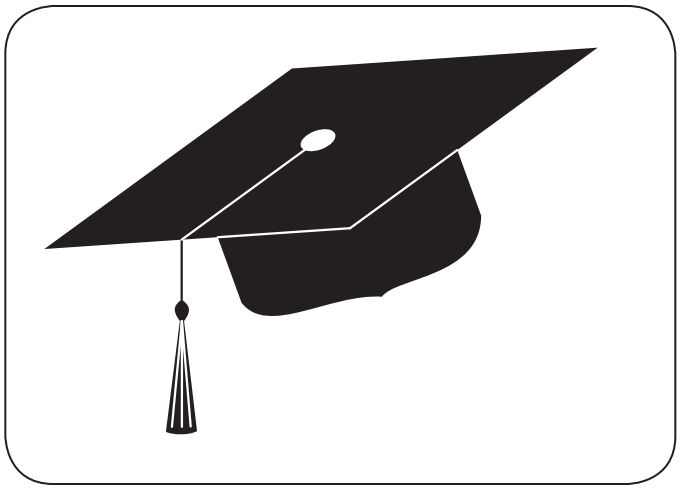
Section 6.1



Implement Circuit - General System

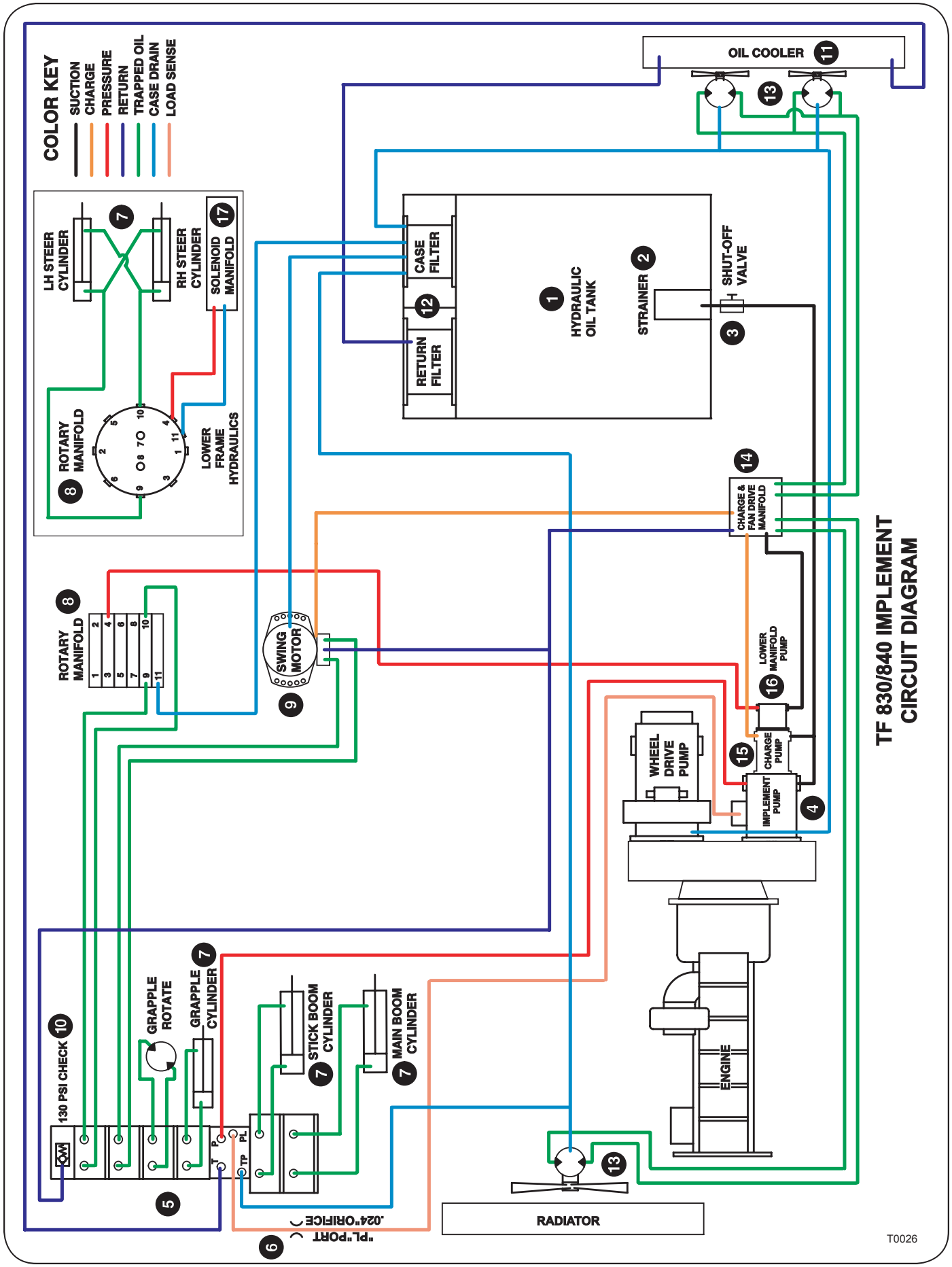


Figure 1: Simplified TF 830 Implement Circuit Diagram (Typical)

General - TF Configurations

(See Figure 1)

The TimberPro TF 830 implement circuit is a “closed center” hydraulic system.

The system uses state-of-the-art components such as a load sensing axial piston pump, radial piston motors, and pressure compensated (electric-controlled-pilot operated) control valves.

The main components in the system are:

1) 60 gal. (227 litre) hydraulic oil tank for storage and cooling of the hydraulic oil. See Section 3.2 in this manual for important information on the hydraulic tank and its components.

2) 100-mesh implement suction strainer w/ magnetic stem.

3) Suction line shut-off valve.

4) Rexroth AA11VO145 95 gpm (360 litres) variable displacement axial piston implement pump with pressure flow compensating capabilities.

5) VOAC 6-section main control valve with load sensing and flow compensation capabilities. All sections are electric-controlled-pilot operated.

6) Load sense orifice (.024). This orfice is located in the #6 connector turned into the “PL” port on the mid inlet section of the control valve.

7) High pressure, double acting cylinders and radial piston motors.

8) 14-port rotary manifold for 360° continuous rotation swing. In the implement circuit it provides the hydraulic link to the steer cylinders located in the rear frame.

9) Rexroth AA2FE series fixed displacement, bi-directional, piston motor mated to a Lohamnn GFB-72 planetary reduction gearbox with a wet mult-disc brake and anti-cavitation manifold.

10) 130 psi (1,03 Mpa) return line check valve. To create back pressure in the system to help with Anti-Cavatation on the Swing Motor. This check valve is located inside the end cap of the Voac control valve.

11) High capacity oil cooler with a 120°-140°F (49°-60°C) thermal bypass and 50 psi (3,45 kPa) back pressure bypass.

12) Return and case drain filters in the hydraulic tank. See Section 3.2 in this manual for important information on the hydraulic tank and its components.

13) Fixed displacement, bi-directional, gear motors that turn the cooling fans for the engine radiator and hydraulic oil cooler.

14) Charge and Fan Drive Manifold. This manifold is supplied oil from the charge pump and controls the oil cooler fans, the radiator fan and also regulates and filters the charge oil being supplied to the wheel drive pump.

15) Charge pump piggy-back mounted to the implement pump. The charge pump is a 52cc gear pump that supplies oil to the wheel drive pump charge circuit and supplies oil for the radiator and cooler fans.

16) Lower Manifold Supply pump piggy-back mounted to the Charge pump. The Lower Manifold Supply pump is a 10cc gear pump and supplies oil that is used in the lower manifold.

17) Lower Manifold is used to operate things like the brakes, gear box, motor shift, differential lock, frame lock and is also used to flush hot oil from the wheel drive motors.

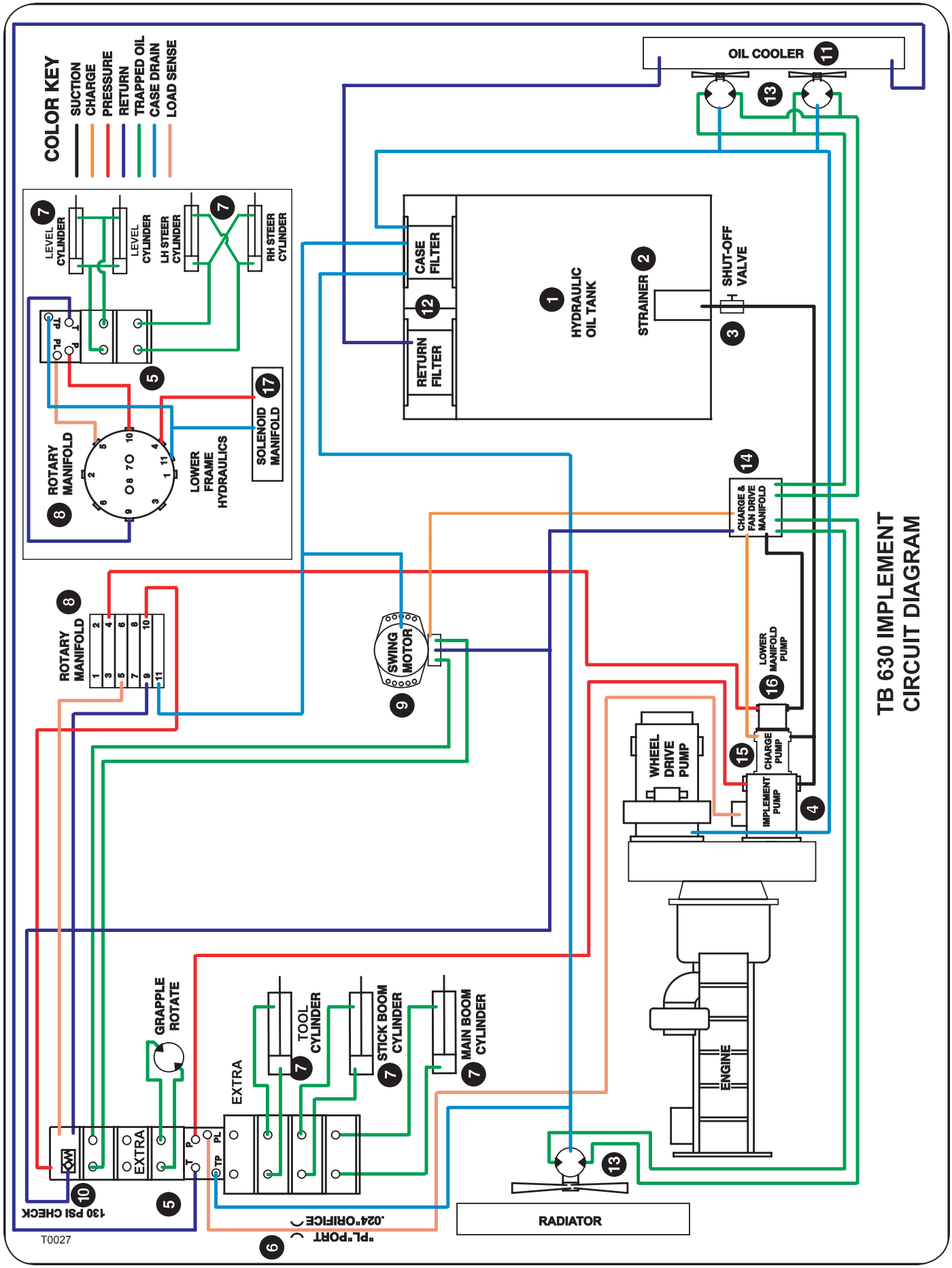


Figure 2: Simplified TB 630 Implement Circuit Diagram

General - TB Configurations

(See Figure 1)

The TimberPro TB 630 implement circuit is a “closed center” hydraulic system.

The system uses state-of-the-art components such as a load sensing axial piston pump, radial piston motors, and pressure compensated (electric-controlled-pilot operated) control valves.

The main components in the system are:

1) 60 gal. (227 litre) hydraulic oil tank for storage and cooling of the hydraulic oil. See Section 3.2 in this manual for important information on the hydraulic tank and its components.

2) 100-mesh implement suction strainer w/ magnetic stem.

3) Suction line shut-off valve.

4) Rexroth AA11VO145 95 gpm (360 litres) variable displacement axial piston implement pump with pressure flow compensating capabilities.

5) VOAC main control valves with load sensing and flow compensation capabilities. All sections are electric-controlled-pilot operated.

6) Load sense orifice (.024). This orfice is located in the #6 connector turned into the “PL” port on the mid inlet section of the control valve.

7) High pressure, double acting cylinders and radial piston motors.

8) 14-port rotary manifold for 360° continuous rotation swing. In the implement circuit it provides the hydraulic link to the steer cylinders located in the rear frame.

9) Rexroth AA2FE series fixed displacement, bi-directional, piston motor mated to a Lohamnn GFB-72 planetary reduction gearbox with a wet mult-disc brake and anti-cavitation manifold.

10) 130 psi (1,03 Mpa) return line check valve. To create back pressure in the system to help with Anti-Cavatation on the Swing Motor. This check valve is located inside the end cap of the Voac control valve.

11) High capacity oil cooler with a 120°-140°F (49°-60°C) thermal bypass and 50 psi (3,45 kPa) back pressure bypass.

12) Return and case drain filters in the hydraulic tank. See Section 3.2 in this manual for important information on the hydraulic tank and its components.

13) Fixed displacement, bi-directional, gear motors that turn the cooling fans for the engine radiator and hydraulic oil cooler.

14) Charge and Fan Drive Manifold. This manifold is supplied oil from the charge pump and controls the oil cooler fans, the radiator fan and also regulates and filters the charge oil being supplied to the wheel drive pump.

15) Charge pump piggy-back mounted to the implement pump. The charge pump is a 52cc gear pump that supplies oil to the wheel drive pump charge circuit and supplies oil for the radiator and cooler fans.

16) Lower Manifold Supply pump piggy-back mounted to the Charge pump. The Lower Manifold Supply pump is a 10cc gear pump and supplies oil that is used in the lower manifold.

17) Lower Manifold is used to operate things like the brakes, gear box, motor shift, differential lock, frame lock and is also used to flush hot oil from the wheel drive motors.

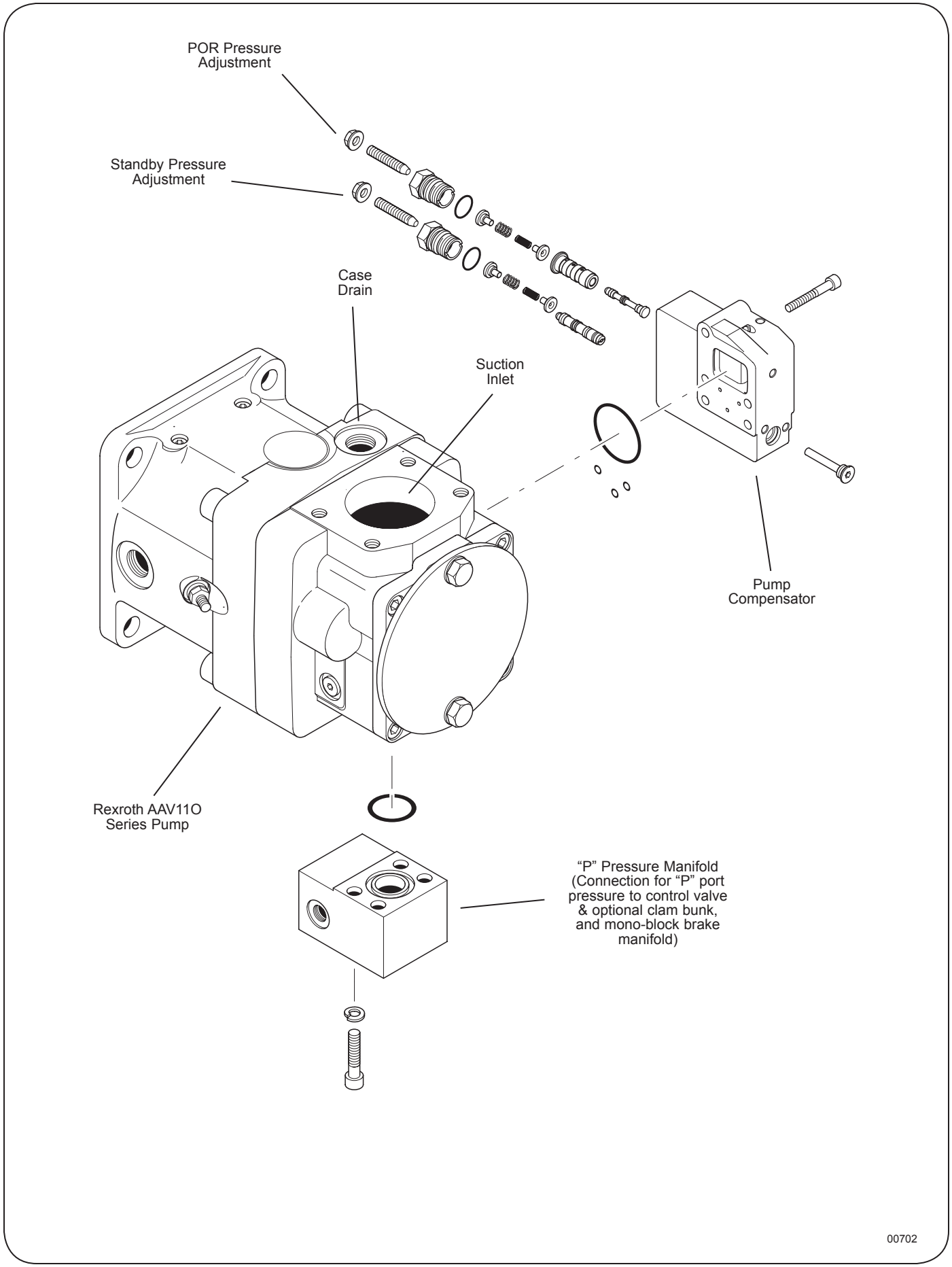


Figure 3: Implement Pump Breakdown

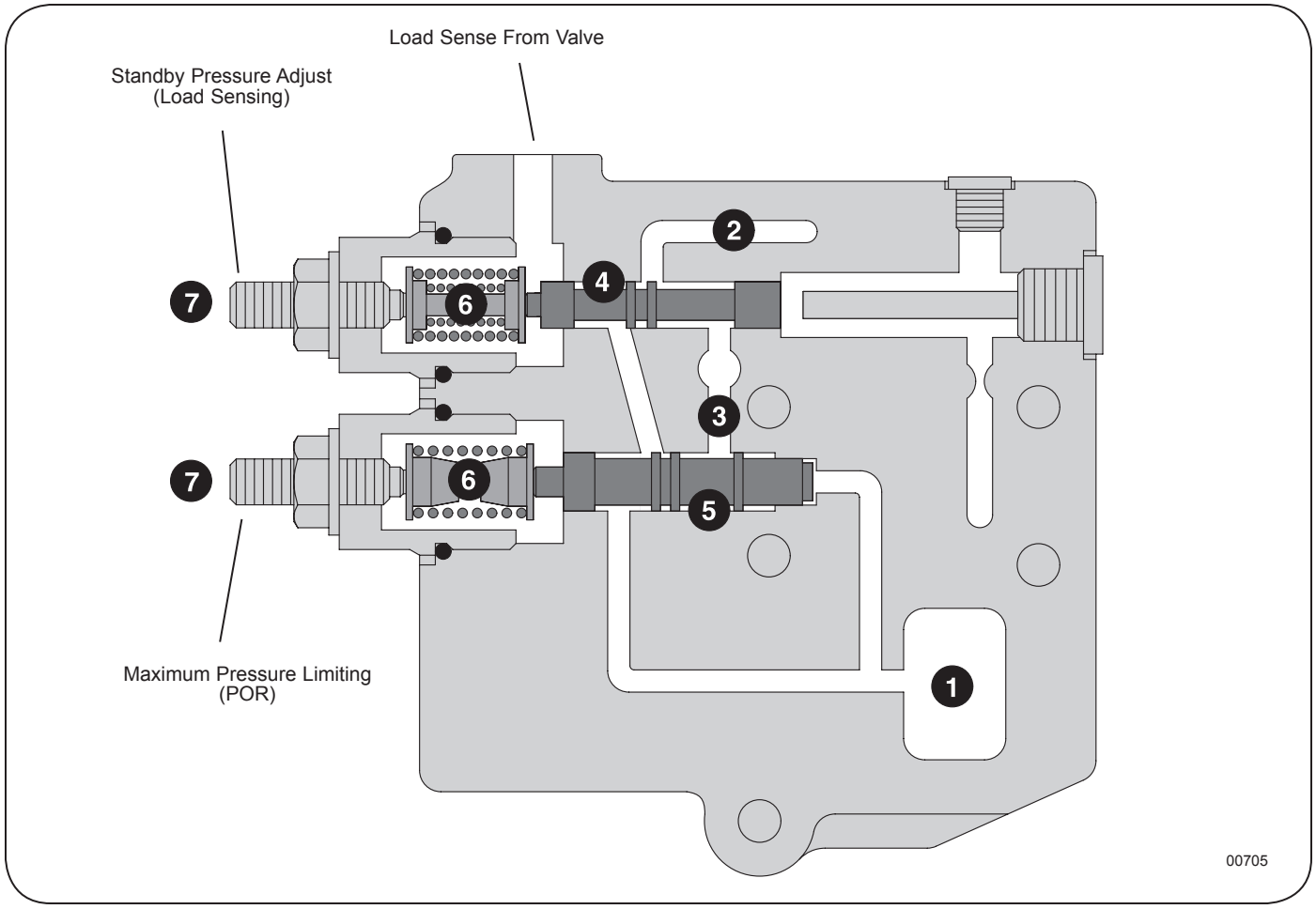


Figure 4: Pump Compensator Control

Operational Description

General

The implement hydraulic system uses a Rexroth AA11VO series hydraulic pump. This is a variable displacement piston pump with a load sensing, pressure limiting compensator control.

Compensator Control

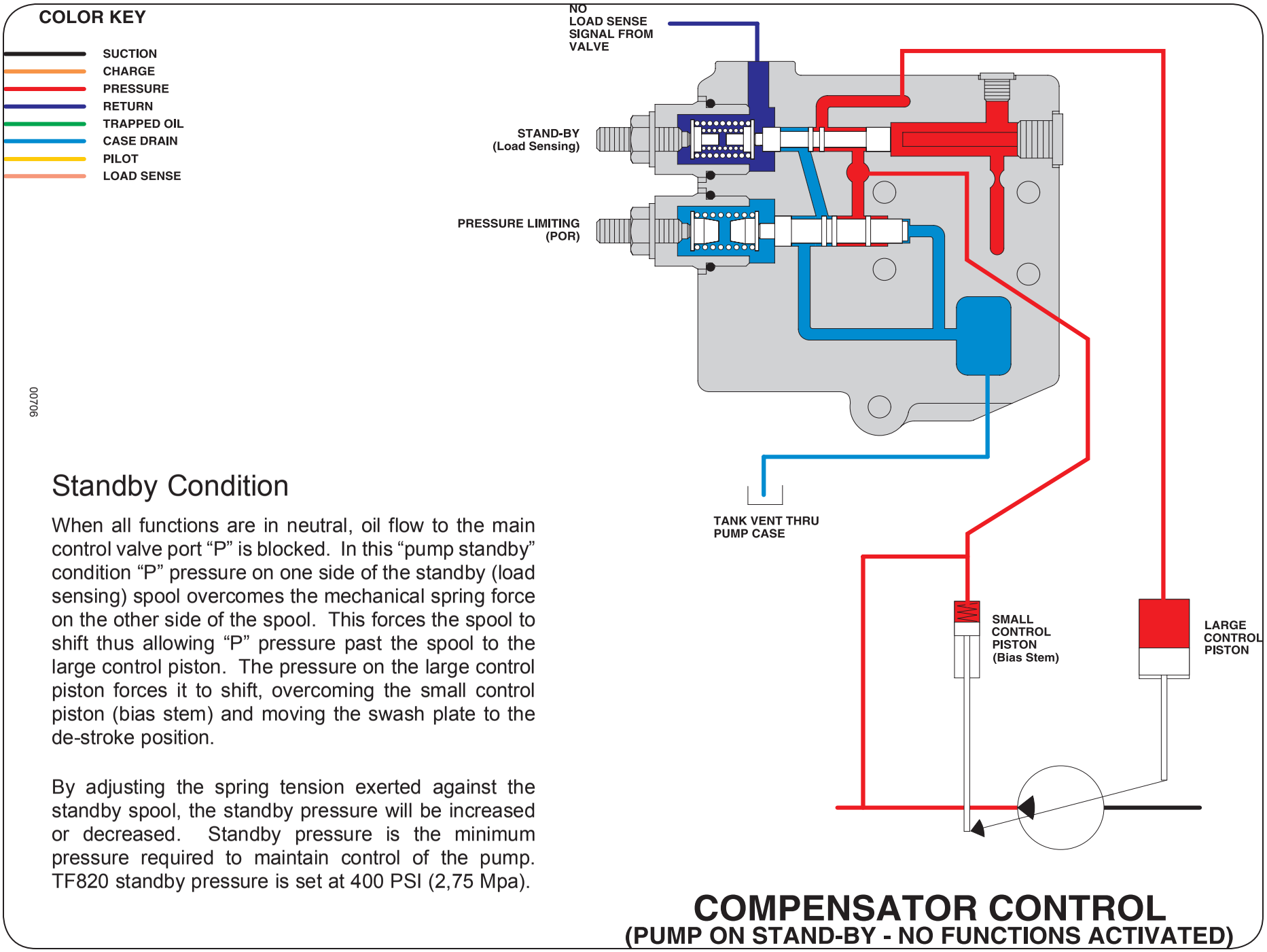
(See Figure 4)

The compensator control has three main oil galleries that connect to the pump at its mounting base. The first gallery (Ref #1) vents to tank via the pump case. The second gallery (Ref #2) connects to the pump's large control piston. The third gallery (Ref #3) is the "P" pressure connection. "P" pressure is the pressure seen at the outlet of the pump and at the pumps' small control piston (bias stem).

Inside the compensator control are two spools; stand-by (Ref #4), and pressure limiting, (Ref #5). Each spool has a mechanical spring force applied at one end (Ref #6). The amount of spring force can be changed by turning an adjustment setscrew (Ref #7) IN or OUT to preload the spring. Turning the adjustment screw IN increases spring preload, requiring more force at the opposite end of the spool to overcome the spring. Turning the adjustment screw OUT decreases spring preload, requiring less force at the opposite end of the spool to overcome the spring.

Both spools are open on the opposite end to "P" pressure. "P" pressure" provides the hydraulic force used to overcome the mechanical spring force.

Figure 5: Implement Pump Compensator Control - Standby Condition

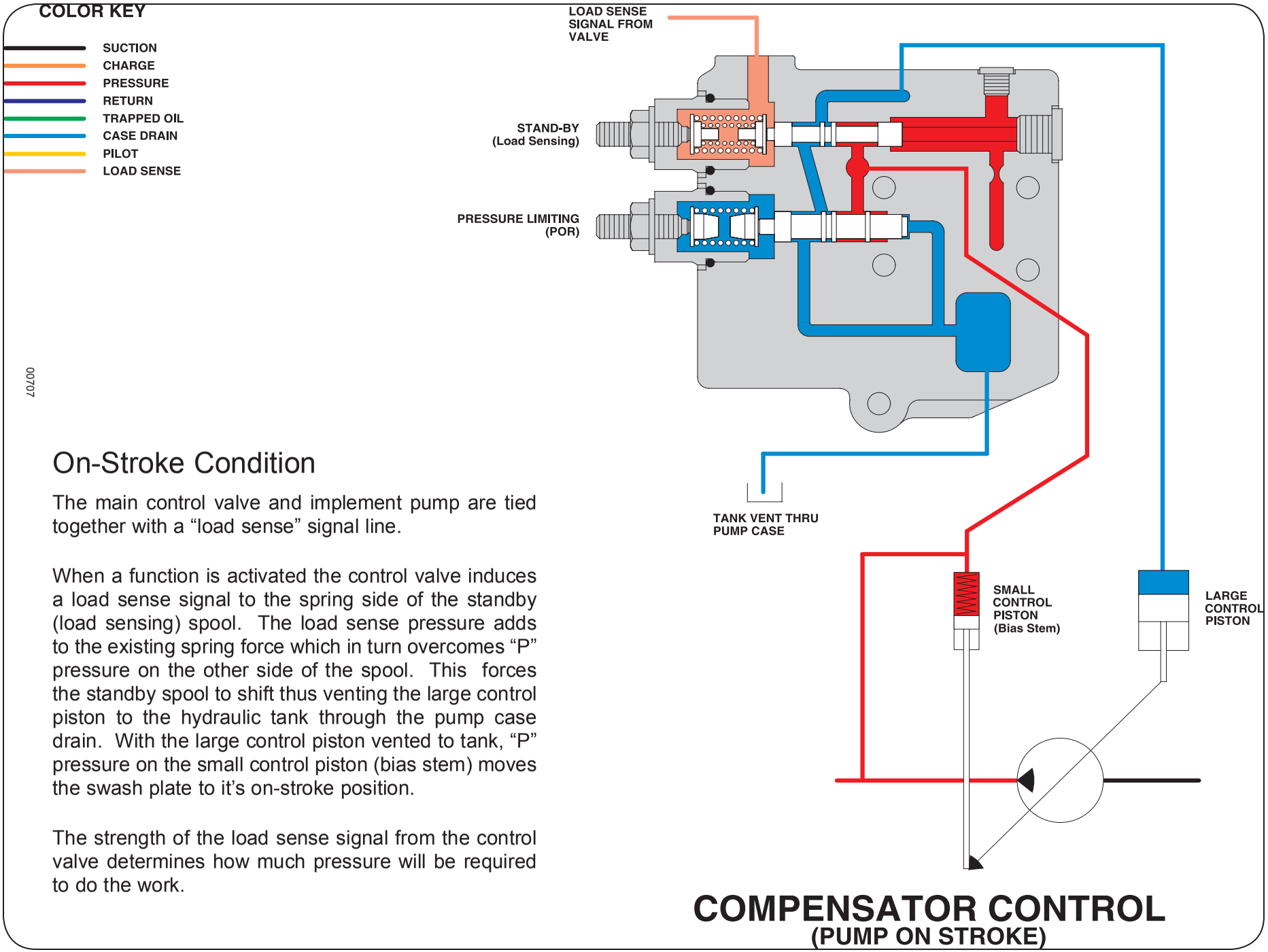


Standby Condition

When all functions are in neutral, oil flow to the main control valve port “P” is blocked. In this “pump standby” condition “P” pressure on one side of the standby (load sensing) spool overcomes the mechanical spring force on the other side of the spool. This forces the spool to shift thus allowing “P” pressure past the spool to the large control piston. The pressure on the large control piston forces it to shift, overcoming the small control piston (bias stem) and moving the swash plate to the de-stroke position.

By adjusting the spring tension exerted against the standby spool, the standby pressure will be increased or decreased. Standby pressure is the minimum pressure required to maintain control of the pump. TF820 standby pressure is set at 400 PSI (2,75 Mpa).

COMPENSATOR CONTROL
(PUMP ON STAND-BY - NO FUNCTIONS ACTIVATED)



On-Stroke Condition

The main control valve and implement pump are tied together with a “load sense” signal line.

When a function is activated the control valve induces a load sense signal to the spring side of the standby (load sensing) spool. The load sense pressure adds to the existing spring force which in turn overcomes “P” pressure on the other side of the spool. This forces the standby spool to shift thus venting the large control piston to the hydraulic tank through the pump case drain. With the large control piston vented to tank, “P” pressure on the small control piston (bias stem) moves the swash plate to it’s on-stroke position.

The strength of the load sense signal from the control valve determines how much pressure will be required to do the work.

Figure 6: Implement Pump Compensator Control - On-Stroke Condition

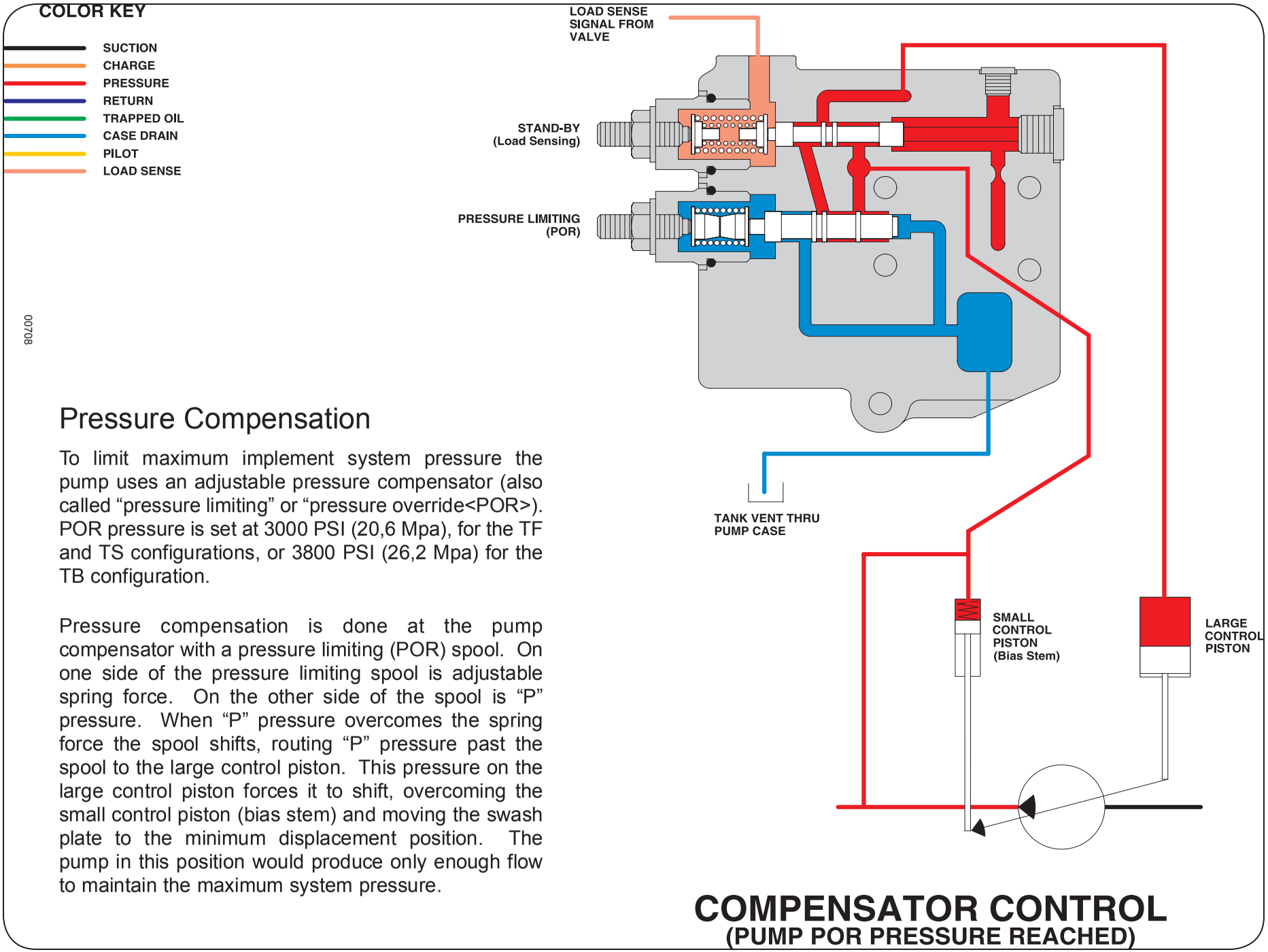


Figure 7: Implement Pump Compensator Control - Pressure Compensation

Pressure Compensation

To limit maximum implement system pressure the pump uses an adjustable pressure compensator (also called “pressure limiting” or “pressure override<POR>). POR pressure is set at 3000 PSI (20,6 Mpa), for the TF and TS configurations, or 3800 PSI (26,2 Mpa) for the TB configuration.

Pressure compensation is done at the pump compensator with a pressure limiting (POR) spool. On one side of the pressure limiting spool is adjustable spring force. On the other side of the spool is “P” pressure. When “P” pressure overcomes the spring force the spool shifts, routing “P” pressure past the spool to the large control piston. This pressure on the large control piston forces it to shift, overcoming the small control piston (bias stem) and moving the swash plate to the minimum displacement position. The pump in this position would produce only enough flow to maintain the maximum system pressure.

Implement Control Valve

Description

The Timberpro T800 utilizes a VOAC L90LS or K220 series directional control valve. The valve is a stackable proportional, load sensing and flow compensated, closed center valve. The valve is controlled with proportional, electric-over-hydraulic controls.

L90LS Operation

NOTE: Operation of the K220 valve used on the TB configuration is very similar in operation to the L90LS valve used on the TF and TB configurations.

By breaking the VOAC valve down into its three major components (Mid inlet section, end section, and spool section) it will be easier to understand.

Inlet Section

The inlet section is where the pump connections are made. These connections are the load sense line and pump pressure line and tank.

A direct acting main safety relief is also incorporated into the inlet section to protect the valve and pump from pressure spikes. This relief is a cartridge style relief that is factory preset at 4350 PSI (300 bar) and is not adjustable.

End Section

Internal pilot pressure supply is a valve function built into the end section. The end section is fitted with a non-adjustable pilot pressure reducing valve factory preset at 320 PSI (22 bar). This gives an internal pilot supply for the electro-hydraulic pilot caps to shift the main valve spools. For safety reasons, the pilot pressure reducing valve is equipped with a separate non-adjustable safety relief factory preset at 500 PSI (35 bar).

Also incorporated into the end section is a pilot oil filter equipped with a bypass. The filter protects internal pilot circuit from contamination.

Four ports are used in the end section.

1) T2B - Return oil to tank.
2) T3B - Oil supply for the frame lock circuit
3) LSP - Load sense drain
4) P2 - Auxiliary pressure port that supplies the mono-block valve

Spool Section (See Figure 8)

The spool section consists of a body, 4-way main spool, compensator spool, port relief valves, and electric proportional solenoids.

The electric proportional solenoids (Ref #6 & #7) are controlled by a proportional current signal from the IQAN digital control system. As the current to the solenoids changes, the valve produces a pilot signal proportional to the current supplied. This changing pilot pressure pushes the 4-way main spool (Ref #2) in either the “A” or “B” direction. Not only is direction determined, but also how far the spool travels.

Primary load sense is connected through the timed drillings in the main spool (Ref #4). When the main spool shifts the load sense will communicate with the work ports. The load sense signal travels to the pump control through the section shuttle valve (not shown). These shuttles are hardened seats located between each section. The series of shuttles allow only the load sense signal from the section with the highest pressure to reach the pump.

The load sense signal also travels into the spring chamber (Ref #9) of the section compensator spool (Ref #10). The compensator spool spring and the section’s load sense pressure maintain a constant pressure across the main spool. Having a constant pressure drop across the main spool allows the section to deliver oil flow that is proportional to the main spool position.

Port reliefs (Ref #3 & #5) are also used on all sections. The port reliefs on standard machines are set at 4060PSI (280 bar). All port reliefs have an anti-cavitation feature. The system tank line has a 130 PSI (9 bar) back pressure check valve. The back pressure check valve causes the oil flow through the anti-cavitation checks to maintain back pressure on all components.

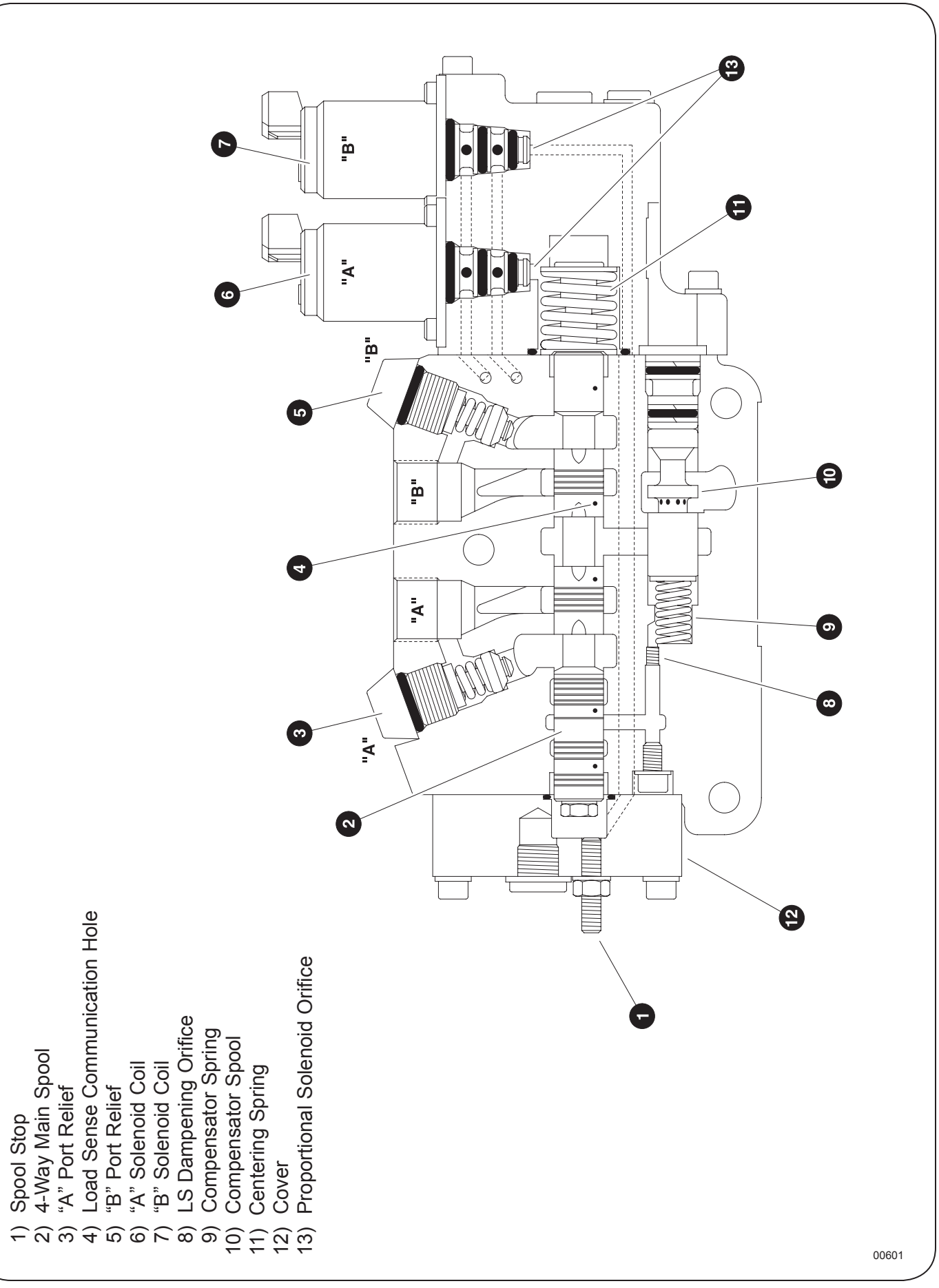


Figure 8: Implement Control Valve Spool Section Cut-Away - LS90

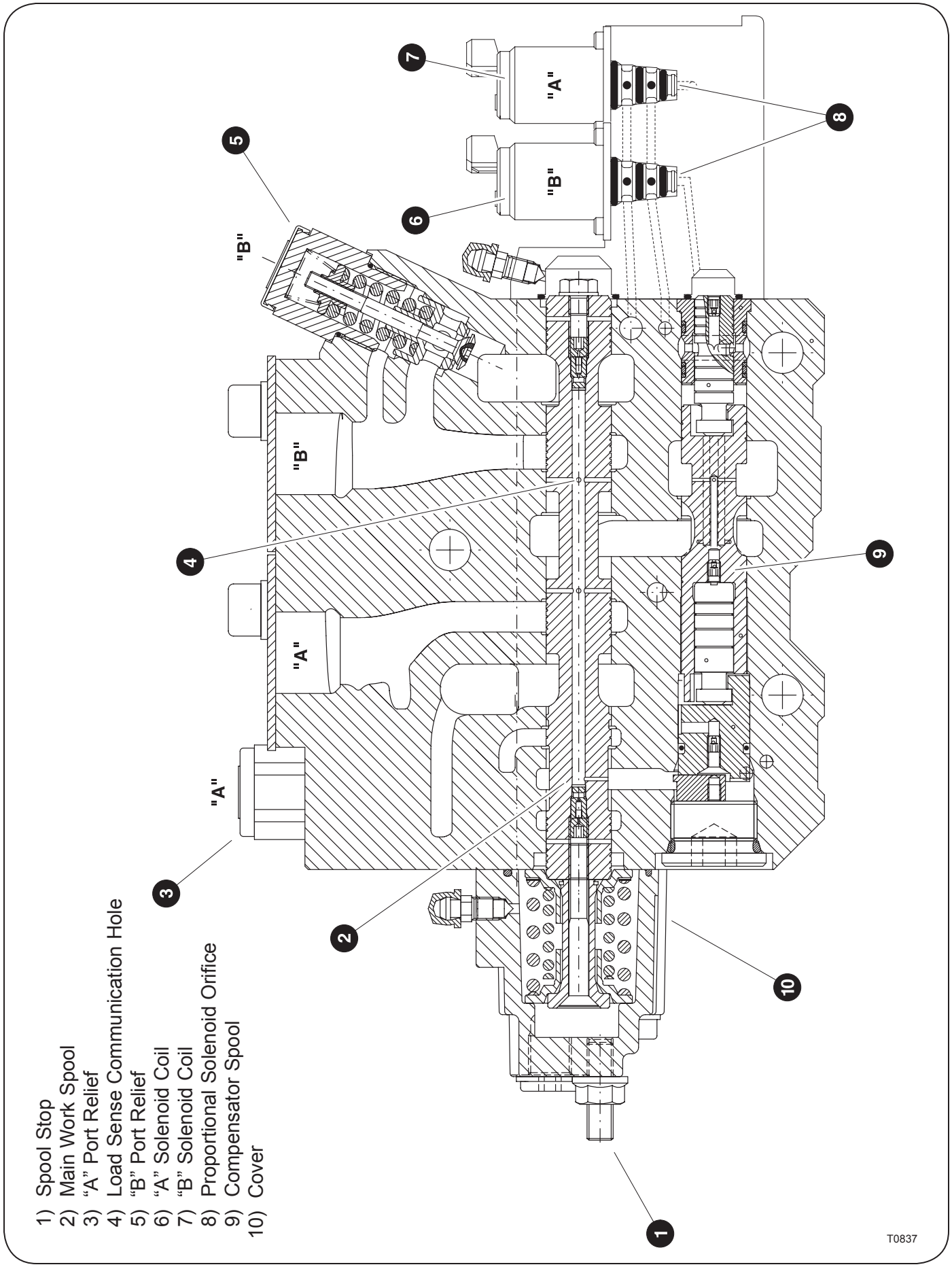


Figure 9: Implement Control Valve Spool Section Cut-Away - K220