Flow Regulation of Cryogenic Fluids: Design of a High-Rangeability Control Valve

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To control the mass flow, the pressure or the temperature in a cryogenic plant, often cryogenic control valves are used. These valves regulate thanks to the axial movement of a throttling element with defined geometry, controlled by a pneumatic actuator and an electro-pneumatic positioner.

The electro-pneumatic positioner in combination with a pneumatic actuator drives the valve to the position where the needed opening is being realized. The smoother the relationship of the opening vs. the stroke of the valve is, the more precise the positioner can accomplish its task.

In particular in the case, when the same valve should be able to operate in several working points (for example cool down, warm up and cold operation) or with different loads of the plant, the opening vs. stroke curve becomes challenging. It demands to cover a high range of regulation values (high rangeability). In extreme cases, the plant may have a smaller valve for the control of low mass flows in parallel to a larger valve, because the needed “rangeability” cannot be reached in only one valve.

This contribution shows how a high “rangeability” can be reached in order to cover multiple functions with the same valve and shows the comparison of the calculated values with Kv measurements.