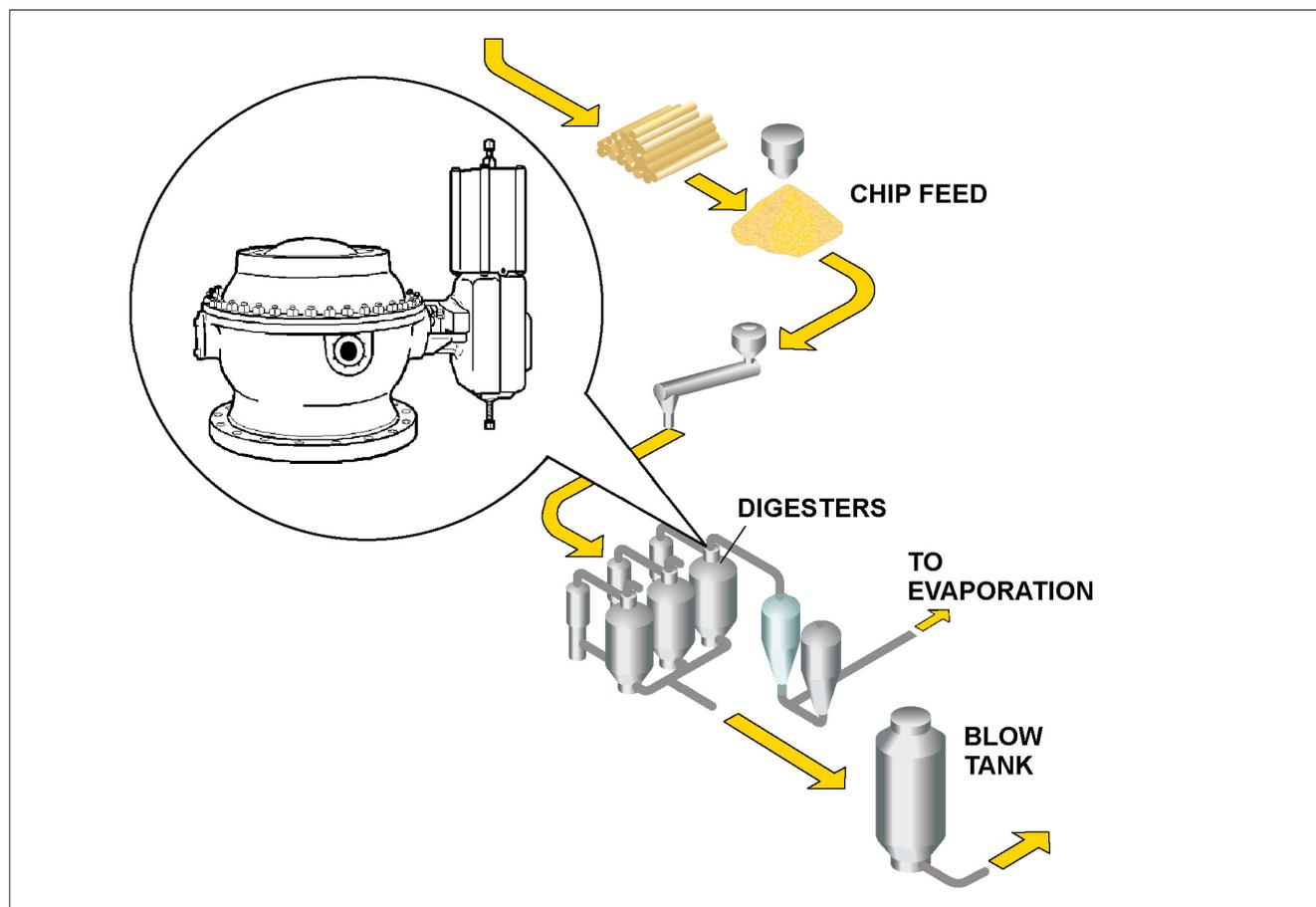


## Capping valves for batch digesters



### Overview of the process

The batch cooking system consists of several batch digesters and liquor accumulators. Accumulators are necessary for balancing the flows between different cooking stages. Production rate is determined by the number and size of digesters. The major objective is to produce highest quality pulp in the shortest period of time while meeting strict environmental standards.

### The process

The digester itself and the circulation system must stand the high pressure. Remote-controlled ball valves, capping valve and blow valve, are installed at the top and bottom of the digester.

Batch digesters are completely automated in modern pulp mills. Chip filling, air removal, liquor filling, heating, cooking, displacement and also emptying (blowing) the digester are all accomplished with automated valves. Digesters in modern pulp mill can basically be run by one person. The speed at which the chips can be filled, cooked and blown must be as fast as possible. Making sure that enough chips have been introduced to the digester is also a concern and is aided by steam or liquor packing as well as air evacuation during the filling of the digester. Minutes saved in these areas eventually add up to entire cooks and extra cooks mean more usable pulp and eventually more profits. One of the biggest time savers is the automated capping valve.

## Features and benefits

- Capping valves are used to automate the filling operation. We can estimate that the automation of the cover closing can save six minutes per batch. So the valves return their investment in a short time.
- The ball flow path is provided with a linear insert to allow smooth passage of the chips for fast filling.
- The lower body half is modified in accordance with the digester flange dimensions and standard.
- A preloading device assists the ball to the seat with the desired pressure for tight sealing.
- The preloading device is outside the body to prevent chips and liquor from causing hazards.
- Failsafe system could be a mechanical or electrical or both.
- Mechanical jammer is inside the pneumatic actuator housing. The jammer is completed with two limit switches and a spring return air cylinder for the jammer operation.
- Electrical interlocking system based on one or two pressure switches (sensing the digester pressure) and solenoid valves.

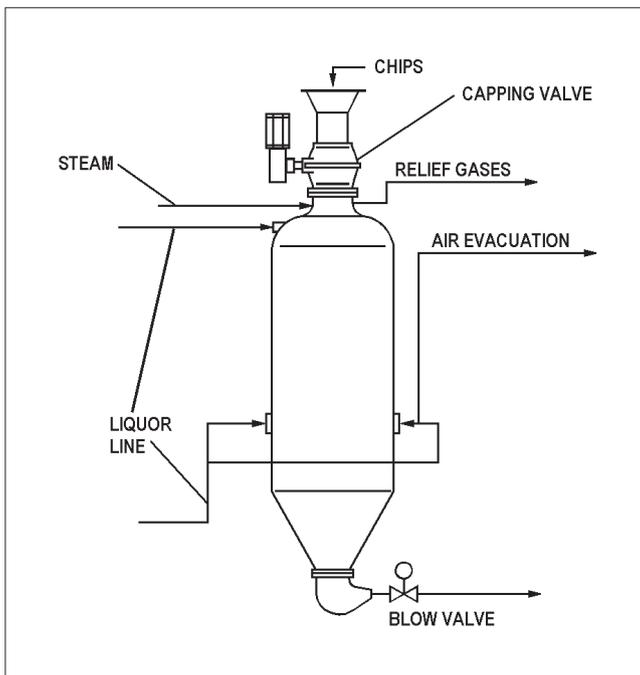


Fig. 1.

## Chip feeding arrangement

The chips are taken from wood yard to the digester house by belt conveyors and further by screws directly into the chip chute.

The chips chute is mounted directly to the capping valve and only protection from weather and rain is required around the top of the digester.

The chip chute is arranged so that the chips fall vertically through to packing devices. Normally the chute is conical. Using the steam packer devices and efficient air removal systems, the filling time can be minimized and packing degree maximized. Also steam packing heats the chips and removes air resulting in better liquor impregnation at the same time distribute the chips evenly across the digester cross section. During chip filling air and uncondensed steam is evacuated from the digester through the suction screen by means of an evacuation fan.

## Interlocking

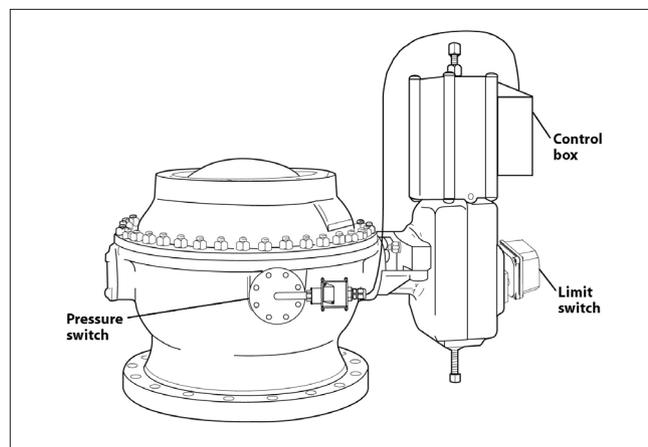


Fig. 2. Electrical interlocking system

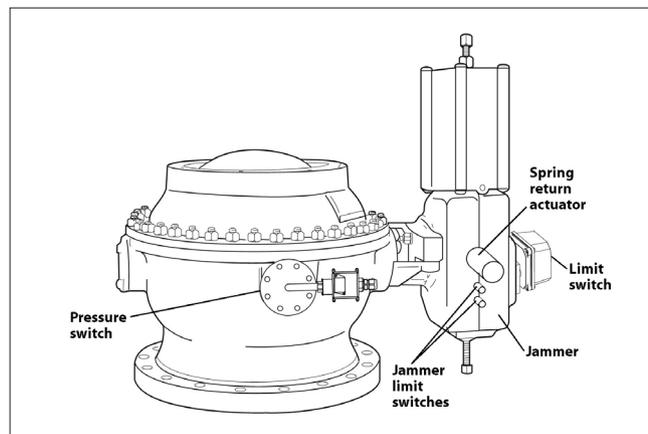


Fig. 3. Mechanical jammer device

Interlocking system could be an electrical, a mechanical or it could use both.

- Electrical interlocking system (Fig. 2) consist of two separate pressure switches, limit switches and a control box (including solenoid valves and relay).
- Mechanical jammer device (Fig. 3) is built in the actuator housing, jammer mechanism prevent the actuator piston rod to move when valve is close position. The jammer is guided by spring return actuator, limit switches and solenoid valve.

Electrical and mechanical interlocking systems works independently, operation of the capping valve is virtually impossible when digester is under pressure.

The function of the packing steam valve can also be tied to this interlocking system.

### Determining port size for batch digester capping valves

The required port size for a Neles capping valve is determined by the digester volume and the desired filling time.

1. Using a conveyor belt chip transport so that excessive air (from digester) moves upwards through the capping valve. In this case the filling speed could be from 5 m<sup>3</sup>/min to 7 m<sup>3</sup>/min depend on port size.

#### For example: Digester 160 m<sup>3</sup>

Valve DN500 → 4 m<sup>3</sup>/min = Filling time 35 min

Valve DN600 → 5,3 m<sup>3</sup>/min = Filling time 30 min

#### For example: Digester 200 m<sup>3</sup>

Valve DN500 → 5 m<sup>3</sup>/min = Filling time 40 min

Valve DN600 → 6,7 m<sup>3</sup>/min = Filling time 30 min

2. Using a screw-type conveyor, packing steam system (LP-steam) and air evacuation from the digester through the suction screen by means of an evacuation fan. In this case the filling speed could be about 17 m<sup>3</sup>/min.

#### For example: Digester 400 m<sup>3</sup> Packing steam 1,5-2,0 bar Air evacuation about 8000 norm. m<sup>3</sup>/h

Valve DN500 → 17 m<sup>3</sup>/min = Filling time 24 min

## Performance and recommendations

### Valve tightness

All PZ capping valves are factory tested to fulfill ISO 5208 Rate D leakage test. Corresponding leakage valves, tested with water 1,1 x nominal pressure.

DN	NPS	ml/min, wa
500	20	3,0
600	24	3,6
700	30	4,5

### Operation time

During start-up or other exceptional circumstances, capping valves must meet extreme conditions where pressure, impurities and high operational velocities can cause material damages (ball/seat ring). Therefore PZ capping valves have a recommended minimum operation time for 90° rotation as listed.

Adjusted operation time are factory preset values, obtained air supply lines between solenoid valve and actuator cylinder.

Valve size	Minimum operation time 90° full stroke	Adjusted operating time with 6 bar supply pressure, B1C actuator
DN 500	8 seconds	10 seconds
DN 600	10 seconds	12 seconds
DN 700	12 seconds	15 seconds

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