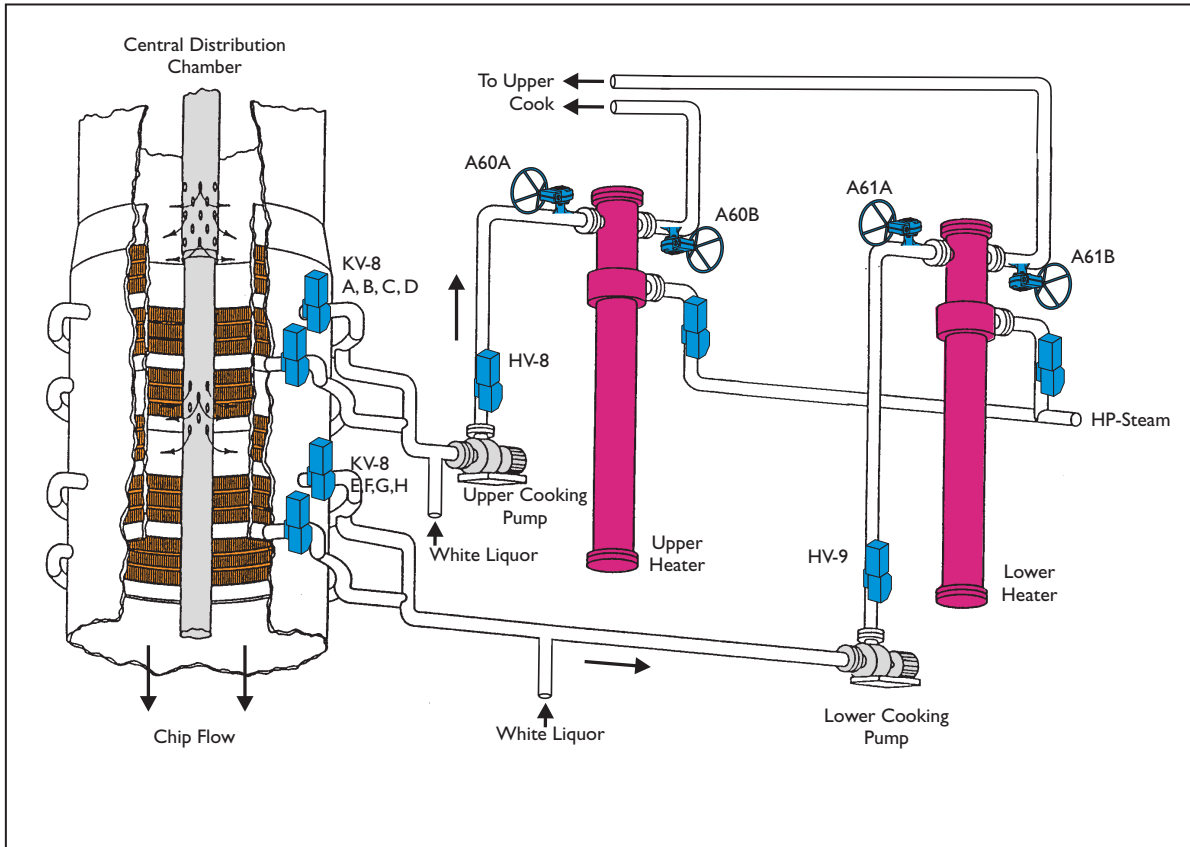


# Continuous digester

## ANDRITZ Continuous Pulp Cooking System Digester Cooking Zone



### 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. The cooking zones, their circulations and the application of valves from Metso Automation in this process will be addressed in this bulletin.

### Process description

The cooking circulation loops are used to add the heat needed to cook the chips. Circulation loops are established by the use of screens located around the circumference of the digester and the centerpipe located along the centerline of the digester. The circulating liquor travels from the screens, through the circulation pump, heat exchanger, to the centerpipe where it travels radially through the chip mass, heating the chips as it passes through them, returning to the screens to be recirculated. Two loops are commonly used to achieve the desired cooking temperature, upper cooking and lower cooking.

Tag #	A60 (A,B), A61 (A,B),	Two Vessel System	X	Single Vessel System
<b>A64 (A,B), A65 (A,B), A66 (A,B)</b>				
Application:	Upper, Lower & Spare Heater Isolation Valves Black Liquor — On-Off Valve These valves are used to isolate the heaters from the digester during acid cleaning.			
Shut-Off:	160 psid = 11 bar	Temp:	240 °F = 177 °C	
<b>Control valve</b>	<b>ASME</b>	<b>DIN</b>		
Class:	300	PN25		
Size:	6", 8", 10", 12"	DN 150, 200, 250, 300		
Recommendation:	M2DA06AP-M14 M2DA08AP-M15 M2DA10AP-M16 M2DA12AP manual gear operator	M1LA__AP-manual gear operator		
Comments:	Metso Automation's scraper seats and special heater isolation tolerances. Actuator must be at least 150 % larger to compensate for scale.			

Tag #	A235-F, A245-F	X	Two Vessel System	Single Vessel System
Application:	Isolation Valves for Bottom Circulation Heaters #1, 2, 3 Black Liquor — On-Off Valve These valves are used to isolate the heaters from the digester during acid cleaning.			
Shut-Off:	160 psid = 11 bar	Temp:	240 °F = 177 °C	
<b>Control valve</b>	<b>ASME</b>	<b>DIN</b>		
Class:	300	PN 25		
Size:				
Recommendation:	M2DA__AP-manual gear operator	M1LA__AP-manual gear operator		
Comments:	Metso Automation's scraper seats and special heater isolation tolerances. Actuator must be at least 150 % larger to compensate for scale.			

Tag #	TV-8H	Two Vessel System	X	Single Vessel System
Application:	Upper Circulation Temperature Control Steam – Control Valve The steam that sent to the circulation heaters is used to control the temperature of the exiting black liquor. After being heated, the black liquor is added to the upper cooking zone of the single vessel digester.			
Differential:	5-35 psid = 0,3-2,4 bar	Shut-off:	180 psid = 12,4 bar	
Temp:	400-520 °F = 200-271 °C	Flow:	10000-40000 lbs/hr = 4500-18200 kg/hr	
<b>Control valve</b>	<b>ASME</b>	<b>DIN</b>		
Class:	300	PN 25		
Size:	4"	DN 100		
Recommendation:	(<485 °F) REDA04CJJST-B1C6-ND	(<250 °C) RELA100AJJST-B1C6-ND		

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.

Tag #	TV-60A	X	Two Vessel System	Single Vessel System
Application:	Upper Circulation Temperature Control Steam – Control Valve Bottom Circulation Temperature #1 Control Steam – Control Valve.			
	This valve operates with TV-60B and TV-60C to regulate the temperature at the discharge end of the impregnation vessel. The steam that sent to the circulation heaters is used to control the temperature of the exiting black liquor. After being heated, the black liquor is added to the bottom circulation zone of the impregnation vessel through valves FV-60, FV-61 and FV-61A.			
	Differential: 5-35 psid = 0,3-2,4 bar Shut-off: 180 psid = 12,4 bar			
	Temp: 400-520 °F = 200-271 °C Flow: 10000-40000 lbs/hr = 4500-18200 kg/hr			
Control valve	ASME		DIN	
Class:	300		PN 25	
Size:	4"		DN 100	
Recommendation:	(<485 °F) REDA04CJJST-B1C6-ND		(<250 °C) RELA100AJJST-B1C6-ND	

Tag #	KV-8A & KV-8B	X	Two Vessel System	Single Vessel System
Application:	Trim Liquor Switching Black Liquor — On-Off Valve			
	Tag # KV-8A and KV-8B are a set of valves which control the flow direction of liquor through the screens at several zones in the cooking vessel. The objective is to maintain liquor circulation in the chip mass resulting in uniform temperatures.			
	Shut-off: 152 psid = 10,5 bar Temp: 325 °F = 163 °C			
	Flow: 1500 gal/min = 5700 liters/min			
Control valve	ASME		DIN	
Class:	300		PN 25	
Size:	8"		DN 200	
Recommendation:	B2B08AABD-B1CU11		LW8MT200AANAT/L-B1CU11-SV T = Switching valve construction	

Tag #	KV-8 (A-H)		Two Vessel System	X	Single Vessel System
Application:	Cooking Circulation Switching Black Liquor—On-Off Valve				
	There are four (4) valves in each of the upper and lower cooking zones. Cooking liquor flows through the screens then circulates through the heaters and back to the top of the digester. Screens must be switched, the valves are required to open and close every 90 seconds. Switching allows the moving pulp mass to wipe clean the screens when the valves are closed. Only two valves are open at a given time.				
	Shut-off: 160 psid = 11 bar Temp: 350 °F = 180 °C				
	Flow: 4000 gal/min = 15100 liters/min				
Control valve	ASME		DIN		
Class:	300		PN 25		
Size:	12"		DN 300		
Recommendation:	B2B12AABD-B1CU17		LW8MT300AAJA-B1CU17-SV T = Switching valve construction		
Comments:	This service is very difficult. Valves stroke 350000 times per year. Therefore, stellite bearings and double packing are required.				

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Tag #	TV-9H	Two Vessel System	X	Single Vessel System
Application:	Spare Circulation Temperature Control Steam — Control Valve (Two vessel system ref. TV-60B) These valves control steam to the "spare" heater.			
Differential:	5-35 psid = 0,3-2,4 bar		Shut-off:	180 psid = 12,4 bar
Temp:	400-520 °F = 200-271 °C		Flow:	10000-40000 lbs/hr = 4500-18200 kg/hr
<b>Control valve</b>	<b>ASME</b>	<b>DIN</b>		
Class:	300	PN 25		
Size:	4"	DN 100		
Recommendation:	REDA04CJJST-B1C6-ND	RELA100AJJST-B1C6-ND		
Comments:	This application is very similar to tag TV-8H.			

Tag #	TV-60B	X	Two Vessel System	Single Vessel System
Application:	Bottom Circulation Temperature #2 Steam — Control Valve (Single vessel system ref. TV-8/9H) These valves control steam to the "spare" heater.			
Differential:	5-35 psid = 0,3-2,4 bar		Shut-off:	180 psid = 12,4 bar
Temp:	400-520 °F = 200-271 °C		Flow:	10000-40000 lbs/hr = 4500-18200 kg/hr
<b>Control valve</b>	<b>ASME</b>	<b>DIN</b>		
Class:	300	PN 25		
Size:	4"	DN 100		
Recommendation:	REDA04CJJST-B1C6-ND	RELA100AJJST-B1C6-ND		
Comments:	This application is very similar to tag # TV-60A.			

Tag #	HV-8, HV-9	Two Vessel System	X	Single Vessel System
Application:	Upper (HV-8) & Bottom (HV-9) Cooking Circulation Flow Control Black Liquor — Control Valve Tags HV-8 and HV-9 are installed on the outlet sides of both upper and lower cooking pumps. Tags HV-8 and HV-9 control flow from the upper and lower cooking pumps to the upper and lower heaters respectively.			
Differential:	5 psid = 0,3 bar		Shut-off:	55-265 psid = 3,8-18,3 bar
Temp:	350 °F = 180 °		Flow:	4000 gal/min = 15100 liters/min
<b>Control valve</b>	<b>ASME</b>	<b>DIN</b>		
Class:	300	PN 25		
Size:	10"	DN 250		
Recommendation:	B2B10AABD-B1CU17-ND-F-SS	LW8MT250AANAT/L-B1CU17-ND T = Switching valve construction		
Comments:	Prior to the addition of these valves to the single vessel system, flow control was accomplished by modulating manual heater isolation valves V60 and V61.			

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Tag #	HV-8	X	Two Vessel System	Single Vessel System
Application:	Trim Liquor Downflow Control Black Liquor — Control Valve			
	HV-8 controls the flow of black liquor on the discharge side of the trim liquor pump to the bottom circulation heaters.			
	Differential: 10-50 psid = 0,7-3,4 bar		Shut-off: 300 psid = 20,7 bar	
	Temp: 325 °F = 163 °C		Flow: 500-1500 gal/min = 1900-5700 liters/min	
<b>Control valve</b>	<b>ASME</b>		<b>DIN</b>	
Class:	300		PN 25	
Size:	6"		DN 150	
Recommendation:	REDA06CJJST-B1C6-ND		RELA150AJJST-B1C6-ND	

Tag #	TV-9H		Two Vessel System	X	Single Vessel System
Application:	Lower Circulation Temperature Control Steam — Control Valve.				
	The steam that sent to the circulation heaters is used to control the temperature of the exiting black liquor.				
	Differential: 5-35 psid = 0,3-2,4 bar		Shut-off: 180 psid = 12,4 bar		
	Temp: 400-520 °F = 200-271 °C		Flow: 10000-40000 lbs/hr = 4500-18200 kg/hr		
<b>Control valve</b>	<b>ASME</b>		<b>DIN</b>		
Class:	300		PN 25		
Size:	4"		DN 100		
Recommendation:	REDA04CJJST-B1C6-ND		RELA100AJJST-B1C6-ND		

Tag #	TV-60C	X	Two Vessel System	Single Vessel System
Application:	Bottom Circulation Temperature #3 Control Steam — Control Valve			
	This valve operates with TV-60A and TV-60B to regulate the temperature at the discharge end of the impregnation vessel. The steam that sent to the circulation heaters is used to control the temperature of the exiting black liquor. After being heated, the black liquor is added to the bottom circulation zone of the impregnation vessel.			
	Differential: 5-35 psid = 0,3-2,4 bar		Shut-off: 180 psid = 12,4 bar	
	Temp: 400-520 °F = 200-271 °C		Flow: 10000-40000 lbs/hr = 4500-18200 kg/hr	
<b>Control valve</b>	<b>ASME</b>		<b>DIN</b>	
Class:	300		PN 25	
Size:	4"		DN 100	
Recommendation:	REDA04CJJST-B1C6-ND		RELA100AJJST-B1C6-ND	

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Tag #	FV-3 (B-E)	Two Vessel System	X	Single Vessel System
Application:	White Liquor to Upper & Lower Circulation White Liquor — Control Valve FV-3B, FV-3C, FV-3D and FV-3E control white liquor flow to the upper and lower cooking zones of the digester.			
Differential:	98 psid = 6,8 bar	Shut-off:	335 psid = 23 bar	
Temp:	185 °F = 85 °C	Flow:	180 gal/min = 680 liters/min	
Control valve		ASME	DIN	
Class:	300		PN 25	
Size:	2"		DN 50	
Recommendation:	M2DA02AP-B1C9-ND		M1LA050AP-B1C9-ND	

Tag #	FV-3B	X	Two Vessel System	Single Vessel System
Application:	White Liquor to Bottom Circulation White Liquor – Control Valve FV-3B in the two vessel system provides white liquor flow control to the bottom circulation pump. The bottom circulation pump supplies liquor to the bottom cooking zone of the impregnation vessel.			
Differential:	98 psid = 6,8 bar	Shut-off:	335 psid = 23 bar	
Temp:	185 °F = 85 °C	Flow:	180 gal/min = 680 liters/min	
Control valve		ASME	DIN	
Class:	300		PN 25	
Size:	2"		DN 50	
Recommendation:	M2DA02AP-B1C9-ND		M1LA050AP-B1C9-ND	

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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.

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