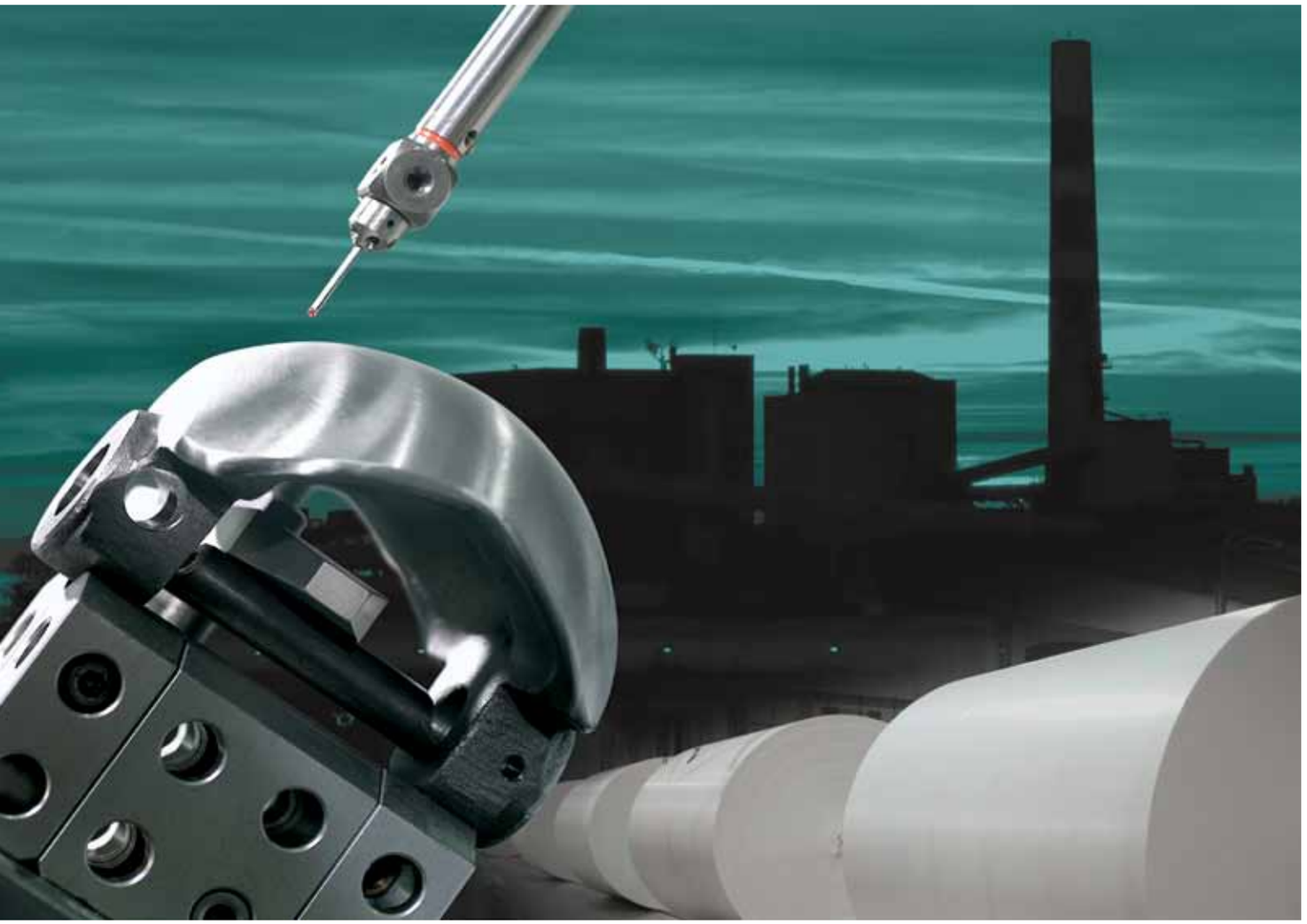
Fisher® Pulp and Paper Solutions

Reliable control valve technologies for on-specification product.



FISHER®

EMERSON™
Process Management

Discover the Right Solution for You

The pulp and paper industry, in recent years, has seen some difficult times. However, it's likely that no other manufactured product plays a more significant role in daily human activity than paper products. Paper provides the means to recording and disseminating most of today's information, news, and data. From the brochure you're reading now, to the newspaper you read this morning, paper is used for many purposes and it will remain this way for many years to come.

The uses and applications of paper and paper products are truly vast, and new products are constantly being developed. At the same time, the industry itself faces much competition. The key to remaining competitive today is to adopt and maintain reliable technologies to keep your mill operating at peak performance levels. To do so, you need control valves and technologies that stand up to even the most adverse conditions like erosive slurries, scaling, noise, and vibration while maintaining tight loop control.

Please use this brochure as a guide to discovering the breadth of best-in-class Fisher® control valve solutions that offer new levels of performance and reliability to your mill, and keep your mill operating at its full potential.

Papermaking Overview

The Process of Papermaking

Although not present at all mills, there are six major steps to the papermaking process: mechanical preparation of the wood into wood chips, turning wood chips into pulp (digestion), chemical recovery, pulp whitening through bleaching, pulp stock preparation, and finally paper formation.

The first of these steps uses strictly mechanical processes to form small chips from the logs supplied to the mill. By-products such as bark, and even some chips themselves, are used as fuel to produce steam and electricity for mill use. Although some water may be used for lubrication purposes, this is primarily a dry process and proceeds with minimal process instrumentation.

The pulping process has many variations, the most common being the kraft process, which uses caustic chemicals to digest the lignin in the wood chips. This is different than the sulfite process, which uses acidic chemicals to digest lignin.

No matter the process, the chemicals used are regenerated in a multi-stage recovery process that reduces chemical costs and minimizes waste disposal costs. Appropriate process control helps to ensure maximum chemical regeneration.

After cooking the wood chips, pulp stock leaves the digester as a brown slurry. Depending on the end product, it may be bleached or remain brown. If bleaching is necessary, large quantities of expensive bleaching chemicals like chlorine dioxide (ClO_2) are used and must be precisely controlled to minimize financial impact.

The slurry then heads toward the stock preparation section of the mill. Here, different batches of pulp may be blended to produce paper of various required properties. Starches, clays, and other retention aids are added to improve the wetting properties of the paper so the end product meets customer specifications.

The paper machine is the final step in the process of producing the correctly specified end product. Reliable control valves are necessary to ensure the appropriate percentage stock is sprayed onto the paper machine felt, appropriate temperatures are obtained for drying the paper, and vacuum controls are running to dispense condensate.

Control of steam pressures and temperatures are likely the most critical applications in a pulp and paper mill. Steam is used for wood chip preparation, process heating, paper drying, boiler cleaning, energy production, and in many other applications.

Wherever your tough application exists, the reliability of your control valves play a critical role in helping improve your process. In this brochure, we'll discuss the many application challenges you encounter in each process and ways that Fisher control valves and technologies can help to combat these application challenges while ensuring your mill operates at its peak performance.

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Damaging Effects of the Papermaking Process

Material Damage

Physical damage to control valves can mean high maintenance costs, lack of predictability of the damage, and unplanned shutdown or downtime. Damage can consist of a mechanical and/or selective chemical nature on material surfaces.

Cavitation damage is a concern in many processes, including the power and recovery boiler units. This mechanical damage is characterized by a very irregular, pitted, and rough appearance. Control valves with extensive damage may have large amounts of material missing and may severely affect the valve's operability. Fisher cavitation solutions help to minimize cavitation damage and prevent the severity of erosion.

Erosion in a paper mill is also a concern. Erosive slurries including pulp stock and lime mud can severely erode the internals of control valves, thus minimizing the service life of the product. In some cases, the erosion is severe enough to cause pressure boundary parts to become unstable. This is a safety risk to the mill. Appropriate material selection is necessary to ensure long-lasting products and to maximize uptime.

Scaling, also known as fouling, is common in boilers and heat exchangers operating with hard water that can often result in lime scale. In addition, scaling can be found in the digester due to white liquor; the evaporator and concentrator units due to black liquor; or the recausticizing process due to green liquor and lime mud. This can cause flow instabilities, increase pressure drops, induce vibrations that lead to high noise, and a large number of other unanticipated problems.

Finally, corrosion is prevalent throughout the paper mill. Material selections are highly important to ensure long-lasting products in each particular service.

It is important to work with your Emerson local business partner or sales office to choose the correct products to minimize risk.

Excessive Noise and Vibration

Noise control is crucial to achieving compliance with environmental and workplace regulations. High noise levels can be a serious health risk and can cause hearing damage by reason of one very loud event, a series of loud events, or days, weeks, and years of loud noise in a work or recreational environment. Noise created by cavitation, flowing slurries, steam, or even fluid leaking past a closed orifice can create an environment that is unsafe for personnel for extended periods of time.

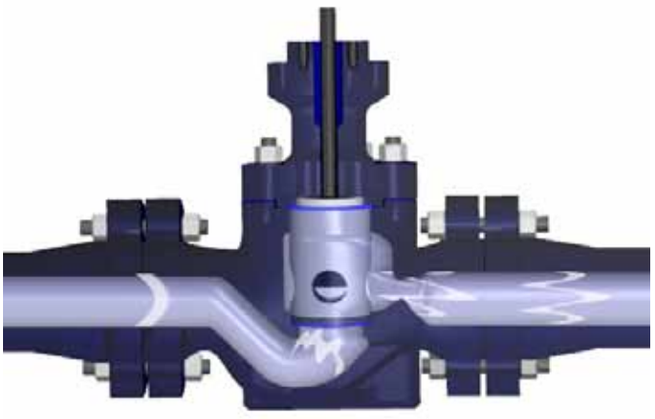
Regulatory agencies detail the maximum permissible sound levels and occupational exposure beyond which mitigation measures and personal protective equipment are required. In the past, simply presuming hearing protection would be provided was enough. Today, not providing engineered controls is deemed an unacceptable work practice.

Designing and incorporating noise mitigation techniques can include complex procedures, and are often handled as a separate design discipline. Noise can be found anywhere in a facility or in a control valve, and must be taken into account. Detailed sound level predictions are often required during the facility's design phase and regulatory compliance sound level measurements are often required immediately after plant commissioning.

Facility health and safety engineers are employed to pinpoint noisy processes and equipment, and explore mitigation techniques to lessen the noise. Emerson design engineers continually research noise mitigation technologies and bring Fisher technology solutions to a noisy world.

It is imperative, when working with your Emerson local business partner or sales office, to review all applications so the best noise mitigation solutions are appropriately selected for your applications and assets.

A fully equipped materials lab is staffed by Emerson technologists who verify that materials and coatings will perform to expectations.



View a video about noise at www.FisherSevereService.com under the noise video link to the right.

Cavitation

Simply stated, cavitation is the formation and collapse of cavities in a flowing liquid. It becomes critically important for appropriate valve sizing, selection of products and materials, and cavitation mitigation technologies to ensure problems do not arise. Emerson provides a wide range of cavitation control technologies for clean or dirty service. Utilizing Fisher application engineers and experienced design engineers will ensure you receive a custom solution for your application.

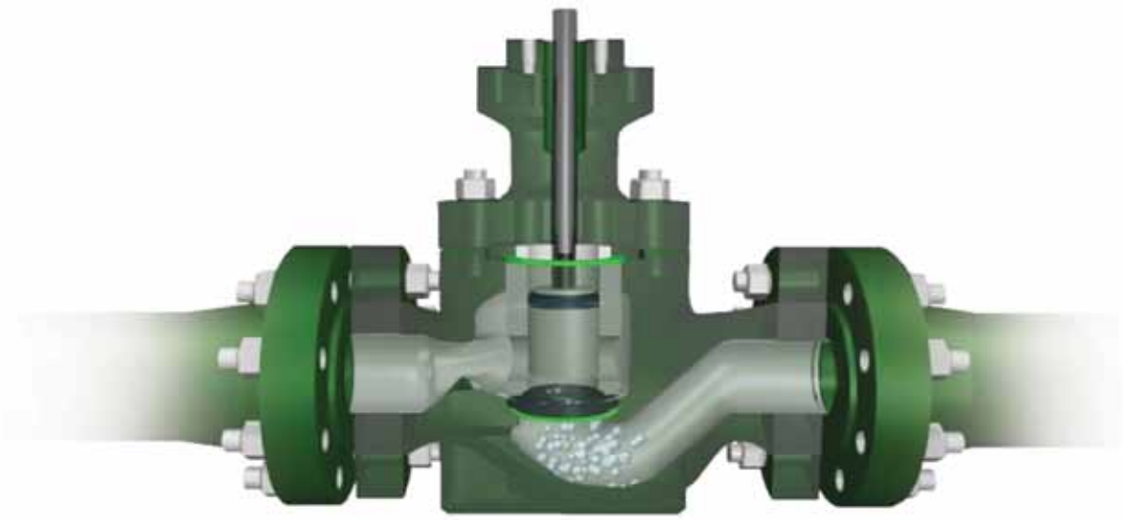
Cavitation is a concern for plant operators and maintenance personnel because it can reduce plant operations and profitability. Cavitation not only decreases flow capability through control valves, but it may also cause material damage, excessive noise, and high vibration. This material damage can severely affect the control valve's operability and overall control loop performance.

Flashing

Although similar to cavitation, flashing creates a liquid-vapor mixture where the proportion of gas and liquid phase changes as pressure or temperature change. Whereas cavitation creates an irregular, pitted surface on components, flashing creates a shiny and smooth appearance.

However, flashing is of concern because of its ability to limit flow through the control valve and its highly erosive nature. This can cause operational problems, increased maintenance, and unexpected downtime.

This valve plug has sustained extensive cavitation damage. It shows a complete loss of seating surfaces.



Click on the QR code to view the Fisher Cavitation-Control Technologies brochure.

View an animation video on cavitation at www.FisherSevereService.com

Optimize Your Process, Maximize Your Profitability

Control Valve Selection and Design

Selecting a control valve is more of an art than a science. Clearly, a single product design is not sufficient for the wide variation of applications across the entire pulp and paper process. Emerson uses multiple approaches to address application-specific issues.

Industry experience by application, damaging effects of the papermaking process, cavitation science, and the effect of control valve size, type, trim style, geometry, and materials are all critical to providing reliable solutions.

Special considerations may require out-of-the-ordinary control valve solutions. There are Fisher control valve designs and special trims available to handle high noise applications, flashing, cavitation, high pressure, high temperature, erosive processes, and combinations of these conditions.

Using Fisher technology for your tough papermaking applications is the best way to achieve efficient, productive, and safer plant operation.

FIELDVUE™ Performance Diagnostics

Reliability is a key requirement for all process facilities. FIELDVUE™ digital valve controllers installed on Fisher control valves protect your assets by giving a view of operating characteristics such as supply pressure, control signal, friction, and seat load. FIELDVUE Performance Diagnostics run continuously, analyzing valve and actuator data while the valve remains in service. If problems are detected, information can be directed to the appropriate personnel automatically when installed in a PlantWeb™ system. These notifications help you keep the control valve and the process loop functioning optimally.

Reliable Fluid Control

Emerson has led the way in engineering and manufacturing control valves and technologies that solve pulp and paper customer issues. Correct engineering and manufacturing of these technologies is critical to overall operation and life expectancy. Selecting the right materials, the right noise abatement technology, and the most appropriate control valve for the application can be the difference between your process running at its full potential or a shutdown.

Emerson provides the quality, accuracy, and engineered solutions demanded by these difficult papermaking applications. Local service is provided before the sale and through the life of your mill. Emerson local business partners and sales offices are backed by global manufacturing sites that can effectively manufacture, measure, and assemble these highly-engineered solutions. No matter where your Fisher pulp and paper control valve or technology is manufactured, product quality remains a constant. Parts and service are available to minimize downtime and maximize throughput.

If you want help to ensure your next control valve and related technologies are optimizing your process and maximizing your profitability, contact your Emerson local business partner or sales office. You will receive the support you need to accurately size, select, and install the right control valve for your toughest papermaking challenge.

For more information on the Fisher pulp and paper control valves and technologies you read about here, please contact your local business partner or go to www.EmersonProcess.com/Fisher.

Fisher control valves undergo extensive testing for proof of performance.

The PlantWeb™ dynamic performance lab enables thorough product differentiation testing and analysis.

Serving You Through The Life of Your Plant

Click on the QR code to find the sales office nearest you.

Parts

Confidence in papermaking solutions relies on true OEM engineering and manufacturing specifications. Replicator parts typically do not last as long as genuine Fisher parts, so you have to replace them more often. This can be due to wrong materials specifications, incorrect machining and tolerances used, or essential design features not being incorporated into the components.

You can find replicator parts for Fisher control valves, actuators, and instruments from a variety of sources, but using non-OEM parts puts your facility at risk. Non-OEM parts can result in higher costs for additional parts and may cause lost production and downtime, thus affecting your profitability. Although these replicator parts may initially cost you less, you may pay more in the long run.

Service

Emerson provides your projects and facilities with the instrument and electrical technicians to guide you through comprehensive startups, troubleshooting, repair, and maintenance services. We can mobilize our technicians to any location in the world to help your company achieve its goals.

All technicians obtain training and education at specialized colleges and institutes. This training, coupled with practical field experience in various industries, will provide your company with the highest quality of expertise in the instrumentation and electrical field, as well as designated trade certifications and engineering technologies.

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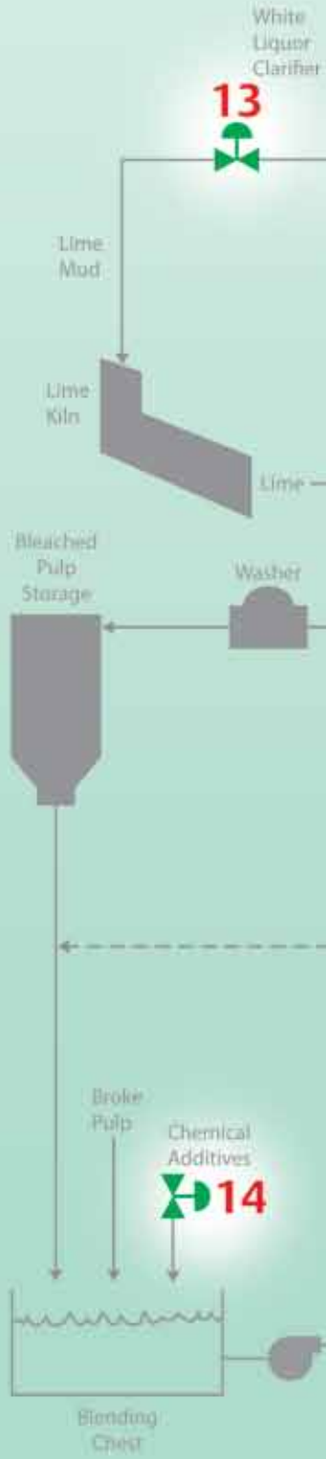
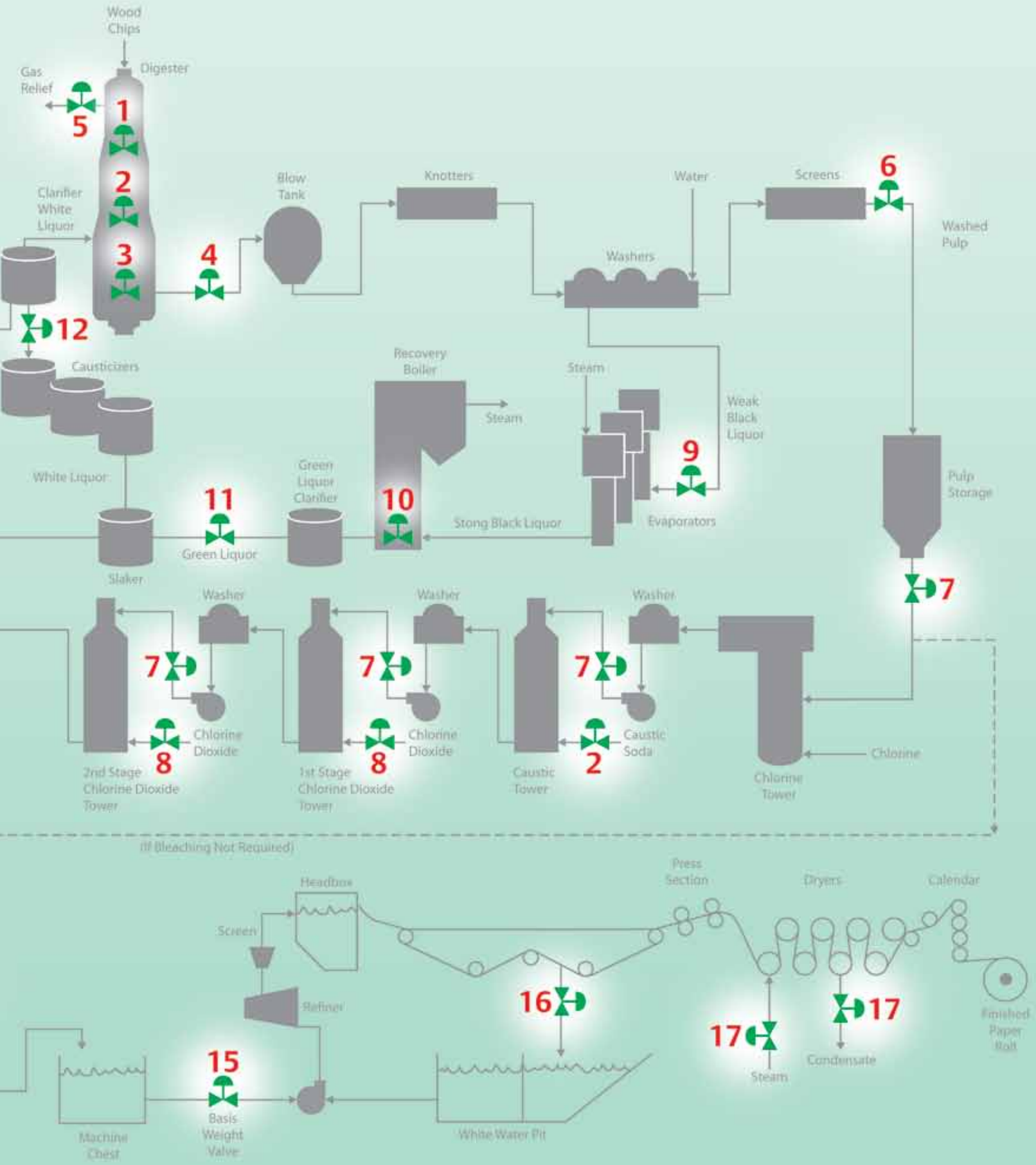


Papermaking Process



Cooking

Caustic Addition

Chips are fed via a screwfeeder into the top of a digester where it is mixed with cooking liquor then cooked to a schedule. The cooking liquor, sodium hydroxide (NaOH) solution, is a caustic chemical used with sodium sulfide to create white liquor. This fluid is used to break down the lignin that binds cellulosic fibers while in the digester.

Digesting is the process of removing lignin and other non-fibrous components of the wood from the cellulose fibers, which are used to make paper. Lignin is essentially the glue that holds the wood fibers together. It can rapidly decompose and discolor paper if it is left in the pulp. To retain end product quality, it is imperative lignin is removed.

Sodium hydroxide is a highly used chemical that requires accurate addition to the wood chips. Poor control can lead to economic loss in sodium hydroxide solution and can also lead to wood chip degradation.

Product Solutions

- MAXIMUM FLOW CONTROL — V-notch ball contouring provides modified equal percent characteristic for maximum flow control.
- MINIMAL LOST MOTION — Clamped driveshaft ensures minimal lost motion allowing for tight control.
- TIGHT SHUTOFF — Heavy duty seal provides tight shutoff.
- EASE OF MAINTENANCE — Drop-in-place installation for easy maintenance.
- REDUCED INSTALLATION TIME — Flanged valve body design reduces alignment and installation time.
- SMALL ACTUATOR PROFILE — Actuator design promotes smaller envelope package size for tight spaces.

Fisher V150 Vee-Ball™ control valve, FieldQ™ actuator, and FIELDVUE DVC2000 digital valve controller

Cooking

Digester Liquor Level Control

Continuous digester liquor level control is a critical and demanding application. The liquor level is critical to digester operational stability, providing correct throughput, and reducing kappa variation (lignin measure in the pulp). Found in the make-up liquor line after the make-up liquor pump, the control valve controls liquor flow to the top of the impregnation vessel in a two vessel system.

The valve is subjected to cavitation, flashing, erosion, scaling, vibration, and noise issues.

Product Solutions

- MAXIMUM FLOW CONTROL — V-notch ball contouring provides modified equal percent characteristic for maximum flow control.
- INCREASED THROUGHPUT — Unrestricted, straight-through flow design provides greater capacity.
- TIGHT SHUTOFF — Self-centering seat ring and rugged V-notch ball allow for tight shutoff.
- REDUCED DOWNTIME — Rugged seat ring has two shutoff surfaces that are easily reversed, reducing downtime.
- ANTI-SCALING — Cammed Vee-Ball design reduces effects of scaling.

Fisher CV500 control valve, 1061 actuator and FIELDVUE DVC6200

Cooking

Digester Switching

In a continuous digester's cooking zone, cooking liquors are circulated in loops to add the appropriate heat and chemicals to cook the wood chips. Valves control the circulating liquor as it travels from the screens lining the interior of the digester, to the circulation pump, through the heat exchanger, and returns the liquor to the digester cooking zone. This application generally consists of two loops, one for both the upper and lower cooking zones.

Switching valves are also commonly found in the digester's extraction or wash zone. Here, wash filtrate is added to the bottom of the digester with counter-current flow to the chip mass. As the wash fluid extracts the used cooking liquors, valves remove the wash fluid for further processing.

These valves frequently see high cycling, high temperatures, high pressures, and corrosive chemicals.

Product Solutions

- EXTENDED SERVICE LIFE — PTFE packing and heavy duty valve bearings extend service life capabilities.
- ZERO LOST MOTION — Splined shaft and taper pin/disk connections provide tight control.
- INCREASED FLOW CAPACITY — Contoured disk increases flow capacity while reducing operating torque.
- EMISSION CONTROL — Superior sealing and ENVIRO-SEAL™ packing reduces emissions.
- EASY INSTALLATION — Centering holes and line flange bolts reduces valve centering issues for easy installation.

Fisher DSV High Performance Eccentric Disk Digester Switching Valve with 1061 actuator

Cooking

Digester Blow

After the wood chips are sufficiently cooked, they must be discharged from the digester. Digester blow valves, typically found at the bottom of digesters and/or near the top of the blow tank, ensure pulp stock retains its integrity while still allowing all cooking liquors to be recovered. However, insufficient discharge can ruin valuable pulp and cause loss of expensive steam and cooking liquors. In batch and continuous digesters, these valves are subjected to erosion and high vibration from high velocity stock flow.

High levels of sand and other debris from the chip feed stock will also cause premature valve body and ball erosion. Additionally, in batch digesters, it is critical for the valve to retain its pressure boundary and prevent leakage as this can lead to inefficient cooking of the wood chips. Precise control is necessary to achieve the required pulp kappa value.

Product Solutions

- MAXIMUM FLOW CONTROL — V-notch ball contouring provides modified equal percent characteristic for maximum flow control.
- ZERO LOST MOTION — Splined driveshaft ensures zero lost motion allowing for tight control.
- TIGHT SHUTOFF — Heavy duty seal provides tight shutoff.
- EASE OF MAINTENANCE — Drop-in-place installation for easy maintenance.
- REDUCED MAINTENANCE — Flanged valve body design reduces alignment and installation time.
- SMALL ACTUATOR PROFILE — Actuator design promotes smaller envelope package size for tight spaces.
- POSITIONER FEEDBACK — Linkage-less and non-contact feedback improves reliability in high vibration.

Fisher V150 Vee-Ball control valve, 2052 actuator, and FIELDVUE DVC2000

Cooking

Batch Digester Gas Relief

A batch digester is essentially a large pressure cooker. As steam is applied to the mass of chips and liquor, a quantity of resinous vapors are distilled off. These vapors, along with entrained air in the chips and a small quantity of non-condensed steam, can collect at the top of the digester. These accumulated additional gases can be sufficient to indicate false high pressures relative to the steam saturation temperature inside the digester, thereby causing the wood chips to be undercooked.

If a gas relief valve is necessary, then gases, cooking liquors, cellulosic fibers and chips can severely erode and corrode the gas relief valve.

Product Solutions

■ EROSION CONTROL	Specially designed valve body and trim combats the process of erosion.
■ WEAR RESISTANCE	Solid metal seat ring and valve plug for erosion resistance and long service life.
■ RUGGED CONSTRUCTION	Sealed metal bearings help prevent particle buildup and valve shaft seizure.
■ TIGHT SHUTOFF	Self-centering seat ring and rugged plug for tight shutoff and reduced internal wear.
■ EASY INSTALLATION	Centering holes and line flange bolts reduces valve centering issues for easy installation.
■ POSITIONER FEEDBACK	Linkage-less and non-contact feedback improves reliability in high vibration.

Fisher V500 control valve, 1061 actuator, and FIELDVUE DVC6200

Pulping

Brown Stock Rejects

Pulp from cooking always contains some unwanted solid material. Some of the fibrous material may not be completely in the form of individual fibers. The main purpose of the pulp screening process is to separate harmful impurities from pulp with minimal fiber loss, and at an acceptable cost level.

Bark, sand, shives, and rocks are typically found within the cooked chips and must be removed. It is important for these impurities to be removed from the process stream as it can have negative effects on end product quality, may damage downstream process equipment, and may cause operational problems.

Product Solutions

- WASH OUT PROTECTION — Reverse flow installation ensures erosive slurries remain downstream of valve body and trim.
- MAXIMUM FLOW CONTROL — V-notch ball contouring provides modified equal percent characteristic for maximum flow control.
- VALVE BODY PROTECTION — Hard, wear-resistant trim materials fully protect valve body, shaft, and bearings.
- HARDENED MATERIALS — High Chrome Iron (HCI) and/or Partially Stabilized Zirconia (PSZ) MATERIAL protect body internals.
- EASE OF MAINTENANCE — Valve body design allows for easy replacement of trim and valve internals.
- MINIMIZED IMPINGEMENT — Flow ring matched to pipe bore size minimizes impingement on pipe wall.

Fisher V150S Slurry Vee-Ball control valve, 2052 actuator, and FIELDVUE DVC6200

Pulping

Medium Consistency Pump Discharge

Medium consistency pumping (dry solid content between 8-18%) and chemical mixing systems are the most important stock transfer equipment in the modern oxygen delignification and bleaching processes, with recycled fiber and in mechanical pulp lines. These valves can be used in two distinct ways: with variable speed pumps, the valve is run at full 90 degrees open, and with static head pumps, the valve needs to be throttled.

Restrictions in the flow path can discourage appropriate process flow and cause decreases in throughput. Additionally, high vibration can cause serious damage to piping and supporting structures around the stock pumps, creating production delays and safety issues.

Product Solutions

- OPTIMAL FLOW PATH — Expanded outlet provides optimal flow path for pulp slurry.
- CUSTOM CONFIGURATION — Body configuration accommodates medium consistency pump piping requirements.
- REDUCED INSTALLATION TIME — Flanged valve body design reduces alignment and installation time.
- MAXIMUM FLOW CONTROL — V-notch ball contouring provides modified equal percent characteristic for maximum flow control.
- EXTENDED SERVICE LIFE — Heavy duty valve bearings and PTFE packing extend service life capabilities.
- SMALL ACTUATOR PROFILE — Actuator design promotes smaller envelope package size for tight spaces.
- POSITIONER FEEDBACK — Linkage-less and non-contact feedback improves reliability in high vibration.

Fisher V150E Expanded Outlet Vee-Ball control valve, 2052 actuator, and FIELDVUE DVC6200

Bleaching

Chlorine Dioxide Addition

After digestion, end products that are required to be whitened go to the bleach plant. Chlorine dioxide has rapidly become the industry standard bleaching agent because of its selectivity in destroying pulp lignin without degrading cellulosic fibers, thus preserving pulp strength and providing stable brightness.

Modern mills typically have pulp stock enter the oxygen delignification stage before the medium consistency pulp heads to the conventional bleaching sequence. These can vary from four to six separate stages depending on the end-user's requirements. A standard mill would utilize a $DE_{OP}DED$ sequence, or an alternating sequence of chlorine dioxide (D), alkaline extraction stages (E), oxygen (O), and peroxide (P) brightening stage. This alternating sequence of chlorine dioxide and alkaline help to break down the increasingly smaller amounts of residual lignin.

This valve is subjected to high corrosion due to the chlorine dioxide material, and accurate control is necessary because of the high costs of chemicals.

Product Solutions

- MAXIMUM FLOW CONTROL — V-notch ball contouring provides modified equal percent characteristic.
- ZERO LOST MOTION — Splined driveshaft and shaft-to-ball pinning allows for tight control.
- LONG SERVICE LIFE — Rugged seal and bearing design for extended service.
- LOW FRICTION — Bearings with minimal friction provide optimal control and drop-in-place for easy maintenance.
- REDUCED MAINTENANCE — Flanged valve body reduces alignment and installation time.
- ASSEMBLY SIZE — Actuator profile promotes smaller envelope package size for tight spaces.
- EXOTIC MATERIALS — Alloy valve capabilities available for high corrosion applications.

Fisher V150 Vee-Ball control valve, 2052 actuator, and FIELDVUE DVC6200

Recovery

Black Liquor Evaporation

The change of weak black liquor to strong black liquor via an evaporation plant allows black liquor to be burned as fuel in the recovery boiler and serves as the major application in the recovery cycle of the paper mill. The main purpose of the evaporation plant is to increase the dry solids content of the black liquor by evaporating water until reaching a concentration suitable to allow burning in the recovery boiler. With the help of a concentrator, black liquor is 65-80% solids after leaving the evaporation plant.

An evaporation plant usually consists of several heat transfer units connected in a series. A valve in this environment is subjected to scaling due to thick media, and must perform in both a traditional throttling and on/off application.

Green Liquor Dissolving Tank Density

Molten smelt from the recovery boiler flows by gravity to the dissolving tank. Here, it is mixed with weak wash to a solution suitable for pumping known as green liquor. Two valves in parallel control the density of the dissolving tank.

Green liquor has a tendency to scale, and can bind the internals of the control valve body.

Product Solutions

- MAXIMUM FLOW CONTROL — V-notch ball contouring provides modified equal percent characteristic.
- ZERO LOST MOTION — Splined driveshaft and shaft to ball pinning allows for tight control.
- EXTENDED SERVICE LIFE — Heavy duty seal and rugged bearing design are robustly designed for extended service.
- EASE OF MAINTENANCE — Bearings provide optimal control and drop-in for easy maintenance.
- REDUCED MAINTENANCE — Flanged valve body reduces alignment and installation time.
- SMALL ACTUATOR PROFILE — Actuator design promotes smaller envelope package size for tight spaces.
- POSITIONER FEEDBACK — Linkage-less and non-contact feedback improves reliability in high vibration.

Fisher V150 Vee-Ball control valve, 2052 actuator, and FIELDVUE DVC6200

Recovery

White Liquor Pressure Filter Switching

The white liquor pressure filter is the preferred method for separating white liquor slurry into its primary components of white liquor and lime mud. This slurry is pumped through the feed valve into the filter vessel where the fluid is forced through a filter. The solid lime mud cannot pass through the filter and cakes onto the filter itself. When the filter is too caked with lime mud, the recirculation valve opens and causes the pressure to suddenly drop and create a backflow against the filter. This knocks off the lime mud. This opening and closing of the discharge valve occurs every five to ten minutes.

This process will see frequent and fast switching and is hard on valves and actuators. Damage includes piston seal wear, bearing wear, and packing box leaks. Additionally, this slurry is very erosive due to high solids content, and must maintain tight shutoff.

Product Solutions

- EXTENDED SERVICE LIFE — Heavy duty valve bearings and PTFE packing extend service life capabilities.
- LOST MOTION — Minimal lost motion with taper pin/disk connection and splined shaft.
- FLOW CAPACITY — Contoured disk increases flow capacity and reduces operating torque.
- EMISSION CONTROL — Superior sealing and ENVIRO-SEAL packing reduces emissions.
- EASY INSTALLATION — Centering holes and line flange bolts reduces valve centering issues for easy installation.

Fisher 8532 High Performance Butterfly Valve, 1061 actuator, and FIELDVUE DVC6200

Recovery

Black Liquor Guns

Black liquor from the evaporator set is introduced into the recovery boiler via liquor guns. These guns produce a spray that is combustible by a hot flue gas. The spray is controlled by a valve that is subjected to corrosion due to high black liquor content. Additionally, this valve must precisely control the black liquor flow as this can directly affect the recovery boiler's burning and steam generation efficiency.

Lime Mud Underflow

Once lime mud is removed via the pressure filter, it is washed to remove any residual chemicals and sent to a settling tank. Here, the lime mud settles to the bottom of the tank and exits via an underflow valve while the washing fluid, called weak wash, overflows from the top. The underflow valve is throttled to control mud density, which directly impacts the operation and efficiency of the lime kiln. The valve must be made of wear-resistant materials due to the extremely erosive nature of the fine particulate and high solids concentration.

Product Solutions

- EROSION CONTROL — Specially designed valve body and trim combats the process of erosion.
- WEAR RESISTANCE — Solid metal or Very Tough Ceramic (VTC) seat ring and valve plug for erosion resistance and long service life.
- RUGGED CONSTRUCTION — Sealed metal bearings help prevent particle buildup and valve shaft seizure in erosive applications.
- TIGHT SHUTOFF — Self-centering seat ring and rugged plug for tight shutoff and reduced internal wear.
- CORROSION CONTROL — Alloy material options promote corrosion resistance and long service life.
- EASY INSTALLATION — Centering holes and line flange bolts reduces valve centering issues for easy installation.
- POSITIONER FEEDBACK — Linkage-less and non-contact feedback improves reliability in high vibration.

Fisher V500 control valve, 2052 actuator, and FIELDVUE DVC6200

Paper Machine

Paper Additives

Prior to stock entering the headbox, various additives are combined with the pulp during stock preparation. For instance, the combination of rosin size and aluminum sulfate resists penetration by fluids, and is critical for ink printing operation. Other agents and starches help increase the paper's internal strength. Fillers such as precipitated calcium carbonate (PCC) and titanium dioxide help with paper brightness, opacity, and smoothness of paper.

All agents must be added precisely to pulp stock so the end product meets the particular needs of an end user. Special consideration must be given because of the low flow and sometimes erosiveness of certain chemicals such as titanium dioxide and PCC.

Product Solutions

■ LOW FLOW CONTROL	Optional V-notch ball allows for a wide range of low-flow control options.
■ EROSION CONTROL	V-notch ball made in a variety of materials for erosive applications.
■ ZERO LOST MOTION	Splined driveshaft and shaft to ball pinning allows for tight control.
■ EXTENDED SERVICE LIFE	Heavy duty seal and rugged bearing design are robustly designed for extended service.
■ EASE OF MAINTENANCE	Low friction bearings with minimal friction provide optimal control and drop-in place.
■ REDUCED MAINTENANCE	Flanged valve body reduces alignment and installation time.
■ SMALL ACTUATOR PROFILE	Actuator profile promotes smaller envelope package size for tight spaces.
■ POSITIONER FEEDBACK	Linkage-less and non-contact feedback improves reliability in high vibration.

Fisher ceramic Micro-Notch ball

Paper Machine

Basis Weight

Pulp stock consistency is a key factor in determining the grade and quality of the end product. Basis weight measured at the dry end of the machine is fed back via control logic to the basis weight valve at the wet end of the machine. Appropriate adjustments can then be made to produce an end product that meet's customer specifications. This makes the basis weight valve one of the most critical in the mill.

Quick, accurate step changes to setpoint are a must. Response time must also be quick. Correct control logic between the course and trim valves are necessary to ensure correct end product basis weight.

Product Solutions

- MAXIMUM FLOW CONTROL — V-notch ball provides modified equal percent flow characteristic.
- ZERO LOST MOTION — Splined driveshaft and shaft-to-ball pinning allows for tight control.
- EXTENDED SERVICE LIFE — Rugged bearing design for extended service life.
- EASE OF MAINTENANCE — Low friction bearings drop in place for easy maintenance.
- REDUCED MAINTENANCE — Flanged valve body reduces alignment and installation time.
- SMALL ACTUATOR PROFILE — Actuator profile promotes smaller envelope package size for tight spaces.
- POSITIONER FEEDBACK — Linkage-less and non-contact feedback provides valve position accuracy and improves reliability.

Fisher V150 Vee-Ball control valve, 2052 actuator, and FIELDVUE DVC6200

Paper Machine

Vacuum Box

After the pulp stock is sprayed on the forming fabric, the sheet is still very wet and must be removed. A vacuum box, or flatbox, under the forming fabric helps to remove the excess water. These valves help to control the amount of vacuum being pulled on the sheet, and can have a big effect on the rest of the paper machine. Poor control in the forming section can lead to problems with end product consistency and formation leading to off-spec product.

Dryer Steam and Condensate Return

After water is removed from the sheet via vacuum and the press section of the paper machine, heat is applied to evaporate the remaining water to the desired paper dryness. Steam is sent to large diameter steam-heated cylinders to provide the necessary heat, and the resulting condensate must be returned to the mill's boiler feedwater system. Correct steam, and thereby heat, is important to ensure end product is at the correct dryness and on-specification.

Product Solutions

- CONTROL RANGE — Expanded butterfly control range of 15-70 degrees of operation.
- ZERO LOST MOTION — Splined driveshaft and shaft to disk pinning allows for tight control.
- MAXIMUM FLOW CONTROL — Disk provides equal percent characteristic for improved throttling range.
- PIPELINE ORIENTATION — Spring loaded shaft for either vertical or horizontal valve orientation.
- SMALL ACTUATOR PROFILE — Actuator profile promotes smaller envelope package size for tight spaces.
- POSITIONER FEEDBACK — Linkage-less and non-contact feedback improved reliability in high vibration applications.

Fisher Control-Disk™ rotary valve, 2052 actuator, and FIELDVUE DVC6200

Power

1 Boiler Feedwater Startup

2 Boiler Feedwater Regulating

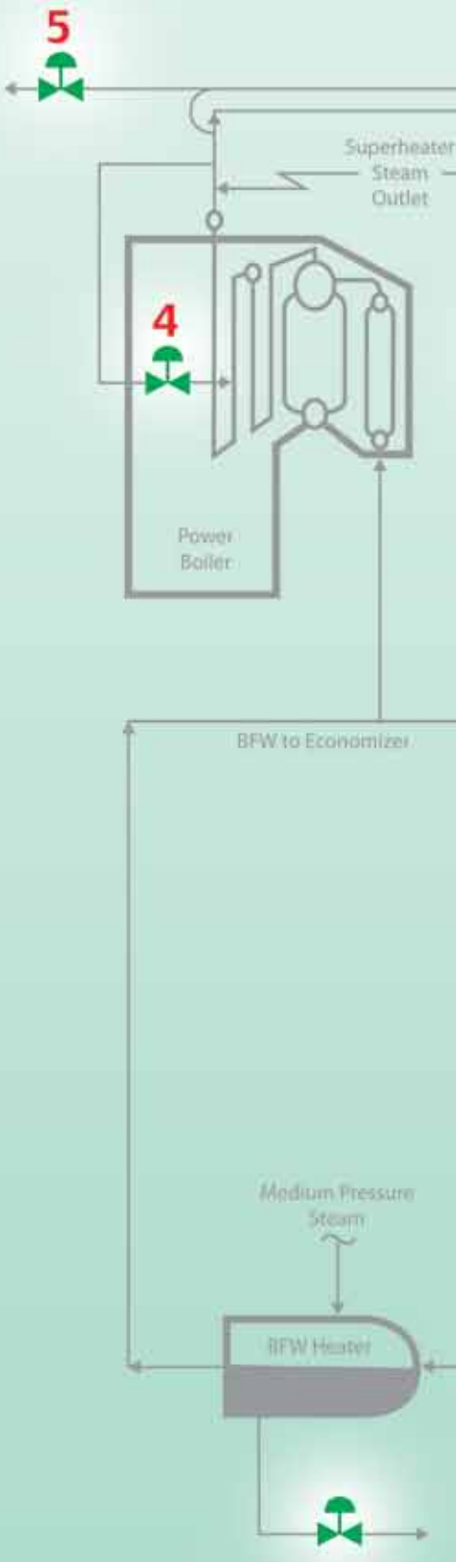
3 Boiler Feedwater Recirculating

4 Sootblower

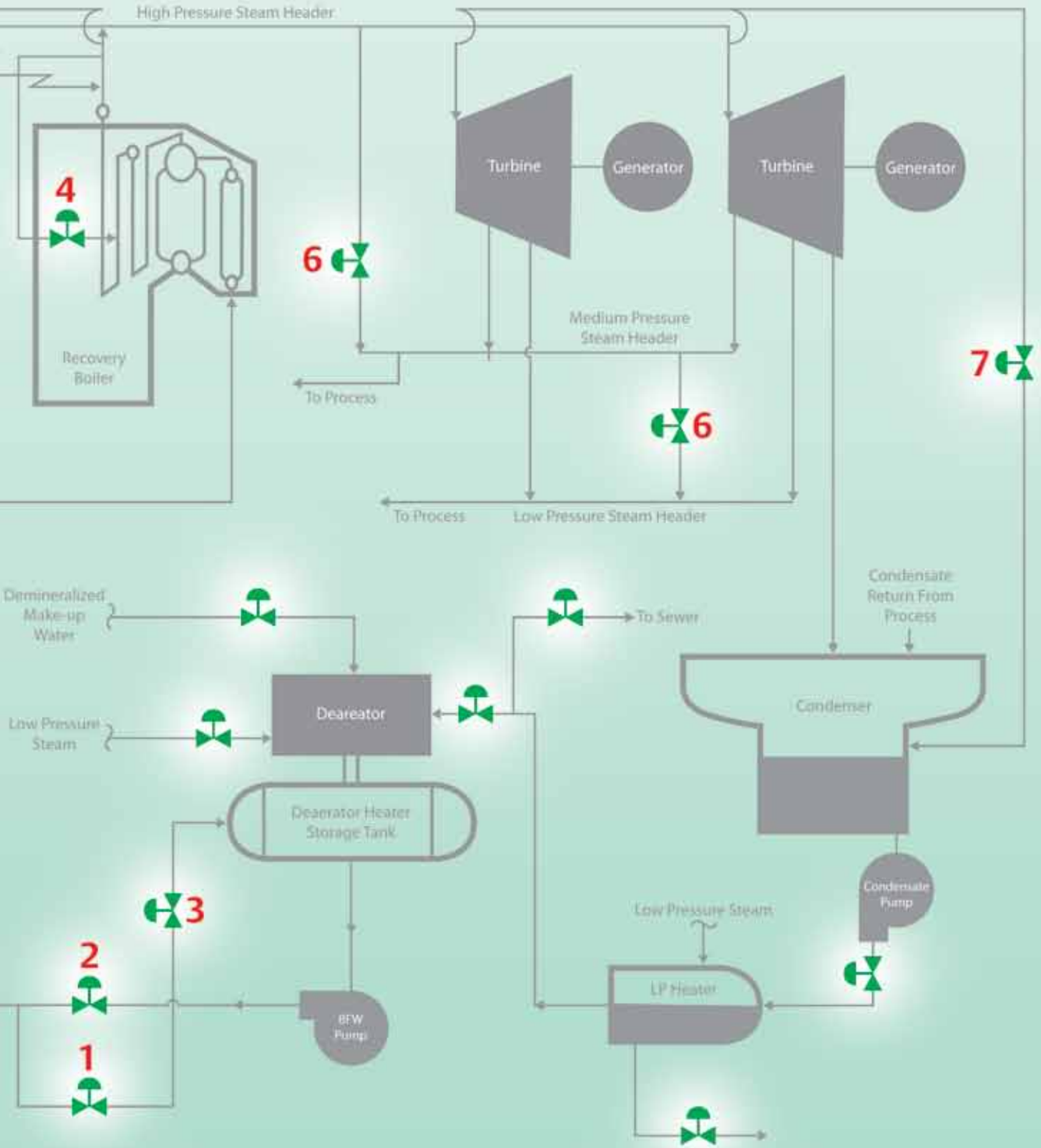
5 Sky Vent

6 Main Steam Pressure Reducing Valve

7 Turbine Bypass



Steam Cycle Process



Power and Steam Cycle

Boiler Feedwater Startup and Regulating

In the normal range of plant operation, the boiler feedwater regulator experiences high flow rates with low differential pressure. However, during startup, this valve experiences low flow rates with very high differential pressure, which can cause severe cavitation damage. Some feedwater systems are designed using one valve to handle startup and normal operating conditions. Others are designed using a separate small startup valve to handle low flow, cavitating conditions and a second larger valve to handle high flow rates required for normal operation.

Boiler Feedpump Recirculation

The boiler feedpump recirculation valve faces some of the toughest conditions of any control valve in a power plant. The boiler feedpump takes its suction from the deaerator at relatively low pressure, and increases the pressure to approximately 10% above the main steam pressure. During startup or low load conditions, flow to the boiler may not be adequate to meet the minimum flow requirements of the boiler feedpump.

Boiler feedpump recirculation valves protect the feedpump by ensuring adequate flow is passing through the pump at all times. These valves will experience extreme cavitation caused by high temperatures and pressure drops.

Product Solutions

- MAXIMUM FLOW CONTROL — Pneumatic actuation provides highly accurate step positioning and stable valve response.
- FLOW RESPONSE — Optional accessories ensure quick step valve positioning for precise throughput and control.
- FLOW THROUGHPUT — Valve design ensures high turndown even in extreme flowrates.
- TIGHT SHUTOFF — Advanced sealing technology provides tight shutoff and extends valve's service life.
- CAVITATION MITIGATION — Provides low-flow cavitation protection during startup and standard operation, and reduces vibration and noise.
- POSITIONER FEEDBACK — Linkage-less and non-contact feedback improves reliability in high vibration applications.

Fisher EH control valve, 585C actuator, FIELDVUE DVC6200

Power and Steam Cycle

Sootblower

In the power and recovery boiler, firing fuels such as coal, oil, or other waste products cause degradation of the boiler tubes. Deposits from the combustion process can collect on the heat exchanging tubes, which reduces thermal efficiency and may cause operational problems.

Sootblower valves provide steam to the sootblower system to remove deposits from the boiler tubes and must withstand high pressure, high vibration, and thermal cycling to maintain unit efficiency.

Product Solutions

■ HIGH PRESSURE CAPABILITIES	Rugged design and valve options allow for a multitude of pressure class ratings.
■ HIGH TEMPERATURE OPTIONS	Customized soot blower trim provides high temperature capabilities, reduces noise, and withstands both heavy vibration and thermal cycling.
■ EXTENDED SERVICE LIFE	Wear resistant hardened trims extend service life.
■ TIGHT SHUTOFF	Advanced sealing technology provides tight shutoff.
■ EASE OF MAINTENANCE	Valve can remain in pipeline during removal of trim parts for inspection or maintenance.
■ POSITIONER FEEDBACK	Linkage-less and non-contact feedback improves reliability in high vibration.

Fisher HP control valve, 667 actuator, FIELDVUE DVC6200

Power and Steam Cycle

Sky Vent

Sky vent valves may operate during startup and shutdown of the heat recovery steam generator, bypassing main steam around the steam turbine to the atmosphere.

Sky vent valves must withstand the full pressure drop that occurs as the valve dumps high pressure and temperature steam directly to the atmosphere. They should operate quietly during dump operation and provide tight shutoff during normal operation to prevent valuable steam leakage.

Product Solutions

- MAXIMUM FLOW CONTROL — Pneumatic actuation provides highly accurate step positioning and stable valve response.
- FLOW RESPONSE — Optional accessories ensure quick step valve positioning for precise throughput and control.
- NOISE REDUCTION — Noise abatement technology reduces the harmful effects of noise and vibration.
- TIGHT SHUTOFF — Advanced sealing technology provides tight shutoff and extends valve's service life.
- EASE OF MAINTENANCE — Valve can remain in pipeline during removal of trim parts for inspection or maintenance.
- POSITIONER FEEDBACK — Linkage-less and non-contact feedback improves reliability in high vibration.

Fisher HPT control valve, 585C actuator, and FIELDVUE DVC6200

Power and Steam Cycle

Main Steam Pressure Reduction

Most mills need to accommodate a variety of steam pressure requirements for the various processes in the mill. Steam from the power and recovery boilers supply high pressure and temperature steam to the high pressure header, and can be staged down to accommodate the pressures needed at the other headers.

Pressure reduction between headers can be achieved through the use of pressure reducing valves (PRV) or a steam turbine. These valves are exposed to high pressure and temperature steam, high ambient temperatures, severe vibration, and high levels of noise.

Product Solutions

- HIGH PRESSURE CAPABILITIES — Rugged design and valve options allow for a multitude of pressure class ratings.
- HIGH TEMPERATURE OPTIONS — Valve options provide high temperature capabilities that also reduce vibration, mechanical noise, and maintain valve plug stability.
- NOISE REDUCTION — Available trim technologies to ensure the safety of personnel and meeting regulatory requirements.
- TIGHT SHUTOFF — Advanced sealing technology provides correct shutoff and extends valve's service life.
- EASE OF MAINTENANCE — Valve can remain in pipeline during removal of trim parts for inspection or maintenance.
- POSITIONER FEEDBACK — Linkage-less and non-contact feedback improves reliability in high vibration.

Fisher EWT, 585CLS, and FIELDVUE DVC6000

Power and Steam Cycle

Turbine Bypass

Turbine bypass systems permit operation of the steam generator independently of the turbine during startup, shutdown, and plant upset conditions. They must be adequately sized to meet the needs of normal startup and shutdown, as well as transients. They must also operate at acceptable noise levels. To minimize unplanned downtime, bypass valves are installed in parallel with the turbine to ensure pressure reduction occurs even when the turbine is offline.

Fisher steam conditioning units combine the control of steam pressure and temperature into one system. These valves address the need for better control of steam conditions brought on by increased energy costs and more rigorous plant operation. They provide the needed temperature control and noise
abatement technology.

Product Solutions

- HIGH PRESSURE CAPABILITIES — Rugged design and valve options allow for a multitude of pressure class ratings.
- HIGH TEMPERATURE OPTIONS — Valve options provide high temperature capabilities.
- NOISE REDUCTION — Available trim technologies to ensure the safety of personnel and meeting regulatory requirements, reduces vibration and mechanical noise, and maintains valve plug stability.
- TIGHT SHUTOFF — Advanced sealing technology provides tight shutoff and extends valve's service life.
- STEAM CONDITIONING — Integral spraywater nozzles engineered for your steam requirements.
- EASE OF MAINTENANCE — Valve can remain in pipeline during removal of trim parts for inspection or maintenance.
- POSITIONER FEEDBACK — Linkage-less and non-contact feedback improves reliability in high vibration.

Fisher TBX steam conditioning control valve and 585 CLS actuator

Power and Steam Cycle

Steam Conditioning

As with any superheated steam cycle, the temperature of the superheat needs to be controlled to ensure that it does not exceed the material limits of the process equipment. Temperature control is accomplished by use of an attemperator or desuperheater that injects a controlled amount of cooling water into the superheated steam flow.

Ring and insertion style attemperators are designed to work in conjunction with supporting superheat and reheat control valves. This system prevents damage to the process equipment and extends its service life. Some attemperators use anti-flashing nozzles to provide the required amount of water needed for accurate temperature control.

Product Solutions

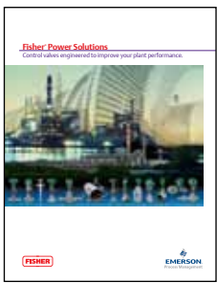
■ HIGH RANGEABILITY	Water flange connections offer high rangeability for excellent system control.
■ HIGH TEMPERATURE CAPABILITIES	Materials and design are suitable for temperatures up to 593° C (1100° F).
■ EXTENDED SERVICE LIFE	Some insertion style attemperators use vortex shedding technology to minimize vibration and extend service life.
■ TEMPERATURE CONTROL	Variable geometry spray nozzles ensure complete mixing and rapid vaporization of spraywater.

Fisher DMA/AF-HTC Insertion Style Desuperheater

If you found this brochure valuable, may we also recommend the following literature:

"Fisher® Pulp & Paper Sourcebook"

Document Number: D103540X012
www.EmersonProcess.com/Fisher/Documentation



"Fisher® Power Industry Solutions"

Document Number: D351920X012
www.EmersonProcess.com/Fisher/Documentation

"Fisher® Vee-Ball Rotary Control Valves"

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"Fisher® Technology Development Brochure"

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