Continuous digester
ANDRITZ Continuous Pulp Cooking System
Main Top Circulation

Introduction and background
Continuous cooking is a method of chemical cooking in which wood chips and cooking liquors are fed at controlled rates into the pressurized digester, the chips move down through successive cooking zones within the digester and are continuously discharged at the bottom as pulp. Transfer of the chips from the feed system to the cooking vessel(s) and the application of valves from Metso Automation in this process will be addressed in this bulletin.

Process description
The chips need to be transferred from the 1.2 bar pressure of the steaming vessel to the 8-9 bar pressure of the cooking vessel(s). This is done via a liquor filled system. Chips fall from the steaming vessel into the chip chute; here they are mixed with liquor. The liquor/chip slurry flows into the high pressure feeder (HPF). The HPF is a rotary plug valve that transfers the chips to the top circulation line (TC) where they are sluiced from the HPF by the TC flow and transported to the top separator. The top separator is located in the top of the digester in a single vessel system or the top of the Impregnation vessel in a two vessel system. The top separator allows the chips to be separated from the TC transfer liquor. The chips fall into the cooking vessel and the liquor is recirculated back to the high pressure feeder to collect more chips.
Valves sizes and process data that are shown on this page are for REFERENCE ONLY. To appropriately size a valve, use actual process data obtained from the system.
## CONTINUOUS DIGESTER

### APPLICATION REPORT 10/11

### Tag # HV-51 (RO2) | X | Two Vessel System | X | Single Vessel System

**Application:** Top Circulation Line Isolation

Strong Black Liquor – On-Off Valve

HV-51 is also known as RO2 (Remote Operated Valve #2) Tag HV-51 is the isolation valve for the main digester return line for both single and double vessel systems. The main digester return line recirculates liquor back to the top circulation pump (TCP) and high pressure feeder for sluicing of chips.

**Shut-Off:** 250 psid = 3,4 bar  
**Temp:** 240 °F = 116 °C

**Control valve**

- **ASME:** 300
- **DIN:** PN 25
- **Size:** 12", 14", 16"  
- **Class:** DN 300, 350, 400
- **Recommendation:** M2DB_AS12-B1C40-SV, M2DB_AS13-B1C40-SV

**Comments:** HV-51 is normally open and only closed when the digester vessel (single vessel system) or impregnation vessel (two vessel system) must be isolated from the top circulation pump and high pressure feeder.

### Tag # HV-52 (RO1) | X | Two Vessel System | X | Single Vessel System

**Application:** Top Circulation Line Isolation Valve

Strong Black Liquor and Chips – On-Off Valve

HV-52 is the main digester feed line isolation valve for both single and double vessel systems. HV-52 is normally open and only closed when the digester vessel (or impregnation vessel) must be isolated from the high pressure feeder.

**Shut-Off:** 250 psid = 17,2 bar  
**Temp:** 240 °F = 116 °C

**Flow:** 9000 gal/min = 34100 liters/min

**Control valve**

- **ASME:** 300
- **DIN:** PN 25
- **Size:** 12", 14", 16"  
- **Class:** DN 300, 350, 400
- **Recommendation:** M2DB_AS12-B1C40-SV, M2DB_AS13-B1C40-SV

**Comments:** HV-52 is also known as “RO1” (Remote Operated Valve #1).

### Tag # HV-54 | X | Two Vessel System | X | Single Vessel System

**Application:** Pressurization of Top Circulation Line

Black Liquor – Control Valve

HV-54 is used only during start-up to pressurize the main feed top circulation line prior to starting the top circulation pump (TCP). This valve is closed during normal operation.

**Differential:** 40-50 psid = 2,8-3,4 bar  
**Temp:** 170 °F = 77 °C

**Shut-Off:** 320 psid = 22,1 bar  
**Flow:** 400 gal/min = 1500 liters/min

**Control valve**

- **ASME:** 300
- **DIN:** PN 25
- **Size:** 3"  
- **Class:** DN 80
- **Recommendation:** M2DA03AP-B1C11-ND

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**APPLICATION REPORT**

**Tag #** | **PV-30** | **X** | **Two Vessel System** | **X** | **Single Vessel System**
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**Application:** | Impregnation Vessel Pressure Relief Valve |    |    |    |    
| Black Liquor – Control Valve |    |    |    |    |    
| This valve acts as a pressure relief device by drawing off excess liquor from the upper impregnation zone, and feeding it to the inlet of the no. 2 flash tank. |    |    |    |    |    
| Pressure relief is required when the inlet separator screens become plugged. |    |    |    |    |    
| Differential: | 80-160 psid = 5,5-11 bar | Shut-Off: | 230 psid = 16 bar |    |    
| Temp: | 260 °F = 130 °C | Flow: | 2800 gal/min = 10600 liters/min |    |    
**Control valve** | **ASME** | **DIN**
--- | --- | ---
| Class: | 300 | PN 25 |    |    |    
| Size: | 4” | DN 100 |    |    |    
| Recommendation: | M2DA04AP-B1J12-ND | M1LA100AP-B1J12-ND |    |    |    

**Tag #** | **FV-3A** | **X** | **Two Vessel System** | **X** | **Single Vessel System**
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**Application:** | White Liquor Purge of High Pressure Feeder |    |    |    |    
| White Liquor – Control Valve |    |    |    |    |    
| A white liquor purge line was added to the high pressure feeder through the end bell equalization header. The continuous white liquor purge helps to keep the end bells free of fines and acts as a lubricant between the bell and housing. |    |    |    |    |    
| Differential: | 50-90 psid = 3,4-6,2 bar | Shut-Off: | 280 psid = 19,3 bar |    |    
| Temp: | 160 °F = 71 °C | Flow: | 50-125 gal/min = 190-475 liters/min |    |    
**Control valve** | **ASME** | **DIN**
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| Class: | 300 | PN 25 |    |    |    
| Size: | 1 1/2” | DN 40 |    |    |    
| Recommendation: | M2DA1HAP-B1C6-ND | M1LA040AP-B1C6-ND |    |    |    
| Comments: | This is very difficult control application because of the scaling potential of the white liquor. A metal seated ball valve with scraper style locked seats is required to remove scale build-up. The actuator should be sized with a generous safety margin due to the potential orque requirements. On older systems, this valve was designated as HV-3A or HV-35. |    |    |    |    

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The information provided in this bulletin is advisory in nature, and is intended as a guideline only. For specific circumstances and more detailed information, please consult with your local automation expert at Metso.