Ensuring control valve reliability

Metso valves
Solutions for severe service
For over 50 years, Metso’s control valves have proven to provide optimum performance in severe service valve installations. Today’s control valve portfolio includes a variety of rotary and linear valve trims for demanding applications, such as noise, cavitation, flashing and erosive conditions.

Operation and maintenance costs make up the bulk of the lifetime cost of a valve. Considering application challenges and reliability of the design in valve selection increases process uptime and valve lifetime, and can deliver considerable savings in industry.

Planned maintenance reduces lifecycle costs
It is particularly important in demanding applications to recognize maintenance needs that help extend device lifecycle. Based on process and device criticality, a maintenance plan should always be created to secure the functionality, reliability and safety of the planned process. The maintenance plan along with high-quality execution ensures that the lifecycle cost of valves remains at the desired level.

Control valve development

| 1970's          | · Q-trim low-noise anti-cavitation for rotary control ball valves
                  | · Nelsize sizing program |
|-----------------|--------------------------|
| 1980's          | · Segment valves with Q-trim
                  | · S-disc for butterfly valves |
| 1990's          | · Full ceramic control valve for extreme erosion
                  | · Finetrol eccentric plug with Q-trim |
| 2000's          | · Rotary globe with balanced low-noise anti-cavitation trim
                  | · Neles globe valve introduced with Tendril and Omega low-noise anti-cavitation trims
                  | · Q2-trim for enhanced noise attenuation |
Oil & Gas
Pulp & Paper
Industrial gas
Power
Refining & Petrochemical
LNG
Addressing common challenges for valves in severe service

**Eliminating cavitation**
High noise, heavy vibration, material and mechanical damages are common difficulties seen in control valves in cavitative conditions. If heavy cavitation is disregarded, severe damages in valve and trim may occur in a fairly short time frame. Controlling the velocity and the pressure in the trim is an effective method to eliminate cavitation and minimize damages. The division of flow into multiple small streams further enhances cavitation resistance and reduces the intensity of noise and vibration.

**Managing flashing**
Flashing flow may cause erosion and vibration, but unlike cavitation, the reason is the impingement of high velocity liquid droplets to valve body and trim parts. Flashing phenomenon can not be avoided in the valve, but damages can be defeated by carefully considering the valve design, materials, process conditions and valve installations.

**Noise attenuation**
Excessive valve noise in gas applications is an indications of high pressure losses. In addition to health risks, this can cause vibration and mechanical damages in valves, instrumentation or pipeline. Noise abatement by using source treatment methods such as anti-noise trims are generally preferable as preventing noise is the best way to ensure operational reliability. Path treatment methods such as thermal insulation may sometimes provide an alternative method to dampen excessive noise emission from valve to environment but mechanical integrity need to be confirmed against acoustically induced vibration.

**Extending valve lifetime in erosive services**
Erosion is dependent on flow velocity and presence of hard particles in the fluid flow. It is also strongly related to the properties of the materials being used. Trim style and material selection should be done carefully in applications where erosive particles with high velocities exist. Typically hardened valve trims and/or hard bodies are used to protect valve failures in erosive services.

**Meeting today’s safety and environmental requirements**
Certified live-loaded low emission gland packings are standard characteristics for Metso valves. These solutions offer full compliance with the strictest environmental regulations. Long-lasting tight shut-off and fire-tested options are also available in Metso’s extensive valve portfolio. This feature, rarely available in modulating control valves, has gained the attention of the world’s most advanced hydrocarbon processing companies.
Nelprof 6

An easy tool designed to help you select the correct control, automated on/off and emergency valves from Metso’s portfolio.

Performance analysis can be used to study valve controllability in a closed control loop. The module also includes multi-phase flow sizing as well as noise and cavitation prediction analysis.
Metso rotary control valves combine superior controllability and wide rangeability with optional top-notch cavitation and noise abatement. High capacity provides an ideal solution for bottlenecking, and a smaller body size requires less piping support. Versatility in terms of installation direction saves space on site. Metso rotary control valves offer excellent long-lasting fugitive emission control and suitability for dirty, erosive and extreme temperatures as standard.
Rotary control valves
Field proven results in severe applications

Q-trim Genuine multistaged pressure control with wide control range

Q2-trim Perfecting rotary valve noise reduction

Neles Q2-trim takes the patented Q-trim technology to a new level. The technology combines various techniques:
- Pressure staging
- Flow division
- Peak frequency shifting
- Velocity control

S-DISC Enhancing eccentric disc capabilities

S-DISC balances flow forces and reduces dynamic torque

Q2 noise reduction

<table>
<thead>
<tr>
<th>Pressure ratio</th>
<th>Standard control valve</th>
<th>Q-Trim</th>
<th>Q2-Trim</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td>0</td>
<td>-10</td>
<td>-20</td>
</tr>
<tr>
<td>1</td>
<td>-20</td>
<td>-30</td>
<td></td>
</tr>
</tbody>
</table>
Linear control valves
New generation Globe and Angle valves

- **Intelligent positioner**
  - NDX
  - ND9000

- **Actuator**
  - Field reversible diaphragm actuator - Series VD
  - Fail safe piston actuator - Series VC

- **Certified emission packing**
  - Extension bonnet
  - Bellows extension bonnet

- **Valve**
  - Various trim constructions
  - Hardened & corrosion resistant trim materials

Metso linear control valves combine modern, innovative design to the traditional strong points of the linear control valve construction. Fundamentally simple design makes the valve robust, and integration to the latest generation Smart control valve positioners makes it easy to use. It is also easy to adapt the unit to different applications. Even in the toughest process conditions, there is a solution that ensures maximum reliability and performance.

- Innovative and fundamentally simple construction
- Smart technology seamlessly integrated
- Specially designed for process industry needs
Linear control valves
Effective noise and cavitation control for demanding applications

**Tendril** 1 or 2 stage multihole trim

- Multi-hole 1- or 2-stage trim for both balanced and unbalanced models
- Flow division by multiple-hole flow channels
- Sudden expansion and jet impignement
- Velocity and pressure control by individual flow paths
- Preventing exit jet interaction

**Omega** Multistage, multipath, multturn trim

- Multistage, multipath, multturn construction
- Controlling trim velocity by multistaged, multturn 2- or 3 dimensional flow passage
- Flow division by multiple flow channels
- Sudden expansion and contraction in individual flow path
- Preventing exit jet interaction
- Enhancing noise and cavitation reduction by optimising the number of turns in the trim
Severe service solutions

Better product designs and speedy design process

Digital simulations in product development enable us to cut down the number of laboratory tests, while increasing performance, safety and reliability without compromising on product quality. We utilize virtual modelling, simulations and tests that are especially helpful during the early design phase, allowing us to quickly identify optimized design combinations.

Controlling noise and cavitation – rotary

<table>
<thead>
<tr>
<th>Item</th>
<th>Model</th>
<th>Valve types</th>
<th>Sizes</th>
<th>Temperature</th>
<th>Pressure</th>
<th>Typical applications</th>
</tr>
</thead>
</table>
| Balanced disc             | S-disc    | Butterfly valves: Series L                       | 3" - 80"| -200 to +600 °C | ASME 150 - 600 | • Gas and liquid services  
|                           |           |                                                  |         |             |          | • Moderate dP and temperature range  
|                           |           |                                                  |         |             |          | • Large sizes                                                                      |
| Versatile rotary          | Q-trim    | Ball valves: Series D, X, T, M V-ported segment  | 2" - 36"| -200 to +600 °C | ASME 150 - 600 | • Gas and liquid services  
|                           |           | segment valves: Series R                         |         |             |          | • Clean and dirty fluids, wide dP and temperature range                             |
|                           |           | Eccentric rotary plug valves: Series FC          |         |             |          |                                                                                     |
| Enhanced cavitation       | QLM-trim  | Ball valves: Series D                            | 2" - 36"| -200 to +600 °C | ASME 150 - 600 | • Liquid services  
| elimination               |           |                                                  |         |             |          | • Clean and dirty fluids, wide dP and temperature range                             |
| Enhanced noise elimination| Q2-trim   | Ball valves: Series D, X and T                   | 2" - 16"| -200 to +600 °C | ASME 150 - 600 | • Gas services  
|                           |           |                                                  |         |             |          | • Clean fluids, wide dP and temperature range                                       |
| Rotary globe              | Balanced  | Rotary globe: Series ZX                          | ½" - 4" | -80 to +425 °C  | ASME 150 - 1500 | • Gas and liquid services  
|                           | trim      |                                                  |         |             |          | • Wide temperature and dP range                                                    |
|                           |           |                                                  |         |             |          | • Clean services, small sizes, low Cv                                               |
### Controlling noise and cavitation – linear

<table>
<thead>
<tr>
<th>Item</th>
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</tr>
</thead>
</table>
| Single stage multihole | Tendril-1 | Globe valves: Series GU, GB | 1” - 24” | -196 to +593 °C | ASME 150 - 2500 | • Gas and liquid services  
• Clean fluids, very wide dP and temperature range |
| | | Angle valves: Series AU, AB | | | | |
| Two stage multihole | Tendril-2 | Globe valves: Series GU, GB | 1” - 24” | -196 to +593 °C | ASME 150 - 2500 | • Gas and liquid services  
• Clean fluids, very wide dP and temperature range |
| | | Angle valves: Series AU, AB | | | | |
| Multistage, multipath, multiturn | Omega | Globe valves: Series GM | 1” - 24” | -196 to +593 °C | ASME 150 - 2500 | • Gas and liquid services  
• Very wide temperature and dP range, clean fluids |
| | | Angle valves: Series AM | | | | |

#### Rotary / Linear

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<th>Sizes</th>
<th>Temperature</th>
<th>Pressure</th>
<th>Typical applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed resistors</td>
<td>Multi- and single hole plates, diffusers</td>
<td>All valve types</td>
<td>1” - 36”</td>
<td>-196 to +593 °C</td>
<td>ASME 150 - 600</td>
<td>• Gas and liquid services</td>
</tr>
</tbody>
</table>

#### Controlling erosive and flashing

<table>
<thead>
<tr>
<th>Item</th>
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<th>Valve types</th>
<th>Sizes</th>
<th>Temperature</th>
<th>Pressure</th>
<th>Typical applications</th>
</tr>
</thead>
</table>
| Balanced eccentric plug | Flow reverse | Eccentric rotary plug valves: Series FC | 1” - 10” | -200 to +425 °C | ASME 150 - 600 | • Flashing and erosive services  
• Wide temperature and dP range, moderately severe |
| Non-tight erosive | Segment | V-ported segment valves: Series R | 1” - 32” | -80 to +425 °C | ASME 150 - 300 | • Flashing and erosive non-tight service  
• Medium temperature and dP range, moderately severe |
| Severe erosive | Ceramic, HIP* | Ball valves: Series X, D, E | 1” - 8”  
1” - 16” | -50 to +450 °C | ASME 150 - 600 | • Very erosive services  
• Wide temperature and dP range |
| Severe angle | Linear angle | Angle valves: Series AU, AB, AM | 1” - 48” | -196 to +593 °C | ASME 150 - 2500 | • Very erosive and severe flashing services  
• Very wide temperature and dP range |

* Wear and erosion resistant valves manufactured by using Hot Isostatic Pressing technology (HIP)