TE VALVE TECHNICAL MANUAL

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Revision A

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1.0 FEATURES

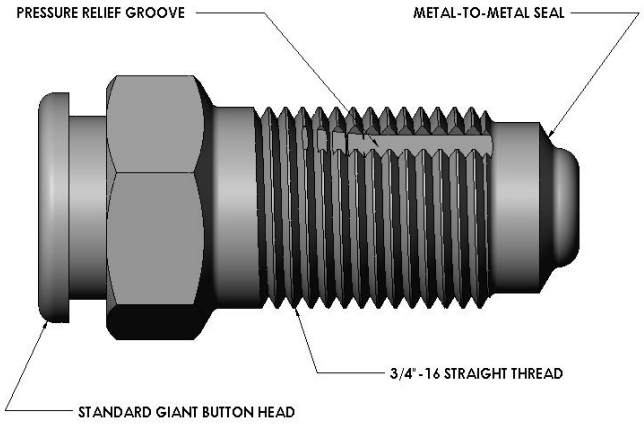
The MSI TE Plug Valve is a lubricated, straight pocket, quarter-turn plug valve for rapid full open or close operation. The valve cavity is straight to ensure low-torque operation and uniform sealing of the components at the full range of pressures. The MSI TE Plug Valve and replacement parts are engineered to provide low operating torque and resistance to the toughest abrasive and corrosive conditions.

MSI offers more end connection choices than any other plug valve manufacturer in the industry. Connection types such as Hammer Unions, Line Pipe, API Flanged, Clamp Hub, and our own patented metal-to-metal WingSeal (WS20 and WS30) are just a few of the available choices. All sizes of MSI valves can be outfitted with your choice of end connections or combinations to suit your specific application. Custom end-to-end lengths are also available on some valves.

- Compact design
- Lightweight
- Top Entry
- Longer lasting internals
- Ease of repair
- Interchangeability
- SafeTap™ grease fitting
- GREASEAL™ plug for full 360° greasing
- Widest range of end connections in the industry
    - Hammer union (all sizes of 602, 1002, 1502, 2002, 2202)
    - API Flange (all sizes and working pressures)
    - WingSeal 20 (2.00”ID) & 30 (3.00”ID) *patented metal-to-metal
    - Clamp Hub (all sizes such as B20, GR14, GR31, plus API clamp hubs)
    - Threaded Ends (all sizes of Line Pipe, EU, NU, and premium threads)

1.1 SAFETAP™ GREASE FITTING

SafeTap™ grease fittings are designed to provide maximum safe operation in the field. These fittings are standard in all TE valves. Key features include:

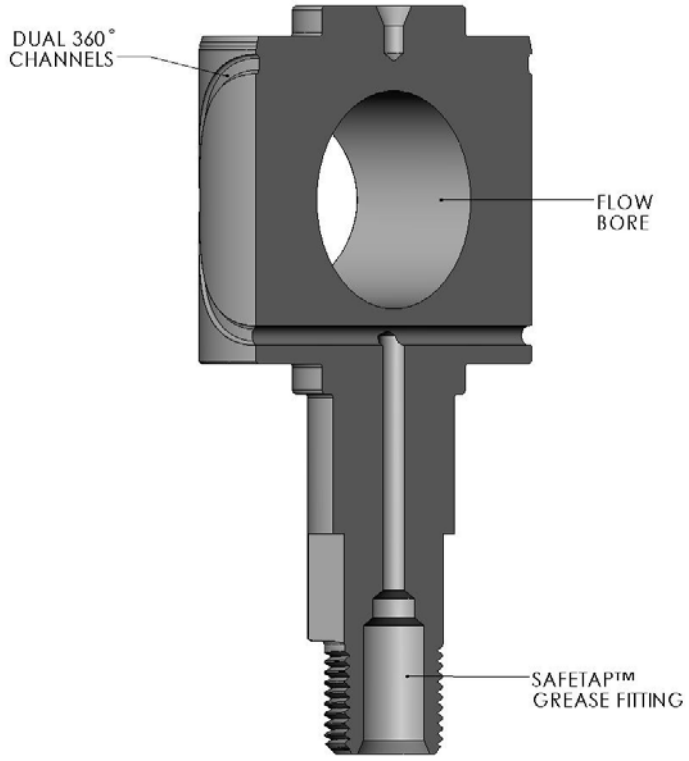


- The unique metal-to-metal seal eliminates wetted threads and pipe taps. Since the threads do not perform a sealing function they do not require Teflon tape or other sealing aids.
- The heavier cross section stands up better to impacts.
- Each fitting has a slot machined through the threads which serves as a pressure relief path in the event of a leak.
- The metal-to-metal seal and the pressure relief slot of the SafeTap™ grease fitting also allow a means to safely bleed any residual internal pressure.

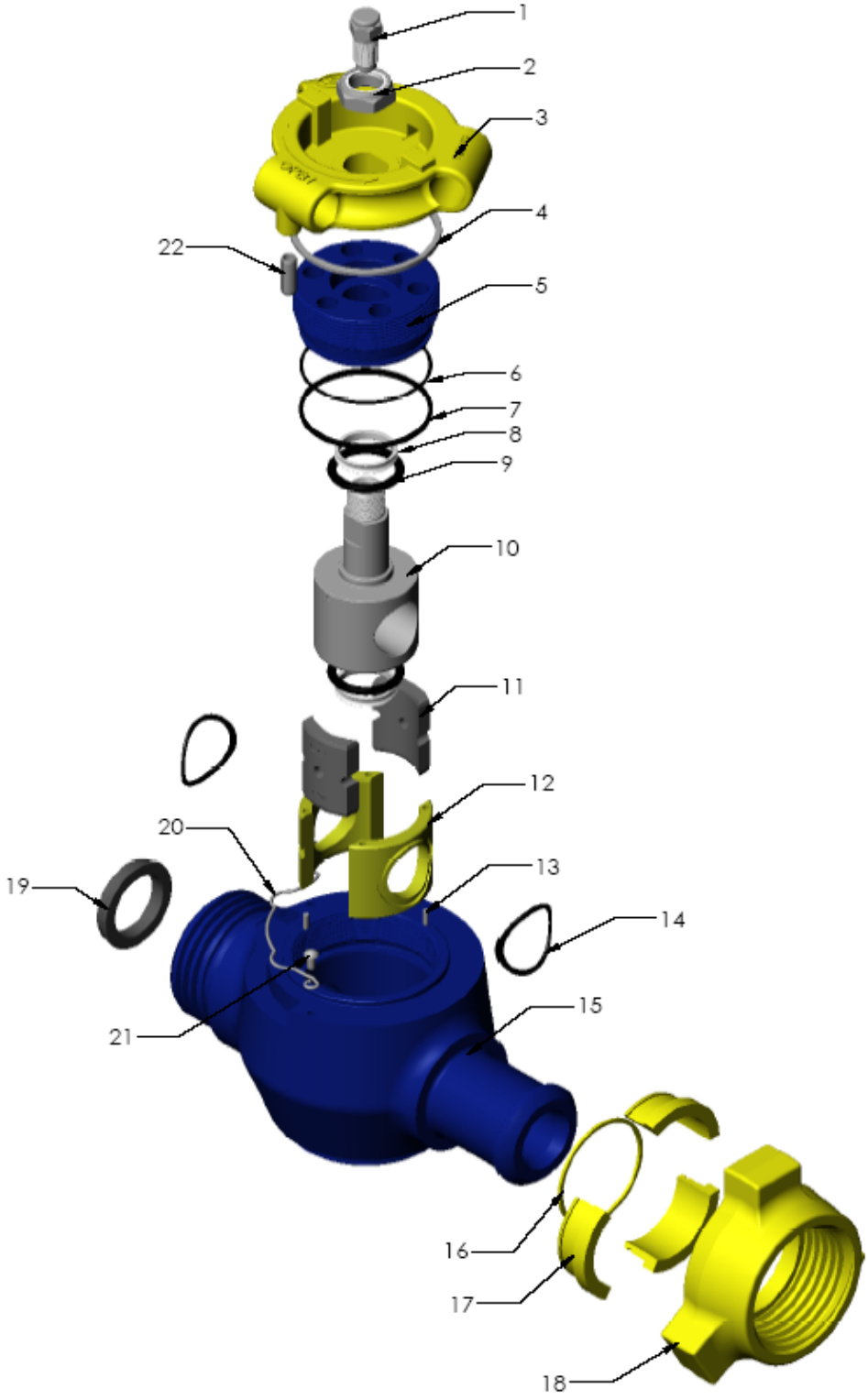
1.2 GREASEAL™ PLUG

The patented GreaSeal™ plug is designed to provide maximum lubrication in the harshest field conditions. Key features include:

- The only plug that allows greasing in the opened or closed position while in service.
- Dual 360° grease channels.
- Forces grease into 360° of the seal area when closed.
- Allows for complete distribution of lubricant immediately prior to opening a valve when exposure to high temperatures and well fluids may have compromised the existing grease.
- Greasing in the closed position can stop or significantly slow leaks in valves with worn or damaged parts.
- Grease fitting installs from the bottom of the plug for added protection from impacts.



2.0 EXPLODED VIEW



2.1 PARTS LIST

NO.	QTY REQ'D	DESCRIPTION
1	1	SAFETAP™ GREASE FITTING
2	1	HANDLE LOCKNUT
3	1	HANDLE ADAPTER
4	1	HANDLE GASKET
5	1	BODY CAP
6	1	PARBAK RING
7	1	O-RING
8	2	PLUG SEAL RING
9	2	O-RING
10	1	PLUG
11	2	SIDE SEGMENT
12	1	SEGMENT SET
13	2	GROOVED PIN
14	2	O-RING
15	1	VALVE BODY
16	1	SPIRAL RETAINER RING
17	1	NUT RETAINER SET
18	1	WING NUT
19	1	RESILIENT SEAL
20	1	HANDLE SPRING
21	2	DRIVE PIN
22	1	ROLL PIN

3.0 ASSEMBLY PROCEDURE (PICTORIAL SEQUENCE)

NOTE: It is imperative that the workstation being used to assemble the valve be 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.

- Check surfaces around the valve bore inside the valve pocket for sharp edges and pitting that could cause cutting of the segment o-rings.

- Screw the clean **body cap (5)** all the way into the valve body to make sure the threads are not damaged.

- After inspection, remove the **body cap (5)**, grease the sealing groove and install the body cap **parbak ring (6)** on the side of the groove away from the pressure and the curved face towards the pressure.

NOTE: The 1" valve does not use a parbak ring (6).

- Install the **o-ring (7)** into the groove so that it sits on the curved side of the **parbak o-ring (6)** towards the pressure.

- Check the **pins (13)** in the bottom of the valve body pocket to make sure they are not bent or broken.

- Lubricate the valve pocket with multipurpose grease.

- Check the surface finish of the **segment set (12)** making sure they do not have any scratches, dings, nicks, or sharp edges that could affect the sealing area. See **6.2 SANDING TIPS** for repair.

- Inspect the **o-rings (14)** for any possible non-conformity.

- Coat the **o-rings (14)** with stick grease and install onto the **segment set (12)**.

- Place the set into the valve body, making sure to engage the **dowel pins (13)**.

- Place the **side segments (11)** into the valve body between the **segment set (12)**.

- Make sure the tops of all 4 pieces are at the same height.

- Check the **plug (10)** outside diameter for surface defects such as nicks, dings, scratches, etc. that could possibly affect the sealing area. See **6.2 SANDING TIPS** for repair.

- Install the upper and lower plug **seal rings (8)** and **o-rings (9)** onto the ends of the **plug (10)**.

- Apply grease to both seals.

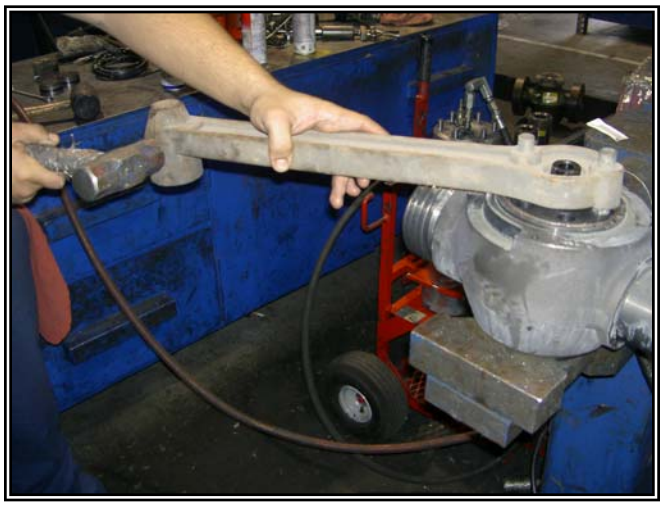
- Apply a thin film of grease to the entire O.D. of the **plug (10)**.

- Push the assembled plug with seals into the valve body, making sure it is properly aligned with the **segment set (12)** and **side segments (11)** until it is seated all the way down. Make sure the valve is in the open position.

- Apply thread compound (Never-Seez) to the threads on the **valve body (15)** and **body cap (5)**, along with a light coat on the body cap sealing surfaces.

- Tighten the **body cap (5)** until snug.

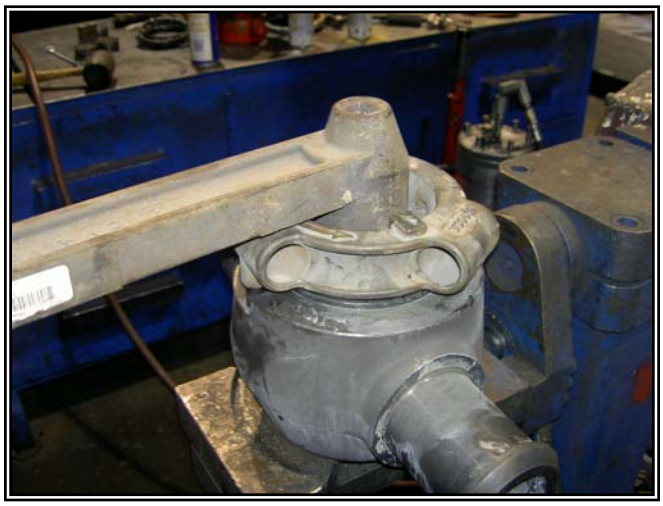
- Hit wrench with hammer a couple times to make sure it is firmly seated.



- Add **handle gasket (4)** to **handle adapter (3)** and lubricate gasket.

- Install the **handle adapter (3)** to the end of the **plug (10)**.

- Secure the **handle adapter (3)** with **handle lock-nut (2)**.

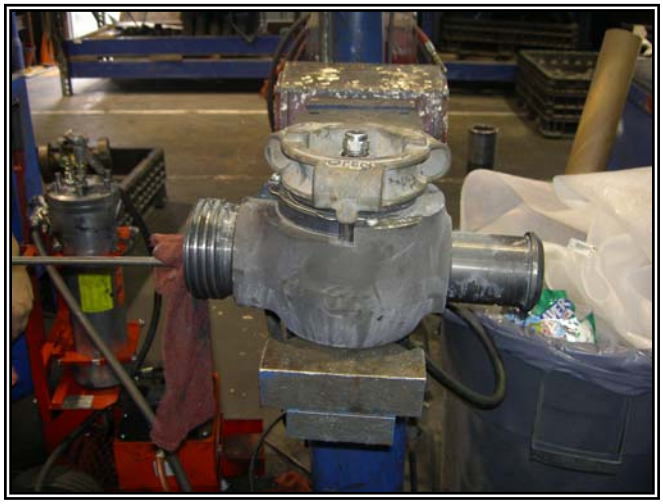


- Apply thread compound (Never-Seez) to the threads on the SafeTap™ **grease fitting (1)**.

NOTE: Do not use Teflon tape on the grease fitting.

- Install SafeTap™ **grease fitting (1)** and torque to 135 ft-lbs.

- Remove excess grease from valve bore.



- Ensure that the plug, segment set, and valve bore are properly aligned.

- Place **spiral retainer ring (16)** on male end connection (if required).

- Next place **wing nut (18)** on male end connection (if required).

- Add **nut retainer set (17)** to **wing nut (18)** (if required).

- Secure retainers with spiral ring (if required).

- Grease the counter bore of the valve body female end and press the **resilient seal (19)** lipend towards valve in until the lip on the OD of the seal snaps into the groove in the back of the counter bore.

3.1 ASSEMBLY PROCEDURE (TEXT ONLY)

NOTE: It is imperative that the workstation being used to assemble the valve be 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. Check surfaces around the valve bore inside the valve pocket for sharp edges and pitting that could cause cutting of the segment o-rings.

2. Screw the clean **body cap (5)** all the way into the valve body to make sure the threads are not damaged.

3. After inspection, remove the **body cap (5)** and install the body cap **parbak ring (6)** on the side of the groove away from the pressure and the curved face towards the pressure. **NOTE: The 1" valve does not use a parbak ring (6).**

4. Install the **o-ring (7)** into the groove, so that it sits on the curved side of the parbak **o-ring (6)** towards the pressure.

5. Check the **pins (13)** in the bottom of the valve body pocket to make sure they are not bent or broken.

6. Lubricate the valve pocket.

7. Check the surface finish of the **segment set (12)** making sure they do not have any scratches, dings, nicks, or sharp edges that could affect the sealing area. See **6.2 SANDING TIPS** for repair.

8. Inspect the **o-rings (14)** for any possible non-conformity.

9. Coat the **o-rings (14)** with grease and install onto the **segment set (12)**.

10. Place the set into the valve body, making sure to engage the **dowel pins (13)**.

11. Place the **side segments (11)** into the valve body between the **segment set (12)**.

12. Make sure the tops of all 4 pieces are at the same height.

13. Check the **plug (10)** outside diameter for surface defects such as nicks, dings, scratches, etc. that could possibly affect the sealing area. See **6.2 SANDING TIPS** for repair.

14. Install the upper and lower plug **seal rings (8)** and **o-rings (9)** onto the ends of the **plug (10)**.

15. Apply grease to both seals.

16. Apply a thin film of grease to the entire O.D. of the **plug (10)**.

17. Push the assembled plug with seals into the valve body, making sure it is properly aligned with the **segment set (12)** and **side segments (11)** until it is seated all the way down. Make sure the valve is in the open position.

18. Apply thread compound (Never-Seez) to the threads on the **valve body (15)** and **body cap (5)**, along with a light coat on the body cap sealing surfaces.

19. Tighten the **body cap (5)** until snug.

20. Hit wrench with hammer a couple times to make sure it is firmly seated.

21. Add **handle gasket (4)** to **handle adapter (3)** and lubricate gasket.

22. Install the **handle adapter (3)** to the end of the **plug (10)**.

23. Secure the **handle adapter (3)** with **handle lock-nut (2)**.

24. Apply thread compound (Never-Seez) to the threads on the SafeTap™ **grease fitting (1)**. **NOTE: Do not use Teflon tape on the grease fitting.**

25. Install SafeTap™ **grease fitting (1)** and torque to 135 ft-lbs.

26. Remove excess grease from valve bore.

27. Ensure that the plug, segment set and valve bore are properly aligned.

28. Place **spiral retainer ring (16)** on male end connection (if required).

29. Next place **wing nut (18)** on male end connection (if required).

30. Add **nut retainer set (17)** to **wing nut (18)** (if required).

31. Secure retainers with spiral ring (if required).

32. Grease the counter bore of the valve body female end and press the **resilient seal (19)** lipend towards valve in until the lip on the OD of the seal snaps into the groove in the back of the counter bore (if required).

4.0 DISASSEMBLY PROCEDURE

Note: If **handle adapter (3)** or **body cap (5)** appears to be stuck or locked, pressure may be trapped in the valve. This is also known as "pressure locking." Do not attempt to disassemble a "pressure locked" valve. See section **6.1 DISASSEMBLY TIPS** for pressure relieving procedures.

- Remove the SafeTap™ **grease fitting (1)** and **handle adapter (3)**. Screw out (turning counter-clockwise) the **body cap (5)**.
- Remove the **plug (10)** along with upper and lower plug **seal rings (8)** and **o-rings (9)**.
- Remove the **side segments (11)**.
- Remove the **segment set (12)**.
- Remove the segment set **o-rings (14)**, body cap **o-rings (7)**, plug **o-rings (9)** and **plug seal rings (8)**.
- Clean all of the old lubricant and debris from the parts and valve body internal profile.

5.0 MAINTENANCE

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 greased while under pressure. In addition, 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.

Do not attempt to disassemble a “pressure locked” valve. See section **6.1 DISASSEMBLY TIPS** for pressure relieving procedures.

6.0 REPAIR AND 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 section **4.0 DISASSEMBLY PROCEDURES** for detailed instructions on valve disassembly. Remove old grease and debris from valve pocket with a solvent and inspect for wear or damage such as:

- In the body cap seal bore of the pocket: Scratches could be caused by previous installation of a damaged body cap. Dings can also occur during assembly. Pitting is usually caused by failure to disassemble and clean valves after they are in service. Use your fingers to feel for any surface defects which may either fail to seal against the o-ring or may even damage the o-ring during assembly.
- On the body cap o-ring groove area: Check for scratches, dings, or pitting. Dings and scratches here are usually caused by careless use of sharp metal objects when trying to remove old o-rings. Feel for any raised edges that might scratch the internal seal bore of the valve body and sand or file as necessary.
- On the body cap threads: Check for damaged threads, especially the lead thread. Use your fingers to check for any raised edges and carefully sand as needed. Severely damaged threads must be repaired at the factory.
- On the pocket walls: Scratches, dings, or pitting, especially in the area immediately surrounding the valve bore. Use your fingers to feel for any surface defects which may either fail to seal against the o-ring or may even damage the o-ring during assembly. Check for any sharp edges around the valve bore that can cut the insert o-rings. These can be caused by using a bar when swabbing excess grease or using a bar to carry the valve.
- On the internal threads: Check for damaged threads, especially the lead thread. Use your fingers to check for any raised edges and carefully sand as needed. Severely damaged threads must be repaired at the factory.
- On the plug seal area: Check for scratches, dings, or pitting. Dings and scratches here are usually caused by careless use of sharp metal objects when trying to remove old seals.
- On the plug outside diameter: Check plug for washout, which will render the part unusable. Hold part in a well illuminated area and inspect for slight scratches in plug. If scratches are visible, use a 600 grit sandpaper to remove them.

On the segment set inside diameter: Check segments for washout, which will render the parts unusable. Hold parts up to a well illuminated area and inspect for slight scratches in outer and inner diameters of inserts. If scratches are visible, use a 600 grit sandpaper to remove them.

If the flow bore is washed and eroded larger than when the bore I.D. was new, the plug and segment set can only be used when the wear conforms to the guidelines detailed below. Since the bore will no longer be a perfect circle, you must measure the largest gap from one side of the bore to the other. If the bore tapers in either direction, measure the largest dimension. Compare the measurement to the following maximum acceptable dimensions:

- 1" Plugs and Segment sets – 1.090" max
- 2" Plugs and Segment sets – 2.120" max
- 3" Plugs and Segment sets – 3.120" max

Plug valves seal on the downstream side or the side opposite the pressure. The o-ring in the segment is pressured inward, trying to collapse the inside wall toward the bore. Dimensions larger than these guidelines will produce walls too thin to support the working pressure of the valve and these parts should be scrapped.

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.

See the **Minimum Wall Thickness Datasheet** for wall thickness inspection procedures and allowable erosion values.

6.1 DISASSEMBLY TIPS

Note: If **handle adapter (3)** or **body cap (5)** appears to be stuck or locked, pressure may be trapped in the valve. This is also known as "pressure locking." Do not attempt to disassemble a pressure locked valve. Pressure locking is caused by a rapid decrease in line pressure which traps fluid at the original line pressure. The trapped pressure causes a net upward force of the plug due to a differential in pressure area from top to bottom.

- Best practice for relieving trapped pressure in a plug valve is to bring the valve to its last highest pressure. This will put the internal parts in equilibrium and allow you to actuate the valve. Then, a gradual decrease in line pressure will ensure the plug maintains freedom of rotation.
- The SafeTap™ **grease fitting (1)** allows for the safe relief of trapped pressure within a valve. Extreme caution must be followed when attempting to relieve a pressure locking situation. Slowly turn the grease fitting ¼ CCW turn to relieve the pressure. Actuate the valve to ensure all pressure has been relieved. After the removal of all trapped pressure, you may remove all components. See section **1.1 SAFETAP™ GREASE FITTING** for more details on the SafeTap™ grease fitting

6.2 SANDING TIPS

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

Sanding is necessary to repair blemishes from the sealing surfaces of parts.

- Sanding of scratches, dings, and pitting should always be done with 600 grit sanding cloth that is well lubricated with water or solvent. When sanding sealing surfaces, it is VERY important to avoid sanding in one spot continuously; sand evenly across the entire sealing surface. Sand scratches by moving the sandpaper around the plug, not up and down along the length of the plug. If scratches cannot be removed utilizing this technique, replace the parts. If raised edges or dings in non-sealing areas are too large to be sanded effectively, you may use a rotary flapper-type sanding wheel. It is very important that you do not remove any material other than the actual raised edge. Do not remove any of the base material or you may permanently damage the valve and render it unsafe for use.

6.3 ASSEMBLY TIPS

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

If you choose to mix old and new parts, you must make absolutely sure that the old part does not have any defects. Using 600 grit sanding cloth, wet sand any surface blemishes as described in section **6.2 Sanding Tips**.

- See section **3.0 ASSEMBLY PROCEDURES** for detailed assembly instructions.

7.0 STORAGE

Disassemble the valve completely. See section **4.0 DISASSEMBLY PROCEDURES** for detailed instructions on valve disassembly. Remove old grease and debris from valve pocket with a solvent and inspect for wear or damage per **6.0 REPAIR AND INSPECTION**.

- 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.

7.1 SHELF LIFE

The following is recommended for maximum equipment shelf life:

# of Months in Storage	Manufacturers Recommendations
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 or scraping.
6+ months	Disassemble, rebuild & retest the valve. Replace all internal seals

8.0 ACCESSORIES

Use only MSI recommended wrenches.

MSI Part Number	Description
VC0494	1” TE Valve Wrench
VC0495	2” TE Valve Wrench

8.1 GREASES

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's Website
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

8.2 GREASE REQUIREMENTS

Valve Size	Approximate amount of grease
1” VALVE	⅓ STICK
2” VALVE	½ STICK
3” VALVE	1 STICK

8.3 ACTUATORS

MSI uses the following brands of actuators. Information is available by clicking on the hyperlinks.

Pneumatic	**El-O-Matic**
Hydraulic	**Damcos**
Gear Operated	**Williams Machine**

8.4 RUBBER PRODUCTS

MSI offers many 0-ring and plug seal materials for a variety of environmental and operating conditions such as low/high temperature, C02 service, and H2S service.