Basis Weight Valve Package-Payback Considerations

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INTRODUCTION

The requirements for paper quality are getting higher, as for example the equipment in printing houses is becoming more efficient and demanding.

This relates with the need to improve the control of the paper making process. More and more distributed control systems, computer-based gauging and programmable controllers are being installed.

On-line quality control systems are developed to reduce property variations in the machine direction (MD). The latest equipment is geared to respond quickly to changes during disturbances, grade changes etc. to minimise the quality losses.

The basis weight valve is one of the connected devices where all the efforts can be lost. This paper discusses the payback for investment in a state of art Basis Weight Valve Package.

THE NELCONT® BASIS WEIGHT VALVE PACKAGE

Designed specifically for basis weight control, it comprises a V-port metal seated segment valve with a two speed stepping motor driven backlash-free actuator.

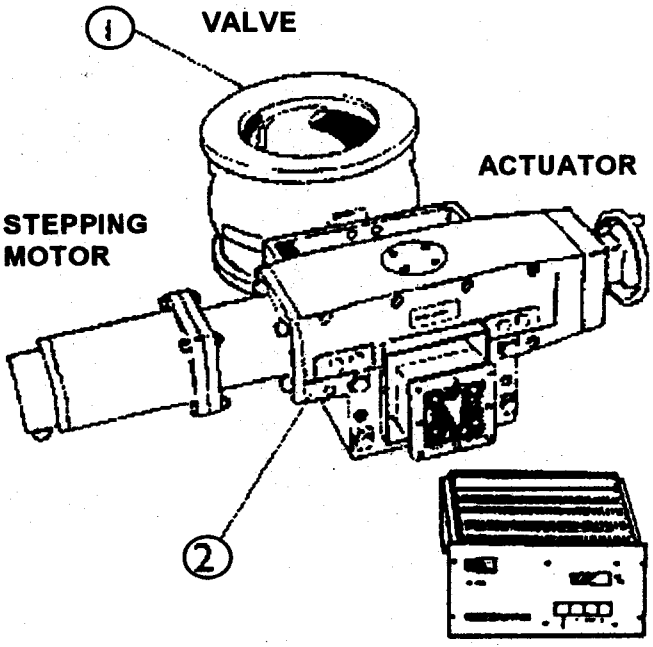

Figure-1

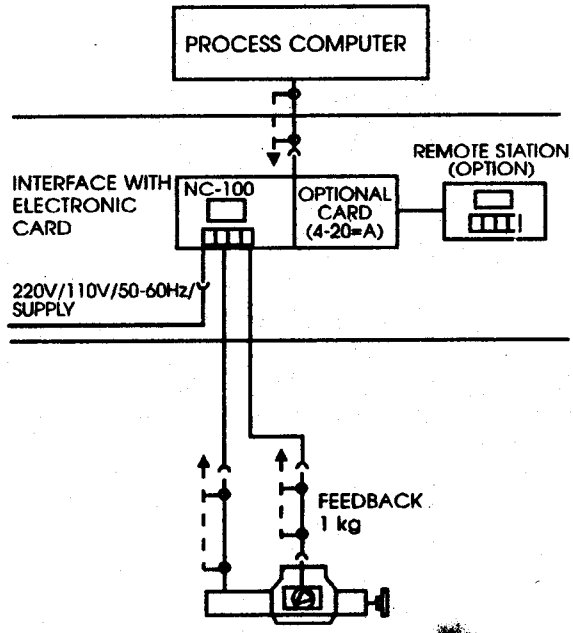

Figure-2

M/s Blue Star Limited
(Process Instruments Department)
13, Community Centre, New Friends Colony,
New Delhi-110 065,

on behalf of

M/s Neles-Jamesbury Pte. Ltd.
(Pulp & Paper Division)
501 Orchards Road # 05-09
Wheelock Place
Singapore-508960,

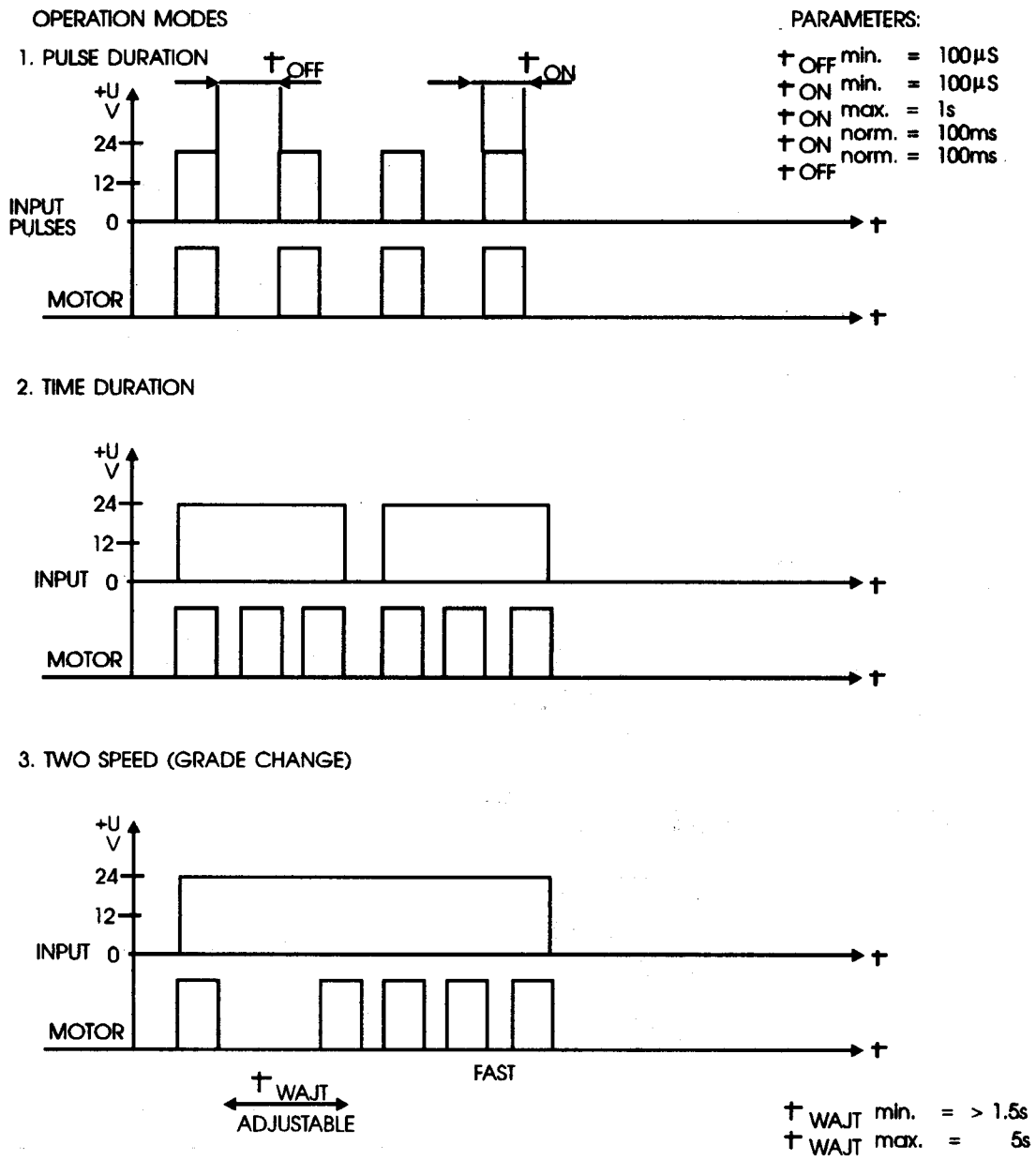

Figure-3

The metal seats in the control valve ensure long trouble free performance with no requirement of seat replacement as in conventional soft seated valves.

The stepper motor actuator has a resolution of upto 8800 repeatable steps for 90 degree rotation.

An interface unit transfers the computer output signals to the actuator. This ready to install rack accomodates the electronic card to transfer the computer output signals to the actuator.

OPERATION METHODS

The basis weight valve package has features to adopt different digital control signals **(figure 3).**

In automatic control the unit operates using alternatively different methods depending on input signal and installed electronic card:

Pulse train mode

Time duration mode

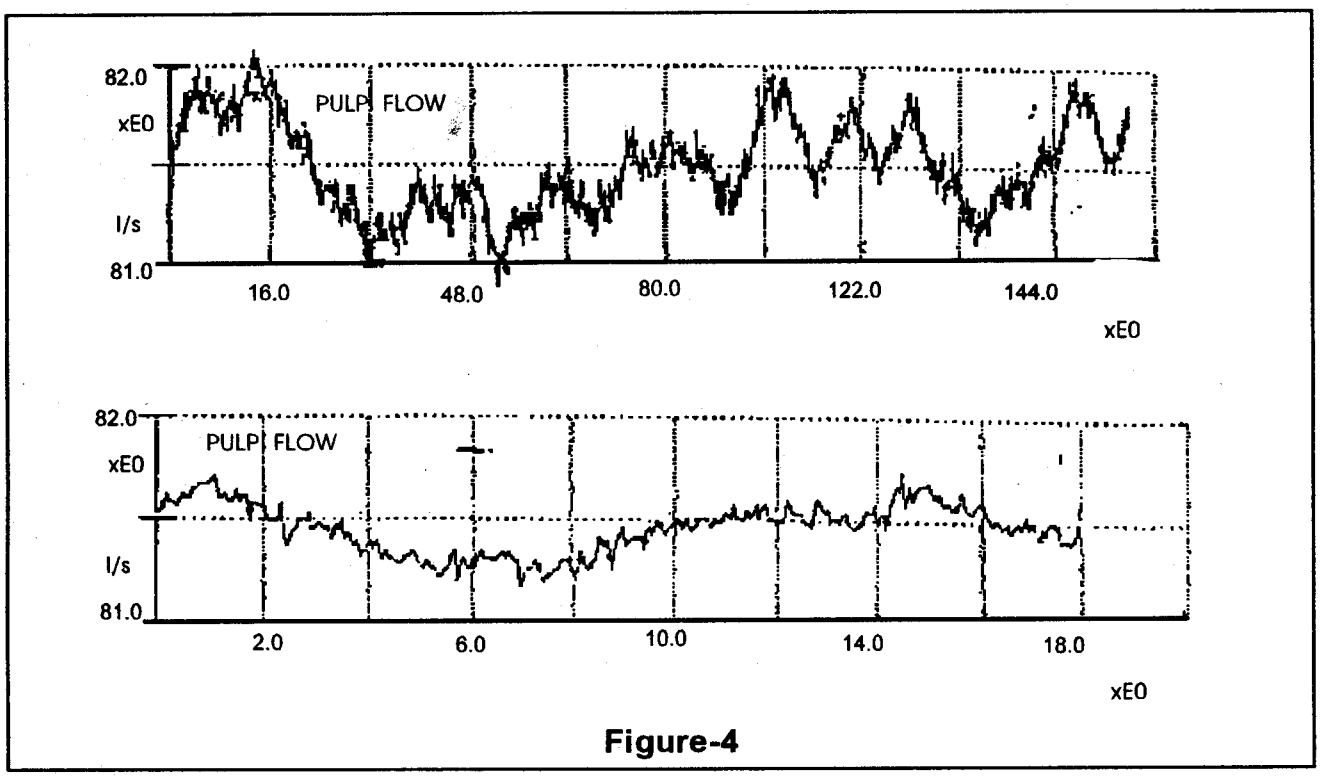

Figure-4

The combination of pulse and time duration mode enable the switch to fast actuator rotation. This two speed feature is beneficial at e.g. grade change (see 3. mode in figure 3).

ECONOMY CONSIDERATIONS

Paper and Paper board are sold by weight. In some grades (printing) the specification allows no greater than 0.2gm/m² variation.

The faster we can make the adjustments for the correcting action and for example reduce the time spent for grade changes the more efficient is our paper machine.

As known, the typical variations in the machine stock flow are quick and the amplitude is short. Below is a sample reading of a flow transmitter (l/s) over 150 seconds and 20 seconds in **figure 4.**

As the variations in the thick stock flow appear commonly as high as 0.2 l/s in an amplitude range of 10 seconds, it becomes obvious to arrange the control loop so that both long term and short term upsets can be managed.

In some paper grades the percentage of costly fibres can be reduced by installing a new basis weight valve package.

In the sample cases presented below we show the benefits of installing a quality valve.

FEATURE I: FAST GRADE CHANGE

The speed of the actuator is beneficial in all grade changes. Let us look at a paper machine producing paper 60g/m² and we have to make a grade change of 10 g/m².

SAMPLE CASE 1

Production	100000 t/a
Efficiency	85%
Flow	9000 l/min
Valve Opening	50%
One signal (step/pulse) results	71/min

See attached control valve sizing sheet(figure 5)

In the grade change:

Change of flow	1500 l/m
Change of opening	8.3%

NELES-JAMESBURY CONTROL VALVE SIZING SHEET VO92 3.0

----------REFERENCE DATA----------

Item/Tag No. ----------	ONE PULSSIGNAL INFLUENCE TO FLOW RATE
Date/Initials ----------	03-06-93 / JB
Customer/Inquiry No. ----------	
Neles-Jamesbury ref.no.	RILN250AJJK-NELCONT 3000 30/W30-NC100 SI

----------PROCESS DATA----------

Pipe inlet diameter	--- mm	350.00		
outlet diameter	--- mm	350.00	schedule no.----	40
Fluid nature	-------		Pulp	
description	-------		Kraft/Chemical pulp	
consistency	-------		4.00	
critical pressure		mH_2OA	2259.4	
Case no.	-------		1.	2.
Flow rate	-------	l/m	9000.0	9007.0
Upstream temperature	-------	degC	35.000	35.000
pressure	------	mH_2OA	24.000	24.000
vapour pressure	-------	mH_2OA	0.573	0.573
Differential pressure	-------	mH_2O	8.100	8.100

---------- VALVE SELECTION ----------

Description R-SERIES SEGMENT VALVES, METAL SEAT(RED./1-4) Code R
Size mm 250 Max. FpCv 2671.7 Travel type 95 degrees

----------CALCULATED PERFORMANCE----------

Capacity	FpCv	743.56	744.14
Percent of full travel		63.94	63.96
Opening in degrees		62.90	62.92
Sound pressure level	dBA	49.45	49.45
Flow velocity (inlet)	m/s	3.056	3.058
Terminal pressure drop	mH_2O	16.70	16.70

Figure-5

Time taken by Nelcont 3000	5.8 seconds	Total production	250 days
Time taken by competitors	43... 53 seconds	Total time saving	18.5 hrs
Gain with Nelcont 3000	0.75 min/change	Production increase	362 tons
Changes/day	6 times	Price of Paper	780 USD/ton

Increase of turnover	280,000 USD
Target profit	25%
Increase in profit	70,000 USD

NOTE: Above figures are indicative and approximate
USD=U.S. Dollars

At the same time the amount of broke decreases and the efficiency improves. In a paper machine an average energy consumption is 0.8 Mwh/ton and the steam consumption is 4.5 GJ/ton. During breaks the energy wasted stays on the same level, but the steam needed is approx. 50%.

FEATURE 2: ACCURACY OF THE CONTROL

Some paper grades may have a slight variation in their average basis weight. In others the basis weight may never be off.

In all cases we gain in other important paper properties, such as printability, gloss etc., if we can keep the basis weight variation (2 sigma) narrow.

For example moisture variations can be caused by upsets in the basis weight. In paper grades where a coating is applied this can generate serious problems.

In woodcontaining printing papers a tight control of the target basis weight pays back through savings in the consumption of chemical sulfate pulp.

A paper machine may suffer from breaks caused by weak areas in the sheet. To fight this you may want to keep the sulfate fiber content at a certain level.

If we can keep the basis weight variation low we can set the target for sulfate component lower (by 1%) and gain the following savings in costs.

Sample case 2.1: Lowering the sulfate percentage

Production	1 00 000 t/a
% sulfate component	15
% sulfate, new target	14
Reduction of sulphate	1000 t/a
Price of replaced pulp(sulphate)	2800 FIM/ton
Price of replaced pulp(mechanical)	2000 FIM/ton
Difference	800 FIM/ton
Annual savings	8 00 000 FIM

Some savings can be achieved in paper machine running limited by the drying capacity. The tight tolerances in basis weight will allow us to raise the target moisture at the reeling section by 0.1%.

The steam consumption can be reduced and the production increases.

Sample case 2.2: Seeking new moisture target

Steam consumption	4.5GJ/ton
Dryness after press section	48%
Moisture at reeling	8%
New target	8.1%
Savings in steam	1000 GJ
Added electricity	278 MWh
Savings	@ 170 FIM/MWh
Production increases	227 tons
Price of Paper	3500 FIM/ton
Increase in turnover	749 000 FIM
Profit	25%
Increase in profit	198 000 FIM

We can calculate also annual fiber savings in case the basis weight target is not changed

Amount of saved pulp	100 tons
Average price	2 100 FIM/ton
Total savings	2 10 000 FIM

NOTE: Above figures are indicative and approximate
FIM = Finnish Mark

To resume the above considerations we can say that the reduction of the sulfate pulp (component) by only 0.5% is very effective in the pay-back calculation and the investment can be justified. The increased accuracy results in better paper quality. The above described benefits can be achieved in cases where the valve unit can be controlled with the max. resolution 2...4 times every second. Not all control systems can do it.

PROBLEMS

Below are listed few things which are very often problems in connection with the basis weight control:

- piping arrangements cause vortex whirls.
- consistency compensation in the control systems is excessively filtered and the basis weight is reacting on this like on a real change of value. Often also the proportional band is set way too high.
- the pressure in the consistency water header fluctuates.
- the control system is tuned as for ordinary valves. With Nelcont 3000 you should set the hysteresis to zero in the valve logic block.
- the mixing of pulp and white water is not complete. The velocity of the pulp flow should be 6...10 higher than the flow velocity of white water.
- the level control in the machine chest is not steady.