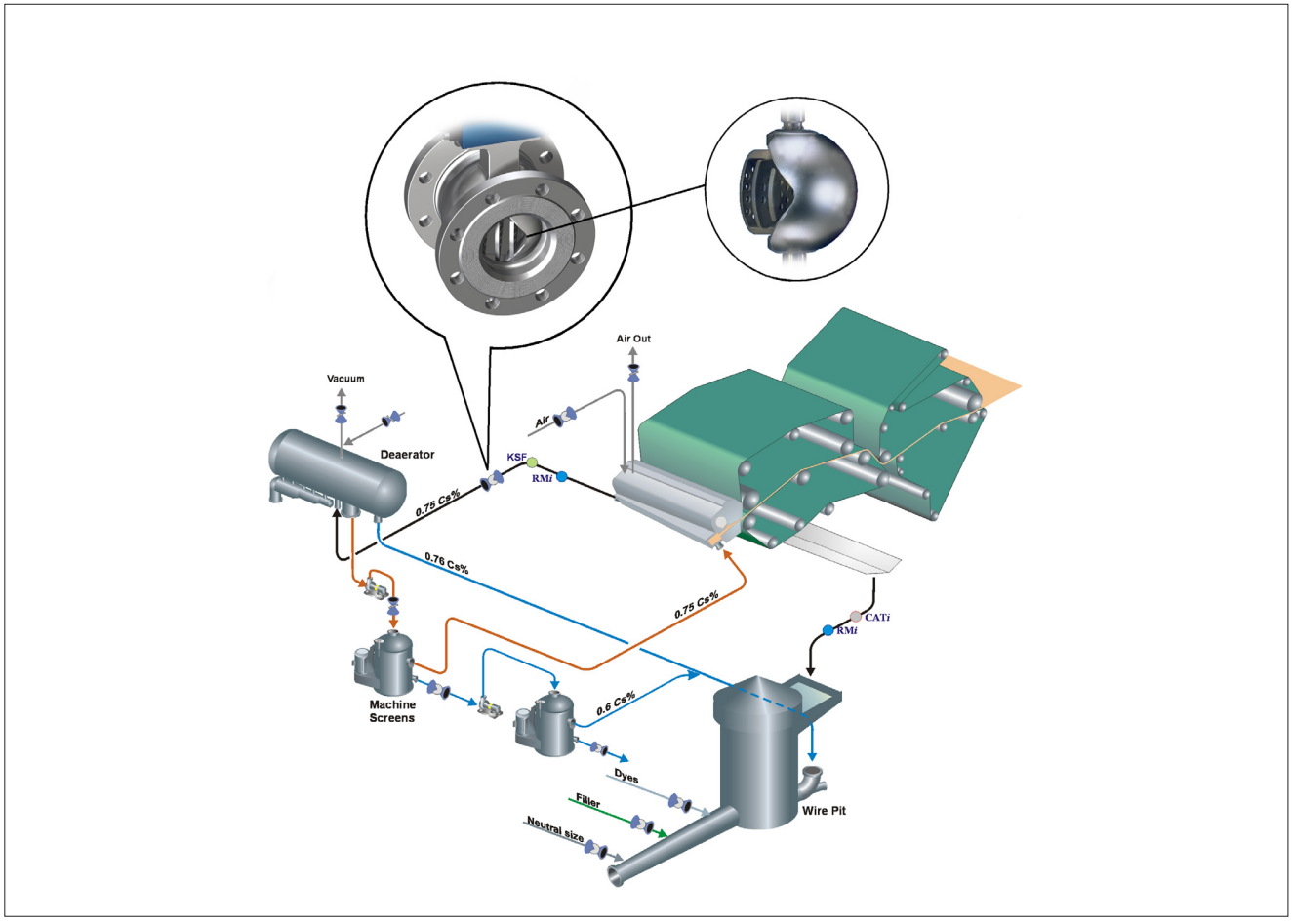
Q-Trim™ in paper machine headbox loops



Overview of the process

To meet the current demand for producing greater amounts of quality grade paper in the shortest possible time, modern paper machines run at even higher speeds (1500 m/min...4900 ft/min) than in the past. Because this requires higher pressures within the headbox, it is important that pulsations or vibration caused by cavitation resulting from high pressure drops across control valves be eliminated.

The process

The part of the process where the stock is blended with white water and pumped through the approach flow piping to the headbox is called short circulation. White water, which falls through the wire into the wire pit contains fibers and additives. Fast running machines require higher headbox pressure, therefore, cavitation may occur in the recirculation control valve.

Results

Normally some 10 % of the total flow is recirculated through the bypass line after the inlet header. Control of the headbox is critical and seeks to eliminate any pulsations or flow velocity differences across the full width of the wire.

Recirculation control valve

Fast running machines require high pressure, 4 bar (60 psi), in the inlet header and in the headbox. To maintain the same pressure conditions in the front end and in the rear end of the tapered inlet header a recirculation valve is used.

As the differential over the recirculation valve remains high, cavitation can occur. Vibration can be carried to the headbox and cause disturbances to the paper quality.

To avoid the cavitation in ball and ball segment type valves we have developed the Q-Trim. It has been used successfully in headbox recirculation systems on many paper machines.

The combination of holes and plates produces the multi-stage pressure drop needed to prevent cavitation. A few installations are listed below.

Company, mill	Machine	Paper	Speed m/min	Valve type
Shotton Paper Co. PLC, United Kingdom	PM2	News	1500 (4921 ft/min)	Q-R V-port segment valve
Cellulose de Stracel, France	PM1	News	1500 (4921 ft/min)	Q-R V-port segment valveve
United Paper Mills, Finland Kaipola Rauma	 PM7 PM2	 News SC	 1500 (4921 ft/min) 1400 (4593 ft/min)	QL-C2C ball valve
Oji Paper Co., Japan Nishinan Yonago	 PM3 PM1	 Fine Fine	 ≈1000 (3280 ft/min) ≈1000 (3280 ft/min)	Q-R V-port segment valve
Willamette Industries, Bennettsville, S.C. USA	PM1	Uncoated Fine	1100 (3500 ft/min)	Q-R V-port segment valve
Enso Fine Papers Oy, Finland Oulu Kemi	 PM6 PM7 PM2 PM5 PM7	 Fine Fine Fine LWC Fine	 1200 (3937 ft/min) 1600 (5249 ft/min)	 Q-C2C ball valve Q-R V-port segment valve Q-R V-port segment valve Q-R V-port segment valve Q-R V-port segment valve

How does the Q-Trim work?

The Q-Trim is controlling the fluid velocity: this is an effective mean avoiding cavitation. The aim of this is to get the lowest pressure in the valve trim above the vapour pressure for the liquid in question.

A Q-Trim valve utilizes a combination of the following effects:

- The pressure drop is taken in multiple stages, leading to lower valve trim velocity and higher trim minimum pressure.
- Division of the flow into multiple streams diffuses the flow and provides acoustic control.
- The trim outlet is designed in such way that the flow is spread out evenly across the downstream flow port.

The rotary motion in rotary type of valves, such as the segment valve gives additional benefits of being able to handle a very large flow range and pass pulp fibers through the valve.

The demonstration

To demonstrate how effective the Q-Trim is in this application we have made two sizing calculations with typical process data.

Case 1:

Two butterfly valves installed in series (common in many mills)

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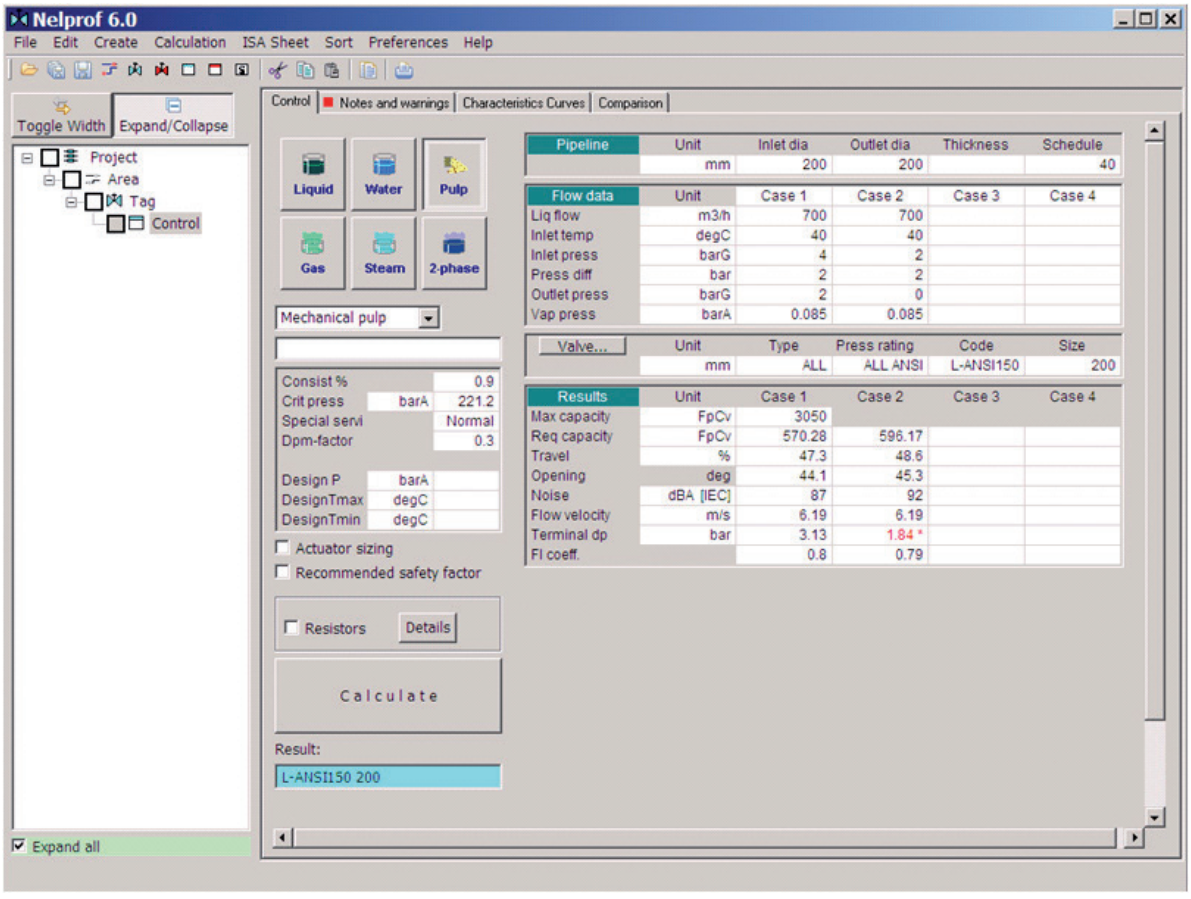


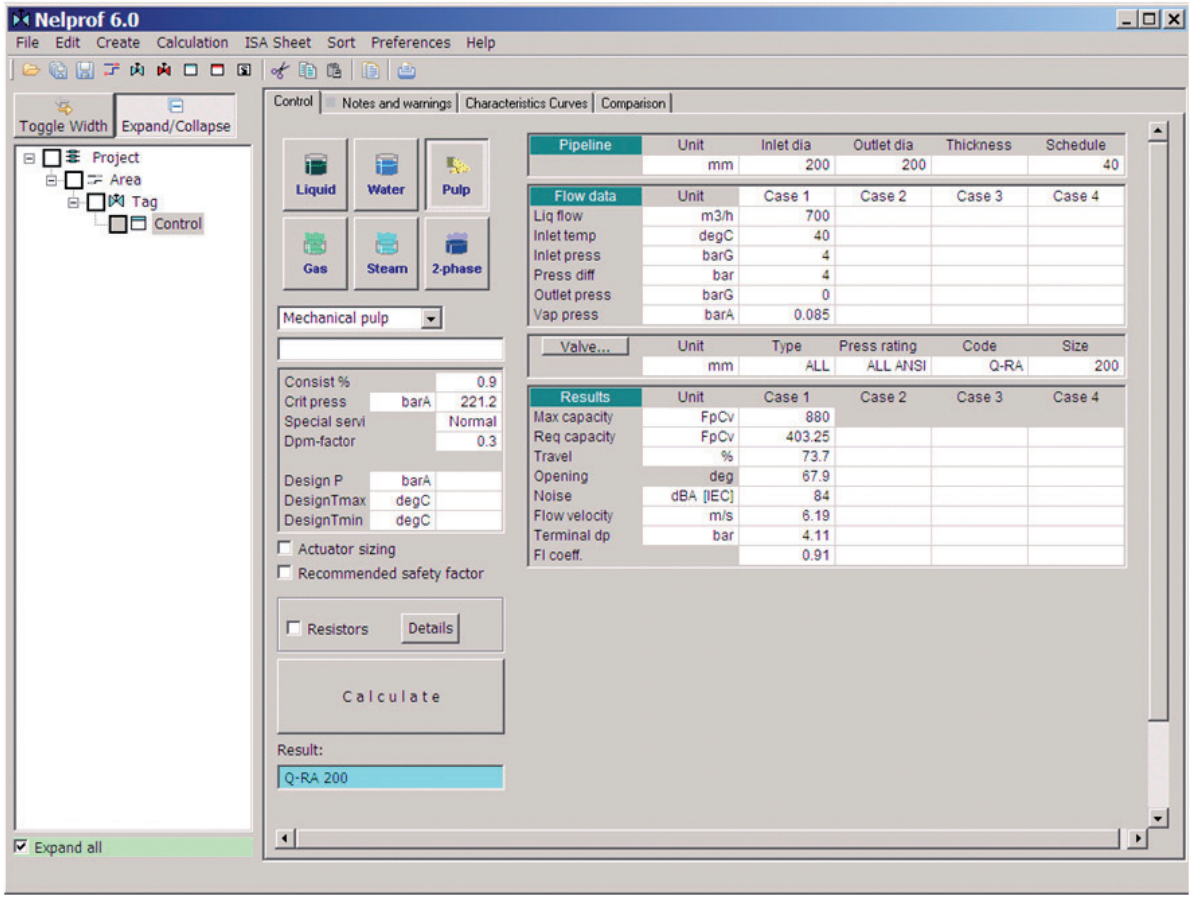
Case 2:

One valve in use: Q-Trim R-series

Like the attached calculation data shows the two butterfly valves (half of the pressure drop taken by each) cause cavitation and high noise/vibration.

One Q-Trim can handle these conditions without problems.

Case 2:



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