

**OPERATION AND MAINTENANCE MANUAL, 2 INCH FIGURE 1502  
1000-15000 PSI PRESSURE RELIEF VALVE**

Rev	ECN No.	Date	Reviewed By	Approved By	Status
C	5016425	08-SEP-2006	Stroebe, Brent	Douglas, Don	RELEASED

**Summary:**

This Operation and Maintenance Manual covers operating procedures as well as assembly and disassembly procedures for the 2" Figure 1502 1,000 to 15,000 psi Pressure Relief Valve.

## Table of Contents

Section	Title	Page
1.0	Introduction and Product Explanation .....	6
2.0	Recommended Operating Practices.....	6
3.0	Disassembly Procedure.....	8
4.0	Inspection of Disassembled Components.....	9
5.0	Assembly Procedure .....	10
6.0	Setting and Adjusting Operating Pressures .....	12
7.0	Kits Available.....	13
8.0	Hazardous Conditions .....	13

---

## List of Tables

---

<b>Tables</b>	<b>Page</b>
Table 1: 2" FIG 1502 1,000 to 15,000 psi Pressure Relief Valve Components.....	5
Table 2: Pressure Relief Valve Kits .....	13
Table 3: Hazardous Conditions and the Means to Avoid the Hazard.....	13

---

---

## List of Figures

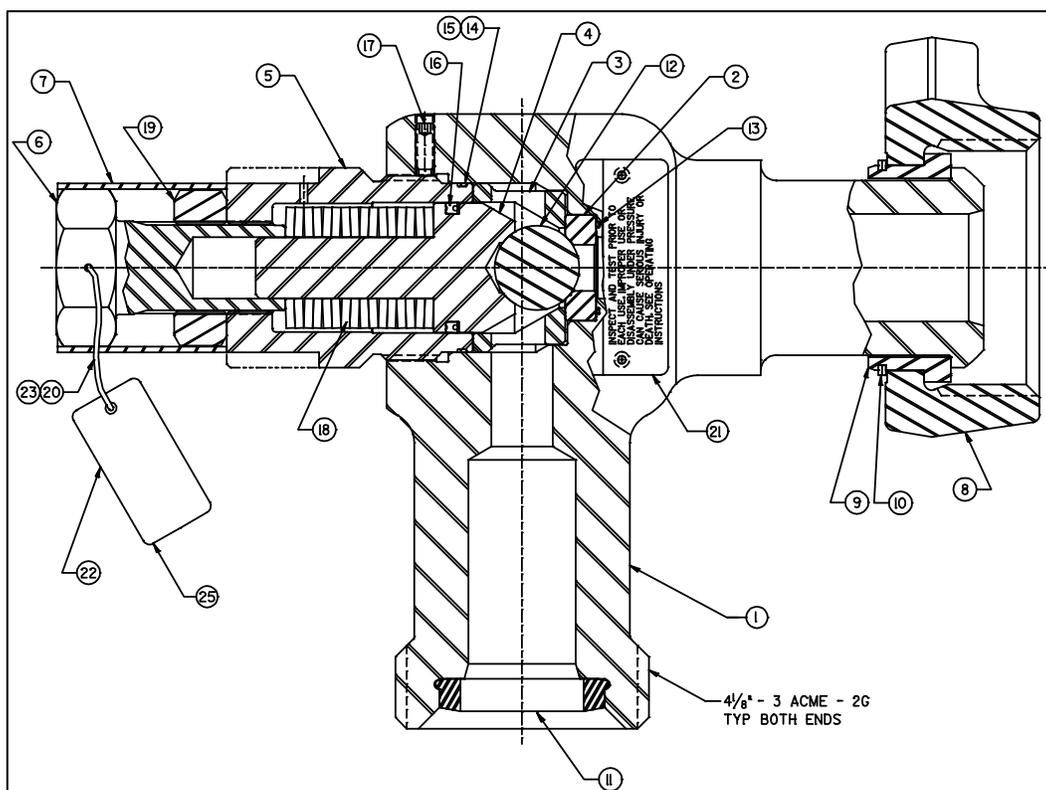
---

<b>Figures</b>	<b>Page</b>
Figure 1: 2" FIG 1502 1,000 to 15,000 psi Pressure Relief Valve.....	5
Figure 2: Spring Configurations.....	11

---

**Table 1: 2" FIG 1502 1,000 to 15,000 psi Pressure Relief Valve Components**

1	BODY:	13	O-RING:
2	SEAT:	14	O-RING:
3	SPACER BOWL:	15	BACK-UP RING:
4	BALL KEEPER:	16	SEAL:
5	BODY CAP:	17	SCREW:
6	ADJUSTMENT SCREW:	18	SPRING:
7	PRESET SLEEVE:	19	NUT:
8	DETACHABLE NUT:	20	WIRE:
9	RETAINER SEGMENT:	21	WARNING LABEL:
10	RETAINER RING:	22	FACTORY SETTING PRESSURE LABEL:
11	SEAL RING:	23	SLEEVE:
12	BALL:	24	NAMEPLATE: (not shown)
		25	LABEL: F/VALVES FACTORY SET <5KSI



**Figure 1: 2" FIG 1502 1,000 to 15,000 psi Pressure Relief Valve**

# OPERATION AND MAINTENANCE MANUAL

## 1.0 Introduction and Product Explanation

The FMC 2" Figure 1502 1,000 to 15,000 psi pressure relief valve is a direct acting, self reseating valve. The relieving mechanism is a spring loaded ball and seat arrangement and will relieve fluid at pressures up to 15,000 psi. An adjustment screw at the top of the valve allows the relieving pressure to be adjusted from 1,000 to 5,000 psi or 5,000 to 15,000 psi based on the spring configuration and number of springs. The valve can be preset at the factory or adjusted in the field. The integral end connections for the valve are FMC WECO Figure 1502, wing union connections.



The valve is not designed to open fully when the set pressure is reached, but only to alert the user that the set pressure has been achieved.

### NOTE



If the factory setting pressure is not specified at the time of order placement, the valve will be factory set at 15,000 psi. It then becomes the users responsibility to assure that the valve is set at the required relief pressure setting before use.

### NOTE

## 2.0 Recommended Operating Practices

### Installation and Maintenance Requirements

The FMC relief valve should be mounted in the vertical position on a branch of the high pressure line. Mounting the valve vertically will reduce the likelihood of any contaminants settling inside the valve, thus, reducing the chance that the valve will remain open and leak after it has relieved. To assure that the valve will continuously reseal after relieving, one should only relieve liquids that do not contain large suspended particles. Fluids that contain large particles, such as proppants, should be isolated from the valve using an isolator valve between the pressure line and the relief valve.

When installing a relief valve, the following standard practices should be used:

1. Lubricate the connector threads prior to initial make-up.
2. Inspect the seal ring (item #11) prior to each installation.
3. Assure that the end connections are made up fully and tight before pressurization.
4. Assure that all pressure is bled from the line before loosening any end connections.
5. Insure the valve or the attached discharge plumbing is positioned with the discharge pointing away from personnel and equipment.
6. Insure that there are no restrictions in the discharge piping.
7. Make sure the pressure setting is correct on the relief valve for the application.

## 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 warnings could result in serious injury or death!**

1. The valve is not designed to open fully when the set pressure is reached. When the set pressure is achieved, fluid will start to weep past the ball and seat interface alerting the user. If there is sufficient fluid volume present in the line, the pressure will continue to rise and other measures must be taken to prevent the pressure from increasing.
2. The rated working pressure is not to be exceeded during field service or field testing.
3. Standard service relief valves are not intended for use in a sour gas (H<sub>2</sub>S) environment. Contact your FMC representative for information regarding valves for this type of service.
4. Assemblies consisting of components with different pressure ratings are always limited to the lowest rating given on any individual component.

5. Union parts that are for the same type of service and exhibit the same figure numbers are interchangeable. Mixing parts with different figure numbers and/or different service conditions is hazardous and can cause wing union failure.
6. Substituting parts other than original FMC parts voids pressure ratings and is at the users risk.
7. When tightening union nuts, personnel must wear suitable eye protection to protect against metal fragments that may be loosened from the surfaces of the nut or hammer.
8. Use of excessive hammering force or over tightening can damage wing unions and must be avoided.
9. Never hammer on a pressurized union connection.
10. Do not adjust relief pressure with the valve in service.
11. Inspect and test prior to each use. Improper use or disassembly under pressure can cause serious injury or death.

### **Inspection Requirements**

Periodic inspection of the relief valve is required to verify the condition of the assembly. Initially, it is recommended that the valve be broken down and internally inspected after each relief occurrence. This will allow the user to establish an inspection program that best fits their needs. The purpose of the inspection is to detect erosional and/or corrosional loss of wall thickness in the body and the outlet hubs.

If the valve is exposed to the environment for long periods of time, or is continuously placed in pressure relief situations, it is possible that the relief pressure could change slightly. To assure that the valve relieves at the correct pressure, it is recommended that the relief pressure be tested prior to each use.

It is important to inspect the valve for leakage while in service. If any leakage is detected from the valve, it should be taken out of service immediately and rebuilt.

## **3.0 Disassembly Procedure**

For this disassembly procedure, refer to Table 1 and Figure 1 for item numbers and part descriptions.

1. Secure the body (item #1) of the relief valve in a vise. Secure it in a manner that will provide access to the body cap and adjustment screw.
2. Remove the set screw (item #17) from the side of the body.
3. Remove the wire rope and preset sleeve (items #20 & #7).
4. Loosen the jam nut (item #19) and remove the adjustment screw (item #6) from the body cap (item #5).

5. Remove the body cap from the body. The springs (item #18) and the keeper (item #4) should come out with the cap when it is removed from the body.
6. Remove the ball (item #12) and bowl (item #3) from the body.
7. Remove the seat (item #2).
8. Remove the o-ring (item #13) from the body cavity.
9. Remove the keeper from the body cap.
10. Remove the springs from the keeper.

## 4.0 Inspection of Disassembled Components

### 1. Body (Item #1)

Visually inspect all threads for signs of damage, corrosion, or wear. If body threads are less than full height, or the mating threads will not engage without forcing, replace the body.

Visually inspect the o-ring groove at the bottom of the body cavity and the body cap o-ring sealing diameter. If either one of these areas has been excessively damaged due to erosion or corrosion, replace the body. Note: The body can not be repaired.

Visually inspect the fluid discharge area on the inside of the body cavity for signs of erosion or corrosion damage. If any location on the inner diameter of the body has damage in excess of .060" deep, the body must be replaced.

Visually inspect the union end connections. If excessive damage has occurred, replace the body.

### 2. Body Cap (Item #5)

Visually inspect all threads, the o-ring groove, and the keeper sealing diameter for signs of damage. If excessive damage exists, replace the cap.

### 3. Ball Keeper (Item #4)

Visually inspect the outer profile of the keeper for any signs of damage. If any location on the keeper is damaged to a point that would inhibit it from functioning properly, replace the keeper.

### 4. Ball Seat (Item #2)

Inspect both the 50° seal surface on the top of the seat and the o-ring sealing surface on the bottom side of the seat. If damage has occurred which could prevent the seat from functioning properly, the seat should be replaced.

### 5. Ball (Item #12)

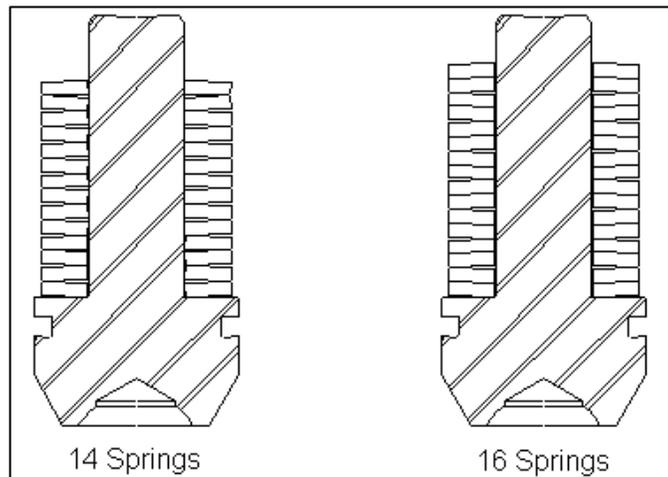
- Inspect the ball for any signs of wear or erosive damage. If damage exists, replace the ball.
6. Spacer Bowl (Item #3)  
Visually inspect the fluid discharge areas on the bowl for any signs of erosion or corrosion. If any damage exist which is deeper that .060", the bowl should be replaced.
  7. Disk Springs (Item #18)  
Inspect the springs for any signs of wear, cracks, or corrosive damage, which might prevent them from functioning properly. If any damage is present, replace the springs.
  8. Seals (Items #11, 13, 14, 15 and 16)  
Replace all seals upon disassembly of the relief valve.
  9. Adjustment Screw (Item #6)  
Inspect the threads on the adjustment screw. Thread the screw into the cap. If the threading action is not smooth and easy, replace the screw.
  10. Jam Nut (Item #19)  
Inspect the threads on the nut. Thread the nut onto the adjustment screw. If the threading action is not smooth and easy, replace the nut.

## 5.0 Assembly Procedure

For this assembly procedure, refer to Table 1 and Figure 1 for item numbers and part descriptions.

1. Place the body (item #1) in a vise. The body cavity should be visible when looking down on top of the valve.
2. Lubricate with Lubriplate<sup>®</sup> Hi Temp grease and install the seat seal o-ring (item #13) into the o-ring groove in the body.
3. With the 50° sealing surface facing upward, place the seat (item #2) into the body. The seat should sit on top of the o-ring.
4. Place the spacer bowl (item #3) inside the body, on top of the seat. The bowl should be touching the seat when it is fully landed.
5. Place the ball (item #12) inside the bowl.
6. Lubricate with Lubriplate<sup>®</sup> Hi Temp grease and install the keeper seal (item #16) onto the keeper (item #4). The o-ring inside the seal assembly should be pointed toward the tapered end of the keeper.

7. Apply copper seal to the faces of each spring (item #18) and place them over the stem of the keeper. For the 1,000 to 5,000 psi valve, 14 springs are required. Beginning with the inner diameter of the first spring touching the keeper (concave side up), alternate the direction of every spring. When finished stacking up the springs, the inner diameter of the last spring should be on top (concave side down). For the 5,000 to 15,000 psi valve, 16 springs are required. Beginning with the inner diameter of the first spring touching the keeper (concave side up), alternate the direction of every other spring. When finished stacking up the springs, there should be eight sets of two springs stacked in parallel. Refer to Figure 2.



**Figure 2: Spring Configurations**

8. Once all the springs have been positioned correctly on the keeper, liberally grease the outer diameter of all the springs and the outer diameter of the keeper.
9. Insert the keeper, stem first, into the body cap (item #5).
10. Lubricate with Lubriplate<sup>®</sup> Hi Temp grease and install the body cap o-ring and backup ring (items #14 and 15) into the groove at the lower end of the body cap. The back up ring is located between the o-ring and the outer body cap threads.
11. Grease both the body cap acme threads and the body threads with anti seize lubricant.
12. Thread the cap into the body until it is fully shouldered. Using a 36" wrench, apply a preload to the cap, bowl, and seat by shouldering the cap against the bowl in a quick snapping manner (equivalent to 200-300 foot pounds of torque).



If specified torque is not applied, the body to seat o-ring may extrude and cause the valve to leak.

**NOTE**

13. Lubricate with Lubriplate<sup>®</sup> Hi Temp grease and install the brass tipped set screw (item #17) in the side of the body. Make sure the screw is securely tightened.
14. Thread the jam nut (item #19) completely onto the adjustment screw (item #6).
15. Apply anti seize to the adjustment screw threads and screw into the body cap until the screw touches the springs.
16. Thread the jam nut down the adjustment screw until the nut is fully landed on the valve cap.

## 6.0 Setting and Adjusting Operating Pressures

1. Secure the body of the valve assembly in a vise or clamp. Position the valve so that the inlet is pointing slightly downward and the outlet is pointing upward.
2. Set the relief pressure of the valve to the lowest amount possible by rotating the adjustment screw counterclockwise (out of the body cap). Rotating the screw counterclockwise will remove preload from the springs in the valve.
3. Using a high pressure low volume liquid pump, purge all air from the valve by flowing through the valve.



Before attempting to set the valve, make sure all air has been purged from the valve.

**NOTE**

4. After all air has been purged from the valve, turn the pump off and set the relief pressure by rotating the adjustment screw clockwise (into the body cap). If the set pressure is 15,000 psi, the number of turns required by the adjustment screw should be a maximum of 2 2/3 turns.

5. Using the low volume liquid pump, apply pressure to the valve to determine at what pressure the valve will relieve. If the valve relieves at the wrong pressure, turn the pump off, bleed pressure from the line, adjust the adjustment screw, and retest the valve.
6. Once the correct relief pressure is obtained, bleed all pressure from the high pressure line and tighten the jam nut. Reinstall the preset cable wire rope and preset label with correct pressure setting.
7. The valve is now ready for service.

## 7.0 Kits Available

There are three types of kits available for servicing the 2" Fig. 1502 Pressure Relief Valves. The kits are listed below in Table 3.

**Table 2: Pressure Relief Valve Kits**

	Spring Kit	Repair Kit	Elastomer Set
2" Fig. 1502 Standard	3267383	3267382	3267328
2" Fig. 1502 Sour	3267383	P504649	P504648

## 8.0 Hazardous Conditions



**WARNING**

The following table contains hazardous conditions and the means to avoid the hazard. Failure to avoid these conditions may result in severe property damage, serious injury, or death.

**Table 3: Hazardous Conditions and the Means to Avoid the Hazard**

<u>Hazardous Conditions</u>	<u>Means to Avoid Hazard</u>
<p>*Use of incompatible end connections on mating, piping, or equipment may result in catastrophic failure of the connection at pressures far below the rated working pressure of the relief valve.</p> <p>*Mating end components not manufactured by FMC or its licensees may result in catastrophic failure of the connections at pressures far below the rated working pressure of the FMC component.</p> <p>*Use of relief valves at pressures above the rated working pressure will result in</p>	<p>*Examine the end connections for identification markings to ensure that they are identical. If not identical, do not use; consult the factory.</p> <p>*Carefully examine all components for FMC identification marking. FMC Corporation cannot assure compatibility or performance of components not made by FMC.</p> <p>*Include rated working pressure limitations in written operating procedures</p>

<p>accelerated deterioration of the internal components and possible catastrophic failure of the valve.</p> <p>*Uncontrollable hazardous conditions may result from the use of eroded, corroded, worn, or “second hand” relief valves, or the modification of the valve by welding, machining, plating, heating, or substitution of components not made by FMC or its licensees.</p> <p>*Use of the relief valve after initial leakage has been detected may result in contaminated springs, external leakage of hazardous fluids, inaccurate relieving pressures, and possible over pressuring of the valve.</p>	<p>and train operators in the use of the procedures.</p> <p>*Used or worn Relief Valve components must be destroyed to prevent inadvertent or intentional reuse and potential injury to subsequent users. An inspection program must be initiated.</p> <p>*Inspect Relief Valves for signs of leakage. Immediately discontinue use and maintain per maintenance procedures if leakage is detected.</p>
---	--