

## Protect your system and personnel

Rapid changes in flow velocity in pipelines and marine loading and unloading can produce rapid pressure surges. If these surges are not controlled immediately before they exceed the pressure limits, they can damage your equipment and become a serious safety and environment hazard (see chart 1). A surge relief valve protects your system from build-up of pressure surges.

### Surge pressures are created from:

- Closure of an automatic emergency shutdown device (ESD valve)
- Rapid closure or opening of a manual or power operated valve
- Slamming shut of a non-return valve
- Starting or stopping of a pump

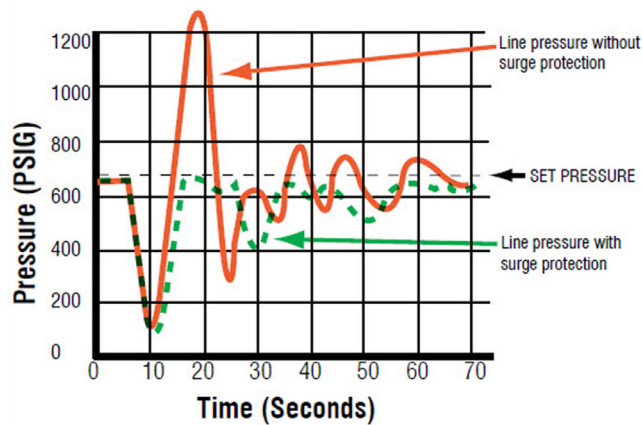


Chart 1: Typical pressure / time response with and without surge relief protection

## Selecting the right valve

Selecting the right pressure relief valve for the intended application is extremely important. Factors that must be considered are:

- **Valve response time:** Valve response time is extremely important in controlling peak surges and does vary by valve type. For instance, a gas-loaded relief valve is considerably faster than a pilot-operated valve.
- **Valve flow coefficient ( $C_v$ ):**  $C_v$  is a formula used to determine the correct size valve required and is defined as the quantity of water (in gallons/minute) that will flow through a wide open valve with 1 psi drop. It is recommended that the required  $C_v$  should not exceed 85% of the selected valve size actual  $C_v$ . Valve  $C_v$  varies by size type and manufacturer.
- **Excess pressure above set point to reach required flow rate:** When line pressure exceeds the force (bias pressure) keeping the valve closed, the valve begins to open. As the valve opens, the bias force or pressure increases; so should the line pressure if the valve is to stay open. This bias force varies by type and operating characteristics, such as between a hydraulically balanced or unbalanced design of a valve.
- **Valve characteristic control curve:** Defines the relationship between both opening and closing characteristics (strokes) of a valve and flow rate under constant pressure conditions. There are three characteristic control curves: linear, equal percentage, and fast. Valve stroke is the percent opening of the valve and is tied to percent flow ( $\%C_v$ ).

## Daniel valves deliver results

Although many design approaches can help alleviate surge pressure, a surge relief valve should be installed to protect your system. Some of the benefits of using Daniel surge relief valves include:

- High flow capacities or coefficients ( $C_v$ ) means smaller and / or fewer valves to save installation costs and weight
- Fast response – rapid opening, controlled closing without slamming shut (allow the valve to “track the surge”)
- Oil reservoir helps extend the life of the seals and in addition eliminates the possibility of nitrogen gas permeating the seals with reduced nitrogen consumption
- Line pressure operated – no separate power source required
- 45 degree valve design allows for vertical operation of the piston. This ensures that the valve opening does not get affected by debris when the valve cycles during an occasional surge
- Ratio of nitrogen pressure to set pressure is 1:1 (less force exerted by spring)
- Linear action valves are the preferred choice for surge control application

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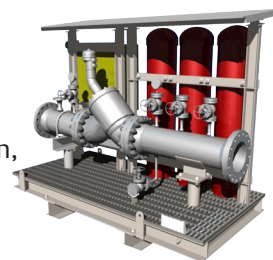
## Complete surge relief solutions

From single valve installations to complex turnkey skid mounted solutions, Daniel's surge relief systems are a single-source solution proven to minimize risk and deliver precise control.

Each of Daniel's surge relief systems is designed to specific requirements using a complete hydraulic transient analysis to meet the challenges of today's petroleum and environmental needs.

### Complete Surge Relief Solutions

- Single point of responsibility for the complete system, including design, engineering, fabrication, testing, installation, commissioning, and operator training



### Nitrogen Loaded Pressure Relief Valves

- Suitable for all types of petroleum products, including dirty or high viscosity products
- Exceptionally fast response
- Can also be used to maintain a minimum back pressure for more efficient operating conditions



### Pilot Operated Pressure Relief Valves

- Suitable for low viscosity refined products
- Completely self-contained
- Relatively slow response

