Technical Manual
SAFE-Weight 3:16 Plug Valve

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TABLE OF CONTENTS

WARNING: 3

PARTS 4

2” 3:16 Valve STD 4

2” 3:16 Valve H2S 6

ASSEMBLY 8

Tools and lubricants needed for assembly; Model 3:16 Valve Specific Tools 8

Assembly Procedure 9

Disassembly Procedure 21

MAINTENANCE 22

Maintenance Tips 22

Storage 22

Shelf Life 23

Greases and Lubrication Requirements 23

INSPECTION AND REPAIR 24

Inspection 24

WARNING:

The MSI SAFE-Weight 3:16 Plug Valve is used in high-pressure and high flow well service applications. High pressure equipment, if not used and maintained properly, can cause serious injury or death and damage to equipment and property. Not taking proper precautions and failing to perform routine maintenance and inspections can also contribute to loss of well control, and such loss could cause serious injury or death and damage to equipment and property.

ALL OPERATORS AND MAINTENANCE PERSONNEL SHOULD BE THOROUGHLY TRAINED IN THE SAFE OPERATION, MAINTENANCE, AND INSPECTION OF THIS EQUIPMENT.

Usage Note: The primary function of MSI plug valves is to direct/isolate the flow of pressurized fluids within a system. Plug valves in general, are not to be used to throttle the flow of fluid. In systems where this is required, appropriate style throttling valves and/or chokes should be used in conjunction with plug valves.

SECTION 1 PARTS

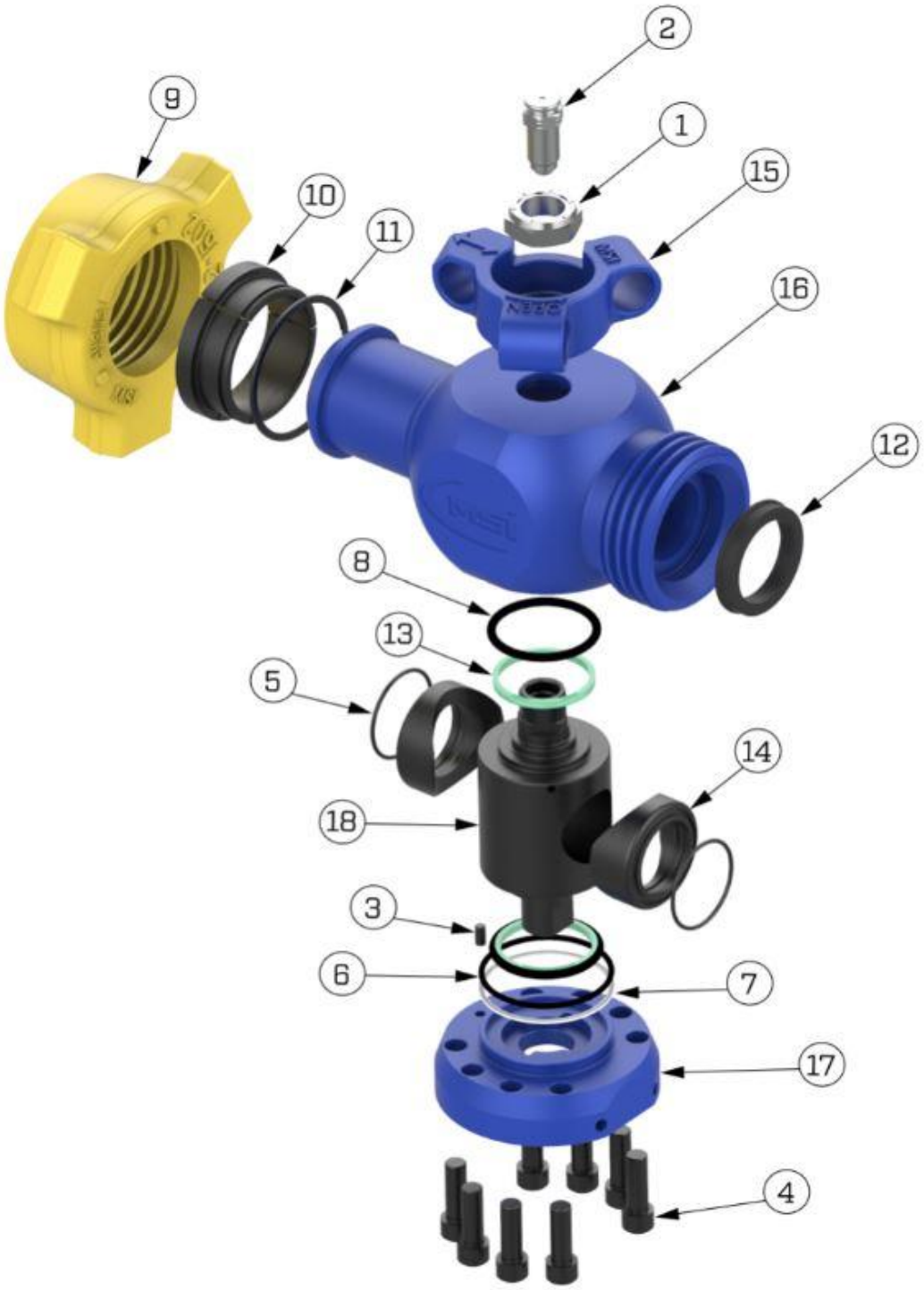


FIGURE 1: 316A-2S2U-M-3 EXPLODED VIEW

Bill of Materials for 316A-2S2U-M-3:

NO.	QTY	DESCRIPTION	PART NUMBER
1	1	HANDLE LOCK-NUT 2” COMPACT VALVE	HC0198
2	1	GREASE FITTING, ¾” SAFETAP H2S GBH	HC0226
3	1	PIN, ¼” x ½”	HC1283
4	8	SOCKET HEAD CAPSCREW, ½”-20 X 1 ½” ASTM A574	HC1035
5	2	O-RING, 2-137 BUNA 90	OC0208
6	1	O-RING, 2-233 BUNA 90	OC0209
7	1	PAR-BACK, (8-233) PTFE	OC0210
8	2	O-RING, 2-331 BUNA 90	OC0216
9	1	WINGNUT, 2” 1502 STD	UC0002
10	1	NUT RETAINER SET, 2” 1502	UC0003
11	1	SPIRAL RETAINER RING, 2” 1502	UC0004
12	1	RESILIENT SEAL, 2” 602/1002/1502 STD (BUNA)	UC0011
13	2	PLUG SEAL RING, 2.125”	VC0862
14	2	SEAT, MODEL 316, 2”	316C-2S-S-1
15	1	HANDLE, MODEL 316, 2”	316C-2-H-1
16	1	VALVE BODY-316, 2” X 2” 1502 STD 15M 10.56”	316C-2S2U-B-3
17	1	CAP, MODEL 316, 2”	316C-2S-C-1
18	1	PLUG, MODEL 316, 2”	316C-2S-P-1

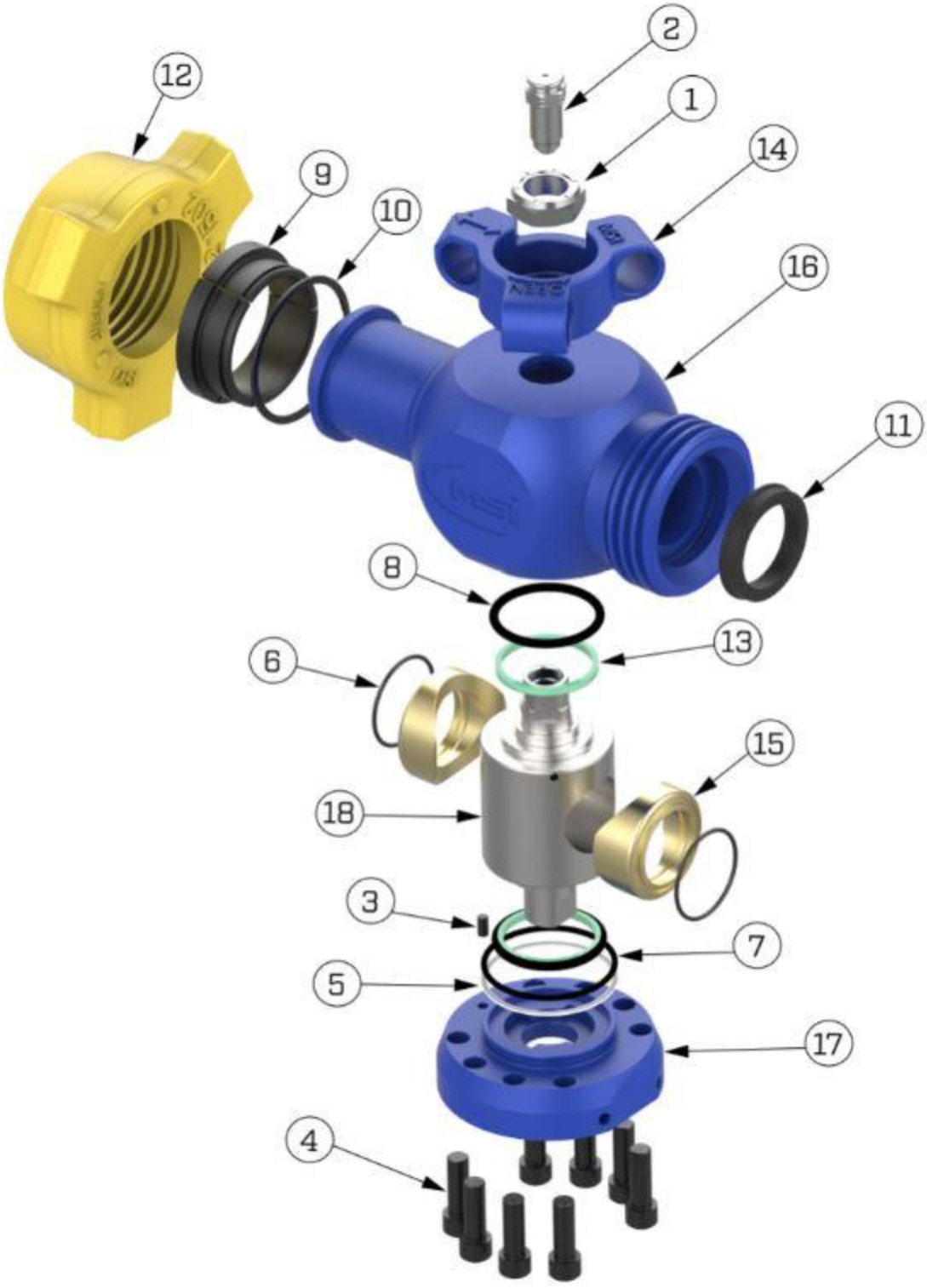


FIGURE 2: 316A-2H2U-M-1 EXPLODED VIEW

Bill of Materials for 316A-2H2U-M-1:

NO.	QTY	DESCRIPTION	PART NUMBER
1	1	HANDLE LOCK-NUT 2” COMPACT VALVE	HC0198
2	1	GREASE FITTING, ¾” SAFETAP H2S GBH	HC0226
3	1	PIN, ¼” x ½”	HC1283
4	8	SOCKET HEAD CAPSCREW, ½”-20 X 1 ½” ASTM A574	HC1035
5	1	PAR-BACK, (8-233) PTFE	OC0210
6	2	O-RING, 2-137 HNBR	OC0217
7	1	O-RING, 2-233 HNBR	OC0218
8	2	O-RING, 2-331 HNBR	OC0219
9	1	NUT RETAINER SET, 2” 1502	UC0003
10	1	SPIRAL RETAINER RING, 2” 1502	UC0004
11	1	RESILIENT SEAL, 2” 602/1002/1502 H2S (HNBR)	UC0012
12	1	WINGNUT, 2” 1502 H2S	UC0131
13	2	PLUG SEAL RING, 2.125”	VC0862
14	1	HANDLE, MODEL 316, 2”	316C-2-H-1
15	2	INSERT, MODEL 316, 2” H2S	316C-2H-S-1
16	1	VALVE BODY-316, 2” X 2” 1502 H2S 10M 10.56”	316C-2H2U-B-1
17	1	CAP, MODEL 316, 2” H2S	316C-2H-C-1
18	1	PLUG, MODEL 316, 2” H2S	316C-2H-P-1

Please contact MSI, for specific part numbers as they apply to particular valve assembly numbers. I.E. special service, product specification level (PSL2 or PSL3).

SECTION 2 ASSEMBLY

Tools and lubricants needed for assembly; Model 3:16 Valve Specific Tools

Use only MSI Tools when working on 3:16 Valves:

MSI Part Number	Description
VA-316-TK0001	MSI Tool Kit
VC-316-0015	2” 3:16 INSERT INSTALLATION TOOL
VC-316-0016	2” 3:16 PLUG INSTALLATION TOOL
VC-316-0017	CIRCLE NUT TOOL

VC-316-0015:

VC-316-0016:

Additional Tools Required:

- 12” Crescent Wrench
- Torque Wrench with 120 ft*lb minimum capacity
- ⅜” Allen Wrench
- ⅜” Allen Socket
- ⅞” Socket
- 1-⅝” Socket

Assembly Procedure

The assembly procedure is identical for both STD & H2S assemblies. Although the part numbers of some of the items differ between the two models the generic names of the respective parts are used interchangeably within the nomenclature of the assembly procedure.

NOTE: It is important that the workstation being used to assemble the valve is clean and free of anything that could possibly contaminate the grease such as metal shavings, dirt, rust, old paint, etc. Do not sand or deburr near the workstation.

1. Before assembly, inspect all metal parts for defects such as metal burrs, or sharp edges that could cut seals or scratch sealing surfaces. Count all components and compare them to the BOM. Inspect all O-Ring and Par-Back assemblies for damage.

2.

3. Install the Insert O-Ring into the insert. **DO NOT USE ANY GREASE OR LUBRICANT ON THE O-RING DURING THIS STEP. THE O-RING AND THE GROOVED SURFACE OF THE INSERT MUST BE COMPLETELY CLEAN AND DRY.**

4. Slip the insert into the valve body and repeat step 3 for the other side.

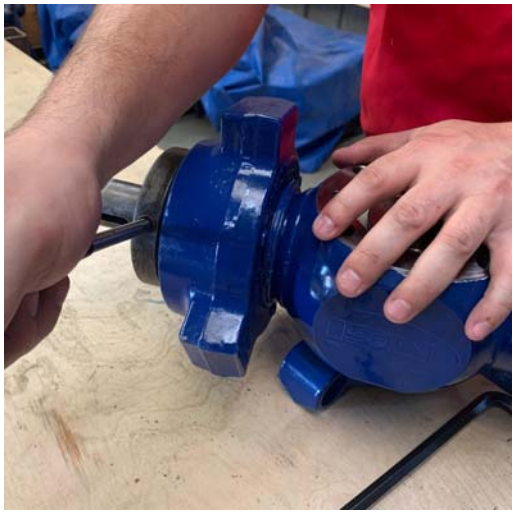
5. Take the Insert Installation Tool (VC-316-0015) and back out the nut on the end of the tool until the collet fingers on the opposite side collapse. Then slide it into the valve bore with the collet side facing toward the insert. When the collet side is in line with the internal grooves of the insert, turn the nut on the end of the tool until the collet fingers extend outward and grasp the insert. You can be sure you have securely grasped the insert when the pin near the nut on the end of the tool has hit the end of its slot. Hand tighten the large round nut against the valve body. Perform this step for both sides of the valve:

6.

7. With both Insert Installation Tools installed, now take the Plug Installation Tool (VC-316-0016) and insert it into the valve pocket with the plastic halves facing the inserts as shown:
   Push firmly on the top knob of the plug installation tool. This will orient the inserts correctly in their respective pockets.

8. Tighten the large circle nut on both sides using the circle nut tool (VC-316-0017). **You must tighten the circle nut until it comes to a dead stop. The plug will not go into the pocket if this step is not performed correctly.**

Tighten the circle nut against the body:



9. With the circle nuts completely tight, take a hammer and firmly tap on the top knob of the Plug Installation Tool (VC-316-0016). This step will ensure the inserts are aligned properly. Alternate between Steps 6 and 7 until the circle nuts come to a dead stop.

10. After a few taps, the inserts should be aligned and you can now remove the Plug Installation Tool. Take the plug and do a test fit by inserting the plug into the valve bore. **AGAIN, DO NOT ATTEMPT TO HAMMER THE PLUG IN. IF THE PLUG DOES NOT SLIDE IN EASILY THEN THE SEATS ARE NOT PROPERLY BOTTOMED OUT AND/OR ALIGNED.**

11. When the plug partially slides in you know the seats are properly aligned and a thin layer of grease can now be applied to the seats sealing surface.

12. Assemble the Plug Seals by snapping the Plug O-Ring over the Plug Seal Ring. Grease the Plug Seals lightly and install the seals on the top and bottom of the plug. With both seals installed on the plug insert the plug into the valve with the stop tabs facing up:

13. Verify the dowel pin is installed into the cap.

14. Install the Par-Back Ring onto the cap. Be careful not to scratch the surfaces of the groove if using a tool as an installation aid.

15. Install the Cap O-Ring into the Cap O-Ring groove on top of the par-bak and lightly coat the Cap O-Ring with valve grease.

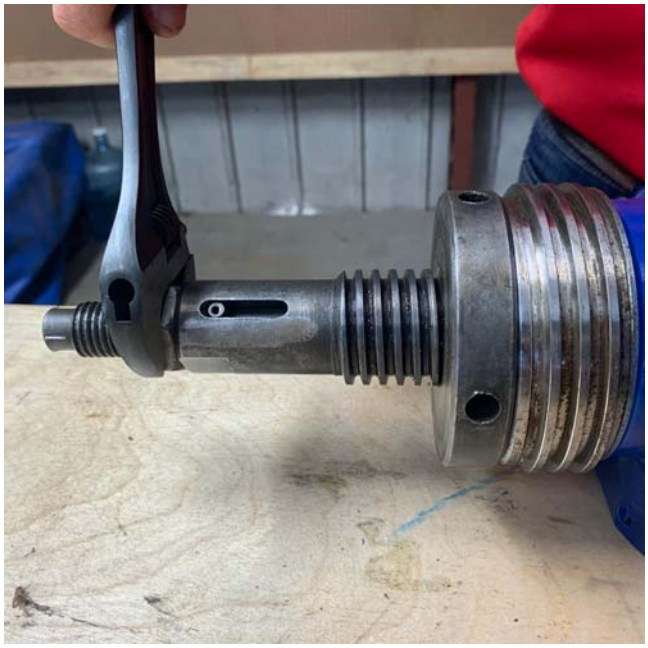
16. Turn the plug to a 45 degree angle relative to the valve bore.

17. Install the cap by positioning it over the valve with the dowel pin in the cap lined up with the corresponding dowel pin hole on the valve body. **DO NOT ATTEMPT** to push the cap down yet, bolts will be used to seat the cap in later steps.

18. Take 2 bolts, apply anti-seize to the bolts and screw them into two bolt holes opposite each other. Use a 3/8” Allen wrench to carefully seat the cap onto the valve body. Tighten the bolts by turning them half a turn back and forth, alternating between the two bolts until the cap is bottomed out evenly. Once the cap is seated apply anti-seize to the rest of the bolts and install them. Do not torque the bolts yet.

19. Turn the valve over and apply Anti-Seize to the plug threads. Place the handle onto the shaft of the plug by aligning the semi-triangular profile of the plug shaft to the profile on the handle. One corner of this profile is narrower than the other two so the handle cannot be put on incorrectly. Turn the handle so that the arrow on the handle is in line with the plug bore, this will ensure the valve is in the fully open position.

20. Loosen the nut at the end of the tool and push the threaded shaft forward. The seat fingers will collapse and the tool can be removed. It is not necessary to loosen the circle nut that is pushing against the valve body. Remove both installation tools.



21. Clamp the valve to a vise or, if the 1502 wing nut is already installed, thread the valve to a 2” 1502 end connection. If the wing nut is not installed, it can be installed now. Take the grease fitting and apply anti-seize to the threads. Install the grease fitting and the handle lock nut onto the plug. (The grease fitting can be installed before the handle lock nut or visa versa.)

22. Install the resilient seal into the valve body:

23. With the valve tightly secured, torque the bolts and the grease fitting to **125 ft*lbs**. The lock nut just needs to be snugged up past hand tight.

24. The valve may be pressure tested at this time. **Do not exceed the rated working pressure of the valve.**

25. With the valve in the open position grease to a minimum of 3,000 psi and max of 6,000 psi. Close the valve to relieve pressure and then reopen.

26. Remove excess grease from the valve bore. Store the valve in the open position.

Disassembly Procedure

1. The SafeTap™ grease fitting allows for the safe relief of trapped pressure within a valve. To do this, slowly turn the grease fitting ¼" CCW. Actuate the valve to ensure all pressure has been relieved.
2. Remove the SafeTap™ grease fitting and handle lock-nut.
3. Remove the handle.
4. Take out all 8 bolts and remove the cap**.** To get the cap out you may need to gently tap on the sides of the cap alternating back and forth on opposite sides. The plug shaft can also be used to push the cap off but caution must be taken to avoid damaging the threads on the plug shaft.
5. Remove the plug along with upper and lower Plug Seal Rings and O-Ring**s**. When removing the plug the Plug Seal located at the bottom of the valve pocket may be stuck to the valve body and may not come out with the plug. If this happens use a pick or similar tool to remove the seal from the bottom of the valve pocket.
6. Remove the seats. If the seats will not slide out easily the Seat Installation Tool may be used to remove them **(VC-316-0015)**. Use the same steps as outlined in the assembly procedure (step 4) to operate the tool. However, after the fingers are grasping the seats, instead of tightening the circle nut, back off the circle nut, then tap on the threaded end of the tool and the seat will come out.
7. Remove the Seat O-Rings**,** Body Cap O-Rings, Par-Back, and Resilient Seal.
8. Thoroughly clean all of the old lubricant, grease, and debris from the parts. Inspect all parts for damage and replace as needed. See the section titled Inspection.

SECTION 3 MAINTENANCE

Maintenance Tips

Valves should be greased as part of a regular maintenance program. Regular greasing will increase the service life of the internal valve parts. Routine disassembly and cleaning as part of a maintenance program can prevent unnecessary damage to the valve body. Dixie Iron Works, Ltd. recommends that valves be greased after every job or every 5 actuations, whichever one comes first.

Valves should be greased according to the severity of use. Each operating company should establish guidelines for a greasing and/or disassembly program. These guidelines should be based on the operating conditions. Special consideration should be given for conditions in which the following would be involved:

- ➔ Abrasives in the fluid stream
- ➔ High flow rates
- ➔ Caustic or Acidic fluid streams
- ➔ High Temperature
- ➔ Fluid Streams that would act as solvents such as condensate
- ➔ High number of valve actuations

Valves should not be disassembled for repair while part of an operating arrangement such as a manifold. This should not be attempted even though the valve may be isolated from the fluid stream by other valves.

If the valve is NOT pressurized, MSI recommends greasing the valve to a pressure of 3,000 minimum 6,000psi maximum. The valve can safely be greased up to the rated working pressure if the valve. If the valve is pressurized, the greasing pressure needs to be greater than the internal pressure of the valve, but always less than the rated working pressure of the valve. In all cases the maximum greasing pressure will be the difference between the internal pressure and the rated working pressure of the valve. The greasing pump must have pressure measuring capability.

Storage

Disassemble the valve completely. See section Disassembly Procedure for detailed instructions on valve disassembly. Remove old grease and debris from the valve pocket with a solvent and inspect for wear or damage.

- Drain after testing. All equipment should be drained and lubricated after testing and prior to storage or shipment.
- All components and assemblies should be cleaned of dirt, rust, and other contaminants.
- Rust Prevention: Equipment should have exposed metallic surfaces protected with a rust inhibitor which will not become fluid and run at a temperature less than 125°F (52°C).
- Sealing surface protection: Exposed sealing surfaces should be protected from mechanical damage.

Shelf Life

The following is recommended for maximum equipment shelf life**:**

Time in Storage	Manufacturers Recommendation
0-3 months	Nothing required
3-6 months	Re-grease and operate. Operate by rotating the plug. Check to see that rotation is smooth without grinding, scraping or binding.
6+ months	Disassemble, rebuild and retest the valve. Replace all internal seals

Greases and Lubrication Requirements

Use only MSI recommended greases. Greases intended for gate valves or other applications may result in failure to achieve a good test and may actually damage the new parts.

MSI Part Number	Description	Manufacturer
VC0012	#972 General Service (size K)	Val-Tex
VC0426	#972 General Service (size 5.5)	Val-Tex
VC0669	#972 General Service (size V)	Val-Tex
VC0527	#750 Low Temperature (size J)	Val-Tex
VC0402	#750 Low Temperature (size K)	Val-Tex
VC0357	#700 CO2 / Hi-Temp / Condensate (size J)	Val-Tex
GREASE002	1502-S-7 Low Pressure Testing (7 lb. can)	Val-Tex
	#80HM Suitable for Acid Service	Val-Tex

SECTION 4 INSPECTION AND REPAIR

Inspection

When repairing a MSI plug valve, the following basic guidelines can help you ensure a good hydrostatic test of the reassembled valve.

Disassemble the valve completely. See the section titled Disassembly Procedure for detailed instructions on valve disassembly. Remove old grease and debris from the valve pocket with an oil based solvent and inspect for wear or damage. Ensure inspection is performed in a clean well illuminated area. The following are areas that should be inspected:

- Sealing Surfaces:
  - Body Cap: O-Ring Groove and Seal Bore.
  - Valve Body: pocket walls and seat sealing area.
  - Valve Plug: Plug O-Ring Seal area and plug outside diameter, pay special attention to the seat sealing area on the plug OD.
  - Insert Seats: O-Ring groove and inside and outside diameters. Pay special attention to the seat plug seal area.

During the inspection you should check for scratches, dings, pitting or other surface defects. Pay particular attention to surfaces which may fail to seal against O-Ring sealing surfaces or even damage the O-Ring during installation. Also look for evidence of washout. Closely inspect the metal to metal sealing surfaces on the plug OD and Insert sealing surface for any scratches or wear. Any scratches that can be felt by a fingernail can cause leakage.

Because the bore is larger than when new and because the eroded area tends to be uneven, worn parts create a larger internal upset in the valve which increases turbulence. This increased turbulence means that the rate of wear will increase exponentially so special consideration should be given to the application of valves with worn parts to minimize the possibility of failure during the course of the job. Continued use of parts with eroded flow bores may reduce the life of the valve body. MSI recommends that valves with working but washed parts within these guidelines be used in locations of the rig-up that see less abrasive flow.

For minimum wall thickness data contact an MSI representative. Any visible cracks or excessive corrosion are not acceptable and the affected parts should be replaced.

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BUREAU
VERITAS

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