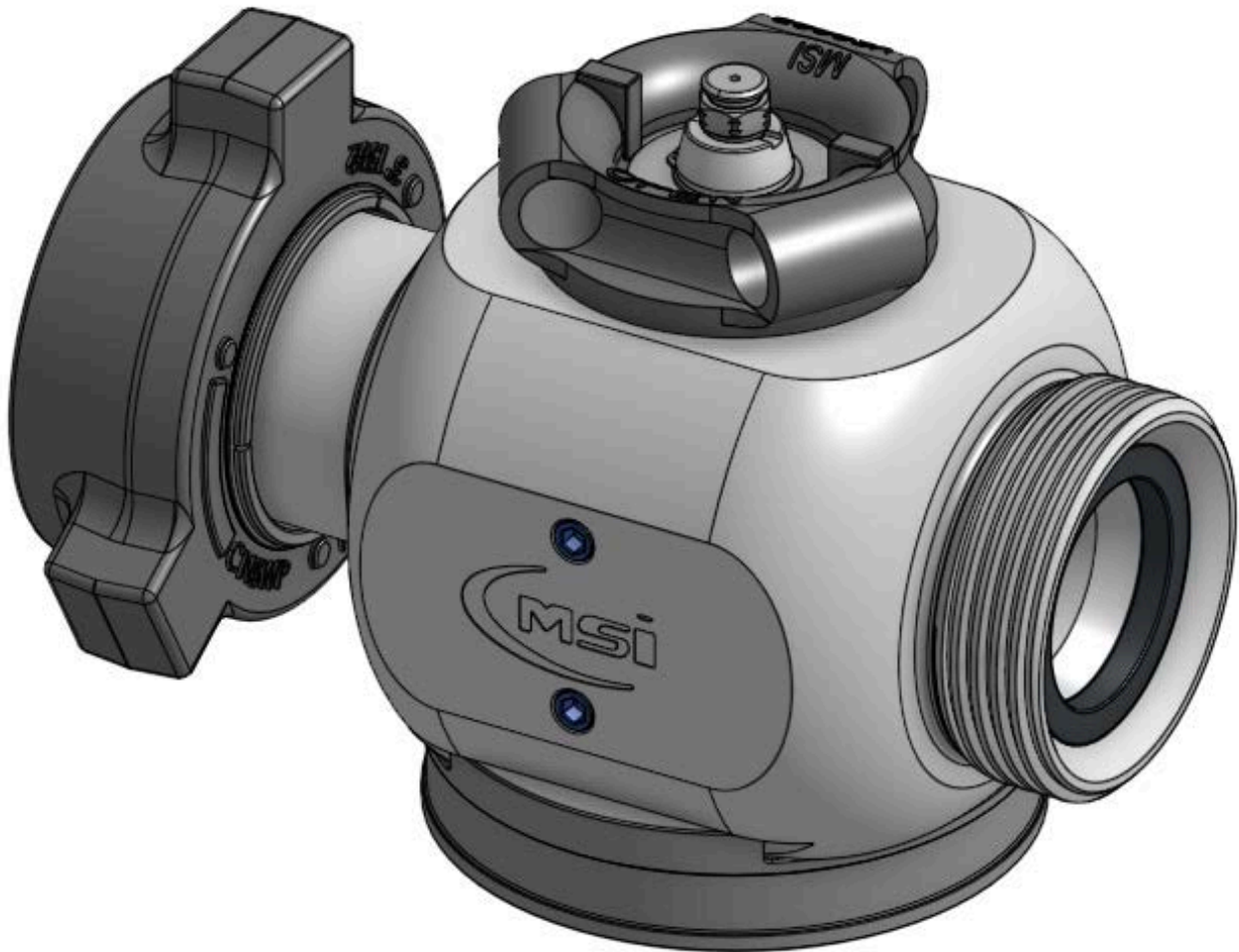




Technical Manual  
SAFE-Weight 3" 3:16 Plug Valve



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## TABLE OF CONTENTS

<u>WARNING:</u>	<u>3</u>
<u>SECTION 1 GENERAL DESCRIPTION</u>	<u>4</u>
<u>SECTION 2 PARTS</u>	<u>5</u>
<u>SECTION 3 TOOLS</u>	<u>6</u>
<u>SECTION 4 DISASSEMBLY</u>	<u>7</u>
<u>SECTION 5 INSPECTION</u>	<u>12</u>
<u>SECTION 6 ASSEMBLY</u>	<u>16</u>
<u>SECTION 7 MAINTENANCE</u>	<u>26</u>

**WARNING:**

This equipment is intended for use 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.

Only operate the valve in the full open or full close position, never flow through the valve in a partially open state as severe erosion may occur and create a hazardous situation.

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.**

## SECTION 1 GENERAL DESCRIPTION

The MSI model 3:16 is a quarter turn plug valve intended for the control of high pressure fluids. It is normally provided with a handle adapter for operating with a valve bar but can also be provided with hydraulic, pneumatic, or gear-assisted actuators.

Compared to other plug valves of the same nominal size the model 3:16 valve is lighter at 151 lbs, requires less grease, and reduces total cost of ownership over the life of the valve due to precise alignment of the internal flow bores.

The standard (STD) service valve is intended for use in non-sour service wells. A sour service (H2S) version is available for use in wells defined by NACE MR0175 as sour. The operating temperature is -20F to 250F in STD service, and -50F to 250F in H2S trim. Working pressures are up to 15,000 psig for STD service and 10,000 psig for H2S service.

API Product Specification Level 1 is standard and PSL2 and PSL3 are available. The valve has been successfully tested to API Performance Requirement 2 which involves operating the valve under full differential pressure for 200 cycles without failure.

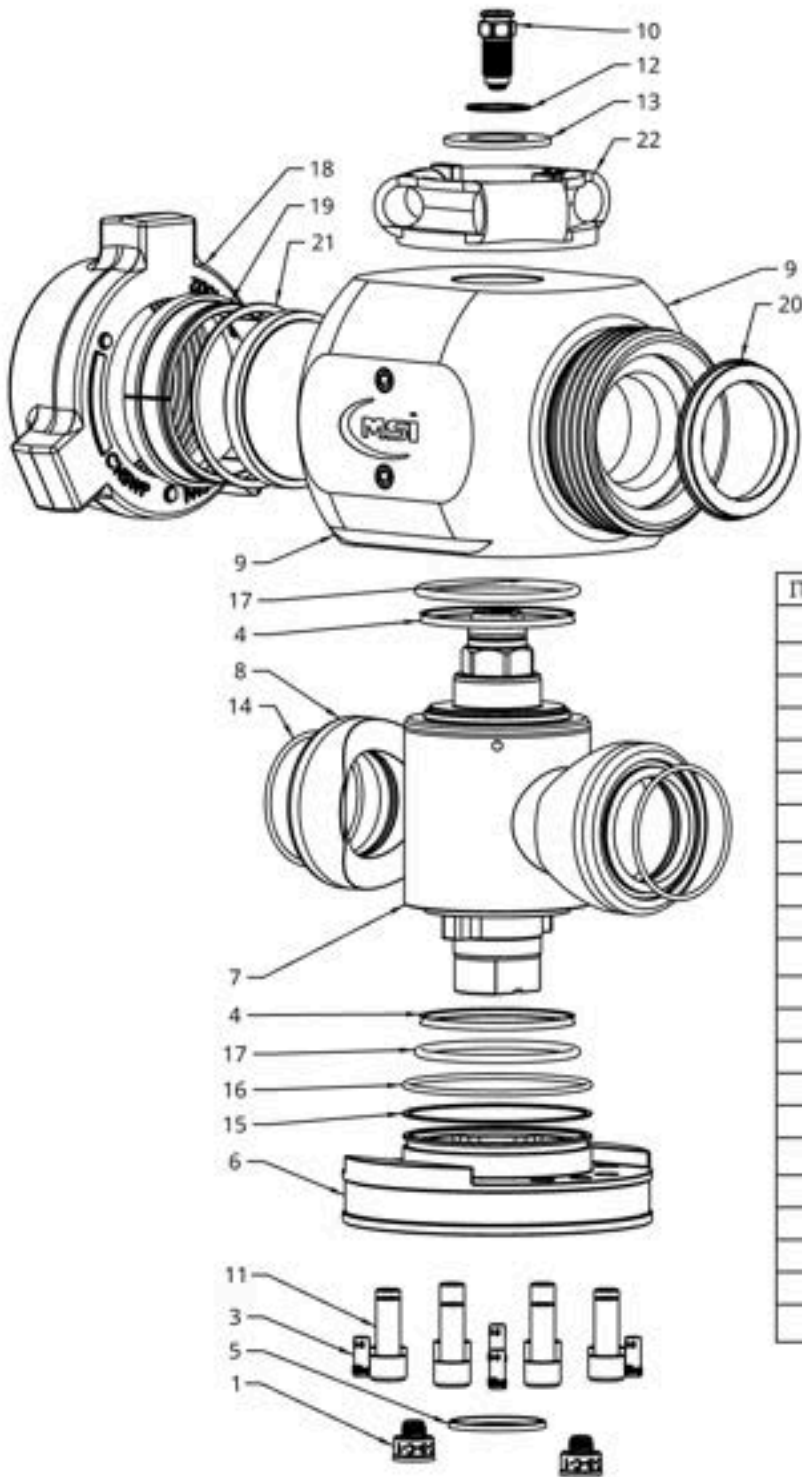
Breakaway torque is approximately 1300 ft-lbs with a 15,000 psi differential pressure applied across the plug.

General materials of construction:

- valve body and cap: low-alloy steel (STD and H2S)
- plug: low-alloy steel (STD), stainless steel (H2S)
- seats: ductile iron (STD), bronze (H2S)
- seals: NBR (STD), HNBR or FKM (H2S)

Alternate seal materials are available for service conditions that require special considerations for temperature or chemical compatibility.

## SECTION 2 PARTS



ITEM NO.	STD	H2S	DESC
1	316C-3-C-1		CAP PLUG
2	316C-3-C-2		BODY PLUG
3	316C-3-C-3		CAP ACT HOLE PLUG
4	316C-3-R-1		PLUG SEAL RING
5	316C-3-R-2		CAP DUST RING
6	316C-35-C-1	316C-3H-C-1	CAP
7	316C-35-P-1	316C-3H-P-1	PLUG
8	316C-35-S-1	316C-3H-S-1	SEAT
9	VARIES		VALVE BODY
10	HC0226		GREASE FITTING
11	HC1287		CAP SCREW
12	HC3024		SNAP RING
13	HC3025		WASHER
14	OC0005	OC0017	SEAT SEAL
15	OC0093-BU		CAP SEAL BACKUP RING
16	OC0093	OC0251	CAP SEAL
17	OC0242	OC0252	PLUG SEAL
18	UC0009	UC0005	WINGNUT
19	UC0006		NUT RETAINER SET
20	UC0013	UC0014	UNION SEAL
21	UC0015		RETAINER RING
22	VC0062		HANDLE ADAPTER

## SECTION 3 TOOLS

### Recommended tools:

1. 316T-3 seat tools
2. engineers' hammer
3. ball peen hammer
4. torque wrench rated for at least 250 ft-lbs
5. breakover bar
6. adjustable wrench for turning plug
7. 1/2" hex bit (to fit torque wrench and breakover bar)
8. 1/2" hex wrench
9. 5/16" hex wrench
10. small pick for seal removal
11. pipe or bar for turning handle
12. snap ring pliers (external) for removing handle snap ring
13. 3"1502 union affixed to sturdy table
14. LSA0003 lift sub
15. STA0008 service tool adapter

**NOTE: It is important that the workstation being used to disassemble the valve is clean and free of anything such as metal shavings, dirt, rust, old paint, etc.**

## SECTION 4 DISASSEMBLY

1. Prepare a work area and tools for maintenance. A sturdy table with a 3"1502 female union welded to it is helpful.
2. Remove both plugs from one side of the valve using the 5/16" hex key.



3. Attach STA0008 service tool to the side of the valve using a 1/2" hex wrench.



4. Lift the valve using LSA0003 lift sub and attach to the work table with the STA0008 adapter.



5. Rotate valve so that the handle is facing up and tighten the STA0008 wingnut to prevent rotation. Use snap ring pliers to remove the snap ring holding the handle to the plug.



6. Once the snap ring, washer, and handle have been removed, loosen the STA0008 wingnut and rotate the valve so that the cap is facing up. Retighten the wingnut.
7. Remove the two plastic plugs using a 1/2" hex key and set them aside, do not discard.





8. Next remove all 8 screws using the 1/2" hex key and breakover bar.
9. Insert 2 of the screws into the tapped holes of the cap and alternate turning them CW (clockwise) until the cap is lifted off of the valve body.

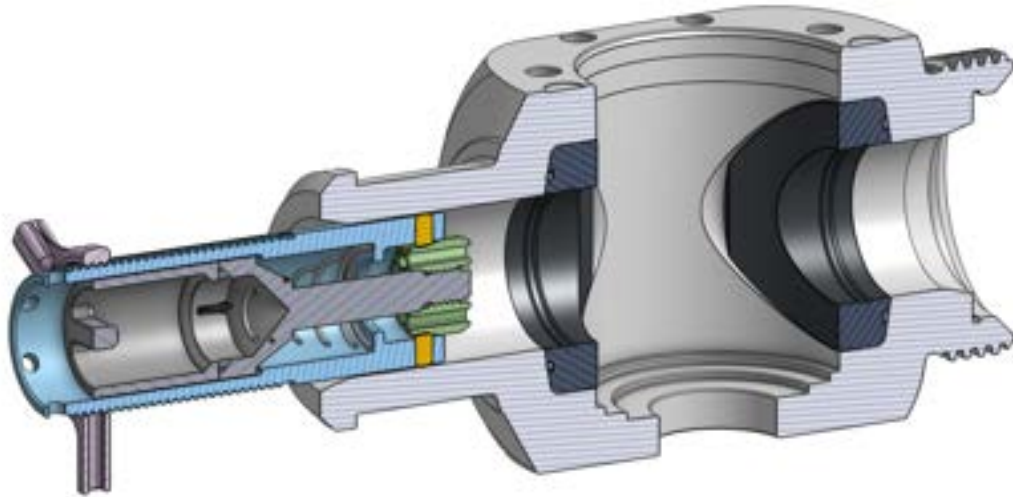


10. Set the cap aside then remove the seal and backup ring with a pick and discard them.
11. Turn the valve so that the pocket is facing the side and using an adjustable wrench, rotate the plug and simultaneously push it outward from the bottom of the valve.

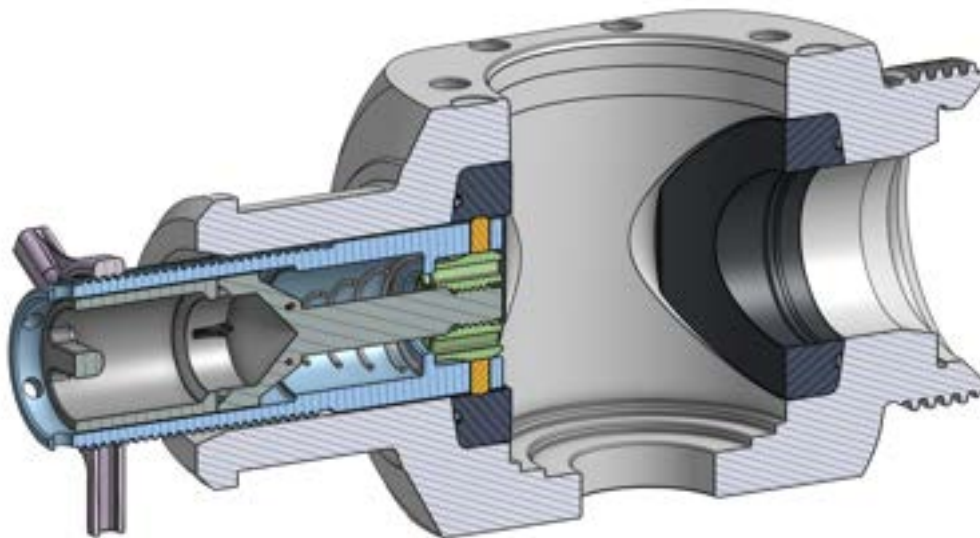


12. Once the plug has been pushed partially out, grasp it using the bore and pull straight out in one continuous motion.
13. Set the plug aside, being careful not to damage the larger cylindrical surface, assuming you are reusing the plug. Use the pick to remove the plug seal from each end, discard the seals and backup rings.

14. Use the seat tool to extract the seats by depressing the internal plunger with your thumbs then sliding the tool into the end of the valve until the grippers are inside the seat groove.



15. Release the plunger to allow the grippers to extend and lock into the seat groove. Now use the tool to push the seat out of the bore. Remove and discard the seat seals.



## SECTION 5 INSPECTION

Metallic parts may be reused if they are in good condition. The following photographs detail critical areas where corrosion, pitting, or scratches may render the part unusable. Clean the following areas thoroughly then inspect. If parts are damaged they should be replaced.

### BODY

Cap seal bore (top arrow), both seat seal faces (middle arrow) and plug seal face (bottom arrow).



### PLUG

Stem sealing surfaces (top arrow) and the seat sealing surface (bottom arrow) on both ends and sides of the plug, respectively.



## SEATS

Front face and seal groove, plug sealing face.



## CAP

Seal groove (right arrow) and inspect keys (left arrow) for dings. If the keys are dinged they should be dressed with a file.



## SECTION 6 ASSEMBLY

**NOTE: It is important that the workstation being used to assemble the valve is clean and free of any foreign materials that could possibly contaminate the parts. Do not sand or deburr near the workstation.**

1. Support the valve body with the STA0008 service tool adapter. Make sure that the seat pockets (middle arrow), plug seal face (bottom arrow), and cap seal bore (top arrow) are clean and free of contaminants.



2. Apply a small amount of grease to the seat seals then insert into the groove of each seat.
3. Apply a light coat of plug valve grease to the outside of the seats, being sure to avoid getting grease on the front face of the seat (red arrows). If grease is on this face, wipe it off.



4. Lower the seat into the valve cavity and press it into the pocket with the plug sealing face aligned with the pocket axis. Repeat for the other side. Next apply a light coat of plug valve grease to the entire exposed face of each seat.



5. The seat tool may be used to ease plug installation but it is not mandatory for assembly, the plug may be pressed directly through the seats.

If using the seat tool - back the seat tool wingnut out enough to allow full insertion of the tool. Depress the internal plunger to insert the tool then release the plunger to allow the grippers to engage the groove in the seat. While keeping the seats aligned, spin the wingnut until it contacts the end connection then use a 5/16" rod or small hammer to tighten the nut against the end, just enough to compress the seat seal. Make sure the mandrel (blue arrow) that extends the grippers is fully retracted into the tool body, and clear of the plug bore, on both seats before inserting the plug.



6. Apply a light coat of plug valve grease onto the plug stem seals then snap them onto the backup rings.



7. Press the seals onto each end of the plug being sure they are firmly seated. There should be enough grease present to keep the bottom seal from falling off.



8. Before continuing to the next step verify rotational alignment on both seats. If adjustment is needed, loosen the seat tool wingnut and make the necessary adjustment, then retighten the wingnut.

9. Set the plug into the valve cavity grease fitting end down and in an approximately closed position. Align it to the pocket cavity as close as possible.
10. While keeping the plug aligned, firmly push it down until it is fully inserted into the valve cavity. Do not rock the plug back and forth as this may damage the seats and/or plug.



11. Rotate the plug to the open position and remove the seat tools (if used).





12. Place the seal backup ring onto the cap and push to the bottom of the groove. One side of the backup ring is cupped and should face the seal, but installing it in either direction is acceptable. Apply a light coat of plug valve grease on the cap seal then place it into the groove on top of the backup ring. Go around the seal with your finger to evenly distribute it in the groove.



13. Place the cap on the valve such that the screw holes and keys are aligned with those on the valve body. It does not matter which direction the cap goes on otherwise.
14. Apply a light coat of copper anti-seize to the threads of the cap screws.
15. Insert 2 screws into opposing holes on the key side of the cap.
16. Using a 1/2" hex wrench or socket, alternate tightening these 2 screws to gradually bring the cap into full level engagement with the valve body. Do not use power tools for this step.



17. Once the cap is fully seated against the valve body, install the remaining 6 screws and tighten with hex key until fully engaged. Then use a torque wrench set to 230 ft-lbs to tighten all 8 screws in a cross pattern.



18. Reinstall the plastic plugs into the jack screw holes.
19. Rotate the valve so that the cap is down then install the handle. Make certain that the machined indicator slots on the end of the plug align with the indicators on the handle.



20. Replace the washer then snap ring. A plastic tool is provided in repair kits to push the snap ring down and into the groove.



21. Rotate the plug to full open and full close a few times to verify movement is smooth and there is no binding or roughness. If the rotation is not smooth, disassemble the valve and inspect for foreign materials.
22. Valve is now ready for greasing [explained in the following section]. Following greasing, remove the STA0008 tool and replace the plastic body plugs.

## SECTION 7 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 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 psig minimum. The valve can safely be greased up to the rated working pressure of 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. **Valves without Greaseal plugs must be greased in the open position, valves with Greaseal plugs may be greased in the open or closed position.**

### Storage

Disassemble the valve completely. See the Disassembly Procedure section 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	Manufacturer's Recommendation
0-3 months	Nothing required
3-6 months	Re-grease and 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

MSI WETFIT plug valve grease is recommended for all applications. It has exceptionally high metal adhesion and resistance to all commonly encountered fluids. WETFIT grease is available in K and V size sticks or containers for use in commercially available stick lube pumps. Approximately 1/4 of a K size stick is needed to lubricate a dry valve.

WETFIT-K-G	GREASE STICK, SIZE K, GEN SVC (-10F TO 400F)
WETFIT-V-G	GREASE STICK, SIZE V, GEN SVC (-10F TO 400F)
WETFIT-K-A	GREASE STICK, SIZE K, ARCTIC SVC (-50F TO 400F)
WETFIT-V-A	GREASE STICK, SIZE V, ARCTIC SVC (-50F TO 400F)

Other plug valve greases may be used after being thoroughly evaluated for performance in the intended service conditions.



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