



Operators Manual

SL3100

Singline[®] Automatic Spray Systems
Installation, Operation, Parts List

SL3100 r#5



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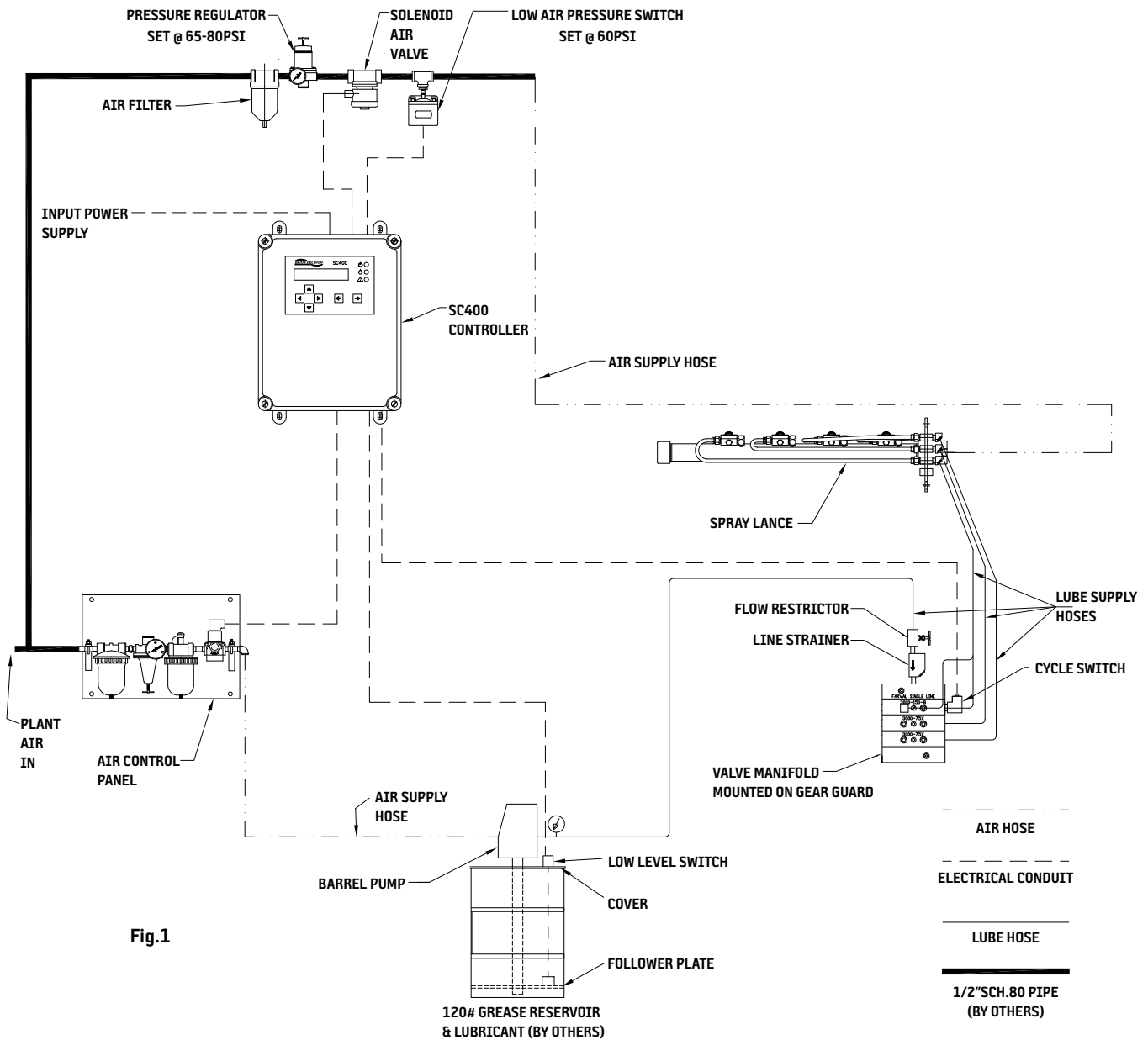
INTRODUCTION

The spray systems described in this bulletin are used to lubricate large gear and pinion sets such as found on ball mills, rod mills, kilns, etc. Each systems includes an air operated pumping station, a measuring valve panel, a spray nozzle, electrical controls and a number of optional features.

Gear face widths of 2" to 42" can be lubricated with nozzles and nozzle spacing designed accordingly. Since Bijur Delimon gear spray systems operate intermittently they can be thought of as film maintaining devices. The electrical controls provide broad cycling flexibility as well as fault monitoring and after blow to purge the nozzles.

**Illustrations and specifications are not binding in detail.
 Designs are subject to modification and improvement without notice.**

TYPICAL SYSTEM (Pump Close To Valve Panel)



1. SC400 times out, opening the two solenoid air valves. The pump starts. A measured volume of lubricant discharges from each outlet of the valve manifold to its spray nozzle. Air flows thru the air manifold to the spray nozzles, atomizing the lubricant to a penetrating spray.
2. Lubricant flow from the pump cycles the manifold. When the number of cycles reach a pre-determined amount (programmed in the SC400 control) the pump solenoid air valve closes.
3. A time delay programmed in the control keeps the nozzle solenoid air valve open for a period up to 99 seconds after lube flow stops. This after-blow time cleanses the nozzles to prevent plugging.
4. The end of the after-blow interval completes the lubrication cycle. System will remain idle until timer initiates another cycle.
5. SC400 provides system monitoring.

TYPICAL SYSTEM (Pump Remote To Valve Panel)

NOTES

1. Study Fig.1 on page 3. The lube supply hose is 6 feet long. There are occasions when the pump must be located some distance from the valve panel and a 6 foot hose length is inadequate.
2. Where pumps must be remotely located from the valve panel a pipe supply line is run to within 30" of the valve panel and a 36" hose assembly is used to connect to the panel.
3. To assure good pressure distribution under various operating temperature conditions select the pipe size from table in Fig.2.

Pipe Sizing Table - Fig. 2

PIPE SIZE	OPERATING TEMPERATURE (°F)		
	50° - 90°	32° - 50°	0° - 32°
1/2	60 FT.	40 FT.	20 FT.
3/4	-	60 FT.	30 FT.
1	-	-	40 FT.

NOTE: Longer lengths and larger diameter pipe is not recommended due to the fact that the compressed volume of lubricant, within a pipe, causes the valve manifold to cycle after the pump shuts down. This can result in excessive consumption of lubricant and/or cause the SC400 control to fault.

SYSTEM COMPONENTS

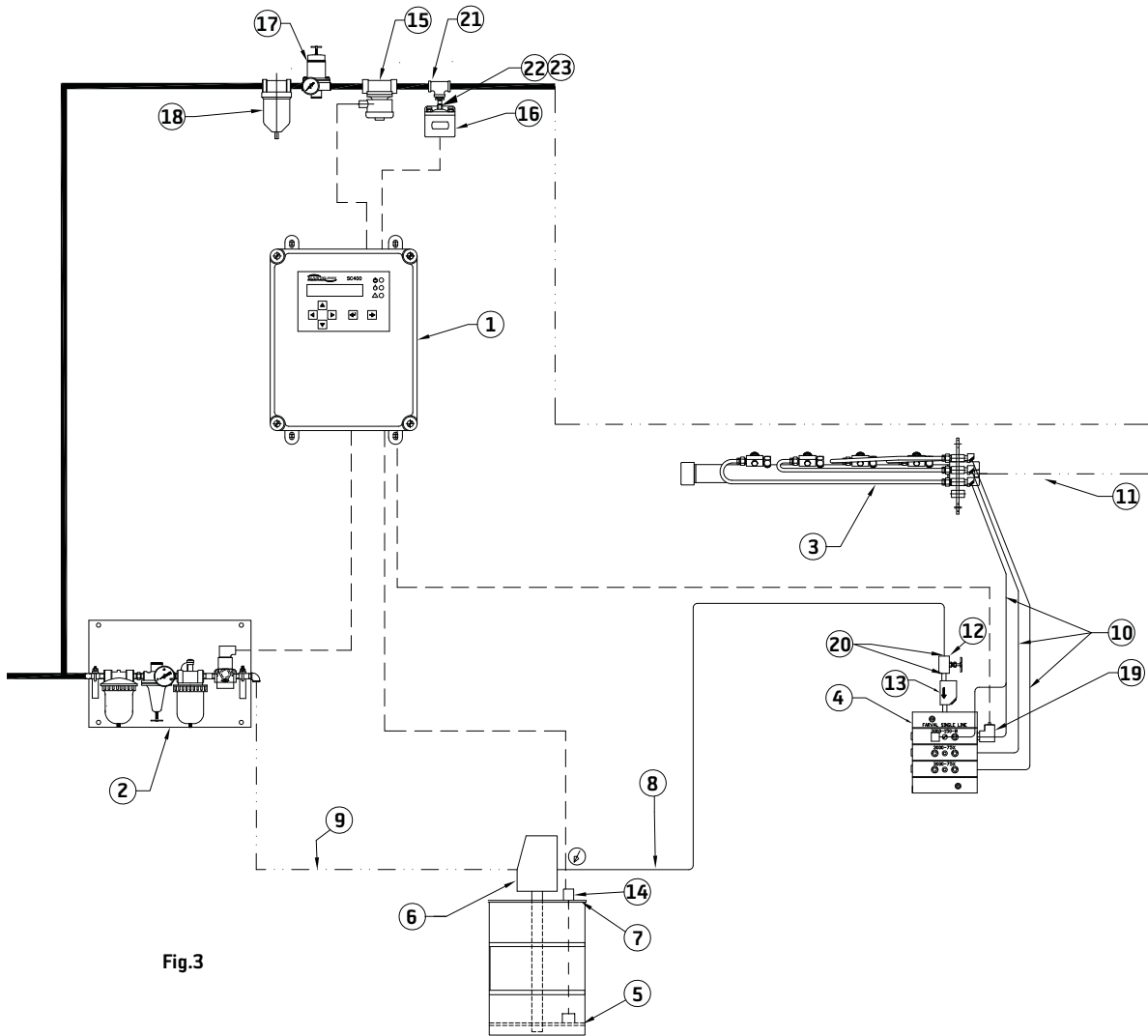


Fig.3

PARTS LIST

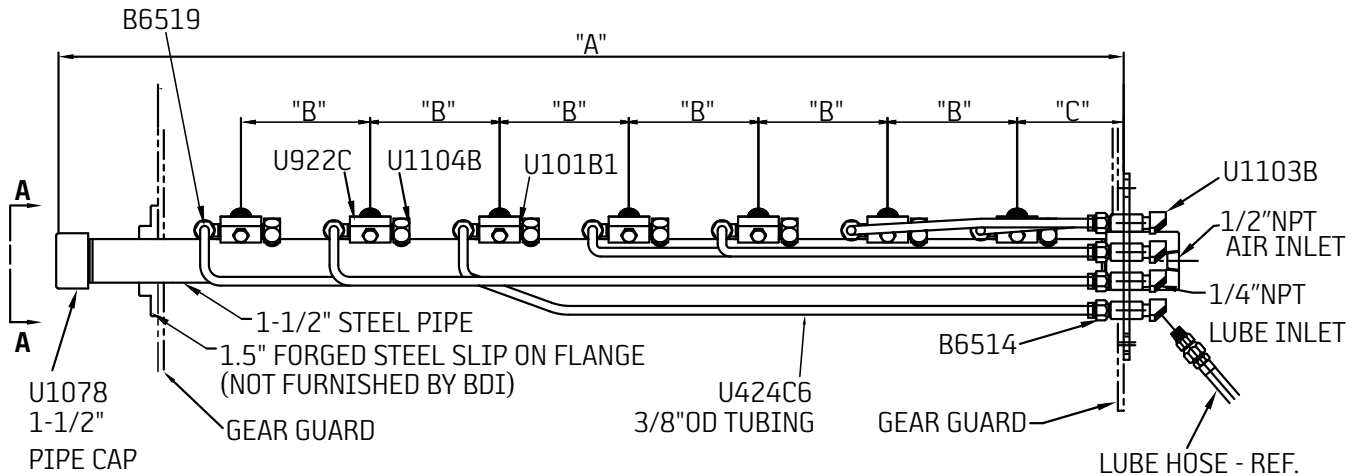
ITEM #	PART NUMBER	QTY.	DESCRIPTION
1	SC400	1	Solid State Controller
2	LD7767CA1	1	Air Control Panel - 110/120 VAC - 50/60 Hz.
+3	LD9327XXXXX	1	1 To 8 Point Spray Lance Assembly
+4	3001X7	1	Manifold Valve W/O Switch - (1 TO 8 Outlets, typically 3 or 4 sections)
5	F964	1	Follower Plate - 120# Drum
6	F302	1	Pump - 120# Drum, 55:1 Ratio, 40"cu.in./minute
7	F1936	1	Cover - 120# Drum
8	200275	1	Kit - Lube Supply Hose W/ Gauge - 72" - 3/8" NPT Ends
9	200325	1	Kit - Air Supply Hose - 72" - 1/2" NPT X 1/4" NPT
10	201223	1 TO 8	Kit - Lube Supply Hose - 36" - 1/4" NPT Ends
11	201502	1	Kit - Air Supply Hose - 36" (To Lance) - 1/2" NPT Ends
12	LB9425	1	Flow Restrictor - 1/2" NPT Ports
13	LS03120	1	Line Strainer - Grease - 3/8" NPT
14	LC10243	1	Kit - Low Level Switch
*15	201594	1	Air Solenoid Valve, 120VAC 50/60Hz, 1/2" NPT, NEMA 4X
16	201595	1	Air Solenoid Valve, 120VAC 50/60Hz, 3/4" NPT, NEMA 4X
	U623	1	Pressure Switch, Air, 150PSI Max, NEMA 4, 1/4" NPT
*17	F976	1	Air Regulator with Gauge, 1/2" NPT
	F980	1	Air Regulator with Gauge, 3/4" NPT
*18	F978	1	Air Filter, 1/2" NPT
	F982	1	Air Filter, 3/4" NPT
19	201134	1	Switch & Bracket Assembly - NEMA 4
20	U10403	2	Bushing 3/8" NPT(F) X 1/2" NPT(M)
21	U163D	1	Tee 1/2" NPT
22	U10402	1	Bushing 1/4" NPT(F) X 1/2" NPT (M)
23	32485-2	1	1/4" NPT Hex Nipple

*Order parts 15, 17, and 18 with 1/2" ports for 1 to 3 nozzle systems and with 3/4" ports for 4 to 8 nozzle systems

+Only the basic number is shown for items 3, 4. The balance of the number varies with the installation.

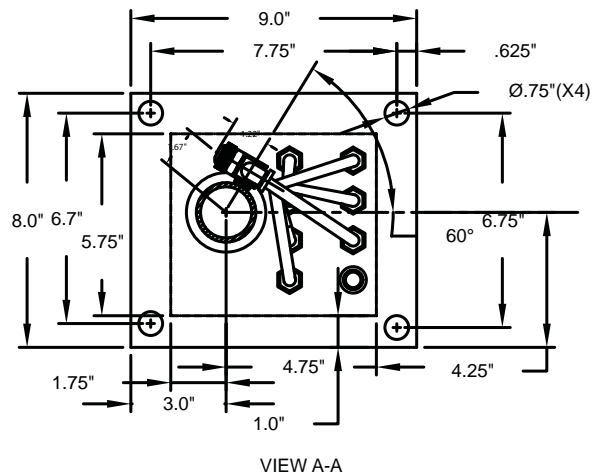
SPRAY LANCE - MODEL LD-9327

Model LD-9327 spray lances described below include spray nozzles in which air under pressure atomizes lubricant from the valve panels and sprays it onto the gear face. Note that guard width must be exactly 3" wider than gear face width. Contact factory for special applications.



Group 1 - Assembly Numbers and Dimensions

ASSEMBLY PART #	GEAR FACE WIDTH	GUARD WIDTH	NO. OF SPRAY NOZZLES	DIMENSIONS		
				A	B +/- 1/16"	C +/- 1/16"
LD93271020S	2"	4.5"	1	8"	-	2.25
LD93271030S	3"	5.5"	1	10"	-	2.75
LD93271040S	4"	6.5"	1	11"	-	3.25
LD93271050S	5"	7.5"	1	12"	-	3.75
LD93271060S	6"	8.5"	1	13"	-	4.50
LD93272070S	7"	9.5"	2	14"	4.00	2.25
LD93272080S	8"	10.5"	2	15"	4.50	3.00
LD93272090S	9"	11.5"	2	16"	4.50	3.50
LD93272100S	10"	12.5"	2	17"	5.00	3.75
LD93272110S	11"	13.5"	2	18"	5.25	4.13
LD93273120S	12"	14.5"	3	19"	4.38	2.87
LD93273130S	13"	15.5"	3	20"	4.38	3.37
LD93273140S	14"	16.5"	3	21"	4.68	3.57
LD93273150S	15"	17.5"	3	22"	5.00	3.75
LD93273160S	16"	18.5"	3	23"	5.25	4.00
LD93274170S	17"	19.5"	4	24"	4.50	3.00
LD93274180S	18"	20.5"	4	25"	4.50	3.50
LD93274190S	19"	21.5"	4	26"	4.75	3.75
LD93274200S	20"	22.5"	4	27"	5.00	4.00
LD93274210S	21"	23.5"	4	28"	5.25	3.88
LD93275220S	22"	24.5"	5	29"	4.50	3.25
LD93275230S	23"	25.5"	5	30"	4.75	3.50
LD93275240S	24"	26.6"	5	31"	5.00	3.75
LD93275250S	25"	27.5"	5	32"	5.25	4.00
LD93276260S	26"	28.5"	6	33"	4.38	3.30
LD93276270S	27"	29.5"	6	34"	4.38	3.80
LD93276280S	28"	30.5"	6	35"	4.68	3.55
LD93276290S	29"	31.5"	6	36"	4.68	4.05
LD93276300S	30"	32.5"	6	37"	5.00	3.75
LD93276310S	31"	33.5"	6	38"	5.25	3.63
LD93277320S	32"	34.5"	7	39"	4.38	4.11
LD93277330S	33"	35.5"	7	40"	4.68	3.71
LD93277340S	34"	36.5"	7	41"	5.00	3.25
LD93277350S	35"	37.5"	7	42"	5.00	3.75
LD93277360S	36"	38.5"	7	43"	5.25	3.50
LD93277370S	37"	39.5"	7	44"	5.25	4.00
LD93278380S	38"	40.5"	8	45"	4.68	3.87
LD93278390S	39"	41.5"	8	46"	4.80	3.95
LD93278400S	40"	42.5"	8	47"	5.00	3.75
LD93278410S	41"	43.5"	8	48"	5.10	3.90
LD93278420S	42"	44.5"	8	49"	5.25	3.88



NOTE:
 "S" series spray lances are shipped with round spray nozzles installed. Flat spray nozzle set is also included with each spray lance.

SC400 MULTI-FUNCTION CONTROLLER/MONITOR

General

The SC400 Controller is a full featured lubrication control, offering “two plus one” functionality. The controller has the ability to operate a single pump and two zone valves (e.g. frequent/infrequent lubrication cycles) or two separate pumps (e.g. one oil pump & one grease pump). For single zone systems, the SC400 Controller also offers two intervals (e.g. weekday /weekend). The controller can activate a fill pump as needed to maintain proper fluid levels in the oil or grease reservoir.

Features

- + 2 zone operation (for Progressive, Injector and Dualine Hydraulic systems).
- + IP56 enclosure, constructed of molded polyester fiberglass.
- + CE approved.
- + Four supported languages (English, French, Spanish, German).
- + Pump output may be powered externally or via control power.
- + Valve A, Valve B and Fill pump may be powered externally or via controller.
- + Critical Inputs accept PNP, NPN or mechanical switches.
- + 500 mA of 24 VDC is available to power customer's accessories.
- + Primary alarm inputs may be programmed for N.O. or N.C. functionality.
- + Machine watchdog and cycle monitoring.
- + Pause (standby), jog (manual operation).
- + Accepts all BDI electric reversing valves and cycle/pressure/"end-of-line" switches.

Technical Data

Input Voltage	85 to 265 VAC, 50/60 Hz
Output Rating (Line A & B)	8 amp (90 to 250 VAC)
Enclosure Rating	IP-56
Idle Time Range	1 second to 100 days
Machine Cycle Counts	1 to 999,999 Counts (30 counts/second at 50% duty cycle)
Watchdog Timer	1 second to 60 minutes
Monitor Time	1 second to 24 hours
Cycle Counts On	1 to 999 counts
Over Counts	0 to 9
Net Weight	5 lb
Length x Width x Height	12.3" x 9.2" x 5"
Fault Relay Contacts	5 amp

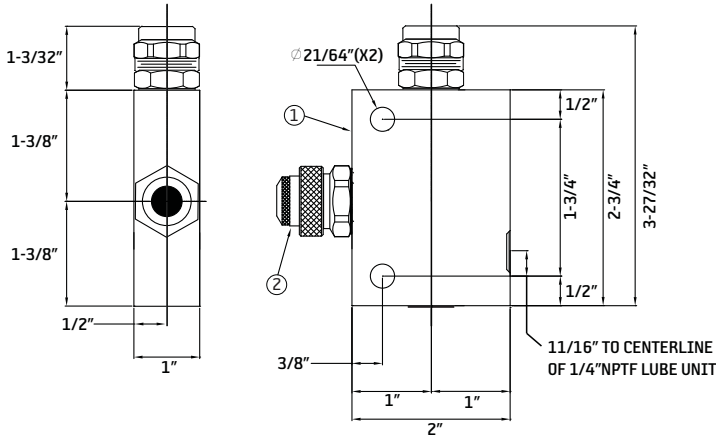


Refer to the following documents for more info:

+ *Datasheet #35980: SC400 Controller*

BDI SPRAY CONTROL VALVE & NOZZLE ASSEMBLIES

APPLICATION: SC1-2 spray control valves are used on manually operated spray systems, automatic gear spray systems on shovels and drag lines, and on older gear spray panels. **(NOTE: Not used in conjunction with spray lances on page 6.)**



COMPONENT ASSEMBLIES

1. SC1 Series spray control valve (identical for all assemblies)
2. U943 spray nozzle setup (model selected depends on lubricant and application)

NOTE:
SC1-2 spray control valve and U943 spray nozzles are sold separately. Must purchase individually.

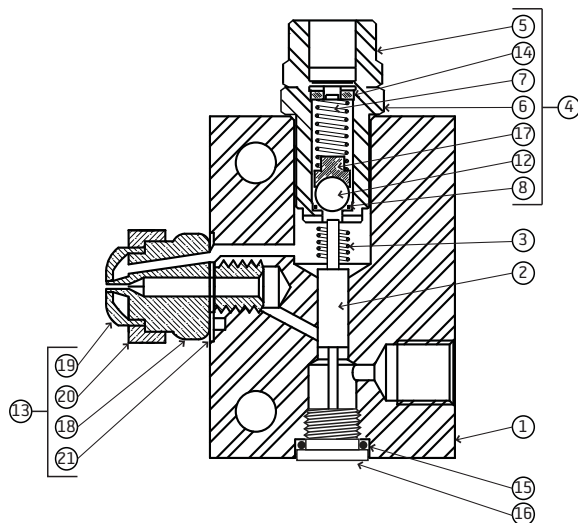
HOW TO ORDER EXAMPLES:

- A. **Spray nozzle setup if known:** One SC1-2 spray control valve with spray nozzle setup. (Specify correct spray nozzle setup, whether U943A, C or F.)
- B. **SC1-2 w/After Blow:** Order P.N. SPR13241B (Order U943 separately)
- C. **Spray nozzle setup:**
 1. U943A - for light oil.
 2. U943C - for oil or grease - recommended for most spray applications.
 3. U943F - used when flat spray pattern is desired such as spraying wire rope.

SC1-2 SPRAY CONTROL VALVE WITH U943 SPRAY NOZZLE SET-UP

ITEM #	PART NO.	DESCRIPTION
*1	N/A	Valve Body
*2	N/A	Piston
3	SC110061	Spring-Piston Stop
4	SC110072	Air Check Valve Assy.
**5	N/A	Check Valve Body
**6		Lock Nut
**7		Spring
**8		Quad Ring
9	U204B6	5/16-18 x 1-3/4 Cap Scr.
10	U213F	5/16 Lockwasher
11	U219B	5/16-18 Hex Nut
**12	N/A	5/16" Check Ball
13	U943	Spray Nozzle Set Up
**14	N/A	7/16-20 Dr. Ret. Scr.
15	U1305G	7/16" Copper Washer
16	U1522D	Closure Plug
**17	N/A	Ball Retainer

*Items 1 & 2 shown for reference only - not for resale.
 **Items must be purchased in item#4.



U-943 SPRAY NOZZLE SET-UP

ITEM	PART NO.			NAME
	U943A	U943C	U943F	
18	UX943A1	UX943C1	UX943F1	Fluid Nozzle
19	UX943A2	UX943C2	UX943F2	Air Nozzle
20	UX943A3	UX943A3	UX943A3	Hex Retainer
21	UX943A4	UX943A4	UX943A4	Gasket

BDI SPRAY CONTROL VALVE & NOZZLE ASSEMBLY

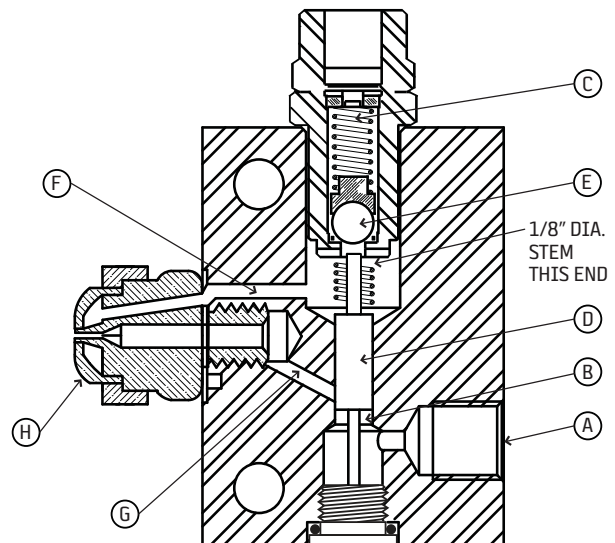
HOW TO ADJUST MODEL SC1 SPRAY CONTROL VALVES

SC1 valves are factory adjusted to function properly with NLGI #0 consistency lubricant. If other lubricants are used, the following adjustment may be needed to improve atomization or to eliminate nozzle burping at the start and end of the lube cycle.

1. Pump to 1000 psi on the pressure gauge. Relieve system with the pump solenoid valve and then loosen locknut (item 6, page 9) at the air inlet and turn check valve body (5) clockwise until air slows thru spray nozzle (13). Finally turn check valve body counterclockwise until no air escapes.
2. Repeat "1" several times if needed for good atomization. Then tighten locknut. **Caution:** To prevent a change in setting, hold check body firmly while tightening locknut.

HOW SPRAY CONTROL VALVE & NOZZLE ASSEMBLIES OPERATE

1. Lube under pressure flows thru port A into chamber B causing piston D to move toward ball E. this both unseats the ball and opens a port from chamber B to passage G.
2. Air flows past ball E thru passage F and lube flows thru passage G. They meet in air nozzle H and produce a spray. Removal of the air nozzle will only produce a more concentrated spray.



ASSEMBLY NOTES

When assembling an SC1 valve, install large (1/8" dia.) end of piston D toward ball as shown in figure.

SCI PERFORMANCE DIAGNOSIS - (Valve fails to operate properly)

Cause	Repair
1. Insufficient air supply.	1. Check pressure - should be 80psi minimum (not less than 60 psi during spray cycle)
2. Incorrect setting of air control valve.	2. Re-adjust - see above for details.
3. Clogged spray nozzle.	3. Wash with solvent and reassemble.
4. Clogged spray control.	4. Remove pilot piston and clean it and the piston bore with solvent. Reassemble.

SCI CONVERSION - TO PROVIDE AFTER BLOW

(FOR EXISTING SPRAY PANELS EQUIPPED WITH SC1 VALVES)

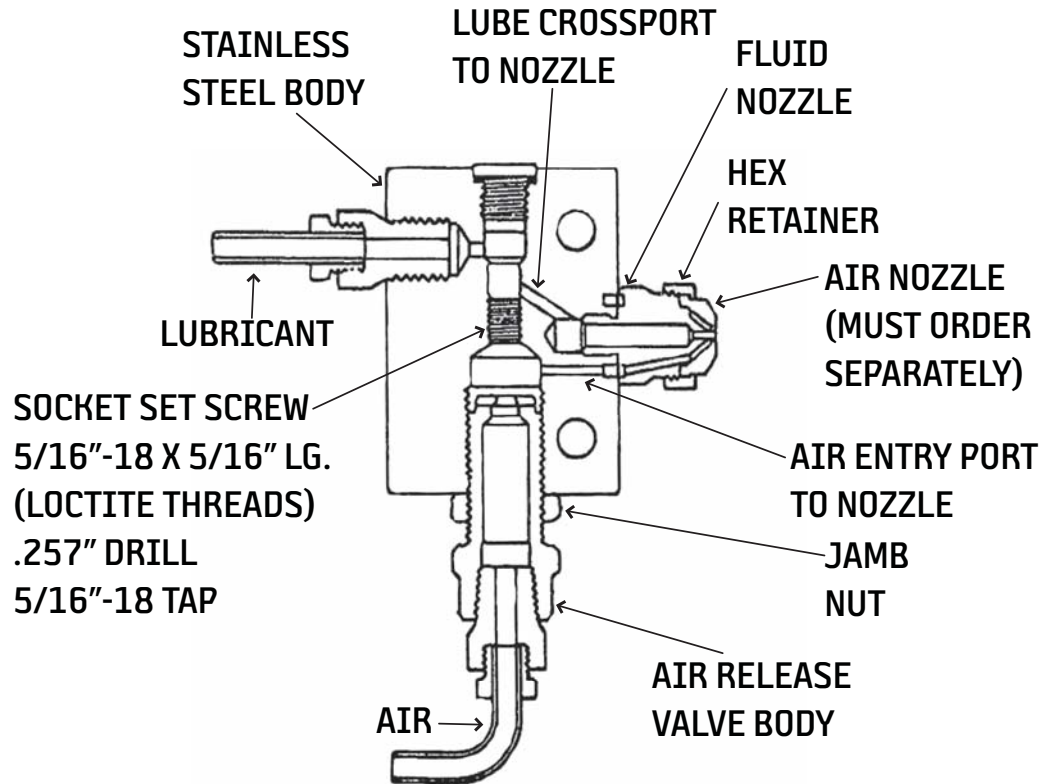


FIGURE - 14

NOTES

Existing spray panels equipped with SC1-2 spray control valves can be upgraded to incorporate after blow by employing the following procedure:

1. Remove items (shown on page 9) numbers 2, 3, 8, 12, 17, 7 and 14.
2. Drill piston bore .257" then tap 5/16"-18.
3. Insert 5/16"-18 x 5/16" long set screw coated with Loctite thread locker.
4. Insert solenoid air shut-off valve in air line to nozzles and wire in parallel with air operated barrel pump.
5. Install time delay relay in control circuit to provide approximately 60 seconds after blow.

CAN ORDER SC1-2 WITH AFTER BLOW FROM BDI. PART # SPR13241B. MUST ORDER AIR NOZZLE SEPARATELY(SEE PG 8)

SYSTEM AIR REQUIREMENTS

A free air volume of V_a cubic feet, calculated by the equation below, should be provided for each lube cycle. This is twice the theoretical air volume needed to operate both pump and nozzle. A lube cycle is defined on page 3.

$$V_a = 2V_1(T_1 + NT_2) + 2V_2(T_1 + NT_2 + T_3)$$

Where:

V_1 = Free air volume used by the pump.
assume = 5.0 cfm.

V_2 = Free air volume used by the nozzles in cu.ft. per minute
see Fig. 6.

T_1 = Time in minutes to compress lube in distribution lines.
see Fig. 7.

T_2 = Time in minutes required by a pump to discharge lube
from the nozzles during one count. See Fig. 6.

T_3 = Time in minutes for air to clean lube from nozzles after
discharge. Allow 0.50 minutes.

N = Lube discharge sensing switch cycles programmed into
SC400 control.

Example: Find the free air volume needed by the spray system shown in Fig.3(Page 5). Four times an hour the system is to discharge 6 cycles of lube at 0.15 cu.in. per cycle to each of the four spray nozzles. Distribution lines consist of 100' of 1" pipe.

$$V_a = 2 \times 5 \times (.18 + 6 \times .015) + 2 \times 54 \times (.18 + 6 \times .015 + .5) = 86 \text{ cu.ft. per lube cycle}$$

Volume of free air required for one hour is: $4 \times 86 = 344 \text{ cu.ft.}$

NO. OF NOZZLES	T2*	V2 (cfm)
1	.004	13.5
2	.008	27.0
3	.011	40.5
4	.015	54.0
5	.019	67.5
6	.023	81.0
7	.026	94.5

Fig. 6 - Values for T_2 and V_2 .

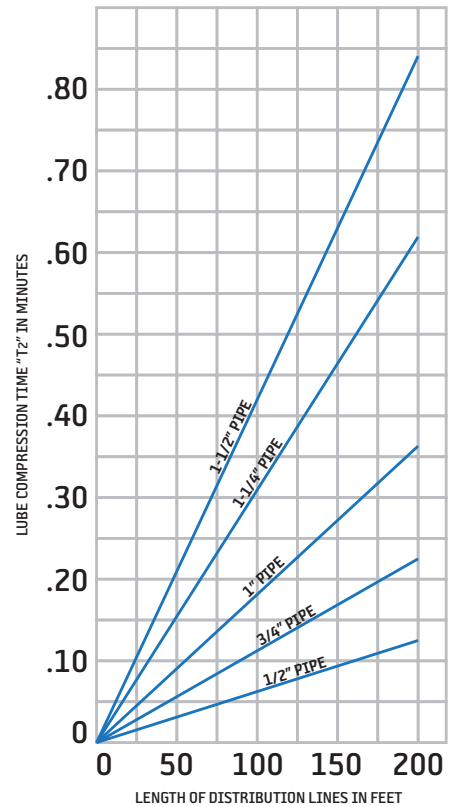


Fig. 7 - Lube compression time "T1"
(based on 1% compressibility of lubricant).

*Values for T_2 in Fig. 6 are calculated from the equation $T_2 = V \times Q \div 40$ using a "V" of .150 cu.in. in the equation, "V" is the lube discharge per count to each nozzle, "Q" is the number of nozzles and "40" is the pump output in cu.in./minute at 1000psi line back pressure and a pressure regulator setting of 80 to 100 psi.

INSTALLATION INSTRUCTIONS

- A. Lube supply pipe should be extra heavy (Schedule 80) with clean cut threads free of burrs. Use 3000 psi forged steel fittings. Air supply pipe can be schedule 40 with 150 pound malleable iron fittings.
- B. Clean inside of pipe thoroughly before installation to remove all scale, chips, dirt or burrs.
- C. Pipe sealing compound, if a good grade and if applied carefully so that none gets inside the pipe, may be applied to threaded connections. Pull threaded connections tight.
- D. Install pipe in protected locations and firmly clamp in place.
- E. For low temperature operation, prevent stiffening of gear spray oils by heating the lube container with a drum heater or the lube supply line with a thermostatically controller heating cable. Do not use strip heaters or immersion heaters which will localize and concentrate the heat at one point and thus possibly cook the grease. Drum pump heaters can be purchased.

NOTE: The above applies only to gear spray oils. CUT BACK LUBRICANTS CONTAINING DILUENTS MUST NOT BE HEATED: RATHER, IT IS NECESSARY TO USE A LIGHTER GRADE LUBRICANT. Heating cut back lubricants drives off the solvent, resulting in a heavier residue which will plug up lines and spray nozzle orifices.

Install air supply lines as follows:

- A. Keep pressure loss low. Select pipe so that the loss between the air regulator and the spray nozzle panel or lance is not more than 10 to 20 psi as calculated from the table. For air flow in scfm see V2 in Fig 6.
- B. Provide compressed air at 80 to 100 psi in sufficient volume to operate the air pump and not drop below 60 psi at the spray panels. For air volume required see page 11.
- C. Set the low pressure warning switch, U623 if installed. This switch is located in the line leading to the spray lance and should be set to warn when line pressure drops below 60 psi. The switch can be wired to operate the SC400 low pressure light or an audible device. Switch U623 is usually set at the factory to close at 60 psi on decreasing pressure.
- D. Set pressure regulator at the control so that maximum pump discharge is 2000 psi. This would be 40 psi for a F302 Std. duty pump since it has a pressure ratio of 55:1. Such a setting would operate the system and yet assure that the pump would stall out at 2000 psi and thus prevent damage from excessive pressure in case of line blockage. Need for a pressure relief valve is thus eliminated.

AIR PRESSURE LOSS (PSI)					
For every 100 feet of clean commercial Steel Pipe					
(80 psi at pressure regulator)					
cfm FREE AIR	NOMINAL PIPE DIAMETER				
	1/2 inch	3/4 inch	1 inch	1-1/4 inch	1-1/2 inch
10	.45	.11	.04		
20	1.75	.40	.15		
30	3.85	.90	.30		
40	6.95	1.55	.45		
50	10.5	2.40	.75	.18	
60		3.45	1.00	.25	
70		4.75	1.35	.35	.16
80		6.15	1.75	.45	.20
90		7.75	2.25	.55	.25
100		9.60	2.70	.65	.30
125		15.5	4.20	1.05	.45
150		23.0	5.75	1.45	.65
175			8.10	2.00	.90
200			10.9	2.60	1.15
250				4.05	1.80
300				5.80	2.55
350				7.90	3.55
400				10.3	4.55
450					5.80
500					7.10

Connect electric wiring as follows:

- A. Connect electric wiring according to the appropriate schematic diagram - See SC400 Service Data Sheet 35979.

Install the air operated pump as described in F302 Data Sheet 35993.

INSTALLATION
LOCATION FOR VALVE PANEL AND SPRAY LANCE

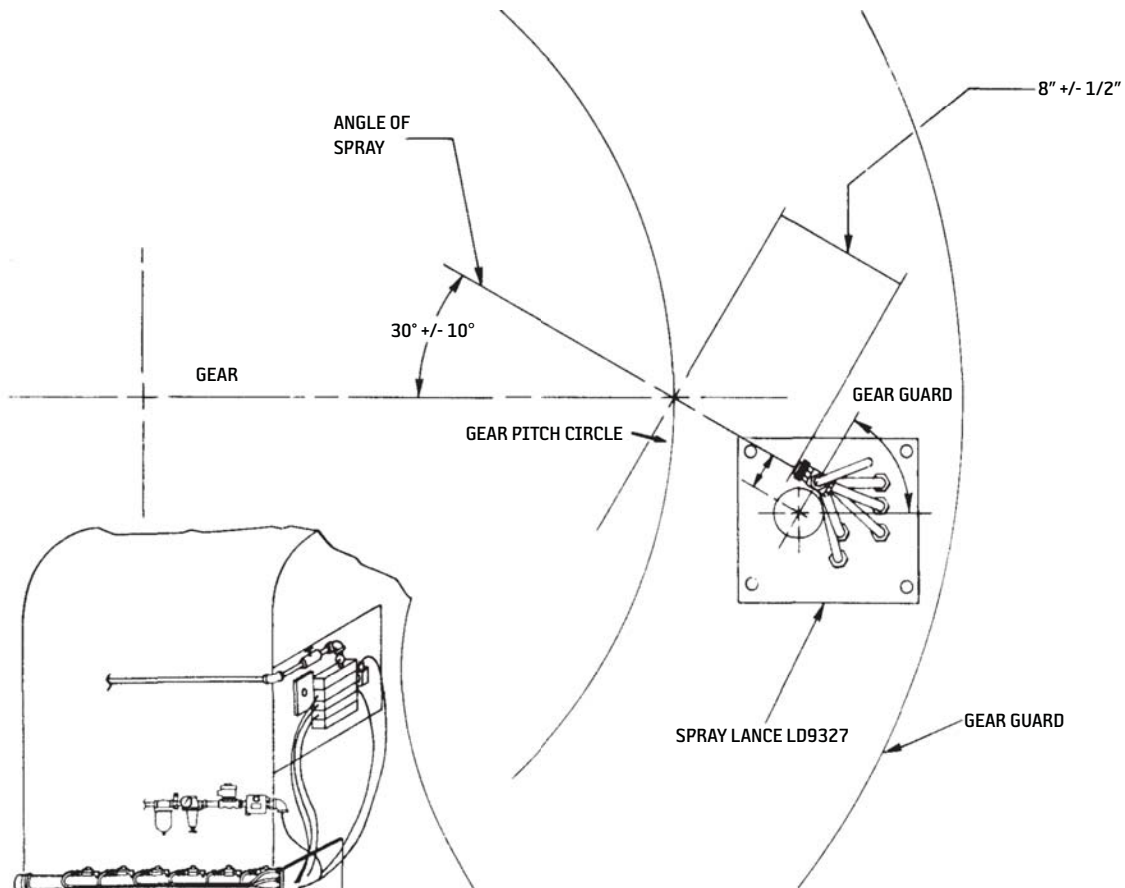


Fig. 9 - LOCATION OF SPRAY LANCE WITH RESPECT TO MILL GEAR.

Fig. 10 - TYPICAL GEAR GUARD WITH EQUIPMENT MOUNTED.

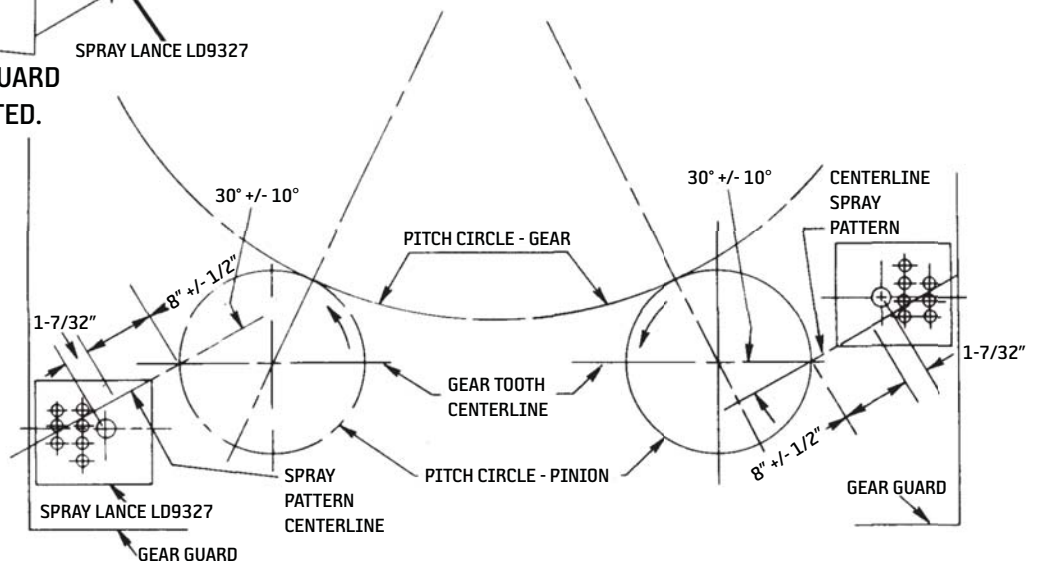


Fig. 11 - LOCATION OF SPRAY LANCE WITH RESPECT TO KILN PINIONS.

START UP PROCEDURE

- A. In the pump air line (see Fig.1), fill the air lubricator to the proper level with SAE 10 oil. Adjust the pressure regulator to about 40 psi.
- B. Fill the pump discharge line by disconnecting it at the point where it attaches to the valve manifold inlet port and operating the pump until lubricant appears at the manifold end free of air and foreign matter. The pump may be started and stopped manually by the SC400 push button. Reconnect the line and then operate the pump until the valve manifold to spray lance supply hoses are filled with lube.
- C. Every piston in the metering valve manifold moves back and forth in a predetermined sequence. Each piston must complete its movement (displacing a precise quantity of lubricant to one of the spray nozzles) before the next piston in the valve can move. The flow regulating needle valve between the pump and the valve manifold should be cracked open to permit the manifold to cycle at a rate which will produce about one "cycle" of the limit switch every 2 seconds (minimum). A faster cycle rate will cause too much lubricant to be sprayed on only one portion of the gear.
- D. Coat the gear teeth with lubricant before starting up the mill and lubricating system. For complete coverage, this will require several successive manually activated lubricating cycles of the spray system because the system is timed to make up for the loss of lubricant rather than complete coverage.
- E. Set the air regulator in the line leading to the spray nozzles to 60 - 80 psi. Re-adjust for best spray.
- F. Program the SC400 controller. Spray lubrication frequency depends on such factors as peripheral speed of the gear and type of lubricant. An initial frequency of once every 15 minutes is suggested for average ball mill gears and 30 to 40 minutes for slower speed gears such as girth gears of rotary kilns. The ultimate setting is normally determined by cycling frequently during gear run-in, then cutting back on time intervals until visual inspection shows adequate coverage remaining between cycles.

MAINTENANCE

- A. Too much water in the air filter drain bowl on the air control panel will make the filter ineffective and water will enter the pump. Empty it regularly. If moisture in the air supply line requires frequent draining of the air filter we suggest installing automatic drain assembly.
- B. Be sure lube container has plenty of lubricant. Pumping from an empty drum will force air into system, causing difficulty in building pressure.
- C. Use clean lubricant. Foreign matter will clog valve manifold.
- D. Keep line stainers clean. These are usually installed in the line leading to the valve manifold. Establish regular intervals for this service.
- E. Inspect entire system regularly including hose (replace if damaged), connections (they should be tight), and the gear (see that the teeth are being properly lubricated). Check spray pattern frequently by inserting a piece of cardboard in front of the spray nozzles while the system is operating. Complete coverage of the gear face is important.
- F. Completely clean the system with a flushing solvent every year or two to extend its life.

TROUBLE SHOOTING

SYSTEM DIAGNOSIS

CONDITION	CAUSE	REMEDY
A. Pump doesn't operate	1. Insufficient air supply.	1. Adjust air pressure to 40/50 psi.
	2. Timer control failing to operate solenoid shut-off.	2. Check wiring of system timer according to instructions and SC400 controller. Also check timer for proper programming.
	3. Lubricant has hardened in drum.	3. Use smaller sized drums - diluent in some lubricants tends to evaporate causing lubricant to harden.
B. Pump operates but doesn't build pressure.	1. Reservoir empty.	1. Check and renew lubricant supply. Purge air from lines.
	2. Broken line.	2. Repair or replace as necessary.
	3. Air in system.	3. Bleed lines and valves as described on page 14.
C. Manifold valve indicator doesn't operate.	1. Lack of pressure.	1. Repair - see condition B.
	2. Valve manifold is blocked.	2. Replace.
	3. Plugged discharge line.	3. Locate obstruction, remove line and blow clean, or replace faulty section.

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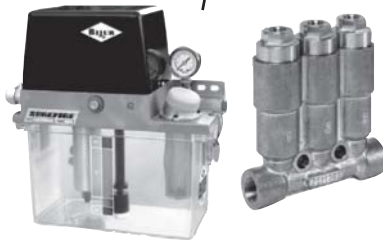
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