Precision Vacuum Regulator Improves Package Sealing Quality

Today's vacuum-sealed food packaging requires milli-second control.

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Abstract

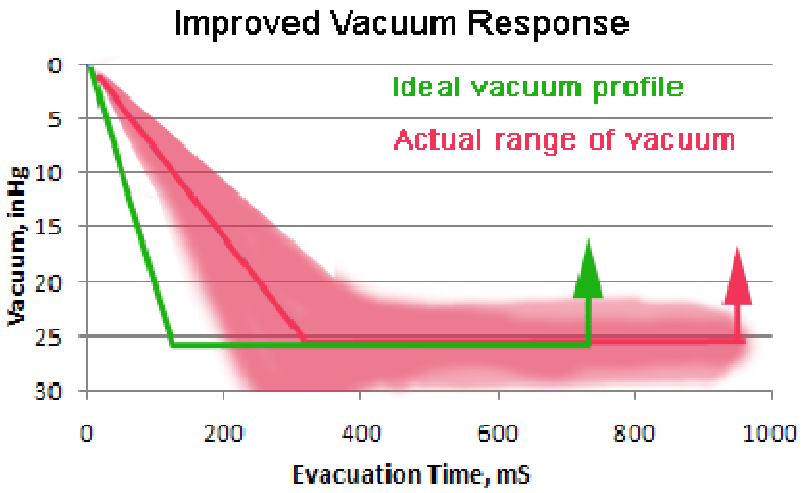
Today many fresh meats and vegetables are packaged using a process called Modified Atmosphere Packaging (MAP) where oxygen is removed and an inert gas is substituted. A strong vacuum must be quickly deployed inside the package before Nitrogen or Carbon Dioxide is injected. To do this economically, each of these processes must occur very quickly, challenging the performance of traditional gas handling systems.

This paper describes how a major US processed foods producer improved the quality of their vacuum sealed products with the introduction of a new and innovative vacuum regulator. By providing stable vacuum pressures under quickly varying flow rates, this precision regulator dramatically reduced the variability from package to package, thereby improving the quality of the product and the productivity of the process.

The Cryovac VR8610 is an example of commercially available Modified Atmosphere Packaging Systems.

Introduction

The Customer has a proprietary sequence for evacuating and flushing their food packages. In summary, their process requires achieving a vacuum of 26 inHg inside the package before the flushing sequence can take place. However, it is important that the vacuum be consistent from package to package and not deviate above 26 inHg to avoid other process problems.



The challenge was that inconsistent vacuum levels forced an unwelcome delay in the production sequence. In the chart shown, the ideal vacuum response is shown in green - a fast approach to the target vacuum. After a specified delay (in milliseconds), the gas injection can proceed. The red area in the chart shows the actual observed range of variability due to inconsistent vacuum application. The injection of inert gases must be delayed to compensate for the variability of evacuation. Not only does this slow down the production rate, the resulting variability of the package oxygen concentration reduces the quality of the product.

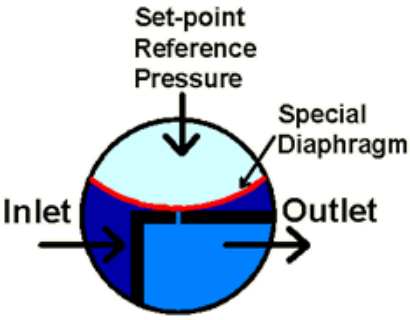
New Precision Vacuum Regulator

The customer's approach was to upgrade the quality of the vacuum control at the header supplying two separate sealing devices. After surveying the available vacuum regulator solutions on the internet, the Quality Improvement Engineer contacted Equilibar about a new type of precision vacuum regulator.

Equilibar Precision Vacuum Regulator

Equilibar's new EVR Series regulator uses patented technology to provide for much higher pressure stability across widely varying flow rates and vacuum supply pressures.

Because the Equilibar uses only a direct sealing diaphragm with no friction or inertia, the response times are much faster than with traditional vacuum control systems.



The regulator works by creating a 3-fluid force balance on a special diaphragm directly over seat orifices. The vacuum pump, connected to the Outlet, pulls the Inlet pressure down to the Reference Pressure, but is blocked from pulling the Inlet lower than the Reference pressure due to the sealing effect of the diaphragm over the orifice.

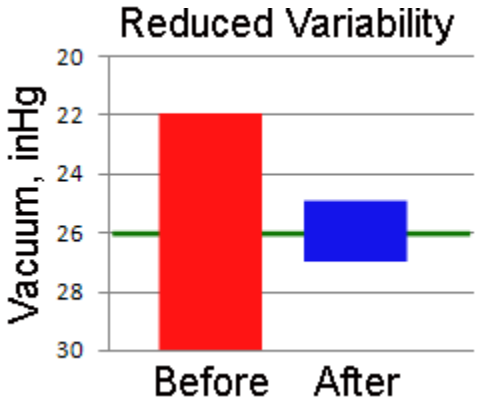
The Reference pressure is generated by a sensitive 20-turn vacuum regulator on the top of larger diaphragm regulator. The end result is dramatically improved pressure stability across widely varying flow rates; approximately 5X the precision of traditional spring-type regulators.

Equilibar 1" EVR-8 PVC Precision Vacuum Regulator

The Customer purchased and installed the 2 ½" PVC Equilibar Precision Vacuum Regulator to improve the vacuum control at their food package sealing machine.

Improved Quality & Productivity

The result of the Quality Improvement project was a dramatic reduction in the variability of vacuum pressure at the sealing head. The Customer's Quality Engineer reports a reduction in variability of applied vacuum from +/- 4 inHg to +/- 1 inHg from the 26 inHg setpoint.



Because of the reduction in vacuum variability and response time, the Customer has been able to measure a significant reduction in oxygen variability, as well as an increase in productivity on their food packaging product line.

More information about the new Equilibar Vacuum Regulator can be found at www.equilibar.com.