Broken Line Indicator

SAFETY

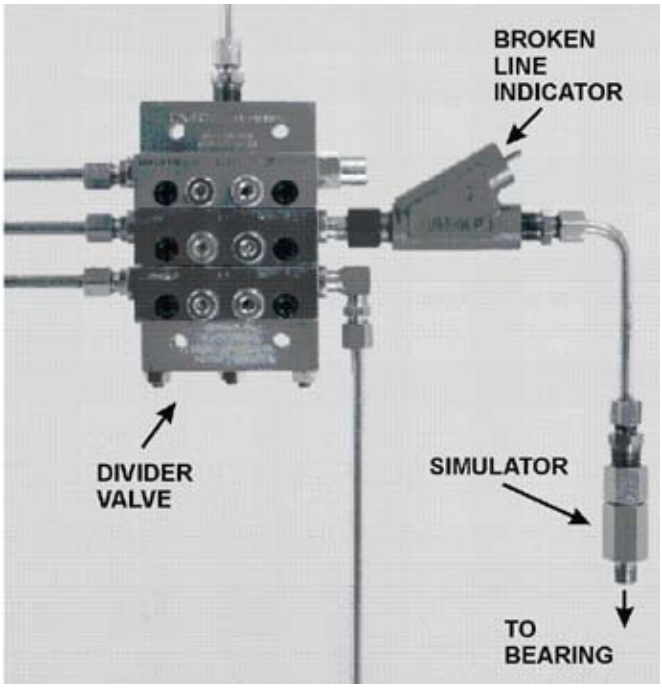
Operators and service personnel should read the entire manual before attempting to operate, service or maintain the equipment. Personnel should review all instructions concerning company safety procedures provided at the installation location. Use and service of the equipment should be restricted to qualified machine operators and maintenance personnel. Observe the following warnings and safety considerations at all times:

- Know the location of EMERGENCY STOP push buttons before proceeding with any service or maintenance operation.
- Wear safety glasses, approved by the company, at all times.
- Ensure that the operator work area is kept clean. Do not work on slippery floors and surfaces. Remove all chips and hazardous obstacles.
- Read and observe all signs posted on the equipment.
- High pressure can exist in lines when the lubrication system is operating or after shutdown for an extended period of time, depending on the integrity of the system. Relieve system pressure prior to opening pressure lines.
- When there is a warning because of a broken line, other parts of the lube system may still contain pressure.
- Use hoses and tubing that are rated for the required pressures.
- If high pressure develops, use caution when finding the problem so as not to relieve pressure near eyes or face.

DESCRIPTION (Refer to Figure 1)

Broken Line Indicators (5) are small monitoring devices which are installed in divider valve outlet ports (1) for terminating oil and grease or recirculating oil systems. They are designed to monitor line integrity of lubricant transmission lines (2) and (9) for critical bearing points (3) on a machine.

Broken Line Indicators provide a visual indication at the divider valve outlet of the lubrication point being monitored to enable easy location of broken lines (severed or leaking connections).



The Indicator also generates a central high-pressure warning [via pressure switch (8)] in the main line (4) between the pump and master divider in the event of line breakage.

The Broken Line Indicator Kit includes an Indicator (5) and a Simulator (6). The Simulator is a preset relief valve. It is an O-ring sealed, piston-type relief valve for positive retention of line pressure. (See Figure 2 for cutaway views.)

The Indicator is installed in the divider valve outlet port (1) and the Simulator (6) is installed in the bearing tap (3). It is highly recommended that performance indicators (reset with memory type) be installed in the alternate outlet ports (7) of the master divider to assist in troubleshooting the system. Pressure rating of the performance indicators will be the same as the Indicator (5) rating. (See Graco Bulletin L15401 for performance indicators.)

Typical System Schematic

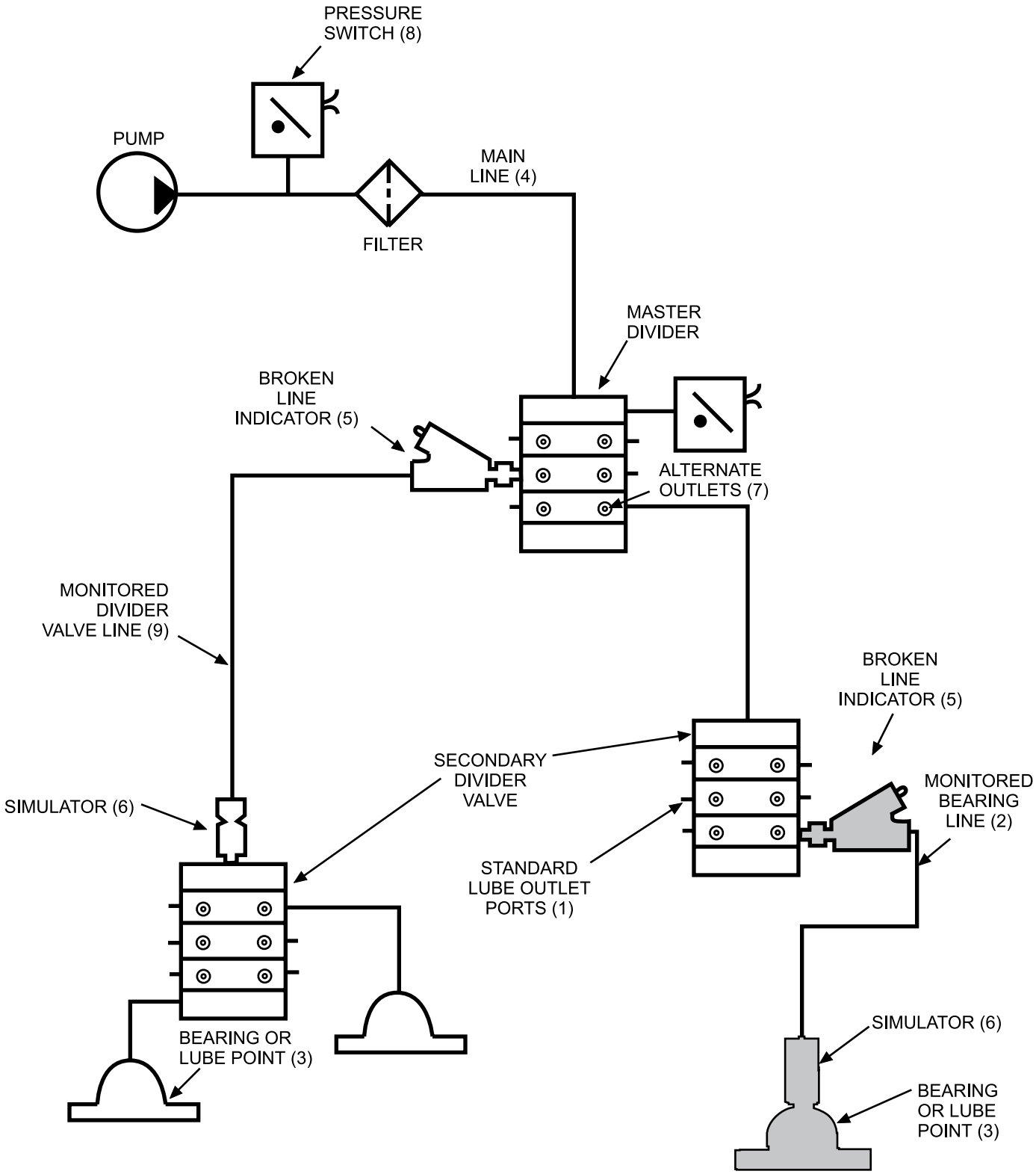


Figure 1

OPERATION (Refer to Figure 2)

In a system without broken line indicators, pressure builds up in all unbroken lines while the pump is operating. Between lube cycles when the pump is at rest, pressure slowly decreases as lubricant continues to flow into the lube points.

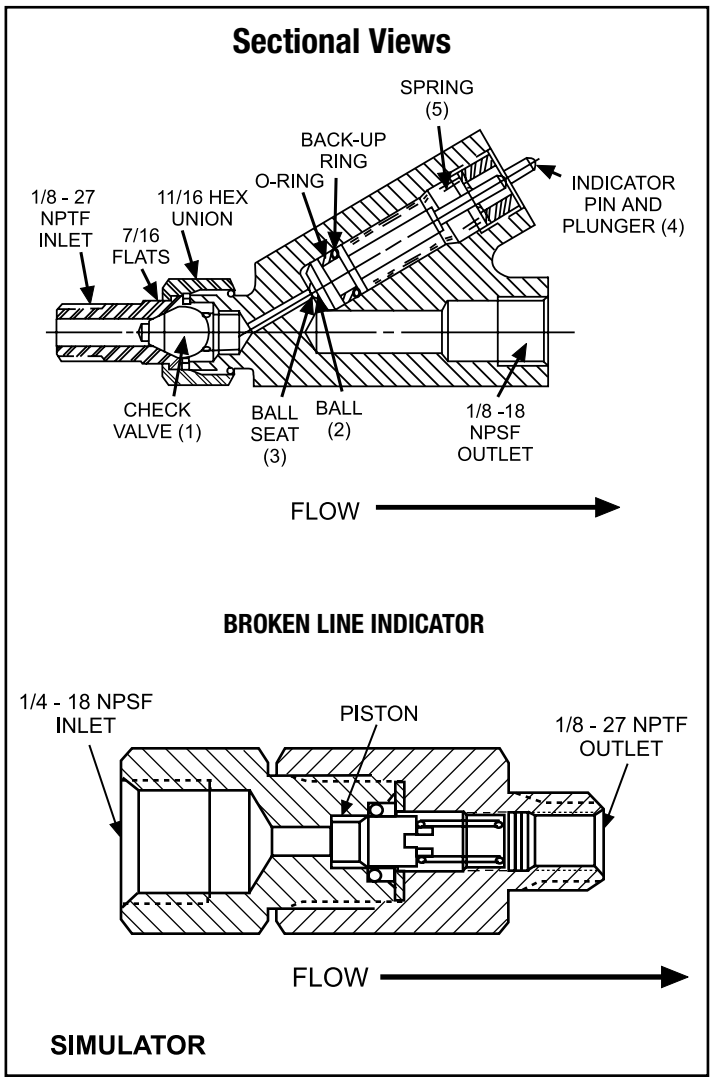


Figure 2

When a Broken Line Indicator (BLI) kit is installed in a line, the simulator acts as a "zero leakage" relief valve which closes off the lube point end of the line at the end of a lube cycle. The check valve (1) in the BLI closes off the divider valve end of the line at the completion of a lube cycle. Thus pressure is maintained in the line between pump operation. As long as the line is pressurized (unbroken), this pressure acts on the plunger o-ring seal diameter to keep the indicator pin/plunger (4) in the extended (up) position. Therefore, the extended pin indicates a normal condition.

If the lube line is broken, pressure is relieved. This causes the spring (5) in the BLI to return the indicator pin/plunger (4) to its retracted (seated) position. During successive lube cycles while the pump is operating, the spring loaded plunger of the BLI applies a force to the ball (2). This force must be overcome by pump pressure before lubricant can flow down the broken line. The magnitude of this pressure depends on the BLI kit selected, and is listed as the BLI Rating in Table 1. This high pressure condition is detected by the pressure switch in the main line.

When a high pressure signal is observed, broken lines can be located quickly by simply checking the pin positions of the Broken Line Indicators. Since the pin portion of the piston is normally extended, a retracted pin gives visual evidence of the location of a broken line. Even if the indicator pin and plunger (4) are extended, high pressure could exist elsewhere in the lube system due to a blocked, crushed or otherwise damaged line. Check the divider valve performance indicators for extended pins to assist in your troubleshooting. Follow standard troubleshooting procedures to determine system problem. (See Bulletin 30101.)

A pressure switch (8, Figure 1) should be installed in the main line between the pump and master divider.

SELECTION AND SPECIFICATIONS

In order to select the correct Broken Line Indicator Kit for a lubrication system it is important to know the system's operating pressure. Selecting a Broken Line Indicator Kit without operating pressure information requires use of the following tables and graphs.

NOTE: Broken Line Indicator can be utilized with oil and grease up to NLGI No.1 in viscosity. Use of higher Viscosity lubricants can result in false warnings due to pressure drop in system.

For typical terminating oil systems select the 1,000 psi Broken Line Indicator Kit per Table 1.

For a terminating grease system the 1,500 psi Broken Line Indicator Kit would be used following the guidelines in Table 2 for tubing lengths.

If the application is a circulating oil system, refer to the graphs in Figure 3 which show typical MX, MX to MSP, or MSP size divider valve systems.

Replacement springs for the Broken Line Indicators should be selected per Table 3.

Broken Line Indicator (BLI) Kit Selection

System	BLI Rating (PSI)	Simulator Rating (PSI)	P	Pressure Switch Setting (PSI)	Pump Relief Valve (PSI)	Blow-out Disc (PSI)	Min Pump Capacity (PSI)	BLI Kit Part No. (Old Part No.)	Simulator Part No. (Old Part No.)
Re-Circulating Oil (1, 2)	500	60	440	400	700	–	1000	563078 (463-440-000)	563075 (463-420-000)
Re-Circulating Oil (1, 2)	1000	100	900	850	1400	–	1500	563079 (463-440-010)	563076 (463-420-010)
Terminating Oil	1000	100	900	850	–	1450	2000	563079 (463-440-010)	563076 (463-420-010)
Terminating Grease (4)	1500	150	1350	1300	–	2350	2500	563080 (463-440-020)	563077 (463-420-020)

Table 1

Notes:
1. Consult operating pressure graphs (Figure 3) for selection of proper Broken Line Indicator for circulating oil systems
2. Circulating oil systems with flow rates above 30 in^3/min should have an accumulator at the power unit
3. Flow controls are recommended to eliminate pressure surges in the input of Graco's pneumatic and hydraulic pumps
4. See Table 2 for recommended maximum line size and length
5. At temperatures below 60ºF it may be necessary to set the pressure switch at a higher level, but it should never exceed the pump blow-out disc rating or pump capacity
6. The above data is based on typical installations and is to be used as a guideline only. Consult the factory for applications not covered above

Broken Line Indicator-Maximum Line Lengths Permitted in Grease Systems

Line Size	Temp (ºF)	Max Length (ft)
1/4T, 3/16H, 1/4H, 1/8P	70 60 50 40	10 10 10 5
3/8T, 5/16H, 3/8H, 1/4P	70 60 50 40	20 15 10 10
1/2T, 13/32H, 1/2H	70 60 50 40	25 20 15 10

Table 2

T = Tubing* *Based on the following nominal I.D.
H = Hose 1/4 Tube—0.188 I.D.
P = Pipe 3/8 Tube—0.312 I.D.
1/2 Tube—0.438 I.D.

NOTE: The above data are guidelines for sizing the line between the Broken Line Indicator and the Simulator and are based on NLGI No. 1 and lower grease at the stated temperature. Contact factory for greases heavier than NLGI No. 1 or temperatures colder than shown.

Table 3. Broken Line Indicator (BLI) Replacement Spring Selection

Part No. (Old Part No.)	Pressure Rating (PSI)	Replacement Spring Part No. (Old Part No.)
563068 (463-400-000)	500	556954 (458-005-840) White
563069 (463-400-010)	1000	556955 (458-005-841) Red
563070 (463-400-020)	1500	556956 (458-005-842) Blue

Table 3

Pressure Switches (Bulletin L15521)

System	Part No. (Old Part No.)
Oil	557828 (542-210-107)
Grease	– (542-210-116)

Table 4

Typical Operating Pressure For MX, MX to MSP, and MSP Systems

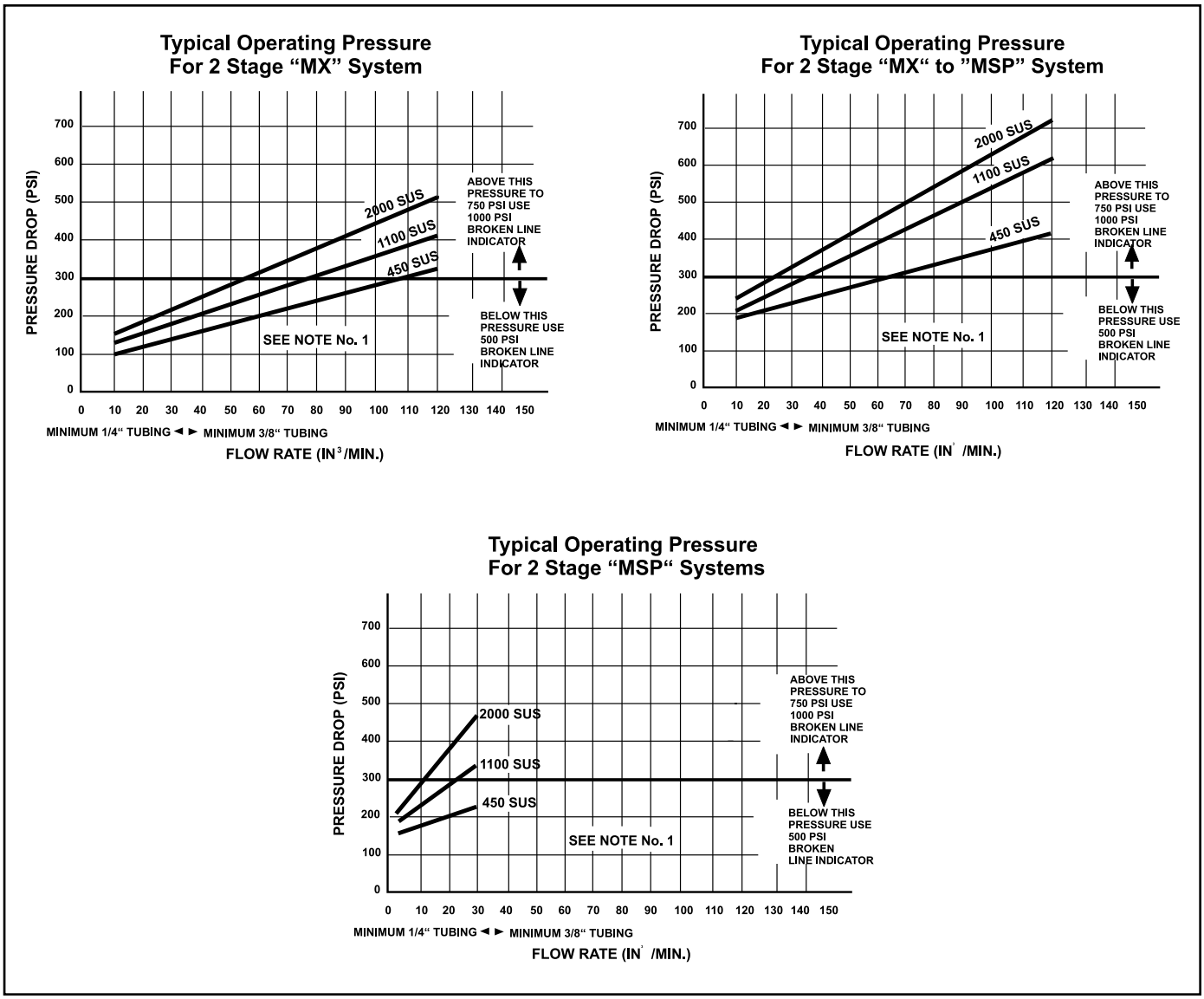


Table 3

NOTES:

1. These graphs are based on three-section feeder manifolds with average displacements. Pressure drop will vary slightly depending on specific manifold size and capacity. The graphs do not consider injection pressures. These must be added to the pressure drops.
2. Use graphs only to approximate system cycle pressure for selecting the appropriate Broken Line Indicator.
3. Single stage system operates at approximately 70% of two-stage system.
4. In using provided graphs, use the highest viscosity rating of the specific lubricant used considering ambient temperature.
5. Maximum cycle rate with appropriate proximity switch is 120 cycles/mm.

DIMENSIONS

Broken Line Indicator and Simulator

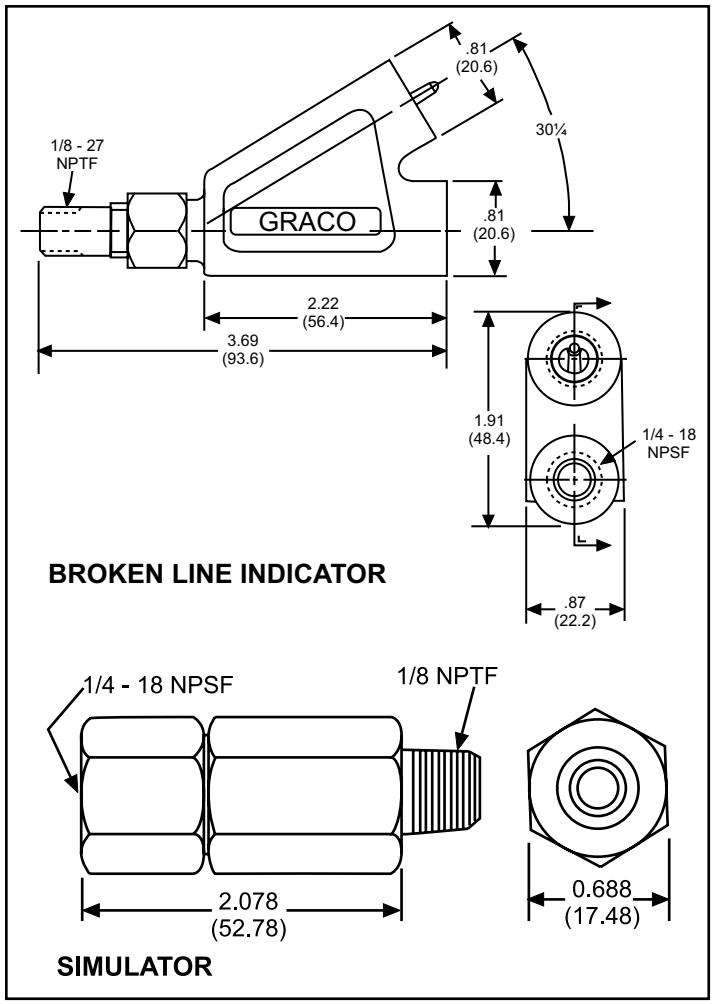


Figure 4

INSTALLATION

Install the Broken Line Indicator and Simulator as follows:

1. Estimate normal system operating pressure and pump capacity before installing Broken Line Indicator and Simulator. (Refer to Selection and Specifications.)

   NOTE: The design or use of three-stage divider valve circuits is not recommended.

2. Put 1/4 inch spacers between the divider valve and mounting area to assure clearance for installing the indicator.

3. Install the Broken Line Indicator into the divider valve outlet port (1, Figure 1) per steps D and E following.

4. Use pipe sealant (not PTFE tape) to assure zero leakage in the monitored bearing line (2). Do not allow the sealant to get into lubricant lines.

5. Loosen the 11/16 inch hex union (Figure 2) on the inlet of the Indicator (DO NOT REMOVE) and use the 7/16 inch flats to screw the Indicator (5, Figure 1) into the divider outlet port (1).

6. Install the pressure Simulator (6) as close as possible to the lubrication point (3) being monitored.

7. Keep lubrication point line as short as possible (see Table 2). When using hose, the lubrication point line should be 3/8 inch diameter tubing maximum and should be of a low volumetric expansion (LVE) material for terminating systems.

8. Select and install the associated pressure switch (8) and connect per Graco Bulletin 15521 (reference Table 4). The pressure switch must meet the pressure setting requirements in Table 1.

9. Pre-fill the system with the proper lubricant prior to start-up.

NEW SYSTEM VISUAL CHECKOUT

(See Graco Troubleshooting Card No. 415)

1. Inspect system for obvious errors.
2. Check that hoses, tubing and fittings are as specified (size and material).
3. Inspect for broken or disconnected lines, chafing hoses and loose fittings.
4. Inspect Indicators for proper settings.
5. Inspect control system with power off for proper adjustments, correct panel wiring and correct cycle switch wiring.
6. Inspect for correct lubricant.
   - Lubricant used should be compatible with Buna-N material.
   - Grease should be proper for design and ambient temperature. NLGI No.1 or lower consistency.

NEW SYSTEM OPERATIONAL CHECKOUT

(See Graco Bulletin 30103.)

1. Inspect for properly tilled reservoir. Bleed the system of air per Graco Bulletin L30103.
    - Connect hand pump into system fill near pump.
    - Operate hand pump slowly and note cycle pressure and cycle Indicator operation.
    - The hand pump procedure should indicate the system is filled properly, has no blockages and will deliver lubricant.
2. Apply power and verify proper operation of system.
    - Remove cycle switch
    - Turn power on. Note Correct control operation.
    - Cycle Indicator. Note Correct movement.
3. Replace cycle switch when all operations are Correct.
4. Verify adjustments.

PREPARATION FOR OPERATION

Once installation and checkout procedures are complete, prepare the system for operation as follows:

1. Make sure the pump and blowout disc meet pressures required in Table 1.
2. Turn on the system and develop pressure to set the Broken Line Indicator.
3. Set the associated pressure switch as described under Adjustments below.

NOTE: If the lube system has been shut down for an extended period, there may be a loss of line pressure between the Indicator and Simulator. This may be due to leakage, temperature change, etc. If there is a loss of line pressure, the Indicator will cause a temporary high system pressure upon start-up until the Indicator has been reset, This temporary condition should be ignored or by passed by the monitor system.

ADJUSTMENTS

Adjust the associated main line pressure switch (8, Figure 1) as follows:

1. Operate the system for a short period of time and determine if the system is developing a pressure under normal operating conditions that is activating the pressure switch.
2. Adjust the pressure switch to a slightly higher setting, if required, as follows:
    - Terminating oil systems generally operate in the 250 to 700 psi range. Selecting the 1,000 psi Indicator with the 100 psi Simulator is recommended. Initially, the pressure switch should be set at 850 psi. If after installation it is found that the switch is being actuated (850 psi or greater system pressure spikes), the speed of the pump should be reduced by installing an air/hydraulic restrictor.
    - Grease systems usually require the 1,500 psi Indicator with a 150 psi Simulator. As with the terminating oil system, adjustments to the pressure switch setting and/or speed of pump stroke can be adjusted to tune system. Using the Broken Line Indicator on grease heavier than No.1 is not recommended and when using any grease, the ambient temperature must remain above 60^0F.

TROUBLESHOOTING

Refer to Table 5 for possible problems and the corrective actions.

Troubleshooting Chart

TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
1. High-pressure warning: indicator pin is in.	1a. Broken or cracked line	1a. Replace broken line as required.
	1b. Loose tube/pipe connection	1b. Tighten connection
	1c. Indicator or Simulator leaking	1c. Using a hand pump with a shut-off and gauge assembly, connect to simulator inlet. Pump lube until it flows through simulator. Close shut-off with pressure maintained in simulator. Observe for leakage over time. If it leaks, replace it. if there is no leak, replace Indicator.
2. High-pressure warning: indicator pin is out.	2a. Pressure switch set too low.	2 Reset pressure switch
	2b. Normal system pressure has increased.	2b. Install higher pressure Indicator and Simulator
	2c. Increase lubricant viscosity due to temperature (grease)	2c. Change to lower viscosity lubricant
3. System is unable to attain high-pressure signal	3a. Leak in main line or lines leading to secondary divider(s)	3a. Repair leak
	3b. Air/hydraulic pressure supply to pump is set too low	3b. Increase pressure
	3c. Pressure switch setting is too high	3c. Reset pressure switch
	3d. Pump/system air bound	3d. Bleed air
	3e. Reservoir empty	3e. Fill reservoir
	3f. Pump inoperative	3f. Determine cause and correct
4. Indicator pin does not extend	4a. Incorrect Simulator installed	4a. Install correct Simulator
	4b. Simulator damaged	4b. Replace Simulator
	4c. Indicator damaged	4c. Replace Indicator
	4d. See 3 above	4d. See 3 above

Table 5

All written and visual data contained in this document are based on the latest product information available at the time of publication. Graco reserves the right to make changes at any time without notice.

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