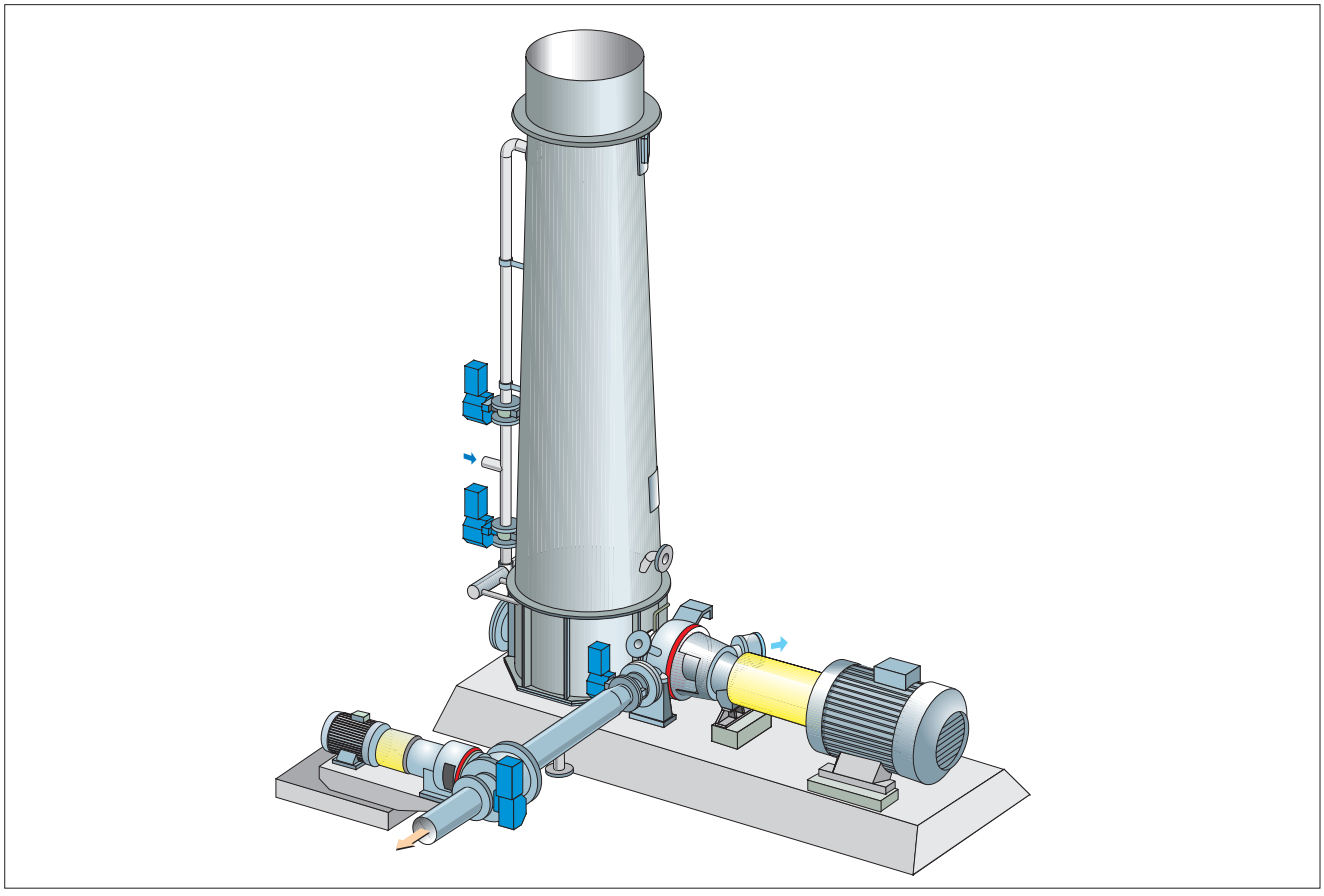
Medium consistency flow control valves



Overview of the process

In many pulp applications, 8-19 % medium consistency is used to achieve cost savings or technical benefits in the process.

The process

The medium consistency pump, designed for handling stocks from 8 % to 19 %, is basically a centrifugal pump with an open impeller. It acts as a turbulence generator fluidizing the pulp at the inlet.

A normal head is up to 150 meters and pulp flow is controlled by means of a valve mounted straight to the pump discharge flange.

There is two basic ways to run the pumps, variable speed pumps and static head pumps. There is clear difference how to use the medium consistency valves with these two pump styles.

In case of variable speed pump it is important to run the pump with fully 90 degree open valve. Thus creating minimum resistance in the valve. Valve will be throttled only when the pressure differential over the valve goes below critical point creating danger of blocking the valve. This can happend only with very low speed of the pump.

The other case is the conventional way where static head pumps' head is controlled by means of medium consistency valve. In these cases the valve opening is typically limited to 70 degree to be sure that the pressure differential over the valve stays above critical level. With the static head pumps also 90 degree openings can be used if pressure differential over the valve is guaranteed to be above critical level.

More mills are going towards variable speed pumps to get energy savings and also better pulp quality. When pulp is run vigorosly through throttling valve fibers can be damaged and this can effect the final pulp sheet quality.

Solution

Valmet has created a specially designed segment valve for this highly visible application. Extensive amount of testing and cooperation has beed conducted with a leading pump manufacturer and an university. This research work has given us important knowledge of the flow behaviour and clogging prevention in this demanding application.

This specially designed segment valve provides an optimized flow path for medium consistency pulp. The flow path in the valve is continiously increased to eliminate restrictions where material may build up. The outlet flange is one size bigger than the inlet to ensure this. Additionally, the body is equipped with a flushing connection.

The flow path is V-contoured to be able to control small capacities without risk of dewatering.

Special attention must be brought to actuator size. All our medium consistency segment valves are equipped with oversized actuators to ensure valve operation in all conditions.

Valve has single piece body and it has flanges to ensure easy and correct mounting of the valve.

Material of the valve can be stanless steel, 254 SMO or titanium.

Special attention must be paid for positioners in these applications due to high vibration levels.

Pulp stock behavor

It is known that pulp stock flow behavior is strongly depend on flow velocity (see figure 1).

When the flow velocity of pulpstock is very small, it flows in the pipe like a solid plug and forms "rolls", that spin between the plug and pipe wall. As the flow velocity is increased, the flow changes, first mixed flow then turbulent flow.

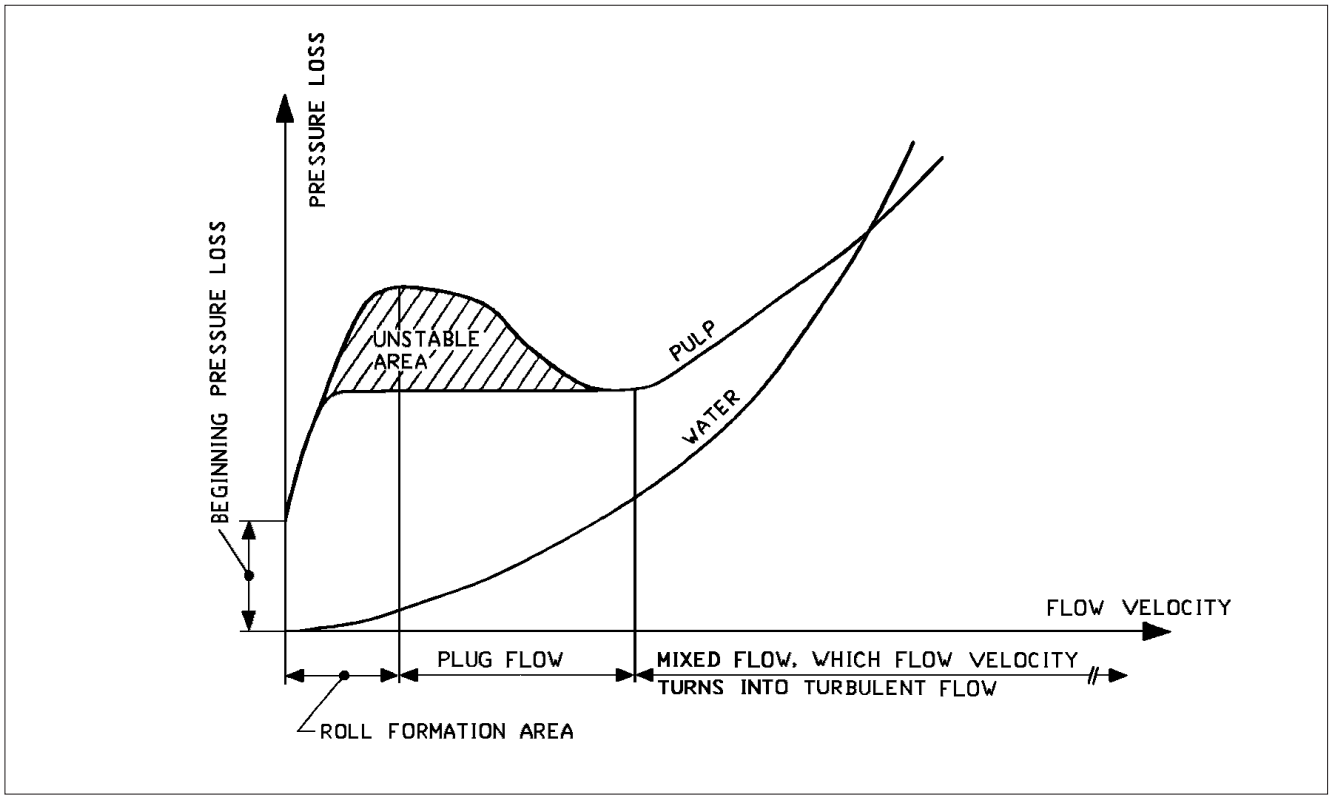


Fig. 1.

High consistency valves open angle restriction to 70º

In the extensive testing a flow correction coefficient k was created. Correction coefficient varies between 0.3 and 1.

k = (flow of stock)/(flow of water)

The differential pressure across a pulp stock control valve has largest effect on the correction coefficient k. Particularly very small differential pressure need a large correction (see figure 2).

When more flow goes through the valve typically the pressure differential over the valve degreases and also the correction coefficient degreases. If the pressure differential goes low enough pulp stock will be plugged in the valve.

To ensure smooth flow through the valve at all cases 70 degree opening restriction is used (pressure differential stays at higher level over the valve). If at all times big enoug pressure differential can ben guaranteed this restriction is not needed.

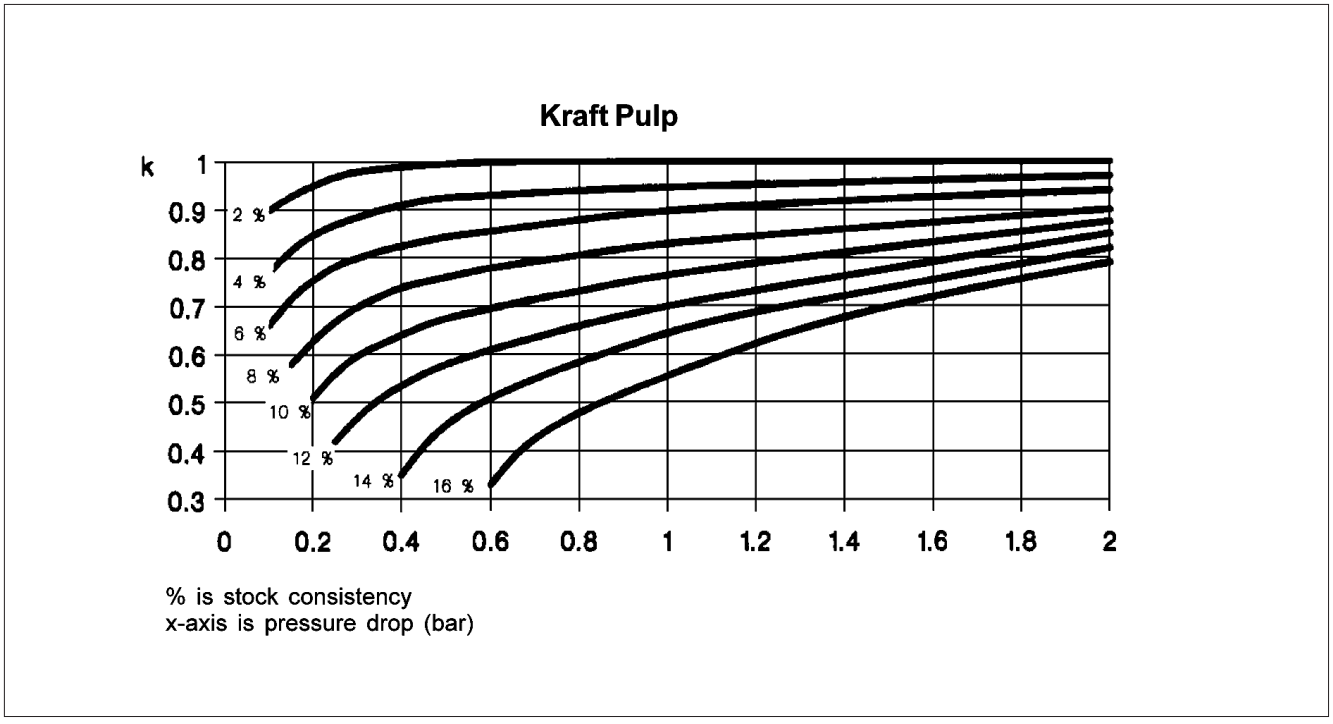


Fig. 2.

Recommended units

Below units are recommended when air supply is 5 barg.

	Double acting actuator
Dimensions in mm	R2_S080/100CJJK - B1CU9/20 - ND9103
	R2_S100/150CJJK - B1CU9/20 - ND9103
	R2_S150/200CJJK - B1CU11/25 - ND9103
	R2_S200/250CJJK - B1CU13/25 - ND9103 R2_S250/300CJJK - B1CU17/35 - ND9106 R2_S350/400CJJK - B1CU20/70 - ND9106
	R2_S400/450CJJK - B1CU25/95 - ND9106
Dimensions in mm	R2_S03/04CJJK - B1CU9/20 - ND9103
	R2_S04/06CJJK - B1CU9/20 - ND9103
	R2_S06/08CJJK - B1CU11/25 - ND9103
	R2_S08/10CJJK - B1CU13/25 - ND9103 R2_S10/12CJJK - B1CU17/35 - ND9106 R2_S12/16CJJK - B1CU20/70 - ND9106
	R2_S16/418CJJK - B1CU25/95 - ND9106

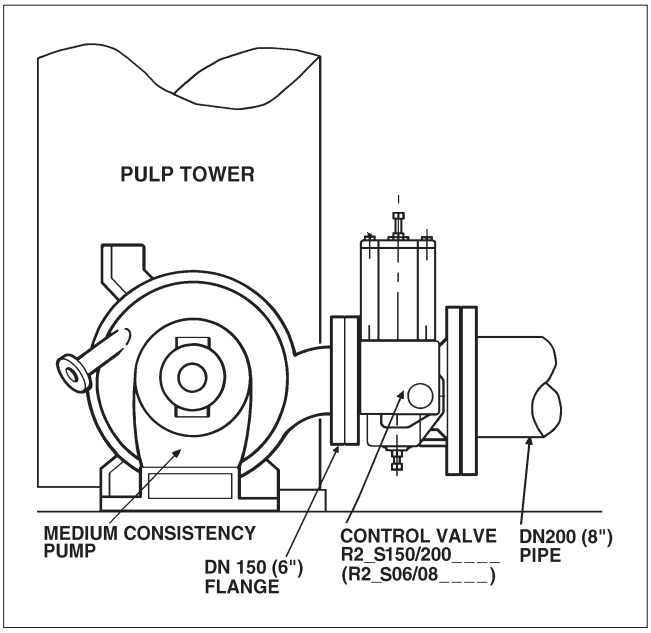


Fig. 3.

In case of electro-pneumatic positioners (NE) option W vibration resistance model must be used.
Available pressure classes are:

- J = DIN PN10
- K = DIN PN16
- L = DIN PN25
- M = DIN PN40
- C = ASME 150
- D = ASME 300
- R = JIS 10K
- S = JIS 16K
- T = JIS 20K

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