

1 TEC-1 TO BE MOUNTED IN MANUFACTURER SUPPLIED CONTROLLER ENCLOSURE

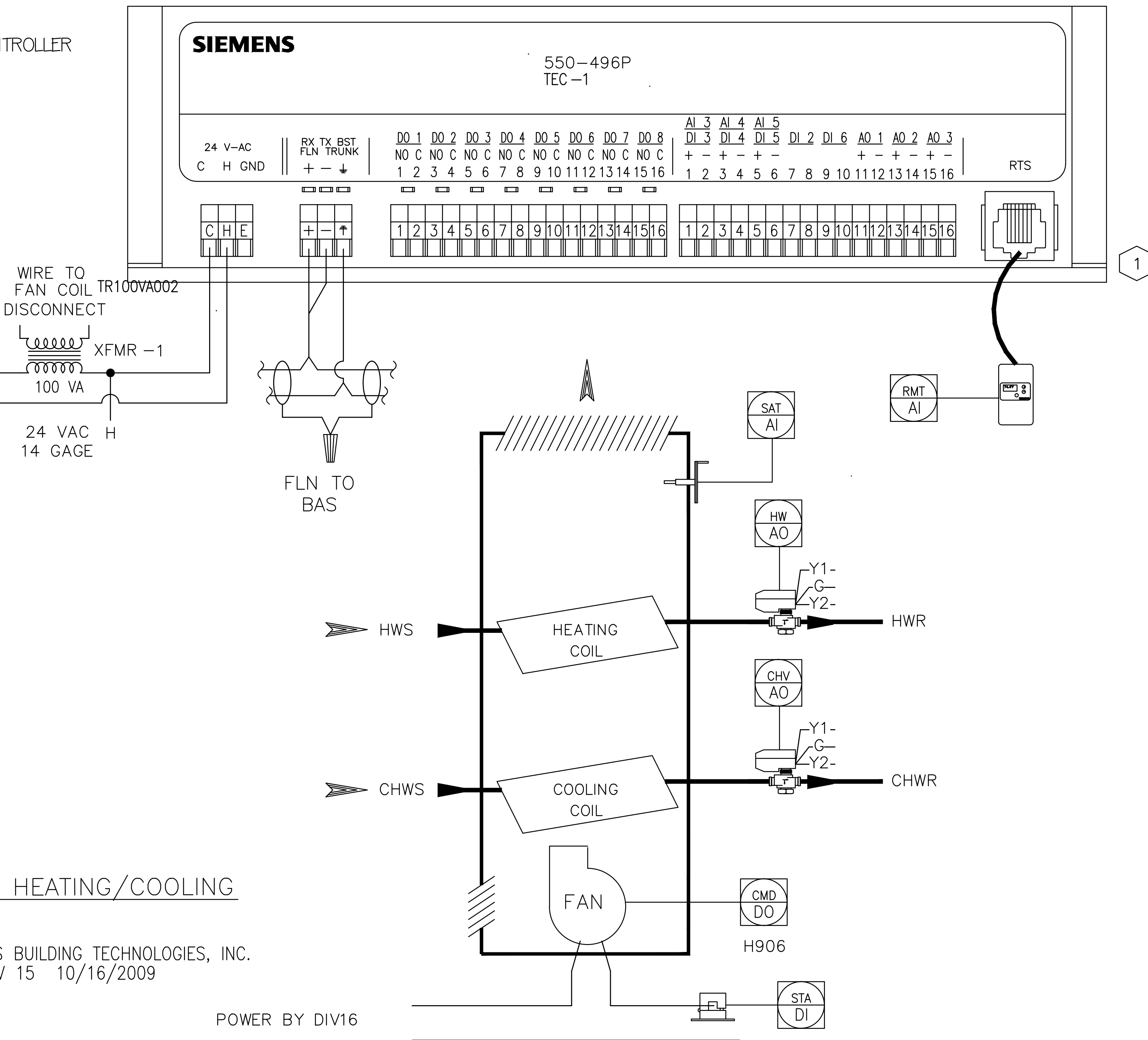
FAN COIL UNIT HEATING/COOLING SEQUENCE OF OPERATIONS

An application specific DDC controller using electric actuation controls the fan coil unit. The space served by the FCU is controlled in Occupied and Unoccupied modes as follows:

**Occupied**  
The FCU fan operates continuously. The controller monitors the room temperature sensor and modulates the FCU heating/cooling valves in sequence to maintain the space temperature at set point.

**Unoccupied**  
The FCU is controlled using the Unoccupied space temperature set point. The FCU fan is off when the space is unoccupied. The controller may reset to the Occupied mode for a predetermined time period upon a signal from the control system or manually from a switch at the room sensor.

The DDC system uses a current switch to monitor the FCU fan status.



FAN COIL UNIT HEATING/COOLING

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ETGXXD01 REV 15 10/16/2009

POWER BY DIV16

FAN COIL UNIT HEATING/COOLING CONTROL DIAGRAM

SCALE  
NONE 2

Sequence of Operations:

The hot water system consists of two boilers with integral primary pumps and two hot water secondary pumps equipped with VFDs. All suggested set points are adjustable. Hot water system supply and return temperatures shall be monitored. Hot water system differential pressure in central plant and at remote location shall be monitored.

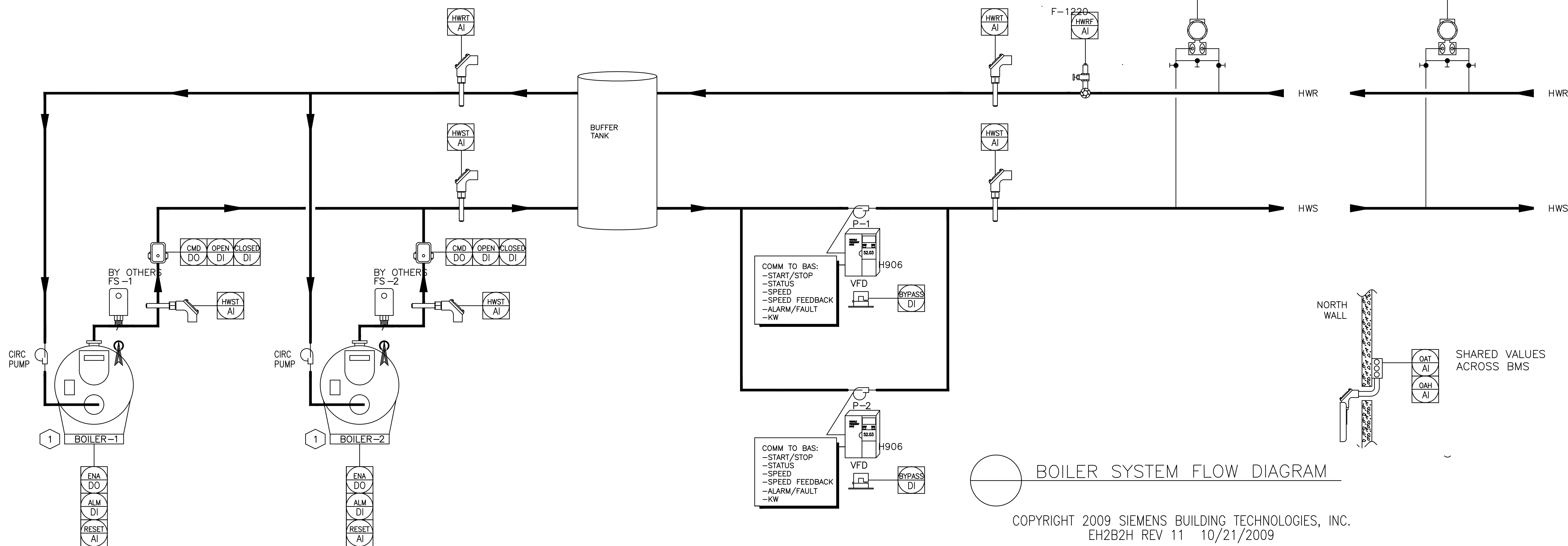
Hot Water System Secondary Pumps

Selection of the lead/lag hot water pump shall be evaluated on a weekly basis to equalize equipment runtime. The pump with the least runtime shall be designated as lead at 9:00 AM on every Wednesday. If the old lead pump is running, the new lead pump shall ramp up to desired speed and then the old lead pump shall turn OFF. The lead hot water pump shall run anytime the hot water system is enabled (determined by 3 or more hot water valves being open more than 80% for more than 2 minutes) and maintain the hot water differential pressure in central plant at set point. Based on the reading of the remote differential pressure sensor, the set point of the central plant differential pressure sensor shall be reset to maintain a differential pressure set point (initially set at 15 psi) at remote differential pressure sensor. If lead hot water pump is in alarm or it is running above 90% speed for more than 2 minutes and cannot maintain the hot water differential pressure within 2 psi of set point or both lead and lag boilers are ENABLED the lag pump shall turn ON. It shall ramp up to the same speed as the lead pump and they shall run in conjunction to maintain the hot water differential pressure at set point. Once the hot water differential pressure is at set point and both pumps are running at less than 50% speed for more than 2 minutes and the lead pump is not in alarm and only lead or lag boiler is ENABLED, then the lag pump shall turn OFF. 15 minutes after the hot water system is disabled (determined by all hot water valves being open less than 20% for more than 2 minutes) the lead hot water pump shall turn OFF. Hot water pumps' status shall be monitored and if the hot water pumps' command and status do not match, an alarm shall be generated.

Boiler

Selection of the lead/lag boiler shall be evaluated on a weekly basis to equalize equipment runtime. The boiler with the least runtime shall be designated as lead at 10:00 AM on every Wednesday. If the hot water system is enabled and at least one hot water secondary pump is proved ON, then the lead boiler shall be ENABLED and in turn the boiler in-line primary pump shall be started by the boiler's internal control. Also, the hot water supply temperature set point shall be maintained under the boiler's internal control. If lead boiler is ENABLED and lead boiler is in alarm, or five minutes after enabling the lead boiler the lead boiler supply water temperature is less than 180 deg F, or if the lead boiler has been running for 15 minutes and the hot water system return temperature is below 150 deg F the lag boiler shall be ENABLED. If the lead boiler is not in alarm and the lead boiler supply water temperature is above 180 deg F and the hot water system return temperature is above 160 deg F then the lag boiler shall be DISABLED.

When hot water system is disabled the boilers shall be DISABLED, however, the internal primary pumps shall continue to run for another 15 minutes under boiler's internal control to dissipate the residual heat. Boiler alarm shall be monitored. Boiler hot water supply temperatures shall be monitored.



BOILER SYSTEM FLOW DIAGRAM

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BOILER SYSTEM FLOW DIAGRAM

SCALE  
NONE 3

INSTALLATION NOTES:

- 1 VIBRATION SWITCH WIRED DIRECTLY TO VFD SAFETY CIRCUIT. SWITCH PROVIDED BY PLUMBING CONTRACTOR.
- 2

Cooling Tower Sequence of Operations

The condenser water system consists of two cooling towers with variable frequency drives and two condenser water pumps with variable frequency drives. All suggested set points and settings are adjustable.

Selection of the lead/lag cooling tower is evaluated on a weekly basis to equalize equipment runtime. The cooling tower with the least runtime shall be designated as lead at 9:00 AM on every Wednesday.

Condenser Water Supply Temperature Setpoint

The cooling tower shall operate to maintain the condenser water supply temperature as follows:  
50% Chiller Load - Setpoint is Wet Bulb Temperature + 4°F  
120% Chiller Load - Setpoint is Wet Bulb Temperature + 11°F.

Cooling Tower Control

After any cooling towers are commanded, the program waits for 15 minutes before issuing any other commands.

On a call for condenser water from any of the chillers, the lead cooling tower isolation valve opens and the cooling tower control loop is enabled. The lag cooling tower isolation valves are staged open to maintain condenser water supply temperature setpoint. After both cooling towers' isolation valves are open, if the condenser water supply temperature increases above setpoint, the cooling tower fans are sequenced on at minimum speed. After all cooling tower fans are on at minimum speed, the cooling tower fan variable frequency drives are modulated in unison to maintain the condenser water set point.

When the condenser water supply temperature decreases below setpoint, the cooling tower fans are first modulated in unison to minimum speed. When all cooling tower fans are at minimum speed, a further decrease in condenser water supply temperature causes the fans to be cycled off.

Vibration Switch

Vibration switches shall be wired directly to the associated Cooling Tower VFD safeties. Any vibration shutdown shall require a manual reset.

COOLING TOWER CONTROL DIAGRAM

SCALE  
NONE 1

REVISIONS

NO.	DATE	DESCRIPTION
1	05/07/2015	Medium 02
2	09/04/2015	Medium 03
3	10/20/2015	Medium 04
4	05/27/2016	Medium 05

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MISC. CONTROL DIAGRAMS

DRAWN CM

CHECKED -

APPROVED -

SCALE -

SHEET M-408

DATE June 25, 2013

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