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LEVEL TANK CONTROL

PROCESS
The valve controls white/black liquor flow to the top of the impregnation vessel and maintains the liquor level in the digester or impregnation vessel.

PROCESS FLOW

APPLICATION DATA
— Tag = LV-7
— Fluid = white/black liquor
— T = 235°F
— P = 300 psig
— dP = 45 to 90 psi
— Q = 1000 to 3000 gpm
— Size = NPS 6 to 8

CUSTOMER PAINS
— Scaling
— Poor controllability when using a full bore ball valve for control
— Cavitation
— Capacity limitations

QUESTIONS TO ASK THE CUSTOMER
— What valve is currently used in this application?
— How often do you have to take the valve out for maintenance?
— Are you having controllability or cavitation issues?

SOLUTION
Fisher™ V300 or CV500 valves (for KOB3 replacements, very heavy scaling)
— CL300
— CG8M SST construction
— Sealed bearings (only for CV500 valves)
— Reverse flow
— Alloy 6 seats

HIGHLIGHTS
— The Fisher CV500 valve reduces issues with scaling.
— Straight-through flow design provides high capacity.
— Precise contouring of the V-notch ball provides excellent flow characteristics and control.
— The V-notch ball cams into and out of the seat, minimizing contact with the seat ring for reduced wear and friction (decreases need for constant maintenance).

COMPETITIVE INFORMATION
— Older digesters originally used Fisher CL300 A body valves.
— Newer digesters use Neles full bore PD series valves.
— Neles offers full bore ball valve with scraper seats, but has poor control.
— The CV500 valve offers better controllability and has a rugged design. Make sure Cv requirements are met.
DIGESTER SWITCHING VALVE

PROCESS
Liquor is extracted from different areas of the digester and sent to the bottom circulation heaters to cook the wood chips. Valves fully stroke every 90 seconds to cause a flow reversal through the extraction screens, preventing the screens from plugging the chips and fiber.

PROCESS FLOW

CUSTOMER PAINS
— Short service life due to wear, erosion, and high-cycling

QUESTIONS TO ASK THE CUSTOMER
— What valve is currently used in this application?
— How often do you have to take the valve out for maintenance?
— Do you experience short service life of valves due to high-cycle operation?

SOLUTION
Fisher 8580 high-performance butterfly valve with 2052 actuator and DVC6200 digital valve controller
— CL300
— CF3M body/disc, chrome-plated disc
— 316 SST/nitrided bearings
— Flowing ring, no seal
— ENVIRO-SEAL™ packing

HIGHLIGHTS
— The Fisher 8580 has been tested for 1,000,000 cycles.
— The Fisher 2052 has been tested for 500,000 cycles.
— Reduced maintenance requirement compared to quad seal.
— Leverage Fisher high-cycle application documentation to differentiate us from the competition.

COMPETITIVE INFORMATION
— Many Kamyr digesters have Neles valves.
— Typical valves are Neles B2/M series.
— Actuators need to be rebuilt every year and packing needs to be changed every one to two years.
APPLICATION DATA

**Trim Liquor Switching**
- Tag = KV-8 A&B
- Fluid = black liquor
- T = 325°F
- P = 130 psig
- dP = 130 psi
- Q = 1500 gpm
- Size = NPS 6 to 8

**Modified Cooking Extracting Switching**
- Tag = KV-19 A-D, E, F
- Fluid = black liquor
- T = 325°F
- P = 170 psig
- dP = 170 psi
- Q = N/A
- Size = A-D: NPS 8, E and F: NPS 3

**Bottom Circulation Return Switching**
- Tag = KV-60 A&B
- Fluid = black liquor
- T = 325°F
- P = 120 psig
- dP = 120 psi
- Q = N/A
- Size = NPS 12 to 14

**Digester Extraction Switching**
- Tag = KV-16 A-D
- Fluid = black liquor
- T = 325°F
- P = 150 psig
- dP = 150 psi
- Q = 1500 gpm
- Size = NPS 6 to 8

**Bottom Circulation Screen Backflush**
- Tag = KV-60 C&D
- Fluid = black liquor
- T = 325°F
- P = 120 psig
- dP = 120 psi
- Q = N/A
- Size = NPS 6 to 8

**Wash Extraction Switching**
- Tag = KV-20 A-D
- Fluid = black liquor
- T = 260°F
- P = 185-195 psig
- dP = 185-195 psi
- Q = 1500 gpm
- Size = NPS 3 to 8
**PROCESS**
This valve is located at the top of the digester to control pressure. The flow through the valve allows direct steam to pass through the chips/liquor in the digester during the early phase of cooking.

**PROCESS FLOW**

**APPLICATION DATA**
—Tag = PV-1
—Fluid = steam

**CUSTOMER PAINS**
—High wear

**QUESTIONS TO ASK THE CUSTOMER**
—What valve is currently used in this application?
—Does this valve require frequent attention or maintenance?
—Has this valve contributed to any process interruptions or unplanned shutdowns?

**SOLUTION**
Fisher V500 valve with 2052 actuator and DVC6200 digital valve controller
—CG8M SST body
—Reverse flow
—Stage-two trim minimum, stage-three trim preferred
—Sealed bearings

**HIGHLIGHTS**
The Fisher V500 valve combines the ruggedness of a globe valve with the efficiency of a rotary valve.
Streamlined flow passages, durable components, and an array of erosion-resistant trim materials help promote longer, dependable service life.

**COMPETITIVE INFORMATION**
In the past, Fisher offered the V100 valve and Neles offered full ball designs, including the S2, PC, QC, and QMA models.
This is not an easy-to-win opportunity. Understand the customer’s current situation and perception. Determine why the customer is getting their current results. Investigate the application, including a sizing review, valve damage assessment, and review piping geometry.
It is also beneficial to have larger downstream pipe diameter right at the discharge of the gas off valve and in a straight line.
PROVEN RESULTS

MAINTENANCE COST REDUCTION WITH REVERSE FLOW VALVES

CHALLENGE
All eight batch digester gas off valves were severely damaged about every six months of operation due to highly erosive service using a competitor’s valve. All valves were rebuilt or replaced every eight months. The valves were usually leaking before the scheduled rebuild. The site had already worked with the control valve vendor, trying various hardness treatments and materials, with no appreciable improvement in service life.

SOLUTION
R.E. Mason (REM) provided new 2-inch Fisher V500 control valves with digital valve controllers using reverse flow. Downstream piping was expanded from two to three inches to reduce downstream velocities and piping damage. Before replacing all valves, REM visually inspected and performed FIELDVUE diagnostics on the first valve installed after 14 months of service. It was in like-new condition and still has no appreciable wear today, after five years of service.

RESULTS
The customer was able to increase reliability and repeatability with an engineered product they trust. The time and expense of the ongoing valve maintenance has been eliminated. An annual maintenance cost reduction of $30,000 to $50,000 USD resulted from valve parts savings alone. Also, the valves now operate as commanded by the control system and there is some reduction in the amount of steam vented.

For more information on successes, contact the Global Industry Sales Pulp and Paper Team.
**NATURAL GAS FRACTIONATION**  
**PULP & PAPER PLAYBOOK**  
Company Confidential—For Internal Use Only

**DIGESTER BLOW VALVE**

**PROCESS**  
The blow line flow control valve helps control stock flow out of the digester to the blow tank. Cooked chips that pass through the valve are subjected to a sharp pressure drop. This causes them to explode and break up into individual fiber bundles, which are a form of raw pulp with high consistency (10%). Typically there are two lines; customers run one or both, depending on throughput and utilization rates.

**APPLICATION DATA**  
— Tag = FV-12A/12B  
— Fluid = high consistency pulp (10%)  
— T = 180°F  
— P = 225-350 psig  
— dP = 80 psi

**CUSTOMER PAINS**  
— Excessive wear on control valves  
— High consistency of pulp can cause plugging if the wrong valve model is selected  
— Erosion

**QUESTIONS TO ASK THE CUSTOMER**  
— What valve is currently used in this application?  
— What are the maintenance requirements for this valve?  
— Are you seeing issues with plugging? If it is a full bore ball valve in-service, are you seeing issues with control?

**PROCESS FLOW**

**SOLUTION**  
Fisher V300 valve with 2052 actuator and DVC6200 digital valve controller  
— CG8M SST body  
— Alloy 6 V-notch and bearings  
— HD metal seal  
— Chrome carbide coating  
— Operate valve at >60% open  
— Oversized actuator

**HIGHLIGHTS**  
— Position the Fisher V300 valve with the key message around a lower potential for plugging than full bore ball valves. In some cases, the CV500 valve option should be considered.

**COMPETITIVE INFORMATION**  
— Neles offers a full bore ball valve solution.
CHLORINE DIOXIDE

PROCESS
Chlorine dioxide is used to bleach and brighten pulp. This chemical addition helps minimize degradation of cellulose fibers. The bleaching sequence can vary from four to six separate stages.

PROCESS FLOW

APPLICATION DATA
— Fluid = chlorine dioxide solution
— Size = NPS 1 to 6

CUSTOMER PAINS
— High chemical usage
— Targeted brightness not achieved

QUESTIONS TO ASK THE CUSTOMER
— What valve is currently used in this application?
— What are the maintenance requirements for this valve?
— Are you having high chemical usage due to poor control of the CIO\textsubscript{2} injection valve?

SOLUTION
Fisher V150 valve with 2052 actuator and DVC6200 digital valve controller

For CIO\textsubscript{2} into stock (>3000 ppm):
— Titanium C3 body/ball
— TCM plus seal
— Titanium GR 5 shaft and titanium bearings
— ENVIRO-SEAL packing

For residual (1000 to 3000 ppm):
— Avesta 254 SMO body/ball
— PEEK HD seal
— Tantalum wave spring
— CK3MCuN shaft
— ENVIRO-SEAL packing

For caustic towers (<1000 ppm):
— Standard SST construction is acceptable

HIGHLIGHTS
— Our key messages should be around very fine control for CIO\textsubscript{2} injection to prevent high chemical usage and target the correct brightness when the solution is in the pulp stock.
— Performance differentiation message could be used to showcase valve performance.
— Reference the Vee-Ball sales guide.

COMPETITIVE INFORMATION
— Globe valves were used in the past. Rotary offerings are more commonly seen due to their cost competitiveness.
— Main competitors are Metso and Valtek.
PROVEN RESULTS

PAPER MILL DECREASES VALVE SET POINT BY 3%

CHALLENGE
A paper mill monitored their critical loops (CLPM report) and found several valves that control ClO₂ to be out of tolerance. The valves were oversized—years ago they needed more ClO₂ in their process, but now they don’t. So, their Vee-Ball valves are operating between 15 to 20% open.

SOLUTION
The existing 2-inch and 3-inch titanium Vee-Ball valves were rebuilt and several new 1-inch and 1.5-inch titanium Vee-Ball valves with DVC6200 digital valve controllers were installed.

RESULTS
— Several valves are currently operating at 4% over set point by flow
— ClO₂ cost per ton $12.13 USD
— Paper machine (PM) 1 = 475 tons per day, PM 2 = 435 tons per day, PM 3 = 1463 tons per day
— Total 2373 tons per day x $12.13 ClO₂ per ton x 335 day per year = $9,642,804 USD
— For every 1% in set point change = $96,428 USD per year
— Savings of $867,852 USD per year with all three lines decreasing set point by 3%
PROVEN RESULTS

TITANIUM VALVE BODY REDUCES PROCESS VARIABILITY AND OPTIMIZES CHEMICAL USAGE

CHALLENGE
A United States (US) paper mill utilized Fisher RSS teflon-lined globe control valves for chlorine dioxide bleaching control. The RSS valve experienced reliability issues because the lined globe design was prone to material wear, resulting in corrosion. Rebuilds were expensive and time consuming, which meant lengthy periods of time without a control valve in place. During this time, only manual control was available, so there was a high level of process variability.

SOLUTION
Control Southern worked with the mill to come up with a more reliable solution that would have control capabilities comparable to that of a globe valve style. The solution was a Fisher V150 control valve made of titanium. The control valves were supplied with spring and diaphragm actuators and DVC6200 series digital valve controllers for excellent controllability. The Vee-Ball valve construction was very familiar to the mill technicians and provided a high level of long-term reliable operation.

RESULTS
Three of the mill’s valves have been switched over to the titanium V150 valve, with a resulting average coefficient of variability (COV) reduction of 40%. This reduction in average COV is based on when the control valve was in manual mode or the RSS valves were in poor condition, which occurred approximately 30% of the time. A savings in chlorine dioxide can be attributed to a lower COV because the process can run closer to set point without over-dosing to make up for variability.

For more information on successes, contact the Global Industry Sales Pulp and Paper Team.
MC PUMP DISCHARGE

PROCESS
Pulp stock is pumped continuously to other areas of the mill. The stock can be up to 18% consistency. Many MC pump manufacturers require expanded downstream piping.

PROCESS FLOW

CUSTOMER PAINS
— Plugging
— Short valve life due to the demanding service
— High maintenance requirements
— Short seat life

QUESTIONS TO ASK THE CUSTOMER
— What valve is currently used in this application?
— What are your maintenance intervals?
— Are you facing any issues with the pump due to the valve? Pressure differential across the valve has to stay above the critical point.

SOLUTION
Fisher V150E valve
— CG8M SST body/ball
— Titanium available for applications where pulp has a high concentration of ClO₂
— Alloy 6 HD seal

HIGHLIGHTS
— Leverage relationship with MC pump vendors to sell V150E valve in this application.
— The V150E titanium valve could be used to displace poorly performing competitor valves in applications with high ClO₂.

COMPETITIVE INFORMATION
— Neles offers their R series with an expanded outlet.
— Neles can offer CL150 and CL300 valves in this application.

For more information, see a flyer about the Fisher Vee-Ball V150E control valve.
GREEN LIQUOR WEAK WASH

PROCESS
This valve controls the flow of weak wash to a dissolving tank. Weak wash contains entrained particulate from lime washing, which can cause scaling. Control of weak wash determines how much green liquor can be produced, which affects the amount of white liquor returning to the digester.

PROCESS FLOW

APPLICATION DATA
— Tag = FV-9
— Fluid = secondary condensate
— T = 176°F
— P = 75 psig
— dP = 40 to 45 psi

CUSTOMER PAINS
— Scaling
— Poor control

QUESTIONS TO ASK THE CUSTOMER
— What valve is currently used in this application?
— How often do you have to take the valve out for maintenance?
— What is your main concern with these valves, precise control or tight shutoff?

SOLUTION
Fisher V150 or CV500 valves with 2052 actuator and DVC6200 digital valve controller (for KOB3 replacements or very heavy scaling)
— CG8M SST body
— Alloy 6 HD seal
— Alloy 6 bearings

HIGHLIGHTS
— The Fisher CV500 valve is an excellent choice to prevent scaling.
— This valve is a control valve and not an on/off valve. Customers value a valve that provides good control over tight shutoff. This should be our key message against competition.

COMPETITIVE INFORMATION
— Neles will offer a V-notch if they see a Vee-Ball valve on site. Otherwise, they will offer their eccentric plug, Finetrol.
— Masoneilan offers the Camflex.
— Some competitors approach with a full bore valve with scraper seats, but they can be expensive.
— Sometimes valves do not get cycled enough, which causes worry about dead spaces. Soft seal should be offered in these cases.
PROVEN RESULTS

PAPER MILL SAVES ROUGHLY $2,000 USD PER MONTH

CHALLENGE
A Virginia (USA) paper mill reopened for business in June 2012. The mill only runs one machine, which was converted into a fluff machine that produces rolls of fluff paper. The mill had two 6-inch Masoneilan Camflex II control valves on a green liquor application in the #6RB area. The actuator diaphragm has a boot-like rubber material. The valves were not performing well, maintenance was becoming cumbersome, and runtime was affected by these valves.

Maintenance was receiving calls and work orders from operations about once a month because the valves were not controlling the green liquor properly. The actuator diaphragms kept tearing, which resulted in air leaks and poor valve performance. Maintenance replaced four diaphragms in a six month period. The area supervisor was tired of replacing diaphragms and having to isolate the valves when they needed to change them out.

SOLUTION
The solution was to replace both 6-inch Masoneilan control valves with two Fisher V150 ball valves with 2052 actuators and DVC6200 digital valve controllers with Advanced Diagnostics (AD).

RESULTS
Since the installation of both valves, the maintenance department has received zero work orders or calls from operations for either of the Fisher valves. The valves have saved the mill roughly $2,000 USD per month in material and labor costs. In six months, the valves paid for themselves.

For more information on successes, contact the Global Industry Sales Pulp and Paper Team.
WHITE LIQUOR PRESSURE FILTER SWITCHING

PROCESS
White liquor is separated from lime mud through a pressure filter. Lime mud builds up on the filter and the valve opens causing a pressure drop, which removes the build-up. This occurs every five to ten minutes and has a solid content of 15 to 20%.

APPLICATION DATA
— Tag = FV-14/15
— Fluid = lime mud or white liquor
— T = 200°F
— P = 50 psig
— dP = 40 to 50 psi

CUSTOMER PAINS
— Erosion
— Wear, due to frequent and fast switching
— Poor (too low) and inconsistent chemical conversion
— Excessive wear of mechanical equipment due to corrosive and abrasive material
— Poor consistency in lime feed to slaker

QUESTIONS TO ASK THE CUSTOMER
— What valve is currently used in this application?
— What are the maintenance requirements for this valve?

SOLUTION
Fisher 8580, 8532 valves with 2052 actuator and DVC6200 digital valve controller, or TriTork with Valve Automation™ actuation (if triple offset is required)
— CG8M SST body
— Stainless steel chrome-plated disk
— Alloy 6 bearings

HIGHLIGHTS
— The Fisher 8580 valve has been tested for 1,000,000 cycles.
— The Fisher 2052 actuator has been tested for 500,000 cycles and reduces maintenance requirements compared to a quad seal.
— Leverage high-cycle application documentation to differentiate us from the competition.

COMPETITIVE INFORMATION
— Difficult application, so customers switch valves out frequently.
— Solids can build up in the valve if tight shutoff is not achieved.
— Pentair offers their Vanessa triple off-set valves.
— Neles offers butterfly valves (B2 and M series).
— Other competitors’ manual butterflies are seen in this application. They are cheap, but do not last in the long run.
PROVEN RESULTS

PAPER MILL IMPROVES DELIVERY DATE AND RETURN ON INVESTMENT

CHALLENGE
A Southeastern United States paper mill has one fluff machine that produces fluff paper. They had two 20-inch Jamesbury butterfly valves on their white liquor pressure switching application. The valves cycle many times and the maintenance department had been replacing the packing and actuators because the valves were leaking.

The two valves are installed horizontally, so that pipe valve A is above valve B. The Jamesbury actuator is very heavy and puts a lot of weight and pressure on the valves’ packing and bonnets. When valve A would leak out of the packing, it would leak onto valve B’s actuator and would cause corrosion. The supervisor had to purchase new valves, replace the packing, and buy new actuators for this application. The customer desired a solution that was more reliable, required shorter lead times, and provided a better return on investment.

SOLUTION
The solution was to replace both 20-inch Jamesbury valves with 20-inch Fisher 8532 high-performance butterfly valves. The Fisher valves included a 1061 piston actuator with Alloy 6 bearings and ENVIRO-SEAL live-loaded PTFE packing.

RESULTS
The paper mill’s return on investment was realized as soon as they sent a purchase order. This solution provided the mill with a shorter delivery date (five weeks) compared to the Jamesbury solution. The price per valve was also $14,000 USD less than the Jamesbury solution, having an up-front savings of $24,000 USD. The Fisher valve assembly requires less maintenance and will provide the mill with additional savings.

For more information on successes, contact the Global Industry Sales Pulp and Paper Team.
LIME MUD UNDERFLOW

PROCESS
Lime mud underflow from white liquor clarifier must be washed to recover residual cooking chemicals. Washed lime mud is removed at 45 to 50% of suspended solids and then sent to storage.

PROCESS FLOW

APPLICATION DATA
—Tag = FV-6, 8, 16, 19
—Fluid = lime mud
—T = 175°F
—P = 35 psig
—dP = 20 to 30 psi
—Q = 100 to 300 gpm
—Size = NPS 3 to 6
—SG = 1.36

CUSTOMER PAINS
—Very erosive, caustic (pH > 12) fluid
—Application with the highest amount of solids
—High pressure drop
—High energy use caused by moisture variation in kiln feed
—Poor calcining
—Poor combustion control, flame profile control

QUESTIONS TO ASK THE CUSTOMER
—What valve is currently used in this application?
—What maintenance is required for this valve?
—Does the valve meet your control requirements?

SOLUTION
Fisher V500 valve with 2052 actuator and DVC6200 digital valve controller
—Erosion resistant materials: VTC plug, seal, retainer and Alloy 6 sealed bearings
—Reverse flow
—Plug-up orientation

HIGHLIGHTS
—Position the Fisher V500 ceramic trim valve as a way to achieve reduced maintenance and higher controllability.

COMPETITIVE INFORMATION
—NilCor and Fujikun offer a ceramic plug valve.
—Neles offers the Finetrol.
—Masoneilan offers the Camflex (not a major player).
—Cashco offers the Ranger. It is cheaper, but not as robust.
—Flowrox offers a cheap pinch valve which has a liner that must be changed for maintenance. However, these are more useful in on/off applications rather than control.
ECCENTRIC PLUG VALVE REDUCES MAINTENANCE

CHALLENGE
Lime mud is extremely erosive and difficult to handle due to fine particulate and a high solids concentration. This application is a critical path for the recovery system and has a direct economic impact on the mill. A competitor’s full port ceramic ball valves had been installed in this paper mill’s mud washer for several years. While ceramic is indeed part of the solution, the flow profile and rotating-grinding action of a full port ball valve leads to its demise in lime mud service. These valves would typically fail in seven to ten months, requiring frequent maintenance trips to the field and unnecessary waste.

SOLUTION
Control Southern recommended the mill’s engineering department install the Fisher V500 valve, a proven solution that would significantly prolong valve lifecycle and provide better control. The V500 valve is an eccentric plug valve that is similar to a segmented ball valve. The key difference for this application is the cam action that prevents the seat and plug (ball) from the rotating-grinding action that typically occurs with standard ball valves. The valve’s construction also creates a dramatically different flow profile, relieving the internal velocity found in a standard ball valve body.

RESULTS
Coupled with ceramic trim and a sealed Alloy 6 bearing, this valve will last three to five years before requiring service. The valve seat is reversible, which extends the life of the seat ring. While the initial cost of these valves was approximately one and one-half times the existing installation, the number of valves required to keep operating over a five year period was reduced by a factor of 1:8. There was also savings associated with fewer maintenance trips and loss of production time during valve changes.

Total investment: $12,000 USD

Five-year average savings: $60,000 to $70,000 USD

For more information on successes, contact the Global Industry Sales Pulp and Paper Team.
BLACK LIQUOR TO NOZZLES

PROCESS
Black liquor is introduced into the recovery furnace through nozzles or liquor guns. A valve controls the black liquor flow through the nozzles. With improved control, there will be more black liquor to burn, which increases the amount of steam produced and results in more power to the grid.

PROCESS FLOW

APPLICATION DATA
— Tag = FV-5
— Fluid = black liquor

CUSTOMER PAINS
— Corrosion
— Poor control
— Frequent valve maintenance requirement

QUESTIONS TO ASK THE CUSTOMER
— What valve are you currently using?
— Do you see frequent maintenance on these valves?
— Are you having any control problems?

SOLUTION
Fisher V150 valve with 2052 actuator and DVC6200 digital valve controller, or easy-e™ valve (if customer prefers globe valve solution)
— CG8M SST body
— TCM plus seal (for V150 valve)

HIGHLIGHTS
— The Vee-Ball valve helps provide much of the required control and the seal protector ring allows quick and easy seal replacement without having to remove the actuator or ball segment from the valve.

COMPETITIVE INFORMATION
— Neles offers full bore ball valves and RA series valves.
— Controllability of the valve is important to the customer.
PROVEN RESULTS

PAPER MILL AVOIDS PIPING MODIFICATION AND SAVES MONEY WITH INSTANT REPAIR

CHALLENGE
A stainless steel A body valve with a Fisher 657 actuator and a competitor’s pneumatic positioner controlled pressure to a paper mill’s recovery boiler black liquor injection header. Using the Fisher FlowScanner™ diagnostic system, Emerson personnel discovered that the valve was performing marginally. After a meeting with Emerson and Control Southern, the mill decided to replace the valve rather than repair it, due to obsolescence. With only two weeks before the outage, there was little time to get a new valve without incurring substantial expediting expense.

SOLUTION
Switching to an alternate valve style would have required significant time and expense to modify existing piping, so Emerson and Control Southern offered a plan for an “instant repair.” With this plan, Emerson obtained a used 316 stainless steel Fisher easy-e ED body valve and actuator, repaired it back to factory specifications, installed a new Fisher positioner, and had it to the mill prior to the outage. Control Southern helped the mill swap out the valves and returned the old A body valve to Emerson after the outage.

RESULTS
The mill realized a total savings of $7,000 USD by implementing the instant repair, as opposed to expediting a new stainless steel globe valve.

For more information on successes, contact the Global Industry Sales Pulp and Paper Team.
BASIS WEIGHT VALVE

PROCESS
The stock from the stuffbox flows by gravity through a pipe leading down into the basis weight valve. This valve controls the amount of stock going to the fan pump. The basis weight valve influences moisture, brightness, opacity, and strength.

PROCESS FLOW

CUSTOMER PAINS
— Paper machine performance
— Product quality
— High basis weight variability (causes breaks and quality)
— Poor consistency control
— Unexpected bearing and roll failures causing machine shutdown
— Poor headbox pressure/level measurement
— Weak points in the paper which cause web breaks
— Long time needed to change paper grades

QUESTIONS TO ASK THE CUSTOMER
— What valve are you currently using?
— How often do you take the valve out for maintenance?
— Are you seeing a lot of variability in the process because of the valve?
— Is reliability, availability, and maintenance a concern?

SOLUTION
Two Fisher V150 valves with 2052 actuator and DVC6200 digital valve controller
— Coarse control valve (NPS 6-12)
— Fine control valve (NPS 3-6)
— CG8M SST body
— TCM plus seal

HIGHLIGHTS
— Customers prefer the stepper motor product (SKF) with a Fisher DVC6200 digital valve controller with Performance Diagnostics (PD). Position the 2052 actuator with the DVC6200-PD digital valve controller by messaging reliability and availability of service and parts, as opposed to continuously maintaining something old with fewer parts available and non-existent service. This will require a piping modification to install the bypass line for the fine control valve.

COMPETITIVE INFORMATION
— This is an extremely critical application for efficiently operating a paper machine. Many mills have a DeZurik plug style valve with eccentric stepper motor actuator. DeZurik has dominated this application for many years. However, performance is slow and maintenance is difficult because they did not update their product.
LOW FLOW APPLICATIONS

APPLICATIONS
— Coated paper machines
— TiO₂ addition
— Precipitated Calcium Carbonate (PCC) addition
— Ground Calcium Carbonate (GCC) addition
— Lime or ash slurry for pH control
— Talc
— Other abrasives

CUSTOMER PAINS
— Poor controllability
— Short valve life due to wear

QUESTIONS TO ASK THE CUSTOMER
— What valve is currently used in this application?
— Are you having problems with controllability?
— How often are you having to take the valve out for maintenance?

SOLUTION
Fisher Micro-Notch, Macro-Notch balls
— Trims available in 1-inch V150, V200, and V300 valves
— Designed as a standard metal trim for low flow applications
— Ceramic Micro-Notch ball: added to handle abrasive particulate at low flow
— Ceramic Macro-Notch ball: developed to handle abrasive particulate where V500 ceramic capacity is too high and Micro-Notch Cs are too low

HIGHLIGHTS
— Provides excellent control for low flow applications.
— Fisher Ceramic Micro/Macro-Notch can give longer service life (three to five years) depending on pressure drop.

COMPETITIVE INFORMATION
— Many competitive valves fail in four to six weeks in abrasive low flow applications.

SIZING/APPLICATION CONSIDERATIONS
— Small/low flows require accurate data
— Pressure drop is critical
— Viscosity of fluid can have a large affect on sizing
— Long piping runs can have a significant affect on actual P1 at the valve
— Best installation practice on abrasives is reverse flow
### C, DATA

**Metal Micro-Scratch ball**
- 10° = .0033
- 20° = .0109
- 30° = .0232
- 40° = .0396
- 50° = .0542
- 60° = .2032
- 70° = 1.136
- 80° = 2.672
- 90° = 5.155

**Metal Micro-Notch ball**
- 10° = .014
- 20° = .13
- 30° = .36
- 40° = .66
- 50° = 1.03
- 60° = 1.43
- 70° = 2.0
- 80° = 3.25
- 90° = 5.23

**Ceramic Micro-Notch ball**
- 10° = .018
- 20° = .148
- 30° = .415
- 40° = .786
- 50° = 1.28
- 60° = 1.78
- 70° = 2.34
- 80° = 2.86
- 90° = 3.64

**Metal Macro-Notch ball**
- 10° = N/A
- 20° = .206
- 30° = 1.11
- 40° = 2.79
- 50° = 5.23
- 60° = 7.64
- 70° = 9.18
- 80° = 9.56
- 90° = 9.57

*Ceramic Macro-Notch ball coming soon.

### Table 1: Vee-Ball Low Flow Trim
PROVEN RESULTS

IMPROVED KAPPA ANALYZER PERFORMANCE

CHALLENGE
An Augusta, Georgia, USA paper mill needed to install kappa analyzers in two of its bleach plants. One of the control valve applications for this project involved a low flow rate with a high pressure drop. The typical solution for this application would be a globe valve with anticavitation trim. This type of trim, however, is a fairly expensive feature for a control valve, so it was not the ideal solution for the mill.

SOLUTION
Control Southern worked with Emerson to review the application and determined that the Fisher Vee-Ball valve with Micro-Notch ball was a fitting solution. This solution provides a sufficiently high cavitation coefficient to prevent cavitation, while costing less than a globe valve with anticavitation trim. This solution was also appealing due to its quick delivery time.

RESULTS
Upon Control Southern’s recommendation for this construction, the mill moved forward with the purchase. The mill realized savings of $8,000 USD and a six-week delivery improvement.
MAIN STEAM PRV

PROCESS
This valve is located downstream of the recovery and power boilers and is used to bridge the high, medium, and low pressure headers. It reduces the steam pressure and temperature to be usable in the plant. Typically, desuperheaters are installed downstream.

PROCESS FLOW

CUSTOMER PAINS
— Noise
— Vibration
— High pressure and temperature
— Tight shutoff requirement
— High turndown requirement
— Inaccurate valve selection due to working from process data received at the project stage leading to poor control
— Unable to control low flow (valves have poor turndown)
— Low throttling causes plug tip erosion and bell clapper effect due to lateral instability in plugs
— High wear on control valves
— High energy costs
— Steam pressure and temperature variation
— Infrequently used PRVs sometimes do not work properly after sitting for extended periods

QUESTIONS TO ASK THE CUSTOMER
— What valve is currently used in this application?
— Are you having any pressure or temperature control issues?
— Have you seen vibration damage or packing leaks with your current valves?
— Are your valves too noisy?

SOLUTION
Fisher EH or HP valves (depending on pressure class)
— Whisper Trim™ valve
— Class V shutoff
— DVC6200 digital valve controller (potential for remote mounting)
— In-line diffuser (if needed)

HIGHLIGHTS
— Characterized Whisper Trim valves could be an excellent solution for valves with high turndown requirements.
— Fisher is regarded as the valve of choice in this application.

COMPETITIVE INFORMATION
— Masoneilan and CCI/Bailey globe valves are the main competitors with Copes Vulcan sometimes being seen for this application. Typically CCI will offer their drag trim and Copes Vulcan will offer their raven trim.
— Maintenance is recommended every few years during a cold outage, depending on the mill.
— Low throttling is required.
FEEDWATER STARTUP AND REGULATOR

PROCESS
The feedwater startup valve is used to initially fill the boiler and then transitions operation to the feedwater regulator valve.

PROCESS FLOW

CUSTOMER PAINS
— Cavitation
— Leakage or inability to maintain tight shutoff
— High turndown requirement
— The most common issue is leakage, which can be caused by: insufficient information to determine valve selection, failure to specify tight shutoff, improper operation, poor control strategy, and entrained particulate.

QUESTIONS TO ASK THE CUSTOMER
— What valve is currently used in this application?
— How often are you having to take the valve out for maintenance?
— Are you having any leakage issues when the valve is closed?
— Are you experiencing control issues when transitioning from the startup valve to the regulator valve?

SOLUTION
For startup valve:
— Fisher HP or e-body valve (depending on boiler pressure)
— Class V shutoff
— NotchFlo™, Dirty Service Trim, Cavitrol™ III with protected inside seat (depending on water quality)
— HTS1 option with improved pressure balance seal
— DVC6200 digital valve controller with low travel cut-off

For regulator:
— HP or e-body valve
— 80/20 rule should be followed: 80% capacity of the startup valve should equal 20% capacity of the regulator
— Class V shutoff
— Standard cage (equal-percentage characteristic)

*NOTE: Some customers use the same valves to satisfy both conditions. Contact the Global Industry Sales Pulp and Paper Team for characterized valve cage requirements.

HIGHLIGHTS
— Fisher is regarded as the valve of choice in this application.
— Protected inside seat designs could prevent low flow erosion issues.

COMPETITIVE INFORMATION
— Masoneilan and CCI/Bailey globe valves are the main competitors with Copes Vulcan sometimes being seen. Typically, CCI will offer their drag trim and Copes Vulcan will offer their raven trim.
— Some customers expect the same valve to work for both startup and normal flow conditions.

<table>
<thead>
<tr>
<th>Solution</th>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>One Valve</td>
<td>Less expensive</td>
<td>Trim damage at startup caused by low flow</td>
</tr>
<tr>
<td></td>
<td>Less complicated parts</td>
<td>Usually, custom trim sets and parts have low availability</td>
</tr>
<tr>
<td></td>
<td>No control strategy for transition needed, but the valve travel must be limited so it does not open past the Cavitrol III protection</td>
<td></td>
</tr>
<tr>
<td>Two Valves</td>
<td>Better control range</td>
<td>Proper transition between startup and regulator valves can be complicated</td>
</tr>
<tr>
<td></td>
<td>Less risk of trim damage</td>
<td></td>
</tr>
<tr>
<td></td>
<td>High availability of spare parts</td>
<td></td>
</tr>
</tbody>
</table>
PROVEN RESULTS

PAPER MILL REDUCES TRIM DAMAGE AND IMPROVES OPERATIONAL PERFORMANCE

CHALLENGE
A Southeastern United States paper mill was trying to reduce maintenance costs and repetitive outage tasks through reliability improvements. The power boiler feedwater control valves were reviewed due to the cost of parts required each outage, the time to rebuild the valves, and the risk of problems requiring additional time and resources to complete the repairs. The paper mill was replacing all trim in their 6-inch EHD feedwater control valves on both power boilers every three years. The trim set was damaged beyond repair (cage, plug, and seat ring) creating an expense of $20,000 USD. The operations department also complained that the tuning of the loop was slower than desired due to the process gain of the standard equal-percentage cage.

SOLUTION
The paper mill worked with Emerson and R.E. Mason to get a characterized cage with cavitation protection and lower gain in the area of operation. The mill installed cavitation protection trim for the process loads, reducing trim damage and improving operational performance. This change required a new actuator for longer travel. The installation cost of the new trim was $70,000 USD, but the typical lifespan is three times as long.

RESULTS
The paper mill has gone through two repair cycles since the transition. Both inspections of the valve showed only minor wear with no need for trim replacement, saving $40,000 USD in parts. The mill has gained confidence in the solution and increased the repair cycle to six years for these two critical valves using the FIELDVUE PD tier diagnostics to monitor condition. The additional time between repairs will save the mill $15,000 USD. The cage is not indicating any wear and will not be replaced on the next repair, saving $18,000 USD, for a total cost elimination of $73,000 USD.

The reduced gain of the valve has allowed more aggressive tuning of these loops, provided increased control capability during large demand swings to prevent trips, and enabled relief venting. The mill is duplicating the efforts on the recovery boiler feedwater applications.
PROVEN RESULTS

PERFORMANCE DIAGNOSTICS REDUCES BOILER TRIPS

CHALLENGE
During a loop tuning exercise at a paper mill, the #2 recovery boiler feedwater level valve was determined to exhibit very slow response to changing input signals. Using AMS Valvelink™ software, R.E. Mason discovered a relay calibration issue and a high air mass flow alert that was further analyzed to be an actuator piston seal leak, which slowed the valve’s responsiveness.

SOLUTION
R.E. Mason used AMS Valvelink software and the Performance Diagnostics tier of the digital valve controller. They modified the responsiveness of the valve and monitored the air leak for two months leading up to a boiler outage. They wanted to make sure the leak did not worsen to a point where the valve could not control. R.E. Mason also provided the mill an emergency repair procedure, if it was needed.

RESULTS
The valve leak did not worsen between the time of discovery and the outage. Also, the actuator was rebuilt to factory specifications. After the outage, the feedwater loop was tuned and the overall steam pressure control was optimized and stabilized. A boiler trip leads to machine downtime, which costs the mill between $12,000 and $36,000 USD per hour in production losses, depending on the number of machines affected by the trip. The number of trips attributed to steam header pressure instability has decreased by two in the 60 days following the boiler outage.
MATERIAL UPGRADE ELIMINATES BODY EROSION

CHALLENGE
A major pulp mill has a Fisher globe valve installed for the drum level control for the power boiler. Due to body erosion problems, the valve requires removal and repair every two to three years. The original valve installed was a carbon steel HP style body. The valve is torn down each year during the annual maintenance outage for inspection. The most common problem found was “washing” of the body in the seat landing area of the lower bowl of the body. The 3-inch valve had to be cut out of the piping, sent for weld repair and heat treatment, welded back into the piping, and reassembled. This is a costly and time consuming process.

SOLUTION
After investigating the root cause of the problem (particulate in high velocity water), Emerson and John H. Carter Company severe service engineers recommended changing the body to WC9 Cr-Mo material. They also recommended upgrading 440 HT trim components.

RESULTS
The upgraded valve construction has been placed in-service. The carbon steel body valve typically has required weld repair every two to three years. The addition of weld repair to the overall repair scope would add $5,000 to $7,000 USD to repair cost. A conservative estimate of repair savings, due the body material changes, is expected be about $20,000 USD every three years. Similar savings have been realized with this material upgrade at other pulp and paper mills. The mill has found no body erosion issues, has experienced less costly repairs involving only trim, and has required less time to repair during outages.

For more information on successes, contact the Global Industry Sales Pulp and Paper Team.
SOOTBLOWER

PROCESS
This valve is used to supply air or steam to the sootblowers to remove deposits from the boiler tubes.

PROCESS FLOW

CUSTOMER PAINS
— Noise
— Vibration
— Erosion
— High wear on control valves
— High energy costs due to leakage
— Steam pressure and temperature variation
— Thermal cycling

QUESTIONS TO ASK THE CUSTOMER
— What valve is currently used for this application?
— Are you having problems with vibration?
— How often are you having to take the valve out for maintenance?
— Are the valves noisy in this application?
— How often does the sootblower system operate?

SOLUTION
Fisher easy-e, HP, or EH valves (for replacements)
— Whisper Trim
— Class V shutoff
— Oversized stem and welded stem connection
— DVC6200 digital valve controller
— Sootblower-specific offerings in OED II

HIGHLIGHTS
— Because of the temperature, there are digital valve controller remote mount opportunities.
— Fisher is regarded as the valve of choice in this application.

COMPETITIVE INFORMATION
— Masoneilan and CCI/Bailey globe valves are the main competitors with Copes Vulcan sometimes being seen. Typically CCI will offer their drag trim and Copes Vulcan will offer their raven trim.
PROVEN RESULTS

PROPER SIZING AND SELECTION IMPROVES CONTROLLABILITY
AND ALLOWS FOR TIGHTER SHUTOFF

CHALLENGE
A paper mill had been experiencing flow control valve problems. On the #2 paper machine, they were using a 6-inch Fisher ET for the warm water and cold water valves to the white water chest and an 8-inch Fisher ET for the cold water valve to the warm water chest valve. They also needed to increase the throughput on each of the three valve applications and replace them with digital valve controllers in lieu of an existing 3582 actuator.

SOLUTION
John H. Carter Company (JHC) worked with the process engineer and the engineering/maintenance manager to assist with this opportunity. A quote was provided for replacing the valves, new per contract pricing. Upon further review of the quote and application, both production and maintenance were looking for ways to increase flow and obtain tighter shutoff classification for each of these applications. JHC recommended switching to the Fisher 8580 (PTFE seat) control valves and provided valve sizing to support the specified flow conditions. It was also noted that these 8580 valves were already on site, as part of the JHC and Emerson consignment program, so there was no need to issue a purchase order and wait for delivery.

RESULTS
The mill was able to use Fisher rotary control valves from the consigned inventory. The estimated control valve savings, due to sizing and selection, was approximately $65,170 USD. Emerson was able to provide an increased flow characteristic and tighter shutoff.
CHALLENGE
On a previous capital project, a mill removed a portion of their knockout cones (hydrocyclones) to increase throughput in the recycled paper area. This increased the amount of solids and debris passed on to the primary screens. This has created a number of problems, including erosion holes in critical equipment, such as: pump casings, screen baskets, and control valve bodies on the rejects process of the screens. The control valves in these applications (4-inch or 6-inch depending on screen line) were only lasting about three to four months before eroding. The mill had tried, unsuccessfully, using third party Fisher V150 valves that were internally spray coated in an attempt to harden the wetted area and extend the life of the valves.

SOLUTION
John H. Carter Company (JHC) provided the Fisher V150 valve with an alloy 6 HD ball seal, chrome carbide internal body surface coating, and COCR-A V-notch ball. The six valves have been replaced with this construction and have been in-service for over a year without failure. The mill has standardized on these valves for their reject applications. They are currently replacing the existing standard valves as failures occur.

The valve assemblies being replaced have been equipped with the 2052 actuator and DVC6200-AD digital valve controllers. In some applications, the mill has replaced only the valve body and reused the existing actuator and digital valve controller.

RESULTS
The mill has been able to run recycle area screen reject lines longer and without washing out valve bodies. First-year savings totaled $37,920 USD due to the reduction in frequency of replacement of standard Vee-Ball valves.
PROVEN RESULTS

FISHER VALVE REPLACEMENT LEADS TO DESUPERHEATER PERFORMANCE IMPROVEMENTS

CHALLENGE
Reliability engineers at a mill were asked to investigate the cause of temperature swings in the mill’s 65# steam header feeding all process areas of the mill. They used PI to determine the 65# desuperheater water valve was operating at less than 10% open. Lack of proper water control was causing poor temperature control and poor heat transfer in the process heat exchangers.

The 65# steam system is located after the turbine and feeds 325,000 pph of steam to all process areas of the mill. The mill had installed a CCI desuperheater and a Fisher water control valve to keep the steam at a 380°F set point. Over time, the water temperature had changed. The water valve was found to be operating at 10% open (or less), resulting in poor temperature control, flooding of the steam header, and poor heat transfer at the process heat exchangers.

SOLUTION
Severe service engineers at John H. Carter Company modeled the system using a Fisher desuperheater with a similar Cₚ and the correct process conditions. They recommended changing the 1-inch easy-e EZ valve from the existing 3/4-inch port to a smaller 3/8-inch diameter port.

RESULTS
The correct trim components were supplied to the mill and were swapped during a 1-day shutdown. The water control valve now operates at or above 50% open and the steam header is controlled within +/- 10°F of the desired 380°F set point. A $75,000 USD savings was realized by saving one sheet break on the paper machine. The mill has achieved better control resolution and less variance.
FISHER VENT VALVES ELIMINATE SUPERHEATED STEAM LOSS

CHALLENGE
Superheated steam from a power boiler must be vented to the atmosphere during a boiler startup to protect turbines. During normal operations, the valve must be set to open on high pressure before the header relief valves lift to prevent problems. A paper mill had an existing target rock valve for this application. Due to high pressure drops and high temperatures, the process valve provided poor control performance and leaked to the atmosphere. This valve had to be repaired at every outage and emitted high noise levels at the vent outlet. The target rock valve was blocked-in during normal boiler operations to prevent steam leakage, leaving the system relief valves as the only pressure relief option.

SOLUTION
John H. Carter provided a Fisher CL1500 RTJ HPS valve. It was constructed with a WC9 body and unbalanced Whisper Trim III cage. A 585C actuator with a trip system and a remote-mounted digital valve controller with Advanced Diagnostics (AD) was installed. Also, a 6013 vent diffuser was added to reduce noise when steam is vented out.

RESULTS
The customer saved $125,000 USD by eliminating steam loss to the atmosphere and reducing repair costs of control and relief valves. A safety issue was also resolved by reducing environmental noise levels. This was achieved using the proper Fisher severe service control valve and vent diffuser. The valve does not leak when reseated so it can be left in-service to protect relief valves, plus costly steam is not wasted. The digital valve controller with AD provides diagnostic capabilities.
FIELDVUE INSTRUMENTS ALLOW FOR IN-LINE VALVE MAINTENANCE, INCREASING PROCESS AVAILABILITY

CHALLENGE
At a Southern United States paper mill, previous maintenance practices involved pulling 30 to 40 control valves twice a year on long outages. The current maintenance practice is to only pull the control valves that need to be serviced. This is determined by monitoring the control valve assembly performance via the DVC6000 digital valve controller and comparing the data with the previous year’s data. Only those control valves with a significant decline in performance are pulled for repair.

Critical control valves that malfunction can shut the entire process down, costing hundreds of thousands of dollars in lost production and maintenance costs. In order to avoid lost production, the maintenance department would pull a number of control valves out during shutdowns and long outages. Without a means to gather data related to the control valve health, control valves were pulled that had no issues. Other valves with no visible issue were not pulled, but failed before the next outage. A tool was needed to provide better predictive data.

SOLUTION
The mill’s maintenance and engineering departments began installing the FIELDVUE digital valve controllers on critical valves, project valves, and valves that were located in areas with poor access. The DVC6000 digital valve controllers not only provided the diagnostic capabilities and data needed by maintenance, but they also provided better control resolution.

RESULTS
Initially, the maintenance department used the Fisher 275 and 375 field communicators for extracting data from the FIELDVUE instruments. The AMS ValveLink software was installed, allowing a more convenient method for collecting and monitoring the data. The tools provided a means for maintenance to check the health of a control valve without pulling it out, wasting time and money. Control valve trim wear can now be determined and documented by comparing routine dynamic scans with the initial baseline scan. Alerts in AMS ValveLink software can notify the technicians that problems exist in either the equipment or the process. The mill uses FIELDVUE instruments as tools in their CLPM and IEPM predictive maintenance programs. The mill has benefited from shorter, planned shutdowns and has experienced an annual savings of approximately $500,000 USD.

For more information on successes, contact the Global Industry Sales Pulp and Paper Team.
PROVEN RESULTS

REDUCING CAVITATION AT A SOUTHEASTERN UNITED STATES PAPER MILL

CHALLENGE
A 6-inch Dezurik V-Port ball valve, serving as the level control on paper machine #2 chest, failed due to cavitation vibrational damage. It was replaced with a 6-inch Fisher Vee-Ball™ valve, which failed in a short time, too. Also, both valves performed poorly before failure. Pressures and flows were analyzed. The downstream valve pressure was increased about four pounds per square inch gage by modifying the discharge piping in the chest.

SOLUTION
The line size was increased to eight inches on both sides of the valve and a new Fisher 6-inch Vee-Ball valve with 2052 actuator and a FIELDVUE DVC6200 digital valve controller with Performance Diagnostics were installed in the reverse-flow direction. Expansion joints were also installed between the valve and the chest.

RESULTS
With the new assembly and piping modifications, the cavitation damage was reduced to an acceptable level and the valve has been in-service ever since. Mill managers say the solution eliminated about $42,000 USD of lost paper production (five hours) per failure event.

For more information on successes, contact the Global Industry Sales Pulp and Paper Team.
ADDITIONAL REFERENCE MATERIAL

BROCHURES

- Fisher V500 Rotary Eccentric Plug Control Valve (D352309X012)
- Fisher Vee-Ball Rotary Control Valves (D350004X012)
- Fisher easy-e Control Valves (D350365X012)
- Fisher Severe Service Answers (D351289X012)
- Fisher Pulp and Paper Solutions (D351985X012)

PRODUCT BULLETINS

- Fisher EH and EHA Control Valves (D100042X012)
- Fisher Cavitrol III Trim (D100196X012)
- Fisher CV500 Rotary Control Valve (D101606X012)
- Fisher HP Series Control Valves (D101635X012)
- Fisher Whisper Trim III Cages (D100191X012)
- Fisher V500 Rotary Control Valve (D100054X012)
- Fisher Vee-Ball V150, V200, and V300 Rotary Control Valves (D351363X012)

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- Tactical Excellence Calls (recordings of previous calls are available)