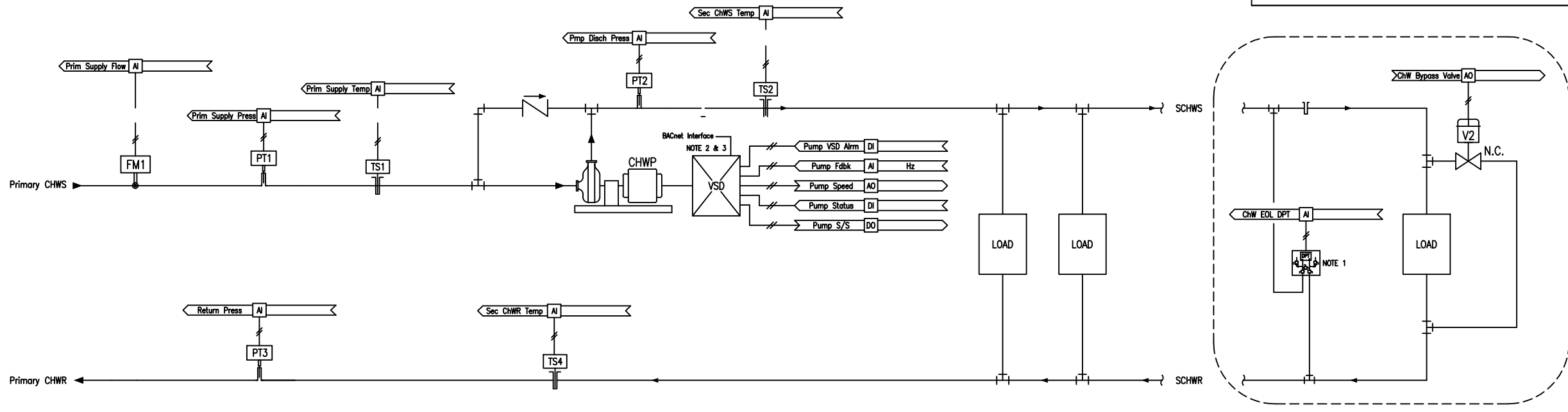


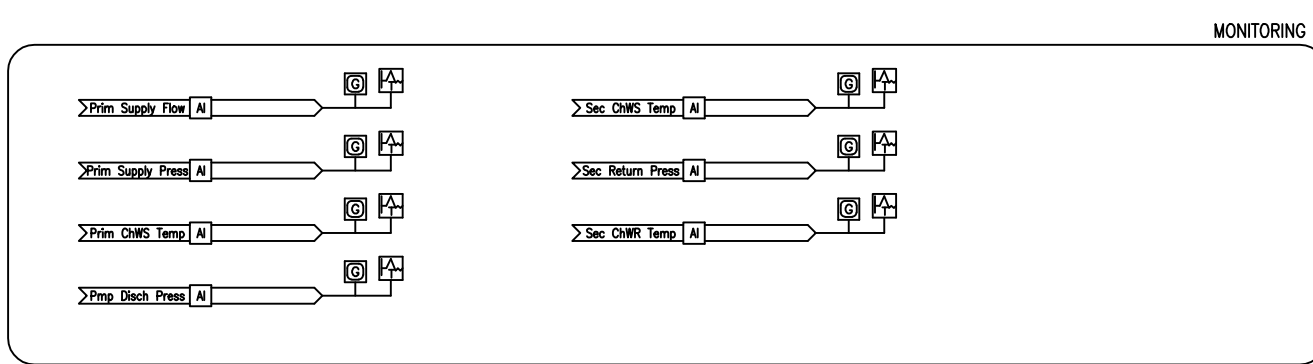
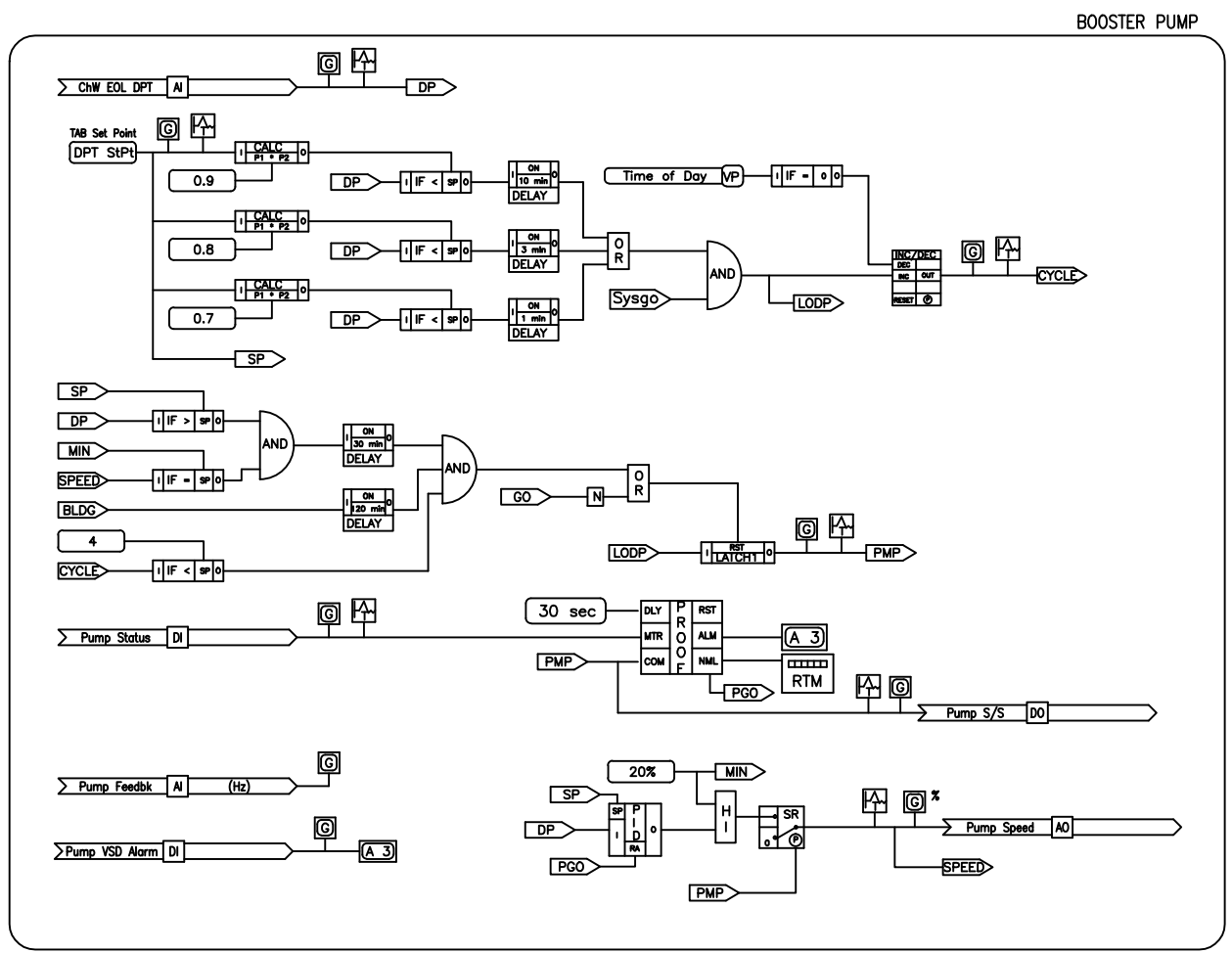
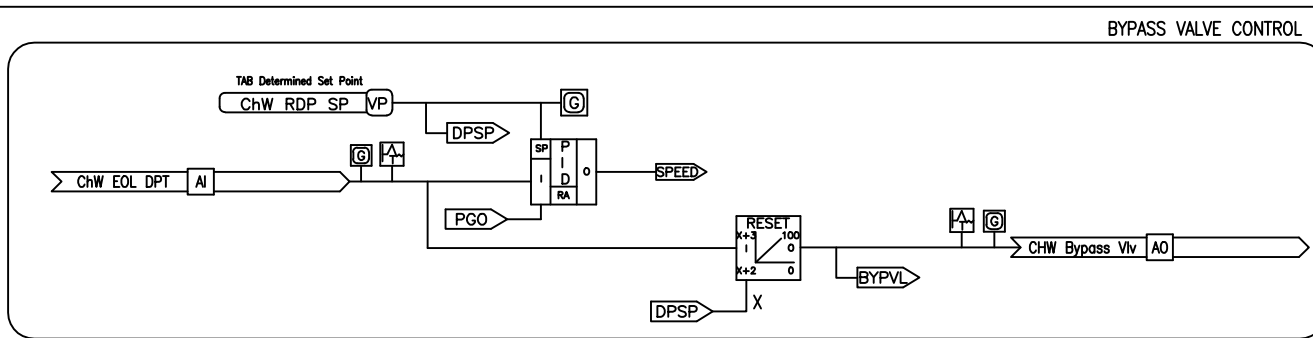
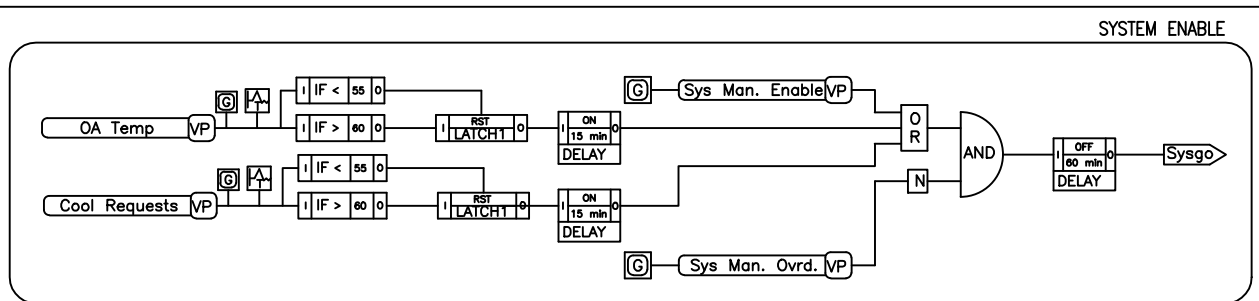
BILL OF MATERIAL			
DESIG	QTY	MODEL NO.	DESCRIPTION
V 1, 2	2		Control Valve
FM 1	1		Flow Meter
PT 1,2,3	3		Pressure Transducer
T 1-5	5		Temperature Sensor, Immersion
DPT	1		Differential Pressure Transducer

- NOTES**
- Locate End-of-Line (EOL) differential pressure sensor at most remote CHW coil, as directed. Install transmitter and bypass assembly no higher than 6 feet AFF.
  - Provide communications interface to the control system for diagnostic point information.
  - Provide BACnet interface to the control system for diagnostic point information. VSD rate of change (Acceleration/Deceleration) shall be programmed in to the VSD controller and not rely on BAS logic.
  - Meter to be owner furnished and contractor installed per UVA FDG.

POINTS LIST					
POINT NAME	POINT DESCRIPTOR	POINT TYPE			REMARKS
		DI	AI	DO	
CHWxx,S-F	Supply Flow		1		
CHWxx,S-P	Supply Pressure		1		
CHWxx,S-T	Supply Temperature		1		
CHWxx,PMP-DIS-P	Pump Disch Pressure		1		
CHWxx,PMP-DIS-T	Pump Disch Temp		1		
CHWxx,PMP-ALARM	Pump VSD Alarm	1			
CHWxx,PMP-FDBK	Pump Feedback		1		
CHWxx,PMP-SPEED	Pump Speed			1	
CHWxx,PMP-STS	Pump Status	1			
CHWxx,PMP-C	Pump Start/Stop			1	
CHWxx,EOL-DP	End of Line DP		1		
CHWxx,R-P	Return Pressure		1		
CHWxx,R-T	Return Temperature		1		
<b>TOTALS</b>		<b>2</b>	<b>9</b>	<b>1</b>	<b>1</b>



NETWORK INTERFACE POINT LIST				
POINT	POINT DESCRIPTOR	POINT TYPE		UNITS
		READ	WRITE	
(Variable Speed/Freq Drives)				
VSD_SPD	Speed	Y		RPM
VSD_FREQ	Output Frequency	Y		Hz
VSD_AMPS	Current	Y		A
VSD_TORQ	Torque	Y		% of motor
VSD_PWR	Power	Y		KW
VSD_DCBV	DC Bus Voltage	Y		V
VSD_OV	Output Voltage	Y		V
VSD_ACC	Accelerate	Y	Y	Hz per second
VSD_DEC	Decelerate	Y	Y	Hz per second
VSD_LOCAL	Panel Local	Y		ON/OFF
VSD_FAULT	Fault Status	Y		Mfg Code
VSD_DRV	Drive Status	Y		Mfg Code
VSD_KWHR	Kilowatt Hours	Y		KWh



**SEQUENCE OF OPERATION**

**General:** The chilled water booster pump shall be mechanically placed in series with the campus chilled water loop connection. BAS shall fully control this chilled water system and equipment and provide monitoring and diagnostic information for management purposes.

**Cooling Enable:** Cooling shall be enabled by the operator at the operator interface via a graphic icon OR when outside air temperature is above 60°F (adj.) with a 5°F cycle differential OR when a minimum number of cooling requests have been received from served equipment. Once enabled, cooling shall remain enabled for at least two hours.

**Booster Pump:** BAS shall control the pump as follows:  
**Start/Stop:** The pump is enabled to run whenever a remote differential pressure transmitter served by the pump falls below set point as follows:  
 1. If the EOL differential pressure is less than 90% (adj.) of the set point for more than 10 minutes OR  
 2. If the EOL differential pressure is less than 80% (adj.) of the setpoint for more than 3 minutes OR  
 3. If the EOL differential pressure is less than 70% (adj.) of the setpoint for more than 1 minute.

An excessive cycling counter will increment by 1 every time the pump is started per the above sequence. This counter is to operate independently of the pump command. Every 24 hours the counter will decrement by 1.

The pump will be disabled as follows:  
 1. If the pump has been at minimum speed and the EOL differential pressure has been greater than set point for 30 minutes AND  
 2. The excessive cycling counter is less than 4.

**Proof:** BAS shall prove pump operation and use the status indication to accumulate runtime. Upon failure of the pump, BAS shall enunciate an alarm.

**VSD Control:** Whenever the pump is enabled, BAS shall control the output of the pump VSD via a RA PID loop to maintain the worst case CHW remote differential pressure (DPT) setpoint (initially 15 psid). Booster pump speed shall be limited to prevent imposing more load on the campus system than designed.

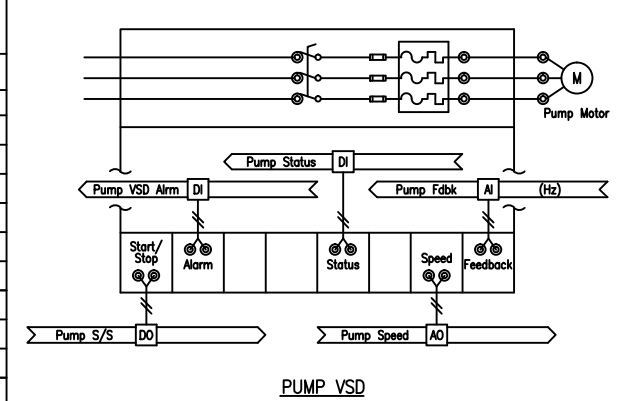
**Pressure Optimization:** The remote differential pressure setpoint shall be re-set between minimum and maximum setpoints (determined by the balancer) every 10 minutes (adj) to maintain the most open chilled water valve at 95%.

**CHW Bypass Valve:** BAS shall modulate the position of the valve as required to maintain each CHW DPT at least 2 psid above the CHW DPT set point.

UNIVERSITY OF VIRGINIA  
 FACILITIES MANAGEMENT

HVAC CONTROLS STANDARDS

**ELECTRIC LADDER DIAGRAMS**



LOGIC VARIABLES				
BINARY	ANALOG	DESCRIPTION	#	
		GO	ON WHEN CHILLED WATER VALVE IS ENERGIZED AND STATUS PROVEN	3
		LODP	ON WHEN CONDITIONS ENABLE BUILDING CHANGE-OVER	2
		PMP	ON WHEN PUMP IS ENERGIZED	3
		PGO	ON WHEN PUMP IS ENERGIZED AND STATUS PROVEN	2
		DP	VARIABLE VALUE OF DIFFERENTIAL PRESSURE	6
		SP	VARIABLE VALUE OF SETPOINT	3
		CYCLE	VARIABLE VALUE EXCESSIVE CYCLING COUNTER	2
		MIN	VARIABLE VALUE MINIMUM PUMP SPEED	2
		PSPD	VARIABLE VALUE PUMP SPEED	2

Eng	HJN
Drawn	HJN
Checked	HJN
Updated	12/07/2015
Updated by	UYA - WGS
Job No.	10080
Scale	N/A
Proj Code	

STANDARD

BUILDING  
 CHILLED WATER  
 SYSTEM

27 OF 30  
 SHEET NUMBER

C-4.1

DWG NUMBER