HANDLING, CIRCULATION, AND FILTERING IN METERING SIZE PRESS INSTALLATIONS, PART 1

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METERING SIZE PRESS INSTALLATIONS VARY BY EQUIPMENT, SITE CONSTRAINTS, AND PAPER GRADES PRODUCED. DESIGN PLAYS A CRITICAL ROLE IN THE DELIVERY OF HIGH CONSISTENT QUALITY TO THE METERING SIZE PRESS.

THE METERING SIZE PRESS HAS TRANSFORMED THE definitions of a size press. Some of the challenges and design criteria for a traditional flooded nip size press have been removed and some remain. The comparison to this simpler design helps to define the unique differences that the metering size press can offer the papermaker today.

Some points to consider:

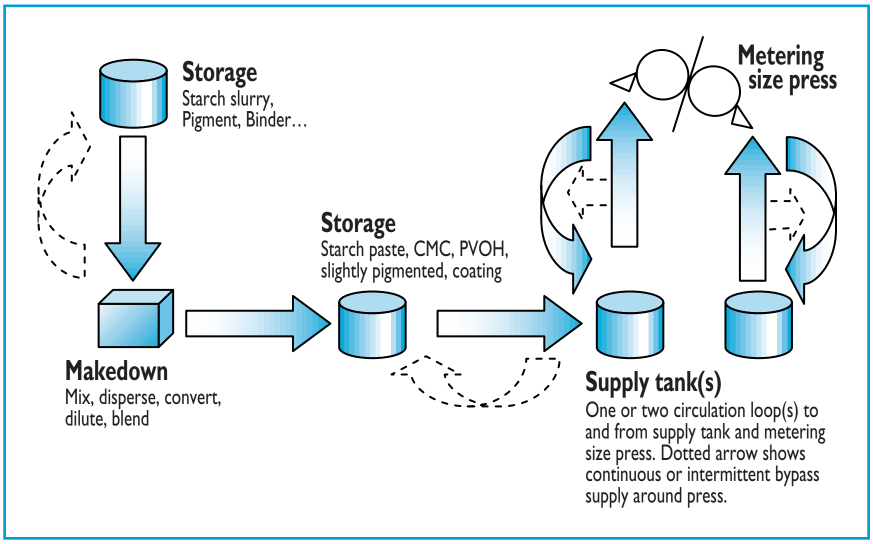
- Because the metering size press applies liquid in a pressured environment, a change in flow or pressure to the press can produce a quality upset or even a web break in very sensitive installations.
- The liquid recirculating from and to the metering size press is much cleaner than the flooded nip size press. Gone are large pieces of broke returning to the supply tank as a result of cleaning the size press during a web break. Also, because the base sheet does not enter a flooded nip, the tendency for washing loose particulate off the sheet, including hard particles and fibers, is reduced. Fibers, sand, and other materials are picked off the sheet and enter the recirculating flow as the backing roll enters the applicator.
- A papermaker has the options of treating one side of the paper or board, treating both sides with the same treatment, or using different coatings on each side of the paper.
- Use of slightly pigmented size or high solids coatings is possible with greater cross direction and machine direction control of the film thickness.
- Variation in the flow feeding the metering size press must be minimized with appropriate mill controls over flow rate, flow velocity, pressure, temperature, pH, percent dry solids, clarity, viscosity, and retention of individual additives.
- The use of higher dry solids starch and pigmented coatings increases the sensitivity to dewatering or dilution.
- A metering size press design may be a combination of compromises due to wide swings in non-pigmented and pigmented flows that sometimes have conflicting needs.
- Fitting into an existing paper machine may at times present challenges that could compromise the "perfect" installation.

CIRCULATION—DELIVERY AND RETURN

Flow

Flow rates to metering size presses vary from 0.5 to 3 gal/min/in. of machine width (5 to 26 L/h/mm). Papermakers reporting flows that are 10% or lower than this estimated flow rate range are probably quoting the amount that applied to the paper, not the flow to the metering size press.

Figure 1 shows a simplified version of the flow path to a metering size press. Depending upon the grades and equipment provided, one supply tank for both sides of the metering size press or two supply systems (one for each side) may be used. The flow from the supply tank(s) may be diverted continuously or intermittently back to the supply tank. Diversion of all the flow to the supply tank occurs in some installations only during a web break. Recycling during a web break aids filtration efficiency by exposing the flow to repetitive passes through



1. Flow between size and coating preparation, storage, supply, and the metering size press. Dotted arrows represent alternative flow paths showing recirculating flow back to storage tanks or a bypass returning all or a portion of the metering size press flow to the supply tank(s).

the filter as the metering size press is cleaned and the machine rethreaded.

Not all installations include a recirculation flow during a down or web break. Some papermakers do not believe this added recirculation of starch is good papermaking practice. They caution that if sufficient shear is put on the starch, it could lead to amylose crystal formation or setback.

Supply tank

The metering size press is the user and the major source of variation that the supply system is designed to regulate.

Some issues to consider with regard to supply tanks include:

- Mild agitation avoids stratification and prevents drying and bacteriological activity at the surface of the tank. Tank baffles may be necessary to aid mixing. Turn off the agitator when tank levels are low to avoid vortexing and creating foam.
- A tank cover is recommended to hold in humidity and avoid drying of size or coating as tank levels vary. A cover also prevents the accidental introduction of foreign particles into the tank.
- Cylindrical and conical shaped tanks are used with the outlet in the tank bottom.
- Jackets in some tanks are used to maintain hot starch temperatures or to cool to increase relative humidity in closed tanks when pigmented coatings are used.
- The tank volume is sized to hold the piping fill volume, the volume of the filters, the volume of the metering size press, a timed volume based on the output of the pump, and an added buffer volume.
- The fill level is regulated by fresh size or coating supply if continuous or by level controls (high and low) in the tank. Keep the distance between level controls small to help reduce solids, viscosity, and temperature variability when fresh size or coating is introduced.
- The return flow into the supply tank should not create foam. Avoid a free fall return flow into the tank. Tangential flow below minimal working level in the supply tank is recommended. Agitation may not be required if the return flow supplies sufficient mixing.
- Most return flows are gravity fed. Piping angles and slopes can control velocity of flow. If they are too high, then entraining air may result. Size an inclined pipe return and a larger diameter pipe just before the supply tank to help reduce the velocity of the liquid when it enters the supply tank. When the distance between the metering size press and the supply tank(s) is too long or the height of the supply tank too high, then a pump on the return flow may be required. A second smaller tank may be necessary to act as a sump for the returning flow. The sump avoids bringing air into the suction side of the returning pump.
- Defoamers are used in very small amounts in some installations to control foam.
- Some recirculating surface treatments may selectively lose one or more of their ingredients. This scavenging or scalping of the coating may require some mills to add to the supply tank lost pigment or binders during production. Any continuously added material unregulated by the current condition of the size or coating must be stopped when the paper machine is down, or overuse of the additive will result.
- Dilution water may be added intermittently or continuously to control the percent of dry solids or viscosity. Dewatering may occur due to the temperature or porosity of the base sheet.

Pumps

Positive displacement pumps are used to supply metering size presses. Positive displacement pumps are desirable since they produce a stable flow output independent of downstream restrictions to flow. If a restriction exists, such as a partially closed valve or a filter that is collecting dirt, the pressure before the restriction increases, but the flow rate remains constant. Because of this feature, most installations include a high-pressure switch or relief valve to avoid overpressurizing the system. Pressure sensors are also used to detect low pressure to shut off a pump and avoid running a pump dry. Pumps also can be shut off using a low-level control on the supply tank.

Proper maintenance of pumps is very important to avoid any entrainment of air or water into the interior of the pump and therefore to the metering size press. A spare pump is recommended for each side of the metering size press, or one spare can act as a common spare for either side's supply.

Piping

Metering size presses present a challenge to the design engineer if a paper mill is considering using the metering size press for both non-pigmented and pigmented size or coatings. The characteristics of the liquid may demand different piping considerations and may even require different flow rates to the metering size press. Sizing piping for the higher flow of one may create a flow with too low velocity on another grade.

Velocity of low solids slurries, such as starch slurry or low solids pigmented coatings to remain in suspension, are recommended to flow at least 1.5 ft/s (46 cm/s). In general, controlling piping diameters to maintain a 2 to 6 ft/s (60 to 183 cm/s) flow are quoted for starch and coating installations. For sizing headers or piping for multiple station or vessel filter systems, a velocity of 5 to 7 ft/s (150 to 213 cm/s) is used to set the pipe size. If the flow rate is too low, there is danger of settling and creating post filter contamination in lines when higher solids pigmented coatings tend to solidify.

Purchasing a system designed for future capacity could create runnability issues when the startup conditions do not warrant the piping or filter sizing of the future. Good piping practices will avoid buildup of solids on too large diameter piping, especially when pigment is used, and avoid air entrainment or solids trapping in piping systems.

To avoid pressure losses and vibration past the pump, install straight lines of piping with long radius elbows where possible. Valves can be placed for control, isolation, and maintenance to access piping for cleaning during downs. Minimize the length of pipe and number of elbows. Avoid dead areas or pockets where coating or low solids pigmented size could settle out. Support piping where necessary and add expansion joints to avoid vibration or transfer of vibration to downstream equipment.

HOUSEKEEPING

Variation in the delivery to the metering size press, the flow, and the quality of the size or coating have a large impact on the end quality of the product. Several areas in this process can affect this quality. They are designed to deal with the expected variations in the metering size press process.

Boilouts

As with any coating or size press installation, the use of regular boilouts keep piping clean and eliminate any sources for biological growth in the system. After the piping and filters have been boiled out, the system should be rinsed well. If pigmented coatings are used and a higher debris residue level or surface defects are noted right after a boilout, then the particulate may not be carried out of the supply system with water alone. Some mills use false coatings or pigment to help carry out this heavy material.

In addition to regular boilouts, it may be necessary to use biocides on starch-based systems and treat the water used to make down the starch. Clean mill water, lacking bacteriological or fungal activity, is important to the success of starch size. Bacterial growth can reduce starch viscosity, lower the pH, and produce an odor or color change.

Dumping supply tank

Dumping starch is usually a result of the paper or board product failing a quality test. Mills develop habits based on past experience to dump size on each shift or daily to avoid creating reject product. An alternative strategy is to avoid or control the accumulation of contaminants that hurt the performance of the sheet. These contaminants include wood based and synthetic fibers, other debris from the base sheet surface, additives, water, and amylose crystals.

Starch setback

Setback or the retrogradation of starch is best avoided by using preconverted starch in place of pearl starch. The precipitation of amylose crystals can cause an increase in oven dry solids that will not agree with refractometer readings of the same starch. The only way to correct setback is to drain and clean the system. Remaining crystals can speed the process of setback in the next batch if not properly removed. Timing may vary with the percent solids and temperature at which the starch is stored.

Store starch at a temperature less than or equal to 160°F (72°C). Starch crystallization is prone to start at temperatures between 160°F and 190°F (72°C and 88°C). Starch gelling or congealing is favorable in temperatures under 140°F (60°C). Poor makedown can create sludge, when the starch becomes too viscous with unconverted starch granules. The longer you hold the starch, the greater the chance of spoilage and retrogradation. Starch should not be kept for more than eight hours. Filtration of the starch size is important, as any particle can act as a catalyst for setback. **TJ**

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