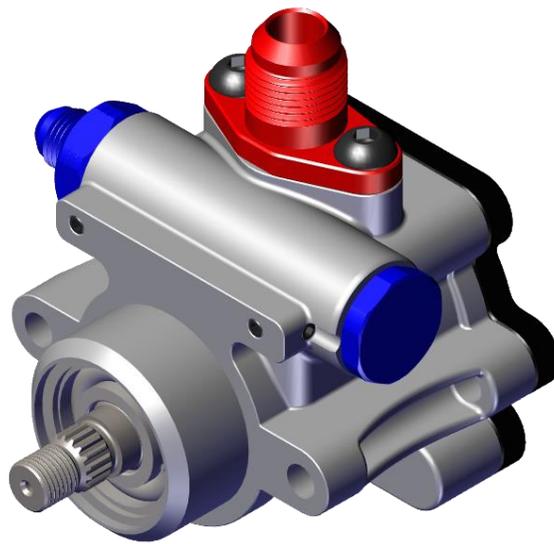


***Basics of the Pro Series III Power Steering Pump***

***KRC Engineering Department***



The KRC Pro Series III Power Steering Pump is similar in design to the Saginaw Type II (TC) pumps found on many vehicles on the road today. What sets the two pumps apart is the improved flow, customizability, and weight reduction of the KRC Pro Series III. This document is intended to show the basics of how the Pro Series III works.

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One of the improvements of the Pro Series III over previous versions is the improved inlet port design. Figure 1 shown below illustrates how fluid enters the pump.

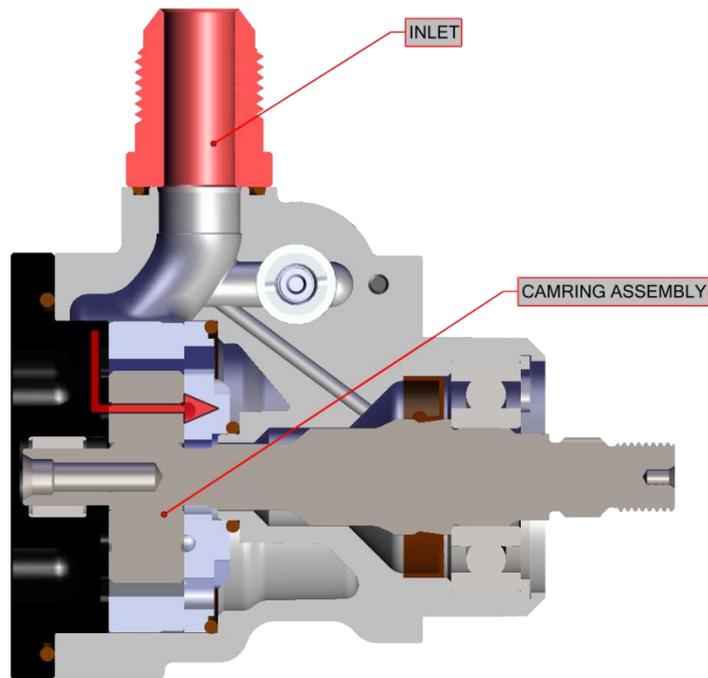


Figure 1 - Inlet Port and Fitting

Fluid flows from the inlet and is directed to the back of the camring assembly. This assembly is made up of 4 main types of parts: the camring, the rotor, rotor vanes (10), and the pressure plate. Fluid is “sucked” into the back of the camring where it is directed inside and compressed by the rotor and rotor vanes. The centrifugal force of the spinning pump causes the vanes to be thrown outward. They are then forced back into their groove by the constricting camring. This is how the fluid is pressurized and is “squeezed” out through the pressure plate. This pressurized fluid is now pushed through a passage that goes to the pressure bore (see Figure 3).

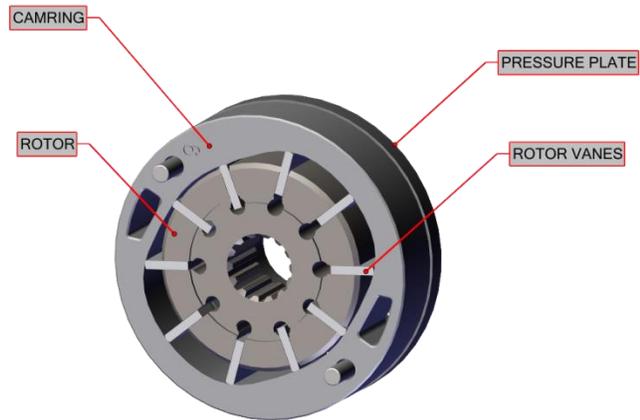


Figure 2 - Rear of Camring

The passage that carries the fluid from the camring can be seen below. Referring to Figure 3, you can see a cross section of the pressure bore and all of its internal components.

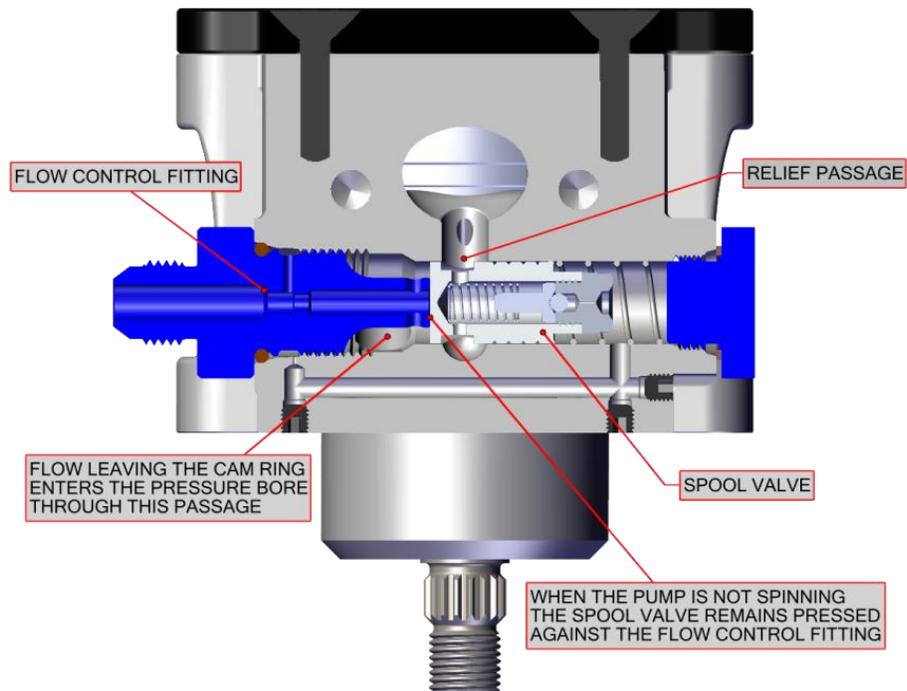


Figure 3 - Pressure Bore with PSIII-Not Spinning

With the engine at idle (assuming the wheels are either stopped or rolling slowly), the driver needs the most assistance. With the pump spinning at low RPM, fluid flows through the passage and pressurizes the bore causing the spool valve (also known as the pressure relief valve) to move back against the spring. This allows fluid to flow through the flow control fitting. In Figure 4, note that the spool valve is slightly open but still closing off the relief passage. This means that the steering gear is getting all of the pump's flow at this speed.

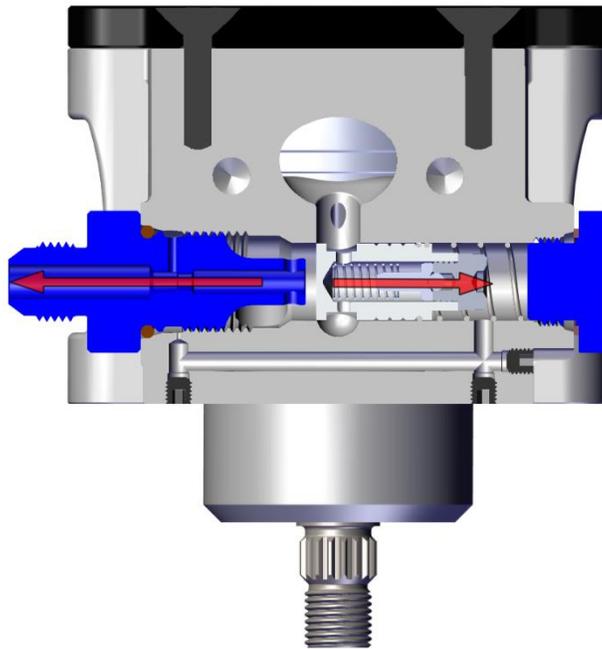


Figure 4 - Pump at Low RPM

At higher RPM (assuming the wheels are rolling at a high speed), the driver needs much less assistance. To allow the pump to not overwork itself when it isn't needed, a relief passage is necessary. Since the pump is spinning faster, more fluid is flowing and the pressure is higher. This pushes the spool valve back even further against the spring, opening up the relief passage.

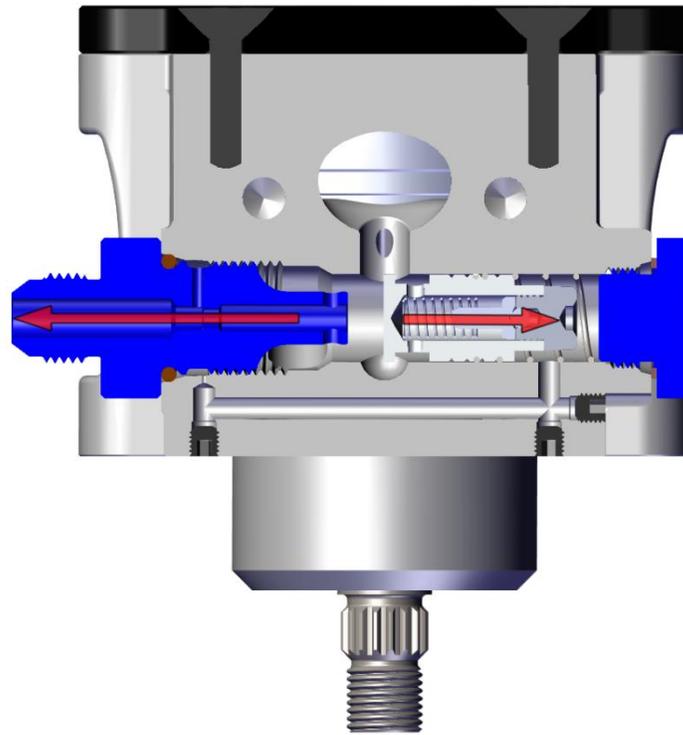


Figure 5 - Pump at High RPM

The relief passage opens up the pressure bore to the intake port allowing un-needed flow to be directed back into the pump. This keeps the flow and pressure fairly consistent over a wide RPM range. If this feature was not available, the gear would have excess pressure, making a touchy steering system. Our pump reaches its maximum efficiency between 1500 RPM and 2000 RPM. This RPM range provides the most assistance with minimal parasitic drag on the engine. It is important to choose the right diameter pulley for your application.

The pump could flow indefinitely if there was no resistance. With the steering gear connected to the pump, the flow resistance creates some but not much pressure, normally between 100-150 psi. If there is extreme friction between the tires and the ground, or the gear is against its stops, this creates a lot of flow resistance, and therefore pressure. When the pressure becomes too great, there is a built in feature of this pump that will allow the pressure to be relieved in the steering system. We call this feature pressure relief. As illustrated in Figure 6, the spool valve is forced shut against the flow control fitting when pressure in the bore gets to its maximum pressure.

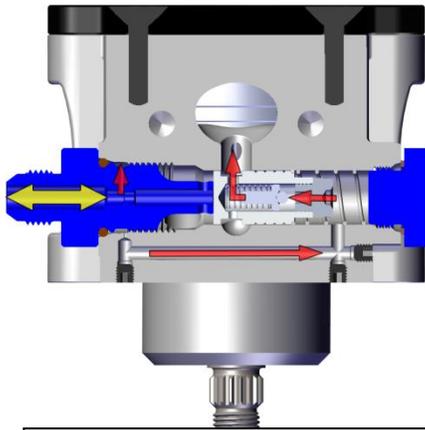


Figure 6 - Pump in Pressure Relief

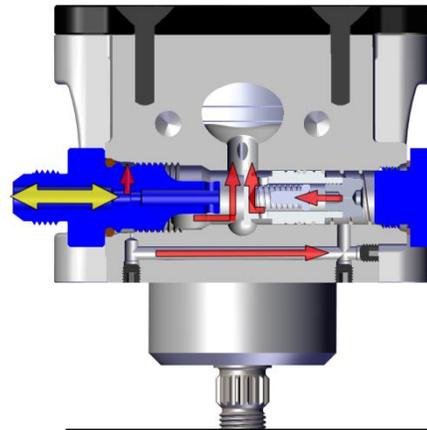


Figure 7 - Pump in Pressure Relief

The yellow arrows in Figure 6 and 7 represent the pressure that is caused by flow resistance in the gear. Pressure can now be seen in the passage that connects the back of the spool valve and the flow control fitting. The pressure pushes the ball inside the spool valve compressing the spring and allowing fluid to enter it. This is what pushes the spool valve against the flow control fitting. Holes are located in the side of the spool valve that relieves pressure in the system by allowing some of the over-pressurized fluid in the lines to drain back into the pump.

While the pump is in pressure relief, it is only allowed to recirculate what is in the pump and is not allowed to expel this fluid. This heats the fluid rapidly, and can be detrimental to the pump if done for too long. Since the system pressure can be relieved quickly, the pressure drops and the spool valve comes off of pressure relief allowing the pump to continue flowing. If the external resistance is still there, the pump will quickly go back into pressure relief. This cycle happens rapidly and repeatedly until the resistance is removed (turning the wheel off its stops or having less friction on the tires). You can hear this cycle on a pump tester when engine noise doesn't drown it out.

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## Pump Customization

Most vane type power steering pumps have a 2-step control valve, which is the spool valve (one internal spring, and one external spring). KRC pumps add one more level of flow control with our series of interchangeable flow control fittings.

KRC Power offers several combinations of pump sizes and flow control fittings for each application. Each driver can dial in the pump for the feel they desire. KRC offers three camring sizes: 5.9cc, 7.2cc, and 9.6cc. We offer nine different flow control fittings, both in aluminum and steel. Each choice has its own advantages and disadvantages. More flow will create more assistance, but its tradeoff is feel. Smaller flow control fittings will give the driver more feel for how the car is reacting, but will provide less assist.

We have noticed that in 5.9cc pumps, the larger flow valves can create issues. This is because the smaller camring pump can only produce so much flow, and the larger flow fittings are so large, they reduce the velocity of the fluid. If the flow control fitting is too large, the pump will not have enough pressure to work properly. This means that if there is not enough pressure, the pump can create a pulsating flow because of the fluid being expelled by each rotor vane. This affects the flow rate and pressure that assists the gear in a negative way (see charts). On the contrary, a 7.2cc pump with a standard flow control fitting will take slightly more horsepower to run, and will flow slightly less. Do not let this fool you, the fluid leaving the pump is traveling at a much higher velocity, and increases the fluid's *dynamic* pressure. This way you are not "starving" the pump and are creating pressure inside of the pump so it can work properly.