

FEMA Proportional Pressure Control Valve Troubleshooting Guide

Background

The FEMA PPC (Proportional Pressure Control) is used in complex hydraulic systems to control pressure proportionally to input current. The FEMA PPC is typically used as a pilot to control a secondary valve, such as a ventable relief or pressure reducing valve.

Theory of Operation

The standard FEMA PPC is a two-way proportional pressure control unit. If you have a three or four-way unit, please contact your FEMA Applications Engineer for troubleshooting.

The fundamental operating principle of the standard PPC is to provide varying resistance to incoming flow, thereby increasing pressure in the control circuit. The section view in Figure 1 shows pictorially how the two-way FEMA PPC is configured.

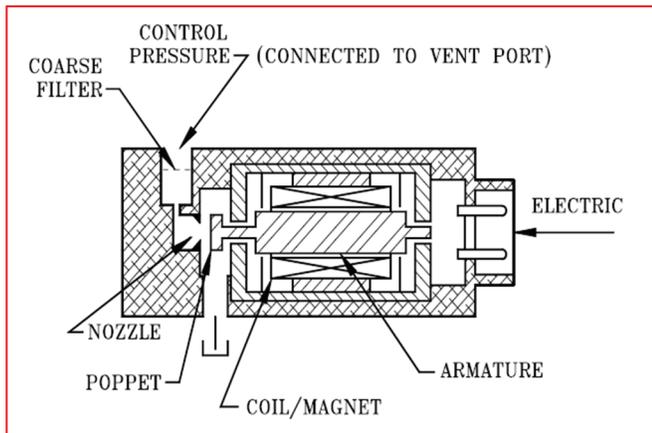


Figure 1 – Cross section of 2-way FEMA PPC

As electrical current is increased to the valve, the armature/poppet is driven towards the nozzle, causing a restriction to tank which in turns builds pressure proportionally at the control pressure port.

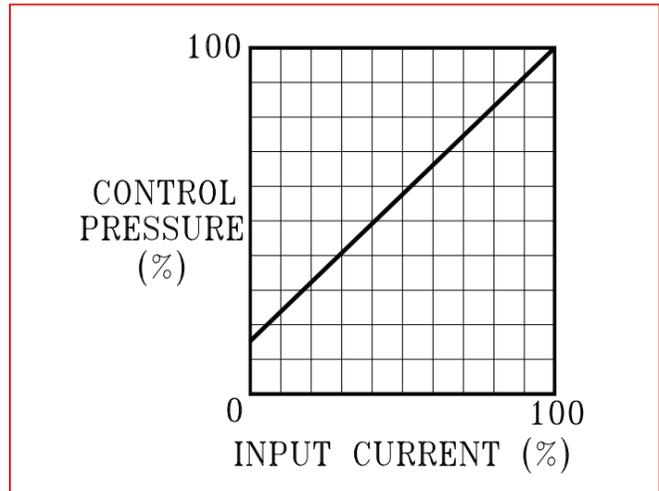


Figure 2 – Example Pressure vs. Current Plot for a typical PPC

The FEMA PPC is a precision device used to interface two technologies: Hydraulics and Electronics. This presents difficulties in terms of troubleshooting because the problem could be from one or both of these systems. It is important to use a logical sequence while troubleshooting. Often, the FEMA PPC will merely be replaced to see whether or not the problem is eliminated. Often, however, the result (sometimes not in the initial hours) is that the new PPC will be damaged. The following guide is designed to help expedite troubleshooting while keeping costs contained.

Problem: System will not build pressure

FEMA's experience dictates that troubleshooting should begin with the electrical system. The first step to troubleshooting a system that will not build or increase pressure is to measure current at the PPC with a current or multi-meter, ensuring that the proper electrical signal is being supplied to the valve. A separate meter is recommended as the control system itself may indicate an incorrect current reading. If current is not measurable, it may be appropriate to try a replacement electronic valve driver. In fact a simple

potentiometer and battery or power supply capable of at least 600 milliamps can easily control a PPC.

If pressure can be controlled smoothly and proportionally by the second power source, then the problem is likely in the electronic system (refer to sales drawing of PPC for electrical "current" specification; typically it is 420 to 600 milliamps max). If current is measured at the PPC, but there is no pressure output or controllability, the problem is likely hydraulic. However, we do not recommend the PPC be replaced at this point.

Next, try reversing the polarity to the PPC as outlined in the following procedure. Reverse the electrical polarity to the PPC by switching the positive/negative leads. Rated current can then be applied with reverse polarity, which causes the poppet to move further from the nozzle. This may allow contaminate to flush through the PPC to tank. Switch polarity back to normal and attempt to run the system again.

If this is not successful, we recommend that the PPC tank line be disconnected and the flow measured. This flow is typically 0.2-0.4 GPM [0.8-1.5 LPM]. The intended flow rate for the design may be found in the PPC sales drawing. If flow is not adequate, check flow directly from the vent port of the relief valve or your supply oil source upstream of the PPC. If upstream or supply flow is within specification but downstream (post-PPC) flow is not, then the PPC is likely plugged by contamination. If flow from relief valve is not to specification, check with the valve manufacturer or verify the upstream orifice is sized correctly and not plugged.

If flow is adequate, remove the PPC and replace it with a small manual relief valve or needle valve. The relief or needle valve can be modulated manually, which in turn should control the overall system. If the system can be controlled with the manual valve, then the problem is likely in the PPC. Do NOT install a new PPC at this point either. The system will first have to be flushed of possible contaminants and cleaned. Do not replace the PPC until both the fluid and the system are cleaned.

There are many ways to clean up a contaminated system. Replacing the fluid is one possibility, yet this may not be feasible. A circulating filtration device is another approach. A third is running and cycling the system with the manual relief valve installed. This is a good way to flush the lines, especially those that will feed the new PPC. A new filter elements should be installed before flushing, allowing the system to filter additional debris and improve cleanliness.

After the system has been flushed and cleaned, operate the manual relief valve a few more times to ensure that the system is operating satisfactorily. It is a good idea to replace the system filter elements once again after flushing.

At this point, a new PPC can be installed.

Note: Do not use Teflon tape on the PPC fittings; pipe sealant is, however, acceptable. Also note that the PPC has a built in filter, either in the manifold port, or if a plumbed unit, in the inlet fitting. Never remove or tamper with this filter.

Problem: System stays at partial or full pressure

Disconnect the electronic signal to the PPC. If pressure drops, the fault is likely due to the valve controller and should be corrected. If system stays at full pressure, the PPC may be "clogged". Verify the flow rate upstream and downstream of the PPC and compare to the specification.

Next, reverse the electrical polarity to the PPC by switching the positive/negative leads. As described previously, current can be increased with reverse polarity to pull retract the poppet from the nozzle, potentially allowing contaminate to flush from the unit. Switch polarity back to normal and attempt to run the system again.

If this is not successful, remove the PPC and replace it with a small manual relief or needle valve as described previously. Cycle and flush the system, followed by installation of a new PPC.

Please feel free to contact us via www.fema-corp.com for additional assistance.