# OPERATION AND MAINTENANCE MANUAL, 2 INCH ULT PLUG VALVE

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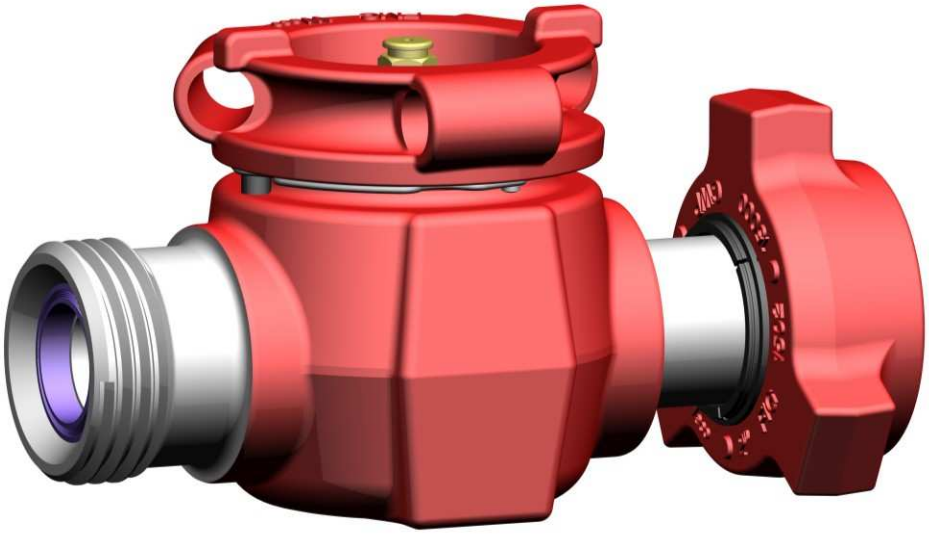
Summary:

This document covers the safe operation, maintenance, troubleshooting and repair of the 2 inch ULT Plug Valve.

By: Paul Crawford



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# Operating and Maintenance Manual

## 1.0 Warnings

FMC cannot anticipate all of the situations a user may encounter while installing and using FMC products. Therefore, the user of FMC products MUST know and follow all applicable industry specifications on the safe installation and use of these products. Refer to the FMC product catalogues, product brochures and installation, operating and maintenance manuals for additional product safety information or contact FMC at 800-772-8582.

**Failure to follow these safety warnings could result in death, serious personal injury, and/or severe property damage.**

**WARNING**

1. Never mix or assemble components, parts or end connections with different pressure ratings. Mismatched conditions, including but not limited to that of a 2" Figure 1502 male sub end connected to a 2" Figure 602 female sub, may fail under pressure resulting in death, serious personal injury or severe property damage.

2. Never use or substitute non FMC components or parts in FMC products or assemblies.

3. Never modify or repair FMC products in a manner not specifically directed in instructions published by FMC Technologies.

4. Never strike, tighten, loosen or attempt repairs on pressurized components or connections.

5. Never exceed the rated working pressure of the product.

6. Complete and proper make-up of components and connections is required to attain rated working pressure. Always apply essential care, attention, handling and inspection to threaded components before, during and after make-up.

7. Never use severely worn, eroded or corroded products. Contact FMC Technologies for more information on how to identify the limits of erosion and corrosion.

8. Never strike wing union nuts having severely flattened and extruded ears. This condition can result in flying debris leading to serious personal injury and must

immediately be addressed by either grinding off extruded material or removing the nut from service.

9. Always follow safe practices when using products in overhead applications. Products not properly secured could fall.
    - Never exceed the load rating of lifting devices on products or lifting equipment.
    - Use of FMC products in suspension applications can result in over-stress conditions leading to catastrophic failure. If externally applied loads are anticipated, consult factory.
10. Always follow safe practices when manually lifting and carrying products.
11. Always select only appropriate product and materials for the intended service:
    - Never expose standard service products to sour gas fluids. (Refer to NACE MR0175). Do not interchange sour gas with standard service components.
    - Always use appropriate safety precautions when working with ferrous products in below freezing temperatures. Freezing temperatures lower the impact strength of ferrous materials.
12. Always follow manufacturer's instructions and Material Safety Data Sheet directions when using solvents.
13. Always make certain that personnel and facilities are protected from residual hazardous fluids before disassembly of any product.
14. Whenever leakage is detected from FMC Technologies products, remove them from service immediately to prevent death, serious personal injury, and/or property damage.

**SAFETY INSTRUCTIONS:** The applications of FMC products are in working environments and systems which must be properly designed and controlled. Safety procedures and policies MUST be clearly established by the user and followed. Always use appropriate protective equipment.

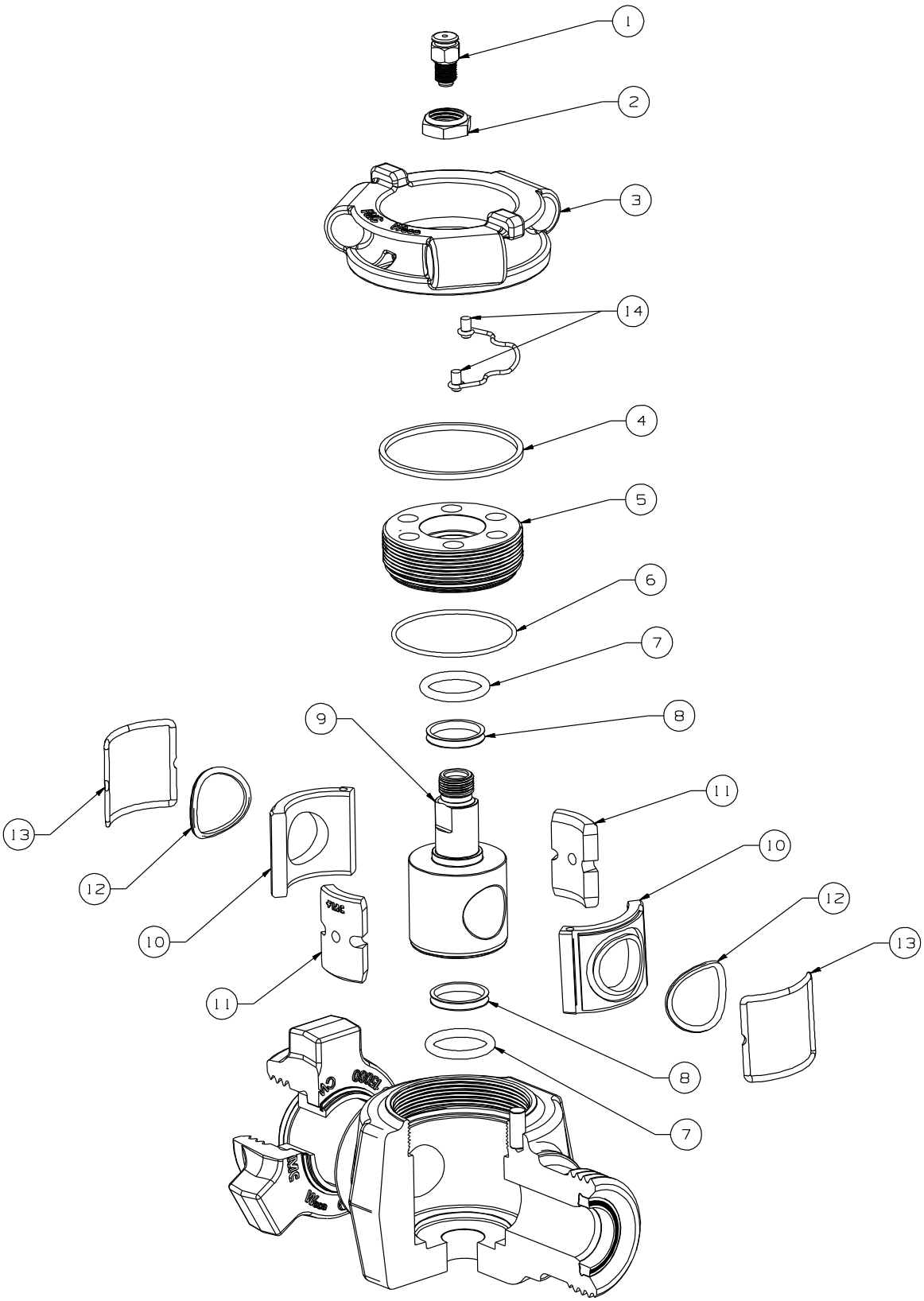


Figure 1: Exploded View of 2” ULT Plug Valve

# 2.0 Operating Instructions

**Never look into the valve bore while the valve is in a flow line. Pressure and fluids could escape from the valve causing bodily injury.**

**WARNING**

**Use ULT Plug Valves in the full open or closed positions, only. Use of ULT plug valves in throttling applications will shorten the useful life of the valve.**

**NOTE**

1. Grease valves after each use with FMC approved Plug Valve grease.
   - Between 32°F and 250°F use Weco® plug valve lubricant and sealant No. 3256666.
   - Between -50°F and 200°F use Weco plug valve lubricant and sealant No. 3251968.
   - Between -20°F and 600°F use optional Val-Tex® lubricant and sealant P540648
   - Between -50°F and 375°F use optional Val-Tex® lubricant and sealant P540720

**Grease valve in open position until grease can be seen through the bore of the valve. Cycle valve closed to open and pump a little more grease into valve while valve is in the open position. If valve is in line, grease valve a moderate amount until maximum grease pressure is attained during greasing, then cycle valve and re-grease. Typical grease gun pressures attained during greasing of valve range from 6,000 to 15,000 psi.**

**NOTE**

2. Re-grease valves immediately after pumping solvents through them.
3. Thoroughly flush valves with clean water after each use to wash away any cement or acids that may have been left in the valve (where applicable).
4. Spray rust preventative oil over exposed threads on valve to prevent rusting during storage.
5. Replace grease fittings that become damaged to prevent leaks and to allow proper greasing of the valve.
6. Disassemble plug valves and replace worn parts on a routine basis to prevent corrosion and erosion of the valve body and remove old grease.

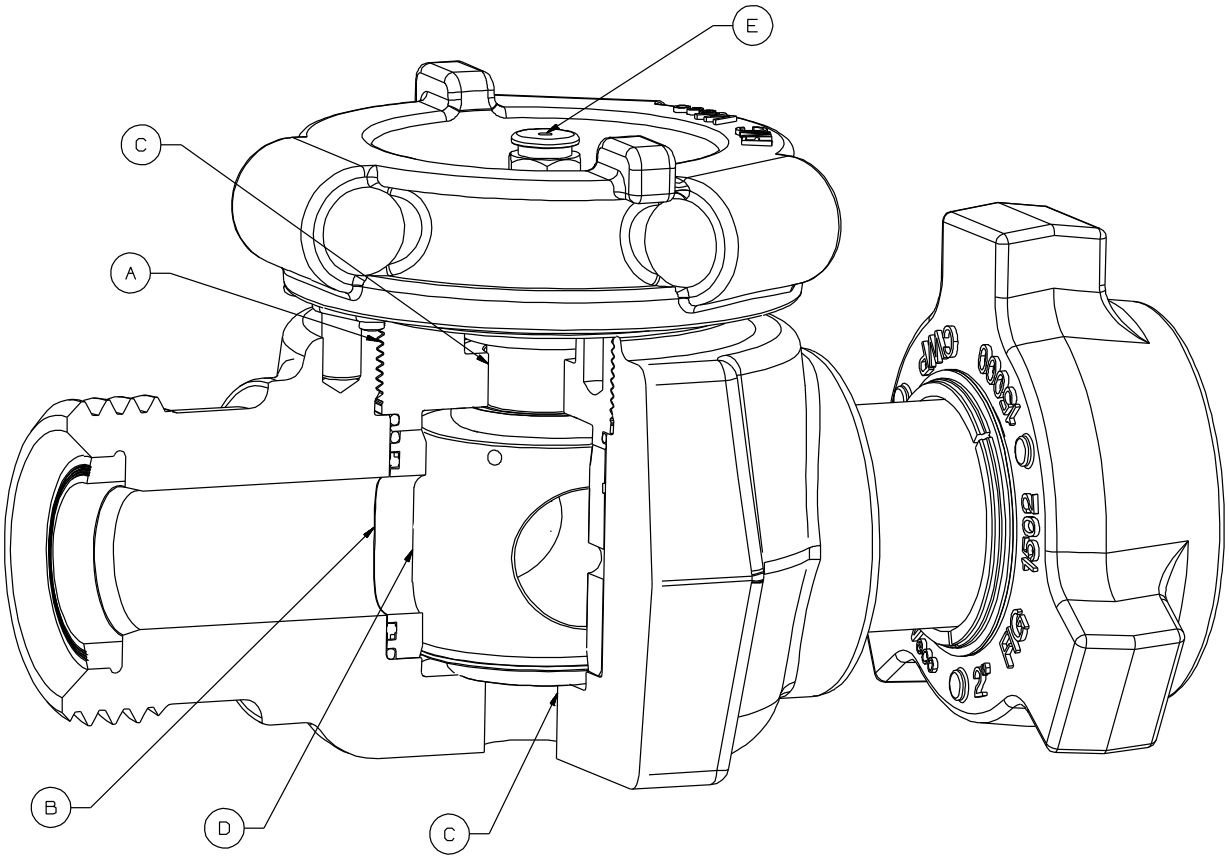


Figure 2: Possible Leak Paths in 2” ULT Plug Valve

Table 1: Leak Path Codes

| | |
|---|---|
| **A** | Leak at body cap threads |
| **B** | Leak between seal segment and body |
| **C** | Leak at top or bottom of the valve past plug stem seal |
| **D** | Leak between seal segment and plug (downstream side) |
| **E** | Leak at grease fitting |

Table 2: Trouble Shooting Guide

| Problem | Possible Cause | Recommended Repair |
|---|---|---|
| Leak at body cap threads.<br><br>(See Figure 1, leak path “A”) | Damaged body cap o-ring. | Remove body cap. Replace cap o-ring. Check for scratches, dents or corrosion/erosion in the body cap sealing area. Repair minor scratches and corrosion with 400 grit sandpaper. Deep dents or gouges may require the body and/or cap to be replaced. |
| Leak between seal segment and body.<br><br>(See Figure 1, leak path “B”) | Contamination between the seal segment and body. | Cycle valve open and close several times. Fully grease valve and cycle several more times. |
| | Damaged or aged segment seals | Disassemble valve. Replace segment seals |
| | Damaged seal segment seal area due to scratches, corrosion or erosion | Disassemble valve. Inspect the seal segment for scratches, dents or corrosion/erosion of the OD sealing area and seal grooves. Repair minor scratches and corrosion with 400 grit sandpaper. Deep dents or gouges may require the seal segment to be replaced. |
| Leak at top or bottom of valve past plug stem seals.<br><br>(See Figure 1, leak path “C”) | Damaged plug o-rings or backups | Disassemble valve. Inspect the plug o-rings and backup rings for age, cracks or damage. Replace any damaged o-rings or backups. |
| | Damaged or contaminated plug to body cap seal surfaces | Disassemble valve. Inspect plug to body cap seal area for scratches, dents, or corrosion/erosion. Repair minor scratches and corrosion with 400 grit sandpaper. Deep dents or gouges may require the plug or body cap to be replaced. |
| | Damaged or contaminated body to plug seal surfaces | Disassemble valve. Inspect the body seal area for scratches, dents, or corrosion/erosion. Repair minor scratches and corrosion with 400 grit sandpaper. Deep dents or gouges may require the body to be replaced. |

Table 3: Trouble Shooting Guide (continued)

| Problem | Possible Cause | Recommended Repair |
|---|---|---|
| Leak between seal segment and plug.<br><br>(See Figure 1, leak path "D") | Damaged seal segment due to scratches, corrosion or erosion | Disassemble valve. Inspect the seal segment for scratches, dents, or corrosion/erosion on the I.D. sealing area. Repair minor scratches and corrosion with 400 grit sandpaper. Because this is a metal seal surface it is sensitive to surface defects. Even minor dents or gouges may require the seal segments to be replaced. |
| | Damaged plug sealing surface due to scratches, corrosion, erosion, chipped or damaged plating | Disassemble valve. Inspect the plug for scratches, dents, or corrosion/erosion in the sealing area. Repair minor scratches and corrosion with 400 grit sandpaper. Because this is a metal seal surface it is sensitive to surface defects. Even minor dents or gouges may require the plug to be replaced. |
| Leak at grease fitting.<br><br>(See Figure 1, leak path "E") | Loose Grease fitting | Relieve line pressure and tighten grease fitting*. |
| | Damaged or contaminated grease fitting | Relieve line pressure and remove grease fitting and replace with new grease fitting.* |
| | Damaged or contaminated grease fitting threads | Relieve line pressure and remove grease fitting. Clean and inspect threads. If threads are intact reinstall grease fitting.* If threads are damaged replace with new grease fitting.* |
| | | * Insure that grease fitting(s) installs hand tight without Teflon tape 4 to 4.5 turns. Apply 3 to 4 wraps of Teflon tape to grease fitting(s), install and tighten with wrench 5 to 6.5 turns total. On Autoclave grease fittings, do not use Teflon tape and tighten with torque wrench to 40 ft-lbs. |

# 3.0 Maintenance Instructions

## 3.1 Recommended Routine Maintenance

1. Grease valves after each use with FMC approved Plug Valve grease**.

   - Grease valve in full open position until grease can be seen through the bore of the valve
   - Cycle valve closed to open position and pump a little more grease into valve while valve is in the full open position.
   - If valve is in line, grease valve a moderate amount until maximum grease pressure is attained during greasing, then cycle valve and re-grease.

**Typical grease gun pressures attained during greasing of valve range from 6,000 psi to 15,000 psi.**

**NOTE**

2. Re-grease valves immediately after pumping solvents through them.
3. Thoroughly flush valves with clean water after each use to wash any cement or acids that may have been left in the valve (where applicable). See comments under Operating Instructions.
4. Spray rust preventative oil over exposed threads on valve to prevent rusting during storage.
5. Replace grease fittings that become damaged to prevent leaks and to allow proper greasing of the valve.

## 3.2 Required Tools

400 grit sandpaper, soft-faced mallet, adjustable wrench, and screwdriver

| | |
|---|---|
| P512223 | Wrench, Body Cap |
| 3251969 | Hi-pressure Grease Gun with Pressure Gage (Uses “K” size stick grease) |
| 3251970 | Grease Gun Head and Handle Assembly |
| 3251971 | Giant Button Head Coupler |
| 3251972 | Giant Button Head to Vent Cap Adapter |

## 3.3 Disassembly

**Tools:** Body cap wrench, 400 grit sandpaper, soft-faced mallet, adjustable wrench, screwdriver.

**WARNING**

**Remove all pressure from the system and valve before beginning any maintenance. e this box as a warning notice that failure to follow these procedures can result in bodily harm.**

1. Remove plug cap (3) or actuator/operator and mounting bracket.
2. Using the appropriate body cap wrench, remove body cap (5).
3. Remove plug (9) by lifting (while twisting it back and forth) with an adjustable wrench on the plug flats. If necessary, hammer plug out using a punch placed through the bottom hole in the valve body. Be careful not to damage plug.
4. Remove side segments (11) by prying them up from the body cavity with a screwdriver.
5. Remove seal segments (10). If seal segments and side segments must be pried loose, be careful not to score or dent body cavity wall.
6. Remove grease fitting (1), seals (6), (7), and (8). It is recommended that all seals be replaced during servicing.
7. Remove grease from all valve components. Some solvents and some detergent solutions will soften or partially dissolve the grease, allowing it to be wiped away with a rag.
8. After degreasing parts, visually inspect them for wear and corrosion. The portions of the body cavity that are contacted by the seal segment seals (12 and 13), the plug stem seals (7 and 8) and the body cap seal (6) must be smooth. The mating surfaces of the plug (9) and seal segments (10) must be smooth and free of score marks and surface defects.
9. Use a file or sandpaper to remove rust from outside diameter portion of seal segments (10) that contact the body. Scrape and then lightly sand rust from body surfaces touching the outside diameter portion of the seal segments.
10. Using 400 grit sandpaper clean all other seal surfaces.

**IMPORTANT: Parts with sealing surfaces that cannot be made smooth should be replaced.**

**NOTE**

## 3.4 Assembly

**Tools:** Body cap wrench, soft-faced mallet, adjustable wrench, screwdriver, grease gun.

1. Check/verify parts against parts list to insure correct parts are used to assemble valve.
2. Clean inside of valve body with clean rag soaked in solvent. Blow remaining dirt out of body with compressed air.
3. Clean two seal segments (10) using a clean rag soaked in solvent. Blow dry with compressed air.
4. Install segment seals (12) & (13) on both seal segments. The die formed inner segment seal (12) must be installed with brass anti-extrusion ring facing outward.
5. Apply a very thin film of plug valve grease** to surface of the seal segments (10) which contacts the body. Install both seal segments in valve body.

**Over greasing between segment seals will increase effort to push the plug in which can cause plug/segment damage or displacement of the outer seal.**

**NOTE**

6. Apply a liberal amount of plug valve grease** to exposed inside surface of seal segments (10) and to exposed portion of body cavity which will contact side segments. Install both side segments in the body cavity.
7. Clean side segments (11) with clean rag.
8. Apply a liberal amount of plug valve grease** to side segments (11) and install them half way in the body cavity between the seal segments (10).
9. Clean plug with clean rag soaked in solvent. Blow dry with compressed air. Blow all dirt out of grease passageways.

10. Apply liberal amount of plug valve grease** to outside diameter of plug (9) and to stem seal areas of plug. Place stem seal o-rings (7) and nylon backup rings (8) on top and bottom of plug.

11. Orient the plug in a fully closed position (plug bores facing the side segments). Using the side segments (11) as guide, install the plug (9) by applying firm pressure to plug. After the plug is partially installed by hand, a soft face mallet may be used to drive the plug the remaining distance into valve. After installation, check to assure that the top of the outer seals (13) stay in the groove. Use a blunt object such as blade type screw driver to push top of the seal back in the groove if necessary.

12. Push side segments (11) into body cavity until they reach bottom.

13. Install o-ring (6) on body cap (5). O-ring should fit firmly in groove in body cap (5).

14. Remove excess grease from the body cap shoulder area of body. Apply anti-seize compound (or lithium molybdenum disulfide grease) to body cap threads and install body cap into body. Tighten body cap (5) by hand using proper body cap wrench.

15. Finish tightening body cap (5) using impact or hammer wrench. Mark line on body cap and body and tighten body cap until no movement is noticed between the body cap and body.

16. Check both detent spring retaining pins (14) in plug cap (3) for tightness. If loose, lightly tap pin with hammer until tight.

17. Install felt grease retainer ring (4) on plug cap (3). Install plug cap on plug (9), and tighten elastic stop nut (2) until snug.

18. Insure that grease fitting (s) installs hand tight without Teflon tape 4 to 4.5 turns. Apply 3 to 4 wraps of Teflon tape to grease fitting (s), install and tighten with wrench 5 to 6.5 turns total. On Autoclave grease fittings, do not use Teflon tape and tighten with torque wrench to 40 ft-lbs.

## 3.5 Plug Valve Grease Selections

In the above assembly section “plug valve grease**” refers one of the products listed below. FMC Technologies does not warrant the performance of ULT plug valves after use of other valve sealants or greases.

| | |
|---|---|
| 3256666 | Climax 800XH stick grease for standard service (32°F to 250°F) |
| 3251968 | Climax 8204M stick grease for low temperature service (-50°F to 200°F) |
| P540648 | Optional Val-Tex stick grease, standard service (-20°F to 600°F) |
| P540720 | Optional Val-Tex stick grease, low temperature service (-50°F to 375°F) |

**WARNING**

**Mismatched hammer union connections and components result in hazardous assemblies that can fail under pressure causing serious personal injury, death, and/or property damage. For information on make-up/break-out of hammer unions, including a copy of FMC Fluid Control Safety and Technical Alert, Avoiding the Dangers of Mismatching Hammer Unions, call 1-800-772-8582 or visit www.fmcfluidcontrol.com**

**NOTE**

**FMC Fluid Control cannot anticipate all of the situations a user may encounter while installing and using FMC Fluid Control products. Therefore, the user of FMC Fluid Control products MUST know and follow all applicable industry specifications on the safe installation and use of these products. Refer to FMC Fluid Control product catalogs, product brochures and installation, operating and maintenance manuals for additional product safety information or contact FMC Fluid Control at 800/772-8582 or visit our web site at www.fmcfluidcontrol.com**

## 3.6 Repair Kit Bill Of Material

Table 4: Repair Kit Bills of Material (see Figure 1 for item numbers)

| Item No. | Part Name | Qty | 2" ULT50<br>2" ULT100<br>2" ULT150 | 2" ULT 50<br>2" ULT150<br>Sour Gas | $1^1/_2$" ULT150<br>2" ULT200 | 2" ULT200<br>Sour Gas |
|---|---|---|---|---|---|---|
| | Repair Kit | | P538985 | P543731 | CF | CF |
| 1(1) | Grease Fitting | 1 | 3226457 | 3262409 | CF | CF |
| 2 | Lock Nut, Hex | 1 | 3226656 | 3226656 | CF | CF |
| 3 (1) | Plug Cap | 1 | P533920 | P533920 | CF | CF |
| 4 | Grease Retainer Ring | 1 | P534583 | P534583 | CF | CF |
| 5 (1) | Body Cap | 1 | P533865 | P543329 | CF | CF |
| 6 | O-Ring for Body Cap | 1 | 3226706 | 3233599 | CF | CF |
| 7 | O-Ring for Plug | 2 | 3217008 | 3237995 | CF | CF |
| 8 | Nylon Backup Ring | 2 | 3217010 | 3217010 | CF | CF |
| 9 | Plug | 1 | P533856 | P533856 | CF | CF |
| 10 | Seal Segment | 2 | P534062 | P543331 | CF | CF |
| 11 | Side Segment | 2 | P534571 | P534571 | CF | CF |
| 12 | Inner Seal | 2 | P534581 | P543335 | CF | CF |
| 13 | Outer Seal | 2 | P534582 | P543334 | CF | CF |

(1) Not included in repair kit CF = Consult factory

# 4.0 Storage Instructions

When not in use, the valve and repair kits should be stored in an area that protects it from sun, rain, sand, and other debris. Before storing the valve, ensure that the operating fluids have been removed by flushing with water. After cleaning, fully drain all fluids from the valve and spray the valve with a water displacing lubricant such as a Teflon / oil mix. Spray inside both flow bores as far into the valve as possible. Also spray the threads of the union ends. During long-term storage keep the valve dry and painted to prevent corrosion.