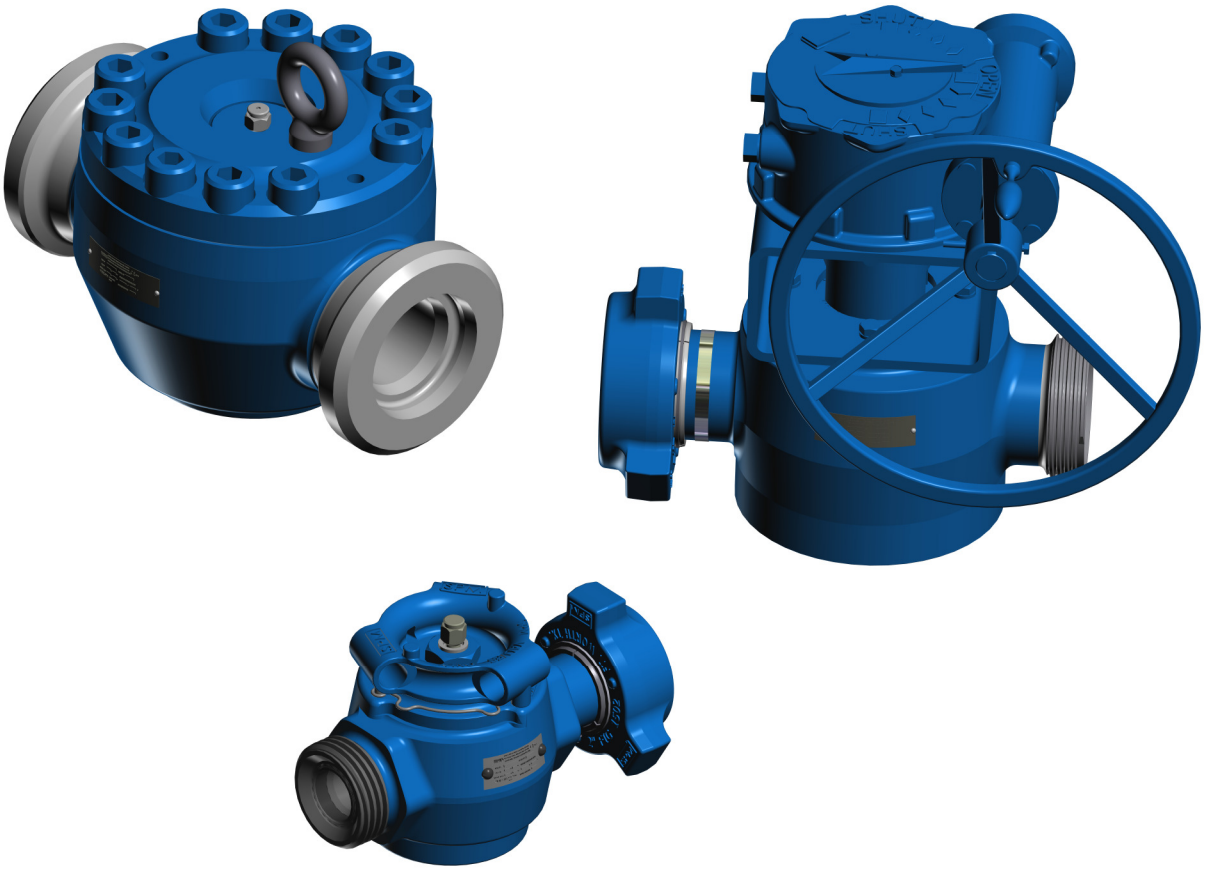
SPM® Well Service Pumps & Flow Control Products

Plug Valves
Operation Instruction and Service Manual

Oil & Gas



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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 PERSONAL 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!!

SPM® flow products contain elastomeric seals and are not intended to provide proper functionality when exposed to fire.

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. It is important to read and understand the "General Safety Data for all SPM® Products" and the SPM® Product Safety Guide for "Union and Union End Products". Both of these are available from Weir Oil & Gas.

Safety Guide for Plug Valves:

Personal Responsibilities:

When using these assemblies, appropriate PPE is required: safety glasses, approved safety shoes and hard hat must be worn. Hammering and lifting these assemblies must be done with caution. Where unions are present, read and understand the SPM® Safety Guide for Unions and Union End Products.

Personnel should only hammer on makeup lugs and not strike union nut or valve body. Fractures can occur from repeated misuse. Excessive hammering can damage components.

Proper leg lifting should be used when lifting. Back lifts should be avoided.

Only the proper actuator bar should be used to turn SPM® plug valves. Valves require torque to operate. Makeshift bars can become dislodged easily and cause an accident. Use only an SPM® actuator bar, part number 3P19958 for 1” Plug Valves and 3P11542, for 2" & 3” Plug Valves. It is a personal responsibility to become knowledgeable and trained in the proper use and handling of this tool.

Do not hammer on, or be around valve assemblies when pressure is present.

Hand actuation (with the appropriate actuator bar) should be done only by specially trained personnel under direct supervisory instruction; and only when necessary due to application.

On Location:

Proper transportation of plug valves is important. Racks that will secure valves and prevent accidental unloading are critical. Never transport any SPM® product in a fashion that would allow it to become dislodged and cause an accident.

Valve unions should be clean and lightly oiled prior to each use. A visual inspection for damage should also be performed at this time. Union seals should be checked, and replaced when worn or damaged.

Each valve has a size and pressure code designated on the valve. Use this code for proper mating and pressure limits.

CAUTION: SINCE PLUG VALVES MAY BE REPAINTED IN DIFFERENT COLORS FOR VARIOUS APPLICATIONS, DO NOT USE FACTORY COLOR AS PRIMARY MEANS OF IDENTIFICATION.

Valve usage should be monitored by a qualified supervisor or foreman. Supervisory personnel must approve proper placement, position, and handling of all plug valves in the system. Only specially trained personnel under direct supervisory instruction, should actuate valves under pressure.

Prior to applying pressure, valves should be greased in both the opened and closed position. This should be done before each use. If valve is excessively hard to operate, it should be removed and not used until repairs are made.

It is sometimes necessary to turn valves when pressure is present. It is recommended that remote control actuators be used for this purpose. If this is not feasible, then only experienced specially trained personnel under direct supervisory instruction should perform this task.

Venting flammable or explosive gases to the atmosphere through individual SPM® plug valves must be avoided. Choke manifolds are available from Weir Oil & Gas and should be used for this purpose. If used for bleeding, ample anchoring of the valve manifold must be done. Specially designed torture valves are available from Weir Oil & Gas for bleed off applications.

WARNING: GASES, OR FLUIDS CONTAINING GASES, WILL CAUSE VALVES TO WHIP AND CAN CAUSE SERIOUS INJURY OR DEATH!

When opening an SPM® plug valve under pressure, the initial torque to start the stem turning is always greater than the moving torque. You must position your body to be able to compensate for this change.

Do not position any part of your body in the path of exit flow of the valve.

Do not position the exit of any plug valve, used for bleeding, where rocks or debris may be picked up by the exit stream.

If any valve becomes plugged, or does not operate properly, contact a supervisor immediately. DO NOT look into the end of the valve to check for debris, blockage, or for any other reason.

If valve is slow to open or close, remove it from service. Do not hammer on the valve's actuator cap.

It is recommended that a rate in excess of 42 feet per second be avoided. Rates above this will cause a more rapid wear and erosion.

Flush clean and grease after each job with water and the proper SPM® valve grease. Use only an SPM® pressure rated gun for greasing. Cycle valve to insure grease is evenly distributed.

Special Precautions:

Welding, brazing, or heating on SPM® plug valves is prohibited.

Valve operation sometimes requires personnel to be around pressured lines. Experienced personnel only should be dispatched for this purpose. Exposure time should be a minimum. Always use remote controlled valves whenever possible. Never look into, or position yourself in, the path of the exit flow of the valve.

Never alternate a valve's service. Acid service should never be followed by cold temperature service. When acid etching or erosion is present, replace the valve.

Weir Oil & Gas offers specially designed valves for torture service, cold temperature service, H2S service, and aromatic service. Only valves designed and approved for these special services should be used in these applications.

Each integral 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 integral union connections 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:

Valves should be greased after each use. Use only the following SPM® gun and grease.

Recommended Lube Grease: Valtex 972: SPM® P32553
Gun Assembly: SPM® P13335

(Do not mix Assembly Greases – This will increase the amount of friction between internal components of the valve. -- Contact Weir Oil & Gas Engineering for other approved grease)

Any alteration of the SPM® valve is prohibited.

Use only repair methods as outlined by SPM® valve service literature. Use only the proper SPM® repair tools.

SPM® Repair Kits should be used for repair. Valve Body and all components must be clean and SPM® assembly grease used as recommended.

Recommended Assembly Grease: Val-Tex 1502 SPM® P36791

(Weir Oil & Gas does not recommend mixing competing types of assembly grease – This may result in reduced "tack" at the interface between each grease, and allow for an increase grease loss rate during pumping operations.)

Weir Oil & Gas does not allow weld repair to be attempted on its product. Replacing worn components is a more effective and safe approach.

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SECTION I: General Information

This service manual covers:

1 inch & 1-1/2 inch	1A12173	PLUG VA/1 SP50TF
	1A12174	PLUG VA/1 SP150WU
	1A11747	PLUG VA/1X2 LPTLM
	1A14483	PLUG VA/1X2 SP150WU/LT
	1A14483V	PLUG VA/1X2 SP150WU/LT/VIT
	1A14483A	PLUG VA/1X2 SP150WU/AIR ACT/LT
	1A19748	PLUG VA/1X2 SP150WU/TORTURE/LT
	1A19777	PLUG VA/1X2 SP150WU/LT/H2S
	1A14483HB	PLUG VA/1X2 SP150WU/HYD ACT/BRC1000
	1A25037	PLUG VA/1X2 SP150WU/LT/LESS ACT/MOD
	2A26276	PLUG VA/1X2 SP150WU/HT/VIT
	1A19777HB	PLUG VA/1X2 SP150WU/LT/H2S/HYD ACT/BRC10
	1A25038	PLUG VA/1X2 SP150WU/LT/LESS ACT/VIT
	2A26270	PLUG VA/1X2 SP150WU/HT/H2S
2 inch	1A12477	PLUG VA/2 SP50TF X 2 LPTL F
	1A12478	PLUG VA/2 SP100TF
	1A11742	PLUG VA/2 SP150TF
	2A26271	PLUG VA/2 SP150WU/HT/H2S
	1A14487	PLUG VA/2 SP150WU/LT
	1A14487A	PLUG VA/2 SP150WU/LT/AIR ACT
	1A14492	PLUG VA/2 SP150WU/LT/H2S
	1A14487HB	PLUG VA/2 SP150WU/HYD ACT/BRC1000
	1A24017	PLUG VA/2 SP150WU/LT/LESS ACT/MOD
	2A26277	PLUG VA/2 SP150WU/HT/VIT
	1A20211	PLUG VA/2 SP150WU/LT/ACID SOLV
	2A27973	PLUG VA/2 SP150/SFTY IRN/LT/BUNA
	2A42920	PLUG VA/2X3 SP150WU (USE 2” KITS)*
3 inch	2A26611	PLUG VA/3 SP150/LT/MAN
	2A27943	PLUG VA/3 SP150/SFTY IRN/MANUAL/BUNA
	1A14496	PLUG VA/3 SP150/LT/GEAR
	1A14496H	PLUG VA/3 SP150/LT/HYD ACT
	2A27942	PLUG VA/3 SP150/SFTY IRN/BUNA
	1A14496A	PLUG VA/3 SP150/LT/AIR ACT
	1A19585H	PLUG VA/3 SP150/LT/H2S/HYD ACT
	1A20933	PLUG VA/3 SP150/LT/H2S/LESS ACT
	2A30297	PLUG VA/3 SP150/LT/GEAR/LOW PROFILE
	1A18962	PLUG VA/3 SP150/LT/LESS ACT

***Includes 3”1502 End Connections and 2” internal plug components**

This service manual covers (Cont.):

4 inch	2A28135	PLUG VA/4 SP150/SBI
	2A25168	PLUG VA/4 SP150WU
	2A25167	PLUG VA/4 SP150/LESS ACT
	2A25168HB	PLUG VA/4 SP150WU/HYD ACT
	2A27872	PLUG VA/4 SP100/SFTY IRN
	2A25182	PLUG VA/4 SP100/W ACT
	2A25182HB	PLUG VA/4 SP100/HYD ACT/BRC2000

Rebuild Kits:

1 inch	**PARTS KITS**	
	4L11769	KIT/PARTS/PV/1.00
	4L16800	KIT/PARTS/PV/1.00 ACID-SOLV NOT FOR H2S
	4L20096	KIT/PARTS/PV/1.00/TORTURE
	4L20215	KIT/PARTS/PV/1.00/TORTURE/ACID SOLV
	4L20230	KIT/PARTS/PV/1.00/H2S SP150
	SEAL KITS	
	4L14203	KIT/SEAL/PV/1.00
	4L16783	KIT/SEAL/PV/1.00/ACID-SOLV NOT FOR H2S
	4L20094	KIT/SEAL/1 PV/TORTURE
	4L20214	KIT/SEAL/PV/1.00/TORTURE/ACID SOLV
	ELASTOMER KITS	
	4L20947	KIT/ELASTOMER/PV/1.00
	4L20949	KIT/ELASTOMER/PV/1.00/H2S/ACID-SOLV
	O-RING/PACKING ASSY	
	4A11985	SEAL&BKUP ASSY/1 PV
	4A16802	SEAL&BKUP ASSY/1 PV
1-1/2 inch	**PARTS KITS**	
	4L12487	KIT/PARTS/PV/1.50/STD
	SEAL KITS	
	4L14442	KIT/SEAL/PV/1.50 NOT FOR H2S
	ELASTOMER KITS	
	4L23926	KIT/ELASTOMER/PV/1.50
	O-RING/PACKING ASSY	
	4L11979	SEAL&BKUP ASSY/1.50 PV

Rebuild Kits (Cont.)

2 inch	**PARTS KITS**	
	4L11982	KIT/PARTS/PV/2.00
	4L16826	KIT/PARTS/PV/2.00/ACID-SOLV NOT FOR H2S
	4L14522	KIT/PARTS/PV/2.00/H2S
	4L20574	KIT/PARTS/PV/2.00/H2S/NO SIDE PORTS
	4L13928	KIT/PARTS/PV/2.00/SP200/H2S
	SEAL KITS	
	4L13694	KIT/SEAL/PV/2.00/STD
	4L16824	KIT/SEAL/2 PV/ACID-SOLV NOT FOR H2S
	4L14989	KIT/SEAL/PV/2.00/H2S SIDE PORTS
	4L20575	KIT/SEAL/PV/2.00/H2S/NO SIDE PORTS
	4L19822	KIT/SEAL/2 SP200 PV/H2S
	ELASTOMER KITS	
	4L20948	KIT/ELASTOMER/PV/2.00
	4L20950	KIT/ELASTOMER/PV/2.00/H2S/ACID-SOLV
	O-RING/PACKING ASSY	
	4A11979	SEAL&BKUP ASSY/2 PV
	4A16825	SEAL&BKUP ASSY/2 PV/H2S
	4A19829	SEAL&BKUP ASSY/2 SP200 PV/H2S
3 inch	**PARTS KITS**	
	2A30675	KIT/PARTS/PV/3.00/LT/SD
	2A33786	KIT/PARTS/PV/3.00/LT/SD/H2S
	2A34110	KIT/PARTS/PV/3.00/LT/SD/LESS SIDE SGMTS
	SEAL KITS	
	2A30677	KIT/SEAL/PV/3.00/LT/SD
	2A33787	KIT/SEALS/PV/3.00/LT/SD/H2S
	ELASTOMER KITS	
	2A30678	KIT/ELASTOMER/PV/3.00/LT/SD
	2A33788	KIT/ELASTOMER/PV/3.00/LT/SD/H2S
	O-RING/PACKING ASSY	
	4A16827	SEAL&BKUP ASSY/3 PV
	4A20372	SEAL&BKUP ASSY/3 PV/H2S
4 inch	**4 inch PARTS KITS**	
	2A26353	KIT/PARTS/PV/4.00/SP100
	2A26354	KIT/PARTS/PV/4.00/SP150
	4 inch SEAL KITS	
	2A26358	KIT/SEAL/PV/4.00/SP100
	2A26359	KIT/SEAL/PV/4.00/SP150
	4 inch ELASTOMER KITS	
	2A26361	KIT/ELASTOMER/PV/4.00/SP100
	2A26362	KIT/ELASTOMER/PV/4.00/SP150
	4 inch O-RING/PACKING ASSY	
	2A26356	SEAL&BKUP ASSY/4 PV

Product Description:

SPM® Plug Valves are designed to regulate the transport of fluid through a flow line. By rotating the plug 90°, the flow can either be terminated, or allowed to flow through the Plug Valve Bore. They require minimum space, are simple to operate, exhibit a fast response, and add relatively little internal disturbance to the flow. Therefore pressure drop across the valve is low.

The valves are intended for both onshore and offshore use. Onshore, the plug valves are used in connection with mobile pumping service units used to kill wells, cement wells, acidize and fracture wells. They are also used in hydraulic lines to control wellhead protector tools. The lists of applications are lengthy. Offshore, the valves are used on stimulation vessels in a number of applications. They are used in essentially permanent installations in pump rooms to isolate the discharges of the triplex pumps used in fracturing wells. They have also been used in choke and kill manifold systems.

Operation is accomplished by a 90° rotation of the plug. This can be performed manually, or with pneumatic or hydraulic actuators

All SPM® Plug Valves are in compliance with the following regulations:

- Pressure Equipment Directive 97/23/EC.
- U.K. DEN SI 289
- Det Norske Veritas' Rules of Classification of Mobile Offshore Units
- API 6A, 16C Approved
- NACE MR0175-09 (H2S Exposure)

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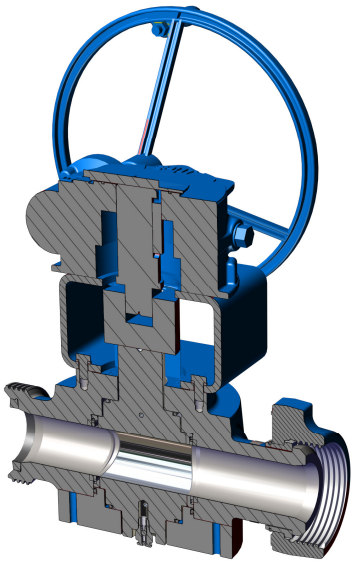


SPM® 1 inch, 1 inch x 2 inch, and 2 inch plug valves

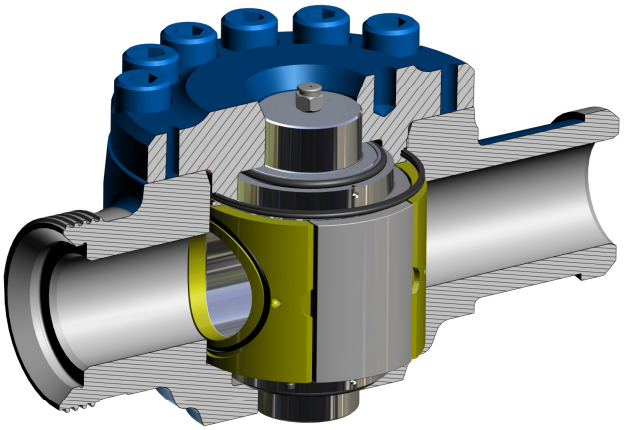
These plug valves are available for standard and H2S service. The H2S Plug Valves conform to NACE MR0175-09 for exposure to H2S. It is important that the correct Plug Valve be used for the specific application.

Characteristics

- Improved body cap seal arrangement eliminates cap leakage found in some competitive valves.
- No need to remove valve from line for maintenance.
- No special tools needed for operation or maintenance.
- Precision-ground floating seal segments insure positive seal between fluid stream and cylindrical plug.
- Excellent sealing provided by precision ground metal-to-metal seal between seal segments and plug.
- Pressure-enhanced sealing between segments and body provided by molded rubber static segment seal.
- Segment design ensures easy operation up to the full working pressure of the valve.
- Precision-ground plug is plated standard for maximum corrosion protection.
- Quality components throughout unit including forged heat-treated alloy steel body for greater dependability, minimum weight and maximum strength.
- Plug bar cap has visible indication of open or closed position and detent spring to insure valve stays open or closed.
- Hydraulically-actuated models optional.
- Remote-control actuator available.
- Each valve is thoroughly tested prior to shipment.
- Inventory stock of complete valves, spare parts and seal kits available.

Can be used in the following service:

- Fresh Water and Sea Water Lines
- Drilling Mud Lines, including Choke and Kill Lines
- Well Service Lines for cementing, fracturing, acidizing, and flow testing
- Hydraulic Lines, including BOP control lines
- Crude Oil Production Lines
- Utility Lines



SPM® 2 inch light weight plug valve:

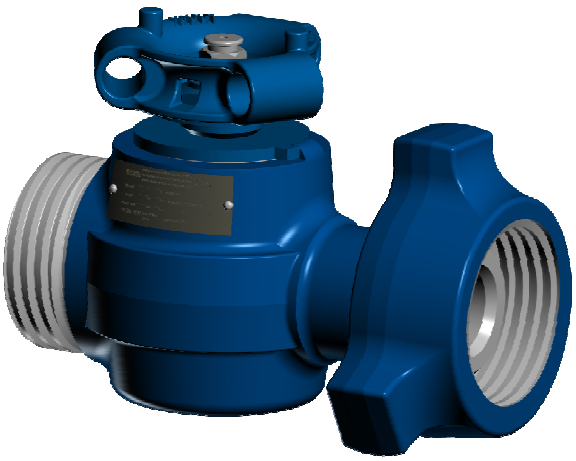
The SPM® 2 inch light weight (LW) plug valve is engineered with one thing in mind: Safety.
It provides the following advantages to the Oil and Gas Industry:

- Compact/Lightweight Design
- Meets HSE Lifting Requirements*
- Easy Assembly/ Disassembly
- DNV Certification Available
- CE Compliant (97/23/EC)

*HSE compliant products offer a safe lifting weight of 55 lbs. (25 kg) or less to be lifted and carried by one person.

Like other SPM® high pressure plug valves, the 2 inch LW plug valve is able to provide the same dependable service for applications such as:

- Acidizing
- Cementing
- Coil Tubing
- Fracturing
- Sand Control
- Well Kill



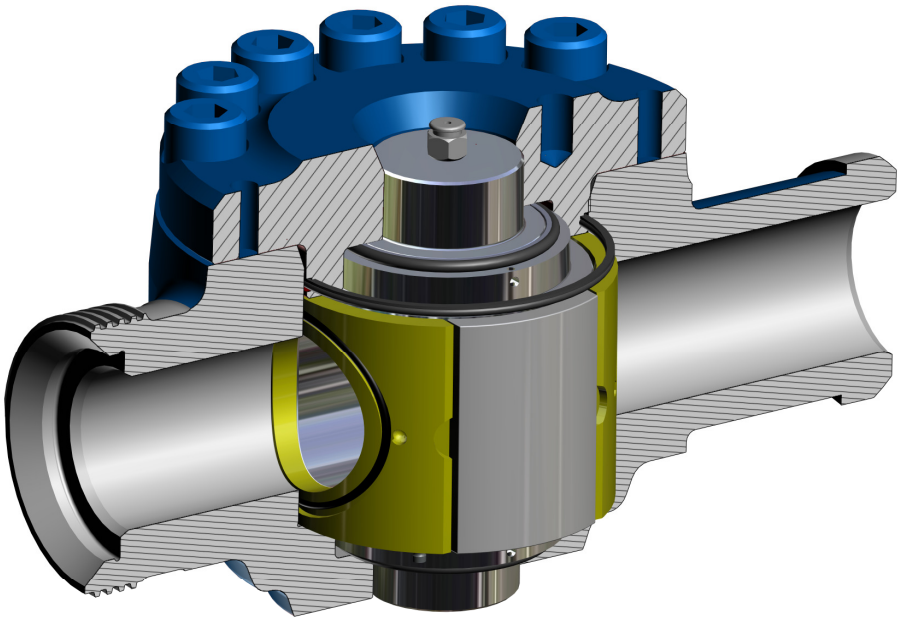
Refer to SPM® 2 inch light weight plug valve (HSE Approved) Operation and Maintenance Instruction Manual for further information on this valve.

SPM® 3 inch and 4 inch plug valves

SPM® 3 inch and 4 inch plug valves are available in pressure ratings to 15,000 psi NSCWP*. Features include a flanged body for easier maintenance, integral inlets and outlets, hand crank, locked-open and shut gear drive standard, and multiple lubricating inlets. Standard service and sour gas service models are available.

Characteristics

• Low operating torque due to balanced stem makes valve easier to operate.
• Flanged body for easier maintenance.
• Integral inlets and outlets are standard.
• Quality components throughout unit including forged steel body.
• Hand crank, and locked-open and shut gear drive is standard.
• Hydraulic and pneumatic actuators with either a 12-volt power system or hand-operated hydraulic pump are optional.
• New manual actuated design now available.
• Cylindrical balanced plug utilizes sealing segments to permit easier operation under pressure, and assure positive seal.
• Flanged body construction for safer operation and easier maintenance.
• No adjustments or special tools needed for maintenance or operation.
• Visible quarter-turn stop indicates when the valve is open or fully closed.



End Connection Options:

The SPM® plug valve family is available with SPM® wing union or Safety Iron® connections. The nameplate will indicate the allowable cold working pressure for each assembly.

Wing union connections on the plug valve are interchangeable with other union connections of the same size and figure (pressure rating). Caution must be taken to avoid mixing different ratings of wing connections. There are various sizes and figures that are capable of making marginal connections. SPM® Safety Iron® connections are universal requiring no male or female as does the wing union. Failure to observe good judgment may lead to failure of components and danger to life and limb. Always verify working pressure ratings of each connection before use.

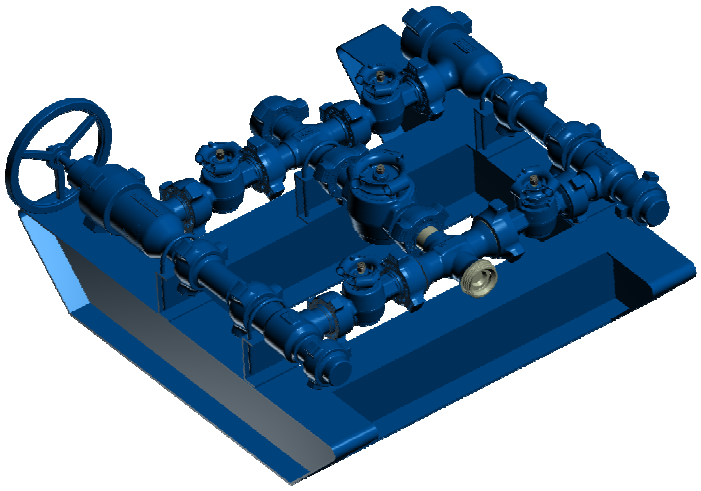
WARNING: OBSERVE ALL INSTRUCTIONS, CAUTIONS AND WARNINGS AS NOTED IN THIS MANUAL. FAILURE TO DO SO CAN LEAD TO EQUIPMENT DAMAGE AND **PERSONAL INJURY OR DEATH!**

SECTION II: Installation and Operation

Installation:

1 inch, 1 inch x 2 inch, 1½ inch and 2 inch plug valves

SPM® Plug Valves in these sizes are primarily installed in line of a flow back system on a fracturing site, Manifold Assemblies, or any other location that a plug valve with this rating and capacity is needed. The important thing is to ensure that the size of the plug valve meets the correct application. Figure below shows a SPM® Flowline Manifold, which consists of plug valves, tees, crosses and chokes.



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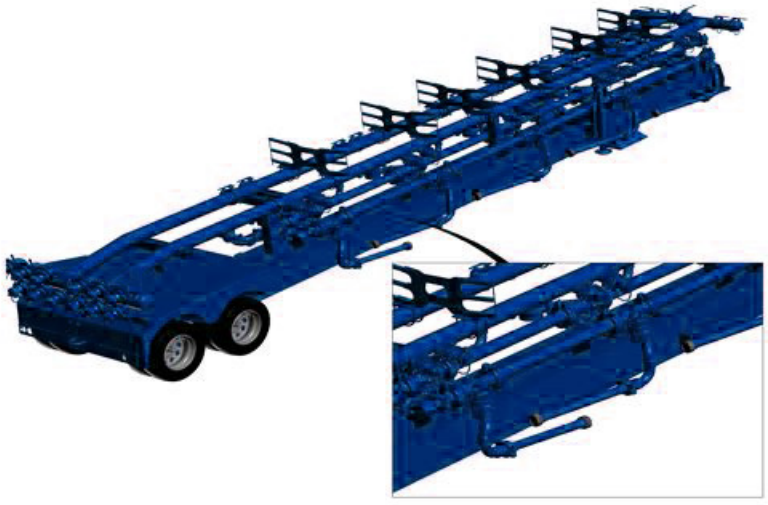
3 inch and 4 inch plug valves

3 inch and 4 inch plug valves are installed in line with the high pressure fracturing lines or manifold trailers, however other applications may apply. Figures below show plug valves installed on a SPM® manifold trailer and used as an isolation valve on a SPM® Emergency back pressure relief valve.



Calibration Guide:

Refer to Vessel Testing Section on page 31.

Pressure/Temperature Ratings:

Part Number	Description		Service	Working Pressure (PSI)	Temperature Range (F)	
1A14483	1 inch X 2 inch SP150 WU	LT	STD	15,000	-30	110
1A13280	1 inch X 2 inch SP150 WU	LT/VITON	STD	15,000	-30	110
1A19777	1 inch X 2 inch SP150 WU	LT	H2S	10,000	-30	110
1A19748	1 inch X 2 inch SP150 WU	TORTURE LT	STD	15,000	-30	110
1A20855	1 inch X 2 inch SP150 WU	TORTURE LT	H2S	10,000	-30	110
1A11687	2 inch SP150WU		STD	15,000	0	110
1A13279	2 inch SP150WU	LT/VITON	STD	15,000	-30	110
1A14492	2 inch SP150WU	LT	H2S	10,000	-30	110
2A27270	2 inch SP150SI	LT/SAFETY IRON	STD	15,000	-30	110
1A14802	2 inch SP200WU	LT	STD	20,000	-30	110
2A42920	2x3 inchSP150WU	LT	STD	15,000	-30	110
1A14498	3 inch SP100WU	LT	STD	10,000	-30	110
1A14174	3 inch SP100WU	LT/VITON	STD	10,000	-30	110
1A14496	3 inch SP150WU	LT	STD	15,000	-30	110
1A13278	3 inch SP150WU	LT/VITON	STD	15,000	-30	110
1A19585	3 inch SP150WU	LT	H2S	10,000	-30	110
2A27942	3 inch SP150SI	LT/SAFETY IRON	STD	15,000	-30	110
2A25154	4 inch SP100WU	LT	STD	10,000	-30	110
2A25168	4 inch SP150WU	LT	STD	15,000	-30	110
2A25175	4 inch SP150SI	LT/SAFETY IRON	STD	15,000	-30	110

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SECTION III: Maintenance and Repair

WARNING: DISASSEMBLY UNDER PRESSURE CAN CAUSE **SERIOUS BODILY INJURY, DEATH, OR PROPERTY DAMAGE.**

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. Check sealing surface areas of valve gate and nozzle for pitting, erosion or other flaws. Failure in sealing can result if these areas are not smooth.
6. Use only SPM® parts on SPM® products.
7. This device is intended to discharge atmospherically when it relieves.

Required Tools:

1. 400 Grit Sandpaper
2. Soft Face Mallet
3. Grease Gun (SPM® P13335)
4. Val-Tex 1502 (Temp Range -20F to 400F) SPM® P/N P36791 (For Re-greasing)
5. Val-Tex 972- (Temp Range -20F to 600F), SPM® P/N P32553 (For assembly)
6. Appropriate PPE for your company; Safety Glasses, Steel Toe Boots, Gloves, Protective Clothing
7. Special tool for specific SPM® valve size: Body Cap Wrench- 1 inch valve (SPM® 2P12258), 2 inch valve (SPM® 2P12259), 3 inch valve (3/4- inch Allen wrench)

Maintenance Requirements:

SPM® plug valves 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. These fluids operate at high velocities and usually at high pressures. Some fluids may also require being conveyed at elevated temperatures. Combinations of any and all of these conditions will speed up 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. This can lead to unnecessary material replacement along with the danger of injury to personnel.

Proper knowledge and application of the plug valve is necessary for safe operation. It is recommended that a routine maintenance program include, at the very least:

1. Inspection of wall thickness loss
2. Routine replacement of o-rings and seals
3. Scheduled greasing of the Plug Valve after every fracturing job with recommended lubricants:

    - Val-Tex 1502 (Temp Range -20F to 400F) SPM® P/N P36791
    - Val-Tex 972- (Temp Range -20F to 600F), SPM® P/N P32553

(Do not mix Assembly Greases – This will increase the amount of friction between internal components of the valve. -- Contact Weir Oil & Gas Engineering for other approved grease)

Frequent greasing will prevent the voids from occurring and will ensure easy operation of the valve. Please reference “Recommended Greasing Procedure” on Page 19.

Once the plug valve body wall thickness falls below the minimums listed in Engineering Specification 1S19644 for Standard Service and 1S23257 for H2S Service flow products, it must be removed from service. Wall thickness may be measured by mechanical, sonic, or visual means.

Maintenance Requirements (Cont.):

Weir Oil & Gas recommends that the valve be serviced during the following:

1. ***Preventative Maintenance (After every Frac and/or stage job)***

Re-greasing the Plug Valve after every Fracturing and/or stage job will increase the life of the Plug Valve. Normal working operations will allow for grease loss if the plug valve is not maintained. This can create voids within the assembly. These voids will quickly accumulate sand and proppants thus increasing the force required to open/close the valve. Frequent greasing of the valve will ensure easier operation.

Reference – "Recommended Re-Greasing Procedure" beginning on page 20.

2. ***Periodic Inspection***

Periodic inspections are required to ensure that all internal components of the valve are working properly and are to Weir Oil & Gas Engineering's specifications. It is imperative that a qualified Weir Oil & Gas Technician follow the assembly/disassembly/inspection instructions beginning on page 24.

Rebuild kits are available through Weir Oil & Gas Service Centers. They are referenced on pages 7 & 8.

Periodic Inspection will include recertification of the Plug Valve which will include the following:

- Inspection of sealing surfaces, evidence of wear and pitting of all components.
- Disassembly
- New Kitting
- Ultra-Sonic Inspection / Minimum Wall Inspection
- Reassembly
- Pressure testing to 100% the product's normal working pressure per SPM® Specification 4S12497 Section
- Magnetic Particle Inspection (Per Request)

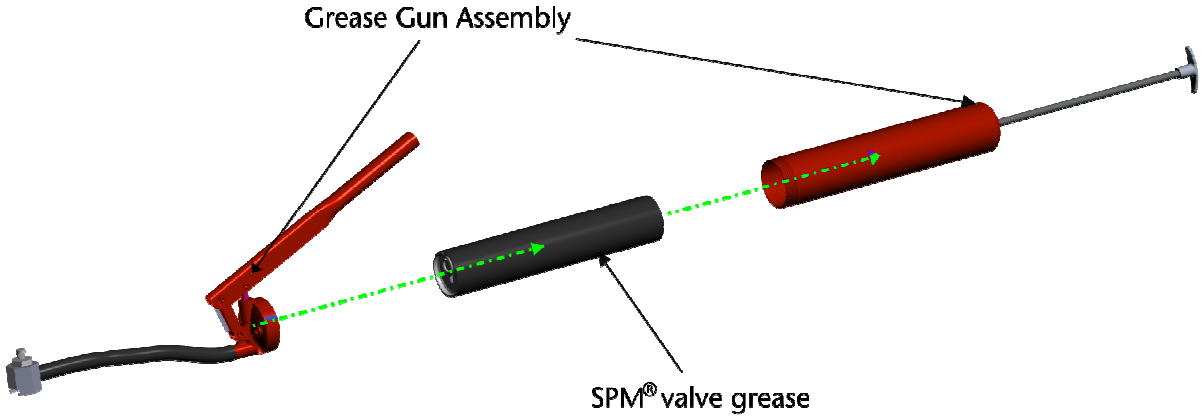
Recommended Re-Greasing Procedure:

To maximize the valve's performance and longevity, it is recommended that the lubrication maintenance procedure described below be followed. Safety

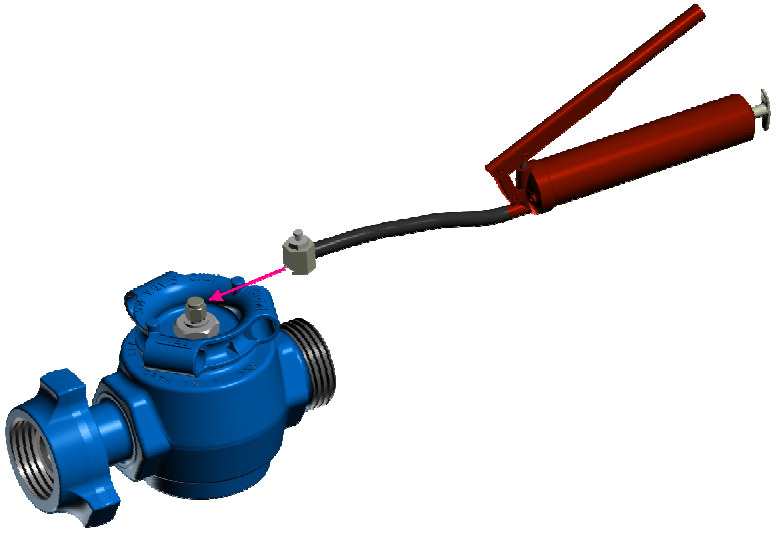
NOTE: ALWAYS WEAR PROPER PPE EQUIPMENT WHILE PERFORMING WORK ON ANY VALVES.

1. After each job, flush valve with clean water to wash away any contaminants in the valve.

2. After each job, grease with approved SPM® valve grease to displace contaminants in between valve's internal components. Engineering recommends using Val-Tex 1502 Assembly Grease whenever disassembly of the valve is required. Roll the plug to completely coat the O.D. of the plug. Grease the O.D. surfaces of the seal segment. Reassemble Valve using new seal components.



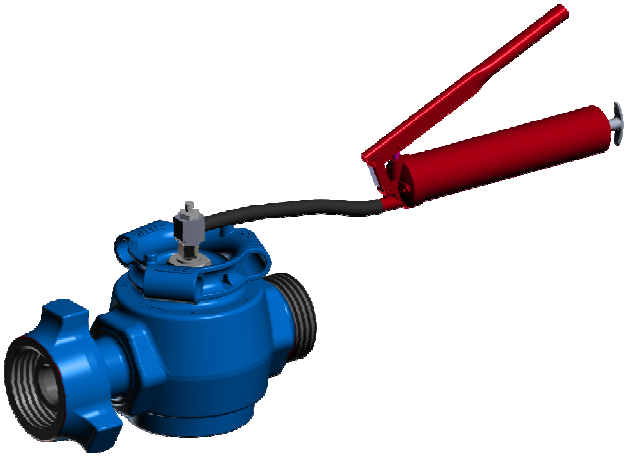
3. Slide the grease gun fitting over the valve's grease fitting.
4. Make sure the valve is in the OPEN position prior to pumping the grease.



4. Using the grease gun, pump the lever in order to push the grease into the valve. Val-Tex 972 (SPM® Part Number P32553) stick grease is recommended.

CAUTION: Do NOT mix greases between different manufacturers.

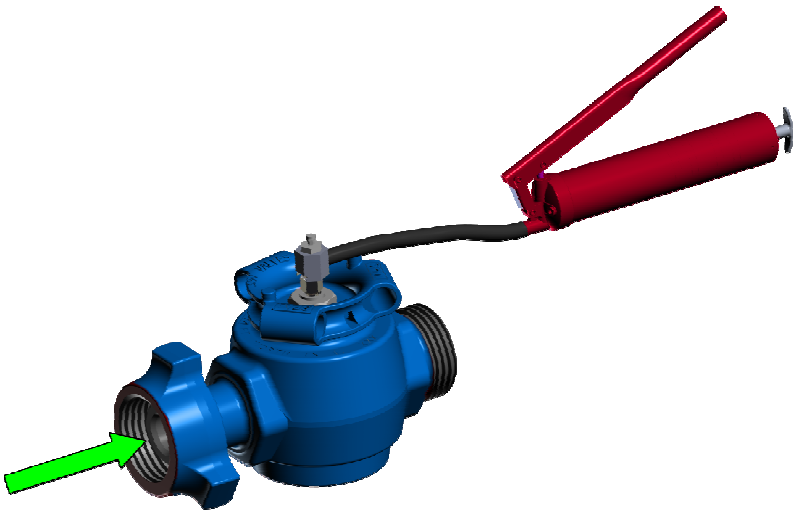
Alternatively, use a heavy duty pneumatic grease gun. SPM® part number P28682



5. Keep pumping the grease gun until you can see the grease expanding around the plug. Inject a minimum of 6,000 psi to insure proper filling of valve. (gauge reading on pneumatic grease gun)

6. Visually inspect inside the valve to ensure the grease is extracting around the sides of the plug.

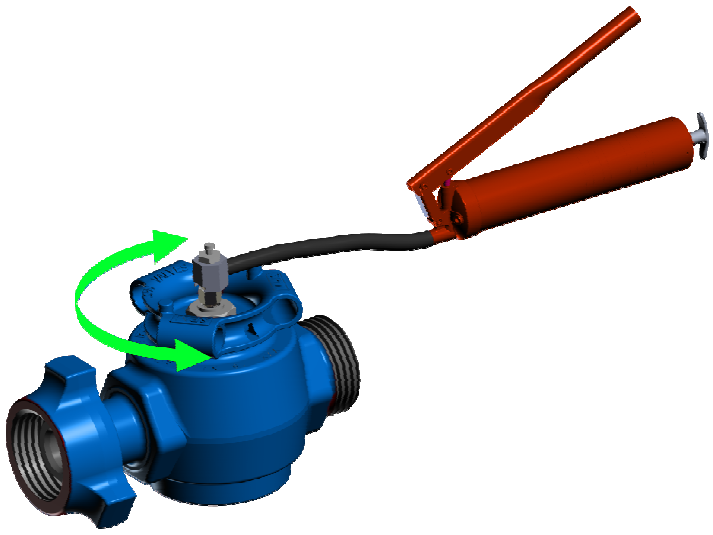
NOTE: USE EXTREME CAUTION WHEN INSPECTING THE INTERIOR PORTION OF THE VALVE FOR GREASE IS UNDER HIGH PRESSURE.



7. Close the valve and reopen it.

NOTE: AIR WILL BE HEARD "POPPING" DURING OPENING AND CLOSING AND ALLOW MORE COMPLETE FILLING OF GREASE IN THE VALVE ASSEMBLY.

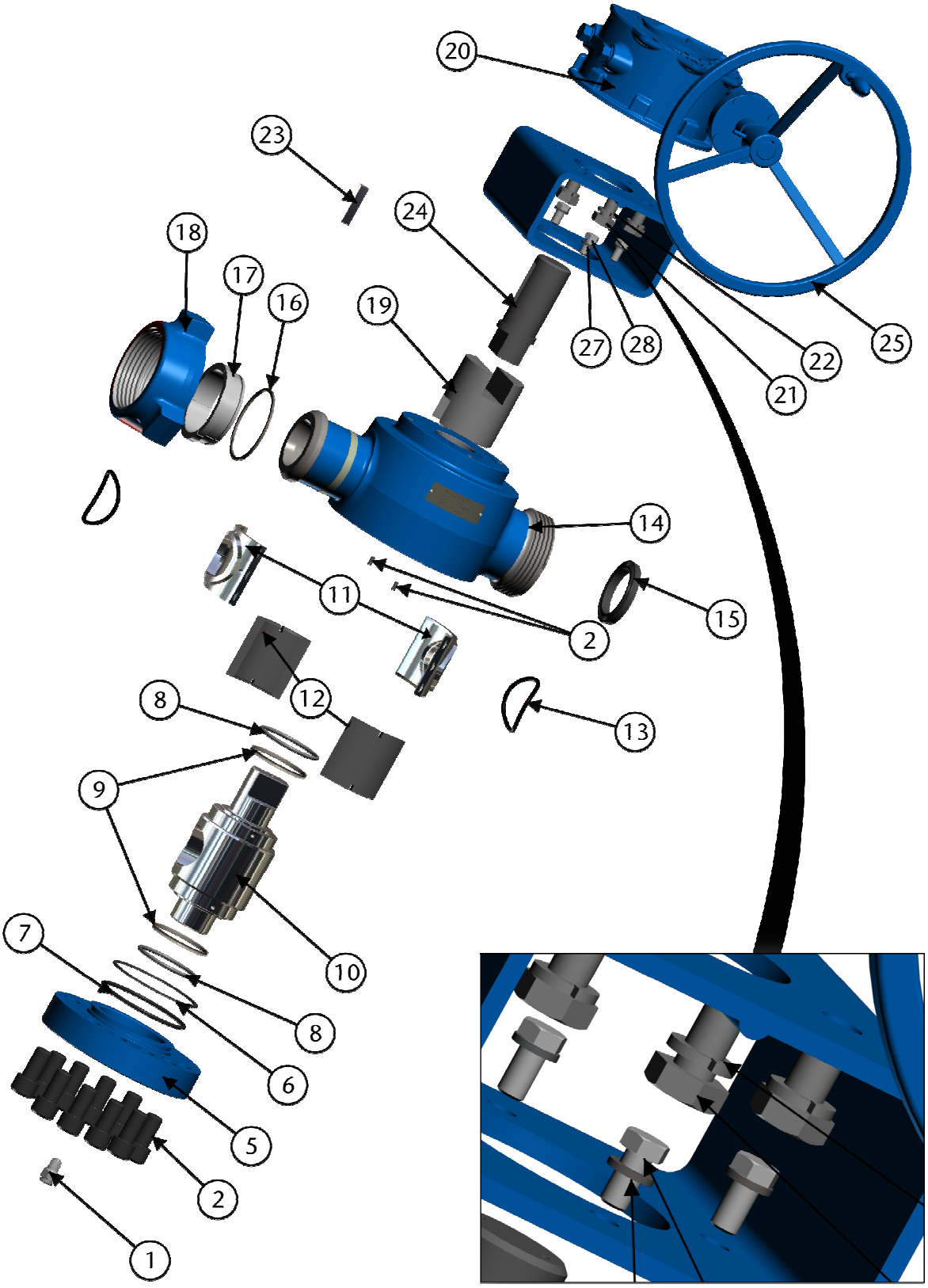
Repeat the above grease process two more times to insure complete valve filling while maintaining the 6000 psi pressure.



BOM Table:

1A14496 BOM			
BOM ID	**Qty.**	**Part Number**	**Description**
1	1	P10064	Grease Fitting
2	10	P18258	1 inch-8NC x 2.00 Socket Head Cap Screw
3	2	P11694	Grooved Pin
5	1	2P14494	End Plate
6	1	P13008	Ring Backup
7	1	P12851	Seal
8	2	P12850	Seal
9	2	3P12840	Backup Ring
10	1	1P14495	Plug
11	2	2P27074	Seal Segment
12	2	3P10013	Side Segment Casting
13	2	P103884	Segment O-ring
14	1	1P14493	Plug Valve Body
15	1	4P10258	Union Seal
16	1	P10261	Retainer Ring
17	3	3P10260	Retainer Segments
18	1	2P10257	Wing Nut
19	1	2P10875	Adapter
20	1	2P36354	Gear Operator Assembly
21	1	P11036	Mounting Adapter Bolts (Upper)
22	1	P11037	Mounting Adapter Washers (Upper)
23	1	P11040	Adapter Key
24	1	2P36662	Adapter
25	1	2P36356	Hand wheel (16 inch)
26	1	2P24223	Mounting Adapter
27	1	P12461	Mounting Adapter Bolts (Lower)
28	1	P10456	Mounting Adapter Washers (Lower)

Exploded View:



Preventative Maintenance and Disassembly:

WARNING: ENSURE ALL PRESSURE IS RELIEVED PRIOR TO PERFORMING ANY MAINTENANCE OR DISSASEMBLY!

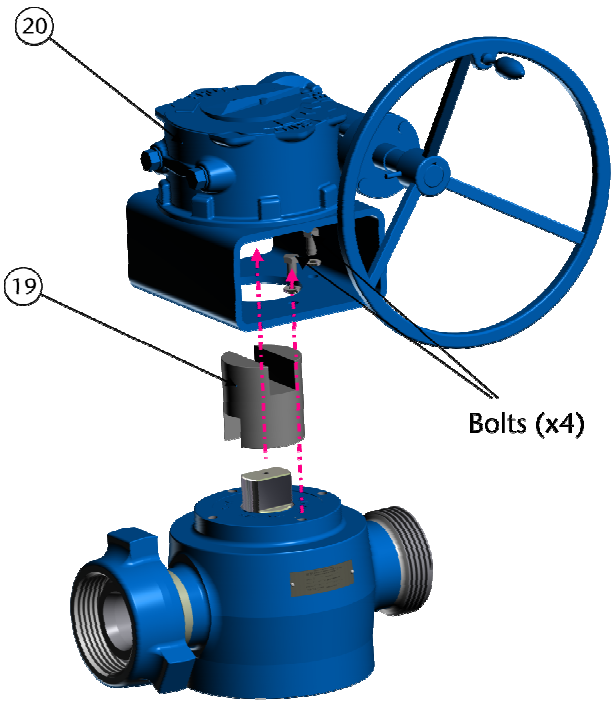
See “ALWAYS REMEMBER” section on page 16 before assembly.
The reassembly of the valve is in approximate reverse order to the disassembly process.
Lightly lubricate all surfaces prior to assembly with assembly grease SPM® part number P36791

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!

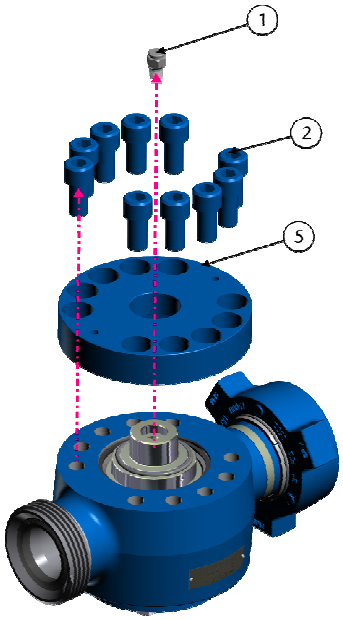
CAUTION: Make sure there is no pressure on the valve!!!

1. If valve has gear actuator assembly, remove assembly (20) by removing bolts and lifting off assembly.

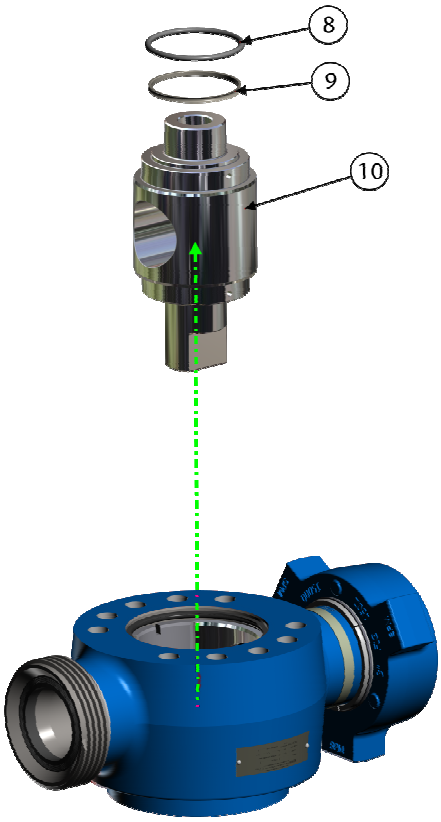
CAUTION: A hoist will be required to lift actuator assembly. Always use proper lifting techniques.



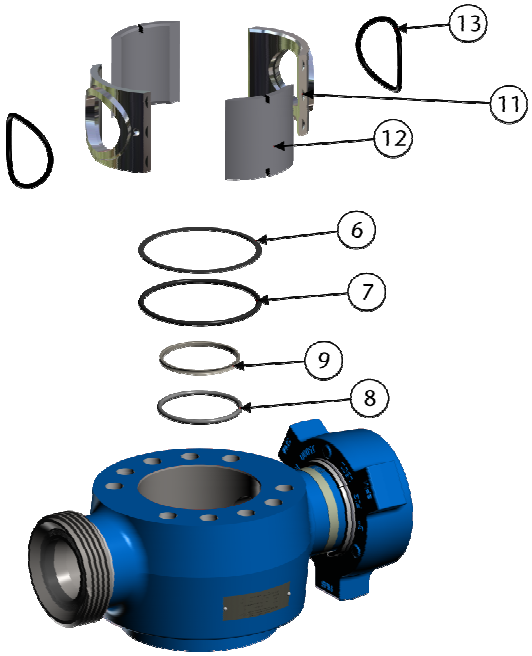
2. Remove the grease fitting (1).
3. Remove bolts (2).
4. Remove top plate (5).



5. Remove the plug (10) by lifting, while twisting it back and forth. Sometimes it is necessary to hammer slightly from the bottom to remove.

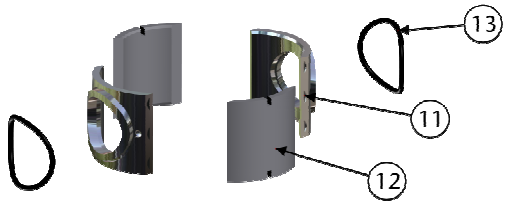


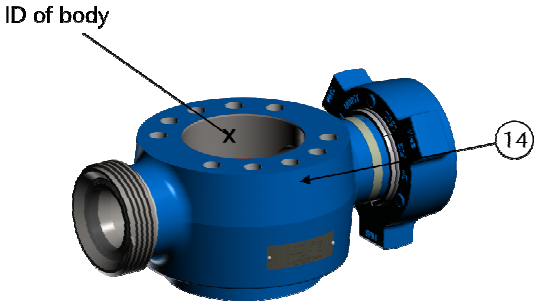
6. Remove the side segments (12) and then the seal segments (11).
7. Remove the segment seal rings (13), plug seal rings (8), and back-up rings (9), body cap seal ring (7) and back-up ring (6), if installed.
8. Clean all grease and foreign material from the valve and component parts.



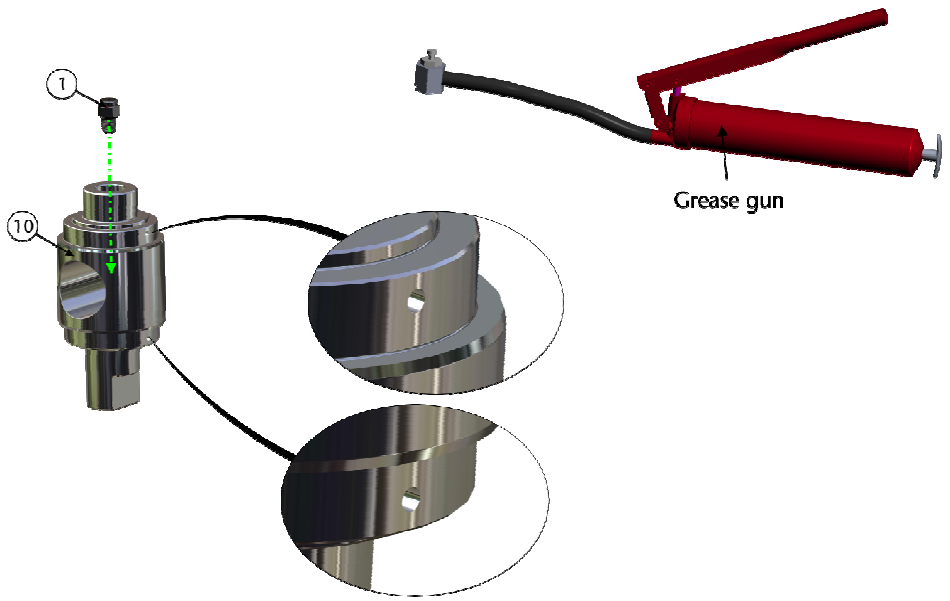
Assembly:

1. For best results and most efficient use of time, Weir Oil & Gas recommends complete kit replacement. If any old internal parts are to be reused; degrease, and inspect components for wear and corrosion.
2. If using old side segments and seal segments, thoroughly clean rust from sealing areas of seal segments that contact the plug and body. Scrape and lightly sand rust (with 400 grit sandpaper) from valve body surfaces which touch the center portion of the seal segments.
3. Using 400 grit sandpaper, clean all other seal surfaces.
4. Visually inspect all new parts and remove any foreign contaminates.
5. Apply a thin film of assembly grease on OD of seal segments (11), seals (13) and ID of body (14). If excessive grease is used, it can make the plug hard to start or dislodge the segment seal rings.
6. Install seals (13) in seal segment grooves and install seal segments and side segments (12) in valve. Seal segments should always be installed in pairs from the same manufacturer.

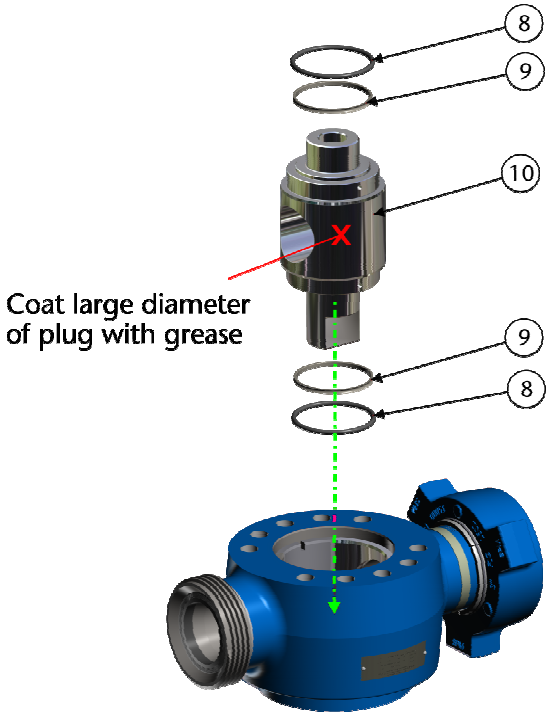


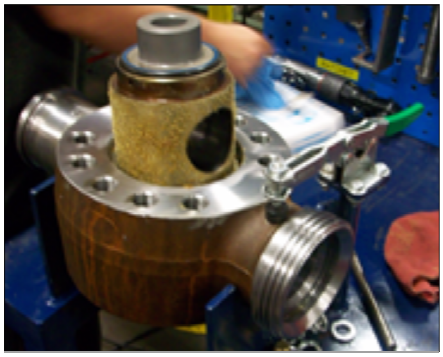


7. To test passages, install grease fitting (1) into plug (10); tighten 50-60 ft. lbs. Pump grease into plug until clean grease exits passages.



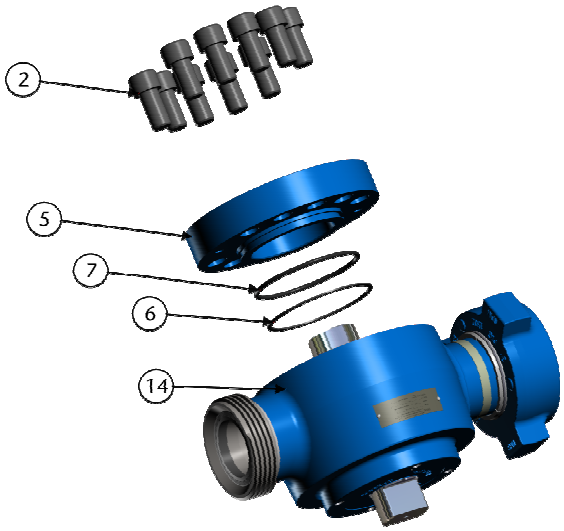
8. Coat plug (10) liberally with assembly grease and install top and bottom plug seals (8), and nylon back-up rings (9).
9. Install plug (10) into valve. You should be able to install plug by hand. If necessary, a soft face mallet may be used to lightly tap plug in.





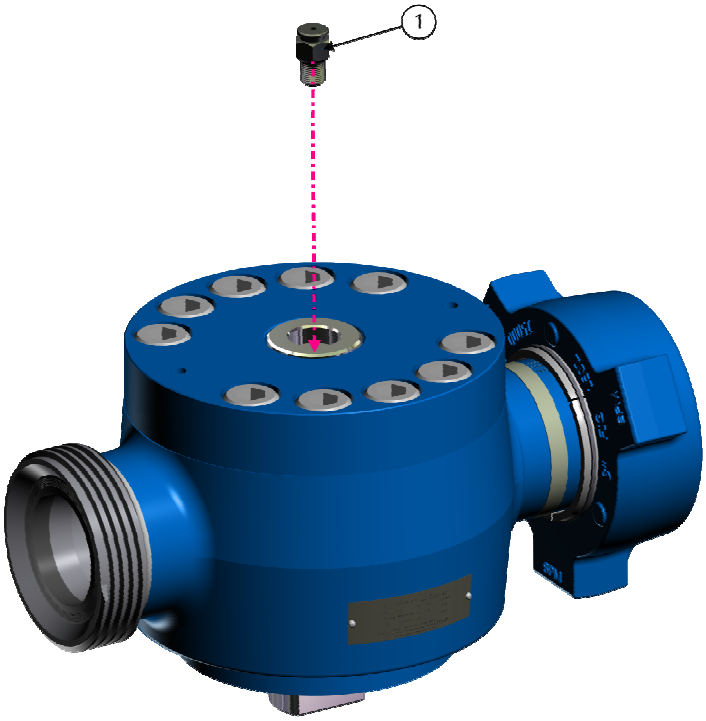
10. Install body cap seal (7) and back-up ring (6), where required, onto body cap (5) with valve assembly grease.
11. Install body cap in valve. On 3 inch valves, socket head screws are to be torqued to 475 ft. lbs. (dry), 355 ft. lbs. (lubricated).

Use only SPM® body caps in SPM® valves!



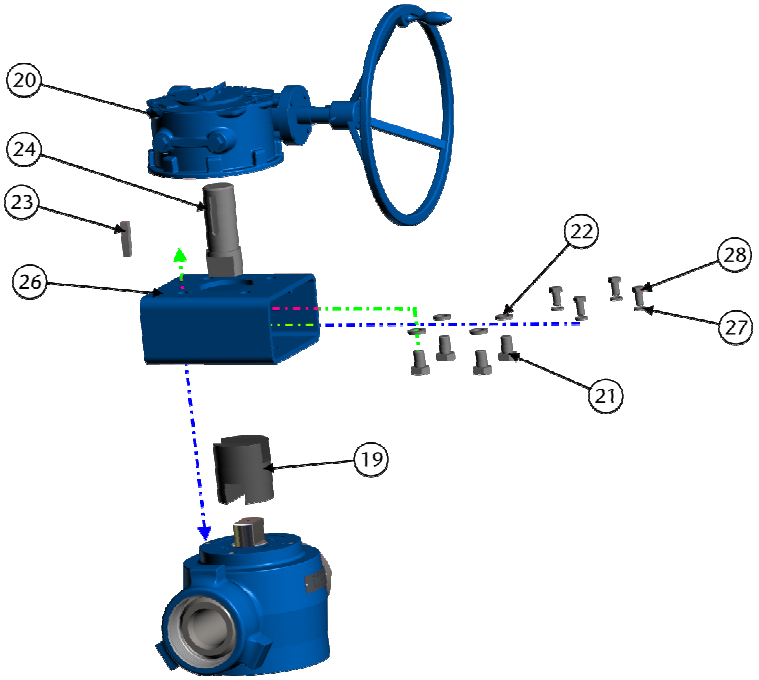
12. Replace actuator cap and felt gasket (when required). Install grease fitting (1) using Teflon tape or pipe dope, and tighten to 50-60 ft. lbs. Tighten stop nut (2) until snug (when required).

Use only SPM® actuator caps on SPM® valves!

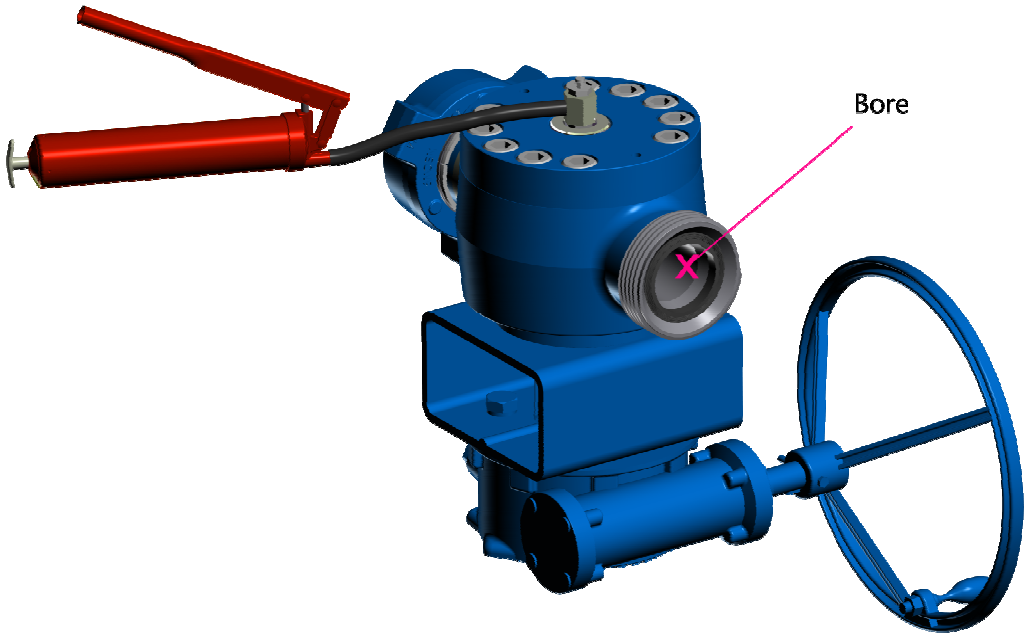


13. Install and bolt actuator assembly onto valve body (when required) Install adapter key (23) into adapter (24) and both into operator assembly (20). Install mounting adapter (26) onto operator assembly (20). Install upper washers and bolts (21, 22).

14. Install adapter (19) onto plug valve. Lower gear operator assembly (20) onto plug valve. Install lower washers and bolts (27, 28) and tighten.



15. With valve in the open position, pump valve full of grease (usually 15 to 20 pumps is sufficient). The valve is full when grease flows from bore.
16. Test valve per instructions included in every repair kit.



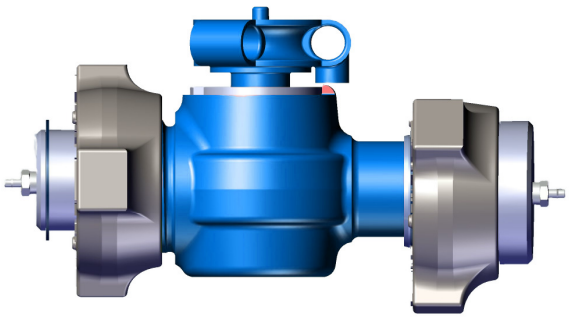
Test Procedures:

Prior to shipment, product testing procedure 4S12497 requires that each emergency valve pass a one-time vessel test at 150% it's rated working pressure; then, when conducting subsequent vessel tests on used or re-certified valves, limit the pressure to 100% of rated working pressure as required by 4S12497.

Upon final assembly or reassembly of valve, a pressure test is to be performed as follows:

CAUTION: PRIOR TO ANY PRESSURE TESTING ALL AIR MUST BE EVACUATED FROM THE VALVE AND PRESSURE APPARATUS. FAILURE TO DO SO COULD RESULT IN PERSONNEL INJURY OR DEATH AND/OR SEVERE DAMAGE TO THE VALVE.

1. Both ends of the valve are to be capped. Both caps must have pressure access ports as shown in the figure below. Valve is to be tested so as to have pressure applied to both sides of plug - hence the need for pressure access ports at both ends of the plug.



Pressure Access Ports

2. With caps in place and valve in the OPEN position and filled with liquid - (all air must be evacuated from valve at this point) - pressure valve slowly to maximum working pressure and inspect for visible signs of leakage, or failure to maintain pressure at the gauge.

3. Reduce pressure to zero and place valve in CLOSED position.

4. With the valve in CLOSED position - (again air must be evacuated from valve and system) - apply pressure slowly to one side of the valve, leaving the opposite side open, to a pressure equal to the maximum non-shock cold working pressure of the valve and maintain for a period of at least 3 minutes. Reduce pressure to zero. Open and shut the valve. Re-pressurize the valve to its maximum non-shock cold working pressure and maintain for an additional 3 minutes. Inspect the valve during this procedure for any signs of leakage. Bleed the pressure off of the valve.

5. Reverse the valve and reconnect the pressure source to the opposite side of valve and repeat step #4 making sure all air is evacuated from valve and system.

6. Consult Weir Oil & Gas engineering on any valve not performing properly during any phase of test or operation.

Troubleshooting Guide:

The following is intended as a general guide in helping resolve most problems encountered in repairing plug valves.

PROBLEM:	SOLUTION:
A.) Valve leaks through bore when closed	1. Seal segments from two different manufacturers have been installed. (ALWAYS REPLACE SEGMENTS IN PAIRS FROM THE SAME MANUFACTURER). 2. Sealing area of segments or body scored or pitted. Resurface with 400 grit sandpaper or replace segments and/ or body. 3. Plug scored or worn. Replace plug. 4. ID of body or OD of seal segments not cleaned properly. Remove parts and clean out any contaminants. If the ID of the body is not cleaned properly, this will not let the O-ring or seal segments seat properly. ID of body may be too pitted to reuse. 5. Segments seal left out, not properly installed, or damaged during assembly. Remove segments, inspect seals and reinstall or replace as necessary. 6. Wrong actuator cap installed forcing plug to tilt to one side. Ensure actuator cap is from same manufacturer as body. **(Always use SPM® actuator caps on SPM® valves)**.
B.) Valve will not fully open.	1. Worn or damaged actuator cap or not an SPM® actuator cap. Remove and install SPM® actuator cap. **(Always use SPM® actuator caps on SPM® valves).**
C) Valve leaks at body threads.	1. Body cap not tight. Re-tighten. Cap should bottom out. 2. Body cap O-ring scored or cut or no longer maintains seal. Replace O-ring. 3. Body cap damaged or worn. Replace cap. **(Always use SPM® body caps in SPM® valves).** 4. On SPM® 2 inch valves, back-ring not installed. Install back-up ring above the O-ring with concave surface touching the O-ring. 5. Seal area scored or pitted in body. Clean up with 400 grit sandpaper or replace body.
D) Seals swollen and softened or tacky.	1. Avoid solvents. Bune-N seals are not compatible with solvents such as toluene or xylene. If Buna seals are used, replace with Viton.
E) Lower edge of plug chipped.	1. Always start plug into valve upon reassembly by hand to align chambers on plug and seal segments. Hammering plug before it is properly started can chip the plug's leading edge and often score or damage the seal segments. Use only soft type hammers.

PROBLEM:	SOLUTION:
F) Valve leaks out the bottom.	1. Body cap not SPM® product. Remove and reinstall SPM® body cap. SPM® bodies and body caps are designed differently to eliminate leaking cap problems. **(Always use SPM® body caps in SPM® valves).** 2. Actuator cap not SPM® product. Remove and re-install SPM® actuator cap. (**Actuator caps from competitor valves will not work properly on SPM® valves**). 3. Plug seal O-ring and back-up ring on bottom of plug not seated properly. Remove plug and reinstall O-ring and Nylon back-up ring.
G) Valve leaks around plug top stem.	1. Top plug seal O-ring and back-up scored or not seated properly. Replace or re-install. 2. Body cap not properly tightened. Re-tighten snugly until it bottoms out. 3. Body cap damaged or worn. Replace. 4. Body cap not SPM® product. Remove and re-install SPM® body cap. SPM® bodies and body caps are designed differently to eliminate leaking cap problems. **(Always use SPM® body caps in SPM® valves).**
H) Valve binding up. Hard or impossible to open or close.	1. ID of body not clean. Clean body and components. Re-assemble. 2. Pins that hold detent spring may be interfering with actuator cap. Re-tighten pins in body. 3. Actuator cap is not SPM® product or is worn. Remove and install SPM® actuator cap and felt gasket. (Always use SPM® actuator caps on SPM® valves).

NOTE: IF PROBLEMS ARE NOT RESOLVED BY USING THE TROUBLESHOOTING GUIDE, CONTACT WEIR OIL & GAS FOR ASSISTANCE.

SECTION IV: Service and Support

Service Center Order Information:

Weir 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.global.weir

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