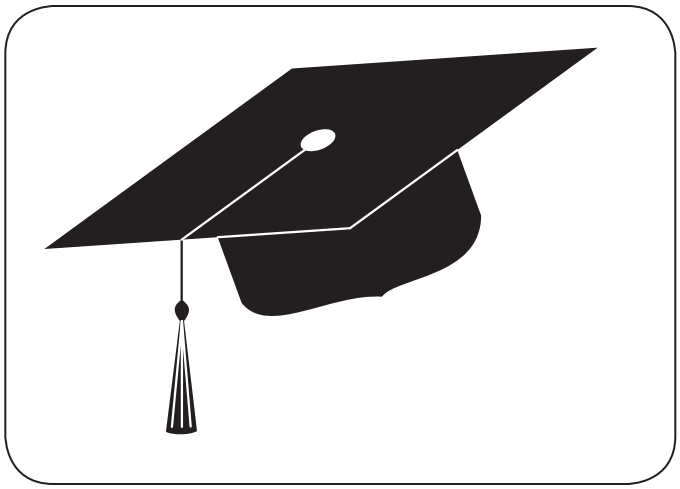
Section 6.1



Implement Circuit - General System

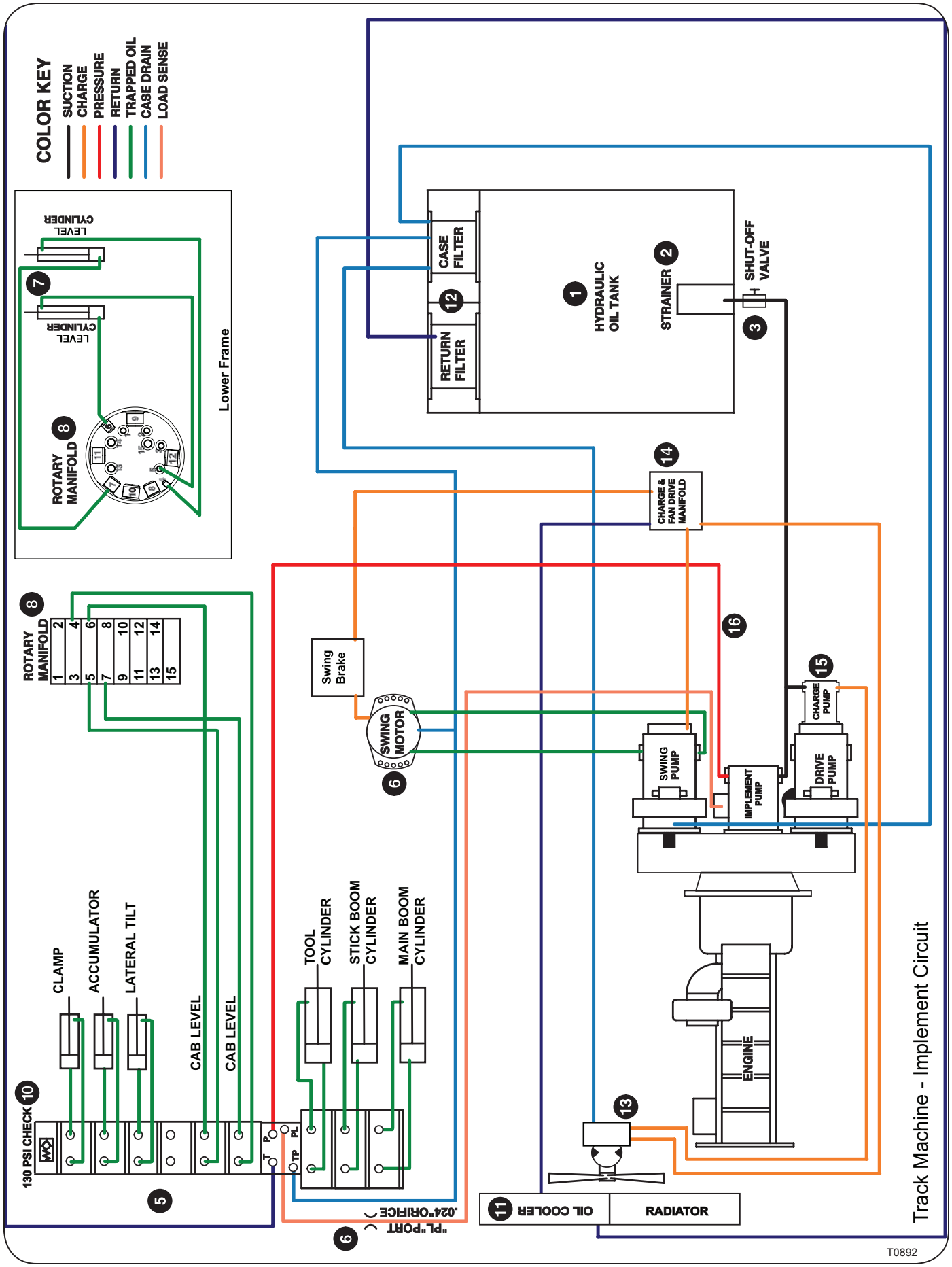


Figure 1: Simplified Implement Circuit Diagram (Typical)

General - Configurations (See Figure 1)

The TimberPro 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 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) 15-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. This motor also has built in valving to control fan speed and fan reversing.

14) Charge and Fan Drive Manifold. This manifold is supplied oil from the charge pump and regulates and filters the charge oil being supplied to the track 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 fan.

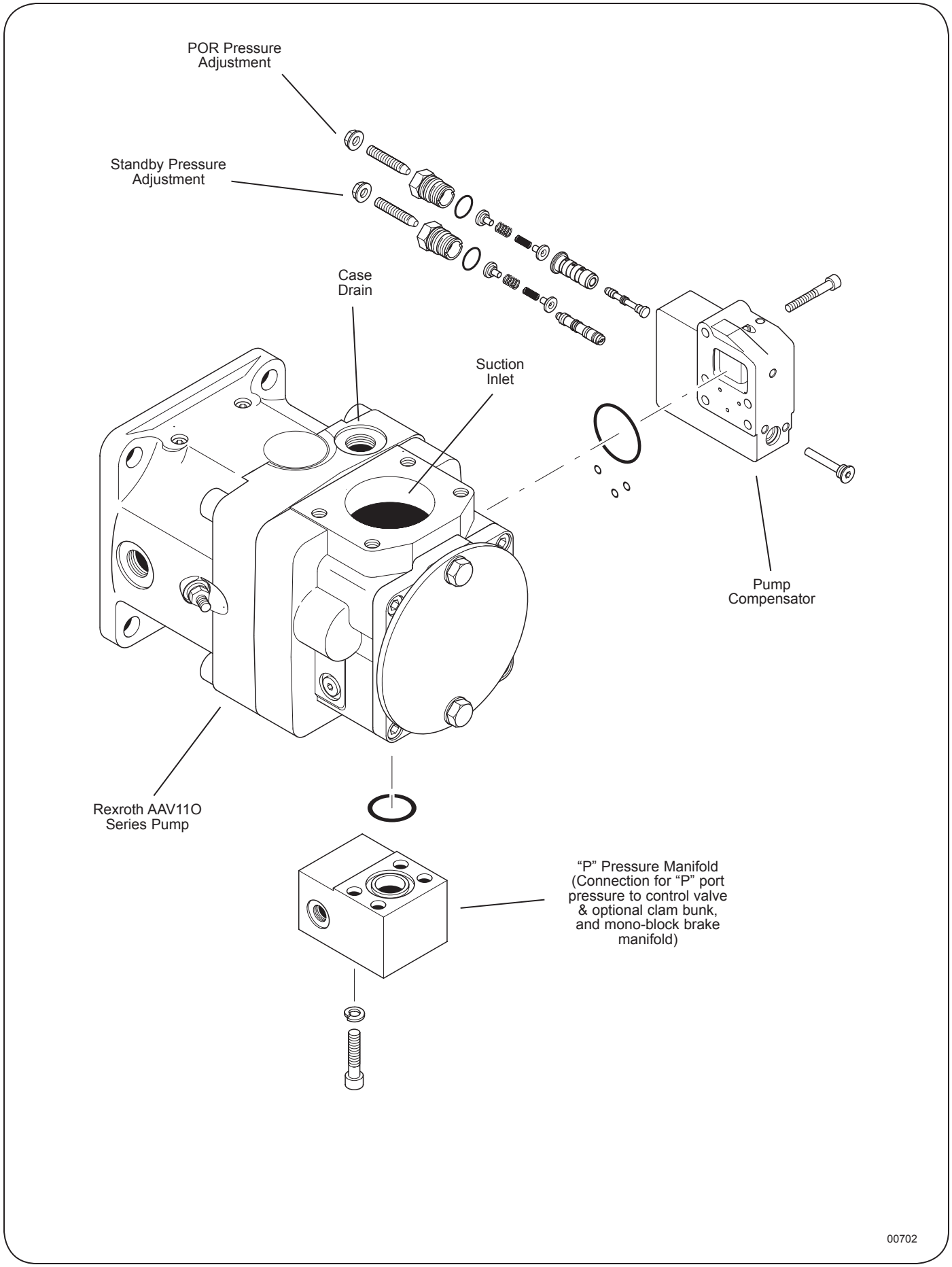


Figure 3: Implement Pump Breakdown

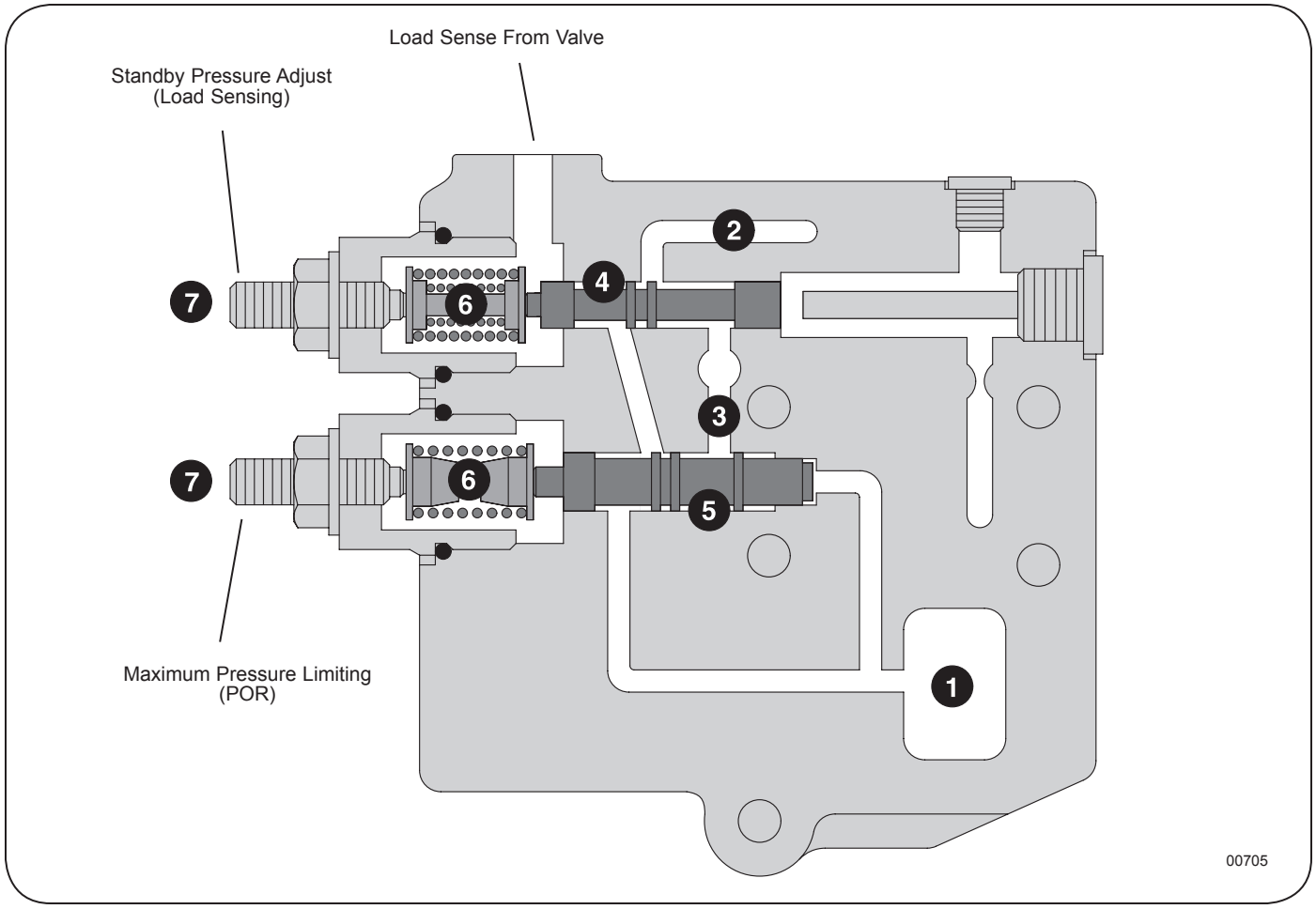


Figure 4: Pump Compensator Control

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.

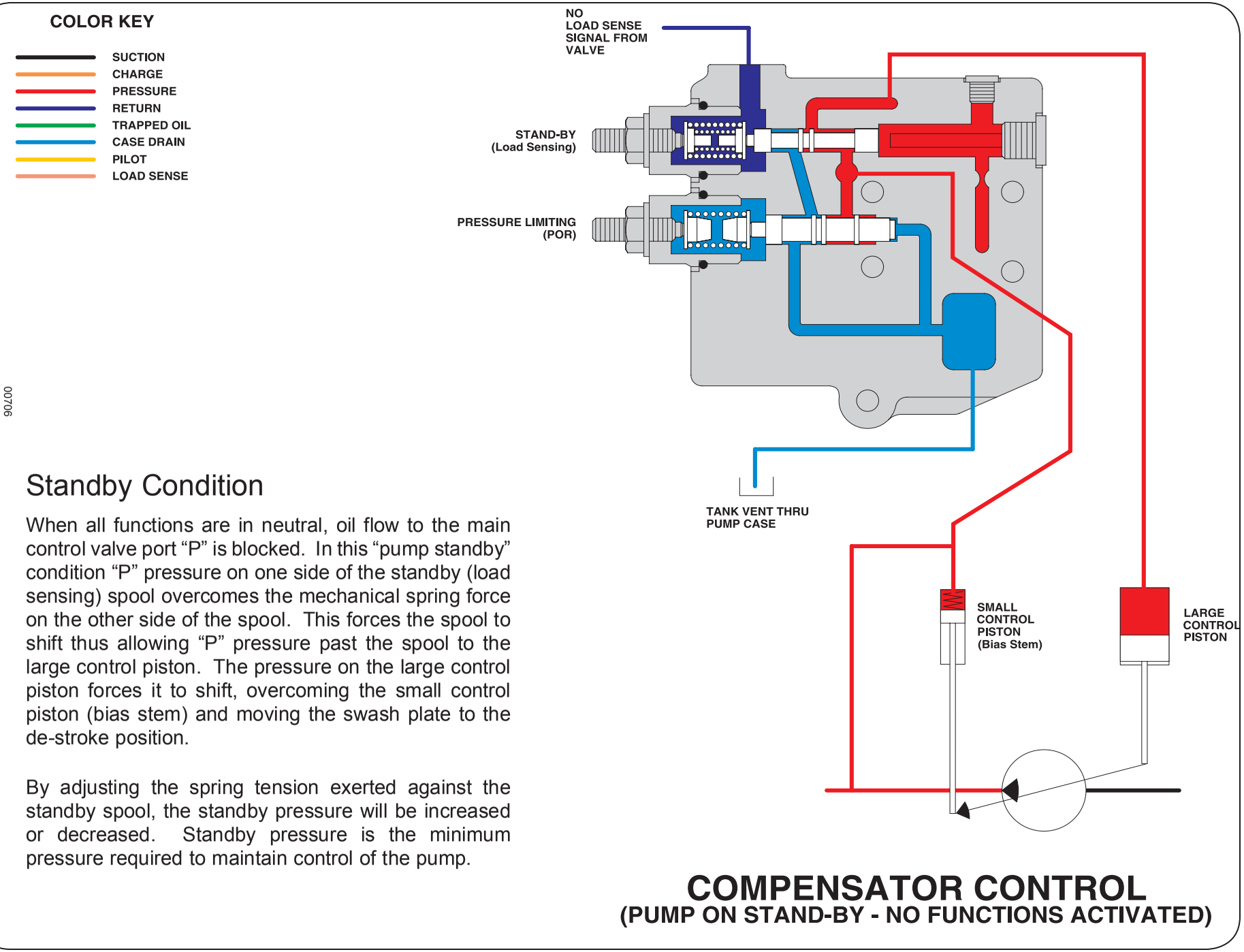
Compensator Control

(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.



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.

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

Figure 5: Implement Pump Compensator Control - Standby Condition

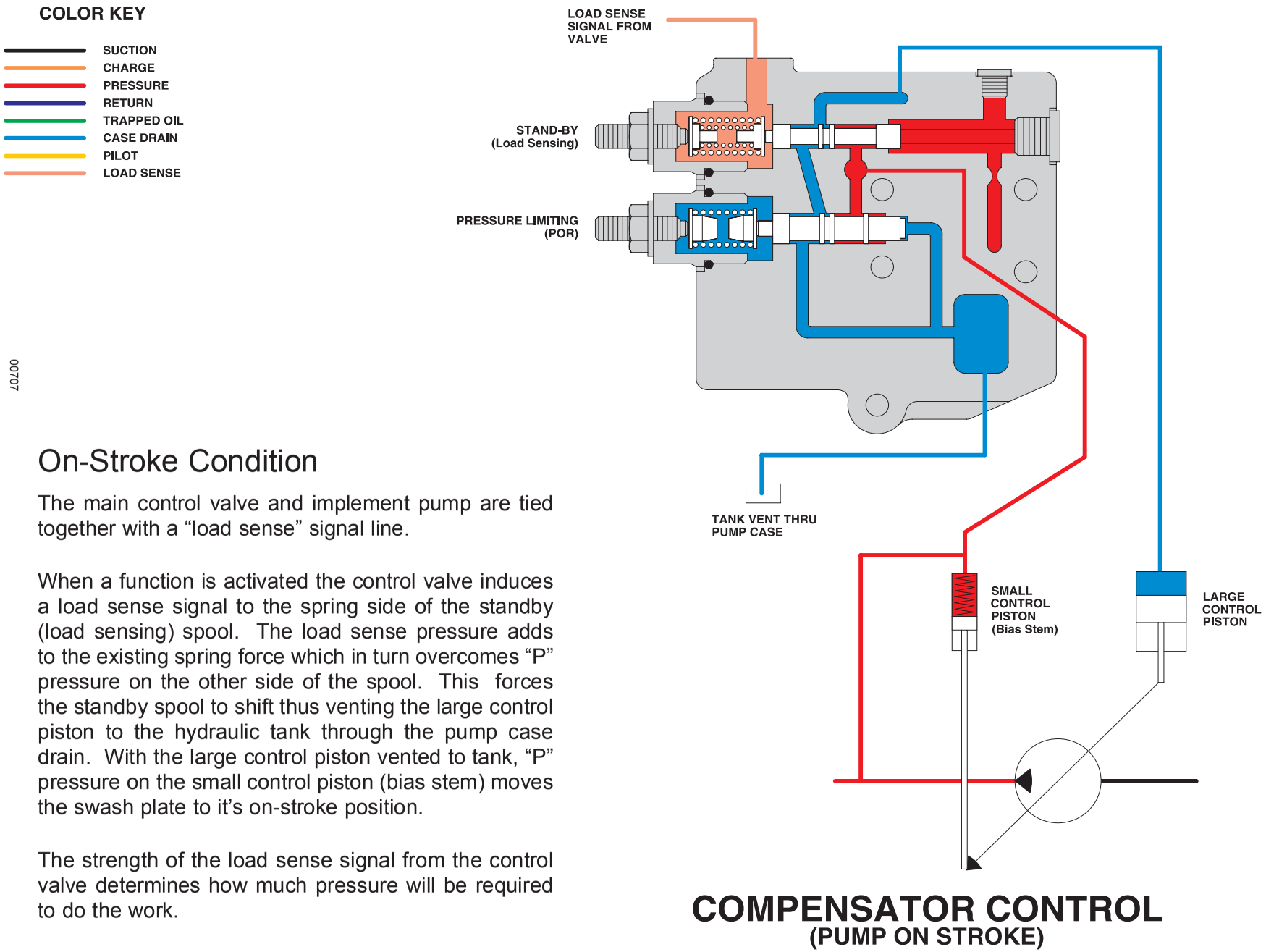


Figure 6: Implement Pump Compensator Control - On-Stroke Condition

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.

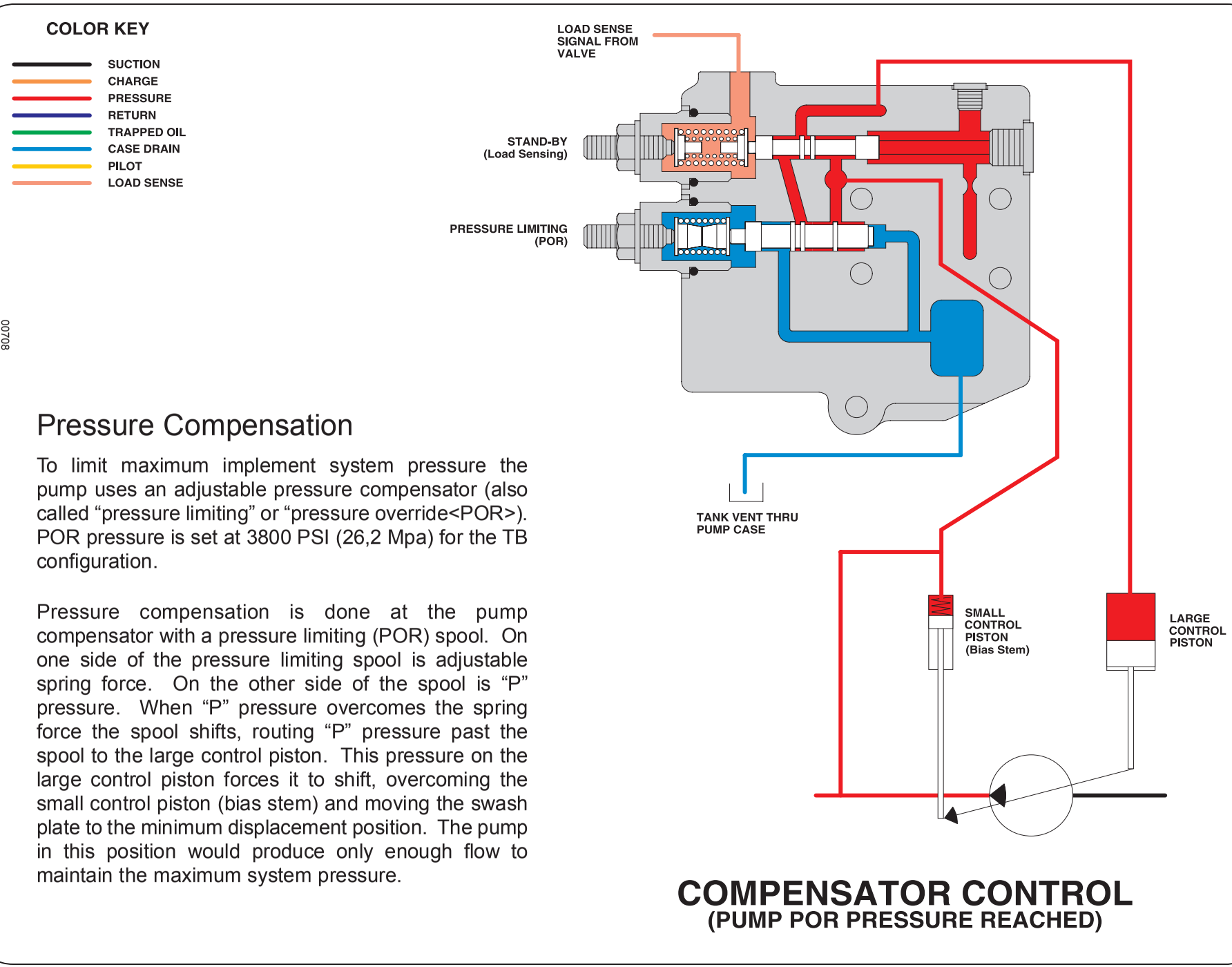


Figure 7: Implement Pump Compensator Control - Pressure Compensation

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 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.

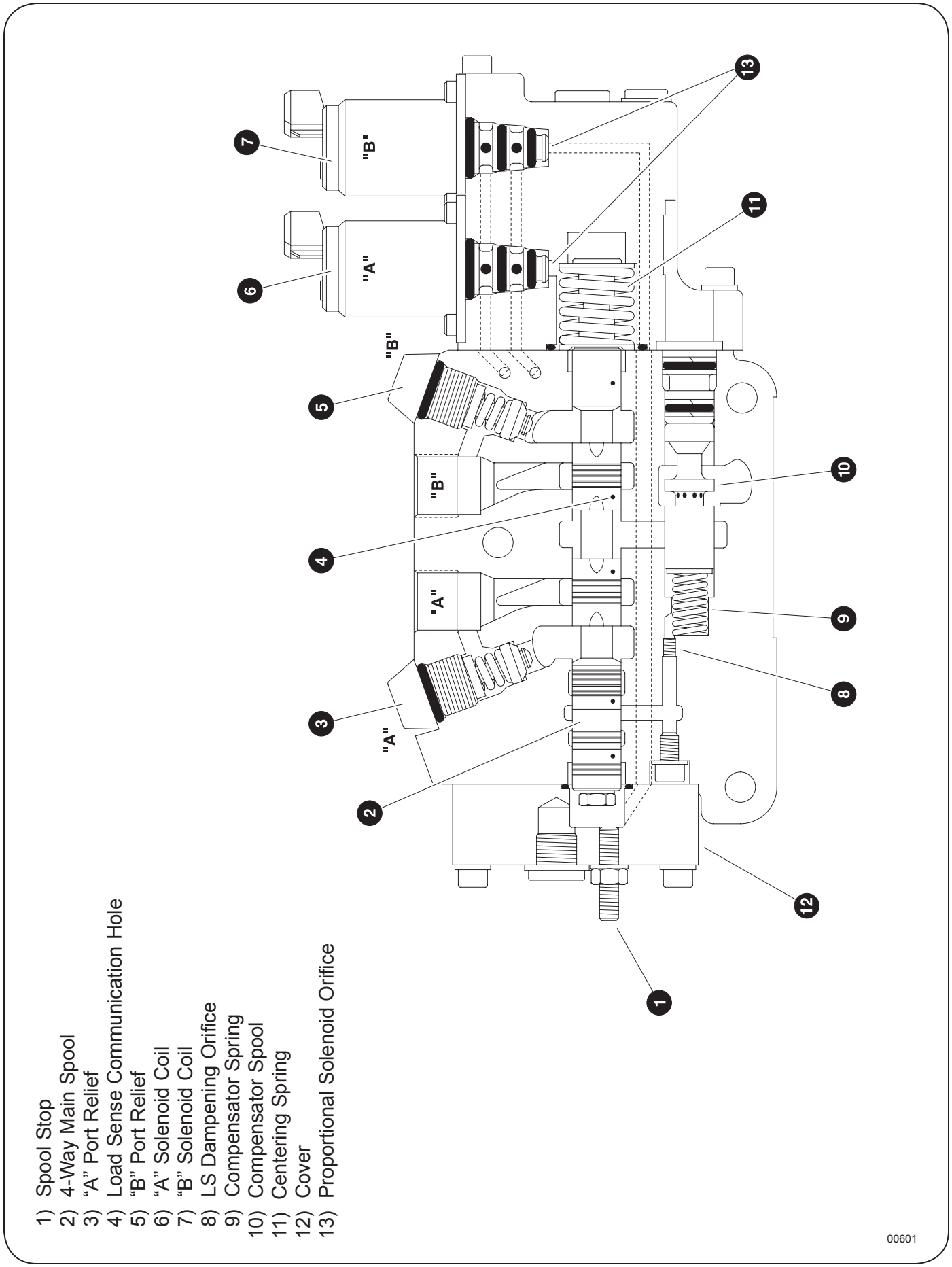


Figure 8: Implement Control Valve Spool Section Cut-Away - LS90

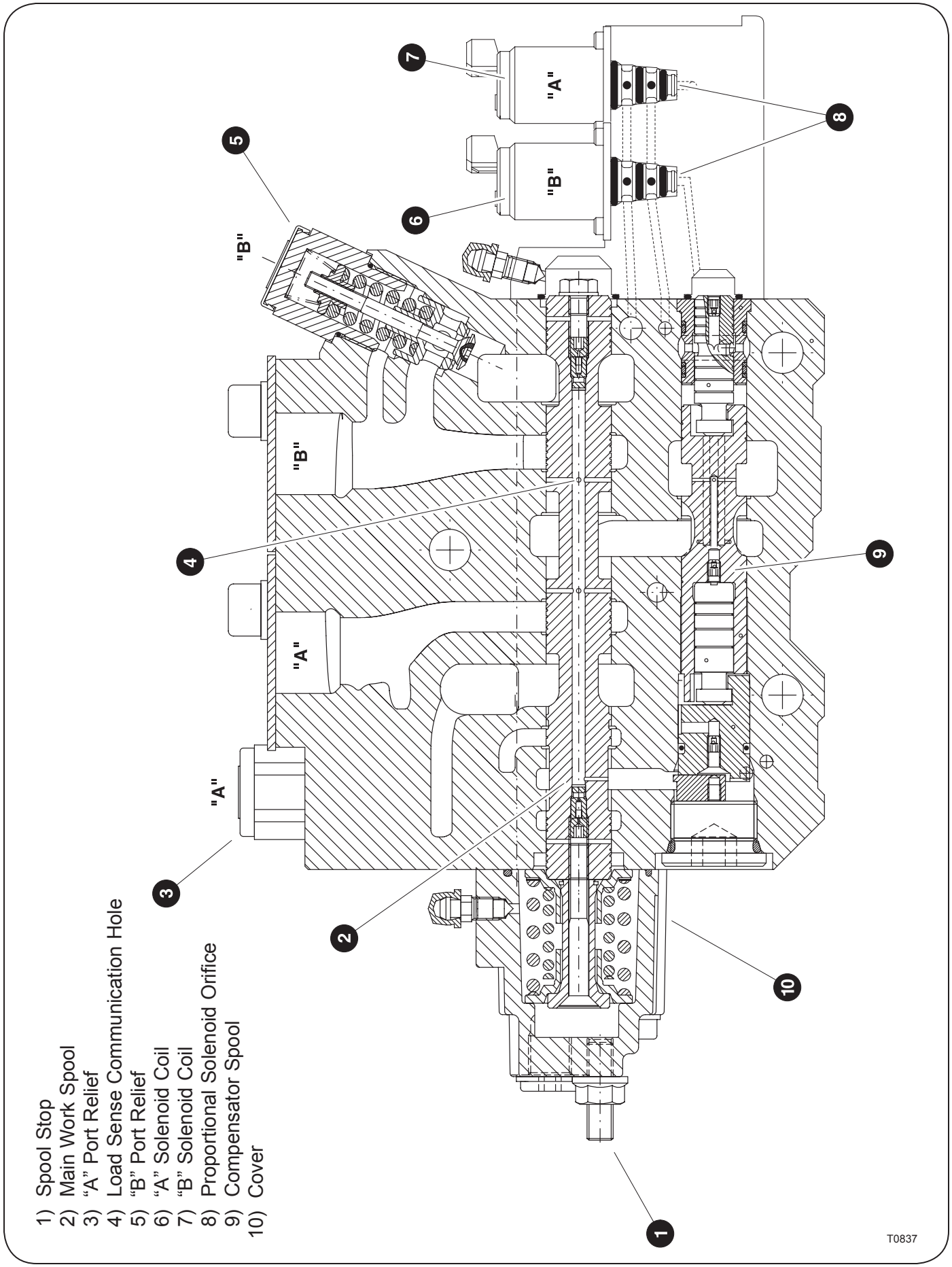
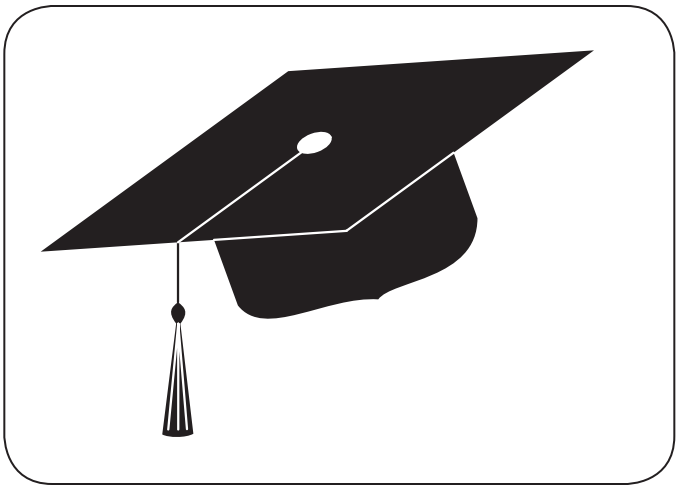


Figure 9: Implement Control Valve Spool Section Cut-Away - K220

Section 6.2



Implement Circuit - Tests & Adjustments

Safety information

NOTICE

You must read and understand the warnings and basic safety rules, found in Group-1 of the Operation & Maintenance manual, before performing any operation, test or adjustment procedures.

00015

Diesel exhaust fumes contain elements that are hazardous to your health. Always run engine in a well ventilated area. If in an enclosed space, vent exhaust to the outside.

00017

At operating temperature, the engine, exhaust system components, cooling system components and hydraulic system components are HOT. Any contact can cause severe burns.

Tools Required

- Tachometer
- 0 - 60 psi (0 - 1000 kPa) pressure gauge
- 0 - 600 psi (0 - 5 Mpa) pressure gauge
- 0 - 10,000 psi (0 - 80 Mpa) pressure gauge
- 9/16”, 11/16”, 3/4”, 13/16”, 1-1/4”, & 1-3/8” wrenches
- 13mm wrench
- 4mm allen wrench
- PN# 15437, #12 ORS cap
- PN# 15869, quick-couple adapter
- PN# 18838, #6 ORS plug
- PN# 18839, #6 ORS cap
- Gauge test hose
- #12 ORBM - #4 JICM adapter
- Calibrated container - 10 gallons (38 litres)
- Stop watch

- The operator or another mechanic may be required to operate a control while a pressure reading is being taken.

NOTE: Each machine is shipped from the factory with at least one 600 psi and one 10,000 psi gauge with quick-couple adapters. The gauges can be found in the machine Up-Time Kit.

Implement Pump Stand-By Pressure

Specification:

400-425 psi (28 bar)

Test Standards:

- Hydraulics at operating temperature of 140°F (60°C) or greater.
- Engine operating at idle

Procedure:

1. Ensure the hydraulics are at correct operating temperature.

2. Access the implement pump behind the swing-out guard located below the hydraulic tank.

3. Use the 13/16" wrench to disconnect the implement pump's load sense line were it connects to the load sense shuttle valve. See Figure 1.

   NOTE: The load sense must be disconnected before testing or adjusting the implement pump stand-by pressure. This prevents false readings from the control valve interacting with the pump.

3. Plug the Hose, but leave the pump open to atmosphere.

4. Start the engine and run at idle.

5. Connect the 600 psi pressure gauge, with the quick-couple adapter attached, to the gauge port tap provided on the centralized pressure check manifold. See Figure 2.

   NOTE: Only install a 600 psi pressure gauge after the engine is running. If the gauge is installed before the engine is started it can be damaged.

6. Read the pressure gauge, the implement pump stand-by pressure should be set at 400-425 psi (28 bar).

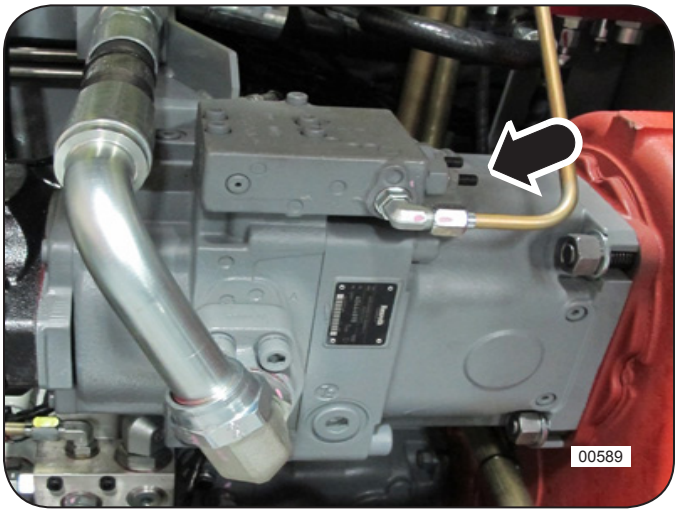


Figure 1: Disconnect Load Sense Line (Typical)

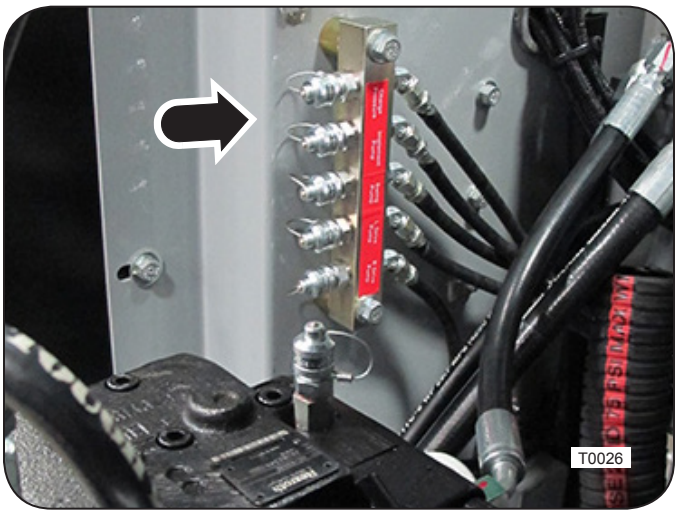


Figure 2: Implement Pump Pressure Gauge Port Tap

If implement pump stand-by pressure setting is correct, go to step #11. If adjustment is required, continue with step #7.

7. Use the 13mm wrench to loosen the jam nut on the stand-by pressure adjustment setscrew. See Figure 3.

8. Use the 4mm allen wrench to turn the adjustment setscrew.

   Turning the adjustment setscrew CLOCKWISE increases the pressure setting. Turning the setscrew COUNTER-CLOCKWISE decreases the pressure setting.

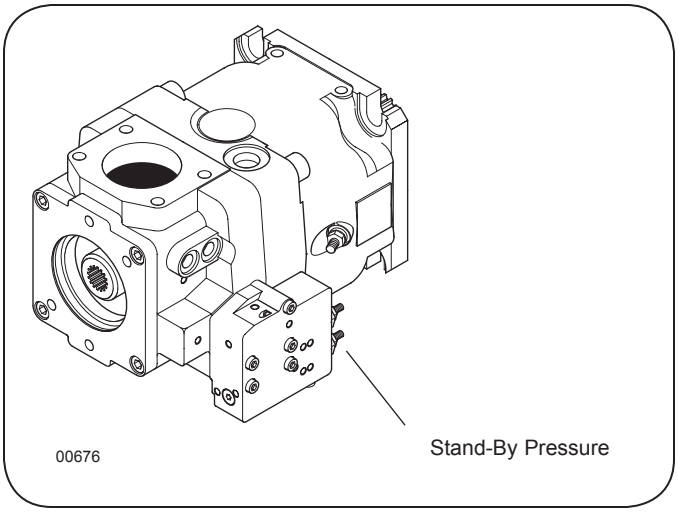


Figure 3: Implement Pump Stand-By Pressure Adjustment

9. Read the pressure gauge and adjust pressure setting as required.

10. After the correct pressure setting is made, tighten the jam nut to lock the setscrew.

11. Remove the pressure gauge and shut down the engine.

12. Re-connect the load sense line removed in step #3.

    NOTE: It is not necessary to bleed the load sense line because the pump is vented internally.

13. Close and secure the rear engine guard.

Implement Pump POR Pressure

Specification:

3800 +/- 50 psi (262 +/- 3.5 bar)

NOTE: The settings listed above are standard settings for most TimberPro machines. Some specialized machines with special attachments can require these settings to be different. Please contact your TimberPro dealer if you have any question on the setting of your machine.

Test Standards:

- Hydraulics at operating temperature of 140°F (60°C) or greater.
- Engine operating at high idle (approx. 1200 RPM).

Procedure:

1. Ensure the hydraulics are at correct operating temperature.
2. Access the implement pump behind the operator's cab in front of the hydraulic tank.
3. Connect the 10,000 psi pressure gauge, with the quick-couple adapter attached, to the gauge port tap provided on the centralized pressure check manifold. See Figure 2.
4. Start engine and increase engine throttle to high idle (approx. 1200 RPM).
5. Instruct the operator or another mechanic to bottom out an implement function while you read the pressure gauge, implement pump POR pressure should be set at specification. (Because different function have different pressure settings make sure and select a function (stick boom) that has a main relief setting higher than the implement pump POR.)
6. If implement pump POR pressure setting is correct, go to step #10. If adjustment is required, continue with step #7.

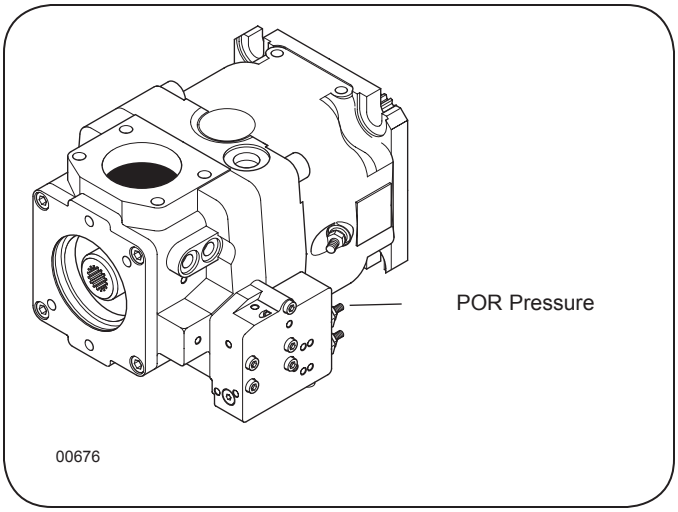


Figure 5: Implement Pump POR Pressure Adjustment

7. Use the 13 mm wrench to loosen the jam nut on the POR pressure adjustment setscrew. See Figure 5.
8. Use the 4 mm allen wrench to turn the adjustment setscrew.

   Turning the adjustment setscrew CLOCKWISE increases the pressure setting. Turning the setscrew COUNTER-CLOCKWISE decreases the pressure setting.

9. Instruct the operator or another mechanic to bottom out an implement function while you read the pressure gauge, implement pump POR pressure should be set at specification. (Because different function have different pressure settings make sure and select a function (stick boom) that has a main relief setting higher than the implement pump POR.)
10. After the correct pressure setting is made, tighten the jam nut to lock the setscrew.
11. Shut down the engine.
12. Remove the pressure gauge then close and secure all access panels and guards.

Implement Pump Case Drain Pressure

Specification:

Maximum 35 psig (2.4 bar) allowed.

Test Standards:

- Hydraulics at operating temperature of 140°F (60°C) or greater.
- Engine operating at full throttle (approx. 2000 RPM).
- Implement pump pressure at specification.

Procedure:

1. Produce a gauge test hose that will allow you to tee in a 60 psi (4 bar) gauge to the #12 ORFS connector that will be installed into the implement pump case drain port.
2. Ensure the hydraulics are at correct operating temperature.
3. Access the implement pump behind the operator's cab next to the hydraulic tank.
4. Locate and remove the implement pump case drain hose and connector and tee in a fitting and 60 psi (4 bar) gauge.
5. Install the gauge test hose and pressure gauge to the case drain port adapter.

NOTICE

Be sure the pump case is full of oil before starting the machine otherwise catastrophic damage to the pump will occur.

6. Start engine and run at full throttle.
7. Instruct the operator or another mechanic to bottom out an implement function and hold it for a full minute while you observe the pressure gauge.

   The implement pump case drain pressure should not exceed specification. If the specification is exceeded, look for conditions that would increase backpressure in the case drain circuit such as a plugged case drain filter element, failing component, etc.
8. After completing the test, cycle all implement functions for a least 2-minutes to cool the hydraulics down.
9. Shutdown the engine and remove the adapter tee that was installed for testing.
10. Close and secure the rear engine guard.

Implement Pump Case Drain Flow

Specification:

- New or rebuilt - Maximum 4.6 gpm (17,5 litres) allowed.
- Used - Maximum 5.8 gpm (22 litres) allowed.

Test Standards:

- Hydraulics at operating temperature of 140°F (60°C) or greater.
- Engine operating at full throttle (approx 2000 RPM).
- Implement pump pressure at specification.

Procedure:

1. Ensure the hydraulics are at correct operating temperature.
2. Access the implement pump behind the operator's cab in front of the hydraulic tank.
3. Use the 1-1/4" and 1-3/8" wrenches to remove the implement pump case drain line at the hydraulic tank. Cap the fitting to prevent contaminates from entering the hydraulic system.
4. Place the open end of the case drain hose into the calibrated container.

NOTICE

Be sure the pump case is full of oil before starting the machine otherwise catastrophic damage to the pump will occur.

5. Start engine and run at full throttle. Immediately have the operator or another mechanic bottom out an implement function and hold it for a full minute.
6. After one minute, deactivate the implement function and shutdown the engine.
7. Remove implement pump case drain hose from the container and re-connect it to the hydraulic tank.
8. Cycle all implement functions for a least 2-minutes to cool the hydraulics down.
9. Measure the oil in the container. If the amount exceeds specification, the implement pump is worn or failing and may have to be replaced.
10. Close and secure the rear engine guard.

Disc Saw Pump Stand-By Pressure

Specification:

145 - 200 psig (10 - 13.8 bar)

Test Standards:

- Hydraulics at operating temperature of 140°F (60°C) or greater.
- Engine operating at idle

Tools Required:

- 17 mm wrench
- 3/16” Allen wrench
- 3 mm Allen wrench
- 0 - 600 psi (0 - 41.37 bar) pressure gauge

Procedure:

1. Be sure the disc saw circuit switch on the right Joystick Pod is in the OFF position so that the disc saw blade does not start during the procedure. See Figure 6.

2. Open the rear gullwing guard to access the disc saw pump.

3. Install the gauge at the disc saw pump pressure output block See Figure 7.

4. Start the engine and run at low idle.

5. Ensure the hydraulics are at correct operating temperature.

6. Connect the 600 PSI pressure gauge to the gauge test hose.

7. Increase engine throttle to 1500 RPM.

8. Read the pressure gauge. The disc saw stand-by pressure should be set at

145 - 200 psig (10 - 13.8 bar).

Figure 6: Disc Saw Circuit “ON and OFF” Switch

If the disc saw stand-by pressure setting

is correct, go to step #12. If adjustment is required, continue with step #9.

9. Locate the stand-by pressure adjustment setscrew on the disc saw pump compensator. See Figure 7.

10. Use the 17 mm wrench to remove the protective acorn nut. Use the 3 mm Allen wrench to hold the adjustment setscrew stationary while loosening the jamnut with the 17 mm wrench.

11. Turn the adjustment setscrew out COUNTERCLOCKWISE until the gauge reads about 100 psig (690 kPa), then in CLOCKWISE until the gauge reads the correct pressure of 145 - 200 psig (10 - 13.8 bar).

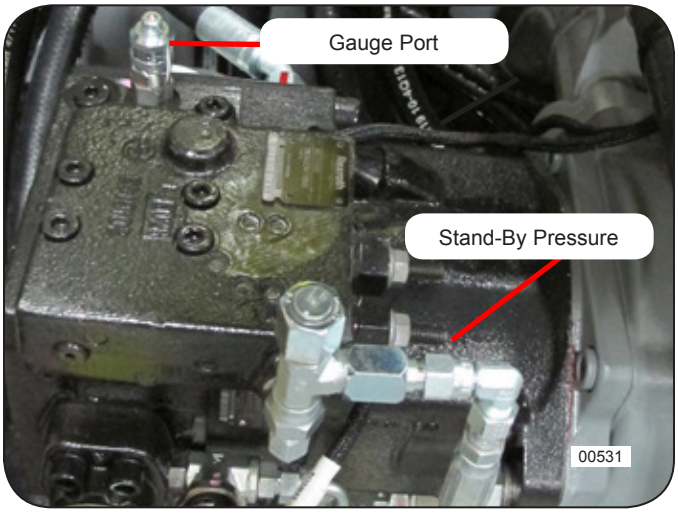


Figure 7: Stand-by Pressure Gauge Installation (Typical)

Tighten the jamnut to lock in the adjustment. See Figure 7.

12. Shut-down the engine and remove the gauge test hose and pressure gauge.

13. Close and secure the rear gullwing guard.

14. Procedure complete.

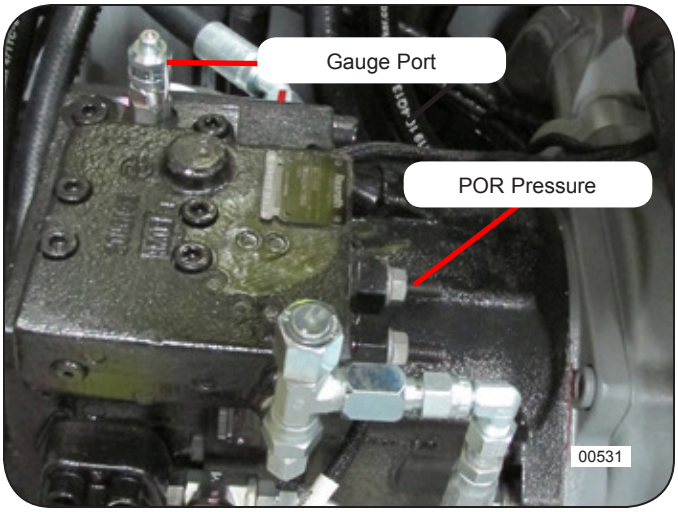


Figure 9: POR Pressure Gauge Installation (Typical)

Disc Saw Pump POR Pressure

Tools Required:

- 17 mm wrench
- 3 mm Allen wrench

Specification: 3950 psig (272 bar)

Test Standards:

- Hydraulics at operating temperature of 140° F (60° C) or greater.
- Engine operating at 1250 - 1500 RPM.

Procedure:

Figure 8: Disc Saw Circuit “ON and OFF” Switch

1. Be sure the disc saw circuit switch on the right Joystick Pod is in the OFF position so that the disc saw blade does not start during the procedure. See Figure 8.

2. Open the rear gullwing guard to access the disc saw pump.

3. Start the engine and run at low idle.

4. Ensure the hydraulics are at correct operating temperature.

5. In order to get an accurate compensator pressure reading, the cutting disc must be pinned to prevent rotation. See the disc saw attachment manual for this procedure.

6. Increase engine speed to full throttle.

NOTICE

Flying objects and moving parts can cause serious personal injury or death. Keep clear of disc saw cutting attachment when in operation.

7. Turn the disc saw circuit “ON” to signal the disc saw to come on-stroke. See Figure 8.

8. Read the pressure gauge mounted in the cab on the front left dash panel. See Figure

7. The disc saw POR pressure should be set at 3800 psig (262 bar). If the disc saw POR pressure setting is correct, go to step #12. If

adjustment is required, continue with step #9.

9. Locate the compensator pressure adjustment setscrew on the disc saw pump compensator. See Figure 9.

10. Use the 17 mm wrench to remove the protective acorn nut. Use the 3 mm Allen wrench to hold the adjustment setscrew stationary while loosening the jamnut with the 17 mm wrench.

11. Turn the adjustment setscrew out COUNTERCLOCKWISE until the gauge reads about 3200 psig (220.6 bar), then in CLOCKWISE until the gauge reads the correct pressure of 3950 psig (272 bar). Tighten the jamnut to lock in the adjustment. See Figure 9.

12. Shut-down the engine.

13. Close and secure the swing-out pump access guard.

14. Procedure complete.