



# Technical Manual

## MSI TE (Top Entry) Valve



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## **SECTION 1      WARNINGS**

The MSI Top Entry (TE) 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.

## **2.1      TE Valve Description**

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.

## **2.2      TE Valve Specifications**

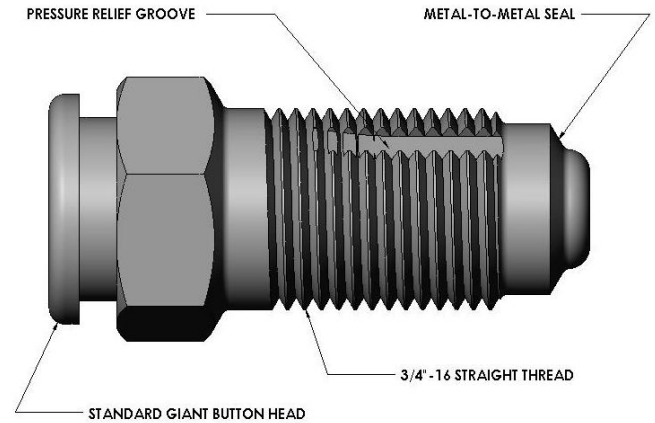
MSI offers more end connection choices than any other plug valve manufacturer in the industry. Connection types such as Hammer Unions, Line Pipe, API Flanged, Clamp Hub, and our own metal-to-metal WingSeal (WS20 and WS30) are just a few of the available choices. All sizes of MSI valves can be outfitted 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) \*metal-to-metal
  - Threaded Ends (all sizes of Line Pipe, EU, NU, and premium threads)

## 2.3 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:

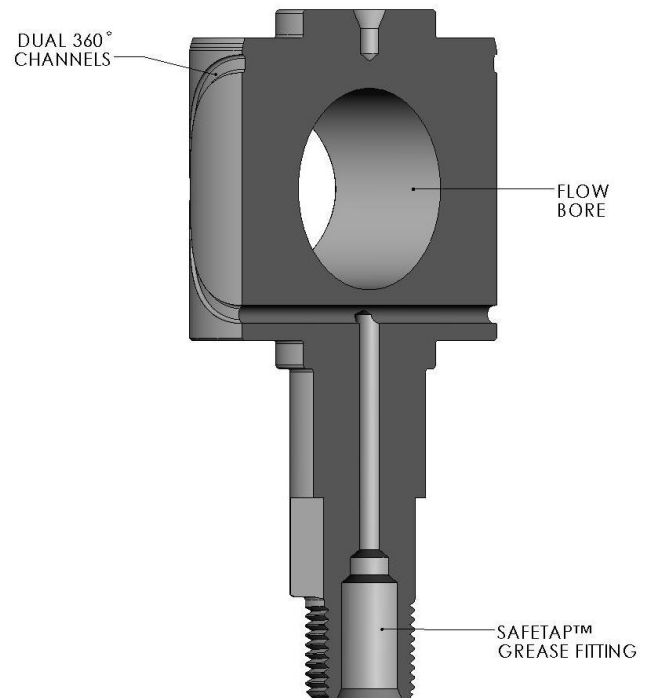
- The unique metal-to-metal seal eliminates wetted threads and pipe taps. Since the threads do not perform a sealing function they do not require Teflon tape or other sealing aids.
- The heavier cross section stands up better to impacts.
- Each fitting has a slot machined through the threads which serves 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 off any residual internal pressure.



## 2.4 GreaSeal™ Plug

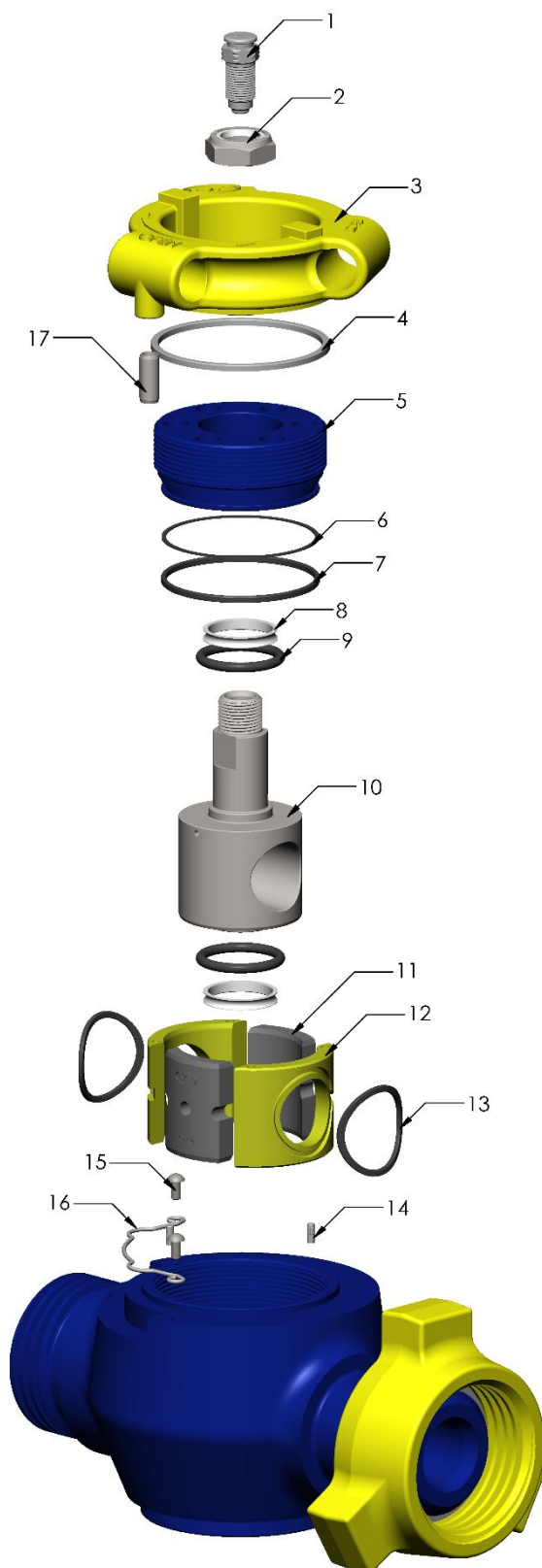
The patented GreaSeal™ plug is designed to provide maximum lubrication in the harshest field conditions. Key features include:

- 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.



### 3.1 Exploded View 1" & 2" TE Valves

See the following drawings and bills of materials for replacement parts. 2" TE valve is shown below, but the 1" TE valve is similar.



### 3.2 Bill of Materials 1" TE Valves

These part numbers are the common part numbers as they apply to Standard and H2S service 1" x 1" 1502 valve. 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).

NO.	QTY	DESCRIPTION	H2S	STD
1	1	SAFETAP™ GREASE FITTING	HC0226	HC0226
2	1	HANDLE LOCKNUT	HC0197	HC0197
3	1	HANDLE ADAPTER	VC0492	VC0492
4	1	HANDLE GASKET	VC0498	VC0498
5	1	BODY CAP	VC0525	VC0490
6	1	PARBAK RING, BODY CAP	N/A	N/A
7	1	O-RING, BODY CAP	OC0095	OC0086
8	2	PLUG SEAL RING	VC0496	VC0496
9	2	O-RING, PLUG SEAL	OC0096	OC0087
10	1	PLUG	VC0521P	VC0500P
11	2	SIDE SEGMENT	VC0502	VC0502
12	1	SEGMENT SET	VC0522	VC0501
13	2	O-RING, SEGMENT	OC0100	OC0092
14	2	GROOVED PIN	VC0513	VC0513
15	2	DRIVE SCREW	HC0200	HC0200
16	1	HANDLE SPRING	VC0505	VC0505
17	1	ROLL PIN	HC0196	HC0196

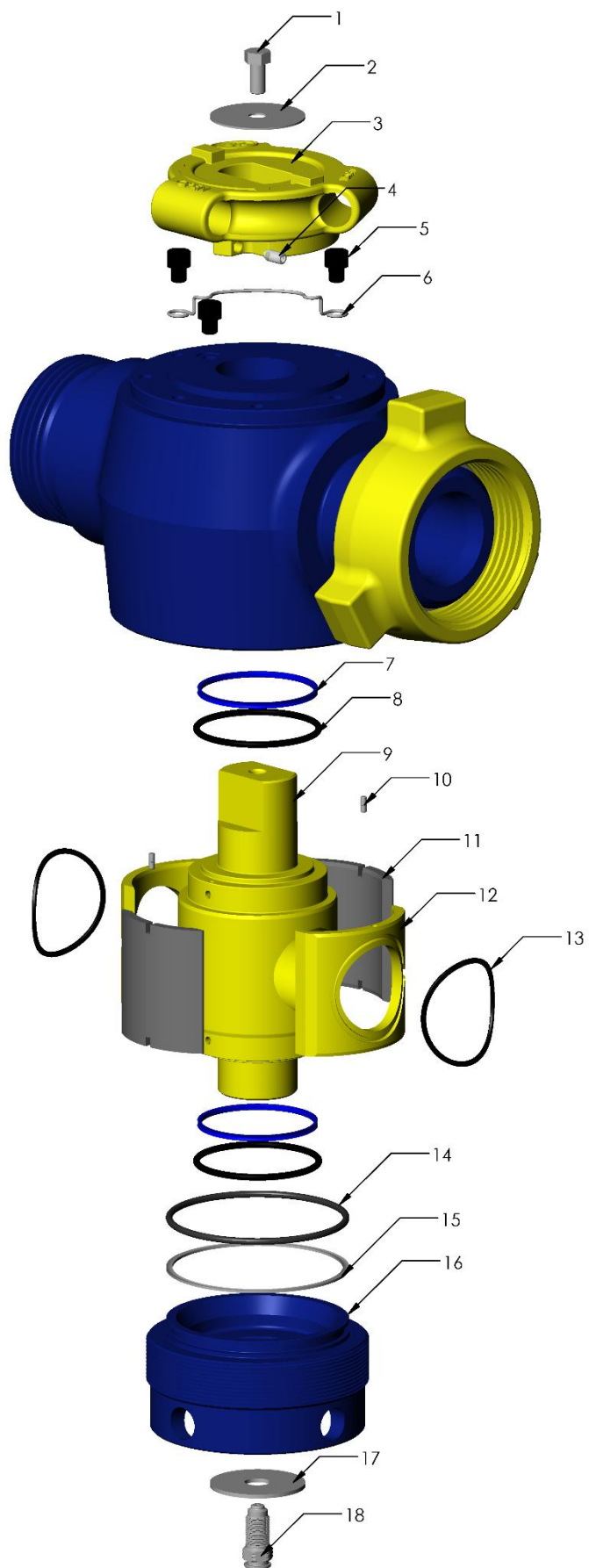
### 3.3 Bill of Materials 2" TE Valves

These part numbers are the common part numbers as they apply to Standard and H2S service 2" x 2" 1502 valve. 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).

NO.	QTY	DESCRIPTION	H2S	STD
1	1	SAFETAP™ GREASE FITTING	HC0226	HC0226
2	1	HANDLE LOCKNUT	HC0198	HC0198
3	1	HANDLE ADAPTER	VC0493	VC0493
4	1	HANDLE GASKET	VC0499	VC0499
5	1	BODY CAP	VC0526	VC0491
6	1	PARBAK RING, BODY CAP	OC0098	OC0098
7	1	O-RING, BODY CAP	OC0097	OC0088
8	2	PLUG SEAL RING	VC0497	VC0497
9	2	O-RING, PLUG SEAL	OC0099	OC0090
10	1	PLUG	VC0523P	VC0507P
11	2	SIDE SEGMENT	VC0506	VC0506
12	1	SEGMENT SET	VC0524	VC0508
13	2	O-RING, SEGMENT	OC0101	OC0091
14	2	GROOVED PIN	VC0513	VC0513
15	2	DRIVE SCREW	HC0200	HC0200
16	1	HANDLE SPRING	VC0511	VC0511
17	1	ROLL PIN	HC0196	HC0196



### 3.4 Exploded View 3" TES Valve



### 3.5 Bill of Materials 3" TES Valves

These part numbers are the common part numbers as they apply to Standard and H2S service 3" x 3" 1502 valve. 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).

NO.	QTY	DESCRIPTION	H2S	STD
1	1	HEX HD CAP SCREW	HC0009	HC0009
2	1	FLAT WASHER	HC0260	HC0260
3	1	HANDLE ADAPTER	VC0577	VC0577
4	2	SOC SET SCREW	HC0259	HC0259
5	3	SOC HD CAP SCREW	HC0008	HC0008
6	1	HANDLE SPRING	VC0583	VC0583
7	2	PLUG SEAL RING	VC0568	VC0568
8	2	O-RING, PLUG SEAL	OC0183	OC0115
9	1	PLUG	VC0792P	VC0565P
10	2	GROOVED PIN	VC0513	VC0513
11	2	SIDE SEGMENT	VC0794	VC0567
12	2	SEGMENT SET	VC0793	VC0566
13	2	O-RING, SEGMENT	OC0184	OC0116
14	1	PARBAK RING, BODY CAP	OC0120	OC0118
15	1	O-RING, BODY CAP	OC0185	OC0117
16	1	BODY CAP	VC0795	VC0569
17	1	FLAT WASHER	HC0262	HC0262
18	1	SAFETAP™ GREASE FITTING	HC0226	HC0226

## SECTION 4 ASSEMBLY

### 4.1 Tools and lubricants needed for assembly TE Valve Specific Tool

#### 1) TE Valve Specific Tool

Use only MSI recommended wrenches for working on TE Valves.

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

VC0494



VC0495



#### 2) Lubricants

- Copper based anti-seize lubricant
- Valve grease. See [5.4 Greases and Lubrication Requirements](#)

## 4.2 Assembly Procedure (Pictorial)

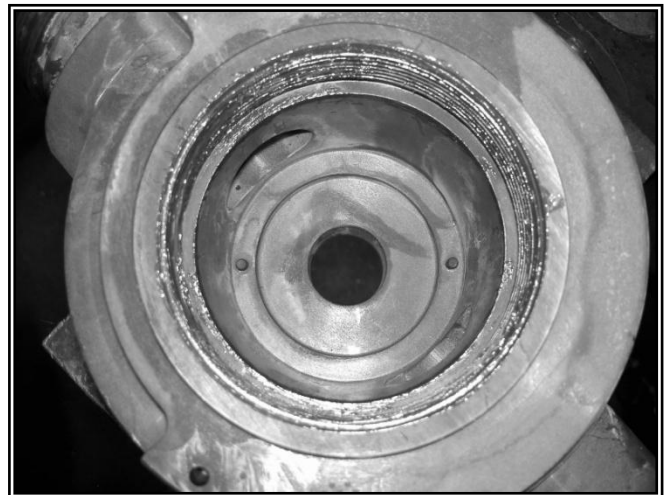
**NOTE:** It is imperative that the workstation being used to assemble the valve be clean and free of anything that could possibly contaminate the grease such as metal shavings, dirt, rust, old paint, etc. Do not sand or deburr near the workstation.

**NOTE** item numbers within ( ) refer to 1" & 2" TE valve drawing, and item numbers within [ ] refer to the 3" TES valve drawing.

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



- Check the **pins (14) [10]** in the bottom of the valve body pocket to make sure they are not bent or broken.

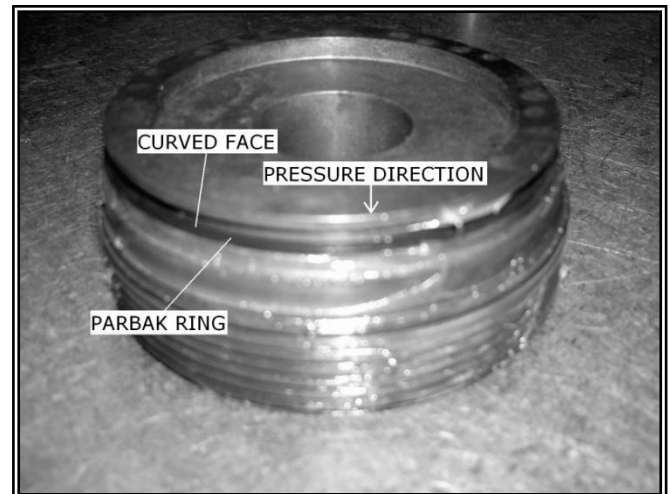


- Lightly lubricate the threads with anti-seize, then screw the clean **body cap (5) [16]** all the way into the valve body to make sure the threads are not damaged.



- Remove the **body cap (5) [16]**, lubricate the sealing groove with valve grease and install the body cap **parbak ring (6) [14]** on the side of the groove away from the pressure and the curved face towards the pressure.

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



- Install the **o-ring (7) [15]** into the groove so that it sits on the curved side of the **parbak ring (6) [14]** towards the pressure.



- Lubricate the valve pocket with valve grease.



- Check the surface finish of the **segment set (12)** [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 **segment o-rings (13)** [13] for any possible non-conformity.





- Coat the **o-rings (13)** [13] with valve grease and install onto the **segment set (12)** [12].



- Place the set into the valve body, making sure to engage the **dowel pins (14)** [10].



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



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



- Check the **plug (10) [9]** 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) [7]** and **o-rings (9) [8]** onto the ends of the **plug (10) [9]**.





- Apply valve grease to both seals.



- Apply a thin film of valve grease to the entire O.D. of the **plug (10) [9]**.

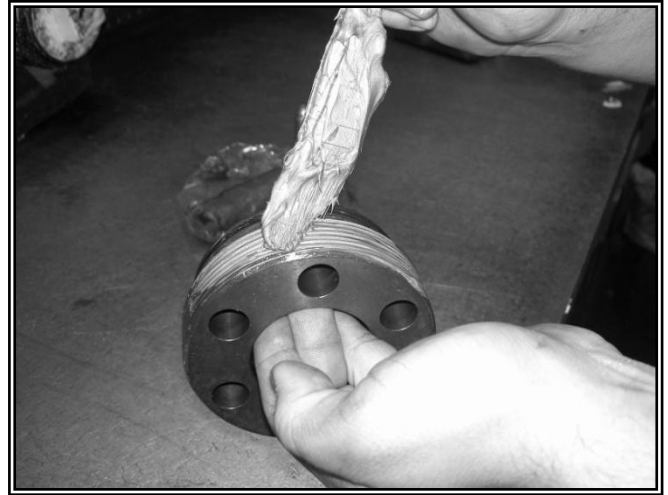


- Push the assembled plug with seals into the valve body, making sure it is properly aligned with the **segment set (12) [12]** and **side segments (11) [11]** until it is seated all the way down. Make sure the valve is in the open position.

**NOTE: Install the plug with straight downward force. DO NOT APPLY SIDE TO SIDE MOTION as this will damage segments**



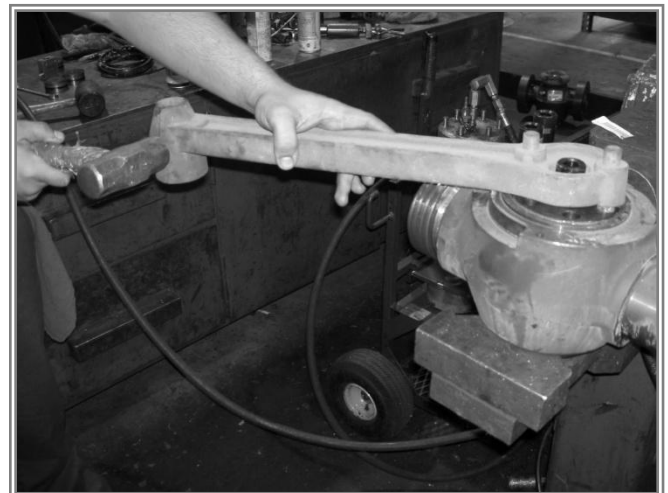
- Apply anti-seize compound to the threads on the valve body and **body cap (5) [16]**, along with a light coat of valve grease on the body cap sealing surfaces.



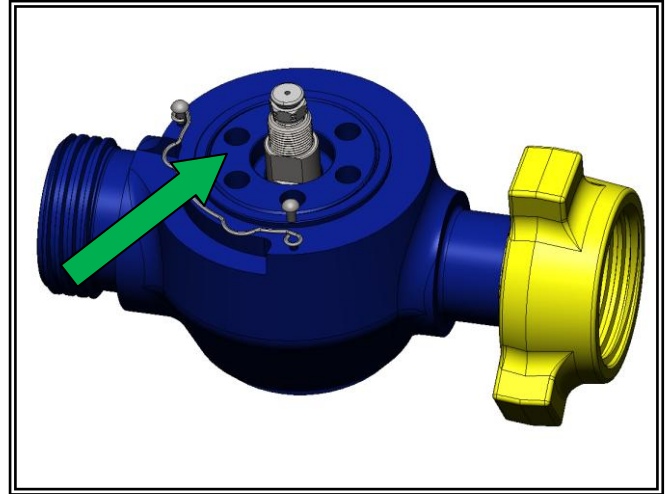
- Tighten the **body cap (5) [16]** until snug.



- Hit valve wrench with hammer a couple times to make sure it is firmly seated. This is necessary to fully compress the plug seal o-ring.

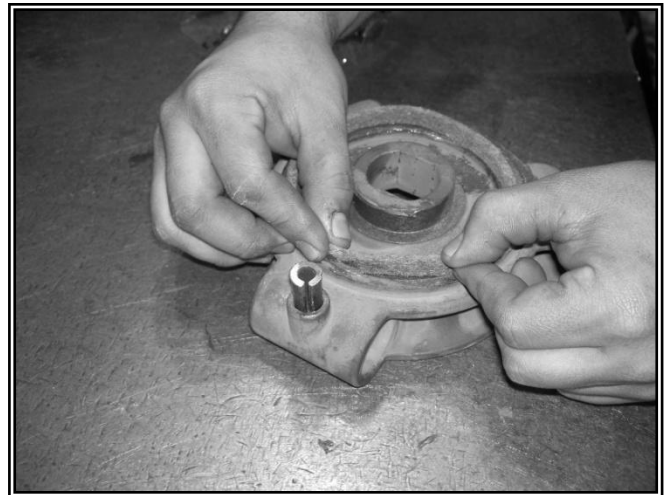


- Install the **handle spring (16)** [6] and **drive screws (15)** or **socket head cap screws [5]**.



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

**NOTE: 3" TES valve does not use a handle gasket**



- Install the **handle adapter (3)** [3] onto the top of the **plug (10)** [9].

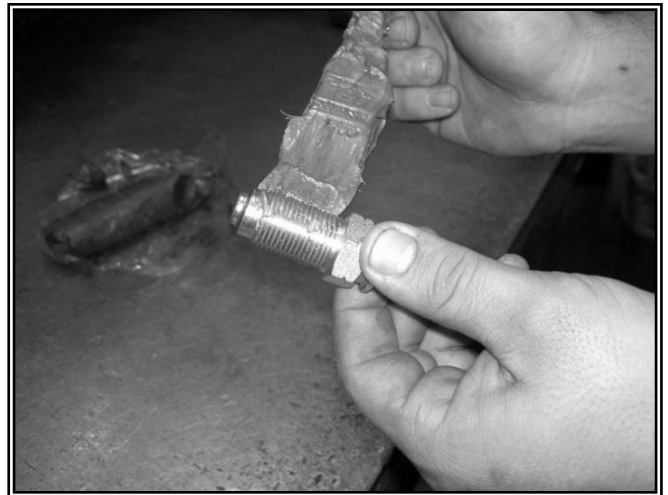


- Secure the **handle adapter (3)**[3] with **handle lock-nut (2)** for 1" & 2" TE valves or **hex-hd cap screw [1]** and flat washer [2] for 3" TES valves.



- Apply anti-seize compound to the threads on the SafeTap™ **grease fitting (1)** [18].

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



- Install SafeTap™ **grease fitting (1)** [18] and torque to 80 ft-lbs for 1" TE valves & 125 ft-lbs for all others.

**NOTE:** 3" TES valve uses a **flat washer [17]** in addition to the **grease fitting [18]**. The fitting also is threaded into plug on the body cap end. See [3.4 Exploded View 3" TES Valve](#)

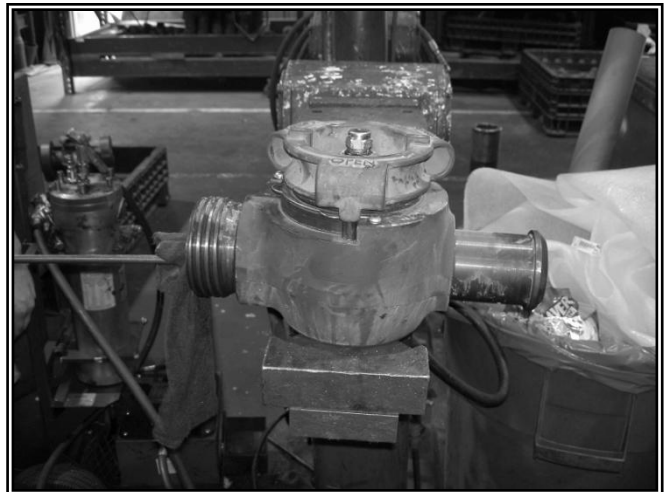




- Grease valve according to [ENG SPEC# 9-2001](#).



- Remove excess grease from valve bore.



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



### 4.3 Assembly Procedure (Text)

**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. Check the **pins (14) [10]** in the bottom of the valve body pocket to make sure they are not bent or broken.
3. Lightly lubricate the threads with anti-seize, then screw the clean **body cap (5) [16]** all the way into the valve body to make sure the threads are not damaged.
4. Remove the **body cap (5) [16]** and install the body cap **parbak ring (6) [14]** 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).**
5. Install the **o-ring (7) [15]** into the groove, so that it sits on the curved side of the parbak **o-ring (6) [14]** towards the pressure.
6. Lubricate the valve pocket with valve grease.
7. Check the surface finish of the **segment set (12) [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 **segment o-rings (13) [13]** for any possible non-conformity.
9. Coat the **o-rings (13) [13]** with valve grease and install onto the **segment set (12) [12]**.
10. Place the set into the valve body, making sure to engage the **dowel pins (14) [10]**.
11. Place the **side segments (11) [11]** into the valve body between the **segment set (12) [12]**.
12. Make sure the tops of all 4 pieces are at the same height.
13. Check the **plug (10) [9]** 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) [7]** and **o-rings (9) [8]** onto the ends of the **plug (10) [9]**.
15. Apply valve grease to both seals.
16. Apply a thin film of valve grease to the entire O.D. of the **plug (10) [9]**.
17. Push the assembled plug with seals into the valve body, making sure it is properly aligned with the **segment set (12) [12]** and **side segments (11) [11]** until it is seated all the way down. Make sure the

valve is in the open position. **NOTE: Install the plug with straight downward force. DO NOT APPLY SIDE TO SIDE MOTION, as this will damage segments.**

18. Apply anti-seize compound to the threads on the valve body and **body cap (5) [16]**, along with a light coat of grease on the body cap sealing surfaces.
19. Tighten the **body cap (5) [16]** until snug.
20. Hit valve wrench with hammer a couple times to make sure it is firmly seated. This is necessary to fully compress the plug seal o-ring.
21. Install the **handle spring (16) [6]** and **drive pins (15)** or **socket head cap screws [5]**
22. Add **handle gasket (4)** to **handle adapter (3)**. **NOTE: The 3" TES valve does not use a handle gasket (4).**
23. Install the **handle adapter (3) [3]** to the end of the **plug (10) [9]**.
24. Secure the **handle adapter (3)[3]** with **handle lock-nut (2)** for 1" & 2" TE valves or **hex-hd cap screw [1]** and **flat washer [2]** for 3" TES valves.
25. Apply anti-seize compound to the threads on the SafeTap™ **grease fitting (1) [18]**. **NOTE: DO NOT USE TEFLON TAPE ON THE GREASE FITTING.**
26. Install SafeTap™ **grease fitting (1) [18]** and torque to 80 ft-lbs for 1" TE valves & 125 ft-lbs for all others. **NOTE: 3" TES valve uses a flat washer [17]** in addition to the **grease fitting [18]**. The fitting also is threaded into the plug on the body cap end. See [3.4 Exploded View 3" TES Valve](#).
27. Grease valve according to [ENG SPEC# 9-2001](#).
28. Remove excess grease from valve bore.
29. Ensure that the plug, segment set and valve bore are properly aligned.

#### 4.4 Disassembly Procedure

1. The SafeTap™ grease fitting allows for the safe relief of trapped pressure within a valve. Slowly turn the grease fitting ¼ CCW turn to relieve the pressure. See section [2.3 SafeTap™ Grease Fitting](#) for more details on the SafeTap™ grease fitting.
2. Actuate the valve to ensure all pressure has been relieved.
3. Remove the SafeTap™ **grease fitting (1) [18]** and **handle adapter (3) [3]**. Note the 3" TES requires you to remove **hex hd cap screw [1]** and **flat washer [2]**. Screw out (turning counter-clockwise) the **body cap (5) [16]**.
4. Remove the **plug (10) [9]** along with upper and lower plug **seal rings (8) [7]** and **o-rings (9) [8]**.
5. Remove the **side segments (11) [11]**.
6. Remove the **segment set (12) [12]**.
7. Remove the segment set **o-rings (13) [13]**, body cap **o-rings (7) [15]**, plug **o-rings (9) [8]** and **plug seal rings (8) [7]**.
8. Clean all of the old lubricant and debris from the parts and valve body internal profile.



### **5.1      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 in the open position may be lubricated when line pressure is present. If a Greaseal™ plug is being used, plugs may be lubricated in the open or closed position. 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.

If the valve is NOT pressurized, MSI recommends greasing the valve to a minimum of 3,000 psi greasing pressure. 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.

### **5.2      Storage**

Disassemble the valve completely. See section [4.4 Disassembly Procedure](#) for detailed instructions on valve disassembly. Remove old grease and debris from valve pocket with a solvent and inspect for wear or damage per [6.1 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.

### 5.3 Shelf Life

The following is recommended for maximum equipment shelf life:

# of Months 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

### 5.4 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)	<a href="#">Val-Tex</a>
VC0426	#972 General Service (size 5.5)	<a href="#">Val-Tex</a>
VC0669	#972 General Service (size V)	<a href="#">Val-Tex</a>
VC0527	#750 Low Temperature (size J)	<a href="#">Val-Tex</a>
VC0402	#750 Low Temperature (size K)	<a href="#">Val-Tex</a>
VC0357	#700 CO2 / Hi-Temp / Condensate (size J)	<a href="#">Val-Tex</a>
GREASE002*	1502-S-7 Low Pressure Testing (7 lb. can)	Val-Tex
	#80HM Suitable for Acid Service	Val-Tex

\*Val-Tex 1502 grease is for hand application only and not to be pumped. Therefore, it is to be used only during the assembly process. Inject body grease prior to testing and after each actuation.

Valve Size	Approximate amount of grease
1" valve	1/3 stick
2" valve	1/2 stick
3" valve	1 stick

## 6.1 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 [4.4 Disassembly Procedure](#) for detailed instructions on valve disassembly. Remove old grease and debris from valve pocket with a solvent and inspect for wear or damage. Ensure inspection is performed in a clean well illuminated area. Minor damage and imperfections may be repaired. See section [6.2 Sanding Tips](#) for more information.

The following are areas that should be inspected:

- Threads: Inspect the body cap and valve pocket threads. Check for damage such as nicks, dings, or raised edges especially the lead thread. Carefully sand as needed.
- Sealing Surfaces:
  - Body cap: o-ring groove and seal bore
  - Valve body: pocket walls and plug seal area
  - Valve plug: plug seal area and plug outside diameter
  - Segment set: o-ring groove and inside and outside diameters.

During the inspection you should check for scratches, dings, pitting or other surface defects. Paying particular attention to surfaces which may fail to seal against the o-ring or even damage the o-ring during installation. Also look for evidence of washout.

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.

## 6.2 Sanding Tips

**When repairing a MSI plug valve, the following basic guidelines can help you ensure a successful 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 [4.2 Assembly Procedures](#) for detailed assembly instructions.



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