



Electronic Engine/Pump Governors

"They do so much more for your pump operators!"

"We can do better and we will do more.", is a quote from the president of the major standards making group as he explained what was happening within his organization. It's not likely that he was referring to apparatus engine governors but the quote does apply to what is changing with the pressure regulating/safety devices on our apparatus. Just the new governor systems alone have more built-in "smarts" than the total of all the intelligence we had in apparatus of 20 years ago. And, the good part is, they are just waiting for you and the apparatus builders to use more of their vast array of capability.

Why we have governors or relief valves.

A safety device is needed (and the NFPA apparatus standards require one) to prevent over-pressuring of remaining open hose lines when one or more lines are shut down. In real world terms, they are there to prevent the firefighter on the attack line at the top of the 24' ladder from getting a surge in pressure when he or she isn't expecting it.

How can that happen? In a fire ground situation, it's common to have one pumper supplying several pre-connects, a 4" line to an aerial or portable deluge gun, and a 3" line to an installed monitor. The engine speed is well above idle to supply the needed water which means a good amount of fuel is being fed into the engine. When, for whatever reason, the 4" supply line or the deck gun is shut down, the energy that was being used to send the device it's water, is now excess and very basically, rambling around the pump and plumbing looking for a place to go. (it has to go somewhere.)

What happens when you have a relief valve?

When you have this scenario and you have a discharge relief valve system, the excess capacity (water) is dumped back into the suction side of the pump where a good bit of the energy is absorbed. Remember, with relief valves, no adjustments have been made to the fuel supply system, so the engine is still roaring away at the same rpm that we started with. The system is merely trying to keep the discharge pressure set on the mechanical spring control device equal to what you had set when the operation started (you did set it, didn't you?).

What happens when you have an electronic governor?

When one or more lines are shut down, and you have an electronic governor set-up, a pressure sensing device, called a transducer, on the discharge side of the pump sees a slight increase in pressure and immediately sends a signal to the ECM (electronic control module) on the engine telling it to reduce the amount of fuel being given to the engine. consequently, the engine slows down and the pressure is maintained at whatever the pre-set level was.

What is the difference with the two systems?

When the 3" line is opened again, a relief valve system will sense the lower pressure and close off its passage to the suction side of the pump. If additional lines are needed, it cannot adjust engine fuel availability, so all the open lines suffer a drop in flow and pressure due to an increase demand.

With the same situation, in a system controlled by a governor, when another discharge is opened, the transducer detects a drop in discharge pressure and sends a signal to the ECM to increase fuel to the engine. This adds rpm and also increases the discharge pressure until it reaches the pre-set level. This is all done without the pump operator having to make any adjustments!

Why wouldn't everyone have a governor?

When the fire service started to use steam engines to power fire pumps, a spring-loaded relief valve was a part of the package. Its function was to open a vent to atmosphere when the steam pressure in the boiler got too high. Today we are still using relief valve on fire pumps, although now they are installed to prevent over-pressures in the discharge lines (perhaps because boilers have long since departed?). The NFPA has, for many years, required a safety device to prevent over-pressurizing the discharge lines on an apparatus.

In the 40's and 50's, another device called a governor was adapted as a safety device to prevent rapid increases in discharge pressures. It controlled the fuel flow to the engine as compared to the relief valve that "dumped" water into the suction side of a pump. Governors had another advantage and that is, they could, when set and operating properly, automatically increase the fuel flow to supply additional water, when another discharge or two was opened.

The older governors were mechanical devices that either had very small passages (which could easily clog with dirt) or lots of water hoses to direct water pressure to a pressure regulating valve. Both types were prone to failure due to various problems, so governors developed a bad reputation. As a result of their unreliability and also because they worked better with high speed gas engines, they fell out of favor and were not used much after diesels started to make inroads into the fire service in the early 70's.

What makes up a discharge relief valve system?

This is the discharge safety system that is commonly found on most pumper today. Water piping arrangements direct discharge pressure back into the suction side of a pump (not to the ground) when a pre-set pressure is exceeded. Engine fuel is not adjusted unless the pump operator changes the throttle. They are reliable systems that have been proven over time. However, please note, they cannot relieve pressure below the incoming pressure and this can be a problem when you have a "hot" hydrant or the sending pumper is delivering too much water. For this you need an intake (suction) side relief valve which serves a different purpose than does the discharge relief valve system we have just covered.

What makes the intake relief valve system different?

First this is what most of us have called a suction-side dump valve. Ross or Kunkle were the popular manufacturers of these valves for many years. The operation involves a spring that is bearing against a plate. As you tighten the spring, it takes more pressure to open (thereby relieving water pressure). The converse is also true. When this type of valve does open, water is directed to the ground, usually in large quantities. Elkhart, Hale, Waterous, and Darley all have excellent and reliable versions of this concept.

Since 1991, the NFPA Apparatus Standards have required this type of relief in addition to a governor or installed relief valve. These valves must be installed permanently on the apparatus. External, screw-on, suction tube relay supply line relief valves will not meet this requirement.

What is P.E.C.S. and what does it do for you?

P.E.C.S. is short for the "Pumper Electronic Control System" and it describes the newest governor systems that are specifically designed to help simplify pump operations on the fire ground.

P.E.C.S. have two modes; pressure and RPM. When put in the pressure setting, a pressure transducer in the discharge chamber monitors the master discharge pressure and sends the pressure reading to the engine electronic control module (ECM). The ECM regulates fuel volume in order to maintain a set pump pressure regardless of the flow or engine speed (within the capabilities of the engine, pump and water supply).

In the RPM mode, the ECM regulates the fuel flow to the engine to maintain whatever RPM has been selected by the operator. This mode is commonly used for pto generators or when increasing engine speed to generate more amps in a standby situation such as an EMS call (when not using the pump).



When P.E.C.S. is installed, it is the throttle control. Changes in the rpm are done by pushing either the increase or decrease button on the display. In addition, the units have a pre-set feature that allows pump operators to have the engine rpm or pump pressure rise to a pre-set position by merely pushing the pre-set button. It's simple, almost error-proof and it saves a lot of time. In case there is an emergency (hose burst or the like), just a touch of the red "idle" button will return the system to idle until the problem is fixed and the operator is ready to resume operations.

With P.E.C.S., there is no need for an installed discharge relief valve; in fact, it can and will complicate operations, as it can sometimes work against what the P.E.C.S. is trying to do. So, when specifying the new governors on your next pumper, mention that there is no need for a separate throttle or discharge relief valve system (it should be worth a nice credit towards the cost of the P.E.C.S.).

With both the Detroit Diesel Electronic Fire Commander and the newer Class 1 Captain governor control units, and alpha-numeric display in the center of the unit will notify operators (in plain English) of engine or pump problems as they may occur. Once an audible alarm is tripped, the operator need only look at the display to see what is happening.

With both of the above units, there are features such as rpm ramp speed, and, responsiveness (sensitivity), that can be changed to meet individual department needs.

What happens when I run out of water?

This is commonly called cavitation, and it usually occurs when additional lines are opened and the incoming supply of water has "maxed out" or suction is lost on a supply pumper that is drafting. The governor system senses a need for more water and increases the fuel to the engine. If additional water is not available, cavitation occurs and in plain terms, you have run away from your water. In short order (0 - 5 seconds) governors will sense this and tell the engine fuel control center to reduce the fuel flow, and return the engine to idle.

What does the governor do better?

They actually can run your pumping system to let the pump operator take care of other things. They can raise the rpm or psi to a pre-set level at the touch of a button. They can increase fuel flow to meet increasing needs and reduce it when demands have been reduced. They act as throttle control and are tied into an interlock system that will prevent inadvertent movement of the apparatus. If there is a problem, and alpha-numeric display tells the operator what is happening.

And... we are just getting started with all they can do for our pump operators. It's easy to see that very soon, the entire vehicle will be linked together into a common computer system with the ability to do almost anything we can think of. The only limitation, is we, the users, and our ability to understand what computers can do for us.

We have to do our jobs better and smarter to be able to keep up with the changing demands of the fire/emergency service. P.E.C.S. are here, they are reliable and they do more for our operators.