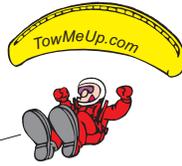


SuperTow Hydraulic Payout Winch Schematic

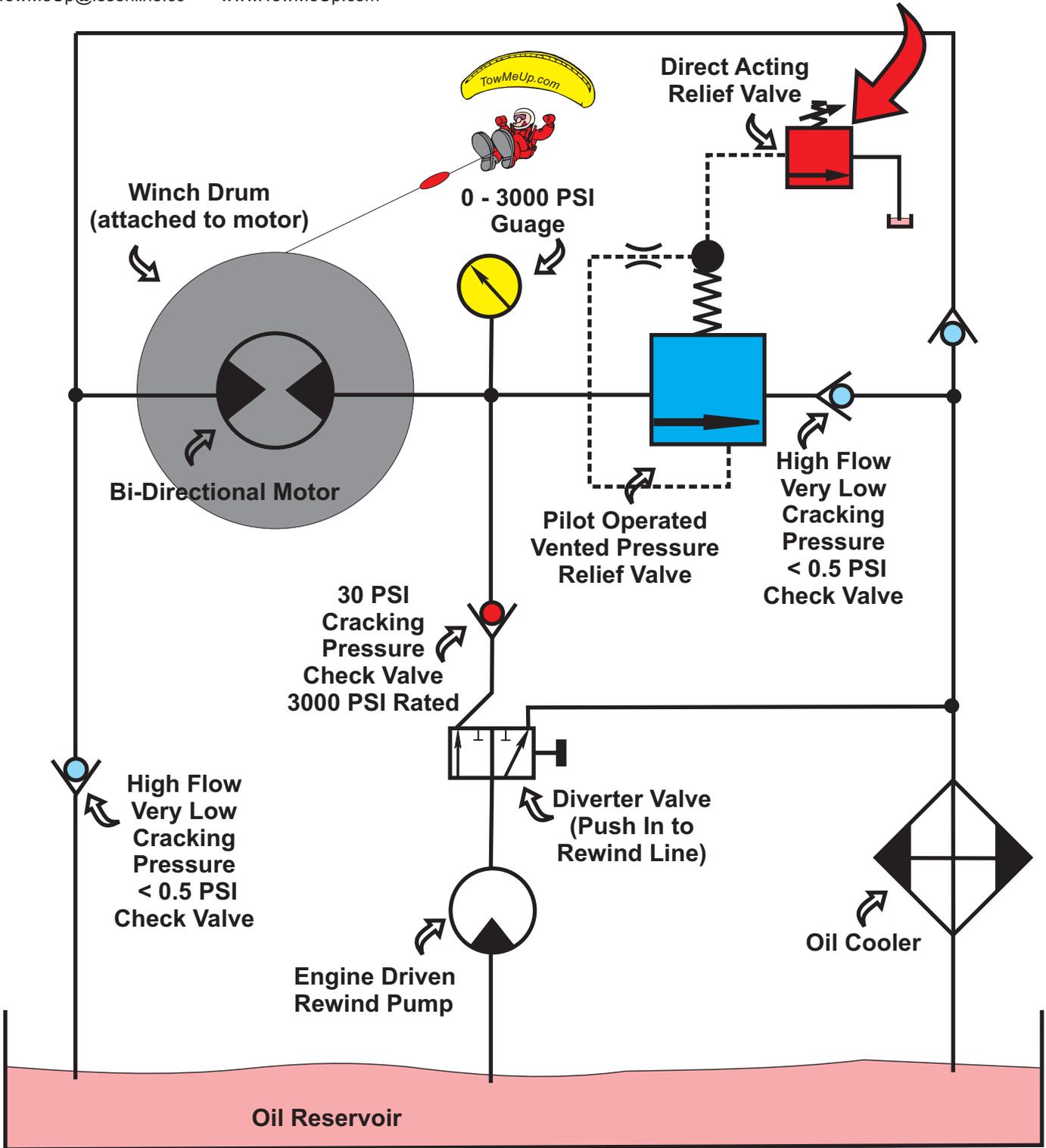
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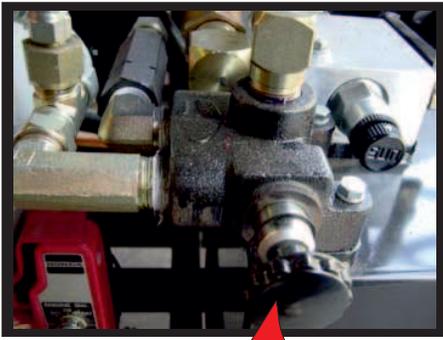
23102 NE 3rd Avenue, Ridgefield, WA, USA 98642
 (360) 887-0702 Voice • (360) 887- 3325 Fax
 TowMeUp@iesonline.cc • www.TowMeUp.com



WARNING!
 This circuit shows the use of a specially modified fast adjusting 3000 PSI relief valve available **ONLY** from TowMeUp.com **DO NOT** substitute a standard 0 - 3000 PSI 5 turn relief valve for this component, or the winch will be dangerously unsafe!



DIVERTER VALVE OPERATION

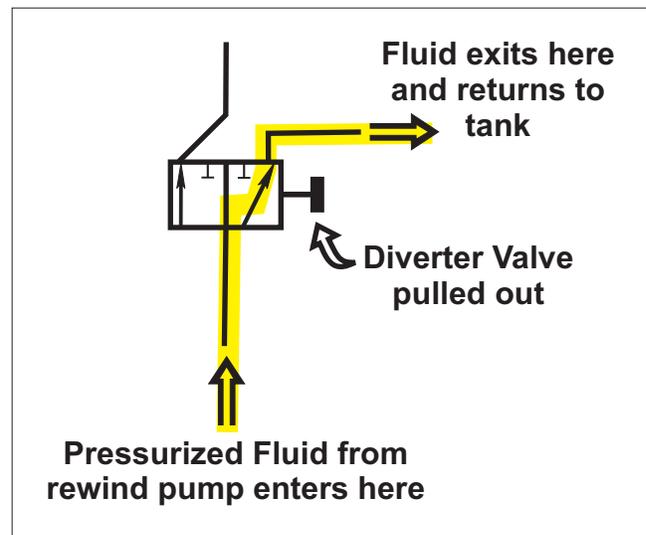
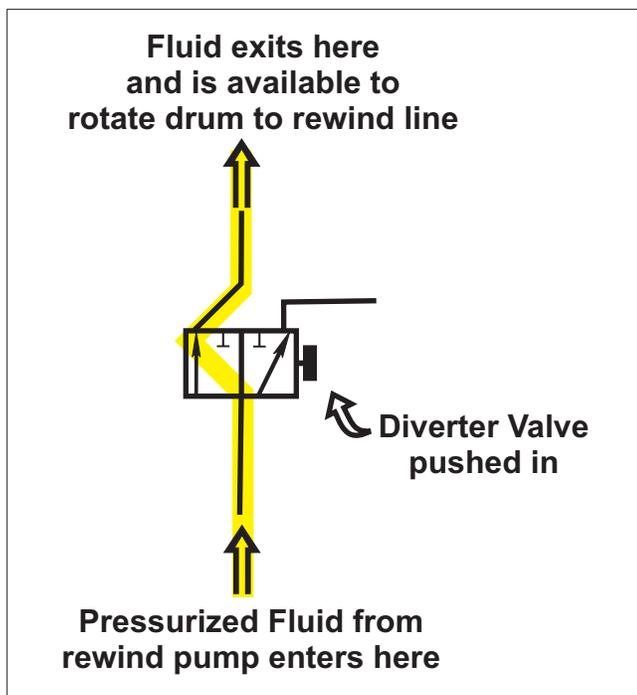


DIVERTER VALVE

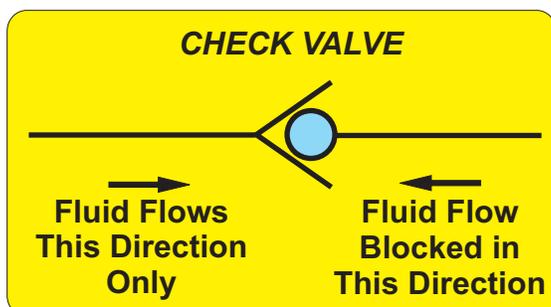
A diverter valve is used to make it easy to manually start the gas powered motor that drives the hydraulic pump used to rewind the line.

With the diverter valve pulled out (To make it easy to remember just think PAY - OUT) this pump sucks fluid from the tank, goes through the diverter and is pumped back to the tank.

With the diverter valve pushed in (think PAY - IN) this pump supplies pressurized fluid to the rewind circuit and is available to rewind the line.



CHECK VALVE OPERATION



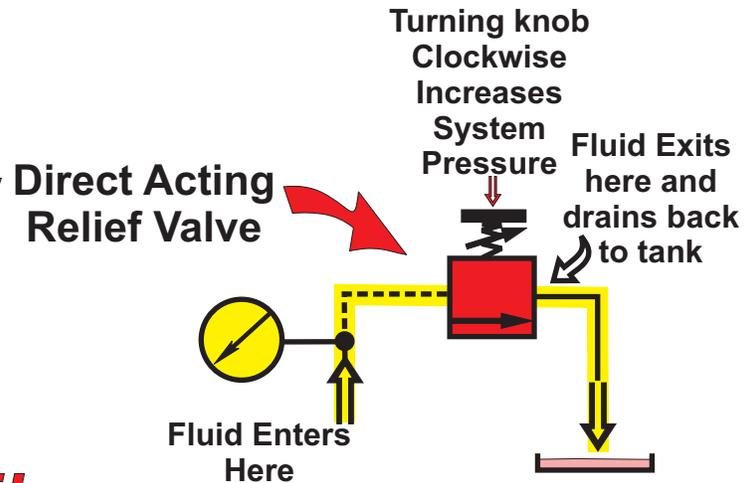
Check Valves are used to force fluid to follow a certain path, or prevent it from flowing where you don't want it to. Fluid can only flow in one direction through the check valve. 4 check valves are used in a standard winch system. The valve from the diverter is a standard hydraulic check that cracks at 30PSI and is rated to 3000 PSI. The remaining 3 check valves are a very special valves because they allow high flow rates at very low system pressures. They must crack at less than 0.5 PSI to function properly.

DIRECT ACTING RELIEF VALVE OPERATION

A direct acting relief valve is typically used to control excess pressure in a hydraulic circuit to prevent injury or damage from ruptured hoses, components, etc. This particular type valve is typically controlled by a knob that has a range of 5 turns. Turned all the way out, it allows all fluid to flow freely through the valve and no build up of pressure will occur. As the valve is screwed in, it restricts the flow of fluid through the valve and causes the system pressure to rise.

A direct acting valve should **NEVER** be used as the primary relief, or as the main system valve, because it will only let out enough oil to maintain the pressure it is set to regulate.

In a TowMeUp.com winch, we use this valve as a pilot valve to control the system operating pressure which is regulated by a large, vented, pressure relief valve.

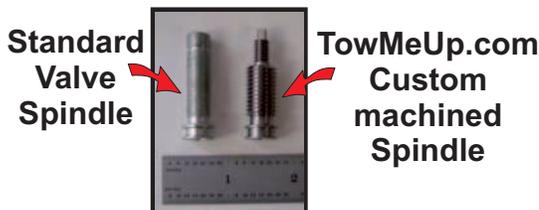


SAFETY NOTICE!

All winches MUST have a means of rapidly dropping line tension to prevent overtopping the pilot in case of an emergency (pilot trips on launch, etc). At TowMeUp.com we tried several methods. Using a standard 5 turn valve made it impossible to drop the pressure quickly enough since you need 2 1/2 - 3 turns to generate enough system pressure to launch a pilot, and you can't turn it out fast enough to drop the pressure to zero. Adding a circuit with a dump valve to immediately drop pressure, lets the drum freespool and the line goes everywhere. Gearing down a standard valve took the feel out of it and proved mechanically unreliable in wet or sandy environments.

The solution we chose was to dis-assemble a standard valve with a 24 pitch thread and machine our own valve spindle with a double start 8 pitch thread. We then bore out the valve body to match the threaded spindle, carefully reassemble and test the valve. This process requires that the machinist be capable of setting up and machining to a tolerance within 0.0005" for the component to function properly. **DO NOT EVER substitute any other valve for this application. Doing so will make it impossible to quickly drop the pressure, which is how we drop the towline tension, and it will make the winch dangerously UNSAFE!**

Standard Spindle & Knob



Direct Acting Relief Valve (Pilot Valve) Components shown dis-assembled



TowMeUp.com manufactured Spindle and Knob

PILOT OPERATED - VENTED - RELIEF VALVE

OPERATION

Pilot Operated, Vented relief valves are ideal for use when we need to regulate system pressure and allow for high fluid flow rates. To work properly in a hydraulic winch, they must be fast acting, have a low pressure rise vs. flow curve and be easy to adjust. The use of a pilot circuit allows us to use low fluid flow rates (and hence use smaller hoses) to run from the main winch control panel. It allows us to position the control up to 20 feet from the winch, and allows an easy upgrade path. Through the use of electro-proportional control valves the system can be operated from virtually any distance. It can even be operated autonomously by a computer or PLC with a manual over-ride like we use in our premier towboat systems.

Pilot Operated Vented Pressure Relief Valve

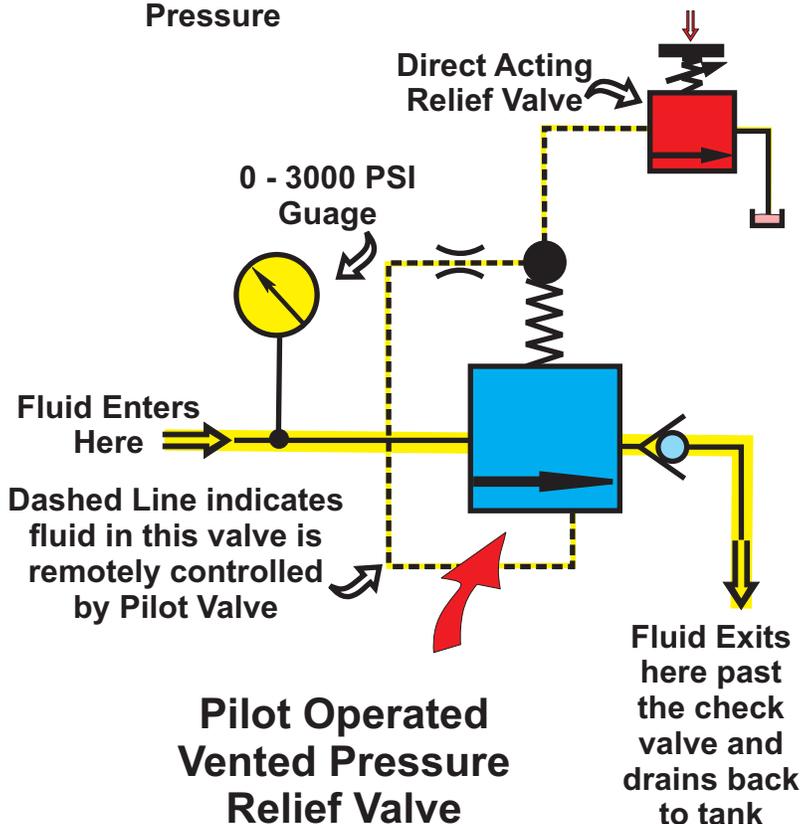


Control Knob Used to set Maximum system Pressure

Turning knob Clockwise Increases System Pressure

The Pilot Operated, Vented relief valve is controlled 2 ways. The main system pressure is regulated by the 5 turn control knob (shown as black in the picture to the left). Ordinarily it is screwed all the way in, so the Pilot valve can control the system pressure through a range from 0 - 3000 PSI. System pressure is then controlled by the Pilot Valve (Direct Acting Relief Valve). Normally the valve is screwed all the way out (counterclockwise) as the tow is started. The valve is screwed in to increase the system pressure, hence increasing the torque, which causes tension to build in the tow line. Increasing the system pressure increases the towline tension and allows the pilot to climb out at a faster rate. In the event that the line tension needs to be dropped suddenly, the control valve can be rapidly backed out due to the special modifications made to this valve by TowMeUp.com

***NOTE* DO NOT SUBSTITUTE ANY OTHER VALVE FOR THIS SPECIALLY MODIFIED VALVE, OR THE WINCH WILL BE DANGEROUSLY UNSAFE!**



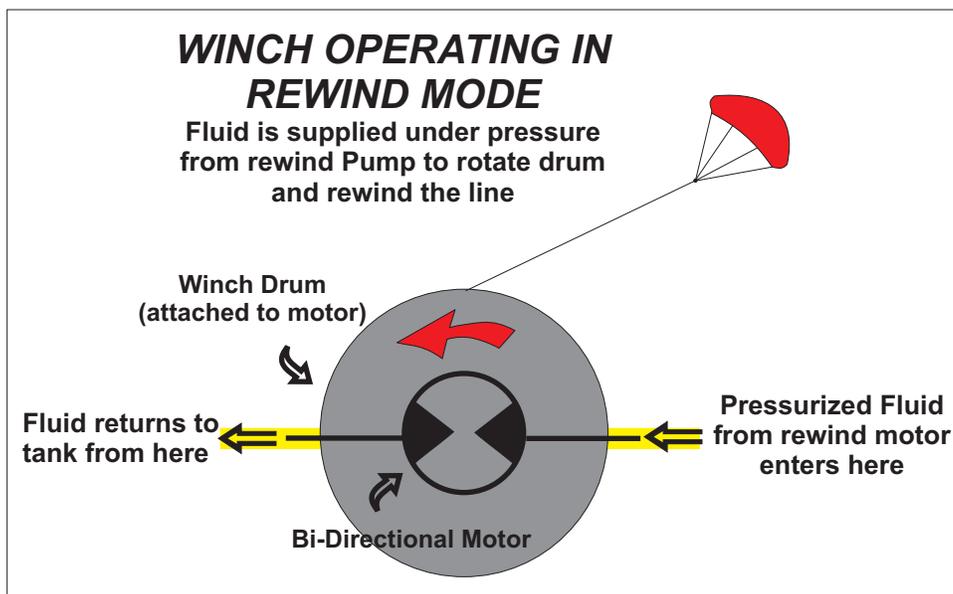
In some applications (particularly when training new winch operators) you may wish to limit the maximum towline tension to a specific value. This is easily done by backing the control knob out so that the system pressure can never exceed that value. For example if the valve is screwed out 2 1/2 turns, the system pressure will be limited to 1500 PSI. This equates to a maximum towline tension of approximately 150 pounds. During the tow the tension is normally controlled by the pilot valve. In the case above, even screwing the pilot valve all the way in, the system pressure will be limited to the 1500 PSI set by the control knob. Pilots who only tow Paragliders may choose to limit the maximum system pressure to 1500 PSI or so to prevent pilots from being over towed.

PAYOUT WINCH HYDRAULIC MOTOR OPERATION

A hydraulic motor is the ideal method to be used to control line tension. If set up properly it operates very smoothly, and allows infinite adjustment of towline tension. We prefer this technique of controlling line tension since it allows for back to back solo or tandem tows, with no loss of efficiency. Operators have reported performing over 200 tows in a weekend on a single winch with absolutely no problems or complaints.

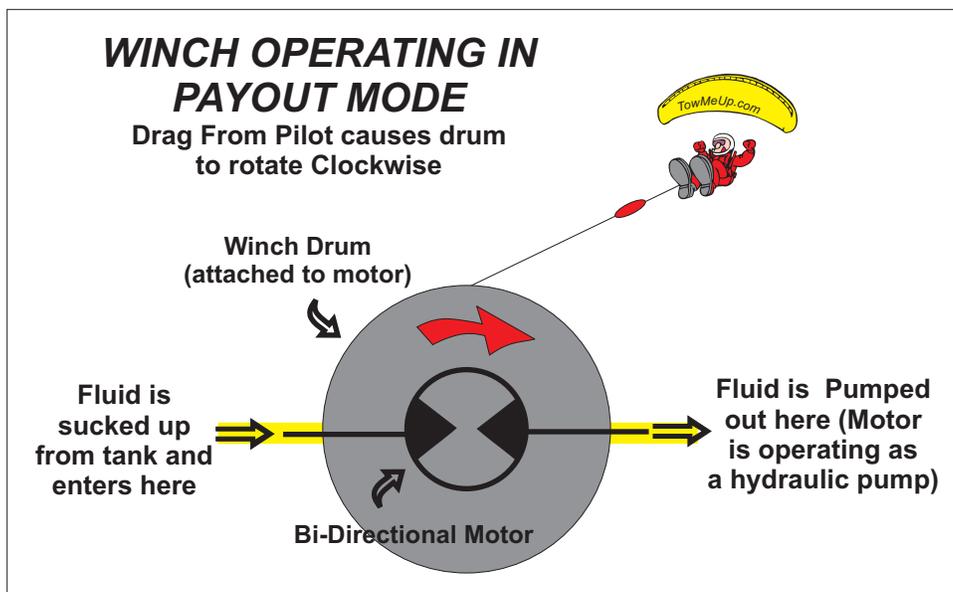
Essentially, a hydraulic motor works by forcing pressurized fluid (in our case supplied by an engine driven hydraulic pump) into one port of the motor and forcing it to rotate. The fluid then exits from the remaining port under low pressure and returns back to the tank. All TowMeUp.com hydraulic winches mount the drum that holds the towline directly to the hydraulic motor shaft for exceptional reliability. The speed that the drum rotates is controlled by how much fluid flows through it. The torque that the drum exerts is controlled by the system pressure supplied to the motor.

A cool characteristic of a hydraulic motor that we exploit in our winches, is that if you rotate the motor shaft (or the drum directly connected to it) you can suck fluid into the intake port, pressurize it (the motor works like a hydraulic pump when forced to turn) and then manipulate the pressurized fluid as it returns to the tank. If you allow the fluid to return freely back to the tank, the drum can be spun easily and no tension will build in the line. If you restrict the fluid flow by turning in the pilot valve control wheel, the system pressure will build, which increases the torque on the drum and allows the line tension to increase. If you were to somehow able



to completely block the flow of fluid out of the pump, you would find it virtually impossible to turn the drum. This could create an extremely dangerous situation, since it could allow system pressures to exceed the strength of the components used in its construction.

In our case we use a Pilot Operated, Vented Pressure relief Valve to control the system pressure. It is ordinarily used to adjust the system pressure over a range from 0 - 3000 PSI. This allows a typical towline tension adjustment range from 0 - 300 pounds.



Due to the built in safety feature of this relief valve, it will bypass fluid to prevent the system pressure from exceeding 3000 PSI, thus keeping the pressure below the safe working level of all components used in the construction of the system.

If you require a winch that exceeds 300 pounds of line tension, please contact us at TowMeUp.com and we can custom build you a system designed to safely work at higher pressures.

