

Relief Valve Operation and Adjustment Procedure

The following is an overview of how the optional relief valves found in Procon pumps operate.

There are two basic types of valves- the standard valve and the balanced valve.

The standard valve will be addressed first, then the balanced valve will be addressed. Although both valves are designed to help prevent over pressurization, they do function differently.

Standard Relief Valve

The standard relief valve resides in a chamber connecting the inlet port to the discharge port. It is held "closed" by two forces: the amount of compressive force held on the valve by the relief valve pressure spring and the incoming fluid pressure.

When discussing the standard relief valve settings (i.e. -the default settings of 50PSI, 99 PSI, 130 PSI, 170 PSI, and 250 PSI), we are referring to the "fully opened" position of the valve, also referred to as the "full by-pass" mode. The valve actually begins to partially open several PSI prior to the specified setting, allowing a slight amount of by-pass, and continues to open further as the pressure increases, until the valve is moved as far away from its seating position as required to allow full by-pass. For proper operation of the relief valve, the normal operating pressure of the pump should be below the partial opening point of the valve. This will ensure that the relief valve will only be used as a safety feature to protect the system against over pressurization caused by some type of blockage or restriction.

There should be a 50 PSI differential between the operating pressure of the pump and the full by-pass setting to allow for the gradual movement of the valve (ie - if the typical operating pressure of the pump is 150 PSI, with zero PSI inlet pressure, the relief valve pressure setting should be 200 PSI). When Procon sets the relief valve pressure at the factory, there is effectively 0 PSI inlet pressure. If there is any amount of inlet pressure coming to the pump at the installation site, the relief valve setting is effectively raised by that amount. For example, with a standard default setting of 170 PSI from the factory and an inlet pressure at the application site of 40 PSI, the effective relief setting is raised to 210 PSI. This now means that the pump can operate up to 160 PSI without reaching the cracking point of the relief valve. Any operation above 160 PSI would not be desirable because the relief valve would begin to move off of its seat which would lead to erosion of the relief valve seat and premature reduction in pump performance.

The maximum recommended discharge pressure for standard Procon pumps, which do not contain an internal relief valve is 250 PSI. Procon will set internal relief valves up to pressures of 250 PSI, which would allow operating pressures up to 200 PSI. For all applications operating in excess of 200 PSI discharge pressure, Procon recommends the use of an external relief valve, not Procon's optional internal relief valve. External relief valves

may be purchased from various valve manufacturers and distributors.

Should field adjustment of Procon's internal relief valve be required, the following procedure may be used to perform the adjustment.

- 1) Connect the inlet line to the pump.
 - 2) Install a liquid-filled pressure gauge directly into the discharge port of the pump so the pump is "dead-headed" into the gauge and no fluid is able to exit the pump.
- Caution:** Dead-heading the pump will generate a great amount of heat. If the adjustment process takes more than about 120 seconds, remove the gauge, flush the pump with cool fluid and begin the process again.
- 3) Remove the relief valve acorn nut in order to have access to the set screw.
 - 4) Start the pump/motor package and monitor the gauge pressure.
 - 5) Turn the set screw clockwise to increase the setting or counter-clockwise to decrease the setting.
 - 6) Continue to turn the set screw until the gauge registers a pressure that is 50 PSI above the standard operating pressure created by the restrictions in the system.

(i.e. - If the system generally creates a back pressure on the pump of 180 PSI, then adjust the valve until the gauge registers 230 PSI). Setting the valve 50 PSI above the operating pressure will ensure that, in normal operation, the relief valve will remain in the closed position.
 - 7) Re-install the relief valve acorn nut, being sure that the proper acorn nut gasket or o-ring is in place.
 - 8) Tighten the nut (while monitoring the gauge pressure to ensure that the set screw did not inadvertently turn, raising the set pressure).
 - 9) Stop the pump/motor package.
 - 10) Remove the gauge and connect the discharge line to the discharge port. The pump/motor package is now ready for operation.

Regardless of the inlet pressure conditions (pressurized or simply flooded) this procedure remains the same, as the pressure gauge will reflect the actual setting, taking into account any inlet pressure that might be present at that application site.

Using the variables defined below, the following formulas may be helpful.

D = relief valve dead-head pressure setting, where all flow is by-passed internally and no

flow is exiting the pump.

S = spring force held on the valve by the relief valve spring.

I = inlet pressure feeding the pump.

M = this represents both the pressure level at which the valve will begin to move off of its seat in the chamber, allowing the fluid to begin by-passing through the chamber, as well as maximum operating pressure that should be attempted for normal operation of the pump.

$$1. D = S + I$$

$$2. M = S + I - 50$$

Balanced Relief Valve

The balanced relief valve resides in a chamber connecting the inlet port to the discharge port. It is effectively held "closed" by only one force - the amount of compressive force held on the valve by the relief valve pressure spring. The body/spring configuration of this valve is much different than that of a standard relief valve. Because of the design of the balanced relief valve, variations in inlet fluid pressure do not effect the set pressure or cracking pressure of the valve. For instance, if the relief valve set pressure from the factory is 200 PSI (which is set with 0 PSI inlet pressure), the pump will have a full by-pass setting of 200 PSI whether the inlet fluid pressure is 0 PSI or 100 PSI at the installation site. The operating pressure of the pump should still remain at least 50 PSI below the dead-head setting of the valve. So in this example, the maximum operating pressure of the pump should be no greater than 150 PSI.

For further assistance on relief valve operation and/or adjustment, please contact a member of Procon's technical support staff.