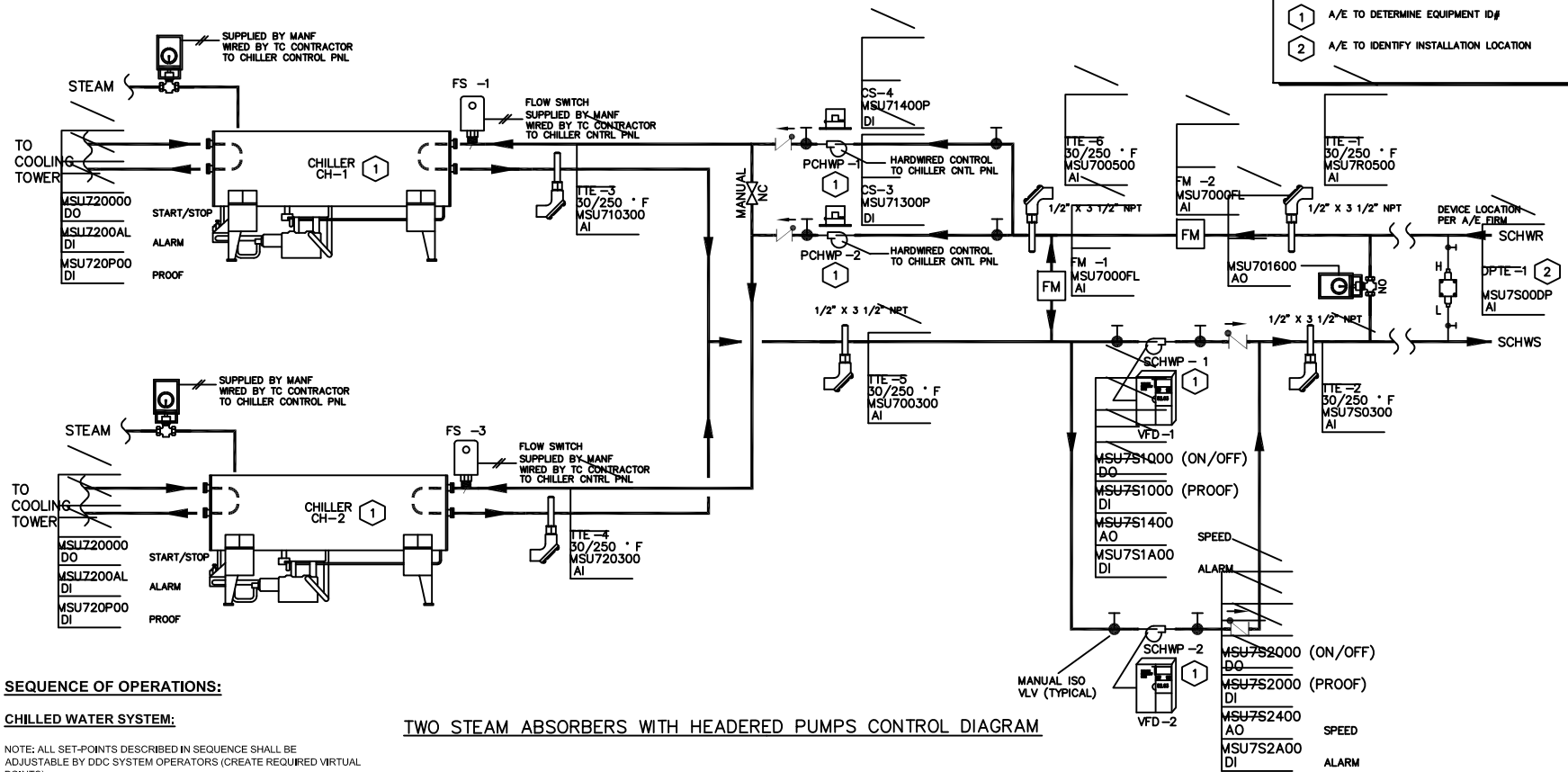


INSTALLATION NOTES:
 1 A/E TO DETERMINE EQUIPMENT ID#
 2 A/E TO IDENTIFY INSTALLATION LOCATION



SEQUENCE OF OPERATIONS:

CHILLED WATER SYSTEM:

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

- 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 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.
- 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.
- FOR NORMAL OPERATION, EACH CHILLER WILL CONTROL THE STARTING AND STOPPING OF THEIR RESPECTIVE CHW PRIMARY PUMP AND CW PUMP. EACH PUMP IS DEDICATED TO EACH CHILLER. CHILLER-1 SHALL BE HARDWARE INTERLOCKED TO OPERATE WITH PRIMARY CHW CP-1 AND CW CP-4. CHILLER-2 SHALL BE HARDWARE INTERLOCKED TO OPERATE WITH PRIMARY CHW CP-2 AND CW CP-5.
- BASED ON THE DDC "SYSTEM ENABLE" POINT THE DDC SYSTEM SHALL START "LEAD" CHILLER AND THE "LEAD" CHILLER WILL START ITS ASSOCIATE PRIMARY CHW PUMP AND CW PUMP. THE CW PUMP SHALL BE STARTED UPON ITS ASSOCIATED COOLING TOWER ISOLATION VALVE END SWITCH CLOSURE (VALVE IN OPEN POSITION). THE COOLING TOWER ISOLATION VALVE SHALL BE HARDWIRED TO ITS RESPECTIVE PUMP SO THAT UPON PUMP START SIGNAL (HAND OR AUTOMATIC) THE VALVE SHALL OPEN AND THE VALVES INTERNAL END SWITCH SHALL START THE PUMP. DDC SHALL MONITOR CHW & CW 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).

- CHILLER PRIMARY CHW PUMP & CW PUMP CONTROL:**
- CHILLER STAGING:**
- LAG CHILLER OPERATION SHALL BE ACTIVATED WHEN DEFICIT FLOW OCCURS IN THE DECOUPLER AT 10% OF THE LEAD CHILLER FLOW CAPACITY.
 - WHEN A CHILLER IS STAGED ON, IT MAY NOT BE STOPPED UNTIL A 30-MINUTE TIME DELAY EXPIRES.
 - 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.
 - WHEN A CHILLER IS STAGED OFF, IT MAY NOT BE RESTARTED UNTIL A 30-MINUTE TIME DELAY EXPIRES.
- SECONDARY CHW CONTROL:**
- CHW SYSTEM SECONDARY CIRC PUMPS CP-3 & CP-4 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.

TWO STEAM ABSORBERS WITH HEADERED PUMPS CONTROL DIAGRAM

- 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).
- WHEN CHW AND CW FLOWS ARE PROVEN BY DIFFERENTIAL PRESSURE SWITCHES AND CHILLER PUMP INTERLOCKS (CW & CHW AUX. 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).
- 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.
- DDC SHALL MONITOR SECONDARY SYSTEM LOOP DIFFERENTIAL PRESSURE AT SPECIFIED LOCATION WITHIN THE BUILDING. SET-POINT SHALL INITIALLY BE SET TO 30FT HEAD (ACTUAL SET-POINT SHALL BE DETERMINED DURING SYSTEM COMMISSIONING AND/OR BY THE WATER BALANCE CONTRACTOR).
- DDC SHALL MODULATE THE VARIABLE SPEED DRIVE ON THE "LEAD" SECONDARY CHW PUMP THRU LAN COMMUNICATION CAPABILITIES TO MAINTAIN THE DIFFERENTIAL PRESSURE SET POINT.
- DDC SHALL MONITOR OPERATING STATUS OF EACH PUMP THRU RESPECTIVE CURRENT SWITCH. UPON PUMP FAILURE (60 SECOND TIME DELAY) DDC SHALL ACTIVATE FAILURE ALARM, DEACTIVATE FAILED PUMP AND AUTOMATICALLY START THE STANDBY PUMP.
- VSD COMMON FAILURE ALARM FOR EACH CIRC PUMP SHALL BE MONITORED BY DDC THRU LAN COMMUNICATION CAPABILITIES.

- COOLING TOWER CONTROL:**
- FOR NORMAL OPERATION, COOLING TOWERS ARE DEDICATED TO EACH CHILLER, COOLING TOWER CT-1 AND RESPECTIVE ISOLATION VALVE SHALL BE HARDWARE INTERLOCKED THRU ITS RESPECTIVE CW PUMP MOTOR STARTER, COOLING TOWER'S CT-2 AND ITS RESPECTIVE ISOLATION VALVE SHALL BE HARDWARE INTERLOCKED THRU ITS RESPECTIVE CW PUMP MOTOR STARTER.
 - COOLING TOWER FAN'S HAVE VFD'S WITH SPEED CONTROL FROM DDC THRU HARWIRE CONNECTION.
 - UPON DDC SYSTEM ENABLE AND PROOF OF CW 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.

- DDC SHALL MONITOR COOLING TOWER FAN OPERATION THRU RESPECTIVE CURRENT SWITCH. 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 CHILLERS SHALL OPERATE UNTIL PACKAGED CONTROL SAFETIES DEACTIVATES CHILLER (S).
- VFD COMMON FAILURE ALARM FOR EACH TOWER FAN SHALL BE MONITORED BY DDC THRU LAN COMMUNICATION CAPABILITIES.
- 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)