

SKOFLO

Pressure Independent
Flow Controller



SkoFlo Valve Model SF15000NMFB

OPERATION AND MAINTENANCE INSTRUCTIONS

SKOFLO INDUSTRIES INC.

SkoFlo Valve Model SF15000NMFB

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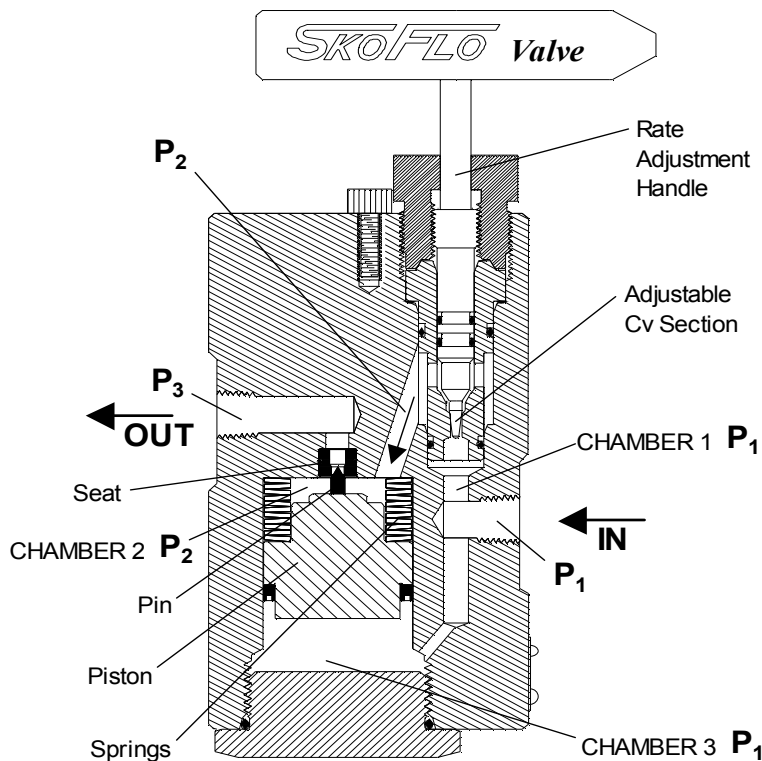
INSTALLATION PROCEDURES:

1. Install valve so that the flow is in the proper direction. The "IN" connection and the "OUT" connection are MP20000 connections for 3/4" tubing, and are marked respectively.
2. Install an inline filter in the system. Generally, this is located upstream of the pump. Clean chemical and proper filtering is very important. A 200 micron size filter is recommended.

START UP PROCEDURES:

1. Open the supply isolation valve to the flow controllerslowly.
2. Turn the rate adjustment handle until you are at the desired flow rate
3. The flow controller is now set and further adjustments are not required.

PRINCIPLE OF OPERATION

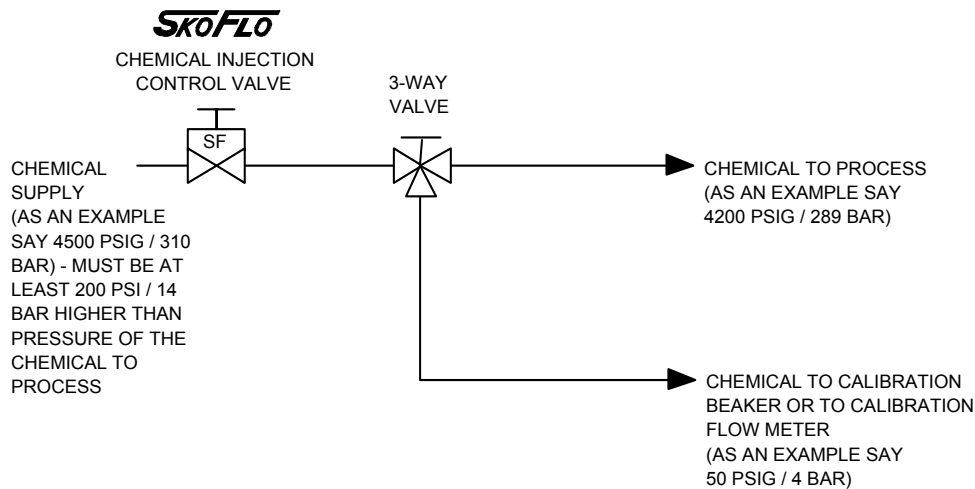


The SkoFlo valve is a pressure independent flow control valve used in the petroleum industry to accurately inject chemicals. The valve consists of a body, a base plate that is bolted to the body, and a flow rate adjustment handle.

The principle of operation of the Model SF15000NMF SkoFlo valve is that it internally maintains a constant differential pressure across an adjustable Cv section, thus resulting in a constant flow through that Cv section. The piston/spring assembly utilizes system pressure to adjust the internal pin and seat Cv section, which then sets a constant differential pressure across the adjustable Cv section, thus maintaining a constant flow. Flow rate changes through the valve can only be made by adjusting the rate adjustment handle.

Fluid enters the valve inlet at pressure P_1 and flows into chamber 1. It then flows through the adjustable Cv section into chamber 2 where the piston and springs are located. These springs put a force against the piston based on how much the springs are deflected. The spring force against the piston is set by the differential pressure between P_1 in chamber 3 and P_2 in chamber 2. This pressure balance establishes the pressure P_2 in chamber 2 at a fixed differential from P_1 . Flow then exits the valve at pressure P_3 after passing through the seat. The flow through the seat is held back by the pin that mates with the seat. As the pressure in chamber 2 changes, either as a result of a change in P_1 or a change in P_3 , the pin moves in relation to the seat and controls pressure P_2 . As soon as equilibrium flow through the valve is established, the flow rate will remain constant even when pressures upstream and/or downstream of the valve change.

ADJUSTMENT AND CALIBRATION:



The SkoFlo Valve is a pressure independent flow control valve. Once the valve is set at a desired flow rate, that flow rate is maintained even though the pressure conditions upstream and/or downstream of the valve may change considerably.

The standard Multi-Point SkoFlo valve is set by manually adjusting the rate adjustment handle. When the desired flow rate is set, the valve needs no further adjustment, and the valve remains at that fixed flow rate until the rate adjustment handle is turned to a new setting.

The flow rate can be set using a flow meter in the line to the process. However, a flow meter in this line must be capable of withstanding the process pressure. This normally limits the availability of this type flow meter.

The most common method of calibrating the SkoFlo Valve is with a 3-way valve and a line to a calibration beaker or to a low pressure flow meter. Once the flow rate is set, the 3-way valve is switched to direct the chemical to the process.

Since the SkoFlo Valve flows at the set rate independent of the pressure differential across the SkoFlo Valve, the flow rate to the process is the same as the flow rate set using the beaker or flow meter. Overall monitoring of the flows is done by taking inventory of the usage from the supply tank.

In the above example, the SkoFlo Valve is set with a differential pressure of 4450 psi / 306 bar across the valve. The flow rate set will remain the same when the chemical is routed to process and the SkoFlo Valve has a differential pressure of 300 psi / 21 bar. Note that the SkoFlo valve should not be operated continuously at differential pressures above 3000 psi / 207 bar.

OPERATION NOTES AND WARNINGS:

1. The SkoFlo valve has hard seats and is not designed to provide complete "bubble-tight" shut off. Separate isolation valves should be used for shutting off the flow. **Overtightening the handle could cause damage to the stem section.** If flow rate does not decrease when turning the handle in, see "Trouble Shooting Improper Valve Performance".
2. The model SF15000NMF valve should not be operated at flow rates below 0.2 gpm. Lower rates can cause excessive pressure drops in the stem section.
3. Operating valve with continuous differential pressures above 3000 psi / 207 bar may cause premature internal wear and must be avoided.
4. The SkoFlo Valve is designed for flow in one direction only. Do not flow backwards through the SkoFlo valve. Some internal seals are designed for one direction only and could possibly become dislodged. The valve will not control flow in the reverse direction. Flow Control Industries recommends installation of a check valve in the outlet line from the SkoFlo valve (see "Multi-Point System Sample Schematic") to avoid reverse flow of process fluids into the chemical system.
5. When lifting the SkoFlo valve, lift from the base. Do not lift using the handle as this can damage the handle.

MAINTENANCE:

1. **Replacing Seals:** When replacing valve seals, it is recommended that the Piston Seal Installer Tool (P/N SF15000N-T1) be used.
 - A. Remove SkoFlo valve from system.
 - B. Remove the adjustment handle retainer lock bolt. Remove the retainer lock plate. Unscrew the stem retainer and pull the rate adjustment handle out of the body.
 - C. Pull out the needle trim using a hooked probe or similar device. Use care to avoid damage to the internal surfaces of the SkoFlo valve. (See Figure I).

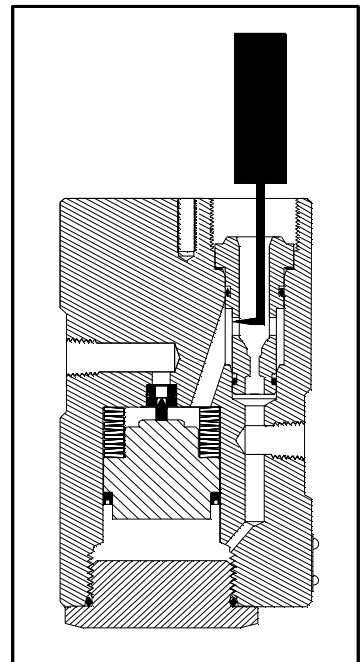
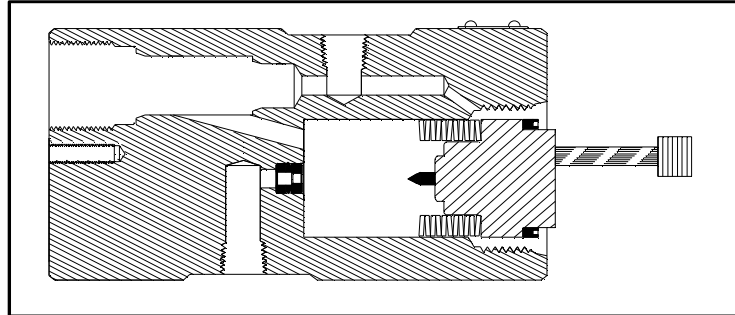


Figure I

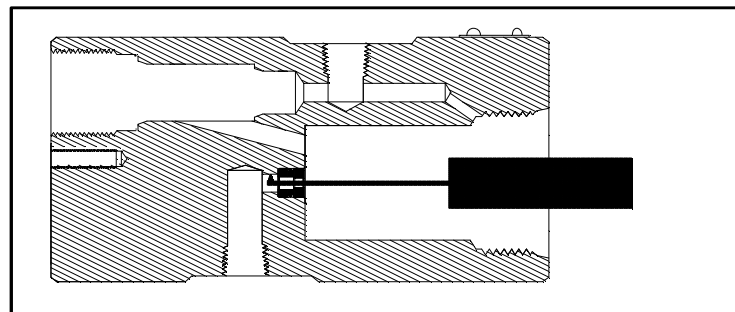
- D. Unscrew and remove the base cap.
- E. Screw a bolt into the thread on the piston (use handle retainer lock bolt or any M8 bolt) and carefully pull out the piston assembly and the springs. (See Figure II).

Figure II



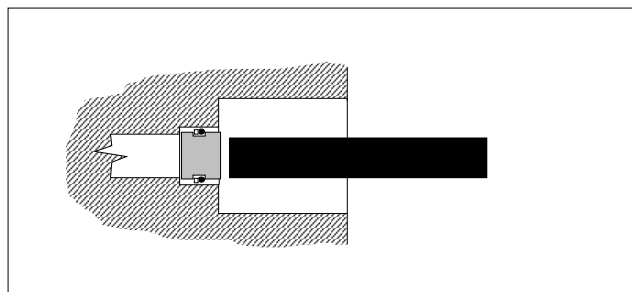
- F. If replacing the seal on the ceramic seat, remove the snap ring and seat retainer. Use a hooked probe to carefully remove the seat. (See figure III).

Figure III



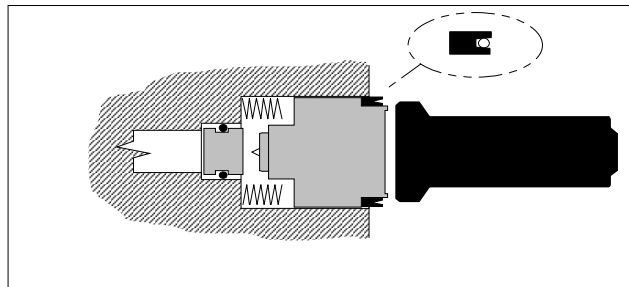
- G. Lubricate new seat seal with Parker Super Lube or equivalent. Slide seal onto seat holder. Install back up ring on low pressure side of o-ring (toward outlet). Insert the seat into the body by slowly pushing with a tool which will not chip the ceramic seat. Orient seat with largest hole end into the body. Reinstall seat retainer and snap ring.

Figure IV



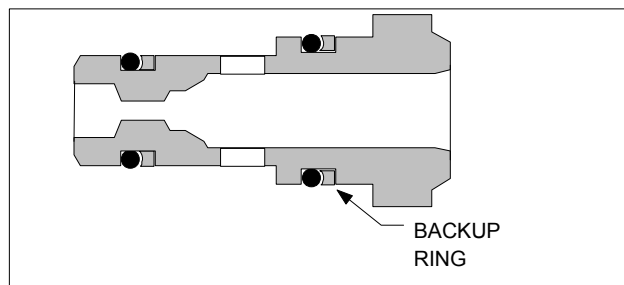
- H. Remove piston cup seal snap ring and cup seal retainer. Remove seal. Lubricate new piston seal with Parker Super Lube or equivalent. Slide seal onto piston (orient seal correctly). Replace cup seal retainer and snap ring. Place piston spring stack into the valve body (orient as shown in attached drawing "Assembly Section / Parts List"). Carefully slide the piston assembly into the valve body. Using the Piston Seal Installer Tool, push seal and piston assembly into body to clear base plate (See Figure V).

Figure V



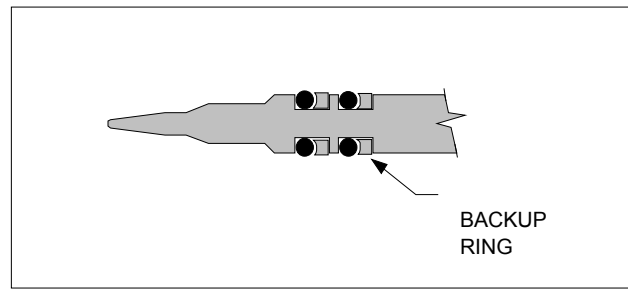
- I. Lubricate base o-ring with Parker Super Lube or equivalent. Place o-ring into o-ring groove of base. Install back up ring on low pressure side of o-ring.
- J. Screw base plug into body until just past the edge of the body. Install the base plug lock bolt and torque to maximum 10 foot-pounds (1.4 kg-m). Be careful not to overtighten.
- K. Install o-rings and backup rings on the needle trim. Locate the backup rings on the low pressure side of the o-rings as shown in Figure VI.

Figure VI



- L. Push needle trim into the body.
- M. Install o-rings and backup rings on the needle stem. Locate the backup rings as shown in Figure VII.

Figure VII



- N. Install adjustment handle assembly into the body. Torque the stem retainer to 10 - 30 foot-pounds (1.4 - 4 kg-m). Orient the stem retainer so that the retainer lock plate and retainer lock bolt will fit in place.
- O. Install the retainer lock plate and lock bolt onto the body. Torque the retainer lock bolt to 10 foot-pounds (1.4 kg-m).

2. **Replacing Needle Stem Assembly:**

- A. Disassemble and reassemble the SkoFlo valve using new seals as described in the "Replace Seals" section above.

3. **Replacing Piston / Pin Assembly:**

- A. Disassemble and reassemble the SkoFlo valve using new seals and piston assembly as described in the "Replace Seals" section above.
- B. When installing pin holder into piston, hold piston in a manner where the surface finish will not be damaged. Torque pin holder to 100 inch-pounds (1.15 kg-m).

TROUBLE SHOOTING IMPROPER VALVE PERFORMANCE:

| <u>SYMPTOM</u> | <u>CAUSE</u> | <u>REMEDY</u> |
|-------------------------------|---|--|
| 1. No Flow | Upstream filter is plugged. | Clean or replace filter element. |
| | Supply valve is shut off. | Open valve <u>slowly</u> . |
| | Discharge line is shut off. | Open valve. |
| 2. Fluctuations in flow rates | Internal passage in valve body between inlet and piston chamber is plugged. | Dismantle the valve and clean up the passage. |
| | Piston Springs are not installed properly. | Install springs in accordance with drawing SF-0738 and Figure V. |
| | Seat or pin worn or damaged. | Replace seat holder or piston assembly. |
| | Supply pressure is not adequate. | The flow controller requires a minimum of 200 psi (14 bar) differential pressure across the valve for proper operation. (Valves designed for special high flows may require a higher differential pressure). |

RECOMMENDED SPARE PARTS:

| <u>QTY</u> | <u>PART NUMBER</u> | <u>DESCRIPTION</u> |
|------------|--------------------|-------------------------------------|
| 1 | SF15000NMFB-20 | Seal Kit (Qty 1 for each 10 valves) |

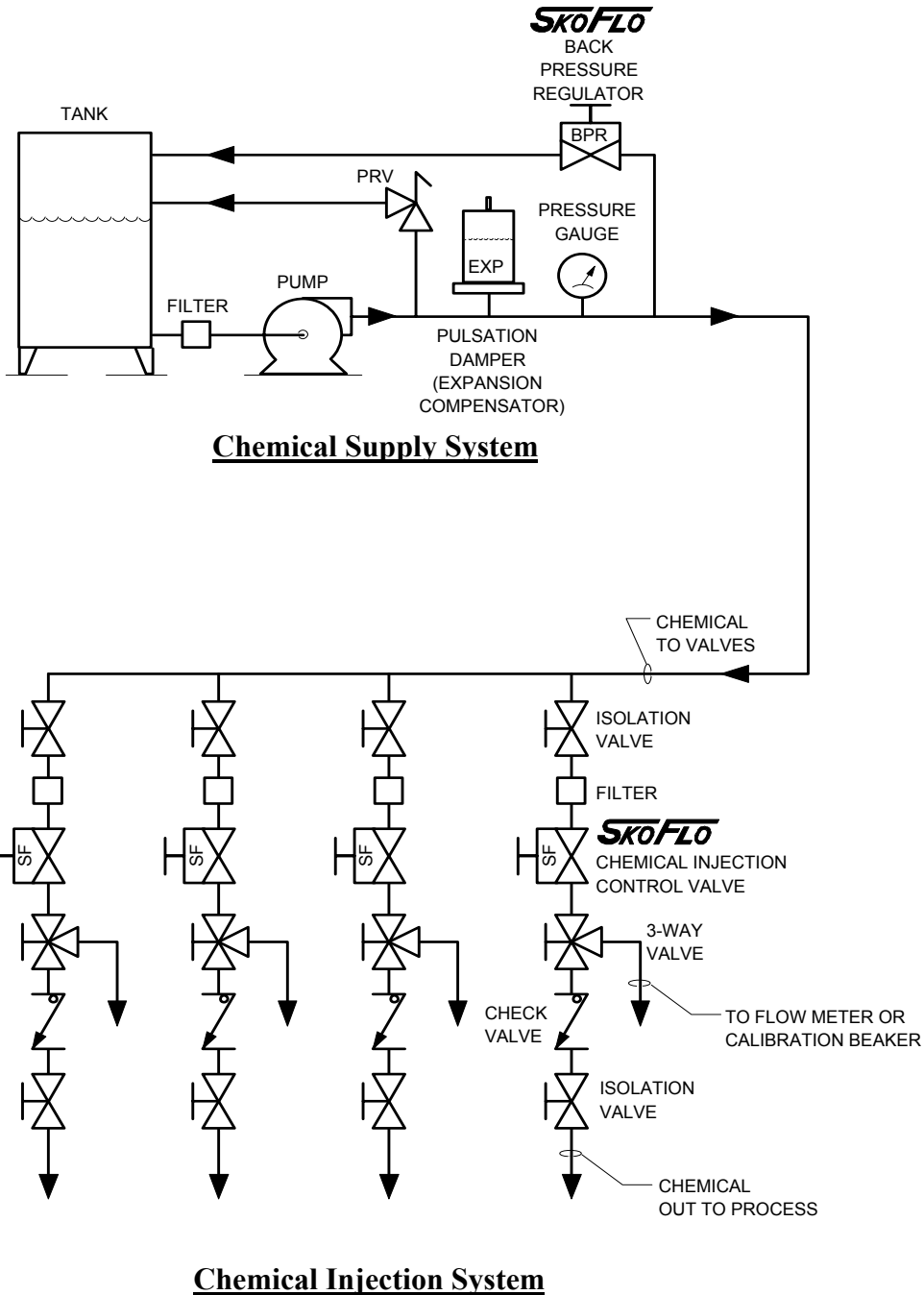
STORAGE:

1. When storing SkoFlo valves prior to first use, it is recommended that the valves be stored indoors. If stored outdoors, apply a light coating of protectant to the exterior of the valve. The shipping plugs in the INLET and OUTLET should remain in place.
2. When storing SkoFlo valves after being in use, dismantle, thoroughly clean and reassemble. Then store as noted in number 1 above.

Please call the factory in Woodinville, Washington USA at phone number 425-485-7816 if you have any questions.

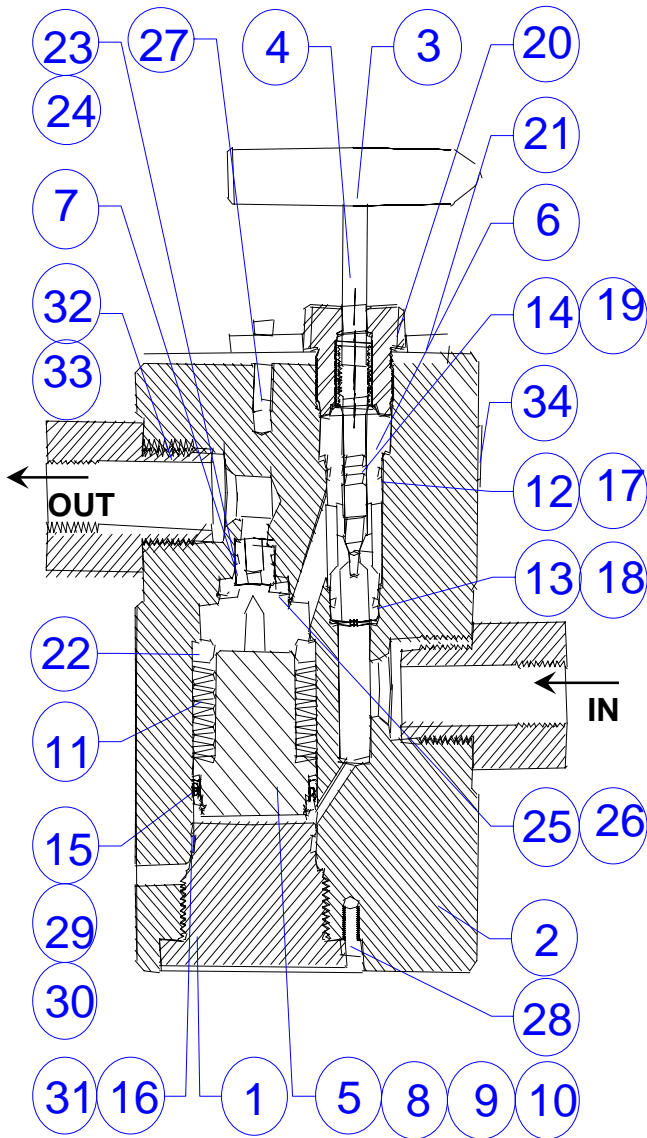
E-Mail: butchs@skoflo.com

Multi-Point System Sample Schematic



Notes:

1. Any number of injection points can be served by a single pump and header system. The only limitation is the flow capability of the pump.
2. Check valve must be installed within 5 feet from the SkoFlo valve.



| MATERIAL LIST - Sko-Flo Valve | | | | | |
|-------------------------------|-----|-----------------|-----------|---------------------------|-------------------------|
| SF15000NMFB | | | | | |
| ITEM | QTY | PART NO. | MRP NO | DESCRIPTION | MATERIALS |
| 1 | 1 | SF15000NMFB-1 | 20282 | BASE PLUG | 316LSS |
| 2 | 1 | SF15000NMFB-2 | 20673 | BODY | 316LSS |
| 3 | 1 | SF15000NMFA-3A | 20693 | HANDLE (with set screw) | 316SS |
| 4 | 1 | SF15000NMFB-3B | 20674 | NEEDLE STEM | NITRONIC 60 SS |
| 5 | 1 | SF15000NMFA-4 | 20613 | PISTON | NITRONIC 60 SS |
| 6 | 1 | SF15000NMFA-5 | 20617 | NEEDLE TRIM | NITRONIC 60 SS |
| 7 | 1 | SF15000N-6-XXXL | 20275 | SEAT | CERAMIC |
| 8 | 1 | SF15000NMFA-7 | 20639 | PIN HOLDER | 316LSS |
| 9 | 1 | SF15000N-8-XXXL | 20638 | PIN | CERAMIC |
| 10 | 1 | SF15000NMFA-9 | 71002075 | PIN SPRING | 304SS |
| 11 | 15 | SF15000NMFA-10 | 22110 | PISTON SPRING | 316SS |
| 12 | 1 | SF15000NMFA-11 | SEE BELOW | O-RING (UPPER TRIM) | EPR (KALREZ) |
| 13 | 1 | SF15000NMFA-12 | SEE BELOW | O-RING (LOWER TRIM) | EPR (KALREZ) |
| 14 | 2 | SF5000C-12 | SEE BELOW | O-RING (STEM) | EPR (KALREZ) |
| 15 | 1 | SF15000NMFB-13 | 71001867 | CUP SEAL (PISTON) | TEFLON w/ GRAPHITE |
| 16 | 1 | SF15000NMFA-16 | SEE BELOW | O-RING (BASE TO BODY) | EPR (KALREZ) |
| 17 | 1 | SF15000NMFA-27 | 71001932 | BACK UP RING FOR ITEM 12 | PEEK |
| 18 | 1 | SF15000NMFA-28 | 71001930 | BACK UP RING FOR ITEM 13 | PEEK |
| 19 | 2 | SF15000NMFA-29 | 71001924 | BACK UP RING FOR ITEM 14 | PEEK |
| 20 | 1 | SF15000NMFA-17 | 20675 | STEM RETAINER | 316LSS w/ NI-BR BUSHING |
| 21 | 1 | SF15000NMFB-18 | 20677 | RETAINER LOCK PLATE | 316SS |
| 22 | 1 | SF15000NMFB-24 | 20689 | PISTON GUIDE WASHER | NITRONIC 60 SS |
| 23 | 1 | SF15000-18-XXXL | SEE BELOW | O-RING (SEAT) | EPR (KALREZ) |
| 24 | 1 | SF15000NMFA-30 | 71001929 | BACK UP RING FOR ITEM 23 | PEEK |
| 25 | 1 | SF15000NMFA-31 | 20528 | SEAT RETAINER | NITRONIC 60 SS |
| 26 | 1 | SF15000NMFA-32 | 71002969 | SNAP RING (SEAT) | 15-7 SS |
| 27 | 1 | SF15000NMFA-22 | 71002882 | RETAINER LOCK BOLT | 316SS |
| 28 | 2 | SF15000NMFA-23 | 71002091 | BASE PLUG LOCK BOLT | 316SS |
| 29 | 1 | SF15000NMFA-33 | 20288 | CUP SEAL RETAINER | NITRONIC 60 SS |
| 30 | 1 | SF15000NMFA-34 | 71001945 | SNAP RING (CUP SEAL) | 302SS |
| 31 | 1 | SF15000NMFA-35 | 71001943 | BACK UP RING FOR ITEM 16 | PEEK |
| 32 | 2 | BPR15000MF-79 | 20531 | CONNECTION ADAPTER | 316SS |
| 33 | 2 | SF15000NMFA-35 | SEE BELOW | O-RING (AE ADAPTER TO BOD | EPR (KALREZ) |
| 34 | 1 | SF15000-25 | 21353 | NAMEPLATE | 302SS |

NOTES: SF15000NMFA-11, EPDM - 71001766
 SF15000NMFA-11, KALREZ - 71001768
 SF15000-18-XXXL, EPDM - 71001758
 SF15000-18-XXXL, KALREZ - 71001762
 SF5000C-12, EPDM - 71001738
 SF5000C-12, KALREZ - 71001741
 SF15000NMFA-16, EPDM - 71001803
 SF15000NMFA-16, KALREZ - 71001805
 SF15000-18-XXXL, EPDM - 71001753
 SF15000-18-XXXL, KALREZ - 71001756
 SF15000NMFA-35, EPDM - 71001829
 SF15000NMFA-35, KALREZ - 71001830

SEAL KIT, SF10000NMFA -20, EPDM - 22088
 SEAL KIT, SF10000NMFA -20, KALREZ - 22089

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| | | | |
|--|--------------|--|--------|
| SkoFlo Valve Model SF15000NMFB | | SkoFlo INDUSTRIES INC. Woodinville, WA | |
| SCALE: NONE | APPROVED BY: | DRAWN BY: FJG | |
| DATE: 2/13/03 | | REVISED: 11/27/06 | |
| SF15000NMFB FLOW CONTROLLER ASSEMBLY SECTION / PARTS LIST | | DRAWING NUMBER: SF-0738 | REV: A |

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Woodinville Wa, 98072 USA
425.485.7816 FAX 425.368.1696

Our focus is on you our customer and for ISO 9001:2000 compliance we have prepared and request that you take the time to complete this **customer satisfaction survey**.

| | |
|----------|--|
| Company: | |
| Contact: | |
| Email: | |
| Phone: | |

| Please rate following categories | Highly Dissatisfied | | N/A | | | Highly Satisfied | |
|----------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 1. Product Quality | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. Product Features | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. Reliability | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. After sale support | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. Implementation | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 6. Delivery | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

| Score from 1 (Low) to 7 (High) | (Low) | | N/A | | | (High) | |
|--|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Recommend SkoFlo to friend or colleague. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Likely to Purchase Products from SkoFlo | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Overall quality of relationship with SkoFlo | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Overall level of satisfaction with SkoFlo | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Overall level of satisfaction with respect to Product Valve | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Overall level of satisfaction with respect to product engineering | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Level of confidence of SkoFlo abilities to provide compliant product | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Comments: | | | | | | | |
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