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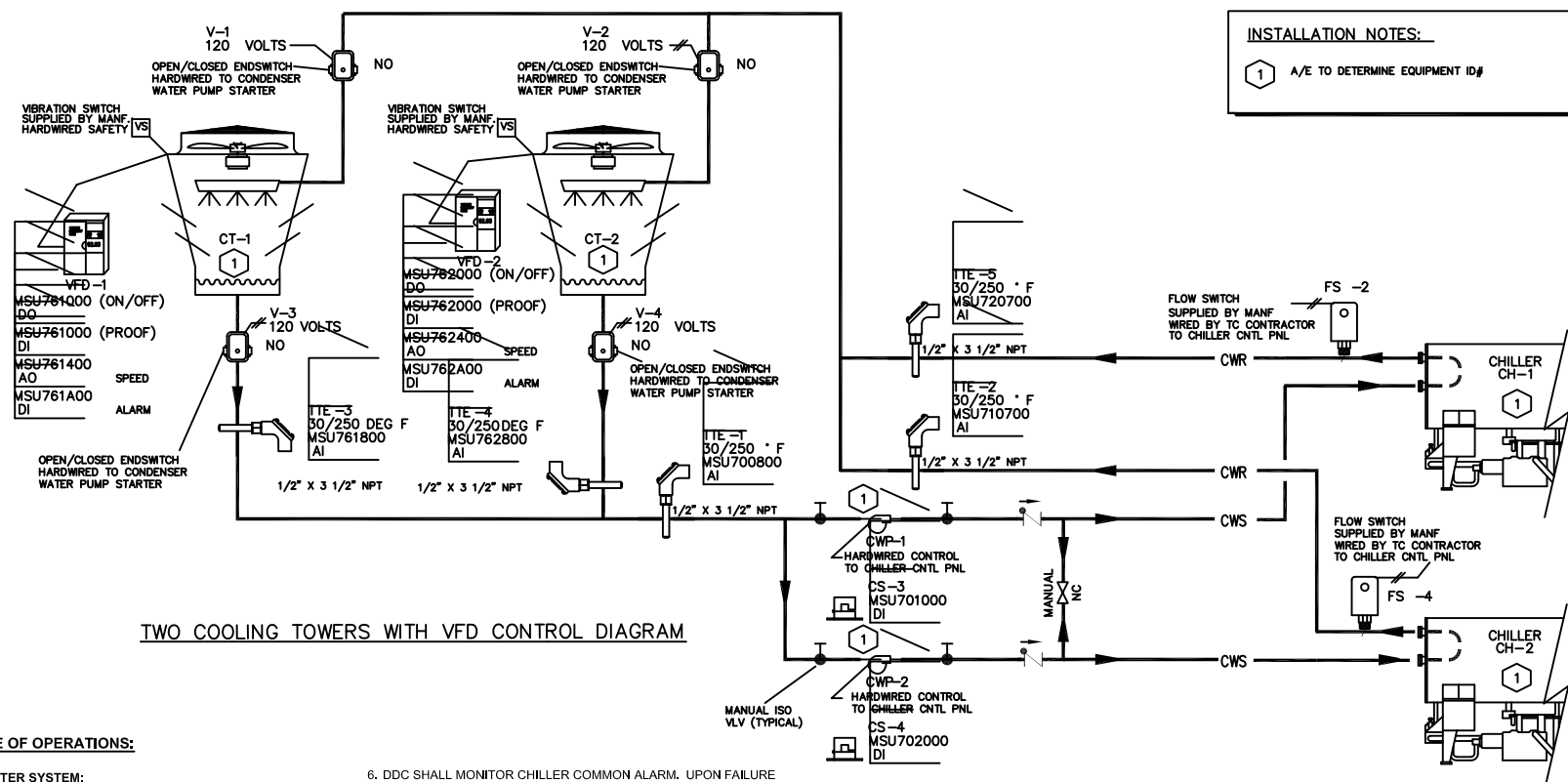
DRAWN

REVISION
7/11/16
RLANDRUM

DETAIL NO.
XXXXXX-XX

SHEET
OF ONE

INSTALLATION NOTES:
1 A/E TO DETERMINE EQUIPMENT ID#



TWO COOLING TOWERS WITH VFD CONTROL DIAGRAM

SEQUENCE OF OPERATIONS:

CHILLED WATER SYSTEM:

NOTE: ALL SET-POINTS DESCRIBED IN SEQUENCE SHALL BE ADJUSTABLE BY DDC SYSTEM OPERATORS (CREATE REQUIRED VIRTUAL POINTS).

1. CHW SYSTEM SHALL BE STARTED AND STOPPED BASED ON OUTDOOR AIR TEMPERATURE AND CONFIRMATION OF AT LEAST (1) HVAC UNIT OPERATING. DDC OPERATORS SHALL ALSO BE ABLE TO ENABLE AND DISABLE CHW SYSTEM BASED OPERATOR COMMAND.

CHILLER PRIMARY PCHWP PUMP & CWP PUMP CONTROL:

2. CHILLER LEAD/LAG SHALL BE SELECTABLE THROUGH DDC AND SET TO RUN CH-1 AS THE LEAD CHILLER DURING THE ODD MONTHS AND CH-2 AS THE LEAD CHILLER DURING THE EVEN MONTHS.

3. THE DDC SYSTEM OPERATOR SHALL HAVE THE ABILITY TO MANUALLY SELECT LEAD/LAG ASSIGNMENT AND HAVE THE ABILITY TO PRECLUDE A CHILLER FROM OPERATION SELECTION.

4. FOR NORMAL OPERATION, EACH CHILLER WILL CONTROL THE STARTING AND STOPPING OF THEIR RESPECTIVE PCHWP PRIMARY PUMP AND CWP PUMP. EACH PUMP IS DEDICATED TO EACH CHILLER. CHILLER-1 SHALL BE HARDWIRED INTERLOCKED TO OPERATE WITH PRIMARY PCHWP-1 PUMP AND CWP-1 PUMP. CHILLER-2 SHALL BE HARDWIRED INTERLOCKED TO OPERATE WITH PRIMARY PCHWP-2 PUMP AND CWP-2.

5. BASED ON THE DDC "SYSTEM ENABLE" POINT THE DDC SYSTEM SHALL START "LEAD" CHILLER AND THE "LEAD CHILLER WILL START ITS ASSOCIATE PRIMARY PCHWP-1 PUMP AND CWP-1 PUMP THE CWP-1 PUMP SHALL BE STARTED UPON ITS ASSOCIATED COOLING TOWER ISOLATION VALVES END SWITCHES CLOSURE (VALVE IN OPEN POSITION). THE COOLING TOWER ISOLATION VALVES SHALL BE HARDWIRED TO ITS RESPECTIVE PUMP SO THAT UPON PUMP START SIGNAL (HAND OR AUTOMATIC) THE VALVES SHALL OPEN AND THE VALVES INTERNAL END SWITCHES SHALL START THE PUMP. DDC SHALL MONITOR PCHWP & CWP PUMP OPERATION THROUGH RESPECTIVE CURRENT SWITCHES. UPON FAILURE, DDC SHALL PROVIDE ALARM, DEACTIVATE FAILED CHILLER (ASSOCIATED PUMPS WILL BE DEACTIVATED THROUGH CHILLER CONTROLS) AND ACTIVATE RESPECTIVE "LAG" CHILLER (ASSOCIATED PUMPS WILL BE ACTIVATED THROUGH CHILLER CONTROLS).

6. DDC SHALL MONITOR CHILLER COMMON ALARM. UPON FAILURE (BASED ON ALARM & HIGH CHILLER SUPPLY WATER TEMPERATURE) DDC SHALL PROVIDE ALARM, DEACTIVATE FAILED CHILLER (ASSOCIATED PUMPS WILL BE DEACTIVATED THROUGH CHILLER CONTROLS) AND ACTIVATE RESPECTIVE "LAG" CHILLER (ASSOCIATED PUMPS WILL BE DEACTIVATED THROUGH CHILLER CONTROLS).

7. WHEN PCHW AND CW FLOWS ARE PROVEN BY DIFFERENTIAL PRESSURE SWITCHES AND CHILLER PUMP INTERLOCKS (CW & PCHW INX. CONTACTS) THE CHILLER PACKAGED CONTROL PANEL WITH INTEGRAL TEMPERATURE SENSORS SHALL SEQUENCE CHILLER OPERATION TO MAINTAIN THE CHILLER'S CHW SUPPLY SET-POINT OF 44 DEGREES (ADJUSTABLE AT CHILLER PANEL).

CHILLER STAGING:

8. LAG CHILLER OPERATION SHALL BE ACTIVATED WHEN DEFICIT FLOW OCCURS IN THE DECOUPLER AT 10% OF THE LEAD CHILLER FLOW CAPACITY AND THE DEFICIT HAS BEEN MAINTAINED FOR 5 MINUTES. THERE SHALL ALSO BE A DELAY ADDED FROM INITIAL SYSTEM START (FIRST START OF THE DAY) TO PREVENT THE LAG CHILLER FROM STARTING UNTIL THE "SYSTEM ENABLE POINT" HAS BEEN ON FOR A PERIOD LONGER THAN 30 MINUTES.

9. WHEN A CHILLER IS STAGED ON, IT MAY NOT BE STOPPED UNTIL A 30-MINUTE TIME DELAY EXPIRES.

10. AS THE CHW LOAD DECREASES THE LEAD CHILLER SHALL BE DEACTIVATED BY DDC WHEN SURPLUS FLOW OCCURS IN THE DECOUPLER AT 110% OF THE LAG CHILLER CHW FLOW CAPACITY AND THE SURPLUS HAS BEEN MAINTAINED FOR 5 MINUTES.

11. WHEN A CHILLER IS STAGED OFF, IT MAY NOT BE RESTARTED UNTIL A 30-MINUTE TIME DELAY EXPIRES.

SECONDARY SCHW CONTROL:

12. CHW SYSTEM SECONDARY CIRC PUMPS SCHWP-1 & SCHWP-2 SHALL HAVE START/STOP CAPABILITY FROM THE DDC SYSTEM. ONE OF THE TWO PUMPS SHALL BE ACTIVATED BASED ON THE DDC SYSTEM ENABLE POINT. THE OTHER PUMP WILL SERVE AS A STANDBY.

13. DDC SHALL ALTERNATE PUMP OPERATION BASED ON MONTH. EVEN MONTHS THE EVEN NUMBERED PUMP SHALL RUN AND ON ODD MONTHS THE ODD NUMBERED PUMP SHALL RUN.

14. DDC SHALL MONITOR SECONDARY SYSTEM LOOP DIFFERENTIAL PRESSURE AT SPECIFIED LOCATION WITHIN THE BUILDING. (SET-POINT SHALL BE DETERMINED BY THE DESIGN ENGINEER)

15. DDC SHALL MODULATE THE VARIABLE SPEED DRIVE ON THE "LEAD" SECONDARY SCHWP PUMP THRU HARWIRED CONNECTION TO MAINTAIN THE DIFFERENTIAL PRESSURE SET POINT.

16. DDC SHALL MODULATE THE BYPASS VALVE OPEN TO PREVENT CHW FLOW FROM DROPPING BELOW LOW LIMIT SET POINT (SET-POINT SHALL BE DETERMINED BY THE DESIGN ENGINEER). WHEN CHW FLOW IS ABOVE SET POINT DDC SHALL MODULATE BYPASS VALVE CLOSED. FLOW SHALL BE MEASURED FROM FLOW MEASURING STATION (FM-2). BYPASS VALVE SHALL ALSO MODULATE OPEN TO PREVENT HIGH SYSTEM DIFFERENTIAL PRESSURE AS SENSED BY DIFFERENTIAL PRESSURE TRANSMITTER (DPT-1). (SET-POINT SHALL BE DETERMINED BY THE DESIGN ENGINEER).

17. DDC SHALL MONITOR OPERATING STATUS OF EACH PUMP THRU "SIEMENS P-1" LAN COMMUNICATION. UPON PUMP FAILURE (60 SECOND TIME DELAY) DDC SHALL ACTIVATE FAILURE ALARM, DEACTIVATE FAILED PUMP AND AUTOMATICALLY START THE STANDBY PUMP.

18. VFD COMMON FAILURE ALARM FOR EACH CIRC PUMP SHALL BE MONITORED BY DDC THRU "SIEMENS P-1" LAN COMMUNICATION

COOLING TOWER CONTROL:

19. FOR NORMAL OPERATION, COOLING TOWERS ARE DEDICATED TO EACH CHILLER. COOLING TOWER CT-1 AND RESPECTIVE ISOLATION VALVE SHALL BE HARDWIRED INTERLOCKED THRU ITS RESPECTIVE CW PUMP MOTOR STARTER. COOLING TOWERS CT-2 AND ITS RESPECTIVE ISOLATION VALVE SHALL BE HARDWIRED INTERLOCKED THRU ITS RESPECTIVE CW PUMP MOTOR STARTER.

20. COOLING TOWER FANS HAVE VFD'S WITH SPEED CONTROL FROM DDC THRU HARWIRED CONNECTION.

21. UPON DDC SYSTEM ENABLE AND PROOF OF CWP PUMP OPERATION DDC SHALL MODULATE COOLING TOWER FAN SPEED TO MAINTAIN CWS TEMP SET-POINT OF 85 DEGREES. IF CWS SUPPLY TEMP FALLS BELOW 75 DEGREES THE DDC SHALL DISABLE FAN OPERATION AND RE-ENABLE FAN OPERATION AT 80 DEGREES

22. DDC SHALL MONITOR COOLING TOWER FAN OPERATION THRU "SIEMENS P-1" LAN COMMUNICATION. UPON FAILURE AND HIGH CWS WATER TEMPERATURE, DDC SHALL PROVIDE ALARM AND SHUT DOWN THE CHILLER. IF ONLY ONE CHILLER IS ACTIVATED THEN ACTIVATE THE LAG CHILLER. IF BOTH CHILLERS ARE ACTIVATED, THE COOLING TOWER IN ALARM SHALL BE DEACTIVATED AND THE AFFECTED CHILLER SHALL OPERATE UNTIL PACKAGED CONTROL SAFETIES DEACTIVATES CHILLER

23. VFD COMMON FAILURE ALARM FOR EACH TOWER FAN SHALL BE MONITORED BY DDC THRU "SIEMENS P-1" LAN COMMUNICATION

24. COOLING TOWER FAN VIBRATION SWITCHES ARE TO BE HARDWIRED TO VFD'S AS A SAFETY INTERLOCK.

ALARMING

- NORMAL**
- ALL PUMP FAILURE
 - CHILLER FAILURE
 - COOLING TOWER FAILURE
 - CHILLED WATER SUPPLY TEMPERATURE
 - CONDENSER WATER SUPPLY TEMPERATURE
 - DIFFERENTIAL PRESSURE (+/- 25% OF SETPOINT)

"ENHANCED" 24/7