Cooling Circuits

The hydraulic systems on Steiger tractors operate in a wide range of applications and environments and for this reason it is often desireable to have an oil cooling circuit to rid the system of some heat caused in extreme conditions.

Three types of approved cooling circuits are used on the Steiger Series III hydraulics. The earliest factory installation (Fig. 100), routes EXCESS FLOW from the flow regulator, into the cooler, then back to the reservoir as shown.

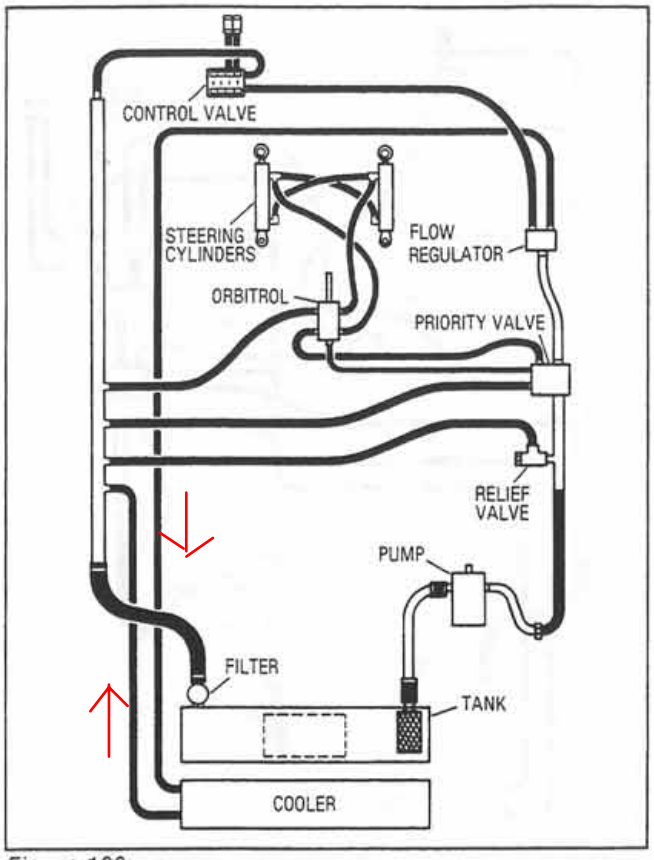


Figure 100:

The second type (Fig. 101) routes exhaust flow from the implement control valve to the cooler. However, some of this exhaust flow is permitted to go directly into the return manifold by means of a check valve when too much pressure is needed to force oil into the cooler. The discharge flow from the cooler is fed into the return manifold then filtered before going into the reservoir.

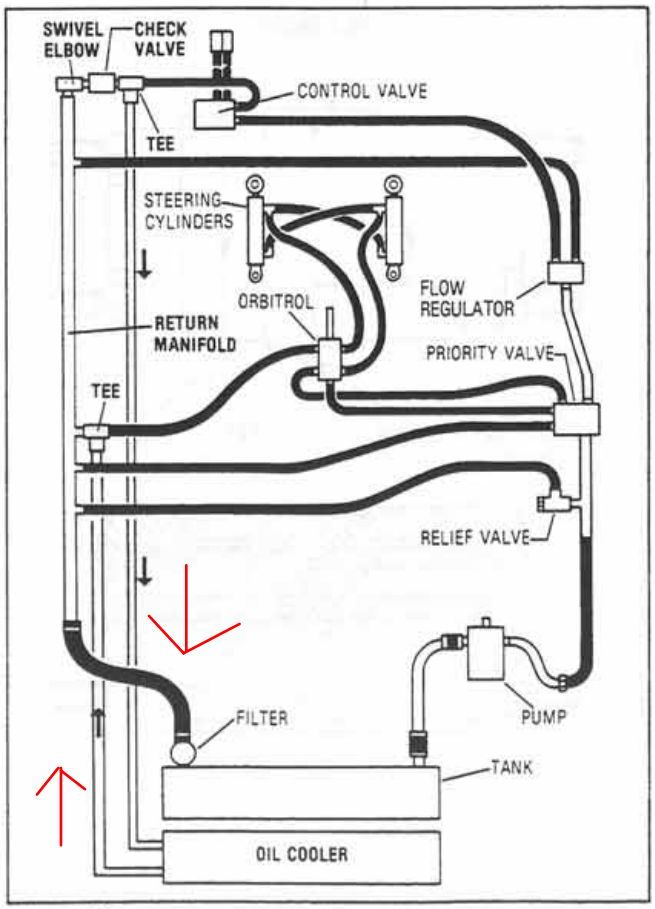


Figure 101:

This third cooler arrangement (Fig. 102) is used when part of the tractors hydraulic system is used to operate accessories such as hydraulic motors or other continuous demands.

A FLOW-DIVIDER receives all the flow from the implement port of the priority valve. The flow divider discharges controlled flow on TWO PORTS, one of these feeds the flow regulator and implement control valve as the priority valve did beforehand.

The remaining flow-divider discharge flow is sent to a solenoid valve intended to control hydraulic accessories. The exhaust flow from this valve directs oil into the cooler before entering the return manifold, filter and reservoir.

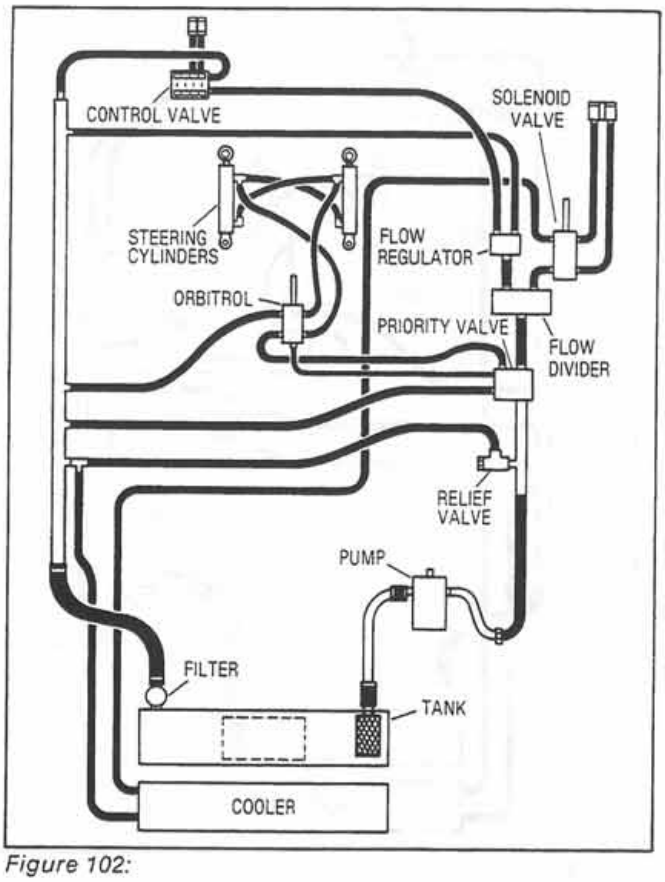


Figure 102:

Accessory Hydraulics (optional)

The FLOW DIVIDER (Fig. 103) used in the ACCESSORY HYDRAULIC circuit is similar to a DUAL—SECTION GEAR PUMP that is driven hydraulically. The one used in the Steiger application has pumping sections of UNEQUAL VOLUME. The gears are connected by a shaft to assure they all turn at the same speed. The result is that inlet flow is split inside the flow divider and sent out the discharge ports in relation to the size of each pumping section. One-third (1/3) of the inlet flow is discharged to the solenoid valve.

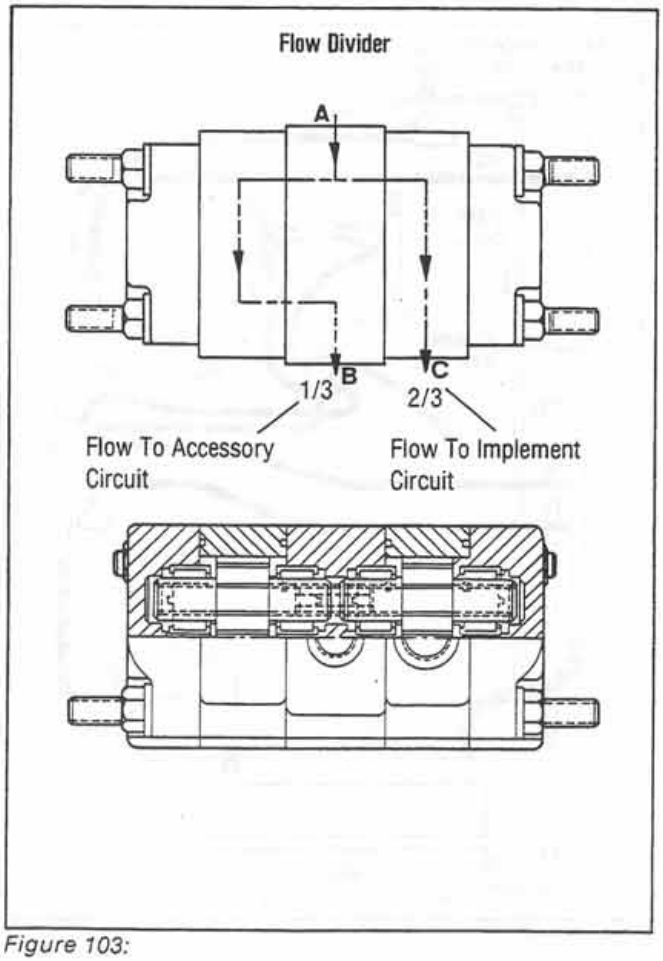


Figure 103:

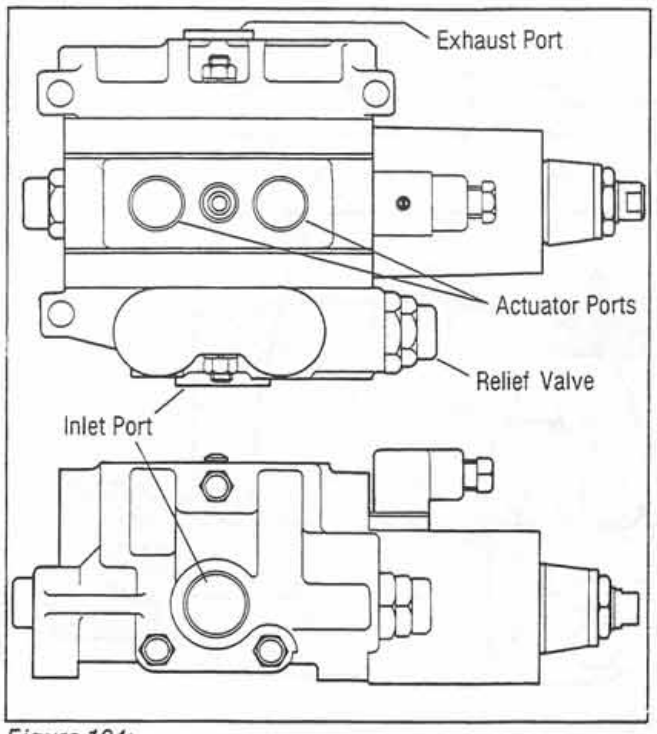


Figure 104:

The SOLENOID VALVE (Fig. 104) is operated by a rocker switch on the instrument panel to change spool position inside the valve.

When the solenoid coil is NOT ENERGIZED (Fig. 105) the spool stays in a neutral position. In this position, inlet flow immediately escapes by surrounding the spool undercut that mates with the exhaust passage. The exhaust port discharges the same oil toward the cooler.

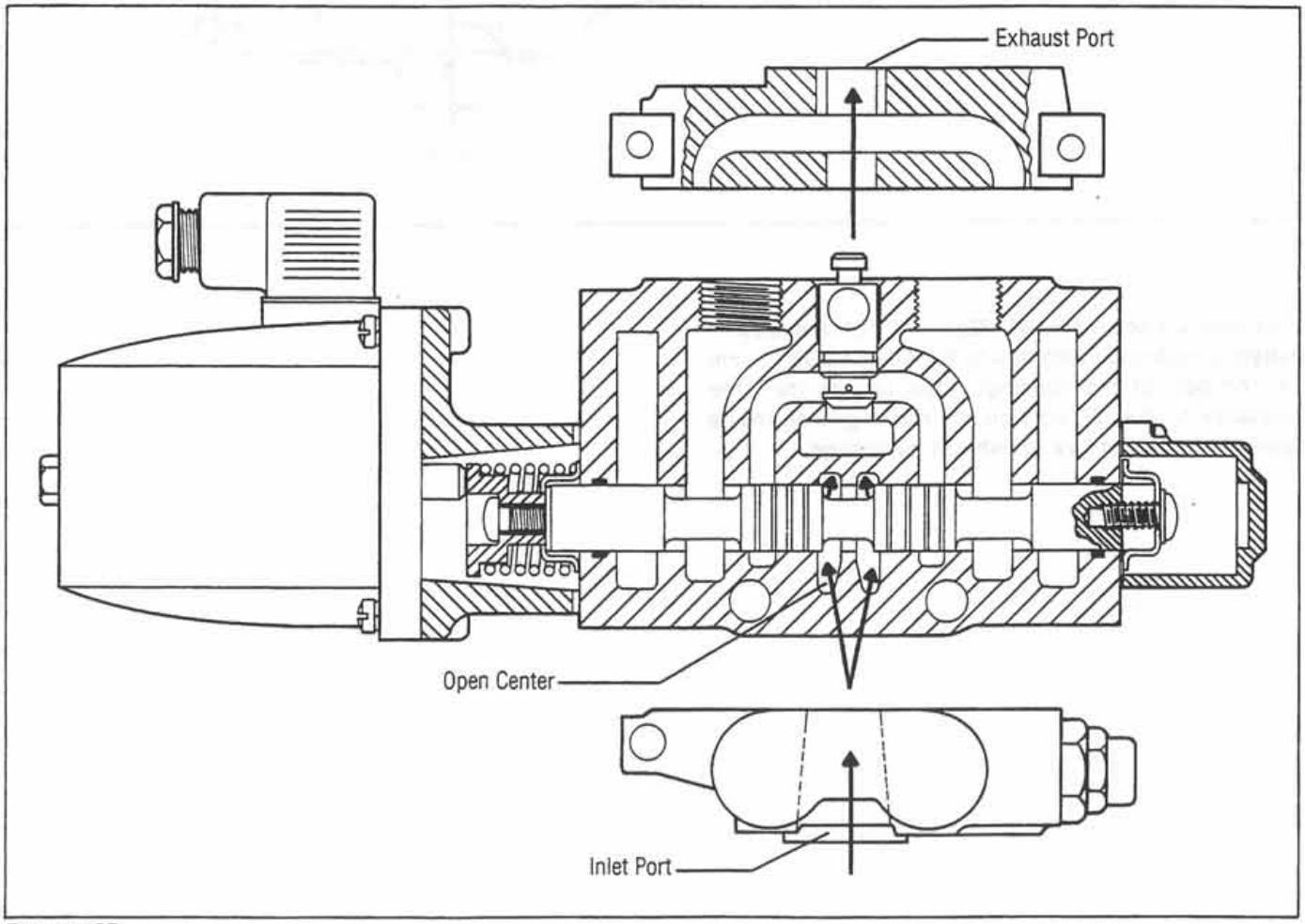
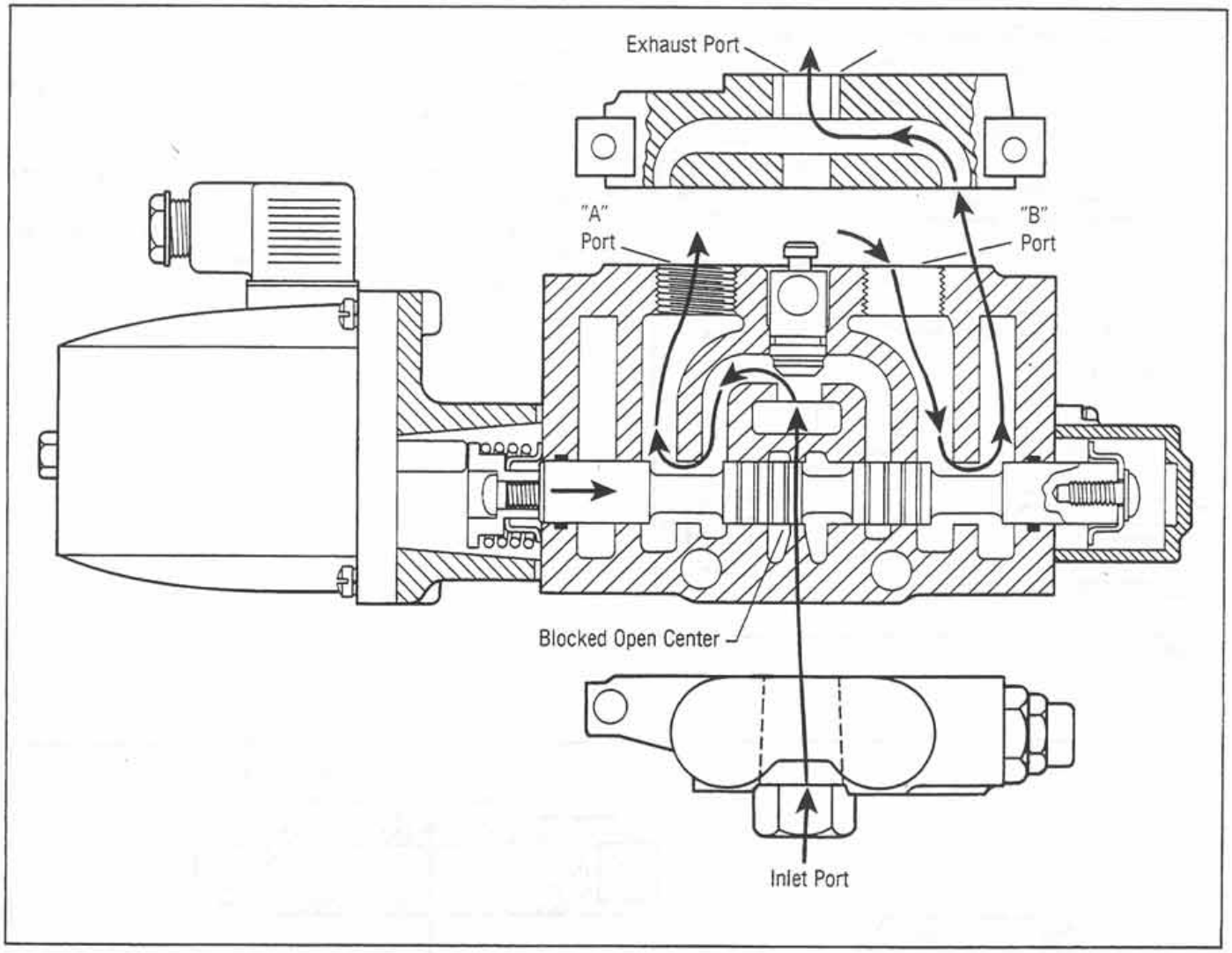


Figure 105:



If the solenoid coil is ENERGIZED, (Fig. 106) the spool is shifted to route incoming flow to the ACCESSORY (from the "A" port of the housing). Flow returns from the accessory to the "B" port on the housing, then inside passages will direct flow to exhaust for cooling.

Recommendations for Installing Laser Control Systems on Steiger Series III Hydraulic Circuits

General Information:

Steiger Series III hydraulic systems are open center design. The pressure and flow available is adequate to power all presently known implements with laser control. The problem is matching the implement hydraulic requirements to the laser control valve and then both these requirements must be matched to the tractor system.

Presently there are two known types of laser systems: proportional time (PT) and proportional current (PC). The type used in a particular application depends on the reaction time of the implement that is needed at a particular vehicle ground speed. The PT type is the most common and the slower of the two types. The PT type can be used to control open center solenoid valves or closed center solenoid valves, and is generally considered fast enough for all ag-related laser control operations.

PC is a faster and much more expensive type of laser control. PC type must be used with a servo valve and because of its speed and desired reaction time, works best with a high pressure closed center hydraulic supply.

With the present Series III open center hydraulic system, it is possible to use either PT or PC type laser control in a proper installation.

The Item Numbers in the following discussions are referenced to the hydraulic schematic shown. *(see Fig. 107)*

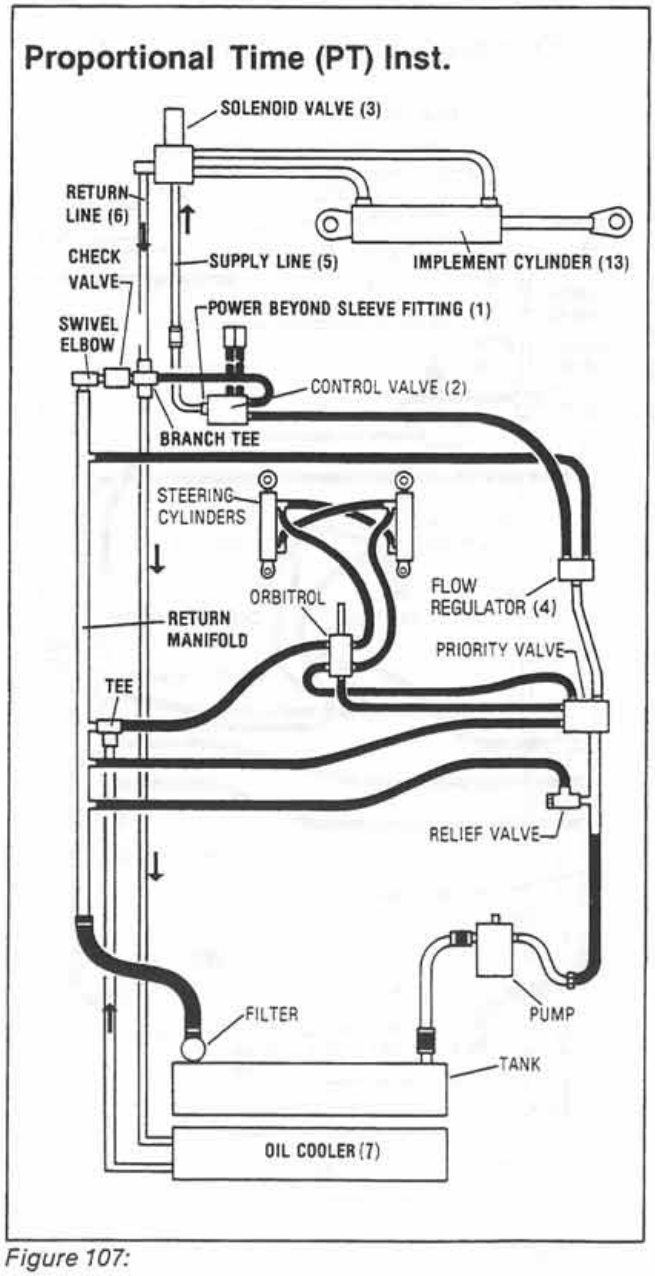


Figure 107:

Proportional Time (PT) Laser Hydraulic Systems

As mentioned earlier, with the PT type laser control either an open center solenoid valve or closed center solenoid valve can be used.

Open Center Recommendations:

Open center means there is continual flow through the solenoid valve and this flow is deverted to the cylinders on command from the laser control electronics. In order to provide this flow, a powerbeyond sleeve (1) must be added to the control valve (2). This makes full control valve flow and pressure available downstream to the solenoid valve (3). It must be remembered that once a powerbeyond sleeve (1) is added, this line must not be capped, but must always flow through an additional valve or be connected directly back to the tank. If the line from the powerbeyond sleeve (1) is blocked in some manner, the flow will not have a path back to the tank. This will cause the main relief valve to open and overheat the system if allowed to operate in this fashion.

When connected in the above described manner, the laser solenoid valve will receive full control valve (2) flow when the control valve is not being used. If the control valve (2) is being used, solenoid valve (3) flow is temporarily blocked. The amount of flow to the control valve (2) and eventually to the solenoid valve (3) is determined by the adjustable setting of the flow regulator (4). This flow should be set as low as possible to maintain adequate laser control and reduce back pressure in the circuit. Hoses 5 and 6 should be 3/4" I.D. minimum and if hydraulic quick couplers are installed in these hose lines, they should be 3/4" nominal size.

Adding a hydraulic oil cooler (7) is required! Certain models of Steiger tractors already have a hydraulic system cooler. On these models, it will not be necessary to add a hydraulic cooler. If a cooler must be added, cooler kits are available for all models as follows:

TIGER III	35-1329T91
"ST"	35-1331T91
"PT" (w/o PTO)	35-1330T91
"PT" (w PTO)	35-1332T91

Closed Center Recommendations:

If a PT type laser system is used, but with a closed center solenoid valve, the adaption to a Steiger Tractor is different. *(see Fig. 108)*

Closed center means no flow in the lines until a valve or function is activated; pressure in the lines is maintained at slightly below relief valve setting while not being used. The pressure a closed center system maintains when not being used is referred to as "standby pressure".

To adapt an open center Steiger hydraulic system so it is capable of running a closed center solenoid valve, an additional charge valve (10) must be added. This valve blocks the open center flow temporarily and pressurizes (charges) line (12) to a preset maximum pressure; "cutout" pressure. An accumulator (11) is put into the line on a tee so that a given volume of oil can be stored at this high pressure. This oil at high pressure is now the equivalent to a closed center hydraulic system at standby pressure. Line (12) is then connected to a closed center solenoid valve (3), which blocks this high pressure oil until it receives a command from the laser electronics.

When oil is demanded, the accumulator supplies the requirement until the pressure in the accumulator drops to a "cut-in" pressure. Then the charge valve again blocks open center flow and changes to the "cut-out" pressure.

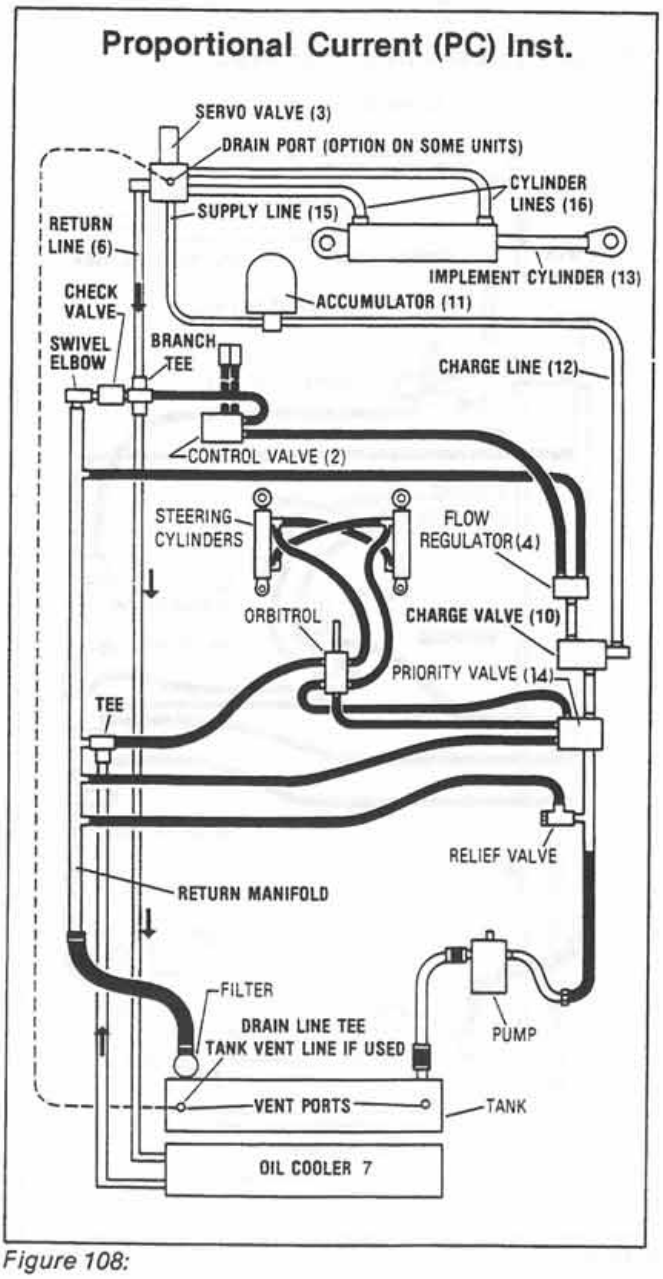


Figure 108:

The "cut-in" and "cut-out" pressure normally differs by about 400 psi, so a typical system could have a cut-in pressure of 1800 psi and cut-out 2200 psi. With the cut-in pressure in this example at 1800 psi, care must be taken to insure that the maximum pressure to move a cylinder (13) does not exceed 1800 psi. If the load on a lift cylinder exceeds the cut-in pressure, the load pressure will match the accumulator pressure and the load will not move. If this occurs, the charge valve pressure can be set up to, but cannot exceed, system relief valve setting, or larger diameter cylinders may be installed.

With this installation, flow to the control valve (2) is interupted while the charge valve is pressurizing the accumulator circuit.

The location of the charge valve (10) in the open center flow can be made before or after the flow control (4). If it is before the flow control (4) (after priority valve 14), it will receive a larger flow rate and therefore have to be sized to accommodate the larger flow. The size of Lines (12), (15) and (16) can be 1/2" I.D., but experience has shown that sizing up Lines (15) and (16) can improve response time. Also, response time is improved by having Lines (15) and (16) as short as possible; mount solenoid valve (3) and accumulator (11) as close to cylinder (13) as possible.

The hydraulic oil cooler (7) is also required for this installation.

Proportional Current (PC) Inst.

Proportional Current (PC) Laser Control

With PC Laser control, the use of a servo valve in place of solenoid valve (3) is required. Because most all servo valves (of the size and performance needed) are closed center, no open center circuit will be discussed.

The closed center hydraulic supply for a PC laser system is the same as the supply for a closed center PT system described above. Again, a Steiger tractor can be used with the charge valve (1) supplying the closed center hydraulic requirements; a hydraulic cooler (7) is also required.

The laser system and hydraulic supply system needed depends on the application. Sizing of the components: accumulators, servo and solenoid valves, charge valves, etc. will affect the performance in any application. The above recommendations reflect Steiger Tractor's suggested approach when using their tractors as the hydraulic and drawbar power source.

Additional information should be gathered from laser and implement people to insure a successful installation.