Overpressure Shutoff Valves

Key Components of your Fuel Train

By Steve Ogonek

In combustion systems, the fuel train poses its own risk from explosions due to excessive pressure from the fuel train. For protection of people, plants and equipment, overpressure safety-shutoff valves play an important role.

According to section 7.7.1.6 (safety shutoff) of the NFPA 86 standard (2003 edition), safety-shutoff valves "shall not be subjected to supply pressures in excess of the manufacturer's ratings." For many system designers, this requirement has led them to select safety-shutoff valves that can withstand the full upstream pressure of the fuel supply. This pressure will be present at safety-shutoff valves in the event of a pressure-regulator failure (figure 1). (The terms "upstream" and "downstream" relate to the direction of fuel flow, with upstream referring to devices closer to the fuel supply.)

While this is a sound and reasonable precaution that meets NFPA requirements, many plant-level fuel distribution systems carry pressures in excess of 15 psi. Using safety-shutoff valves rated for supply pressures above 15 psi can be expensive not only in the original capital cost, but also in the operation over the life of the system. For these reasons, many combustion system designers specify valves rated for lower pressures.

How can you select safety-shutoff valves rated below the maximum supply pressure and still meet NFPA 86 7.7.1.6?

The answer is given in another paragraph from NFPA 86, 7.7.1.8, which states: "If the inlet pressure to a fuel pressure regulator exceeds the pressure rating of any downstream component, overpressure protection shall be provided." In other words, if a system designer has selected safety-shutoff valves or other components that are not rated for the fuel-supply pressure upstream of the pressure regulator, some method of preventing an overpressure condition must be added.

Slam-Shut Valves

The good news is that an overpressure shutoff valve can provide the protection required by both paragraphs 7.7.1.6 and 7.7.1.8. These valves also are called "slam-shut" valves because they slam closed with an audible "clack" when activated.

How Do They Work? Overpressure shutoff valves mechanically monitor fuel-supply pressure and compare it to setpoint pressure. If the sensed pressure exceeds the setpoint, the valve closes. Supply pressure is monitored via a sense line piped downstream of the pressure-reducing regulator and upstream of the safety-shutoff valves (figure 2). The setpoint pressure is adjusted via a spring in the overpressure valve that should be set and tested by a qualified combustion technician.

A slam-shut valve should be used in combination with a safety relief valve. The safety relief valve is designed to reduce temporary pressure surges downstream of the pressure regulator caused by fluctuations in system operations. The setpoint of a safety relief valve is always

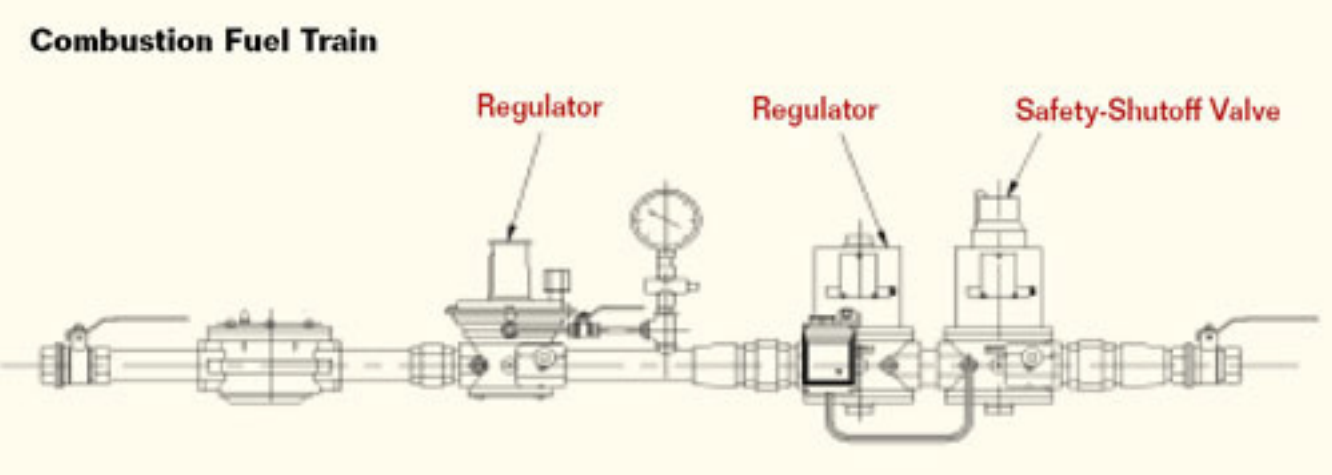

Figure 1. If the fuel train regulator fails, the safety-shutoff valves are subject to full upstream pressure. "Upstream" refers to fuel-flow direction and to devices closer to the fuel supply.

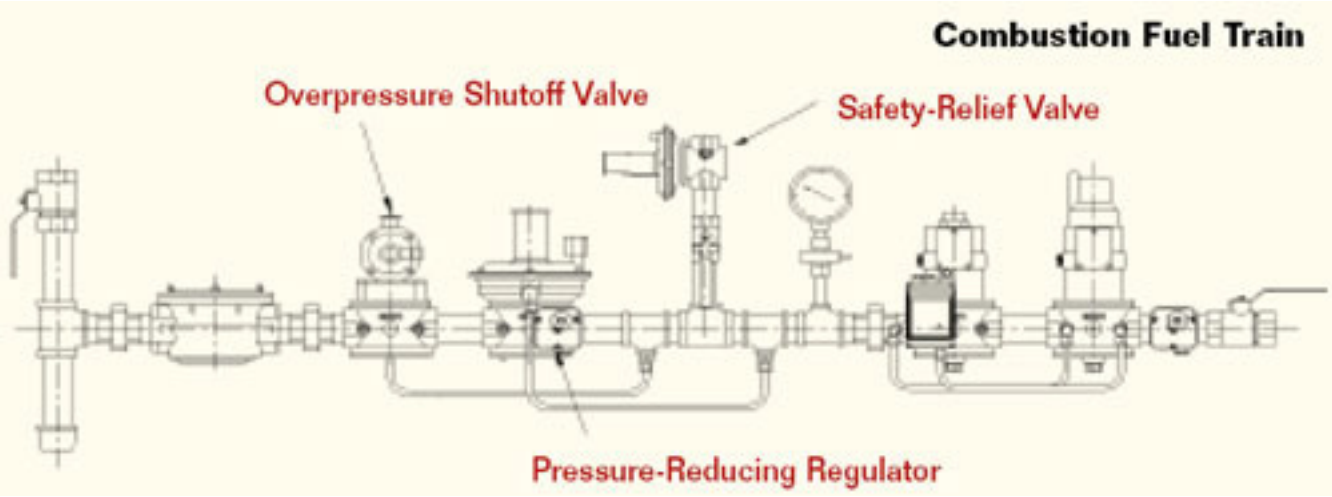

Figure 2. An overpressure shutoff valve in the combustion fuel train senses downstream pressure via a sense, or impulse, line located after the pressure reducing regulator. "Downstream" refers to fuel-flow direction.

lower than the setpoint of the slam-shut valve. In these cases, use of a small vent valve is required.

Advantages. Using an overpressure shutoff valve has advantages. The obvious one is that it allows the use of less expensive safety-shutoff valves while still meeting NFPA 86 requirements. In addition to costing less, many of these lower pressure-rated safety-shutoff valves have duty-cycle ratings in excess of one million cycles. They also are significantly smaller than high-pressure valves, which can lead to a much smaller footprint for fuel trains even when accounting for the space required for the overpressure valve.

A more subtle advantage in using an overpressure shutoff valve comes from another NFPA 86 paragraph (6.2.5.4.4): "A fuel gas regulator shall not be required to be vented if an automatic device shuts off gas upstream of the fuel gas regulator as a result of system overpressurization." This requirement allows the system designer to eliminate the vent line to a regulator. If the system also incorporates a valve-proving device, the vent line often required between the safety-shutoff valves also can be eliminated saving hundreds of dollars per installation.

Is using an overpressure shutoff valve safer than using high pressure valves? From a safety standpoint, the two systems are comparable. However, as with all combustion system designs, a qualified combustion professional needs to make the final determination on which system is best for any given application.

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Given the complexity and diversity of combustion applications, this article is not intended to relieve any user and/or company from taking it upon themselves to gain a thorough understanding of NFPA codes and standards, and the requirements for compliance of the user and/or company's own operation. As such, the author and any company named herein disclaim liability for any personal injury or property or other damages of any nature whatsoever, whether special, indirect, consequential or compensatory, directly or indirectly resulting from the publication, use of or reliance on this article.

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