Something to Consider When Choosing a Regulator

There are many things to consider when choosing a gas regulator for a specific application; desired range of outlet pressure, inlet pressure, gas purity, desired flow, gas compatibility, and so on. For this article, the focus will be on one, often overlooked, variable; Supply Pressure Effect.

The Supply Pressure Effect (SPE) of a regulator can be defined as the change in outlet pressure as a result of the change in inlet pressure. For most regulators, as the supply pressure of the gas to the regulator decreases, the outlet pressure of the regulator will increase. SPE is typically measured as an outlet pressure rise per some inlet pressure decrease (i.e. 1 psi per 100 psi decrease). The SPE is unique to each manufacturer’s regulator.

The two basic types of regulators, Single Stage and Two Stage, handle SPE very differently. Single Stage Regulators typically have a large SPE when compared to Two Stage Regulators, thus allowing for a greater rise in outlet pressure as the supply pressure decreases. Two Stage Regulators handle SPE much better and often times have an SPE 10 to 25 times less than that of a single stage regulator. As a result, two stage regulators can show little rise in outlet pressure as the inlet pressure decreases. This is due in part to the design of the two stage regulator which regulates the supply pressure down to an intermediate pressure before the final regulation of the outlet pressure.

How SPE affects regulator performance can be calculated using the equation below:

\[
\Delta P(\text{outlet}) = \Delta P(\text{inlet}) \times \text{SPE}
\]

Suppose you have a cylinder with an initial pressure of 2,200 psi and the cylinder is used down to a pressure of 200 psi. Now suppose the regulator being used is a single stage regulator with an SPE of 1 psi per 100 psi and is set to a desired outlet pressure of 100 psi. The SPE performance of the regulator in this situation would be:

\[
\Delta P(\text{outlet}) = (2,200 - 200) \text{psi} \times (1 \text{psi/100 psi})
\]

\[
\Delta P(\text{outlet}) = 2,200 \text{psi} \times 0.01
\]

\[
\Delta P(\text{outlet}) = 20 \text{psi}
\]

In other words, if no adjustments were made to the regulator, the outlet pressure of the regulator would rise to 120 psi over the course of using the cylinder from 2,200 psi to 200 psi.

If the same scenario above used a two stage regulator with an SPE of 0.02 psi per 100 psi, the regulator would perform as below:

\[
\Delta P(\text{outlet}) = (2,200 - 200) \text{psi} \times (0.02 \text{psi/100 psi})
\]

\[
\Delta P(\text{outlet}) = 2,000 \text{psi} \times 0.0002
\]

\[
\Delta P(\text{outlet}) = 0.4 \text{psi}
\]

In other words, if no adjustments were made to the regulator, the outlet pressure of the regulator would rise to 100.4 psi over the course of using the cylinder.

So what does all this mean when selecting a regulator? Of course this is only one of many aspects to consider when selecting a regulator. But, in situations where the inlet pressure will vary and strict control of the outlet pressure is desired, choose a two stage regulator. In situations where the inlet pressure does not vary or if adjustments can be made frequently to the regulator; a single stage regulator may be adequate.

If you need help selecting the right regulator for your application, please don’t hesitate to call a General Air representative.

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