

SKOFLO

Pressure Independent
Flow Controller



SkoFlo Valve Model SF1000DRS

OPERATION AND MAINTENANCE INSTRUCTIONS

SKOFLO INDUSTRIES INC.

SkoFlo Valve Model SF1000DRS

OPERATION AND MAINTENANCE INSTRUCTIONS

INSTALLATION PROCEDURES:

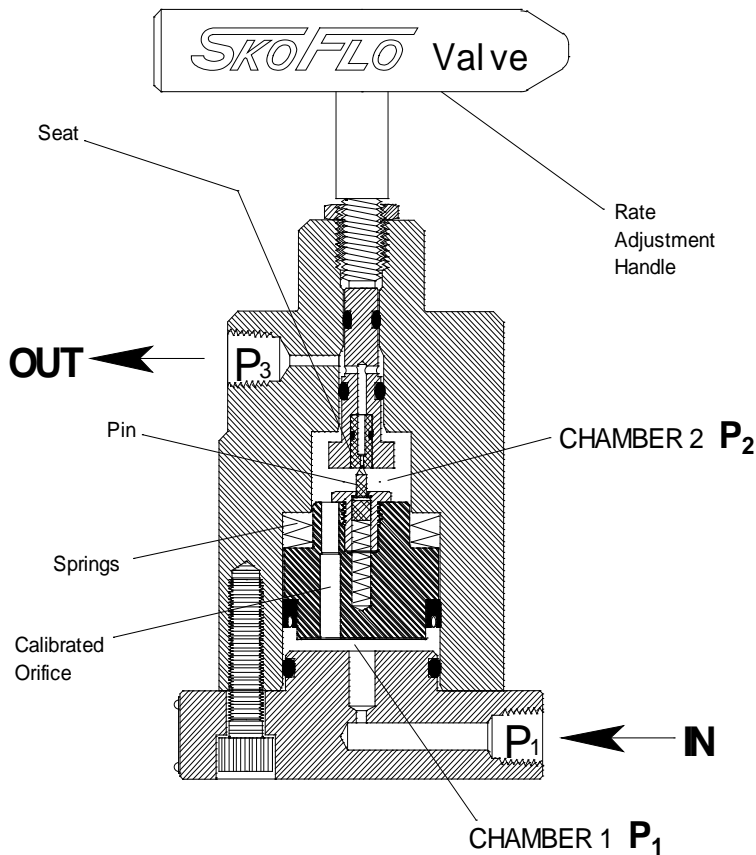
1. Install valve so that the flow is in the proper direction. The "IN" connection and the "OUT" connection are Autoclave Engineers MP20000 style for 3/8" tubing and are marked respectively. See drawing SF-SK201 for details.
2. Install an inline filter upstream of the SkoFlo Valve. Clean chemical and 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



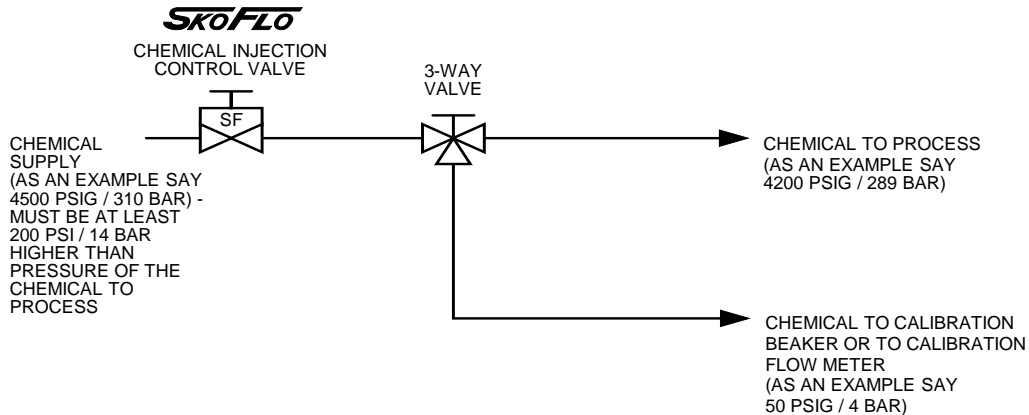
The SkoFlo valve is a pressure independent flow control valve used in the petroleum industry to accurately inject chemicals. The valve consists of a body, a base plate that is bolted to the body, and a flow rate adjustment handle.

The principle of operation of the SkoFlo valve is that it maintains a constant differential pressure across a fixed calibrated orifice, thus resulting in a constant flow 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. Flow rate changes through the valve can only be made by adjusting the spring force on the piston by 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 a the calibrated orifice into chamber 2 where the 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 rate adjustment handle. This spring force establishes the pressure P_2 in chamber 2. Flow then exits the valve after passing through the seat. The flow through the seat is held back by the pin that mates with the seat. As the pressure builds, 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.

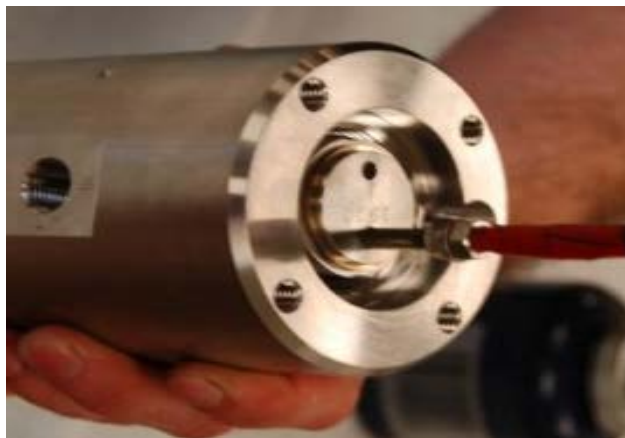
OPERATION NOTES AND WARNINGS:

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:

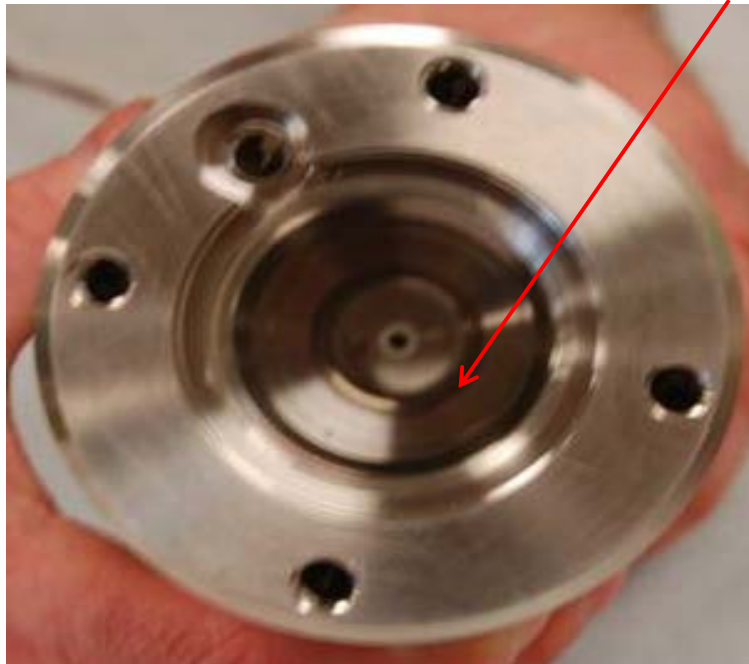
1. **Replacing Seals:** When replacing valve seals, it is recommended that the Seat Holder Installer Tool (P/N SF5000-T1), and O-Ring Installation Kit (P/N SF5000-T3) be used.
 - A. Remove SkoFlo valve from system.
 - B. Remove the base cap and the adjustment handle.
Install a 6mm bolt in Piston as shown.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

Figure I



- C. Remove Serial 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



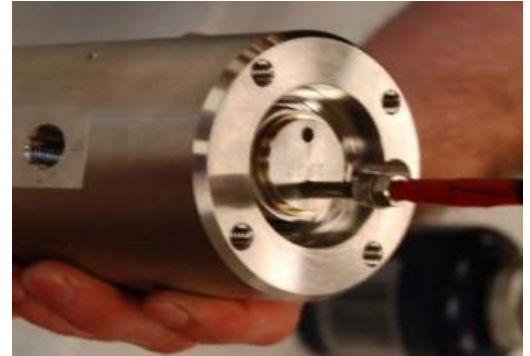
- G. Install Sprial Ring that retains Seat Holder in place
Use Compression Tool to properly install Sprial Ring. (See Figure VI)

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:

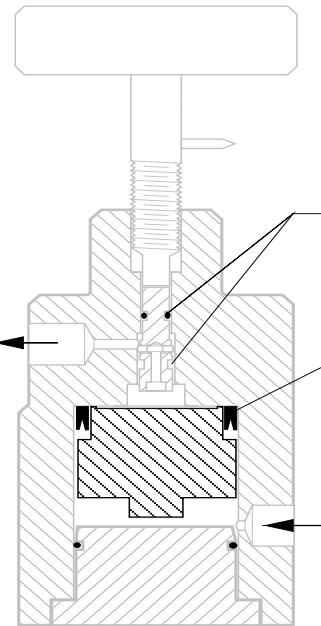
- A. Disassemble and reassemble the SkoFlo valve using new seals and piston assembly as described in the "Replace Seals" section above.
- B. When installing pin holder into piston, hold piston in a manner where the surface finish will not be damaged. Torque pin holder to 100 inch-pounds (1.15 kg-m).

5. Orifice Backflushing Procedure:

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

INSTALL SEAT HOLDER WITH ATMOSPHERE SEAL BUT NOT THE SEAT, SEAT SEAL OR SEAT HOLDER SEAL (TO AVOID DISLODGING AND DAMAGING THE SEALS)

Figure IX



INSTALL PISTON SEAL BACKWARDS ON THE PISTON, INSTALL PISTON IN BODY UPSIDE DOWN.

B. Install the piston seal on the piston backward position. (The spring face of the seal will be Install the pin holder in the piston WITHOUT

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.

<u>SYMPTOM</u>	<u>CAUSE</u>	<u>REMEDY</u>
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:

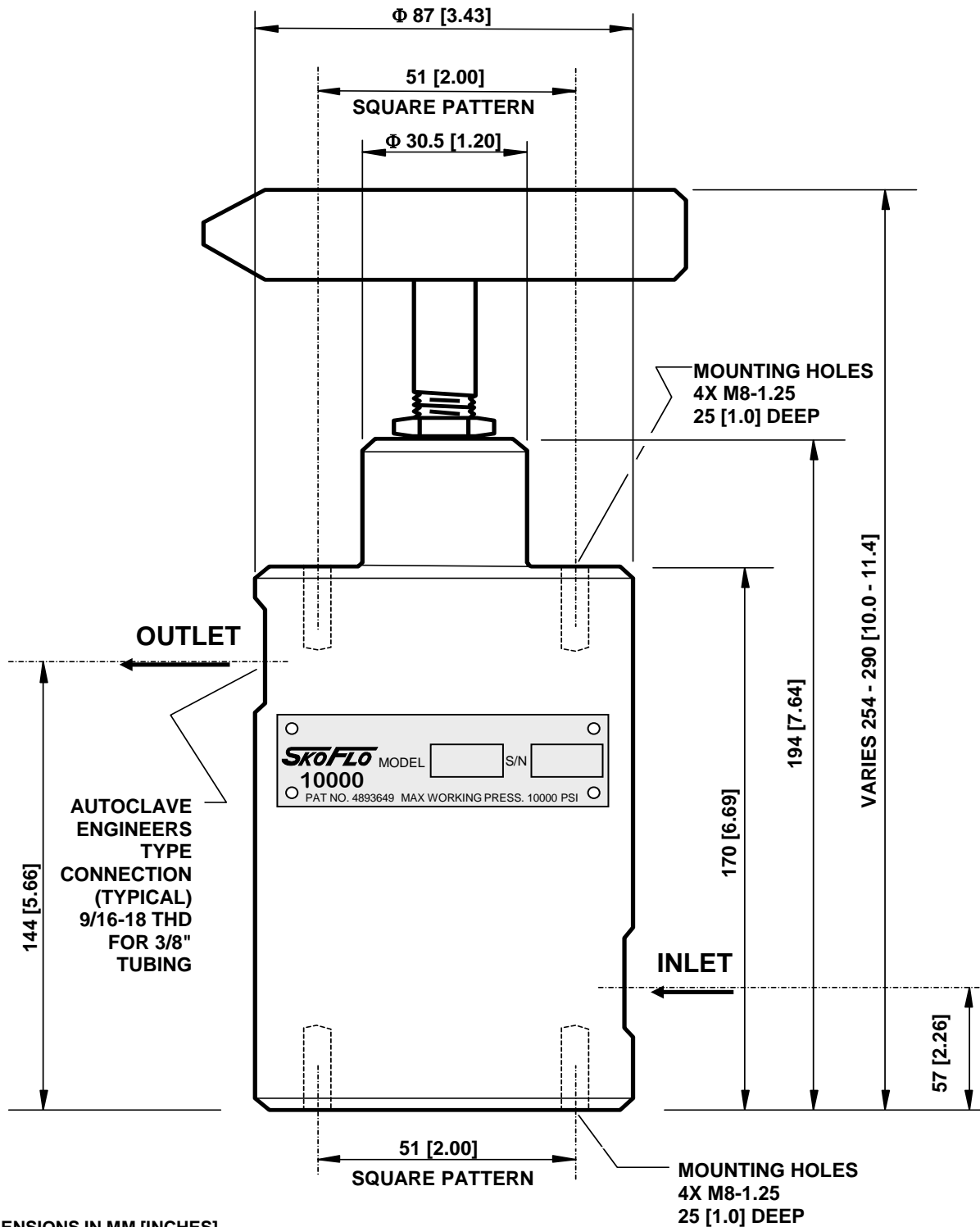
<u>QTY</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>
1	20845	Piston/Orifice Assembly for dash size (x) Valve (Qty 1 for each different dash size)
1	20841 - STD	Seat Holder with seat (Qty 1 for each 20 valves of dash size 2 thru 75)
1	20841 - XL	Seat Holder with seat (Qty 1 for each 20 valves of dash size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

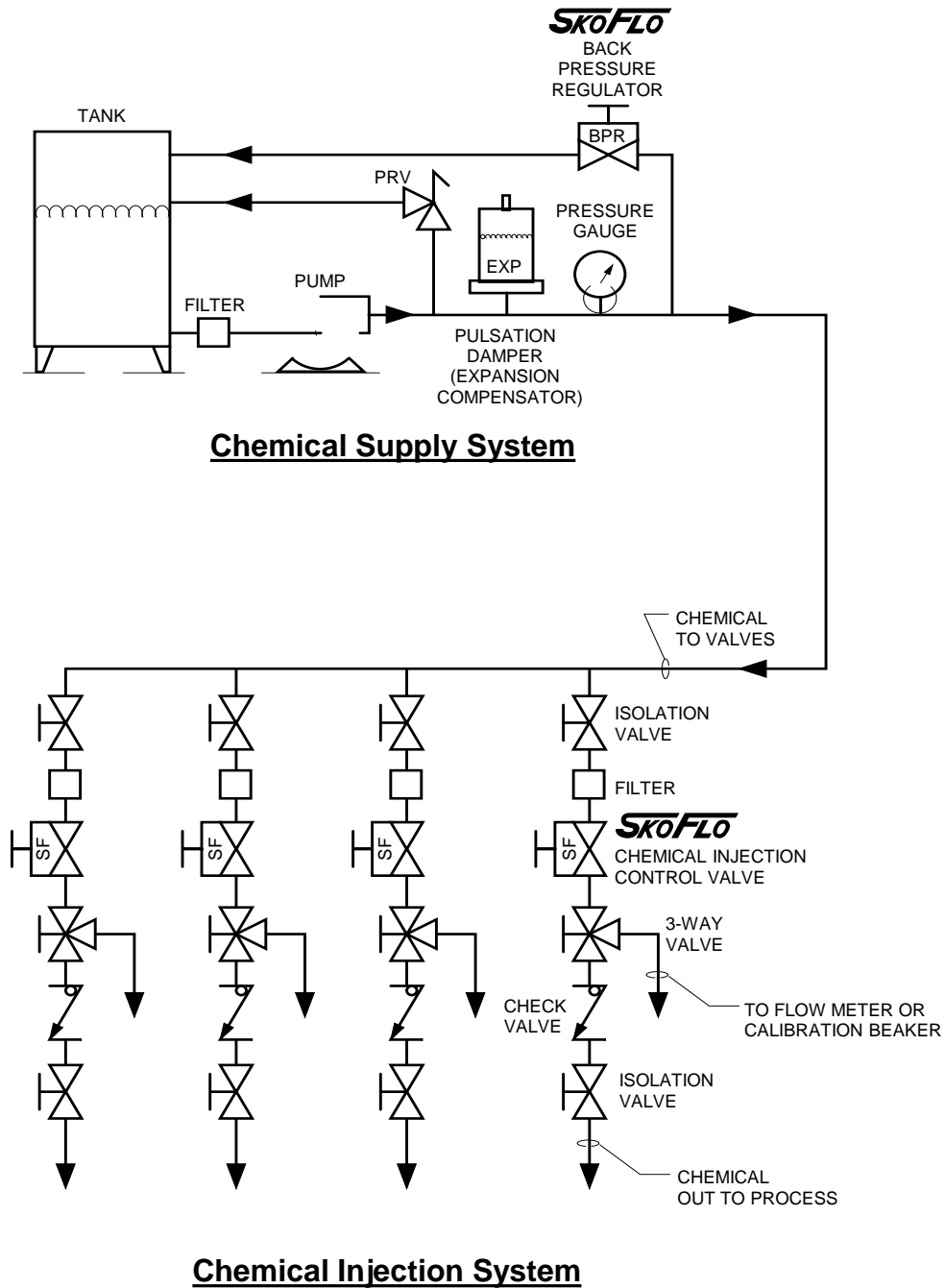
Please call the factory in Woodinville, Washington USA at phone number (425)485-7816 if you have any questions.
E-Mail: butchs@skoflo.com



- 1) DIMENSIONS IN MM [INCHES]
- 2) STANDARD MATERIALS:
 BODY: 316L ss
 SEAL: Graphite Fiber Reinforced PTFE
 O-RING: Viton
- 3) ORIENTATION
 Inlet opposite side of Outlet

SkoFlo Valve Model SF1000DRS		SkoFlo INDUSTRIES INC. Woodville, VA	
SCALE: NONE	APPROVED BY:	DRAWN BY: FJG	
DATE: 9/12/00		REVISED: 3/3/04	
OUTLINE DIMENSIONS		DRAWING NUMBER SF-SK201	REV B

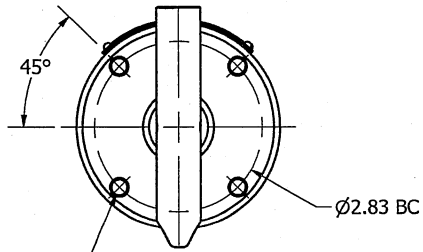
Multi-Point System Sample Schematic



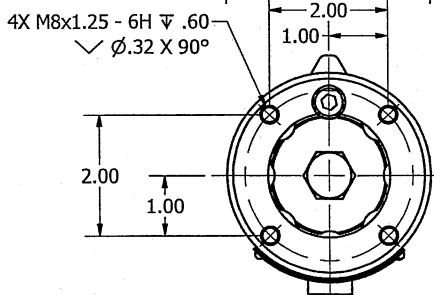
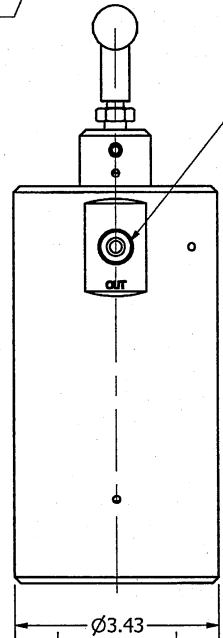
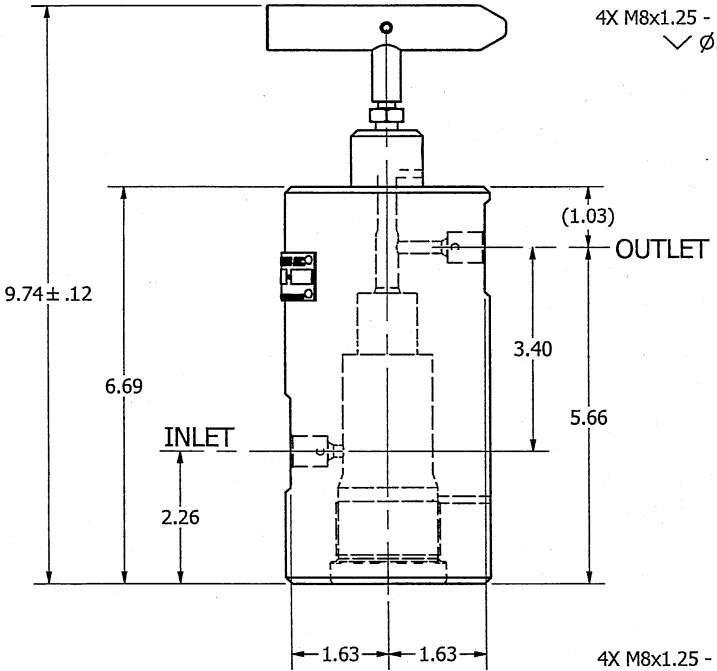
Notes:

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.

ECN		REVISION HISTORY		
REV	DESCRIPTION	BY	DATE	APPROVED
A	INITIAL RELEASE	G JONES	7/28/11	<i>[Signature]</i>



4X M8x1.25 - 6H ∇ .60
 ∇ Ø.32 X 90°
2X 3/8" MP AE PORT

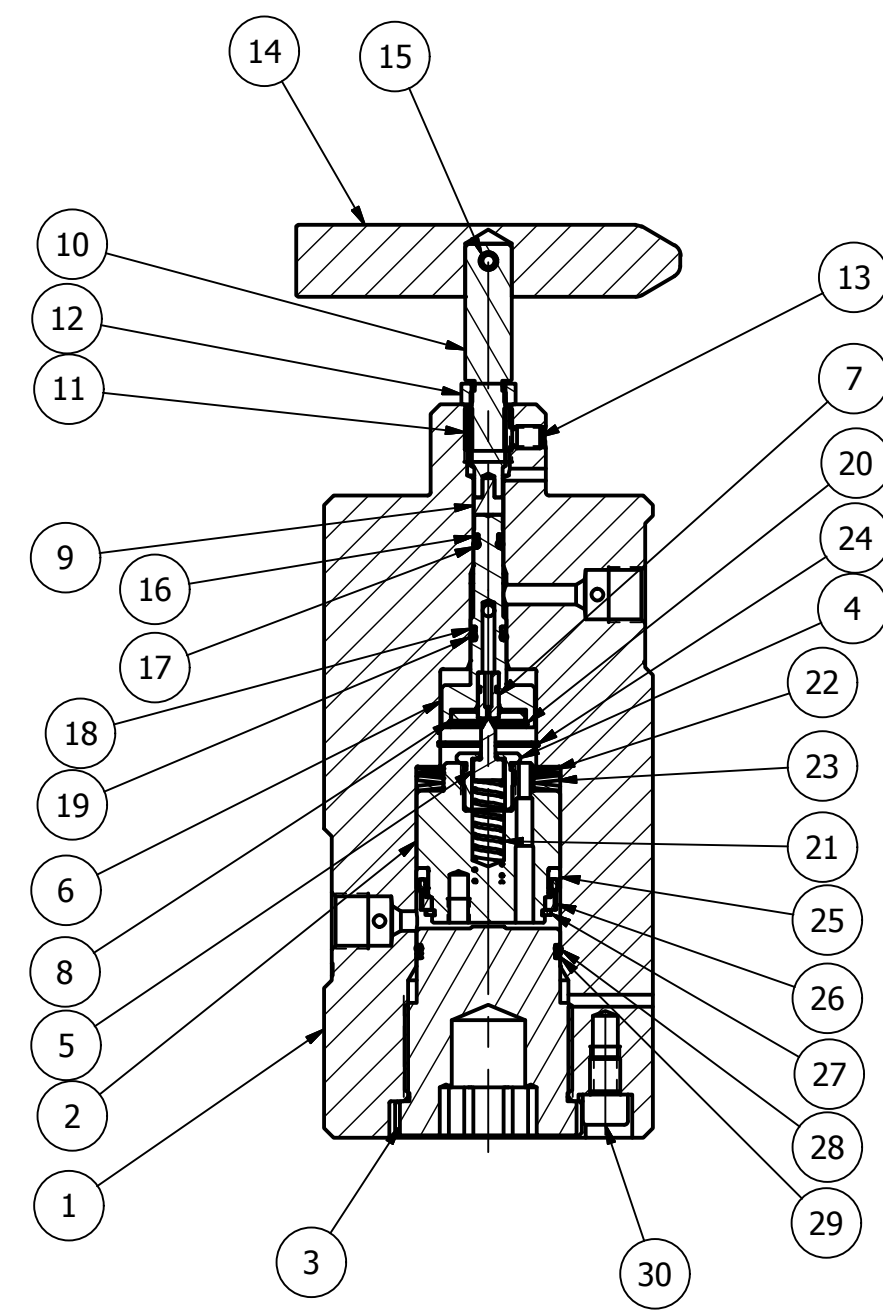
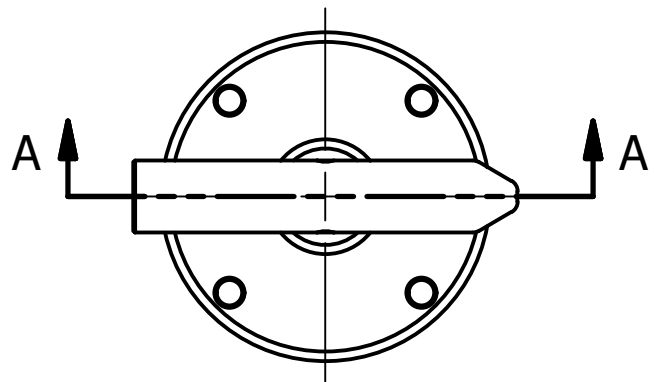


- NOTES:
1) INTERPRET DRAWING PER ANSI Y14.5M-1982
2) REFER TO DRAWING 28066 FOR ASSEMBLY

ALL DIMS IN INCHES UNLESS OTHERWISE SPECIFIED		DRAWN Gil Jones 7/27/2011		SKOFLO INDUSTRIES, INC. WOODINVILLE, WA
FRACTIONS ± 1/16 X ± .03 XX ± .010 XXX ± .005 XXXX ± .0005 ANGULAR ± 1.0°		CHECKED		VALVE, SF10000/15000 D/DRS
DEBURR AND BREAK EDGES .005/.015 RMS SURF QUAL 63 FILLET R .005/.015 ALL HOLES AND BORES ROUND TO .005 TIR		FIG ENG	OUTLINE DIMENSION	REV A
THIS DOCUMENT CONTAINS INFORMATION WHICH IS PROPRIETARY TO SKOFLO 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.		DWG NO 28065.idw		SHEET 1 OF 1

PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	28051	BODY, SF15000C /CRS
2	1	20845	PISTON, Ø.150 PIN
3	1	20847	VALVE BODY CAP
4	1	20846	PIN HOLDER, .165 PIN
5	1	20652	PIN
6	1	20841	SEAT HOLDER, STD
7	1	20077	SEAT, CERAMIC, Ø.031
8	1	20385	RETAINER, SEAT
9	1	27423	TIP, ACTUATOR STEM
10	1	27522	STEM FOR ACTUATOR
11	1	20096	BUSHING, THREADED
12	1	71002111	3/8-24 JAM NUT
13	1	71002101	SHSS CUP, M6 X 8
14	1	20228	HANDLE, STEM
15	1	71002082	ROLL PIN, .1875 DIA X 0.75 LG
16	1	71001887	SL, BU RING, 2-008
17	1	SELECTION	SL, O RING, 2-008
18	1	71001891	SL, BU RING, 8-010
19	1	SELECTION	SL, O RING, 2-010
20	1	71001946	SPIRAL RING, WH-78-S16
21	1	71002067	SPRING, PIN, .039 FOR NC/DRS
22	2	71001960	BELVIL SPRING, S1490-J-025-316-B
23	2	71001962	BELVIL SPRING 1.500 OD X 1.000 ID
24	1	71001947	SPIRAL RING, WH-100-S16
25	1	71001872	SL, CUP, Ø1.50 OD X Ø1.25 ID
26	1	20184	PISTON CUP SEAL RETAINER
27	1	71001948	SPIRAL RING, WST-118-S16
28	1	SELECTION	SL, O RING, 2-028
29	1	71001938	SL, BU RING, 8-028
30	1	71002091	SHCS, M8 X 10

REVISION HISTORY				
ECN	REV	DESCRIPTION	DESIGNER	DATE
	A	INITIAL RELEASES	GPJ	3/10/15



SEAL KITS ARE LISTED ON FOLLOWING PAGE

PAGE 15 of 16

NOTES:
1) INTERPRET DRAWING PER ANSI Y14.5M-1982

ALL DIMS IN INCHES UNLESS OTHERWISE SPECIFIED		DRAWN gil.jones	3/10/2015	SKOFLO INDUSTRIES, INC. WOODINVILLE, WA
FRACTIONS ± 1/16 .X ± .03 .XX ± .010 .XXX ± .005 .XXXX ± .0005 ANGULAR ±1°		CHECKED		
DEBURR AND BREAK EDGES .005/.015 RMS SURF QUAL 63 FILLET R .003/.015 ALL HOLES AND BORES ROUND TO .005 TIR		ENG		VALVE ASSEMBLY, SF10000DRS BOM
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PISTON / ORIFICE SELECTION TABLE FOR SF1000DRS

Maximum GPD	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

SEAT HOLDER SELECTION TABLE FOR SF1000DRS

PART NO.	DESCRIPTION
22051	SEAT HOLDER W/ SEAT, STD, KALREZ
22054	SEAT HOLDER W/ SEAT, XL, KALREZ
22057	SEAT HOLDER W/ SEAT, XLS, KALREZ
22060	SEAT HOLDER W/ SEAT, XXL, KALREZ

SEAL KIT SELECTION TABLE FOR SF1000DRS

PART NO.	DESCRIPTION
22068	SEAL KIT, SF1000D, EPDM
22069	SEAL KIT, SF1000D, KALREZ
22070	SEAL KIT, SF1000D, VITON
22283	SEAL KIT, SF1000D, VITON B
22284	SEAL KIT, SF1000D, HNBR