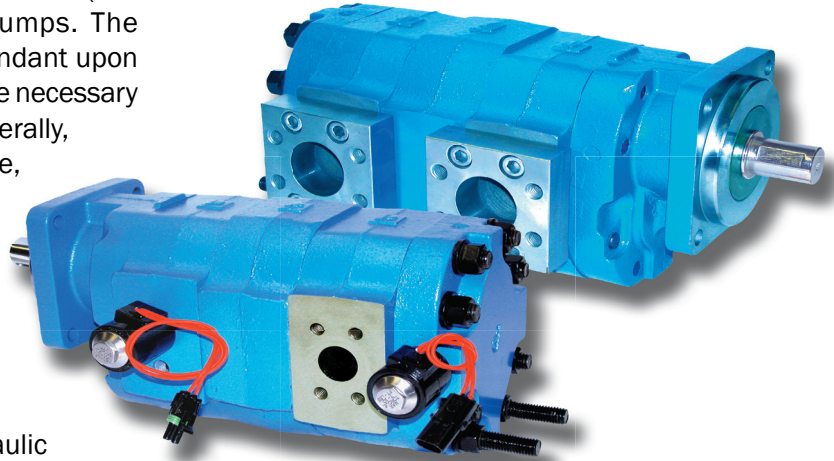




Genesis Pump System: Low RPM / Fuel Savings

The Genesis Fuel Saving Systems are tandem (two pumping sections) P7600 dry valve pumps. The displacement of the two sections is dependant upon the desired controlled engine speed and the necessary GPM's required for proper cycle times. Generally, for a commercial front loader, for instance, the requirements are in the 45-60 GPM range. With a front or rear loader, it is usually required that the vehicle be able to operate while in motion. This creates a problem in that while delivering the required GPM's at or near idle RPM's, the operator would have the ability to substantially over-speed the hydraulic system (and in turn the mechanics of the truck) while operating the vehicle at RPM's associated with moving (roading) the vehicle. Permco's Genesis system essentially eliminates this possibility by controlling both sections of the pumping group independently.

Both sections of the pump are controlled independently by an electronic speed sensor with different speed settings for each pumping section. At idle speed (600-850 RPM's) both pumping sections are in the wet mode, which means that maximum fluid is available to the hydraulic system. At any time the engine RPM is increased above the 1st speed switch setting (approximately 650 RPM's) the front pumping section of the pump goes into the dry mode (no fluid output). The back section of the pump is still operational (wet mode) until the engine reaches the 2nd speed switch setting (approximately 1200 RPM's) when it then also goes into the dry mode. When the engine then reaches a speed below approximately 1100 RPM's the back pumping section returns to the wet mode. When the engine RPM reaches the setting of the front section it then returns to the wet mode. At this point both pumping sections are back into the wet mode.



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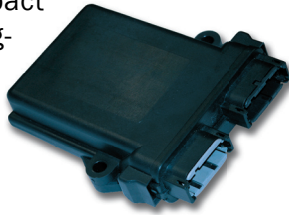
Control of the system is accomplished through the use of four (4) on/off solenoids and one (1) speed sensor. A closed loop input/output digital controller is used to open and close the solenoids in response to varying speeds. A microprocessor converts the speed sensor input teeth/seconds into RPM's and sends a signal to the four (4) on/off solenoid valves to vary their output based on user selected set points. Two (2) of the solenoids are electric/air, which control the dry valves. The other two (2) solenoids are used as "bleed valves" and are independently mounted in the bearing carrier and port end cover on the discharge side of the pump. There is a check valve internal to the pump which allows the front pumping section to combine with the rear pumping section when both pumping sections are in the wet mode and/or segregate the front pumping section when that pumping section is in the dry mode.



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The digital controller is a compact IP67 rated packaging with plug-in connections for remote mounting. Power supply is 12 or 24 VDC with reverse polarity, transient surge and over-current protection provided.



The controller interfaces with a PC using RS232 communications for configuration of the module. Windows HyperTerminal or Palm OS can be used to set or change the RPM ranges from their default settings.

Although a tandem dry valve system is the standard setup system, we can customize your system for specific needs. A combination dry valve/unloader system which incorporates a flow control can also be used. The system can also be setup so that the pack cycle is completed before a pump or pumping section is kicked out due to speed settings. Also, the system can be designed so that only one (1) pumping section is activated for low flow requirements such as top doors and tailgates.

There are many ways that the Genesis fuel saving system can be tailored to fit you system and at the same time it is reliable, efficient, and one that has been proven to save fuel.

Reliability has been addressed on several levels.

1. Permco and Torrington have teamed up to design the new, patented "controlled stress" roller bearing. The life of the pump is directly related to the life of the bearings. With the new Torrington bearings Permco is seeing a greater that 30% longer life than pumps that do not use this new technology.
2. 100% of Permco pumps are factory tested to eliminate even the possibility of an occasional problem.
3. Permco uses a front outboard bearing seal that eliminates the possibility of contamination getting into the front outboard bearing. This front outboard bearing seal extends the life of the pump, but, at the same

time, we also know that contamination getting to that bearing often shortens the life of the pump. Rather than eliminating the outboard bearing as other suppliers have done, we leave the bearing in to maintain stability but we protect it to eliminate premature failure.

4. Running hot and cavitation are often associated with dry valve systems. We have eliminated these by establishing a positive bleed valve system eliminating the possibility of pressure on the discharge side of the pump in the dry mode. When the electric/air solenoids controlling the air to the dry valves go into the dry mode, the corresponding electric/hydraulic solenoids open, ensuring a direct path for the fluid back to tank.

Efficiency is another aspect about which Permco is concerned. With the hundreds of thousands refuse vehicles operating daily, each vehicle must be running at capacity and at as low maintenance cost as possible. With this new Permco Genesis system, we have documentation showing increased productivity and fuel savings over the common Unloader systems.

Because we are controlling the hydraulic system, we can give the operator hydraulic operations at the appropriate time and at the appropriate rate. By closely controlling the hydraulic system, issues such as heat and flow saturation of the system are virtually eliminated.

Gear pumps are an efficient and cost effective means to supply the required gallons per minute/pressure for this industry's hydraulic requirements. Other more expensive pumps are not as tolerant of conditions that exist in the refuse market. Replacement and downtimes are minimized because of reliability, availability, and simplicity of design.

Fuel savings, probably the most important consideration, will more easily be accomplished through the use of a dry valve system than other systems. Permco's Genesis units are currently saving several gallons of fuel per day over the supplied unloading systems and other low RPM systems based on more sophisticated hydraulic components.



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