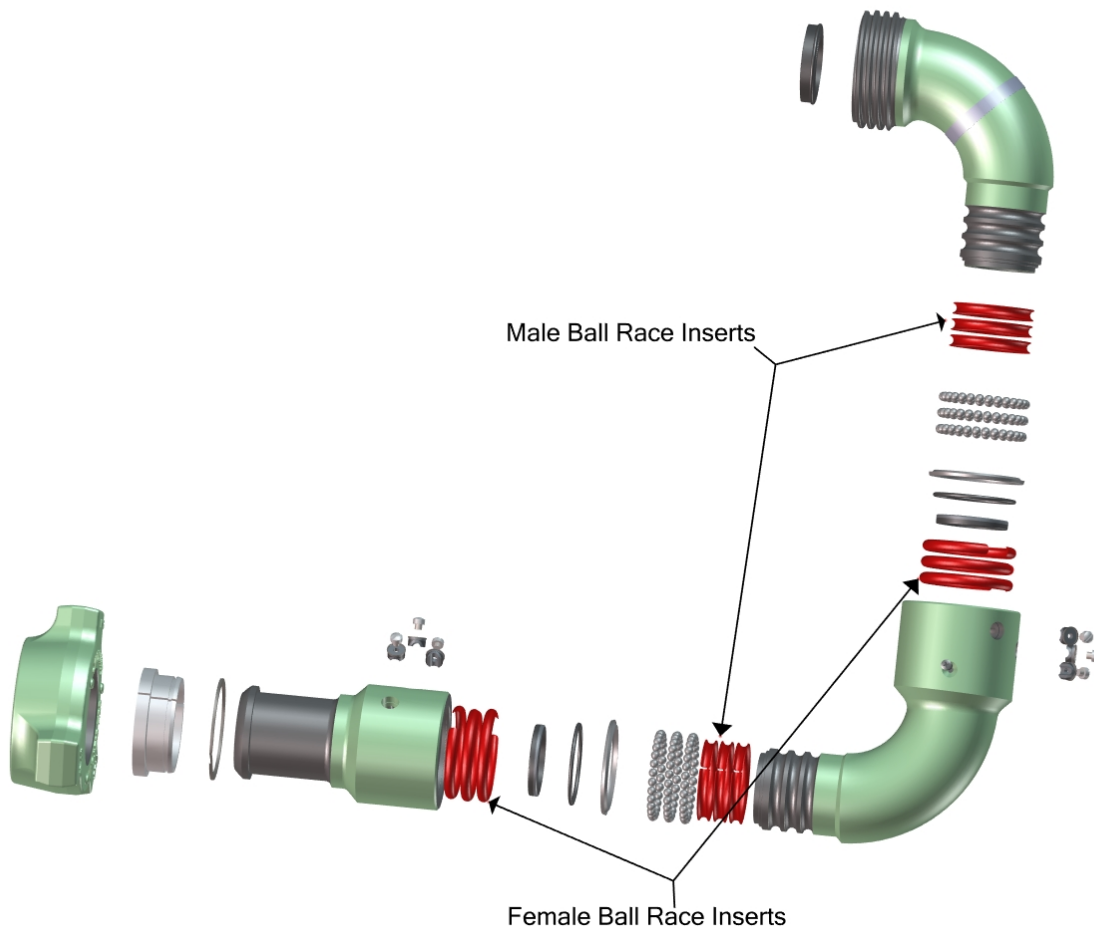
2. Mount the female portion of the swivel in a vise with the ball filler holes pointed down. Use a container to capture the balls as they fall from the filler holes.



3. Rotate the male portion of the swivel by hand or with a pipe wrench. As the male rotates, the balls will be fed into the holes and will drop into the container.

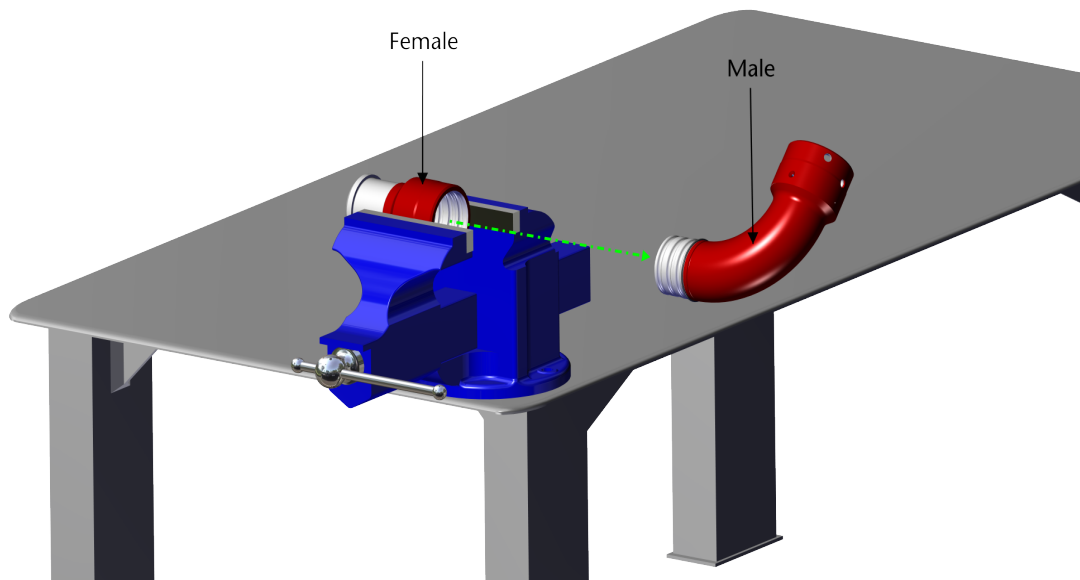
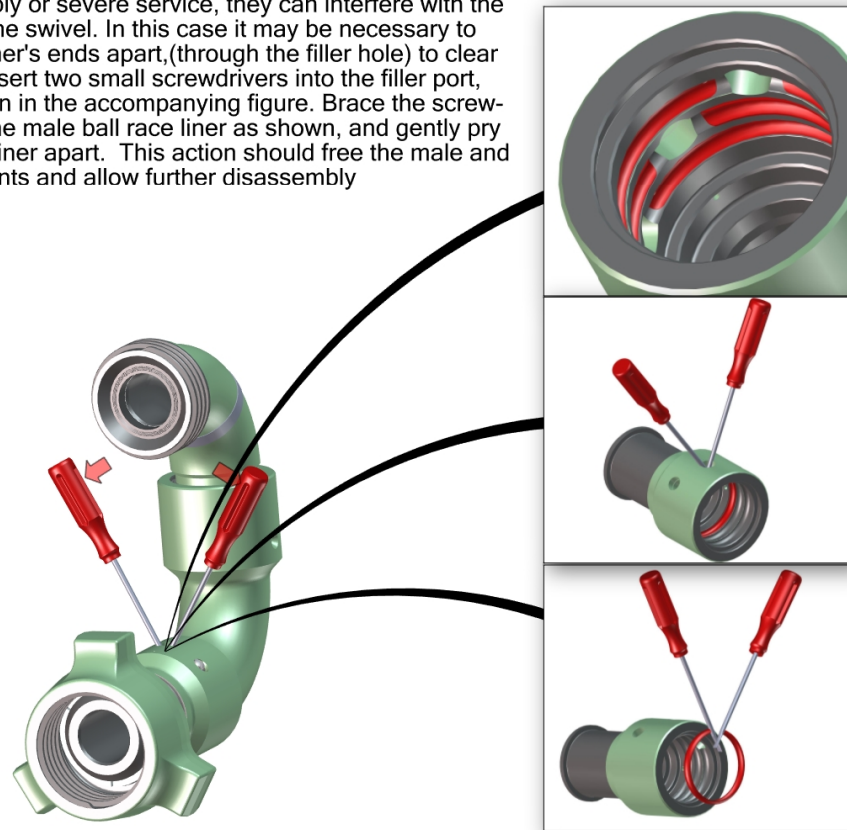


H2S Swivels incorporate Male and Female Ball Race Inserts as shown below. Each Coupling/Elbow connection includes a Female and Male Ball Race Insert for each Ball Race.

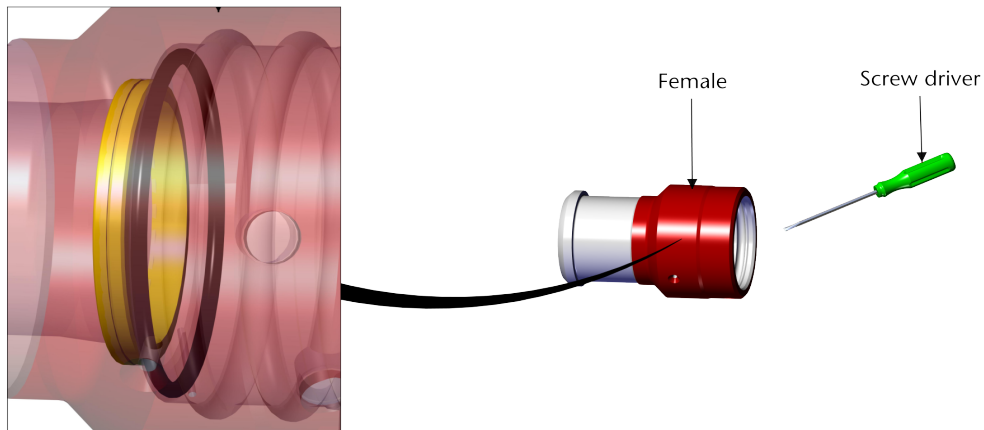


(LOOSE LINER REMOVAL - H2S ONLY)

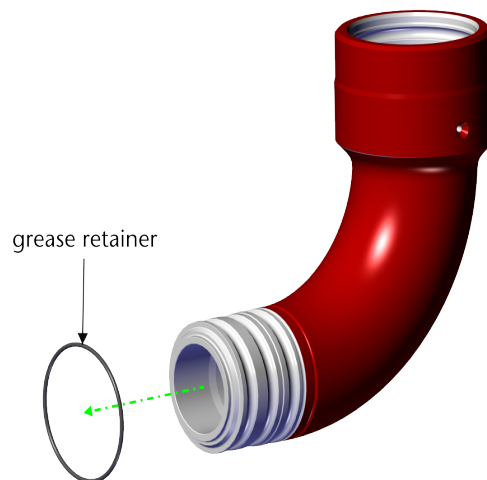
If the male and female liners become loose in their grooves, either from mis-assembly or severe service, they can interfere with the disassembly of the swivel. In this case it may be necessary to pry the female liner's ends apart, (through the filler hole) to clear the male liner. Insert two small screwdrivers into the filler port, crossed as shown in the accompanying figure. Brace the screwdrivers against the male ball race liner as shown, and gently pry the female race liner apart. This action should free the male and female components and allow further disassembly



4. Using a screwdriver, remove old packing from female portion. Remove backup seal (2", 3", & 4" three race) from the male portion. Exercise care so as not to damage the seal surfaces on either part.



4a. Remove grease retainer (dust seal) from the male portion. Discard all kit components.

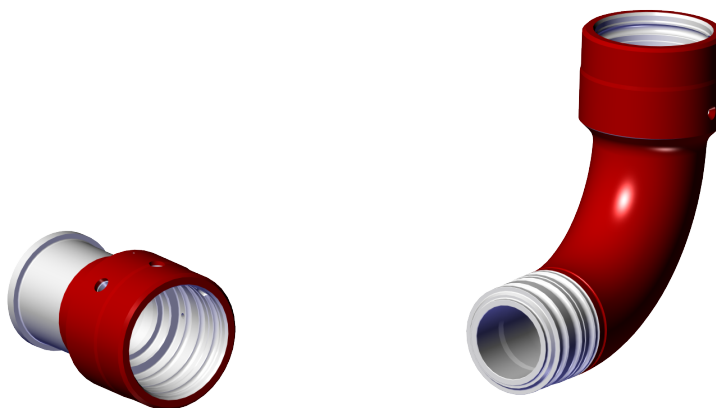


Preventative Maintenance- Inspecting components:

5. Clean parts with petroleum solvent and carefully inspect each item.

Particular attention should be paid to:

- a.) Ball races for excessive wear, corrosion, and mechanical damage.
- b.) Seal surfaces for pitting corrosion, and general deterioration.
- c.) Inside surfaces of fluid passages in both straights and elbows, for erosion and corrosion.



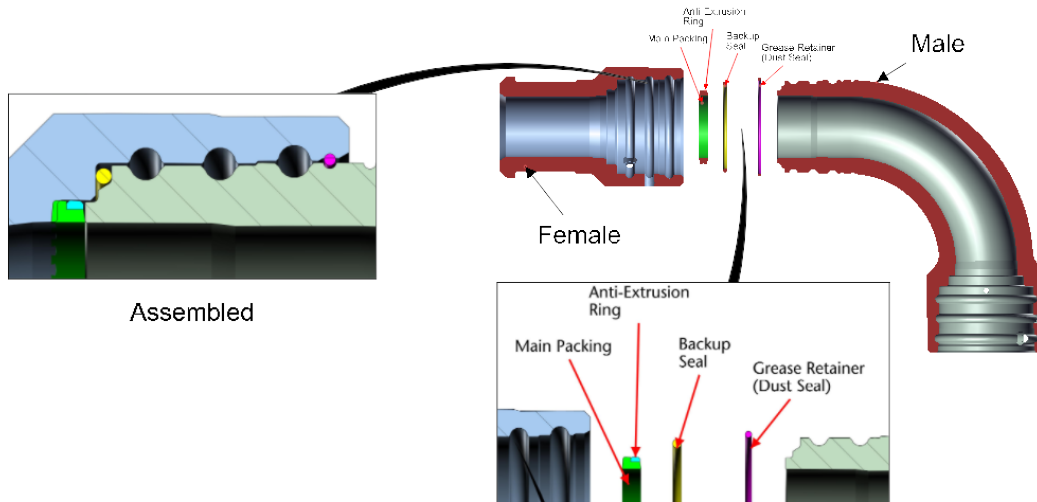
Preventative Maintenance - Replacement and assembly:

- See ALWAYS REMEMBER Section on page 13 before disassembling or assembling.
- The reassembly of the valve is in approximate reverse order to the disassembly process.

1. Always use SPM® new parts kit for reassembly.
2. If the male and/or female parts are to be reused, carefully inspect sealing surfaces for wear and damage. Surfaces should be polished smooth using a fine abrasive. Remove grit from polishing with a solvent before proceeding.



3. Apply a thin coat of SPM grease (PN: P45305) to the seal surfaces of the mating parts. Install the main packing in the female portion with the anti-extrusion ring (on the packing) facing outward, or toward the male portion. Verify that the main packing is seated firmly into the packing chamber. Put the grease retainer (dust seal) on the male portion at the far end of the ball race area. Install backup seal into the female component as shown.

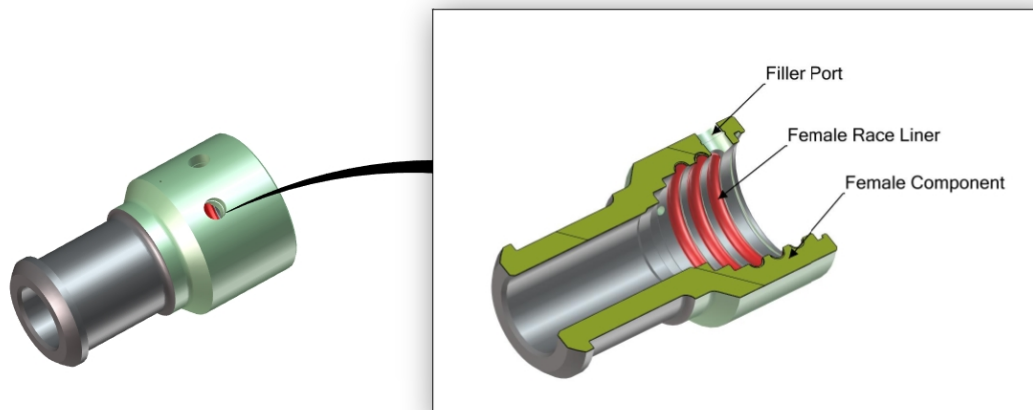


Liner Installation

Female Race Liner:

(FEMALE LINER INSTALLATION - H2S ONLY)

1. Inspect female race grooves for damage to surfaces. Nicks and burrs should be removed. Damage to race surfaces is cause for the component to be taken out of service. The race surfaces should also be clean to allow for correct fit with the female liners.
2. Inspect female liners for nicks and burrs and insure that liner surfaces are free of dirt and grit.
3. Place one end of the liner in the middle groove of the female component. As the liner is moved into the groove, slip its trailing edge into the third groove; and move the liner completely into the third groove. Position the liner, so that when installed, the split in the liner will align with the ball filler hole of the third groove.
4. Follow, using the same technique, with the second liner (into the second groove), and the third liner (into the first groove), paying attention to the orientation of the liners around the ball filler holes.
5. When all liners are installed, space each so that the ends of the liners are equally spaced on each side of the filler holes.



(MALE LINER INSTALLATION - H2S ONLY)

Liner Installation

Male Race Liner:

1. Inspect male race grooves for damage to surfaces. Nicks and burrs should be removed. Damage to race surfaces is cause for the component to be taken out of service. The race surfaces should also be clean to allow for correct fit with the male liners.
2. Inspect male liners for nicks and burrs and insure that liner surfaces are free of dirt and grit.
3. Place one end of the liner in the first groove and with a circular motion, move the rest of the liner into the first groove. Using a screwdriver (or similar tool), slip the trailing end of the liner into the second groove. Follow the same technique with the liner in the second groove and move its trailing edge to the third groove, and finish the process.
4. Install the second liner onto the middle groove using the same technique as the first.
5. Finish with the third liner on the first groove.

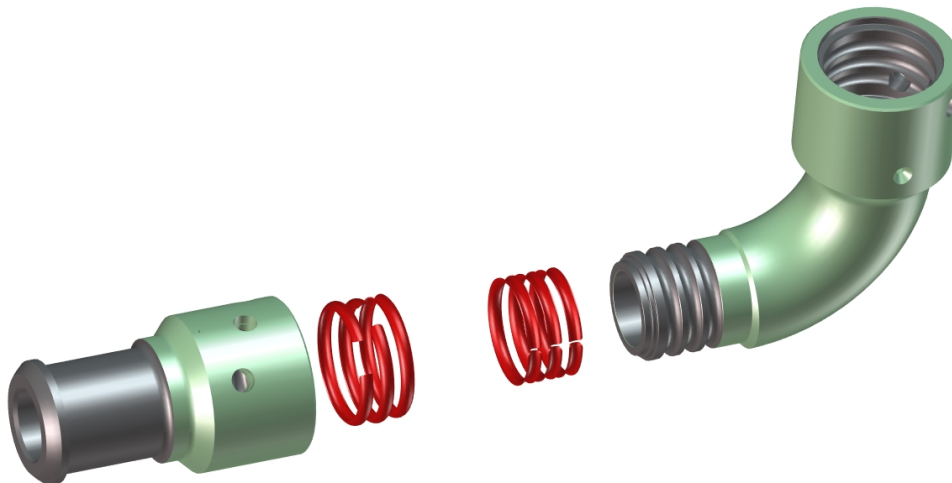


(LINER INSTALLATION CAUTION - H2S ONLY)

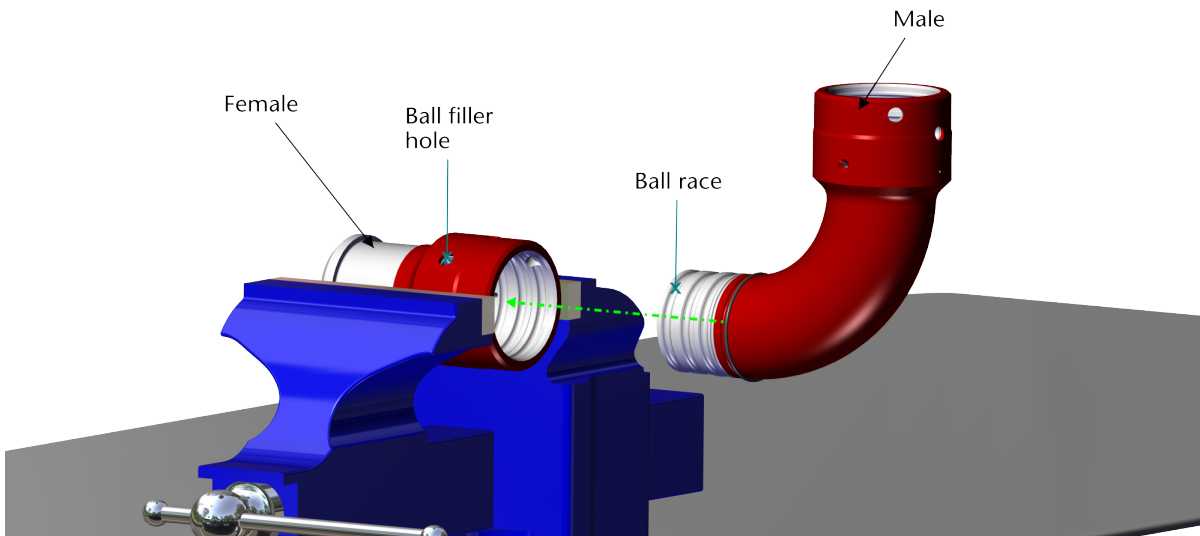
Exercise care when handling liners. Mishandling might lead to injury or damage to critical surfaces of the swivel.

Care should be exercised when installing male and female liners to avoid bending these components. Within limits of reasonable handling, the parts will nest properly when installed.

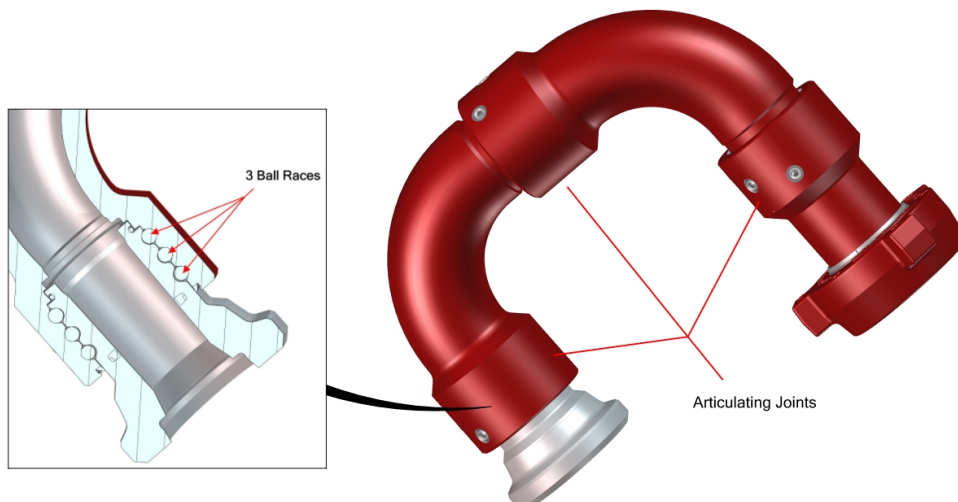
If the parts are subjected to severe distortion, they may take a "set" and not fit properly in their groove. Loose fitting liners can cause interference between male and female swivel halves during assembly or disassembly. If liners do not fit properly in grooves, replace them and also inspect the grooves for nicks, burrs, or grit.



4. Mount the female portion in a vise with the ball filler holes up. Insert the male portion into the female until the ball races in the male end align with the filler holes. Initially the alignment will not be exact due to the width of the packing ring. To compress the packing, drop the first ball into the middle filler hole and pry the ball into the male ball race with the screwdriver, using care not to damage ball race surfaces. Turning the male portion at the same time greatly assists in starting the first ball.

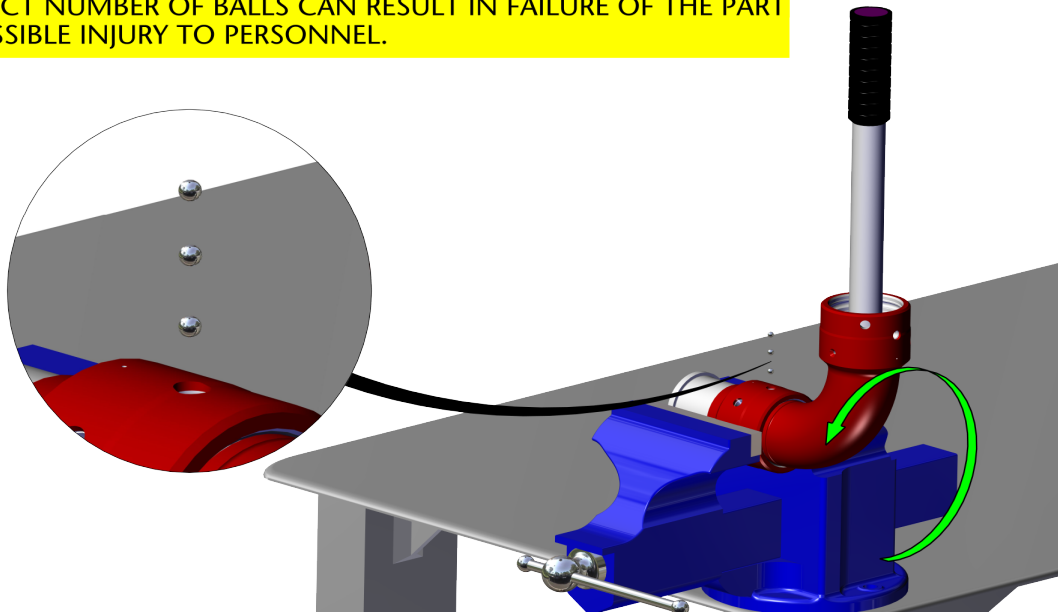


The number of articulating joints on a swivel depends on its style. Each articulating joint incorporates 3 ball races. Each Part Kit will have sufficient amount of balls to re-kit one articulating joint. i.e. The swivel below will require 3 Part Kits in order to have the right amount of balls for all ball races.



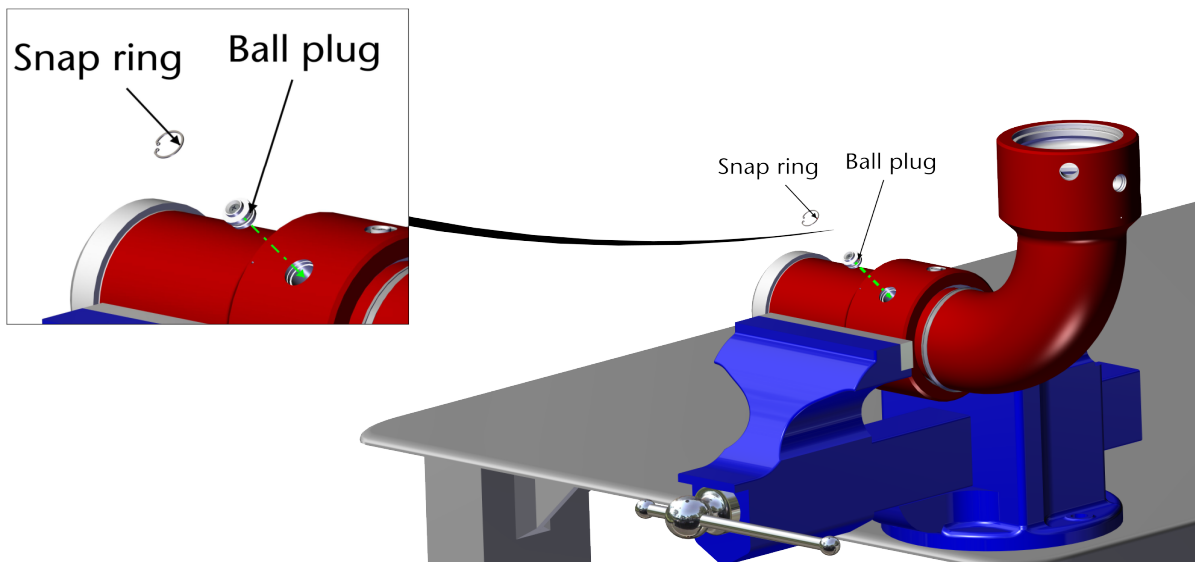
4a. Working with the same filler hole, insert the remainder of balls by rotating the male member as the balls are dropped in. Light tapping with the aluminum or brass drift may aid in inserting the last few balls. Carefully count the number of balls installed. This amount must equal the quantity required for each ball race as indicated by the parts list.

INCORRECT NUMBER OF BALLS CAN RESULT IN FAILURE OF THE PART AND POSSIBLE INJURY TO PERSONNEL.

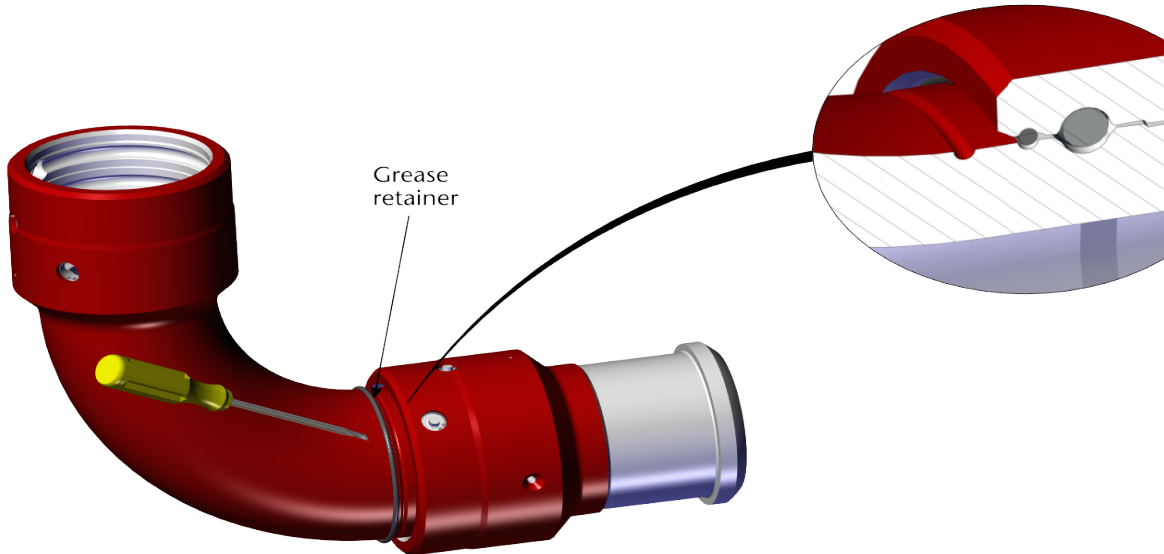


4b. Place the ball plug in this filler hole and secure with snap ring. Verify the ball plug in this filler hole and secure with snap ring. Verify that the snap ring is seated firmly into the groove.

5. Sufficient compression of the packing ring is accomplished with the installation of the first ball in the first race. No further compression is required. Continue by filling and plugging the second and (except for the 4" LR-6) the third ball race.

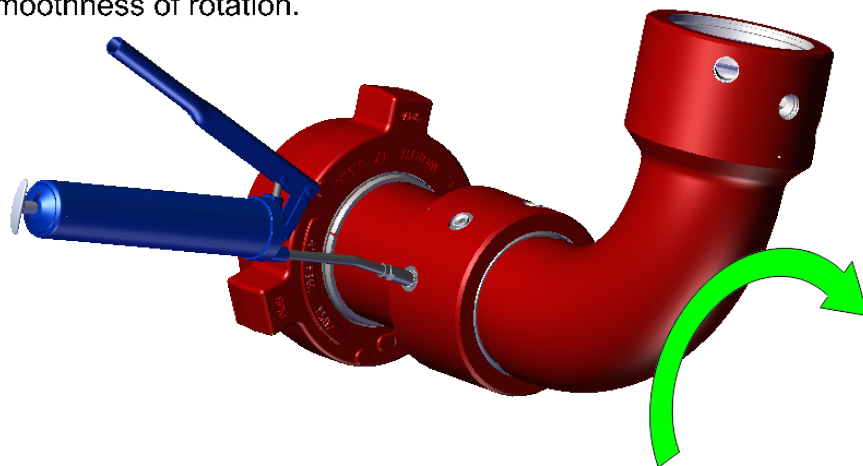


6. Work the grease retainer into the pocket of the female end carefully using a screwdriver.

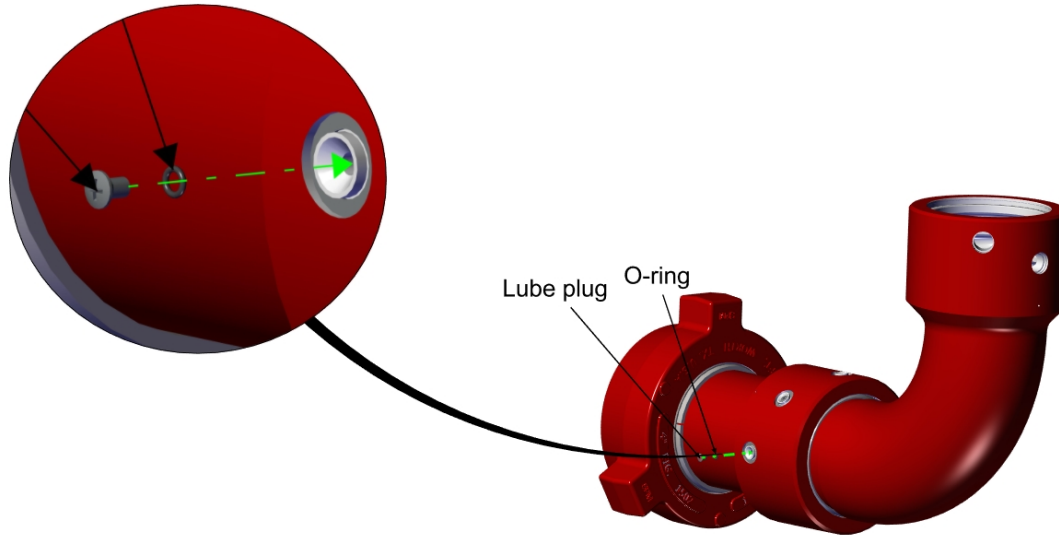


7. Using a removable lube fitting (except for the 4" LR-6) or the ball plug fitting (4" LR-6), lubricate the swivel with a small hand held grease gun and SPM grease. (PN: P45305) Do not use a high- pressure grease gun. Never grease while swivel is under pressure.

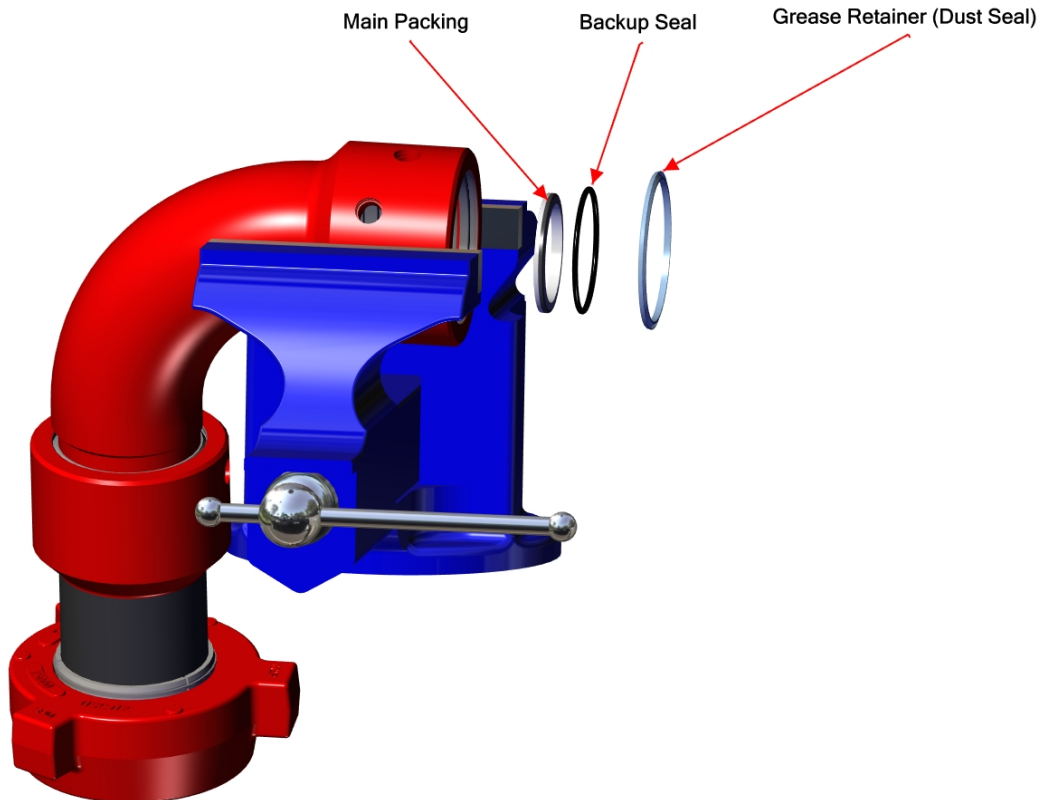
- a) Remove slotted screw in ball plug (4" LR-6).
- b) Apply two strokes to grease gun.
- c) Rotate assembly 90 degrees and apply two more strokes.
- d) Rotate assembly 90 degrees twice more and apply two strokes of grease each time.
- Do not over grease.
- e) check for smoothness of rotation.



- 7f) Replace slotted screw in ball plug (4" LR-6).
8. Insert lube plug with o-ring into lube filler port and hand tighten with screwdriver.

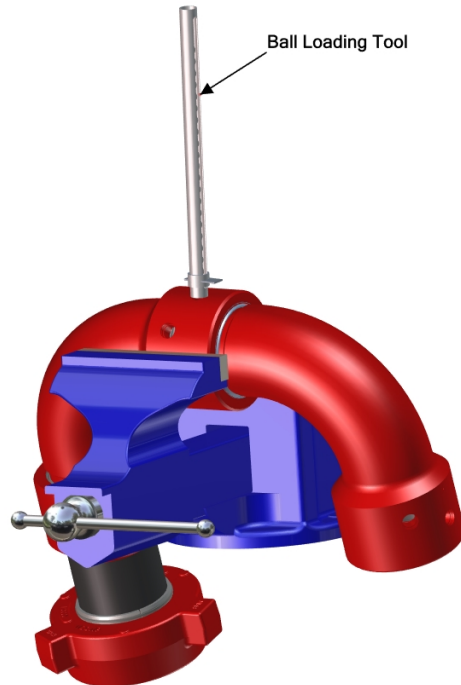


9. Position Assembly into vise as shown, with lube plug holes in the up position.
10. Apply a thin coat of SPM grease (P45305) to the seal surfaces of the mating parts.
11. Install the main packing in the female portion with the anti-extrusion ring on the packing facing outward, or toward the male portion. Verify that the main packing is seated firmly into the packing chamber. Position the grease retainer (dust Seal) on the male portion at the far end of the ball race area. Install Backup Seal into the female component as shown.

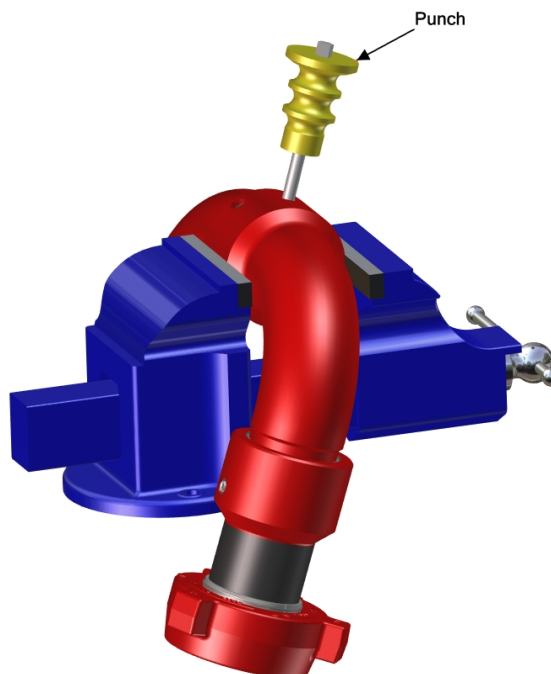


12. Insert Male Elbow End into Female Elbow End. Initially the alignment will not be exact due to the width of the packing ring. To compress the packing, drop the first ball into the middle filler hole and pry the ball into the male ball race with a screwdriver, using care not to damage ball race surfaces. Turning the Elbow at the same time greatly assists the first ball placement.

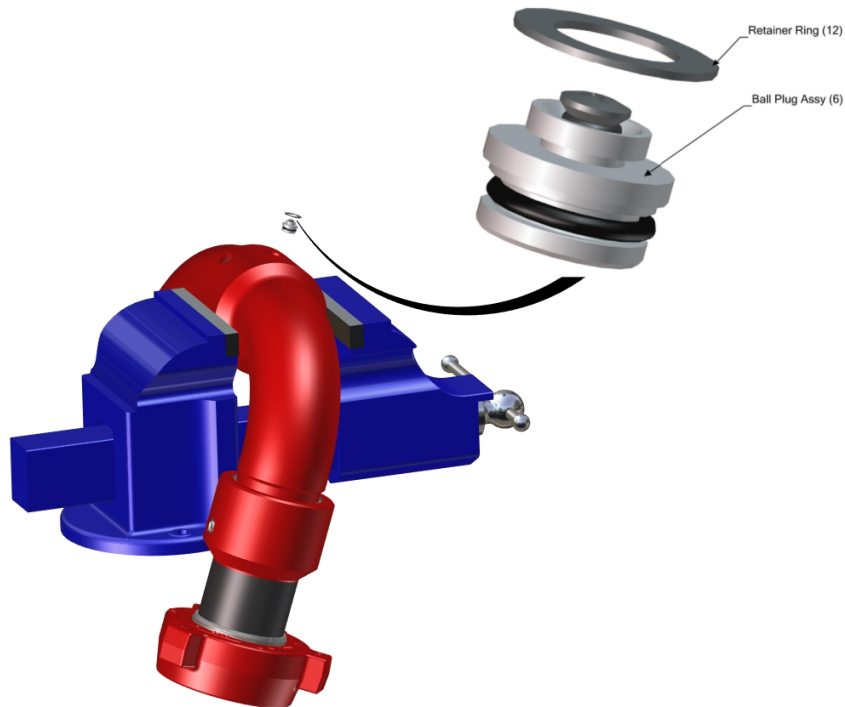
13. After the first Ball Placement, a Ball Loaded Tool can be used to load the remaining balls into each Ball Race.



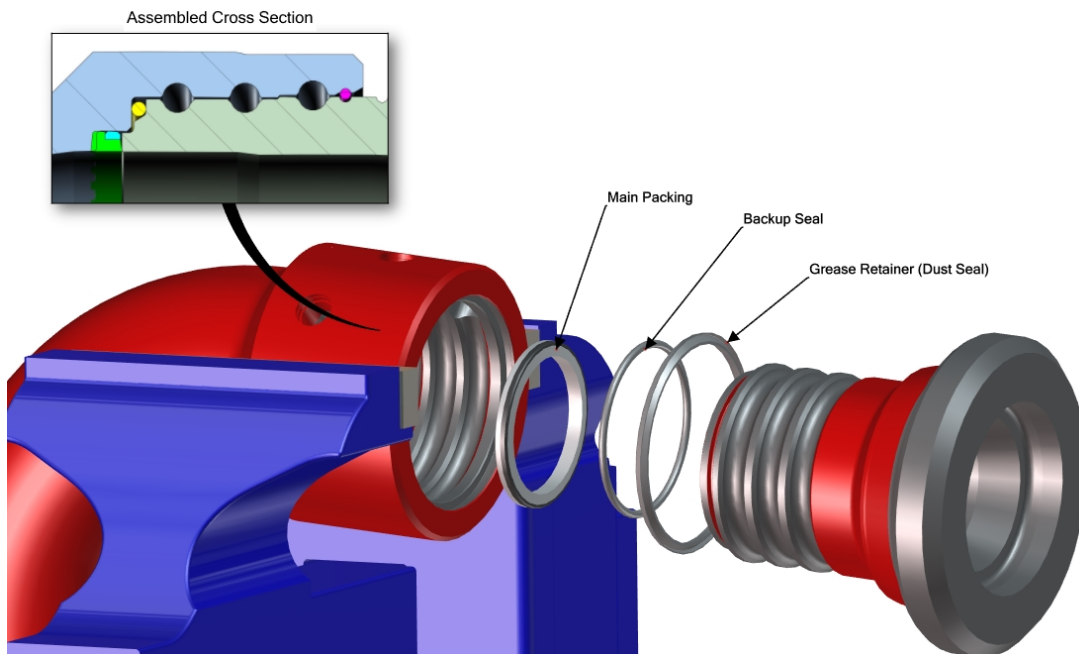
14. Use punch and hammer to drive in the last balls into each Ball Race. This is also used to ensure that the correct amount of balls are inserted into each race. Once the Ball Race is full the extra ball will not slide into Ball Race profile.



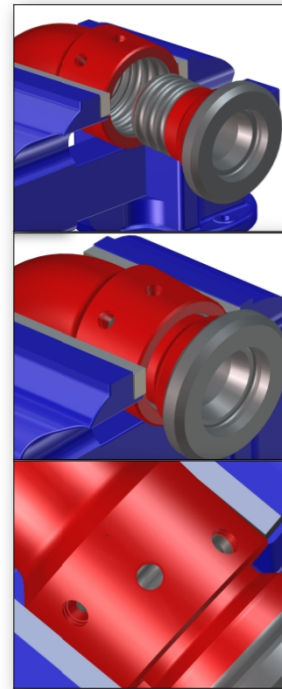
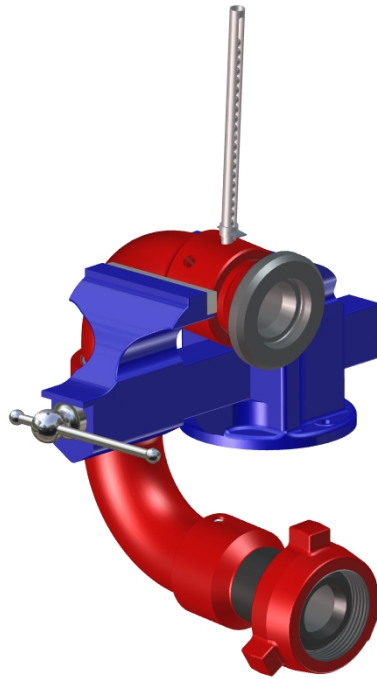
15. Install Ball Plug Assembly followed by a Retainer Ring to hold the Ball Plug Assembly in place. Use Truarc Pliers to install Retainer Ring.



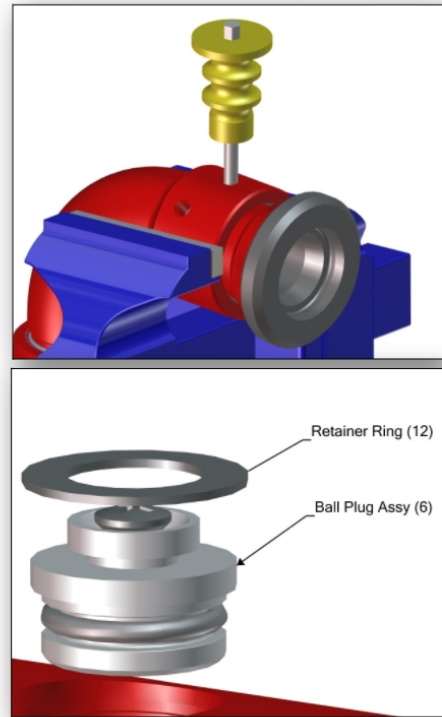
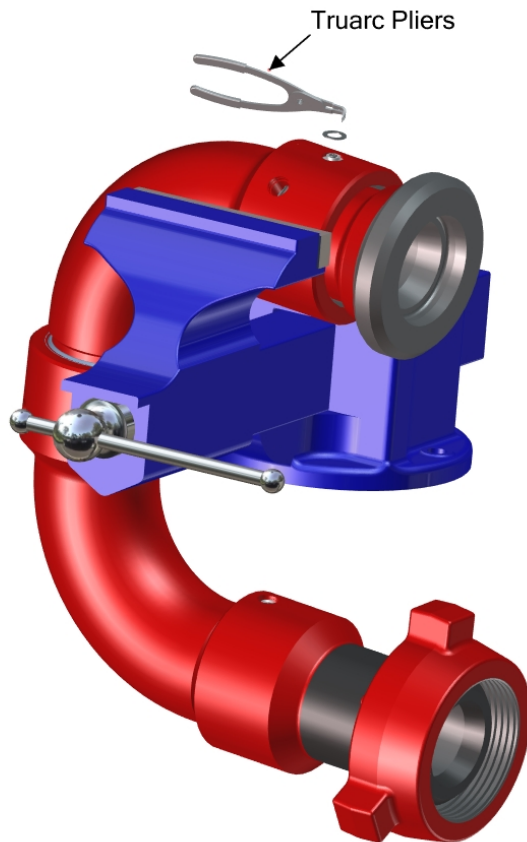
16. Position Assembly into vise as shown, with lube plug holes in the up position.
17. Apply a thin coat of SPM grease (P45305) to the seal surfaces of the mating parts.
18. Install the main packing in the female portion with the anti-extrusion ring on the packing facing outward, or toward the male portion. Verify that the main packing is seated firmly into the packing chamber. Position the grease retainer (Dust Seal) on the female portion at the far end of the ball race area. Install Backup Seal into the female component as shown.



19. Align and insert the Male Coupling into the Elbow as shown below ensuring that Ball Races align with each respective hole. Initially the alignment will not be exact due to the width of the packing ring. To compress the packing, drop the first ball into the middle filler hole and pry the ball into the male ball race with a screwdriver, using care not to damage ball race surfaces. Turning the Coupling with a Chain Wrench greatly assists the first ball placement.
20. After the first ball placement, a Ball Loading Tool can be used to load the remaining balls into each Ball Race.

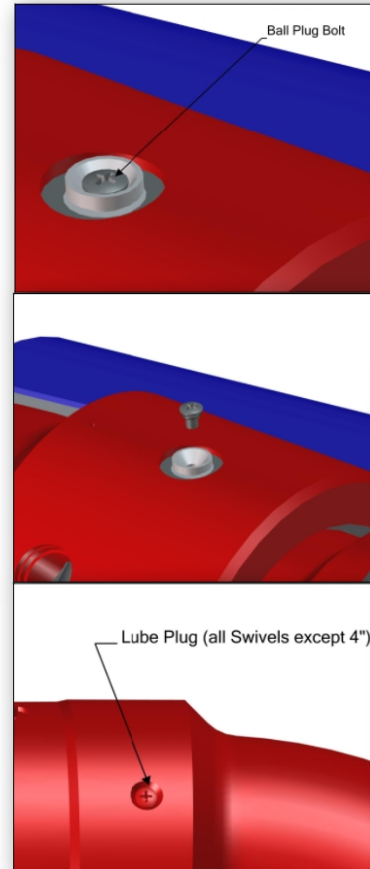
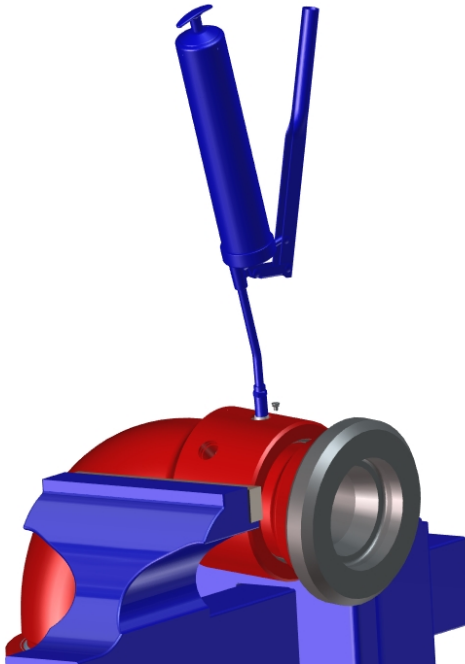


21. Use punch and hammer to drive in the last balls into each Ball Race. This is also used to ensure that the correct amount of balls are inserted into each ball race. Once the Ball Race is full the extra ball will not slide into Ball Race profile.
22. Install Ball Plug Assembly followed by a Retainer Ring to hold the Ball Plug Assembly in place. Use Truarc Pliers to install Retainer Ring.



23. Locate the Ball Plug Bolt as shown and loosen the bolt. Lubricate the Swivel with a small hand held grease gun and SPM Grease (SPM PN: P45305). DO NOT use high pressure grease guns. NEVER grease while Swivel is under pressure.

- a. Remove slotted screw.
- b. Apply (2) strokes of grease.
- c. Rotate Assembly 90 degrees, apply (2) more strokes.
- d. Rotate Assembly 90 degrees twice more and apply strokes of grease each time. Do Not over grease.
- e. Check for smoothness of rotation.
- f. Replace slotted screw in Ball Plug.



SECTION IV: Service and Support

Service Center Order Information:

SPM™ Oil and Gas stocks a large inventory of genuine original equipment replacement parts. In order to expedite a parts order and avoid any delays, please provide the following information with your order:

- The part number and description (refer to drawings and parts lists in this section) of each item ordered.
- The quantity of each part, kit, or assembly ordered.
- The model number and serial number.
- Your purchase order number.
- Specify method of shipment, complete shipping address, complete billing address and telephone number at the destination of the shipment.

Please refer to our web site for global locations: www.spmoilandgas.com

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