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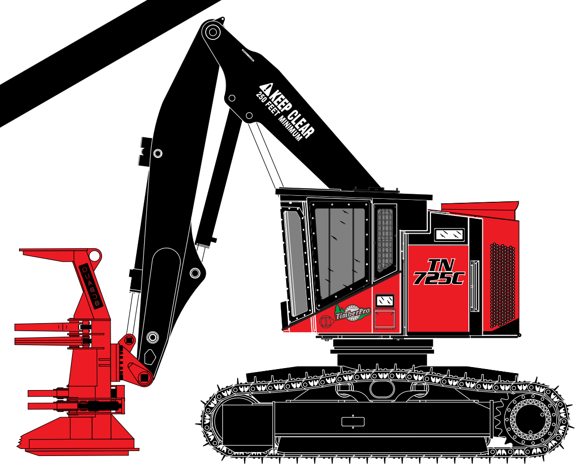
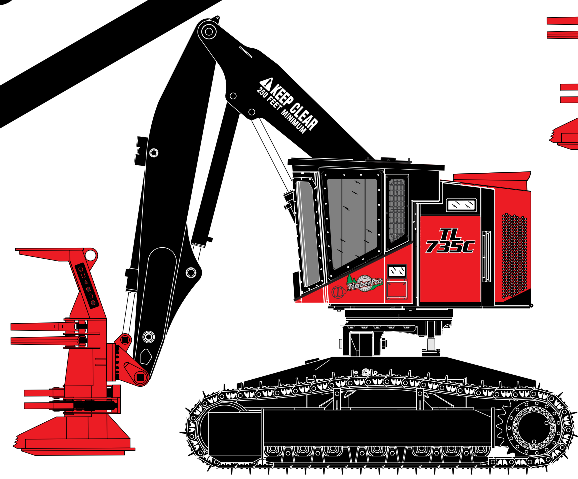
700C Series

Operators Training, Maintenance, and Troubleshooting Manual





Foreward ...

Dear Valued Customer,

With this training manual, TimberPro has decided to take a different approach and add more technical information on the machine. Because of the new technology in today's equipment, the large initial cost and the dependence on this equipment for survival in the logging business, TimberPro felt a little more "in-depth" training should be done. With the remoteness of most logging operations a dealer is not always available to take care of every problem. In most cases, what determines the availability of a machine is not only how it is used and maintained, but also the technical knowledge of the people responsible to make it work.

Most operators and forestry workers have not been trained extensively in this new hydraulic technology. With this manual, TimberPro is attempting to make this technology more understandable. Knowing that many operators do not fully understand hydraulic schematics, TimberPro has used pictorial drawings of all the hydraulic circuits to make them easy to follow. There is also a glossary that defines many of the hydraulic terms used which should help in the understanding of the hydraulic systems on the machine.

The logging business by nature is perhaps the most abusive industry on equipment, therefore, knowledge is essential to make it all work. The biggest mistake some loggers make is continuously striving for production at the expense of the equipment. A steady production pace and good maintenance practices without excessive abuse of equipment will always, over the long haul, out-profit the "production at any cost" method of logging.

TimberPro strongly advises that you take this training manual home and study it so that you have an understanding and working knowledge of your new machine.

Thank You,

Pat Crawford
President
TimberPro, LLC

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Hydraulic and Electrical Schematics

Glossary Of Terms

Amp

A measurement of electrical current. The IQAN digital control system actuates solenoid coils by sending proportional current to them. This current is measured in milliampere (1/1000 Amp).

Volt / Voltage

A measurement of electrical signal. The IQAN digital control system understands control actuators and sensors by supplying them with a set voltage and then monitoring the return voltage signal.

Anti-Cavitation Check Valve (Anti-cav Valve)

An anti-cavitation Check valve is a low pressure check valve (See Check Valve) that allows reverse flow of oil to a cylinder or motor when the normal supply of oil flow is limited (example: a cylinder that overruns control due to force of gravity). Anti-cavitation check valves typically have a very low cracking pressure (See Cracking Pressure), sometimes as low as 3 PSI (20 kPa).

In mobile equipment, control valves use port relief valves (See Port Relief Valve) that are equipped with anti-cavitation check valves as a standard feature.

Case Flushing Orifice

A case flushing orifice is used in hydrostatic drive systems to reduce heat build-up. The flushing orifice allows a set volume of oil from the low pressure side of the hydrostatic loop to escape, via a pump or motor case drain, where it is sent to the oil cooler. The removed oil that is replaced by fresh charge oil (See Charge Oil) at the hydrostatic pump.

Charge Oil

Charge oil is used to replace any oil volume lost in a closed loop hydrostatic system due to pump/motor leakage or case flushing orifices (See Case Flushing Orifice). Without charge oil, a closed loop hydrostatic system will run low on oil volume and cause cavitation damage to components. Charge oil is typically supplied by an auxiliary gear pump or an internal gear pump on the hydrostatic pump. Charge oil must be pressurized to enter the hydrostatic loop (See Charge Pressure) and is always filtered.

Charge oil is also commonly used as make-up oil for the main control valve or swing motor to prevent cavitation in those work circuits.

Charge Pressure

Charge oil enters a hydrostatic loop on the low pressure leg so it must be pressurized greater than its entry point (otherwise loop oil would enter the charge oil circuit). Charge pressure is set between 400-475 PSI (2,8-3,3 Mpa) by a relief valve in the circuit. Most hydrostatic systems also use charge pressure as an internal pressure signal to actuate the hydrostatic pump's swash plate control.

On TimberPro machines, charge pressure is also used as a pressure signal to release the swing motor brake.

Check Valve

A check valve typically has two ports and is designed to allow oil flow in one direction only. Most check valves use mechanical spring force acting against a poppet assembly (usually a steel ball and machined seat). The rate of spring force used determines what hydraulic pressure is required before the valve opens and allows oil flow to pass. This spring rate/pressure is called the check valve's cracking pressure.

Check valves have many uses. Most common are to prevent back flow of oil in a circuit, to maintain a required back pressure in a circuit, or as a low pressure relief like an oil cooler bypass.

Counterbalance Valve

A counterbalance valve is used to trap oil in a component, such as a cylinder or motor, to prevent uncontrolled movement. TimberPro machines use counterbalance valve in several locations such as in the cab leveling cylinders, swing motor work ports and frame lock cylinder.

Counterbalance valve are usually used in pairs and are pilot operated from the opposing valve. For example, the cab leveling cylinders use counterbalance valves to prevent the cylinder from collapsing if a hose burst. A pilot signal from the pressurized side of the cylinder is required to open the opposing counterbalance valve to let oil out of the non-pressurized side. Without the pilot signal, oil cannot escape the cylinder. This creates a hydrostatic lock which prevents the cylinder from moving.

Load Sense Orifice

A load sense orifice is used to stabilize or smooth control of the hydraulic system by reducing the rate of change in the load sense signal to the pump. Changing the size of the load sense orifice, or even the physical size of the load sense signal line, can dramatically change the performance of the machine. A load sense orifice that is too large would result in jerky controls and an orifice too small (or restricted) would result in sluggish controls.

Load Sense Pump

A load sense pump works by having a control ability to maintain a pressure differential or margin over an orifice. This orifice is typically a proportional directional control valve. The pump, after getting a load sense signal, will maintain enough flow so that the pump output pressure remains higher than the load sense signal pressure (this is the pressure differential or margin). The load sense differential or margin pressure is usually about 300 PSI (2.0 Mpa).

Oil Cooler

An oil cooler is designed to remove heat from hydraulic oil. An oil cooler is made up of a top and bottom manifold connected by many small tubes surrounded by very fine external fins. Hot oil travels through the tubes where its heat is drawn into the mass of external fins. Air flow from the engine fan then draws the heat from the fins and away from the oil cooler. The tubes are also equipped with turbulators that increase the surface area of contact with the oil inside the tubes. Turbulators also disrupt oil flow so the moving oil cannot form an insulating layer (oil moving through center of tube stays hotter than oil next to the wall of the tube).

(POR) Pressure Override Valve

A pressure override valve is normally used to automatically stroke a pump swash plate back toward neutral to limit system pressure without forcing oil over a relief valve, which creates excess heat. POR valves are used on almost all closed loop hydrostatic pumps and also some open loop pumps.

Pressure Compensated

A) When referring to a pump, pressure compensated means the pump has the capability to maintain a constant output pressure, even without an external load sense signal. The pump will vary its stroke or flow output to maintain a constant output pressure.

B) When referring to a control valve, pressure compensated means the valve is designed to maintain a specific flow regardless of load or system pressure changes. The typical pressure compensated valve uses a component called a compensator spool that adjusts (shifts) to maintain a controlled pressure drop across a variable orifice.

Port Relief Valve

Port relief valves are usually installed in the work port galleries of control valves to protect the control valve and components in the circuit from high pressure spikes. Port relief valves are typically set at 200 PSI (1.4 Mpa) above the system POR pressure (See POR Pressure). A port relief set too low will open before the system POR pressure is reached. This will result in loss of flow, excessive heat generation, and a greater horsepower requirement when operating the function. Port reliefs are usually equipped with an anti-cavitation (See Anti-Cavitation Check Valve) feature to protect against a cavitation condition in the circuit.

Pressure Drop

Pressure drop is the loss of pressure due to the flow of oil. Pressure drop can be reduced by using properly sized lines for the amount of oil flow travelling through them.

Relief Valve

A relief valve is normally a 2 port valve used to limit pressure. If pressure exceeds a set value, the relief valve opens and vents the excess pressurized oil to tank. Relief valves can be direct-acting or a pilot operated 2-stage type.

Sequence Valve

A sequence valve is very similar to a relief valve (See Relief Valve). Unlike a relief valve, the sequence valve has a drain line in its spring chamber. This drain allows the sequence valve to have pressure in the tank line without a system pressure change.

Stand-by Pressure

Stand-by pressure is the pressure a load sense pump (See Load Sense Pump) maintains when there is no external load sense signal (such as from the main control valve). This pressure is regulated by the compensator control of the pump and is determined by the normal off-stroke pressure required by the pump.

Suction Filter

A suction filter is similar to a suction strainer except that it can filter to a much finer level. Suction filters are typically made up of a cellulose or synthetic paper medium instead of a wire mesh screen.

Suction Strainer

A suction strainer is designed to filter large contaminates from hydraulic oil in a pump's suction inlet. Suction strainers are usually made of a wire mesh screen that can filter to approximately 150-micron. The implement suction strainer used in Timberpro machines is also equipped with a magnetic stem.

Thermal Bypass

A thermal bypass is used in a fluid cooler to limit flow into the cooler when the fluid is cold. Most thermal bypass valves use a temperature sensitive coil spring that works a poppet check against a seat. The spring contracts when cold (bypass open) and expands when warm (bypass closed). In an oil cooler, the thermal bypass remains open while the oil is cold and forces the oil to bypass the cooler and travel directly back to tank. This allows the hydraulic system to reach operating temperature quicker in cold climates. When the oil reaches a preset “warm” temperature the thermal bypass closes and the oil is routed through the oil cooler.