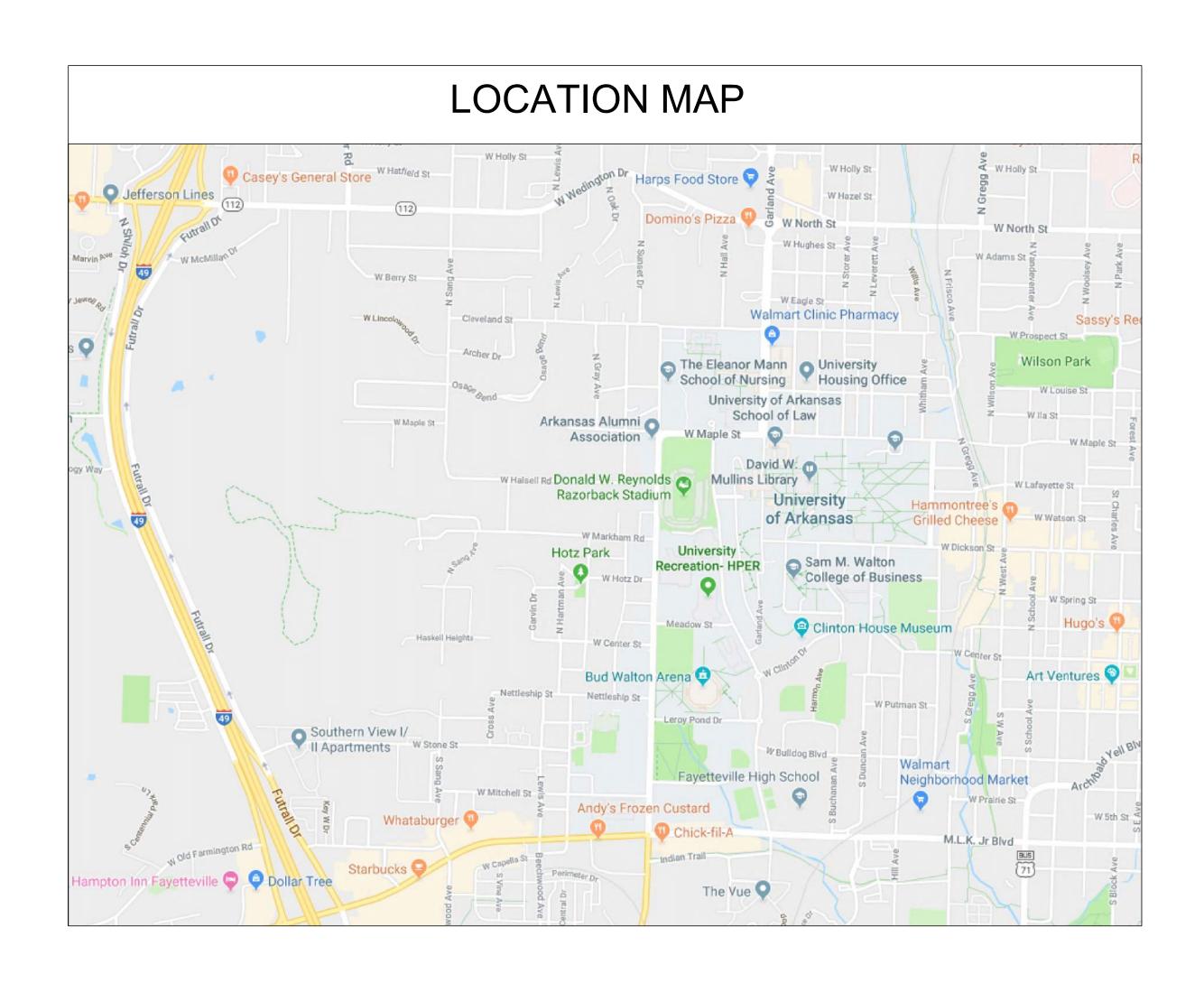
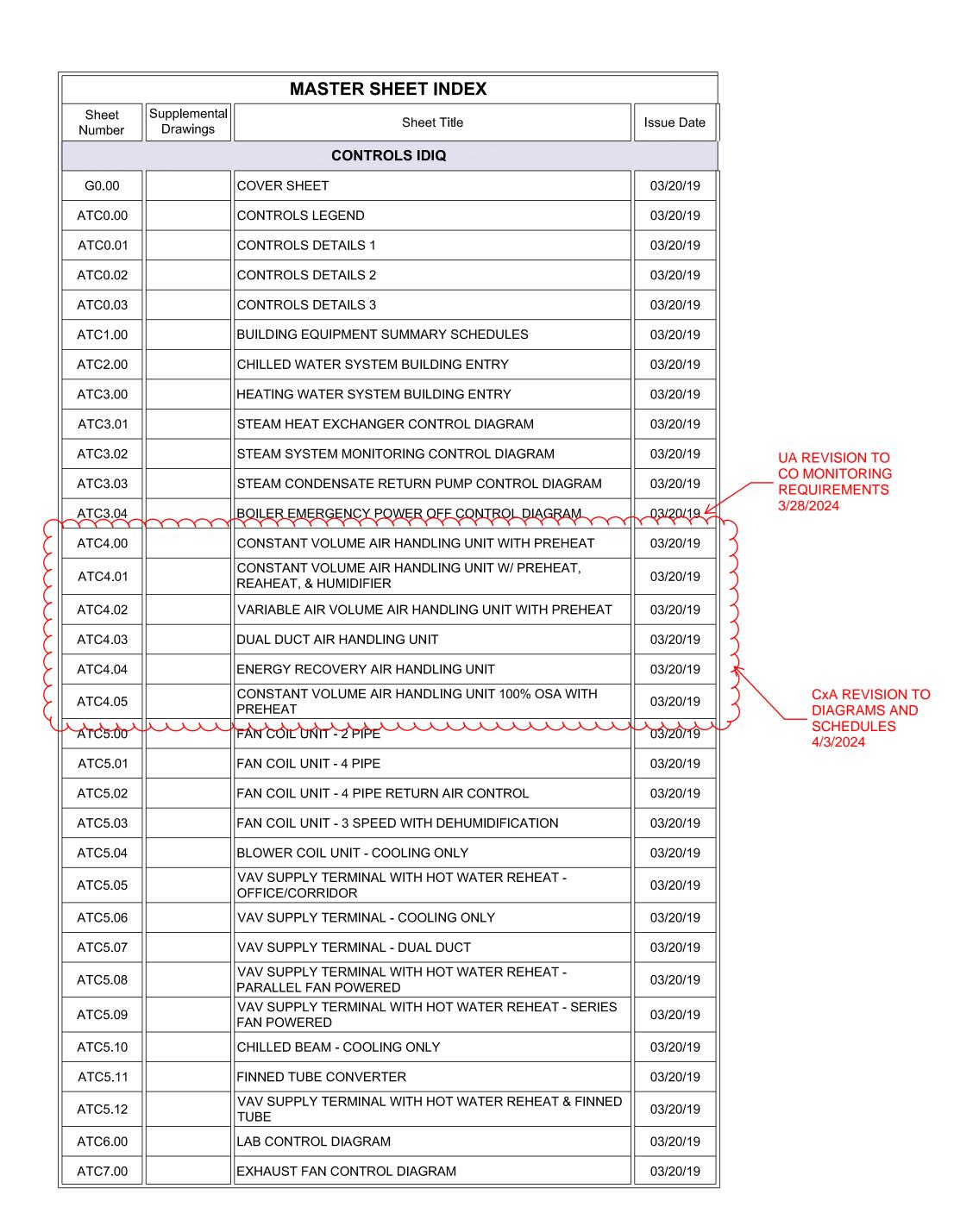


AUTOMATIC TEMPERATURE CONTROLS INDEFINITE DELIVERY INDEFINITE QUANTITY (IDIQ)

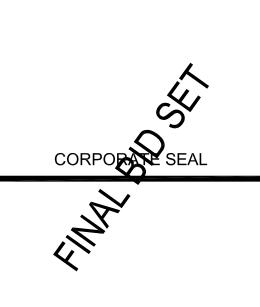




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ENGINEER SEAL

DIQ CONTROL DRAWINGS

UNIVERSITY OF ARKANSAS

FAYETTEVILLE, ARKANSAS

ISSUE DATE: 03/20/19

PROJECT NUMBER: 04-18-0072

GENERAL NOTES APPLICABLE TO ALL CONTROL DIAGRAMS 1. ALL CONTROL DEVICES SHOWN ON THE CONTROL DIAGRAMS ARE FURNISHED BY DIVISION 230900 UNLESS OTHERWISE NOTED OR SPECIFIED. ALL COMPONENTS REQUIRED FOR THE SEQUENCES OF OPERATION, SHOWN ON THE CONTROL DIAGRAMS, DESCRIBED IN THE SPECIFICATION, OR AS REQUIRED FOR A PROPERLY OPERATING SYSTEM SHALL BE FURNISHED AND INSTALLED BY DIVISION 230900 UNLESS OTHERWISE NOTED, SHOWN, OR SPECIFIED. DIVISION 230900 IS RESPONSIBLE TO FURNISH, INSTALL, AND WIRE ALL COMPONENTS REQUIRED FOR INTEGRATION OF INFORMATION SHOWN TO BE ACCESSED BY THE EMS FROM OTHER SYSTEMS AND EQUIPMENT UNLESS OTHERWISE NOTED OR SPECIFIED. ALL POWER WIRING AND TRANSFORMERS FOR SENSORS. ACTUATORS, AND OTHER CONTROL COMPONENTS AS REQUIRED FOR THE EMS AND/OR DDC SYSTEMS TO FUNCTION PROPERLY. SHALL BE FURNISHED AND INSTALLED BY DIVISION 23 UNLESS OTHERWISE SHOWN, NOTED, OR SPECIFIED. ALL POWER WIRING FOR SENSORS, ACTUATORS, AND OTHER DEVICES SHALL BE FROM THE EQUIPMENT CONTROLLERS DDC PANELS OR THE FEP PANELS OF THE ASSOCIATED SYSTEM. ALL CONTROL, INTERLOCK, AND POWER WIRING SHALL BE INSTALLED PER THE DIVISION 26, LOCAL, STATE, AND NATIONAL CODES. RACEWAY SHALL BE INSTALLED PER THE ELECTRICAL SPECIFICATIONS. ALL CONTROL POINTS SHOWN ON THE CONTROL DIAGRAMS SHALL BE PROVIDED AND INTEGRATED INTO AN EMS SYSTEM GRAPHIC REPRESENTATIVE OF THE CONTROL DIAGRAMS. ALL CONTROL BANDS, SETPOINTS, SETPOINT LIMITS, SETPOINT INCREMENT VALUES, SETPOINT DECREMENT VALUES, ALARM LIMITS, AND OTHER PARAMETERS SHALL BE ADJUSTABLE FROM THE EMS. ALL CONTROL BANDS, SETPOINTS, TIME DELAYS, CONTROL LOOPS, AND OTHER PARAMETERS SHALL BE COMMISSIONED BY THE DIVISION 230900 TO PROVIDE STABLE CONTROL OF ALL SYSTEMS. ALL SETPOINTS SHALL BE ADJUSTABLE FROM THE EMS SYSTEM GRAPHIC(S). 11. SPACE SETPOINTS SHALL BE ADJUSTABLE FROM THE ROOM SENSOR UNLESS OTHERWISE SHOWN ON DRAWINGS OR SPECIFIED. 12. THE EMS SYSTEM GRAPHICS SHALL BE LINKED WITH ASSOCIATED BUILDING FLOOR PLANS FROM THE SPACE SENSOR OR AREA 13. WHERE ONE SYSTEM IS ASSOCIATED WITH ANOTHER SYSTEM, THE SYSTEM GRAPHIC SHALL BE LINKED TO THE ASSOCIATED GRAPHIC AS WELL AS THE BUILDING FLOOR PLAN GRAPHIC. EXAMPLE - AN AIR HANDLING UNIT SYSTEM GRAPHIC SHALL BE LINKED TO THE CHILLED WATER SYSTEM GRAPHIC IN ADDITION TO BOTH BEING LINKED TO THE BUILDING FLOOR PLAN. 14. THE BUILDING FLOOR PLAN SHALL DISPLAY THE SPACE TEMPERATURE AND THE ACTIVE SET POINT AT EACH SPACE SENSOR LOCATION WITH AREA SERVED DISPLAYED IN SEPARATE COLORS BASED ON THE CONDITION OF THE ZONE. AREAS WITH HUMIDITY AND PRESSURE CONTROL WILL ALSO HAVE THOSE VALUES DISPLAYED. EXAMPLE - ALARM, NORMAL, HIGH OR LOW TEMPERATURE, HIGH OR LOW HUMIDITY, ETC. ALL GRAPHICS (SCHEDULES, PLANS, AND DIAGRAMS) WILL INDICATED EQUIPMENT , POINTS, AND AREAS IN ALARM VIA A RED ALARM INDICATOR, RED TEXT, AND/OR A RED HIGHLIGHT. OVERRIDDEN POINTS WILL BE INDICATED WITH PURPLE. THE BUILDING FLOOR PLAN SHALL DISPLAY THE DUCTWORK AND THE PIPING LAYOUT. THE DUCTWORK AND PIPING SHALL BE ABLE TO TOGGLE ON AND OFF INDEPENDENTLY. 17. ALL BUILDING FLOOR PLANS AND SYSTEM GRAPHICS SHALL DISPLAY OUTSIDE AIR TEMPERATURE AND HUMIDITY. 18. THE FLOOR PLAN GRAPHICS SHALL BE LINKED TO A BUILDING GRAPHIC WITH A DIGITAL PHOTOGRAPH BACKGROUND OF THE ACTUAL BUILDING. DURING CONSTRUCTION A TEMPORARY GRAPHIC MAY BE USED THAT IS REPRESENTATIVE OF THE BUILDING. 19. ALL GRAPHICS SHALL BE SUBMITTED IN COLOR WITH THE ATC SUBMITTAL. FAILURE TO INCLUDE ALL GRAPHICS IN SUBMITTAL SHALL BE CAUSE FOR REJECTION OF COMPLETE SUBMITTAL. 20. VARIABLE FREQUENCY DRIVES ARE FURNISHED BY DIVISION 230900, INSTALLED AND WIRED BY DIVISION 26. REFER TO VARIABLE FREQUENCY DRIVE SCHEDULE. VERIFY ALL EXISTING MOTOR HORSEPOWER AND ELECTRICAL RATINGS PRIOR TO SUBMITTAL AND ORDERING VARIABLE FREQUENCY DRIVES. 21. POWER WIRING (PWR) FROM POWER SOURCE TO VARIABLE FREQUENCY DRIVES AND FROM VARIABLE FREQUENCY DRIVES TO MOTORS SHALL BE FURNISHED AND INSTALLED BY DIVISION 26. 22. POWER WIRING (PWR) FROM POWER SOURCE TO MOTOR STARTERS AND FROM MOTOR STARTERS TO MOTORS SHALL BE FURNISHED AND INSTALLED BY DIVISION 26. 23. POWER WIRING (PWR) FROM POWER SOURCE TO DDC, AND FEP PANELS SHALL BE FURNISHED AND INSTALLED BY THE DIVISION 26 UNLESS OTHERWISE NOTED ON DRAWINGS. GLOBAL DDC SYSTEM POINTS ARE DEFINED AS A SINGLE POINT USED IN ALL SYSTEMS IN A BUILDING OR CAMPUS TO MAINTAIN CONSISTENCY OF CONTROL ACTIONS THROUGHOUT THE BUILDING OR CAMPUS. EXAMPLE: OUTSIDE AIR TEMPERATURE POINT BUILDING OR CAMPUS. COMPATIBILITY, AND FEASIBILITY WITH ACTUAL CONDITIONS, BUILDING EQUIPMENT, AND THEIR OWN HARDWARE AND

SAMPLED ON THE NORTH SIDE OF A BUILDING USED TO ENABLE/DISABLE AIRSIDE ECONOMIZER OPERATION THROUGHOUT THE THE PROJECT SEQUENCES ARE WRITTEN IN A GENERAL FORM INTENDED FOR IMPLEMENTATION BY ANY CONTROLS SYSTEM AND CONTRACTOR. DIVISION 230900 SHALL REVIEW ALL SPECIFICATIONS AND CONTROL SEQUENCES FOR CONSTRUCTABILITY, SOFTWARE LIMITATIONS AND CAPABILITIES. CONTROL SEQUENCES ARE INTENDED TO BE THE GENERAL STRUCTURE OF THE CONTRACTORS PROGRAMING, BUT DO NOT NECESSARILY CONTAIN ALL THE REQUIRED DETAILS (LOOP AND TABLE STATEMENT TUNING, RAMPS, LIMITS, ETC) AND BEST PRACTICES FOR THE FINAL PRODUCT. DIVISION 230900 SHALL PROVIDE A COMPLETE, OPERABLE, AND TUNED CONTROL SYSTEM THAT MEETS THE INTENDED SEQUENCES AND THE SPECIFIC EQUIPMENT REQUIREMENTS. IF UPON IMPLEMENTATION IT IS DISCOVERED THAT ADDITIONAL PROGRAMMING IS REQUIRED TO MEET THE INTENDED DESIGN OF THE CONTROLS SYSTEM, DIVISION 230900 SHALL PROVIDE THE ADDITIONAL PROGRAMMING AT NO ADDITIONAL COST. ALL PROGRAMMING (GRAPHICAL AND/OR TEXT BASED) SHALL BE REVIEWED WITH THE DIVISION 230900 AS PART OF THE SUBMITTAL AND COMMISSIONING PROCESSES. DIVISION 230900 WILL PROVIDE A SUBMITTAL OF THE GRAPHICAL AND/OR TEXT BASED PROGRAMMING FOR A SIDE TO SIDE COMPARISON WITH THE CONTRACT DOCUMENTS. THIS REVIEW WILL PART OF A SCHEDULED MEETING INVOLVING THE BAS CONTROLS DESIGN TEAM, DIVISION 230900, AND THE COMMISSIONING AGENT. LIBERTIES TAKEN BY DIVISION 230900 ARE ALLOWED AFTER REVIEW AND APPROVAL FROM THE BAS DESIGN TEAM. ALL MODIFICATIONS SHALL BE RECORDED IN THE AS-BUILT DOCUMENTS. DIVISION 230900 SHALL BE REQUIRED SET UP TRENDING AS INDICATED BY THE CONSTRUCTION DOCUMENTS, AND AS REQUESTED BY THE BAS DESIGN AND COMMISSIONING TEAM(S).

- ALL EQUIPMENT SHALL HAVE THE OPTION OF BEING EXCLUDED FROM INDIVIDUAL RESET STRATEGIES BY EQUIPMENT SUMMARY SCHEDULES AND BY EQUIPMENT GRAPHICS.
- ALL EQUIPMENT CONTROLLERS IN THIS PROJECT SHALL BE HARD WIRED. NO WIRELESS SENSORS SHALL BE ALLOWED UNLESS WRITTEN APPROVAL IS GIVEN BY THE OWNER AND EOR AND THE WIRELESS FREQUENCY BANDS ARE COORDINATED WITH THE
- 28. AN ALARM SUMMARY SHALL BE CREATED FOR REVIEW OF FACILITY PERSONNEL DAILY. ALARM SUMMARY TO BE CAPABLE OF BEING SORTED BY ALARM LEVEL AND TIME OF ALARMS.
- 29. AN OVERRIDE SUMMARY SHALL BE PROVIDED FOR ALL OVERRIDES AND SHALL BE CAPABLE OF BEING SORTED BY DATE,
- DURATION, AND LEVEL OF PRIORITY.
- CONTROL LOGIC AND COMPONENTS SHALL BE ADJUSTED TO OBTAIN AT A MINIMUM THE FOLLOWING RESULTS.
- B. AIRFLOW CONTROL SHALL DEVIATE FROM SET POINT NO MORE THAN 2% OF THE SYSTEM SET POINT, OR SET POINT FOR THAT BRANCH OF SYSTEM, WITHIN A PERIOD OF LESS THAN 5 MINUTES.
- C. HYDRONIC FLOW CONTROL SHALL DEVIATE FROM SET POINT NO MORE THAN 2% OF THE SYSTEM SET POINT, OR SET
- POINT FOR THAT BRANCH OF SYSTEM, WITHIN A PERIOD OF LESS THAN 5 MINUTES. D. ACTUATORS SHALL NOT OSCILLATE MORE THAN 1% WITHIN A 5 MINUTE PERIOD.
- E. VARIABLE FREQUENCY DRIVE COMMANDS SHALL NOT OSCILLATE MORE THAN 1% IN A 5 MINUTE PERIOD.

A. TEMP CONTROL SHALL DEVIATE FROM SET POINT NO MORE THAN 0.2°F WITH PERIODS OF LESS THAN 1 MINUTE.

32. ALL GRAPHICS TO DISPLAY APPROPRIATE UNITS FOR VALUES DISPLAYED.

30. OVERRIDES SHALL BE CAPABLE OF TIMED RESETS.

LEGEND

CONTROL PIPING, FURNISHED AND INSTALLED BY DIVISION

LOCAL AREA NETWORK DATA PORT DROP, FURNISHED

NORMALLY CLOSED - POWERED OPEN RELAY CONTACT

NORMALLY OPEN - POWERED CLOSED RELAY CONTACT

PNEUMATIC CONTROL SUPPLY AIR CONNECTION

AND INSTALLED BY DIVISION 26.

NC NORMALLY CLOSED - POWERED OPEN

TO FLOOR DRAIN

NORMALLY OPEN - POWERED CLOSED

E-PWR EMERGENCY (ESSENTIAL) ELECTRICAL POWER

DIRECT DIGITAL CONTROL POINT TYPES

ANALOG INPUT SENSORS

GLOBAL DDC SYSTEM ANALOG INPUT

GLOBAL DDC SYSTEM ANALOG OUTPUT

GLOBAL DDC SYSTEM DIGITAL OR

GLOBAL DDC SYSTEM DIGITAL OR

AVERAGING DUCT TEMPERATURE SENSOR;

FURNISHED, INSTALLED, AND WIRED BY

PIPE TEMPERATURE SENSOR: FURNISHED

AND WIRED BY DIVISION 230900; THERMAL

AIR PRESSURE SENSOR: FURNISHED.

GAS PRESSURE SENSOR; FURNISHED,

INSTALLED BY DIVISION 23.

PRESSURE REQUIREMENTS.

WIRED BY DIVISION 230900.

WELL INSTALLED IN THE PIPING BY DIVISION

INSTALLED, AND WIRED BY DIVISION 230900.

TAP AND ISOLATION VALVE FURNISHED AND

INSTALLED, AND WIRED BY DIVISION 230900.

TAP AND ISOLATION VALVE FURNISHED AND

INSTALLED BY DIVISION 23. COORDINATE

ROOM HUMIDITY SENSOR WITH DIGITAL

DISPLAY; FURNISHED, INSTALLED, AND

ROOM HUMIDITY SENSOR: FURNISHED,

DUCT STATIC PRESSURE SENSOR WITH

AND WIRED BY DIVISION 230900.

DIFFERENTIAL PRESSURE SENSOR WITH

AND WIRED BY DIVISION 230900.

DIGITAL DISPLAY; FURNISHED, INSTALLED

DIGITAL DISPLAY; FURNISHED, INSTALLED

PRESSURE SENSOR FOR WET MEDIA WITH DIGITAL DISPLAY; FURNISHED, INSTALLED,

AND WIRED BY DIVISION 230900. ISOLATION

ROOM CARBON DIOXIDE SENSOR WITH

DUCT CARBON DIOXIDE SENSOR WITH

DIGITAL DISPLAY: FURNISHED, INSTALLED.

GAS FLOW METER - FURNISHED AND WIRED

FUME HOOD CONTOL WITH DISPLAY AND

KEYPAD; FURNISHED, INSTALLED, AND

WIRED BY DIVISION 230900.

BY DIVISION 230900. INSTALLED IN PIPING BY

AND WIRED BY DIVISION 230900.

AND WIRED BY DIVISION 230900.

DIVISION 23.

DIGITAL DISPLAY: FURNISHED, INSTALLED,

VALVES AND TAPS IN PIPING BY DIVISION 23.

INSTALLED, AND WIRED BY DIVISION 230900.

DIVISION 230900. REFER TO DETAIL I.

BINARY OUTPUT POINT TYPE

BINARY INPUT POINT TYPE

POINT TYPE

POINT TYPE

DDC SYSTEM ANALOG INPUT POINT

DDC SYSTEM ANALOG OUTPUT POINT

DDC SYSTEM DIGITAL OR BINARY

DDC SYSTEM DIGITAL OR BINARY

DUCT TEMPERATURE SENSOR; FURNISHED.

INSTALLED, AND WIRED BY DIVISION 230900.

OUTSIDE AIR TEMPERATURE SENSOR;

FURNISHED, INSTALLED, AND WIRED BY

VACUUM PRESSURE SENSOR; FURNISHED.

INSTALLED, AND WIRED BY DIVISION 230900.

ROOM TEMPERATURE SENSOR WITH

ROOM TEMPERATURE SENSOR WITH

SETPOINT, AND OVERRIDE PUSHBUTTON:

BUILDING STATIC PRESSURE SENSOR WITH

DIGITAL DISPLAY; FURNISHED, INSTALLED,

AND WIRED BY DIVISION 230900. REFER TO

DIFFERENTIAL PRESSURE SENSOR FOR WET

MEDIA WITH DIGITAL DISPLAY: FURNISHED.

INSTALLED, AND WIRED BY DIVISION 230900.

ISOLATION VALVES AND TAPS IN PIPING BY

- FURNISHED, INSTALLED, AND WIRED BY

STRAP ON TEMPERATURE SENSOR;

FURNISHED, INSTALLED, AND WIRED BY

LIQUID FLOW METER - FURNISHED AND

FURNISHED, INSTALLED, AND WIRED

ROOM PRESSURE MONITOR: FURNISHED,

FUME HOOD PROXIMITY SENSOR;

FURNISHED, INSTALLED, AND WIRED

INSTALLED, AND WIRED BY DIVISION 230900.

WIRED BY DIVISION 230900. INSTALLED IN

DUCT RELATIVE HUMIDITY SENSOR;

DIVISION 230900.

DIVISION 230900.

PIPING BY DIVISION 23.

ROOM PRESSURE SENSOR:

BY DIVISION 230900.

BY DIVISION 230900.

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TFD

FURNISHED, INSTALLED, AND WIRED BY

AND WIRED BY DIVISION 230900.

DIVISION 230900.

DETAIL F.

SETPOINT, OVERRIDE PUSHBUTTON, AND

DIGITAL DISPLAY: FURNISHED, INSTALLED,

TAP AND ISOLATION VALVE FURNISHED AND

INPUT POINT TYPE

OUTPUT POINT TYPE

DIVISION 230900.

INSTALLED BY DIVISION 23.

TYPE

TYPE

	LLOLIAD
	THREE PHASE POWER WIRING; FURNISHED AND INSTALLED BY DIVISION 26 (PWR)
	SINGLE PHASE POWER WIRING; FURNISHED AND INSTALLED BY DIVISION 26 (PWR)
	CONTROL AND INTERLOCK WIRING, FURNISHED AND INSTALLED BY Division 230900 (ILK)
	EMS ETHERNET LAN COMMUNICATION WIRING, FURNISHED AND INSTALLED BY Division 230900 (EMS LAN)
	EMS SUB-NETWORK COMMUNICATION WIRING, FURNISHED AND INSTALLED BY Division 230900 (EMS SN)
	ROOM SENSOR COMMUNICATION WIRING, FURNISHED AND INSTALLED BY Division 230900 (EMS RS)
	COMMUNICATION WIRING FOR OTHER HVAC SYSTEMS, FURNISHED AND INSTALLED BY Division 230900 (EMS OTH)
	PNEUMATIC CONTROL TUBING, FURNISHED AND INSTALLED BY DIVISION 230900

DIGITAL INPUT SENSORS

HIGH STATIC PRESSURE LIMIT SWITCH WITH

ELECTRONIC WATER FLOW SENSOR;

230900; INSTALLED IN PIPING BY DIVISION

EFS | FURNISHED, AND WIRED BY DIVISION

LOW LIMIT TEMPERATURE SWITCH WITH

KEYED SWITCH; FURNISHED, INSTALLED

AND WIRED BY DIVISION 230900.

Т	rll S	MANUAL RESET; FURNISHED, INSTALLED, AND WIRED BY DIVISION 230900. DPDT SWITCH FOR HARDWIRE INTERLOCK TO FANS AND DDC MONITORING. REFER TO DETAIL H.	HSL	MANUAL RESET; FURNISHED, INSTALLED, AND WIRED BY DIVISION 230900. DPDT SWITCH FOR HARDWIRE INTERLOCK TO FANS AND DDC MONITORING. ORIENT FOR STATIC PRESSURE SENSING.
(0		OCCUPANCY SENSOR; FURNISHED AND WIRED BY DIVISION 230900, INSTALLED IN LIGHTING CIRCUIT BY DIVISION 26.	CSR	CURRENT SENSING RELAY; FURNISHED, INSTALLED, AND WIRED BY DIVISION 230900.
[I	ES	END SWITCH: FURNISHED, INSTALLED AND WIRED BY Division 230900 UNLESS OTHERWISE NOTED, SHOWN ON THE DRAWINGS, OR SPECIFIED.	FIL DP SW H	FILTER DIFFERENTIAL PRESSURE SWITCH; FURNISHED, INSTALLED, AND WIRED BY DIVISION 230900.
(W	WFS	WATER FLOW SWITCH SPECIFIED TO BE FURNISHED WITH HVAC EQUIPMENT; INSTALLED BY Division 230900; WIRED BY DIVISION 230900.	L DP SW H WM	DIFFERENTIAL PRESSURE SWITCH FOR WET MEDIA; FURNISHED, INSTALLED, AND WIRED BY DIVISION 230900. PRESSURE TAPS IN PIPING BY DIVISION 23.
	RM	WALL MOUNTED ROOM OCCUPANCY SWITCH; FURNISHED, INSTALLED, AND WIRED BY DIVISION 230900.	RM OCC	CEILING MOUNTED ROOM OCCUPANCY SWITCH. FURNISHED, INSTALLED, AND WIRED BY DIVISION 230900.
	MS	MOISTURE SENSOR: FURNISHED, INSTALLED, AND WIRED BY DIVISION 230900.	PE SW	PRESSURE TO ELECTRIC SWITCH: FURNISHED, INSTALLED, PNEUMATIC PIPING, AND ELECTRICAL WIRING BY DIVISION 230900.

	OUTPUT DEVI	<u>CES</u>	
VA	CONTROL VALVE (2-WAY) WITH ELECTRIC OR ELECTRONIC ACTUATOR; FURNISHED AND WIRED BY DIVISION 230900. INSTALLED IN PIPING BY DIVISION 23.	VA ES	CONTROL VALVE (2-WAY) WITH ELECTRONIC ACTUATOR AND INTEGRAL END SWITCH; FURNISHED AND WIRED BY DIVISION 230900. INSTALLED IN PIPING BY DIVISION 23.
VA	CONTROL VALVE (3-WAY) ELECTRIC OR ELECTRONIC; FURNISHED AND WIRED BY DIVISION 230900; INSTALLED IN PIPING BY DIVISION 23.	VA ES	CONTROL VALVE (3-WAY) WITH ELECTRONIC ACTUATOR AND INTEGRAL END SWITCH; FURNISHED AND WIRED BY DIVISION 230900; INSTALLED IN PIPING BY DIVISION 23.
VA	BUTTERFLY CONTROL VALVE (2-WAY) WITH ELECTRONIC ACTUATOR; FURNISHED AND WIRED BY DIVISION 230900; INSTALLED IN PIPING BY DIVISION 23.	VA ES	BUTTERFLY CONTROL VALVE (2-WAY) WITH ELECTRONIC ACTUATOR AND INTEGRAL END SWITCH; FURNISHED AND WIRED BY DIVISION 230900; INSTALLED BY DIVISION 23.
VA	BUTTERFLY CONTROL VALVE (3-WAY) WITH ELECTRONIC ACTUATOR; FURNISHED AND WIRED BY DIVISION 230900; INSTALLED BY DIVISION 23.	VA ES	BUTTERFLY CONTROL VALVE (3-WAY) WITH ELECTRONIC ACTUATOR AND INTEGRAL END SWITCH; FURNISHED AND WIRED BY DIVISION 230900; INSTALLED IN PIPING BY DIVISION 23.
DA	DAMPER ACTUATOR; FURNISHED, INSTALLED, AND WIRED BY DIVISION 230900 UNLESS OTHERWISE NOTED ON DRAWINGS OR IN SPECIFICATIONS.	DA ES	DAMPER ACTUATOR WITH INTEGRAL END SWITCH(ES); FURNISHED, INSTALLED, AND WIRED BY DIVISION 230900 UNLESS OTHERWISE NOTED ON DRAWINGS OR IN SPECIFICATIONS.

ELECTRIC TO PRESSURE TRANSDUCER: FURNISHED, INSTALLED, PIPED, AND WIRED BY DIVISION 230900.

SMOKE DAMPER ACTUATOR(S) FURNISHED

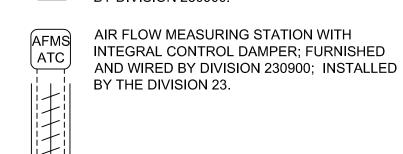
AND INSTALLED BY DIVISION 23. REFER TO

FURNISHED AND INSTALLED BY DIVISION 23.

FIRE/SMOKE DAMPER ACTUATOR(S):

DETAIL G.

REFER TO DETAIL G.



AIR FLOW MEASURING STATION; FURNISHED AND WIRED BY DIVISION 230900; INSTALLED ATC BY DIVISION 23.

SMOKE DAMPER ACTUATOR(S) WITH

(F/SDA) FIRE/SMOKE DAMPER ACTUATOR(S) WITH

DETAIL G.

INTEGRAL END SWITCH: FURNISHED AND

INTEGRAL END SWITCH: FURNISHED AND

INSTALLED BY DIVISION 23. REFER TO

INSTALLED BY DIVISION 23. REFER TO

I — I	ı
	EXHAUST AIRFLOW MEASURING DEVICE; FURNISHED BY DIVISION 230900; INSTALLE BY DIVISION 23; DIFFERENTIAL PRESSURE SENSOR FURNISHED AND INSTALLED BY DIVISION 230900.

OTHER CONTROL DEVICES

FEP	FIELD EQUIPMENT PANEL (FEP); FURNISHED AND INSTALLED BY DIVISION 230900. POWER WIRING TO FEP BY DIVISION
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FILTER GAGE: FURNISHED WITH FILTERS; INSTALLATION AND INSTRUMENT PIPING BY DIVISION 230900

BALL-IN-TUBE VISUAL OFFSET INDICATOR FURNISHED AND INSTALLED BY DIVISION 230900.

	CONTROL DEVICES FURNIS	SHED E	BY OTHER TRADES:
HHL EQ	HUMIDITY HIGH LIMIT SENSOR; FURNISHED WITH THE STEAM HUMIDIFIER; INSTALLED AND WIRED BY DIVISION 230900.		PLENUM FAN INLET BELL HOUSING AIRFLOW MEASURING STATION FURNISHED AND INSTALLED BY THE FAN MANUFACTURER.
SV EG	EMERGENCY GENERATOR SOLENOID VALVE; FURNISHED AND INSTALLED BY THE FUEL OIL SYSTEM SUPPLIER, WIRED BY DIVISION 23.		CENTRIFUGAL FAN INLET BELL HOUSING AIRFLOW MEASURING STATION FURNISHED AND INSTALLED BY THE FAN MANUFACTURER.
AFMS EQ	AIR FLOW MEASURING STATION; FURNISHED AND INSTALLED BY THE AIR HANDLING UNIT MANUFACTURER. WIRING FROM THE AFMS TO THE DDC PANEL BY DIVISION 230900. POWER WIRING BY DIVISION 26.	AFMS SM	AIR FLOW MEASURING STATION; FURNISHED, AND INSTALLED BY DIVISION 23. WIRING FROM THE AFMS TO THE DDC PANEL BY DIVISION 230900. POWER WIRING BY DIVISION 26.
VA EQ	CONTROL VALVE (2-WAY) WITH ELECTRIC OR ELECTRONIC ACTUATOR; FURNISHED WITH EQUIPMENT (EQ); WIRED BY DIVISION 230900; INSTALLED IN PIPING BY DIVISION 23.	NC NC	CONTROL DAMPER; FURNISHED AND INSTALLED BY DIVISION 230900. DAMPER ACTUATOR FURNISHED INSTALLED AND WIRED BY DIVISION 230900.
AFMS EQ 11111 NO	AIR FLOW MEASURING STATION WITH INTEGRAL CONTROL DAMPER; FURNISHED AND INSTALLED BY THE AIR HANDLING UNIT MANUFACTURER. WIRING TO DDC SYSTEM BY DIVISION 230900.	AFMS SM NC	AIR FLOW MEASURING STATION WITH INTEGRAL CONTROL DAMPER; FURNISHED AND INSTALLED BY DIVISION 23.
FAR	FIRE ALARM PROGRAMMABLE RELAY (FAR) FOR SMOKE PURGE OPERATION (SMK); FURNISHED, INSTALLED, AND PROGRAMMED BY DIVISION 28. FAR SHALL BE LOCATED IN SAME ROOM AS HVAC EQUIPMENT SERVED PER NFPA. ALL WIRING FROM FAR TO FIRE ALARM SYSTEM BY DIVISION 28. INTERLOCK WIRING FROM FAR TO ATC PANEL BY DIVISION 230900.	FAR	FIRE ALARM PROGRAMMABLE RELAY (FAR); FURNISHED, INSTALLED, AND PROGRAMMED BY DIVISION 28. FAR SHALL BE LOCATED IN SAME ROOM AS HVAC EQUIPMENT SERVED PER NFPA. ALL WIRING FROM FAR TO FIRE ALARM SYSTEM BY DIVISION 28. INTERLOCK WIRING FROM FAR TO ATC PANEL BY DIVISION 230900.

ABBREVIATIONS

DUCT MOUNTED SMOKE DETECTOR(S); FURNISHED, INSTALLED, AND WIRED BY

SYSTEM.

DIVISION 28 AS PART OF THE FIRE ALARM

HWS	HEATING WATER SUPPLY	MA	MIXED AIR
HWR	HEATING WATER RETURN	MAT	MIXED AIR TEMPERATURE
DHWS	DISTRICT HEATING WATER SUPPLY	MAH	MIXED AIR HUMIDITY
DHWR	DISTRICT HEATING WATER RETURN	DAT	DISCHARGE AIR TEMPERATURE
CWS	CONDENSER SUPPLY	DAH	DISCHARGE AIR HUMIDITY
CWR	CONDENSER RETURN	DB	DRY BULB
CHS	CHILLED WATER SUPPLY	WB	WET BULB
CHR	CHILLED WATER RETURN	RH	RELATIVE HUMIDITY
DCHS	DISTRICT CHILLED WATER SUPPLY	ILK	INTERLOCK
DCHR	DISTRICT CHILLED WATER RETURN	AHU	AIR HANDLING UNIT
SETP.	SETPOINT	вссо	BLOWER COIL UNIT COOLING ONLY
SP	STATIC PRESSURE	BCU	BLOWER COIL UNIT
DP	DIFFERENTIAL PRESSURE	CVET	CONSTANT VOLUME EXHAUST TERMINAL
OA	OUTSIDE AIR	CVRT	CONSTANT VOLUME RETURN TERMINAL
OAF	OUTSIDE AIRFLOW	CVST	CONSTANT VOLUME SUPPLY TERMINAL
OAT	OUTSIDE AIR TEMPERATURE (DRY BULB)	FCCO	FAN COIL UNIT COOLING ONLY
OAH	OUTSIDE AIR HUMIDITY	FCHO	FAN COIL UNIT HEATING ONLY
RA	RETURN AIR	FCU	FAN COIL UNIT
RAF	RETURN AIRFLOW	IUH	INDUCTION UNIT HEATER
RAT	RETURN AIR TEMPERATURE	PFST	PARALLEL FAN SUPPLY TERMINAL
RAH	RETURN AIR HUMIDITY	SFST	SERIES FAN SUPPLY TERMINAL
SA	SUPPLY AIR	UH	UNIT HEATER
SAF	SUPPLY AIRFLOW	VVET	VARIABLE VOLUME EXHAUST TERMINAL
SAT	SUPPLY AIR TEMPERATURE	VVRT	VARIABLE VOLUME RETURN TERMINAL
		VVST	VARIABLE VOLUME SUPPLY TERMINAL

SHEET ABBREVIATIONS

	STANDARD SYSTEM
E	STANDARD MATERIALS AND EQUIPME

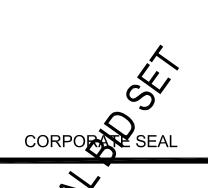
STANDARD DETAIL

(1) CONTROL SYMBOL LEGEND

GENERAL NOTE: THESE STANDARD SYSTEM DIAGRAMS AND SEQUENCES ARE DEVELOPED AS THE BASIS FOR DESIGN AND MAY NOT BE DIRECTLY APPLICABLE AS IS DUE TO EXISTING EQUIPMENT OR SYSTEM CAPABILITIES, OR DUE TO SYSTEM OR EQUIPMENT ARRANGEMENTS. IT IS THE RESPONSIBILITY OF THE ENGINEER OF RECORD TO MODIFY THESE DOCUMENTS AS REQUIRED FOR THE SPECIFIC CONDITIONS OF A PROJECT. REFER TO THE RFP DOCUMENTS FOR MODIFICATION PROCEDURES.

Engineering 2039 NORTH GREEN ACRES

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ENGINEER SEAL

MARK DATE DESCRIPTION ISSUE DATE: 03/20/19

ROJECT NUMBER: 04-18-0072 SHEET TITLE:

CONTROLS LEGEND

POWER **WIRING BY**

DIVISION

26 (PWR)

L1 L2 L3

EMS COMMUNICATION

MOTOR SPEED

AO CONTROL (SPD)

AUTO START/

MOTOR SPEED

STATUS (STAT)

MOTOR STATUS

√DO STOP CONTROL

-(AI) FEEDBACK

(SPD FBK)

VFD ALARM

SAFETIES AS REQUIRED FOR

(SAF) -- CONTACTS OPEN ON

(STAT)

SEQUENCE OF OPERATION

UNSAFE CONDITION

LOCKABLE

> ·· + ·· - WIRING BY DIVISION 230900

VARIABLE FREQUENCY DRIVE

TERMINAL BLOCKS IN

DRIVE FOR SAFETY

VARIABLE FREQUENCY

TEMPERATURE

LOW LIMIT

SAFETY

40F

DETAIL G

CONTROL DIAGRAM

SYMBOL

STEAM

HUMIDIFIER

CONTROL

PANEL

DETAIL K

#AO CTL

CONTROL DIAGRAM

SYMBOL

INTERVALS NOTED TO COVER THE ENTIRE COIL.

_____ ILK

VFD FOR SPEED

VFD FOR ALARM

FEEDBACKS

INTERLOCK

STATUS

VFD FOR START STOP

VFD FOR SPEED

EMS COMMUNICATION

MOTOR SPEED

AO CONTROL (SPD)

AUTO START/

-⟨DO⟩ STOP CONTROL

—(AI) FEEDBACK

(SPD FBK)

VFD ALARM

MOTOR SPEED

STATUS (STAT)

SAFETIES AS REQUIRED FOR

SEQUENCE OF OPERATION

UNSAFE CONDITION

(STAT)

120 VAC POWER BY DIVISION 26

FROM FIRE ALARM RELAY TO FAS BY

FROM FAN START SIGNAL TO OPEN

TO FAN SAFETY INTERLOCK BY

DAMPER STATUS (STAT)

DIVISION 230900 (ILK)

NOTE:

ALL SMOKE DAMPERS LOCATED AT

DUCT PENETRATIONS OF SHAFTS

AND RATED SMOKE BARRIERS

SHALL BE CONTROLLED BY THE

STATIC PRESSURE

HIGH LIMIT SAFETY

— ON HIGH DUCT STATIC

INTERLOCK TO STOP FAN

PRESSURE CONDITION (ILK)

STATUS (STAT)

FIRE ALARM SYSTEM.

DIVISION 28 (FAS)

230900 (ILK)

SMOKE OR FIRE SMOKE ☐ DAMPER ACTUATOR

WITH END SWITCHES

SMOKE OR

FIRE/SMOKE

DAMPER

SMOKE OR FIRE/SMOKE DAMPER(S) ARE FURNISHED BY DIVISION 23 WITH ELECTRONIC SPRING RETURN TO

3. FIRE ALARM RELAY(S) ARE FURNISHED AND INSTALLED BY DIVISION 28 AT THE SMOKE OR FIRE/SMOKE DAMPER

4. INTERLOCK WIRING FROM THE FIRE ALARM RELAY TO THE SMOKE OR FIRE/SMOKE DAMPER ACTUATOR(S) IS BY

WHERE SMOKE OR FIRE/SMOKE DAMPERS ARE USED AS ISOLATION DAMPERS FOR AIR HANDLING UNITS, THE

INTERLOCK WIRING FROM THE FAN START SIGNAL TO OPEN THE ISOLATION SMOKE OR FIRE/SMOKE DAMPERS IS

INTERLOCK WIRING FROM THE SMOKE OR FIRE/SMOKE DAMPER ACTUATOR END SWITCH(ES) TO THE FAN SAFETY

A MANUAL RESET DUCT HIGH STATIC PRESSURE LIMIT (HSL) SWITCH(ES) WITH DPST OR DPDT CONTACTS FOR

HARDWIRE INTERLOCK TO FANS AND DDC MONITORING SHALL BE PROVIDED. CONTACTS SHALL INCLUDE OPEN

2. DUCT HIGH STATIC PRESSURE LIMIT (HSL) SWITCH(ES) SHALL BE INSTALLED TO SENSE DUCT STATIC PRESSURE

MULTIPLE DUCT HIGH STATIC PRESSURE LIMIT (HSL) SWITCHES MAY BE REQUIRED AS SHOW ON THE CONTROL

DIAGRAMS. THE MULTIPLE DUCT HIGH STATIC LIMIT SWITCHES SHALL BE WIRED IN SERIES FOR FAN SHUTDOWN

I. INTERLOCK WIRING FROM THE DUCT HIGH STATIC PRESSURE LIMIT (HSL) SWITCHES TO THE FAN CONTROLLER IS

5. DUCT HIGH STATIC PRESSURE LIMIT (HSL) SWITCHES SHALL HAVE SETPOINT ADJUSTMENT AND MANUAL RESET

6. DUCT HIGH STATIC LIMIT (HSL) SWITCHES SHALL BE INSTALLED PER MANUFACTURER RECOMMENDATIONS.

DETAIL: DUCT STATIC PRESSURE HIGH LIMIT SWITCH

ON ALARM CONTACT FOR FAN SHUTDOWN AND A CLOSE ON ALARM CONTACT FOR ALARM STATUS.

AND STOP THE ASSOCIATED FAN TO PREVENT DAMAGE TO THE DUCT WORK.

AND WIRED IN PARALLEL FOR ALARM STATUS.

DETAIL: SMOKE OR FIRE/SMOKE DAMPER INTERLOCK
NOT TO SCALE

(SAF) - CONTACTS OPEN ON

(EMS SN)

- WIRING BY DIVISION 230900

VFD FOR EMS

INTERFACE

CONTROL

POWER

WIRING BY

DIVISION

26 (PWR)

L1 L2 L3

VARIABLE FREQUENCY DRIVE

VFD FOR EMS

INTERFACE

CONTROL

TERMINAL BLOCKS IN

TERMINAL BLOCKS IN

TERMINAL BLOCKS IN

VFD FOR START STOP

TERMINAL BLOCKS IN

TERMINAL BLOCKS IN

TERMINAL BLOCKS IN

VARIABLE FREQUENCY

B DETAIL: VARIABLE FREQUENCY DRIVE INTERLOCK

DRIVE FOR SAFETY

VFD FOR SPEED

VFD FOR ALARM

FEEDBACKS

STATUS

INTERLOCK

VFD FOR SPEED

VARIABLE

DRIVE

DETAIL B

(o) MOTOR

CONTROL DIAGRAM SYMBOL

DAMPER

DETAIL F

CONTROL DIAGRAM

DIVISION 28.

CIRCUIT(S) IS BY DIVISION 230900.

HIGH STATIC PRESSURE

LIMIT SAFETY

4.0" WG

DETAIL J

CONTROL DIAGRAM

SYMBOL

BY DIVISION 230900.

CLOSED OR OPEN ACTUATOR(S) AND END SWITCH(ES).

2. SMOKE OR FIRE SMOKE DAMPER(S) ARE INSTALLED BY DIVISION 23.

HAO SPD

AUX-H-FREQUENCY

AUX # MOTOR

SAF # DETAIL A

STARTER

CONTROL DIAGRAM SYMBOL

BUILDING

PRESSURE

DETAIL F

CONTROL DIAGRAM

SYMBOL

SENSING LOCATIONS.

SPACE

PRESSURE

DETAIL I

CONTROL DIAGRAM

SYMBOL

DIFFERENTIAL

CSR (DI STAT

AUXILIARY

(AUX)

CONTACT(S)

POWER

DIVISION 26

(PWR)

L1 L2 L3

DETAIL: MOTOR STARTER INTERLOCK DETAIL

NOT TO SCALE

TUBING IN

LOCATE BUILDING INTERIOR

PRESSURE SENSING POINTS

AS SHOWN ON THE PLANS OR

AS PER ENGINEER'S

2. CAPPED TEES ON DIFFERENTIAL PRESSURE TEST PORTS FURNISHED AND INSTALLED BY DIVISION 230900.

DETAIL: BUILDING PRESSURE SENSOR

LOCATE BUILDING PRESSURE SENSOR TO ALLOW EQUAL LENGTHS OF TUBING TO BOTH INTERIOR AND EXTERIOR

INSTRUCTIONS.

EMT CONDUIT

MOTOR STARTER WITH HOA AND

BY DIVISION 26.

BUILDING

PRESSURE

MUST BE

└─ EQUAL LENGTHS -

OF TUBING

DIFFERENTIAL

PRESSURE

DETAIL I

MUST BE

└- EQUAL LENGTHS-

OF TUBING

3/8" POLY 🥿 TUBING IN

LOCATE AS

SHOWN ON THE

PLANS OR AS PER

ENGINEER'S

INSTRUCTIONS.

1. LOCATE BUILDING PRESSURE SENSOR TO ALLOW EQUAL LENGTHS OF TUBING TO BOTH SENSING LOCATIONS.

2. CAPPED TEES ON DIFFERENTIAL PRESSURE TEST PORTS FURNISHED AND INSTALLED BY DIVISION 230900.

DETAIL: SPACE DIFFERENTIAL PRESSURE SENSOR
NOT TO SCALE

EMT CONDUIT 🥎

120 VAC CONTROL TRANSFORMER

INTERLOCK(S)

AUTO START/

MOTOR STATUS

''J (STAT)

BUILDING PRESSURE

INTEGRAL DIGITAL

SENSOR WITH

DISPLAY

LOCATE BUILDING EXTERIOR

PRESSURE SENSING POINTS

AS SHOWN ON THE PLANS

OR AS PER ENGINEER'S

INSTRUCTIONS.

DIFFERENTIAL

WITH INTEGRAL

LOCATE AS

SHOWN ON THE

PLANS OR AS PER

ENGINEER'S

INSTRUCTIONS.

DIGITAL DISPLAY

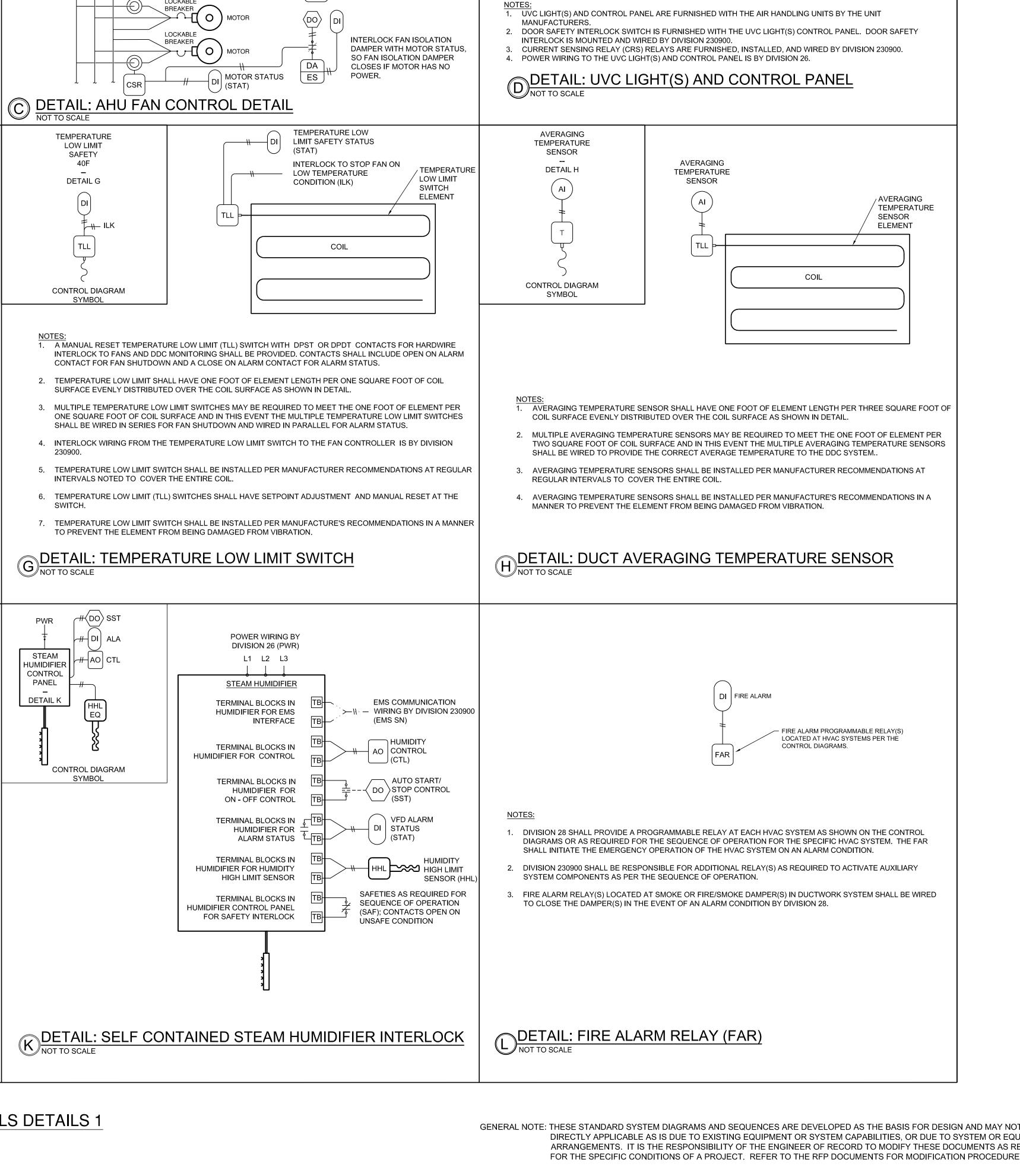
PRESSURE SENSOR

--- DO STOP CONTROL

WIRING BY

GENERAL NOTE: THESE STANDARD SYSTEM DIAGRAMS AND SEQUENCES ARE DEVELOPED AS THE BASIS FOR DESIGN AND MAY NOT BE DIRECTLY APPLICABLE AS IS DUE TO EXISTING EQUIPMENT OR SYSTEM CAPABILITIES, OR DUE TO SYSTEM OR EQUIPMENT ARRANGEMENTS. IT IS THE RESPONSIBILITY OF THE ENGINEER OF RECORD TO MODIFY THESE DOCUMENTS AS REQUIRED

FOR THE SPECIFIC CONDITIONS OF A PROJECT. REFER TO THE RFP DOCUMENTS FOR MODIFICATION PROCEDURES.



CSR DH DI STAT

CONTROL DIAGRAM

SYMBOL

(DS)

INTERLOCK FAN ISOLATION

SO FAN ISOLATION DAMPER

CLOSES IF MOTOR HAS NO

POWER.

DAMPER WITH MOTOR STATUS,

UVC

LIGHTS

MARK DATE

ISSUE DATE:

ROJECT NUMBER:

SHEET TITLE:

CONTROLS **DETAILS 1**

SHEET NUMBER:

DESCRIPTION

03/20/19

04-18-0072

ENGINEER SEAL

Phone: (479) 521-8634 Fax: (479) 521-1014 bernhard.com

FAYETTEVILLE, AR 72703

2039 NORTH GREEN ACRES

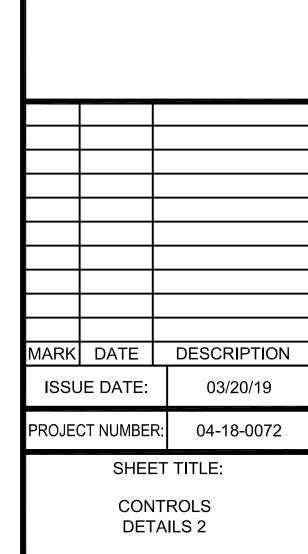
Engineering



CORPORATE SEAL

ENGINEER SEAL

OIQ CONTROL DRAWINGS
UNIVERSITY OF ARKANSAS



SHEET NUMBER:

ATC0.02

	1 —
HP1-SC	Building Chill Pmp 1-SC
HP1VSD	Chill Wtr Pmp 1 VSD CS
WRT-SP	Pri Chill Wtr Temp SetP
HWR-T	Pri Chill Wtr Return T
WHS-T	Pri Chill Wtr Supply T
HW-F	Pri Chill Wtr Flow
W-DP	Pri Chill Wtr Diff Press
HW-VLV	Pri Chill Wtr Valve
#NAME?	MISC POINTS
NHT-A	Dom Hot Wtr High T-Alm
R-A	Main Air Loss-Alm
CP1-S	Hot Wtr Cir Pmp 1 Status
MW-F	Dom Water Flow 1=1000gal
Z1-ALM	RPZ 1 Alarm
I-S	Dom Wtr Boost Pmp 1-Stat
NS-A	Tunnel Sump Alarm
SEMS-A	Basement Sump Alarm
JMP-A	Elevator Sump High Alarm
N-DT	Pri Chill Wtr Delta T
-TONS	Chill Wtr Load 15Min Avg
WF-TOT	Pri Chill Wtr Load Tot
WFTOT2	PCWF TOT X 32000+PCWFTOT
MW-TOT	DOM Wtr Total x 1000
MWTOT2	DOMWTOT x 32MIL+DOMW-TOT
S-FLOW	Gas Flow x 10 CFM
SF-TOT	Gas Flow Total x 10
SFTOT2	GASFTOT x320000+GASF-TOT
01 10 12	S. (S. 131 A020000 : G. (G. 101
C-CMD	Occupided Command
J-SMB N-RST	Supply Fan Reset Cmd
ALM	Supply Fan Alarm
S	Supply Fan Status
<u>C</u>	Supply Fan Command
r-sp	Discharge Air Temp SP
T	Discharge Air Temp
>VLV	Heat/Cool Valves
-SP	Warm-Up Temp SetPoint
-SP -MODE	Warm-Up Mode Status
-MODE 60	Return Air Temp < 60 Deg
T	Return Air Temp
T-SP	Static Pressure SP
SP	Discharge Air Static Pre
SP SSC	Supply Fan Speed Control
SP	
<u> </u>	Outside Air CFM SetPoint
-CFM	Outside Air CFM
P-CMD	OA/RA Damper CMD
<u>T</u>	Outside Air Temp
-T	Mixed Air Temp
NR-T	Chill Wtr Return Temp

Typical T	erminal Unit Definit
RMxx-T	Room xxx Description Temp

Typical H	ardware Definitions
HWP2-VSD	HWP2-VSD N2=101
BCHP1VSD	BCHP1-VSD N2=102
BCHP2VSD	BCHP2-VSD N2=103
AHU1-DX	AHU1-DX N2=21
CHW-DX	CHW-DX N2=23

U1-DX	AHU1-DX N2=21	
W-DX	CHW-DX N2=23	

SHEET NUMBER: ATC0.03

MARK DATE DESCRIPTION

PROJECT NUMBER: 04-18-0072

SHEET TITLE:

CONTROLS DETAILS 3

ISSUE DATE:

Engineering

2039 NORTH GREEN ACRES

FAYETTEVILLE, AR 72703 Phone: (479) 521-8634 Fax: (479) 521-1014

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ENGINEER SEAL

STANDARD NAMING CONVENTIONS
NOT TO SCALE

Item	Description
UNOC-OCC	UNOCC/OCC Comand
STEAM & HEATING POINTS	
HWDP-SP	Hot Water Diff Pres SetP
HW-DP	Hot Water Diff Pressure
HWP1-C	Hot Water Pump 1 Command
HWP1-S	Hot Water Pump 1 Status
HWP1-SC	Hot Wtr Pmp 1 Speed Ctl
HWP1-VSD	Hot Wtr Pmp 1 VSD CS
HWST-SP	Hot Water Temp SetP
HWS-T	Hot Water Supply Temp
HWR-T	Hot Water Return Temp
HWEX-VLV	Hot Wtr Exchanger Valve
STM-F	Steam Flow x 10
HSTM-P	High Steam Pressure
LSTM-P	Low Steam Pressure
VENT-ALM	Steam Relief Temp Monitor
CHILL WATER POINTS	Cleam Hener Temp Wernter
TEM-PRES	Temp or Pressure Mode
CWBYP-V	Chill Wtr ByPass Valve
SCWDP-SP	Sec Chil Wtr DP SetP
SCHW DP	Sec Chill Wtr Diff Press
CWPTOT-R	CWP'S Total Reset
BCHP1-C	Building Chill Pmp 1 Cmd
BCHP1-S	Building Chill Pmp 1-S
BCHP1-SC	Building Chill Pmp 1-SC
BCHP1VSD	Chill Wtr Pmp 1 VSD CS
PCWRT-SP	Pri Chill Wtr Temp SetP
PCHWR-T	Pri Chill Wtr Return T
PCWHS-T	Pri Chill Wtr Supply T
PCHW-F	Pri Chill Wtr Flow
PCW-DP	Pri Chill Wtr Diff Press
PCHW-VLV	Pri Chill Wtr Valve
#NAME?	MISC POINTS
DHWHT-A	Dom Hot Wtr High T-Alm
MAIR-A	Main Air Loss-Alm
HWCP1-S	Hot Wtr Cir Pmp 1 Status
DOMW-F	Dom Water Flow 1=1000gal
RPZ1-ALM	RPZ 1 Alarm
BP1-S	Dom Wtr Boost Pmp 1-Stat
TUNS-A	Tunnel Sump Alarm
BASEMS-A	Basement Sump Alarm
ESUMP-A	Elevator Sump High Alarm
PCW-DT	Pri Chill Wtr Delta T
CW-TONS	Chill Wtr Load 15Min Avg
PCWF-TOT	Pri Chill Wtr Load Tot
PCWFTOT2	PCWF TOT X 32000+PCWFTOT
DOMW-TOT	DOM Wtr Total x 1000
DOMWTOT2	DOMWTOT x 32MIL+DOMW-TC
GAS-FLOW	Gas Flow x 10 CFM
GASF-TOT	Gas Flow Total x 10
GASFTOT2	GASFTOT x320000+GASF-TOT
-	2.
OCC-CMD	Occupided Command
FAN-RST	Supply Fan Reset Cmd
SF-ALM	Supply Fan Alarm
SF-S	Supply Fan Status
SF-C	Supply Fan Command
DAT-SP	Discharge Air Temp SP
DA-T	Discharge Air Temp
H C-VLV	Heat/Cool Valves
MU-SP	Warm-Up Temp SetPoint
WU-MODE	Warm-Up Mode Status
RAT-60	Return Air Temp < 60 Deg
RA-T	Return Air Temp < 60 Deg
STAT-SP	Static Pressure SP
DA-SP	
	Discharge Air Static Pre
SFC-SC	Supply Fan Speed Control
OA-SP	Outside Air CFM SetPoint
OA-CFM	Outside Air CFM
DMP-CMD	OA/RA Damper CMD
OA-T	Outside Air Temp
MA-T	Mixed Air Temp
CHWR-T	Chill Wtr Return Temp
HSP-L	High Static Press Limit
MA-LL	Mixed Air Low Limit
	Prefilter Status

LIST OF CURRENT UA JOHNSON CONTROL SYSTEMS NOT TO SCALE
NOT TO SCALE

evice Type	BUILDING	IP	10.25.22.6 Device Type	ADS001/Outside BUILDING	IP	Device Type	BUILDING	IP	Device Type	BUILDING	IP	Device Type	BUILDING	IP
NAE-55	BELL	172.16.200.1	NAE-55	SCEN	172.16.200.51	???	???	172.16.200.101	NCE-25	ECHP	172.16.200.151	NAE-55	CHIL	172.16.200.20
NAE-55	ENGR	172.16.200.2	NAE-55	SCEN	172.16.200.52	NAE-55	ADSB	172.16.200.102	NAE-55	GEAR	172.16.200.152		-	
NCE-25	BGHL	172.16.200.3	NAE-55	СНВС	172.16.200.53	NCE-25	ASUP	172.16.200.103	Integration	ECHP/Bacnet gateway	172.16.200.153	Desktop	NANO	172.16.200.20
NCE-25	HAPG	172.16.200.4	NAE-55	WCOB	172.16.200.54	NAE-35	MCHS	172.16.200.104	NAE-55	ENGR	172.16.200.154	•		172.16.200.20
NAE-55	AGRI	172.16.200.5	NAE-55	MHSR	172.16.200.55	NAE-55	ARAS	172.16.200.105	NAE-55	HOTZ	172.16.200.155			172.16.200.20
NAE-55	HOEC	172.16.200.6	NAE-55	MHSR	172.16.200.56	NAE-55	AFLS	172.16.200.106	NAE-55	HOTZ	172.16.200.156			172.16.200.20
NAE-55	KIMP	172.16.200.7	NAE-55	POMF	172.16.200.57	???	???	172.16.200.107	NAE-55	HOTZ	172.16.200.157			172.16.200.20
NAE-55	MUSC	172.16.200.8	NAE-55	MJWH	172.16.200.58	NAE-55	MULN	172.16.200.108	NAE-55	POMF	172.16.200.158			172.16.200.2
NAE-55	GRAD	172.16.200.9	NAE-55	MJWH	172.16.200.59	NAE-55	POSC	172.16.200.109	NAE-55	POMF	172.16.200.159			172.16.200.2
NAE-55	MEMH	172.16.200.10	NAE-55	UNHS	172.16.200.60	NAE-55	PEAH	172.16.200.110	NCE-25	FBOC/Metering	172.16.200.160			172.16.200.2
NAE-55	NANO	172.16.200.11	NAE-55	FUTR	172.16.200.61	NCE-25	ARKU	172.16.200.111	NAE-55	ECHP	172.16.200.161			172.16.200.2
NAE-55	MAIN	172.16.200.12	NAE-55	PTSC	172.16.200.62	NCE-25	CHIL/RTU	172.16.200.112	NAE-55	YOCM	172.16.200.162			172.16.200.2
NAE-55	FUTR	172.16.200.13	NAE-55	DUNR	172.16.200.63	Integration	NANO/HUMID	172.16.200.113	NAE-55	YOCM	172.16.200.163			172.16.200.2
NAE-55	HOCM	172.16.200.13	NAE-55	PDTF	172.16.200.64	NAE-55	HILL	172.16.200.114	NAE-55	YOCM	172.16.200.164			172.16.200.2
NAE-55	GREG	172.16.200.14	NAE-55	BELL	172.16.200.65	NAE-35	WAXX	172.16.200.114	NAE-35	ENRC	172.16.200.165			172.16.200.2
NCE-25	UNST	172.16.200.15	NAE-55	HUNT	172.16.200.66	NAE-55	ARKU	172.16.200.116	NAE-55	Housing Office	172.16.200.166			172.16.200.2
NAE-55	SCIE	172.16.200.16	NAE-55	MAIN	172.16.200.67	NAE-55	ARKU	172.16.200.117	NCE-25	HEATING PLANT	172.16.200.167			172.16.200.2
NCE-25	YOCM	172.16.200.17	NAE-55	PHYS	172.16.200.67	NAE-55	ARKU	172.16.200.117	NAE-55	WATR	172.16.200.167			172.16.200.2
NAE-55				PHYS		-					 			
NAE-55	HUMP	172.16.200.19	NAE-55	BIOR	172.16.200.69	NAE-55 NAE-55	ARKU-ADD HLTH	172.16.200.119 172.16.200.120	NCE-25 ???	North Chiller Plant ???	172.16.200.169			172.16.200.2
	NANO	172.16.200.20	NAE-55		172.16.200.70		t	 	_		172.16.200.170			172.16.200.2
NAE-55	POMF	172.16.200.21	NAE-35	FAMA	172.16.200.71	NCE-25	GREG	172.16.200.121	???	???	172.16.200.171			172.16.200.2
???	SAEF	172.16.200.22	NAE-55	AGRI	172.16.200.72	NAE-55	DAVH	172.16.200.122	Integration	ECHP/AC-SMART	172.16.200.172			172.16.200.2
NAE-55	HOTZ	172.16.200.23	NAE-55	ALUM	172.16.200.73	NCE-25	POSC	172.16.200.123	???	???	172.16.200.173			172.16.200.2
NAE-55	GIBS	172.16.200.24	NAE-55	BAND	172.16.200.74	NAE-55	NWQA	172.16.200.124	???	???	172.16.200.174			172.16.200.2
NAE-55	AFLS	172.16.200.25	NAE-55	GAPG	172.16.200.75	NAE-55	REID	172.16.200.125	Integration	ENGR/Phoenix	172.16.200.175			172.16.200.2
NAE-55	MEEG	172.16.200.26	NAE-55	KIMP	172.16.200.76	NAE-55	REID	172.16.200.126	NCE-25	BGHL	172.16.200.176			172.16.200.2
NAE-55	NANO	172.16.200.27	NAE-55	GRAD	172.16.200.77	NAE-55	NWQB	172.16.200.127	BAU-1	HOTZ-BAU-1	172.16.200.177			172.16.200.2
NAE-55	WATR	172.16.200.28	NCE-25	NANO	172.16.200.78	NAE-55	NWQC	172.16.200.128	BAU-2	HOTZ-BAU-2	172.16.200.178			172.16.200.2
NAE-55	CHEM	172.16.200.29	NCE-25	YOCM	172.16.200.79	NAE-55	NWQD	172.16.200.129	Phoenix	POSC PHOENIX	172.16.200.179			172.16.200.2
NAE-55	CHEM	172.16.200.30	Integration	NANO/phoenix	172.16.200.80	Integration	YOCM/RTU	172.16.200.130	NAE-35	ADMN/4th FL	172.16.200.180			172.16.200.2
NAE-55	POSC	172.16.200.31	NAE-55	HPER	172.16.200.81	Integration	YOCM/RTU	172.16.200.131	NAE-35	ESPL/Pryor	172.16.200.181			172.16.200.2
NAE-55	MHWR	172.16.200.32	NAE-55	HPER	172.16.200.82	NCE-25	HPER/HEATPLANT	172.16.200.132	NAE-55	CHPN	172.16.200.182			172.16.200.2
NAE-55	MHER	172.16.200.33	NAE-55	ADMN	172.16.200.83	NAE-55	FNDR	172.16.200.133	NCE-25	BBPF/Metering	172.16.200.183			172.16.200.2
NAE-55	JBHT	172.16.200.34	NCE-25	MEMH	172.16.200.84	NAE-55	FNDR	172.16.200.134	NCE-25	SASC/Metering	172.16.200.184			172.16.200.2
NAE-55	JBHT	172.16.200.35	NCE-25	MULN	172.16.200.85	NAE-55	FNDR	172.16.200.135	NAE-55	FPAC	172.16.200.185			172.16.200.2
NCE-25	BUCH	172.16.200.36	NCE-25	MULN	172.16.200.86	NAE/55	WALK	172.16.200.136	DELTAV	NIE-85	172.16.200.186			172.16.200.2
NCE-25	GLAD	172.16.200.37	NAE-55	PTSC	172.16.200.87	NAE-55	WALK	172.16.200.137	Delta V OPC Server	OPC Server	172.16.200.187			172.16.200.2
NAE-55	SINF	172.16.200.38	NCE-25	FAMA	172.16.200.88	NAE-55	GEAR	172.16.200.138	NAE-55	LCAF-188	172.16.200.188			172.16.200.2
NAE-55	FSBC	172.16.200.39	NCE-25	ENRC	172.16.200.89	NCE-25	HUMP	172.16.200.139	Integration	LCAF MIT-1	172.16.200.189			172.16.200.2
NCE-25	GLBL	172.16.200.40	NCE-25	WAHR	172.16.200.90	NAE-55	HUMP	172.16.200.140	Integration	LCAF MIT-2	172.16.200.190			172.16.200.2
NAE-55	POSC	172.16.200.41	NCE-25	BWAR	172.16.200.91	NAE-55	HUMP	172.16.200.141	NCE-25	PRESS	172.16.200.191			172.16.200.2
NAE-55	POSC	172.16.200.42	NCE-25	JBAR	172.16.200.92	NCE-25	PGDF	172.16.200.142	Wireless T-Stat RM 163	ADSB	172.16.200.192			172.16.200.2
NAE-55	POSC	172.16.200.43	NCE-25	RSEA	172.16.200.93	NAE-55	ARMY	172.16.200.143	NAE-55	SCUL	172.16.200.193			172.16.200.2
NAE-55	POSC	172.16.200.44	NCE-25	IDPA	172.16.200.94	NAE-55	WILR	172.16.200.144	NCE AHU-9	ARKU	172.16.200.194			172.16.200.2
NAE-55	RCED	172.16.200.45	NCE-25	POMF	172.16.200.95	NAE-55	POMF	172.16.200.145	Boilers	AGRI	172.16.200.195			172.16.200.2
NAE-55	MULN	172.16.200.46	NCE-25	MAIN	172.16.200.96	NCE-25	NWQB	172.16.200.146	Phoenix RMI 300-1	AGRI	172.16.200.196			172.16.200.2
NAE-55	FNAR	172.16.200.47	???	???	172.16.200.97	NAE-55	GEAR	172.16.200.147	Phoenix RMI 300-2	AGRI	172.16.200.197			172.16.200.2
NAE-55	FERR	172.16.200.48	NCE-25	BLCA	172.16.200.98	NAE-55	JTCD	172.16.200.148	NAE-45	AGRI	172.16.200.198			172.16.200.2
NAE-55	FERR	172.16.200.49	NAE-55	WATR	172.16.200.99	NAE-55	ENRC	172.16.200.149	NAE-55	AGRI	172.16.200.199			172.16.200.2
NAE-55	SCEN	172.16.200.50	NAE-55	ROSE	172.16.200.100	NCE-25	HOEC	172.16.200.150	???	???	172.16.200.200			172.16.200.2

- 1. BAS GRAPHICS SHALL INCLUDE EQUIPMENT SUMMARIES FOR THE ENTIRE BUILDING / CAMPUS.
- 2. SUMMARIES SHALL INDICATE THE SYSTEM SERVED BY THE COMPONENT. 3. OPERATORS WITH APPROPRIATE CLEARANCE SHALL BE CAPABLE OF CHANGING THE AIR FLOWS AND SET
- POINTS FROM THE SUMMARY TABLE. 4. DIVISION 230900 TO ASSIGN AIR FLOWS TO SUPPLY TERMINALS BASED ON ROOM VENTILATION SCHEDULE. 5. OVERRIDDEN VALUES SHALL BE HIGHLIGHTED OR THE TEXT COLOR SHALL CHANGE TO INDICATE VALUES HAVE
- BEEN OVERRIDDEN. 6. EQUIPMENT IN ALARM SHALL BE HIGHLIGHTED RED OR THE TEXT SHALL TURN RED TO INDICATE AN ALARM. 7. IDENTIFY ALL ALARMS ASSOCIATED WITH EACH PIECE OF EQUIPMENT. A GENERAL ALARM STATUS CAN BE
- DISPLAYED AND SPECIFIC ALARMS CAN BE VIEWED BY CLICKING ON THE ALARM STATUS FOR THAT BOX.
- 8. REPORTS ARE NOT AN ACCEPTABLE FORM OF SYSTEM SUMMARIES. REPORTS SHALL CONTAIN LIVE DATA. 9. SCHEDULE COLUMNS SHALL BE CAPABLE OF BEING TOGGLED ON AND OFF. 10. ALL EQUIPMENT SHALL BE CAPABLE OF BEING EXCLUDED FROM ANY RESET CALCULATION.
- 11. GRAPHICS SHALL INCLUDE A SUMMARY TABLE SIMILAR TO THAT SHOWN. THIS PROJECT MAY REQUIRE ADDITIONAL ROWS, COLUMNS, GRAPHICS, AND CALCULATIONS TO BE INCORPORATED (CONTROL LOOP OUTPUTS, BUILDINGS, ETC).
- 12. PROVIDE LINKS TO AND FROM BUILDING FLOOR GRAPHICS AND SYSTEM GRAPHICS. 13. TABLES INDICATED HERE ARE PROVIDED TO CONVEY THE MINIMUM LEVEL OF DETAIL EXPECTED. 14. TERMINAL SUMMARY SCHEDULES SHALL BE PROVIDED PER AIR HANDLING UNIT.

CHILLE	ED V	VA	ΓER SY	STEM SU	JMM	IAR'	Y SCH	EDUL	Ε			
DESIGNATION		1 .	AREA ERVED	EQUIPMENT PRIORITY LEVEL	SET	VE DAT POINT °F)	DAT (°F)	CHW PRESSU SETP. RES		CHW VALVE COMMAND	CHW VALVE POSITION	ALARMS
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FCCO-###		AF	REA ###	-		_	-	₹		-	-	-
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SUMMARY		•					•	-	-	MIN. / MAX.		
	I									,		
PLANT SUPPI TEMP SET POIN		-	PLANT RETU	JRN TEMPERATUR	RE (°F)	_	ZONE 1 DF	P (IN. W.G.)	_	ZONE 3 DI	P (IN. W.G.)	_
PLANT SUPPL TEMPERATURE		-				_	ZONE 2 DF	P (IN. W.G.)	_	PLANT DP	(IN. W.G.)	-

HEATING \	NATI	ER	SYSTE	M SUMM	IAR'	Y SCHE	DULE	-			
DESIGNATION	ARE SERV		EQUIPMENT PRIORITY LEVEL	ACTIVE DAT SET POINT (°F)	DAT (°F)	HW PRESSURE. SETP. RESET	HW TE RESE	ET	HW VALVE COMMAND	HW VALVE POSITION	ALARMS
AHU-###	AREA	\ ###	1	-	-	A	\mathbf{Y}		-	-	-
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VVST-###	AREA	\ ###	-	-	-	\mathbf{Z}	\mathbf{Z}		-	-	-
SUMMARY	·								MIN. / MAX. - / -		
PLANT SUPPLY TEMP SET POINT(°F)	- P	PLANT	RETURN TEMP	PERATURE (°F)	1	ZONE 1 DP (IN	. W.G.)	_			
PLANT SUPPLY TEMPERATURE (°F)	_ F	PLANT	FLOW CONTR	OL OUTPUT	-	ZONE 2 DP (IN	I. W.G.)	_	PLANT DE	P (IN. W.G.)	-

GENERAL NOTE: THESE STANDARD SYSTEM DIAGRAMS AND SEQUENCES ARE DEVELOPED AS THE BASIS FOR DESIGN AND MAY NOT BE

DIRECTLY APPLICABLE AS IS DUE TO EXISTING EQUIPMENT OR SYSTEM CAPABILITIES, OR DUE TO SYSTEM OR EQUIPMENT ARRANGEMENTS. IT IS THE RESPONSIBILITY OF THE ENGINEER OF RECORD TO MODIFY THESE DOCUMENTS AS REQUIRED

FOR THE SPECIFIC CONDITIONS OF A PROJECT. REFER TO THE RFP DOCUMENTS FOR MODIFICATION PROCEDURES.

UNITAR	Y EQU	IPMEN	NT SUM	IMARY	SCH	EDL	JLE																		
DESIGNATION	AREA	EQUIP. PRIORITY	SPACE TEMP CONTROL	ILVIN OLEED		MIN SPACE	MAX SPACE	ACTIVE SPACE TEMP.	MAX SAT DIFF. SET	SPACE	DAT	CLG DAT SET	HTG DAT SET	HW PRESSURE.	HW VALVE	HEATING VALVE	CHW PRESSURE.	CHW VALVE	CHW VALVE			OCCUPA	-		ALARMS
22010111111011	SERVED	LEVEL	LOOPOUT	SET POINT	SPEED		SETP.	SET POINT	POINT	TEMP		POINT	POINT	RESET	COMMAND		RESET	COMMAND		SCHED	SWITCH	SENSOR	OVERRIDE	STATUS	
FCU-###	AREA ###	-	-	-	-	-	-	-	-	-	-	-	-	\mathbf{Y}	-	-	☑	-	-	-	-	-	-	-	-
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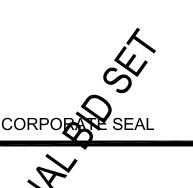
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	AHU	ADEA	EQUIP.	SPACE TEMP	MIN	MAX	ACTIVE	D SPAC	SE	MAX SAT	RELATIVE	RELATIVE	ALD AC	TIVE AIR	TERMINAL		COOLING COIL	HW	HEATING		NG AIRFL	LOW		HEATING	AIRFL	DW			0001104	NOV		
DESIGNATION	SERVED	AREA SERVED	PRIORIT	CONTROL	SPACE	SPACE	SPACE TEM	^{ĬĔ} ╌│──⋿⋈	CE DAT AHU IP DAT DAT	Dill. OLI				OW SET	DAMPER	PRESSURE	TEMP.	PRESSURE.	VALVE	OCC.		UNOC.	(OCC.		JNOC.		OOLIED OW!	OCCUPA	NCY	TOTATUO	ALARMS
	SLITVLD	JEINVED	LEVEL	LOOPOUT	SETP.	SETP.	SET POINT	「	" DAT	POINT	SET POINT		LOVV F	POINT	POSITION	SETP. RESET	RESET	SETP. RESET	POSITION	MIN.	MAX	MIN.	MAX I	MIN. I	MAX	MIN.	MAX	SCHED SWI	ICH SENSOR	OVERRIDE	SIAIUS	
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AIR HA	ANDL	ING UI	TIV	T SUN	/MAF	RY SC	HEDULE												
DESIGNATION	AREA SERVED	SAT CONTROL LOOPOUT	SAT		MIN SAT SET POINT	MAX SAT SET POINT	CHW PRESSURE. SETP. RESET	CHW VALVE COMMAND	CHW VALVE POSITION	CC DAT	MAX ST COOLING LOOPOUT	MAX ST CLG LOOPOUT SETP.	HW PRESSURE. SETP. RESET	HW VALVE COMMAND	HW VALVE POSITION	HC DAT	HW RECIRC. PUMP STATUS	FILTER DP / MAX FILTER DP SETP.	VA PRESS. SETP. RESET
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AIR HA	NDLIN	NG UNIT S	SUMMAF	RY SCHE	DULE (CO	NTINUED))																				
DESIGNATION	SUPPLY AF / AF SETP.	SA STATIC PRESS./STATIC PRESS. SETP.	MIN. SA STATIC PRESS. SET POINT	MAX. SA STATIC PRESS. SETP.	SF SPEED SET POINT SF1/SF2/SF3/SF4	SF SPEED SF1/SF2/SF3/SF4	EXHAUST AF / AF SETP.	EA STATIC PRESS./STATIC PRESS. SETP.	MIN. EA STATIC PRESS. SET POINT	MAX. EA STATIC PRESS. SETP.	MAX ET DAMPER POSTION	EF SPEED SET POINT EF1/EF2/EF3/EF4	EF SPEED EF1/EF2/EF3/EF4	ACTIVE WHEEL SPEED SETP.	WHEEL BYPASS SPEED / DAMPER STATUS COMMAN	R DAMPER	DAMPER	DAMPER	VENTILATION AIR FLOW		MAT	RAT F	RH RA	MIN / MA A RH ETP. RH	AX MIN / MAX E SPACE RH SETP.		ALARMS
AHU-###	-/-	-/-	-	-	-/-/-	-/-/-/-	-/-	-/-	-	-	=	-/-/-	-/-/-	-		-	-	-	-	-	-	-	- ,	-//-	-/-		-
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1 BUILDING EQUIPMENT SUMMARY SCHEDULES
NOT TO SCALE

2039 NORTH GREEN ACRES FAYETTEVILLE, AR 72703 Phone: (479) 521-8634 Fax: (479) 521-1014 bernhard.com



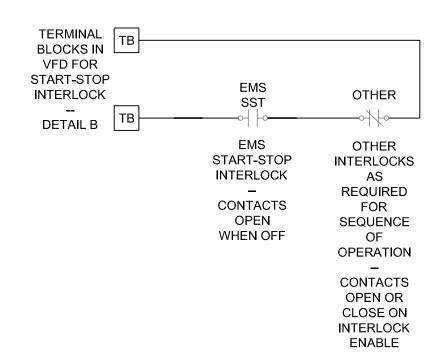
ENGINEER SEAL

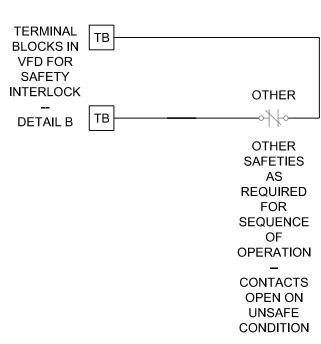
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> **BUILDING EQUIPMENT** SUMMARY SCHEDULES

KEYED NOTES:

- ALL AVAILABLE HARD WIRED CONTROL POINTS SHALL BE HARDWIRED DIRECTLY TO CONTROLLER. CONTROL VIA COMM. FOR POINTS AVAILABLE BY HARD WIRE CONNECTION IS UNACCEPTABLE.
- 2 BAS SHALL RECEIVE ALL COMMUNICATED POINTS AVAILABLE FROM VARIABLE FREQUENCY DRIVE. COORDINATE WITH ENGINEER OF RECORD ALL INFORMATION THAT IS TO BE DISPLAYED IN GRAPHICS. THE POINTS SPECIFIED IN THE PROJECT MANUAL SHALL BE THE MINIMUM REQUIRED TO BE INDICATED ON THE CHILLER





2 CHILLED WATER PUMP(S) VFD INTERLOCKS
NOT TO SCALE

GENERAL NOTES:

OR CHANGE COLORS.

APPLICATION.

- 1. IF EQUIPMENT (CHILLERS, PUMPS, ETC.) IS DISABLED DUE TO MAINTENANCE SHUTDOWN OR A FAULT CONDITION, OR OVERRIDDEN, EQUIPMENT SHALL BE HIGHLIGHTED, OUTLINED,
- VARIABLE FREQUENCY DRIVES FURNISHED BY 230900, INSTALLED BY DIVISION 26.
 CONTROL VALVES, FLOW METERS, THERMOWELLS, AND TAPS ARE PROVIDED BY DIVISION 230900 AND INSTALLED BY DIVISION 23 IN LOCATIONS INDICATED BY THE CONTROL DIAGRAMS AND AS SPECIFIED. TRANSFORMERS ARE PROVIDED BY DIVISION 230900, INSTALLED BY DIVISION 26.
- ALL ACTUATORS, SENSORS, SWITCHES, TUBING, AND POINTS INDICATED ON THE PLANS ARE PROVIDED BY DIVISION 230900, UNLESS NOTED OTHERWISE.
 ALL POINTS AND COMPONENTS INDICATED ON THE CONTROL DRAWINGS ARE NEW, PROVIDED BY DIVISION 230900, UNLESS INDICATED OTHERWISE.
- PROVIDED BY DIVISION 230900, UNLESS INDICATED OTHERWISE.

 6. EQUIPMENT PROVIDED WITH CONTROLLERS (CHILLERS, VARIABLE FREQUENCY DRIVES, ETC) SHALL COMMUNICATE DIRECTLY WITH THE BAS. ALL REQUIRED GATEWAYS AND ROUTERS SHALL BE PROVIDED WITH EQUIPMENT WHERE POSSIBLE. ALL AVAILABLE POINTS SHALL BE OBTAINED FROM THE EQUIPMENT CONTROLLER AND THE BAS SHALL PROVIDE SET POINTS, COMMANDS, ETC, TO THE EQUIPMENT PER THE SEQUENCE OF
- OPERATIONS.

 7. EQUIPMENT SHALL HAVE DEDICATED GRAPHICS PER SPECIFICATIONS. ALL COMMUNICATED POINTS SHALL BE AVAILABLE IN A LIST FORMAT WITH COMPLETE DESCRIPTIONS OF THE POINT, INCLUDING ALARMS. THE OPERATOR SHALL NOT HAVE TO REFER TO DOCUMENTATION TO DETERMINE WHAT THE POINT IS.

 8. VARIABLE FREQUENCY DRIVES SHALL INDICATE HAND, OFF, AUTO, AND BYPASS STATUS.

9. CONTROL VALVES SHALL BE SELECTED WITH PROPER AUTHORITY FOR THEIR GIVEN

- 10. CONTROL WIRING BY DIVISION 230900.11. REFER TO IDIQ STANDARD SYSTEM VALVE SCHEDULE FOR VALVE AND PIPE SIZES FOR
- BASE PRICING.

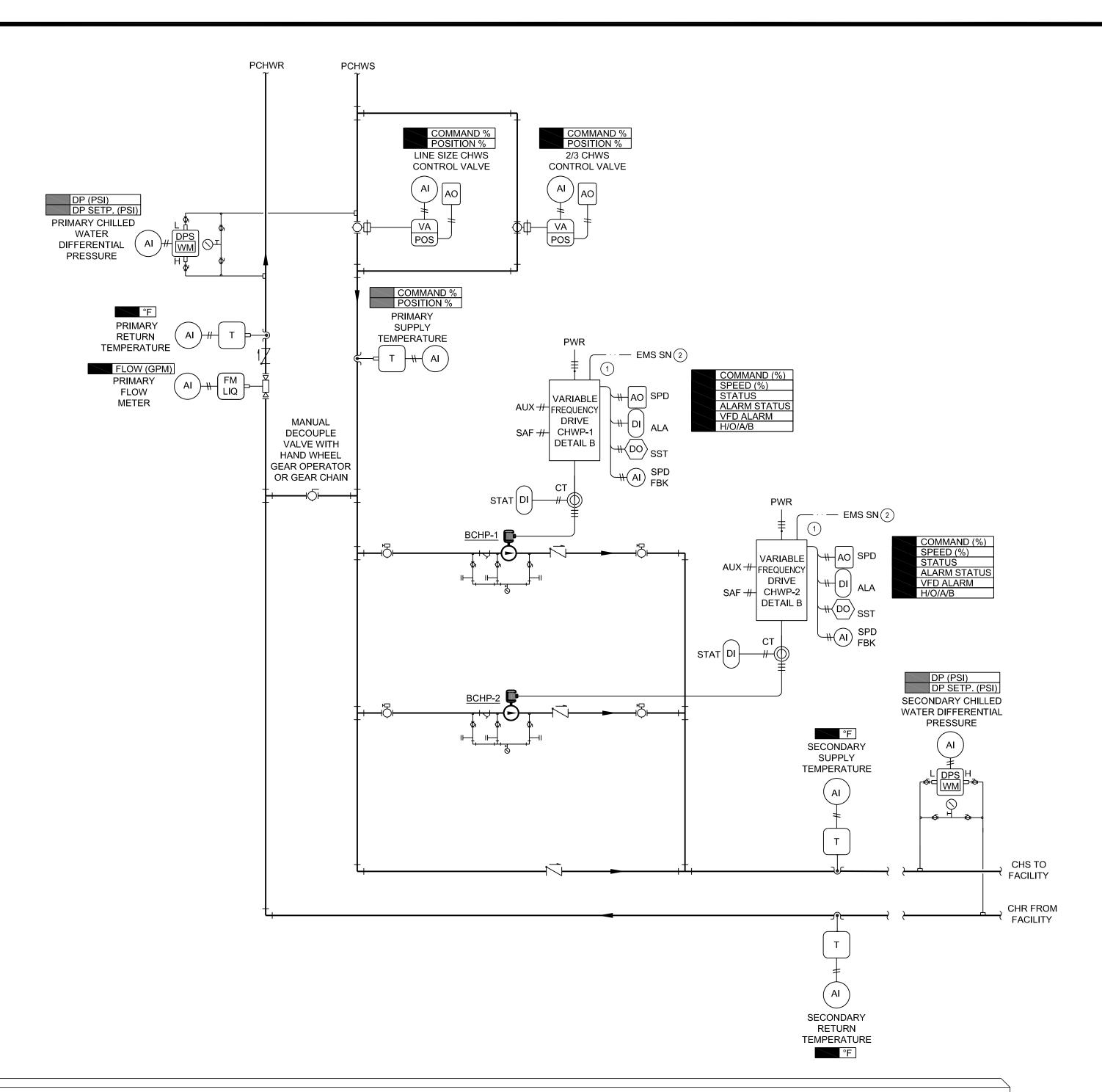
 12. POWER WIRING BY DIVISION 26.
- 13. ALL COMMUNICATED POINTS SHALL BE BROUGHT INTO THE BAS AND LABELED.
 REFERENCE TO ANOTHER DOCUMENT FOR ADDRESS DEFINITION IS NOT ACCEPTABLE.
 14. ALL EXISTING SAFETIES AND INTERLOCKS SHALL BE MAINTAINED.
- 15. VFD SHALL BE CONFIGURED TO KEEP PREVIOUS SETTINGS ON A POWER FAILURE.

 16. F3200 FLOW METERS TO BE USED FOR HOT WATER DISTRIBUTION LOCATIONS. F3500
- FLOW METERS TO BE USED FOR STANDARD ACCURACY METER LOCATIONS.

 17. METER FLOW TO BE BASED ON MAXIMUM DESIGN. UNLESS SPECIFICALLY STATED,
- MINIMUM FLOW TO BE BASED ON 10% OF MAXIMUM DESIGN.

 18. PRESSURE CONTROL MODE AND TEMPERATURE CONTROL MODE SHALL BE NOTED ON
- THE USER INTERFACE. PROGRAMMING FOR EACH MODE SHALL BE WITHIN THE CONTROLLER.

													INF	PUTI	DEV	ICE											(OUT	PUT	DEV	ICE							
	l,	/O C	OUN	IT				ANA	ALO(G								DIG	ITAL					Р		ΑN	ALO	G			DI	GIT/	۸L		TRA	ACKIN	٧G	
JOB NAME: CHILL WATER SYSTEM	ANALOG INPUT	DIGITAL INPUT	ANALOG OUTPUT	DIGITAL OUTPUT	TEMPERATURE	HUMIDITY	PRESSURE	CURRENT SENSOR	CO2 SENSOR	FLOW	LEVEL	UNIT TERM	NETWORKED INPUT	DRY CONTACT	LIMIT SWITCH	CURRENT SWITCH	RELAY	LOW TEMP. CUTOUT	PRESSURE SWITCH	DUCT SMOKE	AUXILLARY CONTACT	UNIT TERM	NETWORKED POINT	PULSE	0-10/4-20mA	DAMPER ACTUATOR		PNEUMATIC TRANSDUCER	UNIT TERM	RELAY	DAMPER ACTUATOR	VALVE ACTUATOR	UNIT TERM	EP RELAY	TRENDING	COV TREND	TOTALIZE	TOTALIZE MONTHLY
SYSTEM / DESCRIPTION	₹	◘	Ā	◘	<u> </u>	ヹ	<u> </u>	<u>ರ </u>	<u>წ</u>	ᄑ	쁘	5	Ž		5	ರ	<u>R</u>	C	4	٥	¥	5	<u> </u>	4	 	<u> </u>	>	<u>ā</u>	키	22	۵	>	5	<u> </u>	<u> </u>	8	+	ᆮ
PRIMARY CHILL WATER DP	Х						Х		\top	1													十	十											1 min		\Box	
CHILL WATER CONTROL VALVE OUT			Х																				T	T	x		Х								1 min	\Box		
PRIMARY CHILL WATER SUPPLY TEMPERATURE	Х				Х																														5 min			
BUILDING CHILL WATER SUPPLY TEMPERATURE	Х				Х																														5 min			
PRIMARY CHILL WATER RETURN TEMPERATURE	Х				Х																														5 min			
BUILDING CHILL WATER RETURN TEMPERATURE	Х				Х																														5 min			
BUILDING CHILL WATER DP	Х						Х																												1 min			
PRIMARY CHILL WATER FLOW	Х									Х																									1 min		Х	Х
VFD PUMP 1 START STOP				Х																										Х						Х		
VFD PUMP 1 SPEED OUT			Χ																						Х										5 min			
VFD PUMP 1 STATUS		Χ																															Χ			Х		
VFD PUMP 2 START STOP				Х																										Х						Х		
VFD PUMP 2 SPEED OUT			Х																						Х										5 min	\Box		
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VFD PUMP LEAD LAG				Х																			х													\Box		
DE-COUPLER VALVE OUT				Х																												Χ			10 min			



SEQUENCE OF OPERATION:

MODE OF OPERATION: THE MODE OF OPERATION FOR THE BUILDING CHILL WATER SYSTEM SHALL BE EITHER "PRESSURE CONTROL" OR "TEMPERATURE CONTROL". THE MODE OF OPERATION SHALL TYPICALLY BE "PRESSURE CONTROL" ("TEMPERATURE CONTROL" MODE OF OPERATION SHALL ONLY BE USED IN THE EVENT OF A LOW BUILDING CHILL WATER TEMPERATURE DIFFERENCE THAT CANNOT BE IMMEDIATELY RECTIFIED). THE MODE OF OPERATION SHALL BE SELECTED AT THE DDC CONTROL PANEL. WHEN THE MODE OF OPERATION IS "PRESSURE CONTROL", THE AUTOMATIC CONTROL VALVE IN THE DE-COUPLER MUST BE COMMANDED CLOSED. WHEN THE MODE OF OPERATION IS "TEMPERATURE CONTROL", THE AUTOMATIC CONTROL VALVE IN THE DE-COUPLER MUST BE COMMANDED OPEN.

OCCUPIED "PRESSURE CONTROL" MODE: WHEN IN THE "PRESSURE CONTROL" MODE, THE BUILDING CHILL WATER CONTROL VALVE SHALL BE MODULATED AS REQUIRED TO MAINTAIN THE BUILDING DIFFERENTIAL PRESSURE AT SETPOINT. IF THE BUILDING DIFFERENTIAL PRESSURE IS MORE THAN 2 PSIG (ADJUSTABLE) BELOW THE BUILDING DIFFERENTIAL PRESSURE SETPOINT AND THE BUILDING CHILL WATER CONTROL VALVE IS MORE THAN 95% OPEN (ADJUSTABLE) FOR MORE THAN 10 MINUTES (ADJUSTABLE), THE BUILDING CHILL WATER VALVE SHALL BE COMMANDED FULLY OPEN, THE MODULATING LINE SIZE BYPASS CHILL WATER VALVE SHALL FULLY OPEN, AND THE BUILDING LEAD CHILL WATER PUMP SHALL BE COMMANDED ON. WHEN THE LEAD BUILDING CHILL WATER PUMP HAS BEEN COMMANDED ON, THE PUMP SPEED SHALL BE MODULATED FROM A MINIMUM OF 25% (ADJUSTABLE) TO A MAXIMUM OF 100% (ADJUSTABLE) AS REQUIRED TO MAINTAIN THE BUILDING DIFFERENTIAL PRESSURE AT A SETPOINT OF 7 PSIG (ADJUSTABLE).

WHEN THE LEAD BUILDING CHILLED WATER PUMP EXCEEDS 95% PUMP SPEED, THE LAG PUMP SHALL START AND THE SPEED OF THE PUMPS SHALL BE CONTROLLED IN UNISON TO MAINTAIN THE BUILDING REMOTE CHILLED WATER DIFFERENTIAL PRESSURE SETPOINT.

WHEN THE LEAD BUILDING CHILLED WATER PUMP SPEED IS BELOW 35% (ADJUSTABLE) AND THE BUILDING DIFFERENTIAL IS AT OR 2 PSIG ABOVE SETPOINT FOR MORE THAN 10 MINUTES (ADJUSTABLE), THE PUMP SHALL BE AUTOMATICALLY STOPPED, THE 2-POSITION LINE SIZE CHILL WATER BYPASS VALVE SHALL CLOSE, AND THE BUILDING CHILLED WATER CONTROL VALVE SHALL MODULATE TO MAINTAIN THE BUILDING REMOTE DIFFERENTIAL PRESSURE AT SETPOINT. A TIME DELAY OF 30 MINUTES SHALL ELAPSE BEFORE THE PUMP SHALL BE ABLE TO RESTART.

IN THE EVENT THE LEAD BUILDING CHILLED WATER PUMP FAILS, THE LEAD BUILDING CHILLED WATER PUMP SHALL BE LOCKED OUT, AN ALARM GENERATED AT THE EMS AND THE ROTATION SEQUENCE SHALL BE INDEXED FOR THE LAG BUILDING CHILLED WATER PUMP TO BE ENABLED AS THE LEAD BUILDING CHILLED WATER PUMP. WHEN THE FAILURE IS RESET, THE SEQUENCING PROGRAM SHALL BE NOTIFIED THAT THE LAG BUILDING CHILLED WATER PUMP IS AVAILABLE. THE LEAD AND LAG BUILDING CHILLED WATER PUMP AND VFD SHALL BE AUTOMATICALLY ALTERNATED ON A REGULAR BASIS TO EQUALIZE RUNTIMES. OWNER SHALL BE ABLE TO SELECT ROTATION FREQUENCY FROM THE EMS BY SELECTING DAILY, WEEKLY, MONTHLY, OR CUSTOM ROTATION.

THE BUILDING REMOTE CHILLED WATER PRESSURE SETPOINT SHALL BE RESET FROM A 5 PSIG TO 20 PSIG BASED UPON THE POSITION OF THE MOST OPEN AIR HANDLING UNIT CHILLED WATER COIL CONTROL VALVE. WHEN THE MOST OPEN AIR HANDLING UNIT CHILLED WATER COIL CONTROL VALVE IS MORE THAN 95% OPEN, THE SETPOINT SHALL BE INCREASED BY 10% OF THE PREVIOUS SETPOINT VALUE AT A FREQUENCY OF 5 MINUTES UNTIL THE MAXIMUM SETPOINT IS REACHED. WHEN THE MOST OPEN AIR HANDLING UNIT CHILLED WATER CONTROL VALVE IS LESS THAN 85% OPEN, THE SETPOINT SHALL BE DECREASED BY 10% OF THE PREVIOUS SETPOINT VALUE AT FREQUENCY OF 10 MINUTES UNTIL THE MINIMUM SETPOINT IS REACHED.

THE BUILDING MAXIMUM CHILL WATER FLOW (IN GPM) SHALL BE ADJUSTABLE AND THE BUILDING CHILL WATER VOLUMETRIC CONTRACT DEMAND SEQUENCE SHALL BE ENABLED OR DISABLED BY THE OPERATOR. IN PRESSURE MODE, IF THIS SEQUENCE IS ENABLED, THE PRIMARY CHILL WATER FLOW SHALL NOT EXCEED THE SET POINT (MAX FLOW). THE AUTOMATIC DECOUPLER VALVE (DEC-V) SHALL MODULATE OPEN AND THE BUILDING CHILL WATER CONTROL AND BYPASS VALVES SHALL MODULATE CLOSED AS REQUIRED TO MAINTAIN THE PRIMARY CHILL WATER FLOW AT THE ADJUSTABLE MAXIMUM SET POINT.

THE BUILDING MAXIMUM CHILL WATER TONNAGE (IN TONS) SHALL BE ADJUSTABLE AND THE BUILDING CHILL WATER REFRIGERATION CONTRACT DEMAND SEQUENCE SHALL BE ENABLED OR DISABLED BY THE OPERATOR. IN PRESSURE MODE, IF THIS SEQUENCE IS ENABLED, THE PRIMARY CHILL WATER TONNAGE SHALL NOT EXCEED THE SET POINT (MAX TONNAGE). THE AUTOMATIC DECOUPLER VALVE (DEC-V) SHALL MODULATE OPEN AND THE BUILDING CHILL WATER CONTROL AND BYPASS VALVES SHALL MODULATE CLOSED AS REQUIRED TO MAINTAIN THE PRIMARY CHILL WATER TONNAGE AT THE ADJUSTABLE MAXIMUM SETPOINT.

OCCUPIED "TEMPERATURE CONTROL" MODE: WHEN IN THE "TEMPERATURE CONTROL" MODE, THE BUILDING CHILL WATER VALVE SHALL BE MODULATED AS REQUIRED TO MAINTAIN THE BUILDING CHILL WATER RETURN TEMPERATURE AT A SETPOINT OF 54 DEG F (ADJUSTABLE), AND THE MODULATING LINE SIZE CHILL WATER BYPASS VALVE SHALL REMAIN CLOSED. THE BUILDING CHILL WATER PUMP SHALL BE STARTED AND THE PUMP SPEED SHALL BE MODULATED FROM A MINIMUM OF 25% (ADJUSTABLE) TO A MAXIMUM OF 100% (ADJUSTABLE) AS REQUIRED TO MAINTAIN BUILDING DIFFERENTIAL PRESSURE AT SETPOINT.

THE BUILDING MAXIMUM CHILL WATER FLOW (IN GPM) SHALL BE ADJUSTABLE AND THE BUILDING CHILL WATER VOLUMETRIC CONTRACT DEMAND SEQUENCE SHALL BE ENABLED OR DISABLED BY THE

OPERATOR. IN TEMPERATURE MODE, IF THIS SEQUENCE IS ENABLED, THE PRIMARY CHILL WATER FLOW SHALL NOT EXCEED THE SET POINT (MAX FLOW). THE AUTOMATIC DECOUPLER VALVE (DEC-V) SHALL REMAIN OPEN AND THE BUILDING CHILL WATER CONTROL VALVE SHALL MODULATE CLOSED AS REQUIRED TO MAINTAIN THE PRIMARY CHILL WATER FLOW AT THE ADJUSTABLE MAXIMUM SET POINT.

THE BUILDING MAXIMUM CHILL WATER TONNAGE (IN TONS) SHALL BE ADJUSTABLE AND THE BUILDING CHILL WATER REFRIGERATION CONTRACT DEMAND SEQUENCE SHALL BE ENABLED OR DISABLED BY THE OPERATOR. IN TEMPERATURE MODE, IF THIS SEQUENCE IS ENABLED, THE PRIMARY CHILL WATER TONNAGE SHALL NOT EXCEED THE SET POINT (MAX TONNAGE). THE AUTOMATIC DECOUPLER VALVE (DEC-V) SHALL REMAIN OPEN AND THE BUILDING CHILL WATER CONTROL VALVE SHALL MODULATE CLOSED AS REQUIRED TO MAINTAIN THE PRIMARY CHILL WATER TONNAGE AT THE ADJUSTABLE MAXIMUM

UNOCCUPIED MODE: THE BUILDING CHILLED WATER BYPASS CONTROL VALVE SHALL CLOSE AND THE BUILDING CHILLED WATER PUMP SHALL BE OFF. WHEN ANY HVAC SYSTEM REQUIRING CHILLED WATER OPERATES DURING THE UNOCCUPIED MODE FOR SPACE TEMPERATURES ABOVE THE UNOCCUPIED COOLING SETPOINT, THE BUILDING CHILLED WATER SYSTEM SHALL OPERATE IN THE OCCUPIED MODE. WHEN ALL HVAC SYSTEMS REQUIRING CHILLED WATER ARE UNOCCUPIED, THE SYSTEM SHALL RETURN TO THE UNOCCUPIED MODE.

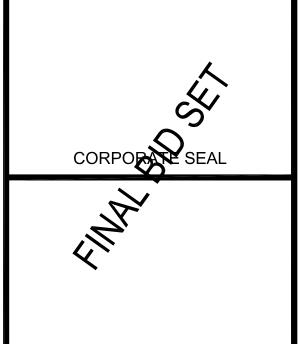
CHILLED WATER SYSTEM BUILDING ENTRY NOT TO SCALE [CHW]

GENERAL NOTE: THESE STANDARD SYSTEM DIAGRAMS AND SEQUENCES ARE DEVELOPED AS THE BASIS FOR DESIGN AND MAY NOT BE DIRECTLY APPLICABLE AS IS DUE TO EXISTING EQUIPMENT OR SYSTEM CAPABILITIES, OR DUE TO SYSTEM OR EQUIPMENT ARRANGEMENTS. IT IS THE RESPONSIBILITY OF THE ENGINEER OF RECORD TO MODIFY THESE DOCUMENTS AS REQUIRED FOR THE SPECIFIC CONDITIONS OF A PROJECT. REFER TO THE RFP DOCUMENTS FOR MODIFICATION PROCEDURES.

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ENGINEER SEAL

NTROL DRAWINGS

MARK DATE DESCRIPTION
ISSUE DATE: 03/20/19

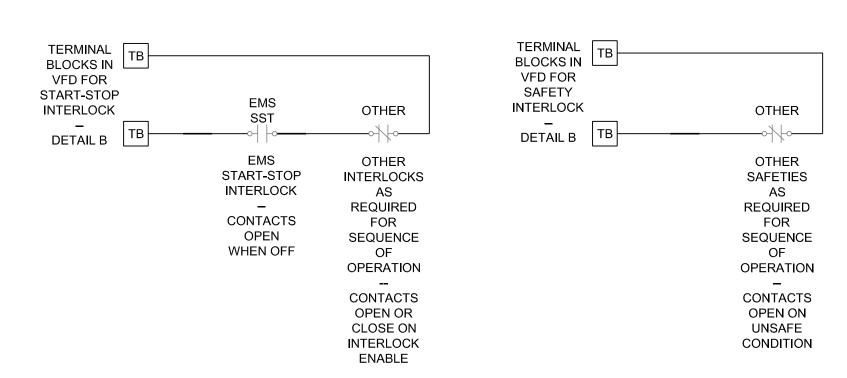
SHEET TITLE:
CHILLED WATER
SYSTEM BUILDING
ENTRY

04-18-0072

ROJECT NUMBER:

SHEET NUMBER:

ATC2.00



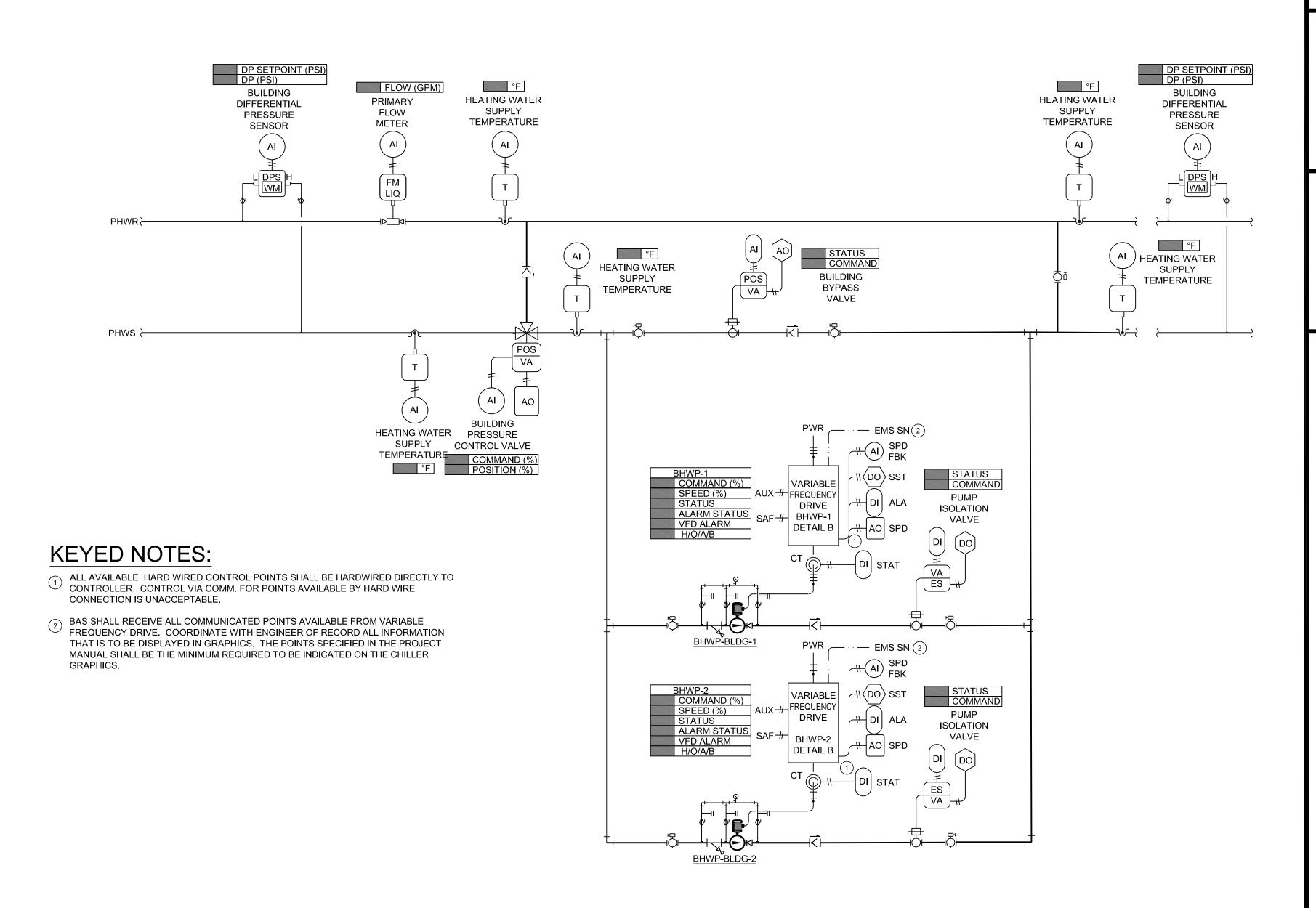
PHEATING WATER PUMP(S) VFD INTERLOCKS
NOT TO SCALE

GENERAL NOTES:

- 1. IF EQUIPMENT (CHILLERS, PUMPS, ETC.) IS DISABLED DUE TO MAINTENANCE SHUTDOWN OR A FAULT CONDITION, OR OVERRIDDEN, EQUIPMENT SHALL BE HIGHLIGHTED, OUTLINED, OR CHANGE COLORS.
- VARIABLE FREQUENCY DRIVES FURNISHED BY 230900, INSTALLED BY DIVISION 26.
 CONTROL VALVES, FLOW METERS, THERMOWELLS, AND TAPS ARE PROVIDED BY DIVISION 230900 AND INSTALLED BY DIVISION 23 IN LOCATIONS INDICATED BY THE CONTROL DIAGRAMS AND AS SPECIFIED. TRANSFORMERS ARE PROVIDED BY DIVISION 230900, INSTALLED BY DIVISION 26.
- ALL ACTUATORS, SENSORS, SWITCHES, TUBING, AND POINTS INDICATED ON THE PLANS ARE PROVIDED BY DIVISION 230900, UNLESS NOTED OTHERWISE.
 ALL POINTS AND COMPONENTS INDICATED ON THE CONTROL DRAWINGS ARE NEW, PROVIDED BY DIVISION 230900, UNLESS INDICATED OTHERWISE.
- 6. EQUIPMENT PROVIDED WITH CONTROLLERS (CHILLERS, VARIABLE FREQUENCY DRIVES, ETC) SHALL COMMUNICATE DIRECTLY WITH THE BAS. ALL REQUIRED GATEWAYS AND ROUTERS SHALL BE PROVIDED WITH EQUIPMENT WHERE POSSIBLE. ALL AVAILABLE POINTS SHALL BE OBTAINED FROM THE EQUIPMENT CONTROLLER AND THE BAS SHALL PROVIDE SET POINTS, COMMANDS, ETC, TO THE EQUIPMENT PER THE SEQUENCE OF OPERATIONS.
- 7. EQUIPMENT SHALL HAVE DEDICATED GRAPHICS PER SPECIFICATIONS. ALL COMMUNICATED POINTS SHALL BE AVAILABLE IN A LIST FORMAT WITH COMPLETE DESCRIPTIONS OF THE POINT, INCLUDING ALARMS. THE OPERATOR SHALL NOT HAVE TO REFER TO DOCUMENTATION TO DETERMINE WHAT THE POINT IS.
- VARIABLE FREQUENCY DRIVES SHALL INDICATE HAND, OFF, AUTO, AND BYPASS STATUS.
 CONTROL VALVES SHALL BE SELECTED WITH PROPER AUTHORITY FOR THEIR GIVEN APPLICATION.
 CONTROL WIRING BY DIVISION 230900.
- 11. REFER TO IDIQ STANDARD SYSTEM VALVE SCHEDULE FOR VALVE AND PIPE SIZES FOR BASE PRICING.
- 12. POWER WIRING BY DIVISION 26.13. ALL COMMUNICATED POINTS SHALL BE BROUGHT INTO THE BAS AND LABELED.
- REFERENCE TO ANOTHER DOCUMENT FOR ADDRESS DEFINITION IS NOT ACCEPTABLE.

 14. ALL EXISTING SAFETIES AND INTERLOCKS SHALL BE MAINTAINED.
- 15. VFD SHALL BE CONFIGURED TO KEEP PREVIOUS SETTINGS ON A POWER FAILURE.
 16. F3200 FLOW METERS TO BE USED FOR HOT WATER DISTRIBUTION LOCATIONS. F3500 FLOW METERS TO BE USED FOR STANDARD ACCURACY METER LOCATIONS.
- 17. METER FLOW TO BE BASED ON MAXIMUM DESIGN. UNLESS SPECIFICALLY STATED,
 MINIMUM FLOW TO BE BASED ON 10% OF MAXIMUM DESIGN.
- 18. PRESSURE CONTROL MODE AND TEMPERATURE CONTROL MODE SHALL BE NOTED ON THE USER INTERFACE. PROGRAMMING FOR EACH MODE SHALL BE WITHIN THE CONTROLLER.

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JOB NAME: HOT WATER SYSTEM	ANALOG INPUT	DIGITAL INPUT	ANALOG OUTPUT	DIGITAL OUTPUT	TEMPERATURE	HUMIDITY	PRESSURE	CURRENT SENSOR	CO2 SENSOR	FLOW	LEVEL	UNIT TERM	NETWORKED INPUT	DRY CONTACT	LIMIT SWITCH	CURRENT SWITCH	RELAY	LOW TEMP. CUTOUT	PRESSURE SWITCH	DUCT SMOKE	AUXILLARY CONTACT	UNIT TERM	NETWORKED POINT	PULSE	0-10/4-20mA	DAMPER ACTUATOR	VALVE ACTUATOR	PNEUMATIC TRANSDUCER	UNIT TERM	RELAY	DAMPER ACTUATOR	VALVE ACTUATOR	UNIT TERM	EP RELAY	TRENDING	COV TREND	TOTALIZE	TOTALIZE MONTHLY
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SEQUENCE OF OPERATION:

TO MAINTAIN THE REMOTE HEATING WATER DIFFERENTIAL PRESSURE AT SETPOINT.

RESTART.

MODE OF OPERATION: THE BUILDING HEATING WATER SYSTEM MODE OF OPERATION SHALL BE OCCUPIED SUMMER, OCCUPIED WINTER, OR UNOCCUPIED BASED ON A SCHEDULE COMMUNICATED FROM THE EMS, OR AN OPERATOR OVERRIDE COMMAND FROM THE EMS.

OCCUPIED SUMMER MODE: THE BUILDING HEATING WATER BYPASS CONTROL VALVE SHALL BE CLOSED AND THE LEAD BUILDING HEATING WATER PUMP SHALL OPERATE CONTINUOUSLY TO MAINTAIN THE REMOTE BUILDING HEATING WATER DIFFERENTIAL PRESSURE AT SETPOINT. INITIAL REMOTE BUILDING HEATING WATER DIFFERENTIAL PRESSURE SETPOINT SHALL BE 10 PSIG ON TRANSITION FROM UNOCCUPIED TO OCCUPIED MODE.

THE BUILDING HEATING WATER PUMP SHALL MODULATE FROM 15% TO 100% SPEED TO MAINTAIN THE BUILDING REMOTE HEATING WATER DIFFERENTIAL PRESSURE SETPOINT. WHEN THE LEAD BUILDING HEATING WATER PUMP EXCEEDS 95% PUMP SPEED, THE LAG PUMP SHALL START AND THE SPEED OF THE PUMPS SHALL BE CONTROLLED IN UNISON TO MAINTAIN THE BUILDING REMOTE CHILLED WATER DIFFERENTIAL PRESSURE SETPOINT.

AS THE REMOTE BUILDING HEATING WATER DIFFERENTIAL PRESSURE INCREASES ABOVE SETPOINT THE VARIABLE FREQUENCY DRIVE SHALL REDUCE THE SPEED OF THE BUILDING HEATING WATER PUMP(S) TO MAINTAIN SETPOINT. WHEN THE SPEED OF THE OPERATING PUMPS DROP BELOW 40%, THE LAG PUMP SHALL STOP AND THE LEAD PUMP SHALL MODULATE TO MAINTAIN THE BUILDING REMOTE HEATING WATER DIFFERENTIAL PRESSURE SETPOINT.

IF THE REMOTE BUILDING HEATING WATER DIFFERENTIAL PRESSURE REMAINS ABOVE SETPOINT WITH THE BUILDING HEATING WATER PUMP AT MINIMUM SPEED, THE HEATING WATER MINIMUM FLOW CONTROL VALVE SHALL MODULATE OPEN

THE BUILDING REMOTE HEATING WATER PRESSURE SETPOINT SHALL BE RESET FROM A 5 PSIG TO 20 PSIG BASED UPON THE POSITION OF THE MOST OPEN HEATING WATER COIL CONTROL VALVE. WHEN THE MOST OPEN HEATING WATER COIL CONTROL VALVE IS MORE THAN 95% OPEN, THE SETPOINT SHALL BE INCREASED BY 10% OF THE PREVIOUS SETPOINT VALUE AT A FREQUENCY OF 5 MINUTES UNTIL THE MAXIMUM SETPOINT IS REACHED. WHEN THE MOST OPEN HEATING WATER CONTROL VALVE IS LESS THAN 85% OPEN, THE SETPOINT SHALL BE DECREASED BY 10% OF THE PREVIOUS SETPOINT VALUE AT FREQUENCY OF 10 MINUTES UNTIL THE MINIMUM SETPOINT IS REACHED.

THE BUILDING HEATING WATER TEMPERATURE CONTROL VALVE SHALL MODULATE TO MAINTAIN THE HEATING WATER SUPPLY TEMPERATURE AT SETPOINT. THE HEATING WATER SUPPLY TEMPERATURE SETPOINT SHALL BE RESET BASED ON THE OUTSIDE AIR TEMPERATURE. THE HEATING WATER SUPPLY TEMPERATURE SETPOINT SHALL BE RESET FROM 90 DEG F AT 80 DEG F OUTSIDE AIR TEMPERATURE AND ABOVE TO A HEATING WATER SUPPLY TEMPERATURE SETPOINT OF 155 DEG F AT AN OUTSIDE AIR TEMPERATURE OF 40 DEG F AND BELOW. ALL TEMPERATURE SETTINGS IN THE RESET SCHEDULE SHALL BE ADJUSTABLE FROM THE EMS.

OCCUPIED WINTER MODE:
THE BUILDING HEATING WATER MINIMUM FLOW CONTROL VALVE SHALL CLOSE AND THE BUILDING HEATING WATER TEMPERATURE CONTROL VALVE SHALL BE OPEN TO THE DISTRICT HEATING WATER SUPPLY, CLOSED TO BYPASS.

THE BUILDING HEATING WATER BYPASS CONTROL VALVE SHALL MODULATE IN SEQUENCE WITH THE BUILDING HEATING WATER PUMPS TO MAINTAIN THE REMOTE BUILDING HEATING WATER DIFFERENTIAL PRESSURE AT SETPOINT SUBJECT TO A MAXIMUM BUILDING HEATING WATER FLOW LIMIT AS SCHEDULED. INITIAL SETPOINT SHALL BE 10 PSIG ON TRANSITION FROM UNOCCUPIED TO OCCUPIED MODE.

DIFFERENTIAL PRESSURE AT SETPOINT SUBJECT TO THE MAXIMUM BUILDING HEATING WATER FLOW LIMIT AS SCHEDULED.

IF AFTER 30 MINUTES THE BUILDING HEATING WATER BYPASS CONTROL VALVE IS GREATER THAN 95% OPEN WITH THE BUILDING REMOTE HEATING WATER DIFFERENTIAL PRESSURE BELOW SETPOINT AND THE HEATING WATER FLOW RATE BELOW THE MAXIMUM BUILDING HEATING WATER FLOW RATE, THE BUILDING HEATING WATER FLOW CONTROL VALVE SHALL FULLY CLOSE, AND THE BUILDING HEATING WATER PUMP SHALL BE ENABLED. THE BUILDING HEATING WATER PUMP

SHALL MODULATE FROM 15% TO 100% SPEED TO MAINTAIN THE BUILDING REMOTE HEATING WATER DIFFERENTIAL PRESSURE SETPOINT UP TO THE MAXIMUM BUILDING HEATING WATER FLOW RATE. THE BUILDING HEATING WATER BYPASS

ON TRANSITION FROM UNOCCUPIED TO OCCUPIED, THE BUILDING HEATING WATER BYPASS CONTROL VALVE MODULATES THE FLOW OF DISTRICT HEATING WATER TO THE BUILDING TO MAINTAIN THE BUILDING REMOTE HEATING WATER

CONTROL VALVE SHALL REMAIN CLOSED WHEN ANY BUILDING HEATING WATER PUMP IS IN OPERATION.

AS THE REMOTE BUILDING HEATING WATER DIFFERENTIAL PRESSURE INCREASES ABOVE SETPOINT, THE VARIABLE FREQUENCY DRIVE SHALL REDUCE THE SPEED OF THE BUILDING HEATING WATER PUMP TO MAINTAIN SETPOINT.

WHEN THE BUILDING HEATING WATER PUMP SPEED IS LESS THAN 17% OF FULL SPEED FOR 15 MINUTES WITH THE BUILDING REMOTE DIFFERENTIAL PRESSURE ABOVE SETPOINT, THE BUILDING HEATING WATER PUMP SHALL BE DISABLED AND THE BUILDING HEATING WATER BYPASS CONTROL VALVE SHALL MODULATE TO MAINTAIN THE BUILDING REMOTE DIFFERENTIAL PRESSURE AT SETPOINT. A TIME DELAY OF 30 MINUTES SHALL ELAPSE BEFORE THE PUMP SHALL BE AVAILABLE TO

THE BUILDING REMOTE HEATING WATER PRESSURE SETPOINT SHALL BE RESET FROM 5 PSIG TO 20 PSIG BASED UPON THE POSITION OF THE MOST OPEN HEATING WATER COIL CONTROL VALVE. WHEN THE MOST OPEN HEATING WATER COIL CONTROL VALVE IS MORE THAN 95% OPEN, THE SETPOINT SHALL BE INCREASED BY 10% OF THE PREVIOUS SETPOINT VALUE AT A FREQUENCY OF 5 MINUTES UNTIL THE MAXIMUM SETPOINT IS REACHED. WHEN THE MOST OPEN HEATING WATER CONTROL VALVE IS LESS THAN 85% OPEN, THE SETPOINT SHALL BE DECREASED BY 10% OF THE PREVIOUS SETPOINT VALUE AT FREQUENCY OF 10 MINUTES UNTIL THE MINIMUM SETPOINT IS REACHED.

UNOCCUPIED MODE: THE BUILDING HEATING WATER PUMP SHALL BE OFF, THE BUILDING HEATING WATER BYPASS CONTROL VALVE SHALL CLOSE, THE BUILDING HEATING WATER MINIMUM FLOW CONTROL VALVE SHALL OPEN, AND THE

BUILDING HEATING WATER TEMPERATURE CONTROL VALVE SHALL CLOSE TO THE DISTRICT HEATING WATER SUPPLY, OPEN TO BYPASS.

WHEN ANY HVAC SYSTEM REQUIRING HEATING WATER OPERATES DURING THE UNOCCUPIED MODE FOR SPACE TEMPERATURES ABOVE THE UNOCCUPIED COOLING SETPOINT, THE BUILDING HEATING WATER SYSTEM SHALL OPERATE IN THE OCCUPIED MODE. WHEN ALL HVAC SYSTEMS REQUIRING HEATING WATER ARE UNOCCUPIED, THE SYSTEM SHALL RETURN TO THE UNOCCUPIED MODE.

HEATING WATER SYSTEM BUILDING ENTRY
NOT TO SCALE [HWS]

GENERAL NOTE: THESE STANDARD SYSTEM DIAGRAMS AND SEQUENCES ARE DEVELOPED AS THE BASIS FOR DESIGN AND MAY NOT BE
DIRECTLY APPLICABLE AS IS DUE TO EXISTING EQUIPMENT OR SYSTEM CAPABILITIES, OR DUE TO SYSTEM OR EQUIPMENT
ARRANGEMENTS. IT IS THE RESPONSIBILITY OF THE ENGINEER OF RECORD TO MODIFY THESE DOCUMENTS AS REQUIRED

FOR THE SPECIFIC CONDITIONS OF A PROJECT. REFER TO THE RFP DOCUMENTS FOR MODIFICATION PROCEDURES.

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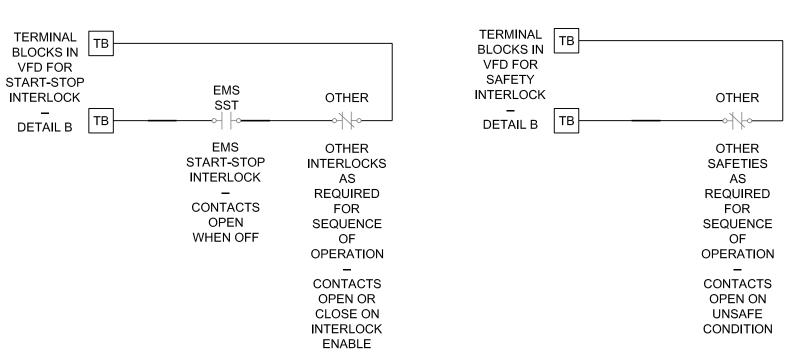
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CONTROL DRAWING UNIVERSITY OF ARKANSAS

MARK DATE DESCRIPTION
ISSUE DATE: 03/20/19

ROJECT NUMBER: 04-18-0072
SHEET TITLE:

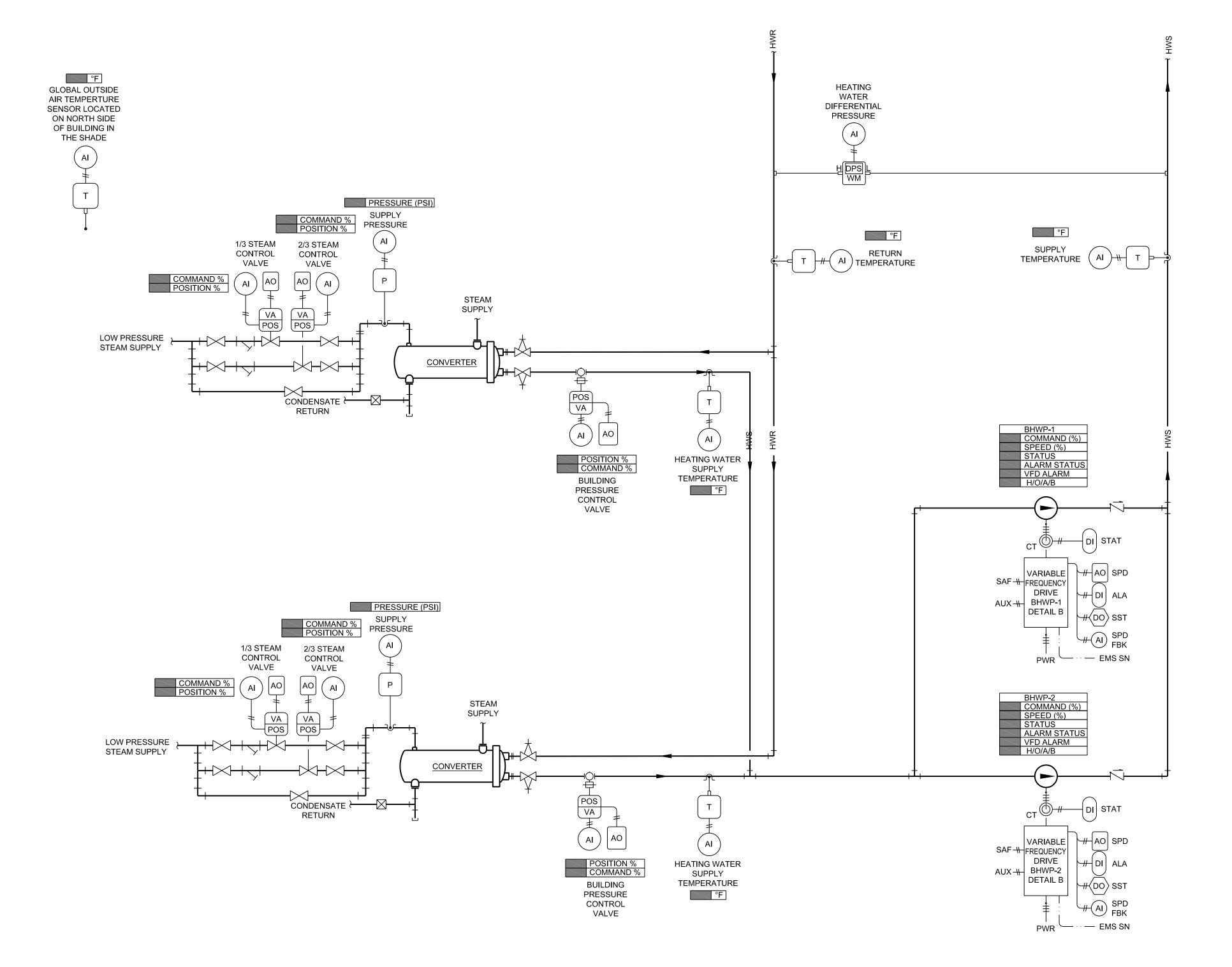
HEATING WATER SYSTEM BUILDING ENTRY

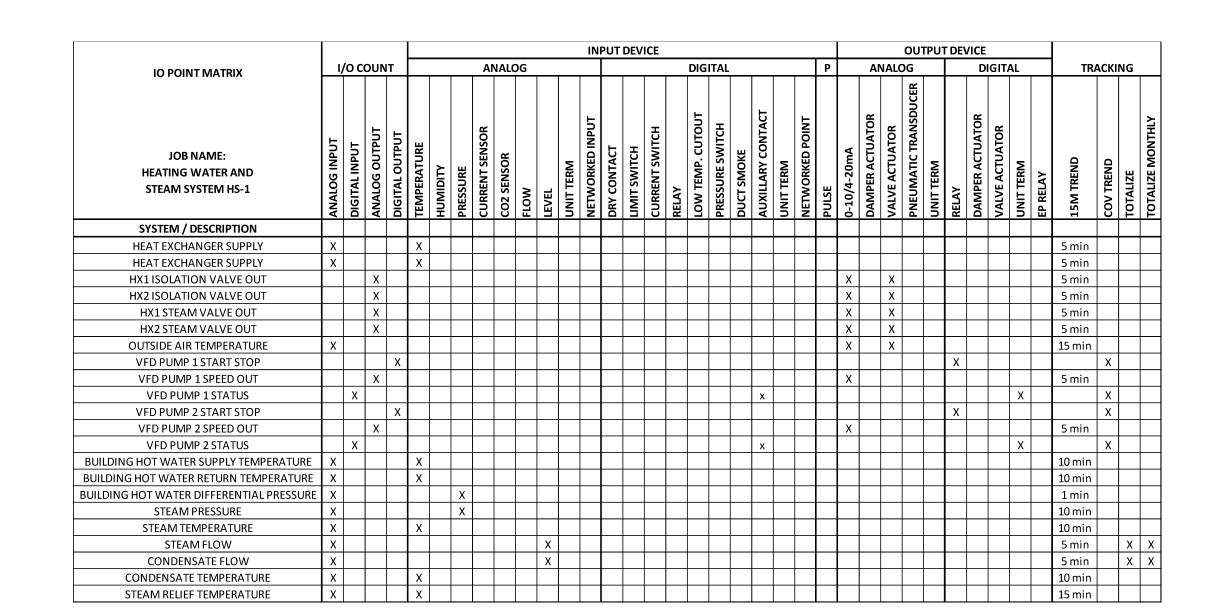


PHEATING WATER PUMP(S) VFD INTERLOCKS NOT TO SCALE

GENERAL NOTES:

- 1. IF EQUIPMENT (CHILLERS, PUMPS, ETC.) IS DISABLED DUE TO MAINTENANCE SHUTDOWN OR A FAULT CONDITION, OR OVERRIDDEN, EQUIPMENT SHALL BE HIGHLIGHTED, OUTLINED, OR CHANGE COLORS.
- 2. VARIABLE FREQUENCY DRIVES FURNISHED BY 230900, INSTALLED BY DIVISION 26. 3. CONTROL VALVES, FLOW METERS, THERMOWELLS, AND TAPS ARE PROVIDED BY DIVISION 230900 AND INSTALLED BY DIVISION 23 IN LOCATIONS INDICATED BY THE CONTROL DIAGRAMS AND AS SPECIFIED. TRANSFORMERS ARE PROVIDED BY DIVISION 230900,
- INSTALLED BY DIVISION 26. 4. ALL ACTUATORS, SENSORS, SWITCHES, TUBING, AND POINTS INDICATED ON THE PLANS ARE PROVIDED BY DIVISION 230900, UNLESS NOTED OTHERWISE. 5. ALL POINTS AND COMPONENTS INDICATED ON THE CONTROL DRAWINGS ARE NEW,
- PROVIDED BY DIVISION 230900, UNLESS INDICATED OTHERWISE. 6. EQUIPMENT PROVIDED WITH CONTROLLERS (CHILLERS, VARIABLE FREQUENCY DRIVES, ETC) SHALL COMMUNICATE DIRECTLY WITH THE BAS. ALL REQUIRED GATEWAYS AND ROUTERS SHALL BE PROVIDED WITH EQUIPMENT WHERE POSSIBLE. ALL AVAILABLE POINTS SHALL BE OBTAINED FROM THE EQUIPMENT CONTROLLER AND THE BAS SHALL PROVIDE SET POINTS, COMMANDS, ETC, TO THE EQUIPMENT PER THE SEQUENCE OF
- 7. EQUIPMENT SHALL HAVE DEDICATED GRAPHICS PER SPECIFICATIONS. ALL COMMUNICATED POINTS SHALL BE AVAILABLE IN A LIST FORMAT WITH COMPLETE DESCRIPTIONS OF THE POINT, INCLUDING ALARMS. THE OPERATOR SHALL NOT HAVE TO REFER TO DOCUMENTATION TO DETERMINE WHAT THE POINT IS.
- 8. VARIABLE FREQUENCY DRIVES SHALL INDICATE HAND, OFF, AUTO, AND BYPASS STATUS. 9. CONTROL VALVES SHALL BE SELECTED WITH PROPER AUTHORITY FOR THEIR GIVEN APPLICATION.
- 10. CONTROL WIRING BY DIVISION 230900. 11. REFER TO IDIQ STANDARD SYSTEM VALVE SCHEDULE FOR VALVE AND PIPE SIZES FOR BASE PRICING.
- 12. POWER WIRING BY DIVISION 26.
- 13. ALL COMMUNICATED POINTS SHALL BE BROUGHT INTO THE BAS AND LABELED. REFERENCE TO ANOTHER DOCUMENT FOR ADDRESS DEFINITION IS NOT ACCEPTABLE. 14. ALL EXISTING SAFETIES AND INTERLOCKS SHALL BE MAINTAINED.
- 15. VFD SHALL BE CONFIGURED TO KEEP PREVIOUS SETTINGS ON A POWER FAILURE. 16. F3200 FLOW METERS TO BE USED FOR HOT WATER DISTRIBUTION LOCATIONS. F3500 FLOW METERS TO BE USED FOR STANDARD ACCURACY METER LOCATIONS. 17. METER FLOW TO BE BASED ON MAXIMUM DESIGN. UNLESS SPECIFICALLY STATED,
- MINIMUM FLOW TO BE BASED ON 10% OF MAXIMUM DESIGN. 18. PRESSURE CONTROL MODE AND TEMPERATURE CONTROL MODE SHALL BE NOTED ON THE USER INTERFACE. PROGRAMMING FOR EACH MODE SHALL BE WITHIN THE CONTROLLER.





SEQUENCE OF OPERATION:

HOT WATER PUMP CONTROL: THE OPERATOR SELECTED LEAD HOT WATER PUMP SHALL AUTOMATICALLY START WHEN THE OUTSIDE AIR TEMPERATURE FALLS BELOW THE SYSTEM ENABLE SETPOINT. WHEN THE OUTSIDE AIR TEMPERATURE RISES ABOVE THIS SETPOINT PLUS A DIFFERENTIAL, THE HOT WATER PUMP SHALL TURN OFF. WHEN ENABLED, THE PUMP SHALL START AND RUN CONTINUOUSLY. WHILE RUNNING THE HOT WATER PUMP SHALL MODULATE TO MAINTAIN THE HOT WATER DIFFERENTIAL PRESSURE AT SETPOINT. IF FOR ANY REASON ITS STATUS DOES NOT MATCH ITS COMMANDED VALUE AN ALARM SHALL BE GENERATED. THE LAG PUMP SHALL START IF THE LEAD PUMP IS AN

STEAM CONTROL VALVES: THE LEAD HEAT EXCHANGER STEAM CONTROL VALVES SHALL MODULATE IN A 1/3 - 2/3 CAPACITY CONFIGURATION TO MAINTAIN THE HOT WATER SUPPLY TEMPERATURE AT A SETPOINT THAT IS RESET INVERSELY TO THE OUTSIDE AIR TEMPERATURE WHEN EITHER ONE OF THE HOT WATER PUMPS HAS A STATUS OF ON. 2/3 VALVE OPERATES ONLY AFTER 1/3 VALVE HAS MODULATED OPEN . VALVE CONTROL SHALL BE OVERRIDDEN TO PREVENT THE CONVERTER LEAVING WATER TEMPERATURE FROM EXCEEDING 200 DEG F. ALTERNATE LEAD AND LAG DUTY HEAT EXCHANGER.

HW CONTROL VALVE: CONTROL VALVE IN RETURN WATER TO HEAT EXCHANGER SHALL OPEN WHEN HEAT EXCHANGER IS OPERATIVE AND CLOSE WHEN HEAT EXCHANGER IS NOT OPERATING.

STEAM SYSTEM: BUILDING STEAM USAGE IS MEASURED BY A FLOW METER WITH FLOW TRANSMITTER. BUILDING STEAM FLOW IS TOTALIZED. STEAM PRESSURE AND RELIEF VALVE OPERATION SHALL BE MONITORED BY DDC CONTROLLER THROUGH TEMPERATURE SENSOR AT RELIEF PIPING.

HOT WATER RESET SCHEDULE: THE HOT WATER TEMPERATURE WILL BE RESET IN A LINEAR FASHION AS FOLLOW S (SETPOINTS ADJUSTABLE:) OUTDOOR AIR 90 DEG =1 20 DEG HOT WATER SETPOINT

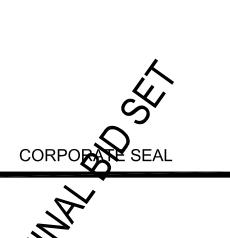
STEAM HEAT EXCHANGER CONTROL DIAGRAM NOT TO SCALE [HS]

OUTDOOR AIR 40 DEG = 180 DEG HOT WATER SETPOIN T

GENERAL NOTE: THESE STANDARD SYSTEM DIAGRAMS AND SEQUENCES ARE DEVELOPED AS THE BASIS FOR DESIGN AND MAY NOT BE DIRECTLY APPLICABLE AS IS DUE TO EXISTING EQUIPMENT OR SYSTEM CAPABILITIES, OR DUE TO SYSTEM OR EQUIPMENT ARRANGEMENTS. IT IS THE RESPONSIBILITY OF THE ENGINEER OF RECORD TO MODIFY THESE DOCUMENTS AS REQUIRED FOR THE SPECIFIC CONDITIONS OF A PROJECT. REFER TO THE RFP DOCUMENTS FOR MODIFICATION PROCEDURES.

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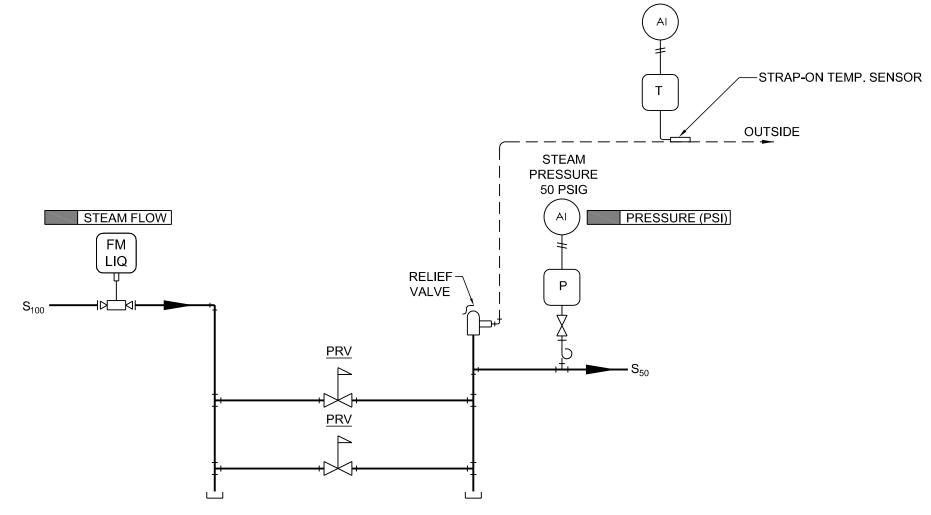
MARK DATE DESCRIPTION ISSUE DATE: 03/20/19

PROJECT NUMBER: 04-18-0072 SHEET TITLE:

> STEAM HEAT **EXCHANGER** CONTROL DIAGRAM

SHEET NUMBER: ATC3.01

- 1. IF EQUIPMENT (CHILLERS, PUMPS, ETC.) IS DISABLED DUE TO MAINTENANCE SHUTDOWN OR A FAULT CONDITION, OR OVERRIDDEN, EQUIPMENT SHALL BE HIGHLIGHTED, OUTLINED,
- OR CHANGE COLORS. 2. VARIABLE FREQUENCY DRIVES FURNISHED BY 230900, INSTALLED BY DIVISION 26. 3. CONTROL VALVES, FLOW METERS, THERMOWELLS, AND TAPS ARE PROVIDED BY DIVISION 230900 AND INSTALLED BY DIVISION 23 IN LOCATIONS INDICATED BY THE CONTROL DIAGRAMS AND AS SPECIFIED. TRANSFORMERS ARE PROVIDED BY DIVISION 230900,
- INSTALLED BY DIVISION 26. 4. ALL ACTUATORS, SENSORS, SWITCHES, TUBING, AND POINTS INDICATED ON THE PLANS ARE PROVIDED BY DIVISION 230900, UNLESS NOTED OTHERWISE.
- 5. ALL POINTS AND COMPONENTS INDICATED ON THE CONTROL DRAWINGS ARE NEW, PROVIDED BY DIVISION 230900, UNLESS INDICATED OTHERWISE. 6. EQUIPMENT PROVIDED WITH CONTROLLERS (CHILLERS, VARIABLE FREQUENCY DRIVES,
- ETC) SHALL COMMUNICATE DIRECTLY WITH THE BAS. ALL REQUIRED GATEWAYS AND ROUTERS SHALL BE PROVIDED WITH EQUIPMENT WHERE POSSIBLE. ALL AVAILABLE POINTS SHALL BE OBTAINED FROM THE EQUIPMENT CONTROLLER AND THE BAS SHALL PROVIDE SET POINTS, COMMANDS, ETC, TO THE EQUIPMENT PER THE SEQUENCE OF OPERATIONS.
- 7. EQUIPMENT SHALL HAVE DEDICATED GRAPHICS PER SPECIFICATIONS. ALL COMMUNICATED POINTS SHALL BE AVAILABLE IN A LIST FORMAT WITH COMPLETE DESCRIPTIONS OF THE POINT, INCLUDING ALARMS. THE OPERATOR SHALL NOT HAVE TO
- REFER TO DOCUMENTATION TO DETERMINE WHAT THE POINT IS. 8. VARIABLE FREQUENCY DRIVES SHALL INDICATE HAND, OFF, AUTO, AND BYPASS STATUS. 9. CONTROL VALVES SHALL BE SELECTED WITH PROPER AUTHORITY FOR THEIR GIVEN APPLICATION.
- 10. CONTROL WIRING BY DIVISION 230900. 11. REFER TO IDIQ STANDARD SYSTEM VALVE SCHEDULE FOR VALVE AND PIPE SIZES FOR
- BASE PRICING. 12. POWER WIRING BY DIVISION 26.
- 13. ALL COMMUNICATED POINTS SHALL BE BROUGHT INTO THE BAS AND LABELED. REFERENCE TO ANOTHER DOCUMENT FOR ADDRESS DEFINITION IS NOT ACCEPTABLE. 14. ALL EXISTING SAFETIES AND INTERLOCKS SHALL BE MAINTAINED.



STEAM SYSTEM MONITORING: STEAM PRESSURE SHALL BE MONITORED BY DIVISION 230900. STEAM PRESSURE RELIEF VALVE OPERATION SHALL BE MONITORED BY DIVISION 230900.

ALARM MONITORING:

AN ALARM WILL BE GENERATED AT THE EMS PC WORKSTATION IF ANY OF THE FOLLOWING OCCUR: 1. LOW STEAM PRESSURE ALARM (EACH STAGE) 2. HIGH STEAM PRESSURE ALARM (EACH STAGE) 3. RELIEF VENT ALARM

STEAM SYSTEM MONITORING CONTROL DIAGRAM
NOT TO SCALE

GENERAL NOTE: THESE STANDARD SYSTEM DIAGRAMS AND SEQUENCES ARE DEVELOPED AS THE BASIS FOR DESIGN AND MAY NOT BE

DIRECTLY APPLICABLE AS IS DUE TO EXISTING EQUIPMENT OR SYSTEM CAPABILITIES, OR DUE TO SYSTEM OR EQUIPMENT ARRANGEMENTS. IT IS THE RESPONSIBILITY OF THE ENGINEER OF RECORD TO MODIFY THESE DOCUMENTS AS REQUIRED

FOR THE SPECIFIC CONDITIONS OF A PROJECT. REFER TO THE RFP DOCUMENTS FOR MODIFICATION PROCEDURES.



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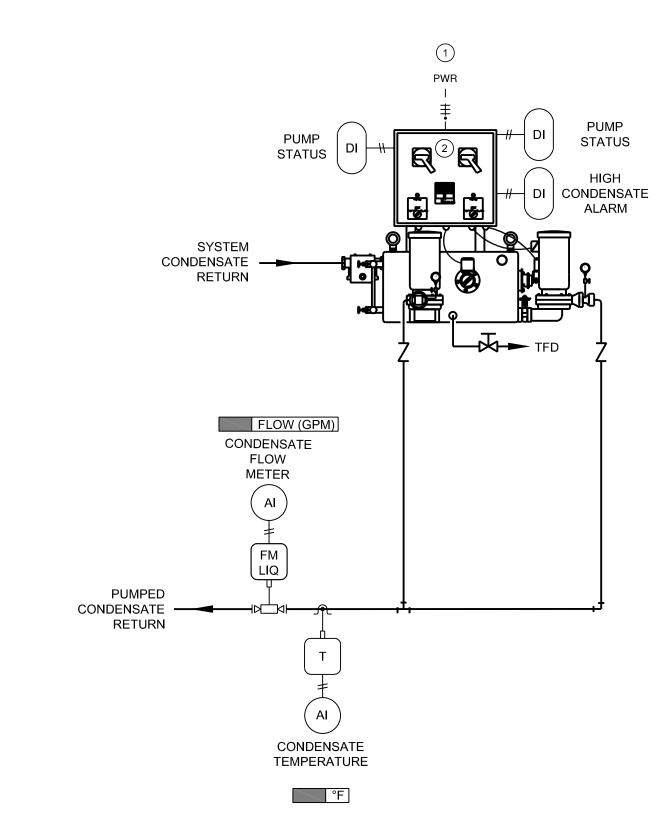
PROJECT NUMBER: 04-18-0072

SHEET TITLE:

STEAM SYSTEM MONITORING CONTROL DIAGRAM

SHEET NUMBER:

ISSUE DATE:



CONDENSATE RETURN PUMP SYSTEM MONITORING:
THE DUPLEX CONDENSATE RETURN PUMP UNIT SHALL BE MONITORED BY THE EMS FOR HIGH CONDENSATE ALARM CONDITIONS. DUPLEX CONDENSATE PUMP UNIT SHALL BE PROVIDED WITH A SET OF ALARM CONTACTS TO INDICATE A CONDENSATE LEVEL IN THE TANK ABOVE NORMAL OPERATING CONDITIONS.

AN ALARM WILL BE GENERATED AT THE EMS PC WORKSTATION IF ANY OF THE FOLLOWING OCCUR:

1. HIGH CONDENSATE ALARM (EACH DUPLEX PUMP UNIT).

2. SIGNAL ALARM IF CONDENSATE PUMPS ARE ON AS SIGNALED BY THE CURRENT SWITCH AND THE FLOW MEASURED AT THE CONDENSATE FLOW METER IS LESS THAN THE PUMP FLOW RATE.

DIAGRAM GENERAL NOTES:

- 1. POWER WIRING (PWR) BY DIVISION 26. ATC CONTRACTOR IS RESPONSIBLE FOR POWER WIRING FROM FIELD EQUIPMENT PANEL TO CONTROLS REQUIRING POWER.
- 2. DUPLEX CONDENSATE RETURN UNIT WITH FACTORY FURNISHED AND WIRED CONTROL PANEL. CONTROL PANEL INCLUDES A HIGH CONDENSATE LEVEL ALARM CONTACTS FOR MONITORING BY EMS.

STEAM CONDENSATE RETURN PUMP CONTROL DIAGRAM
NOT TO SCALE

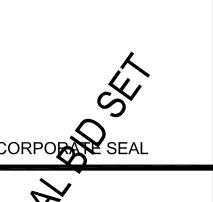
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ARRANGEMENTS. IT IS THE RESPONSIBILITY OF THE ENGINEER OF RECORD TO MODIFY THESE DOCUMENTS AS REQUIRED FOR THE SPECIFIC CONDITIONS OF A PROJECT. REFER TO THE RFP DOCUMENTS FOR MODIFICATION PROCEDURES.



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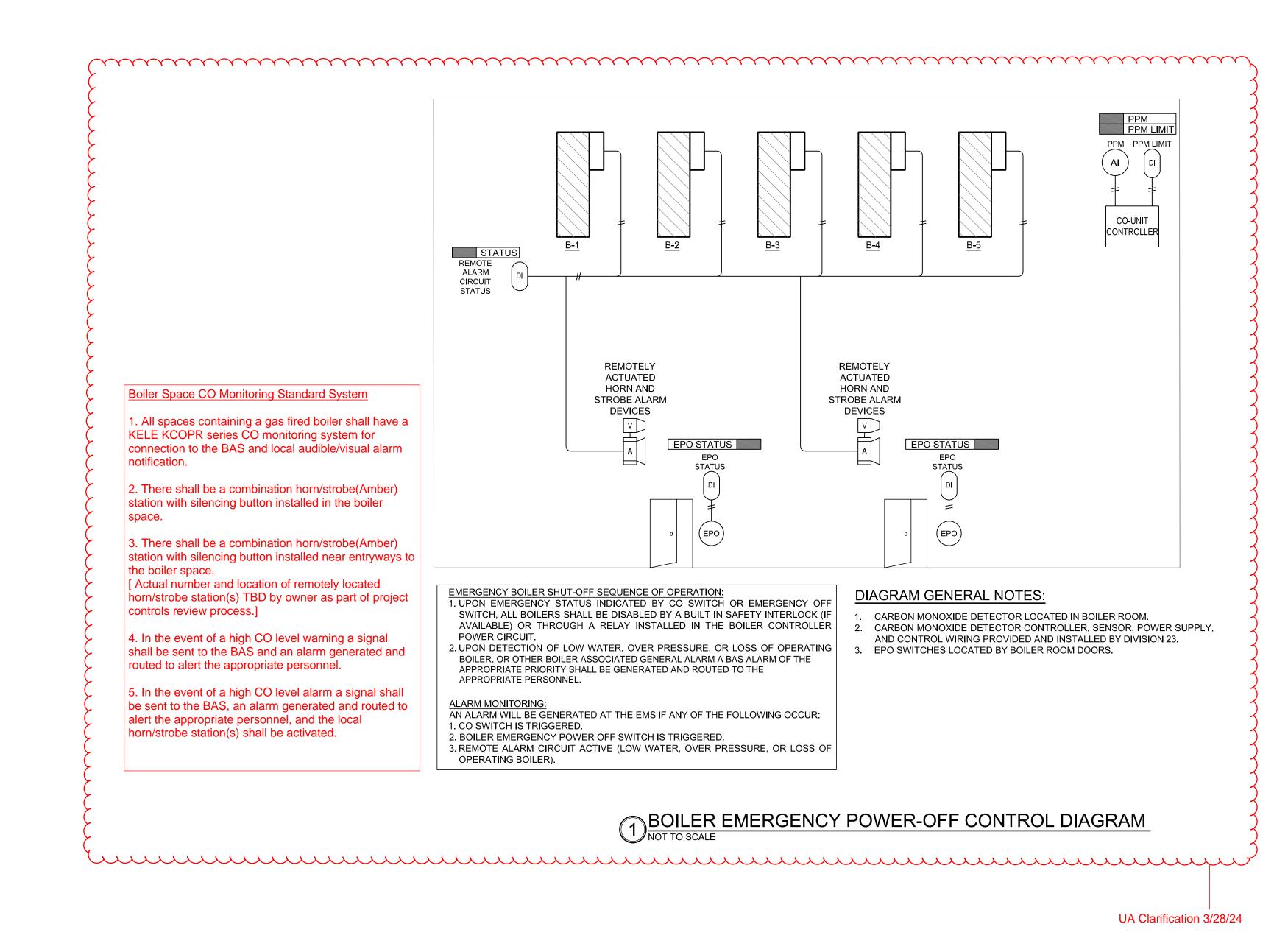


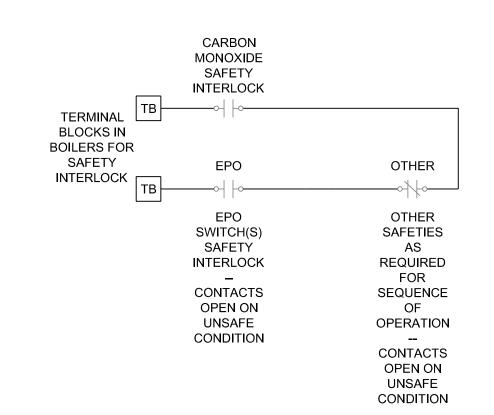
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ISSL	JE DATE:		03/20/19
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SHEET TITLE: STEAM CONDENSATE **RETURN PUMP**

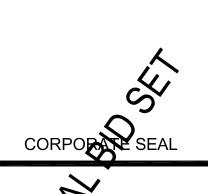
CONTROL DIAGRAM SHEET NUMBER:





BOILER EMERGENCY POWER-OFF INTERLOCKSNOT TO SCALE





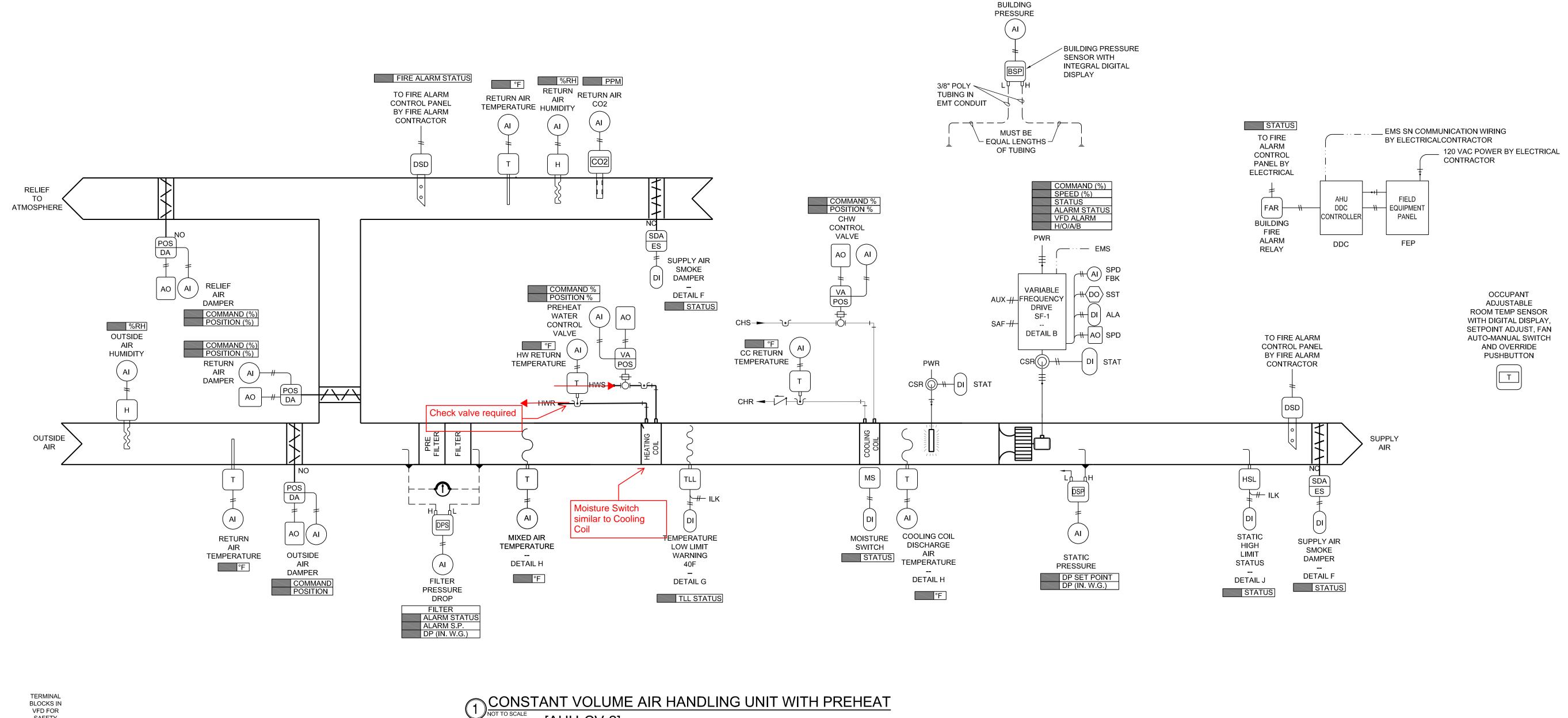


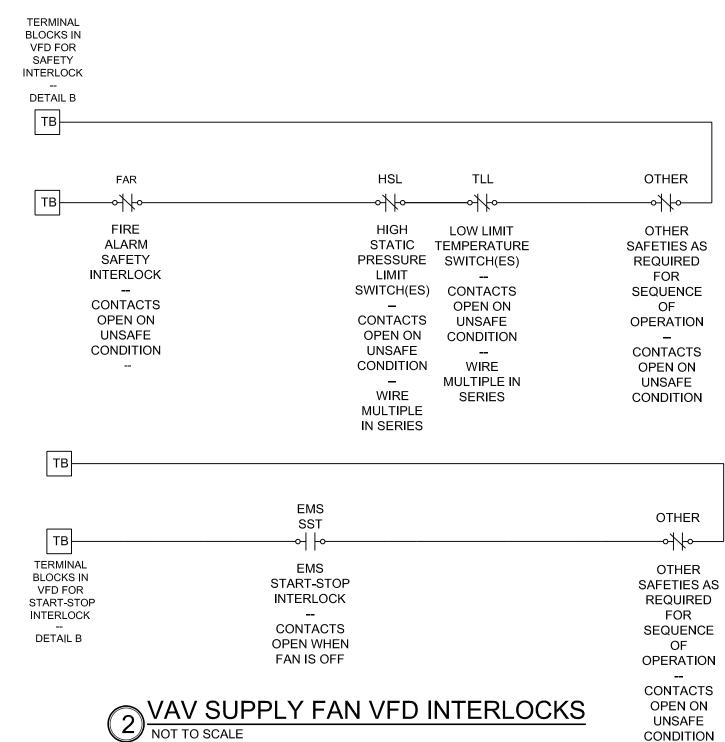
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CONTROL DRAWINGS
UNIVERSITY OF ARKANSAS

MARK DATE DESCRIPTION
ISSUE DATE: 03/20/19
PROJECT NUMBER: 04-18-0072
SHEET TITLE:

BOILER EMERGENCY POWER-OFF CONTROL DIAGRAM





CONDITION

Moisture Switch, DI,

Auxiliary Contact,

COV Trend

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SEQUENCE OF OPERATION:

SUPPLY FAN: STARTED AND STOPPED THROUGH PUSHBUTTONS AT THE VFD, OPERATOR COMMAND, OR BY THE DDC PANEL BASED UPON A WEEKLY OCCUPIED / UNOCCUPIED SCHEDULE. THE FAN SHALL BE AUTOMATICALLY STOPPED BY THE FIRE ALARM PANEL, HIGH STATIC PRESSURE ALARM, OR THE LOW LIMIT IN THE EVENT OF AN UNSAFE OR ALARM CONDITION. THE FAN VFD SHALL BE MODULATED TO MAINTAIN A DISCHARGE AIR STATIC PRESSURE SET POINT AS ESTABLISHED BY THE TEST AND BALANCE CONTRACTOR. THE SPEED SHALL MODULATE TO OVERCOME SYSTEM PRESSURE DROPS (FILTER LOADING).`

CHILL WATER CONTROL VALVES: WHEN THE FAN IS IN OPERATION, THE CHILL WATER CONTROL VALVE SHALL MODULATE AS REQUIRED TO MAINTAIN THE SPACE TEMPERATURE AT SET POINT (ADJUSTED AT THE THERMOSTAT) VIA SPACE RESET OF DISCHARGE AIR TEMPERATURE. THE CHILL WATER VALVES SHALL CLOSE WHEN THE SUPPLY FAN IS NOT IN OPERATION. IF THE LOW LIMIT TRIPS, THE CHILL WATER VALVES SHALL OPEN FULLY TO FLOW THROUGH THE COIL.

HEATING WATER CONTROL VALVE: WHEN THE FAN IS IN OPERATION, THE HEATING WATER CONTROL VALVE SHALL MODULATE AS REQUIRED TO MAINTAIN THE SPACE TEMPERATURE AT SET POINT (ADJUSTED AT THE THERMOSTAT) VIA SPACE RESET OF DISCHARGE AIR TEMPERATURE. THE HEATING WATER VALVE SHALL CLOSE WHEN THE SUPPLY FAN IS NOT IN OPERATION. IF THE LOW LIMIT TRIPS, THE HEATING WATER VALVE SHALL OPEN FULLY TO FLOW THROUGH THE COIL.

AIR DAMPERS: WHEN THE SUPPLY FAN IS IN OPERATION, THE OUTSIDE, RETURN, AND RELIEF DAMPERS SHALL MODULATE TO PROVIDE OUTSIDE AIR AS NEEDED TO PREVENT THE RETURN CO2 FROM EXCEEDING SET POINT. THE MIXED AIR SENSOR SHALL OVERRIDE THE OUTSIDE AND RELIEF DAMPER CLOSED AND THE RETURN DAMPER OPEN TO MAINTAIN A MINIMUM SET POINT (45 DEGREES, ADJUSTABLE). THE OUTSIDE AND RELIEF DAMPER SHALL CLOSE AND THE RETURN DAMPER SHALL OPEN WHEN THE UNIT IS NOT IN OPERATION.

MOISTURE DETECTOR TRIP: UPON ACTIVATION OF THE MOISTURE DETECTION SENSOR AN ALARM WILL BE GENERATED AND SENT TO THE EMS. THE UNIT SHALL BE SHUT DOWN, THE OUTSIDE AIR ACTUATOR SHALL BE COMMANDED CLOSED, AND ALL CONTROL VALVES WILL BE COMMANDED CLOSED.

GENERAL NOTES:

12. POWER WIRING BY DIVISION 26.

- 1. IF EQUIPMENT (CHILLERS, PUMPS, ETC.) IS DISABLED DUE TO MAINTENANCE SHUTDOWN OR A FAULT CONDITION, OR OVERRIDDEN, EQUIPMENT SHALL BE HIGHLIGHTED, OUTLINED. OR CHANGE COLORS.
- 2. VARIABLE FREQUENCY DRIVES FURNISHED BY 230900, INSTALLED BY DIVISION 26. 3. CONTROL VALVES, FLOW METERS, THERMOWELLS, AND TAPS ARE PROVIDED BY DIVISION 230900 AND INSTALLED BY DIVISION 23 IN LOCATIONS INDICATED BY THE CONTROL DIAGRAMS AND AS SPECIFIED. TRANSFORMERS ARE PROVIDED BY DIVISION 230900, INSTALLED BY DIVISION 26.
- 4. ALL ACTUATORS, SENSORS, SWITCHES, TUBING, AND POINTS INDICATED ON THE PLANS ARE PROVIDED BY DIVISION 230900. UNLESS NOTED OTHERWISE. 5. ALL POINTS AND COMPONENTS INDICATED ON THE CONTROL DRAWINGS ARE NEW,
- PROVIDED BY DIVISION 230900, UNLESS INDICATED OTHERWISE. 6. EQUIPMENT PROVIDED WITH CONTROLLERS (CHILLERS, VARIABLE FREQUENCY DRIVES, ETC) SHALL COMMUNICATE DIRECTLY WITH THE BAS. ALL REQUIRED GATEWAYS AND ROUTERS SHALL BE PROVIDED WITH EQUIPMENT WHERE POSSIBLE. ALL AVAILABLE POINTS SHALL BE OBTAINED FROM THE EQUIPMENT CONTROLLER AND THE BAS SHALL PROVIDE SET POINTS, COMMANDS, ETC, TO THE EQUIPMENT PER THE SEQUENCE OF OPERATIONS.
- 7. EQUIPMENT SHALL HAVE DEDICATED GRAPHICS PER SPECIFICATIONS. ALL COMMUNICATED POINTS SHALL BE AVAILABLE IN A LIST FORMAT WITH COMPLETE DESCRIPTIONS OF THE POINT, INCLUDING ALARMS. THE OPERATOR SHALL NOT HAVE TO REFER TO DOCUMENTATION TO DETERMINE WHAT THE POINT IS.
- 8. VARIABLE FREQUENCY DRIVES SHALL INDICATE HAND, OFF, AUTO, AND BYPASS STATUS. 9. CONTROL VALVES SHALL BE SELECTED WITH PROPER AUTHORITY FOR THEIR GIVEN
- 10. CONTROL WIRING BY DIVISION 230900. 11. REFER TO IDIQ STANDARD SYSTEM VALVE SCHEDULE FOR VALVE AND PIPE SIZES FOR BASE PRICING.
- 13. ALL COMMUNICATED POINTS SHALL BE BROUGHT INTO THE BAS AND LABELED. REFERENCE TO ANOTHER DOCUMENT FOR ADDRESS DEFINITION IS NOT ACCEPTABLE. 14. ALL EXISTING SAFETIES AND INTERLOCKS SHALL BE MAINTAINED.

GENERAL NOTE: THESE STANDARD SYSTEM DIAGRAMS AND SEQUENCES ARE DEVELOPED AS THE BASIS FOR DESIGN AND MAY NOT BE DIRECTLY APPLICABLE AS IS DUE TO EXISTING EQUIPMENT OR SYSTEM CAPABILITIES, OR DUE TO SYSTEM OR EQUIPMENT ARRANGEMENTS. IT IS THE RESPONSIBILITY OF THE ENGINEER OF RECORD TO MODIFY THESE DOCUMENTS AS REQUIRED FOR THE SPECIFIC CONDITIONS OF A PROJECT. REFER TO THE RFP DOCUMENTS FOR MODIFICATION PROCEDURES.

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MARK DATE DESCRIPTION

SHEET TITLE:

CONSTANT VOLUME AHU WITH PREHEAT

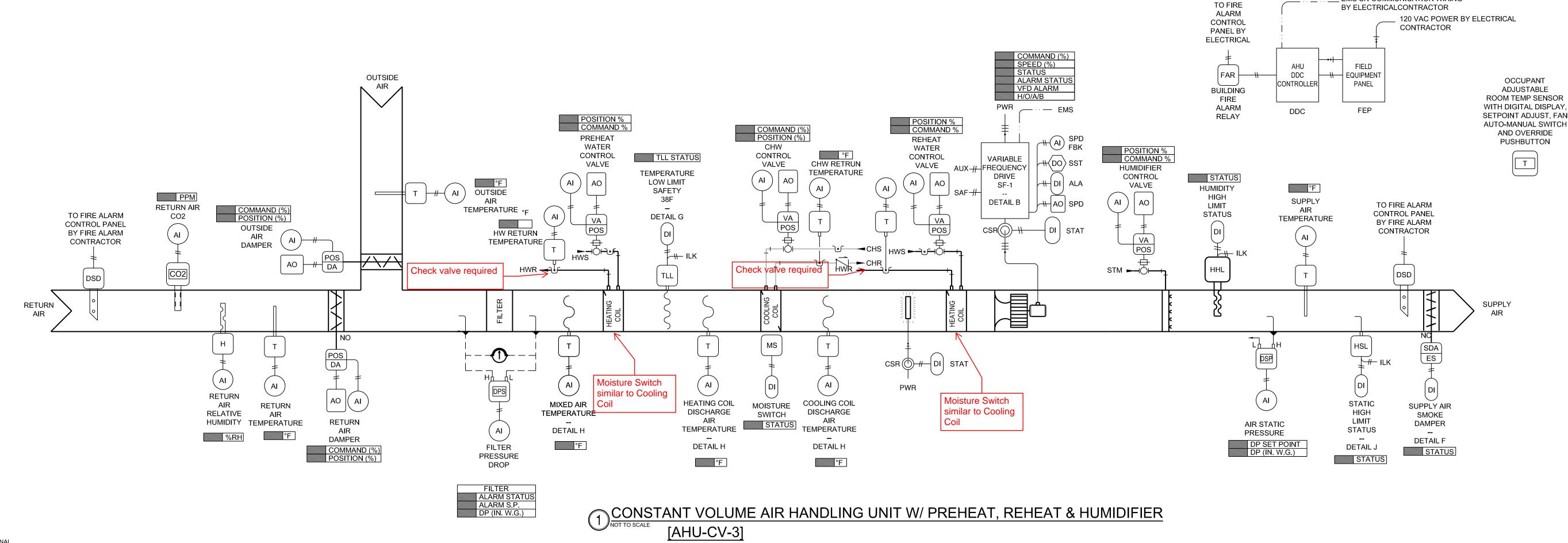
SHEET NUMBER:

03/20/19

04-18-0072

ISSUE DATE:

PROJECT NUMBER:



BLOCKS IN VFD FOR INTERLOCK DETAIL B OTHER FIRE HIGH LOW LIMIT OTHER ALARM STATIC TEMPERATURE SAFETIES AS PRESSURE SWITCH(ES) SAFETY REQUIRED INTERLOCK FOR SWITCH(ES) CONTACTS SEQUENCE CONTACTS OPEN ON OPEN ON CONTACTS UNSAFE OPERATION UNSAFE OPEN ON CONDITION CONDITION UNSAFE CONTACTS CONDITION WIRE OPEN ON MULTIPLE IN UNSAFE SERIES CONDITION MULTIPLE IN SERIES OTHER **TERMINAL** OTHER BLOCKS IN START-STOP SAFETIES AS VFD FOR INTERLOCK REQUIRED START-STOP INTERLOCK FOR CONTACTS SEQUENCE DETAIL B OPEN WHEN FAN IS OFF OPERATION CONTACTS VAV SUPPLY FAN VFD INTERLOCKS OPEN ON UNSAFE CONDITION

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SEQUENCE OF OPERATION:

STATUS

_ EMS SN COMMUNICATION WIRING

SUPPLY FAN: STARTED AND STOPPED THROUGH PUSHBUTTONS AT THE VFD, OPERATOR COMMAND, OR BY THE DDC PANEL BASED UPON A WEEKLY OCCUPIED / UNOCCUPIED SCHEDULE. THE FAN SHALL BE AUTOMATICALLY STOPPED BY THE FIRE ALARM PANEL, HIGH STATIC PRESSURE ALARM, OR THE LOW LIMIT IN THE EVENT OF AN UNSAFE OR ALARM CONDITION. THE FAN VFD SHALL BE MODULATED TO MAINTAIN A DISCHARGE AIR STATIC PRESSURE SET POINT AS ESTABLISHED BY THE TEST AND BALANCE CONTRACTOR. THE SPEED SHALL MODULATE TO OVERCOME SYSTEM PRESSURE DROPS (FILTER LOADING).

PREHEAT WATER CONTROL VALVE: WHEN THE FAN IS IN OPERATION, THE PREHEAT CONTROL VALVE SHALL MODULATE AS REQUIRED TO MAINTAIN LEAVING AIR TEMPERATURE AT SET POINT (50 DEG. F. ADJUSTABLE). THE PREHEAT VALVE SHALL CLOSE WHEN THE SUPPLY FAN IS NOT IN OPERATION. IF THE LOW LIMIT TRIPS, THE PREHEAT VALVE SHALL OPEN FULLY TO FLOW THROUGH THE COIL.

CHILL WATER CONTROL VALVE: WHEN THE FAN IS IN OPERATION, THE CHILL WATER CONTROL VALVE SHALL MODULATE AS REQUIRED TO MAINTAIN THE SPACE TEMPERATURE AT SET POINT (ADJUSTED AT THE THERMOSTAT) VIA SPACE RESET OF DISCHARGE AIR TEMPERATURE.

DEHUMIDIFICATION CONTROL: THE CHILL WATER VALVE SHALL MODULATE TO MAINTAIN 55 DEG. F. LEAVING AIR WHEN THE RETURN AIR HUMIDITY EXCEEDS ITS SET POINT (45%RH ADJUSTABLE). THE CHILL WATER VALVE SHALL CLOSE WHEN THE SUPPLY FAN IS NOT IN OPERATION. IF THE LOW LIMIT TRIPS, THE CHILL WATER VALVE SHALL OPEN FULLY TO FLOW THROUGH THE COIL.

RE-HEAT WATER CONTROL VALVE: WHEN THE FAN IS IN OPERATION, THE HEATING WATER CONTROL VALVE SHALL MODULATE AS REQUIRED TO MAINTAIN THE SPACE TEMPERATURE AT SET POINT (ADJUSTED AT THE THERMOSTAT) VIA SPACE RESET OF DISCHARGE AIR TEMPERATURE. THE HEATING WATER VALVE SHALL CLOSE WHEN THE SUPPLY FAN IS NOT IN OPERATION. IF THE LOW LIMIT TRIPS, THE HEATING WATER VALVE SHALL OPEN FULLY TO FLOW THROUGH THE COIL.

AIR DAMPERS: WHEN THE SUPPLY FAN IS IN OPERATION, THE OUTSIDE AND RETURN DAMPERS SHALL MODULATE TO PROVIDE OUTSIDE AIR AS NEEDED TO PREVENT THE RETURN CO2 FROM EXCEEDING SET POINT. THE MIXED AIR SENSOR SHALL OVERRIDE THE OUTSIDE DAMPER CLOSED AND THE RETURN DAMPER OPEN TO MAINTAIN A MINIMUM SET POINT (35 DEGREES, ADJUSTABLE). THE OUTSIDE DAMPER SHALL CLOSE AND THE RETURN DAMPER SHALL OPEN WHEN THE UNIT IS NOT IN OPERATION.

HUMIDIFIER VALVE SHALL MODULATE THROUGH HUMIDITY HIGH LIMIT (MAX 85% RH) TO MAINTAIN RETURN AIR HUMIDITY SET POINT (45% RH ADJUSTABLE).

UPON ACTIVATION OF THE MOISTURE DETECTION SENSOR AN ALARM WILL BE GENERATED AND SENT TO THE EMS. THE UNIT SHALL BE SHUT DOWN, THE OUTSIDE AIR ACTUATOR SHALL BE COMMANDED CLOSED, AND ALL CONTROL VALVES WILL BE COMMANDED CLOSED.

GENERAL NOTES:

- 1. CONTROL VALVES, FLOW METERS, THERMOWELLS, AND TAPS ARE PROVIDED BY DIVISION 230900 AND INSTALLED BY DIVISION 23 IN LOCATIONS INDICATED BY THE CONTROL DIAGRAMS AND AS SPECIFIED.
- 2. ALL CONTROLLERS, ACTUATORS, SENSORS, SWITCHES, TUBING, AND POINTS INDICATED ON THE PLANS ARE PROVIDED AND INSTALLED BY DIVISION 230900, UNLESS NOTED OTHERWISE. CONTROL VALVES AND THERMOWELLS ARE PROVIDED BY DIVISION 230900, INSTALLED BY DIVISION
- 23. TRANSFORMERS ARE PROVIDED BY DIVISION 230900, INSTALLED BY DIVISION 26. 3. ALL POINTS INDICATED ON THE CONTROL DRAWINGS ARE NEW, PROVIDED BY DIVISION 230900, UNLESS INDICATED OTHERWISE.
- 4. A SINGLE TRANSFORMER CAN BE PROVIDED FOR UP TO 10 CONTROLLERS PROVIDED LENGTH OF RUNS AND ZONING IS TAKEN INTO
- 5. ATC CONTRACTOR SHALL TUNE ALL LOOPS AND TABLES FOR SMOOTH, STABLE OPERATION. NUMBERS INDICATED IN THESE DIAGRAMS ARE FOR A STARTING POINT ONLY. THESE DIAGRAMS REPRESENT THE BASIC FUNCTION OF THE CONTROLS SEQUENCE AND IS NOT ALL INCLUSIVE. THE ATC CONTRACTOR IS STILL REQUIRED TO PROVIDE, DEFINE, AND INDICATE ALL ALARMS, SET POINTS, AND FUNCTIONS REQUIRE TO ACHIEVE THE INTENT OF THE SEQUENCE, AND MAINTAINED ALL EQUIPMENT MANUFACTURER REQUIREMENTS.
- 6. EQUIPMENT PROVIDED WITH CONTROLLERS (BOILERS, VARIABLE FREQUENCY DRIVES, ETC) SHALL COMMUNICATE DIRECTLY WITH THE BAS. ALL REQUIRED GATEWAYS AND ROUTERS SHALL BE PROVIDED WITH EQUIPMENT WHERE AVAILABLE,. ALL AVAILABLE POINTS SHALL BE OBTAINED FROM THE EQUIPMENT CONTROLLER AND THE BAS SHALL PROVIDE SET POINTS, COMMANDS, ETC, TO THE EQUIPMENT PER THE SEQUENCE OF
- 7. EQUIPMENT SHALL HAVE DEDICATED GRAPHICS PER SPECIFICATIONS. ALL COMMUNICATED POINTS SHALL BE AVAILABLE IN A LIST FORMAT WITH COMPLETE DESCRIPTIONS OF THE POINT, INCLUDING ALARMS. THE OPERATOR SHALL NOT HAVE TO REFER TO DOCUMENTATION TO DETERMINE
- 8. VARIABLE FREQUENCY DRIVES SHALL INDICATE HAND, OFF, AUTO, AND BYPASS STATUS.
- 9. CONTROL VALVES SHALL BE SELECTED WITH PROPER AUTHORITY FOR THEIR GIVEN APPLICATION. 10. ATC CONTRACTOR SHALL MEET ALL REQUIREMENTS OF THE EQUIPMENT MANUFACTURER.
- 11. IF EQUIPMENT (BOILERS, PUMPS, ETC.) IS DISABLED DUE TO MAINTENANCE SHUTDOWN OR A FAULT CONDITION, THE LEAD, LAG, LAG#1, ... STATUS OF THE REMAINING EQUIPMENT SHALL MOVE UP IN THE STAGING QUEUE AUTOMATICALLY. STAGING BASED ON RUN TIME. THE COMPONENT
- SHALL BE HIGHLIGHTED, OUTLINED, FLASH, OR CHANGE COLORS. 12. THIS DIAGRAM, GRAPHICAL SEQUENCE, THE SCHEDULES, AND TABLES (ALARMS, SET POINTS, MODES OF OPERATION, ETC), SHALL BE REPRESENTED AS A GRAPHIC ON THE BAS, INCLUDING THE RESULTS OF AS-BUILT PROGRAMMING. THE GRAPHIC IS TO BE POPULATED WITH LIVE
- VALUES. SET POINTS SHALL BE ADJUSTABLE FROM THIS GRAPHIC AND LINKS SHALL BE PROVIDED TO TRENDING GROUPS. 13. THE SCHEDULES AND TABLES INDICATED ON THIS SHEET (ALARMS, SET POINTS, MODES OF OPERATION, ETC) SHALL BE PROVIDED AS GRAPHICS,
- EDITABLE FROM THE GRAPHICS. 14. ALL POINTS ARE TO BE TRENDED AT 15 MINUTE INTERVALS AND BACKED UP AS SPECIFIED.
- 15. TRENDING GROUPS ARE IDENTIFIED ON THE SEQUENCE BY HEX NOTES. CONTRACTOR SHALL SET UP A TREND GROUP GRAPHIC FOR THE HEX NOTE DESIGNATIONS LISTED. EACH TREND GROUP SHALL CONTAIN ALL OF THE TRENDS WITH LIKE HEX NOTES. TREND GROUPS SHALL BE
- TRENDED AT A MINIMUM OF 30 SECOND INTERVALS FOR A DURATION OF 48 HOURS. 19. COORDINATE AIR FLOW MEASURING STATION LOCATION WITH SITE CONDITIONS AND MANUFACTURER'S REQUIREMENTS / RECOMMENDATIONS.

GENERAL NOTE: THESE STANDARD SYSTEM DIAGRAMS AND SEQUENCES ARE DEVELOPED AS THE BASIS FOR DESIGN AND MAY NOT BE DIRECTLY APPLICABLE AS IS DUE TO EXISTING EQUIPMENT OR SYSTEM CAPABILITIES, OR DUE TO SYSTEM OR EQUIPMENT ARRANGEMENTS. IT IS THE RESPONSIBILITY OF THE ENGINEER OF RECORD TO MODIFY THESE DOCUMENTS AS REQUIRED FOR THE SPECIFIC CONDITIONS OF A PROJECT. REFER TO THE RFP DOCUMENTS FOR MODIFICATION PROCEDURES.

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MARK DATE

ISSUE DATE:

PROJECT NUMBER: 04-18-0072

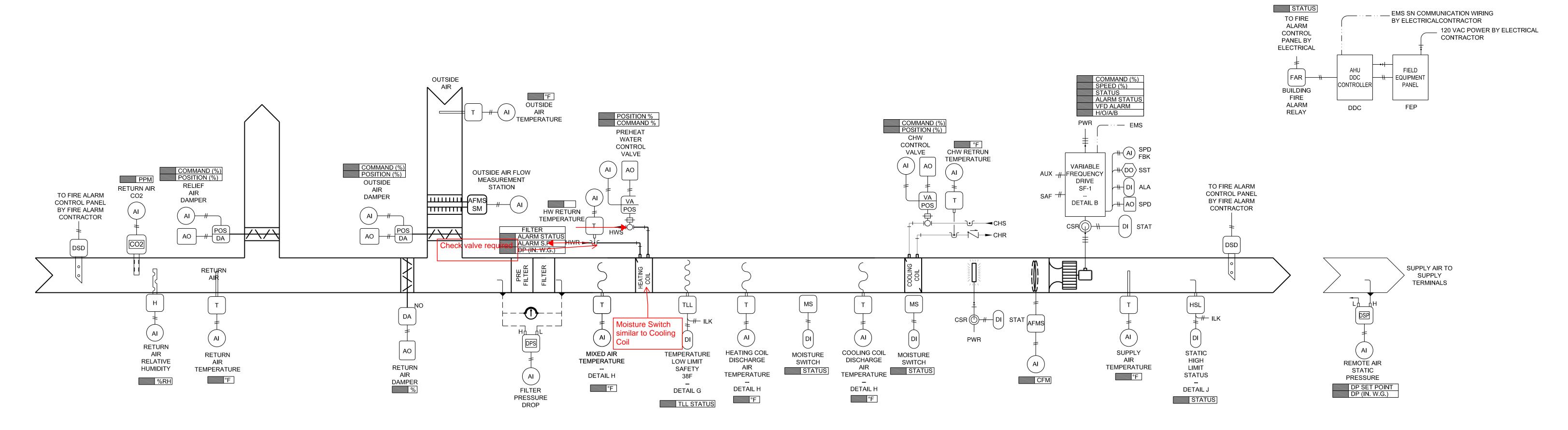
SHEET TITLE:

CONSTANT VOLUME AIR

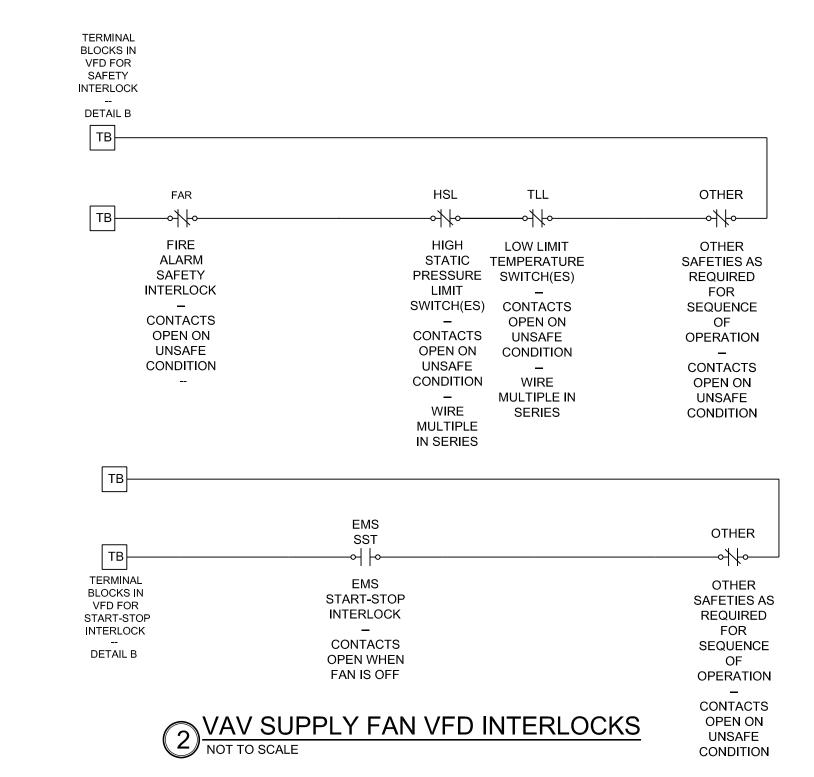
HANDLING UNIT W/ PREHEAT, REHEAT, & HUMIDIFIER

SHEET NUMBER:

DESCRIPTION







TRACKING ANALOG **IO POINT MATRIX** JOB NAME: VARIABLE AIR VOLUME AHU SYSTEM / DESCRIPTION **OUTSIDE AIR TEMPERATURE** DAMPER COMMAND FILTER ALARM MIXED AIR TEMPERATUR PREHEAT VALVE OUT LOW LIMIT ALARM PREHEAT TEMPERATURE COOLING COIL OUT CHILL WATER RET TEMPERATURE VFD SPEED OUT VFD START STOP VFD FAN STATUS DISCHARGE AIR TEMPERATURI DISCHARGE DUCT PRESSURE RETURN AIR TEMPERATURE RETURN AIR CO2 Moisture Switch, DI, Auxiliary Contact, COV Trend

SEQUENCE OF OPERATION:

AHU-VV - VAR.AIR VOL.

SEQUENCE OF OPERATION:

SUPPLY FAN: THE SUPPLY FAN SHALL BE STARTED AND STOPPED BY THE PUSH BUTTON SWITCH AT THE FAN VARIABLE FREQUENCY DRIVE. WHEN THE SWITCH IS IN THE LOCAL POSITION, THE FAN SHALL BE STARTED AND STOPPED LOCALLY AT THE VFD. WHEN THE SWITCH IS IN THE AUTO POSITION, THE FAN SHALL BE STARTED AND STOPPED BY THE DDC CONTROLLER BASED UPON A WEEKLY SCHEDULE, OPERATOR COMMAND, OR WHEN ANY OF THE ASSOCIATED VAV BOXES ARE IN OCCUPIED OR TEMPORARY OVERRIDE. THE SUPPLY FAN SHALL BE AUTOMATICALLY STOPPED BY THE FIRE ALARM SYSTEM, LOW LIMIT SWITCH, OR SUPPLY AIR HIGH STATIC PRESSURE ALARM WHENEVER AN UNSAFE CONDITION OCCURS. STATUS OF THE SUPPLY FAN SHALL BE MONITORED BY THE DDC CONTROLLER. THE SPEED OF THE SUPPLY FAN SHALL BE MODULATED TO MAINTAIN THE DUCT STATIC PRESSURE AT SET POINT (1.0" WC ADJUSTABLE). THE STATIC PRESSURE SET POINT SHALL BE RESET TO MAINTAIN THE MOST OPEN TERMINAL DAMPER AT 95%. ALL TERMINALS SHALL HAVE THE ABILITY TO BE EXCLUDED FROM THE CALCULATION.

OUTSIDE AIR DAMPER: THE OUTSIDE AIR DAMPER SHALL PROVIDE THE SCHEDULED AMOUNT OF OUTSIDE AIR (SET BY THE TEST AND BALANCE CONTRACTOR). THE RETURN AIR CO2 SENSOR SHALL MODULATE THE OUTSIDE AIR DAMPER TO MAINTAIN SET POINT. THE MIXED AIR SENSOR SHALL OVERRIDE THE OUTSIDE DAMPER CLOSED TO MAINTAIN A MINIMUM SET POINT (35 DEGREES, ADJUSTABLE). THE OUTSIDE AIR DAMPER SHALL CLOSE WHEN THE UNIT IS NOT IN OPERATION. IF CONDITIONS ALLOW FOR ECONOMIZER OPERATION, THE OUTSIDE, RETURN, AND RELIEF AIR DAMPER SHALL MODULATE IN TOGETHER IN SEQUENCE TO MEET THE MIXED AIR TEMPERATURE SETPOINT, WHICH WILL BE RESET BASED ON THE DISCHARGE AIR TEMPERATURE SETPOINT REQUIREMENTS. ECONOMIZER OPERATION WILL BE SUBJECT TO OVERRIDE BY PRIORITY OF THE MIXED AIR LOW-LIMIT SEQUENCE AND BUILDING PRESSURE.

CHILL WATER AND HEATING WATER VALVES: THE CHILL WATER AND THE HEATING WATER CONTROL VALVES SHALL MODULATE IN SEQUENCE TO TO MAINTAIN THE SUPPLY AIR TEMPERATURE AT SET POINT. THE SET POINT IS 55 DEG. F. (ADJUSTABLE). THE VALVES SHALL CLOSE WHEN THE SUPPLY FAN IS NOT IN OPERATION. UPON A LOW LIMIT TRIP, THE VALVES SHALL BOTH OPEN FULLY TO FLOW THROUGH THE COIL. THE SUPPLY AIR TEMPERATURE SHALL BE RESET TO TO MAINTAIN THE HIGHEST TERMINAL COOLING LOOP OUTPUT AT 95%. ALL TERMINALS SHALL HAVE THE ABILITY TO BE EXCLUDED FROM THIS CALCULATION. THE SUPPLY AIR TEMPERATURE SHALL ALSO BE CAPABLE OF BEING RESET IN ORDER TO MAINTAIN THE RETURN AIR HUMIDITY BELOW 55%. THE UNIT SHALL OPERATE TO THE LOWER SET POINT FROM THE TWO CONTROL METHODS.

FILTERS: THE FILTER PRESSURE DROP SHALL BE MONITORED BY FILTER ALARM FROM A DIFFERENTIAL PRESSURE SWITCH. IF THE PRESSURE DROP EXCEEDS THE SET POINT (0.5"WC, LOCAL ADJUSTMENT) AN ALARM SHALL BE SENT TO OPERATOR STATION.

MOISTURE DETECTOR TRIP:
UPON ACTIVATION OF THE MOISTURE DETECTION SENSOR AN ALARM WILL BE GENERATED AND SENT TO THE EMS. THE UNIT SHALL BE SHUT DOWN, THE OUTSIDE AIR ACTUATOR SHALL BE COMMANDED CLOSED, AND ALL CONTROL VALVES WILL BE COMMANDED CLOSED.

GENERAL NOTES:

- 1. CONTROL VALVES, FLOW METERS, THERMOWELLS, AND TAPS ARE PROVIDED BY DIVISION 230900 AND INSTALLED BY DIVISION 23 IN LOCATIONS INDICATED BY THE CONTROL DIAGRAMS AND AS SPECIFIED.
- 2. ALL CONTROLLERS, ACTUATORS, SENSORS, SWITCHES, TUBING, AND POINTS INDICATED ON THE PLANS ARE PROVIDED AND INSTALLED BY DIVISION 230900, UNLESS NOTED OTHERWISE. CONTROL VALVES AND THERMOWELLS ARE PROVIDED BY DIVISION 230900, INSTALLED BY DIVISION 23. TRANSFORMERS ARE PROVIDED BY DIVISION 230900, INSTALLED BY DIVISION 26.
- ALL POINTS INDICATED ON THE CONTROL DRAWINGS ARE NEW, PROVIDED BY DIVISION 230900, UNLESS INDICATED OTHERWISE.
 A SINGLE TRANSFORMER CAN BE PROVIDED FOR UP TO 10 CONTROLLERS PROVIDED LENGTH OF RUNS AND ZONING IS TAKEN INTO CONSIDERATION.
- ATC CONTRACTOR SHALL TUNE ALL LOOPS AND TABLES FOR SMOOTH, STABLE OPERATION. NUMBERS INDICATED IN THESE DIAGRAMS ARE FOR A STARTING POINT ONLY. THESE DIAGRAMS REPRESENT THE BASIC FUNCTION OF THE CONTROLS SEQUENCE AND IS NOT ALL INCLUSIVE. THE ATC CONTRACTOR IS STILL REQUIRED TO PROVIDE, DEFINE, AND INDICATE ALL ALARMS, SET POINTS, AND FUNCTIONS REQUIRE TO ACHIEVE THE INTENT OF THE SEQUENCE, AND MAINTAINED ALL EQUIPMENT MANUFACTURER REQUIREMENTS.
 EQUIPMENT PROVIDED WITH CONTROLLERS (BOILERS, VARIABLE FREQUENCY DRIVES, ETC) SHALL COMMUNICATE DIRECTLY WITH THE BAS. ALL REQUIRED GATEWAYS AND ROUTERS SHALL BE PROVIDED WITH EQUIPMENT WHERE AVAILABLE,. ALL AVAILABLE POINTS SHALL BE OBTAINED FROM THE EQUIPMENT CONTROLLER AND THE BAS SHALL
- PROVIDE SET POINTS, COMMANDS, ETC, TO THE EQUIPMENT PER THE SEQUENCE OF OPERATIONS.
 7. EQUIPMENT SHALL HAVE DEDICATED GRAPHICS PER SPECIFICATIONS. ALL COMMUNICATED POINTS SHALL BE AVAILABLE IN A LIST FORMAT WITH COMPLETE DESCRIPTIONS OF
- THE POINT, INCLUDING ALARMS. THE OPERATOR SHALL NOT HAVE TO REFER TO DOCUMENTATION TO DETERMINE WHAT THE POINT IS.

 8. VARIABLE FREQUENCY DRIVES SHALL INDICATE HAND, OFF, AUTO, AND BYPASS STATUS.

 9. CONTROL VALVES SHALL BE SELECTED WITH PROPER AUTHORITY FOR THEIR GIVEN APPLICATION.
- 10. ATC CONTRACTOR SHALL MEET ALL REQUIREMENTS OF THE EQUIPMENT MANUFACTURER.

 11. IF EQUIPMENT (BOILERS, PUMPS, ETC.) IS DISABLED DUE TO MAINTENANCE SHUTDOWN OR A FAULT CONDITION, THE LEAD, LAG, LAG#1, ... STATUS OF THE REMAINING EQUIPMENT SHALL MOVE UP IN THE STAGING QUEUE AUTOMATICALLY. STAGING BASED ON RUN TIME. THE COMPONENT SHALL BE HIGHLIGHTED, OUTLINED, FLASH, OR CHANGE COLORS.
- THIS DIAGRAM, GRAPHICAL SEQUENCE, THE SCHEDULES, AND TABLES (ALARMS, SET POINTS, MODES OF OPERATION, ETC), SHALL BE REPRESENTED AS A GRAPHIC ON THE BAS, INCLUDING THE RESULTS OF AS-BUILT PROGRAMMING. THE GRAPHIC IS TO BE POPULATED WITH LIVE VALUES. SET POINTS SHALL BE ADJUSTABLE FROM THIS GRAPHIC AND LINKS SHALL BE PROVIDED TO TRENDING GROUPS.
 THE SCHEDULES AND TABLES INDICATED ON THIS SHEET (ALARMS, SET POINTS, MODES OF OPERATION, ETC) SHALL BE PROVIDED AS GRAPHICS, EDITABLE FROM THE GRAPHICS.
- 14. ALL POINTS ARE TO BE TRENDED AT 15 MINUTE INTERVALS AND BACKED UP AS SPECIFIED.
 15. TRENDING GROUPS ARE IDENTIFIED ON THE SEQUENCE BY HEX NOTES. CONTRACTOR SHALL SET UP A TREND GROUP GRAPHIC FOR THE HEX NOTE DESIGNATIONS LISTED. EACH TREND GROUP SHALL CONTAIN ALL OF THE TRENDS WITH LIKE HEX NOTES. TREND GROUPS SHALL BE TRENDED AT A MINIMUM OF 30 SECOND INTERVALS FOR A DURATION OF 48
- HOURS.
 19. COORDINATE AIR FLOW MEASURING STATION LOCATION WITH SITE CONDITIONS AND MANUFACTURER'S REQUIREMENTS / RECOMMENDATIONS.

GENERAL NOTE: THESE STANDARD SYSTEM DIAGRAMS AND SEQUENCES ARE DEVELOPED AS THE BASIS FOR DESIGN AND MAY NOT BE DIRECTLY APPLICABLE AS IS DUE TO EXISTING EQUIPMENT OR SYSTEM CAPABILITIES, OR DUE TO SYSTEM OR EQUIPMENT ARRANGEMENTS. IT IS THE RESPONSIBILITY OF THE ENGINEER OF RECORD TO MODIFY THESE DOCUMENTS AS REQUIRED FOR THE SPECIFIC CONDITIONS OF A PROJECT. REFER TO THE RFP DOCUMENTS FOR MODIFICATION PROCEDURES.

Bernhard TME

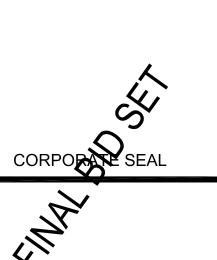
Engineering

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ENGINEER SEAL

ONTROL DRAWINGS
UNIVERSITY OF ARKANSAS

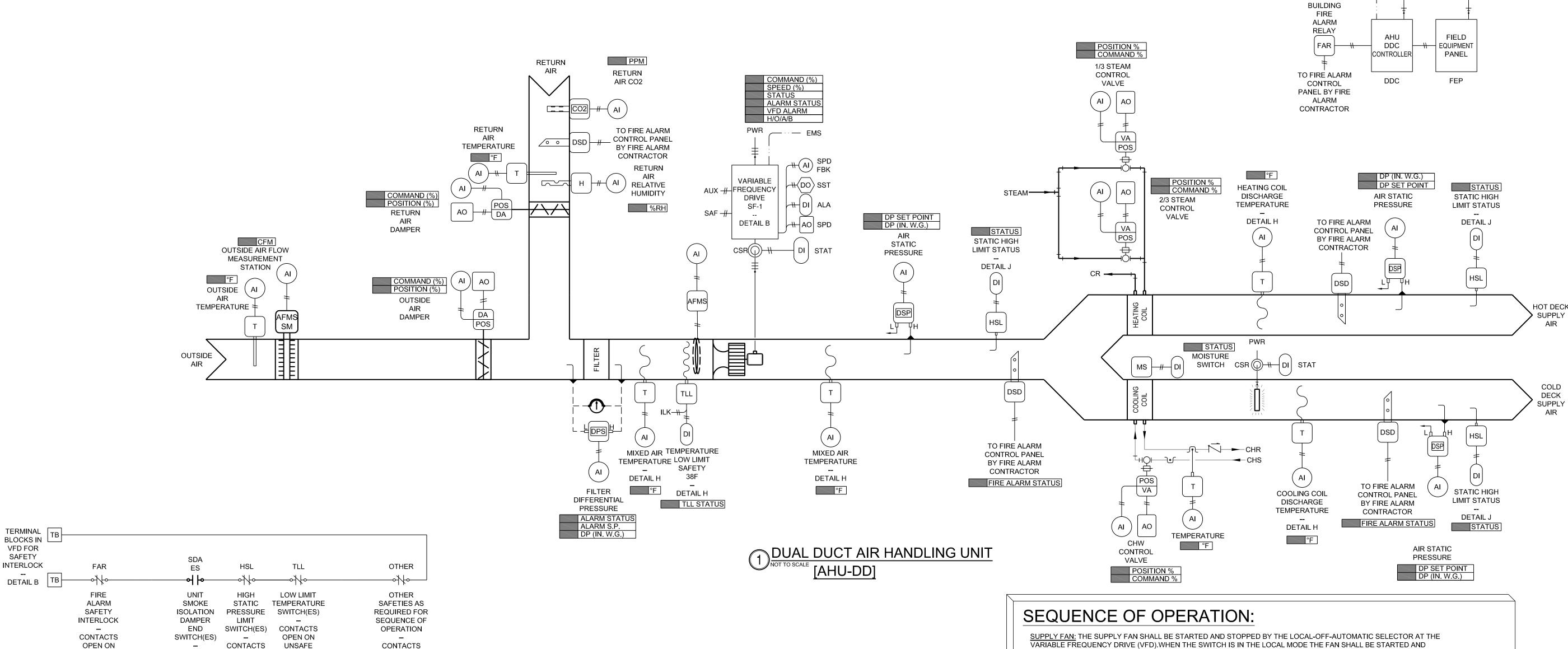
MARK DATE DESCRIPTION

ISSUE DATE: 03/20/19

PROJECT NUMBER: 04-18-0072

SHEET NUMBER:

SHEET TITLE: VARIABLE AIR VOLUME AIR HANDLING UNIT WITH PREHEAT



SUPPLY FAN VFD INTERLOCKS
NOT TO SCALE

CONTACTS

CLOSE

DAMPER

FULLY

OPEN

WIRE

MULTIPLE

IN SERIES

SST

START-STOP

INTERLOCK

CONTACTS

OPEN

WHEN FAN

IS OFF

WHEN

OPEN ON

UNSAFE

CONDITION

WIRE

MULTIPLE

IN SERIES

CONDITION

WIRE

MULTIPLE

IN SERIES

OPEN ON

CONDITION

OTHER

OTHER

INTERLOCKS AS

REQUIRED FOR

SEQUENCE OF

OPERATION

CONTACTS

OPEN OR

CLOSE ON

INTERLOCK

ENABLE

UNSAFE

UNSAFE

TERMINAL

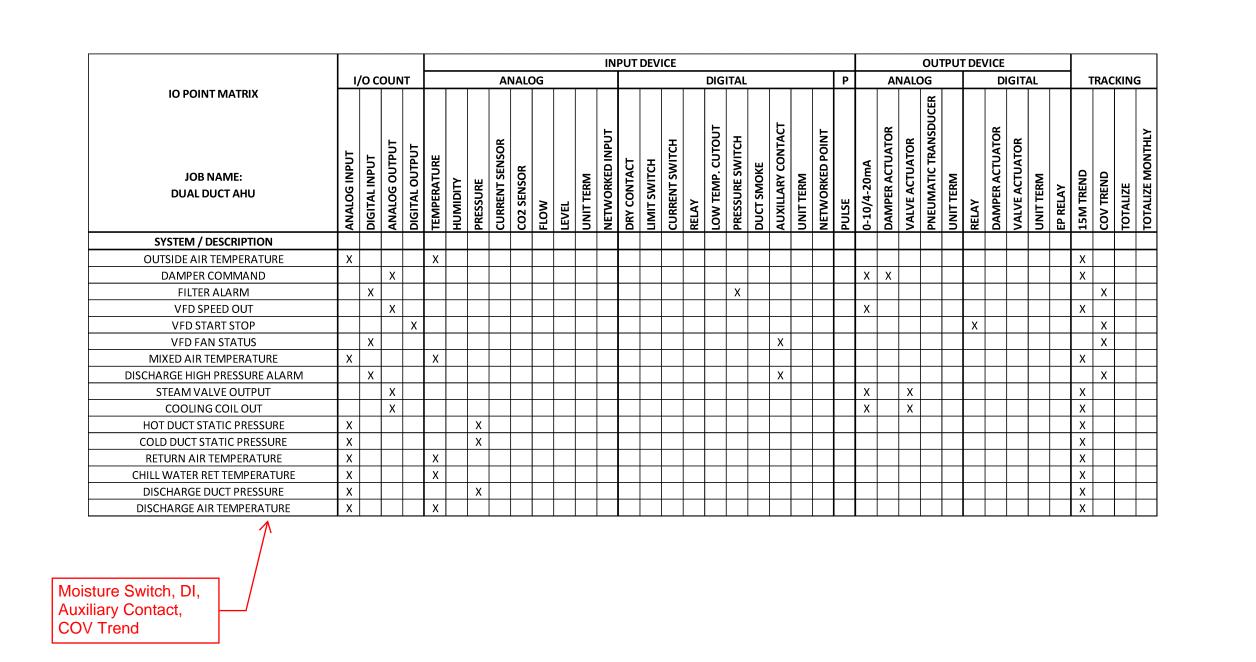
BLOCKS IN VFD FOR

START-STOP

INTERLOCK

--DETAIL B TB

CONDITION



VARIABLE FREQUENCY DRIVE (VFD). WHEN THE SWITCH IS IN THE LOCAL MODE THE FAN SHALL BE STARTED AND STOPPED LOCALLY AT THE VFD. WHEN THE SWITCH IS IN THE AUTO MODE THE FAN SHALL BE STARTED AND STOPPED BY THE DIGITAL CONTROLLER. THE FAN SHALL BE ON EXCEPT IN THE UNOCCUPIED MODE. WHEN UNOCCUPIED, IF THE SPACE TEMPERATURE EXCEEDS 78 DEGREES OR DECREASES BELOW 65 DEGREES AS SENSED BY ANY DUAL DUCT BOX SPACE SENSOR, THE UNIT SHALL CYCLE ON UNTIL SETPOINT HAS BEEN ACHIEVED. THE SUPPLY FAN SHALL ALSO BE AUTOMATICALLY STOPPED BY THE UNITS SMOKE DETECTORS, LOW LIMIT, OR HIGH STATIC PRESSURE ALARM WHENEVER AN UNSAFE CONDITION OCCURS THROUGH THE VFD SAFETY CIRCUIT. STATUS OF THE SUPPLY FAN SHALL BE MONITORED BY THE DIGITAL CONTROLLER. THE SPEED OF THE SUPPLY FAN SHALL BE MODULATED BY THE DIGITAL CONTROLLER AS REQUIRED TO MAINTAIN THE DUCT STATIC PRESSURE (LOWEST PRESSURE OF TWO DUCTS) AT SETPOINT (ADJUSTABLE). THE STATIC PRESSURE SET POINT SHALL BE RESET TO MAINTAIN THE MOST OPEN TERMINAL DAMPER AT 95%. ALL TERMINALS SHALL HAVE THE ABILITY TO BE EXCLUDED FROM THE CALCULATION.

HOT DECK: THE STEAM CONTROL VALVES SHALL BE MODULATED IN SEQUENCE BY THE DIGITAL CONTROLLER ANALOG OUTPUT TO MAINTAIN THE HOT DECK TEMPERATURE AT SETPOINT. SETPOINT SHALL BE RESET BASED ON OUTSIDE AIR TEMPERATURE FROM 110 DEGREES AT 40 DEGREES OUTSIDE AIR TO 80 DEGREES AT 70 DEGREES OUTSIDE AIR.

<u>COLD DECK:</u> THE CHILL WATER CONTROL VALVE SHALL BE MODULATED BY THE DIGITAL CONTROLLER ANALOG OUTPUT TO MAINTAIN THE COLD DECK TEMPERATURE AT SEPOINT (55 DEGREES ADJUSTABLE). THE SUPPLY AIR TEMPERATURE SHALL BE RESET TO MAINTAIN THE HIGHEST TERMINAL COOLING LOOP OUTPUT AT 95%. ALL TERMINALS SHALL HAVE THE ABILITY TO BE EXCLUDED FROM THIS CALCULATION. THE SUPPLY AIR TEMPERATURE SHALL ALSO BE CAPABLE OF BEING RESET IN ORDER TO MAINTAIN THE RETURN AIR HUMIDITY BELOW 55%. THE UNIT SHALL OPERATE TO THE LOWER SET POINT FROM THE TWO CONTROL METHODS.

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FILTERS: THE FILTER PRESSURE DROP SHALL BE MONITORED BY THE DIGITAL CONTROLLER DIGITAL INPUT FROM A DIFFERENTIAL PRESSURE SWITCH. IF THE PRESSURE DROP EXCEEDS THE SETPOINT (0.5"WG ADJUSTABLE) AN ALARM

EXHAUST FAN: EXHAUST FAN SHALL BE COMMANDED ON WHEN AHU IS ON AND OFF WHEN AHU IS OFF. MOISTURE DETECTOR TRIP: UPON ACTIVATION OF THE MOISTURE DETECTION SENSOR AN ALARM WILL BE GENERATED AND SENT TO THE EMS. THE UNIT SHALL BE SHUT DOWN, THE OUTSIDE AIR ACTUATOR SHALL BE COMMANDED CLOSED,

GENERAL NOTES:

AND ALL CONTROL VALVES WILL BE COMMANDED CLOSED.

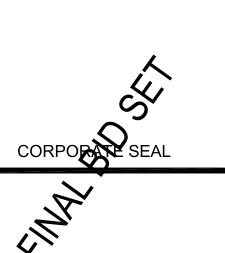
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Engineering

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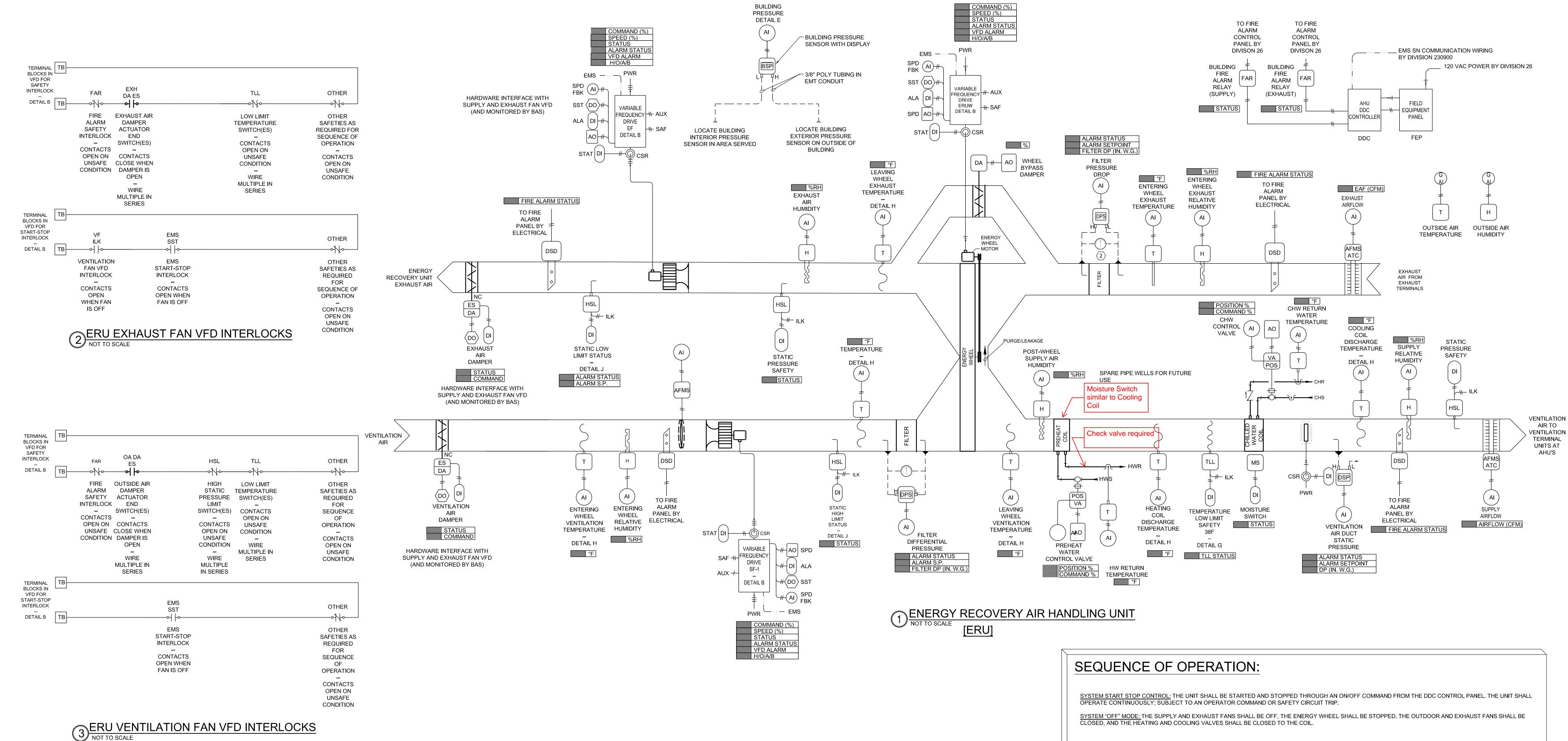
ENGINEER SEAL

MARK DATE DESCRIPTION ISSUE DATE: 03/20/19

PROJECT NUMBER:

SHEET TITLE: DUAL DUCT AIR HANDLING UNIT

04-18-0072



Moisture Switch, DI, Auxiliary Contact, COV Trend

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	JOB NAME: ENERGY RECOVERY AHU	ANALOG INPUT	DIGITAL INPUT	ANALOG OUTPUT	DIGITAL OUTPUT	TEMPERATURE	HUMIDITY	PRESSURE	CURRENT SENSOR	CO2 SENSOR	FLOW	LEVEL	UNIT TERM	NETWORKED INPUT	DRY CONTACT	LIMIT SWITCH	CURRENT SWITCH	RELAY	LOW TEMP. CUTOUT	PRESSURE SWITCH	DUCT SMOKE	AUXILLARY CONTACT	UNIT TERM	NETWORKED POINT	PULSE	0-10/4-20mA	DAMPER ACTUATOR	PNEUMATIC TRANSDUCER	UNIT TERM	RELAY	DAMPER ACTUATOR	VALVE ACTUATOR	UNIT TERM	EP RELAY	TRENDING	COV TREND	TOTALIZE	TOTALIZE MONTHLY
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GENERAL NOTES:

OPERATIONS.

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CLOSED, AND THE HEATING AND COOLING VALVES SHALL BE CLOSED TO THE COIL.

SYSTEM "ON" MODE:
SUPPLY AND EXHAUST FAN CONTROL: SUPPLY AND EXHAUST FAN CONTROL: WHEN THE UNIT IS COMMANDED ON, THE OUTDOOR AND EXHAUST DAMPERS SHALL OPEN. AFTER THE END SWITCHES HAVE PROVEN OPEN DAMPER CONDITIONS, THE FANS SHALL START. DAMPERS WILL BE COMMANDED SEPARATELY FROM FAN COMMAND. END SWITCH STATUS WILL BE MONITORED THROUGH METASYS AND HARDWIRED FOR OPERATIONAL SAFETY.

SUPPLY AND EXHAUST FAN SPEED CONTROL: THE SUPPLY FAN AND EXHAUST FAN SHALL BE STARTED AND STOPPED BY THE HOA SWITCH AT THE FAN VARIABLE FREQUENCY DRIVE. WHEN THE SWITCHES ARE IN THE LOCAL POSITION, THE FANS SHALL BE STARTED AND STOPPED LOCALLY AT THE VFD. WHEN THE SWITCHES ARE IN THE AUTO POSITION, THE FANS SHALL BE STARTED AND STOPPED BY THE DDC CONTROLLER BASED UPON A WEEKLY SCHEDULE, OPERATOR COMMAND, OR WHEN ANY OF THE ASSOCIATED UNITS ARE IN OCCUPIED OR TEMPORARY OVERRIDE. THE FANS SHALL BE AUTOMATICALLY STOPPED BY THE FIRE ALARM SYSEM, LOW LIMIT SWITCH, OR STATIC PRESSURE ALARMS WHENEVER AN UNSAFE CONDITION OCCURS. STATUS OF THE FANS SHALL BE MONITORED BY THE DDC CONTROLLER. THE SPEED OF THE SUPPLY FAN SHALL BE MODULATED TO MAINTAIN THE DUCT STATIC PRESSURE AT SET POINT (1.0"WC ADJUSTABLE). SPEED OF THE EXHAUST FAN SHALL BE MODULATED TO MAINTAIN THE OFFSET BETWEEN SUPPLY AND EXHAUST AIRFLOW.

OUTSIDE AIR INTAKE AND EXHAUST AIR DAMPERS: WHEN THE ENERGY RECOVERY SYSTEM IS ENABLED, THESE DAMPERS ARE OPENED THROUGH THE ENERGY RECOVERY CONTROL SYSTEM (PROVIDED WITH UNIT). WHEN THE SYSTEM IS DISABLED, THE DAMPERS ARE CLOSED.

HEATING AND COOLING COIL CONTROL: THE HEATING WATER AND CHILL WATER CONTROL VALVES SHALL MODULATE IN SEQUENCE TO MAINTAIN THE UNIT DISCHARGE AIR TEMPERATURE AT ITS RESET SET POINT.

UNIT DISCHARGE AIR TEMPERATURE SET POINT RESET: DISCHARGE AIR TEMPERATURE SET POINT SHALL BE RESET BASED ON FOLLOWING SCHEDULE:

<u>OAT</u> <u>DAT</u> 35 DEG. F. 75 DEG. F. 60 DEG. F. 55 DEG. F.

PREVENT FROSTING.

THESE SET POINTS SHALL BE ADJUSTABLE FROM THE DDC CONTROL PANEL.

ENERGY WHEEL CONTROL: THE ENERGY WHEEL SHALL BE STARTED THROUGH A LOCAL HAND-OFF-AUTO SWITCH WHEN IN HAND. WHEN IN THE AUTO POSITION, ENERGY WHEEL SHALL BE STARTED THROUGH THE DDC CONTROL PANEL. WHEN THE SUPPLY AND EXHAUST FANS VFD ARE IN "ON" MODE AND THE OUTDOOR AIR TEMPERATURE IS ABOVE 80 DEG. F. (ADJ) THE ENERGY WHEEL SHALL OPERATE AT FULL SPEED. WHEN THE OUTDOOR AIR TEMPERATURE IS BETWEEN 80 AND 50 DEG. F., THE WHEEL SHALL OPERATE AT MINIMUM SPEED. WHEN THE OUTDOOR AIR TEMPERATURE IS BETWEEN 50 AND 30 DEG. F., THE WHEEL SHALL MODULATE TO MAINTAIN ENERGY RECOVERY TEMPERATURE AT 50 DEG. F. (ADJ). WHEN THE OUTDOOR AIR TEMPERATURE IS BELOW 30 DEG. F. THE ENERGY WHEEL SHALL MODULATE WITH SPEED AS HIGH AS POSSIBLE BUT LIMITED TO PREVENT THE LEAVING EXHAUST AIR TEMPERATURE FROM FALLING BELOW 35 DEG. F. (ADJ) TO

START-UP CONTROL: UPON START UP OF THE SYSTEM, THE CLOSED HEATING AND COOLING VALVES SHALL GRADUALLY OPEN APPROPRIATELY AS THE SYSTEM FAN SPEED RAMPS UP TO CONTROL SET POINT. START UP PARAMETERS SHALL BE SET TO MINIMIZE OVERSHOOT AND UNDERSHOOT.

FIRE PROTECTION: A SIGNAL FROM THE FIRE ALARM SYSTEM SHALL SHUT DOWN THE SUPPLY AND EXHAUST FANS, STOP THE ENERGY WHEEL, AND CLOSE THE OUTDOOR AND EXHAUST AIR DAMPERS. SMOKE DETECTORS MUST BE MANUALLY RESET.

HIGH DUCT STATIC PRESSURE: THESE SWITCHES SHALL STOP THE SUPPLY AND EXHAUST FANS, STOP THE ENERGY WHEEL, AND CLOSE THE OUTDOOR AND EXHAUST AIR DAMPERS UPON SENSING EXCESSIVE DUCT STATIC PRESSURE. STATIC PRESSURE SWITCHES MUST BE MANUALLY RESET.

LOW TEMPERATURE LIMITS: THESE SWITCHES SHALL STOP THE SUPPLY AND EXHAUST FANS, STOP THE ENERGY WHEEL, OPEN BOTH THE HEATING AND CHILL WATER CONTROL VALVES, AND CLOSE THE OUTDOOR AND EXHAUST AIR DAMPERS UPON SENSING A TEMPERATURE BELOW ITS LOCAL SETTING. THESE SWITCHES MUST BE MANUALLY RESET.

ALARM MONITORING: AN ALARM SHALL BE GENERATED AT THE DDC CONTROL PANEL IF ANY OF THE FOLLOWING OCCUR: (1) ENERGY WHEEL FAILURE, (2) SUPPLY FAN FAILURE TO START, (3) EXHAUST FAN FAILURE TO START, (4) EXCESSIVE FILTER PRESSURE DROP, AND (5) VFD FAULT.

MOISTURE DETECTOR TRIP: UPON ACTIVATION OF THE MOISTURE DETECTION SENSOR AN ALARM WILL BE GENERATED AND SENT TO THE EMS. THE UNIT SHALL BE SHUT DOWN, THE OUTSIDE AIR ACTUATOR SHALL BE COMMANDED CLOSED, AND ALL CONTROL VALVES WILL BE COMMANDED CLOSED.

GENERAL NOTE: THESE STANDARD SYSTEM DIAGRAMS AND SEQUENCES ARE DEVELOPED AS THE BASIS FOR DESIGN AND MAY NOT BE DIRECTLY APPLICABLE AS IS DUE TO EXISTING EQUIPMENT OR SYSTEM CAPABILITIES, OR DUE TO SYSTEM OR EQUIPMENT ARRANGEMENTS. IT IS THE RESPONSIBILITY OF THE ENGINEER OF RECORD TO MODIFY THESE DOCUMENTS AS REQUIRED FOR THE SPECIFIC CONDITIONS OF A PROJECT. REFER TO THE RFP DOCUMENTS FOR MODIFICATION PROCEDURES.

Engineering 2039 NORTH GREEN ACRES

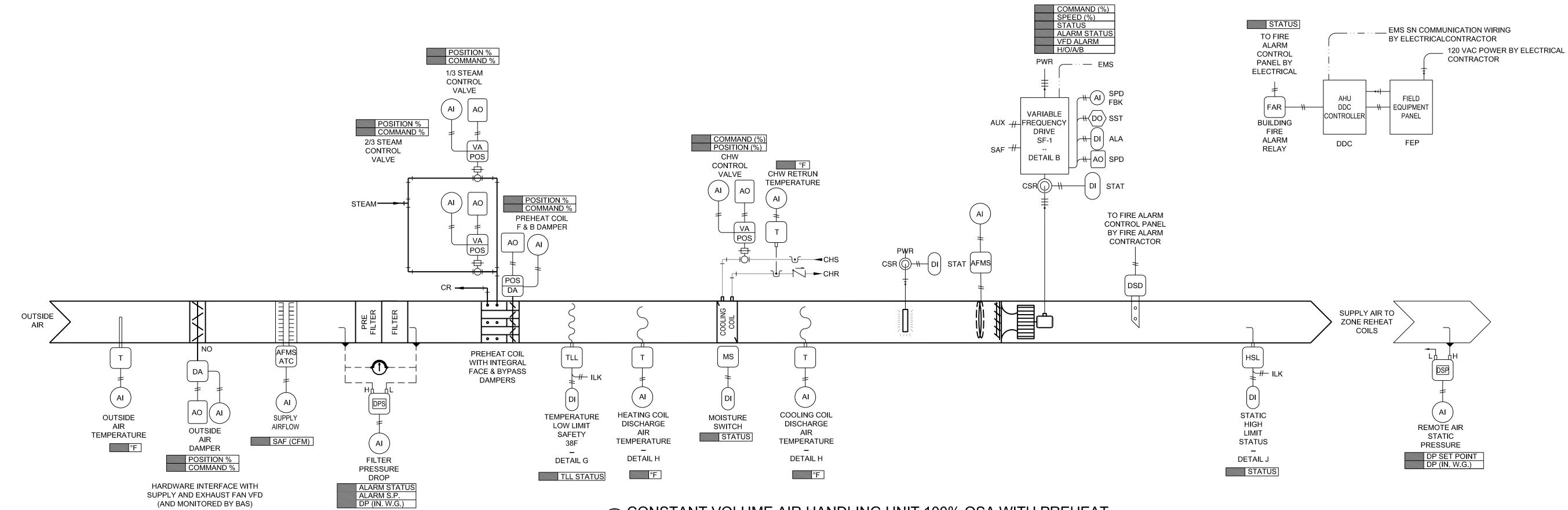
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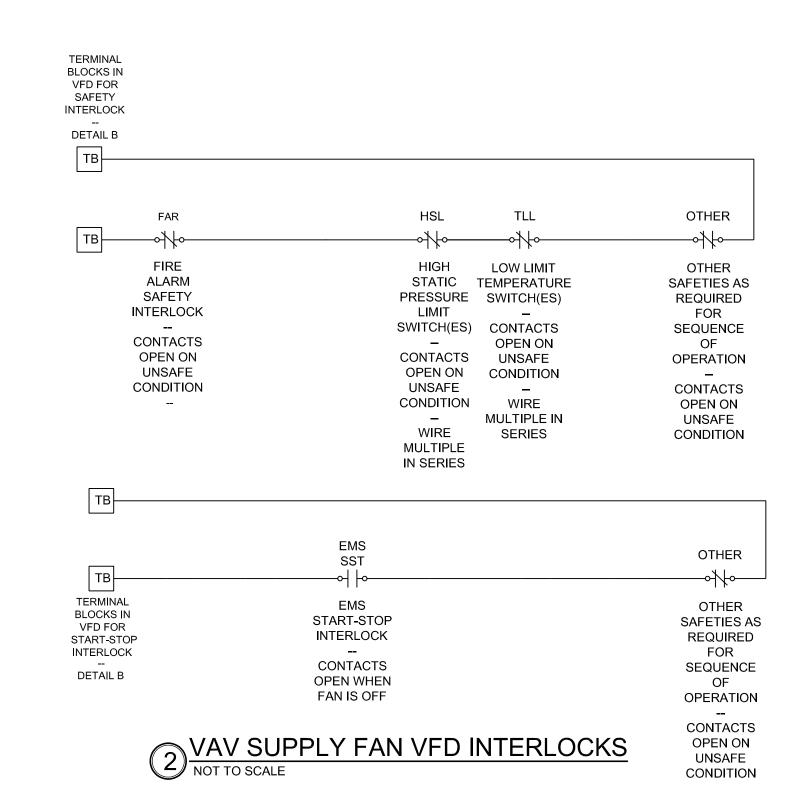
MARK DATE DESCRIPTION **ISSUE DATE:** 03/20/19

ROJECT NUMBER: 04-18-0072 SHEET TITLE:

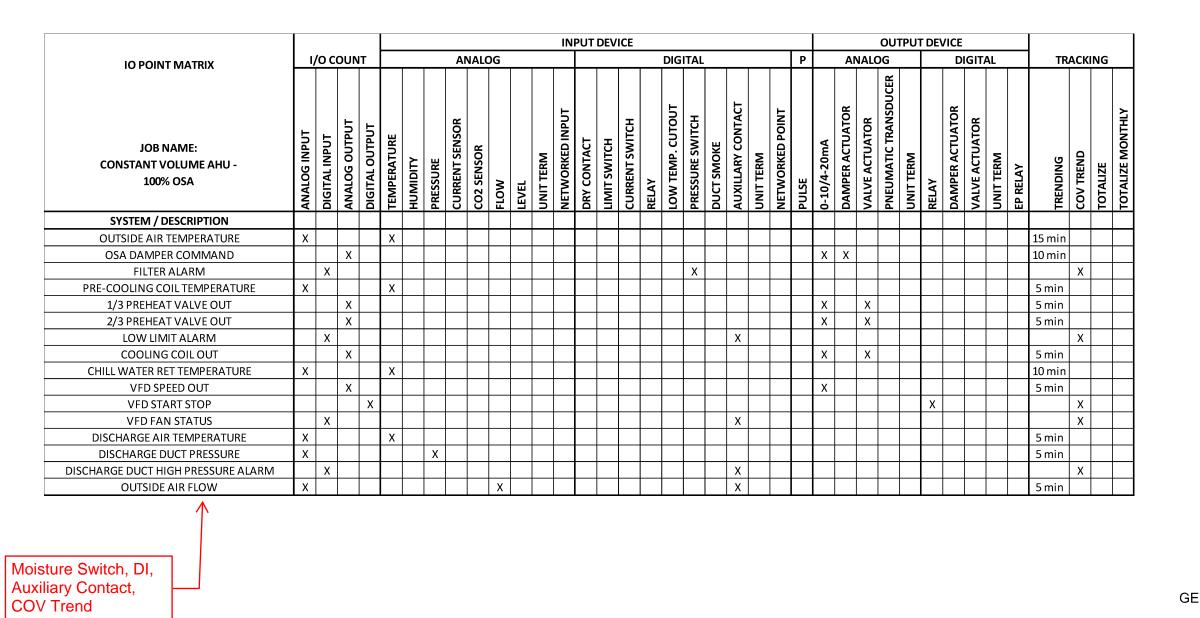
ENERGY RECOVERY AIR HANDLING UNIT



CONSTANT VOLUME AIR HANDLING UNIT 100% OSA WITH PREHEAT [AHU-OSA]



(AND MONITORED BY BAS)



SEQUENCE OF OPERATION:

SUPPLY FAN: THE SUPPLY FAN SHALL BE STARTED AND STOPPED BY THE PUSH BUTTON SWITCH AT THE FAN VARIABLE FREQUENCY DRIVE. WHEN THE SWITCH IS IN THE LOCAL POSITION, THE FAN SHALL BE STARTED AND STOPPED LOCALLY AT THE VFD. WHEN THE SWITCH IS IN THE AUTO POSITION, THE FAN SHALL BE STARTED AND STOPPED BY THE DDC CONTROLLER BASED UPON A WEEKLY SCHEDULE, OPERATOR COMMAND, OR WHEN ANY OF THE ASSOCIATED VAV BOXES ARE IN OCCUPIED OR TEMPORARY OVERRIDE. HOWEVER, THE SUPPLY FAN SHALL NOT BE STARTED UNTIL THE OUTDOOR AIR DAMPER IS PROVEN OPEN BY END SWITCH. THE SUPPLY FAN SHALL BE AUTOMATICALLY STOPPED BY THE FIRE ALARM SYSEM, LOW LIMIT SWITCH, OR SUPPLY AIR HIGH STATIC PRESSURE ALARM WHENEVER AN UNSAFE CONDITION OCCURS. STATUS OF THE SUPPLY FAN SHALL BE MONITORED BY THE DDC CONTROLLER. THE SPEED OF THE SUPPLY FAN SHALL BE MODULATED TO MAINTAIN THE DUCT STATIC PRESSURE AT SET POINT (1.0"WC ADJUSTABLE). THE OUTDOOR AIR FLOW MEASUREMENT SHALL BE MONITORED ONLY.

CHILL WATER CONTROL VALVES: WHEN THE FAN IS IN OPERATION, THE CHILL WATER CONTROL VALVES SHALL MODULATE AS REQUIRED TO MAINTAIN THE DISCHARGE AIR TEMPERATURE SETPOINT. THE CHILL WATER VALVES SHALL CLOSE WHEN THE SUPPLY FAN IS NOT IN OPERATION. IF THE LOW LIMIT TRIPS, THE CHILL WATER VALVES SHALL OPEN FULLY TO FLOW THROUGH THE COIL.

HEATING CONTROL: WHEN THE FAN IS IN OPERATION, THE FACE AND BYPASS DAMPERS AND STEAM COIL VALVES SHALL MODULATE AT OUTDOOR TEMPERATURES ABOVE 40 DEG. F. TO MAINTAIN DISCHARGE TEMPERATURE SETPOINT. WHEN OUTDOOR TEMPERATURES ARE BELOW 40 DEG. F., THE STEAM COIL VALVE SHALL BE AT 100%, THE FACE DAMPER SHALL BE FULL OPEN, AND THE BYPASS DAMPER SHALL MODULATE TO MAINTAIN DISCHARGE TEMPERATURE

OUTSIDE AIR DAMPER: WHEN THE SUPPLY FAN IS IN OPERATION, THE OUTSIDE, DAMPER SHALL OPEN. DAMPER SHALL CLOSE WHEN FAN IS OFF.

MOISTURE DETECTOR TRIP: UPON ACTIVATION OF THE MOISTURE DETECTION SENSOR AN ALARM WILL BE GENERATED AND SENT TO THE EMS. THE UNIT SHALL BE SHUT DOWN, THE OUTSIDE AIR ACTUATOR SHALL BE COMMANDED CLOSED, AND ALL CONTROL VALVES WILL BE COMMANDED CLOSED.

GENERAL NOTES:

- 1. CONTROL VALVES, FLOW METERS, THERMOWELLS, AND TAPS ARE PROVIDED BY DIVISION 230900 AND INSTALLED BY DIVISION 23 IN LOCATIONS INDICATED BY THE CONTROL DIAGRAMS AND AS SPECIFIED. 2. ALL CONTROLLERS, ACTUATORS, SENSORS, SWITCHES, TUBING, AND POINTS INDICATED ON THE PLANS ARE PROVIDED AND INSTALLED BY DIVISION 230900, UNLESS NOTED OTHERWISE. CONTROL VALVES AND
- PROVIDED BY DIVISION 230900, INSTALLED BY DIVISION 26. 3. ALL POINTS INDICATED ON THE CONTROL DRAWINGS ARE NEW, PROVIDED BY DIVISION 230900, UNLESS

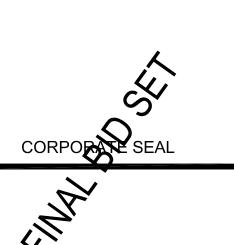
THERMOWELLS ARE PROVIDED BY DIVISION 230900, INSTALLED BY DIVISION 23. TRANSFORMERS ARE

- INDICATED OTHERWISE. 4. A SINGLE TRANSFORMER CAN BE PROVIDED FOR UP TO 10 CONTROLLERS PROVIDED LENGTH OF RUNS AND ZONING IS TAKEN INTO CONSIDERATION.
- 5. ATC CONTRACTOR SHALL TUNE ALL LOOPS AND TABLES FOR SMOOTH, STABLE OPERATION. NUMBERS INDICATED IN THESE DIAGRAMS ARE FOR A STARTING POINT ONLY. THESE DIAGRAMS REPRESENT THE BASIC FUNCTION OF THE CONTROLS SEQUENCE AND IS NOT ALL INCLUSIVE. THE ATC CONTRACTOR IS STILL REQUIRED TO PROVIDE, DEFINE, AND INDICATE ALL ALARMS, SET POINTS, AND FUNCTIONS REQUIRE TO ACHIEVE THE INTENT OF THE SEQUENCE, AND MAINTAINED ALL EQUIPMENT MANUFACTURER REQUIREMENTS.
- 6. EQUIPMENT PROVIDED WITH CONTROLLERS (BOILERS, VARIABLE FREQUENCY DRIVES, ETC) SHALL COMMUNICATE DIRECTLY WITH THE BAS. ALL REQUIRED GATEWAYS AND ROUTERS SHALL BE PROVIDED WITH EQUIPMENT WHERE AVAILABLE,. ALL AVAILABLE POINTS SHALL BE OBTAINED FROM THE EQUIPMENT CONTROLLER AND THE BAS SHALL PROVIDE SET POINTS, COMMANDS, ETC, TO THE EQUIPMENT PER THE SEQUENCE OF OPERATIONS.
- EQUIPMENT SHALL HAVE DEDICATED GRAPHICS PER SPECIFICATIONS. ALL COMMUNICATED POINTS SHALL BE AVAILABLE IN A LIST FORMAT WITH COMPLETE DESCRIPTIONS OF THE POINT, INCLUDING ALARMS. THE OPERATOR SHALL NOT HAVE TO REFER TO DOCUMENTATION TO DETERMINE WHAT THE
- 8. VARIABLE FREQUENCY DRIVES SHALL INDICATE HAND, OFF, AUTO, AND BYPASS STATUS. 9. CONTROL VALVES SHALL BE SELECTED WITH PROPER AUTHORITY FOR THEIR GIVEN APPLICATION. 10. ATC CONTRACTOR SHALL MEET ALL REQUIREMENTS OF THE EQUIPMENT MANUFACTURER. 11. IF EQUIPMENT (BOILERS, PUMPS, ETC.) IS DISABLED DUE TO MAINTENANCE SHUTDOWN OR A FAULT CONDITION, THE LEAD, LAG, LAG#1, ... STATUS OF THE REMAINING EQUIPMENT SHALL MOVE UP IN THE STAGING QUEUE AUTOMATICALLY. STAGING BASED ON RUN TIME. THE COMPONENT SHALL BE HIGHLIGHTED, OUTLINED, FLASH, OR CHANGE COLORS.
- 12. THIS DIAGRAM, GRAPHICAL SEQUENCE, THE SCHEDULES, AND TABLES (ALARMS, SET POINTS, MODES OF OPERATION, ETC), SHALL BE REPRESENTED AS A GRAPHIC ON THE BAS, INCLUDING THE RESULTS OF AS-BUILT PROGRAMMING. THE GRAPHIC IS TO BE POPULATED WITH LIVE VALUES. SET POINTS SHALL BE ADJUSTABLE FROM THIS GRAPHIC AND LINKS SHALL BE PROVIDED TO TRENDING GROUPS. 13. THE SCHEDULES AND TABLES INDICATED ON THIS SHEET (ALARMS, SET POINTS, MODES OF OPERATION,
- ETC) SHALL BE PROVIDED AS GRAPHICS, EDITABLE FROM THE GRAPHICS. 14. ALL POINTS ARE TO BE TRENDED AT 15 MINUTE INTERVALS AND BACKED UP AS SPECIFIED. 15. TRENDING GROUPS ARE IDENTIFIED ON THE SEQUENCE BY HEX NOTES. CONTRACTOR SHALL SET UP A TREND GROUP GRAPHIC FOR THE HEX NOTE DESIGNATIONS LISTED. EACH TREND GROUP SHALL CONTAIN ALL OF THE TRENDS WITH LIKE HEX NOTES. TREND GROUPS SHALL BE TRENDED AT A MINIMUM
- OF 30 SECOND INTERVALS FOR A DURATION OF 48 HOURS. 19. COORDINATE AIR FLOW MEASURING STATION LOCATION WITH SITE CONDITIONS AND MANUFACTURER'S REQUIREMENTS / RECOMMENDATIONS.

GENERAL NOTE: THESE STANDARD SYSTEM DIAGRAMS AND SEQUENCES ARE DEVELOPED AS THE BASIS FOR DESIGN AND MAY NOT BE DIRECTLY APPLICABLE AS IS DUE TO EXISTING EQUIPMENT OR SYSTEM CAPABILITIES, OR DUE TO SYSTEM OR EQUIPMENT ARRANGEMENTS. IT IS THE RESPONSIBILITY OF THE ENGINEER OF RECORD TO MODIFY THESE DOCUMENTS AS REQUIRED FOR THE SPECIFIC CONDITIONS OF A PROJECT. REFER TO THE RFP DOCUMENTS FOR MODIFICATION PROCEDURES.

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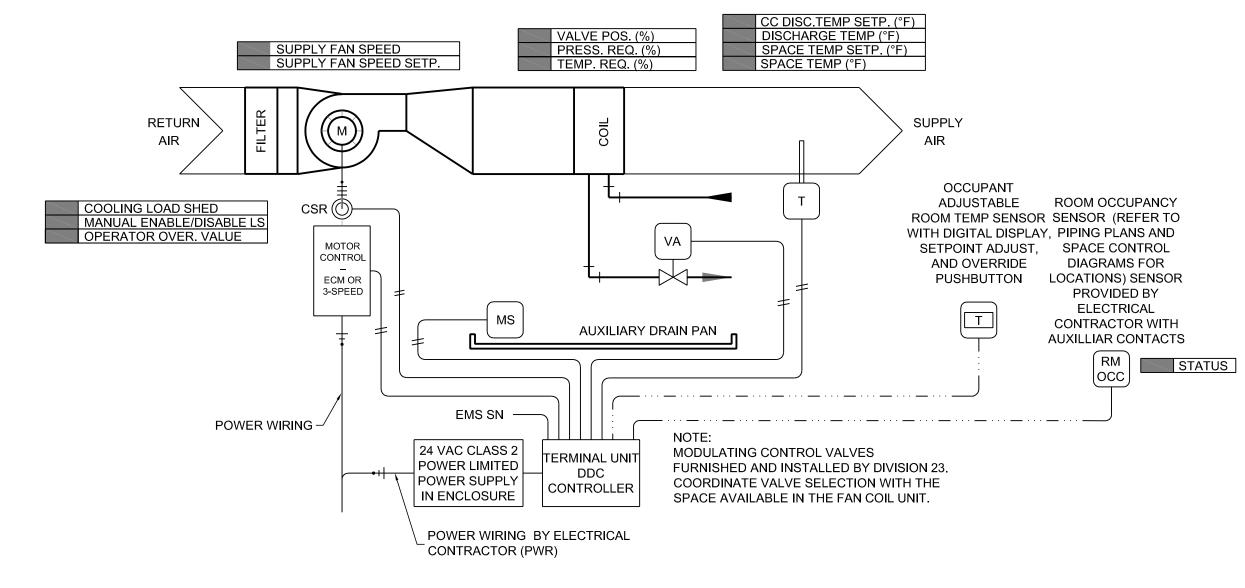


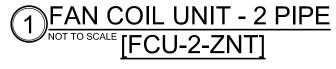
ENGINEER SEAL

MARK DATE DESCRIPTION **ISSUE DATE:** 03/20/19 ROJECT NUMBER: 04-18-0072

> SHEET TITLE: CONSTANT VOLUME AIR HANDLING UNIT 100% OSA WITH PREHEAT

- 1. IF COMPONENT IS DISABLED DUE TO MAINTENANCE SHUTDOWN OR A FAULT CONDITION,
- COMPONENT SHALL BE HIGHLIGHTED, OUTLINED, FLASH, OR CHANGE COLORS. 2. THIS GRAPHIC SHALL BE REPRESENTED ON THE BAS, INCLUDING THE RESULTS OF AS-BUILT CONDITIONS. THE GRAPHIC IS TO BE POPULATED WITH LIVE VALUES. SET POINTS SHALL BE
- ADJUSTABLE FROM THIS GRAPHIC AND LINKS SHALL BE PROVIDED TO TRENDING GROUPS. 3. IF MULTIPLE UNITS SERVE THE SAME AREA, ONE OF THE CONTROLLERS WILL BE DESIGNATED AS THE MASTER CONTROLLER AND ALL OTHER CONTROLLERS WILL BE DESIGNATED AS SLAVE CONTROLLERS. VALVE ACTUATORS OF THE SLAVE CONTROLLERS WILL TRACK THOSE OF THE MASTER TERMINAL. 4. ALL CONTROLLERS, ACTUATORS, SENSORS, SWITCHES, TUBING, AND POINTS INDICATED ON THE
- PLANS ARE PROVIDED AND INSTALLED BY DIVISION 230900, UNLESS NOTED OTHERWISE. 5. ALL POINTS AND COMPONENTS INDICATED ON THE CONTROL DRAWINGS ARE NEW, PROVIDED BY DIVISION 230900, UNLESS INDICATED OTHERWISE.
- 6. CONTROL VALVES SHALL BE SELECTED WITH PROPER AUTHORITY FOR THEIR GIVEN APPLICATION, PROVIDED BY DIVISION 230900, INSTALLED BY DIVISION 23. 8. A SINGLE TRANSFORMER CAN BE PROVIDED FOR UP TO 10 CONTROLLERS PROVIDED LENGTH OF RUNS AND ZONING IS TAKEN INTO CONSIDERATION.
- 9. CONTROL WIRING BY DIVISION 230900. 10. REFER TO MECHANICAL SHEETS FOR PIPE AND DUCT SIZES.
- 11. POWER WIRING BY DIVISION 26.
- 12. THIS GRAPHICAL SEQUENCE SHALL BE REPRESENTED AS A GRAPHIC ON THE BAS, INCLUDING THE RESULTS OF AS-BUILT PROGRAMMING. THE GRAPHIC IS TO BE POPULATED WITH LIVE VALUES. SET POINTS SHALL BE ADJUSTABLE FROM THIS GRAPHIC AND LINKS SHALL BE PROVIDED TO TRENDING
- 13. THE SCHEDULES AND TABLES INDICATED ON THIS SHEET (ALARMS, SET POINTS, MODES OF OPERATION, ETC) SHALL BE PROVIDED AS GRAPHICS.
- 14. ALL POINTS ARE TO BE TRENDED AT 15 MINUTE INTERVALS AND BACKED UP AS SPECIFIED. 15. TRENDING GROUPS ARE IDENTIFIED ON THE SEQUENCE BY HEX NOTES. CONTRACTOR SHALL SET UP A TREND GROUP GRAPHIC FOR THE HEX NOTE DESIGNATIONS LISTED. EACH TREND GROUP SHALL CONTAIN ALL OF THE TRENDS WITH LIKE HEX NOTES. TREND GROUPS SHALL BE TRENDED AT A MINIMUM OF 30 SECOND INTERVALS FOR A DURATION OF 48 HOURS.
- 16. ATC CONTRACTOR SHALL TUNE ALL LOOPS AND TABLES FOR SMOOTH, STABLE OPERATION. NUMBERS INDICATED IN THESE DIAGRAMS ARE FOR A STARTING POINT ONLY. THESE DIAGRAMS REPRESENT THE BASIC FUNCTION OF THE CONTROLS SEQUENCE AND IS NOT ALL INCLUSIVE. THE ATC CONTRACTOR IS STILL REQUIRED TO PROVIDE, DEFINE, AND INDICATE ALL ALARMS, SET POINTS, AND FUNCTIONS REQUIRE TO ACHIEVE THE INTENT OF THE SEQUENCE, AND MAINTAINED ALL EQUIPMENT MANUFACTURER REQUIREMENTS...
- 17. REFER TO MECHANICAL SHEETS AND SCHEDULES FOR FINAL COUNTS AND LOCATIONS. CONTROL DIAGRAM AND SEQUENCE TYPICAL OF: FCD-1-4 (EMERGENCY ELECTRICAL ROOM), FCD-1-6 (FIRE COMMAND), FCD-2-1 (ELEVATOR MACHINE ROOM), FCD-5-2 (MECHANICAL ROOM, D&T LEVEL 5), AND FCD-5-3 (ELEVATOR MACHINE ROOM, D&T LEVEL 5). CONTRACTOR TO VERIFY FINAL QUANTITIES WITH MECHANICAL SCHEDULES AND PLANS.





SEQUENCE OF OPERATION:

FAN COIL UNIT: FAN OPERATION SHALL BE ENABLED/DISABLED THROUGH DDC CONTROL PANEL. FAN SHALL OPERATE THROUGH MANUFACTURER'S ECM CONTROLLER.

COOLING MODE: MODULATE THE CONTROL VALVE AS REQUIRED TO MAINTAIN A DISCHARGE TEMPERATURE SET POINT OF 55 DEG. F WHEN THE UNIT IS CALLING FOR COOLING. THE FAN SPEED SHALL BE MODULATED FROM MINIMUM FAN SPEED SET POINT TO MAXIMUM FAN SPEED SET POINT TO MAINTAIN THE SPACE TEMPERATURE AT SET POINT (ADJUSTABLE).

HEATING MODE: MODULATE THE CONTROL VALVE AS REQUIRED TO MAINTAIN THE SPACE TEMPERATURE SET POINT. WHEN THE VALVE IS FULLY OPEN, MODULATE THE FAN SPEED FROM MINIMUM FAN SPEED SET POINT TO MAXIMUM FAN SPEED SET POINT TO MAINTAIN THE SPACE TEMPERATURE AT SET POINT (ADJUSTABLE). FAN SPEED SHALL BE INCREASED UP TO MAXIMUM SPEED TO LIMIT THE DISCHARGE TEMPERATURE FROM EXCEEDING 15 DEG. F ABOVE THE RETURN TEMPERATURE

SUMMER/WINTER OPERATION SHALL MATCH THE SYSTEM MODE.

MODES OF OPERATION: FAN COIL MODE OF OPERATION IS EITHER "OCCUPIED", "STANDBY", OR "UNOCCUPIED": OCCUPIED AND UNOCCUPIED MODES ARE DETERMINED BASED ON A CALENDAR AND TIME OF DAY SCHEDULE. STANDBY MODE IS DETERMINED DURING THE OCCUPIED MODE WITH INPUT FROM OCCUPANCY SENSOR. UNOCCUPIED MODE CAN BE OVERRIDDEN TO OCCUPIED MODE BY EITHER BUTTON AT THERMOSTAT FOR 2 HOURS (ADJUSTABLE) OR BY OCCUPANCY SENSOR.

OCCUPIED MODE: DURING THE "OCCUPIED" MODE OF OPERATION, THE SET POINT SHALL BE ADJUSTED THROUGH THE DDC CONTROL PANEL BETWEEN A MINIMUM OF 71 DEG. F AND MAXIMUM OF 75 DEG. F. THERE SHALL BE A 1 DEG. F. DEAD BAND ON EITHER SIDE OF THE SETPOINT.

STANDBY MODE: WHEN A SPACE MOTION DETECTOR IS PRESENT AND SENSES OCCUPANCY, MODE OF OPERATION SHALL BE "OCCUPIED." IF SENSOR DOES NOT SENSE OCCUPANCY, THEN SPACE WILL BE IN STANDBY MODE. DURING THE "STANDBY" MODE OF OPERATION, THE SET POINT SHALL BE ADJUSTED THROUGH THE DDC CONTROL PANEL BETWEEN A MINIMUM OF 71 DEG. F AND MAXIMUM OF 75 DEG. F. THERE SHALL BE A 3 DEG. F. DEAD BAND ON EITHER SIDE OF THE SETPOINT.

UNOCCUPIED MODE: DURING THE "UNOCCUPIED" MODE OF OPERATION, THE SET POINT SHALL BE ADJUSTED THROUGH THE DDC CONTROL PANEL BETWEEN A MINIMUM OF 71 DEG. F AND MAXIMUM OF 75 DEG. F. THERE SHALL BE A 6 DEG. F. DEAD BAND ON EITHER SIDE OF THE SETPOINT.

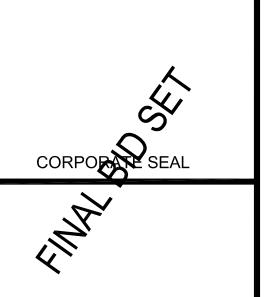
MOISTURE DETECTOR TRIP: UPON ACTIVATION OF THE MOISTURE DETECTION SENSOR AN ALARM WILL BE GENERATED AND SENT TO THE EMS. THE UNIT SHALL BE SHUT DOWN, AND CONTROL VALVE(S) WILL BE COMMANDED CLOSED.

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JOB NAME: FAN COIL UNIT - 2 PIPE	ANALOG INPUT	DIGITAL INPUT	ANALOG OUTPUT	DIGITAL OUTPUT	TEMPERATURE	HUMIDITY	PRESSURE CHRRENT SENSOR		FLOW	LEVEL	UNIT TERM	NETWORKED INPUT	DRY CONTACT	LIMIT SWITCH	CURRENT SWITCH	RELAY LOW TEMP. CUTOUT	PRESSURE SWITCH	DUCT SMOKE	AUXILLARY CONTA	UNIT TERM	NETWORKED POINT	PULSE		DAMPER ACTUATOR		MATIC	UNIT TERM		R AC	VALVE ACTUATOR	UNIT TERM	EP RELAY	TRENDING	COV TREND	TOTALIZE	TOTALIZE MONTHLY
SYSTEM / DESCRIPTION																																				
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GENERAL NOTE: THESE STANDARD SYSTEM DIAGRAMS AND SEQUENCES ARE DEVELOPED AS THE BASIS FOR DESIGN AND MAY NOT BE DIRECTLY APPLICABLE AS IS DUE TO EXISTING EQUIPMENT OR SYSTEM CAPABILITIES, OR DUE TO SYSTEM OR EQUIPMENT ARRANGEMENTS. IT IS THE RESPONSIBILITY OF THE ENGINEER OF RECORD TO MODIFY THESE DOCUMENTS AS REQUIRED FOR THE SPECIFIC CONDITIONS OF A PROJECT. REFER TO THE RFP DOCUMENTS FOR MODIFICATION PROCEDURES.



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ENGINEER SEAL

MARK DATE DESCRIPTION ISSUE DATE: PROJECT NUMBER: 04-18-0072

> **FAN COIL UNIT** - 2 PIPE

SHEET TITLE:

- POWER WIRING BY DIVISION 26.
 CONTROL WIRING BY DIVISION 230900.
- CONTROL WIKING BT DIVISION 230900.
 ALL CONTROLLERS, ACTUATORS, SENSORS, SWITCHES, TUBING, AND POINTS INDICATED ON THE PLANS ARE PROVIDED AND INSTALLED BY DIVISION 230900, UNLESS NOTED OTHERWISE. CONTROL VALVES AND THERMOWELLS ARE PROVIDED BY DIVISION 230900, INSTALLED BY DIVISION 23. TRANSFORMERS ARE PROVIDED BY DIVISION 230900, INSTALLED BY DIVISION 26.
- 4. ALL POINTS INDICATED ON THE CONTROL DRAWINGS ARE NEW, PROVIDED BY DIVISION 230900, UNLESS INDICATED OTHERWISE.
 5. A SINGLE TRANSFORMER CAN BE PROVIDED FOR UP TO 10 CONTROLLERS PROVIDED LENGTH OF RUNS AND ZONING IS TAKEN INTO CONSIDERATION
- REFER TO MECHANICAL SHEETS FOR FINAL COUNTS, LOCATIONS, PIPE SIZES, AND DUCT SIZES.
 IF MULTIPLE TERMINALS SERVE THE SAME AREA, ONE OF THE CONTROLLERS WILL BE DESIGNATED AS THE MASTER CONTROLLER AND ALL OTHER CONTROLLERS WILL BE DESIGNATED AS SLAVE CONTROLLERS. VALVE AND DAMPER ACTUATORS OF THE SLAVE CONTROLLERS WILL TRACK THOSE OF THE MASTER TERMINAL.
- 8. IF COMPONENT IS DISABLED DUE TO MAINTENANCE SHUTDOWN OR A FAULT CONDITION, COMPONENT SHALL BE HIGHLIGHTED, OUTLINED, FLASH, OR CHANGE COLORS.
 9. THIS GRAPHIC SHALL BE REPRESENTED ON THE BAS, INCLUDING THE RESULTS OF AS-BUILT CONDITIONS. THE GRAPHIC IS TO BE
- GROUPS.

 10. THIS GRAPHICAL SEQUENCE SHALL BE REPRESENTED AS A GRAPHIC ON THE BAS, INCLUDING THE RESULTS OF AS-BUILT PROGRAMMING.

 THE GRAPHIC IS TO BE POPULATED WITH LIVE VALUES. SET POINTS SHALL BE ADJUSTABLE FROM THIS GRAPHIC AND LINKS SHALL BE
 PROVIDED TO TRENDING GROUPS.

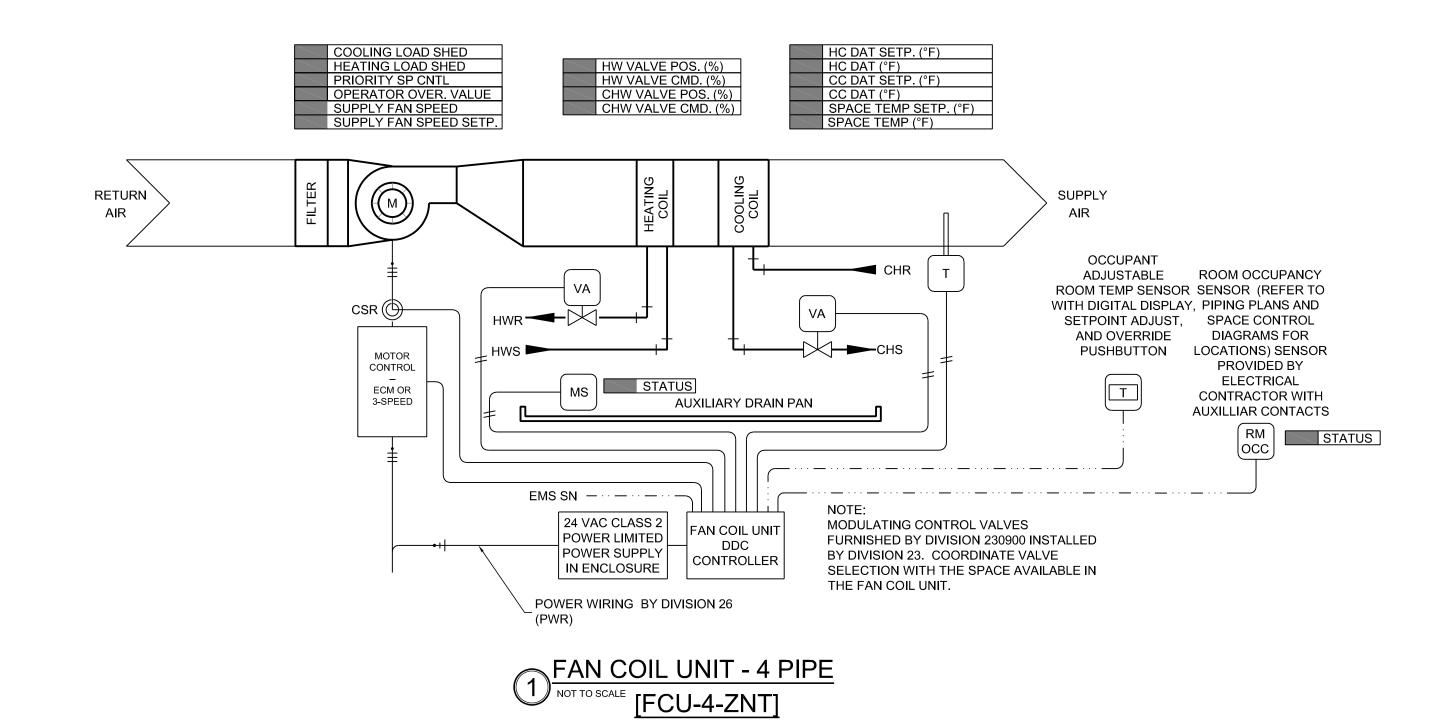
POPULATED WITH LIVE VALUES. SET POINTS SHALL BE ADJUSTABLE FROM THIS GRAPHIC AND LINKS SHALL BE PROVIDED TO TRENDING

THE SCHEDULES AND TABLES INDICATED ON THIS SHEET (ALARMS, SET POINTS, MODES OF OPERATION, ETC) SHALL BE PROVIDED AS GRAPHICS, EDITABLE FROM THE GRAPHICS.
 ALL POINTS ARE TO BE TRENDED AT 15 MINUTE INTERVALS AND BACKED UP AS SPECIFIED.
 TRENDING GROUPS ARE IDENTIFIED ON THE SEQUENCE BY HEX NOTES. CONTRACTOR SHALL SET UP A TREND GROUP GRAPHIC FOR THE

HEX NOTE DESIGNATIONS LISTED. EACH TREND GROUP SHALL CONTAIN ALL OF THE TRENDS WITH LIKE HEX NOTES. TREND GROUPS

SHALL BE TRENDED AT A MINIMUM OF 30 SECOND INTERVALS FOR A MINIMUM DURATION OF 48 HOURS.

14. ATC CONTRACTOR SHALL TUNE ALL LOOPS AND TABLES FOR SMOOTH, STABLE OPERATION. NUMBERS INDICATED IN THESE DIAGRAMS ARE FOR A STARTING POINT ONLY. THESE DIAGRAMS REPRESENT THE BASIC FUNCTION OF THE CONTROLS SEQUENCE AND IS NOT ALL INCLUSIVE. THE ATC CONTRACTOR IS STILL REQUIRED TO PROVIDE, DEFINE, AND INDICATE ALL ALARMS, SET POINTS, AND FUNCTIONS REQUIRE TO ACHIEVE THE INTENT OF THE SEQUENCE, AND MAINTAINED ALL EQUIPMENT MANUFACTURER REQUIREMENTS.



SEQUENCE OF OPERATION:

FAN OPERATION SHALL BE ENABLED/DISABLED THROUGH
DDC CONTROL PANEL. FAN SHALL OPERATE THROUGH MANUFACTURER'S ECM
CONTROLLER.
COOLING MODE: MODULATE THE CONTROL VALVE AS REQUIRED TO MAINTAIN A
DISCHARGE TEMPERATURE SET POINT OF 55 DEG. F WHEN THE UNIT IS CALLING
FOR COOLING. THE FAN SPEED SHALL BE MODULATED FROM MINIMUM FAN SPEED

SET POINT TO MAXIMUM FAN SPEED SET POINT TO MAINTAIN THE SPACE TEMPERATURE AT SET POINT (ADJUSTABLE).
HEATING MODE: MODULATE THE CONTROL VALVE AS REQUIRED TO MAINTAIN THE SPACE TEMPERATURE SET POINT. WHEN THE VALVE IS FULLY OPEN, MODULATE THE FAN SPEED FROM MINIMUM FAN SPEED SET POINT TO MAXIMUM FAN SPEED SET POINT TO MAINTAIN THE SPACE TEMPERATURE AT SET POINT (ADJUSTABLE). FAN SPEED SHALL BE INCREASED UP TO MAXIMUM SPEED TO LIMIT THE DISCHARGE TEMPERATURE FROM EXCEEDING 15 DEG. F ABOVE THE RETURN TEMPERATURE (ADJUSTABLE).

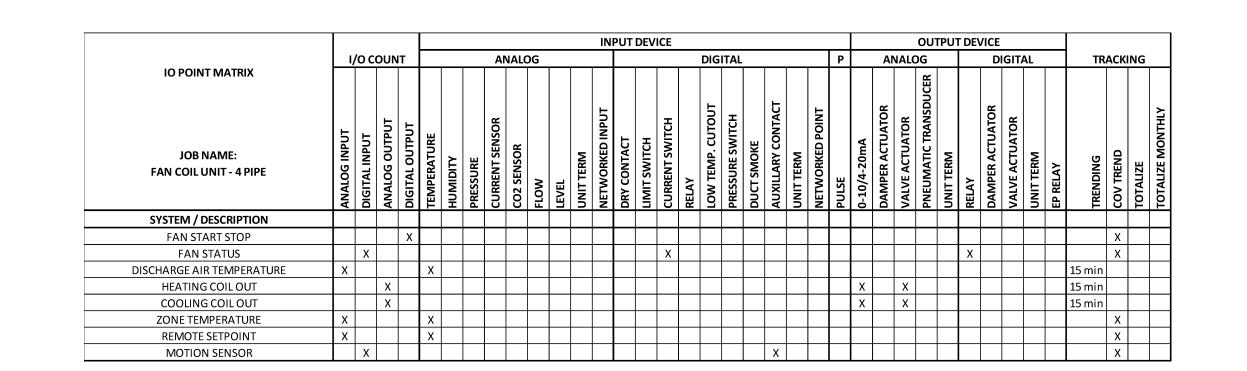
SUMMER/WINTER OPERATION SHALL BE INDEXED BY CALENDAR SCHEDULE. MODES OF OPERATION: FAN COIL MODE OF OPERATION IS EITHER "OCCUPIED", "STANDBY", OR "UNOCCUPIED": OCCUPIED AND UNOCCUPIED MODES ARE DETERMINED BASED ON A CALENDAR AND TIME OF DAY SCHEDULE. STANDBY MODE IS DETERMINED DURING THE OCCUPIED MODE WITH INPUT FROM OCCUPANCY SENSOR. UNOCCUPIED MODE CAN BE OVERRIDDEN TO OCCUPIED MODE BY EITHER BUTTON AT THERMOSTAT FOR 2 HOURS (ADJUSTABLE) OR BY OCCUPANCY SENSOR.

OCCUPIED MODE: DURING THE "OCCUPIED" MODE OF OPERATION, THE SET POINT SHALL BE ADJUSTED THROUGH THE DDC CONTROL PANEL BETWEEN A MINIMUM OF 71 DEG. F AND MAXIMUM OF 75 DEG. F. THERE SHALL BE A 1 DEG. F. DEAD BAND ON EITHER SIDE OF THE SETPOINT.

STANDBY MODE: WHEN A SPACE MOTION DETECTOR IS PRESENT AND SENSES OCCUPANCY, MODE OF OPERATION SHALL BE "OCCUPIED." IF SENSOR DOES NOT SENSE OCCUPANCY, THEN SPACE WILL BE IN STANDBY MODE. DURING THE "STANDBY" MODE OF OPERATION, THE SET POINT SHALL BE ADJUSTED THROUGH THE DDC CONTROL PANEL BETWEEN A MINIMUM OF 71 DEG. F AND MAXIMUM OF 75 DEG. F. THERE SHALL BE A 3 DEG. F. DEAD BAND ON EITHER SIDE OF THE SETPOINT.

UNOCCUPIED MODE: DURING THE "UNOCCUPIED" MODE OF OPERATION, THE SET POINT SHALL BE ADJUSTED THROUGH THE DDC CONTROL PANEL BETWEEN A MINIMUM OF 71 DEG. F AND MAXIMUM OF 75 DEG. F. THERE SHALL BE A 6 DEG. F. DEAD BAND ON EITHER SIDE OF THE SETPOINT.

MOISTURE DETECTOR TRIP: UPON ACTIVATION OF THE MOISTURE DETECTION SENSOR AN ALARM WILL BE GENERATED AND SENT TO THE EMS. THE UNIT SHALL BE SHUT DOWN, AND CONTROL VALVE(S) WILL BE COMMANDED CLOSED.

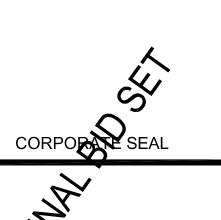


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ENGINEER SEAL

OL DRAWINGS

MARK DATE DESCRIPTION
ISSUE DATE: 03/20/19

SHEET TITLE: FAN COIL UNIT - 4 PIPE

04-18-0072

PROJECT NUMBER:

ATC5.01

- 1. POWER WIRING BY DIVISION 26.
- CONTROL WIRING BY DIVISION 230900.
 ALL CONTROLLERS, ACTUATORS, SENSORS, SWITCHES, TUBING, AND POINTS INDICATED ON THE PLANS ARE PROVIDED AND INSTALLED BY DIVISION 230900, UNLESS NOTED OTHERWISE. CONTROL VALVES AND THERMOWELLS ARE PROVIDED BY DIVISION 230900, INSTALLED BY DIVISION 23. TRANSFORMERS ARE PROVIDED BY DIVISION 230900, INSTALLED BY
- 4. ALL POINTS INDICATED ON THE CONTROL DRAWINGS ARE NEW, PROVIDED BY DIVISION 230900, UNLESS INDICATED OTHERWISE.
 5. A SINGLE TRANSFORMER CAN BE PROVIDED FOR UP TO 10 CONTROLLERS PROVIDED LENGTH OF RUNS AND ZONING IS
- TAKEN INTO CONSIDERATION.

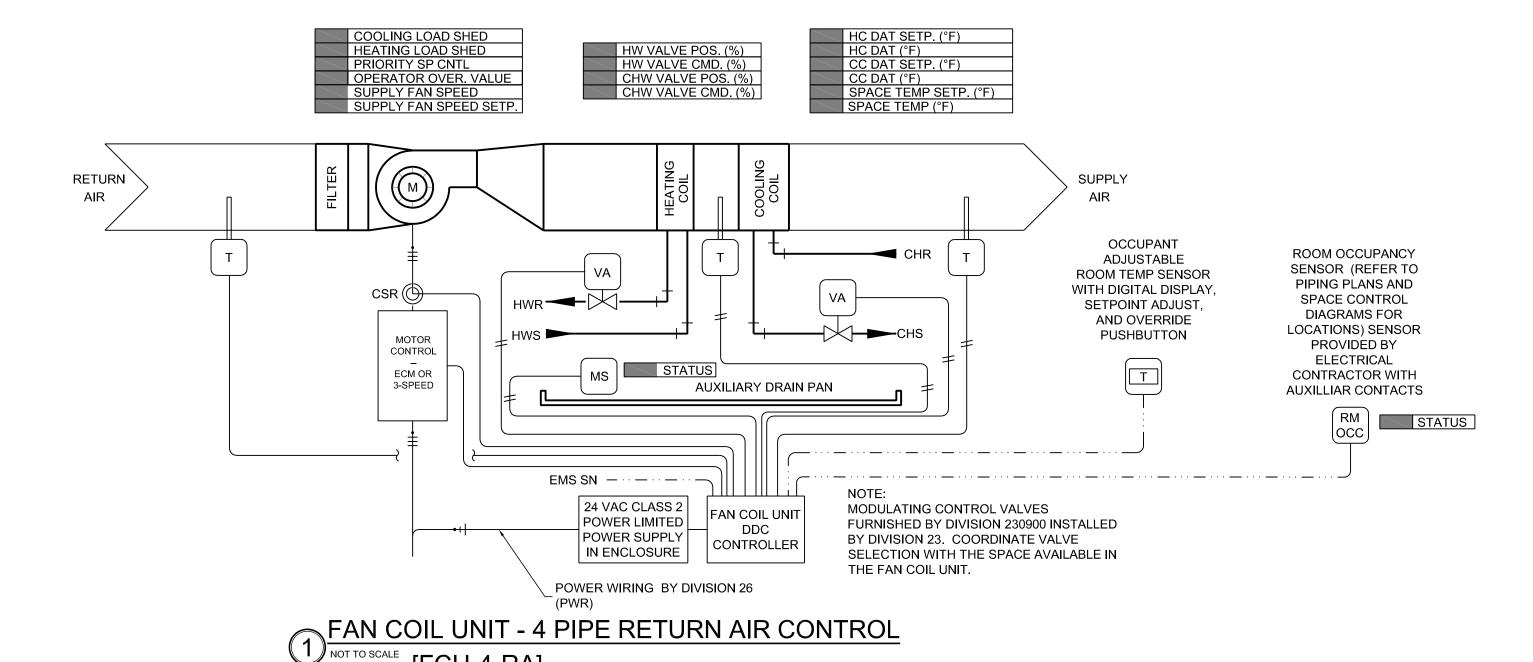
 6. REFER TO MECHANICAL SHEETS FOR FINAL COUNTS, LOCATIONS, PIPE SIZES, AND DUCT SIZES.

 7. IF MULTIPLE TERMINALS SERVE THE SAME AREA, ONE OF THE CONTROLLERS WILL BE DESIGNATED AS THE MASTER
- CONTROLLER AND ALL OTHER CONTROLLERS WILL BE DESIGNATED AS SLAVE CONTROLLERS. VALVE AND DAMPER ACTUATORS OF THE SLAVE CONTROLLERS WILL TRACK THOSE OF THE MASTER TERMINAL.

 8. IF COMPONENT IS DISABLED DUE TO MAINTENANCE SHUTDOWN OR A FAULT CONDITION, COMPONENT SHALL BE
- HIGHLIGHTED, OUTLINED, FLASH, OR CHANGE COLORS.

 9. THIS GRAPHIC SHALL BE REPRESENTED ON THE BAS, INCLUDING THE RESULTS OF AS-BUILT CONDITIONS. THE GRAPHIC IS TO BE POPULATED WITH LIVE VALUES. SET POINTS SHALL BE ADJUSTABLE FROM THIS GRAPHIC AND LINKS SHALL BE PROVIDED TO TRENDING GROUPS.
- 10. THIS GRAPHICAL SEQUENCE SHALL BE REPRESENTED AS A GRAPHIC ON THE BAS, INCLUDING THE RESULTS OF AS-BUILT PROGRAMMING. THE GRAPHIC IS TO BE POPULATED WITH LIVE VALUES. SET POINTS SHALL BE ADJUSTABLE FROM THIS CRAPHIC AND LINKS SHALL BE PROVIDED TO TRENDING CROUPS.
- GRAPHIC AND LINKS SHALL BE PROVIDED TO TRENDING GROUPS.

 11. THE SCHEDULES AND TABLES INDICATED ON THIS SHEET (ALARMS, SET POINTS, MODES OF OPERATION, ETC) SHALL BE PROVIDED AS GRAPHICS, EDITABLE FROM THE GRAPHICS.
- ALL POINTS ARE TO BE TRENDED AT 15 MINUTE INTERVALS AND BACKED UP AS SPECIFIED.
 TRENDING GROUPS ARE IDENTIFIED ON THE SEQUENCE BY HEX NOTES. CONTRACTOR SHALL SET UP A TREND GROUP GRAPHIC FOR THE HEX NOTE DESIGNATIONS LISTED. EACH TREND GROUP SHALL CONTAIN ALL OF THE TRENDS WITH LIKE HEX NOTES. TREND GROUPS SHALL BE TRENDED AT A MINIMUM OF 30 SECOND INTERVALS FOR A MINIMUM DURATION OF 48 HOURS.
- 14. ATC CONTRACTOR SHALL TUNE ALL LOOPS AND TABLES FOR SMOOTH, STABLE OPERATION. NUMBERS INDICATED IN THESE DIAGRAMS ARE FOR A STARTING POINT ONLY. THESE DIAGRAMS REPRESENT THE BASIC FUNCTION OF THE CONTROLS SEQUENCE AND IS NOT ALL INCLUSIVE. THE ATC CONTRACTOR IS STILL REQUIRED TO PROVIDE, DEFINE, AND INDICATE ALL ALARMS, SET POINTS, AND FUNCTIONS REQUIRE TO ACHIEVE THE INTENT OF THE SEQUENCE, AND MAINTAINED ALL EQUIPMENT MANUFACTURER REQUIREMENTS.



SEQUENCE OF OPERATION:

4-PIPE FAN COIL UNIT: FAN OPERATION SHALL BE ENABLED/DISABLED THROUGH DDC CONTROL PANEL.

COOLING MODE: MODULATE THE CONTROL VALVE AS REQUIRED TO MAINTAIN A DISCHARGE TEMPERATURE SET POINT OF 55 DEG. F WHEN THE UNIT IS CALLING FOR COOLING. THE FAN SPEED SHALL BE MODULATED FROM MINIMUM FAN SPEED SET POINT TO MAXIMUM FAN SPEED SET POINT TO MAINTAIN THE RETURN TEMPERATURE AT SET POINT (ADJUSTABLE).

HEATING MODE: MODULATE THE CONTROL VALVE AS REQUIRED TO MAINTAIN THE RETURN TEMPERATURE SET POINT. WHEN THE VALVE IS FULLY OPEN, MODULATE THE FAN SPEED FROM MINIMUM FAN SPEED SET POINT TO MAXIMUM FAN SPEED SET POINT TO MAXIMUM TEMPERATURE AT SET POINT (ADJUSTABLE). FAN SPEED SHALL BE INCREASED UP TO MAXIMUM SPEED TO LIMIT THE DISCHARGE TEMPERATURE FROM EXCEEDING 15 DEG. F ABOVE THE RETURN TEMPERATURE (ADJUSTABLE).

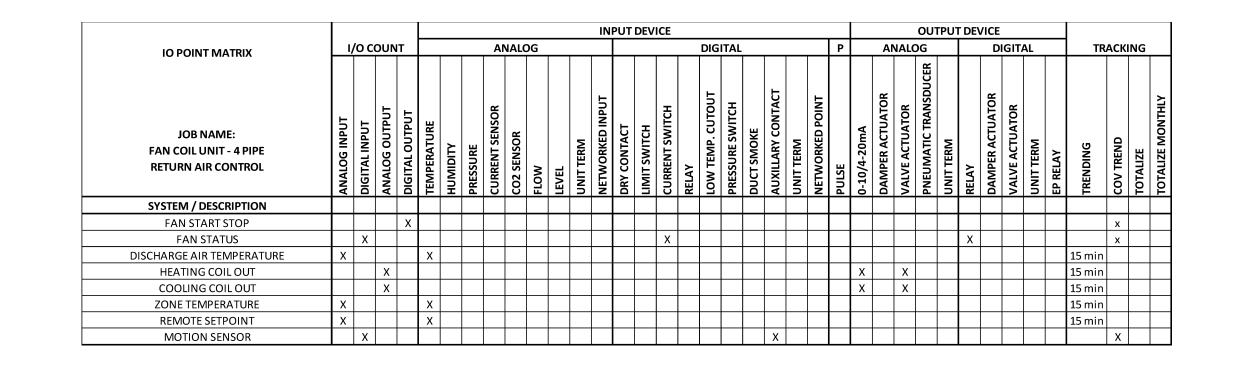
MODES OF OPERATION: FAN COIL MODE OF OPERATION IS EITHER "OCCUPIED", "STANDBY", OR "UNOCCUPIED": OCCUPIED AND UNOCCUPIED MODES ARE DETERMINED BASED ON A CALENDAR AND TIME OF DAY SCHEDULE. STANDBY MODE IS DETERMINED DURING THE OCCUPIED MODE WITH INPUT FROM OCCUPANCY SENSOR. UNOCCUPIED MODE CAN BE OVERRIDDEN TO OCCUPIED MODE BY EITHER BUTTON AT THERMOSTAT FOR 2 HOURS (ADJUSTABLE) OR BY OCCUPANCY

OCCUPIED MODE: DURING THE "OCCUPIED" MODE OF OPERATION, THE SET POINT SHALL BE ADJUSTED THROUGH THE DDC CONTROL PANEL BETWEEN A MINIMUM OF 71 DEG. F AND MAXIMUM OF 75 DEG. F. THERE SHALL BE A 1 DEG. F. DEAD BAND ON EITHER SIDE OF THE SETPOINT.

STANDBY MODE: WHEN A SPACE MOTION DETECTOR IS PRESENT AND SENSES OCCUPANCY, MODE OF OPERATION SHALL BE "OCCUPIED." IF SENSOR DOES NOT SENSE OCCUPANCY, THEN SPACE WILL BE IN STANDBY MODE. DURING THE "STANDBY" MODE OF OPERATION, THE SET POINT SHALL BE ADJUSTED THROUGH THE DDC CONTROL PANEL BETWEEN A MINIMUM OF 71 DEG. F AND MAXIMUM OF 75 DEG. F. THERE SHALL BE A 3 DEG. F. DEAD BAND ON EITHER SIDE OF THE

<u>UNOCCUPIED MODE:</u> DURING THE "UNOCCUPIED" MODE OF OPERATION, THE SET POINT SHALL BE ADJUSTED THROUGH THE DDC CONTROL PANEL BETWEEN A MINIMUM OF 71 DEG. F AND MAXIMUM OF 75 DEG. F. THERE SHALL BE A 6 DEG. F. DEAD BAND ON EITHER SIDE OF THE SETPOINT. ON A CALL FOR COOLING.

MOISTURE DETECTOR TRIP: UPON ACTIVATION OF THE MOISTURE DETECTION SENSOR AN ALARM WILL BE GENERATED AND SENT TO THE EMS. THE UNIT SHALL BE SHUT DOWN, AND CONTROL VALVE(S) WILL BE COMMANDED CLOSED.



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ENGINEER SEAL

DE ARKANSAS

UNIVERSITY OF ARI

MARK DATE DESCRIPTION
ISSUE DATE: 03/20/19

PROJECT NUMBER: 04-18-0072

SHEET TITLE:
FAN COIL UNIT
- 4 PIPE

SHEET NUMBER:

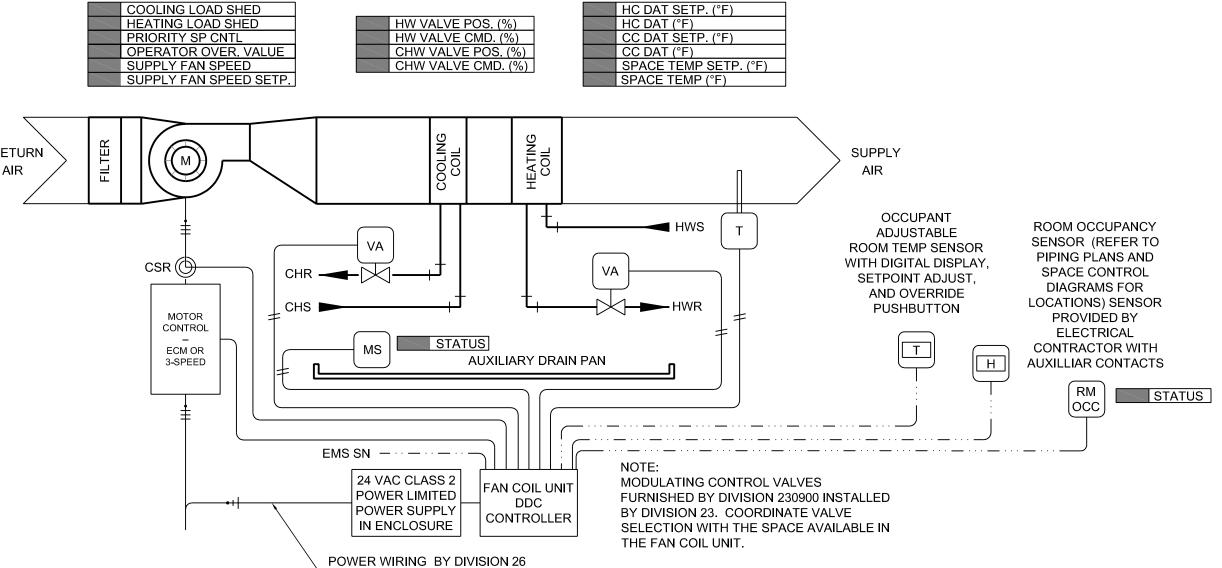
RETURN AIR CONTROL

- 1. POWER WIRING BY DIVISION 26.
- 2. CONTROL WIRING BY DIVISION 230900.
- 3. ALL CONTROLLERS, ACTUATORS, SENSORS, SWITCHES, TUBING, AND POINTS INDICATED ON THE PLANS ARE PROVIDED AND INSTALLED BY DIVISION 230900, UNLESS NOTED OTHERWISE. CONTROL VALVES AND THERMOWELLS ARE PROVIDED BY DIVISION 230900, INSTALLED BY DIVISION 23. TRANSFORMERS ARE PROVIDED BY DIVISION 230900, INSTALLED BY DIVISION 26.
- 4. ALL POINTS INDICATED ON THE CONTROL DRAWINGS ARE NEW, PROVIDED BY DIVISION 230900, UNLESS INDICATED OTHERWISE. 5. A SINGLE TRANSFORMER CAN BE PROVIDED FOR UP TO 10 CONTROLLERS PROVIDED LENGTH OF RUNS AND ZONING IS TAKEN INTO
- REFER TO MECHANICAL SHEETS FOR FINAL COUNTS, LOCATIONS, PIPE SIZES, AND DUCT SIZES.
- 7. IF MULTIPLE TERMINALS SERVE THE SAME AREA, ONE OF THE CONTROLLERS WILL BE DESIGNATED AS THE MASTER CONTROLLER AND ALL OTHER CONTROLLERS WILL BE DESIGNATED AS SLAVE CONTROLLERS. VALVE AND DAMPER ACTUATORS OF THE SLAVE CONTROLLERS WILL TRACK THOSE OF THE MASTER TERMINAL.
- 9. THIS GRAPHIC SHALL BE REPRESENTED ON THE BAS, INCLUDING THE RESULTS OF AS-BUILT CONDITIONS. THE GRAPHIC IS TO BE POPULATED WITH LIVE VALUES. SET POINTS SHALL BE ADJUSTABLE FROM THIS GRAPHIC AND LINKS SHALL BE PROVIDED TO TRENDING

8. IF COMPONENT IS DISABLED DUE TO MAINTENANCE SHUTDOWN OR A FAULT CONDITION, COMPONENT SHALL BE HIGHLIGHTED, OUTLINED,

- 10. THIS GRAPHICAL SEQUENCE SHALL BE REPRESENTED AS A GRAPHIC ON THE BAS, INCLUDING THE RESULTS OF AS-BUILT PROGRAMMING. THE GRAPHIC IS TO BE POPULATED WITH LIVE VALUES. SET POINTS SHALL BE ADJUSTABLE FROM THIS GRAPHIC AND LINKS SHALL BE
- PROVIDED TO TRENDING GROUPS. 11. THE SCHEDULES AND TABLES INDICATED ON THIS SHEET (ALARMS, SET POINTS, MODES OF OPERATION, ETC) SHALL BE PROVIDED AS GRAPHICS, EDITABLE FROM THE GRAPHICS.
- 12. ALL POINTS ARE TO BE TRENDED AT 15 MINUTE INTERVALS AND BACKED UP AS SPECIFIED. 13. TRENDING GROUPS ARE IDENTIFIED ON THE SEQUENCE BY HEX NOTES. CONTRACTOR SHALL SET UP A TREND GROUP GRAPHIC FOR THE HEX NOTE DESIGNATIONS LISTED. EACH TREND GROUP SHALL CONTAIN ALL OF THE TRENDS WITH LIKE HEX NOTES. TREND GROUPS
- SHALL BE TRENDED AT A MINIMUM OF 30 SECOND INTERVALS FOR A MINIMUM DURATION OF 48 HOURS. 14. ATC CONTRACTOR SHALL TUNE ALL LOOPS AND TABLES FOR SMOOTH, STABLE OPERATION, NUMBERS INDICATED IN THESE DIAGRAMS ARE FOR A STARTING POINT ONLY. THESE DIAGRAMS REPRESENT THE BASIC FUNCTION OF THE CONTROLS SEQUENCE AND IS NOT ALL INCLUSIVE. THE ATC CONTRACTOR IS STILL REQUIRED TO PROVIDE, DEFINE, AND INDICATE ALL ALARMS, SET POINTS, AND FUNCTIONS

REQUIRE TO ACHIEVE THE INTENT OF THE SEQUENCE, AND MAINTAINED ALL EQUIPMENT MANUFACTURER REQUIREMENTS.



FAN COIL UNIT- 3 SPEED WITH DEHUMIDIFICATION

SEQUENCE OF OPERATION:

COOLING MODE: WHEN THE SPACE SENSOR INCREASES TWO DEGREES ABOVE SET POINT, THE CONTROLLER SHALL BE COMMANDED TO THE COOLING MODE. MODULATE THE CONTROL VALVE AS REQUIRED TO MAINTAIN A DISCHARGE TEMPERATURE SET POINT OF 55 DEG. F WHEN THE UNIT IS CALLING FOR COOLING. THE FAN SPEED SHALL BE MODULATED FROM MINIMUM FAN SPEED SET POINT TO MAXIMUM FAN SPEED SET POINT TO MAINTAIN THE SPACE TEMPERATURE AT SET POINT (ADJUSTABLE). THE SUPPLY AIR TEMPERATURE SET POINT SHALL BE RESET FROM 65 DEG. F. TO 55 DEG. F. TO MAINTAIN THE SPACE HUMIDITY BELOW 55%. FAN SHALL OPERATE THROUGH MANUFACTURER'S ECM

HEATING MODE: WHEN THE SPACE SENSOR DECREASES TWO DEGREES BELOW SET POINT, THE CONTROLLER SHALL BE COMMANDED TO THE HEATING MODE, HEATING MODE: MODULATE THE CONTROL VALVE AS REQUIRED TO MAINTAIN THE RETURN TEMPERATURE SET POINT. WHEN THE VALVE IS FULLY OPEN, MODULATE THE FAN SPEED FROM MINIMUM FAN SPEED SET POINT TO MAXIMUM FAN SPEED SET POINT TO MAINTAIN THE RETURN TEMPERATURE AT SET POINT (ADJUSTABLE). FAN SPEED SHALL BE INCREASED UP TO MAXIMUM SPEED TO LIMIT THE DISCHARGE TEMPERATURE FROM EXCEEDING 15 DEG. F ABOVE THE RETURN TEMPERATURE (ADJUSTABLE). FAN SHALL OPERATE THROUGH MANUFACTURER'S ECM CONTROLLER.

MODES OF OPERATION: FAN COIL MODE OF OPERATION IS EITHER "OCCUPIED", "STANDBY", OR "UNOCCUPIED": OCCUPIED AND UNOCCUPIED MODES ARE DETERMINED BASED ON A CALENDAR AND TIME OF DAY SCHEDULE. STANDBY MODE IS DETERMINED DURING THE OCCUPIED MODE WITH INPUT FROM OCCUPANCY SENSOR. UNOCCUPIED MODE CAN BE OVERRIDDEN TO OCCUPIED MODE BY EITHER BUTTON AT THERMOSTAT FOR 2 HOURS (ADJUSTABLE) OR BY OCCUPANCY SENSOR.

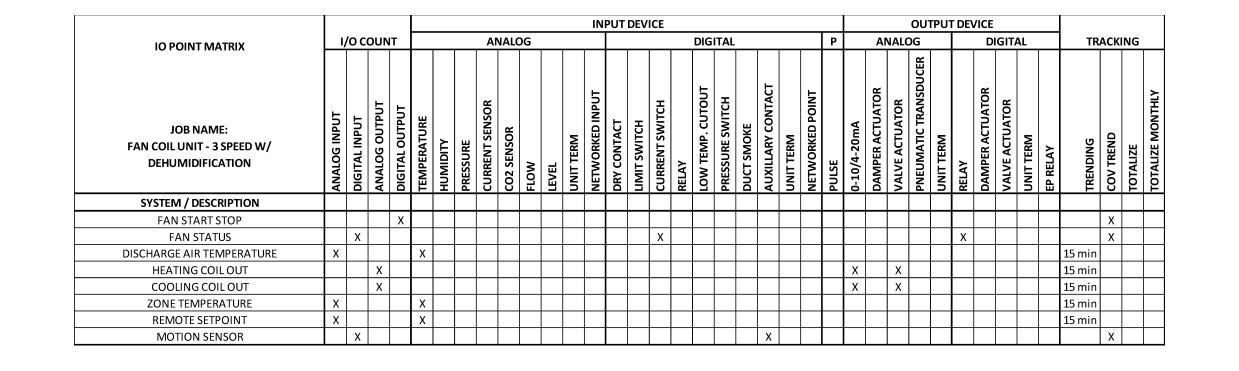
OCCUPIED MODE: DURING THE "OCCUPIED" MODE OF OPERATION, THE SET POINT SHALL BE ADJUSTED THROUGH THE DDC CONTROL PANEL BETWEEN A MINIMUM OF 71 DEG. F AND MAXIMUM OF 75 DEG. F. THERE SHALL BE A 1 DEG. F. DEAD BAND ON EITHER SIDE OF THE SETPOINT.

STANDBY MODE: WHEN A SPACE MOTION DETECTOR IS PRESENT AND SENSES OCCUPANCY, MODE OF OPERATION SHALL BE "OCCUPIED." IF SENSOR DOES NOT SENSE OCCUPANCY, THEN SPACE WILL BE IN STANDBY MODE. DURING THE "STANDBY" MODE OF OPERATION, THE SET POINT SHALL BE ADJUSTED THROUGH THE DDC CONTROL PANEL BETWEEN A MINIMUM OF 71 DEG. F AND MAXIMUM OF 75 DEG. F. THERE SHALL BE A 3 DEG. F. DEAD BAND ON EITHER SIDE OF THE SETPOINT.

UNOCCUPIED MODE: DURING THE "UNOCCUPIED" MODE OF OPERATION, THE SET POINT SHALL BE ADJUSTED THROUGH THE DDC CONTROL PANEL BETWEEN A MINIMUM OF 71 DEG. F AND MAXIMUM OF 75 DEG. F. THERE SHALL BE A 6 DEG. F. DEAD BAND ON EITHER SIDE OF THE SETPOINT.

<u>HUMIDITY MONITORING:</u> ZONE HUMIDITY IS MONITORED ONLY. DEHUMIDIFICATION IS PASSIVE CONTROL THROUGH DISCHARGE AIR CONTROL / FAN SPEED CONTROL AS DESCRIBED IN THE COOLING MODE.

<u>CONDENSATE ALARM:</u> IF CONDENSATE SWITCH INDICATES ALARM, THE FAN WILL BE SHUTDOWN AND THE CONTROL VALVE WILL CLOSE.



GENERAL NOTE: THESE STANDARD SYSTEM DIAGRAMS AND SEQUENCES ARE DEVELOPED AS THE BASIS FOR DESIGN AND MAY NOT BE DIRECTLY APPLICABLE AS IS DUE TO EXISTING EQUIPMENT OR SYSTEM CAPABILITIES, OR DUE TO SYSTEM OR EQUIPMENT ARRANGEMENTS. IT IS THE RESPONSIBILITY OF THE ENGINEER OF RECORD TO MODIFY THESE DOCUMENTS AS REQUIRED FOR THE SPECIFIC CONDITIONS OF A PROJECT. REFER TO THE RFP DOCUMENTS FOR MODIFICATION PROCEDURES.



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ENGINEER SEAL

MARK DATE

ISSUE DATE:

PROJECT NUMBER:

DESCRIPTION

04-18-0072

FAN COIL UNIT - 3 SPEED WITH DEHUMIDIFICATION

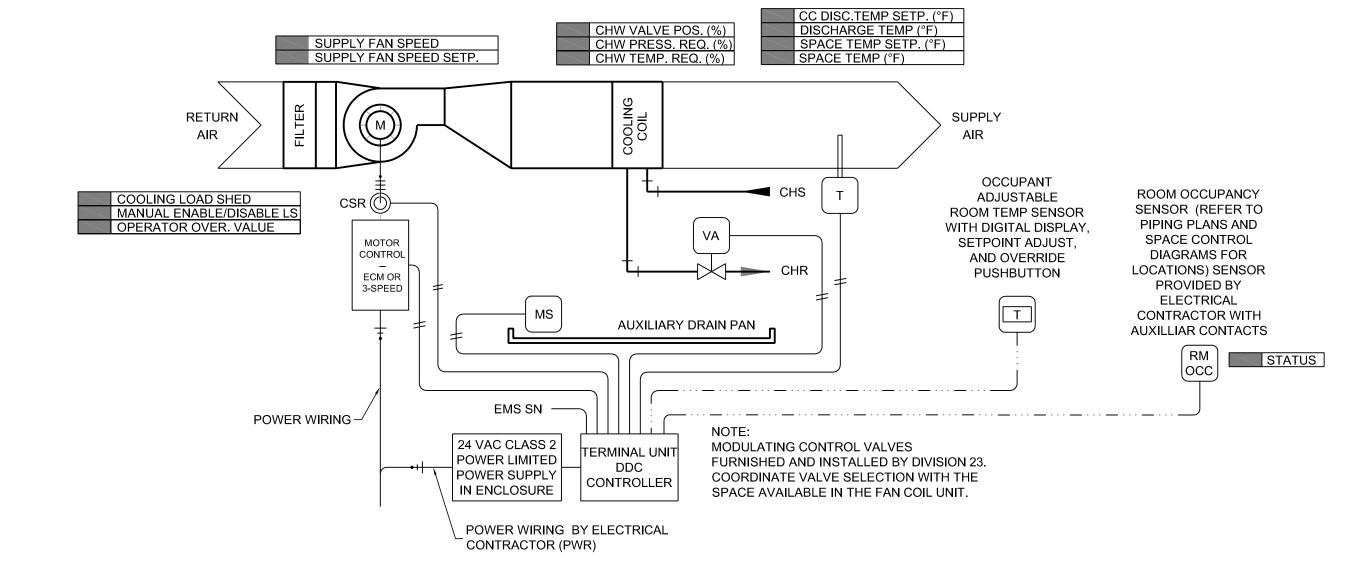
- 1. IF COMPONENT IS DISABLED DUE TO MAINTENANCE SHUTDOWN OR A FAULT CONDITION, COMPONENT SHALL BE HIGHLIGHTED, OUTLINED, FLASH, OR CHANGE COLORS.
- THIS GRAPHIC SHALL BE REPRESENTED ON THE BAS, INCLUDING THE RESULTS OF AS-BUILT CONDITIONS. THE GRAPHIC IS TO BE POPULATED WITH LIVE VALUES. SET POINTS SHALL BE ADJUSTABLE FROM THIS GRAPHIC AND LINKS SHALL BE PROVIDED TO TRENDING GROUPS.
 IF MULTIPLE UNITS SERVE THE SAME AREA, ONE OF THE CONTROLLERS WILL BE DESIGNATED AS
- CONTROLLERS. VALVE ACTUATORS OF THE SLAVE CONTROLLERS WILL TRACK THOSE OF THE MASTER TERMINAL.

 4. ALL CONTROLLERS, ACTUATORS, SENSORS, SWITCHES, TUBING, AND POINTS INDICATED ON THE PLANS ARE PROVIDED AND INSTALLED BY DIVISION 230900, UNLESS NOTED OTHERWISE.

THE MASTER CONTROLLER AND ALL OTHER CONTROLLERS WILL BE DESIGNATED AS SLAVE

- 5. ALL POINTS AND COMPONENTS INDICATED ON THE CONTROL DRAWINGS ARE NEW, PROVIDED BY DIVISION 230900, UNLESS INDICATED OTHERWISE.
- CONTROL VALVES SHALL BE SELECTED WITH PROPER AUTHORITY FOR THEIR GIVEN APPLICATION, PROVIDED BY DIVISION 230900, INSTALLED BY DIVISION 23.
 A SINGLE TRANSFORMER CAN BE PROVIDED FOR UP TO 10 CONTROLLERS PROVIDED LENGTH OF
- RUNS AND ZONING IS TAKEN INTO CONSIDERATION.
 9. CONTROL WIRING BY DIVISION 230900.
- 10. REFER TO MECHANICAL SHEETS FOR PIPE AND DUCT SIZES.11. POWER WIRING BY DIVISION 26.
- 12. THIS GRAPHICAL SEQUENCE SHALL BE REPRESENTED AS A GRAPHIC ON THE BAS, INCLUDING THE RESULTS OF AS-BUILT PROGRAMMING. THE GRAPHIC IS TO BE POPULATED WITH LIVE VALUES. SET POINTS SHALL BE ADJUSTABLE FROM THIS GRAPHIC AND LINKS SHALL BE PROVIDED TO TRENDING GROUPS.
- GROUPS.

 13. THE SCHEDULES AND TABLES INDICATED ON THIS SHEET (ALARMS, SET POINTS, MODES OF OPERATION, ETC) SHALL BE PROVIDED AS GRAPHICS.
- 14. ALL POINTS ARE TO BE TRENDED AT 15 MINUTE INTERVALS AND BACKED UP AS SPECIFIED.
 15. TRENDING GROUPS ARE IDENTIFIED ON THE SEQUENCE BY HEX NOTES. CONTRACTOR SHALL SET UP A TREND GROUP GRAPHIC FOR THE HEX NOTE DESIGNATIONS LISTED. EACH TREND GROUP SHALL CONTAIN ALL OF THE TRENDS WITH LIKE HEX NOTES. TREND GROUPS SHALL BE TRENDED AT A MINIMUM OF 30 SECOND INTERVALS FOR A DURATION OF 48 HOURS.
- 16. ATC CONTRACTOR SHALL TUNE ALL LOOPS AND TABLES FOR SMOOTH, STABLE OPERATION. NUMBERS INDICATED IN THESE DIAGRAMS ARE FOR A STARTING POINT ONLY. THESE DIAGRAMS REPRESENT THE BASIC FUNCTION OF THE CONTROLS SEQUENCE AND IS NOT ALL INCLUSIVE. THE ATC CONTRACTOR IS STILL REQUIRED TO PROVIDE, DEFINE, AND INDICATE ALL ALARMS, SET POINTS, AND FUNCTIONS REQUIRE TO ACHIEVE THE INTENT OF THE SEQUENCE, AND MAINTAINED ALL EQUIPMENT MANUFACTURER REQUIREMENTS. .
- 17. REFER TO MECHANICAL SHEETS AND SCHEDULES FOR FINAL COUNTS AND LOCATIONS. CONTROL DIAGRAM AND SEQUENCE TYPICAL OF: FCD-1-4 (EMERGENCY ELECTRICAL ROOM), FCD-1-6 (FIRE COMMAND), FCD-2-1 (ELEVATOR MACHINE ROOM), FCD-5-2 (MECHANICAL ROOM, D&T LEVEL 5), AND FCD-5-3 (ELEVATOR MACHINE ROOM, D&T LEVEL 5). CONTRACTOR TO VERIFY FINAL QUANTITIES WITH MECHANICAL SCHEDULES AND PLANS.



BLOWER COIL UNIT - COOLING ONLY NOT TO SCALE [BCU-CO]

SEQUENCE OF OPERATION:

COOLING ONLY BLOWER COIL UNIT: FAN SHALL BE STARTED AND STOPPED THROUGH DDC CONTROL PANEL. THE FAN SHALL TYPICALLY BE OPERATED AT ALL TIMES. MODULATE THE CONTROL VALVE AS REQUIRED TO MAINTAIN A DISCHARGE TEMPERATURE SET POINT OF 55 DEG. F WHEN THE UNIT IS CALLING FOR COOLING. THE FAN SPEED SHALL BE MODULATED FROM MINIMUM FAN SPEED SET POINT TO MAXIMUM FAN SPEED SET POINT TO MAINTAIN THE SPACE TEMPERATURE AT SET POINT (ADJUSTABLE).

MODES OF OPERATION: FAN COIL MODE OF OPERATION IS EITHER "OCCUPIED", "STANDBY", OR "UNOCCUPIED": OCCUPIED AND UNOCCUPIED MODES ARE DETERMINED BASED ON A CALENDAR AND TIME OF DAY SCHEDULE. STANDBY MODE IS DETERMINED DURING THE OCCUPIED MODE WITH INPUT FROM OCCUPANCY SENSOR. UNOCCUPIED MODE CAN BE OVERRIDDEN TO OCCUPIED MODE BY EITHER BUTTON AT THERMOSTAT FOR 2 HOURS (ADJUSTABLE) OR BY OCCUPANCY SENSOR.

OCCUPIED MODE: DURING THE "OCCUPIED" MODE OF OPERATION, THE SET POINT SHALL BE ADJUSTED THROUGH THE DDC CONTROL PANEL BETWEEN A MINIMUM OF 71 DEG. F AND MAXIMUM OF 75 DEG. F. THERE SHALL BE A 1 DEG. F. DEAD BAND ON EITHER SIDE OF THE SETPOINT.

STANDBY MODE: WHEN A SPACE MOTION DETECTOR IS PRESENT AND SENSES OCCUPANCY, MODE OF OPERATION SHALL BE "OCCUPIED." IF SENSOR DOES NOT SENSE OCCUPANCY, THEN SPACE WILL BE IN STANDBY MODE. DURING THE "STANDBY" MODE OF OPERATION, THE SET POINT SHALL BE ADJUSTED THROUGH THE DDC CONTROL PANEL BETWEEN A MINIMUM OF 71 DEG. F AND MAXIMUM OF 75 DEG. F. THERE SHALL BE A 3 DEG. F. DEAD BAND ON EITHER SIDE OF THE SETPOINT.

<u>UNOCCUPIED MODE:</u> DURING THE "UNOCCUPIED" MODE OF OPERATION, THE SET POINT SHALL BE ADJUSTED THROUGH THE DDC CONTROL PANEL BETWEEN A MINIMUM OF 71 DEG. F AND MAXIMUM OF 75 DEG. F. THERE SHALL BE A 6 DEG. F. DEAD BAND ON EITHER SIDE OF THE SETPOINT.

MOISTURE DETECTOR TRIP: UPON ACTIVATION OF THE MOISTURE DETECTION SENSOR AN ALARM WILL BE GENERATED AND SENT TO THE EMS. THE UNIT SHALL BE SHUT DOWN, AND CONTROL VALVE(S) WILL BE COMMANDED CLOSED.

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JOB NAME: BLOWER COIL UNIT -	INPUT	INPUT	OUTPUT	ООТРОТ	ATURE	٨	E	T SENSOR	SOR			Σ.	KED INPUT	ТАСТ	/ITCH	SWIICH	AP. CUTOUT	10		RY CONTACT	N.	KED POINT		0mA	ACTUATOR	ACTUATOR	TIC TRANSDUCER	M		DAMPER ACTUATOR	CTUATOR	Z.		G	ND		MONTHLY
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REMOTE SETPOINT	Х				Х																														Х		
MOTION SENSOR		Х																		Х															Х		

GENERAL NOTE: THESE STANDARD SYSTEM DIAGRAMS AND SEQUENCES ARE DEVELOPED AS THE BASIS FOR DESIGN AND MAY NOT BE

DIRECTLY APPLICABLE AS IS DUE TO EXISTING EQUIPMENT OR SYSTEM CAPABILITIES, OR DUE TO SYSTEM OR EQUIPMENT

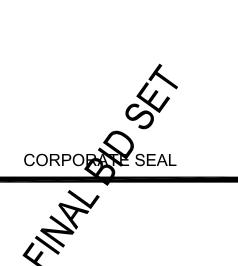
ARRANGEMENTS. IT IS THE RESPONSIBILITY OF THE ENGINEER OF RECORD TO MODIFY THESE DOCUMENTS AS REQUIRED

FOR THE SPECIFIC CONDITIONS OF A PROJECT. REFER TO THE RFP DOCUMENTS FOR MODIFICATION PROCEDURES.

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ENGINEER SEAL

NGS

UNIVERSITY OF ARKANSAS

MARK DATE DESCRIPTION
ISSUE DATE: 03/20/19

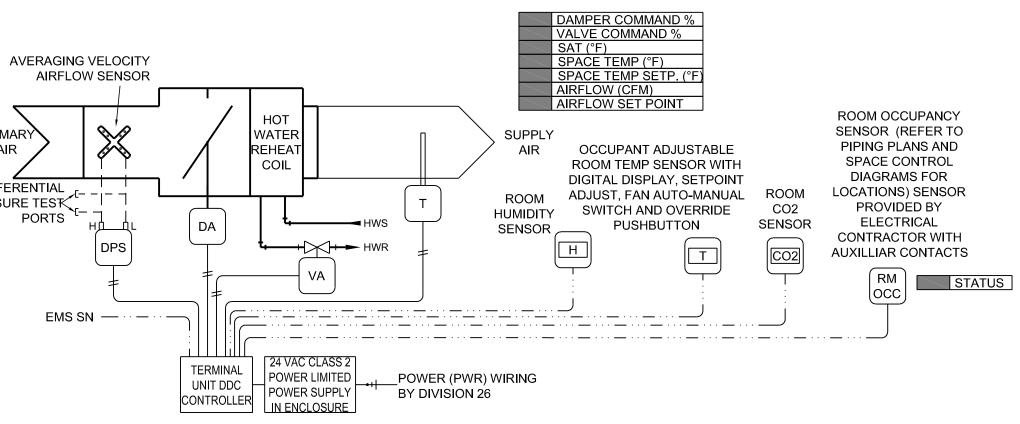
SHEET TITLE:
BLOWER COIL UNIT

- COOLING ONLY

04-18-0072

PROJECT NUMBER:

- POWER WIRING BY DIVISION 26.
- 2. CONTROL WIRING BY DIVISION 230900. 3. ALL CONTROLLERS, ACTUATORS, SENSORS, SWITCHES, TUBING, AND POINTS INDICATED ON THE PLANS ARE PROVIDED AND INSTALLED BY DIVISION 230900, UNLESS NOTED OTHERWISE. CONTROL VALVES AND THERMOWELLS ARE PROVIDED BY DIVISION 230900, INSTALLED BY DIVISION 23. TRANSFORMERS ARE PROVIDED BY DIVISION 230900, INSTALLED BY DIVISION 26.
- 4. ALL POINTS INDICATED ON THE CONTROL DRAWINGS ARE NEW, PROVIDED BY DIVISION 230900, UNLESS INDICATED OTHERWISE.
- 5. A SINGLE TRANSFORMER CAN BE PROVIDED FOR UP TO 10 CONTROLLERS PROVIDED LENGTH OF RUNS AND ZONING IS TAKEN INTO CONSIDERATION.
- 6. REFER TO MECHANICAL SHEETS FOR FINAL COUNTS, LOCATIONS, PIPE SIZES, AND DUCT SIZES. 7. IF MULTIPLE TERMINALS SERVE THE SAME AREA, ONE OF THE CONTROLLERS WILL BE DESIGNATED DIFFERENTIAL AS THE MASTER CONTROLLER AND ALL OTHER CONTROLLERS WILL BE DESIGNATED AS SLAVE PRESSURE TEST CONTROLLERS. VALVE AND DAMPER ACTUATORS OF THE SLAVE CONTROLLERS WILL TRACK
- THOSE OF THE MASTER TERMINAL. 8. IF COMPONENT IS DISABLED DUE TO MAINTENANCE SHUTDOWN OR A FAULT CONDITION, COMPONENT SHALL BE HIGHLIGHTED, OUTLINED, FLASH, OR CHANGE COLORS.
- 9. THIS GRAPHIC SHALL BE REPRESENTED ON THE BAS, INCLUDING THE RESULTS OF AS-BUILT CONDITIONS. THE GRAPHIC IS TO BE POPULATED WITH LIVE VALUES. SET POINTS SHALL BE
- ADJUSTABLE FROM THIS GRAPHIC AND LINKS SHALL BE PROVIDED TO TRENDING GROUPS. 10. THIS GRAPHICAL SEQUENCE SHALL BE REPRESENTED AS A GRAPHIC ON THE BAS, INCLUDING THE RESULTS OF AS-BUILT PROGRAMMING. THE GRAPHIC IS TO BE POPULATED WITH LIVE VALUES. SET POINTS SHALL BE ADJUSTABLE FROM THIS GRAPHIC AND LINKS SHALL BE PROVIDED TO TRENDING GROUPS.
- 11. THE SCHEDULES AND TABLES INDICATED ON THIS SHEET (ALARMS, SET POINTS, MODES OF OPERATION, ETC) SHALL BE PROVIDED AS GRAPHICS, EDITABLE FROM THE GRAPHICS.
- 12. ALL POINTS ARE TO BE TRENDED AT 15 MINUTE INTERVALS AND BACKED UP AS SPECIFIED. 13. TRENDING GROUPS ARE IDENTIFIED ON THE SEQUENCE BY HEX NOTES. CONTRACTOR SHALL SET UP A TREND GROUP GRAPHIC FOR THE HEX NOTE DESIGNATIONS LISTED. EACH TREND GROUP SHALL CONTAIN ALL OF THE TRENDS WITH LIKE HEX NOTES. TREND GROUPS SHALL BE TRENDED
- AT A MINIMUM OF 30 SECOND INTERVALS FOR A MINIMUM DURATION OF 48 HOURS. 14. ATC CONTRACTOR SHALL TUNE ALL LOOPS AND TABLES FOR SMOOTH, STABLE OPERATION. NUMBERS INDICATED IN THESE DIAGRAMS ARE FOR A STARTING POINT ONLY. THESE DIAGRAMS REPRESENT THE BASIC FUNCTION OF THE CONTROLS SEQUENCE AND IS NOT ALL INCLUSIVE. THE ATC CONTRACTOR IS STILL REQUIRED TO PROVIDE, DEFINE, AND INDICATE ALL ALARMS, SET POINTS, AND FUNCTIONS REQUIRE TO ACHIEVE THE INTENT OF THE SEQUENCE, AND MAINTAINED ALL EQUIPMENT MANUFACTURER REQUIREMENTS.



VAV SUPPLY TERMINAL WITH HOT WATER REHEAT - OFFICE/CORRIDOR

SEQUENCE OF OPERATION:

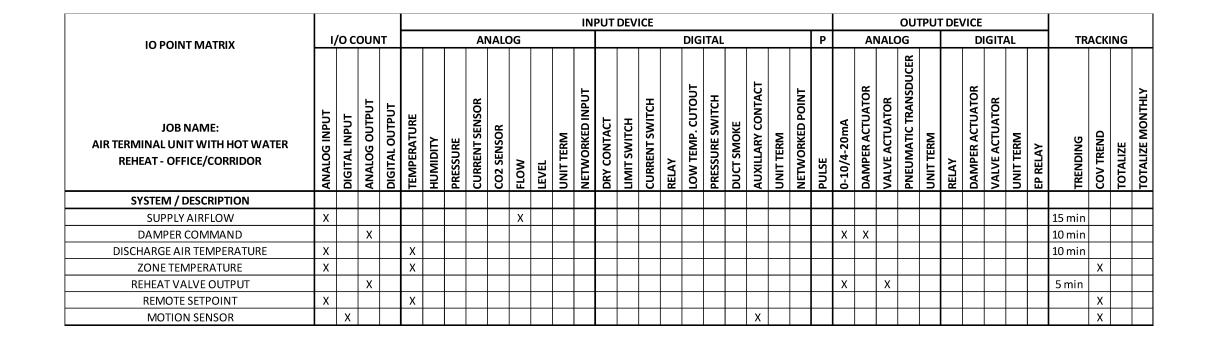
MODES OF OPERATION: AIR TERMINAL MODE OF OPERATION IS EITHER "OCCUPIED", "STANDBY", OR "UNOCCUPIED": OCCUPIED AND UNOCCUPIED MODES ARE DETERMINED BASED ON A CALENDAR AND TIME OF DAY SCHEDULE. STANDBY MODE IS DETERMINED DURING THE OCCUPIED MODE WITH INPUT FROM OCCUPANCY SENSOR. UNOCCUPIED MODE CAN BE OVERRIDDEN TO OCCUPIED MODE BY EITHER BUTTON AT THERMOSTAT FOR 2 HOURS (ADJUSTABLE) OR BY OCCUPANCY SENSOR. TERMINAL CONTROLLER SHALL MODULATED THE TERMINAL DAMPER AND THE HEATING WATER CONTROL VALVE AS REQUIRED TO MAINTAIN THE SPACE TEMPERATURE AT SETPOINT.

OCCUPIED MODE: DURING THE "OCCUPIED" MODE OF OPERATION, THE SET POINT SHALL BE ADJUSTED THROUGH THE DDC CONTROL PANEL BETWEEN A MINIMUM OF 71 DEG. F AND MAXIMUM OF 75 DEG. F. THERE SHALL BE A 1 DEG. F. DEAD BAND ON EITHER SIDE OF THE SETPOINT. ON A CALL FOR COOLING, THE TERMINAL DAMPER SHALL BE MODULATED BETWEEN THE COOLING MINIMUM AND THE COOLING MAXIMUM AIR FLOW RATES SCHEDULED. ON A CALL FOR HEATING, THE CONTROL VALVE SHALL BE MODULATED FROM CLOSED TO OPEN, THEN THE TERMINAL DAMPER SHALL BE MODULATED BETWEEN THE HEATING MINIMUM AND THE MAXIMUM AIR FLOW RATES SCHEDULED. IF THE LEAVING HEATING SUPPLY TEMPERATURE EXCEEDS THE SPACE TEMP BY 15 DEG. F. (ADJ), THE SUPPLY AIR SHALL BE MODULATED UP TO MAXIMUM AIRFLOW RATE AS REQUIRED TO PREVENT THE 15 DEG. F. SET POINT FROM BEING EXCEEDED.

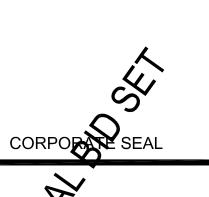
STANDBY MODE: WHEN A SPACE MOTION DETECTOR IS PRESENT AND SENSES OCCUPANCY, MODE OF OPERATION SHALL BE "OCCUPIED." IF SENSOR DOES NOT SENSE OCCUPANCY, THEN SPACE WILL BE IN STANDBY MODE. DURING THE "STANDBY" MODE OF OPERATION, THE SET POINT SHALL BE ADJUSTED THROUGH THE DDC CONTROL PANEL BETWEEN A MINIMUM OF 71 DEG. F AND MAXIMUM OF 75 DEG. F. THERE SHALL BE A 3 DEG. F. DEAD BAND ON EITHER SIDE OF THE SETPOINT. ON A CALL FOR COOLING, THE TERMINAL DAMPER SHALL BE MODULATED BETWEEN THE COOLING MINIMUM AND THE COOLING MAXIMUM AIR FLOW RATES SCHEDULED. ON A CALL FOR HEATING. THE CONTROL VALVE SHALL BE MODULATED FROM CLOSED TO OPEN, THEN THE TERMINAL DAMPER SHALL BE MODULATED BETWEEN THE HEATING MINIMUM AND THE MAXIMUM AIR FLOW RATES SCHEDULED. IF THE LEAVING HEATING SUPPLY TEMPERATURE EXCEEDS THE SPACE TEMP BY 15 DEG. F. (ADJ), THE SUPPLY AIR SHALL BE MODULATED UP TO MAXIMUM AIRFLOW RATE AS REQUIRED TO PREVENT THE 15 DEG. F. SET POINT FROM BEING EXCEEDED.

UNOCCUPIED MODE: DURING THE "UNOCCUPIED" MODE OF OPERATION, THE SET POINT SHALL BE ADJUSTED THROUGH THE DDC CONTROL PANEL BETWEEN A MINIMUM OF 71 DEG. F AND MAXIMUM OF 75 DEG. F. THERE SHALL BE A 6 DEG. F. DEAD BAND ON EITHER SIDE OF THE SETPOINT. ON A CALL FOR COOLING, THE TERMINAL DAMPER SHALL BE MODULATED BETWEEN THE COOLING MINIMUM AND THE COOLING MAXIMUM AIR FLOW RATES SCHEDULED. ON A CALL FOR HEATING, THE CONTROL VALVE SHALL BE MODULATED FROM CLOSED TO OPEN, THEN THE TERMINAL DAMPER SHALL BE MODULATED BETWEEN THE HEATING MINIMUM AND THE MAXIMUM AIR FLOW RATES SCHEDULED. IF THE LEAVING HEATING SUPPLY TEMPERATURE EXCEEDS THE SPACE TEMP BY 15 DEG. F. (ADJ), THE SUPPLY AIR SHALL BE MODULATED UP TO MAXIMUM AIRFLOW RATE AS REQUIRED TO PREVENT THE 15 DEG. F. SET POINT FROM BEING EXCEEDED.

DEHUMIDIFICATION OPERATION: IF THE ZONE SERVED BY TERMINAL UNIT CONTAINS A HUMIDITY SENSOR, THE SPACE HUMIDITY SENSOR SHALL BE UTILIZED TO DROP THE SUPPLY TEMPERATURE AIR SET POINT AT THE AHU.



2039 NORTH GREEN ACRES FAYETTEVILLE, AR 72703 Phone: (479) 521-8634 Fax: (479) 521-1014 bernhard.com





ENGINEER SEAL

DESCRIPTION MARK DATE

PROJECT NUMBER: 04-18-0072 SHEET TITLE

ISSUE DATE:

AIR TERMINAL UNIT WITH HOT WATER REHEAT -

OFFICE/CORRIDOR

SHEET NUMBER:

GENERAL NOTE: THESE STANDARD SYSTEM DIAGRAMS AND SEQUENCES ARE DEVELOPED AS THE BASIS FOR DESIGN AND MAY NOT BE DIRECTLY APPLICABLE AS IS DUE TO EXISTING EQUIPMENT OR SYSTEM CAPABILITIES, OR DUE TO SYSTEM OR EQUIPMENT ARRANGEMENTS. IT IS THE RESPONSIBILITY OF THE ENGINEER OF RECORD TO MODIFY THESE DOCUMENTS AS REQUIRED FOR THE SPECIFIC CONDITIONS OF A PROJECT. REFER TO THE RFP DOCUMENTS FOR MODIFICATION PROCEDURES.

- POWER WIRING BY DIVISION 26.
 CONTROL WIRING BY DIVISION 230900.
- 3. ALL CONTROLLERS, ACTUATORS, SENSORS, SWITCHES, TUBING, AND POINTS INDICATED ON THE PLANS ARE PROVIDED AND INSTALLED BY DIVISION 230900, UNLESS NOTED OTHERWISE. CONTROL VALVES AND THERMOWELLS ARE PROVIDED BY DIVISION 230900, INSTALLED BY DIVISION 23. TRANSFORMERS ARE PROVIDED BY DIVISION 230900, INSTALLED BY DIVISION 26.
- ALL POINTS INDICATED ON THE CONTROL DRAWINGS ARE NEW, PROVIDED BY DIVISION 230900, UNLESS INDICATED OTHERWISE.
 A SINGLE TRANSFORMER CAN BE PROVIDED FOR UP TO 10 CONTROLLERS PROVIDED LENGTH OF
- RUNS AND ZONING IS TAKEN INTO CONSIDERATION.

 6. REFER TO MECHANICAL SHEETS FOR FINAL COUNTS, LOCATIONS, PIPE SIZES, AND DUCT SIZES.

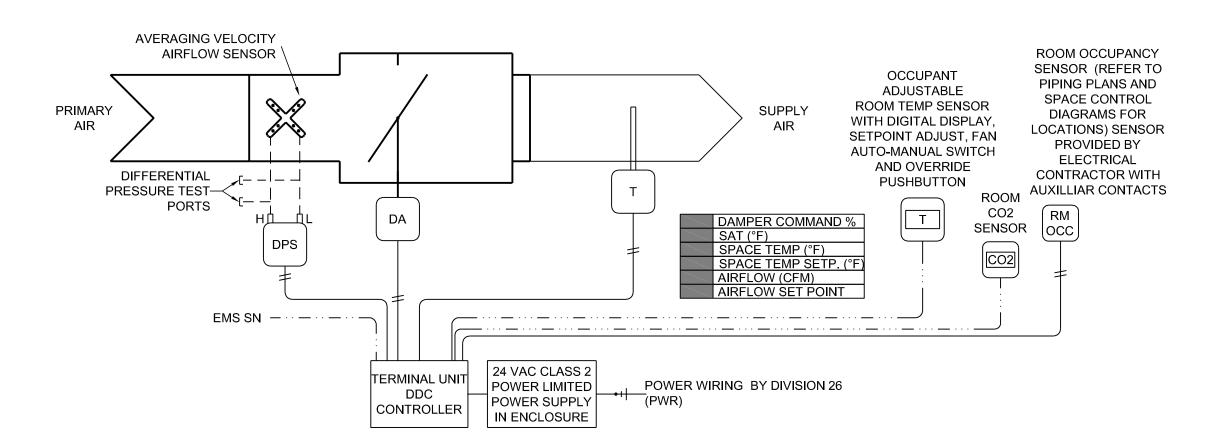
 7. IF MULTIPLE TERMINALS SERVE THE SAME AREA, ONE OF THE CONTROLLERS WILL BE DESIGNATED AS THE MASTER CONTROLLER AND ALL OTHER CONTROLLERS WILL BE DESIGNATED AS SLAVE
- CONTROLLERS. VALVE AND DAMPER ACTUATORS OF THE SLAVE CONTROLLERS WILL TRACK THOSE OF THE MASTER TERMINAL.

 8. IF COMPONENT IS DISABLED DUE TO MAINTENANCE SHUTDOWN OR A FAULT CONDITION,
- COMPONENT SHALL BE HIGHLIGHTED, OUTLINED, FLASH, OR CHANGE COLORS.

 9. THIS GRAPHIC SHALL BE REPRESENTED ON THE BAS, INCLUDING THE RESULTS OF AS-BUILT CONDITIONS. THE GRAPHIC IS TO BE POPULATED WITH LIVE VALUES. SET POINTS SHALL BE ADJUSTABLE FROM THIS GRAPHIC AND LINKS SHALL BE PROVIDED TO TRENDING GROUPS.
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OPERATION, ETC) SHALL BE PROVIDED AS GRAPHICS, EDITABLE FROM THE GRAPHICS.

12. ALL POINTS ARE TO BE TRENDED AT 15 MINUTE INTERVALS AND BACKED UP AS SPECIFIED.



VAV SUPPLY TERMINAL (COOLING ONLY) CONTROL DIAGRAM
NOT TO SCALE [VAV-COOL]

SEQUENCE OF OPERATION:

MODES OF OPERATION: AIR TERMINAL MODE OF OPERATION IS EITHER "OCCUPIED", "STANDBY", OR "UNOCCUPIED": OCCUPIED AND UNOCCUPIED MODES ARE DETERMINED BASED ON A CALENDAR AND TIME OF DAY SCHEDULE. STANDBY MODE IS DETERMINED DURING THE OCCUPIED MODE WITH INPUT FROM OCCUPANCY SENSOR. UNOCCUPIED MODE CAN BE OVERRIDDEN TO OCCUPIED MODE BY EITHER BUTTON AT THERMOSTAT FOR 2 HOURS (ADJUSTABLE) OR BY OCCUPANCY SENSOR. ON A RISE IN SPACE TEMPERATURE, DAMPER POSITION MODULATES OPEN FROM MINIMUM POSITION TO MAXIMUM POSITION. ON A DECREASE IN SPACE TEMPERATURE BELOW SETPOINT, DAMPER CLOSES TO MINIMUM.

OCCUPIED MODE: DURING THE "OCCUPIED" MODE OF OPERATION, THE SET POINT SHALL BE ADJUSTED THROUGH THE DDC CONTROL PANEL BETWEEN A MINIMUM OF 71 DEG. F AND MAXIMUM OF 75 DEG. F. THERE SHALL BE A 1 DEG. F. DEAD BAND ON EITHER SIDE OF THE SETPOINT.

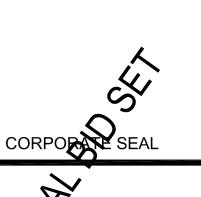
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JOB NAME: AIR TERMINAL UNIT - COOLING ONLY	ANALOG INPUT	DIGITAL INPUT	ANALOG OUTPUT	DIGITAL OUTPUT	TEMPERATURE	ниміріту	PRESSURE	ZENT	CO2 SENSOR	LEVEL	UNIT TERM	NETWORKED INPUT	DRY CONTACT	LIMIT SWITCH	CURRENT SWITCH	_	LOW TEMP. CUTOUT		AUXILLARY CONTACT	UNIT TERM	NETWORKED POINT	PULSE	0-10/4-20mA	<u>~</u>		PNEUMATIC TRANSDUCER	UNIT TERM		DAMPER ACTUATOR	VALVE ACTUATOR	UNIT TERM	KELAY	rending	COV TREND	TOTALIZE	TOTALIZE MONTHLY
CVCTERA / DECCRIPTION	₹	a	₹	D	F	エ		5	<u> </u>	: =	╀╸	Z	۵	=	5	<u>~ `</u>	<u> </u>	10	⋖	ן⊃	z	픠	<u></u>		<u>></u>		귀	~	9	<u>></u>	<u> </u>	╬┼	F	Ö	Ĕ	Ĕ
SYSTEM / DESCRIPTION	-																				-	_				_	-		-		_	+				
SUPPLY AIRFLOW	Х								X																							1!	5 min			
DAMPER COMMAND			X																				Х	Х								1!	5 min			
DISCHARGE AIR TEMPERATURE	Х				Х																											1!	5 min			
ZONE TEMPERATURE	Х				Х																													Х		
REHEAT VALVE OUTPUT			Х																				Х		Х							10	0 min			
REMOTE SETPOINT	Х				Х																													Х		
MOTION SENSOR		Х																	Х															Х		

Bernhard TME
Engineering
2039 NORTH GREEN ACRES

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ENGINEER SEAL

ROL DRAWINGS

MARK DATE DESCRIPTION
ISSUE DATE: 03/20/19

PROJECT NUMBER: 04-18
SHEET TITLE:

VAV SUPPLY TERMINAL -

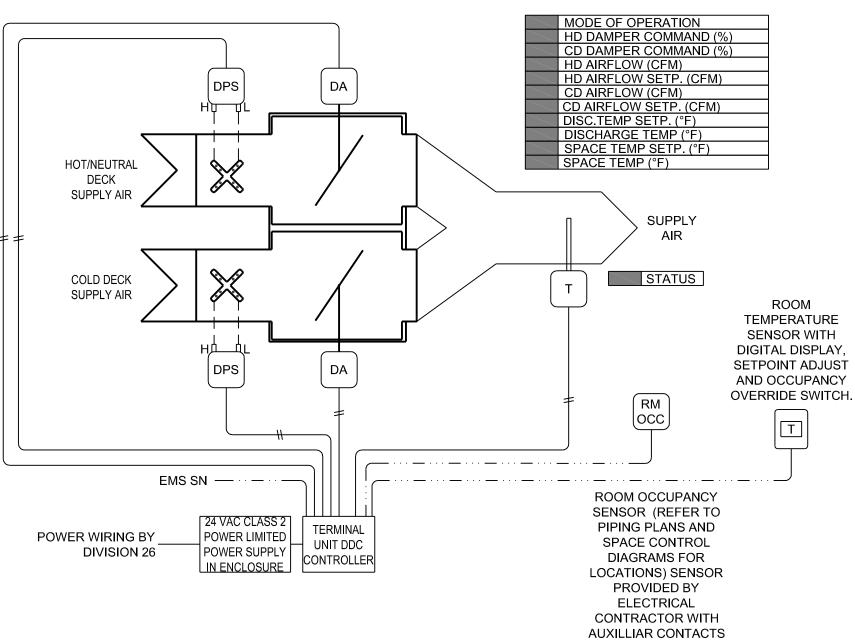
COOLING ONLY

SHEET NUMBER:

ATC5 06

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VAV SUPPLY TERMINAL - DUAL DUCT [VAV-DD]

SEQUENCE OF OPERATION:

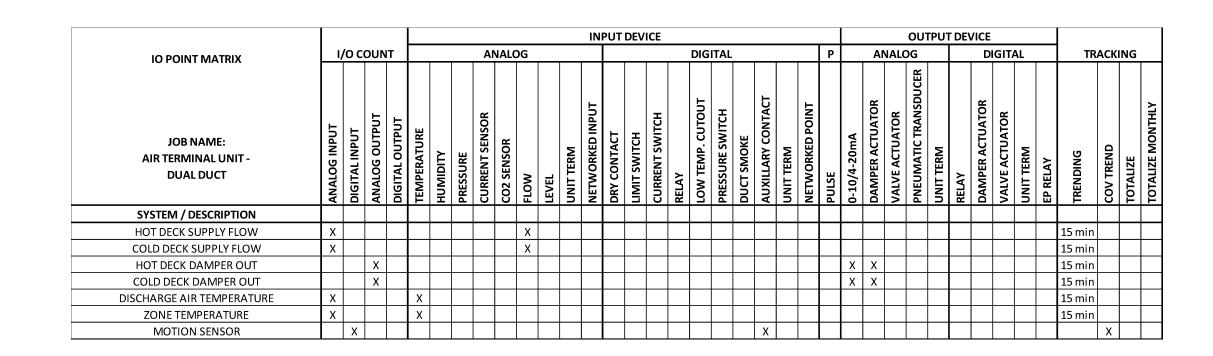
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OCCUPIED MODE: DURING THE "OCCUPIED" MODE OF OPERATION, THE SET POINT SHALL BE ADJUSTED THROUGH THE DDC CONTROL PANEL BETWEEN A MINIMUM OF 71 DEGF AND MAXIMUM OF 75 DEGF. THERE SHALL BE A 1 DEGF DEAD BAND ON EITHER SIDE OF THE SETPOINT. ON AN INCREASE IN SPACE TEMPERATURE ABOVE THE COOLING SETPOINT, THE HOT DUCT DAMPER SHALL BE CLOSED AND THE COLD DUCT DAMPER SHALL BE MODULATED FROM THE COOLING MINIMUM AIR FLOW (10%) TO THE COOLING MAXIMUM AIR FLOW (100% OF DESIGN AIR FLOW). ON A DECREASE IN SPACE TEMPERATURE BELOW THE COOLING SET POINT, THE HOT DUCT DAMPER SHALL REMAIN CLOSED AND THE COLD DUCT DAMPER SHALL BE MODULATED AS REQUIRED TO MAINTAIN THE COLD DUCT AIRFLOW AT THE COOLING MINIMUM (10%). ON A FURTHER DECREASE IN SPACE TEMPERATURE BELOW THE THERMOSTAT SETTING, THE COLD DUCT DAMPER SHALL BE CLOSED AND THE HOT DUCT DAMPER SHALL BE MODULATED AS REQUIRED TO MAINTAIN THE HOT DUCT AIR FLOW AT THE HEATING MINIMUM (10%). ON A FURTHER DECREASE IN SPACE TEMPERATURE BELOW THE HEATING SETPOINT, THE COLD DUCT DAMPER SHALL REMAIN CLOSED, AND THE HOT DUCT DAMPER SHALL BE MODULATED FROM THE HEATING MINIMUM (10%) TO THE HEATING MAXIMUM (MAXIMUM HEATING CFM OR 60% OF MAXIMUM COOLING CFM IF MAX HEATING CFM IS NOT SPECIFIED).

STANDBY MODE: WHEN A SPACE MOTION DETECTOR ISPRESENT AND SENSES OCCUPANCY, MODE OF OPERATION SHALL BE "OCCUPIED". IF SENSOR DOES NOT SENSE OCCUPANCY, THEN SPACE WILL BE IN STANDBY MODE. DURING THE "STANDBY" MODE OF OPERATION, THE SET POINT SHALL BE ADJUSTED THROUGH THE DDC CONTROL PANEL BETWEEN A MINIMUM OF 71 DEGF AND MAXIMUM OF 75 DEGF. THERE SHALL BE A 3 DEGF DEAN BAND ON EITHER SIDE OF THE SETPOINT. ON AN INCREASE IN SPACE TEMPERATURE ABOVE THE COOLING SETPOINT, THE HOT DUCT DAMPER SHALL BE CLOSED AND THE COLD DUCT DAMPER SHALL BE MODULATED FROM THE COOLING MINIMUM AIR FLOW (10%) TO THE COOLING MAXIMUM AIR FLOW (100% OF DESIGN AIR FLOW). ON A DECREASE IN SPACE TEMPERATURE BELOW THE COOLING SET POINT, THE HOT DUCT DAMPER SHALL REMAIN CLOSED AND THE COLD DUCT DAMPER SHALL BE MODULATED AS REQUIRED TO MAINTAIN THE COLD DUCT AIRFLOW AT THE COOLING MINIMUM (10%). ON A FURTHER DECREASE IN SPACE TEMPERATURE BELOW THE THERMOSTAT SETTING, THE COLD DUCT DAMPER SHALL BE CLOSED AND THE HOT DUCT DAMPER SHALL BE MODULATED AS REQUIRED TO MAINTAIN THE HOT DUCT AIR FLOW AT THE HEATING MINIMUM (10%). ON A FURTHER DECREASE IN SPACE TEMPERATURE BELOW THE HEATING SETPOINT, THE COLD DUCT DAMPER SHALL REMAIN CLOSED, AND THE HOT DUCT DAMPER SHALL BE MODULATED FROM THE HEATING MINIMUM (10%) TO THE HEATING MAXIMUM (MAXIMUM HEATING CFM OR 60% OF MAXIMUM COOLING CFM IF MAX HEATING CFM IS NOT SPECIFIED).

UNOCCUPIED MODE: DURING THE "UNOCCUPIED" MODE OF OPERATION, THE SET POINT SHALL BE ADJUSTED THROUGH THE DDC CONTROL PANEL BETWEEN A MINIMUM OF 71 DEGF AND MAXIMUM OF 75 DEGF. THERE SHALL BE A 6 DEGF DEAD BAND ON EITHER SIDE OF THE SETPOINT. ON AN INCREASE IN SPACE TEMPERATURE ABOVE THE COOLING SETPOINT, THE HOT DUCT DAMPER SHALL BE CLOSED AND THE COLD DUCT DAMPER SHALL BE MODULATED FROM THE COOLING MINIMUM AIR FLOW (0%) TO THE COOLING MAXIMUM AIR FLOW (100%). ON A DECREASE IN SPACE TEMPERATURE BELOW THE HEATING SETPOINT, THE COLD DUCT DAMPER SHALL BE CLOSED AND THE HOT DUCT DAMPER SHALL BE MODULATED FROM THE HEATING MINIMUM AIR FLOW (0%) TO THE HEATING MAXIMUM AIR FLOW (MAXIMUM HEATING CFM OR 60% OF MAXIMUM COOLING CFM IF MAX HEATING CFM IS NOT SPECIFIED).

TEMPORARY OVERRIDE: IF THE ZONE IS UNOCCUPIED, AND THE OVERRIDE BUTTON ON THE THERMOSTAT IS DEPRESSED, THE SPACE TEMPERATURE OF THAT ZONE SHALL SELECT WHICH UNIT (COOLING OR HEATING) SHALL BE STARTED. IF THE SPACE TEMPERATURE IS ABOVE THE COOLING SET POINT, START THE COOLING UNIT ONLY. IF THE SPACE TEMPERATURE IS BELOW THE HEATING SET POINT, START THE HEATING UNIT ONLY. IF THE SPACE TEMPERATURE CROSSES OVER SET POINT DURING THE 2 HOUR OVERRIDE TIME, ENABLE THE OTHER UNIT AND LEAVE BOTH ON UNTIL THE END OF THE TEMPORARY OVERRIDE CYCLE

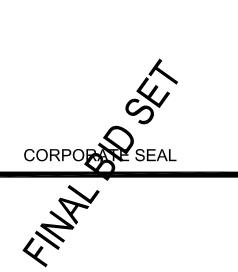


GENERAL NOTE: THESE STANDARD SYSTEM DIAGRAMS AND SEQUENCES ARE DEVELOPED AS THE BASIS FOR DESIGN AND MAY NOT BE DIRECTLY APPLICABLE AS IS DUE TO EXISTING EQUIPMENT OR SYSTEM CAPABILITIES, OR DUE TO SYSTEM OR EQUIPMENT ARRANGEMENTS. IT IS THE RESPONSIBILITY OF THE ENGINEER OF RECORD TO MODIFY THESE DOCUMENTS AS REQUIRED FOR THE SPECIFIC CONDITIONS OF A PROJECT. REFER TO THE RFP DOCUMENTS FOR MODIFICATION PROCEDURES.

Engineering

2039 NORTH GREEN ACRES

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ENGINEER SEAL

MARK DATE DESCRIPTION

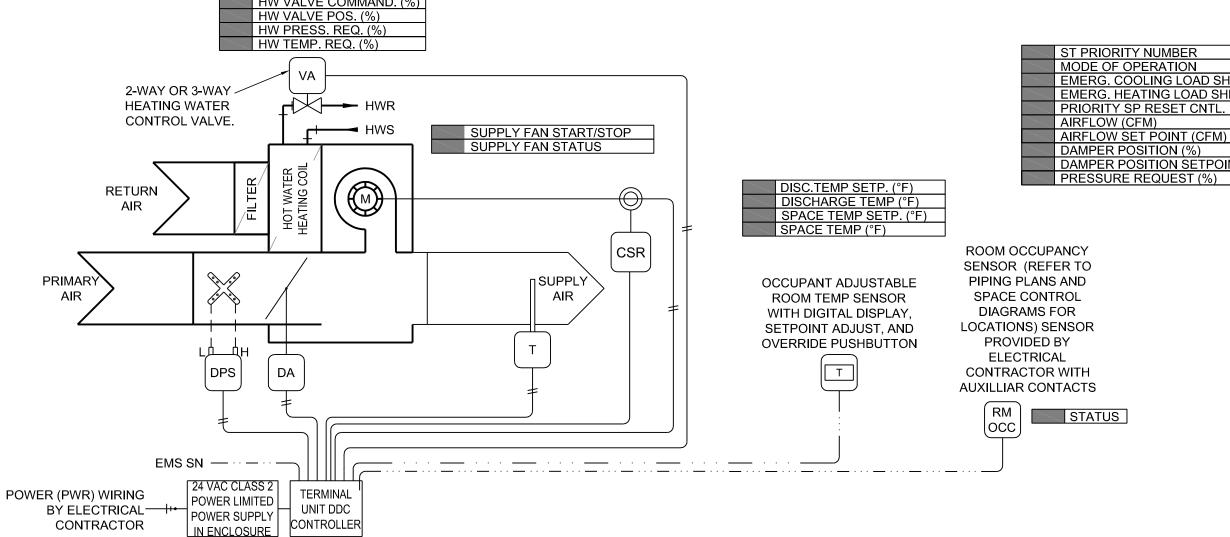
ISSUE DATE: 03/20/19 ROJECT NUMBER: 04-18-0072

> SHEET TITLE: VAV SUPPLY TERMINAL - DUAL DUCT

- 1. POWER WIRING BY DIVISION 26.
- 2. CONTROL WIRING BY DIVISION 230900. 3. ALL CONTROLLERS, ACTUATORS, SENSORS, SWITCHES, TUBING, AND POINTS INDICATED ON THE PLANS ARE PROVIDED AND INSTALLED BY DIVISION 230900, UNLESS NOTED OTHERWISE. CONTROL VALVES AND THERMOWELLS ARE PROVIDED BY DIVISION 230900, INSTALLED BY DIVISION 23. TRANSFORMERS ARE PROVIDED BY DIVISION 230900, INSTALLED BY DIVISION 26.
- 4. ALL POINTS INDICATED ON THE CONTROL DRAWINGS ARE NEW, PROVIDED BY DIVISION 230900, UNLESS INDICATED OTHERWISE.
- 5. A SINGLE TRANSFORMER CAN BE PROVIDED FOR UP TO 10 CONTROLLERS PROVIDED LENGTH OF RUNS AND ZONING IS TAKEN INTO CONSIDERATION.
- 6. REFER TO MECHANICAL SHEETS FOR FINAL COUNTS, LOCATIONS, PIPE SIZES, AND DUCT SIZES. 7. IF MULTIPLE TERMINALS SERVE THE SAME AREA, ONE OF THE CONTROLLERS WILL BE DESIGNATED AS THE MASTER CONTROLLER AND ALL OTHER CONTROLLERS WILL BE DESIGNATED AS SLAVE CONTROLLERS. VALVE AND DAMPER ACTUATORS OF THE SLAVE CONTROLLERS WILL TRACK THOSE OF THE MASTER TERMINAL.
- 8. IF COMPONENT IS DISABLED DUE TO MAINTENANCE SHUTDOWN OR A FAULT CONDITION, COMPONENT SHALL BE HIGHLIGHTED, OUTLINED, FLASH, OR CHANGE COLORS. 9. THIS GRAPHIC SHALL BE REPRESENTED ON THE BAS, INCLUDING THE RESULTS OF AS-BUILT CONDITIONS.
- THE GRAPHIC IS TO BE POPULATED WITH LIVE VALUES. SET POINTS SHALL BE ADJUSTABLE FROM THIS GRAPHIC AND LINKS SHALL BE PROVIDED TO TRENDING GROUPS. 10. THIS GRAPHICAL SEQUENCE SHALL BE REPRESENTED AS A GRAPHIC ON THE BAS, INCLUDING THE RESULTS OF AS-BUILT PROGRAMMING. THE GRAPHIC IS TO BE POPULATED WITH LIVE VALUES. SET

POINTS SHALL BE ADJUSTABLE FROM THIS GRAPHIC AND LINKS SHALL BE PROVIDED TO TRENDING

- GROUPS. 11. THE SCHEDULES AND TABLES INDICATED ON THIS SHEET (ALARMS, SET POINTS, MODES OF OPERATION, ETC) SHALL BE PROVIDED AS GRAPHICS, EDITABLE FROM THE GRAPHICS.
- 12. ALL POINTS ARE TO BE TRENDED AT 15 MINUTE INTERVALS AND BACKED UP AS SPECIFIED. 13. TRENDING GROUPS ARE IDENTIFIED ON THE SEQUENCE BY HEX NOTES. CONTRACTOR SHALL SET UP A TREND GROUP GRAPHIC FOR THE HEX NOTE DESIGNATIONS LISTED. EACH TREND GROUP SHALL CONTAIN ALL OF THE TRENDS WITH LIKE HEX NOTES. TREND GROUPS SHALL BE TRENDED AT A MINIMUM OF 30 SECOND INTERVALS FOR A MINIMUM DURATION OF 48 HOURS.
- 14. ATC CONTRACTOR SHALL TUNE ALL LOOPS AND TABLES FOR SMOOTH, STABLE OPERATION. NUMBERS INDICATED IN THESE DIAGRAMS ARE FOR A STARTING POINT ONLY. THESE DIAGRAMS REPRESENT THE BASIC FUNCTION OF THE CONTROLS SEQUENCE AND IS NOT ALL INCLUSIVE. THE ATC CONTRACTOR IS STILL REQUIRED TO PROVIDE, DEFINE, AND INDICATE ALL ALARMS, SET POINTS, AND FUNCTIONS REQUIRE TO ACHIEVE THE INTENT OF THE SEQUENCE, AND MAINTAINED ALL EQUIPMENT MANUFACTURER REQUIREMENTS.



VAV SUPPLY TERMINAL WITH HOT WATER REAHEAT - PARALLEL FAN POWERED [VAV-FPP]

SEQUENCE OF OPERATION:

MODE OF OPERATION: THE SUPPLY AIR TERMINAL UNIT MODE OF OPERATION WILL BE OCCUPIED, UNOCCUPIED, OR MORNING WARM-UP BASED ON A SCHEDULE COMMUNICATED FROM THE EMS, AN OPERATOR OVERRIDE COMMAND FROM THE EMS, A TEMPORARY OCCUPANCY OVERRIDE SIGNAL FROM THE SPACE TEMPERATURE SENSOR OVERRIDE PUSHBUTTON, OR A SIGNAL FROM THE ZONE OCCUPANCY SENSOR (IF ZONE CONTAINS AN OCCUPANCY SENSOR).

OCCUPIED MODE: THE SPACE TEMPERATURE SETPOINT WILL BE ADJUSTABLE BY THE OCCUPANT AT THE THERMOSTAT BETWEEN A MINIMUM OF 68 DEG F AND A MAXIMUM OF 75 DEG F.THE TERMINAL UNIT PRIMARY AIR DAMPER OCCUPIED MINIMUM AIRFLOW AND OCCUPIED MAXIMUM AIRFLOW ARE AS SCHEDULED. THE EFFECTIVE COOLING SETPOINT WILL BE EQUAL TO THE SPACE TEMPERATURE SETPOINT PLUS 1 DEG F AND THE EFFECTIVE HEATING SETPOINT WILL BE EQUAL TO THE SPACE TEMPERATURE SETPOINT MINUS 1 DEG F.

UNOCCUPIED MODE: THE UNOCCUPIED SPACE TEMPERATURE SETPOINTS WILL BE 65 DEG F SPACE HEATING SETPOINT AND 80 DEG F SPACE COOLING SETPOINT. WHEN THE OCCUPANCY OVERRIDE PUSHBUTTON ON THE SPACE TEMPERATURE SENSOR IS INDEXED TO OCCUPIED, THE UNIT WILL OPERATE IN THE OCCUPIED MODE FOR 2 HOURS, AND THE ASSOCIATED AIR HANDLING UNIT WILL INDEX TO OCCUPIED STATUS FOR THE DURATION OF TIME NEEDED FOR OCCUPANCY OVERRIDE. MORNING

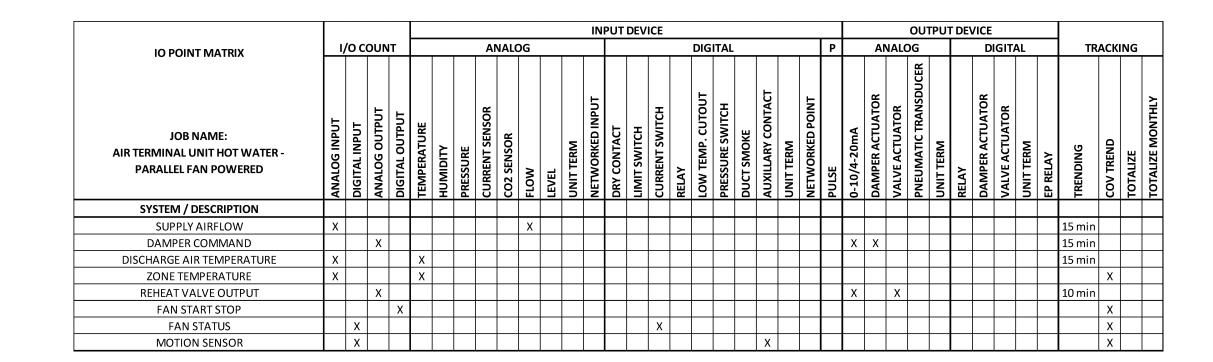
WARM-UP MODE: IF THE SPACE TEMPERATURE IS BELOW THE EFFECTIVE HEATING SETPOINT, THE HEATING WATER CONTROL VALVE WILL MODULATE TO MAINTAIN THE EFFECTIVE HEATING SETPOINT AND THE SUPPLY AIR TERMINAL UNIT DAMPER WILL BE CLOSED. IN MORNING WARM-UP MODE, THERE WILL BE NO TERMINAL UNIT HIGH DISCHARGE AIR TEMPERATURE LIMIT.

TERMINAL UNIT OPERATION: ON AN INCREASE IN SPACE TEMPERATURE ABOVE THE EFFECTIVE COOLING SETPOINT, THE SUPPLY AIR TERMINAL UNIT PRIMARY AIR DAMPER WILL BE MODULATED BETWEEN THE COOLING MINIMUM AND THE COOLING MAXIMUM AIR FLOW RATES TO SATISFY THE COOLING DEMAND BASED ON THE MODE OF OPERATION. ON A DECREASE IN SPACE TEMPERATURE BELOW THE EFFECTIVE COOLING SETPOINT, THE SUPPLY AIR TERMINAL UNIT PRIMARY AIR DAMPER WILL MAINTAIN THE COOLING MINIMUM AIR FLOW RATES BASED ON THE MODE OF OPERATION. ON A DECREASE IN SPACE TEMPERATURE BELOW THE EFFECTIVE HEATING SETPOINT, THE TERMINAL UNIT SUPPLY FAN SHALL BE COMMANDED ON AND THE SUPPLY AIR TERMINAL UNIT PRIMARY AIR DAMPER WILL MAINTAIN THE HEATING MINIMUM AIR FLOW RATE BASED ON THE MODE OF OPERATION. IF THE SPACE TEMPERATURE REMAINS BELOW THE EFFECTIVE HEATING SETPOINT WITH THE SUPPLY AIR TERMINAL UNIT AT MINIMUM HEATING AIRFLOW, THE FINTUBE RADIATION CONTROL VALVE (IF ZONE IS SERVED BY FINTUBE RADIATION) SHALL OPEN TO MAINTAIN SPACE TEMPERTURE HEATING SETPOINT. IF THE SPACE TEMPERATURE REMAINS BELOW THE EFFECTIVE HEATING SETPOINT WITH THE SUPPLY AIR TERMINAL UNIT AT MINIMUM HEATING AIRFLOW AND THE FINTUBE RADIATION CONTROL VALVE OPEN, THE HEATING WATER CONTROL VALVE WILL MODULATE TO MAINTAIN THE EFFECTIVE HEATING SETPOINT SUBJECT TO A TERMINAL UNIT HIGH DISCHARGE AIR TEMPERATURE LIMIT OF 20 DEG F ABOVE THE EFFECTIVE HEATING SETPOINT. IF THE SPACE TEMPERATURE REMAINS BELOW THE EFFECTIVE HEATING SETPOINT WITH THE MINIMUM HEATING AIRFLOW SUPPLY AIR TEMPERATURE 20 DEG F ABOVE EFFECTIVE HEATING SETPOINT, THE SUPPLY AIR TERMINAL UNIT DAMPER WILL BE MODULATED BETWEEN THE HEATING MINIMUM AND HEATING MAXIMUM SCHEDULED AIRFLOWS WHILE MAINTAINING THE DISCHARGE AIR TEMPERATURE LIMIT OF 20 DEG F ABOVE THE EFFECTIVE HEATING SETPOINT.

DEMAND VENTILATION OPERATION: IF THE ZONE SERVED BY TERMINAL UNIT CONTAINS A CO2 SENSOR, THE FOLLOWING CONTROL SEQUENCE SHALL BE UTILIZED: IF THE ZONE CO2 LEVEL EXCEEDS THE MAXIMUM CO2 SETPOINT, THE ASSOCIATED TERMINAL UNIT SHALL MODULATE THE PRIMARY AIR DAMPER OPEN AND THE VAV HEATING COIL CONTROL VALVE SHALL MODULATE TO MAINTAIN ZONE TEMPERATURE SETPOINT AS NEEDED. WHEN THE ZONE CO2 LEVEL FALLS BELOW THE MAXIMUM CO2 SETPOINT, THE TERMINAL UNIT SHALL RETURN TO NORMAL OPERATION.

DEHUMIDIFICATION OPERATION: IF THE ZONE SERVED BY TERMINAL UNIT CONTAINS A HUMIDITY SENSOR, THE FOLLOWING CONTROL SEQUENCE SHALL BE UTILIZED: IF THE ZONE HUMIDITY RISES ABOVE 60% RH, THE ASSOCIATED TERMINAL UNIT SHALL MODULATE THE PRIMARY AIR DAMPER OPEN TO THE MAXIMUM HEATING CFM AND THE VAV HEATING COIL CONTROL VALVE SHALL MODULATE TO MAINTAIN ZONE TEMPERATURE SETPOINT AS NEEDED. WHEN THE ZONE HUMIDITY FALLS BELOW 55% RH, THE TERMINAL UNIT SHALL RETURN TO NORMAL OPERATION.

FINTUBE RADIATION OPERATION: IF THE ZONE SERVED BY TERMINAL UNIT CONTAINS FINTUBE RADIATION. THE FOLLOWING CONTROL SEQUENCE SHALL BE UTILIZED FOR THE FIN TUBE RADIATION CONTROL VALVE AS WRITTEN IN THE TERMINAL UNIT OPERATION SEQUENCE ABOVE: IF THE SPACE TEMPERATURE REMAINS BELOW THE EFFECTIVE HEATING SETPOINT WITH THE SUPPLY AIR TERMINAL UNIT AT MINIMUM HEATING AIRFLOW, THE FINTUBE RADIATION CONTROL VALVE SHALL OPEN TO MAINTAIN SPACE TEMPERTURE HEATING SETPOINT.



GENERAL NOTE: THESE STANDARD SYSTEM DIAGRAMS AND SEQUENCES ARE DEVELOPED AS THE BASIS FOR DESIGN AND MAY NOT BE DIRECTLY APPLICABLE AS IS DUE TO EXISTING EQUIPMENT OR SYSTEM CAPABILITIES, OR DUE TO SYSTEM OR EQUIPMENT ARRANGEMENTS. IT IS THE RESPONSIBILITY OF THE ENGINEER OF RECORD TO MODIFY THESE DOCUMENTS AS REQUIRED FOR THE SPECIFIC CONDITIONS OF A PROJECT. REFER TO THE RFP DOCUMENTS FOR MODIFICATION PROCEDURES.



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ENGINEER SEAL

MARK	DATE	DESCRIPT
ISSL	JE DATE:	03/20/

PROJECT NUMBER:

SHEET TITLE: VAV SUPPLY TERMINAL WITH HOT WATER REHEAT -

PARALLEL FAN POWERED

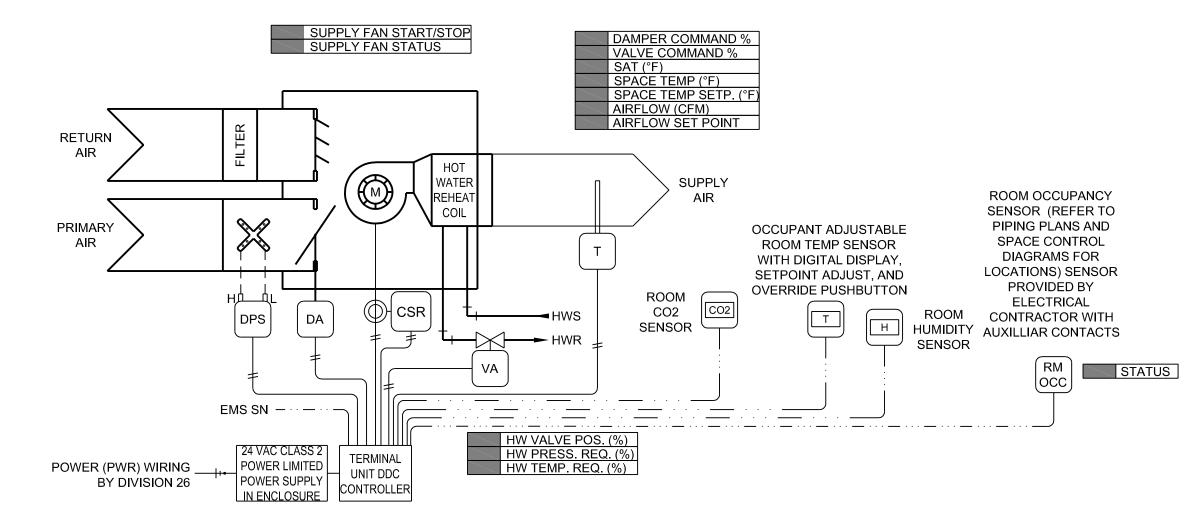
- 1. POWER WIRING BY DIVISION 26. 2. CONTROL WIRING BY DIVISION 230900.
- 3. ALL CONTROLLERS, ACTUATORS, SENSORS, SWITCHES, TUBING, AND POINTS INDICATED ON THE PLANS ARE PROVIDED AND INSTALLED BY DIVISION 230900, UNLESS NOTED OTHERWISE. CONTROL VALVES AND THERMOWELLS ARE PROVIDED BY DIVISION 230900, INSTALLED BY DIVISION 23. TRANSFORMERS ARE PROVIDED BY DIVISION 230900, INSTALLED BY DIVISION 26. 4. ALL POINTS INDICATED ON THE CONTROL DRAWINGS ARE NEW, PROVIDED BY DIVISION 230900,
- UNLESS INDICATED OTHERWISE. 5. A SINGLE TRANSFORMER CAN BE PROVIDED FOR UP TO 10 CONTROLLERS PROVIDED LENGTH
- OF RUNS AND ZONING IS TAKEN INTO CONSIDERATION. 6. REFER TO MECHANICAL SHEETS FOR FINAL COUNTS, LOCATIONS, PIPE SIZES, AND DUCT SIZES. 7. IF MULTIPLE TERMINALS SERVE THE SAME AREA, ONE OF THE CONTROLLERS WILL BE DESIGNATED AS THE MASTER CONTROLLER AND ALL OTHER CONTROLLERS WILL BE DESIGNATED AS SLAVE CONTROLLERS. VALVE AND DAMPER ACTUATORS OF THE SLAVE
- CONTROLLERS WILL TRACK THOSE OF THE MASTER TERMINAL. 8. IF COMPONENT IS DISABLED DUE TO MAINTENANCE SHUTDOWN OR A FAULT CONDITION,
- 9. THIS GRAPHIC SHALL BE REPRESENTED ON THE BAS, INCLUDING THE RESULTS OF AS-BUILT CONDITIONS. THE GRAPHIC IS TO BE POPULATED WITH LIVE VALUES. SET POINTS SHALL BE ADJUSTABLE FROM THIS GRAPHIC AND LINKS SHALL BE PROVIDED TO TRENDING GROUPS. 10. THIS GRAPHICAL SEQUENCE SHALL BE REPRESENTED AS A GRAPHIC ON THE BAS, INCLUDING THE RESULTS OF AS-BUILT PROGRAMMING. THE GRAPHIC IS TO BE POPULATED WITH LIVE

COMPONENT SHALL BE HIGHLIGHTED, OUTLINED, FLASH, OR CHANGE COLORS.

PROVIDED TO TRENDING GROUPS. 11. THE SCHEDULES AND TABLES INDICATED ON THIS SHEET (ALARMS, SET POINTS, MODES OF OPERATION, ETC) SHALL BE PROVIDED AS GRAPHICS, EDITABLE FROM THE GRAPHICS.

VALUES. SET POINTS SHALL BE ADJUSTABLE FROM THIS GRAPHIC AND LINKS SHALL BE

- 12. ALL POINTS ARE TO BE TRENDED AT 15 MINUTE INTERVALS AND BACKED UP AS SPECIFIED. 13. TRENDING GROUPS ARE IDENTIFIED ON THE SEQUENCE BY HEX NOTES. CONTRACTOR SHALL SET UP A TREND GROUP GRAPHIC FOR THE HEX NOTE DESIGNATIONS LISTED. EACH TREND GROUP SHALL CONTAIN ALL OF THE TRENDS WITH LIKE HEX NOTES. TREND GROUPS SHALL BE TRENDED AT A MINIMUM OF 30 SECOND INTERVALS FOR A MINIMUM DURATION OF 48 HOURS.
- 14. ATC CONTRACTOR SHALL TUNE ALL LOOPS AND TABLES FOR SMOOTH, STABLE OPERATION. NUMBERS INDICATED IN THESE DIAGRAMS ARE FOR A STARTING POINT ONLY. THESE DIAGRAMS REPRESENT THE BASIC FUNCTION OF THE CONTROLS SEQUENCE AND IS NOT ALL INCLUSIVE. THE ATC CONTRACTOR IS STILL REQUIRED TO PROVIDE, DEFINE, AND INDICATE ALL ALARMS, SET POINTS, AND FUNCTIONS REQUIRE TO ACHIEVE THE INTENT OF THE SEQUENCE, AND MAINTAINED ALL EQUIPMENT MANUFACTURER REQUIREMENTS.



VAV SUPPLY TERMINAL WITH HOT WATER REAHEAT - SERIES FAN POWERED NOT TO SCALE IVAN EDS1

SEQUENCE OF OPERATION:

MODE OF OPERATION: THE SUPPLY AIR TERMINAL UNIT MODE OF OPERATION WILL BE OCCUPIED, UNOCCUPIED, OR MORNING WARM-UP BASED ON A SCHEDULE COMMUNICATED FROM THE EMS, AN OPERATOR OVERRIDE COMMAND FROM THE EMS, A TEMPORARY OCCUPANCY OVERRIDE SIGNAL FROM THE SPACE TEMPERATURE SENSOR OVERRIDE PUSHBUTTON, OR A SIGNAL FROM THE ZONE OCCUPANCY SENSOR (IF ZONE CONTAINS AN OCCUPANCY SENSOR).

OCCUPIED MODE: THE SPACE TEMPERATURE SETPOINT WILL BE ADJUSTABLE BY THE OCCUPANT AT THE THERMOSTAT BETWEEN A MINIMUM OF 68 DEG F AND A MAXIMUM OF 75 DEG F.THE TERMINAL UNIT PRIMARY AIR DAMPER OCCUPIED MINIMUM AIRFLOW AND OCCUPIED MAXIMUM AIRFLOW ARE AS SCHEDULED. THE EFFECTIVE COOLING SETPOINT WILL BE EQUAL TO THE SPACE TEMPERATURE SETPOINT PLUS 1 DEG F AND THE EFFECTIVE HEATING SETPOINT WILL BE EQUAL TO THE SPACE TEMPERATURE SETPOINT MINUS 1 DEG F. DURING OCCUPIED MODE, THE TERMINAL UNIT SUPPLY FAN SHALL BE COMMANDED ON AND WILL RUN CONTINUOUSLY. UNOCCUPIED MODE: THE UNOCCUPIED SPACE TEMPERATURE SETPOINTS WILL BE 65 DEG F SPACE HEATING SETPOINT AND 80 DEG F SPACE COOLING SETPOINT. WHEN THE OCCUPANCY OVERRIDE PUSHBUTTON ON THE SPACE TEMPERATURE SENSOR IS INDEXED TO OCCUPIED, THE UNIT WILL OPERATE IN THE OCCUPIED MODE FOR 2 HOURS, AND THE ASSOCIATED AIR HANDLING UNIT WILL INDEX TO OCCUPIED STATUS FOR THE DURATION OF TIME NEEDED FOR OCCUPANCY OVERRIDE. DURING UNOCCUPIED MODE, THE TERMINAL UNIT SUPPLY FAN SHALL BE COMMANDED OFF.

MORNING WARM-UP MODE: IF THE SPACE TEMPERATURE IS BELOW THE EFFECTIVE HEATING SETPOINT, THE TERMINAL UNIT SUPPLY FAN SHALL BE COMMANDED ON, THE HEATING WATER CONTROL VALVE WILL MODULATE TO MAINTAIN THE EFFECTIVE HEATING SETPOINT AND THE SUPPLY AIR TERMINAL UNIT DAMPER WILL BE CLOSED. IN MORNING WARM-UP MODE, THERE WILL BE NO TERMINAL UNIT HIGH DISCHARGE AIR TEMPERATURE LIMIT.

TERMINAL UNIT OPERATION: ON AN INCREASE IN SPACE TEMPERATURE ABOVE THE EFFECTIVE COOLING SETPOINT, THE SUPPLY AIR TERMINAL UNIT PRIMARY AIR DAMPER WILL BE MODULATED BETWEEN THE COOLING MINIMUM AND THE COOLING MAXIMUM AIR FLOW RATES TO SATISFY THE COOLING DEMAND BASED ON THE MODE OF OPERATION. ON A DECREASE IN SPACE TEMPERATURE BELOW THE EFFECTIVE COOLING SETPOINT, THE SUPPLY AIR TERMINAL UNIT PRIMARY AIR DAMPER WII MAINTAIN THE COOLING MINIMUM AIR FLOW RATES BASED ON THE MODE OF OPERATION. ON A DECREASE IN SPACE TEMPERATURE BELOW THE EFFECTIVE HEATING SETPOINT, THE SUPPLY AIR TERMINAL UNIT PRIMARY AIR DAMPER WILL MAINTAIN THE HEATING MINIMUM AIR FLOW RATE BASED ON THE MODE OF OPERATION. IF THE SPACE TEMPERATURE REMAINS BELOW THE EFFECTIVE HEATING SETPOINT WITH THE SUPPLY AIR TERMINAL UNIT AT MINIMUM HEATING AIRFLOW, THE FINTUBE RADIATION CONTROL VALVE (IF ZONE IS SERVED BY FINTUBE RADIATION) SHALL OPEN TO MAINTAIN SPACE TEMPERTURE HEATING SETPOINT. IF THE SPACE TEMPERATURE REMAINS BELOW THE EFFECTIVE HEATING SETPOINT WITH THE SUPPLY AIR TERMINAL UNIT AT MINIMUM HEATING AIRFLOW AND THE FINTUBE RADIATION CONTROL VALVE OPEN, THE HEATING WATER CONTROL VALVE WILL MODULATE TO MAINTAIN THE EFFECTIVE HEATING SETPOINT SUBJECT TO A TERMINAL UNIT HIGH DISCHARGE AIR TEMPERATURE LIMIT OF 20 DEG F ABOVE THE EFFECTIVE HEATING SETPOINT. IF THE SPACE TEMPERATURE REMAINS BELOW THE EFFECTIVE HEATING SETPOINT WITH THE MINIMUM HEATING AIRFLOW SUPPLY AIR TEMPERATURE 20 DEG F ABOVE EFFECTIVE HEATING SETPOINT, THE SUPPLY AIR TERMINAL UNIT DAMPER WILL BE MODULATED BETWEEN THE HEATING MINIMUM AND HEATING MAXIMUM SCHEDULED AIRFLOWS WHILE MAINTAINING THE DISCHARGE AIR TEMPERATURE LIMIT OF 20 DEG F ABOVE THE EFFECTIVE HEATING SETPOINT.

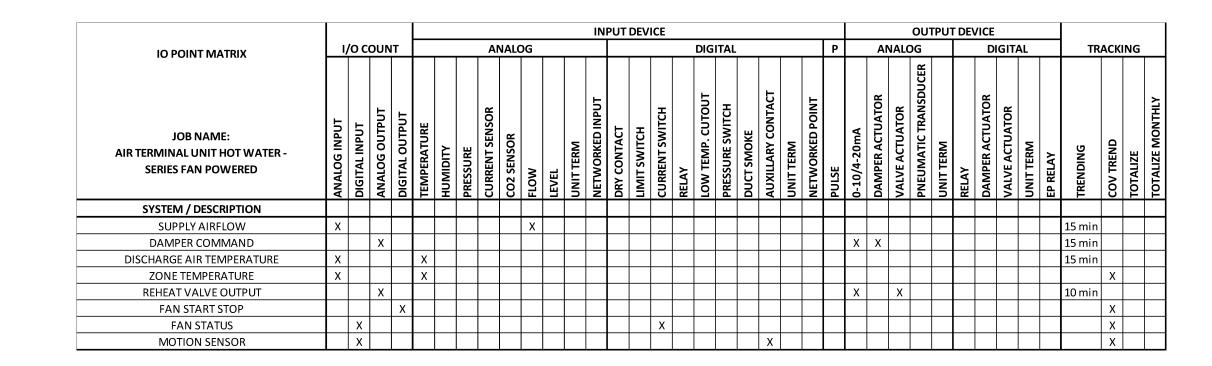
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FOR THE SPECIFIC CONDITIONS OF A PROJECT. REFER TO THE RFP DOCUMENTS FOR MODIFICATION PROCEDURES.

DEHUMIDIFICATION OPERATION: IF THE ZONE SERVED BY TERMINAL UNIT CONTAINS A HUMIDITY SENSOR, THE AHU SUPPLY TEMPERATURE SET POINT SHALL BE RESET DOWN AS REQUIRED TO MAINTAIN A MAXIMUM RH TEMP SET POINT.



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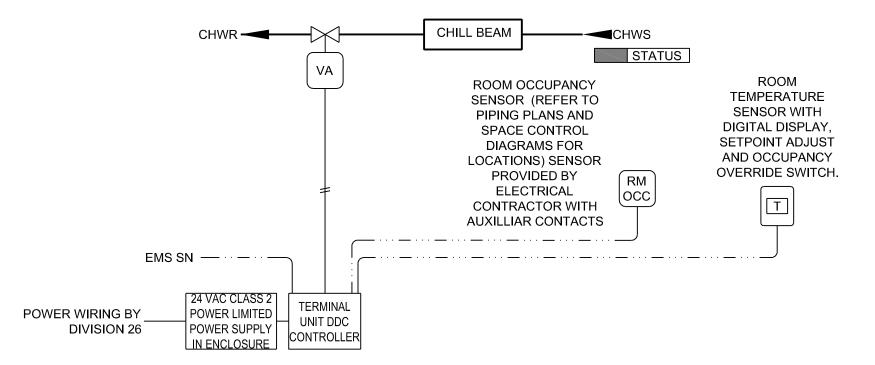
ENGINEER SEAL

MARK DATE DESCRIPTION ISSUE DATE:

PROJECT NUMBER: 04-18-0072 SHEET TITLE

VAV SUPPLY TERMINAL WITH HOT WATER REHEAT - SERIES FAN POWERED

- 1. POWER WIRING BY DIVISION 26.
- 2. CONTROL WIRING BY DIVISION 230900. 3. ALL CONTROLLERS, ACTUATORS, SENSORS, SWITCHES, TUBING, AND POINTS INDICATED ON THE PLANS ARE PROVIDED AND INSTALLED BY DIVISION 230900, UNLESS NOTED OTHERWISE. CONTROL VALVES AND THERMOWELLS ARE PROVIDED BY DIVISION 230900, INSTALLED BY DIVISION 23. TRANSFORMERS
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- 6. REFER TO MECHANICAL SHEETS FOR FINAL COUNTS, LOCATIONS, PIPE SIZES, AND DUCT SIZES. 7. IF MULTIPLE TERMINALS SERVE THE SAME AREA, ONE OF THE CONTROLLERS WILL BE DESIGNATED AS THE MASTER CONTROLLER AND ALL OTHER CONTROLLERS WILL BE DESIGNATED AS SLAVE CONTROLLERS. VALVE AND DAMPER ACTUATORS OF THE SLAVE CONTROLLERS WILL TRACK THOSE
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- MINIMUM OF 30 SECOND INTERVALS FOR A MINIMUM DURATION OF 48 HOURS. 14. ATC CONTRACTOR SHALL TUNE ALL LOOPS AND TABLES FOR SMOOTH, STABLE OPERATION. NUMBERS INDICATED IN THESE DIAGRAMS ARE FOR A STARTING POINT ONLY. THESE DIAGRAMS REPRESENT THE BASIC FUNCTION OF THE CONTROLS SEQUENCE AND IS NOT ALL INCLUSIVE. THE ATC CONTRACTOR IS STILL REQUIRED TO PROVIDE, DEFINE, AND INDICATE ALL ALARMS, SET POINTS, AND FUNCTIONS REQUIRE TO ACHIEVE THE INTENT OF THE SEQUENCE, AND MAINTAINED ALL EQUIPMENT MANUFACTURER REQUIREMENTS.



SEQUENCE OF OPERATION:

CHILL WATER CONTROL VALVE: CHILL WATER CONTROL VALVE SHALL MODULATE AS REQUIRED TO MAIN SPACE TEMPERATURE SETPOINT (ADJ.).

HOURS (ADJUSTABLE) OR BY OCCUPANCY SENSOR.

MODES OF OPERATION: MODE OF OPERATION IS EITHER "OCCUPIED", "STANDBY", OR "UNOCCUPIED": OCCUPIED AND UNOCCUPIED MODES ARE DETERMINED BASED ON A CALENDAR AND TIME OF DAY SCHEDULE. STANDBY MODE IS DETERMINED DURING OCCUPIED MODE WITH INPUT FROM OCCUPANCY SENSOR. UNOCCUPIED MODE CAN BE OVERRIDDEN TO OCCUPIED MODE BY EITHER BUTTON AT THERMOSTAT FOR 2

OCCUPIED MODE: DURING THE "OCCUPIED" MODE OF OPERATION, THE SET POINT SHALL BE ADJUSTED THROUGH THE DDC CONTROL PANEL BETWEEN A MINIMUM OF 71 DEG. F AND MAXIMUM OF 75 DEG. F. THERE SHALL BE A 1 DEG. F. DEAD BAND ON EITHER SIDE OF THE SETPOINT.

STANDBY MODE: WHEN A SPACE MOTION DETECTOR IS PRESENT AND SENSES OCCUPANCY, MODE OF OPERATION SHALL BE "OCCUPIED." IF SENSOR DOES NOT SENSE OCCUPANCY, THEN SPACE WILL BE IN STANDBY MODE. DURING THE "STANDBY" MODE OF OPERATION, THE SET POINT SHALL BE ADJUSTED THROUGH THE DDC CONTROL PANEL BETWEEN A MINIMUM OF 71 DEG. F AND MAXIMUM OF 75 DEG. F. THERE SHALL BE A 3 DEG. F. DEAD BAND ON EITHER SIDE OF THE SETPOINT.

UNOCCUPIED MODE: DURING THE "UNOCCUPIED" MODE OF OPERATION, THE SET POINT SHALL BE ADJUSTED THROUGH THE DDC CONTROL PANEL BETWEEN A MINIMUM OF 71 DEG. F AND MAXIMUM OF 75 DEG. F. THERE SHALL BE A 6 DEG. F. DEAD BAND ON EITHER SIDE OF THE SETPOINT.

MOISTURE DETECTOR TRIP: UPON ACTIVATION OF THE MOISTURE DETECTION SENSOR AN ALARM WILL BE GENERATED AND SENT TO THE EMS. THE CONTROL VALVE(S) WILL BE COMMANDED CLOSED.

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JOB NAME: CHILLED BEAM - COOLING ONLY	ANALOG INPUT	DIGITAL INPUT	ANALOG OUTPUT	DIGITAL OUTPUT	TEMPERATURE	HUMIDITY	PRESSURE	CURRENT SENSOR	CO2 SENSOR	FLOW	LEVEL	UNIT TERM	NETWORKED INPUT	DRY CONTACT	LIMIT SWITCH	CURRENT SWITCH	RELAY	LOW TEMP. CUTOUT	PRESSURE SWITCH	MOK	AUXILLARY CONTACT	UNIT TERM	NETWORKED POINT	PULSE	0-10/4-20mA	DAMPER ACTUATOR	VALVE ACTUATOR	PNEUMATIC TRANSDUCER	UNIT TERM	RELAY	DAMPER ACTUATOR	VALVE ACTUATOR	UNIT TERM	EP RELAY	TRENDING	COV TREND	TOTALIZE	TOTALIZE MONTHLY
SYSTEM / DESCRIPTION																																						
COIL OUTPUT VALVE			Х																						Χ		Χ								15 min			
ZONE TEMPERATURE	Х				Х																															Х		
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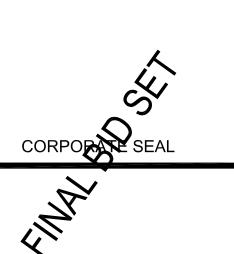
GENERAL NOTE: THESE STANDARD SYSTEM DIAGRAMS AND SEQUENCES ARE DEVELOPED AS THE BASIS FOR DESIGN AND MAY NOT BE

DIRECTLY APPLICABLE AS IS DUE TO EXISTING EQUIPMENT OR SYSTEM CAPABILITIES, OR DUE TO SYSTEM OR EQUIPMENT ARRANGEMENTS. IT IS THE RESPONSIBILITY OF THE ENGINEER OF RECORD TO MODIFY THESE DOCUMENTS AS REQUIRED

FOR THE SPECIFIC CONDITIONS OF A PROJECT. REFER TO THE RFP DOCUMENTS FOR MODIFICATION PROCEDURES.

2039 NORTH GREEN ACRES FAYETTEVILLE, AR 72703

Phone: (479) 521-8634 Fax: (479) 521-1014 bernhard.com



ENGINEER SEAL

MARK DATE DESCRIPTION ISSUE DATE: PROJECT NUMBER:

> CHILLED BEAM -COOLING ONLY

SHEET TITLE:

SHEET NUMBER: ATC5.10

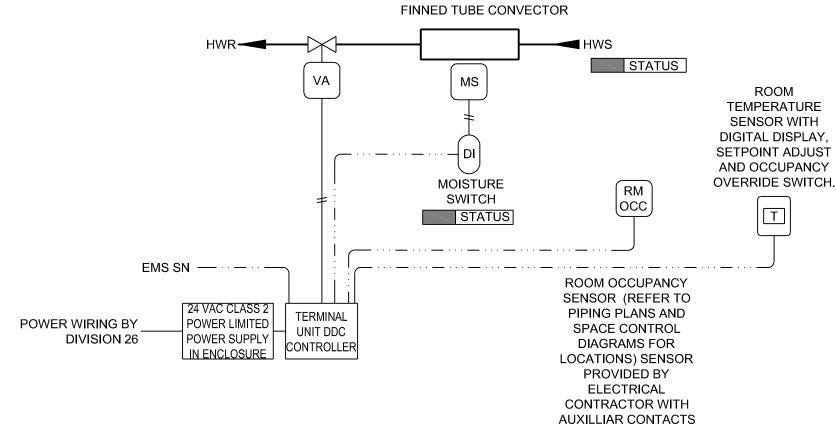
- 1. POWER WIRING BY DIVISION 26.
- CONTROL WIRING BY DIVISION 230900.
 ALL CONTROLLERS, ACTUATORS, SENSORS, SWITCHES, TUBING, AND POINTS INDICATED ON THE PLANS ARE PROVIDED AND INSTALLED BY DIVISION 230900, UNLESS NOTED OTHERWISE. CONTROL VALVES AND THERMOWELLS ARE PROVIDED BY DIVISION 230900, INSTALLED BY DIVISION 23. TRANSFORMERS ARE PROVIDED BY DIVISION 230900, INSTALLED BY DIVISION 26.
- 4. ALL POINTS INDICATED ON THE CONTROL DRAWINGS ARE NEW, PROVIDED BY DIVISION 230900, UNLESS INDICATED OTHERWISE
- 5. A SINGLE TRANSFORMER CAN BE PROVIDED FOR UP TO 10 CONTROLLERS PROVIDED LENGTH OF RUNS AND ZONING IS TAKEN INTO CONSIDERATION.
- REFER TO MECHANICAL SHEETS FOR FINAL COUNTS, LOCATIONS, PIPE SIZES, AND DUCT SIZES.
 IF MULTIPLE TERMINALS SERVE THE SAME AREA, ONE OF THE CONTROLLERS WILL BE DESIGNATED AS THE MASTER CONTROLLER AND ALL OTHER CONTROLLERS WILL BE DESIGNATED AS SLAVE CONTROLLERS. VALVE AND DAMPER ACTUATORS OF THE SLAVE CONTROLLERS WILL TRACK THOSE OF THE MASTER TERMINAL.
- IF COMPONENT IS DISABLED DUE TO MAINTENANCE SHUTDOWN OR A FAULT CONDITION, COMPONENT SHALL BE HIGHLIGHTED, OUTLINED, FLASH, OR CHANGE COLORS.
 THIS GRAPHIC SHALL BE REPRESENTED ON THE BAS, INCLUDING THE RESULTS OF AS-BUILT CONDITIONS. THE CRAPHIC IS TO BE DOD!!! ATED WITH LIVE VALUES, SET DOINTS SHALL BE AD ILISTABLE EDOM THIS CRAPHIC.
- GRAPHIC IS TO BE POPULATED WITH LIVE VALUES. SET POINTS SHALL BE ADJUSTABLE FROM THIS GRAPHIC AND LINKS SHALL BE PROVIDED TO TRENDING GROUPS.

 10. THIS GRAPHICAL SEQUENCE SHALL BE REPRESENTED AS A GRAPHIC ON THE BAS, INCLUDING THE RESULTS OF
- AS-BUILT PROGRAMMING. THE GRAPHIC IS TO BE POPULATED WITH LIVE VALUES. SET POINTS SHALL BE ADJUSTABLE FROM THIS GRAPHIC AND LINKS SHALL BE PROVIDED TO TRENDING GROUPS.

 11. THE SCHEDULES AND TABLES INDICATED ON THIS SHEET (ALARMS, SET POINTS, MODES OF OPERATION, ETC)
- ALL POINTS ARE TO BE TRENDED AT 15 MINUTE INTERVALS AND BACKED UP AS SPECIFIED.
 TRENDING GROUPS ARE IDENTIFIED ON THE SEQUENCE BY HEX NOTES. CONTRACTOR SHALL SET UP A TREND GROUP GRAPHIC FOR THE HEX NOTE DESIGNATIONS LISTED. EACH TREND GROUP SHALL CONTAIN ALL OF THE TRENDS WITH LIKE HEX NOTES. TREND GROUPS SHALL BE TRENDED AT A MINIMUM OF 30 SECOND INTERVALS FOR A MINIMUM DURATION OF 48 HOURS.

SHALL BE PROVIDED AS GRAPHICS, EDITABLE FROM THE GRAPHICS.

14. ATC CONTRACTOR SHALL TUNE ALL LOOPS AND TABLES FOR SMOOTH, STABLE OPERATION. NUMBERS INDICATED IN THESE DIAGRAMS ARE FOR A STARTING POINT ONLY. THESE DIAGRAMS REPRESENT THE BASIC FUNCTION OF THE CONTROLS SEQUENCE AND IS NOT ALL INCLUSIVE. THE ATC CONTRACTOR IS STILL REQUIRED TO PROVIDE, DEFINE, AND INDICATE ALL ALARMS, SET POINTS, AND FUNCTIONS REQUIRE TO ACHIEVE THE INTENT OF THE SEQUENCE, AND MAINTAINED ALL EQUIPMENT MANUFACTURER REQUIREMENTS.



FINNED TUBE CONVECTOR
NOT TO SCALE [FT-CONV]

SEQUENCE OF OPERATION:

CHILLED WATER CONTROL VALVE:THE CHILLED WATER CONTROL VALVE SHALL MODULATE AS REQUIRED TO MAINTAIN SPACE TEMPERATURE SETPOINT (ADJ).

MODE OF OPERATION: MODE OF OPERATION IS EITHER "OCCUPIED", "STANDBY", OR "UNOCCUPIED".

OCCUPIED AND UNOCCUPIED MODES ARE DETERMINED BASED ON A CALENDAR AND TIME OF DAY

SCHEDULE. STANDBY MODE IS DETERMINED DURING THE OCCUPIED MODE WITH INPUT FROM OCCUPANCY SENSOR. UNOCCUPIED MODE CAN BE OVERRIDDEN TO OCCUPIED MODE BY EITHER BUTTON AT THE THERMOSTAT (2 HOURS, ADJUSTABLE TIME) OR BY OCCUPANCY SENSOR.

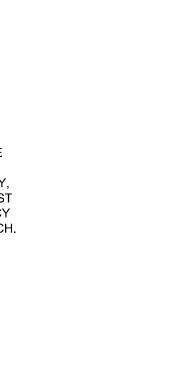
OCCUPIED MODE:DURING OCCUPIED MODE OF OPERATION, THE SETPOINT SHALL BE ADJUSTED THROUGH THE DDC CONTROL PANEL BETWEEN A MINIMUM OF 71 DEGF AND A MAXIMUM OF 75 DEGF. THERE SHALL BE A 1 DEGF DEAD BAND ON EITHER SIDE OF THE SETPOINT.

STANDBY MODE:WHEN A SPACE MOTION DETECTOR IS PRESENT AND SENSES OCCUPANCY, THE MODE OF OPERATION SHALL BE "OCCUPIED." IF THE SENSOR DOES NOT SENSE OCCUPANCY, THE SPACE WILL BE IN "STANDBY" MODE. DURING THE STANDBY MODE OF OPERATION, THE SETPOINT SHALL BE ADJUSTED THROUGH THE DDC CONTROL PANEL BETWEEN A MINIMUM OF 71 DEGF AND A MAXIMUM OF 75 DEGF. THERE SHALL BE A 3 DEGF DEAD BAND ON EITHER SIDE OF THE SETPOINT. UNOCCUPIED MODE:DURING THE "UNOCCUPIED" MODE OF OPERATION, THE SET POINT SHALL BE ADJUSTED THROUGH THE DDC CONTROL PANEL BETWEEN A MINIMUM OF 71 DEGF AND A MAXIMUM OF 75 DEGF. THERE SHALL BE A 6 DEGF DEAD BAND ON EITHER SIDE OF THE SETPOINT.

BUILDING WATER MIXING VALVE: THE BUILDING WATER MIXING VALVE SHALL MODULATE TO MAINTAIN THE DISCHARGE WATER SETPOINT. DEFAULT SETPOINT SHALL BE 65 DEGREES (ADJ).

MOISTURE SENSING:A MOISTURE SENSOR SHALL BE INSTALLED AT THE RETURN CHILLED WATER LINE. IN THE EVENT THAT MOISTURE IS DETECTED, THE CHILLED BEAM VALVE SHALL BE CLOSED AND AN ALARM SHALL BE GENERATED.

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JOB NAME: FINNED TUBE CONVECTOR	ANALOG INPUT	DIGITAL INPUT	ANALOG OUTPUT	DIGITAL OUTPUT	TEMPERATURE	ниміріту	PRESSURE	CURRENT SENSOR	CO2 SENSOR	FLOW	LEVEL	UNIT TERM	NETWORKED INPUT	DRY CONTACT	LIMIT SWITCH	CURRENT SWITCH	RELAY	LOW TEMP. CUTOUT	PRESSURE SWITCH	DUCT SMOKE	AUXILLARY CONTACT	UNIT TERM	NETWORKED POINT	PULSE	0-10/4-20mA	DAMPER ACTUATOR	VALVE ACTUATOR	PNEUMATIC TRANSDUCER	UNIT TERM	RELAY	DAMPER ACTUATOR	VALVE ACTUATOR	UNIT TERM	EP RELAY	TRENDING)	COV TREND		TOTALIZE MONTHLY
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ENGINEER SEAL

2039 NORTH GREEN ACRES

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CONTROL DRAWING

MARK DATE DESCRIPTION
ISSUE DATE: 03/20/19
PROJECT NUMBER: 04-18-0072

SHEET TITLE: FINNED TUBE CONVERTER

SHEET NUMBER:
ATC5.11

- 1. POWER WIRING BY DIVISION 26.
- CONTROL WIRING BY DIVISION 230900.
 ALL CONTROLLERS, ACTUATORS, SENSORS, SWITCHES, TUBING, AND POINTS INDICATED ON THE PLANS ARE PROVIDED AND INSTALLED BY DIVISION 230900, UNLESS NOTED OTHERWISE. CONTROL VALVES AND THERMOWELLS ARE PROVIDED BY DIVISION 230900, INSTALLED BY DIVISION 23. TRANSFORMERS ARE PROVIDED BY DIVISION 230900, INSTALLED BY DIVISION 26.
- 4. ALL POINTS INDICATED ON THE CONTROL DRAWINGS ARE NEW, PROVIDED BY DIVISION 230900, UNLESS INDICATED OTHERWISE.
- 5. A SINGLE TRANSFORMER CAN BE PROVIDED FOR UP TO 10 CONTROLLERS PROVIDED LENGTH OF RUNS AND ZONING IS TAKEN INTO CONSIDERATION.
- REFER TO MECHANICAL SHEETS FOR FINAL COUNTS, LOCATIONS, PIPE SIZES, AND DUCT SIZES.
 IF MULTIPLE TERMINALS SERVE THE SAME AREA, ONE OF THE CONTROLLERS WILL BE DESIGNATED AS THE MASTER CONTROLLER AND ALL OTHER CONTROLLERS WILL BE DESIGNATED AS SLAVE CONTROLLERS. VALVE AND DAMPER ACTUATORS OF THE SLAVE CONTROLLERS WILL TRACK THOSE OF THE MASTER TERMINAL.
 IF COMPONENT IS DISABLED DUE TO MAINTENANCE SHUTDOWN OR A FAULT CONDITION, COMPONENT SHALL BE
- HIGHLIGHTED, OUTLINED, FLASH, OR CHANGE COLORS.

 9. THIS GRAPHIC SHALL BE REPRESENTED ON THE BAS, INCLUDING THE RESULTS OF AS-BUILT CONDITIONS. THE
- GRAPHIC IS TO BE POPULATED WITH LIVE VALUES. SET POINTS SHALL BE ADJUSTABLE FROM THIS GRAPHIC AND LINKS SHALL BE PROVIDED TO TRENDING GROUPS.

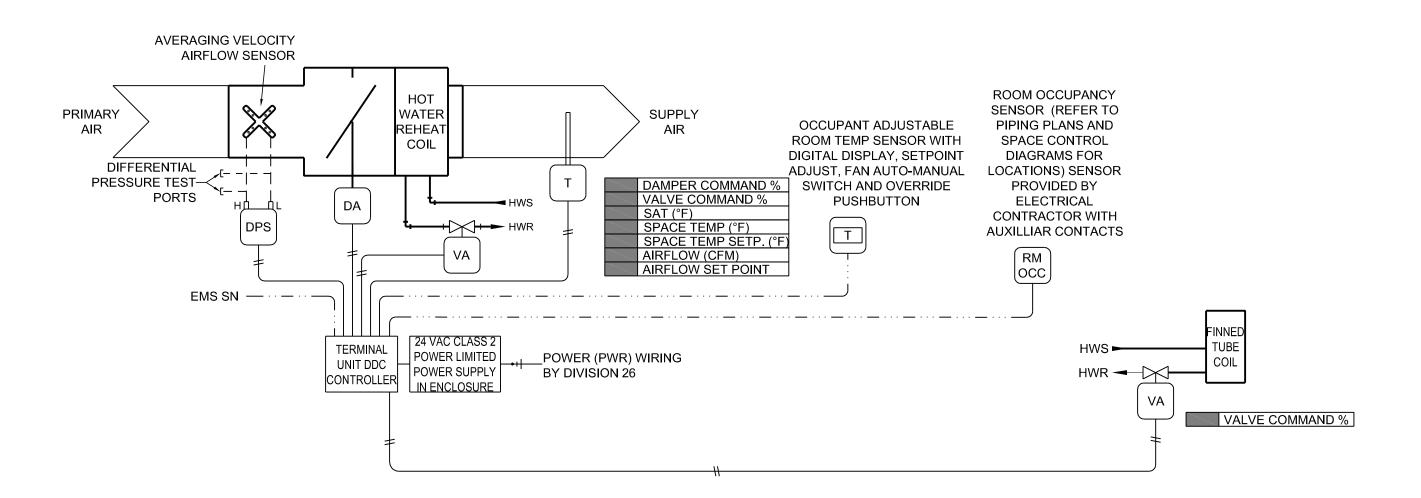
 10. THIS GRAPHICAL SEQUENCE SHALL BE REPRESENTED AS A GRAPHIC ON THE BAS, INCLUDING THE RESULTS OF AS BUILT PROCESSAMMING. THE CRAPHIC IS TO BE POPULATED WITH LIVE VALUES. SET POINTS SHALL BE

SHALL BE PROVIDED AS GRAPHICS, EDITABLE FROM THE GRAPHICS.

- AS-BUILT PROGRAMMING. THE GRAPHIC IS TO BE POPULATED WITH LIVE VALUES. SET POINTS SHALL BE ADJUSTABLE FROM THIS GRAPHIC AND LINKS SHALL BE PROVIDED TO TRENDING GROUPS.

 11. THE SCHEDULES AND TABLES INDICATED ON THIS SHEET (ALARMS, SET POINTS, MODES OF OPERATION, ETC)
- ALL POINTS ARE TO BE TRENDED AT 15 MINUTE INTERVALS AND BACKED UP AS SPECIFIED.
 TRENDING GROUPS ARE IDENTIFIED ON THE SEQUENCE BY HEX NOTES. CONTRACTOR SHALL SET UP A TREND GROUP GRAPHIC FOR THE HEX NOTE DESIGNATIONS LISTED. EACH TREND GROUP SHALL CONTAIN ALL OF THE TRENDS WITH LIKE HEX NOTES. TREND GROUPS SHALL BE TRENDED AT A MINIMUM OF 30 SECOND INTERVALS
- FOR A MINIMUM DURATION OF 48 HOURS.

 14. ATC CONTRACTOR SHALL TUNE ALL LOOPS AND TABLES FOR SMOOTH, STABLE OPERATION. NUMBERS INDICATED IN THESE DIAGRAMS ARE FOR A STARTING POINT ONLY. THESE DIAGRAMS REPRESENT THE BASIC FUNCTION OF THE CONTROLS SEQUENCE AND IS NOT ALL INCLUSIVE. THE ATC CONTRACTOR IS STILL REQUIRED TO PROVIDE, DEFINE, AND INDICATE ALL ALARMS, SET POINTS, AND FUNCTIONS REQUIRE TO ACHIEVE THE INTENT OF THE SEQUENCE, AND MAINTAINED ALL EQUIPMENT MANUFACTURER REQUIREMENTS.



VAV SUPPLY TERMINAL WITH HOT WATER REHEAT AND FINNED TUBE NOT TO SCALE [VAV-RH-FT]

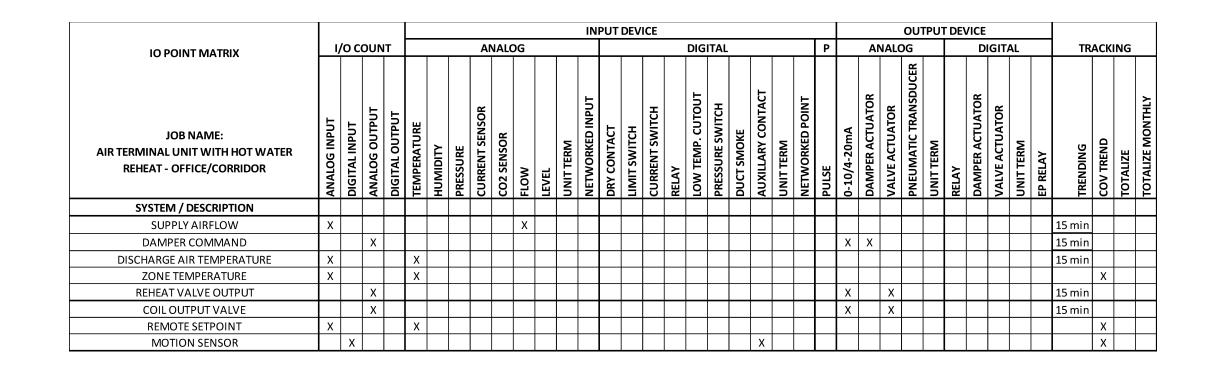
SEQUENCE OF OPERATION:

MODES OF OPERATION: AIR TERMINAL MODE OF OPERATION IS EITHER "OCCUPIED", "STANDBY", OR "UNOCCUPIED": OCCUPIED AND UNOCCUPIED MODES ARE DETERMINED BASED ON A CALENDAR AND TIME OF DAY SCHEDULE. STANDBY MODE IS DETERMINED DURING THE OCCUPIED MODE WITH INPUT FROM OCCUPANCY SENSOR. UNOCCUPIED MODE CAN BE OVERRIDDEN TO OCCUPIED MODE BY EITHER BUTTON AT THERMOSTAT FOR 2 HOURS (ADJUSTABLE) OR BY OCCUPANCY SENSOR. TERMINAL CONTROLLER SHALL MODULATED THE TERMINAL DAMPER AND THE HEATING WATER CONTROL VALVE AS REQUIRED TO MAINTAIN THE SPACE TEMPERATURE AT SETPOINT.

OCCUPIED MODE: DURING THE "OCCUPIED" MODE OF OPERATION, THE SET POINT SHALL BE ADJUSTED THROUGH THE DDC CONTROL PANEL BETWEEN A MINIMUM OF 71 DEG. F AND MAXIMUM OF 75 DEG. F. THERE SHALL BE A 1 DEG. F. DEAD BAND ON EITHER SIDE OF THE SETPOINT. ON A CALL FOR COOLING, THE TERMINAL DAMPER SHALL BE MODULATED BETWEEN THE COOLING MINIMUM AND THE COOLING MAXIMUM AIR FLOW RATES SCHEDULED. ON A CALL FOR HEATING, THE TERMINAL CONTROL VALVE SHALL BE MODULATED FROM CLOSED TO OPEN, THEN THE TERMINAL DAMPER SHALL BE MODULATED BETWEEN THE HEATING MINIMUM AND THE MAXIMUM AIR FLOW RATES SCHEDULED, AFTER THE SYSTEM IS AT MAX AIR FLOW RATE, THE FIN TUBE CONTROL VALVES SHALL MODULATE FROM CLOSED TO OPEN. IF THE LEAVING HEATING SUPPLY TEMPERATURE EXCEEDS THE SPACE TEMP BY 15 DEG. F. (ADJ), THE SUPPLY AIR SHALL BE MODULATED UP TO MAXIMUM AIRFLOW RATE AS REQUIRED TO PREVENT THE 15 DEG. F. SET POINT FROM BEING EXCEEDED.

STANDBY MODE: WHEN A SPACE MOTION DETECTOR IS PRESENT AND SENSES OCCUPANCY, MODE OF OPERATION SHALL BE "OCCUPIED." IF SENSOR DOES NOT SENSE OCCUPANCY, THEN SPACE WILL BE IN STANDBY MODE. DURING THE "STANDBY" MODE OF OPERATION, THE SET POINT SHALL BE ADJUSTED THROUGH THE DDC CONTROL PANEL BETWEEN A MINIMUM OF 71 DEG. F AND MAXIMUM OF 75 DEG. F. THERE SHALL BE A 3 DEG. F. DEAD BAND ON EITHER SIDE OF THE SETPOINT. ON A CALL FOR COOLING, THE TERMINAL DAMPER SHALL BE MODULATED BETWEEN THE COOLING MINIMUM AND THE COOLING MAXIMUM AIR FLOW RATES SCHEDULED. ON A CALL FOR HEATING, THE CONTROL VALVE SHALL BE MODULATED FROM CLOSED TO OPEN, THEN THE TERMINAL DAMPER SHALL BE MODULATED BETWEEN THE HEATING MINIMUM AND THE MAXIMUM AIR FLOW RATES SCHEDULED, AFTER THE SYSTEM IS AT MAX AIR FLOW RATE, THE FIN TUBE CONTROL VALVES SHALL MODULATE FROM CLOSED TO OPEN. IF THE LEAVING HEATING SUPPLY TEMPERATURE EXCEEDS THE SPACE TEMP BY 15 DEG. F. (ADJ), THE SUPPLY AIR SHALL BE MODULATED UP TO MAXIMUM AIRFLOW RATE AS REQUIRED TO PREVENT THE 15 DEG. F. SET POINT FROM BEING EXCEEDED.

UNOCCUPIED MODE: DURING THE "UNOCCUPIED" MODE OF OPERATION, THE SET POINT SHALL BE ADJUSTED THROUGH THE DDC CONTROL PANEL BETWEEN A MINIMUM OF 71 DEG. F AND MAXIMUM OF 75 DEG. F. THERE SHALL BE A 6 DEG. F. DEAD BAND ON EITHER SIDE OF THE SETPOINT. ON A CALL FOR COOLING, THE TERMINAL DAMPER SHALL BE MODULATED BETWEEN THE COOLING MINIMUM AND THE COOLING MAXIMUM AIR FLOW RATES SCHEDULED. ON A CALL FOR HEATING, THE CONTROL VALVE SHALL BE MODULATED FROM CLOSED TO OPEN, THEN THE TERMINAL DAMPER SHALL BE MODULATED BETWEEN THE HEATING MINIMUM AND THE MAXIMUM AIR FLOW RATES SCHEDULED, AFTER THE SYSTEM IS AT MAX AIR FLOW RATE, THE FIN TUBE CONTROL VALVES SHALL MODULATE FROM CLOSED TO OPEN. IF THE LEAVING HEATING SUPPLY TEMPERATURE EXCEEDS THE SPACE TEMP BY 15 DEG. F. (ADJ), THE SUPPLY AIR SHALL BE MODULATED UP TO MAXIMUM AIRFLOW RATE AS REQUIRED TO PREVENT THE 15 DEG. F. SET POINT FROM BEING EXCEEDED.

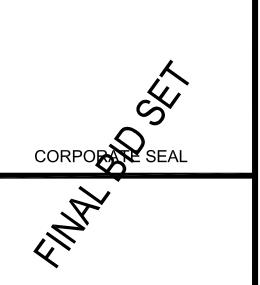


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FOR THE SPECIFIC CONDITIONS OF A PROJECT. REFER TO THE RFP DOCUMENTS FOR MODIFICATION PROCEDURES.



2039 NORTH GREEN ACRES ROAD FAYETTEVILLE, AR 72703 Phone: (479) 521-8634 Fax: (479) 521-1014 bernhard.com



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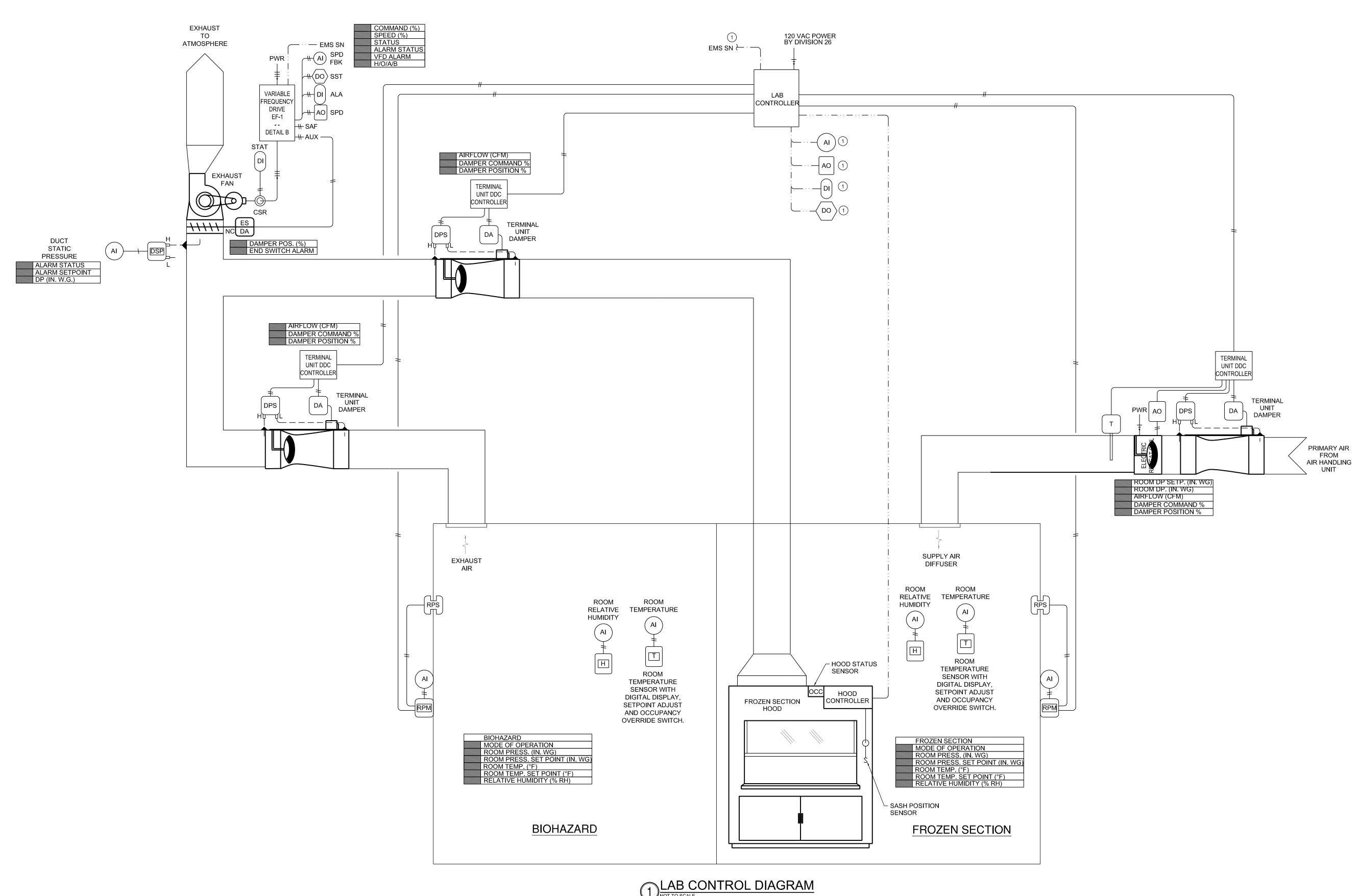
RAWINGS NSAS

UNIVERSITY OF ARKANSA

MARK DATE DESCRIPTION
ISSUE DATE: 03/20/19

PROJECT NUMBER: 04-18-007: SHEET TITLE: VAV SUPPLY TERMINAL WITH HOT WATER

REHEAT & FINNED
TUBE
SHEET NUMBER:



- 1. CONTROL VALVES, FLOW METERS, THERMOWELLS, AND TAPS ARE PROVIDED BY DIVISION 230900 AND INSTALLED BY DIVISION 23 IN LOCATIONS INDICATED BY THE CONTROL DIAGRAMS AND AS SPECIFIED. 2. ALL CONTROLLERS, ACTUATORS, SENSORS, SWITCHES, TUBING, AND POINTS INDICATED ON THE PLANS ARE PROVIDED AND INSTALLED BY DIVISION 230900, UNLESS NOTED OTHERWISE. CONTROL VALVES AND THERMOWELLS ARE PROVIDED BY DIVISION 230900, INSTALLED BY DIVISION 23. TRANSFORMERS ARE PROVIDED BY DIVISION 230900, INSTALLED BY DIVISION 26.
- 3. ALL POINTS INDICATED ON THE CONTROL DRAWINGS ARE NEW, PROVIDED BY DIVISION 230900, UNLESS INDICATED 4. A SINGLE TRANSFORMER CAN BE PROVIDED FOR UP TO 10 CONTROLLERS PROVIDED LENGTH OF RUNS AND
- ZONING IS TAKEN INTO CONSIDERATION. 5. ATC CONTRACTOR SHALL TUNE ALL LOOPS AND TABLES FOR SMOOTH, STABLE OPERATION. NUMBERS INDICATED IN THESE DIAGRAMS ARE FOR A STARTING POINT ONLY. THESE DIAGRAMS REPRESENT THE BASIC FUNCTION OF
- THE CONTROLS SEQUENCE AND IS NOT ALL INCLUSIVE. THE ATC CONTRACTOR IS STILL REQUIRED TO PROVIDE, DEFINE, AND INDICATE ALL ALARMS, SET POINTS, AND FUNCTIONS REQUIRE TO ACHIEVE THE INTENT OF THE SEQUENCE, AND MAINTAINED ALL EQUIPMENT MANUFACTURER REQUIREMENTS. 5. EQUIPMENT PROVIDED WITH CONTROLLERS (BOILERS, VARIABLE FREQUENCY DRIVES, ETC) SHALL COMMUNICATE DIRECTLY WITH THE BAS. ALL REQUIRED GATEWAYS AND ROUTERS SHALL BE PROVIDED WITH EQUIPMENT WHERE
- AVAILABLE,. ALL AVAILABLE POINTS SHALL BE OBTAINED FROM THE EQUIPMENT CONTROLLER AND THE BAS SHALL PROVIDE SET POINTS, COMMANDS, ETC, TO THE EQUIPMENT PER THE SEQUENCE OF OPERATIONS. 7. EQUIPMENT SHALL HAVE DEDICATED GRAPHICS PER SPECIFICATIONS. ALL COMMUNICATED POINTS SHALL BE AVAILABLE IN A LIST FORMAT WITH COMPLETE DESCRIPTIONS OF THE POINT, INCLUDING ALARMS. THE OPERATOR SHALL NOT HAVE TO REFER TO DOCUMENTATION TO DETERMINE WHAT THE POINT IS. 8. VARIABLE FREQUENCY DRIVES SHALL INDICATE HAND, OFF, AUTO, AND BYPASS STATUS.
- 9. CONTROL VALVES SHALL BE SELECTED WITH PROPER AUTHORITY FOR THEIR GIVEN APPLICATION. 10. ATC CONTRACTOR SHALL MEET ALL REQUIREMENTS OF THE EQUIPMENT MANUFACTURER.

19. PROVIDE OCC SENSOR(S) AS REQUIRED FOR FULL COVERAGE OF SPACE.

- 11. IF EQUIPMENT (BOILERS, PUMPS, ETC.) IS DISABLED DUE TO MAINTENANCE SHUTDOWN OR A FAULT CONDITION, THE LEAD, LAG, LAG#1, ... STATUS OF THE REMAINING EQUIPMENT SHALL MOVE UP IN THE STAGING QUEUE AUTOMATICALLY. STAGING BASED ON RUN TIME. THE COMPONENT SHALL BE HIGHLIGHTED, OUTLINED, FLASH, OR
- 12. THIS DIAGRAM, GRAPHICAL SEQUENCE, THE SCHEDULES, AND TABLES (ALARMS, SET POINTS, MODES OF OPERATION, ETC), SHALL BE REPRESENTED AS A GRAPHIC ON THE BAS, INCLUDING THE RESULTS OF AS-BUILT PROGRAMMING. THE GRAPHIC IS TO BE POPULATED WITH LIVE VALUES. SET POINTS SHALL BE ADJUSTABLE FROM THIS GRAPHIC AND LINKS SHALL BE PROVIDED TO TRENDING GROUPS.
- 13. THE SCHEDULES AND TABLES INDICATED ON THIS SHEET (ALARMS, SET POINTS, MODES OF OPERATION, ETC) SHALL BE PROVIDED AS GRAPHICS, EDITABLE FROM THE GRAPHICS.
- 14. ALL POINTS ARE TO BE TRENDED AT 15 MINUTE INTERVALS AND BACKED UP AS SPECIFIED. 15. TRENDING GROUPS ARE IDENTIFIED ON THE SEQUENCE BY HEX NOTES. CONTRACTOR SHALL SET UP A TREND GROUP GRAPHIC FOR THE HEX NOTE DESIGNATIONS LISTED. EACH TREND GROUP SHALL CONTAIN ALL OF THE TRENDS WITH LIKE HEX NOTES. TREND GROUPS SHALL BE TRENDED AT A MINIMUM OF 30 SECOND INTERVALS FOR A DURATION OF 48 HOURS.
- 16. COORDINATE AIR FLOW MEASURING STATION LOCATION WITH SITE CONDITIONS AND MANUFACTURER'S REQUIREMENTS / RECOMMENDATIONS.
- 17. ATC CONTRACTOR SHALL TUNE ALL LOOPS AND TABLES FOR SMOOTH, STABLE OPERATION. NUMBERS INDICATED IN THESE DIAGRAMS ARE FOR A STARTING POINT ONLY. THESE DIAGRAMS REPRESENT THE BASIC FUNCTION OF THE CONTROLS SEQUENCE AND IS NOT ALL INCLUSIVE. THE ATC CONTRACTOR IS STILL REQUIRED TO PROVIDE, DEFINE, AND INDICATE ALL ALARMS, SET POINTS, AND FUNCTIONS REQUIRE TO ACHIEVE THE INTENT OF THE SEQUENCE, AND MAINTAINED ALL EQUIPMENT MANUFACTURER REQUIREMENTS. PROVIDE OCC SENSOR(S) AS REQUIRED FOR FULL COVERAGE OF SPACE
- 18. ATC CONTRACTOR SHALL TUNE ALL LOOPS AND TABLES FOR SMOOTH, STABLE OPERATION, NUMBERS INDICATED IN THESE DIAGRAMS ARE FOR A STARTING POINT ONLY. THESE DIAGRAMS REPRESENT THE BASIC FUNCTION OF THE CONTROLS SEQUENCE AND IS NOT ALL INCLUSIVE. THE ATC CONTRACTOR IS STILL REQUIRED TO PROVIDE, DEFINE, AND INDICATE ALL ALARMS, SET POINTS, AND FUNCTIONS REQUIRE TO ACHIEVE THE INTENT OF THE SEQUENCE, AND MAINTAINED ALL EQUIPMENT MANUFACTURER REQUIREMENTS.

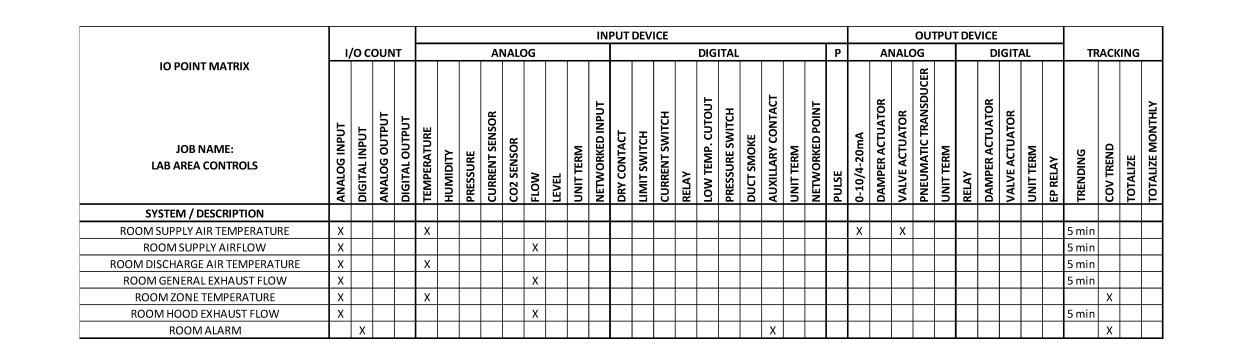
KEYED NOTES:

 BAS SHALL RECEIVE ALL POINTS AVAILABLE FROM HOOD CONTROLLER. COORDINATE WITH ENGINEER OF RECORD ALL INFORMATION THAT IS TO BE DISPLAYED IN GRAPHICS. DAMPER POSITION, ROOM DP SET POINT, ROOM DP, AIRFLOW, AIRFLOW SET POINT, ALARMS, ETC.

SEQUENCE OF OPERATION:

UNLESS SPECIFICALLY SHOWN OTHERWISE ON MECHANICAL ENGINEERING DRAWINGS, TEMPERATURE, HUMIDITY, PRESSURIZATION, AND FUME HOOD CONTROLS FOR LABORATORY AREAS SHALL BE PROVIDED BY LABORATORY HVAC AND CONTROL SYSTEM VENDOR. SUPPLY, GENERAL EXHAUST, AND FUME EXHAUST AIR TERMINALS ARE PROVIDED BY LABORATORY HVAC AND CONTROL SYSTEM VENDOR.

ATC SYSTEM VENDOR SHALL PROVIDE INTERFACE WITH LABORATORY HVAC CONTROLS THAT PROVIDES READ AND WRITE CAPABILITY TO AVAILABLE POINTS.



GENERAL NOTE: THESE STANDARD SYSTEM DIAGRAMS AND SEQUENCES ARE DEVELOPED AS THE BASIS FOR DESIGN AND MAY NOT BE DIRECTLY APPLICABLE AS IS DUE TO EXISTING EQUIPMENT OR SYSTEM CAPABILITIES, OR DUE TO SYSTEM OR EQUIPMENT ARRANGEMENTS. IT IS THE RESPONSIBILITY OF THE ENGINEER OF RECORD TO MODIFY THESE DOCUMENTS AS REQUIRED FOR THE SPECIFIC CONDITIONS OF A PROJECT. REFER TO THE RFP DOCUMENTS FOR MODIFICATION PROCEDURES.

2039 NORTH GREEN ACRES FAYETTEVILLE, AR 72703

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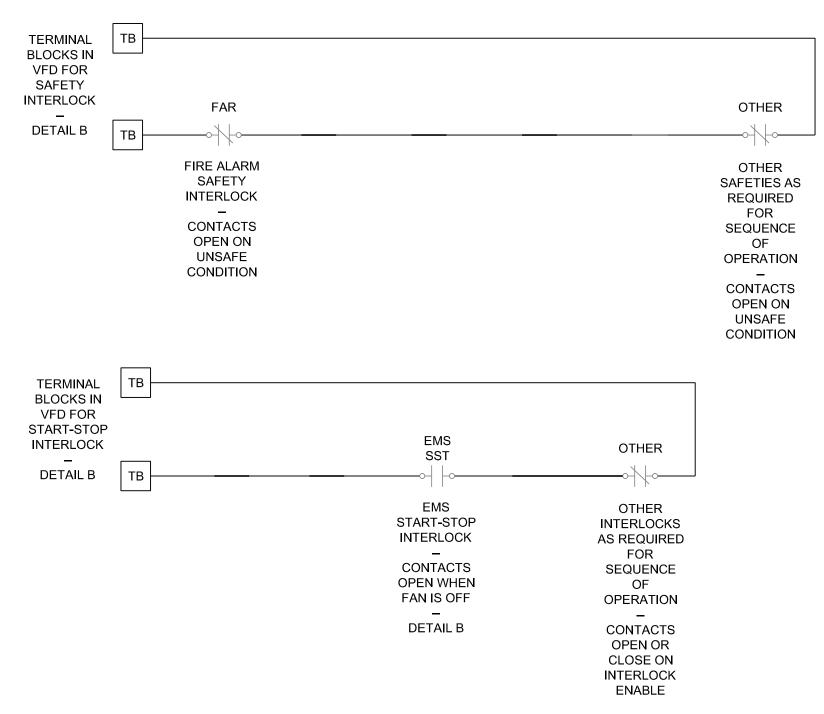
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ENGINEER SEAL

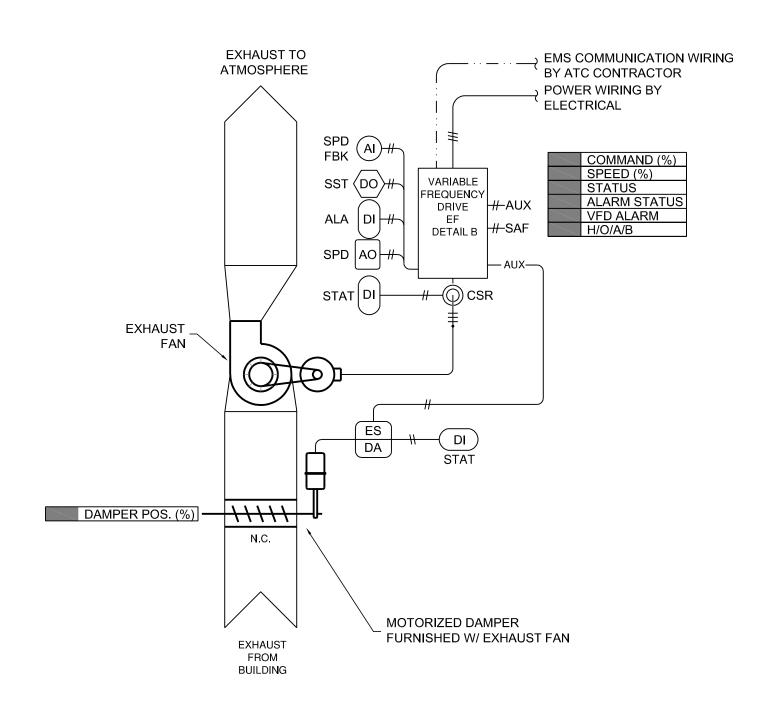
MARK DATE DESCRIPTION ISSUE DATE: PROJECT NUMBER: 04-18-0072

LAB CONTROL DIAGRAM

SHEET TITLE:



2 EXHAUST FAN VFD INTERLOCKS
NOT TO SCALE



EXHAUST FAN CONTROL DIAGRAM
NOT TO SCALE [EXH-D]

EXHAUST FAN SHALL BE STARTED AND OPERATED. EXHAUST FAN SHALL BE STARTED AND OPERATED.

THE EXHAUST FAN SHALL BE STARTED AND OPERATED WHENEVER ITS ASSOCIATED AIR HANDLING UNIT IS IN OPERATION. EXHAUST FAN SHALL NOT BE OPERATED UNLESS AT LEAST ONE ASSOCIATED AIR HANDLING UNIT IS IN OPERATION.

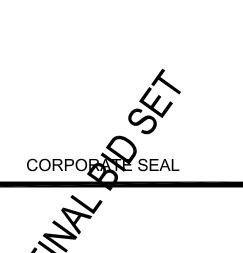
													IN	PUT	DEV	ICE												OUT	TPU1	Γ DE\	/ICE							
		1/0 (OUN	NT				1A	NALC	G								DIG	TAL					Р		ΑŅ	IALC	OG			D	IGIT	AL		TF	RACK	ING	
IO POINT MATRIX													_					_			ל					œ		TRANSDUCER			æ							>
JOB NAME: EXHAUST FAN	ANALOG INPUT	DIGITAL INPUT	ANALOG OUTPUT	DIGITAL OUTPUT	TEMPERATURE	HUMIDITY	PRESSURE	CURRENT SENSOR	CO2 SENSOR	FLOW	LEVEL	UNIT TERM	NETWORKED INPUT	DRY CONTACT	LIMIT SWITCH	CURRENT SWITCH	RELAY	LOW TEMP. CUTOUT	PRESSURE SWITCH	DUCT SMOKE	AUXILLARY CONTACT	UNIT TERM	NETWORKED POINT	PULSE	0-10/4-20mA	DAMPER ACTUATOR	VALVE ACTUATOR	PNEUMATIC TRANS	UNIT TERM	RELAY	DAMPER ACTUATOR	VALVE ACTUATOR	UNIT TERM	EP RELAY	TRENDING	COV TREND	TOTALIZE	TOTALIZE MONTHLY
SYSTEM / DESCRIPTION																																						
DAMPER END SWITCH		Х													Χ																					Х		
DAMPER OUTPUT				Х																						Х									•	Х		
FAN START STOP				Х																										Χ						Х		
FAN SPEED			Х																						Χ										15 min			
FAN STATUS		X														Х																				Х		

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ENGINEER SEAL

IQ CONTROL DRAWINGS

MARK DATE DESCRIPTION
ISSUE DATE: 03/20/19
PROJECT NUMBER: 04-18-0072
SHEET TITLE:

EXHAUST FAN CONTROL DIAGRAM

SHEET NUMBER:

GENERAL NOTE: THESE STANDARD SYSTEM DIAGRAMS AND SEQUENCES ARE DEVELOPED AS THE BASIS FOR DESIGN AND MAY NOT BE DIRECTLY APPLICABLE AS IS DUE TO EXISTING EQUIPMENT OR SYSTEM CAPABILITIES, OR DUE TO SYSTEM OR EQUIPMENT ARRANGEMENTS. IT IS THE RESPONSIBILITY OF THE ENGINEER OF RECORD TO MODIFY THESE DOCUMENTS AS REQUIRED

FOR THE SPECIFIC CONDITIONS OF A PROJECT. REFER TO THE RFP DOCUMENTS FOR MODIFICATION PROCEDURES.



Proposal Cost Worksheet

Indefinite Delivery Indefinite Quantity (IDIQ)

Automatic Temperature Control Systems - New and Existing Buildings University of Arkansas Campus Fayetteville, Arkansas

Standard System Pricing (Input in shaded boxes)

The line item cost MUST INCLUDE ALL product materials, labor, installation (including engineering, shop drawings, and start-up assistance), testing, performance and payment bond, and sales tax if applicable for this project. See RFP for further information.

Date: 3/20/19

Standard Drawing Sheet Number	System Description	Total Installed Cost	Тах	Total Installed Cost Including Taxes	Additional Unit Cost For Comissioning	Total installed cost with Cx Including Taxes
ATC2.00	CHILLED WATER SYSTEM BUILDING ENTRY			\$0.00		\$0.00
ATC3.00	HEATING WATER SYSTEM BUILDING ENTRY			\$0.00		\$0.00
ATC3.01	STEAM HEAT EXCHANGER CONTROL DIAGRAM			\$0.00		\$0.00
ATC3.02	STEAM SYSTEM MONITORING CONTROL DIAGRAM			\$0.00		\$0.00
ATC3.03	STEAM CONDENSATE RETURN PUMP CONTROL DIAGRAM			\$0.00		\$0.00
ATC3.04	BOILER EMERGENCY POWER OFF CONTROL DIAGRAM			\$0.00		\$0.00
ATC4.00	CONSTANT VOLUME AIR HANDLING UNIT WITH PREHEAT			\$0.00		\$0.00
ATC4.01	CONSTANT VOLUME AIR HANDLING UNIT W/ PREHEAT, REAHEAT. & HUMIDIFIER			\$0.00		\$0.00
ATC4.02	VARIABLE AIR VOLUME AIR HANDLING UNIT WITH PREHEAT			\$0.00		\$0.00
ATC4.03	DUAL DUCT AIR HANDLING UNIT			\$0.00		\$0.00
ATC4.04	ENERGY RECOVERY AIR HANDLING UNIT			\$0.00		\$0.00
ATC4.05	CONSTANT VOLUME AIR HANDLING UNIT 100% OSA WITH PREHEAT			\$0.00		\$0.00
ATC5.00	FAN COIL UNIT - 2 PIPE			\$0.00		\$0.00
ATC5.01	FAN COIL UNIT - 4 PIPE			\$0.00		\$0.00
ATC5.02	FAN COIL UNIT - 4 PIPE RETURN AIR CONTROL			\$0.00		\$0.00
ATC5.03	FAN COIL UNIT - 3 SPEED WITH DEHUMIDIFICATION			\$0.00		\$0.00
ATC5.04	BLOWER COIL UNIT - COOLING ONLY			\$0.00		\$0.00
ATC5.05	VAV SUPPLY TERMINAL WITH HOT WATER REHEAT - OFFICE/CORRIDOR			\$0.00		\$0.00
ATC5.06	VAV SUPPLY TERMINAL - COOLING ONLY			\$0.00		\$0.00
ATC5.07	VAV SUPPLY TERMINAL - DUAL DUCT			\$0.00		\$0.00
ATC5.08	VAV SUPPLY TERMINAL WITH HOT WATER REHEAT - PARALLEL			\$0.00		\$0.00
ATC5.09	FAN POWERED VAV SUPPLY TERMINAL WITH HOT WATER REHEAT - SERIES FAN POWERED			\$0.00		\$0.00
ATC5.10	CHILLED BEAM - COOLING ONLY			\$0.00		\$0.00
ATC5.11	FINNED TUBE CONVERTER			\$0.00		\$0.00
ATC5.12	VAV SUPPLY TERMINAL WITH HOT WATER REHEAT & FINNED TUBE			\$0.00		\$0.00
	LAB CONTROL DIAGRAM (Base)			\$0.00		\$0.00
	Additive Alt #1: Add one fast acting supply terminal			\$0.00		\$0.00
ATC6.00	Additive Alt #2: Add one fast acting exhaust terminal			\$0.00		\$0.00
	Additive Alt #3: Add one fume hood			\$0.00		\$0.00
	Additive Alt #4: Add one exahust fan.			\$0.00		\$0.00
ATC7.00	EXHAUST FAN CONTROL DIAGRAM			\$0.00		\$0.00

Proposal Cost Worksheet

Indefinite Delivery Indefinite Quantity (IDIQ)

Automatic Temperature Control Systems - New and Existing Buildings University of Arkansas Campus Fayetteville, Arkansas

Standard Materials and Equipment Pricing (Uninstalled) - Input in Shaded Boxes

The line item cost shall include delivery but not installation.

Date: 3/20/19

Item Number	Description	List Price	Discounted Price to UA Including Delivery	Taxes	Total Cost
1	Modulating Electric Damper Actuator (Sized for 36"x36" Return Air Damper)		,		\$0.00
2	Electric Damper Actuator (Sized for a 10" Round VAV Box)				\$0.00
3	Digital Room Thermostat				\$0.00
4	Duct Mounted Temperature Sensor				\$0.00
5	Pipe Mounted Temperature Sensor				\$0.00
6	Electro-Pneumatic Pressure Transducer				\$0.00
7	Wet Differential Pressure Transmitter				\$0.00
8	Air Terminal Controller				\$0.00
9	Fan Coil Unit Controller				\$0.00
10	Electric Valve Actuator (Sized for a 3" Valve)				\$0.00
11	Pneumatic Valve Actuator (Sized for a 6" Valve)				\$0.00
12	1/2" 3-Way Pneumatic Control Valve				\$0.00
13	Pneumatic Electric Switch				\$0.00
14	Strap-On Temperature Sensor				\$0.00
15	Differential Pressure Switch				\$0.00
16	End Switch				\$0.00
17	Current Switch				\$0.00
18	Static Pressure Switch				\$0.00
19	Duct Static Pressure Transmitter				\$0.00
20	Duct Humidity Transmitter				\$0.00
21	Pneumatic Room Thermostat				\$0.00
22	Software License and Installation per Workstation				\$0.00
23	Annual Software Maintenance Agreement				\$0.00
24	JCI N2 Integration License				\$0.00
25	Building Level Control Panel				\$0.00
TOTAL					\$0.00

		Vorksheet								
	definite Delivery In			its of Automo	C					
Automatic Temperature Conti		ille, Arkansas	ings Univer	sity of Arkans	as Cam	pus				
Summary of Pricing for Prototype Building 1 - Classrooms/Offices									Date: 3/20/19	
	Standard			System Unit Cost				nit Cost	Additional	
Description	Drawing Number	Quantity		Standard em Page)	Total Cost		For Cx (From Stanard System Page		Fee For Comissioning	
	- Tunion		System Page)		0031					
Ground Floor										
Chill Water Entry	ATC2.00	1	\$	-	\$	-	\$	-	\$	-
Steam Service Entry with Building Heat	ATC3.00	1	\$	-	\$	-	\$	-	\$	-
Constant Volume Air Unit	ATC4.00	1	\$	-	\$	-	\$	-	\$	-
Exhaust Fan	ATC7.00	2	\$	-	\$	-	\$	-	\$	-
Hot Water Convector	ATC5.11	4	\$	-	\$	-	\$	-	\$	-
Blower Coil Unit	ATC5.04	2	\$	-	\$	-	\$	-	\$	-
First Floor										
VAV Air Handling Unit	ATC4.02	1	\$	-	\$	-	\$	-	\$	-
Supply Terminal With Reheat	ATC5.05	26	\$	-	\$	-	\$	-	\$	-
Parallel Fan Powered Terminal	ATC5.08	8	\$	-	\$	-	\$	-	\$	-
Series Fan Powered Terminal	ATC5.09	2	\$	-	\$	-	\$	-	\$	-
Second Floor										
Make-up Air Unit	ATC4.05	1	\$	-	\$	-	\$	-	\$	-
Chilled Beams	ATC5.10	20	\$	-	\$	-	\$	-	\$	-
Hot Water Convectors	ATC5.11	10	\$	-	\$	-	\$	-	\$	-
Supply Terminal With Reheat	ATC5.05	6	\$	-	\$	-	\$	-	\$	-
Parallel Fan Powered Terminal	ATC5.08	8	\$	-	\$	-	\$	-	\$	-
Third Floor										
VAV Air Handling Unit	ATC5.04	1	\$	-	\$	-	\$	-	\$	-
Supply Terminal With Reheat	ATC5.05	26	\$	-	\$	-	\$	-	\$	-
Parallel Fan Powered Terminal	ATC5.08	8	\$	-	\$	-	\$	-	\$	-
Series Fan Powered Terminal	ATC5.09	2	\$	-	\$	-	\$	-	\$	-
Roof										
Exhaust Fan	ATC7.00	4	\$		\$	-	\$	-	\$	-
									-	
SUBTOTAL COST PROTOTYPE 1					\$	-			\$	-
Building Level Control Panel(s)		4	\$	-	\$	-				
TOTAL COST PROTOTYPE 1					\$	-			\$	-

	Cost We	orksheet								
	ndefinite Delivery Ind									
Automatic Temperature Con	•	id Existing Buildir e, Arkansas	ngs Universit	y of Arkansas	Campu	S				
Summary of I	Pricing for Protot		2 - Reside	nce Hall					Date: 3/20/19)
		71								
	Standard			n Unit Cost			Unit Cost		Additi	
December 1	Drawing Number	Quantity		Standard em Page)	Total Cost		For Cx (From tanard System Pag		Fee For Comissioning	
Description	Number		Syste	em Page)		COSI	tanaru S	ystem Pag	Comissi	oning
Ground Floor										
Chill Water Entry	ATC2.00	1	\$	-	\$	-	\$	-	\$	-
Heating Water Entry	ATC3.00	1	\$	-	\$	-	\$	-	\$	-
Constant Volume Air Unit	ATC4.00	4	\$	-	\$	-	\$	-	\$	-
Exhaust Fan	ATC7.00	4	\$	-	\$	-	\$	-	\$	-
Blower Coil Unit	ATC5.04	2	\$	-	\$	-	\$	-	\$	-
First Floor										
Fan Coil Unit	ATC5.00	36	\$		\$		\$	_	\$	
Blower Coil Unit	ATC5.04	2	\$	-	\$	-	\$	-	\$	-
Second Floor										
Fan Coil Unit	ATC5.01	24	\$	-	\$	-	\$	-	\$	-
Fan Coil Unit	ATC5.02	8	\$	-	\$	-	\$	-	\$	-
Fan Coil Unit	ATC5.03	8	\$	-	\$	-	\$	-	\$	-
Third Floor										
Fan Coil Unit	ATC5.01	28	\$	_	\$	_	\$	_	\$	-
Fan Coil Unit	ATC5.02	8	\$	_	\$	_	\$	_	\$	-
Fan Coil Unit	ATC5.03	8	\$	-	\$	-	\$	-	\$	-
Penthouse										
Energy Recovery Air Unit	ATC4.04	1	\$		\$		\$	_	\$	_
Fan Coil Unit	ATC4.04 ATC5.01	2	\$	-	\$	-	\$	-	\$	-
Roof										
Exhaust Fan	ATC7.00	4	\$	-	\$	-	\$	-	\$	-
SUBTOTAL COST PROTOTYPE 2					\$	-			\$	_
Building Level Control Panel(s)		4	\$	-	\$	-				
TOTAL COST PROTOTYPE 2					\$	_			\$	_

	Cost Wo	rksheet								
	ndefinite Delivery Inde									
Automatic Temperature Conf	trol Systems - New and Fayetteville	-	ngs Universit	y of Arkansas	Campu	S				
Summary of P	ricing for Prototy		- Science	Building					Date: 3/20/	19
Summary of the	ricing for riototy	oc bananı _s o	Jeienee	Dunumb						
	Standard		System	n Unit Cost			Unit Cost		Addi	tional
	Drawing	Quantity		Standard	Total		For Cx (From tanard System Page		Fee For Comissioning	
Description	Number		Syste	em Page)		Cost	tanara S	ystem Pag	Comis	sioning
Ground Floor										
Chill Water Entry	ATC2.00	1	\$	-	\$	-	\$	•	\$	-
Steam Service Entry with Building Heat	ATC3.01	1	\$	-	\$	-	\$		\$	-
Air Handling Unit	ATC4.03	1	\$	-	\$	-	\$	-	\$	-
Dual Duct Terminals	ATC5.07	16	\$	-	\$	-	\$	-	\$	-
Hot Water Convector	ATC5.11	4	\$	-	\$	-	\$	-	\$	-
Blower Coil Unit	ATC5.04	2	\$	-	\$	-	\$	-	\$	-
First Floor			1.		<u> </u>					
VAV Air Handling Unit	ATC4.02	1	\$	-	\$	-	\$	-	\$	-
Supply Terminal With Reheat	ATC5.05	8	\$	-	\$	-	\$	-	\$	-
Lab System	ATC6.00 (BASE)	10	\$	-	\$	-	\$	-	\$	-
	ATC 6.00 (ATL:1)	2	\$	-	\$	-	\$	-	\$	-
	ATC 6.00 (ATL:2)	2	\$	-	\$	-	\$	-	\$	-
	ATC 6.00 (ATL:3)	2	\$	-	\$	-	\$	-	\$	-
	ATC 6.00 (ATL:4)	2	\$	-	\$	-	\$	-	\$	-
Second Floor										
VAV Air Handling Unit	ATC4.02	1	\$	_	\$	_	\$	_	\$	_
Supply Terminal With Reheat	ATC5.05	8	\$	_	\$	_	\$	_	\$	_
Lab System	ATC6.00 (BASE)	10	\$	_	\$	-	\$	_	\$	_
,	,	-							·	
Penthouse										
Heat Recovery Air Unit	ATC4.04	1	\$	-	\$	-	\$	-	\$	-
Roof	<u> </u>		_		-					
Exhaust Fan	ATC7.00	6	\$	-	\$	-	\$	-	\$	-
SUBTOTAL COST PROTOTYPE 3					\$	-			\$	
Building Level Control Panel(s)		4	\$	-	\$	-				
TOTAL COST PROTOTYPE 3					\$	-			\$	-