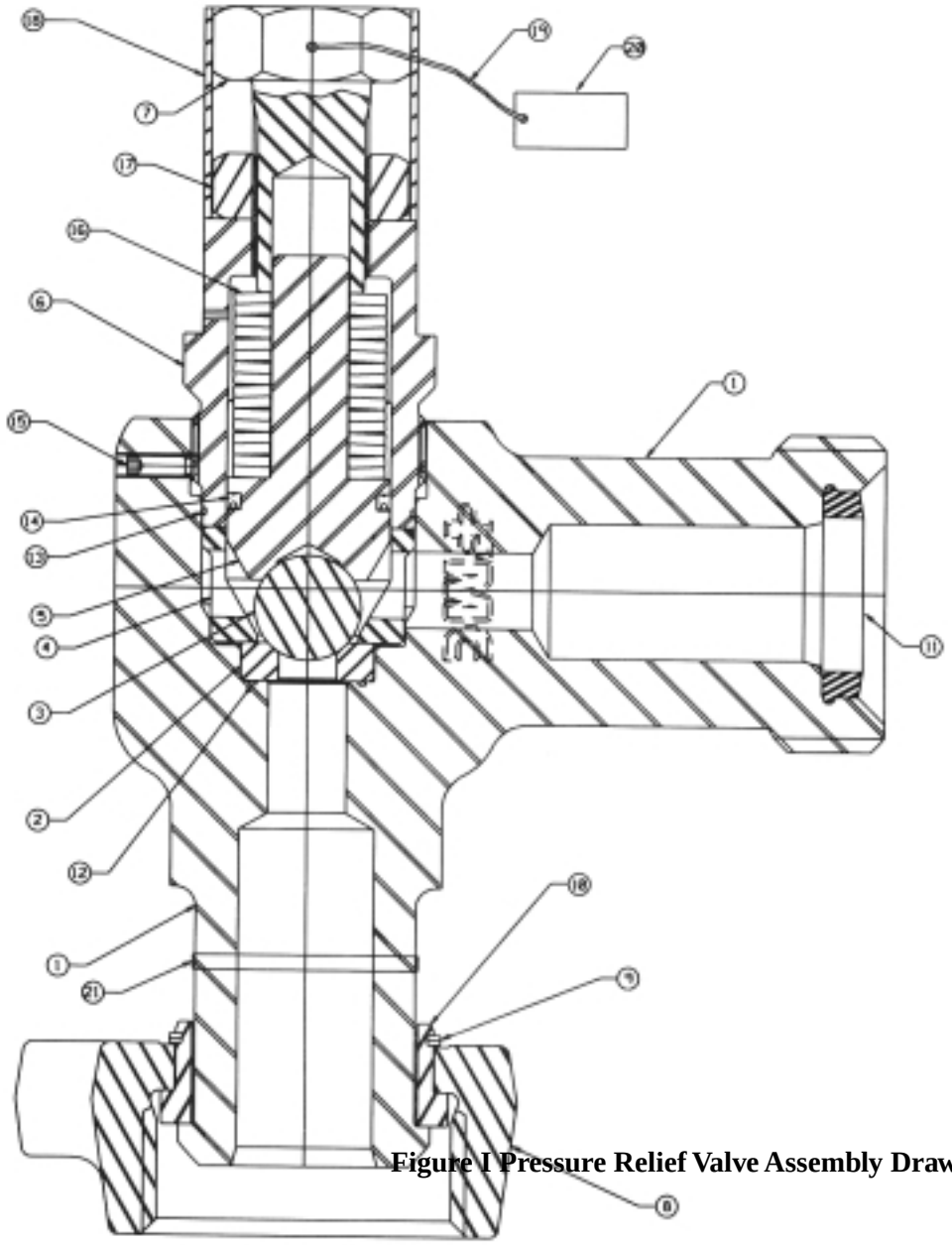
FMC Fluid Control Division

2-inch, 15,000 PSI PRESSURE RELIEF VALVE

OPERATING PROCEDURES

Revised: January 16, 1995

FMC EnergySystems



ITEM	QTY	DESCRIPTION
1	1	BODY:
2	1	BALL SEAT:
3	1	BALL:
4	1	SPACER BOWL:
5	1	BALL KEEPER:
6	1	BODY CAP:
7	1	ADJUSTMENT SCREW:
8	1	DETACHABLE NUT:
9	1	RETAINER RING:
10	3	RETAINER SEGMENT:
11	1	SEAL RING:
12	1	O-RING:
13	1	O-RING & BACK-UP RING:
14	1	STANDARD POLYPAK:
15	1	SOC. SET SCREW:
16	16	BELLEVILLE SPRING:
17	1	HEX JAM NUT:
18	1	PRESSURE PRESET SLEEVE:
19	1	WIRE ROPE:
20	1	PRESET LABEL:
21	1	WARNING LABEL:

Figure I Pressure Relief Valve Assembly Drawing

1.0 INTRODUCTION AND PRODUCT EXPLANATION

The FMC pressure relief valve is a direct acting, self reseating valve. The relieving mechanism is spring loaded ball and seat arrangement and will relieve any fluid at pressures up to 15,000 PSI. An adjustment nut at the top of the valve allows the relieving pressure to be adjusted from 5,000 PSI to 15,000 PSI. 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.

Note: if 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.

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 valve or that 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.

⚠ WARNING:

1. THE RATED WORKING PRESSURE IS NOT TO BE EXCEEDED DURING FIELD SERVICE OR FIELD TESTING.

2. STANDARD SERVICE RELIEF VALVES ARE NOT INTENDED FOR USE IN A SOUR GAS (H2S) ENVIRONMENT. CONTACT YOUR FMC REPRESENTATIVE FOR INFORMATION REGARDING VALVES FOR THIS TYPE OF SERVICE.

3. ASSEMBLIES CONSISTING OF COMPONENTS WITH DIFFERENT PRESSURE RATINGS ARE ALWAYS LIMITED TO THE LOWEST RATING GIVEN ON ANY INDIVIDUAL COMPONENT.

4. 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.

5. SUBSTITUTING PARTS OTHER THAN ORIGINAL FMC PARTS VOIDS PRESSURE RATINGS AND IS AT USERS RISK.

6. 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.

7. USE OF EXCESSIVE HAMMERING FORCE OR OVER TIGHTENING CAN DAMAGE WING UNIONS AND MUST BE AVOIDED.

8. NEVER HAMMER ON A PRESSURIZED UNION CONNECTION.

9. DO NOT ADJUST RELIEF PRESSURE WITH THE VALVE IN SERVICE.

10. 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 Figure I for item numbers and part descriptions.

1 . Secure the body (item #I) 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 # 15) from the side of the body.

3. Remove the wire rope and preset sleeve (item #18 & #19).

4. Loosen the jam nut (item # 17) and remove the adjustment screw (item #7) from the body cap (item #6).

5. Remove the body cap from the body. The springs (item #16) and the keeper (item #5) should come out with the cap when it is removed from the body.

6. Remove the ball (item #3) and bowl (item #4) from the body.

7. Remove the seat (item #2).

8. Remove the 0-ring (item # 12) from the body cavity.

9. Remove the keeper from the body cap by first screwing the adjustment screw out of the cap. The keeper can then be removed.

10. Remove the springs from the keeper.

4.0 INSPECTION OF DISASSEMBLED COMPONENTS

1. Body Inspection (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 0-ring groove at the bottom of the body cavity and the body cap 0-ring sealing diameter. if either one of these areas has been excessively damaged due to erosion or corrosion, replace 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 body.

2. Body Cap (Item #6)

   Visually inspect all threads, the 0-ring groove, and the keeper sealing diameter for signs of damage. if excessive damage exists, replace cap.

3. Keeper (Item #5)

   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 keeper.

4. Ball Seat (Item #2)

   Inspect both the 50" seal surface on the top of the seat and the 0-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 #3)

   Inspect ball for any signs of wear or erosive damage. if damage exists, replace ball.

6. Spacer Bowl (Item #4)

   Visually inspect the fluid discharge areas on the bowl for any signs of erosion or corrosion. If any damage exists which is deeper than .060", the bowl should be replaced.

7. Disk Springs (Item #16)

   Inspect springs for any signs of wear, cracks, or corrosive damage which might prevent them from functioning properly. If any damage is present, replace springs.

8. Seals (Items #11, 12, 13 and 14)

   Replace all seals upon disassembly of the relief valve.

9. Adjustment Screw (Item #7)

   Inspect the threads on the adjustment screw. Thread the screw into the cap. If the threading action is not smooth and easy, replace screw.

10. Jam Nut (Item #17)

    Inspect the threads on the nut. Thread the nut onto the adjustment screw. If the threading action is not smooth and easy, replace nut.

5.0 ASSEMBLY PROCEDURE

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

1. Place body (item #1) in a vise. The body cavity should be visible when looking down on top of the valve.

2. Lubricate with Lubriplate® Hi Temp grease and install the seat seal 0-ring (item # 12) into the 0-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 0-ring (item # 12).

4. Place the spacer bowl (item #4) inside the body, on top of the seat. The bowl should be touching the seat when it is fully landed.

5. Place ball (item #3) inside the bowl.

6. Lubricate with Lubriplate® Hi Temp grease and install the keeper seal (item #14) onto the keeper (item #5). 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 #16) and place them over the stem of the keeper. Beginning with the inner diameter of the first spring touching the keeper, alternate the direction of every other spring. When finished stacking up the springs there should be eight sets of two springs stacked in parallel. See Figure 2.

8. Once all springs have been positioned correctly on the keeper, liberally grease the outer diameter of all springs and the outer diameter of the keeper.

9. Insert the keeper, stem first, into the body cap (item #6).

10. Lubricate with Lubriplate® Hi Temp grease and install the body cap 0-ring and backup ring (item 13) 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 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). **NOTE: If specified torque is not applied, the body to seat 0-ring may extrude and cause the valve to leak.**

13. Lubricate with Lubriplate® Hi Temp grease and install the brass tipped set screw (item #IS) in the side of the body. Make sure the screw is securely tightened.

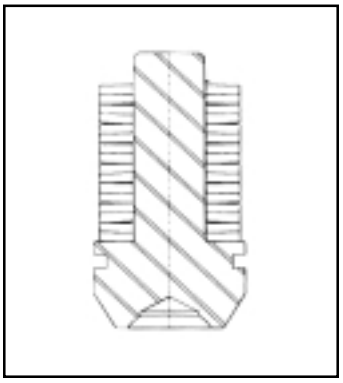


Figure 2 Spring Configuration

14. Thread the jam nut (item #17) completely onto the adjusting screw (item #7).

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.

NOTE: BEFORE ATTEMPTING TO SET VALVE, MAKE SURE ALL AIR HAS BEEN PURGED FROM THE VALVE.

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 adjustment screw should be a maximum of 2 2/3 turns.

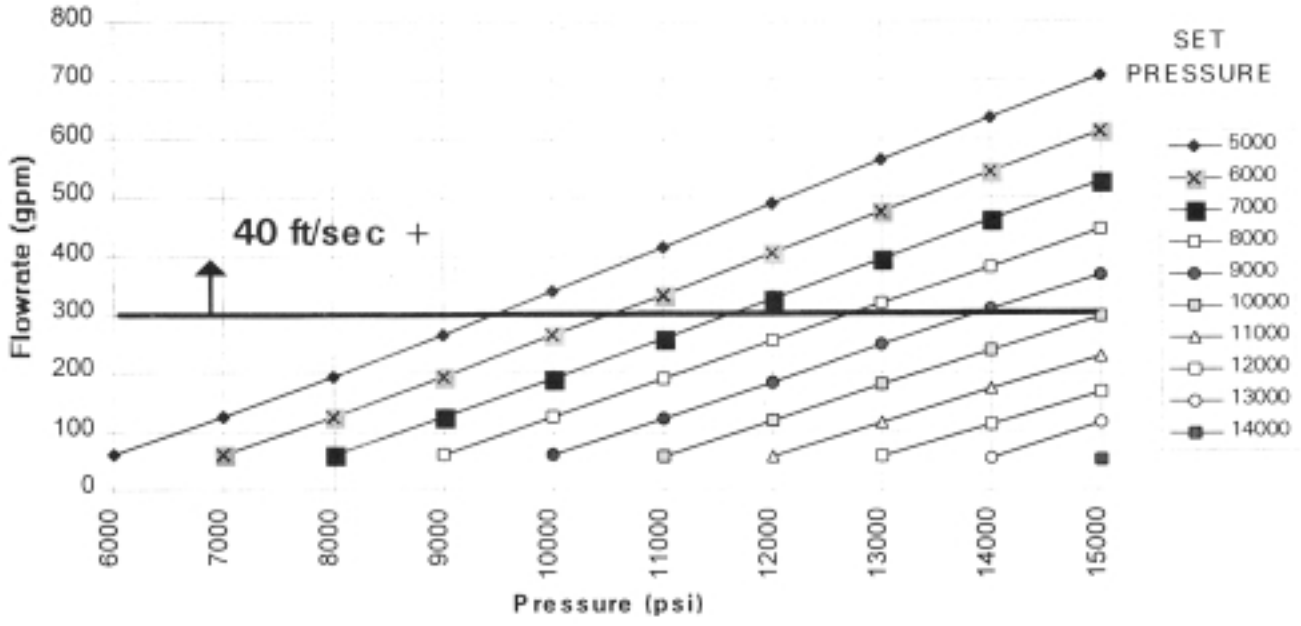
5. Using the low volume liquid pump, apply pressure to the valve to determine at what pressure the valve will relieve. If the valve relieves at the wrong pressure, turn the pump off, bleed pressure from the line, adjust the adjustment screw, and retest the valve.

7. Once the correct relief pressure is obtained, bleed all pressure from the high pressure line and tighten the jam nut. Reinstall preset cable wire rope and preset label with correct pressure setting.

8. The valve is now ready for service.

9. See the following figure for estimated relief valve flow characteristics.

2" RELIEF VALVE FLOW CHARACTERISTICS



Note: This Chart shows the flow rates for different set pressures and input pressures. The flow rate limit is 40 Ft.sec or 300 GPM per API.

HAZARDOUS CONDITIONS

⚠ **WARNING: Following is a list of hazardous conditions which, if not avoided as indicated, may result in severe property damage, serious injury or death.**

Hazardous Conditions	Means to Avoid Hazard
* 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.	* Examine the end connections for identification markings to ensure that they are identical. If not identical, do not use; consult the factory.
* 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.	* Carefully examine all components for FMC identification marking. FMC Corporation cannot assure compatibility or performance of components not made by FMC.
* Use of relief valves at pressures above the rated working pressure will result in accelerated deterioration of the internal components and possible catastrophic failure of the valve.	* Include rated working pressure limitations in written operating procedures and train operators in the use of the procedures.
* 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.	* 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.
* 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.	* Inspect Relief Valves for signs of leakage. Immediately discontinue use and maintain per maintenance procedures if leakage is detected.

FMC EnergySystems

FMC Corporation
Fluid Control Division
Web: www.fmcenergysystems.com
Email: fluid_control@fmc.com

Fluid Control Headquarters
FMC Fluid Control
6677 North Gessner Road
Houston, TX 77040
Phone: (1) 713/510-6800
Fax: (1) 713/510-6803

Manufacturing Facility
FMC Fluid Control
2825 West Washington
P.O. Box 1377
Stephenville, TX 76401
Toll Free: 800/772-8582 (U.S.)
Phone: (1) 254/968-2181
Fax: (1) 254/968-5709

Eastern
FMC Fluid Control
130 St. Nazaire Road
Broussard, LA 70518
P.O. Box 3091
Lafayette, LA 70505
Phone: (1) 318/837-9263
Fax: (1) 318/837-5844

Western
FMC Fluid Control
1675 Broadway, Suite 1800
Denver, CO 80202
Phone: (1) 303/623-4622
Fax: (1) 303/623-7347

West Texas
FMC Fluid Control
3500 West County Road North
Odessa, TX 79764
Phone: (1) 915/550-2084
FAX: (1) 915/366-8538

Scotland
FMC Corporation (U.K.) Ltd.
Fluid Control
Wellington Road Industrial Park
Wellington Circle
Aberdeen AB12 3JG, Scotland
Phone: 011 + 44 + 1224/898-555
Fax: 011 + 44 + 1224/249-460

Singapore
FMC South East Asia Pte. Ltd.
149 Gul Circle
Singapore 629605
Phone: 011 + 65/ 862-3659
Fax: 011 + 65/ 861-8251

United Arab Emirates
FMC International S.A.
Al Moosa Tower, 17th Floor
Box 3228
Dubai, United Arab Emirates
Phone: 011 + 971 + 4/310-948
Fax: 011 + 971 + 4/310-950

Mexico
FMC Equipo Petrolero S.A. de C.V.
Carretera a Buena Vista km. 2.8
Ranchería Miguel Hidalgo
Villahermosa, Tabasco, Mexico
Phone: 011 + 52 + 93/50-0123
Fax: 011 + 52 + 93/50-1661

Venezuela
FMC Services and Supplies Occidente, S.A.
Fluid Control Division
Avenida Intercomunal
Diagonal Carretera "L"
Sector Los Morochas, #202
Cludad Ojeda Edo Zulia, Venezuela
Phone: 011 + 58 + 65-26901
Fax: 011 + 58 + 65-23406

Printed in U.S.A., 1-95