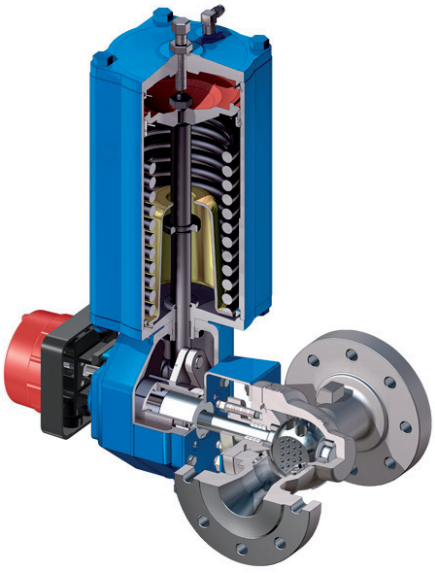
APPLICATION REPORT

Metso depressurizing valves

Serving oil & gas industries



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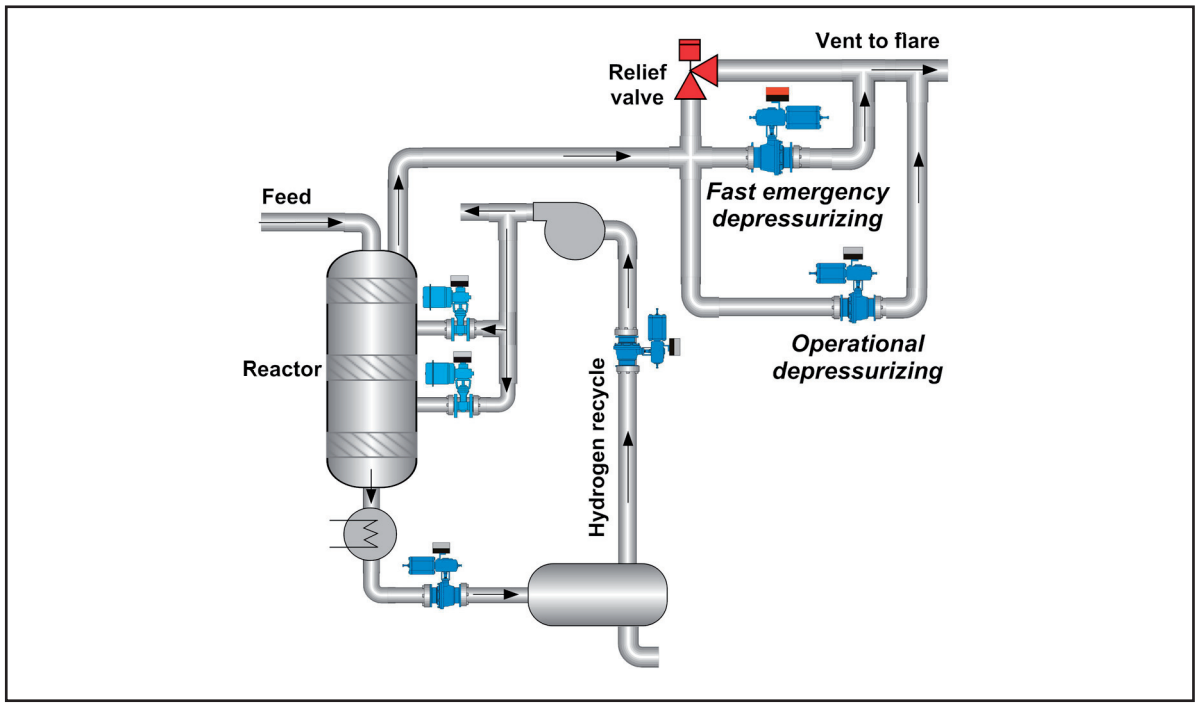
1. Overview



Example of depressurizing system for a hydrocracker reactor unit.

Depressurizing systems are used to reduce the failure potential for scenarios involving overheating (e.g. fire). When metal temperature is increased due to fire or exothermic or runaway process reactions, the metal temperature can reach a level at which stress rupture can occur. Depressurizing reduces the internal stress, extending the life of the vessel at given temperature. A relief valve cannot provide adequate risk reduction or safety to depressurize a vessel - it can only limit the pressure from exceeding the process upset point. Therefore depressurizing valves are used to reduce the risk of losing equipment integrity.

Typical requirement in case of emergency the depressuring system should reduce the pressure of the vessel to a certain value (e.g. 50%) of the design level within a depressurization rate of several minutes to almost an hour. Possibility for remote operation is always needed but depressurizing can be automatically initiated by a signal from emergency shutdown system. The depressurized fluid (gas) is lead from the pressure vessel to a properly designed disposal system, such as the flare. The flare capacity usually limits the use of multiple depressurizing valves at the same time. In general, the depressurization rates should be maximized within the total flare system capacity.

2. Depressurizing system challenges

Process facilities today are facing growing challenges to meet the requirements with respect to environment, health and safety of the plant personnel while maximizing the product output and quality. With increasing energy prices, process plants are set to new challenges to further develop their processes and maximize the yield of valuable products in an energy efficient way. Plant run-time targets are increasing which sets more challenges for equipment reliability and safety.

Health, Safety, Environment – depressurizing system being part of the safety integrity system is a part of the process industry's backbone defense against a threat to personnel and equipment. In terms of lost products and environmental safety – fugitive emissions and valve shut-off tightness are becoming more and more important topics. It is important that the process is stable, flexible and under control.

In many cases – process plant or unit is equipped with two different kind of depressurizing systems; a slow system and a fast system. The slow system can also be called as operational depressurizing system and the fast an emergency depressurizing system. Valve capacity shall be accurately matched with process conditions in order to verify that depressurizing is not done too fast.

2.1 General slow depressurizing system / Operational depressurizing system

A slow depressurizing system is intended for process control or other operational reasons. It is meant to be used as first means of controlling the process before the fast system is taken into consideration. Slow depressurizing system can be initiated manually from the control room or locally from the field or automatically by the distributed control system (DCS) by exceeding the pre-determined limits. Slow depressurizing system is in most cases used parallel with fast emergency depressurizing system. These valves are usually closed when emergency depressurizing valves are operated due to the limitation set by flare capacity.

2.2 Fast depressurizing system / Emergency depressurizing system

Emergency depressurizing system is typically required for hydrocrackers, catalytic reforming units and process heaters. Fast depressurizing system is used in emergency situation to quickly evacuate the system. It can be initiated manually by the operator or automatically by the safety system.

2.3 General requirements or practices for depressurizing valves;

- Matching trim capacity to process conditions
- Tight shut-off (e.g. Class V)
- Noise reduction capability
- Outlet velocity limitations
- High safety integrity and reliability
- Low emissions
- Spring to open actuators, especially for emergency depressurizing. High actuator sizing safety factors (typically from 1.5 to 2).
- Operational depressurizing valve is normally equipped with solenoid valve and a valve controller.
- Instrumentation related to emergency depressuring valve may be more complex than operational depressuring valves. In order to meet the high safety and reliability requirements redundant solenoids may be required.

3. Metso Solution

The valve type selection depends on the process design conditions and customer specifications. Metso offering includes valves for all depressurizing applications from operational to demanding, complex emergency depressurizing. Our product portfolio for depressurizing applications comprises of:

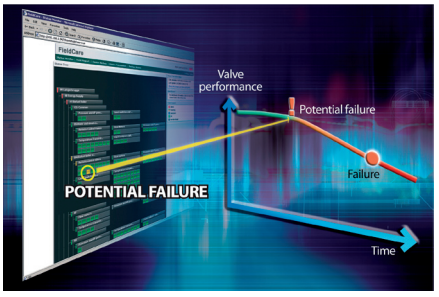
Trunnion mounted ball valves

Top entry valves

Special Cv-trims

Neles ValvGuardTM Intelligent valve controllers for emergency depressurizing

Neles ND9000® Intelligent valve controllers for operational depressurizing



Metso FieldCare asset management and condition monitoring software

The required capacity and noise requirement can be met and designed according to specifications. Common solution by Metso using:

- Custom designed special Cv Q-trim
- Standard Q-trim and attenuator-plate
- Limiting maximum opening of the valve by customized actuator limit stop (tamper proof)

4. Benefits

- Avoid unnecessary flaring due to long lasting metal seated tightness
- Availability in fire emergency conditions due to fire proof construction
- Less valves needed due to wide rangeability
- Reliable valve operation ensured even in conditions with particles in the fluid due to non-clogging design
- Reduced emissions due to rotary stem and spring-loaded packing
- Maximum availability and extended plant uptime due to on-line condition monitoring provided by smart positioned valves for predictive maintenance
- Hidden failures revealed without flaring due to partial stroke testing applied for emergency depressurizing valves
- Common cause failures reduced in redundant instrumentation by replacing a solenoid valve with ValvGuard™
- Metso can verify the flow capacity of the trims according to international standards by testing using in-house flow laboratory or by calculation using CFD-methods
- Simple valve instrumentation (less equipment, such as solenoids) together with higher safety integrity and better reliability provided by ValvGuard™

Summary

Metso depressurizing valves has been successfully used in several projects with global energy companies in applications such as emergency depressurising in hydrocracking reactors and steam crackers. We take clear responsibility as a single manufacturer of all components tested and configured as a complete assembly.

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