Progress Supply Inc. THE INSIDE STORY

Helpful Information for HVAC Contractors from Progress Supply

This is one of a series of technical bulletins from your friends at Progress Supply

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PRESSURE REGULATORS

OPR's, CRO's, IPR's, ORI's, (S)ORIT's, (S)PORIT's, EPR(S). Looks like alphabet soup or maybe the cast of characters out of a novel printed by the U.S. government. No, this is the shorthand data put forth by the control valve manufacturers. No, it is not a hoax being played on you, it is not a contest that we are running to see if you can unscramble all of the letters, it is each of the first letter of the name of the pressure regulator.

Let's look at these and unscramble the notations and understand their individual uses. Let's also understand when and when not to use each one and how they are to be set up if, in fact, they are adjustable.

Refrigeration applications can be classified generally as medium or low temperature applications. There are also ultra low temperature applications. This article will only discuss medium and low temperature applications. Let's look at each of these regulators to understand what they are and where they are used.

OPR, CRO Regulators

OPR, **O**utlet **P**ressure **R**egulator, **CRO**, **C**lose on **R**ise of **O**utlet pressure. These terms are manufacturer specific. These regulators sense their outlet pressure and control the pressure to its setting. Both valves have adjustable settings. Another term for these valves is **C**rankcase **P**ressure **R**egulator, **CPR**.

Why would one want to set the valve outlet pressure? If the term is crankcase pressure regulator, it implies that there must be a compressor involved and we want to control the compressor's crankcase pressure. The statement that we want to control the compressor crankcase pressure is not really the pressure we want to control. What we want to control is the pressure entering the compressor's cylinders.

Let's take a little side trip to the compressor. I'm not sure that many people think of the compressor as a pump moving pounds of refrigerant. In reality, this is exactly what it is doing. Refrigerant has weight and the weight of the refrigerant being moved changes with its pressure, its chemical composition, the volume of each cylinder in the compressor and the number of cylinders. In all refrigerant-containing systems, the weight and/or density is a constantly changing value. The liquid control device meters the refrigerant as the load changes and the amount of refrigerant, its weight, changes. As the system is pulling down, the suction pressure is being lowered, therefore, the density or weight per cubic foot of refrigerant being moved by the compressor is changing. All of this information is saying that the load on the compressor motor is changing. The technician sees this when the tech measures the compressor's amp draw.

Compressors are rated for high temperature, medium temperature, low temperature and extra low temperature applications. It is not a part of this article to explain the differences. It is typically the extra low pressure application compressor that needs to have a CPR in the suction line just before the refrigerant goes into the compressor.

Extra low temperature compressors operate in the saturated suction temperature (SST) range of -40°F to -20°F. At this low temperature range the refrigerant's density is very low, therefore, the pounds of refrigerant being moved by the compressor are low. This results in allowing the use of a smaller horsepower motor than one needed in a low or medium temperature application compressor.

Systems operating below 32°F SST need to have a defrost period. During the defrost period, heat is added to the cooling coil's refrigerant in order to accomplish defrost. During this period the refrigerant pressure rises. In extra low temp applications, this rise in suction pressure and the corresponding increase in the refrigerant density will put a heavy enough load on the compressor motor to cause it to stall when starting up after the defrost period. Here comes the CPR. The CPR, looking at its outlet pressure, the compressor's inlet pressure will hold back the rising pressure increase out of the evaporator during the defrost period. At the end of the defrost period, the compressor is again started. This now will lower the CPR's outlet pressure. The CPR will modulate open, metering the refrigerant out of the evaporator, preventing the pressure entering the compressor from getting too high. The pressure in the evaporator will be reduced to the correct pressure to maintain the temperature in the system.

When should a CPR be checked for setting and/or adjusted for the correct setting? This is done under full load at the time the system is coming out of defrost.

IPR, ORI

Like the CPR, this valve nomenclature is manufacturer-specific. All of these are inlet regulators and in the industry are referred to as **E**vaporator **P**ressure **R**egulators, **EPR's**. The **IPR**, **I**nlet **P**ressure **R**egulator, **ORI**, **O**pen on **R**ise of **I**nlet pressure are basic EPR pressure regulators with no gongs or whistles. These are used in systems with capacities up to approximately 9 ton. It would be an unusual system with only one evaporator that used one of these valves.

When would an EPR be used? Any system that has more than one conditioned space, each with its own evaporator and the system has one condensing unit, one compressor. If the evaporators are controlling at different temperatures, an EPR is needed in the outlet of each evaporator and should be considered even if all spaces are controlled to the same temperature. Let's look at each of these scenarios.

If the refrigeration system is cooling two or more spaces when only one compressor is used, even with all spaces at the same temperature, the load in each space is generally not the same. The compressor's capacity is designed on maximum load. As the load in each space changes, the compressor will continue to remove refrigerant from the system at a rate that will cause the suction pressure to fall. This now causes the temperature in the spaces to drop and may, in fact, cause the temperature to get too low. In some cases, it could cause product to freeze and this is not good if the product is not supposed to be frozen.

The EPR is looking at its inlet pressure, the evaporator's outlet pressure. As the inlet pressure begins to drop to the valve's setting, the valve will begin to close off in order to maintain a satisfactory minimum pressure in the evaporator. This then sets a minimum temperature in the evaporator so that the space will not be overcooled. When the load in the space rises and the inlet pressure rises, the EPR will throttle open so that the evaporator's pressure, temperature will not rise out of bounds.

Why don't we use the EPR on a single coil application? First of all, when the space gets down to temperature we generally shut off the compressor so that the cooling stops. There are, however, systems that must keep the compressor running so that under very light loads the compressor should not be stopped in order to keep from getting too wide of a temperature swing in the process. Although the EPR might look like a valve for this application, it really is not. Why? As the EPR throttles closed, the outlet pressure is being reduced and will fall far enough so that there is not enough refrigerant returning to the compressor to cool the motor. In addition, the lowered pressure now causes a high heat of compression that may cause compressor failure.

In this application, a hot gas bypass valve should be used. This application will not be discussed in this article.

(S)ORIT, (S)PORIT, EPR(S)

These valves, like the ones just discussed, are EPR's but with options not available in the basic EPR's. These valves are physically larger, are pilot-operated and may have a solenoid used to close the valve. These valves are generally used in supermarket rack applications and can have capacities up to 25 ton.

Supermarkets will have one or both of two types of refrigeration racks, ***a single temperature rack or a multi-temperature rack***. In both applications, each circuit will have an EPR on the suction line generally at the rack. Like the multi-evaporator system discussed above, each refrigerant circuit has either its own temperature application or has its own load requirements.

On a single temperature medium temperature rack, each circuit load can vary greatly. Medium temperature racks generally do not need a defrost period so a hot gas or electric defrost system is not used. These valves will not have the (S) in front of the basic part number. The S indicates that a solenoid is used on the valve to close the valve if needed.

Low temperature and mixed temperature racks will have some or all of the circuits that will need to go through a defrost cycle periodically. When the defrost period is energized, the pilot solenoid is energized and the EPR closes. If the defrost method is Hot Gas, the hot gas valve is energized at the same time. If the defrost method is Electric, only the EPR is closed and the electric defrost coils are energized. At the end of the defrost time, the defrost method is turned off and the EPR solenoid is de-energized and the cooling system for that circuit is back in operation.

When does one set the specific pressure and/or check the circuit pressure? EPR's are set when the load is low. It is not set and/or adjusted at start up or when the system is coming out of defrost. This is a maximum pressure regulator unlike the CPR that is a minimum pressure regulator.

There are other pressure regulators like the head pressure regulators. That is a subject for another article.

There is nothing magical about control valves. Sometimes it is the names that tend to throw the newcomer to the field.

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