NELCROSS DILUTION VALVE CONTROL SYSTEM

General
The cross direction basis weight profile control by direct addition of dilution water is an advanced method that offers real benefits for the control of the paper machine headboxes.

Dilution water is fed through a large number of valves and the actuators of these valves control the flow at discrete zones. The above illustration shows the system communication used.

Dilution control results in better resolution
It provides for more precise flow distribution and gives better cross direction basis weight profile quality.

The demand for more stringent web profile uniformity, as well as the advances in measuring and control techniques have made dilution control prominent over the conventional methods.

Neles Controls is now introducing a complete dilution control system, NELCROSS, which directly operates the actuators and the valves. It offers independent cross direction control of the basis weight profile by the dilution valves.

Applying proven technology
Dilution valves are controlled by small stepping-motor-driven actuators. All control units are connected with RS-485 bus to the NELCROSS interface unit. The interface unit allows local control of the valves and RS-232 connection with Modicon Modbus protocol to the process computer (QCS or DCS).

The algorithm in the process computer optimizes individual flow zones and their adjustments based on the basis weight profile.

Neles Controls has many years of experience in the design and installation of the stock flow basis weight valves where similar techniques are applied.

Benefits
The NELCROSS system provides superior advantages:

- More control accuracy and better results than achieved with the conventional slice control method.
- High control resolution.
- Proven special gear ("Harmonic Drive") without mechanical backlash.
- Local control for easy start-up and configuration adjustments by the interface unit.
- Different valve sizes and types depending on the application and the dilution water applied.
Components of the NELCROSS package

Actuators
Every dilution valve in the system is driven by its own compact electric actuator. The actuator consists of a stepping motor unit and a special gear drive assembly. These are designed to ensure backlash free torque transmission.

For manual operation a small handle can be used. It indicates also the valve position.

The valve position is controlled by driving the stepping motor connected to the gear unit. IP65 stainless steel cover protects the stepping motor. To provide the valve position feedback an optical encoder is mounted to the stepping motor. This reads the incremental rotation of the unit and the information is transmitted to the control system. Shielded cables and protected electric plugs are used.

Dilution valves
Neles Controls uses rotary type ball and plug valves and axial flow globe valves in this application. The dilution water supply rate and concept determines the type of valve selected.

To size the valves to achieve the best dilution effect requires knowledge of the valve characteristics and the pressure conditions. The pipe size range is normally between 10...30 mm / 0.4...1.2 inch.

The dilution flow rate needed for the headbox varies depending on the application and different design parameters. As the collection of fibers in use is a concern, dilution valves must have a clean surface finish on the internals. Neles Controls designs gives a smooth flow pattern, low pressure loss and a rigid adaptation to the actuator without mechanical backlash.

Control electronics
The NELCROSS system consists of a valve mounted to an electromechanical actuator with a stepping motor and the control electronics. The main components of the complete system are described as follows:

Interface unit
The interface unit operates in a response to a control signal from the process computer. Its primary function is to be the interface between the stepping motor control units and the control (or quality) system of the paper machine.

The interface unit has a graphical LCD-display and keyboard with push buttons for local operations and configuration of the system.

The operator can activate certain menus to make configurations at start-up. The interface unit display is used to visualize the opening position of the individual dilution valves and their setpoints.

Stepping motor control unit
The communication between the interface unit and the stepping motor control unit is made by the RS485 interface.

One motor control unit can incorporate up to six motor control cards. Each card can drive up to two stepping motors. The system is built by adding these modules up to the needed number of valves for the complete system.
Valves

Standard version:
- 3-piece ball valve
- Body: stainless steel, 1.4404 / AISI 316L
- Ball: stainless steel, 1.4404 / AISI 316L
- Stem: stainless steel, 1.4404 / AISI 316L
- Seat: PTFE
- Liner (space filling): PTFE
- End connections: according to customer’s specification *
- Sizes: DN 10, 15, 20 / 3/8", 1/2", 3/4"
- Pressure class: PN 40
- Actuator mounting: F03/F04

* Standard end connections, one side welded end according to DIN 3239. Other side threaded according to DIN 2999.
(For other valve types please contact your Neles Controls sales contact person.)

Actuator

Gear drive is "Harmonic Drive" type
Stepping motor is 2-phase (bipolar) stepping motor with encoder for position
Output torque is 12 Nm / 8.9 ftlbs.

Interface unit

Mini-Panel "MP100" with RS232 connection and Modicon Modbus protocol.
RS485 interface to the stepping motor control unit.
Keyboard and display included for:
- configuration
- mode of operation
- alarms
- valve position/setpoints indication and local control

Valve/Actuator

These dimensions apply for standard end connections

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Dimensions in mm

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Dimensions in inch

Stepping motor control unit

Installation of electronic cards in a 19" rack:
- power supply card
- interface card
- desired number of motor cards
A complete control unit consists of a desired number of modules. One module serves up to 12 motors/valves.
TYPICAL INSTALLATION

How to specify a NELCROSS system

To specify a system for a dilution headbox the following application data is required.

- Flow data: total feed flow to the headbox and the dilution ratio or the flow through single valves (requested Cv rate)
- Description of the dilution water: clarified white water or other
- Pressure conditions: inlet and pressure differential at the valves
- Number of valves and desired distance between the valves
- End connections for the valves
- Installation environment: where should the electronics and the interface unit be installed
- Other customer requirements of importance

INTERNATIONAL MANUFACTURING AND SALES LOCATIONS

UNITED STATES: Shrewsbury, Massachusetts. MEXICO: Chihuahua. BRAZIL: São José dos Campos.

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