

# SKO FLO

Pressure Independent  
Flow Controller



**SkoFlo Valve Model SF15000CRS**

**OPERATION AND MAINTENANCE INSTRUCTIONS**

***SKoFlo* INDUSTRIES INC.**

DOC-00495

# SkoFlo Valve Model SF15000CRS

## OPERATION AND MAINTENANCE INSTRUCTIONS

### INSTALLATION PROCEDURES:

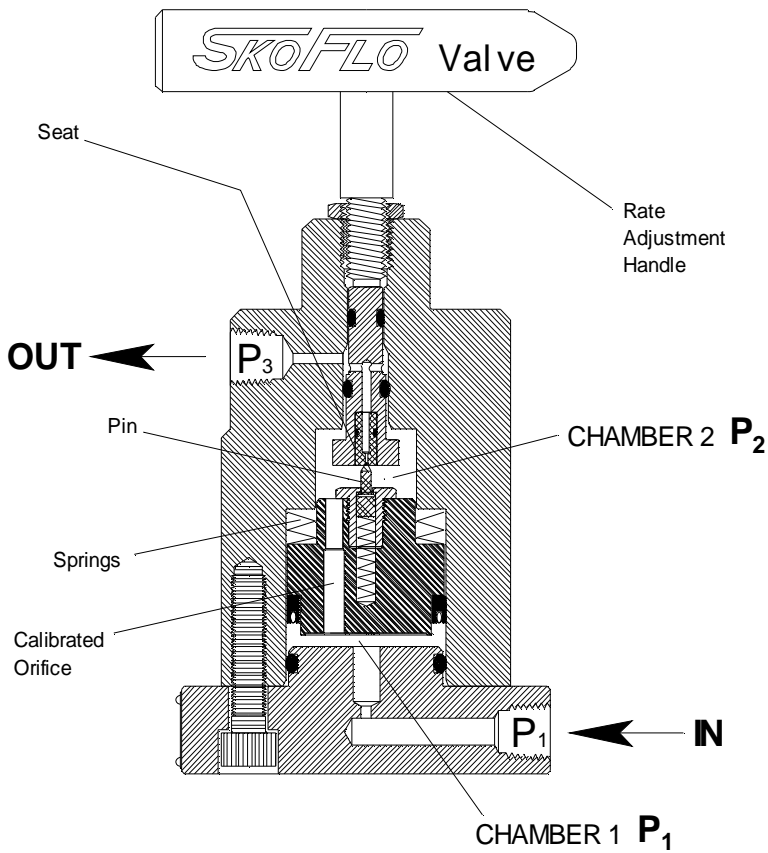
1. Install valve so that the flow is in the proper direction. The "IN" connection and the "OUT" connection are Autoclave Engineers MP20000 style for 3/8" tubing and are marked respectively. See drawing SF-SK201 for details.
2. Install an inline filter upstream of the SkoFlo Valve. Clean chemical and proper filtering is very important. Omitting the filter can cause the SkoFlo Valve to become plugged. Following are recommended filter sizes

SkoFlo Dash Number	Filter Micron Size
2 thru 75	40
100 thru 400	90
500 and above	200

### START UP PROCEDURES:

1. Back out (rotate counterclockwise) the rate adjustment handle on the flow controller at least three turns.  
Note: At this position the flow controller is not controlling (out of range).
2. Open the supply isolation valve to the flow controller **slowly**. This will allow pressures within the flow controller to equalize slowly and valve will stabilize quickly
3. When flow controller is equalized, turn the rate adjustment handle clockwise until the flow reduces noticeably. Then turn the rate adjustment handle approximately 1/4 turn farther. The flow controller is now controlling at the full rated flow range of the unit.
4. Turn the rate adjustment handle clockwise until you are at the desired flow rate.
5. The flow controller is now set and further adjustments are not required. Tighten the lock nut on the handle to avoid inadvertent changes to the adjustment.

## PRINCIPLE OF OPERATION



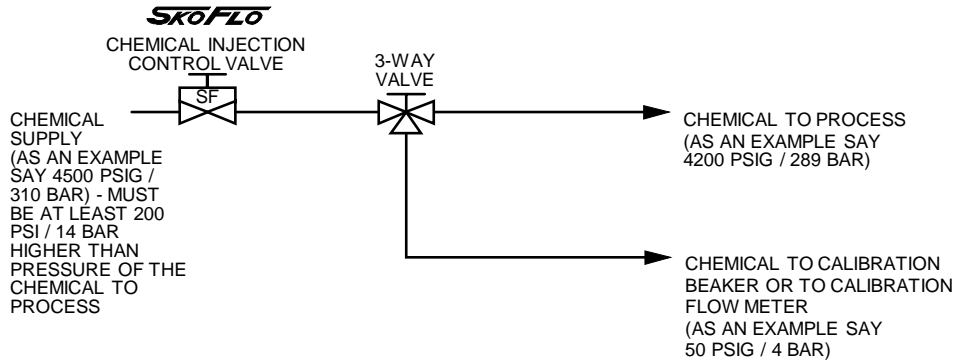
The SkoFlo valve is a pressure independent flow control valve used in the petroleum industry to accurately control chemical inject rates. The valve consists of a body, a base plate and a flow rate adjustment handle.

The principle of operation of the SkoFlo valve is that it maintains constant differential pressure across a fixed calibrated orifice, thus resulting in a constant flow rate through that orifice. We install the orifice into a piston and then use springs to set a constant differential pressure across the piston/orifice assembly, thus maintaining a constant flow output. Flow rate changes through the valve can only be made by adjusting the spring force on the piston when turning the rate adjustment handle.

Fluid enters the valve base plate at pressure  $P_1$ . It flows through the base plate into chamber 1. It then flows through the calibrated orifice into chamber 2 where the springs are located. These springs put force against the piston depending on how much the springs are deflected. The spring force against the piston is set by the rate adjustment handle. This spring force establishes pressure  $P_2$  in chamber 2. Flow then passes through the seat to exit the valve. The flow through the seat is controlled by the pin that mates with the seat. As the pressure builds in Chamber 2, the pin moves away from the seat and allows flow to the valve outlet at pressure  $P_3$ . The flow rate remains constant after the equilibrium flow through the valve is established.

The SkoFlo model SF10000D valve requires a minimum differential pressure across the valve ( $P_1 - P_3$ ) of 200 psi (14 bar) to achieve full rated flow.

## 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 lock nut on the handle is tightened down, 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.

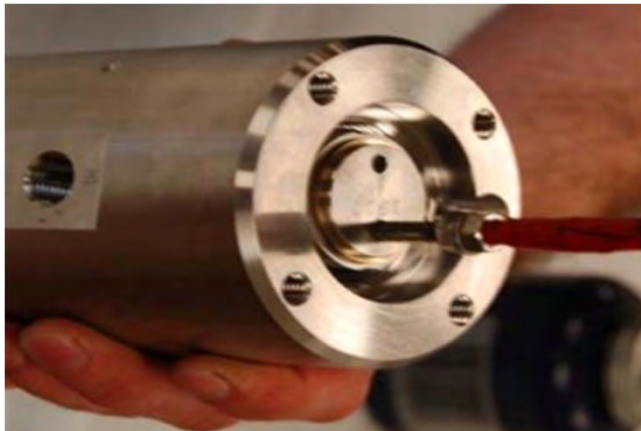
In the above example, the SkoFlo Valve is set with a differential pressure of 4450 psi / 306 bar across the valve. The flow rate set will remain the same when the chemical is routed to process and the SkoFlo Valve has a differential pressure of 300 psi / 21 bar.

## 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. The SkoFlo valve will reach its minimum flow before the handle is bottomed out. **Overtightening the handle will not further reduce flow.** If flow rate does not decrease when turning the handle in, see "Trouble Shooting Improper Valve Performance".
2. Quick opening or closing of valves upstream or downstream of the SkoFlo valve can cause the internal parts to move extremely fast and flow rate may surge. Valves upstream and downstream should be opened slowly to allow internal pressures to balance and minimize shock to valves and piping.
3. 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 in the reverse direction. SkoFlo Industries recommends installation of a check valve in the outlet line **within 5 feet** from the SkoFlo valve (see "Multi-Point System Sample Schematic") to avoid reverse flow of process fluids into the chemical system.

## MAINTENANCE:

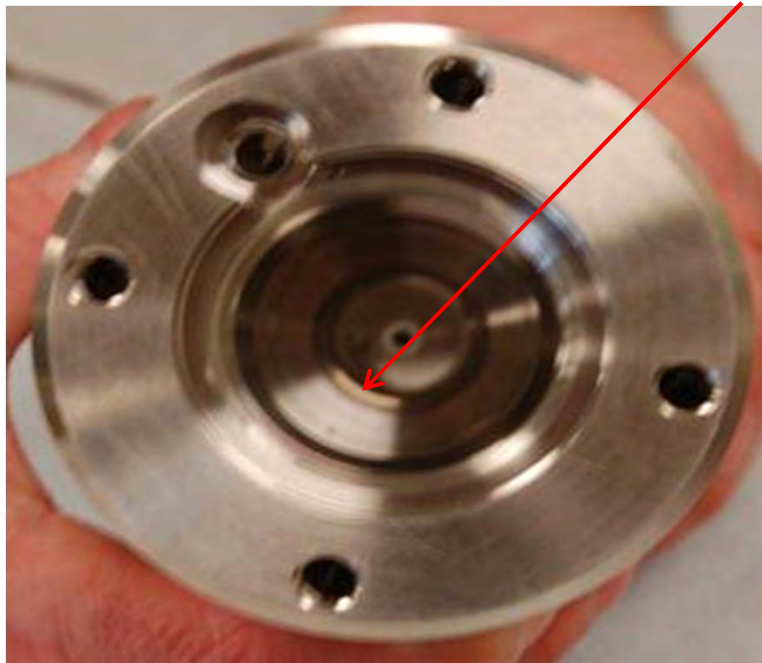
1. **Replacing Seals:** When replacing valve seals, it is recommended that the Seat Holder Installer Tool (P/N SF5000-T1), and O-Ring Installation Kit (P/N SF5000-T3) be used.
  - A. Remove SkoFlo valve from system.
  - B. Remove the base cap and the adjustment handle.  
Install a 6mm bolt in Piston as shown. (See Figure I)  
Remove Piston



*Figure 1*

- C. Remove Sprial Ring that retains Seat Holder in place (See Figure II)

Figure II



- D. Remove Seat Holder by using a brass rod to gently push it out of the body.  
(See Figure III).

Figure III



- E. Lubricate new seat holder seals with Parker Super Lube or equivalent. Slide seals onto seat holder using the O-Ring Installation Kit (See Figure IV). Install backup ring on low pressure side of o-ring. Make sure the backup ring is lined up at the joint.

Figure IV



- F. Using large end of Seat Holder Installer Tool, guide seat holder and seal into the body. Use caution not to push too fast which can damage the seal. (See Figure V).

Figure V



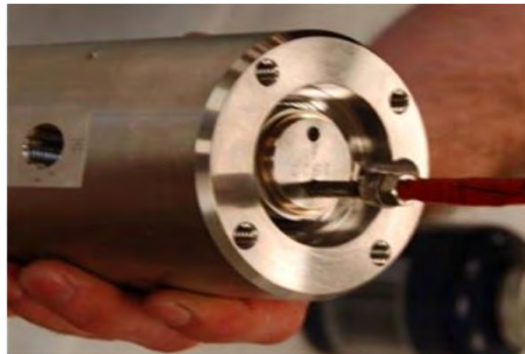
- G. Install Sprial Ring that retains Seat Holder in place  
Use Compression Tool to properly install Sprial Ring. (See Figure VI)

Figure VI



- H. Lubricate piston seal with Parker Super Lube or equivalent. Slide seal onto piston (orient seal correctly). Place piston spring stack on piston/pin holder assembly (orient as shown in "Assembly Section / Parts List"). Carefully slide the complete assembly into the valve body. Do not allow the springs to come off the assembly or they may not line up correctly. Using Piston Seal Installer Tool, push seal and piston into body to clear base cap. (See Figure IV).

Figure VII



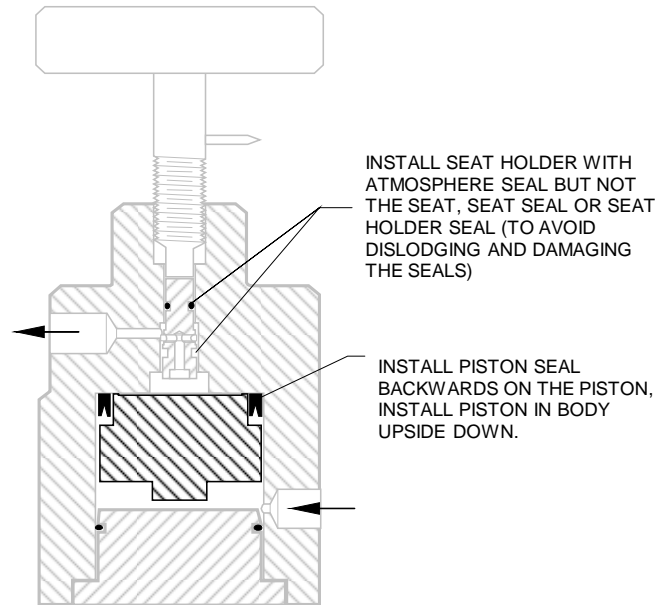
- I. Lubricate base o-ring with Parker Super Lube or equivalent. Place o-ring into o-ring groove of base. Install backup ring on low pressure side of o-ring. Make sure the backup ring is lined up at the joint. Apply anti-seize compound to threads on base cap and screw base cap onto body hand tight. Align cap with set screw hole and install set screw.
- J. Install adjustment handle into the body.
2. **Replacing Seat Holder 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).



5. **Orifice Backflushing Procedure:**

A. Install seat holder in body with the upper (atmosphere) seal only. (See Figure IX).

*Figure IX*



- B. Install the piston seal on the piston backwards from the normal position. (The spring face of the seal will be toward the piston)  
Install the pin holder in the piston WITHOUT the ceramic pin.
- C. Install the piston in the body upside down.
- D. Install the valve base cap.
- E. Apply clean chemical (or water) to the valve inlet. The fluid flow is in the reverse direction to the normal flow thus backflushing the orifice in the piston
- F. If plugging is not relieved by backflushing, the piston assembly must be replaced.

**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.
	Flow controller orifice is plugged.	Back-flush orifice or replace piston/orifice assembly. Correct cause of plugging such as leaking filter.

	Supply valve is shut off.	Open valve <u>slowly</u> .
	Discharge line is shut off.	Open valve.
2. Fluctuations in flow rates	Rate adjustment handle is backed out past control range (valve is not controlling).	Adjust handle in to set flow as noted in "Start Up Procedures".
	Piston Springs are not installed properly.	Install springs in accordance with drawing SF-0480
	Seat or pin worn or damaged.	Replace seat holder or pin.
	Supply pressure is not adequate.	The flow controller requires a minimum of 200 psi (14 bar) differential pressure across the valve for full rated flow.

SYMPTOM

CAUSE

REMEDY

2. Fluctuations in flow rates (cont.)	Debris between pin and seat.	Remove debris.
	Piston seal dislodged.	Reinstall seal. Avoid reverse flow thru valve.

**RECOMMENDED SPARE PARTS:**

<u>QTY</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>
1	20845	Piston/Orifice Assembly for dash size (x) Valve (Qty 1 for each different dash size)
1	20841 - STD	Seat Holder with seat (Qty 1 for each 20 valves of dash size 2 thru 75)
1	20841 - XL	Seat Holder with seat (Qty 1 for each 20 valves of dash size 100 thru 500)
1	20841 - XLS	Seat Holder with seat (Qty 1 for each 20 valves of dash size 750)

- |   |             |  |
|---|-------------|--|
| 1 | 20842 - XXL | Seat Holder with seat (Qty 1 for each 20 valves of dash size 1000 and above) |
| 1 | SF10000D-20 | Seal Kit (Qty 1 for each 20 valves)  |

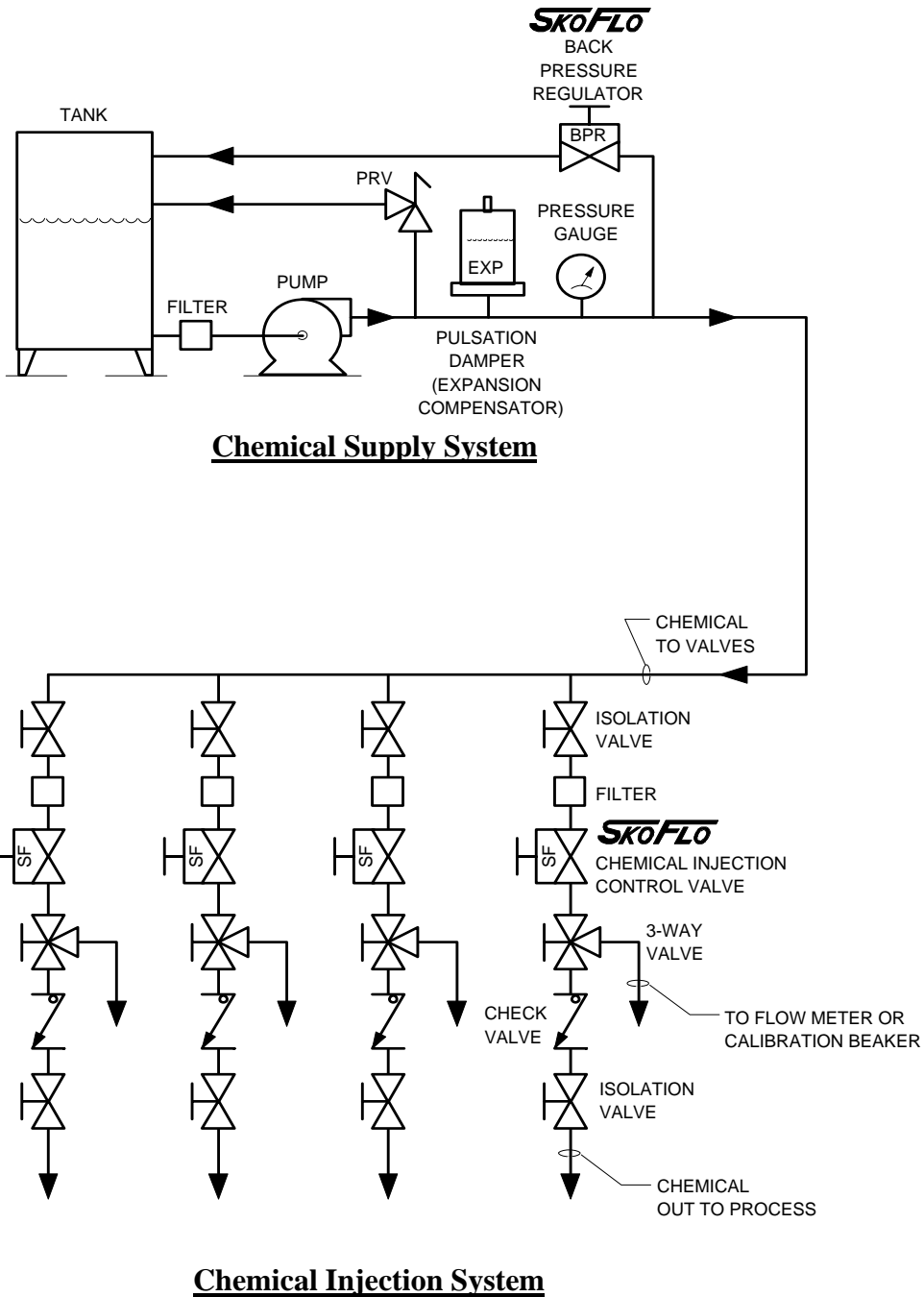
## **STORAGE:**

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](mailto:butchs@skoflo.com)

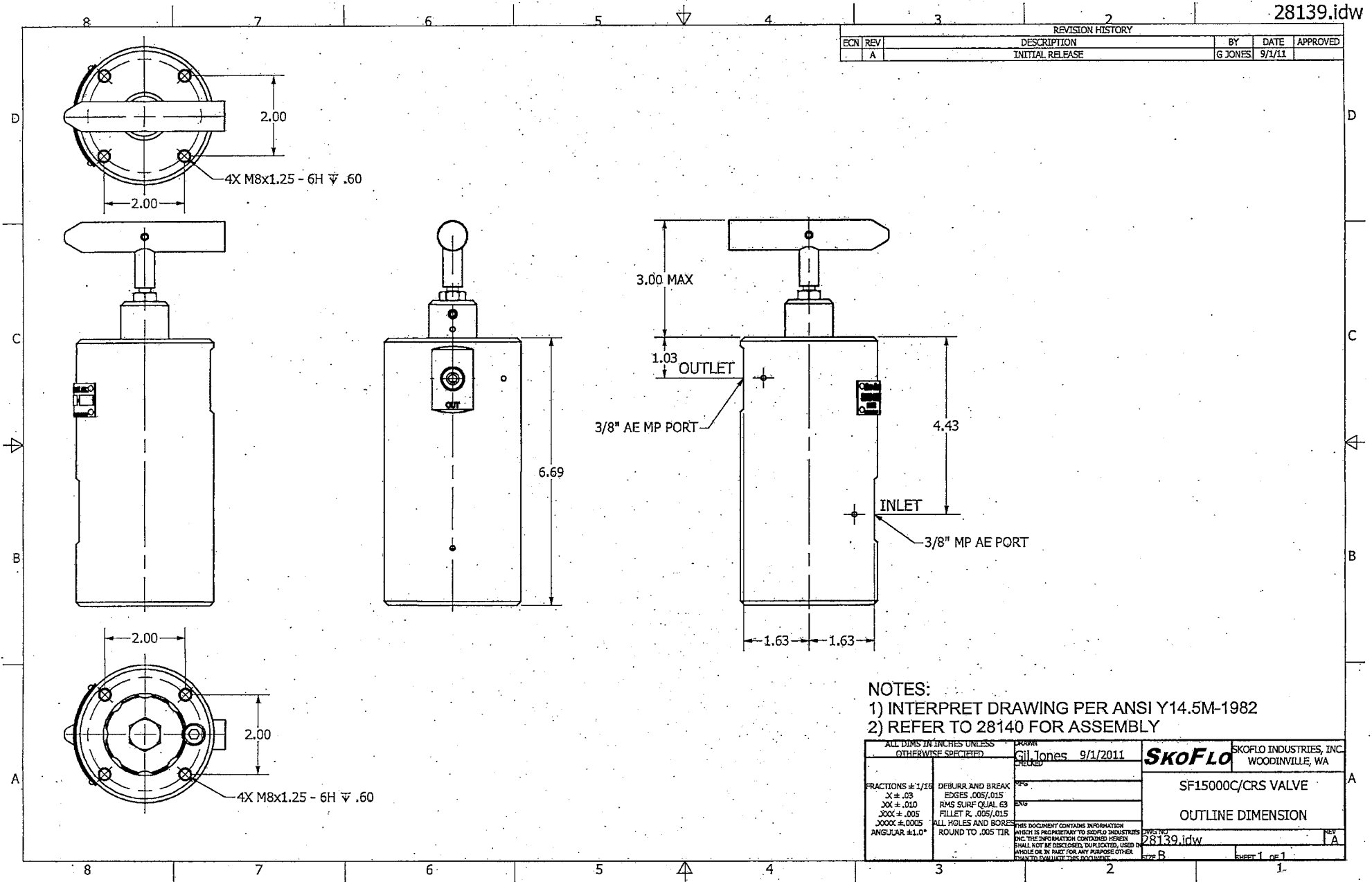
# Multi-Point System Sample Schematic



**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.

REVISION HISTORY					
ECN	REV	DESCRIPTION	BY	DATE	APPROVED
	A	INITIAL RELEASE	G JONES	9/1/11	

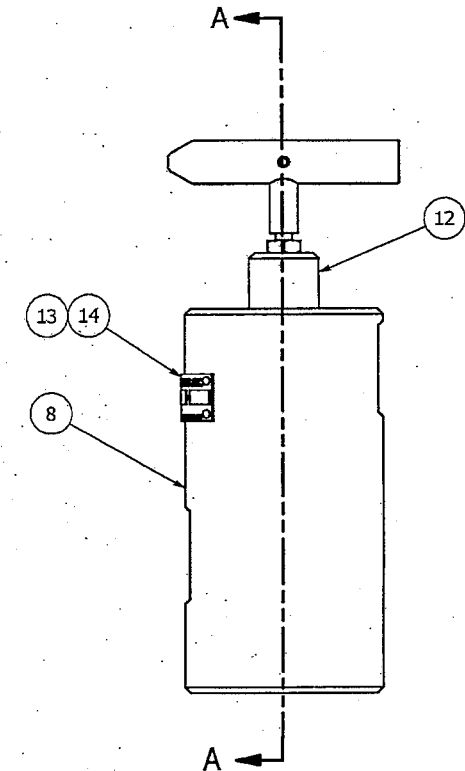


- NOTES:  
 1) INTERPRET DRAWING PER ANSI Y14.5M-1982  
 2) REFER TO 28140 FOR ASSEMBLY

ALL DIMS IN INCHES UNLESS OTHERWISE SPECIFIED		DRAWN Gil Jones 9/1/2011	SKOFL <sup>o</sup> SKOFL <sup>o</sup> INDUSTRIES, INC. WOODINVILLE, WA
FRACTIONS $\neq$ 1/16	DEBURR AND BREAK EDGES .005/.015	ENG	SF15000C/CRS VALVE
X $\neq$ .03	RMS SURF. QUAL. E3	CHKD	OUTLINE DIMENSION
.XXX $\neq$ .010	FILLET R. .005/.015	APP	28139.idw
.XXX $\neq$ .005	ALL HOLES AND BORES ROUND TO .005 TIR	REV	A
ANGULAR $\neq$ 1.0°	THIS DOCUMENT CONTAINS INFORMATION WHICH IS PROPRIETARY TO SKOFL <sup>o</sup> INDUSTRIES, INC. THE INFORMATION CONTAINED HEREIN SHALL NOT BE DISCLOSED, DUPLICATED, USED IN WHOLE OR IN PART FOR ANY PURPOSE OTHER THAN TO EVALUATE THIS DOCUMENT.	DATE	28139.idw
		SIZE	B
		SHEET	1 OF 1

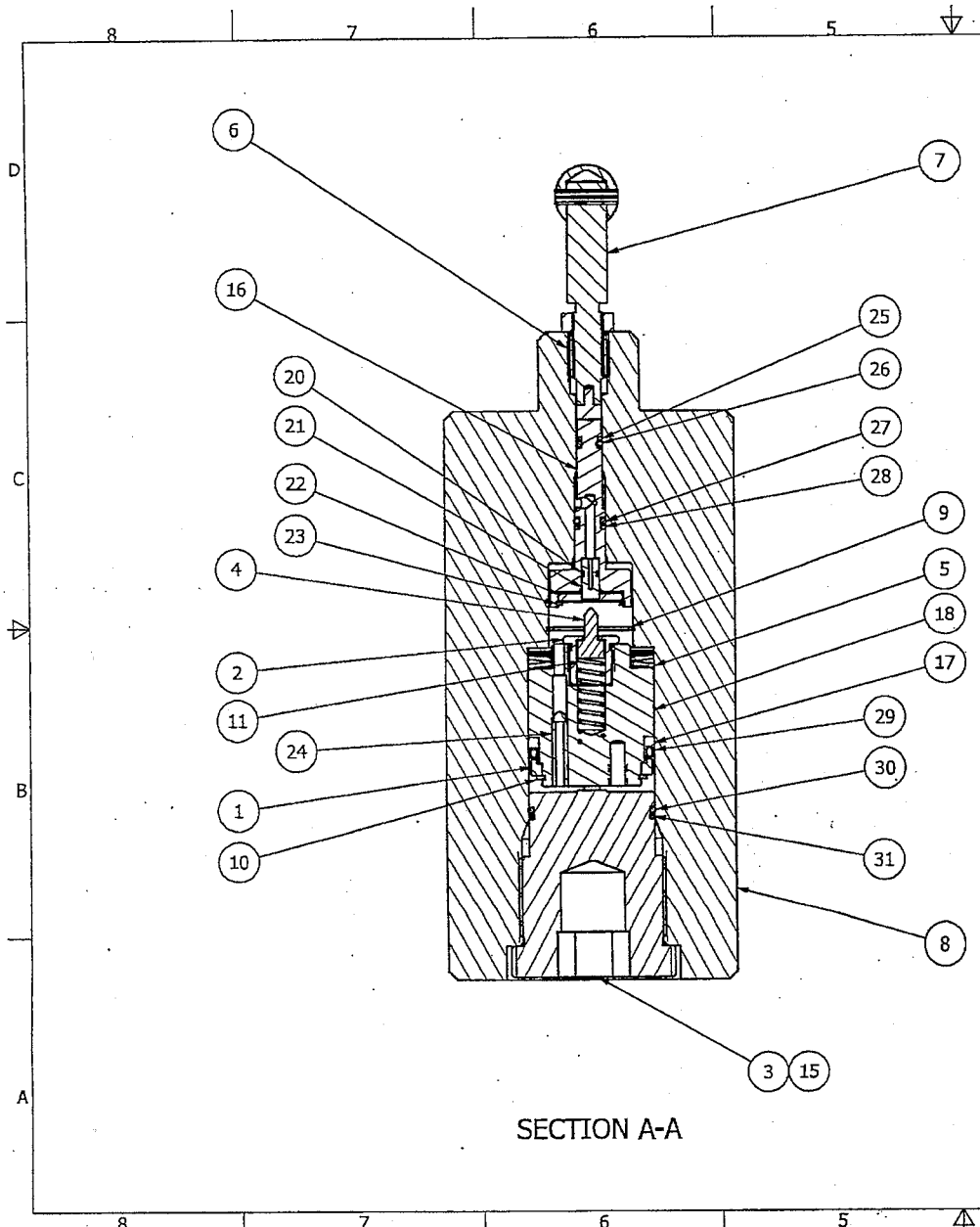
PARTS LIST					
ITEM	QTY	PART NUMBER	DESCRIPTION	MATERIAL	CONTACTS
1	1	20184	PISTON CUP SEAL RETAINER	316L SS	WETTED
2	1	20846	PIN HOLDER, .165 PIN	316L SS	WETTED
3	1	20847	VALVE BODY CAP	316L SS	WETTED
4	1	21523	PIN, CERAMIC, .165	CERAMIC	CHEMICAL
5	1	22108	SPRING SET, SF15000C	316 SS	WETTED
6	1	27419	THREADED STEM BUSHING	TOUGHMET T3AT110	NON WETTED
7	1	27523	ASSEMBLY, TEE HANDLE, BPR15000B	NITRONIC 50 HS, T3AT110	NON WETTED
8	1	28051	BODY, SF15000C /CRS	NITRONIC 50 HS	WETTED
9	1	71001947	SPIRAL RING, WH-100	316 SS	WETTED
10	1	71001948	SPIRAL RING, WST-118	316 SS	WETTED
11	1	71002067	SPRING, PIN, .039	316 SS	WETTED
12	1	71002101	SHSS CUP, M6 X 8	316 SS	NITROGEN
13	4	71002116	NAMEPLATE "SCREWS"	316 SS	NON WETTED
14	1	71002143	NAMEPLATE, SF15000	316 SS	NON WETTED
15	1	71002872	SHCS M8 X 10	316 SS	NON WETTED
16	1	SEE TABLE 2	SEAT HOLDER	NITRONIC 50 HS	WETTED
17	1	SEE TABLE 3	SEAL KIT	SEE TABLE 3	WETTED
18	1	SEE TABLE 4	PISTON W/ ORIFICE	NITRONIC 60	WETTED

REVISION HISTORY					
ECN	REV	DESCRIPTION	BY	DATE	APPROVED
	A	INITIAL RELEASE	G.JONES	9/1/11	



- NOTES:  
 1) INTERPRET DRAWING PER ANSI Y14.5M-1982  
 2) SEE SHEET 2 FOR PART TABLES  
 3) REFER TO DRAWING 28139 FOR OUTLINE DIMENSIONS

ALL DIMS IN INCHES UNLESS OTHERWISE SPECIFIED		DRAWN Gil Jones 9/1/2011	SKOFLO INDUSTRIES, INC. WOODINVILLE, WA
CHECKED		REV	
FRACTIONS ± 1/16 X ± .03 XX ± .010 XXX ± .005 XXXX ± .0005 ANGULAR ± 1.0°	DEBURR AND BREAK EDGES .005/.015 RMS SURF QUAL S3 FILLET R .005/.015 ALL HOLES AND BORES ROUND TO .005 TIR	THIS DOCUMENT CONTAINS INFORMATION WHICH IS PROPRIETARY TO SKOFLO INDUSTRIES INC. THE INFORMATION CONTAINED HEREIN SHALL NOT BE DISCLOSED, REPLICATED, USED IN WHOLE OR IN PART FOR ANY PURPOSE OTHER THAN TO EVALUATE THIS DOCUMENT.	SF15000C/CRS VALVE ASSEMBLY
		DWS NO 28140.idw	REV A
		SIZE B	SHEET 1 OF 2



NOTE:  
FOR ALL SEAT HOLDERS A SEAT  
IS INSTALLED IN SEAT HOLDER  
W/ A CHEMREZ O-RING

SEAT HOLDER TABLE 2		
PART NO.	DESCRIPTION	SEAL MATERIAL
22052	SEAT HOLDER W/ SEAT, STD	CHEMREZ
22055	SEAT HOLDER W/ SEAT, XL	CHEMREZ
22061	SEAT HOLDER W/ SEAT, XLS	CHEMREZ

SEAL KIT TABLE 3		
INSTALLATION DRAWING & PART NO.	DESCRIPTION	MATERIAL
27406	SEAL KIT, SF15000CRS	VITON
27407	SEAL KIT, SF15000CRS	EPDM
27408	SEAL KIT, SF15000CRS	CHEMREZ
27410	SEAL KIT, SF15000CRS	HNBR
27411	SEAL KIT, SF15000CRS	VITON B

PISTON/ORIFICE SELECTION TABLE 4	
GPD MAX	PART NO
1	22184
2	22174
5	22198
7	22193
10	22186
15	22147
20	22142
30	22135
40	22157
50	22156
75	22154
100	22150
150	22146
200	22139
300	22134
400	22158
500	22129
750	22125
1000	22123
1250	22121
1500	22119
2000	22118

ALL DIMS IN INCHES UNLESS OTHERWISE SPECIFIED		DRAWN Gil Jones 9/1/2011 CHECKED	SKOFLOR SKOFLOR INDUSTRIES, INC WOODINVILLE, WA
FRACTIONS $\neq$ 1/16 XX $\neq$ .03 JXX $\neq$ .010 .00XX $\neq$ .005 .000XX $\neq$ .0005 ANGULAR $\neq$ 1.0°	DEBURR AND BREAK EDGES .005/.015 RMS SURF QVAL E3 FILLET R .005/.015 ALL HOLES AND BORES ROUND TO .005 TIR	THIS DOCUMENT CONTAINS INFORMATION WHICH IS PROPRIETARY TO SKOFLOR INDUSTRIES, INC. THIS INFORMATION CONTAINED HEREIN SHALL NOT BE DISCLOSED, DUPLICATED, USED TO REPRODUCE OR IN ANY MANNER FOR ANY OTHER PURPOSE WITHOUT THE WRITTEN PERMISSION OF SKOFLOR INDUSTRIES, INC.	SF15000C/CRS VALVE ASSEMBLY
		28140.idw SIZE B	SHEET 2 OF 2