NORTHRIDGE MIDDLE SCHOOL HVAC CONTROLS

OWNER INFORMATION

CHARLOTTE-MECKLENBURG SCHOOLS
7601 THE PLAZA
CHARLOTTE, NC 28215

ENGINEER INFORMATION

TMG CONSULTING ENGINEERS
401 HAWTHORNE STREET
SUITE 110/170
CHARLOTTE, NC 28204

SYMBOLS LEGEND

- FAN OR PUMP
- PUMP
- MOTORIZED DAMPER
- FILTER
- ELECTRIC HEATING COIL
- DIRECT EXPANSION COIL
- GAS FURNACE HEATING
- HEAT PUMP COIL
- AIRFLOW MONITORING STATION (AMS) TRANSDUCER
- CURRENT TRANSDUCER
- THERMOSTAT (LINE VOLTAGE)
- CONTACT (NORMALLY CLOSED)
- CONTACT (NORMALLY OPEN)
- SWITCH (OPEN)
- SUN SHIELD, OUTSIDE AIR TEMPERATURE SENSOR
  SUN SHIELD, OUTSIDE AIR HUMIDITY SENSOR
  SUN SHIELD, OUTSIDE AIR CARBON DIOXIDE SENSOR
- SPACE SENSOR - TEMPERATURE ONLY
- SPACE SENSOR - TEMPERATURE + HUMIDITY
- SPACE SENSOR - TEMPERATURE + HUMIDITY + CO_2
- 2-WAY CONTROL VALVE, MOTORIZED ACTUATOR
- 3-WAY CONTROL VALVE, MOTORIZED ACTUATOR
- REFRIGERANT MONITORING SENSOR
- MANUAL SWITCH
- DUCT TEMPERATURE SENSOR
- DUCT PRESSURE SENSOR
- DUCT HUMIDITY SENSOR
- DUCT FREEZE STAT
- INSERTION TYPE AQUASTAT
- HYDRONIC INSERTION TEMPERATURE SENSOR
- DIFFERENTIAL PRESSURE SENSOR
- DUCT SMOKE DETECTOR
- IONIZATION SYSTEM
- FEEDBACK SIGNAL (POSITION/FAULT)
- FLOW METER
- VARIABLE FREQUENCY DRIVE
- DIFFERENTIAL PRESSURE SENSOR
- KEY NOTE
- SECTION NUMBER
  WHERE THE SECTION/CONTROL REFERENCED
- CWS
- CWR
- HWS
- HWR
- DTS
- DTR

ABBREVIATIONS LEGEND

ALL ABBREVIATIONS MAY NOT APPEAR IN THIS PROJECT

ADJ	ADJUSTABLE
AHU	AIR HANDLING UNIT
AI	ANALOG INPUT
AMS	AIRFLOW MONITORING SYSTEM
AO	ANALOG OUTPUT
BAS	BUILDING AUTOMATION SYSTEM
BI	BINARY INPUT
BLR	BOILER
BO	BINARY OUTPUT
CHLR	CHILLER
CHW	CHILLED WATER
CWS	CHILLED WATER SUPPLY
CWR	CHILLED WATER RETURN
CWP	CHILLED WATER PUMP
CO	CARBON MONOXIDE
CO2	CARBON DIOXIDE
CR	CURRENT RELAY
CS	CURRENT SWITCH
CT	CURRENT TRANSDUCER
CU	CONDENSING UNIT
CW	CONDENSER WATER
DA	DISCHARGE AIR
DH	DUCT HEATER
DDC	DIRECT DIGITAL CONTROL
DI	DIGITAL INPUT
DO	DIGITAL OUTPUT
DP	DIFFERENTIAL PRESSURE
DPS	DIFFERENTIAL PRESSURE SENSOR
DSS	DUCTLESS SPLIT SYSTEM
DT	DUAL TEMPERATURE WATER
DTS	DUAL TEMPERATURE WATER SUPPLY
DTR	DUAL TEMPERATURE WATER RETURN
DX	DIRECT EXPANSION
EA	EXHAUST AIR
ECM	ELECTRICALLY COMMUTATED MOTOR
EF	EXHAUST FAN
EMS	ENERGY MANAGEMENT SYSTEM
EPT	ELECTRONIC/PNEUMATIC TRANSDUCER
ES	END SWITCH
F	FAN
FACP	FIRE ALARM CONTROL PANEL
FCU	FAN COIL UNIT
FM	FLOW METER
FT	FLOW TRANSMITTER
FZ	FREEZESTAT
H	HUMIDITY SENSOR
HC	HEATING COIL
HP	HEAT PUMP
HHW	HEATING HOT WATER
HWR	HOT WATER RETURN
HWS	HOT WATER SUPPLY
ION	IONIZATION SYSTEM
KEF	KITCHEN EXHAUST FAN
LS	LIMIT SWITCH
M	MOTOR
MCC	MOTOR CONTROL CENTER
MSB	MAIN SWITCH BOARD
NC	NORMALLY CLOSED
NO	NORMALLY OPEN
NPBI	NEEDLEPOINT BIPOLAR IONIZATION
OA	OUTSIDE AIR
P	PUMP
PM	POWER METER
PS	PRESSURE SENSOR
PT	PRESSURE TRANSMITTER
PVHP	PACKAGED VERTICAL HEAT PUMP
RA	RETURN AIR
RAF	RETURN AIR FAN
RF	RELIEF FAN
RH	ROOF HOOD
%RH	RELATIVE HUMIDITY
RPM	REVOLUTION PER MINUTE
S	SMOKE DETECTOR
SA	SUPPLY AIR
SF	SUPPLY FAN
SP	SET POINT
S/S	START/STOP
T	TEMPERATURE
TS	TEMPERATURE SENSOR
TT	TEMPERATURE TRANSMITTER
TYP	TYPICAL
UON	UNLESS OTHERWISE NOTED
UPS	UNINTERRUPTED POWER SUPPLY
UV	UNIT VENTILATOR
V	VALVE
VAV	VARIABLE AIR VOLUME
VFD	VARIABLE FREQUENCY DRIVE
VRF	VARIABLE REFRIGERANT FLOW

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M-105	AREA E FLOOR PLAN
M-106	AREA F FLOOR PLAN
M-107	ROOF PLAN
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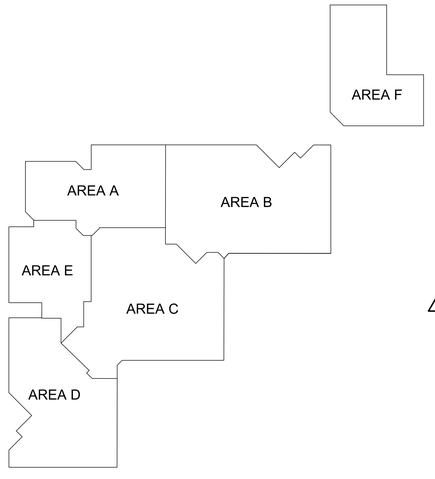
M-815	CENTRAL PLANT SEQUENCES OF OPERATION

1 SITE PLAN
NOT TO SCALE
TRUE NORTH



2 KEY PLAN
NOT TO SCALE
PLAN NORTH

DEMOLITION NOTES

1. DISCONNECT AND REMOVE ANY EXISTING EXPOSED PNEUMATIC EQUIPMENT, PNEUMATIC CONTROL CABINETS, AND TUBING, INCLUDING EQUIPMENT IN THE MECHANICAL ROOMS.
2. REMOVE ALL COMPRESSED AIR GENERATION, FILTRATIONS AND AIR DRYING EQUIPMENT IN THE CENTRAL PLANT. DELIVER EQUIPMENT AND ACCESSORIES TO OWNER.
3. DISCONNECT AND REMOVE ALL EXISTING EMS RELAY CABINETS. INSTALL INTERFACE CONTROL RELAYS PER SPECIFICATIONS TO CONNECT EQUIPMENT TO NEW BAS SYSTEM.
4. DISCONNECT AND REMOVE ANY EXISTING DDC CONTROLLERS THAT ARE NOT BEING INTEGRATED INTO THE NEW BAS SYSTEM. ANY REMOVED DDC CONTROLLERS ARE TO BE DELIVERED TO OWNER.

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5. REMOVE ALL LOCAL FCU AND UV FAN SPEED SWITCHES. EXPOSED BOXES AND CONDUIT SHALL BE REMOVED, AND WALL TOUCHED UP TO MATCH EXISTING CONDITIONS. ALL WIRING SHALL BE REMOVED FROM RECESSED CONDUITS AND JUNCTION BOXES BLANKED OFF WITH AN APPROVED COVER. EXISTING CONDUIT AND BOXES IN GOOD CONDITION MAY BE REUSED FOR INSTALLATION OF NEW THERMOSTATS TO SATISFY NOTE 6.

6. REMOVE EXISTING THERMOSTATS, COVERS AND BRACKETS. NEW BAS THERMOSTATS TO BE INSTALLED AT SAME LOCATION AS EXISTING. PATCH OPENINGS AS NEEDED TO MATCH INSTALLATION REQUIREMENTS OF NEW THERMOSTATS. TOUCH UP WALL TO MATCH EXISTING CONDITIONS.

1
7. REMOVE ALL LOCAL EMERGENCY STOP PUSH BUTTONS AND ADMINISTRATION OVERRIDES. EXPOSED BOXES AND CONDUIT SHALL BE REMOVED, AND WALL TOUCHED UP TO MATCH EXISTING CONDITIONS. ALL WIRING SHALL BE REMOVED FROM RECESSED CONDUITS AND JUNCTION BOXES BLANKED OFF WITH AN APPROVED COVER. EXISTING CONDUIT AND BOXES IN GOOD CONDITION MAY BE REUSED FOR INSTALLATION OF NEW THERMOSTATS TO SATISFY NOTE 6.

SCOPE OF WORK

1. REPLACE EXISTING PNEUMATIC CONTROLS WITH ELECTRICAL/ELECTRONIC CONTROLS. THE NEW SYSTEM SHALL PROVIDE DIRECT DIGITAL CONTROL (DDC) FOR BUILDING AUTOMATION (BAS), FOR ENERGY MANAGEMENT, FOR LIGHTING CONTROLS, AND FOR THE AIR CONDITIONING, HEATING AND VENTILATING SYSTEMS .
2. WORK INVOLVES REPLACEMENT OF CONTROL VALVES, DAMPER AND VALVE ACTUATORS, SENSORS, AND ASSOCIATED PIPING ACCESSORIES THAT SERVE THE HVAC SYSTEM, INCLUDING BOILERS, CHILLERS, PUMPS, AIR-HANDILING UNITS, FAN-COIL UNITS, AND UNIT VENTILATORS.
3. NO NEW HVAC EQUIPMENT WILL BE INSTALLED.FIRE PROTECTION AND PLUMBING SYSTEMS ARE NOT AFFECTED.NO ARCHITECTURAL OR STRUCTURAL WORK IS INVOLVED.NO CHANGE TO OCCUPANCY, USE OR EGRESS.
4. EXISTING BUILDINGS ARE EDUCATIONAL GROUP E OCCUPANCY. SCOPE INCLUDES CHARLOTTE NC NORTHRIDGE MIDDLE SCHOOL, INCLUDING MAIN BUILDING AND CLASSROOM ADDITION.
5. CLASSIFICATION OF WORK FALLS WITHIN ALTERATION LEVEL 1 (RENOVATION), PER EXISTING BUILDING CODE.
6. CONTRACTOR SHALL PERFORM ALL WORK SO AS NOT TO INTERFERE WITH SCHOOL ACTIVITIES DURING SCHOOL OPERATING HOURS.
7. CONTRACTOR MUST MEET CONTRACTUAL DEADLINES FOR COMPLETION THAT WILL LIKELY REQUIRE SIGNIFICANT WORK OFF HOURS. ALL LABOR COSTS SHALL BE INCLUDED IN THE CONTRACT PRICE.
8. CONTRACTOR IS TO MAINTAIN ALL HVAC EQUIPMENT FULLY FUNCTIONAL DURING CONSTRUCTION.
9. CONTRACTOR TO PROVIDE A SINGLE POINT OF CONTACT FOR COMMUNICATIONS BETWEEN TRADES AND CMS.
10. CONTRACTORS SHALL MAINTAIN CONTINUOUS CLEANLINESS OF THE WORK SITES AND RESTORE ALL AREAS TO OCCUPIED CONDITION DAILY.
11. CONTRACTORS SHALL PROVIDE WEEKLY PROGRESS REPORTS.
12. ALL SAFETY AND PROGRESS CONCERNS MUST BE REPORTED IMMEDIATELY.

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NORTH CAROLINA PROFESSIONAL SEAL 033629 ENGINEER CLEMENT T. MILBOURNE

01.25.2023

ISSUED FOR CONSTRUCTION

CHARLOTTE-MECKLENBERG SCHOOLS

NORTHRIDGE MIDDLE SCHOOL
HVAC CONTROLS

CHARLOTTE-MECKLENBERG SCHOOLS
7601 THE PLAZA
CHARLOTTE, NC 28215

REVISIONS

NO.	DESCRIPTION	DATE
	ISSUED FOR CONSTRUCTION	9/27/22
1	REVISION 1	1/13/23
2	REVISION 2	1/25/23

SHEET INFORMATION

DATE	09/27/2022
JOB NUMBER	2202-01-002
DRAWN	LCB
APPROVED	CTM

COVER PAGE

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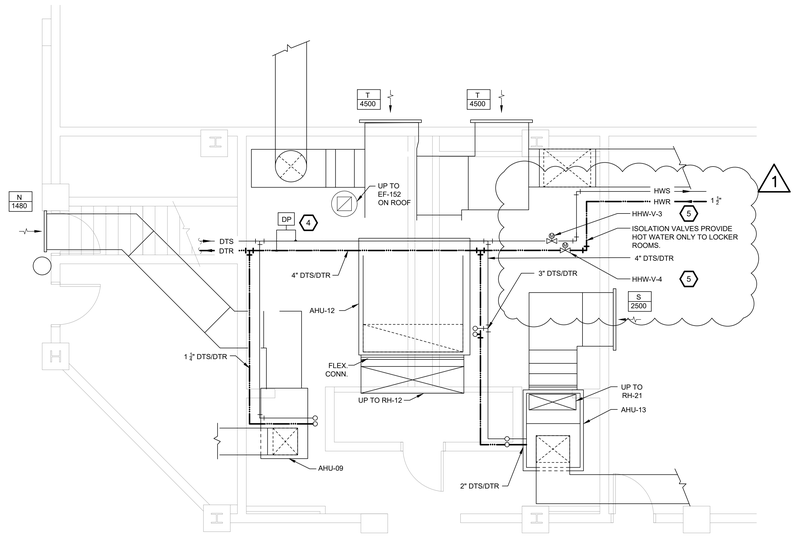
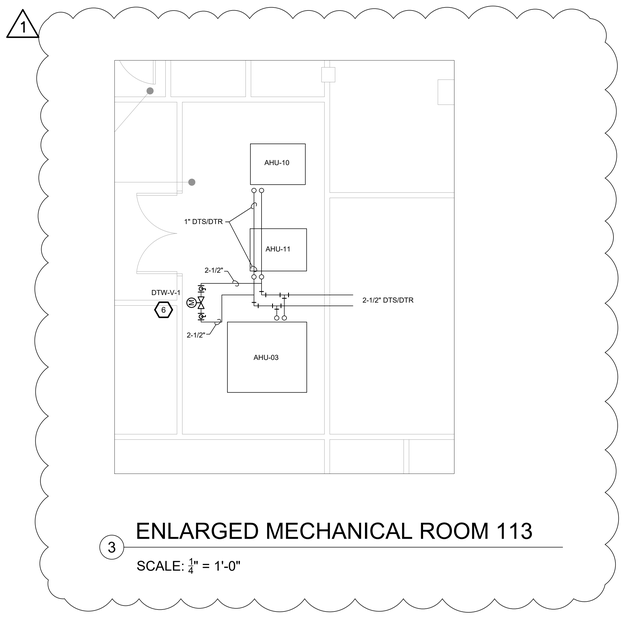
SHEET 1 OF 28



ENLARGED MECHANICAL MEZZANINE PLAN MECHANICAL ROOM AREA "A"

2 SCALE: 1/4" = 1'-0"



ENLARGED MECHANICAL ROOM 113

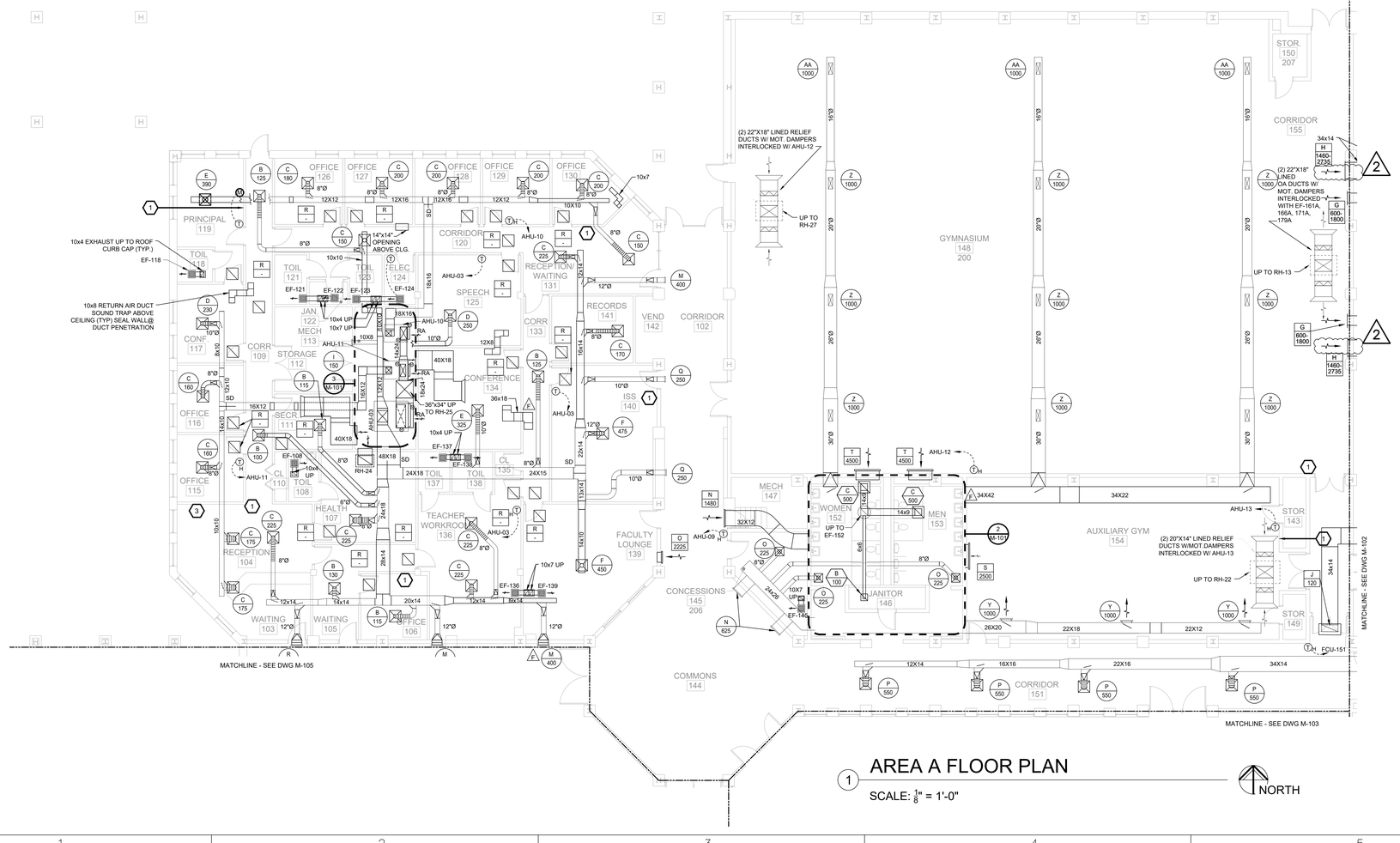
3 SCALE: 1/4" = 1'-0"

GENERAL NOTES

1. NO DEVIATION FROM THE DESIGN DRAWINGS SHALL BE MADE WITHOUT THE WRITTEN APPROVAL OF THE ENGINEER OF RECORD.
2. ALL EXISTING EQUIPMENT, DUCTWORK, PIPING, AND SENSOR LOCATIONS ARE APPROXIMATE. CONTRACTOR IS SOLELY RESPONSIBLE TO FIELD VERIFY EXACT LOCATIONS AND NOTIFY ENGINEER IN WRITING OF ANY SIGNIFICANT DEVIATIONS.
3. CONTRACTOR IS SOLELY RESPONSIBLE TO FIELD CHECK AND VERIFY EXISTING QUANTITIES AND TYPES OF TERMINAL UNITS, DAMPERS, VALVES, ETC.
4. ALL HVAC EQUIPMENT, LOCATIONS AND QUANTITIES ARE BASED ON EXISTING CONDITIONS DRAWINGS AND PRELIMINARY FIELD INVESTIGATIONS. ANY HVAC EQUIPMENT FOUND THAT IS NOT SHOWN ON THE DESIGN DRAWINGS SHALL BE INCLUDED. TYPE OF EQUIPMENT, EXACT LOCATION, AND ALL AVAILABLE NAMEPLATE DATA SHALL BE SUBMITTED TO THE ENGINEER OF RECORD FOR APPROVAL.
5. ALL LOCATIONS REQUIRING PIPING MODIFICATIONS SHALL BE SUBMITTED TO ENGINEER FOR APPROVAL.
6. CONTRACTOR SHALL PROVIDE A COMPREHENSIVE AS-BUILT NETWORK WIRING DIAGRAM OVERLAID ON PLAN DRAWINGS SHOWING WIRING PATHS AND CONTROLLER LOCATIONS. ANY OTHER DEVIATIONS FROM THESE PLANS SHALL ALSO BE INDICATED BY THE CONTRACTOR ON THESE DRAWINGS.
7. DELIVER REQUIRED SUBMITTALS TO ENGINEER FOR REVIEW & APPROVAL.
8. ALL SPACE NAMES WERE BASED ON EXISTING CONDITIONS ARCHITECTURAL DRAWINGS. EXISTING CONDITIONS ARCHITECTURAL ROOM NUMBERS ARE SHOWN WITHIN A BORDER. CURRENT USER-DEFINED SPACE IDENTIFICATIONS, IF INDICATED LOCALLY, ARE SHOWN BELOW THE ARCHITECTURAL NOMENCLATURE FOR REFERENCE. ALL EQUIPMENT TAGGING AND BAS POINT NAMING SHALL USE TAGS AS SHOWN. ANY DEVIATIONS SHALL BE SUBMITTED TO THE ENGINEER FOR APPROVAL.
9. ALL NEW CONTROLLERS SHALL BE MOUNTED IN AN APPROVED ENCLOSURE, FULLY ACCESSIBLE WITHOUT THE USE OF A LADDER IN AN MER OR NO MORE THAN 18" ABOVE A DROP CEILING ON WALL NEAR THE TERMINAL EQUIPMENT.
10. EACH CONTROL CABINET TO HAVE LAMINATED COPY OF WIRING DIAGRAM AND SEQUENCE OF OPERATION FOR CONTROLLERS/ COMPONENTS CONTAINED WITHIN. WIRING WITHIN CABINET TO BE LABELED AND MATCH DIAGRAMS.
11. PROVIDE COMPREHENSIVE LABELING AND TAGGING OF ALL SYSTEM COMPONENTS AND WIRING TERMINALS. SURFACE MOUNTED SPACE TEMPERATURE SENSORS SHALL BE LABELED THE SAME AS THE EQUIPMENT THEY CONTROL. PROVIDE ALL CABINETS, DEVICES AND CEILING ACCESS POINTS WITH ENGRAVED LAMINATED TAGS ATTACHED WITH SCREWS.
12. ALL VALVES, SENSORS, AND OTHER DEVICES SHALL BE EASILY ACCESSIBLE. PROVIDE HINGED ACCESS DOORS WHERE REQUIRED FOR SERVICE.
13. INSTALL ALL NEW FREEZE STATS ACCORDING TO MANUFACTURERS RECOMMENDATIONS. ENSURE SENSOR PROPERLY COVERS ENTIRE COIL, FACE, INCLUDING THE BOTTOM, WITHOUT RESTRICTING AIRFLOW OR MAINTENANCE ACCESS.
14. EXHAUST AND SUPPLY FANS NOT CONTROLLED OR MONITORED BY THE EXISTING EMS ARE NOT INCLUDED IN THIS CONTRACT. SEE FAN EQUIPMENT SCHEDULE FOR EXISTING FANS TO BE CONTROLLED BY THE NEW BAS.
15. PROVIDE AND INSTALL EMT CONDUIT IN ALL EXPOSED AREAS. NO LESS THAN 1" TRADE SIZE CONDUIT FOR NETWORK WIRING OR 1/2" FOR ALL OTHER RUNS, WITH LESS THAN 40% FILL.
16. PROVIDE WIRE TERMINAL MARKERS AT EACH CABLE END. FOR ALL NETWORK WIRING PROVIDE PLENUM RATED CABLE (PURPLE WITH A YELLOW STRIPE) INSTALLED AND RUN NEATLY GROUPED AND SUPPORTED IN ALL OTHER AREAS, PARALLEL AND PERPENDICULAR TO THE BUILDING LINES. FOR ALL OTHER CABLES USE WHITE PLENUM RATED CABLE.
17. A BINARY NEEDLE POINT BI-POLAR IONIZATION (NPBI) STATUS/ALARMING POINT HAS BEEN INCLUDED FOR EACH FCU, UV AND AHU. CONTROL WIRES SHALL BE INSTALLED FROM THE DDC CONTROLLER AND SECURELY COILED UP IN THE FILTER SECTION OF EACH FCU, UV AND AHU REQUIRED. CABLES SHALL BE CLEARLY LABELED AT BOTH THE CONTROLLER AND THE TERMINATION POINT AS "FUTURE NPBI ALARM." NBPI UNITS ARE NOT BEING PROVIDED UNDER THIS CONTRACT.
18. INSTALL NEW LINE-SIZED ISOLATION BALL VALVES ON ALL AHU, FCU, AND UV SUPPLY AND RETURN LINES SIZED 2 INCHES OR LESS.
19. CONTROL VALVES SHALL NOT BE SMALLER THAN ONE PIPE SIZE OF THE CONNECTED COIL. MODIFY PIPING AS NEEDED FOR PROPER VALVE FUNCTIONALITY AND MAINTENANCE ACCESS.
20. CONTRACTOR IS RESPONSIBLE FOR DRAINING, FILLING, AND BLEEDING PIPING SYSTEM.

KEY NOTES

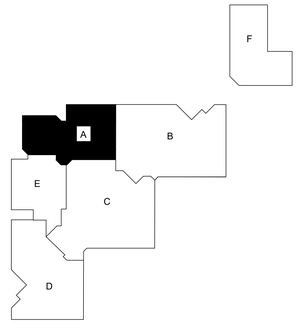
1. REMOVE EXISTING SENSOR, COVER AND BRACKET. BLANK OFF OPENING WITH AN APPROVED COVER. PATCH AND TOUCH UP WALL TO MATCH EXISTING CONDITIONS.
2. NEW WEATHER STATION AND OUTSIDE AIR CARBON DIOXIDE SENSOR TO BE INSTALLED ON NORTH WALL PER SPECIFICATIONS. CONTRACTOR TO SUBMIT EXACT LOCATION AND MOUNTING HEIGHT PER MANUFACTURER RECOMMENDATIONS. CONTRACTOR RESPONSIBLE TO PATCH EXTERIOR AND INTERIOR WALL ASSEMBLIES AROUND CONDUIT PENETRATION TO MATCH EXISTING AND SEAL OPENING TO BE WATER AND AIR TIGHT. TAG WEATHER STATION AND CARBON DIOXIDE SENSOR AND NAME BAS POINTS PER SPECIFICATIONS.
3. REMOVE EMERGENCY STOP PUSH BUTTONS AND ADMINISTRATION OVERRIDES. EXPOSED BOXES AND CONDUIT SHALL BE REMOVED, AND WALL TOUCHED UP TO MATCH EXISTING CONDITIONS. ALL WIRING SHALL BE REMOVED FROM RECESSED CONDUITS AND JUNCTION BOXES BLANKED OFF WITH AN APPROVED COVER.
4. EXISTING DTW DIFFERENTIAL PRESSURE TRANSMITTER IN MEZZANINE MECHANICAL ROOM TO BE REPLACED PER SPECIFICATIONS AND DESIGN DETAILS. CONTRACTOR TO SELECT PRESSURE RANGE AND SUBMIT TO ENGINEER FOR APPROVAL. REMOVE ALL PNEUMATIC CONTROLS AND REPAIR INSULATION PER SPECIFICATIONS. NEW TRANSMITTER TO BE TAGGED: DTW-DP-3.
5. EXISTING ISOLATION VALVES IN MECHANICAL MEZZANINE TO BE REPLACED WITH NEW 2-WAY, 2-POSITION CONTROL VALVES PER SCHEDULE AND SPECIFICATIONS. CONTRACTOR TO SELECT VALVES AND ACTUATORS AND SUBMIT TO ENGINEER FOR APPROVAL. REMOVE ALL ASSOCIATED PNEUMATIC CONTROLS AND REPAIR INSULATION PER SPECIFICATIONS. NEW VALVES SHALL BE TAGGED: HHW-V-3 AND HHW-V-4.
6. INSTALL NEW 2-WAY MODULATING CONTROL VALVE IN DTW PIPING IN MECH ROOM [113] PER SCHEDULE AND SPECIFICATIONS. INSTALL FULL-PORT ISOLATION BALL VALVES AND INSULATE ALL NEW AND EXISTING PIPING PER SPECIFICATIONS. CONTRACTOR TO SELECT VALVE AND SUBMIT TO ENGINEER FOR APPROVAL. NEW VALVE SHALL BE TAGGED: DTW-V-1.



AREA A FLOOR PLAN

1 SCALE: 1/8" = 1'-0"

NORTH



KEYPLAN

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TMG-CONSULTING ENGINEERS — MECHANICAL ENGINEERING — C-3646 — CHARLOTTE, N.C.

NORTH CAROLINA — REGISTERED — Thomas J. Milhoan — SEAL 033629 — ENGINEER — 01.25.2023

ISSUED FOR CONSTRUCTION

CHARLOTTE-MECKLENBERG SCHOOLS

NORTHRIDGE MIDDLE SCHOOL HVAC CONTROLS

CHARLOTTE-MECKLENBERG SCHOOLS
7601 THE PLAZA
CHARLOTTE, NC 28215

NO	DESCRIPTION	DATE
1	ISSUED FOR CONSTRUCTION	9/27/22
1	REVISION 1	1/13/23
2	REVISION 2	1/25/23

SHEET INFORMATION

DATE	09/27/2022
JOB NUMBER	2202-01-002
DRAWN	LCB
APPROVED	CTM

AREA A FLOOR PLAN

M-101

SHEET 2 OF 28

GENERAL NOTES

1. NO DEVIATION FROM THE DESIGN DRAWINGS SHALL BE MADE WITHOUT THE WRITTEN APPROVAL OF THE ENGINEER OF RECORD.
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7. DELIVER REQUIRED SUBMITTALS TO ENGINEER FOR REVIEW & APPROVAL.
8. ALL SPACE NAMES WERE BASED ON EXISTING CONDITIONS ARCHITECTURAL DRAWINGS. EXISTING CONDITIONS ARCHITECTURAL ROOM NUMBERS ARE SHOWN WITHIN A BORDER. CURRENT USER-DEFINED SPACE IDENTIFICATIONS, IF INDICATED LOCALLY, ARE SHOWN BELOW THE ARCHITECTURAL NOMENCLATURE FOR REFERENCE. ALL EQUIPMENT TAGGING AND BAS POINT NAMING SHALL USE TAGS AS SHOWN. ANY DEVIATIONS SHALL BE SUBMITTED TO THE ENGINEER FOR APPROVAL.
1. 9. ALL NEW CONTROLLERS SHALL BE MOUNTED IN AN APPROVED ENCLOSURE, FULLY ACCESSIBLE WITHOUT THE USE OF A LADDER IN AN MER OR NO MORE THAN 18" ABOVE A DROP CEILING ON WALL NEAR THE TERMINAL EQUIPMENT.
10. EACH CONTROL CABINET TO HAVE LAMINATED COPY OF WIRING DIAGRAM AND SEQUENCE OF OPERATION FOR CONTROLLERS/ COMPONENTS CONTAINED WITHIN. WIRING WITHIN CABINET TO BE LABELED AND MATCH DIAGRAMS.
1. 11. PROVIDE COMPREHENSIVE LABELING AND TAGGING OF ALL SYSTEM COMPONENTS AND WIRING TERMINALS. SURFACE MOUNTED SPACE TEMPERATURE SENSORS SHALL BE LABELED THE SAME AS THE EQUIPMENT THEY CONTROL. PROVIDE ALL CABINETS, DEVICES AND CEILING ACCESS POINTS WITH ENGRAVED LAMINATED TAGS ATTACHED WITH SCREWS.
12. ALL VALVES, SENSORS, AND OTHER DEVICES SHALL BE EASILY ACCESSIBLE. PROVIDE HINGED ACCESS DOORS WHERE REQUIRED FOR SERVICE.
13. INSTALL ALL NEW FREEZE STATS ACCORDING TO MANUFACTURERS RECOMMENDATIONS. ENSURE SENSOR PROPERLY COVERS ENTIRE COIL, FACE, INCLUDING THE BOTTOM, WITHOUT RESTRICTING AIRFLOW OR MAINTENANCE ACCESS.
14. EXHAUST AND SUPPLY FANS NOT CONTROLLED OR MONITORED BY THE EXISTING EMS ARE NOT INCLUDED IN THIS CONTRACT. SEE FAN EQUIPMENT SCHEDULE FOR EXISTING FANS TO BE CONTROLLED BY THE NEW BAS.
1. 15. PROVIDE AND INSTALL EMT CONDUIT IN ALL EXPOSED AREAS. NO LESS THAN 1" TRADE SIZE CONDUIT FOR NETWORK WIRING OR 1/2" FOR ALL OTHER RUNS, WITH LESS THAN 40% FILL.
16. PROVIDE WIRE TERMINAL MARKERS AT EACH CABLE END. FOR ALL NETWORK WIRING PROVIDE PLENUM RATED CABLE (PURPLE WITH A YELLOW STRIPE) INSTALLED AND RUN NEATLY GROUPED AND SUPPORTED IN ALL OTHER AREAS, PARALLEL AND PERPENDICULAR TO THE BUILDING LINES. FOR ALL OTHER CABLES USE WHITE PLENUM RATED CABLE.
17. A BINARY NEEDLE POINT BI-POLAR IONIZATION (NPBI) STATUS/ALARMING POINT HAS BEEN INCLUDED FOR EACH FCU, UV AND AHU. CONTROL WIRES SHALL BE INSTALLED FROM THE DDC CONTROLLER AND SECURELY COILED UP IN THE FILTER SECTION OF EACH FCU, UV AND AHU REQUIRED. CABLES SHALL BE CLEARLY LABELED AT BOTH THE CONTROLLER AND THE TERMINATION POINT AS "FUTURE NPBI ALARM." NBPI UNITS ARE NOT BEING PROVIDED UNDER THIS CONTRACT.
1. 18. INSTALL NEW LINE-SIZED ISOLATION BALL VALVES ON ALL AHU, FCU, AND UV SUPPLY AND RETURN LINES SIZED 2 INCHES OR LESS.
19. CONTROL VALVES SHALL NOT BE SMALLER THAN ONE PIPE SIZE OF THE CONNECTED COIL. MODIFY PIPING AS NEEDED FOR PROPER VALVE FUNCTIONALITY AND MAINTENANCE ACCESS.
20. CONTRACTOR IS RESPONSIBLE FOR DRAINING, FILLING, AND BLEEDING PIPING SYSTEM.

KEY NOTES

1. REMOVE EXISTING SENSOR, COVER AND BRACKET. BLANK OFF OPENING WITH AN APPROVED COVER. PATCH AND TOUCH UP WALL TO MATCH EXISTING CONDITIONS.
2. EXISTING DTW DIFFERENTIAL PRESSURE TRANSMITTER IN CLASSROOM [207] TO BE REPLACED PER SPECIFICATIONS AND DESIGN DETAILS. CONTRACTOR TO SELECT PRESSURE RANGE AND SUBMIT TO ENGINEER FOR APPROVAL. REMOVE ALL PNEUMATIC CONTROLS AND REPAIR INSULATION PER SPECIFICATIONS. NEW TRANSMITTER TO BE TAGGED: DTW-DP-2.
3. EXISTING WALL-MOUNTED FAN ON/OFF SWITCHES FOR EF-161A, 166A, 171A, AND 179A TO BE REPLACED WITH 4-HOUR TIMER SWITCHES. CONTRACTOR TO SELECT SWITCH AND SUBMIT TO ENGINEER FOR APPROVAL

1 AREA B FLOOR PLAN

SCALE: 1/8" = 1'-0"

NORTH

KEYPLAN

TMG CONSULTING ENGINEERS
The Wilborne Group Consulting Engineers NC
dba TMG Consulting
227 West Trade Street
Suite 1102700
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TMG-CONSULTING ENGINEERS MECHANICAL ENGINEERING C-3646 CHARLOTTE, N.C. REGISTERED

NORTH CAROLINA PROFESSIONAL SEAL 033629 ENGINEER CLEMENT M. BOTTINI

01.25.2023

ISSUED FOR CONSTRUCTION

CHARLOTTE-MECKLENBERG SCHOOLS

NORTHRIDGE MIDDLE SCHOOL
HVAC CONTROLS

CHARLOTTE-MECKLENBERG SCHOOLS
7601 THE PLAZA
CHARLOTTE, NC 28215

REVISIONS

NO.	DESCRIPTION	DATE
	ISSUED FOR CONSTRUCTION	9/27/22
1	REVISION 1	1/13/23
2	REVISION 2	1/25/23

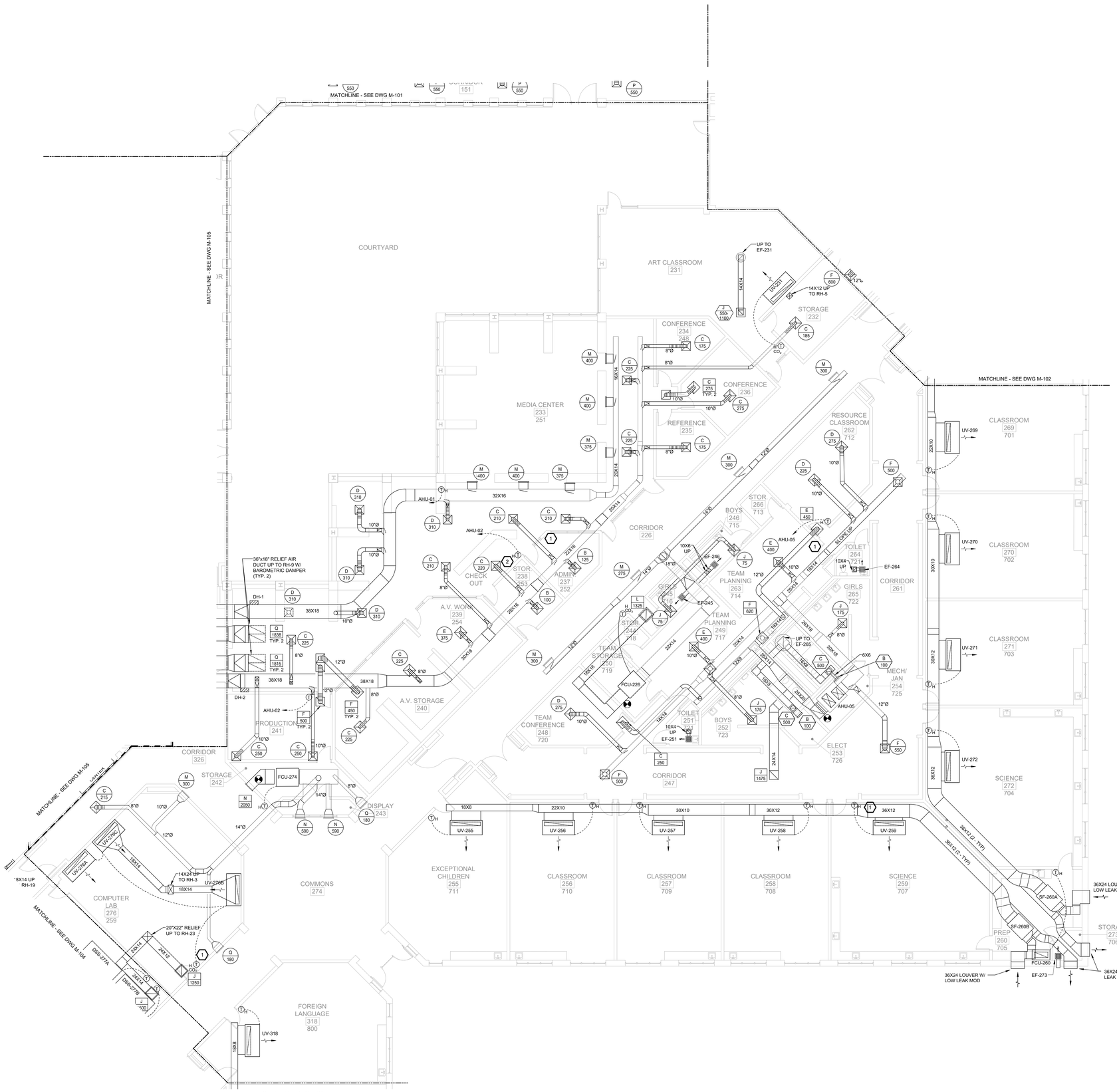
SHEET INFORMATION

DATE	09/27/2022
JOB NUMBER	2202-01-002
DRAWN	LCB
APPROVED	CTM

AREA B FLOOR PLAN

M-102

SHEET 3 OF 28



1 AREA C FLOOR PLAN

SCALE: 1/8" = 1'-0"

NORTH

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5. ALL LOCATIONS REQUIRING PIPING MODIFICATIONS SHALL BE SUBMITTED TO ENGINEER FOR APPROVAL.
6. CONTRACTOR SHALL PROVIDE A COMPREHENSIVE AS-BUILT NETWORK WIRING DIAGRAM OVERLAID ON PLAN DRAWINGS SHOWING WIRING PATHS AND CONTROLLER LOCATIONS. ANY OTHER DEVIATIONS FROM THESE PLANS SHALL ALSO BE INDICATED BY THE CONTRACTOR ON THESE DRAWINGS.
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10. EACH CONTROL CABINET TO HAVE LAMINATED COPY OF WIRING DIAGRAM AND SEQUENCE OF OPERATION FOR CONTROLLERS/ COMPONENTS CONTAINED WITHIN. WIRING WITHIN CABINET TO BE LABELED AND MATCH DIAGRAMS.
11. PROVIDE COMPREHENSIVE LABELING AND TAGGING OF ALL SYSTEM COMPONENTS AND WIRING TERMINALS. SURFACE MOUNTED SPACE TEMPERATURE SENSORS SHALL BE LABELED THE SAME AS THE EQUIPMENT THEY CONTROL. PROVIDE ALL CABINETS, DEVICES AND CEILING ACCESS POINTS WITH ENGRAVED LAMINATED TAGS ATTACHED WITH SCREWS.
12. ALL VALVES, SENSORS, AND OTHER DEVICES SHALL BE EASILY ACCESSIBLE. PROVIDE HINGED ACCESS DOORS WHERE REQUIRED FOR SERVICE.
13. INSTALL ALL NEW FREEZE STATS ACCORDING TO MANUFACTURERS RECOMMENDATIONS. ENSURE SENSOR PROPERLY COVERS ENTIRE COIL, FACE, INCLUDING THE BOTTOM, WITHOUT RESTRICTING AIRFLOW OR MAINTENANCE ACCESS.
14. EXHAUST AND SUPPLY FANS NOT CONTROLLED OR MONITORED BY THE EXISTING EMS ARE NOT INCLUDED IN THIS CONTRACT. SEE FAN EQUIPMENT SCHEDULE FOR EXISTING FANS TO BE CONTROLLED BY THE NEW BAS.
15. PROVIDE AND INSTALL EMT CONDUIT IN ALL EXPOSED AREAS. NO LESS THAN 1" TRADE SIZE CONDUIT FOR NETWORK WIRING OR 1/2" FOR ALL OTHER RUNS, WITH LESS THAN 40% FILL.
16. PROVIDE WIRE TERMINAL MARKERS AT EACH CABLE END. FOR ALL NETWORK WIRING PROVIDE PLENUM RATED CABLE (PURPLE WITH A YELLOW STRIPE) INSTALLED AND RUN NEATLY GROUPED AND SUPPORTED IN ALL OTHER AREAS, PARALLEL AND PERPENDICULAR TO THE BUILDING LINES. FOR ALL OTHER CABLES USE WHITE PLENUM RATED CABLE.
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KEY NOTES

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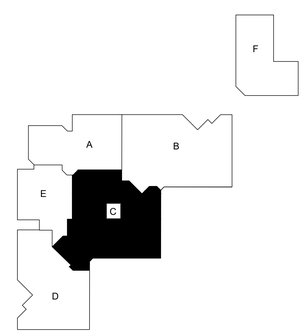
2. REMOVE EXISTING THERMOSTAT, COVER AND BRACKET. REPLACE WITH NEW THERMOSTAT PER PROJECT SPECIFICATIONS.

KEYPLAN



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Website: WWW.TMG-CE.COM

NORTH CAROLINA REGISTERED PROFESSIONAL ENGINEER SEAL 033629 CLEMENT T. MILBORNE

01.25.2023

ISSUED FOR CONSTRUCTION

CHARLOTTE-MECKLENBERG SCHOOLS

NORTHRIDGE MIDDLE SCHOOL HVAC CONTROLS

CHARLOTTE-MECKLENBERG SCHOOLS
7601 THE PLAZA
CHARLOTTE, NC 28215

REVISIONS			
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1	ISSUED FOR CONSTRUCTION	9/27/22	
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2	REVISION 2	1/25/23	

SHEET INFORMATION

DATE	09/27/2022
JOB NUMBER	2202-01-002
DRAWN	LCB
APPROVED	CTM

AREA C FLOOR PLAN

M-103

SHEET 4 OF 28

GENERAL NOTES

1. NO DEVIATION FROM THE DESIGN DRAWINGS SHALL BE MADE WITHOUT THE WRITTEN APPROVAL OF THE ENGINEER OF RECORD.
2. ALL EXISTING EQUIPMENT, DUCTWORK, PIPING, AND SENSOR LOCATIONS ARE APPROXIMATE. CONTRACTOR IS SOLELY RESPONSIBLE TO FIELD VERIFY EXACT LOCATIONS AND NOTIFY ENGINEER IN WRITING OF ANY SIGNIFICANT DEVIATIONS.
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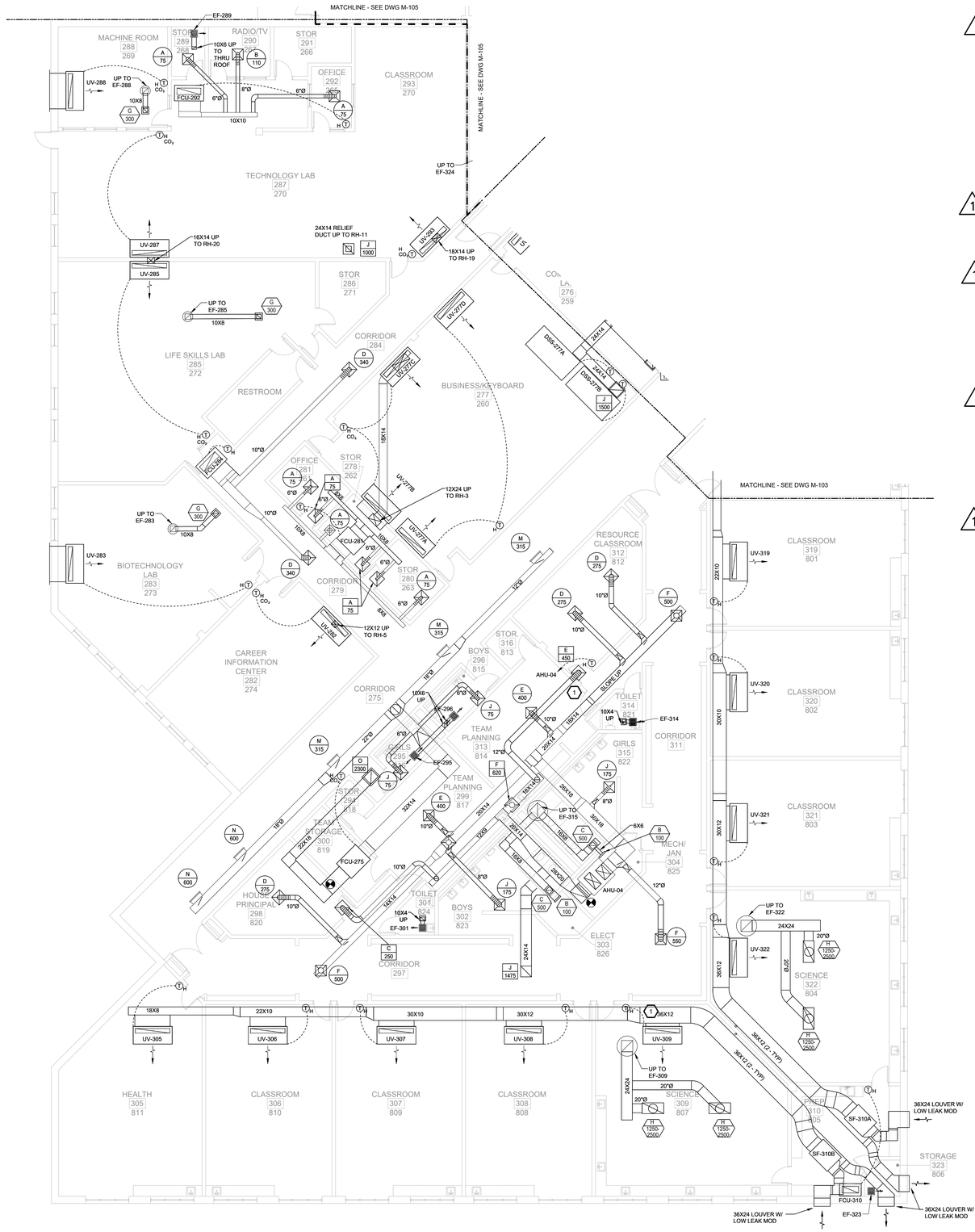
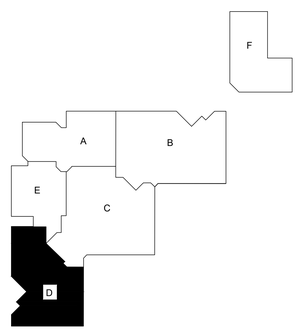


1 AREA D FLOOR PLAN

SCALE: 1/8" = 1'-0"

NORTH



KEYPLAN

TMG CONSULTING ENGINEERS
The Mitsonia Group Consulting Engineers INC
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Suite 102/103
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704.899.7610 Main
704.899.5135 Fax
Website: WWW.TMG-CE.COM

TMG CONSULTING ENGINEERS, C-3646, CHARLOTTE, NC

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 033629 CLEMENT T. MILBOURNE 01.25.2023

ISSUED FOR CONSTRUCTION

CHARLOTTE-MECKLENBERG SCHOOLS

NORTHRIDGE MIDDLE SCHOOL HVAC CONTROLS

CHARLOTTE-MECKLENBERG SCHOOLS
7601 THE PLAZA
CHARLOTTE, NC 28215

NO.	DESCRIPTION	DATE
1	ISSUED FOR CONSTRUCTION	9/27/22
2	REVISION 1	1/13/23
3	REVISION 2	1/25/23

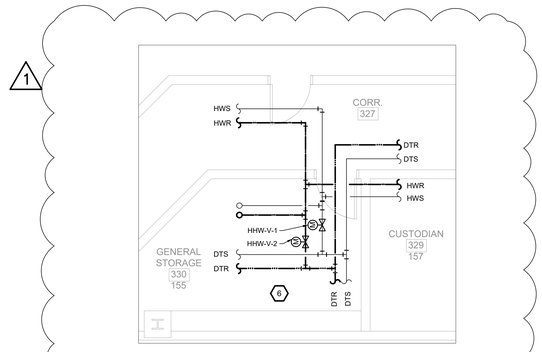
SHEET INFORMATION

DATE	09/27/2022
JOB NUMBER	2202-01-002
DRAWN	LCB
APPROVED	CTM

AREA D FLOOR PLAN

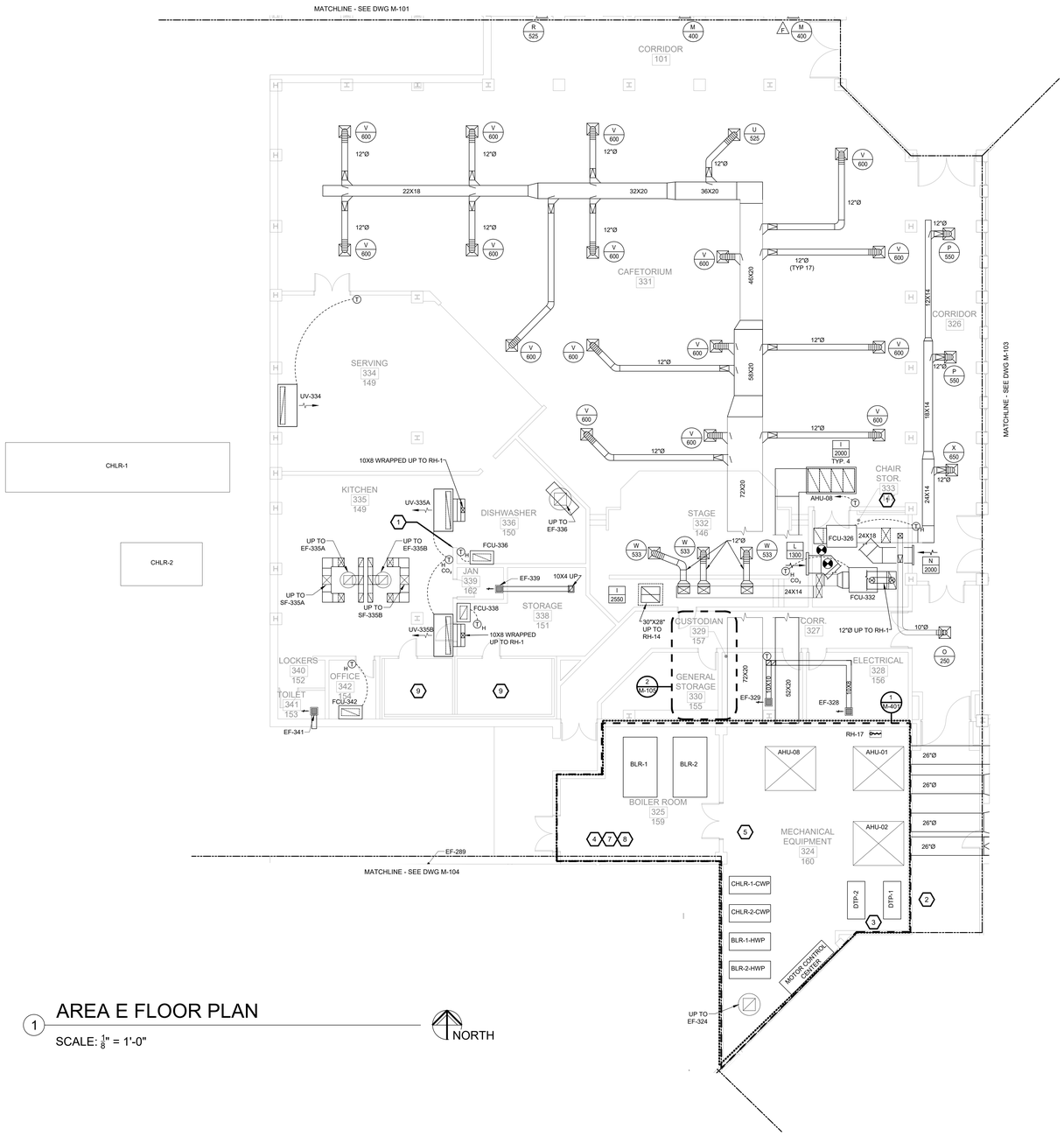
M-104

SHEET 5 OF 28



1 ENLARGED STORAGE 330 MECHANICAL PIPING DETAIL

SCALE: $\frac{1}{4}$" = 1'-0"



1 AREA E FLOOR PLAN

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NORTH

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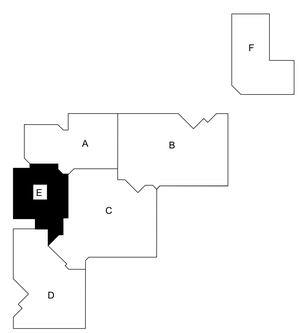
KEY NOTES

1. REMOVE EXISTING SENSOR, COVER AND BRACKET. BLANK OFF OPENING WITH AN APPROVED COVER. PATCH AND TOUCH UP WALL TO MATCH EXISTING CONDITIONS.
2. REMOVE PUMP P-3, SUCTION STRAINER, AND 3-INCH PIPING BACK TO ISOLATION VALVES ON ADJACENT PUMP. REMOVE ALL ELECTRICAL WIRING AND CONDUIT BACK TO MOTOR CONTROL CENTER. PLUG OR CAP 3-INCH ISOLATION VALVES AND RE-INSULATE PER SPECIFICATIONS.
3. INSTALL NEW VARIABLE FREQUENCY DRIVES (VFDS) FOR DUAL TEMPERATURE WATER PUMPS, DTP-1 AND DTP-2, PER SPECIFICATIONS. INSTALL NEW CONDUIT AND POWER WIRING FROM EXISTING MOTOR CONTROL CENTER (MCC). ALL CONTROL WIRING SHALL BE INSTALLED IN SEPARATE CONDUIT(S) FROM POWER WIRING. CONTRACTOR SHALL FIELD VERIFY CURCUIT BREAKER CAPACITY AND CONDITION AND REPLACE AS NEEDED TO MATCH NEW VFDS. CONTRACTOR SHALL FIELD VERIFY THAT EXISTING MOTORS ARE RATED FOR USE WITH VFDS. IF MOTORS ARE NOT COMPATIBLE, CONTRACTOR SHALL SPECIFY NEW MOTORS PER SPECIFICATIONS AND SUBMIT TO ENGINEER FOR APPROVAL. MECHANICAL CONTRACTOR SHALL ENSURE THAT NEW MOTOR SHAFT AND PUMP SHAFT ARE PROPERLY ALIGNED. REMOVE EXISTING MOTOR STARTERS AND ASSOCIATED CONTROLS.
4. EXISTING OUTSIDE AIR SENSOR AND FREEZE PROTECTION THERMOSTAT ON EXTERIOR OF BUILDING TO BE REMOVED. CONTRACTOR RESPONSIBLE TO PATCH EXTERIOR AND INTERIOR WALL ASSEMBLIES AROUND CONDUIT PENETRATION TO MATCH EXISTING AND SEAL OPENING TO BE WATER AND AIR TIGHT.
5. REMOVE EXISTING 2-WAY ISOLATION VALVES, V-2, AND V-4, AND REPLACE WITH CHECK VALVES PER PROJECT SPECIFICATIONS. REPLACE MOTORIZED THREE-WAY VALVES, V-1 AND V-3, WITH NEW VALVES AND ACTUATORS PER PROJECT SPECIFICATIONS. CONTRACTOR TO FIELD VERIFY ALL VALVE SIZES AND SPECS. IF ANY EXISTING SIZES DEVIATE FROM CONTROL VALVE SCHEDULE, SUBMIT ACTUAL VALVE SIZES TO ENGINEER FOR APPROVAL. REPAIR OR REPLACE PIPE INSULATION PER SPECIFICATIONS.
6. EXISTING ISOLATION VALVES IN GENERAL STORAGE [330] TO BE REPLACED WITH NEW 2-WAY, 2-POSITION CONTROL VALVES PER SCHEDULE AND SPECIFICATIONS. CONTRACTOR TO SELECT VALVES AND ACTUATORS AND SUBMIT TO ENGINEER FOR APPROVAL. REMOVE ALL ASSOCIATED PNEUMATIC CONTROLS AND REPAIR INSULATION PER SPECIFICATIONS. NEW VALVES SHALL BE TAGGED: HHW-V-1 AND HHW-V-2.
7. CONNECT EXISTING FIRE ALARM INPUT TO NEW DDC CONTROLLER.
8. CONNECT EXISTING EXTERIOR LIGHTING TIME CLOCK RELAYS TO NEW DDC CONTROLLER. RELAYS MAY BE REPLACED AS NEEDED TO MEET SPECIFICATIONS.
9. EXISTING KITCHEN COOLER AND FREEZER TEMPERATURE SENSORS ARE NOT INCLUDED IN THIS CONTRACT.



KEYPLAN

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TMG-CONSULTING ENGINEERS PLLC — C-3646 — CHARLOTTE, NC

NORTH CAROLINA — CLINTON J. MILLWARE — 32340 — 03629 — ENGINEER — 01.25.2023

ISSUED FOR CONSTRUCTION

CHARLOTTE-MECKLENBERG SCHOOLS

NORTHRIDGE MIDDLE SCHOOL HVAC CONTROLS

CHARLOTTE-MECKLENBERG SCHOOLS
7601 THE PLAZA
CHARLOTTE, NC 28215

REVISIONS

NO	DESCRIPTION	DATE
1	ISSUED FOR CONSTRUCTION	9/27/22
1	REVISION 1	1/13/23
2	REVISION 2	1/25/23

SHEET INFORMATION

DATE	09/27/2022
JOB NUMBER	2202-01-002
DRAWN	LCB
APPROVED	CTM

AREA E FLOOR PLAN

M-105

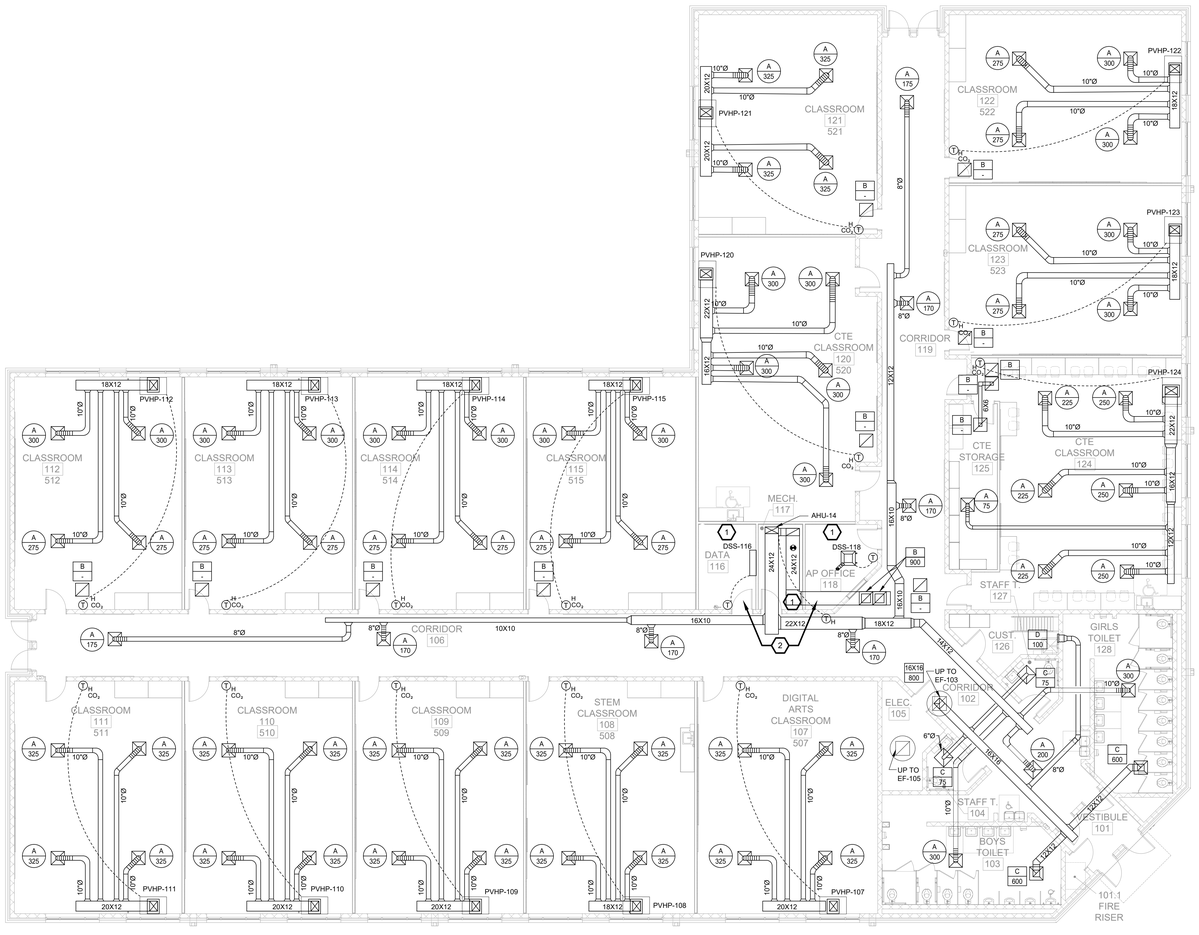
SHEET 6 OF 28

GENERAL NOTES

1. NO DEVIATION FROM THE DESIGN DRAWINGS SHALL BE MADE WITHOUT THE WRITTEN APPROVAL OF THE ENGINEER OF RECORD.
2. ALL EXISTING EQUIPMENT, DUCTWORK, PIPING, AND SENSOR LOCATIONS ARE APPROXIMATE. CONTRACTOR IS SOLELY RESPONSIBLE TO FIELD VERIFY EXACT LOCATIONS AND NOTIFY ENGINEER IN WRITING OF ANY SIGNIFICANT DEVIATIONS.
3. CONTRACTOR IS SOLELY RESPONSIBLE TO FIELD CHECK AND VERIFY EXISTING QUANTITIES AND TYPES OF TERMINAL UNITS, DAMPERS, VALVES, ETC.
4. ALL HVAC EQUIPMENT, LOCATIONS AND QUANTITIES ARE BASED ON EXISTING CONDITIONS DRAWINGS AND PRELIMINARY FIELD INVESTIGATIONS. ANY HVAC EQUIPMENT FOUND THAT IS NOT SHOWN ON THE DESIGN DRAWINGS SHALL BE INCLUDED. TYPE OF EQUIPMENT, EXACT LOCATION, AND ALL AVAILABLE NAMEPLATE DATA SHALL BE SUBMITTED TO THE ENGINEER OF RECORD FOR APPROVAL.
5. ALL LOCATIONS REQUIRING PIPING MODIFICATIONS SHALL BE SUBMITTED TO ENGINEER FOR APPROVAL.
6. CONTRACTOR SHALL PROVIDE A COMPREHENSIVE AS-BUILT NETWORK WIRING DIAGRAM OVERLAID ON PLAN DRAWINGS SHOWING WIRING PATHS AND CONTROLLER LOCATIONS. ANY OTHER DEVIATIONS FROM THESE PLANS SHALL ALSO BE INDICATED BY THE CONTRACTOR ON THESE DRAWINGS.
7. DELIVER REQUIRED SUBMITTALS TO ENGINEER FOR REVIEW & APPROVAL.
8. ALL SPACE NAMES WERE BASED ON EXISTING CONDITIONS ARCHITECTURAL DRAWINGS. EXISTING CONDITIONS ARCHITECTURAL ROOM NUMBERS ARE SHOWN WITHIN A BORDER. CURRENT USER-DEFINED SPACE IDENTIFICATIONS, IF INDICATED LOCALLY, ARE SHOWN BELOW THE ARCHITECTURAL NOMENCLATURE FOR REFERENCE. ALL EQUIPMENT TAGGING AND BAS POINT NAMING SHALL USE TAGS AS SHOWN. ANY DEVIATIONS SHALL BE SUBMITTED TO THE ENGINEER FOR APPROVAL.
9. ALL NEW CONTROLLERS SHALL BE MOUNTED IN AN APPROVED ENCLOSURE, FULLY ACCESSIBLE WITHOUT THE USE OF A LADDER IN AN MER OR NO MORE THAN 18" ABOVE A DROP CEILING ON WALL NEAR THE TERMINAL EQUIPMENT.
10. EACH CONTROL CABINET TO HAVE LAMINATED COPY OF WIRING DIAGRAM AND SEQUENCE OF OPERATION FOR CONTROLLERS/ COMPONENTS CONTAINED WITHIN. WIRING WITHIN CABINET TO BE LABELED AND MATCH DIAGRAMS.
11. PROVIDE COMPREHENSIVE LABELING AND TAGGING OF ALL SYSTEM COMPONENTS AND WIRING TERMINALS. SURFACE MOUNTED SPACE TEMPERATURE SENSORS SHALL BE LABELED THE SAME AS THE EQUIPMENT THEY CONTROL. PROVIDE ALL CABINETS, DEVICES AND CEILING ACCESS POINTS WITH ENGRAVED LAMINATED TAGS ATTACHED WITH SCREWS.
12. ALL VALVES, SENSORS, AND OTHER DEVICES SHALL BE EASILY ACCESSIBLE. PROVIDE HINGED ACCESS DOORS WHERE REQUIRED FOR SERVICE.
13. INSTALL ALL NEW FREEZE STATS ACCORDING TO MANUFACTURERS RECOMMENDATIONS. ENSURE SENSOR PROPERLY COVERS ENTIRE COIL, FACE, INCLUDING THE BOTTOM, WITHOUT RESTRICTING AIRFLOW OR MAINTENANCE ACCESS.
14. EXHAUST AND SUPPLY FANS NOT CONTROLLED OR MONITORED BY THE EXISTING EMS ARE NOT INCLUDED IN THIS CONTRACT. SEE FAN EQUIPMENT SCHEDULE FOR EXISTING FANS TO BE CONTROLLED BY THE NEW BAS.
15. PROVIDE AND INSTALL EMT CONDUIT IN ALL EXPOSED AREAS. NO LESS THAN 1" TRADE SIZE CONDUIT FOR NETWORK WIRING OR 1/2" FOR ALL OTHER RUNS, WITH LESS THAN 40% FILL.
16. PROVIDE WIRE TERMINAL MARKERS AT EACH CABLE END. FOR ALL NETWORK WIRING PROVIDE PLENUM RATED CABLE (PURPLE WITH A YELLOW STRIPE) INSTALLED AND RUN NEATLY GROUPED AND SUPPORTED IN ALL OTHER AREAS, PARALLEL AND PERPENDICULAR TO THE BUILDING LINES. FOR ALL OTHER CABLES USE WHITE PLENUM RATED CABLE.
17. A BINARY NEEDLE POINT BI-POLAR IONIZATION (NPBI) STATUS/ALARMING POINT HAS BEEN INCLUDED FOR EACH FCU, UV AND AHU. CONTROL WIRES SHALL BE INSTALLED FROM THE DDC CONTROLLER AND SECURELY COILED UP IN THE FILTER SECTION OF EACH FCU, UV AND AHU REQUIRED. CABLES SHALL BE CLEARLY LABELED AT BOTH THE CONTROLLER AND THE TERMINATION POINT AS "FUTURE NPBI ALARM." NBPI UNITS ARE NOT BEING PROVIDED UNDER THIS CONTRACT.
18. INSTALL NEW LINE-SIZED ISOLATION BALL VALVES ON ALL AHU, FCU, AND UV SUPPLY AND RETURN LINES SIZED 2 INCHES OR LESS.
19. CONTROL VALVES SHALL NOT BE SMALLER THAN ONE PIPE SIZE OF THE CONNECTED COIL. MODIFY PIPING AS NEEDED FOR PROPER VALVE FUNCTIONALITY AND MAINTENANCE ACCESS.
20. CONTRACTOR IS RESPONSIBLE FOR DRAINING, FILLING, AND BLEEDING PIPING SYSTEM.

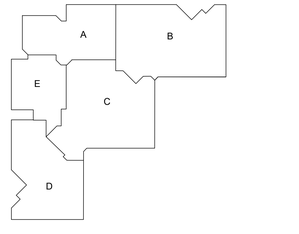
KEY NOTES

1. SEE ROOF PLAN FOR LOCATION OF OUTDOOR CONDENSING UNIT.
2. CONTRACTOR TO FIELD VERIFY IF DSS UNIT CONTROLLERS ARE BACNET COMPATIBLE AND SUBMIT A LIST OF AVAILABLE BACNET POINTS FOR ENGINEER APPROVAL. IF BACNET COMMUNICATION IS NOT POSSIBLE, CONTRACTOR TO SUBMIT LIST OF AVAILABLE HARDWARE POINTS FOR ENGINEER APPROVAL.



1 AREA F FLOOR PLAN

SCALE: 1/8" = 1'-0"



KEYPLAN

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NORTH CAROLINA — PROFESSIONAL — CLEMENT T. MILBOURNE — 033629 — ENGINEER — SEAL

01.25.2023

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NORTHRIDGE MIDDLE SCHOOL HVAC CONTROLS

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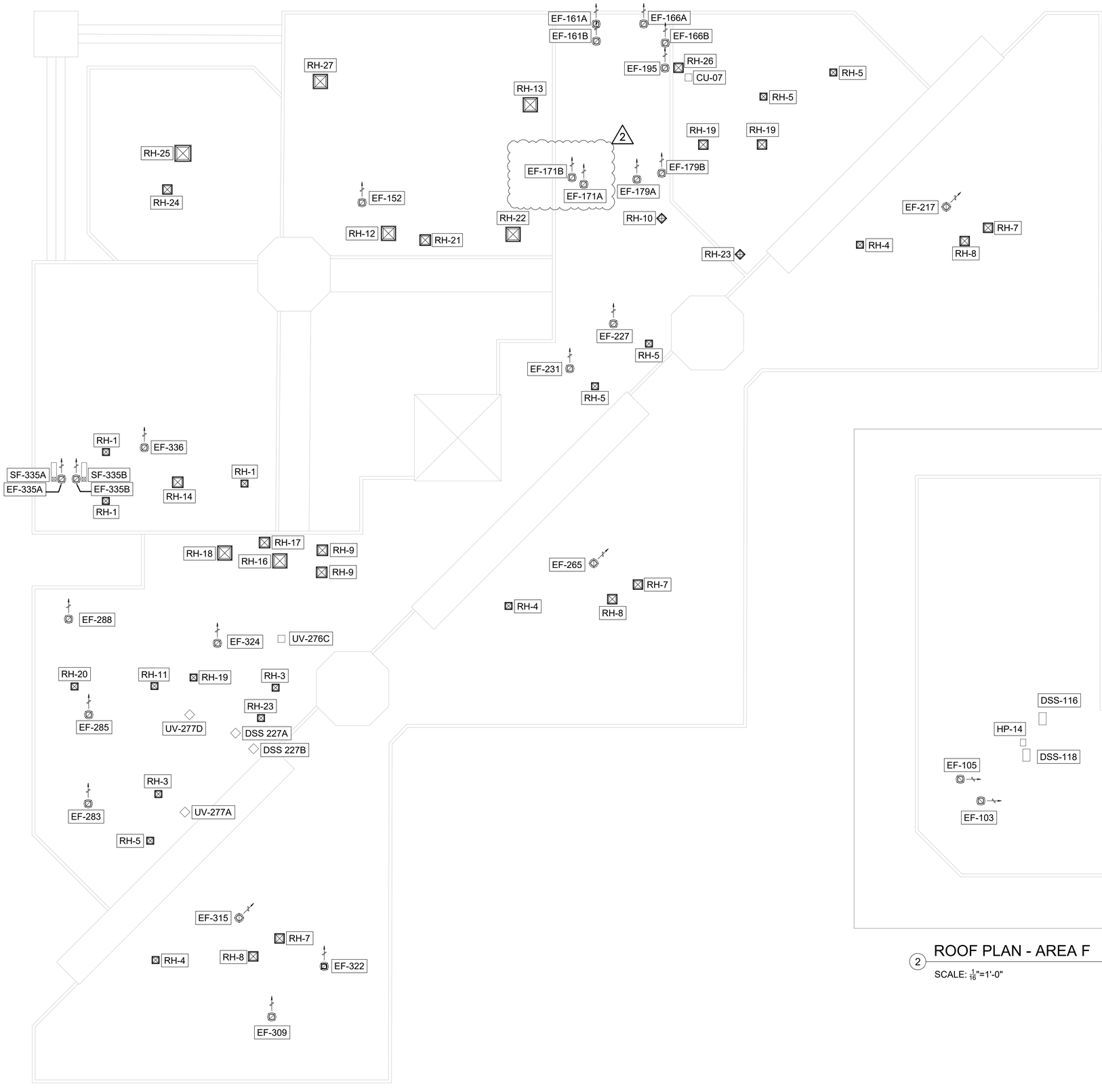
AREA F FLOOR PLAN

M-106

SHEET 7 OF 28



1 ROOF PLAN - AREA A-E

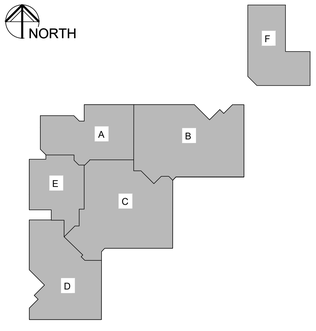
SCALE: $\frac{1}{16}$"=1'-0"

NORTH

2 ROOF PLAN - AREA F

SCALE: $\frac{1}{16}$"=1'-0"

NORTH



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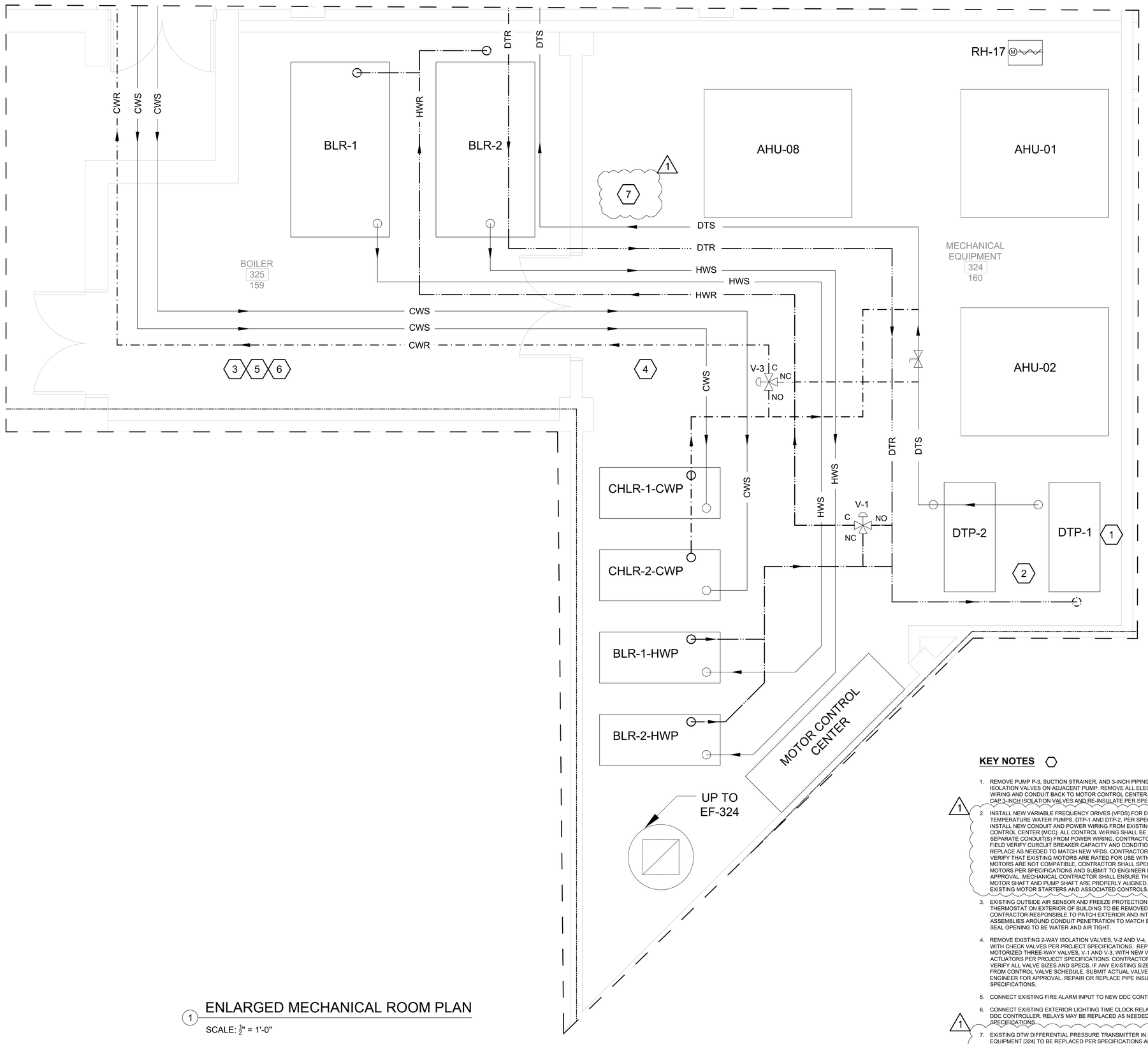
ROOF PLAN

M-107

SHEET 8 OF 28



KEY NOTES

1. REMOVE PUMP P-3, SUCTION STRAINER, AND 3-INCH PIPING BACK TO ISOLATION VALVES ON ADJACENT PUMP. REMOVE ALL ELECTRICAL WIRING AND CONDUIT BACK TO MOTOR CONTROL CENTER. PLUG OR CAP 3-INCH ISOLATION VALVES AND RE-INSULATE PER SPECIFICATIONS.

1
2. INSTALL NEW VARIABLE FREQUENCY DRIVES (VFDS) FOR DUAL TEMPERATURE WATER PUMPS, DTP-1 AND DTP-2, PER SPECIFICATIONS. INSTALL NEW CONDUIT AND POWER WIRING FROM EXISTING MOTOR CONTROL CENTER (MCC). ALL CONTROL WIRING SHALL BE INSTALLED IN SEPARATE CONDUIT(S) FROM POWER WIRING. CONTRACTOR SHALL FIELD VERIFY CURCUIT BREAKER CAPACITY AND CONDITION AND REPLACE AS NEEDED TO MATCH NEW VFDS. CONTRACTOR SHALL FIELD VERIFY THAT EXISTING MOTORS ARE RATED FOR USE WITH VFDS. IF MOTORS ARE NOT COMPATIBLE, CONTRACTOR SHALL SPECIFY NEW MOTORS PER SPECIFICATIONS AND SUBMIT TO ENGINEER FOR APPROVAL. MECHANICAL CONTRACTOR SHALL ENSURE THAT NEW MOTOR SHAFT AND PUMP SHAFT ARE PROPERLY ALIGNED. REMOVE EXISTING MOTOR STARTERS AND ASSOCIATED CONTROLS.

3. EXISTING OUTSIDE AIR SENSOR AND FREEZE PROTECTION THERMOSTAT ON EXTERIOR OF BUILDING TO BE REMOVED. CONTRACTOR RESPONSIBLE TO PATCH EXTERIOR AND INTERIOR WALL ASSEMBLIES AROUND CONDUIT PENETRATION TO MATCH EXISTING AND SEAL OPENING TO BE WATER AND AIR TIGHT.

4. REMOVE EXISTING 2-WAY ISOLATION VALVES, V-2 AND V-4, AND REPLACE WITH CHECK VALVES PER PROJECT SPECIFICATIONS. REPLACE MOTORIZED THREE-WAY VALVES, V-1 AND V-3, WITH NEW VALVES AND ACTUATORS PER PROJECT SPECIFICATIONS. CONTRACTOR TO FIELD VERIFY ALL VALVE SIZES AND SPECS. IF ANY EXISTING SIZES DEVIATE FROM CONTROL VALVE SCHEDULE, SUBMIT ACTUAL VALVE SIZES TO ENGINEER FOR APPROVAL. REPAIR OR REPLACE PIPE INSULATION PER SPECIFICATIONS.

5. CONNECT EXISTING FIRE ALARM INPUT TO NEW DDC CONTROLLER.

6. CONNECT EXISTING EXTERIOR LIGHTING TIME CLOCK RELAYS TO NEW DDC CONTROLLER. RELAYS MAY BE REPLACED AS NEEDED TO MEET SPECIFICATIONS.

1
7. EXISTING DTW DIFFERENTIAL PRESSURE TRANSMITTER IN MECHANICAL EQUIPMENT [324] TO BE REPLACED PER SPECIFICATIONS AND DESIGN DETAILS. CONTRACTOR TO SELECT PRESSURE RANGE AND SUBMIT TO ENGINEER FOR APPROVAL. REMOVE ALL PNEUMATIC CONTROLS AND REPAIR INSULATION PER SPECIFICATIONS. NEW TRANSMITTER TO BE TAGGED: DTW-DP-1.

1 ENLARGED MECHANICAL ROOM PLAN

SCALE: 1/2" = 1'-0"

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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 033629 CLEMENT T. MILBOURNE
01.25.2023

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ENLARGED PLANS

M-401

SHEET 9 OF 28

AIR HANDLING UNITS

TAG	SERVICE				AIRFLOW			FAN MOTOR			DUAL TEMPERATURE COIL					UNIT			NOTES
	DESCRIPTION	LOCATION	AREA	ZONE	TOTAL CFM	MIN OA CFM	ESP IN. WG	VOLT/PH	HP	RPM	TOT. CLG BTUH	COOLING GPM	WPD FT.	HEATING GPM	PIPE CONN. NPT IN.	MANUF.	MODEL	CONTROL SCHEMATIC	
AHU-01	MEDIA PERIMETER	MECH. 324/160	C	4	3800	500	1.00	480/3Φ	3	979	128440	18.6	2.7	3.5	1 1/2	MCQUAY	LSL 108C	AHU TYPE D	①②⑤⑥
AHU-02	MEDIA INTERIOR	MECH. 324/160	C	4	4050	500	1.00	480/3Φ	3	942	135930	21.1	2.9	2.6	1 1/2	MCQUAY	LSL 108C	AHU TYPE D	①②⑤⑥
AHU-03	ADMIN. INTERIOR	MECH. 113	A	1	6050	700	1.00	480/3Φ	5	870	212725	41.4	11.1	4.0	1 1/2	MCQUAY	LSL 111C	AHU TYPE B	①②⑧
AHU-04	TEAM PLAN. CORE 'D'	MECH. 304/825	D	5	3525	690	1.00	480/3Φ	2	903	109000	18.0	2.0	2.0	1 1/2	MCQUAY	LSL 108C	AHU TYPE B	①②⑧
AHU-05	TEAM PLAN. CORE 'C'	MECH. 254/725	C	6	3525	690	1.00	480/3Φ	2	903	109000	18.0	2.0	2.0	1 1/2	MCQUAY	LSL 108C	AHU TYPE B	①②⑧
AHU-06	TEAM PLAN. CORE 'B'	MECH. 206/625	B	7	3525	690	1.00	480/3Φ	2	903	109000	18.0	2.0	2.0	1 1/2	MCQUAY	LSL 108C	AHU TYPE B	①②⑧
AHU-07	P.E. OFFICES	MECH. 194/231	B	11	1225	150	1.50	480/3Φ	2	1721	37500	7.4	0.9	1.0	1 1/2	MCQUAY	LSL 103C	AHU TYPE C	①③⑥⑧
AHU-08	CAFETORIUM	MECH. 324/160	E	2	10000	3000	1.50	480/3Φ	7 1/2	841	480895	91.0	17.7	22.1	2 1/2	MCQUAY	LSL 122D	AHU TYPE B	①②⑧
AHU-09	CONCESSION	MECH. MEZZ.	A	10	1930	0	1.00	480/3Φ	1	1160	59400	9.3	1.4	1.5	1 1/2	MCQUAY	LSL 104C	AHU TYPE A	①④⑧
AHU-10	ADMIN. PERIMETER	MECH. 113	A	1	1500	125	1.00	480/3Φ	1	1622	37500	7.4	0.9	1.1	1 1/2	MCQUAY	LSL 103C	AHU TYPE B	①②⑧
AHU-11	ADMIN. PERIMETER	MECH. 113	A	1	900	150	1.00	480/3Φ	3/4	1469	27500	5.4	0.6	1.0	1 1/2	MCQUAY	LSL 103C	AHU TYPE B	①②⑧
AHU-12	MAIN GYM	MECH. MEZZ.	A	10	12000	3000	1.50	480/3Φ	10	903	589100	116.5	14.1	34.6	2 1/2	MCQUAY	LSL 122D	AHU TYPE B	①②⑧
AHU-13	AUX GYM	MECH. MEZZ.	A	10	3000	750	1.00	480/3Φ	2	1341	140150	27.8	10.7	6.1	1 1/2	MCQUAY	LSL 106C	AHU TYPE B	①②⑧
AHU-14	CORRIDOR / TOILETS	MECH. 117	F	--	2000	200	0.75	208/3Φ	1	--	57547	--	--	--	--	TRANE	TAM7B0C60H1	AHU TYPE E	①④⑦⑧

① COOLING CAPACITY: 80/67 ENTERING AIR DB/WB AND 45 ENTERING WATER TEMPERATURES (DEGF)
② COMBO FILTER MIXING BOX SECTION FOR ECONOMIZER OPERATION
③ FILTER MIXING BOX WITH REMOTE DAMPERS FOR ECONOMIZER OPERATION
④ ANGULAR FILTER SECTION - NO ECONOMIZER
⑤ ELECTIC DUCT HEATERS (35 KW) 4-STAGE FOR DEHUMIDIFICATION CONTROL
⑥ SPLIT SYSTEM: 37500 BTUH COOLING ONLY SUPPLEMENTARY DX COIL (SEE OUTDOOR UNIT SCHEDULE)
⑦ ELECTRIC HEAT FOR DEHUMIDIFICATION CONTROL (SEE OUTDOOR UNIT SCHEDULE)
⑧ NEEDLEPOINT BIPOLAR IONIZATION IN SUPPLY AIR DUCT

FAN COILS

TAG	SERVICE				AIRFLOW			FAN MOTOR			DUAL TEMPERATURE COIL					UNIT			NOTES
	DESCRIPTION	ROOM NO.	AREA	ZONE	TOTAL CFM	MIN OA CFM	ESP IN. WG	VOLT/PH	HP	SPEED / RPM	TOT. CLG BTUH	COOLING GPM	WPD FT.	HEATING GPM	PIPE CONN. NPT IN.	MANUF.	MODEL	CONTROL SCHEMATIC	
FCU-151	CORRIDOR	151	A	10	2300	--	0.50	115V/1Φ	1	1373	60565	12.1	3.1	1.3	1 1/8	MCQUAY	SCB201B	FCU TYPE C	①④⑥
FCU-161	BOYS PE LOCKERS	161/208	B	11	381	--	0.15	115V/1Φ	150 W	HIGH	--	--	4.3	2.2	5/8	MCQUAY	TSC041E	FCU TYPE A	⑤⑥
FCU-163	BOYS TOILET	163/210	B	11	355	--	0.10	115V/1Φ	70 W	HIGH	--	--	2.3	1.6	5/8	MCQUAY	TSC031E	FCU TYPE A	⑤⑥
FCU-166	BOYS TEAM LOCKERS	166/212	B	11	381	--	0.15	115V/1Φ	150 W	HIGH	--	--	4.3	2.2	5/8	MCQUAY	TSC041E	FCU TYPE A	⑤⑥
FCU-171	GIRLS PE LOCKERS	171/226	B	11	381	--	0.15	115V/1Φ	150 W	HIGH	--	--	4.3	2.2	5/8	MCQUAY	TSC041E	FCU TYPE A	⑤⑥
FCU-173	GIRLS TOILET	173/223	B	11	355	--	0.10	115V/1Φ	70 W	HIGH	--	--	2.3	1.6	5/8	MCQUAY	TSC031E	FCU TYPE A	⑤⑥
FCU-179	GIRLS TEAM LOCKERS	179/222	B	11	381	--	0.15	115V/1Φ	150 W	HIGH	--	--	4.3	2.2	5/8	MCQUAY	TSC041E	FCU TYPE A	⑤⑥
FCU-180	COMMONS	180	B	9	2050	--	0.50	115V/1Φ	1	1321	57595	11.5	2.9	1.0	1 1/8	MCQUAY	SCB201B	FCU TYPE C	①④⑥
FCU-181	CORRIDOR	181	B	7	2300	150	0.50	115V/1Φ	1	1373	60565	12.1	3.1	1.3	1 1/8	MCQUAY	SCB201B	FCU TYPE D	①②④⑥
FCU-183	OFFICE	183/242	B	9	330	--	0.20	115V/1Φ	70 W	HIGH	8081	1.6	3.4	1.0	5/8	MCQUAY	TSC031E	FCU TYPE B	①⑥
FCU-189	OFFICE	189/237	B	9	700	10	0.50	115V/1Φ	1/3	1128	22913	4.8	3.1	1.0	7/8	MCQUAY	SCB081B	FCU TYPE E	①③⑥
FCU-212	PREP.	212/605	B	7	404	--	0.00	115V/1Φ	150 W	HIGH	11899	2.3	8.7	1.0	5/8	MCQUAY	TSC041E	FCU TYPE B	①⑦
FCU-230	KILN	230/246	B	9	750	--	0.20	115V/1Φ	250 W	HIGH	23514	4.5	10.5	1.0	5/8	MCQUAY	TSC081E	FCU TYPE B	①⑥
FCU-226	CORRIDOR	226	C	6	1325	150	0.50	115V/1Φ	3/4	1326	38900	7.8	8.8	1.0	1 1/8	MCQUAY	SCB121B	FCU TYPE D	①②④⑥
FCU-260	PREP.	260/705	C	6	404	--	0.00	115V/1Φ	150 W	HIGH	11899	2.3	8.7	1.0	5/8	MCQUAY	TSC041E	FCU TYPE B	①⑦
FCU-274	COMMONS	274	C	8	2050	--	0.50	115V/1Φ	1	1321	57595	11.5	2.9	1.0	1 1/8	MCQUAY	SCB201B	FCU TYPE C	①④⑥
FCU-275	CORRIDOR	275	D	5	2300	150	0.50	115V/1Φ	1	1373	60565	12.1	3.1	1.3	1 1/8	MCQUAY	SCB201B	FCU TYPE D	①②④⑥
FCU-281	OFFICE	281/261	D	8	330	--	0.25	115V/1Φ	70 W	HIGH	8081	1.6	3.1	1.0	5/8	MCQUAY	TSC031E	FCU TYPE B	①⑥
FCU-284	CORRIDOR	284	D	8	754	--	0.20	115V/1Φ	250 W	HIGH	24392	5.1	13.5	1.0	5/8	MCQUAY	TSC081E	FCU TYPE B	①⑥
FCU-292	OFFICE	292/265	D	8	330	--	0.20	115V/1Φ	70 W	HIGH	8081	1.6	3.4	1.0	5/8	MCQUAY	TSC031E	FCU TYPE B	①⑥
FCU-310	PREP.	310/805	D	5	404	--	0.00	115V/1Φ	150 W	HIGH	11899	2.3	8.7	1.0	5/8	MCQUAY	TSC041E	FCU TYPE B	①⑦
FCU-326	CORRIDOR	326	E	2	2000	--	0.50	115V/1Φ	1	965	86189	16.5	1.9	1.2	1 5/8	MCQUAY	SCB201B	FCU TYPE C	①④⑥
FCU-332	STAGE	332/146	E	2	1600	300	0.50	115V/1Φ	3/4	1291	59994	12.0	10.2	1.0	1 1/8	MCQUAY	SCB161B	FCU TYPE D	①②④⑥
FCU-336	DISHWASHER	336/150	E	3	549	--	0.00	115V/1Φ	125 W	MED	16127	3.0	4.8	1.0	5/8	MCQUAY	TSC061E	FCU TYPE B	①⑦
FCU-338	STORAGE	338/151	E	3	330	--	0.00	115V/1Φ	70 W	HIGH	8081	1.6	3.4	1.0	5/8	MCQUAY	TSC031E	FCU TYPE B	①⑦
FCU-342	OFFICE	342/154	E	3	155	--	0.00	115V/1Φ	70 W	LOW	5805	1.6	3.4	1.0	5/8	MCQUAY	TSC031E	FCU TYPE B	①⑦

① COOLING CAPACITY: 80/67 ENTERING AIR DB/WB AND 45 ENTERING WATER TEMPERATURES (DEGF)
② REMOTE OUTSIDE AIR DAMPER FOR ISOLATION
③ REMOTE MIXED AIR DAMPERS (NOT LINKED) FOR ECONOMIZER OPERATION
④ SMOKE DETECTOR IN RETURN AIR DUCT
⑤ HEAT ONLY UNIT - DUAL TEMPERATURE BRANCH ISOLATION VALVE
⑥ NEEDLEPOINT BIPOLAR IONIZATION IN SUPPLY AIR DUCT
⑦ NEEDLEPOINT BIPOLAR IONIZATION IN UNIT CABINET

UNIT VENTILATORS

TAG	SERVICE				AIRFLOW			FAN MOTOR			DUAL TEMPERATURE COIL					UNIT			NOTES
	DESCRIPTION	ROOM NO.	AREA	ZONE	TOTAL CFM	MIN OA CFM	TSP IN. WG	VOLT/PH	HP	SPEED	TOT. CLG BTUH	COOLING GPM	WPD FT.	HEATING GPM	PIPE CONN. NPT IN.	MANUF.	MODEL	CONTROL SCHEMATIC	
UV-182A	THEATER ARTS	182/240	B	9	1000	225	0.25	115V/1Φ	1/8	HIGH	30100	8.0	5.2	1.5	3/4	AAF	AH-3000	UV Type G	①②③④⑤⑧
UV-182B	THEATER ARTS	182/240	B	9	750	50	0.25	115V/1Φ	1/8	HIGH	30100	8.0	5.2	1.5	3/4	AAF	AH-3000	UV Type G	①②③④⑤⑧
UV-185A	INSTRUMENT	185/239	B	9	1000	125	0.25	115V/1Φ	1/8	HIGH	42300	8.0	6.9	1.5	3/4	AAF	AH-4000	UV Type F	①②④⑤⑧
UV-185B	INSTRUMENT	185/239	B	9	1000	125	0.25	115V/1Φ	1/8	HIGH	42300	8.0	6.9	1.5	3/4	AAF	AH-4000	UV Type F	①②④⑤⑧
UV-191A	DANCE	191/229	B	9	1000	225	0.25	115V/1Φ	1/8	HIGH	37500	6.0	4.0	1.5	3/4	AAF	AH-4000	UV Type E	①②③④⑧
UV-191B	DANCE	191/229	B	9	1000	225	0.25	115V/1Φ	1/8	HIGH	37500	6.0	4.0	1.5	3/4	AAF	AH-4000	UV Type E	①②③④⑧
UV-196A	CHORUS	196/238	B	9	1000	225	0.25	115V/1Φ	1/8	HIGH	42300	8.0	6.9	1.5	3/4	AAF	AH-4000	UV Type E	①②③④⑧
UV-196B	CHORUS	196/238	B	9	1000	225	0.25	115V/1Φ	1/8	HIGH	42300	8.0	6.9	1.5	3/4	AAF	AH-4000	UV Type E	①②③④⑧
UV-207	CLASSROOM	207/611	B	7	1250	320	0.25	115V/1Φ	1/8	HIGH	43700	8.0	5.3	1.5	3/4	AAF	AH-5000	UV Type B	①⑥⑧
UV-208	CLASSROOM	208/610	B	7	1250	320	0.25	115V/1Φ	1/8	HIGH	43700	8.0	5.3	1.5	3/4	AAF	AH-5000	UV Type B	①⑥⑧
UV-209	CLASSROOM	209/609	B	7	1250	320	0.25	115V/1Φ	1/8	HIGH	43700	8.0	5.3	1.5	3/4	AAF	AH-5000	UV Type B	①⑥⑧
UV-210	CLASSROOM	210/608	B	7	1250	320	0.25	115V/1Φ	1/8	HIGH	43700	8.0	5.3	1.5	3/4	AAF	AH-5000	UV Type B	①⑥⑧
UV-211	SCIENCE	211/607	B	7	1250	320	0.25	115V/1Φ	1/8	HIGH	46300	8.0	5.0	1.5	3/4	AAF	AH-5000	UV Type B	①⑥⑧
UV-220	HEALTH	220/600	B	7	1250	320	0.25	115V/1Φ	1/8	HIGH	50200	10.0	7.7	1.5	3/4	AAF	AH-5000	UV Type B	①⑥⑧
UV-221	CLASSROOM	221/601	B	7	1250	320	0.25	115V/1Φ	1/8	HIGH	50200	10.0	7.7	1.5	3/4	AAF	AH-5000	UV Type B	①⑥⑧
UV-222	CLASSROOM	222/602	B	7	1250	320	0.25	115V/1Φ	1/8	HIGH	50200	10.0	7.7	1.5	3/4	AAF	AH-5000	UV Type B	①⑥⑧
UV-223	CLASSROOM	223/603	B	7	1250	320	0.25	115V/1Φ	1/8	HIGH	50200	10.0	7.7	1.5	3/4	AAF	AH-5000	UV Type B	①⑥⑧
UV-224	SCIENCE	224/604	B	7	1250	320	0.25	115V/1Φ	1/8	HIGH	53200	12.0	10.8	1.5	3/4	AAF	AH-5000	UV Type B	①⑥⑧
UV-227	ART CLASSROOM	227/243	B	9	1250	450	0.25	115V/1Φ	1/8	HIGH	53200	12.0	10.8	1.5	3/4	AAF	AH-5000	UV Type D	①④⑧
UV-268	HEALTH	268/700	B	6	1250	320	0.25	115V/1Φ	1/8	HIGH	46300	8.0	5.0	1.5	3/4	AAF	AH-5000	UV Type B	①⑥⑧
UV-231	ART CLASSROOM	231	C	9	1250	450	0.25	115V/1Φ	1/8	HIGH	53200	12.0	10.8	1.5	3/4	AAF	AH-5000	UV Type D	①④⑧
UV-255	EXCEPTIONAL CHILDREN	255/711	C	6	1250	320	0.25	115V/1Φ	1/8	HIGH	43700	8.0	5.3	1.5	3/4	AAF	AH-5000	UV Type B	①⑥⑧
UV-256	CLASSROOM	256/710	C	6	1250	320	0.25	115V/1Φ	1/8	HIGH	43700	8.0	5.3	1.5	3/4	AAF	AH-5000	UV Type B	①⑥⑧
UV-257	CLASSROOM	257/709	C	6	1250	320	0.25	115V/1Φ	1/8	HIGH	43700	8.0	5.3	1.5	3/4	AAF	AH-5000	UV Type B	①⑥⑧
UV-258	CLASSROOM	258/708	C	6	1250	320	0.25	115V/1Φ	1/8	HIGH	43700	8.0	5.3	1.5	3/4	AAF	AH-5000	UV Type B	①⑥⑧
UV-259	SCIENCE	259/707	C	6	1250	320	0.25	115V/1Φ	1/8	HIGH	46300	8.0	5.0	1.5	3/4	AAF	AH-5000	UV Type B	①⑥⑧
UV-269	CLASSROOM	269/701	C	6	1250	320	0.25	115V/1Φ	1/8	HIGH	50200	10.0	7.7	1.5	3/4	AAF	AH-5000	UV Type B	①⑥⑧
UV-270	CLASSROOM	270/702	C	6	1250	320	0.25	115V/1Φ	1/8	HIGH	50200	10.0	7.7	1.5	3/4	AAF	AH-5000	UV Type B	①⑥⑧
UV-271	CLASSROOM	271/703	C	6	1250	320	0.25	115V/1Φ	1/8	HIGH	50200	10.0	7.7	1.5	3/4	AAF	AH-5000	UV Type B	①⑥⑧
UV-272	SCIENCE	272	C	6	1250	320	0.25	115V/1Φ	1/8	HIGH	53200	12.0	10.8	1.5	3/4	AAF	AH-5000	UV Type B	①⑥⑧
UV-276A	COMPUTER LAB	276/259	C	8	1000	55	0.25	115V/1Φ	1/8	HIGH	42300	8.0	6.9	1.5	3/4	AAF	AH-4000	UV Type G	①②③④⑤⑧
UV-276B	COMPUTER LAB	276/259	C	8	1000	55	0.25	115V/1Φ	1/8	HIGH	42300	8.0	6.9	1.5	3/4	AAF	AH-4000	UV Type G	①②③④⑤⑧
UV-276C	COMPUTER LAB	276/259	C	8	1500	--	0.25	115V/1Φ	1/4	HIGH	47800	--	--	--	--	AAF	AH-6000	UV Type H	①②⑦⑧
UV-318	FOREIGN LANGUAGE	318/800	C	5	1250	320	0.25	115V/1Φ	1/8	HIGH	46300	8.0	5.0	1.5	3/4	AAF	AH-5000	UV Type B	①⑥⑧
UV-277A	BUSINESS/KEYBOARD	277/260	D	8	1500	--	0.25	115V/1Φ	1/4	HIGH	47800	--	--	--	--	AAF	AH-6000	UV Type H	①②⑦⑧
UV-277B	BUSINESS/KEYBOARD	277/260	D	8	1000	55	0.25	115V/1Φ	1/8	HIGH	42300	8.0	6.9	1.5	3/4	AAF	AH-4000	UV Type G	①②③④⑤⑧
UV-277C	BUSINESS/KEYBOARD	277/260	D	8	1000	55	0.25	115V/1Φ	1/8	HIGH	42300	8.0	6.9	1.5	3/4	AAF	AH-4000	UV Type G	①②③④⑤⑧
UV-277D	BUSINESS/KEYBOARD	277/260	D	8	1500	--	0.25	115V/1Φ	1/4	HIGH	47800	--	--	--	--	AAF	AH-6000	UV Type H	①②⑦⑧
UV-282	CAREER GUIDANCE	282/274	D	8	1250	450	0.25	115V/1Φ	1/8	HIGH	43700	8.0	5.3	1.5	3/4	AAF	AH-5000	UV Type D	①④⑧
UV-283	BIOTECHNOLOGY LAB	283/273	D	8	1250	--	0.25	115V/1Φ	1/8	HIGH	46300	8.0	5.0	1.5	3/4	AAF	AH-5000	UV Type A	①⑧
UV-285	LIFE SKILLS LAB	285/272	D	8	1500	470	0.25	115V/1Φ	1/8	HIGH	64600	14.0	15.9	1.5	3/4	AAF	AH-6000	UV Type E	①③④⑧
UV-287	TECHNOLOGY LAB	287/270	D	8	1000	310	0.25	115V/1Φ	1/8	HIGH	37500	6.0	4.0	1.5	3/4	AAF	AH-4000	UV Type E	①③④⑧
UV-288	MACHINE ROOM	288/269	D	8	1500	???	0.25	115V/1Φ	1/8	HIGH	62300	12.5	12.2	1.5	3/4	AAF	AH-6000	UV Type C	①④⑧
UV-293	CLASSROOM	293/270	D	8	1000	125	0.25	115V/1Φ	1/8	HIGH	37500	6.0	4.0	1.5	3/4	AAF	AH-4000	UV Type F	①④⑤⑧
UV-305	HEALTH	305/811	D	5	1250	320	0.25	115V/1Φ	1/8	HIGH	46300	8.0	5.0	1.5	3/4	AAF	AH-5000	UV Type B	①⑥⑧
UV-306	CLASSROOM	306/810	D	5	1250	320	0.25	115V/1Φ	1/8	HIGH	43700	8.0	5.3	1.5	3/4	AAF	AH-5000	UV Type B	①⑥⑧
UV-307	CLASSROOM	307/809	D	5	1250	320	0.25	115V/1Φ	1/8	HIGH	43700	8.0	5.3	1.5	3/4	AAF	AH-5000	UV Type B	①⑥⑧
UV-308	CLASSROOM	308/808	D	5	1250	320	0.25	115V/1Φ	1/8	HIGH	43700	8.0	5.3	1.5	3/4	AAF	AH-5000	UV Type B	①⑥⑧
UV-309	SCIENCE	309/807	D	5	1250	320	0.25	115V/1Φ	1/8	HIGH	46300	8.0	5.0	1.5	3/4	AAF	AH-5000	UV Type B	①⑥⑧
UV-319	CLASSROOM	319/801	D	5	1250	320	0.25	115V/1Φ	1/8	HIGH	50200	10.0	7.7	1.5	3/4	AAF	AH-5000	UV Type B	①⑥⑧
UV-320	CLASSROOM	320/802	D	5	1250	320	0.25	115V/1Φ	1/8	HIGH	50200	10.0	7.7	1.5	3/4	AAF	AH-5000	UV Type B	①⑥⑧
UV-321	CLASSROOM	321/803	D	5	1250	320	0.25	115V/1Φ	1/8	HIGH	50200	10.0	7.7	1.5	3/4	AAF	AH-5000	UV Type B	①⑥⑧
UV-322	SCIENCE	322/804	D	5	1250	320	0.25	115V/1Φ	1/8	HIGH	53200	12.0	10.8	1.5	3/4	AAF	AH-5000	UV Type B	①⑥⑧
UV-334	SERVING	334/149	E	3	1250	--	0.25	115V/1Φ	1/8	HIGH	50200	10.0	7.7	1.5	3/4	AAF	AH-5000	UV Type A	①⑧
UV-335A	KITCHEN	335/149	E	3	1250	300	0.25	115V/1Φ	1/8	HIGH	50200	10.0	7.7	1.5	3/4	AAF	AH-5000	UV Type D	①④⑧
UV-335B	KITCHEN	335/149	E	3	1250	300	0.25	115V/1Φ	1/8	HIGH	50200	10.0	7.7	1.5	3/4	AAF	AH-5000	UV Type D	①④⑧

① COOLING CAPACITY: 80/67 ENTERING AIR DB/WB, 45 ENTERING WATER, AND 95 OUTDOOR AMBIENT TEMPERATURES (DEGF)
② MULTIPLE UNITS CONTROLLED TOGETHER - SHARE SINGLE ZONE SENSOR
③ COMMON OUTSIDE AIR INTAKE - SHARE SINGLE ISOLATION DAMPER
④ REMOTE OUTSIDE AIR DAMPER FOR ISOLATION
⑤ LINKED MIXED AIR DAMPERS FOR ECONOMIZER OPERATION
⑥ MINIMUM OA IS FORCED BY REMOTE SUPPLY FAN
⑦ SPLIT SYSTEM: 47800 BTUH COOLING ONLY DX COIL (SEE OUTDOOR UNIT SCHEDULE)
⑧ NEEDLEPOINT BIPOLAR IONIZATION IN UNIT CABINET

SPLIT SYSTEM OUTDOOR CONDENSING UNITS

TAG	SERVICE				DIRECT EXPANSION (DX)				ELECTRICAL					UNIT		NOTES
	DESCRIPTION	ROOF LOCATION	AREA	ZONE	INDOOR UNIT	TYPE	NOMINAL TONS	REFRIGERANT	FAN HP	VOLT/PH	MCA	MCOP	S.E.E.R	MANUF.	MODEL	
CU-07	P.E. OFFICES	MECH. RM 194	B	11	AHU-07	COOLING ONLY	3.5	R-22	1/3	208V/1Φ	22.8	35	10+	COMFORTMAKER	AG042G	①②
UV-276C	COMPUTER LAB	276/259	C	8	UV-276C	COOLING ONLY	4.0	R-22	1/5	460V/3Φ	8.3	10	10.0	YORK	H1RA048	①③
UV-277A	BUSINESS/KEYBOARD	277/260	D	8	UV-277A	COOLING ONLY	4.0	R-22	1/5	460V/3Φ	8.3	10	10.0	YORK	H1RA048	①③
UV-277D	BUSINESS/KEYBOARD	277/260	D	8	UV-277D	COOLING ONLY	4.0	R-22	1/5	460V/3Φ	8.3	10	10.0	YORK	H1RA048	①③
DSS-277A	BUSINESS/KEYBOARD	277/260	D	8	DSS-277A	HEAT PUMP	3.0	R-410A	2 x 70 W	208V/1Φ	27.0	30	17.5	DAIKIN	RZQ36PVJU9	①④
DSS-277B	BUSINESS/KEYBOARD	277/260	D	8	DSS-277B	HEAT PUMP	3.0	R-410A	2 x 70 W	208V/1Φ	27.0	30	17.5	DAIKIN	RZQ36PVJU9	①④
HP-14	CORRIDOR / TOILETS	MECH. RM 117	F	--	AHU-14	HEAT PUMP	5.0	R-410A	--	460V/3Φ	10.0	15	16.0	TRANE	4TWA7060A3	①②

① 80/67 ENTERING AIR DB/WB AND 95 AMBIENT TEMPERATURES (DEGF)
② SEE AIR HANDLING UNITS SCHEDULE FOR CORRESPONDING DX COOLING COIL
③ SEE UNIT VENTILATORS SCHEDULE FOR CORRESPONDING DX COOLING COIL
④ DUCTLESS SPLIT SYSTEM WITH CORRESPONDING INDOOR UNIT

PACKAGED VERTICAL HEAT PUMPS

TAG	SERVICE				AIRFLOW				DIRECT EXPANSION (DX)								NOTES
	DESCRIPTION	ROOM NO.	AREA	ZONE	TOTAL CFM	MIN OA CFM	EXHAUST CFM	ESP IN. WG	ELEC. KW	REFRIG.	TOT. CLG BTUH	EVAP. FAN HP	COND. FAN HP	VOLT/PH	MCA / MCOP	E.E.R / I.P.L.V.	MANUF.	MODEL	
PVHP-107	DIGITAL ARTS	107/507	F	--	1300	450	300	0.20	15.0	R-410A	40375	1/2	1/3	460V/3Φ	28 / 30	12 / 15.7	BARD	M2H1DC15RP	①②③④⑤
PVHP-108	STEM CLASSROOM	108/508	F	--	1300	450	300	0.20	15.0	R-410A	40375	1/2	1/3	460V/3Φ	28 / 30	12 / 15.7	BARD	M2H1DC15RP	①②③④⑤
PVHP-109	CLASSROOM	109/509	F	--	1300	450	300	0.20	15.0	R-410A	40375	1/2	1/3	460V/3Φ	28 / 30	12 / 15.7	BARD	M2H1DC15RP	①②③④⑤
PVHP-110	CLASSROOM	110/510	F	--	1300	450	300	0.20	15.0	R-410A	40375	1/2	1/3	460V/3Φ	28 / 30	12 / 15.7	BARD	M2H1DC15RP	①②③④⑤
PVHP-111	CLASSROOM	111/511	F	--	1300	450	300	0.20	15.0	R-410A	40375	1/2	1/3	460V/3Φ	28 / 30	12 / 15.7	BARD	M2H1DC15RP	①②③④⑤
PVHP-112	CLASSROOM	112/512	F	--	1150	450	300	0.15	9.0	R-410A	34225	1/3	1/3	460V/3Φ	24 / 25	12 / 16.5	BARD	I36H1DC09RP	①②③④⑤
PVHP-113	CLASSROOM	113/513	F	--	1150	450	300	0.15	9.0	R-410A	34225	1/3	1/3	460V/3Φ	24 / 25	12 / 16.5	BARD	I36H1DC09RP	①②③④⑤
PVHP-114	CLASSROOM	114/514	F	--	1150	450	300	0.15	9.0	R-410A	34225	1/3	1/3	460V/3Φ	24 / 25	12 / 16.5	BARD	I36H1DC09RP	①②③④⑤
PVHP-115	CLASSROOM	115/515	F	--	1150	450	300	0.15	9.0	R-410A	34

CONTROL VALVES (EXISTING TO BE REPLACED)

TAG	SERVICE						CONTROL VALVE					NOTES
	DESCRIPTION	LOCATION / ROOM NO.	AREA	ZONE	COOLING GPM	HEATING GPM	EXISTING MODEL BARBER-COLMAN	EXISTING SIZE	EXISTING Cv	VALVE TYPE	ACTUATOR CONTROL TYPE	
HW-V-1	HWS - MIXING	MECH. 324/160	C	--	--	245.0	J WESLEY CO.	4" FLANGED	--	3-WAY BUTTERFLY MIXING	MODULATING	①⑤
CHW-V-3	CHWS - MIXING	MECH. 324/160	C	--	848.0	--	J WESLEY CO.	6" FLANGED	--	3-WAY BUTTERFLY MIXING	MODULATING	①⑥
HWS-V-ISO-1	HWS - AREA 'E'	330/155	E	2	--	6.6	VK-9213-302-4-8	1" FNPT	11.0	2-WAY BALL ISOLATION	TWO-POSITION	①②③⑦
HWR-V-ISO-2	HWR - AREA 'E'	330/155	E	2	--	6.6	VK-9213-302-4-8	1" FNPT	11.0	2-WAY BALL ISOLATION	TWO-POSITION	①②③⑦
HWS-V-ISO-3	HWS - AREA 'B'	MECH. MEZZ.	A	11	--	14.8	VK-9213-602-4-10	1-1/2" FNPT	25.0	2-WAY BALL ISOLATION	TWO-POSITION	①②③⑦
HWR-V-ISO-4	HWS - AREA 'B'	MECH. MEZZ.	A	11	--	14.8	VK-9213-602-4-10	1-1/2" FNPT	25.0	2-WAY BALL ISOLATION	TWO-POSITION	①②③⑦
AHU-01	MEDIA PERIMETER	MECH. 324/160	C	4	18.6	3.5	VK-9213-301-4-9	1-1/4" FNPT	16.0	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
AHU-02	MEDIA INTERIOR	MECH. 324/160	C	4	21.1	2.6	VK-9213-301-4-9	1-1/4" FNPT	16.0	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
AHU-03	ADMIN. INTERIOR	MECH. 113	A	1	41.4	4.0	VK4-9213-601-4-11	2" FNPT	40.0	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
AHU-04	TEAM PLAN. CORE 'D'	MECH. 304/825	D	5	18.0	2.0	VK-9213-301-4-9	1-1/4" FNPT	16	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
AHU-05	TEAM PLAN. CORE 'C'	MECH. 254/725	C	6	18.0	2.0	VK-9213-301-4-9	1-1/4" FNPT	16	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
AHU-06	TEAM PLAN. CORE 'B'	MECH. 206/625	B	7	18.0	2.0	VK-9213-301-4-9	1-1/4" FNPT	16	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
AHU-07	P.E. OFFICES	MECH. 194/231	B	11	7.4	1.0	VK-9213-301-4-6	3/4" FNPT	6.2	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
AHU-08	CAFETORIUM	MECH. 324/160	E	2	91.0	22.1	VK4-9213-601-5-12	2-1/2" FLANGED	56.0	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
AHU-09	CONCESSION	MECH. MEZZ.	A	10	9.3	1.5	VK-9213-301-4-7	1" FNPT	8.2	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
AHU-10	ADMIN. PERIMETER	MECH. 113	A	1	7.4	1.1	VK-9213-301-4-6	3/4" FNPT	6.2	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
AHU-11	ADMIN. PERIMETER	MECH. 113	A	1	5.4	1.0	VK-9213-301-4-6	3/4" FNPT	6.2	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
AHU-12	MAIN GYM	MECH. MEZZ.	A	10	116.5	34.6	VK4-9213-601-5-13	3" FLANGED	85.0	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
AHU-13	AUX GYM	MECH. MEZZ.	A	10	27.8	6.1	VK4-9213-601-4-10	1-1/2" FNPT	25.0	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
FCU-151	CORRIDOR	151	A	10	12.1	1.3	VK-9213-301-4-8	1" FNPT	11.0	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
FCU-161	BOYS PE LOCKERS	161/208	B	11	--	2.2	VK-9213-201-4-3	1/2" FNPT	2.2	2-WAY CHARACTERIZED BALL	MODULATING	①②③⑦
FCU-163	BOYS TOILET	163/210	B	11	--	1.6	VK-9213-201-4-2	1/2" FNPT	1.3	2-WAY CHARACTERIZED BALL	MODULATING	①②③⑦
FCU-166	BOYS TEAM LOCKERS	166/212	B	11	--	2.2	VK-9213-201-4-3	1/2" FNPT	2.2	2-WAY CHARACTERIZED BALL	MODULATING	①②③⑦
FCU-171	GIRLS PE LOCKERS	171/226	B	11	--	2.2	VK-9213-201-4-3	1/2" FNPT	2.2	2-WAY CHARACTERIZED BALL	MODULATING	①②③⑦
FCU-173	GIRLS TOILET	173/223	B	11	--	1.6	VK-9213-201-4-2	1/2" FNPT	1.3	2-WAY CHARACTERIZED BALL	MODULATING	①②③⑦
FCU-179	GIRLS TEAM LOCKERS	179/222	B	11	--	2.2	VK-9213-201-4-3	1/2" FNPT	2.2	2-WAY CHARACTERIZED BALL	MODULATING	①②③⑦
FCU-180	COMMONS	180	B	9	11.5	1.0	VK-9213-301-4-8	1" FNPT	11.0	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
FCU-181	CORRIDOR	181	B	7	12.1	1.3	VK-9213-301-4-8	1" FNPT	11.0	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
FCU-183	OFFICE	183/242	B	9	1.6	1.0	VK-9213-201-4-2	1/2" FNPT	1.3	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
FCU-189	OFFICE	189/237	B	9	4.8	1.0	VK-9213-201-4-4	1/2" FNPT	4.8	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
FCU-212	PREP.	212/605	B	7	2.3	1.0	VK-9213-201-4-3	1/2" FNPT	2.2	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
FCU-230	KILN	230/246	B	9	4.5	1.0	VK-9213-301-4-4	1/2" FNPT	2.6	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
FCU-226	CORRIDOR	226	C	6	7.8	1.0	VK-9213-201-4-3	1/2" FNPT	2.2	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
FCU-260	PREP.	260/705	C	6	2.3	1.0	VK-9213-201-4-3	1/2" FNPT	2.2	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
FCU-274	COMMONS	274	C	8	11.5	1.0	VK-9213-301-4-8	1" FNPT	11.0	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
FCU-275	CORRIDOR	275	D	5	12.1	1.3	VK-9213-301-4-8	1" FNPT	11.0	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
FCU-281	OFFICE	281/261	D	8	1.6	1.0	VK-9213-201-4-2	1/2" FNPT	1.3	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
FCU-284	CORRIDOR	284	D	8	5.1	1.0	VK-9213-301-4-5	3/4" FNPT	5.0	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
FCU-292	OFFICE	292/265	D	8	1.6	1.0	VK-9213-201-4-2	1/2" FNPT	1.3	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
FCU-310	PREP.	310/805	D	5	2.3	1.0	VK-9213-201-4-3	1/2" FNPT	2.2	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
FCU-326	CORRIDOR	326	E	2	16.5	1.2	VK-9213-301-4-8	1" FNPT	11.0	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
FCU-332	STAGE	332/146	E	2	12.0	1.0	VK-9213-301-4-8	1" FNPT	11.0	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
FCU-336	DISHWASHER	336/150	E	3	3.0	1.0	VK-9213-201-4-3	1/2" FNPT	2.2	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
FCU-338	STORAGE	338/151	E	3	1.6	1.0	VK-9213-201-4-2	1/2" FNPT	1.3	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
FCU-342	OFFICE	342/154	E	3	1.6	1.0	VK-9213-201-4-2	1/2" FNPT	1.3	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
UV-182A	THEATER ARTS	182/240	B	9	8.0	1.5	VK-9213-301-4-6	3/4" FNPT	6.2	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
UV-182B	THEATER ARTS	182/240	B	9	8.0	1.5	VK-9213-301-4-6	3/4" FNPT	6.2	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
UV-185A	INSTRUMENT	185/239	B	9	8.0	1.5	VK-9213-301-4-6	3/4" FNPT	6.2	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
UV-185B	INSTRUMENT	185/239	B	9	8.0	1.5	VK-9213-301-4-6	3/4" FNPT	6.2	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
UV-191A	DANCE	191/229	B	9	6.0	1.5	VK-9213-301-4-5	3/4" FNPT	5.0	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
UV-191B	DANCE	191/229	B	9	6.0	1.5	VK-9213-301-4-5	3/4" FNPT	5.0	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
UV-196A	CHORUS	196/238	B	9	8.0	1.5	VK-9213-301-4-6	3/4" FNPT	6.2	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
UV-196B	CHORUS	196/238	B	9	8.0	1.5	VK-9213-301-4-6	3/4" FNPT	6.2	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
UV-207	CLASSROOM	207/611	B	7	8.0	1.5	VK-9213-301-4-6	3/4" FNPT	6.2	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
UV-208	CLASSROOM	208/610	B	7	8.0	1.5	VK-9213-301-4-6	3/4" FNPT	6.2	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
UV-209	CLASSROOM	209/609	B	7	8.0	1.5	VK-9213-301-4-6	3/4" FNPT	6.2	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
UV-210	CLASSROOM	210/608	B	7	8.0	1.5	VK-9213-301-4-6	3/4" FNPT	6.2	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
UV-211	SCIENCE	211/607	B	7	8.0	1.5	VK-9213-301-4-6	3/4" FNPT	6.2	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
UV-220	HEALTH	220/600	B	7	10.0	1.5	VK-9213-301-4-7	1" FNPT	8.2	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
UV-221	CLASSROOM	221/601	B	7	10.0	1.5	VK-9213-301-4-7	1" FNPT	8.2	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
UV-222	CLASSROOM	222/602	B	7	10.0	1.5	VK-9213-301-4-7	1" FNPT	8.2	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
UV-223	CLASSROOM	223/603	B	7	10.0	1.5	VK-9213-301-4-7	1" FNPT	8.2	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
UV-224	SCIENCE	224/604	B	7	12.0	1.5	VK-9213-301-4-8	1" FNPT	11.0	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
UV-227	ART CLASSROOM	227/243	B	9	12.0	1.5	VK-9213-301-4-8	1" FNPT	11.0	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
UV-268	HEALTH	268/700	B	6	8.0	1.5	VK-9213-301-4-6	3/4" FNPT	6.2	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
UV-231	ART CLASSROOM	231	C	9	12.0	1.5	VK-9213-301-4-8	1" FNPT	11.0	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
UV-255	EXCEPTIONAL CHILDREN	255/711	C	6	8.0	1.5	VK-9213-301-4-6	3/4" FNPT	6.2	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
UV-256	CLASSROOM	256/710	C	6	8.0	1.5	VK-9213-301-4-6	3/4" FNPT	6.2	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
UV-257	CLASSROOM	257/709	C	6	8.0	1.5	VK-9213-301-4-6	3/4" FNPT	6.2	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
UV-258	CLASSROOM	258/708	C	6	8.0	1.5	VK-9213-301-4-6	3/4" FNPT	6.2	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
UV-259	SCIENCE	259/707	C	6	8.0	1.5	VK-9213-301-4-6	3/4" FNPT	6.2	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
UV-269	CLASSROOM	269/701	C	6	10.0	1.5	VK-9213-301-4-7	1" FNPT	8.2	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
UV-270	CLASSROOM	270/702	C	6	10.0	1.5	VK-9213-301-4-7	1" FNPT	8.2	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
UV-271	CLASSROOM	271/703	C	6	10.0	1.5	VK-9213-301-4-7	1" FNPT	8.2	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
UV-272	SCIENCE	272	C	6	12.0	1.5	VK-9213-301-4-8	1" FNPT	11.0	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
UV-276A	COMPUTER LAB	276/259	C	8	8.0	1.5	VK-9213-301-4-6	3/4" FNPT	6.2	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
UV-276B	COMPUTER LAB	276/259	C	8	8.0	1.5	VK-9213-301-4-6	3/4" FNPT	6.2	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
UV-318	FOREIGN LANGUAGE	318/800	C	5	8.0	1.5	VK-9213-301-4-6	3/4" FNPT	6.2	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
UV-277B	BUSINESS/KEYBOARD	277/260	D	8	8.0	1.5	VK-9213-301-4-6	3/4" FNPT	6.2	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
UV-277C	BUSINESS/KEYBOARD	277/260	D	8	8.0	1.5	VK-9213-301-4-6	3/4" FNPT	6.2	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
UV-282	CAREER GUIDANCE	282/274	D	8	8.0	1.5	VK-9213-301-4-6	3/4" FNPT	6.2	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
UV-283	BIOTECHNOLOGY LAB	283/273	D	8	8.0	1.5	VK-9213-301-4-6	3/4" FNPT	6.2	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
UV-285	LIFE SKILLS LAB	285/272	D	8	14.0	1.5	VK-9213-301-4-8	1" FNPT	11.0	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
UV-287	TECHNOLOGY LAB	287/270	D	8	6.0	1.5	VK-9213-301-4-8	1" FNPT	11.0	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
UV-288	MACHINE ROOM	288/269	D	8	12.5	1.5	VK-9213-000-?-?	1/2" FNPT	1.3	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
UV-293	CLASSROOM	293/270	D	8	6.0	1.5	VK-9213-301-4-5	3/4" FNPT	5.0	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
UV-305	HEALTH	305/811	D	5	8.0	1.5	VK-9213-301-4-6	3/4" FNPT	6.2	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
UV-306	CLASSROOM	306/810	D	5	8.0	1.5	VK-9213-301-4-6	3/4" FNPT	6.2	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
UV-307	CLASSROOM	307/809	D	5	8.0	1.5	VK-9213-301-4-6	3/4" FNPT	6.2	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
UV-308	CLASSROOM	308/808	D	5	8.0	1.5	VK-9213-301-4-6	3/4" FNPT	6.2	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
UV-309	SCIENCE	309/807	D	5	8.0	1.5	VK-9213-301-4-6	3/4" FNPT	6.2	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
UV-319	CLASSROOM	319/801	D	5	10.0	1.5	VK-9213-301-4-7	1" FNPT	8.2	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
UV-320	CLASSROOM	320/802	D	5	10.0	1.5	VK-9213-301-4-7	1" FNPT	8.2	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
UV-321	CLASSROOM	321/803	D	5	10.0	1.5	VK-9213-301-4-7	1" FNPT	8.2	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
UV-322	SCIENCE	322/804	D	5	12.0	1.5	VK-9213-301-4-8	1" FNPT	11.0	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
UV-334	SERVING	334/149	E	3	10.0	1.5	VK-9213-301-4-7	1" FNPT	8.2	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
UV-335A	KITCHEN	335/149	E	3	10.0	1.5	VK-9213-301-4-7	1" FNPT	8.2	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
UV-335B	KITCHEN	335/149	E	3	10.0	1.5	VK-9213-301-4-7	1" FNPT	8.2	2-WAY CHARACTERIZED BALL	MODULATING	①②⑦
UH-195	EQUIP. STORAGE	195	B	11	--	2.2	--	--	--	--	--	②③④
UH-327	CORRIDOR	327	E	2	--	2.2	--	--	--	--	--	②③④
UH-329	CUSTODIAN	329/157	E	2	--	2.2	--	--	--	--	--	②③④
UH-330	GENERAL STORAGE	330/155	E	2	--	2.2	--	--	--	--	--	②③④

① EXISTING CONTROL VALVE INFORMATION IS BASED ON PREVIOUS PROJECT DOCUMENTATION. EXISTING PNEUMATIC ACTUATOR TO BE REPLACED WITH NEW ELECTRIC MODULATING ACTUATOR. THE CONTRACTOR IS SOLELY RESPONSIBLE TO FIELD VERIFY THE CONFIGURATION AND SIZE OF EACH EXISTING VALVE PRIOR TO SUBMITTING NEW CONTROL VALVES TO ENGINEER FOR APPROVAL. ANY CONTROL VALVE THAT DOES NOT MATCH THE EXISTING SCHEDULE SHALL BE CLEARLY IDENTIFIED IN THE SUBMITTAL FOR ENGINEER APPROVAL.
② SELECT 2-WAY, CHARACTERIZED BALL VALVES TO MATCH SIZE AND PERFORMANCE DATA OF THE EXISTING 2-WAY CONTROL VALVES.
③ CONTROL VALVES AT SUPPLY AND RETURN BRANCHES USED ISOLATE CHILLED WATER FLOW FROM HEATING ONLY UNITS.
④ EXISTING CONTROL VALVE FOR INDIVIDUAL UNIT HEATER IS NOT INSTALLED
⑤ VALVE NORMALLY CLOSED TO HW PRIMARY DECOUPLER FOR DEFAULT HEATING
⑥ VALVE NORMALLY OPEN TO CHW PRIMARY DECOUPLER FOR DEFAULT HEATING
⑦ VALVE NORMALLY OPEN

CONTROL VALVES (NEW)

TAG	SERVICE												NOTES
	DESCRIPTION	LOCATION / ROOM NO.	AREA	MFR	MODEL	ACTUATOR	VALVE TYPE	CONTROL TYPE	FAIL SAFE POSITION	CLOSE-OFF PRES.	FLOW RATE	Cv	SIZE	
DTW-V-1	BYPASS VALVE	MECH ROOM 113	A	BELIMO	B239	AFRB24-SR	2-WAY (N.C.)	MODULATING	LAST POSITION	200 PSIG	104 GPM	29	1-1/2" FNPT	①

① ROUTE SUBMITTAL TO ENGINEER FOR APPROVAL

TMG CONSULTING ENGINEERS
The Wilborne Group-Consulting Engineers NC
dba TMG-Consulting Engineers
2001 Rexford Road
Suite 110/170
Charlotte, NC 28204
704.808.7610 Phone
704.808.5105 Fax
Website: WWW.TMG-CE.COM

NORTH CAROLINA PROFESSIONAL ENGINEERING C-3646 CHARLOTTE, NC

NORTH CAROLINA PROFESSIONAL SEAL 033629 ENGINEER CLEMENT T. MILLWARD

01.25.2023

ISSUED FOR CONSTRUCTION

CHARLOTTE-MECKLENBERG SCHOOLS

NORTHRIDGE MIDDLE SCHOOL HVAC CONTROLS

CHARLOTTE-MECKLENBERG SCHOOLS
7801 THE PLAZA
CHARLOTTE, NC 28215

REVISIONS		
NO.	DESCRIPTION	DATE
	ISSUED FOR CONSTRUCTION	9/27/22
1	REVISION 1	1/13/23
2	REVISION 2	1/25/23

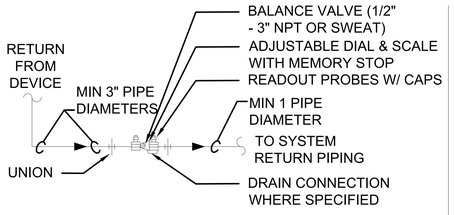
SHEET INFORMATION

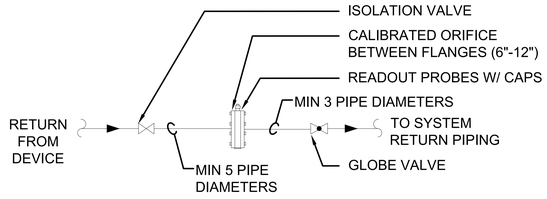
DATE	09/27/2022
JOB NUMBER	2202-01-002
DRAWN	LCB
APPROVED	CTM

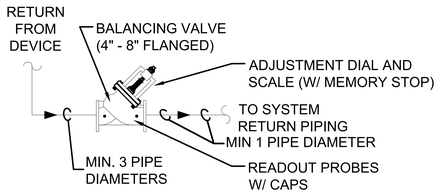
SCHEDULES

M-602

SHEET 11 OF 28







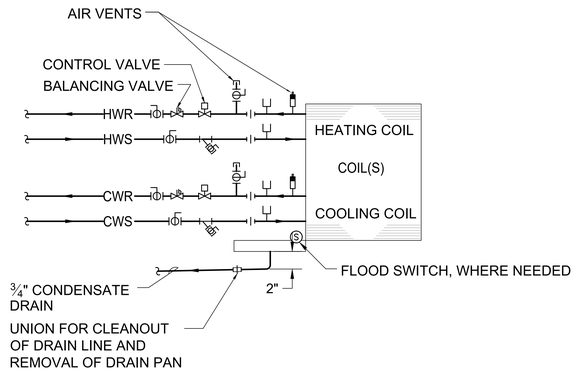
NOTE: FOLLOW MANUFACTURER'S REQUIREMENTS FOR STRAIGHT PIPE (TYPICAL)

1 CALIBRATED BALANCING DEVICE DETAILS

SCALE: NTS

NOTES

1. TERMINAL UNIT MAY BE FAN COIL OR UNIT VENTILATOR AND MAY BE HEATING ONLY, COOLING ONLY, OR BOTH. SEE EQUIPMENT SCHEDULES.
2. CONNECT CHW/HHW SUPPLY TO DOWNSTREAM PORT OF COIL.
3. INSTALL NEW LINE-SIZED ISOLATION BALL VALVES ON ALL FCU AND UV SUPPLY AND RETURN LINES SIZED 2 INCHES OR LESS. (1)
4. INSTALL PIPING UNIONS AS REQUIRED FOR EASY REMOVAL AND REPLACEMENT OF COMPONENTS. IF CONNECTIONS ARE PRESSED OR SOLDERED UNIONS MAY BE OMITTED.
5. BALANCING VALVE: LINE-SIZE UNLESS OTHERWISE INDICATED, T&A MODEL 787H OR APPROVED EQUAL. SEE BALANCING VALVE SPEC.
6. CONTROL VALVE: SHALL NOT BE SMALLER THAN ONE PIPE SIZE OF THE CONNECTED COIL. SEE EQUIPMENT SCHEDULES AND CONTROL VALVE SPECIFICATION. (1)
7. STRAINER: LINE-SIZE THREADED BRONZE BODY, CLASS 125, SS MESH SCREEN WITHOUT PERFORATED METAL LINER, 20 MESH SCREEN FOR FLOWS > 2 GPM, 40 MESH SCREEN FOR FLOWS <= 2 GPM. PROVIDE BLOWDOWN VALVE. NIBCO 221-A OR APPROVED EQUAL.
8. FOR PIPE AND VALVE INSULATION, SEE HVAC PIPING SPECIFICATION.

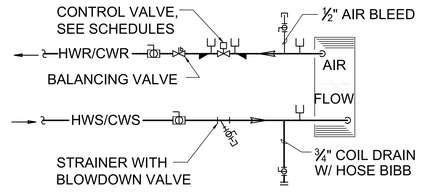


2 TERMINAL UNIT PIPING CONNECTIONS DETAIL

SCALE: NTS

NOTES

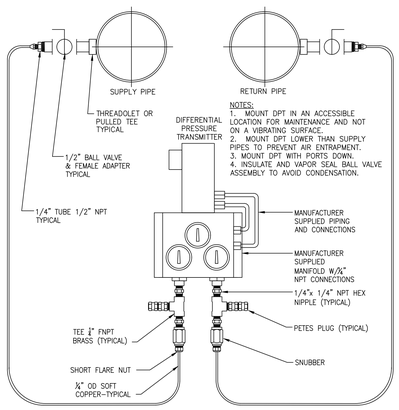
1. DETAIL APPLIES TO COOLING AND HEATING COILS. CONNECT SUPPLY PIPE TO LEAVING AIR (DOWNSTREAM) SIDE OF COIL, AND CONNECT SUPPLY AT BOTTOM OF COIL FOR PROPER AIR VENTING. FOLLOW MANUFACTURER'S INSTRUCTIONS.
2. ARRANGE PIPING TO ALLOW FOR EASY REMOVAL OF COIL, AND PROPER ACCESS FOR SERVICE. ALLOW CLEARANCE FOR AIR FILTER REPLACEMENT.
3. INSTALL NEW LINE-SIZED ISOLATION BALL VALVES ON ALL AHU SUPPLY AND RETURN LINES SIZED 2 INCHES OR LESS. (1)
4. INSTALL PIPING UNIONS AS REQUIRED FOR EASY REMOVAL AND REPLACEMENT OF COMPONENTS. IF CONNECTIONS ARE PRESSED OR SOLDERED, UNIONS MAY BE OMITTED.
5. HORIZONTAL PIPE REDUCERS/INCREASERS SHALL BE ECCENTRIC AND FLAT ON TOP.
6. STRAINER: LINE-SIZE THREADED BRONZE BODY, CLASS 125, 20 MESH SS SCREEN WITHOUT PERFORATED LINER, PROVIDE BLOWDOWN VALVE. SPIRAX-SARCO 351M OR APPROVED EQUAL.
7. BALANCING VALVE: LINE-SIZE UNLESS OTHERWISE INDICATED, T&A MODEL 787H OR APPROVED EQUAL. SEE BALANCING VALVE SPEC.
8. CONTROL VALVE: SHALL NOT BE SMALLER THAN ONE PIPE SIZE OF THE CONNECTED COIL. SEE EQUIPMENT SCHEDULES AND CONTROL VALVE SPECIFICATION. (1)
9. FOR COOLING COIL, SEE CONDENSATE CONNECTION DETAIL.
10. FOR PIPE AND VALVE INSULATION, SEE HVAC PIPING SPECIFICATION.



3 AHU COIL PIPING DETAIL

SCALE: NTS

(1)

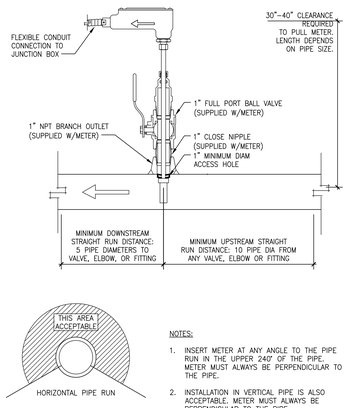


BILL OF MATERIALS				
QTY	UNIT OF MEASURE	DESCRIPTION	MANUFACTURER	PART NUMBER (NOTE 1)
2	EACH	SNUBBER, 1/4" NPT 1500 PSI	WEKSLER	BW42
2	EACH	PETES PLUG 1500 PSI 1/4" NPT (WT#:5054044)	WATTS REGULATOR	0008501
4	EACH	NIPPLE, HEX NPT 1/4" MPT 1/4" (WT#:7069211)	WEATHERHEAD	3325X4
2	EACH	TEE 1/4" IPS BRASS 125# (WT#:5070534)	WEATHERHEAD	3700X4
4	EACH	FLARE NUT 1/4" SHORT (WT#:5056247)	MUELLER INDUSTRIES	NS4-4
2	EACH	MALE CONNECTOR 1/4" TUBE 1/2" NPT 45 DEG	ANDERSON FITTINGS	U1-4D

NOTE: IF RECOMMENDED MANUFACTURER PART NUMBER IS NOT AVAILABLE, AN EQUIVALENT IS ACCEPTABLE.

4 DETAIL - DIFFERENTIAL PRESSURE TRANSMITTER INSTALLATION

SCALE: NTS



NOTES:

1. INSERT METER AT ANY ANGLE TO THE PIPE RUN IN THE UPPER 240° OF THE PIPE. METER MUST ALWAYS BE PERPENDICULAR TO THE PIPE.
2. INSTALLATION IN VERTICAL PIPE IS ALSO ACCEPTABLE. METER MUST ALWAYS BE PERPENDICULAR TO THE PIPE.

NOTES:

1. INSERT METER AT ANY ANGLE TO THE PIPE RUN IN THE UPPER 240° OF PIPE.
2. METER MUST ALWAYS BE PERPENDICULAR TO THE PIPE.
3. SEE MECHANICAL DRAWINGS FOR METER LOCATIONS.
4. FOLLOW MANUFACTURERS INSTALLATION INSTRUCTIONS.
5. METER MAY BE INSTALLED IN VERTICAL PIPE. SAME RULES APPLY.
6. USE STAINLESS STEEL OR BRASS CLOSE NIPPLE ONLY.
7. FOR FUTURE METERS, INSTALL BRANCH OUTLET, CLOSE NIPPLE, AND FULL PORT BALL VALVE.

5 DETAIL - FLOW TRANSMITTER INSTALLATION IN STEEL PIPE

SCALE: NTS

TMG CONSULTING ENGINEERS
The Wilborne Group Consulting Engineers NC
dba TMG Consulting Engineers
2001 Rexford Road
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C-3646 — NORTH CAROLINA — PROFESSIONAL ENGINEER SEAL — CHARLOTTE, NC

NORTH CAROLINA — SEAL 033629 — ENGINEER — CLEMENT T. MILBOURNE — 01.25.2023

ISSUED FOR CONSTRUCTION

CHARLOTTE-MECKLENBERG SCHOOLS

NORTHRIDGE MIDDLE SCHOOL
HVAC CONTROLS

CHARLOTTE-MECKLENBERG SCHOOLS
7601 THE PLAZA
CHARLOTTE, NC 28215

REVISIONS		
NO.	DESCRIPTION	DATE
	ISSUED FOR CONSTRUCTION	9/27/22
1	REVISION 1	1/13/23
2	REVISION 2	1/25/23

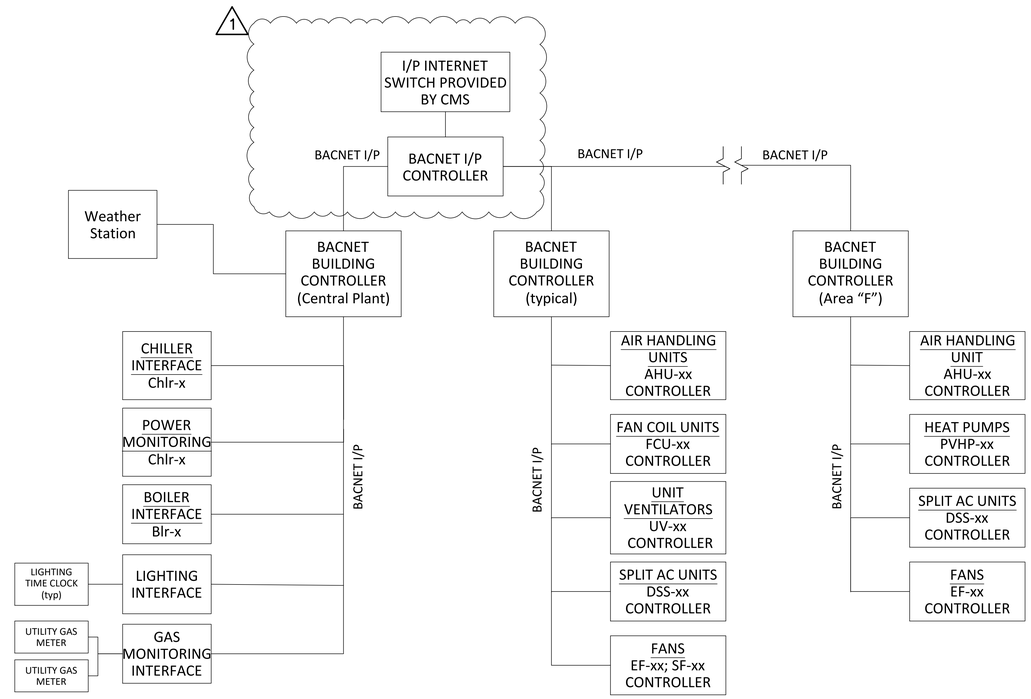
SHEET INFORMATION

DATE	09/27/2022
JOB NUMBER	2202-01-002
DRAWN	AG
APPROVED	CS

DETAILS

M-701

SHEET 12 OF 28



1 BUILDING AUTOMATION SYSTEM ARCHITECTURE

SCALE: NTS

1

BAS VENDOR/MANUFACTURERS	
PREFERRED VENDORS	**APPROVED MANUFACTURED BAS PRODUCTS (BACNET ONLY)**
AUTOMATED LOGIC CORPORATION	AUTOMATED LOGIC - WEBCTRL®
JOHNSON CONTROLS, INC	JCI - METASYS®
TRANE, INC	TRANE - TRACER® SC W/ ENSEMBLE INTEGRATION
PLATINUM BUILDING TECHNOLOGIES	NIAGARA N4 WITH (TBD)
SCHNEIDER ELECTRIC	NIAGARA N4 WITH SCHNEIDER ELECTRIC IA
UNITED AUTOMATION	NIAGARA N4 WITH HONEYWELL

2 BAS VENDOR / MANUFACTURERS

SCALE: NTS

GENERAL NOTES:

1. CONTRACTOR SHALL PROVIDE COMPREHENSIVE AS-BUILT NETWORK WIRING DIAGRAM OVERLAID ON PLAN DRAWINGS SHOWING PATHS AND CONTROLLER LOCATIONS.
2. CONTRACTOR SHALL BRING TO THE ATTENTION OF THE ENGINEER ANY INCONSISTENCY BETWEEN SPECIFICATIONS AND DRAWINGS PRIOR TO PERFORMING INSTALLATION.
3. CONTRACTOR'S WORK SHALL NOT INTERFERE WITH SCHOOL ACTIVITIES AND CONTRACTOR SHALL MAINTAIN ALL HEATING AND COOLING WHEN SCHOOL IS IN SESSION.

1

4. THE SEQUENCES OF OPERATION AND POINTS LISTS ARE INTENDED TO COMMUNICATE THE MINIMUM REQUIREMENTS AND GENERAL DESIGN INTENT TO THE CONTROLS CONTRACTOR. THEY ARE NOT INTENDED TO BE A FULLY DEVELOPED OR COMPLETE SEQUENCE OF OPERATION. IN THE CONTROLS SUBMITTAL, THE CONTROLS CONTRACTOR SHALL FULLY DEVELOP THE SEQUENCES OF OPERATION FOR ALL SYSTEM IDENTIFIED AND SHALL PRESENT ALL SETPOINTS, CONTROL PARAMETERS, TIME DELAYS, ALARM POINTS, ETC. AS REQUIRED TO COMPLY WITH THE DESIGN INTENT. ANY CONTRACTOR RECOMMENDED MODIFICATIONS TO SCHEMATICS, BAS POINTS, SEQUENCES OF OPERATION, OR ALTERNATE DEVICE SELECTIONS SHALL BE SUBMITTED TO ENGINEER FOR APPROVAL PRIOR TO PROCUREMENT AND INSTALLATION.
5. BAS SHALL ALLOW GLOBAL CONTROL OF ALL CONTROL VALVES.
6. CONTRACTOR IS SOLELY RESPONSIBLE TO FIELD CHECK AND VERIFY EXISTING QUANTITIES AND TYPES OF TERMINAL UNITS, DAMPERS, VALVES, ETC.

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7. ALL NEW CONTROLLERS SHALL BE MOUNTED IN AN APPROVED ENCLOSURE, FULLY ACCESSIBLE WITHOUT THE USE OF A LADDER IN AN MER OR NO MORE THAN 18" ABOVE A DROP CEILING ON WALL NEAR THE TERMINAL EQUIPMENT.
8. EACH CONTROL CABINET TO HAVE LAMINATED COPY OF WIRING DIAGRAM AND SEQUENCE OF OPERATION FOR CONTROLLERS/ COMPONENTS CONTAINED WITHIN. WIRING WITHIN CABINET TO BE LABELED AND MATCH DIAGRAMS.

1

9. PROVIDE COMPREHENSIVE LABELING AND TAGGING OF ALL SYSTEM COMPONENTS AND WIRING TERMINALS. SURFACE MOUNTED TEMPERATURE SENSORS SHALL BE LABELED THE SAME AS THE EQUIPMENT THEY CONTROL. PROVIDE ALL CABINETS, DEVICES AND CEILING ACCESS POINTS WITH ENGRAVED LAMINATED TAGS ATTACHED WITH SCREWS.
10. ALL VALVES, SENSORS, AND OTHER DEVICES SHALL BE EASILY ACCESSIBLE. PROVIDE HINGED ACCESS DOORS WHERE REQUIRED FOR SERVICE.
11. INSTALL ALL NEW FREEZE STATS ACCORDING TO MANUFACTURERS RECOMMENDATIONS. ENSURE SENSOR PROPERLY COVERS ENTIRE COIL, FACE, INCLUDING THE BOTTOM, WITHOUT RESTRICTING AIRFLOW OR MAINTENANCE ACCESS.
12. EXHAUST AND SUPPLY FANS NOT CONTROLLED OR MONITORED BY THE EXISTING EMS ARE NOT INCLUDED IN THIS CONTRACT. SEE FAN EQUIPMENT SCHEDULE FOR EXISTING FANS TO BE CONTROLLED BY THE NEW BAS.

1

13. PROVIDE AND INSTALL EMT CONDUIT IN ALL EXPOSED AREAS. NO LESS THAN 1" TRADE SIZE CONDUIT FOR NETWORK WIRING OR 1/2" FOR ALL OTHER RUNS, WITH LESS THAN 40% FILL.
14. PROVIDE WIRE TERMINAL MARKERS AT EACH CABLE END. FOR ALL NETWORK WIRING PROVIDE PLENUM RATED CABLE (PURPLE WITH A YELLOW STRIPE) INSTALLED AND RUN NEATLY GROUPED AND SUPPORTED IN ALL OTHER AREAS, PARALLEL AND PERPENDICULAR TO THE BUILDING LINES. FOR ALL OTHER CABLE USE WHITE PLENUM RATED CABLE.
15. A BINARY NEEDLE POINT BI-POLAR IONIZATION (NPBI) STATUS/ALARMING POINT HAS BEEN INCLUDED FOR EACH FCU, UV AND AHU. CONTROL WIRES SHALL BE INSTALLED FROM THE DDC CONTROLLER AND SECURELY COILED UP IN THE FILTER SECTION OF EACH FCU, UV AND AHU REQUIRED. CABLES SHALL BE CLEARLY LABELED AT BOTH THE CONTROLLER AND THE TERMINATION POINT AS "FUTURE NPBI ALARM." NBPI UNITS ARE NOT BEING PROVIDED UNDER THIS CONTRACT.

1

16. ALL HARDWARE AND SOFTWARE TO PERFORM ANY FUNCTION, INCLUDING PROGRAMMING AND GRAPHICAL CHANGES, SHALL RESIDE ON THE SERVER. ALL HARDWARE AND SOFTWARE, INCLUDING REVISIONS, SHALL BE PROVIDED IN PERPETUITY, LICENSED FREE TO SUPPORT THE INSTALLED EQUIPMENT.

TMG CONSULTING ENGINEERS, PLLC
The Millstone Group Consulting Engineers INC
DBA TMG Consulting Engineers
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704.895.7671 Phone
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Website: www.TMG-CE.COM

C-3646

NORTH CAROLINA PROFESSIONAL SEAL 033629 ENGINEER CLEMENT T. WILBURN
01.25.2023

ISSUED FOR CONSTRUCTION

CHARLOTTE-MECKLENBERG SCHOOLS

NORTHRIDGE MIDDLE SCHOOL HVAC CONTROLS

CHARLOTTE-MECKLENBERG SCHOOLS
7601 THE PLAZA
CHARLOTTE, NC 28215

REVISIONS		
NO.	DESCRIPTION	DATE
	ISSUED FOR CONSTRUCTION	9/27/22
1	REVISION 1	1/13/23
2	REVISION 2	1/25/23

SHEET INFORMATION

DATE	09/27/2022
JOB NUMBER	2202-01-002
DRAWN	LCB
APPROVED	CTM

HVAC CONTROLS GENERAL NOTES

M-800

SHEET 13 OF 28

SEQUENCE OF OPERATIONS

AIR HANDLING UNIT – NO OUTSIDE AIR (SCHEMATIC TYPE A)
(AHU-09) CONCESSION – AREA A

RUN CONDITIONS - SCHEDULED:
THE UNIT SHALL RUN ACCORDING TO A USER DEFINABLE TIME SCHEDULE IN THE FOLLOWING MODES:
OCCUPIED MODE: THE UNIT SHALL CONTINUOUSLY RUN TO MAINTAIN
A 74°F (ADJ.) COOLING SETPOINT
A 70°F (ADJ.) HEATING SETPOINT.
A 60% RH (ADJ.) DEHUMIDIFICATION SETPOINT.
UNOCCUPIED MODE (NIGHT SETBACK): THE UNIT SHALL CYCLE TO MAINTAIN
A 80°F (ADJ.) COOLING SETPOINT
A 62°F (ADJ.) HEATING SETPOINT
A 60% RH (ADJ.) DEHUMIDIFICATION SETPOINT.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
HIGH SPACE TEMP: IF THE SPACE TEMPERATURE IS GREATER THAN THE COOLING SETPOINT BY A USER DEFINABLE AMOUNT (ADJ.).
LOW SPACE TEMP: IF THE SPACE TEMPERATURE IS LESS THAN THE HEATING SETPOINT BY A USER DEFINABLE AMOUNT (ADJ.).

SMOKE DETECTION:
THE UNIT SHALL SHUT DOWN AND GENERATE AN ALARM UPON RECEIVING A SMOKE DETECTOR STATUS.

AHU TYPE A	HARDWARE POINTS				SOFTWARE POINTS						
POINT NAME	AI	AO	BI	BO	AV	BV	LOOP	SCHED	TREND	ALARM	GRAPHIC
DISCHARGE AIR TEMP	x								x		x
RETURN AIR TEMP	x								x		x
SPACE HUMIDITY	x								x		x
SPACE TEMP	x								x		x
DT WATER VALVE		x							x		x
FAN STATUS			x						x		x
IONIZATION SYS - FAULT			x						x	x	x
SMOKE DETECTOR			x						x	x	x
FAN START/STOP				x					x		x
COOLING SETPOINT					x				x		x
HEATING SETPOINT					x				x		x
DAT MAX SETPOINT					x				x		x
DAT MIN SETPOINT					x				x		x
DAT NEUTRAL SETPOINT					x				x		x
DEHUMID CLG OFFSET SP					x				x		x
DEHUMID SETPOINT					x				x		x
CHANGEOVER HTG/CLG						x					
SCHEDULE								x			
FAN FAILURE										x	x
FAN IN HAND										x	x
HIGH DISCHARGE TEMP										x	x
HIGH RETURN TEMP										x	x
HIGH SPACE HUMIDITY										x	x
HIGH SPACE TEMP										x	x
LOW DISCHARGE TEMP										x	x
LOW RETURN TEMP										x	x
LOW SPACE TEMP										x	x
TOTALS	**4**	**1**	**3**	**1**	**7**	**1**	**0**	**1**	**16**	**11**	**25**
TOTAL HARDWARE (9)					**TOTAL SOFTWARE (36)**						

FAN:
THE FAN SHALL RUN ANYTIME THE UNIT IS COMMANDED TO RUN, UNLESS SHUTDOWN ON SAFETIES. TO PREVENT SHORT CYCLING, THE FAN SHALL HAVE A USER DEFINABLE (ADJ.) MINIMUM RUNTIME. THE CONTROLLER SHALL MONITOR THE STATUS OF EACH FAN.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
FAN FAILURE: COMMANDED ON, BUT THE STATUS IS OFF.
FAN IN HAND: COMMANDED OFF, BUT THE STATUS IS ON.

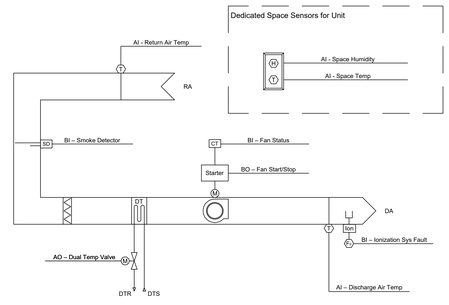
DUAL TEMPERATURE WATER COIL VALVE:
THE CONTROLLER SHALL MEASURE THE DISCHARGE AIR TEMPERATURE AND MODULATE THE WATER COIL VALVE TO MAINTAIN A VARIABLE DISCHARGE AIR TEMPERATURE SETPOINT THAT WILL CHANGE IN RESPONSE TO SPACE TEMPERATURE CHANGES. (SEE DAT CONTROL SEQUENCE.)
THE CHW COOLING SHALL BE ENABLED WHENEVER:
THE CHANGEOVER SIGNAL FROM THE BAS INDICATES COOLING IS AVAILABLE FROM THE CENTRAL PLANT,
AND THE SPACE TEMPERATURE IS ABOVE THE HEATING SETPOINT,
AND THE FAN STATUS IS ON.
THE HW HEATING SHALL BE ENABLED WHENEVER:
THE CHANGEOVER SIGNAL FROM THE BAS INDICATES HEATING IS AVAILABLE FROM THE CENTRAL PLANT,
AND THE SPACE TEMPERATURE IS BELOW THE COOLING SETPOINT,
AND THE FAN STATUS IS ON.
THE WATER COIL VALVE SHALL CLOSE WHENEVER THE CHW COOLING OR THE HW HEATING ARE NOT ENABLED.

DISCHARGE AIR TEMPERATURE (DAT) CONTROL:
THE SPACE TEMPERATURE SHALL BE CONTROLLED BY A CASCADING SEQUENCE THAT MODULATES THE CONTROL VALVE BASED ON A VARIABLE DAT SETPOINT. THE CONTROLLER SHALL MONITOR THE DISCHARGE AIR TEMPERATURE AND THE SPACE TEMPERATURE. THE DAT SETPOINT SHALL BE RESET BASED ON THE SPACE TEMPERATURE DEVIATION FROM SPACE TEMPERATURE SETPOINT.
WHEN CHW COOLING IS ENABLED:
THE CONTROLLER SHALL RESET THE DISCHARGE AIR TEMPERATURE DOWN TO A MINIMUM DAT SETPOINT OF 55°F (ADJ.) WHEN THE SPACE TEMPERATURE IS 2°F (ADJ.) ABOVE THE COOLING SETPOINT. CONVERSELY, AS SPACE TEMPERATURE DEVIATES BELOW THE COOLING SETPOINT, THE DAT SETPOINT IS RESET UP TO THE NEUTRAL DAT SETPOINT OF 70°F (ADJ.).
WHEN HW HEATING IS ENABLED:
THE CONTROLLER SHALL RESET THE DISCHARGE AIR TEMPERATURE UP TO A MAXIMUM DAT SETPOINT OF 85°F (ADJ.) WHEN THE SPACE TEMPERATURE IS 2°F (ADJ.) BELOW THE HEATING SETPOINT. CONVERSELY, AS SPACE TEMPERATURE DEVIATES ABOVE THE HEATING SETPOINT, THE DAT SETPOINT IS RESET DOWN TO THE NEUTRAL DAT SETPOINT OF 70°F (ADJ.).
ALARMS SHALL BE PROVIDED AS FOLLOWS:
HIGH DISCHARGE AIR TEMP: IF THE DISCHARGE AIR TEMPERATURE IS MORE THAN 10°F (ADJ.) ABOVE MAXIMUM DAT SETPOINT.
LOW DISCHARGE AIR TEMP: IF THE DISCHARGE AIR TEMPERATURE IS LESS THAN 10°F (ADJ.) BELOW MINIMUM DAT SETPOINT.

RETURN AIR TEMPERATURE:
THE CONTROLLER SHALL MONITOR THE RETURN AIR TEMPERATURE.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
HIGH RETURN AIR TEMP: IF THE RETURN AIR TEMPERATURE IS GREATER THAN 90°F (ADJ.).
LOW RETURN AIR TEMP: IF THE RETURN AIR TEMPERATURE IS LESS THAN 45°F (ADJ.).

AIR PURIFICATION - IONIZATION SYSTEM:
THE IONIZATION SYSTEM SHALL BE AVAILABLE ANYTIME THE FAN STATUS IS ON. IT IS NOT STARTED BY BAS.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
IONIZATION SYSTEM FAULT: FAN IS COMMANDED ON AND IONIZATION DEVICE FAULT SIGNAL STATUS IS ON.

DEHUMIDIFICATION (LIMITED) - NO REHEAT AVAILABLE:
THE CONTROLLER SHALL MONITOR THE SPACE HUMIDITY AND MAINTAIN THE DEHUMIDIFICATION SETPOINT. IF THE SPACE HUMIDITY LEVEL IS ABOVE SETPOINT WHEN THE CHANGEOVER SIGNAL FROM THE BAS INDICATES COOLING IS AVAILABLE FROM THE CENTRAL PLANT, THE FOLLOWING SHALL OCCUR:
THE FAN SHALL BE COMMANDED TO RUN IN THE OCCUPIED OR UNOCCUPIED MODE.
THE DUAL TEMPERATURE WATER COIL VALVE SHALL MODULATE TO MAINTAIN A 55°F (ADJ.) DISCHARGE AIR TEMPERATURE SETPOINT UNTIL THE SPACE TEMPERATURE FALLS TO A LIMIT OF 2°F (ADJ.) BELOW THE SPACE COOLING SETPOINT. THE WATER COIL VALVE SHOULD THEN CLOSE, ALLOWING THE SPACE TEMPERATURE TO RISE TO A LIMIT OF 1°F ABOVE THE SPACE COOLING SETPOINT. THIS CYCLE SHALL CONTINUE UNTIL THE SPACE HUMIDITY SETPOINT IS SATISFIED.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
HIGH SPACE HUMIDITY: IF THE SPACE HUMIDITY IS GREATER THAN 70% (ADJ.).



A AIR HANDLING UNIT – NO OUTSIDE AIR
(AHU-09) CONCESSION – AREA A
TYPICAL FOR (1) UNIT

SEQUENCE OF OPERATIONS

AIR HANDLING UNIT – ECONOMIZER (SCHEMATIC TYPE B)
(AHU-03, 10, 11) ADMINISTRATION / (AHU-04, 05, 06) TEAM PLAN. CORE / (AHU-08) CAFETORIUM / (AHU-12, 13) GYMNASIUM

RUN CONDITIONS - SCHEDULED:
THE UNIT SHALL RUN ACCORDING TO A USER DEFINABLE TIME SCHEDULE IN THE FOLLOWING MODES:
OCCUPIED MODE: THE UNIT SHALL CONTINUOUSLY RUN TO MAINTAIN
A 74°F (ADJ.) COOLING SETPOINT
A 70°F (ADJ.) HEATING SETPOINT.
A 60% RH (ADJ.) DEHUMIDIFICATION SETPOINT.
UNOCCUPIED MODE (NIGHT SETBACK): THE UNIT SHALL CYCLE TO MAINTAIN
A 80°F (ADJ.) COOLING SETPOINT
A 62°F (ADJ.) HEATING SETPOINT
A 60% RH (ADJ.) DEHUMIDIFICATION SETPOINT.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
HIGH SPACE TEMP: IF THE SPACE TEMPERATURE IS GREATER THAN THE COOLING SETPOINT BY A USER DEFINABLE AMOUNT (ADJ.).
LOW SPACE TEMP: IF THE SPACE TEMPERATURE IS LESS THAN THE HEATING SETPOINT BY A USER DEFINABLE AMOUNT (ADJ.).

FREEZE PROTECTION:
THE UNIT SHALL SHUT DOWN AND GENERATE AN ALARM UPON RECEIVING A FREEZESTAT STATUS.
WHENEVER THE FREEZESTAT IS ON, THE WATER COIL VALVE SHALL MODULATE OPEN TO MAINTAIN THE MIXED AIR TEMPERATURE AT 70°F (ADJ.), THE RETURN AIR DAMPER SHALL FULLY OPEN, THE OUTSIDE AND RELIEF AIR DAMPERS SHALL FULLY CLOSE.

SMOKE DETECTION:
THE UNIT SHALL SHUT DOWN AND GENERATE AN ALARM UPON RECEIVING A SMOKE DETECTOR STATUS.

FAN:
THE FAN SHALL RUN ANYTIME THE UNIT IS COMMANDED TO RUN, UNLESS SHUTDOWN ON SAFETIES. TO PREVENT SHORT CYCLING, THE FAN SHALL HAVE A USER DEFINABLE (ADJ.) MINIMUM RUNTIME. THE CONTROLLER SHALL MONITOR THE STATUS OF EACH FAN.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
FAN FAILURE: COMMANDED ON, BUT THE STATUS IS OFF.
FAN IN HAND: COMMANDED OFF, BUT THE STATUS IS ON.

AHU TYPE B	HARDWARE POINTS				SOFTWARE POINTS						
POINT NAME	AI	AO	BI	BO	AV	BV	LOOP	SCHED	TREND	ALARM	GRAPHIC
DISCHARGE AIR TEMP	x								x		x
MIXED AIR TEMP	x								x		x
RETURN AIR CO2 PPM	x								x		x
RETURN AIR HUMIDITY	x								x		x
RETURN AIR TEMP	x								x		x
SPACE HUMIDITY	x								x		x
*SPACE TEMP 1	x								x		x
*SPACE TEMP 2	x								x		x
*SPACE TEMP 3	x								x		x
****ZONE TEMP 119	x								x		x
DT WATER VALVE		x							x		x
MIXED AIR DAMPERS		x							x		x
***RELIEF AIR DAMPER		x							x		x
***SUPPLY AIR DAMPER		x							x		x
FAN STATUS			x						x		x
FREEZESTAT			x						x	x	x
IONIZATION SYS - FAULT			x						x	x	x
SMOKE DETECTOR			x						x	x	x
FAN START/STOP				x					x		x
**OA ISOLATION DAMPER				x					x		x
*SPACE CONTROL TEMP					x				x		x
COOLING SETPOINT					x				x		x
HEATING SETPOINT					x				x		x
DAT MAX SETPOINT					x				x		x
DAT MIN SETPOINT					x				x		x
DAT NEUTRAL SETPOINT					x				x		x
DEHUMID CLG OFFSET SP					x				x		x
DEHUMID SETPOINT					x				x		x
CO2 MAX SETPOINT					x				x		x
CO2 MIN SETPOINT					x				x		x
OAD MINIMUM POSITION					x				x		x
CHANGEOVER HTG/CLG						x					
SCHEDULE								x			
FAN FAILURE										x	x
FAN IN HAND										x	x
HIGH DISCHARGE TEMP										x	x
HIGH MIXED AIR TEMP										x	x
HIGH RETURN CO2 LEVEL										x	x
HIGH SPACE HUMIDITY										x	x
HIGH SPACE TEMP										x	x
LOW DISCHARGE TEMP										x	x
LOW MIXED AIR TEMP										x	x
LOW SPACE TEMP										x	x
TOTALS	**10**	**4**	**4**	**2**	**11**	**1**	**0**	**1**	**31**	**13**	**41**
TOTAL HARDWARE (20)					**TOTAL SOFTWARE (57)**						

DUAL TEMPERATURE WATER COIL VALVE:
THE CONTROLLER SHALL MEASURE THE DISCHARGE AIR TEMPERATURE AND MODULATE THE WATER COIL VALVE TO MAINTAIN A VARIABLE DISCHARGE AIR TEMPERATURE SETPOINT THAT WILL CHANGE IN RESPONSE TO SPACE TEMPERATURE CHANGES. (SEE DAT CONTROL SEQUENCE.)
THE CHW COOLING SHALL BE ENABLED WHENEVER:
THE CHANGEOVER SIGNAL FROM THE BAS INDICATES COOLING IS AVAILABLE FROM THE CENTRAL PLANT,
AND THE SPACE TEMPERATURE IS ABOVE THE HEATING SETPOINT,
AND THE FAN STATUS IS ON.
THE HW HEATING SHALL BE ENABLED WHENEVER:
THE CHANGEOVER SIGNAL FROM THE BAS INDICATES HEATING IS AVAILABLE FROM THE CENTRAL PLANT,
AND THE SPACE TEMPERATURE IS BELOW THE COOLING SETPOINT.
AND THE FAN STATUS IS ON.
THE WATER COIL VALVE SHALL CLOSE WHENEVER THE CHW COOLING OR THE HW HEATING ARE NOT ENABLED AND THE FREEZESTAT STATUS IS OFF. THE WATER COIL VALVE SHALL MODULATE OPEN AS REQUIRED BY FREEZE PROTECTION SEQUENCE.

DISCHARGE AIR TEMPERATURE (DAT) CONTROL:
THE SPACE TEMPERATURE SHALL BE CONTROLLED BY A CASCADING SEQUENCE THAT MODULATES THE CONTROL VALVE BASED ON A VARIABLE DAT SETPOINT. THE CONTROLLER SHALL MONITOR THE DISCHARGE AIR TEMPERATURE AND THE SPACE TEMPERATURE. THE DAT SETPOINT SHALL BE RESET BASED ON THE SPACE TEMPERATURE DEVIATION FROM SPACE TEMPERATURE SETPOINT.
WHEN CHW COOLING IS ENABLED:
THE CONTROLLER SHALL RESET THE DISCHARGE AIR TEMPERATURE DOWN TO A MINIMUM DAT SETPOINT OF 55°F (ADJ.) WHEN THE SPACE TEMPERATURE IS 2°F (ADJ.) ABOVE THE COOLING SETPOINT. CONVERSELY, AS SPACE TEMPERATURE DEVIATES BELOW THE COOLING SETPOINT, THE DAT SETPOINT IS RESET UP TO THE NEUTRAL DAT SETPOINT OF 70°F (ADJ.).
WHEN HW HEATING IS ENABLED:
THE CONTROLLER SHALL RESET THE DISCHARGE AIR TEMPERATURE UP TO A MAXIMUM DAT SETPOINT OF 85°F (ADJ.) WHEN THE SPACE TEMPERATURE IS 2°F (ADJ.) BELOW THE HEATING SETPOINT. CONVERSELY, AS SPACE TEMPERATURE DEVIATES ABOVE THE HEATING SETPOINT, THE DAT SETPOINT IS RESET DOWN TO THE NEUTRAL DAT SETPOINT OF 70°F (ADJ.).
ALARMS SHALL BE PROVIDED AS FOLLOWS:
HIGH DISCHARGE AIR TEMP: IF THE DISCHARGE AIR TEMPERATURE IS MORE THAN 10°F (ADJ.) ABOVE MAXIMUM DAT SETPOINT.
LOW DISCHARGE AIR TEMP: IF THE DISCHARGE AIR TEMPERATURE IS LESS THAN 10°F (ADJ.) BELOW MINIMUM DAT SETPOINT.

ZONE SUPPLY AIR DAMPER (AHU-10) - PRINCIPAL OFFICE:
THE ZONE SUPPLY AIR DAMPER SHALL MODULATE TO MAINTAIN THE ZONE TEMPERATURE SETPOINT.
WHEN CHW COOLING IS ENABLED:
THE CONTROLLER SHALL MODULATE THE DAMPER OPEN WHEN THE ZONE TEMPERATURE IS 2°F (ADJ.) ABOVE THE COOLING SETPOINT. CONVERSELY, AS ZONE TEMPERATURE DEVIATES BELOW THE COOLING SETPOINT, THE DAMPER BE MODULATED CLOSED.
WHEN HW HEATING IS ENABLED:
THE CONTROLLER SHALL MODULATE THE DAMPER OPEN WHEN THE ZONE TEMPERATURE IS 2°F (ADJ.) BELOW THE HEATING SETPOINT. CONVERSELY, AS ZONE TEMPERATURE DEVIATES ABOVE THE HEATING SETPOINT, THE DAMPER BE MODULATED CLOSED.

RETURN AIR TEMPERATURE AND HUMIDITY:
THE CONTROLLER SHALL MONITOR THE RETURN AIR TEMPERATURE AND HUMIDITY AND USE AS REQUIRED FOR ECONOMIZER ENTHALPY CONTROL.

AIR PURIFICATION - IONIZATION SYSTEM:
THE IONIZATION SYSTEM SHALL BE AVAILABLE ANYTIME THE FAN STATUS IS ON. IT IS NOT STARTED BY BAS.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
IONIZATION SYSTEM FAULT: FAN IS COMMANDED ON AND IONIZATION DEVICE FAULT SIGNAL STATUS IS ON.

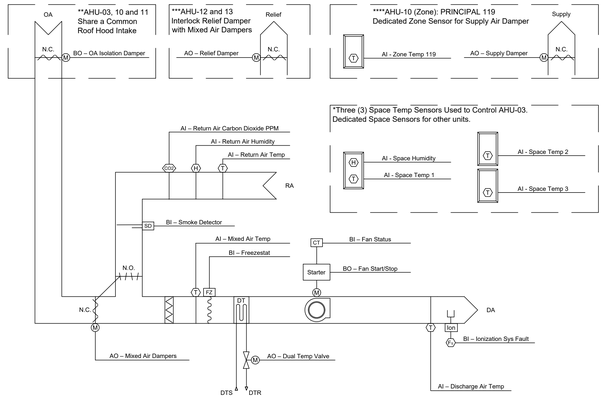
MINIMUM OUTSIDE AIR VENTILATION:
THE MIXED AIR DAMPERS SHALL MAINTAIN A MINIMUM OUTSIDE AIR DAMPER POSITION (ADJ.) WHENEVER THE UNIT RUNS IN OCCUPIED MODE. THE MINIMUM OUTSIDE AIR DAMPER POSITION (DETERMINED BY BALANCING CONTRACTOR) SHALL BE CONFIGURED IN THE CONTROLLER.
THE OUTSIDE AIR DAMPER SHALL FULLY CLOSE AND THE RETURN AIR DAMPER SHALL OPEN WHENEVER:
THE UNIT RUNS IN UNOCCUPIED MODE,
OR MIXED AIR TEMPERATURE DROPS FROM 45°F TO 40°F (ADJ.),
OR THE FAN STATUS IS OFF,
OR THE FREEZESTAT IS ON.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
HIGH MIXED AIR TEMP: IF THE MIXED AIR TEMPERATURE IS GREATER THAN 90°F (ADJ.).
LOW MIXED AIR TEMP: IF THE MIXED AIR TEMPERATURE IS LESS THAN 45°F (ADJ.).

ECONOMIZER:
THE CONTROLLER SHALL MEASURE THE MIXED AIR TEMPERATURE AND MODULATE THE ECONOMIZER DAMPERS IN SEQUENCE, AS A FIRST STAGE OF COOLING, TO MAINTAIN A MIXED AIR SETPOINT THAT IS 3°F (ADJ.) LESS THAN THE DISCHARGE AIR SETPOINT. IF THE DISCHARGE AIR TEMPERATURE REMAINS ABOVE DISCHARGE AIR SETPOINT AFTER THE ECONOMIZER REACHES 100%, THE DUAL TEPERATURE WATER COIL VALVE SHALL MODULATE OPEN IN SEQUENCE, AS A SECOND STAGE OF COOLING.
THE ECONOMIZER SHALL BE ENABLED WHENEVER:
OUTSIDE AIR ENTHALPY IS LESS THAN 28 BTU/LB (ADJ.),
AND OUTSIDE AIR ENTHALPY IS LESS THAN THE RETURN AIR ENTHALPY,
AND THE FAN STATUS IS ON.

DEHUMIDIFICATION (LIMITED) - NO REHEAT AVAILABLE:
THE CONTROLLER SHALL MONITOR THE SPACE HUMIDITY AND MAINTAIN THE DEHUMIDIFICATION SETPOINT. IF THE SPACE HUMIDITY LEVEL IS ABOVE SETPOINT WHEN THE CHANGEOVER SIGNAL FROM THE BAS INDICATES COOLING IS AVAILABLE FROM THE CENTRAL PLANT, THE FOLLOWING SHALL OCCUR:
THE FAN SHALL BE COMMANDED TO RUN IN THE OCCUPIED OR UNOCCUPIED MODE.
THE DUAL TEMPERATURE WATER COIL VALVE SHALL MODULATE TO MAINTAIN A 55°F (ADJ.) DISCHARGE AIR TEMPERATURE SETPOINT UNTIL THE SPACE TEMPERATURE FALLS TO A LIMIT OF 2°F (ADJ.) BELOW THE SPACE COOLING SETPOINT. THE WATER COIL VALVE SHOULD THEN CLOSE, ALLOWING THE SPACE TEMPERATURE TO RISE TO A LIMIT OF 1°F ABOVE THE SPACE COOLING SETPOINT. THIS CYCLE SHALL CONTINUE UNTIL THE SPACE HUMIDITY SETPOINT IS SATISFIED.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
HIGH SPACE HUMIDITY: IF THE SPACE HUMIDITY IS GREATER THAN 70% (ADJ.).

RELIEF DAMPER (AHU-12 AND AHU-13) - GYMNASIUM:
THE RELIEF AIR DAMPER SHALL MODULATE TO MATCH THE POSITION OF OUTSIDE AIR DAMPER AT THE LINKED MIXED AIR DAMPERS. WHENEVER THE OUTSIDE AIR DAMPER IS CLOSED, THE RELIEF DAMPER SHALL BE CLOSED.

DEMAND CONTROLLED VENTILATION:
THE CONTROLLER SHALL MEASURE THE RETURN AIR CO2 CONCENTRATION AND INCREASE THE MINIMUM OUTSIDE AIR DAMPER POSITION TO MAINTAIN THE FOLLOWING CALCULATED CO2 SETPOINTS:
MINIMUM CO2 SETPOINT = OUTSIDE AIR CO2 + 600 PPM (ADJ.)
MAXIMUM CO2 SETPOINT = OUTSIDE AIR CO2 + 1000 PPM (ADJ.)
IF RETURN AIR CO2 CONCENTRATION IS BELOW THE MINIMUM CO2 SETPOINT, THE OUTSIDE AIR DAMPER REMAINS AT ITS MINIMUM POSITION.
AS RETURN AIR CO2 CONCENTRATION INCREASES ABOVE THE MINIMUM CO2 SETPOINT, THE OUTSIDE AIR DAMPER SHALL PROPORTIONALLY MODULATE OPEN UNTIL THE DAMPER IS FULLY OPEN AT, OR ABOVE, THE MAXIMUM CO2 SETPOINT.
AS RETURN AIR CO2 CONCENTRATION DECREASES BELOW THE MAXIMUM CO2 SETPOINT, THE OUTSIDE AIR DAMPER SHALL PROPORTIONALLY MODULATE CLOSED UNTIL THE DAMPER IS AT ITS MINIMUM POSITION AT, OR BELOW, THE MINIMUM CO2 SETPOINT.
THE MINIMUM OUTSIDE AIR DAMPER POSITION REQUIRED FOR VENTILATION WILL NOT PREVENT THE OUTSIDE AIR DAMPER FROM OPENING FURTHER IF REQUIRED FOR ECONOMIZER OPERATION.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
HIGH RETURN CARBON DIOXIDE CONCENTRATION: IF THE RETURN AIR CO2 CONCENTRATION IS GREATER THAN THE MAXIMUM CO2 SETPOINT WHEN IN THE OCCUPIED MODE.



B AIR HANDLING UNITS – ECONOMIZER
(AHU-03, 10, 11) ADMINISTRATION / (AHU-04, 05, 06) TEAM PLAN. CORE / (AHU-08) CAFETORIUM / (AHU-12, 13) GYMNASIUM
TYPICAL FOR (9) UNITS

TMG CONSULTING ENGINEERS
The Mitchell Group Consulting Engineers Inc
d/b/a TMG Consulting Engineers
401 Hawthorne Lane
Suite 110-77
Charlotte, NC 28204
704.895.7601 Phone
704.895.7602 Fax
Website: WWW.TMG-CE.COM

NORTH CAROLINA PROFESSIONAL ENGINEERS SEAL C-3646 MECHANICAL CHARLOTTE, NC

NORTH CAROLINA PROFESSIONAL ENGINEERS SEAL 033629 ENGINEER CLEMENT T. MILBOURNE

01.25.2023

ISSUED FOR CONSTRUCTION

CHARLOTTE-MECKLENBERG SCHOOLS

NORTHRIDGE MIDDLE SCHOOL HVAC CONTROLS

CHARLOTTE-MECKLENBERG SCHOOLS
7601 THE PLAZA
CHARLOTTE, NC 28215

REVISIONS

NO	DESCRIPTION	DATE
	ISSUED FOR CONSTRUCTION	9/27/22
1	REVISION 1	1/13/23
2	REVISION 2	1/25/23

SHEET INFORMATION

DATE	09/27/2022
JOB NUMBER	2202-01-002
DRAWN	LCB
APPROVED	CTM

HVAC CONTROLS
AHU A & B

M-801

SHEET 14 OF 28

SEQUENCE OF OPERATIONS

AIR HANDLING UNIT – ECONOMIZER (SCHEMATIC TYPE C)
(AHU-07) P.E. OFFICES - AREA B

RUN CONDITIONS - SCHEDULED:
THE UNIT SHALL RUN ACCORDING TO A USER DEFINABLE TIME SCHEDULE IN THE FOLLOWING MODES:
OCCUPIED MODE: THE UNIT SHALL CONTINUOUSLY RUN TO MAINTAIN
A 74°F (ADJ.) COOLING SETPOINT
A 70°F (ADJ.) HEATING SETPOINT.
A 60% RH (ADJ.) DEHUMIDIFICATION SETPOINT.
UNOCCUPIED MODE (NIGHT SETBACK): THE UNIT SHALL CYCLE TO MAINTAIN
A 80°F (ADJ.) COOLING SETPOINT
A 62°F (ADJ.) HEATING SETPOINT
A 60% RH (ADJ.) DEHUMIDIFICATION SETPOINT.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
HIGH SPACE TEMP: IF THE SPACE TEMPERATURE IS GREATER THAN THE COOLING SETPOINT BY A USER DEFINABLE AMOUNT (ADJ.).
LOW SPACE TEMP: IF THE SPACE TEMPERATURE IS LESS THAN THE HEATING SETPOINT BY A USER DEFINABLE AMOUNT (ADJ.).

FREEZE PROTECTION:
THE UNIT SHALL SHUT DOWN AND GENERATE AN ALARM UPON RECEIVING A FREEZESTAT STATUS. WHENEVER THE FREEZESTAT IS ON, THE WATER COIL VALVE SHALL MODULATE OPEN TO MAINTAIN THE MIXED AIR TEMPERATURE AT 70°F (ADJ.), THE RETURN AIR DAMPER SHALL FULLY OPEN AND THE OUTSIDE AIR DAMPER SHALL FULLY CLOSE.

SMOKE DETECTION:
THE UNIT SHALL SHUT DOWN AND GENERATE AN ALARM UPON RECEIVING A SMOKE DETECTOR

AHU TYPE C

	HARDWARE POINTS				SOFTWARE POINTS						
POINT NAME	AI	AO	BI	BO	AV	BV	LOOP	SCHED	TREND	ALARM	GRAPHIC
DISCHARGE AIR TEMP	x								x		x
MIXED AIR TEMP	x								x		x
RETURN AIR CO2 PPM	x								x		x
RETURN AIR HUMIDITY	x								x		x
RETURN AIR TEMP	x								x		x
SPACE HUMIDITY	x								x		x
SPACE TEMP	x								x		x
DT WATER VALVE		x							x		x
OUTSIDE AIR DAMPER		x							x		x
RETURN AIR DAMPER		x							x		x
DX COMPRESSOR STATUS			x						x		x
FAN STATUS			x						x		x
FREEZESTAT			x						x	x	x
IONIZATION SYS - FAULT			x						x	x	x
SMOKE DETECTOR			x						x	x	x
DX COOLING STAGE				x					x		x
FAN START/STOP				x					x		x
COOLING SETPOINT					x				x		x
HEATING SETPOINT					x				x		x
DAT MAX SETPOINT					x				x		x
DAT MIN SETPOINT					x				x		x
DAT NEUTRAL SETPOINT					x				x		x
DEHUMID CLG OFFSET SP					x				x		x
DEHUMID SETPOINT					x				x		x
CO2 MAX SETPOINT					x				x		x
CO2 MIN SETPOINT					x				x		x
OAD MINIMUM POSITION					x				x		x
CHANGEOVER HTG/CLG						x					
SCHEDULE								x			
COMP RUNTIME EXCEED										x	x
FAN FAILURE										x	x
FAN IN HAND										x	x
HIGH DISCHARGE TEMP										x	x
HIGH MIXED AIR TEMP										x	x
HIGH RETURN CO2 LEVEL										x	x
HIGH SPACE HUMIDITY										x	x
HIGH SPACE TEMP										x	x
LOW DISCHARGE TEMP										x	x
LOW MIXED AIR TEMP										x	x
LOW SPACE TEMP										x	x
TOTALS	**7**	**3**	**5**	**2**	**10**	**1**	**0**	**1**	**27**	**14**	**38**
TOTAL HARDWARE (17)					**TOTAL SOFTWARE (53)**						

FAN:
THE FAN SHALL RUN ANYTIME THE UNIT IS COMMANDED TO RUN, UNLESS SHUTDOWN ON SAFETIES. TO PREVENT SHORT CYCLING, THE FAN SHALL HAVE A USER DEFINABLE (ADJ.) MINIMUM RUNTIME. THE CONTROLLER SHALL MONITOR THE STATUS OF EACH FAN.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
FAN FAILURE: COMMANDED ON, BUT THE STATUS IS OFF.
FAN IN HAND: COMMANDED OFF, BUT THE STATUS IS ON.

DUAL TEMPERATURE WATER COIL VALVE:
THE CONTROLLER SHALL MEASURE THE DISCHARGE AIR TEMPERATURE AND MODULATE THE WATER COIL VALVE TO MAINTAIN A VARIABLE DISCHARGE AIR TEMPERATURE SETPOINT THAT WILL CHANGE IN RESPONSE TO SPACE TEMPERATURE CHANGES. (SEE DAT CONTROL SEQUENCE.)
THE CHW COOLING SHALL BE ENABLED WHENEVER:
THE CHANGEOVER SIGNAL FROM THE BAS INDICATES COOLING IS AVAILABLE FROM THE CENTRAL PLANT,
AND THE ECONOMIZER IS DISABLED OR FULLY OPEN,
AND THE SPACE TEMPERATURE IS ABOVE THE HEATING SETPOINT,
AND THE FAN STATUS IS ON.
THE HW HEATING SHALL BE ENABLED WHENEVER:
THE CHANGEOVER SIGNAL FROM THE BAS INDICATES HEATING IS AVAILABLE FROM THE CENTRAL PLANT,
AND THE SPACE TEMPERATURE IS BELOW THE COOLING SETPOINT.
AND THE FAN STATUS IS ON.
THE WATER COIL VALVE SHALL CLOSE WHENEVER THE CHW COOLING OR THE HW HEATING ARE NOT ENABLED AND THE FREEZESTAT STATUS IS OFF. THE WATER COIL VALVE SHALL MODULATE OPEN AS REQUIRED BY FREEZE PROTECTION SEQUENCE.

DISCHARGE AIR TEMPERATURE (DAT) CONTROL:
THE SPACE TEMPERATURE SHALL BE CONTROLLED BY A CASCADING SEQUENCE THAT MODULATES THE CONTROL VALVE BASED ON A VARIABLE DAT SETPOINT. THE CONTROLLER SHALL MONITOR THE DISCHARGE AIR TEMPERATURE AND THE SPACE TEMPERATURE. THE DAT SETPOINT SHALL BE RESET BASED ON THE SPACE TEMPERATURE DEVIATION FROM SPACE TEMPERATURE SETPOINT.
WHEN CHW COOLING IS ENABLED:
THE CONTROLLER SHALL RESET THE DISCHARGE AIR TEMPERATURE DOWN TO A MINIMUM DAT SETPOINT OF 55°F (ADJ.) WHEN THE SPACE TEMPERATURE IS 2°F (ADJ.) ABOVE THE COOLING SETPOINT. CONVERSELY, AS SPACE TEMPERATURE DEVIATES BELOW THE COOLING SETPOINT, THE DAT SETPOINT IS RESET UP TO THE NEUTRAL DAT SETPOINT OF 70°F (ADJ.).
WHEN HW HEATING IS ENABLED:
THE CONTROLLER SHALL RESET THE DISCHARGE AIR TEMPERATURE UP TO A MAXIMUM DAT SETPOINT OF 85°F (ADJ.) WHEN THE SPACE TEMPERATURE IS 2°F (ADJ.) BELOW THE HEATING SETPOINT. CONVERSELY, AS SPACE TEMPERATURE DEVIATES ABOVE THE HEATING SETPOINT, THE DAT SETPOINT IS RESET DOWN TO THE NEUTRAL DAT SETPOINT OF 70°F (ADJ.).
ALARMS SHALL BE PROVIDED AS FOLLOWS:
HIGH DISCHARGE AIR TEMP: IF THE DISCHARGE AIR TEMPERATURE IS MORE THAN 10°F (ADJ.) ABOVE MAXIMUM DAT SETPOINT.
LOW DISCHARGE AIR TEMP: IF THE DISCHARGE AIR TEMPERATURE IS LESS THAN 10°F (ADJ.) BELOW MINIMUM DAT SETPOINT.

SPLIT-SYSTEM (CU-07) - DIRECT EXPANSION COIL:
THE CONTROLLER SHALL MEASURE THE DISCHARGE AIR TEMPERATURE AND SHALL USE THE SPLIT-SYSTEM (CU-07) DX REFRIGERANT COOLING COIL TO MAINTAIN THE DISCHARGE AIR TEMPERATURE COOLING SETPOINT WHENEVER THE ECONOMIZER AND THE DUAL TEMPERATURE COIL DO NOT SATISFY THE SPACE TEMPERATURE COOLING SETPOINT. THE COMPRESSOR SHALL RUN ANYTIME THE SPLIT-SYSTEM IS COMMANDED TO RUN, UNLESS SHUTDOWN ON SAFETIES. TO PREVENT SHORT CYCLING, THE COMPRESSOR SHALL HAVE A USER DEFINABLE (ADJ.) MINIMUM RUNTIME. THE CONTROLLER SHALL MONITOR THE STATUS OF THE COMPRESSOR.
THE DX COOLING SPLIT-SYSTEM SHALL BE ENABLED WHENEVER:
THE WATER COIL VALVE IS FULLY OPEN WITH CENTRAL PLANT COOLING AVAILABLE OR THE WATER COIL VALVE IS FULLY CLOSED WITH CENTRAL PLANT HEATING AVAILABLE,
AND THE ECONOMIZER IS DISABLED OR FULLY OPEN,
AND THE SPACE TEMPERATURE IS ABOVE COOLING SETPOINT,
AND THE FAN STATUS IS ON.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
COMPRESSOR RUNTIME EXCEEDED: COMPRESSOR RUNTIME EXCEEDS A USER DEFINABLE LIMIT (ADJ.).

RETURN AIR TEMPERATURE AND HUMIDITY:
THE CONTROLLER SHALL MONITOR THE RETURN AIR TEMPERATURE AND HUMIDITY AND USE AS REQUIRED FOR ECONOMIZER ENTHALPY CONTROL.

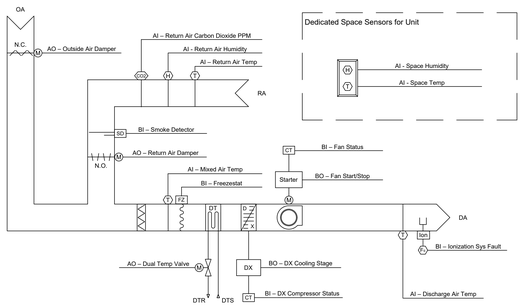
AIR PURIFICATION - IONIZATION SYSTEM:
THE IONIZATION SYSTEM SHALL BE AVAILABLE ANYTIME THE FAN STATUS IS ON. IT IS NOT STARTED BY BAS.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
IONIZATION SYSTEM FAULT: FAN IS COMMANDED ON AND IONIZATION DEVICE FAULT SIGNAL STATUS IS ON.

MINIMUM OUTSIDE AIR VENTILATION:
THE MIXED AIR DAMPERS (ECONOMIZER DAMPERS) SHALL BE SEQUENCED FOR BOTH THE RETURN AIR AND OUTSIDE AIR DAMPERS TO INVERSELY MODULATE AT THE SAME TIME.
THE MIXED AIR DAMPERS SHALL MAINTAIN A MINIMUM OUTSIDE AIR DAMPER POSITION (ADJ.) WHENEVER THE UNIT RUNS IN OCCUPIED MODE. THE MINIMUM OUTSIDE AIR DAMPER POSITION (DETERMINED BY BALANCING CONTRACTOR) SHALL BE CONFIGURED IN THE CONTROLLER.
THE OUTSIDE AIR DAMPER SHALL FULLY CLOSE AND THE RETURN AIR DAMPER SHALL OPEN WHENEVER:
THE UNIT RUNS IN UNOCCUPIED MODE,
OR MIXED AIR TEMPERATURE DROPS FROM 45°F TO 40°F (ADJ.),
OR THE FAN STATUS IS OFF,
OR THE FREEZESTAT IS ON.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
HIGH MIXED AIR TEMP: IF THE MIXED AIR TEMPERATURE IS GREATER THAN 90°F (ADJ.).
LOW MIXED AIR TEMP: IF THE MIXED AIR TEMPERATURE IS LESS THAN 45°F (ADJ.).

ECONOMIZER:
THE CONTROLLER SHALL MEASURE THE MIXED AIR TEMPERATURE AND MODULATE THE ECONOMIZER DAMPERS IN SEQUENCE, AS A FIRST STAGE OF COOLING, TO MAINTAIN A MIXED AIR SETPOINT THAT IS 3°F (ADJ.) LESS THAN THE DISCHARGE AIR SETPOINT. IF THE DISCHARGE AIR TEMPERATURE REMAINS ABOVE DISCHARGE AIR SETPOINT AFTER THE ECONOMIZER REACHES 100%, THE DUAL TEMPERATURE WATER COIL VALVE SHALL MODULATE OPEN IN SEQUENCE, AS A SECOND STAGE OF COOLING. THE DX COIL SHALL RUN IN SEQUENCE, AS A THIRD STAGE OF COOLING.
THE ECONOMIZER SHALL BE ENABLED WHENEVER:
OUTSIDE AIR ENTHALPY IS LESS THAN 28 BTU/LB (ADJ.),
AND OUTSIDE AIR ENTHALPY IS LESS THAN THE RETURN AIR ENTHALPY,
AND THE FAN STATUS IS ON.

DEHUMIDIFICATION (LIMITED) - NO REHEAT AVAILABLE:
THE CONTROLLER SHALL MONITOR THE SPACE HUMIDITY AND MAINTAIN THE DEHUMIDIFICATION SETPOINT. IF THE SPACE HUMIDITY LEVEL IS ABOVE SETPOINT, THE FOLLOWING SHALL OCCUR:
THE FAN SHALL BE COMMANDED TO RUN IN THE OCCUPIED OR UNOCCUPIED MODE.
THE DUAL TEMPERATURE WATER COIL VALVE SHALL MODULATE FIRST (IF CENTRAL PLANT COOLING AVAILABLE), THEN THE DX COIL SHALL RUN FOR ADDITIONAL COOLING TO MAINTAIN A 55°F (ADJ.) DISCHARGE AIR TEMPERATURE SETPOINT UNTIL THE SPACE TEMPERATURE FALLS TO A LIMIT OF 2°F (ADJ.) BELOW THE SPACE COOLING SETPOINT. THE COOLING COIL(S) SHOULD THEN BE DISABLED, ALLOWING THE SPACE TEMPERATURE TO RISE TO A LIMIT OF 1°F ABOVE THE SPACE COOLING SETPOINT. THIS CYCLE SHALL CONTINUE UNTIL THE SPACE HUMIDITY SETPOINT IS SATISFIED.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
HIGH SPACE HUMIDITY: IF THE SPACE HUMIDITY IS GREATER THAN 70% (ADJ.).

DEMAND CONTROLLED VENTILATION:
THE CONTROLLER SHALL MEASURE THE RETURN AIR CO2 CONCENTRATION AND INCREASE THE MINIMUM OUTSIDE AIR DAMPER POSITION TO MAINTAIN THE FOLLOWING CALCULATED CO2 SETPOINTS:
MINIMUM CO2 SETPOINT = OUTSIDE AIR CO2 + 600 PPM (ADJ.)
MAXIMUM CO2 SETPOINT = OUTSIDE AIR CO2 + 1000 PPM (ADJ.)
IF RETURN AIR CO2 CONCENTRATION IS BELOW THE MINIMUM CO2 SETPOINT, THE OUTSIDE AIR DAMPER REMAINS AT ITS MINIMUM POSITION.
AS RETURN AIR CO2 CONCENTRATION INCREASES ABOVE THE MINIMUM CO2 SETPOINT, THE OUTSIDE AIR DAMPER SHALL PROPORTIONALLY MODULATE OPEN UNTIL THE DAMPER IS FULLY OPEN AT, OR ABOVE, THE MAXIMUM CO2 SETPOINT.
AS RETURN AIR CO2 CONCENTRATION DECREASES BELOW THE MAXIMUM CO2 SETPOINT, THE OUTSIDE AIR DAMPER SHALL PROPORTIONALLY MODULATE CLOSED UNTIL THE DAMPER IS AT ITS MINIMUM POSITION AT, OR BELOW, THE MINIMUM CO2 SETPOINT.
THE MINIMUM OUTSIDE AIR DAMPER POSITION REQUIRED FOR VENTILATION WILL NOT PREVENT THE OUTSIDE AIR DAMPER FROM OPENING FURTHER IF REQUIRED FOR ECONOMIZER OPERATION.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
HIGH RETURN CARBON DIOXIDE CONCENTRATION: IF THE RETURN AIR CO2 CONCENTRATION IS GREATER THAN THE MAXIMUM CO2 SETPOINT WHEN IN THE OCCUPIED MODE.



C AIR HANDLING UNIT – ECONOMIZER WITH DX COIL
(AHU-07) P.E. OFFICES – AREA B
TYPICAL FOR (1) UNIT

SEQUENCE OF OPERATIONS

AIR HANDLING UNIT – ECONOMIZER WITH REHEAT (SCHEMATIC TYPE D)
(AHU-01, 02) MEDIA CENTER - AREA C

RUN CONDITIONS - SCHEDULED:
THE UNIT SHALL RUN ACCORDING TO A USER DEFINABLE TIME SCHEDULE IN THE FOLLOWING MODES:
OCCUPIED MODE: THE UNIT SHALL CONTINUOUSLY RUN TO MAINTAIN
A 74°F (ADJ.) COOLING SETPOINT
A 70°F (ADJ.) HEATING SETPOINT.
A 60% RH (ADJ.) DEHUMIDIFICATION SETPOINT.
UNOCCUPIED MODE (NIGHT SETBACK): THE UNIT SHALL CYCLE TO MAINTAIN
A 80°F (ADJ.) COOLING SETPOINT
A 62°F (ADJ.) HEATING SETPOINT
A 60% RH (ADJ.) DEHUMIDIFICATION SETPOINT.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
HIGH SPACE TEMP: IF THE SPACE TEMPERATURE IS GREATER THAN THE COOLING SETPOINT BY A USER DEFINABLE AMOUNT (ADJ.).
LOW SPACE TEMP: IF THE SPACE TEMPERATURE IS LESS THAN THE HEATING SETPOINT BY A USER DEFINABLE AMOUNT (ADJ.).

FREEZE PROTECTION:
THE UNIT SHALL SHUT DOWN AND GENERATE AN ALARM UPON RECEIVING A FREEZESTAT STATUS. WHENEVER THE FREEZESTAT IS ON, THE WATER COIL VALVE SHALL MODULATE OPEN TO MAINTAIN THE MIXED AIR TEMPERATURE AT 70°F (ADJ.), THE RETURN AIR DAMPER SHALL FULLY OPEN AND BOTH OF THE OUTSIDE AIR DAMPERS SHALL FULLY CLOSE.

SMOKE DETECTION:
THE UNIT SHALL SHUT DOWN AND GENERATE AN ALARM UPON RECEIVING A SMOKE DETECTOR

AHU TYPE D

	HARDWARE POINTS				SOFTWARE POINTS						
POINT NAME	AI	AO	BI	BO	AV	BV	LOOP	SCHED	TREND	ALARM	GRAPHIC
DISCHARGE AIR TEMP	x								x		x
MIXED AIR TEMP	x								x		x
RETURN AIR CO2 PPM	x								x		x
RETURN AIR HUMIDITY	x								x		x
RETURN AIR TEMP	x								x		x
SPACE HUMIDITY	x								x		x
*SPACE TEMP 1	x								x		x
*SPACE TEMP 2	x								x		x
*SPACE TEMP 3	x								x		x
DT WATER VALVE		x							x		x
MIXED AIR DAMPERS		x							x		x
FAN STATUS			x						x		x
FREEZESTAT			x						x	x	x
IONIZATION SYS - FAULT			x						x	x	x
OAD ISOLATION STATUS			x						x		x
SMOKE DETECTOR			x						x	x	x
FAN START/STOP				x					x		x
OA ISOLATION DAMPER				x					x		x
DH REHEAT STAGE 1				x					x		x
DH REHEAT STAGE 2				x					x		x
DH REHEAT STAGE 3				x					x		x
DH REHEAT STAGE 4				x					x		x
*SPACE CONTROL TEMP					x				x		x
COOLING SETPOINT					x				x		x
HEATING SETPOINT					x				x		x
DAT MAX SETPOINT					x				x		x
DAT MIN SETPOINT					x				x		x
DAT NEUTRAL SETPOINT					x				x		x
DEHUMID SETPOINT					x				x		x
CO2 MAX SETPOINT					x				x		x
CO2 MIN SETPOINT					x				x		x
OAD MINIMUM POSITION					x				x		x
CHANGEOVER HTG/CLG						x					
SCHEDULE								x			
FAN FAILURE										x	x
FAN IN HAND										x	x
HIGH DISCHARGE TEMP										x	x
HIGH MIXED AIR TEMP										x	x
HIGH RETURN CO2 LEVEL										x	x
HIGH SPACE HUMIDITY										x	x
HIGH SPACE TEMP										x	x
LOW DISCHARGE TEMP										x	x
LOW MIXED AIR TEMP										x	x
LOW SPACE TEMP										x	x
TOTALS	**9**	**2**	**5**	**6**	**10**	**1**	**0**	**1**	**32**	**13**	**42**
TOTAL HARDWARE (22)					**TOTAL SOFTWARE (57)**						

FAN:
THE FAN SHALL RUN ANYTIME THE UNIT IS COMMANDED TO RUN, UNLESS SHUTDOWN ON SAFETIES. TO PREVENT SHORT CYCLING, THE FAN SHALL HAVE A USER DEFINABLE (ADJ.) MINIMUM RUNTIME. THE CONTROLLER SHALL MONITOR THE STATUS OF EACH FAN.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
FAN FAILURE: COMMANDED ON, BUT THE STATUS IS OFF.
FAN IN HAND: COMMANDED OFF, BUT THE STATUS IS ON.

DUAL TEMPERATURE WATER COIL VALVE:
THE CONTROLLER SHALL MEASURE THE DISCHARGE AIR TEMPERATURE AND MODULATE THE WATER COIL VALVE TO MAINTAIN A VARIABLE DISCHARGE AIR TEMPERATURE SETPOINT THAT WILL CHANGE IN RESPONSE TO SPACE TEMPERATURE CHANGES. (SEE DAT CONTROL SEQUENCE.)
THE CHW COOLING SHALL BE ENABLED WHENEVER:
THE CHANGEOVER SIGNAL FROM THE BAS INDICATES COOLING IS AVAILABLE FROM THE CENTRAL PLANT,
AND THE ECONOMIZER IS DISABLED OR FULLY OPEN,
AND THE SPACE TEMPERATURE IS ABOVE THE HEATING SETPOINT,
AND THE FAN STATUS IS ON.
THE HW HEATING SHALL BE ENABLED WHENEVER:
THE CHANGEOVER SIGNAL FROM THE BAS INDICATES HEATING IS AVAILABLE FROM THE CENTRAL PLANT,
AND THE SPACE TEMPERATURE IS BELOW THE COOLING SETPOINT.
AND THE FAN STATUS IS ON.
THE WATER COIL VALVE SHALL CLOSE WHENEVER THE CHW COOLING OR THE HW HEATING ARE NOT ENABLED AND THE FREEZESTAT STATUS IS OFF. THE WATER COIL VALVE SHALL MODULATE OPEN AS REQUIRED BY FREEZE PROTECTION SEQUENCE.

DISCHARGE AIR TEMPERATURE (DAT) CONTROL:
THE SPACE TEMPERATURE SHALL BE CONTROLLED BY A CASCADING SEQUENCE THAT MODULATES THE CONTROL VALVE BASED ON A VARIABLE DAT SETPOINT. THE CONTROLLER SHALL MONITOR THE DISCHARGE AIR TEMPERATURE AND THE SPACE TEMPERATURE. THE DAT SETPOINT SHALL BE RESET BASED ON THE SPACE TEMPERATURE DEVIATION FROM SPACE TEMPERATURE SETPOINT.
WHEN CHW COOLING IS ENABLED:
THE CONTROLLER SHALL RESET THE DISCHARGE AIR TEMPERATURE DOWN TO A MINIMUM DAT SETPOINT OF 55°F (ADJ.) WHEN THE SPACE TEMPERATURE IS 2°F (ADJ.) ABOVE THE COOLING SETPOINT. CONVERSELY, AS SPACE TEMPERATURE DEVIATES BELOW THE COOLING SETPOINT, THE DAT SETPOINT IS RESET UP TO THE NEUTRAL DAT SETPOINT OF 70°F (ADJ.).
WHEN HW HEATING IS ENABLED:
THE CONTROLLER SHALL RESET THE DISCHARGE AIR TEMPERATURE UP TO A MAXIMUM DAT SETPOINT OF 85°F (ADJ.) WHEN THE SPACE TEMPERATURE IS 2°F (ADJ.) BELOW THE HEATING SETPOINT. CONVERSELY, AS SPACE TEMPERATURE DEVIATES ABOVE THE HEATING SETPOINT, THE DAT SETPOINT IS RESET DOWN TO THE NEUTRAL DAT SETPOINT OF 70°F (ADJ.).
ALARMS SHALL BE PROVIDED AS FOLLOWS:
HIGH DISCHARGE AIR TEMP: IF THE DISCHARGE AIR TEMPERATURE IS MORE THAN 10°F (ADJ.) ABOVE MAXIMUM DAT SETPOINT.
LOW DISCHARGE AIR TEMP: IF THE DISCHARGE AIR TEMPERATURE IS LESS THAN 10°F (ADJ.) BELOW MINIMUM DAT SETPOINT.

RETURN AIR TEMPERATURE AND HUMIDITY:
THE CONTROLLER SHALL MONITOR THE RETURN AIR TEMPERATURE AND HUMIDITY AND USE AS REQUIRED FOR ECONOMIZER ENTHALPY CONTROL.

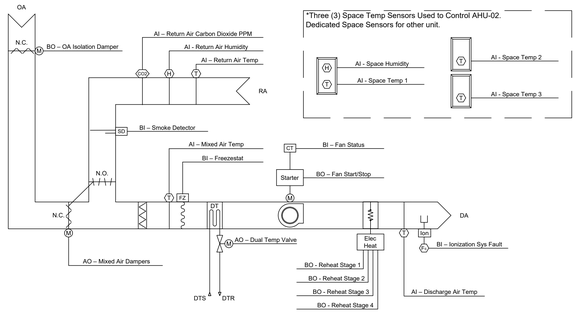
AIR PURIFICATION - IONIZATION SYSTEM:
THE IONIZATION SYSTEM SHALL BE AVAILABLE ANYTIME THE FAN STATUS IS ON. IT IS NOT STARTED BY BAS.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
IONIZATION SYSTEM FAULT: FAN IS COMMANDED ON AND IONIZATION DEVICE FAULT SIGNAL STATUS IS ON.

MINIMUM OUTSIDE AIR VENTILATION:
THE MIXED AIR DAMPERS SHALL MAINTAIN A MINIMUM OUTSIDE AIR DAMPER POSITION (ADJ.) WHENEVER THE UNIT RUNS IN OCCUPIED MODE. THE MINIMUM OUTSIDE AIR DAMPER POSITION (DETERMINED BY BALANCING CONTRACTOR) SHALL BE CONFIGURED IN THE CONTROLLER.
THE OUTSIDE AIR DAMPER SHALL FULLY CLOSE AND THE RETURN AIR DAMPER SHALL OPEN WHENEVER:
THE UNIT RUNS IN UNOCCUPIED MODE,
OR MIXED AIR TEMPERATURE DROPS FROM 45°F TO 40°F (ADJ.),
OR THE FAN STATUS IS OFF,
OR THE FREEZESTAT IS ON.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
HIGH MIXED AIR TEMP: IF THE MIXED AIR TEMPERATURE IS GREATER THAN 90°F (ADJ.).
LOW MIXED AIR TEMP: IF THE MIXED AIR TEMPERATURE IS LESS THAN 45°F (ADJ.).

ECONOMIZER:
THE CONTROLLER SHALL MEASURE THE MIXED AIR TEMPERATURE AND MODULATE THE ECONOMIZER DAMPERS IN SEQUENCE, AS A FIRST STAGE OF COOLING, TO MAINTAIN A MIXED AIR SETPOINT THAT IS 3°F (ADJ.) LESS THAN THE DISCHARGE AIR SETPOINT. IF THE DISCHARGE AIR TEMPERATURE REMAINS ABOVE DISCHARGE AIR SETPOINT AFTER THE ECONOMIZER REACHES 100%, THE WATER COIL VALVE SHALL MODULATE OPEN IN SEQUENCE, AS A SECOND STAGE OF COOLING.
THE ECONOMIZER SHALL BE ENABLED WHENEVER:
OUTSIDE AIR ENTHALPY IS LESS THAN 28 BTU/LB (ADJ.),
AND OUTSIDE AIR TEMPERATURE IS LESS THAN THE RETURN AIR TEMPERATURE,
AND THE FAN STATUS IS ON.

DEHUMIDIFICATION - DUCT HEATER (ELECTRIC REHEAT):
THE CONTROLLER SHALL MONITOR THE SPACE HUMIDITY AND MAINTAIN THE DEHUMIDIFICATION SETPOINT. IF THE SPACE HUMIDITY LEVEL IS ABOVE SETPOINT WHEN THE CHANGEOVER SIGNAL FROM THE BAS INDICATES COOLING IS AVAILABLE FROM THE CENTRAL PLANT, THE FOLLOWING SHALL OCCUR:
THE FAN SHALL BE COMMANDED TO RUN IN THE OCCUPIED OR UNOCCUPIED MODE.
THE DUAL TEMPERATURE WATER COIL VALVE SHALL FULLY OPEN TO PROVIDE CHW TO THE COIL.
THE 4-STAGE ELECTRIC DUCT HEATER SHALL BE STAGED ON TO MAINTAIN THE DISCHARGE AIR TEMPERATURE SETPOINT. TO PREVENT SHORT CYCLING, THERE SHALL BE A USER DEFINABLE (ADJ.) DELAY BETWEEN STAGES, AND EACH STAGE SHALL HAVE A USER DEFINABLE (ADJ.) MINIMUM RUNTIME.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
HIGH SPACE HUMIDITY: IF THE SPACE HUMIDITY IS GREATER THAN 70% (ADJ.).

DEMAND CONTROLLED VENTILATION:
THE CONTROLLER SHALL MEASURE THE RETURN AIR CO2 CONCENTRATION AND INCREASE THE MINIMUM OUTSIDE AIR DAMPER POSITION TO MAINTAIN THE FOLLOWING CALCULATED CO2 SETPOINTS:
MINIMUM CO2 SETPOINT = OUTSIDE AIR CO2 + 600 PPM (ADJ.)
MAXIMUM CO2 SETPOINT = OUTSIDE AIR CO2 + 1000 PPM (ADJ.)
IF RETURN AIR CO2 CONCENTRATION IS BELOW THE MINIMUM CO2 SETPOINT, THE OUTSIDE AIR DAMPER REMAINS AT ITS MINIMUM POSITION.
AS RETURN AIR CO2 CONCENTRATION INCREASES ABOVE THE MINIMUM CO2 SETPOINT, THE OUTSIDE AIR DAMPER SHALL PROPORTIONALLY MODULATE OPEN UNTIL THE DAMPER IS FULLY OPEN AT, OR ABOVE, THE MAXIMUM CO2 SETPOINT.
AS RETURN AIR CO2 CONCENTRATION DECREASES BELOW THE MAXIMUM CO2 SETPOINT, THE OUTSIDE AIR DAMPER SHALL PROPORTIONALLY MODULATE CLOSED UNTIL THE DAMPER IS AT ITS MINIMUM POSITION AT, OR BELOW, THE MINIMUM CO2 SETPOINT.
THE MINIMUM OUTSIDE AIR DAMPER POSITION REQUIRED FOR VENTILATION WILL NOT PREVENT THE OUTSIDE AIR DAMPER FROM OPENING FURTHER IF REQUIRED FOR ECONOMIZER OPERATION.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
HIGH RETURN CARBON DIOXIDE CONCENTRATION: IF THE RETURN AIR CO2 CONCENTRATION IS GREATER THAN THE MAXIMUM CO2 SETPOINT WHEN IN THE OCCUPIED MODE.



D AIR HANDLING UNITS – ECONOMIZER WITH REHEAT
(AHU-01, 02) MEDIA CENTER – AREA C
TYPICAL FOR (2) UNITS

1

TMG CONSULTING ENGINEERS
The Mitchell Gray Consulting Engineers Inc
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401 Hawthorne Lane
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Website: WWW.TMG-CS.COM

NORTH CAROLINA REGISTERED PROFESSIONAL ENGINEER SEAL 033629 ENGINEER CLIMENT T. MILBOURNE

01.25.2023

ISSUED FOR CONSTRUCTION

CHARLOTTE-MECKLENBERG SCHOOLS

NORTHRIDGE MIDDLE SCHOOL HVAC CONTROLS

CHARLOTTE-MECKLENBERG SCHOOLS
700 I THE PLAZA
CHARLOTTE, NC 28215

REVISIONS		
NO.	DESCRIPTION	DATE
1	ISSUED FOR CONSTRUCTION	9/27/22
1	REVISION 1	1/13/23
2	REVISION 2	1/25/23

SHEET INFORMATION

DATE	09/27/2022
JOB NUMBER	2202-01-002
DRAWN	LCB
APPROVED	CTM

HVAC CONTROLS
AHU C & D

M-802

SHEET 15 OF 28

SEQUENCE OF OPERATIONS

AIR HANDLING UNIT – SPLIT-SYSTEM HEAT PUMP WITH REHEAT (SCHEMATIC TYPE E)
(AHU-14) CORRIDOR / TOILETS - AREA F

RUN CONDITIONS - SCHEDULED:
THE UNIT SHALL RUN ACCORDING TO A USER DEFINABLE TIME SCHEDULE IN THE FOLLOWING MODES:
OCCUPIED MODE: THE UNIT SHALL CONTINUOUSLY RUN TO MAINTAIN
A 74°F (ADJ.) COOLING SETPOINT
A 70°F (ADJ.) HEATING SETPOINT.
A 60% RH (ADJ.) DEHUMIDIFICATION SETPOINT.
UNOCCUPIED MODE (NIGHT SETBACK): THE UNIT SHALL CYCLE TO MAINTAIN
A 80°F (ADJ.) COOLING SETPOINT
A 62°F (ADJ.) HEATING SETPOINT
A 60% RH (ADJ.) DEHUMIDIFICATION SETPOINT.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
HIGH SPACE TEMP: IF THE SPACE TEMPERATURE IS GREATER THAN THE COOLING SETPOINT BY A USER DEFINABLE AMOUNT (ADJ.).
LOW SPACE TEMP: IF THE SPACE TEMPERATURE IS LESS THAN THE HEATING SETPOINT BY A USER DEFINABLE AMOUNT (ADJ.).

SMOKE DETECTION:
THE UNIT SHALL SHUT DOWN AND GENERATE AN ALARM UPON RECEIVING A SMOKE DETECTOR

FAN:
THE FAN SHALL RUN ANYTIME THE UNIT IS COMMANDED TO RUN, UNLESS SHUTDOWN ON SAFETIES. TO PREVENT SHORT CYCLING, THE FAN SHALL HAVE A USER DEFINABLE (ADJ.) MINIMUM RUNTIME. THE CONTROLLER SHALL MONITOR THE STATUS OF EACH FAN.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
FAN FAILURE: COMMANDED ON, BUT THE STATUS IS OFF.
FAN IN HAND: COMMANDED OFF, BUT THE STATUS IS ON.

AHU TYPE E	HARDWARE POINTS				SOFTWARE POINTS						
POINT NAME	AI	AO	BI	BO	AV	BV	LOOP	SCHED	TREND	ALARM	GRAPHIC
DISCHARGE AIR TEMP	x								x		x
OUTSIDE AIR TEMP	x								x		x
RETURN AIR TEMP	x								x		x
RETURN AIR CO2 PPM	x								x		x
SPACE HUMIDITY	x								x		x
SPACE TEMP	x								x		x
OUTSIDE AIR DAMPER		x							x		x
DX COMPRESSOR STATUS			x						x		x
FAN STATUS			x						x		x
IONIZATION SYS - FAULT			x						x	x	x
SMOKE DETECTOR			x						x	x	x
DX HTG/CLG STAGE 1				x					x		x
DX HTG/CLG STAGE 2				x					x		x
DX REVERSING VALVE				x					x		x
ELECTRIC HEAT STAGE				x					x		x
FAN START/STOP				x					x		x
COOLING SETPOINT					x				x		x
HEATING SETPOINT					x				x		x
DAT MAX SETPOINT					x				x		x
DAT MIN SETPOINT					x				x		x
DAT NEUTRAL SETPOINT					x				x		x
DEHUMID SETPOINT					x				x		x
CO2 MAX SETPOINT					x				x		x
CO2 MIN SETPOINT					x				x		x
OAD MINIMUM POSITION					x				x		x
SCHEDULE								x			
COMP RUNTIME EXCEED										x	x
FAN FAILURE										x	x
FAN IN HAND										x	x
HIGH DISCHARGE TEMP										x	x
HIGH RETURN AIR TEMP										x	x
HIGH RETURN CO2 LEVEL										x	x
HIGH SPACE HUMIDITY										x	x
HIGH SPACE TEMP										x	x
LOW DISCHARGE TEMP										x	x
LOW RETURN AIR TEMP										x	x
LOW SPACE TEMP										x	x
TOTALS	**6**	**1**	**4**	**5**	**9**	**0**	**0**	**1**	**25**	**13**	**36**

TOTAL HARDWARE (16) **TOTAL SOFTWARE (48)**

HEATING AND COOLING - 2 COMPRESSOR STAGES:
THE CONTROLLER SHALL MEASURE THE SPACE TEMPERATURE AND STAGE THE COMPRESSORS TO MAINTAIN ITS SETPOINT. TO PREVENT SHORT CYCLING, THERE SHALL BE A USER DEFINABLE (ADJ.) DELAY BETWEEN STAGES, AND EACH STAGE SHALL HAVE A USER DEFINABLE (ADJ.) MINIMUM RUNTIME. THE COMPRESSOR SHALL RUN SUBJECT TO ITS OWN INTERNAL SAFETIES AND CONTROLS. THE CONTROLLER SHALL MONITOR THE STATUS OF THE COMPRESSOR.
THE DX COOLING SHALL BE ENABLED WHENEVER:
OUTSIDE AIR TEMPERATURE IS GREATER THAN 60°F (ADJ.),
AND THE SPACE TEMPERATURE IS ABOVE THE HEATING SETPOINT.
AND THE FAN STATUS IS ON,
AND THE THE REVERSING VALVE IS IN COOL MODE.
THE DX HEATING SHALL BE ENABLED WHENEVER:
OUTSIDE AIR TEMPERATURE IS LESS THAN 65°F (ADJ.),
AND THE SPACE TEMPERATURE IS BELOW THE COOLING SETPOINT.
AND THE FAN STATUS IS ON.
AND THE THE REVERSING VALVE IS IN HEAT MODE.
ON MODE CHANGE, THE COMPRESSOR SHALL BE DISABLED AND REMAIN OFF UNTIL AFTER THE REVERSING VALVE HAS CHANGED POSITION.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
COMPRESSOR RUNTIME EXCEEDED: COMPRESSOR RUNTIME EXCEEDS A USER DEFINABLE LIMIT (ADJ.).

SUPPLEMENTAL ELECTRIC HEATING STAGE:
THE CONTROLLER SHALL MEASURE THE SPACE TEMPERATURE AND STAGE THE HEATING TO MAINTAIN ITS HEATING SETPOINT SHOULD THE COMPRESSORS NOT MEET THE HEATING DEMAND. TO PREVENT SHORT CYCLING, THE STAGE SHALL HAVE A USER DEFINABLE (ADJ.) MINIMUM RUNTIME.
THE SUPPLEMENTAL ELECTRIC HEATING SHALL BE ENABLED WHENEVER:
THE HEAT PUMP IS IN HEATING MODE,
AND THE SPACE TEMPERATURE IS 2°F (ADJ.) BELOW THE HEATING SETPOINT.
AND THE FAN STATUS IS ON.

DISCHARGE AIR TEMPERATURE:
THE CONTROLLER SHALL MONITOR THE DISCHARGE AIR TEMPERATURE.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
HIGH DISCHARGE AIR TEMP: IF THE DISCHARGE AIR TEMPERATURE IS GREATER THAN 120°F (ADJ.).
LOW DISCHARGE AIR TEMP: IF THE DISCHARGE AIR TEMPERATURE IS LESS THAN 40°F (ADJ.).

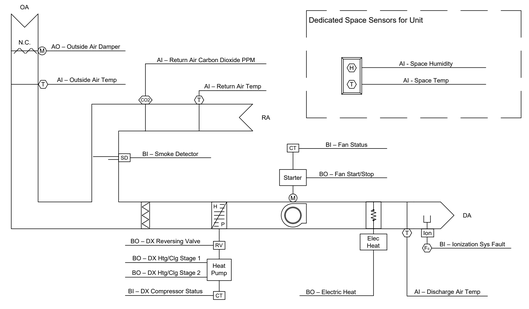
RETURN AIR TEMPERATURE:
THE CONTROLLER SHALL MONITOR THE RETURN AIR TEMPERATURE.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
HIGH RETURN AIR TEMP: IF THE RETURN AIR TEMPERATURE IS GREATER THAN 90°F (ADJ.).
LOW RETURN AIR TEMP: IF THE RETURN AIR TEMPERATURE IS LESS THAN 45°F (ADJ.).

AIR PURIFICATION - IONIZATION SYSTEM:
THE IONIZATION SYSTEM SHALL BE AVAILABLE ANYTIME THE FAN STATUS IS ON. IT IS NOT STARTED BY BAS.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
IONIZATION SYSTEM FAULT: FAN IS COMMANDED ON AND IONIZATION DEVICE FAULT SIGNAL STATUS IS ON.

MINIMUM OUTSIDE AIR VENTILATION:
THE OUTSIDE AIR DAMPER SHALL MAINTAIN A MINIMUM OUTSIDE AIR DAMPER POSITION (ADJ.) WHENEVER THE UNIT RUNS IN OCCUPIED MODE. THE MINIMUM OUTSIDE AIR DAMPER POSITION (DETERMINED BY BALANCING CONTRACTOR) SHALL BE CONFIGURED IN THE CONTROLLER.
THE OUTSIDE AIR DAMPER SHALL FULLY CLOSE WHENEVER THE UNIT RUNS IN UNOCCUPIED MODE OR THE FAN STATUS IS OFF.

DEHUMIDIFICATION - ELECTRIC REHEAT:
THE CONTROLLER SHALL MONITOR THE SPACE HUMIDITY AND MAINTAIN THE DEHUMIDIFICATION SETPOINT. IF THE SPACE HUMIDITY LEVEL IS ABOVE SETPOINT, THE FOLLOWING SHALL OCCUR:
THE FAN SHALL BE COMMANDED TO RUN IN THE OCCUPIED OR UNOCCUPIED MODE.
THE DX COOLING SHALL BE ENABLED WITH BOTH COMPRESSOR STAGES COMMANDED ON.
DURING DEHUMIDIFICATION, THE ELECTRIC HEATING SHALL BE STAGED ON TO MAINTAIN 1°F (ADJ.) LESS THAN THE SPACE COOLING SETPOINT. TO PREVENT SHORT CYCLING, THE STAGE SHALL HAVE A USER DEFINABLE (ADJ.) MINIMUM RUNTIME.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
HIGH SPACE HUMIDITY: IF THE SPACE HUMIDITY IS GREATER THAN 70% (ADJ.).

DEMAND CONTROLLED VENTILATION:
THE CONTROLLER SHALL MEASURE THE RETURN AIR CO2 CONCENTRATION AND INCREASE THE MINIMUM OUTSIDE AIR DAMPER POSITION TO MAINTAIN THE FOLLOWING CALCULATED CO2 SETPOINTS:
MINIMUM CO2 SETPOINT = OUTSIDE AIR CO2 + 600 PPM (ADJ.)
MAXIMUM CO2 SETPOINT = OUTSIDE AIR CO2 + 1000 PPM (ADJ.)
IF RETURN AIR CO2 CONCENTRATION IS BELOW THE MINIMUM CO2 SETPOINT, THE OUTSIDE AIR DAMPER REMAINS AT ITS MINIMUM POSITION.
AS RETURN AIR CO2 CONCENTRATION INCREASES ABOVE THE MINIMUM CO2 SETPOINT, THE OUTSIDE AIR DAMPER SHALL PROPORTIONALLY MODULATE OPEN UNTIL THE DAMPER IS FULLY OPEN AT, OR ABOVE, THE MAXIMUM CO2 SETPOINT.
AS RETURN AIR CO2 CONCENTRATION DECREASES BELOW THE MAXIMUM CO2 SETPOINT, THE OUTSIDE AIR DAMPER SHALL PROPORTIONALLY MODULATE CLOSED UNTIL THE DAMPER IS AT ITS MINIMUM POSITION AT, OR BELOW, THE MINIMUM CO2 SETPOINT.
THE MINIMUM OUTSIDE AIR DAMPER POSITION REQUIRED FOR VENTILATION WILL NOT PREVENT THE OUTSIDE AIR DAMPER FROM OPENING FURTHER IF REQUIRED FOR ECONOMIZER OPERATION.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
HIGH RETURN CARBON DIOXIDE CONCENTRATION: IF THE RETURN AIR CO2 CONCENTRATION IS GREATER THAN THE MAXIMUM CO2 SETPOINT WHEN IN THE OCCUPIED MODE.



E AIR HANDLING UNIT – SPLIT-SYSTEM HEAT PUMP WITH REHEAT
(AHU-14) CORRIDOR / TOILETS – AREA F
TYPICAL FOR (1) UNIT

1

TMG CONSULTING ENGINEERS
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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 033629 ENGINEER CLEMENT T. MILBOURNE

01.25.2023

ISSUED FOR CONSTRUCTION

CHARLOTTE-MECKLENBERG SCHOOLS

NORTHRIDGE MIDDLE SCHOOL HVAC CONTROLS

CHARLOTTE-MECKLENBERG SCHOOLS
7601 THE PLAZA
CHARLOTTE, NC 28215

REVISIONS		
NO.	DESCRIPTION	DATE
	ISSUED FOR CONSTRUCTION	9/27/22
1	REVISION 1	1/13/23
2	REVISION 2	1/25/23

SHEET INFORMATION

DATE	09/27/2022
JOB NUMBER	2202-01-002
DRAWN	LCB
APPROVED	CTM

HVAC CONTROLS
AHU E

M-803

SHEET 16 OF 28

FCU TYPE A

POINT NAME	HARDWARE POINTS AI	AO	BI	BO	SOFTWARE POINTS AV	BV	LOOP	SCHED	TREND	ALARM	GRAPHIC
DISCHARGE AIR TEMP	x								x		x
SPACE TEMP	x								x		x
DT WATER VALVE		x							x		x
FAN STATUS			x						x		x
IONIZATION SYS - FAULT			x						x	x	x
FAN HIGH SPEED				x					x		x
FAN MEDIUM SPEED				x					x		x
FAN LOW SPEED				x					x		x
HEATING SETPOINT					x				x		x
DAT MAX SETPOINT					x				x		x
DAT MIN SETPOINT					x				x		x
CHANGEOVER HTG/CLG						x					
SCHEDULE								x			
FAN FAILURE										x	x
FAN IN HAND										x	x
HIGH DISCHARGE TEMP										x	x
LOW DISCHARGE TEMP										x	x
LOW SPACE TEMP										x	x
TOTALS	**2**	**1**	**2**	**3**	**3**	**1**	**0**	**1**	**11**	**6**	**16**

TOTAL HARDWARE (8) **TOTAL SOFTWARE (22)**

SEQUENCE OF OPERATIONS

FAN COILS – NO OUTSIDE AIR / HEAT ONLY (SCHEMATIC TYPE A)
(FCU-163, 173, 161, 166, 171, 179) BOYS AND GIRLS TOILETS / LOCKER ROOMS – AREA B

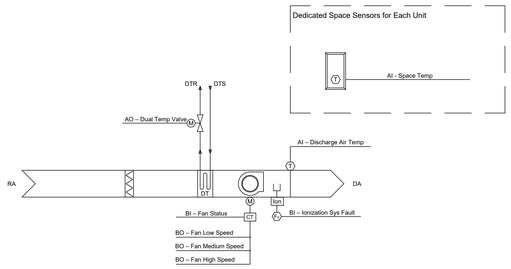
RUN CONDITIONS - SCHEDULED BY BUILDING ZONE:
THE UNIT SHALL RUN ACCORDING TO A USER DEFINABLE TIME SCHEDULE IN THE FOLLOWING MODES:
OCCUPIED MODE: THE UNIT SHALL CONTINUOUSLY RUN TO MAINTAIN
A 70°F (ADJ.) HEATING SETPOINT
UNOCCUPIED MODE (NIGHT SETBACK): THE UNIT SHALL CYCLE TO MAINTAIN
A 62°F (ADJ.) HEATING SETPOINT.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
LOW SPACE TEMP: IF THE SPACE TEMPERATURE IS LESS THAN THE HEATING SETPOINT BY A USER DEFINABLE AMOUNT (ADJ.).

FAN:
THE FAN SHALL RUN ANYTIME THE UNIT IS COMMANDED TO RUN, UNLESS SHUTDOWN ON SAFETIES. TO PREVENT SHORT CYCLING, THE FAN SHALL HAVE A USER DEFINABLE (ADJ.) MINIMUM RUNTIME. THE CONTROLLER SHALL MONITOR THE STATUS OF EACH FAN.
THE FAN SPEEDS SHALL BE INDEXED AS FOLLOWS:
LOW SPEED SHALL RUN WHENEVER THE HEATING LOOP SIGNAL IS 0-25% (ADJ.).
MEDIUM SPEED SHALL RUN WHENEVER THE HEATING LOOP SIGNAL IS 26-74% (ADJ.).
HIGH SPEED SHALL RUN WHENEVER THE HEATING LOOP SIGNAL IS 75-100% (ADJ.).
ALARMS SHALL BE PROVIDED AS FOLLOWS:
FAN FAILURE: COMMANDED ON, BUT THE STATUS IS OFF.
FAN IN HAND: COMMANDED OFF, BUT THE STATUS IS ON.

DUAL TEMPERATURE WATER COIL VALVE:
THE CONTROLLER SHALL MEASURE THE DISCHARGE AIR TEMPERATURE AND MODULATE THE WATER COIL VALVE TO MAINTAIN A VARIABLE DISCHARGE AIR TEMPERATURE SETPOINT THAT WILL CHANGE IN RESPONSE TO SPACE TEMPERATURE CHANGES. (SEE DAT CONTROL SEQUENCE.)
THE WATER COIL VALVE SHALL CLOSE WHENEVER THE CHANGEOVER SIGNAL FROM THE BAS INDICATES COOLING IS AVAILABLE FROM THE CENTRAL PLANT.
THE HW HEATING SHALL BE ENABLED WHENEVER THE CHANGEOVER SIGNAL FROM THE BAS INDICATES HEATING IS AVAILABLE FROM THE CENTRAL PLANT AND THE FAN STATUS IS ON.

DISCHARGE AIR TEMPERATURE (DAT) CONTROL:
THE SPACE TEMPERATURE SHALL BE CONTROLLED BY A CASCADING SEQUENCE THAT MODULATES THE CONTROL VALVE BASED ON A VARIABLE DAT SETPOINT. THE CONTROLLER SHALL MONITOR THE DISCHARGE AIR TEMPERATURE AND THE SPACE TEMPERATURE. THE DAT SETPOINT SHALL BE RESET BASED ON THE SPACE TEMPERATURE DEVIATION FROM SPACE TEMPERATURE SETPOINT.
WHEN HW HEATING IS ENABLED:
THE CONTROLLER SHALL RESET THE DISCHARGE AIR TEMPERATURE UP TO A MAXIMUM DAT SETPOINT OF 85°F (ADJ.) WHEN THE SPACE TEMPERATURE IS 2°F (ADJ.) BELOW THE HEATING SETPOINT. CONVERSELY, AS SPACE TEMPERATURE DEVIATES ABOVE THE HEATING SETPOINT, THE DAT SETPOINT IS RESET DOWN TO THE MINIMUM DAT SETPOINT OF 70°F (ADJ.)
ALARMS SHALL BE PROVIDED AS FOLLOWS:
HIGH DISCHARGE AIR TEMP: IF THE DISCHARGE AIR TEMPERATURE IS MORE THAN 10°F (ADJ.) ABOVE MAXIMUM DAT SETPOINT.
LOW DISCHARGE AIR TEMP: IF THE DISCHARGE AIR TEMPERATURE IS LESS THAN 10°F (ADJ.) BELOW MINIMUM DAT SETPOINT.

AIR PURIFICATION - IONIZATION SYSTEM:
THE IONIZATION SYSTEM SHALL BE AVAILABLE ANYTIME THE FAN STATUS IS ON. IT IS NOT STARTED BY BAS.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
IONIZATION SYSTEM FAULT: FAN IS COMMANDED ON AND IONIZATION DEVICE FAULT SIGNAL STATUS IS ON.



A FAN COILS – NO OUTSIDE AIR / HEAT ONLY
(FCU-163, 173, 161, 166, 171, 179) BOYS AND GIRLS TOILETS / LOCKER ROOMS – AREA B
TYPICAL FOR (6) UNITS

FCU TYPE B

POINT NAME	HARDWARE POINTS AI	AO	BI	BO	SOFTWARE POINTS AV	BV	LOOP	SCHED	TREND	ALARM	GRAPHIC
DISCHARGE AIR TEMP	x								x		x
SPACE HUMIDITY	x								x		x
SPACE TEMP	x								x		x
DT WATER VALVE		x							x		x
FAN STATUS			x						x		x
IONIZATION SYS - FAULT			x						x	x	x
FAN HIGH SPEED				x					x		x
FAN MEDIUM SPEED				x					x		x
FAN LOW SPEED				x					x		x
COOLING SETPOINT					x				x		x
HEATING SETPOINT					x				x		x
DAT MAX SETPOINT					x				x		x
DAT MIN SETPOINT					x				x		x
DAT NEUTRAL SETPOINT					x				x		x
DEHUMID CLG OFFSET SP					x				x		x
DEHUMID SETPOINT					x				x		x
CHANGEOVER HTG/CLG						x					
SCHEDULE								x			
FAN FAILURE										x	x
FAN IN HAND										x	x
HIGH DISCHARGE TEMP										x	x
HIGH SPACE HUMIDITY										x	x
HIGH SPACE TEMP										x	x
LOW DISCHARGE TEMP										x	x
LOW SPACE TEMP										x	x
TOTALS	**3**	**1**	**2**	**3**	**7**	**1**	**0**	**1**	**16**	**8**	**23**

TOTAL HARDWARE (9) **TOTAL SOFTWARE (33)**

SEQUENCE OF OPERATIONS

FAN COILS – NO OUTSIDE AIR (SCHEMATIC TYPE B)
(FCU-183, 281, 292, 342) OFFICES / (FCU-212, 260,310) PREP. / (FCU-284) CORRIDOR / (FCU-338) STORAGE / (FCU-336) DISHWASH / (FCU-230) KILN ROOM

RUN CONDITIONS - SCHEDULED BY BUILDING ZONE:
THE UNIT SHALL RUN ACCORDING TO A USER DEFINABLE TIME SCHEDULE IN THE FOLLOWING MODES:
OCCUPIED MODE: THE UNIT SHALL CONTINUOUSLY RUN TO MAINTAIN
A 74°F (ADJ.) COOLING SETPOINT
A 70°F (ADJ.) HEATING SETPOINT.
A 60% RH (ADJ.) DEHUMIDIFICATION SETPOINT.
UNOCCUPIED MODE (NIGHT SETBACK): THE UNIT SHALL CYCLE TO MAINTAIN
A 80°F (ADJ.) COOLING SETPOINT
A 62°F (ADJ.) HEATING SETPOINT
A 60% RH (ADJ.) DEHUMIDIFICATION SETPOINT.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
HIGH SPACE TEMP: IF THE SPACE TEMPERATURE IS GREATER THAN THE COOLING SETPOINT BY A USER DEFINABLE AMOUNT (ADJ.).
LOW SPACE TEMP: IF THE SPACE TEMPERATURE IS LESS THAN THE HEATING SETPOINT BY A USER DEFINABLE AMOUNT (ADJ.).

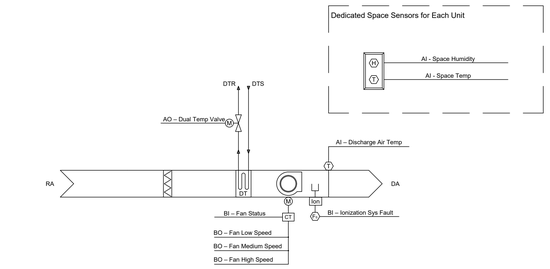
FAN:
THE FAN SHALL RUN ANYTIME THE UNIT IS COMMANDED TO RUN, UNLESS SHUTDOWN ON SAFETIES. TO PREVENT SHORT CYCLING, THE FAN SHALL HAVE A USER DEFINABLE (ADJ.) MINIMUM RUNTIME. THE CONTROLLER SHALL MONITOR THE STATUS OF EACH FAN.
THE FAN SPEEDS SHALL BE INDEXED AS FOLLOWS:
LOW SPEED SHALL RUN WHENEVER THE COOLING OR HEATING LOOP SIGNAL IS 0-25% (ADJ.).
MEDIUM SPEED SHALL RUN WHENEVER THE COOLING OR HEATING LOOP SIGNAL IS 26-74% (ADJ.).
HIGH SPEED SHALL RUN WHENEVER THE COOLING OR HEATING LOOP SIGNAL IS 75-100% (ADJ.).
ALARMS SHALL BE PROVIDED AS FOLLOWS:
FAN FAILURE: COMMANDED ON, BUT THE STATUS IS OFF.
FAN IN HAND: COMMANDED OFF, BUT THE STATUS IS ON.

DUAL TEMPERATURE WATER COIL VALVE:
THE CONTROLLER SHALL MEASURE THE DISCHARGE AIR TEMPERATURE AND MODULATE THE WATER COIL VALVE TO MAINTAIN A VARIABLE DISCHARGE AIR TEMPERATURE SETPOINT THAT WILL CHANGE IN RESPONSE TO SPACE TEMPERATURE CHANGES. (SEE DAT CONTROL SEQUENCE.)
THE CHW COOLING SHALL BE ENABLED WHENEVER:
THE CHANGEOVER SIGNAL FROM THE BAS INDICATES COOLING IS AVAILABLE FROM THE CENTRAL PLANT, AND THE SPACE TEMPERATURE IS ABOVE THE HEATING SETPOINT.
AND THE FAN STATUS IS ON.
THE HW HEATING SHALL BE ENABLED WHENEVER:
THE CHANGEOVER SIGNAL FROM THE BAS INDICATES HEATING IS AVAILABLE FROM THE CENTRAL PLANT, AND THE SPACE TEMPERATURE IS BELOW THE COOLING SETPOINT.
AND THE FAN STATUS IS ON.
THE WATER COIL VALVE SHALL CLOSE WHENEVER THE CHW COOLING OR HW HEATING ARE NOT ENABLED.

DISCHARGE AIR TEMPERATURE (DAT) CONTROL:
THE SPACE TEMPERATURE SHALL BE CONTROLLED BY A CASCADING SEQUENCE THAT MODULATES THE CONTROL VALVE BASED ON A VARIABLE DAT SETPOINT. THE CONTROLLER SHALL MONITOR THE DISCHARGE AIR TEMPERATURE AND THE SPACE TEMPERATURE. THE DAT SETPOINT SHALL BE RESET BASED ON THE SPACE TEMPERATURE DEVIATION FROM SPACE TEMPERATURE SETPOINT.
WHEN CHW COOLING IS ENABLED:
THE CONTROLLER SHALL RESET THE DISCHARGE AIR TEMPERATURE DOWN TO A MINIMUM DAT SETPOINT OF 55°F (ADJ.) WHEN THE SPACE TEMPERATURE IS 2°F (ADJ.) ABOVE THE COOLING SETPOINT. CONVERSELY, AS SPACE TEMPERATURE DEVIATES BELOW THE COOLING SETPOINT, THE DAT SETPOINT IS RESET UP TO THE NEUTRAL DAT SETPOINT OF 70°F (ADJ.).
WHEN HW HEATING IS ENABLED:
THE CONTROLLER SHALL RESET THE DISCHARGE AIR TEMPERATURE UP TO A MAXIMUM DAT SETPOINT OF 85°F (ADJ.) WHEN THE SPACE TEMPERATURE IS 2°F (ADJ.) BELOW THE HEATING SETPOINT. CONVERSELY, AS SPACE TEMPERATURE DEVIATES ABOVE THE HEATING SETPOINT, THE DAT SETPOINT IS RESET DOWN TO THE NEUTRAL DAT SETPOINT OF 70°F (ADJ.).
ALARMS SHALL BE PROVIDED AS FOLLOWS:
HIGH DISCHARGE AIR TEMP: IF THE DISCHARGE AIR TEMPERATURE IS MORE THAN 10°F (ADJ.) ABOVE MAXIMUM DAT SETPOINT.
LOW DISCHARGE AIR TEMP: IF THE DISCHARGE AIR TEMPERATURE IS LESS THAN 10°F (ADJ.) BELOW MINIMUM DAT SETPOINT.

AIR PURIFICATION - IONIZATION SYSTEM:
THE IONIZATION SYSTEM SHALL BE AVAILABLE ANYTIME THE FAN STATUS IS ON. IT IS NOT STARTED BY BAS.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
IONIZATION SYSTEM FAULT: FAN IS COMMANDED ON AND IONIZATION DEVICE FAULT SIGNAL STATUS IS ON.

DEHUMIDIFICATION (LIMITED) - NO REHEAT AVAILABLE:
THE CONTROLLER SHALL MONITOR THE SPACE HUMIDITY AND MAINTAIN THE DEHUMIDIFICATION SETPOINT. IF THE SPACE HUMIDITY LEVEL IS ABOVE SETPOINT WHEN THE CHANGEOVER SIGNAL FROM THE BAS INDICATES COOLING IS AVAILABLE FROM THE CENTRAL PLANT, THE FOLLOWING SHALL OCCUR:
THE FAN SHALL BE COMMANDED TO RUN IN THE OCCUPIED OR UNOCCUPIED MODE.
THE WATER COIL VALVE SHALL MODULATE TO MAINTAIN A 55°F (ADJ.) DISCHARGE AIR TEMPERATURE SETPOINT UNTIL THE SPACE TEMPERATURE FALLS TO A LIMIT OF 2°F (ADJ.) BELOW THE SPACE COOLING SETPOINT. THE WATER COIL VALVE SHOULD THEN CLOSE, ALLOWING THE SPACE TEMPERATURE TO RISE TO A LIMIT OF 1°F ABOVE THE SPACE COOLING SETPOINT. THIS CYCLE SHALL CONTINUE UNTIL THE SPACE HUMIDITY SETPOINT IS SATISFIED.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
HIGH SPACE HUMIDITY: IF THE SPACE HUMIDITY IS GREATER THAN 70% (ADJ.).



B FAN COILS – NO OUTSIDE AIR
(FCU-183, 281, 292, 342) OFFICES / (FCU-212, 260,310) PREP. / (FCU-284) CORR. / (FCU-338) STOR. / (FCU-336) DISHWASH / (FCU-230) KILN
TYPICAL FOR (11) UNITS

FCU TYPE C

POINT NAME	HARDWARE POINTS AI	AO	BI	BO	SOFTWARE POINTS AV	BV	LOOP	SCHED	TREND	ALARM	GRAPHIC
DISCHARGE AIR TEMP	x								x		x
SPACE HUMIDITY	x								x		x
SPACE TEMP	x								x		x
DT WATER VALVE		x							x		x
FAN STATUS			x						x		x
IONIZATION SYS - FAULT			x						x	x	x
SMOKE DETECTOR			x						x	x	x
FAN HIGH SPEED				x					x		x
FAN MEDIUM SPEED				x					x		x
FAN LOW SPEED				x					x		x
COOLING SETPOINT					x				x		x
HEATING SETPOINT					x				x		x
DAT MAX SETPOINT					x				x		x
DAT MIN SETPOINT					x				x		x
DAT NEUTRAL SETPOINT					x				x		x
DEHUMID CLG OFFSET SP					x				x		x
DEHUMID SETPOINT					x				x		x
CHANGEOVER HTG/CLG						x					
SCHEDULE								x			
FAN FAILURE										x	x
FAN IN HAND										x	x
HIGH DISCHARGE TEMP										x	x
HIGH SPACE HUMIDITY										x	x
HIGH SPACE TEMP										x	x
LOW DISCHARGE TEMP										x	x
LOW SPACE TEMP										x	x
TOTALS	**3**	**1**	**3**	**3**	**7**	**1**	**0**	**1**	**17**	**9**	**24**

TOTAL HARDWARE (10) **TOTAL SOFTWARE (35)**

SEQUENCE OF OPERATIONS

FAN COILS – NO OUTSIDE AIR / SMOKE DETECTION (SCHEMATIC TYPE C)
(FCU-180, 274, 151, 326) COMMONS AND CORRIDORS

RUN CONDITIONS - SCHEDULED BY BUILDING ZONE:
THE UNIT SHALL RUN ACCORDING TO A USER DEFINABLE TIME SCHEDULE IN THE FOLLOWING MODES:
OCCUPIED MODE: THE UNIT SHALL CONTINUOUSLY RUN TO MAINTAIN
A 74°F (ADJ.) COOLING SETPOINT
A 70°F (ADJ.) HEATING SETPOINT.
A 60% RH (ADJ.) DEHUMIDIFICATION SETPOINT.
UNOCCUPIED MODE (NIGHT SETBACK): THE UNIT SHALL CYCLE TO MAINTAIN
A 80°F (ADJ.) COOLING SETPOINT
A 62°F (ADJ.) HEATING SETPOINT
A 60% RH (ADJ.) DEHUMIDIFICATION SETPOINT.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
HIGH SPACE TEMP: IF THE SPACE TEMPERATURE IS GREATER THAN THE COOLING SETPOINT BY A USER DEFINABLE AMOUNT (ADJ.).
LOW SPACE TEMP: IF THE SPACE TEMPERATURE IS LESS THAN THE HEATING SETPOINT BY A USER DEFINABLE AMOUNT (ADJ.).

SMOKE DETECTION:
THE UNIT SHALL SHUT DOWN AND GENERATE AN ALARM UPON RECEIVING A SMOKE DETECTOR STATUS.

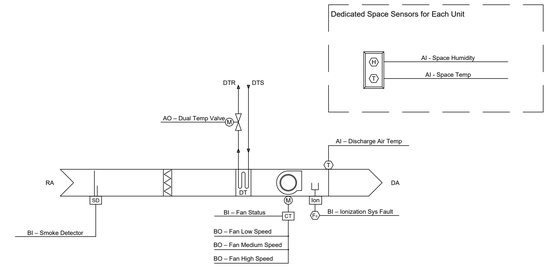
FAN:
THE FAN SHALL RUN ANYTIME THE UNIT IS COMMANDED TO RUN, UNLESS SHUTDOWN ON SAFETIES. TO PREVENT SHORT CYCLING, THE FAN SHALL HAVE A USER DEFINABLE (ADJ.) MINIMUM RUNTIME. THE CONTROLLER SHALL MONITOR THE STATUS OF EACH FAN.
THE FAN SPEEDS SHALL BE INDEXED AS FOLLOWS:
LOW SPEED SHALL RUN WHENEVER THE COOLING OR HEATING LOOP SIGNAL IS 0-25% (ADJ.).
MEDIUM SPEED SHALL RUN WHENEVER THE COOLING OR HEATING LOOP SIGNAL IS 26-74% (ADJ.).
HIGH SPEED SHALL RUN WHENEVER THE COOLING OR HEATING LOOP SIGNAL IS 75-100% (ADJ.).
ALARMS SHALL BE PROVIDED AS FOLLOWS:
FAN FAILURE: COMMANDED ON, BUT THE STATUS IS OFF.
FAN IN HAND: COMMANDED OFF, BUT THE STATUS IS ON.

DUAL TEMPERATURE WATER COIL VALVE:
THE CONTROLLER SHALL MEASURE THE DISCHARGE AIR TEMPERATURE AND MODULATE THE WATER COIL VALVE TO MAINTAIN A VARIABLE DISCHARGE AIR TEMPERATURE SETPOINT THAT WILL CHANGE IN RESPONSE TO SPACE TEMPERATURE CHANGES. (SEE DAT CONTROL SEQUENCE.)
THE CHW COOLING SHALL BE ENABLED WHENEVER:
THE CHANGEOVER SIGNAL FROM THE BAS INDICATES COOLING IS AVAILABLE FROM THE CENTRAL PLANT, AND THE SPACE TEMPERATURE IS ABOVE THE HEATING SETPOINT.
AND THE FAN STATUS IS ON.
THE HW HEATING SHALL BE ENABLED WHENEVER:
THE CHANGEOVER SIGNAL FROM THE BAS INDICATES HEATING IS AVAILABLE FROM THE CENTRAL PLANT, AND THE SPACE TEMPERATURE IS BELOW THE COOLING SETPOINT.
AND THE FAN STATUS IS ON.
THE WATER COIL VALVE SHALL CLOSE WHENEVER THE CHW COOLING OR HW HEATING ARE NOT ENABLED.

DISCHARGE AIR TEMPERATURE (DAT) CONTROL:
THE SPACE TEMPERATURE SHALL BE CONTROLLED BY A CASCADING SEQUENCE THAT MODULATES THE CONTROL VALVE BASED ON A VARIABLE DAT SETPOINT. THE CONTROLLER SHALL MONITOR THE DISCHARGE AIR TEMPERATURE AND THE SPACE TEMPERATURE. THE DAT SETPOINT SHALL BE RESET BASED ON THE SPACE TEMPERATURE DEVIATION FROM SPACE TEMPERATURE SETPOINT.
WHEN CHW COOLING IS ENABLED:
THE CONTROLLER SHALL RESET THE DISCHARGE AIR TEMPERATURE DOWN TO A MINIMUM DAT SETPOINT OF 55°F (ADJ.) WHEN THE SPACE TEMPERATURE IS 2°F (ADJ.) ABOVE THE COOLING SETPOINT. CONVERSELY, AS SPACE TEMPERATURE DEVIATES BELOW THE COOLING SETPOINT, THE DAT SETPOINT IS RESET UP TO THE NEUTRAL DAT SETPOINT OF 70°F (ADJ.).
WHEN HW HEATING IS ENABLED:
THE CONTROLLER SHALL RESET THE DISCHARGE AIR TEMPERATURE UP TO A MAXIMUM DAT SETPOINT OF 85°F (ADJ.) WHEN THE SPACE TEMPERATURE IS 2°F (ADJ.) BELOW THE HEATING SETPOINT. CONVERSELY, AS SPACE TEMPERATURE DEVIATES ABOVE THE HEATING SETPOINT, THE DAT SETPOINT IS RESET DOWN TO THE NEUTRAL DAT SETPOINT OF 70°F (ADJ.).
ALARMS SHALL BE PROVIDED AS FOLLOWS:
HIGH DISCHARGE AIR TEMP: IF THE DISCHARGE AIR TEMPERATURE IS MORE THAN 10°F (ADJ.) ABOVE MAXIMUM DAT SETPOINT.
LOW DISCHARGE AIR TEMP: IF THE DISCHARGE AIR TEMPERATURE IS LESS THAN 10°F (ADJ.) BELOW MINIMUM DAT SETPOINT.

AIR PURIFICATION - IONIZATION SYSTEM:
THE IONIZATION SYSTEM SHALL BE AVAILABLE ANYTIME THE FAN STATUS IS ON. IT IS NOT STARTED BY BAS.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
IONIZATION SYSTEM FAULT: FAN IS COMMANDED ON AND IONIZATION DEVICE FAULT SIGNAL STATUS IS ON.

DEHUMIDIFICATION (LIMITED) - NO REHEAT AVAILABLE:
THE CONTROLLER SHALL MONITOR THE SPACE HUMIDITY AND MAINTAIN THE DEHUMIDIFICATION SETPOINT. IF THE SPACE HUMIDITY LEVEL IS ABOVE SETPOINT WHEN THE CHANGEOVER SIGNAL FROM THE BAS INDICATES COOLING IS AVAILABLE FROM THE CENTRAL PLANT, THE FOLLOWING SHALL OCCUR:
THE FAN SHALL BE COMMANDED TO RUN IN THE OCCUPIED OR UNOCCUPIED MODE.
THE WATER COIL VALVE SHALL MODULATE TO MAINTAIN A 55°F (ADJ.) DISCHARGE AIR TEMPERATURE SETPOINT UNTIL THE SPACE TEMPERATURE FALLS TO A LIMIT OF 2°F (ADJ.) BELOW THE SPACE COOLING SETPOINT. THE WATER COIL VALVE SHOULD THEN CLOSE, ALLOWING THE SPACE TEMPERATURE TO RISE TO A LIMIT OF 1°F ABOVE THE SPACE COOLING SETPOINT. THIS CYCLE SHALL CONTINUE UNTIL THE SPACE HUMIDITY SETPOINT IS SATISFIED.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
HIGH SPACE HUMIDITY: IF THE SPACE HUMIDITY IS GREATER THAN 70% (ADJ.).



C FAN COILS – NO OUTSIDE AIR / SMOKE DETECTION
(FCU-180, 274, 151, 326) COMMONS AND CORRIDORS
TYPICAL FOR (4) UNITS

TMG CONSULTING ENGINEERS
The Milestone Group Consulting Engineers INC
DBA TMG Consulting Engineers
401 Hackberry Lane
Suite 102-77
Denton, Texas 76207
214.505.7671 Phone
Website: WWW.TMG-CE.COM

TMG CONSULTING ENGINEERS C-3646

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 033629 CLEMENT T. MILBOURNE

01.25.2023

ISSUED FOR CONSTRUCTION

CHARLOTTE-MECKLENBERG SCHOOLS

NORTHRIDGE MIDDLE SCHOOL HVAC CONTROLS

CHARLOTTE-MECKLENBERG SCHOOLS
7601 THE PLAZA
CHARLOTTE, NC 28215

REVISIONS

NO	DESCRIPTION	DATE
	ISSUED FOR CONSTRUCTION	9/27/22
1	REVISION 1	1/13/23
2	REVISION 2	1/25/23

SHEET INFORMATION

DATE	09/27/2022
JOB NUMBER	2202-01-002
DRAWN	LCB
APPROVED	CTM

HVAC CONTROLS
FAN COIL UNIT
A, B & C

M-804

SHEET 17 OF 28

SEQUENCE OF OPERATIONS

FAN COILS – MINIMUM OUTSIDE AIR / SMOKE DETECTION (SCHEMATIC TYPE D)
(FCU-322) STAGE / (FCU-181, 226, 275) CORRIDORS

RUN CONDITIONS - SCHEDULED BY BUILDING ZONE:
THE UNIT SHALL RUN ACCORDING TO A USER DEFINABLE TIME SCHEDULE IN THE FOLLOWING MODES:
OCCUPIED MODE: THE UNIT SHALL CONTINUOUSLY RUN TO MAINTAIN
- A 74°F (ADJ.) COOLING SETPOINT
- A 70°F (ADJ.) HEATING SETPOINT.
- A 60% RH (ADJ.) DEHUMIDIFICATION SETPOINT.

UNOCCUPIED MODE (NIGHT SETBACK): THE UNIT SHALL CYCLE TO MAINTAIN
- A 80°F (ADJ.) COOLING SETPOINT
- A 62°F (ADJ.) HEATING SETPOINT
- A 60% RH (ADJ.) DEHUMIDIFICATION SETPOINT.

ALARMS SHALL BE PROVIDED AS FOLLOWS:
- HIGH SPACE TEMP: IF THE SPACE TEMPERATURE IS GREATER THAN THE COOLING SETPOINT BY A USER DEFINABLE AMOUNT (ADJ.).
- LOW SPACE TEMP: IF THE SPACE TEMPERATURE IS LESS THAN THE HEATING SETPOINT BY A USER DEFINABLE AMOUNT (ADJ.).

FREEZE PROTECTION:
THE UNIT SHALL SHUT DOWN AND GENERATE AN ALARM UPON RECEIVING A FREEZESTAT STATUS. WHENEVER THE FREEZESTAT IS ON, THE WATER COIL VALVE SHALL MODULATE OPEN TO MAINTAIN THE MIXED AIR TEMPERATURE AT 70°F (ADJ.). THE OUTSIDE AIR DAMPER SHALL FULLY CLOSE.

FCU TYPE D

	HARDWARE POINTS				SOFTWARE POINTS						
POINT NAME	AI	AO	BI	BO	AV	BV	LOOP	SCHED	TREND	ALARM	GRAPHIC
DISCHARGE AIR TEMP	x								x		x
MIXED AIR TEMP	x								x		x
SPACE CO2 PPM	x								x		x
SPACE HUMIDITY	x								x		x
SPACE TEMP	x								x		x
DT WATER VALVE		x							x		x
FAN STATUS			x						x		x
FREEZESTAT			x						x	x	x
IONIZATION SYS - FAULT			x						x	x	x
SMOKE DETECTOR			x						x	x	x
FAN HIGH SPEED				x					x		x
FAN MEDIUM SPEED				x					x		x
FAN LOW SPEED				x					x		x
OA ISOLATION DAMPER				x					x		x
COOLING SETPOINT					x				x		x
HEATING SETPOINT					x				x		x
DAT MAX SETPOINT					x				x		x
DAT MIN SETPOINT					x				x		x
DAT NEUTRAL SETPOINT					x				x		x
DEHUMID CLG OFFSET SP					x				x		x
DEHUMID SETPOINT					x				x		x
CO2 MAX SETPOINT					x				x		x
CO2 MIN SETPOINT					x				x		x
CHANGEOVER HTG/CLG						x					
SCHEDULE								x			
FAN FAILURE										x	x
FAN IN HAND										x	x
HIGH DISCHARGE TEMP										x	x
HIGH MIXED AIR TEMP										x	x
HIGH SPACE CO2 LEVEL										x	x
HIGH SPACE HUMIDITY										x	x
HIGH SPACE TEMP										x	x
LOW DISCHARGE TEMP										x	x
LOW MIXED AIR TEMP										x	x
LOW SPACE TEMP										x	x
TOTALS	**5**	**1**	**4**	**4**	**9**	**1**	**0**	**1**	**23**	**13**	**33**
TOTAL HARDWARE (14)									**TOTAL SOFTWARE (47)**		

SMOKE DETECTION:
THE UNIT SHALL SHUT DOWN AND GENERATE AN ALARM UPON RECEIVING A SMOKE DETECTOR STATUS.

FAN:
THE FAN SHALL RUN ANYTIME THE UNIT IS COMMANDED TO RUN, UNLESS SHUTDOWN ON SAFETIES. TO PREVENT SHORT CYCLING, THE FAN SHALL HAVE A USER DEFINABLE (ADJ.) MINIMUM RUNTIME. THE CONTROLLER SHALL MONITOR THE STATUS OF EACH FAN.
THE FAN SPEEDS SHALL BE INDEXED AS FOLLOWS:
- LOW SPEED SHALL RUN WHENEVER THE COOLING OR HEATING LOOP SIGNAL IS 0-25% (ADJ.) AND THE DEMAND CONTROLLED VENTILATION SEQUENCE DOES NOT REQUIRE INCREASED VENTILATION.
- MEDIUM SPEED SHALL RUN WHENEVER THE COOLING OR HEATING LOOP SIGNAL IS 26-74% (ADJ.) AND THE DEMAND CONTROLLED VENTILATION SEQUENCE DOES NOT REQUIRE INCREASED VENTILATION.
- HIGH SPEED SHALL RUN WHENEVER THE COOLING OR HEATING LOOP SIGNAL IS 75-100% (ADJ.) OR THE DEMAND CONTROLLED VENTILATION SEQUENCE REQUIRES INCREASED VENTILATION.

ALARMS SHALL BE PROVIDED AS FOLLOWS:
- FAN FAILURE: COMMANDED ON, BUT THE STATUS IS OFF.
- FAN IN HAND: COMMANDED OFF, BUT THE STATUS IS ON.

DUAL TEMPERATURE WATER COIL VALVE:
THE CONTROLLER SHALL MEASURE THE DISCHARGE AIR TEMPERATURE AND MODULATE THE WATER COIL VALVE TO MAINTAIN A VARIABLE DISCHARGE AIR TEMPERATURE SETPOINT THAT WILL CHANGE IN RESPONSE TO SPACE TEMPERATURE CHANGES. (SEE DAT CONTROL SEQUENCE.)
THE CHW COOLING SHALL BE ENABLED WHENEVER:
- THE CHANGEOVER SIGNAL FROM THE BAS INDICATES COOLING IS AVAILABLE FROM THE CENTRAL PLANT,
- AND THE SPACE TEMPERATURE IS ABOVE THE HEATING SETPOINT.
- AND THE FAN STATUS IS ON.

THE HW HEATING SHALL BE ENABLED WHENEVER:
- THE CHANGEOVER SIGNAL FROM THE BAS INDICATES HEATING IS AVAILABLE FROM THE CENTRAL PLANT,
- AND THE SPACE TEMPERATURE IS BELOW THE COOLING SETPOINT.
- AND THE FAN STATUS IS ON.

THE WATER COIL VALVE SHALL CLOSE WHENEVER THE CHW COOLING OR THE HW HEATING ARE NOT ENABLED AND THE FREEZESTAT STATUS IS OFF. THE WATER COIL VALVE SHALL MODULATE OPEN AS REQUIRED BY FREEZE PROTECTION SEQUENCE.

DISCHARGE AIR TEMPERATURE (DAT) CONTROL:
THE SPACE TEMPERATURE SHALL BE CONTROLLED BY A CASCADING SEQUENCE THAT MODULATES THE CONTROL VALVE BASED ON A VARIABLE DAT SETPOINT. THE CONTROLLER SHALL MONITOR THE DISCHARGE AIR TEMPERATURE AND THE SPACE TEMPERATURE. THE DAT SETPOINT SHALL BE RESET BASED ON THE SPACE TEMPERATURE DEVIATION FROM SPACE TEMPERATURE SETPOINT.
WHEN CHW COOLING IS ENABLED:
- THE CONTROLLER SHALL RESET THE DISCHARGE AIR TEMPERATURE DOWN TO A MINIMUM DAT SETPOINT OF 55°F (ADJ.) WHEN THE SPACE TEMPERATURE IS 2°F (ADJ.) ABOVE THE COOLING SETPOINT. CONVERSELY, AS SPACE TEMPERATURE DEVIATES BELOW THE COOLING SETPOINT, THE DAT SETPOINT IS RESET UP TO THE NEUTRAL DAT SETPOINT OF 70°F (ADJ.).

WHEN HW HEATING IS ENABLED:
- THE CONTROLLER SHALL RESET THE DISCHARGE AIR TEMPERATURE UP TO A MAXIMUM DAT SETPOINT OF 85°F (ADJ.) WHEN THE SPACE TEMPERATURE IS 2°F (ADJ.) BELOW THE HEATING SETPOINT. CONVERSELY, AS SPACE TEMPERATURE DEVIATES ABOVE THE HEATING SETPOINT, THE DAT SETPOINT IS RESET DOWN TO THE NEUTRAL DAT SETPOINT OF 70°F (ADJ.).

ALARMS SHALL BE PROVIDED AS FOLLOWS:
- HIGH DISCHARGE AIR TEMP: IF THE DISCHARGE AIR TEMPERATURE IS MORE THAN 10°F (ADJ.) ABOVE MAXIMUM DAT SETPOINT.
- LOW DISCHARGE AIR TEMP: IF THE DISCHARGE AIR TEMPERATURE IS LESS THAN 10°F (ADJ.) BELOW MINIMUM DAT SETPOINT.

AIR PURIFICATION - IONIZATION SYSTEM:
THE IONIZATION SYSTEM SHALL BE AVAILABLE ANYTIME THE FAN STATUS IS ON. IT IS NOT STARTED BY BAS.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
- IONIZATION SYSTEM FAULT: FAN IS COMMANDED ON AND IONIZATION DEVICE FAULT SIGNAL STATUS IS ON.

MINIMUM OUTSIDE AIR VENTILATION:
THE OUTSIDE AIR ISOLATION DAMPER SHALL OPEN WHENEVER THE UNIT RUNS IN OCCUPIED MODE.
THE OUTSIDE AIR ISOLATION DAMPER SHALL CLOSE WHENEVER:
- THE UNIT RUNS IN UNOCCUPIED MODE,
- OR MIXED AIR TEMPERATURE DROPS FROM 45°F TO 40°F (ADJ.),
- OR THE FAN STATUS IS OFF,
- OR THE FREEZESTAT IS ON.

ALARMS SHALL BE PROVIDED AS FOLLOWS:
- HIGH MIXED AIR TEMP: IF THE MIXED AIR TEMPERATURE IS GREATER THAN 90°F (ADJ.).
- LOW MIXED AIR TEMP: IF THE MIXED AIR TEMPERATURE IS LESS THAN 45°F (ADJ.).

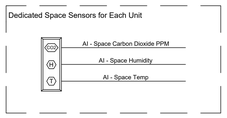
DEHUMIDIFICATION (LIMITED) - NO REHEAT AVAILABLE:
THE CONTROLLER SHALL MONITOR THE SPACE HUMIDITY AND MAINTAIN THE DEHUMIDIFICATION SETPOINT. IF THE SPACE HUMIDITY LEVEL IS ABOVE SETPOINT WHEN THE CHANGEOVER SIGNAL FROM THE BAS INDICATES COOLING IS AVAILABLE FROM THE CENTRAL PLANT, THE FOLLOWING SHALL OCCUR:
- THE FAN SHALL BE COMMANDED TO RUN IN THE OCCUPIED OR UNOCCUPIED MODE.
- THE WATER COIL VALVE SHALL MODULATE TO MAINTAIN A 55°F (ADJ.) DISCHARGE AIR TEMPERATURE SETPOINT UNTIL THE SPACE TEMPERATURE FALLS TO A LIMIT OF 2°F (ADJ.) BELOW THE SPACE COOLING SETPOINT. THE WATER COIL VALVE SHOULD THEN CLOSE, ALLOWING THE SPACE TEMPERATURE TO RISE TO A LIMIT OF 1°F ABOVE THE SPACE COOLING SETPOINT. THIS CYCLE SHALL CONTINUE UNTIL THE SPACE HUMIDITY SETPOINT IS SATISFIED.

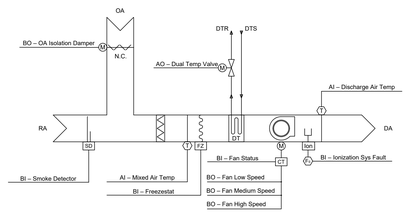
ALARMS SHALL BE PROVIDED AS FOLLOWS:
- HIGH SPACE HUMIDITY: IF THE SPACE HUMIDITY IS GREATER THAN 70% (ADJ.).

DEMAND CONTROLLED VENTILATION:
THE CONTROLLER SHALL MEASURE THE SPACE CO2 CONCENTRATION AND INCREASE THE FANSPEED TO MAINTAIN THE FOLLOWING CALCULATED CO2 SETPOINTS:
- MINIMUM CO2 SETPOINT = OUTSIDE AIR CO2 + 600 PPM (ADJ.)
- MAXIMUM CO2 SETPOINT = OUTSIDE AIR CO2 + 1000 PPM (ADJ.)

IF SPACE CO2 CONCENTRATION IS BELOW THE MINIMUM CO2 SETPOINT, THE FAN SHALL RUN AT THE CONFIGURED SPEED.
IF SPACE CO2 CONCENTRATION INCREASES ABOVE THE MINIMUM CO2 SETPOINT + 200 PPM (ADJ.), THE FAN SHALL RUN AT HIGH SPEED FOR INCREASED VENTILATION.

ALARMS SHALL BE PROVIDED AS FOLLOWS:
- HIGH SPACE CARBON DIOXIDE CONCENTRATION: IF THE SPACE CO2 CONCENTRATIONS IS GREATER THAN THE MAXIMUM CO2 SETPOINT WHEN IN THE OCCUPIED MODE.





D FAN COILS – MINIMUM OUTSIDE AIR / SMOKE DETECTION
(FCU-332) STAGE / (FCU-181, 226, 275) CORRIDORS
TYPICAL FOR (4) UNITS

SEQUENCE OF OPERATIONS

FAN COILS – ECONOMIZER (SCHEMATIC TYPE E)
(FCU-189) OFFICE - AREA B

RUN CONDITIONS - SCHEDULED BY BUILDING ZONE:
THE UNIT SHALL RUN ACCORDING TO A USER DEFINABLE TIME SCHEDULE IN THE FOLLOWING MODES:
OCCUPIED MODE: THE UNIT SHALL CONTINUOUSLY RUN TO MAINTAIN
- A 74°F (ADJ.) COOLING SETPOINT
- A 70°F (ADJ.) HEATING SETPOINT.
- A 60% RH (ADJ.) DEHUMIDIFICATION SETPOINT.

UNOCCUPIED MODE (NIGHT SETBACK): THE UNIT SHALL CYCLE TO MAINTAIN
- A 80°F (ADJ.) COOLING SETPOINT
- A 62°F (ADJ.) HEATING SETPOINT
- A 60% RH (ADJ.) DEHUMIDIFICATION SETPOINT.

ALARMS SHALL BE PROVIDED AS FOLLOWS:
- HIGH SPACE TEMP: IF THE SPACE TEMPERATURE IS GREATER THAN THE COOLING SETPOINT BY A USER DEFINABLE AMOUNT (ADJ.).
- LOW SPACE TEMP: IF THE SPACE TEMPERATURE IS LESS THAN THE HEATING SETPOINT BY A USER DEFINABLE AMOUNT (ADJ.).

FREEZE PROTECTION:
THE UNIT SHALL SHUT DOWN AND GENERATE AN ALARM UPON RECEIVING A FREEZESTAT STATUS. WHENEVER THE FREEZESTAT IS ON, THE WATER COIL VALVE SHALL MODULATE OPEN TO MAINTAIN THE MIXED AIR TEMPERATURE AT 70°F (ADJ.). THE RETURN AIR DAMPER SHALL FULLY OPEN. THE OUTSIDE AIR DAMPER SHALL FULLY CLOSE.

FCU TYPE E

	HARDWARE POINTS				SOFTWARE POINTS						
POINT NAME	AI	AO	BI	BO	AV	BV	LOOP	SCHED	TREND	ALARM	GRAPHIC
DISCHARGE AIR TEMP	x								x		x
MIXED AIR TEMP	x								x		x
SPACE CO2 PPM	x								x		x
SPACE HUMIDITY	x								x		x
SPACE TEMP	x								x		x
DT WATER VALVE		x							x		x
OUTSIDE AIR DAMPER		x							x		x
RETURN AIR DAMPER		x							x		x
FAN STATUS			x						x		x
FREEZESTAT			x						x	x	x
IONIZATION SYS - FAULT			x						x	x	x
FAN HIGH SPEED				x					x		x
FAN MEDIUM SPEED				x					x		x
FAN LOW SPEED				x					x		x
COOLING SETPOINT					x				x		x
HEATING SETPOINT					x				x		x
DAT MAX SETPOINT					x				x		x
DAT MIN SETPOINT					x				x		x
DAT NEUTRAL SETPOINT					x				x		x
DEHUMID CLG OFFSET SP					x				x		x
DEHUMID SETPOINT					x				x		x
CO2 MAX SETPOINT					x				x		x
CO2 MIN SETPOINT					x				x		x
OAD MINIMUM POSITION					x				x		x
CHANGEOVER HTG/CLG						x					
SCHEDULE								x			
FAN FAILURE										x	x
FAN IN HAND										x	x
HIGH DISCHARGE TEMP										x	x
HIGH MIXED AIR TEMP										x	x
HIGH SPACE CO2 LEVEL										x	x
HIGH SPACE HUMIDITY										x	x
HIGH SPACE TEMP										x	x
LOW DISCHARGE TEMP										x	x
LOW MIXED AIR TEMP										x	x
LOW SPACE TEMP										x	x
TOTALS	**5**	**3**	**3**	**3**	**10**	**1**	**0**	**1**	**24**	**12**	**34**
TOTAL HARDWARE (14)									**TOTAL SOFTWARE (48)**		

FAN:
THE FAN SHALL RUN ANYTIME THE UNIT IS COMMANDED TO RUN, UNLESS SHUTDOWN ON SAFETIES. TO PREVENT SHORT CYCLING, THE FAN SHALL HAVE A USER DEFINABLE (ADJ.) MINIMUM RUNTIME. THE CONTROLLER SHALL MONITOR THE STATUS OF EACH FAN.
THE FAN SPEEDS SHALL BE INDEXED AS FOLLOWS:
- LOW SPEED SHALL RUN WHENEVER THE COOLING OR HEATING LOOP SIGNAL IS 0-25% (ADJ.) AND THE DEMAND CONTROLLED VENTILATION SEQUENCE DOES NOT REQUIRE INCREASED VENTILATION.
- MEDIUM SPEED SHALL RUN WHENEVER THE COOLING OR HEATING LOOP SIGNAL IS 26-74% (ADJ.) AND THE DEMAND CONTROLLED VENTILATION SEQUENCE DOES NOT REQUIRE INCREASED VENTILATION.
- HIGH SPEED SHALL RUN WHENEVER THE COOLING OR HEATING LOOP SIGNAL IS 75-100% (ADJ.) OR THE DEMAND CONTROLLED VENTILATION SEQUENCE REQUIRES INCREASED VENTILATION.

ALARMS SHALL BE PROVIDED AS FOLLOWS:
- FAN FAILURE: COMMANDED ON, BUT THE STATUS IS OFF.
- FAN IN HAND: COMMANDED OFF, BUT THE STATUS IS ON.

DUAL TEMPERATURE WATER COIL VALVE:
THE CONTROLLER SHALL MEASURE THE DISCHARGE AIR TEMPERATURE AND MODULATE THE WATER COIL VALVE TO MAINTAIN A VARIABLE DISCHARGE AIR TEMPERATURE SETPOINT THAT WILL CHANGE IN RESPONSE TO SPACE TEMPERATURE CHANGES. (SEE DAT CONTROL SEQUENCE.)
THE CHW COOLING SHALL BE ENABLED WHENEVER:
- THE CHANGEOVER SIGNAL FROM THE BAS INDICATES COOLING IS AVAILABLE FROM THE CENTRAL PLANT,
- AND THE ECONOMIZER IS DISABLED OR FULLY OPEN.
- AND THE SPACE TEMPERATURE IS ABOVE THE HEATING SETPOINT.
- AND THE FAN STATUS IS ON.

THE HW HEATING SHALL BE ENABLED WHENEVER:
- THE CHANGEOVER SIGNAL FROM THE BAS INDICATES HEATING IS AVAILABLE FROM THE CENTRAL PLANT,
- AND THE SPACE TEMPERATURE IS BELOW THE COOLING SETPOINT.
- AND THE FAN STATUS IS ON.

THE WATER COIL VALVE SHALL CLOSE WHENEVER THE CHW COOLING OR THE HW HEATING ARE NOT ENABLED AND THE FREEZESTAT STATUS IS OFF. THE WATER COIL VALVE SHALL MODULATE OPEN AS REQUIRED BY FREEZE PROTECTION SEQUENCE.

DISCHARGE AIR TEMPERATURE (DAT) CONTROL:
THE SPACE TEMPERATURE SHALL BE CONTROLLED BY A CASCADING SEQUENCE THAT MODULATES THE CONTROL VALVE BASED ON A VARIABLE DAT SETPOINT. THE CONTROLLER SHALL MONITOR THE DISCHARGE AIR TEMPERATURE AND THE SPACE TEMPERATURE. THE DAT SETPOINT SHALL BE RESET BASED ON THE SPACE TEMPERATURE DEVIATION FROM SPACE TEMPERATURE SETPOINT.
WHEN CHW COOLING IS ENABLED:
- THE CONTROLLER SHALL RESET THE DISCHARGE AIR TEMPERATURE DOWN TO A MINIMUM DAT SETPOINT OF 55°F (ADJ.) WHEN THE SPACE TEMPERATURE IS 2°F (ADJ.) ABOVE THE COOLING SETPOINT. CONVERSELY, AS SPACE TEMPERATURE DEVIATES BELOW THE COOLING SETPOINT, THE DAT SETPOINT IS RESET UP TO THE NEUTRAL DAT SETPOINT OF 70°F (ADJ.).

WHEN HW HEATING IS ENABLED:
- THE CONTROLLER SHALL RESET THE DISCHARGE AIR TEMPERATURE UP TO A MAXIMUM DAT SETPOINT OF 85°F (ADJ.) WHEN THE SPACE TEMPERATURE IS 2°F (ADJ.) BELOW THE HEATING SETPOINT. CONVERSELY, AS SPACE TEMPERATURE DEVIATES ABOVE THE HEATING SETPOINT, THE DAT SETPOINT IS RESET DOWN TO THE NEUTRAL DAT SETPOINT OF 70°F (ADJ.).

ALARMS SHALL BE PROVIDED AS FOLLOWS:
- HIGH DISCHARGE AIR TEMP: IF THE DISCHARGE AIR TEMPERATURE IS MORE THAN 10°F (ADJ.) ABOVE MAXIMUM DAT SETPOINT.
- LOW DISCHARGE AIR TEMP: IF THE DISCHARGE AIR TEMPERATURE IS LESS THAN 10°F (ADJ.) BELOW MINIMUM DAT SETPOINT.

AIR PURIFICATION - IONIZATION SYSTEM:
THE IONIZATION SYSTEM SHALL BE AVAILABLE ANYTIME THE FAN STATUS IS ON. IT IS NOT STARTED BY BAS.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
- IONIZATION SYSTEM FAULT: FAN IS COMMANDED ON AND IONIZATION DEVICE FAULT SIGNAL STATUS IS ON.

MINIMUM OUTSIDE AIR VENTILATION:
THE MIXED AIR DAMPERS (ECONOMIZER DAMPERS) SHALL BE SEQUENCED FOR BOTH THE RETURN AIR AND OUTSIDE AIR DAMPERS TO INVERSELY MODULATE AT THE SAME TIME.
THE MIXED AIR DAMPERS SHALL MAINTAIN A MINIMUM OUTSIDE AIR DAMPER POSITION (ADJ.) WHENEVER THE UNIT RUNS IN OCCUPIED MODE. THE MINIMUM OUTSIDE AIR DAMPER POSITION (DETERMINED BY BALANCING CONTRACTOR) SHALL BE CONFIGURED IN THE CONTROLLER.
THE OUTSIDE AIR DAMPER SHALL FULLY CLOSE AND THE RETURN AIR DAMPER SHALL OPEN WHENEVER:
- THE UNIT RUNS IN UNOCCUPIED MODE,
- OR MIXED AIR TEMPERATURE DROPS FROM 45°F TO 40°F (ADJ.),
- OR THE FAN STATUS IS OFF,
- OR THE FREEZESTAT IS ON.

ALARMS SHALL BE PROVIDED AS FOLLOWS:
- HIGH MIXED AIR TEMP: IF THE MIXED AIR TEMPERATURE IS GREATER THAN 90°F (ADJ.).
- LOW MIXED AIR TEMP: IF THE MIXED AIR TEMPERATURE IS LESS THAN 45°F (ADJ.).

ECONOMIZER:
THE CONTROLLER SHALL MEASURE THE MIXED AIR TEMPERATURE AND MODULATE THE ECONOMIZER DAMPERS IN SEQUENCE, AS A FIRST STAGE OF COOLING, TO MAINTAIN A MIXED AIR SETPOINT THAT IS 3°F (ADJ.) LESS THAN THE DISCHARGE AIR SETPOINT. IF THE DISCHARGE AIR TEMPERATURE REMAINS ABOVE DISCHARGE AIR SETPOINT AFTER THE ECONOMIZER REACHES 100%, THE WATER COIL VALVE SHALL MODULATE OPEN IN SEQUENCE, AS A SECOND STAGE OF COOLING.
THE ECONOMIZER SHALL BE ENABLED WHENEVER:
- OUTSIDE AIR ENTHALPY IS LESS THAN 28 BTU/LB (ADJ.),
- AND OUTSIDE AIR TEMPERATURE IS LESS THAN THE SPACE AIR TEMPERATURE,
- AND THE FAN STATUS IS ON.

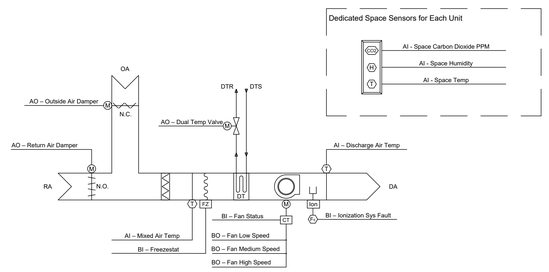
DEHUMIDIFICATION (LIMITED) - NO REHEAT AVAILABLE:
THE CONTROLLER SHALL MONITOR THE SPACE HUMIDITY AND MAINTAIN THE DEHUMIDIFICATION SETPOINT. IF THE SPACE HUMIDITY LEVEL IS ABOVE SETPOINT WHEN THE CHANGEOVER SIGNAL FROM THE BAS INDICATES COOLING IS AVAILABLE FROM THE CENTRAL PLANT, THE FOLLOWING SHALL OCCUR:
- THE FAN SHALL BE COMMANDED TO RUN IN THE OCCUPIED OR UNOCCUPIED MODE.
- THE WATER COIL VALVE SHALL MODULATE TO MAINTAIN A 55°F (ADJ.) DISCHARGE AIR TEMPERATURE SETPOINT UNTIL THE SPACE TEMPERATURE FALLS TO A LIMIT OF 2°F (ADJ.) BELOW THE SPACE COOLING SETPOINT. THE WATER COIL VALVE SHOULD THEN CLOSE, ALLOWING THE SPACE TEMPERATURE TO RISE TO A LIMIT OF 1°F ABOVE THE SPACE COOLING SETPOINT. THIS CYCLE SHALL CONTINUE UNTIL THE SPACE HUMIDITY SETPOINT IS SATISFIED.

ALARMS SHALL BE PROVIDED AS FOLLOWS:
- HIGH SPACE HUMIDITY: IF THE SPACE HUMIDITY IS GREATER THAN 70% (ADJ.).

DEMAND CONTROLLED VENTILATION:
THE CONTROLLER SHALL MEASURE THE SPACE CO2 CONCENTRATION AND INCREASE THE FAN SPEED AND MINIMUM OUTSIDE AIR DAMPER POSITION TO MAINTAIN THE FOLLOWING CALCULATED CO2 SETPOINTS:
- MINIMUM CO2 SETPOINT = OUTSIDE AIR CO2 + 600 PPM (ADJ.)
- MAXIMUM CO2 SETPOINT = OUTSIDE AIR CO2 + 1000 PPM (ADJ.)

IF SPACE CO2 CONCENTRATION IS BELOW THE MINIMUM CO2 SETPOINT, THE FAN SHALL RUN AT THE CONFIGURED SPEED AND THE OUTSIDE AIR DAMPER SHALL OPEN TO THE MINIMUM POSITION.
IF SPACE CO2 CONCENTRATION INCREASES ABOVE THE MINIMUM CO2 SETPOINT + 200 PPM (ADJ.), THE FAN SHALL RUN AT HIGH SPEED FOR INCREASED VENTILATION.
AS SPACE CO2 CONCENTRATION INCREASES ABOVE THE MINIMUM CO2 SETPOINT, THE OUTSIDE AIR DAMPER SHALL PROPORTIONALLY MODULATE OPEN UNTIL THE DAMPER IS FULLY OPEN AT, OR ABOVE, THE MAXIMUM CO2 SETPOINT.
AS SPACE CO2 CONCENTRATION DECREASES BELOW THE MAXIMUM CO2 SETPOINT, THE OUTSIDE AIR DAMPER SHALL PROPORTIONALLY MODULATE CLOSED UNTIL THE DAMPER IS AT THE MINIMUM POSITION AT, OR BELOW, THE MINIMUM CO2 SETPOINT.
THE MINIMUM OUTSIDE AIR DAMPER POSITION REQUIRED FOR VENTILATION WILL NOT PREVENT THE OUTSIDE AIR DAMPER FROM OPENING FURTHER IF REQUIRED FOR ECONOMIZER OPERATION.

ALARMS SHALL BE PROVIDED AS FOLLOWS:
- HIGH SPACE CARBON DIOXIDE CONCENTRATION: IF THE SPACE CO2 CONCENTRATION IS GREATER THAN THE MAXIMUM CO2 SETPOINT WHEN IN THE OCCUPIED MODE.



E FAN COIL – ECONOMIZER
(FCU-189) OFFICE – AREA B
TYPICAL FOR (1) UNIT

1

TMG CONSULTING ENGINEERS
The Mitchell Gray Consulting Engineers Inc
401 Hackberry Lane
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704.905.7641 Phone
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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL C-3646 CHARLOTTE, NC

NORTH CAROLINA REGISTERED SEAL 033629 ENGINEER CLIFFORD T. MILDENBERG

01.25.2023

ISSUED FOR CONSTRUCTION

CHARLOTTE-MECKLENBERG SCHOOLS

NORTHRIDGE MIDDLE SCHOOL HVAC CONTROLS

CHARLOTTE-MECKLENBERG SCHOOLS
700 THE PLAZA
CHARLOTTE, NC 28215

REVISIONS

NO.	DESCRIPTION	DATE
1	ISSUED FOR CONSTRUCTION	9/27/22
2	REVISION 1	1/13/23
3	REVISION 2	1/25/23

SHEET INFORMATION

DATE	09/27/2022
JOB NUMBER	2202-01-002
DRAWN	LCB
APPROVED	CTM

HVAC CONTROLS
FAN COIL UNIT
D & E

M-805

SHEET 18 OF 28

SEQUENCE OF OPERATIONS

FANS – (TOILET EXHAUST): SINGLE PIR VACANCY LIGHT SWITCH INTERLOCK (SCHEMATIC TYPE A)
(EF-108, 118, 121, 123, 137, 138, 160, 170, 190, 197, 198, 203, 216, 245, 246, 251, 264, 295, 296, 301, 314, 341) TOILETS / (EF-122, 339) JANITOR

RUN CONDITIONS - SCHEDULED BY BUILDING ZONE / INTERLOCKED:
THE EXHAUST FAN SHALL BE ENABLED THROUGH THE CONTROLLER TO RUN ACCORDING TO A USER DEFINABLE TIME SCHEDULE IN THE FOLLOWING MODES:
OCCUPIED MODE: THE FAN SHALL RUN WHEN THE OCCUPANT TURNS ON THE LOCAL PIR VACANCY LIGHT SWITCH FOR THE FAN SERVICE AREA. THE FAN SHALL STOP WHEN THE PIR VACANCY SENSOR NO LONGER DETECTS OCCUPANCY AFTER A USER DEFINABLE TIME DELAY.
UNOCCUPIED MODE: THE FAN SHALL STOP.

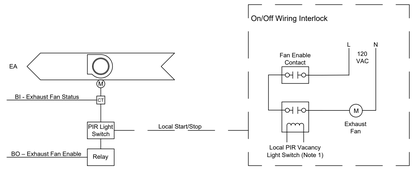
FAN STATUS:
THE CONTROLLER SHALL MONITOR THE STATUS OF THE FAN.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
FAN IN HAND: COMMANDED OFF, BUT THE STATUS IS ON.

NOTES
1. CONTRACTOR TO SELECT THE CORRECT PASSIVE INFRARED (PIR) VACANCY LIGHT SWITCH SENSOR FOR THE APPLICATION AND SUBMIT TO ENGINEER FOR APPROVAL.

FAN TYPE A

POINT NAME	HARDWARE POINTS AI	AO	BI	BO	SOFTWARE POINTS AV	BV	LOOP	SCHED	TREND	ALARM	GRAPHIC
EXHAUST FAN STATUS			x						x		x
EXHAUST FAN ENABLE				x					x		x
SCHEDULE								x			
FAN IN HAND										x	x
TOTALS	0	0	1	1	0	0	0	1	2	1	3

TOTAL HARDWARE (2) TOTAL SOFTWARE (4)



A — FANS – (TOILET EXHAUST): SINGLE PIR VACANCY LIGHT SWITCH INTERLOCK
(EF-108, 118, 121, 123, 137, 138, 160, 170, 190, 197, 198, 203, 216, 245, 246, 251, 264, 295, 296, 301, 314, 341) TOILETS / (EF-122, 339) JANITOR
TYPICAL FOR (24) FANS

SEQUENCE OF OPERATIONS

FAN – (USER DEMAND VENTILATION): LOCAL SWITCH INTERLOCK (SCHEMATIC TYPE B)
(EF-178, 225, 273, 288, 289, 323, 329) STORAGE

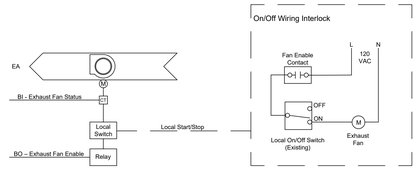
RUN CONDITIONS - SCHEDULED BY BUILDING ZONE / INTERLOCKED:
THE EXHAUST FAN SHALL BE ENABLED THROUGH THE CONTROLLER TO RUN ACCORDING TO A USER DEFINABLE TIME SCHEDULE IN THE FOLLOWING MODES:
OCCUPIED MODE: THE FAN SHALL RUN WHEN THE OCCUPANT TURNS ON THE LOCAL SWITCH FOR THE FAN SERVICE AREA. THE FAN SHALL STOP WHEN THE LOCAL SWITCH IS OFF.
UNOCCUPIED MODE: THE FAN SHALL STOP.

FAN STATUS:
THE CONTROLLER SHALL MONITOR THE STATUS OF THE FAN.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
FAN IN HAND: COMMANDED OFF, BUT THE STATUS IS ON.

FAN TYPE B

POINT NAME	HARDWARE POINTS AI	AO	BI	BO	SOFTWARE POINTS AV	BV	LOOP	SCHED	TREND	ALARM	GRAPHIC
EXHAUST FAN STATUS			x						x		x
EXHAUST FAN ENABLE				x					x		x
SCHEDULE								x			
FAN IN HAND										x	x
TOTALS	0	0	1	1	0	0	0	1	2	1	3

TOTAL HARDWARE (2) TOTAL SOFTWARE (4)



B — FANS – (USER DEMAND VENTILATION): LOCAL SWITCH INTERLOCK
(EF-178, 225, 273, 288, 289, 323, 329) STORAGE
TYPICAL FOR (7) FANS

SEQUENCE OF OPERATIONS

FAN – (KITCHEN EQUIPMENT): LOCAL SWITCH INTERLOCK (SCHEMATIC TYPE C & D)
(EF-336) DISHWASHER / (EF-335A&B AND SF-335A&B) KITCHEN HOOD – AREA E

RUN CONDITIONS - SCHEDULED BY BUILDING ZONE / INTERLOCKED:
THE DISHWASHER FAN, THE KITCHEN HOOD EXHAUST FAN AND SUPPLY FAN SHALL BE ENABLED THROUGH THE CONTROLLER TO RUN ACCORDING TO A USER DEFINABLE TIME SCHEDULE IN THE
OCCUPIED MODE: THE DISHWASHER FAN SHALL RUN WHEN THE EQUIPMENT RUN CONTACT INDICATES THE DISHWASHER IS RUNNING. THE FAN SHALL STOP WHEN THE DISHWASHER STOPS. THE KITCHEN HOOD FANS SHALL RUN WHEN THE OCCUPANT TURNS ON THE KITCHEN HOOD FAN SWITCH. THE FANS SHALL STOP WHEN THE HOOD FAN SWITCH IS OFF.
UNOCCUPIED MODE: ALL FANS SHALL STOP.

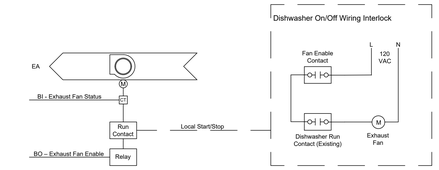
FAN STATUS:
THE CONTROLLER SHALL MONITOR THE STATUS OF EACH FAN.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
FAN RUNTIME EXCEEDED: FAN STATUS RUNTIME EXCEEDS A USER DEFINABLE LIMIT (ADJ.).
FAN IN HAND: COMMANDED OFF, BUT THE STATUS IS ON.

SUPPLY FAN INTAKE AIR DAMPER:
THE SUPPLY FAN INTAKE AIR DAMPER SHALL OPEN WHENEVER THE SUPPLY FAN IS ON. THE INTAKE AIR DAMPER SHALL CLOSE ANYTIME THE FAN IS STOPPED.

FAN TYPE C

POINT NAME	HARDWARE POINTS AI	AO	BI	BO	SOFTWARE POINTS AV	BV	LOOP	SCHED	TREND	ALARM	GRAPHIC
EXHAUST FAN STATUS			x						x		x
EXHAUST FAN ENABLE				x					x		x
SCHEDULE								x			
FAN RUNTIME EXCEEDED										x	x
FAN IN HAND										x	x
TOTALS	0	0	1	1	0	0	0	1	2	2	4

TOTAL HARDWARE (2) TOTAL SOFTWARE (5)

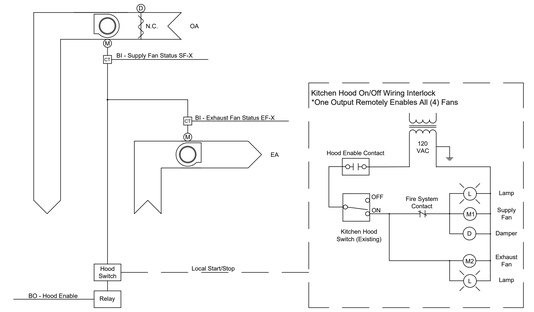


C — FAN – (DISHWASHER EXHAUST): RUN CONTACT SWITCH INTERLOCK
(EF-336) DISHWASHER – AREA E
TYPICAL FOR (1) FAN

FAN TYPE D

POINT NAME	HARDWARE POINTS AI	AO	BI	BO	SOFTWARE POINTS AV	BV	LOOP	SCHED	TREND	ALARM	GRAPHIC
EXHAUST FAN STATUS			x						x		x
*HOOD ENABLE				x					x		x
SCHEDULE								x			
FAN RUNTIME EXCEEDED										x	x
FAN IN HAND										x	x
TOTALS	0	0	1	1	0	0	0	1	2	2	4

TOTAL HARDWARE (2) TOTAL SOFTWARE (5)



D — FANS – (KITCHEN HOOD EXHAUST AND SUPPLY): HOOD SWITCH INTERLOCK
(EF-335A, EF-335B, SF-335A, SF-335B) KITCHEN HOOD – AREA E
TYPICAL FOR (4) FANS

SEQUENCE OF OPERATIONS

FANS – (EQUIPMENT ROOM EXHAUST): THERMOSTAT INTERLOCK (SCHEMATIC TYPE E)
(EF-105, 124, 328) ELECTRICAL / (EF-195, 324) MECHANICAL EQUIPMENT

RUN CONDITIONS - SCHEDULED BY BUILDING ZONE / INTERLOCKED:
THE EXHAUST FAN SHALL BE ENABLED THROUGH THE CONTROLLER TO RUN ACCORDING TO A USER DEFINABLE TIME SCHEDULE IN THE FOLLOWING MODES:
OCCUPIED MODE: THE FAN SHALL RUN WHEN SPACE TEMPERATURE RISES ABOVE 80°F (ADJ.) SETPOINT AT THE HARDWIRED THERMOSTAT. THE FAN SHALL STOP WHEN SPACE TEMPERATURE FALLS BELOW SETPOINT.
UNOCCUPIED MODE: THE FAN SHALL STOP.

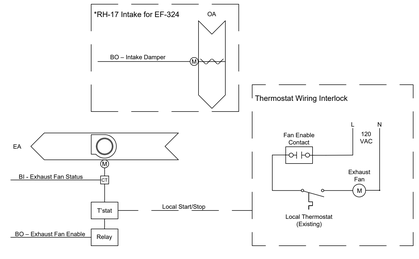
FAN STATUS:
THE CONTROLLER SHALL MONITOR THE STATUS OF THE FAN.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
FAN IN HAND: COMMANDED OFF, BUT THE STATUS IS ON.

INTAKE AIR DAMPER:
THE (RH-17) ROOF HOOD INTAKE AIR DAMPER SHALL OPEN WHENEVER THE (EF-324) EXHAUST FAN RUN STATUS INDICATES IT IS ON. THE INTAKE AIR ISOLATION DAMPER SHALL CLOSE ANYTIME THE FAN RUN STATUS INDICATES IT IS STOPPED.

FAN TYPE E

POINT NAME	HARDWARE POINTS AI	AO	BI	BO	SOFTWARE POINTS AV	BV	LOOP	SCHED	TREND	ALARM	GRAPHIC
EXHAUST FAN STATUS			x						x		x
EXHAUST FAN ENABLE				x					x		x
*INTAKE DAMPER				x					x		x
SCHEDULE								x			
FAN IN HAND										x	x
TOTALS	0	0	1	2	0	0	0	1	3	1	4

TOTAL HARDWARE (3) TOTAL SOFTWARE (5)



E — FANS – (EQUIPMENT ROOM EXHAUST): THERMOSTAT INTERLOCK
(EF-105, 124, 328) ELECTRICAL / (EF-195, 324) MECHANICAL EQUIPMENT
TYPICAL FOR (5) FANS

SEQUENCE OF OPERATIONS

FANS – (USER TIMED DEMAND EXHAUST): TIMER SWITCH INTERLOCK (SCHEMATIC TYPE F)
(EF-283, 285) LABS / (EF227, 231) ART / (EF136, 139) FACULTY / (EF-145) CONCESSION

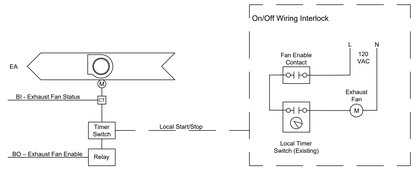
RUN CONDITIONS - SCHEDULED BY BUILDING ZONE / INTERLOCKED:
THE EXHAUST FAN SHALL BE ENABLED THROUGH THE CONTROLLER TO RUN ACCORDING TO A USER DEFINABLE TIME SCHEDULE IN THE FOLLOWING MODES:
OCCUPIED MODE: THE FAN SHALL RUN WHEN THE OCCUPANT TURNS ON THE LOCAL TIMER SWITCH FOR THE FAN. THE FAN SHALL STOP WHEN THE TIMER SWITCH IS OFF.
UNOCCUPIED MODE: ALL FANS SHALL STOP.

FAN STATUS:
THE CONTROLLER SHALL MONITOR THE STATUS OF EACH FAN.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
FAN IN HAND: COMMANDED OFF, BUT THE STATUS IS ON.

FAN TYPE F

POINT NAME	HARDWARE POINTS AI	AO	BI	BO	SOFTWARE POINTS AV	BV	LOOP	SCHED	TREND	ALARM	GRAPHIC
EXHAUST FAN STATUS			x						x		x
EXHAUST FAN ENABLE				x					x		x
SCHEDULE								x			
FAN IN HAND										x	x
TOTALS	0	0	1	1	0	0	0	1	2	1	3

TOTAL HARDWARE (2) TOTAL SOFTWARE (4)



F — FANS – (USER TIMED DEMAND EXHAUST): TIMER SWITCH INTERLOCK
(EF-283, 285) LABS / (EF-227, 231) ART / (EF-136, 139) FACULTY / (EF-145) CONCESSION
TYPICAL FOR (7) FANS

SEQUENCE OF OPERATIONS

FANS – (USER TIMED DEMAND / TWO-SPEED EXHAUST): TIMER SWITCH INTERLOCK (SCHEMATIC TYPE G)
(EF-309, 322) SCIENCE

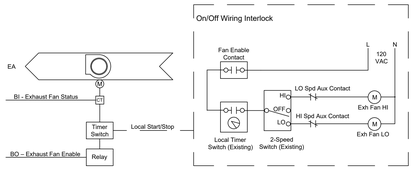
RUN CONDITIONS - SCHEDULED BY BUILDING ZONE / INTERLOCKED:
THE EXHAUST FAN SHALL BE ENABLED THROUGH THE CONTROLLER TO RUN ACCORDING TO A USER DEFINABLE TIME SCHEDULE IN THE FOLLOWING MODES:
OCCUPIED MODE: THE FAN SHALL RUN, AT THE SPEED SELECTED BY THE OCCUPANT AT THE LOCAL TWO-SPEED SWITCH, WHEN THE OCCUPANT TURNS ON THE LOCAL TIMER SWITCH FOR THE FAN. THE FAN SHALL STOP WHEN THE TIMER SWITCH IS OFF.
UNOCCUPIED MODE: ALL FANS SHALL STOP.

FAN STATUS:
THE CONTROLLER SHALL MONITOR THE STATUS OF EACH FAN.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
FAN IN HAND: COMMANDED OFF, BUT THE STATUS IS ON.

FAN TYPE G

POINT NAME	HARDWARE POINTS AI	AO	BI	BO	SOFTWARE POINTS AV	BV	LOOP	SCHED	TREND	ALARM	GRAPHIC
EXHAUST FAN STATUS			x						x		x
EXHAUST FAN ENABLE				x					x		x
SCHEDULE								x			
FAN IN HAND										x	x
TOTALS	0	0	1	1	0	0	0	1	2	1	3

TOTAL HARDWARE (2) TOTAL SOFTWARE (4)



G — FANS – (USER TIMED DEMAND / TWO-SPEED EXHAUST): TIMER SWITCH INTERLOCK
(EF-309, 322) SCIENCE
TYPICAL FOR (2) FANS

SEQUENCE OF OPERATIONS

FANS – (TOILET EXHAUST): MULTIPLE PIR VACANCY LIGHT SWITCHES INTERLOCK (SCHEMATIC TYPE H)
(EF-103, 152, 217, 265, 315) GROUP TOILETS / EQUIPMENT ROOMS

RUN CONDITIONS - SCHEDULED BY BUILDING ZONE / INTERLOCKED:
THE EXHAUST FAN SHALL BE ENABLED THROUGH THE CONTROLLER TO RUN ACCORDING TO A USER DEFINABLE TIME SCHEDULE IN THE FOLLOWING MODES:
OCCUPIED MODE: THE FAN SHALL RUN WHEN THE OCCUPANT TURNS ON ANY OF THE LOCAL PIR VACANCY LIGHT SWITCHES FOR THE FAN SERVICE AREA. THE FAN SHALL STOP WHEN THE PIR VACANCY SENSORS NO LONGER DETECT OCCUPANCY IN ANY SPACE AFTER A USER DEFINABLE
UNOCCUPIED MODE: THE FAN SHALL STOP.

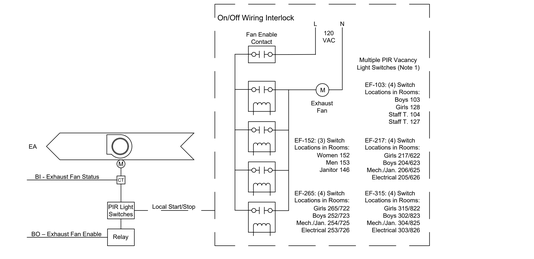
FAN STATUS:
THE CONTROLLER SHALL MONITOR THE STATUS OF THE FAN.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
FAN IN HAND: COMMANDED OFF, BUT THE STATUS IS ON.

NOTES
1. CONTRACTOR TO SELECT THE CORRECT PASSIVE INFRARED (PIR) VACANCY LIGHT SWITCH SENSOR FOR THE APPLICATION AND SUBMIT TO ENGINEER FOR APPROVAL.

FAN TYPE H

POINT NAME	HARDWARE POINTS AI	AO	BI	BO	SOFTWARE POINTS AV	BV	LOOP	SCHED	TREND	ALARM	GRAPHIC
EXHAUST FAN STATUS			x						x		x
EXHAUST FAN ENABLE				x					x		x
SCHEDULE								x			
FAN IN HAND										x	x
TOTALS	0	0	1	1	0	0	0	1	2	1	3

TOTAL HARDWARE (2) TOTAL SOFTWARE (4)



H — FANS – (TOILET EXHAUST): MULTIPLE PIR VACANCY LIGHT SWITCHES INTERLOCK
(EF-103, 152, 217, 265, 315) GROUP TOILETS / EQUIPMENT ROOMS
TYPICAL FOR (5) FANS

TMG CONSULTING ENGINEERS, P.A.
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704.895.1612 Fax
Website: WWW.TMG-CE.COM

NORTH CAROLINA REGISTERED LANDSCAPE ARCHITECTURAL CORPORATION C-3646 CHARLOTTE, NC

NORTH CAROLINA REGISTERED LANDSCAPE ARCHITECT SEAL 033629 ENGINEER CLEMENT T. MILDRIME

01.25.2023

ISSUED FOR CONSTRUCTION

CHARLOTTE-MECKLENBERG SCHOOLS

NORTHRIDGE MIDDLE SCHOOL
HVAC CONTROLS

CHARLOTTE-MECKLENBERG SCHOOLS
7601 THE PLAZA
CHARLOTTE, NC 28215

REVISIONS

NO	DESCRIPTION	DATE
1	ISSUED FOR CONSTRUCTION	9/27/22
2	REVISION 1	1/13/23
3	REVISION 2	1/25/23

SHEET INFORMATION

DATE	09/27/2022
JOB NUMBER	2202-01-002
DRAWN	LCB
APPROVED	CTM

HVAC CONTROLS
FANS A - H

M-806

SHEET 19 OF 28

SEQUENCE OF OPERATIONS

FANS – (USER TIMED DEMAND EXHAUST): TIMER SWITCH INTERLOCK (SCHEMATIC TYPE I)
(EF-161A, 166A, 171A, 179A) LOCKERS AND SHOWERS

RUN CONDITIONS - SCHEDULED BY BUILDING ZONE / INTERLOCKED:
THE EXHAUST FAN SHALL BE ENABLED THROUGH THE CONTROLLER TO RUN ACCORDING TO A USER DEFINABLE TIME SCHEDULE IN THE FOLLOWING MODES:
OCCUPIED MODE: THE FAN SHALL RUN WHEN THE OCCUPANT TURNS ON THE LOCAL TIMER SWITCH FOR THE FAN. THE FAN SHALL STOP WHEN THE TIMER SWITCH IS OFF.
UNOCCUPIED MODE: ALL FANS SHALL STOP.

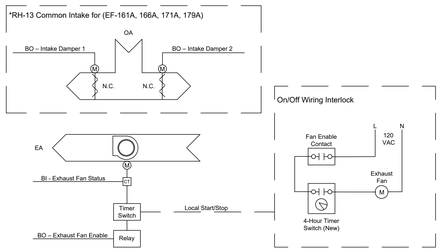
FAN STATUS:
THE CONTROLLER SHALL MONITOR THE STATUS OF EACH FAN.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
FAN IN HAND: COMMANDED OFF, BUT THE STATUS IS ON.

INTAKE AIR DAMPER:

THE (RH-13) ROOF HOOD COMMON INTAKE AIR DAMPERS SHALL OPEN WHENEVER THE EXHAUST FAN RUN STATUS FOR (EF-161A, 166A, 171A OR 179A) INDICATES ANY FAN IS ON. THE INTAKE AIR ISOLATION DAMPERS SHALL CLOSE ANYTIME THE FAN RUN STATUS INDICATES ALL (4) FANS ARE STOPPED.

FAN TYPE I

	HARDWARE POINTS				SOFTWARE POINTS						
POINT NAME	AI	AO	BI	BO	AV	BV	LOOP	SCHED	TREND	ALARM	GRAPHIC
EXHAUST FAN STATUS			x						x		x
EXHAUST FAN ENABLE				x					x		x
*INTAKE DAMPER 1				x					x		x
*INTAKE DAMPER 2				x					x		x
SCHEDULE								x			
FAN IN HAND										x	x
TOTALS	0	0	1	3	0	0	0	1	4	1	5
	TOTAL HARDWARE (4)				TOTAL SOFTWARE (6)						



I FANS – (USER TIMED DEMAND EXHAUST): TIMER SWITCH INTERLOCK
(EF-161A, 166A, 171A, 179A) LOCKERS AND SHOWERS
TYPICAL FOR (4) FANS

2

SEQUENCE OF OPERATIONS

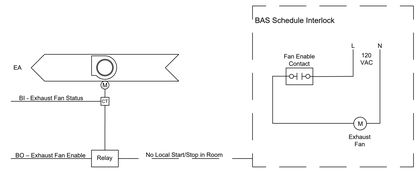
FAN – (TOILET EXHAUST - ROOF): BAS SCHEDULE INTERLOCK (SCHEMATIC TYPE J)
(EF-161B, 166B, 171B, 179B) LOCKERS AND SHOWERS

RUN CONDITIONS - SCHEDULED BY BUILDING ZONE:
THE EXHAUST FAN SHALL BE ENABLED THROUGH THE CONTROLLER TO RUN ACCORDING TO A USER DEFINABLE TIME SCHEDULE IN THE FOLLOWING MODES:
OCCUPIED MODE: THE FAN SHALL RUN.
UNOCCUPIED MODE: THE FAN SHALL STOP.

FAN STATUS:
THE CONTROLLER SHALL MONITOR THE STATUS OF THE FAN.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
FAN IN HAND: COMMANDED OFF, BUT THE STATUS IS ON.

FAN TYPE J

	HARDWARE POINTS				SOFTWARE POINTS						
POINT NAME	AI	AO	BI	BO	AV	BV	LOOP	SCHED	TREND	ALARM	GRAPHIC
EXHAUST FAN STATUS			x						x		x
EXHAUST FAN ENABLE				x					x		x
SCHEDULE								x			
FAN IN HAND										x	x
TOTALS	0	0	1	1	0	0	0	1	2	1	3
	TOTAL HARDWARE (2)				TOTAL SOFTWARE (4)						



J FANS – (TOILET EXHAUST - ROOF): BAS SCHEDULE INTERLOCK
(EF-161B, 166B, 171B, 179B) LOCKERS AND SHOWERS
TYPICAL FOR (4) FANS

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NORTH CAROLINA PROFESSIONAL ENGINEERING SEAL C-3646 CHARLOTTE, NC

NORTH CAROLINA PROFESSIONAL SEAL 033629 ENGINEER CLEMENT J. MILBOURNE

01.25.2023

ISSUED FOR CONSTRUCTION

CHARLOTTE-MECKLENBERG SCHOOLS

NORTHRIDGE MIDDLE SCHOOL HVAC CONTROLS

CHARLOTTE-MECKLENBERG SCHOOLS
7601 THE PLAZA
CHARLOTTE, NC 28215

REVISIONS

NO.	DESCRIPTION	DATE
	ISSUED FOR CONSTRUCTION	9/27/22
1	REVISION 1	1/13/23
2	REVISION 2	1/25/23

SHEET INFORMATION

DATE	09/27/2022
JOB NUMBER	2202-01-002
DRAWN	LCB
APPROVED	CTM

HVAC CONTROLS
FANS I & J

M-807

SHEET 20 OF 28

SEQUENCE OF OPERATIONS

UNIT VENTILATORS – NO OUTSIDE AIR (SCHEMATIC TYPE A)
(UV-283) BIOTECHNOLOGY LAB / (UV-334) SERVING

RUN CONDITIONS - SCHEDULED BY BUILDING ZONE:
THE UNIT SHALL RUN ACCORDING TO A USER DEFINABLE TIME SCHEDULE IN THE FOLLOWING MODES:
OCCUPIED MODE: THE UNIT SHALL CONTINUOUSLY RUN TO MAINTAIN
A 74°F (ADJ.) COOLING SETPOINT
A 70°F (ADJ.) HEATING SETPOINT.
A 60% RH (ADJ.) DEHUMIDIFICATION SETPOINT.
UNOCCUPIED MODE (NIGHT SETBACK): THE UNIT SHALL CYCLE TO MAINTAIN
A 80°F (ADJ.) COOLING SETPOINT.
A 62°F (ADJ.) HEATING SETPOINT.
A 60% RH (ADJ.) DEHUMIDIFICATION SETPOINT.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
HIGH SPACE TEMP: IF THE SPACE TEMPERATURE IS GREATER THAN THE COOLING SETPOINT BY A USER DEFINABLE AMOUNT (ADJ.).
LOW SPACE TEMP: IF THE SPACE TEMPERATURE IS LESS THAN THE HEATING SETPOINT BY A USER DEFINABLE AMOUNT (ADJ.).

FAN:
THE FAN SHALL RUN ANYTIME THE UNIT IS COMMANDED TO RUN, UNLESS SHUTDOWN ON SAFETIES. TO PREVENT SHORT CYCLING, THE FAN SHALL HAVE A USER DEFINABLE (ADJ.) MINIMUM RUNTIME. THE CONTROLLER SHALL MONITOR THE STATUS OF EACH FAN.
THE FAN SPEEDS SHALL BE INDEXED AS FOLLOWS:
LOW SPEED SHALL RUN WHENEVER THE COOLING OR HEATING LOOP SIGNAL IS 0-50% (ADJ.).
HIGH SPEED SHALL RUN WHENEVER THE COOLING OR HEATING LOOP SIGNAL IS 51-100% (ADJ.).
ALARMS SHALL BE PROVIDED AS FOLLOWS:
FAN FAILURE: COMMANDED ON, BUT THE STATUS IS OFF.
FAN IN HAND: COMMANDED OFF, BUT THE STATUS IS ON.

DUAL TEMPERATURE WATER COIL VALVE:
THE CONTROLLER SHALL MEASURE THE DISCHARGE AIR TEMPERATURE AND MODULATE THE WATER COIL VALVE TO MAINTAIN A VARIABLE DISCHARGE AIR TEMPERATURE SETPOINT THAT WILL CHANGE IN RESPONSE TO SPACE TEMPERATURE CHANGES. (SEE DAT CONTROL SEQUENCE.)
THE CHW COOLING SHALL BE ENABLED WHENEVER:
THE CHANGEOVER SIGNAL FROM THE BAS INDICATES COOLING IS AVAILABLE FROM THE CENTRAL PLANT, AND THE SPACE TEMPERATURE IS ABOVE THE HEATING SETPOINT.
AND THE FAN STATUS IS ON.
THE HW HEATING SHALL BE ENABLED WHENEVER:
THE CHANGEOVER SIGNAL FROM THE BAS INDICATES HEATING IS AVAILABLE FROM THE CENTRAL PLANT, AND THE SPACE TEMPERATURE IS BELOW THE COOLING SETPOINT.
AND THE FAN STATUS IS ON.
THE WATER COIL VALVE SHALL CLOSE WHENEVER THE CHW COOLING OR THE HW HEATING ARE NOT ENABLED.

DISCHARGE AIR TEMPERATURE (DAT) CONTROL:
THE SPACE TEMPERATURE SHALL BE CONTROLLED BY A CASCADING SEQUENCE THAT MODULATES THE CONTROL VALVE BASED ON A VARIABLE DAT SETPOINT. THE CONTROLLER SHALL MONITOR THE DISCHARGE AIR TEMPERATURE AND THE SPACE TEMPERATURE. THE DAT SETPOINT SHALL BE RESET BASED ON THE SPACE TEMPERATURE DEVIATION FROM SPACE TEMPERATURE SETPOINT.
WHEN CHW COOLING IS ENABLED:
THE CONTROLLER SHALL RESET THE DISCHARGE AIR TEMPERATURE DOWN TO A MINIMUM DAT SETPOINT OF 55°F (ADJ.) WHEN THE SPACE TEMPERATURE IS 2°F (ADJ.) ABOVE THE COOLING SETPOINT. CONVERSELY, AS SPACE TEMPERATURE DEVIATES BELOW THE COOLING SETPOINT, THE DAT SETPOINT IS RESET UP TO THE NEUTRAL DAT SETPOINT OF 70°F (ADJ.).
WHEN HW HEATING IS ENABLED:
THE CONTROLLER SHALL RESET THE DISCHARGE AIR TEMPERATURE UP TO A MAXIMUM DAT SETPOINT OF 85°F (ADJ.) WHEN THE SPACE TEMPERATURE IS 2°F (ADJ.) BELOW THE HEATING SETPOINT. CONVERSELY, AS SPACE TEMPERATURE DEVIATES ABOVE THE HEATING SETPOINT, THE DAT SETPOINT IS RESET DOWN TO THE NEUTRAL DAT SETPOINT OF 70°F (ADJ.).
ALARMS SHALL BE PROVIDED AS FOLLOWS:
HIGH DISCHARGE AIR TEMP: IF THE DISCHARGE AIR TEMPERATURE IS MORE THAN 10°F (ADJ.) ABOVE MAXIMUM DAT SETPOINT.
LOW DISCHARGE AIR TEMP: IF THE DISCHARGE AIR TEMPERATURE IS LESS THAN 10°F (ADJ.) BELOW MINIMUM DAT SETPOINT.

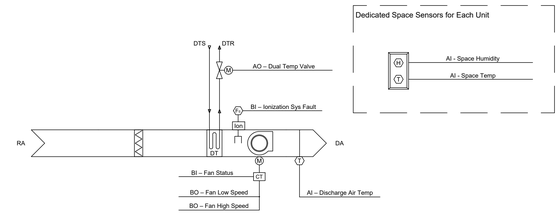
AIR PURIFICATION - IONIZATION SYSTEM:
THE IONIZATION SYSTEM SHALL BE AVAILABLE ANYTIME THE FAN STATUS IS ON. IT IS NOT STARTED BY BAS.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
IONIZATION SYSTEM FAULT: FAN IS COMMANDED ON AND IONIZATION DEVICE FAULT SIGNAL STATUS IS ON.

DEHUMIDIFICATION (LIMITED) - NO REHEAT AVAILABLE:
THE CONTROLLER SHALL MONITOR THE SPACE HUMIDITY AND MAINTAIN THE DEHUMIDIFICATION SETPOINT. IF THE SPACE HUMIDITY LEVEL IS ABOVE SETPOINT WHEN THE CHANGEOVER SIGNAL FROM THE BAS INDICATES COOLING IS AVAILABLE FROM THE CENTRAL PLANT, THE FOLLOWING SHALL OCCUR:
THE FAN SHALL BE COMMANDED TO RUN IN THE OCCUPIED OR UNOCCUPIED MODE.
THE DUAL TEMPERATURE WATER COIL VALVE SHALL MODULATE TO MAINTAIN A 55°F (ADJ.) DISCHARGE AIR TEMPERATURE SETPOINT UNTIL THE SPACE TEMPERATURE FALLS TO A LIMIT OF 2°F (ADJ.) BELOW THE SPACE COOLING SETPOINT. THE WATER COIL VALVE SHOULD THEN CLOSE, ALLOWING THE SPACE TEMPERATURE TO RISE TO A LIMIT OF 1°F ABOVE THE SPACE COOLING SETPOINT. THIS CYCLE SHALL CONTINUE UNTIL THE SPACE HUMIDITY SETPOINT IS SATISFIED.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
HIGH SPACE HUMIDITY: IF THE SPACE HUMIDITY IS GREATER THAN 70% (ADJ.).

UV TYPE A

POINT NAME	HARDWARE POINTS AI	AO	BI	BO	SOFTWARE POINTS AV	BV	LOOP	SCHED	TREND	ALARM	GRAPHIC
DISCHARGE AIR TEMP	x								x		x
SPACE HUMIDITY	x								x		x
SPACE TEMP	x								x		x
DT WATER VALVE		x							x		x
FAN STATUS			x						x		x
IONIZATION SYS - FAULT			x						x	x	x
FAN HIGH SPEED				x					x		x
FAN LOW SPEED				x					x		x
COOLING SETPOINT					x				x		x
HEATING SETPOINT					x				x		x
DAT MAX SETPOINT					x				x		x
DAT MIN SETPOINT					x				x		x
DAT NEUTRAL SETPOINT					x				x		x
DEHUMID CLG OFFSET SP					x				x		x
DEHUMID SETPOINT					x				x		x
CHANGEOVER HTG/CLG						x					
SCHEDULE								x			
FAN FAILURE										x	x
FAN IN HAND										x	x
HIGH DISCHARGE TEMP										x	x
HIGH SPACE HUMIDITY										x	x
HIGH SPACE TEMP										x	x
LOW DISCHARGE TEMP										x	x
LOW SPACE TEMP										x	x
TOTALS	**3**	**1**	**2**	**2**	**7**	**1**	**0**	**1**	**15**	**8**	**22**

TOTAL HARDWARE (8) TOTAL SOFTWARE (32)



A UNIT VENTILATORS – NO OUTSIDE AIR
(UV-283) BIOTECHNOLOGY LAB / (UV-334) SERVING
TYPICAL FOR (2) UNITS

SEQUENCE OF OPERATIONS

UNIT VENTILATORS – SUPPLY FAN FORCED MINIMUM OUTSIDE AIR (SCHEMATIC TYPE B)
ROOMS

RUN CONDITIONS - SCHEDULED BY BUILDING ZONE:
THE UNIT SHALL RUN ACCORDING TO A USER DEFINABLE TIME SCHEDULE IN THE FOLLOWING MODES:
OCCUPIED MODE: THE UNIT SHALL CONTINUOUSLY RUN TO MAINTAIN
A 74°F (ADJ.) COOLING SETPOINT
A 70°F (ADJ.) HEATING SETPOINT.
A 60% RH (ADJ.) DEHUMIDIFICATION SETPOINT.
UNOCCUPIED MODE (NIGHT SETBACK): THE UNIT SHALL CYCLE TO MAINTAIN
A 80°F (ADJ.) COOLING SETPOINT.
A 62°F (ADJ.) HEATING SETPOINT.
A 60% RH (ADJ.) DEHUMIDIFICATION SETPOINT.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
HIGH SPACE TEMP: IF THE SPACE TEMPERATURE IS GREATER THAN THE COOLING SETPOINT BY A USER DEFINABLE AMOUNT (ADJ.).
LOW SPACE TEMP: IF THE SPACE TEMPERATURE IS LESS THAN THE HEATING SETPOINT BY A USER DEFINABLE AMOUNT (ADJ.).

FREEZE PROTECTION:
THE UNIT SHALL SHUT DOWN AND GENERATE AN ALARM UPON RECEIVING A FREEZESTAT STATUS. WHENEVER THE FREEZESTAT IS ON, THE WATER COIL VALVE SHALL MODULATE OPEN TO MAINTAIN THE MIXED AIR TEMPERATURE AT 70°F (ADJ.). THE ASSOCIATED OUTSIDE AIR SUPPLY FAN (SF-X) SHALL STOP AND THE SUPPLY FAN INTAKE ISOLATION DAMPER SHALL CLOSE.

FAN:
THE FAN SHALL RUN ANYTIME THE UNIT IS COMMANDED TO RUN, UNLESS SHUTDOWN ON SAFETIES. TO PREVENT SHORT CYCLING, THE FAN SHALL HAVE A USER DEFINABLE (ADJ.) MINIMUM RUNTIME. THE CONTROLLER SHALL MONITOR THE STATUS OF EACH FAN.
THE FAN SPEEDS SHALL BE INDEXED AS FOLLOWS:
LOW SPEED SHALL RUN WHENEVER THE COOLING OR HEATING LOOP SIGNAL IS 0-50% (ADJ.).
HIGH SPEED SHALL RUN WHENEVER THE COOLING OR HEATING LOOP SIGNAL IS 51-100% (ADJ.).
ALARMS SHALL BE PROVIDED AS FOLLOWS:
FAN FAILURE: COMMANDED ON, BUT THE STATUS IS OFF.
FAN IN HAND: COMMANDED OFF, BUT THE STATUS IS ON.

DUAL TEMPERATURE WATER COIL VALVE:
THE CONTROLLER SHALL MEASURE THE DISCHARGE AIR TEMPERATURE AND MODULATE THE WATER COIL VALVE TO MAINTAIN A VARIABLE DISCHARGE AIR TEMPERATURE SETPOINT THAT WILL CHANGE IN RESPONSE TO SPACE TEMPERATURE CHANGES. (SEE DAT CONTROL SEQUENCE.)
THE CHW COOLING SHALL BE ENABLED WHENEVER:
THE CHANGEOVER SIGNAL FROM THE BAS INDICATES COOLING IS AVAILABLE FROM THE CENTRAL PLANT, AND THE SPACE TEMPERATURE IS ABOVE THE HEATING SETPOINT.
AND THE FAN STATUS IS ON.
THE HW HEATING SHALL BE ENABLED WHENEVER:
THE CHANGEOVER SIGNAL FROM THE BAS INDICATES HEATING IS AVAILABLE FROM THE CENTRAL PLANT, AND THE SPACE TEMPERATURE IS BELOW THE COOLING SETPOINT.
AND THE FAN STATUS IS ON.
THE WATER COIL VALVE SHALL CLOSE WHENEVER THE CHW COOLING OR THE HW HEATING ARE NOT ENABLED AND THE FREEZESTAT STATUS IS OFF. THE WATER COIL VALVE SHALL MODULATE OPEN AS REQUIRED BY FREEZE PROTECTION SEQUENCE.

DISCHARGE AIR TEMPERATURE (DAT) CONTROL:
THE SPACE TEMPERATURE SHALL BE CONTROLLED BY A CASCADING SEQUENCE THAT MODULATES THE CONTROL VALVE BASED ON A VARIABLE DAT SETPOINT. THE CONTROLLER SHALL MONITOR THE DISCHARGE AIR TEMPERATURE AND THE SPACE TEMPERATURE. THE DAT SETPOINT SHALL BE RESET BASED ON THE SPACE TEMPERATURE DEVIATION FROM SPACE TEMPERATURE SETPOINT.
WHEN CHW COOLING IS ENABLED:
THE CONTROLLER SHALL RESET THE DISCHARGE AIR TEMPERATURE DOWN TO A MINIMUM DAT SETPOINT OF 55°F (ADJ.) WHEN THE SPACE TEMPERATURE IS 2°F (ADJ.) ABOVE THE COOLING SETPOINT. CONVERSELY, AS SPACE TEMPERATURE DEVIATES BELOW THE COOLING SETPOINT, THE DAT SETPOINT IS RESET UP TO THE NEUTRAL DAT SETPOINT OF 70°F (ADJ.).
WHEN HW HEATING IS ENABLED:
THE CONTROLLER SHALL RESET THE DISCHARGE AIR TEMPERATURE UP TO A MAXIMUM DAT SETPOINT OF 85°F (ADJ.) WHEN THE SPACE TEMPERATURE IS 2°F (ADJ.) BELOW THE HEATING SETPOINT. CONVERSELY, AS SPACE TEMPERATURE DEVIATES ABOVE THE HEATING SETPOINT, THE DAT SETPOINT IS RESET DOWN TO THE NEUTRAL DAT SETPOINT OF 70°F (ADJ.).
ALARMS SHALL BE PROVIDED AS FOLLOWS:
HIGH DISCHARGE AIR TEMP: IF THE DISCHARGE AIR TEMPERATURE IS MORE THAN 10°F (ADJ.) ABOVE MAXIMUM DAT SETPOINT.
LOW DISCHARGE AIR TEMP: IF THE DISCHARGE AIR TEMPERATURE IS LESS THAN 10°F (ADJ.) BELOW MINIMUM DAT SETPOINT.

AIR PURIFICATION - IONIZATION SYSTEM:
THE IONIZATION SYSTEM SHALL BE AVAILABLE ANYTIME THE FAN STATUS IS ON. IT IS NOT STARTED BY BAS.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
IONIZATION SYSTEM FAULT: FAN IS COMMANDED ON AND IONIZATION DEVICE FAULT SIGNAL STATUS IS ON.

MINIMUM OUTSIDE AIR VENTILATION:
THE ASSOCIATED OUTSIDE AIR SUPPLY FAN (SF-X) SHALL RUN WITH THE FAN INTAKE ISOLATION DAMPER OPEN WHENEVER ANY ONE OF THE (5) ASSOCIATED UNIT VENTILATORS RUN IN OCCUPIED MODE. THE BALANCING CONTRACTOR SHALL SET THE SUPPLY FAN FORCED MINIMUM OUTSIDE AIR USING MANUAL VOLUME DAMPERS, WHILE THE (NON-ACTUATED) MIXED AIR DAMPERS SHALL BE UNLINKED WITH BOTH UNIT VENTILATOR DAMPERS MECHANICALLY FIXED-IN-PLACE TO AN OPEN POSITION.
THE ASSOCIATED OUTSIDE AIR SUPPLY FAN (SF-X) SHALL STOP WITH THE SUPPLY FAN INTAKE ISOLATION DAMPER CLOSED WHENEVER:
ALL OF THE (5) ASSOCIATED UNIT VENTILATORS ARE IN UNOCCUPIED MODE,
OR MIXED AIR TEMPERATURE DROPS FROM 45°F TO 40°F (ADJ.),
OR THE FAN STATUS IS OFF,
OR THE FREEZESTAT IS ON.
THE CONTROLLER SHALL MONITOR THE STATUS OF EACH (SF-X) SUPPLY FAN.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
OA SUPPLY FAN FAILURE: COMMANDED ON, BUT THE STATUS IS OFF.
OA SUPPLY FAN IN HAND: COMMANDED OFF, BUT THE STATUS IS ON.
HIGH MIXED AIR TEMP: IF THE MIXED AIR TEMPERATURE IS GREATER THAN 90°F (ADJ.).
LOW MIXED AIR TEMP: IF THE MIXED AIR TEMPERATURE IS LESS THAN 45°F (ADJ.).

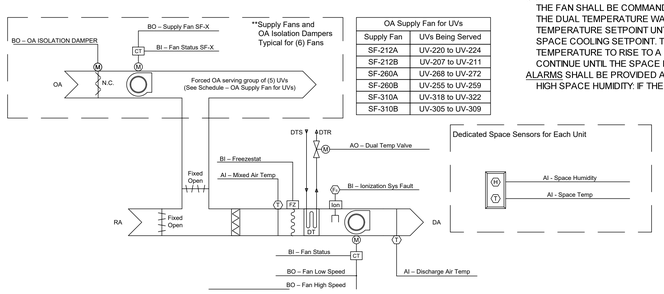
DEHUMIDIFICATION (LIMITED) - NO REHEAT AVAILABLE:
THE CONTROLLER SHALL MONITOR THE SPACE HUMIDITY AND MAINTAIN THE DEHUMIDIFICATION SETPOINT. IF THE SPACE HUMIDITY LEVEL IS ABOVE SETPOINT WHEN THE CHANGEOVER SIGNAL FROM THE BAS INDICATES COOLING IS AVAILABLE FROM THE CENTRAL PLANT, THE FOLLOWING SHALL OCCUR:
THE FAN SHALL BE COMMANDED TO RUN IN THE OCCUPIED OR UNOCCUPIED MODE.
THE DUAL TEMPERATURE WATER COIL VALVE SHALL MODULATE TO MAINTAIN A 55°F (ADJ.) DISCHARGE AIR TEMPERATURE SETPOINT UNTIL THE SPACE TEMPERATURE FALLS TO A LIMIT OF 2°F (ADJ.) BELOW THE SPACE COOLING SETPOINT. THE WATER COIL VALVE SHOULD THEN CLOSE, ALLOWING THE SPACE TEMPERATURE TO RISE TO A LIMIT OF 1°F ABOVE THE SPACE COOLING SETPOINT. THIS CYCLE SHALL CONTINUE UNTIL THE SPACE HUMIDITY SETPOINT IS SATISFIED.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
HIGH SPACE HUMIDITY: IF THE SPACE HUMIDITY IS GREATER THAN 70% (ADJ.).

UV TYPE B

POINT NAME	HARDWARE POINTS AI	AO	BI	BO	SOFTWARE POINTS AV	BV	LOOP	SCHED	TREND	ALARM	GRAPHIC
DISCHARGE AIR TEMP	x								x		x
MIXED AIR TEMP	x								x		x
SPACE HUMIDITY	x								x		x
SPACE TEMP	x								x		x
DT WATER VALVE		x							x		x
FAN STATUS			x						x		x
FREEZESTAT			x						x	x	x
IONIZATION SYS - FAULT			x						x	x	x
**OA FAN STATUS SF-X			x						x		x
FAN HIGH SPEED				x					x		x
FAN LOW SPEED				x					x		x
**OA FAN ISO. DAMPER				x					x		x
**OA SUPPLY FAN				x					x		x
COOLING SETPOINT					x				x		x
HEATING SETPOINT					x				x		x
DAT MAX SETPOINT					x				x		x
DAT MIN SETPOINT					x				x		x
DAT NEUTRAL SETPOINT					x				x		x
DEHUMID CLG OFFSET SP					x				x		x
DEHUMID SETPOINT					x				x		x
CHANGEOVER HTG/CLG						x					
SCHEDULE								x			
FAN FAILURE										x	x
FAN IN HAND										x	x
HIGH DISCHARGE TEMP										x	x
HIGH MIXED AIR TEMP										x	x
HIGH SPACE HUMIDITY										x	x
HIGH SPACE TEMP										x	x
LOW DISCHARGE TEMP										x	x
LOW MIXED AIR TEMP										x	x
LOW SPACE TEMP										x	x
TOTALS	**4**	**1**	**4**	**4**	**7**	**1**	**0**	**1**	**20**	**11**	**29**

TOTAL HARDWARE (13) TOTAL SOFTWARE (40)

OA Supply Fan for UVs	
Supply Fan	UVs Being Served
SF-212A	UV-220 to UV-224
SF-212B	UV-207 to UV-211
SF-260A	UV-268 to UV-272
SF-260B	UV-255 to UV-259
SF-310A	UV-318 to UV-322
SF-310B	UV-305 to UV-309



B UNIT VENTILATORS – SUPPLY FAN FORCED MINIMUM OUTSIDE AIR
(UV-207-211, 220-224, 255-259, 268-272, 305-309, 318-322) PERIMETER CLASROOMS, HEALTH AND SCIENCE ROOMS
TYPICAL FOR (30) UNITS

1

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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 033629 CLEMENT T. MILBOURNE
01.25.2023

ISSUED FOR CONSTRUCTION

CHARLOTTE-MECKLENBERG SCHOOLS

NORTHRIDGE MIDDLE SCHOOL HVAC CONTROLS

CHARLOTTE-MECKLENBERG SCHOOLS
7601 THE PLAZA
CHARLOTTE, NC 28215

REVISIONS

NO.	DESCRIPTION	DATE
1	ISSUED FOR CONSTRUCTION	9/27/22
2	REVISION 1	1/13/23
3	REVISION 2	1/25/23

SHEET INFORMATION

DATE	09/27/2022
JOB NUMBER	2202-01-002
DRAWN	LCB
APPROVED	CTM

HVAC CONTROLS
UNIT VENTILATORS
A & B

M-808

SHEET 21 OF 28

SEQUENCE OF OPERATIONS

UNIT VENTILATORS – MINIMUM OUTSIDE AIR (SCHEMATIC TYPE C, D & E)
(UV-288) MACHINE RM / (UV-227, 231) ART CLASROOMS / (UV-282) CAREER GUIDANCE / (UV-335A, 335B) KITCHEN / (UV-191A, 191B) DANCE / (UV-196A, 196B) CHORUS / (UV-285) LIFE SKILLS / (UV-287) TECHNOLOGY LAB

RUN CONDITIONS - SCHEDULED BY BUILDING ZONE:
THE UNIT SHALL RUN ACCORDING TO A USER DEFINABLE TIME SCHEDULE IN THE FOLLOWING MODES:
OCCUPIED MODE: THE UNIT SHALL CONTINUOUSLY RUN TO MAINTAIN
A 74°F (ADJ.) COOLING SETPOINT
A 70°F (ADJ.) HEATING SETPOINT.
A 60% RH (ADJ.) DEHUMIDIFICATION SETPOINT.
UNOCCUPIED MODE (NIGHT SETBACK): THE UNIT SHALL CYCLE TO MAINTAIN
A 80°F (ADJ.) COOLING SETPOINT.
A 62°F (ADJ.) HEATING SETPOINT.
A 60% RH (ADJ.) DEHUMIDIFICATION SETPOINT.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
HIGH SPACE TEMP: IF THE SPACE TEMPERATURE IS GREATER THAN THE COOLING SETPOINT BY A USER DEFINABLE AMOUNT (ADJ.).
LOW SPACE TEMP: IF THE SPACE TEMPERATURE IS LESS THAN THE HEATING SETPOINT BY A USER DEFINABLE AMOUNT (ADJ.).

FREEZE PROTECTION:
THE UNIT SHALL SHUT DOWN AND GENERATE AN ALARM UPON RECEIVING A FREEZESTAT STATUS. WHENEVER THE FREEZESTAT IS ON, THE WATER COIL VALVE SHALL MODULATE OPEN TO MAINTAIN THE MIXED AIR TEMPERATURE AT 70°F (ADJ.). THE OA ISOLATION DAMPER SHALL FULLY CLOSE.

FAN:
THE FAN SHALL RUN ANYTIME THE UNIT IS COMMANDED TO RUN, UNLESS SHUTDOWN ON SAFETIES. TO PREVENT SHORT CYCLING, THE FAN SHALL HAVE A USER DEFINABLE (ADJ.) MINIMUM RUNTIME. THE CONTROLLER SHALL MONITOR THE STATUS OF EACH FAN.
THE FAN SPEEDS SHALL BE INDEXED AS FOLLOWS:
LOW SPEED SHALL RUN WHENEVER THE COOLING OR HEATING LOOP SIGNAL IS 0-50% (ADJ.) AND THE DEMAND CONTROLLED VENTILATION SEQUENCE DOES NOT REQUIRE INCREASED VENTILATION.
HIGH SPEED SHALL RUN WHENEVER THE COOLING OR HEATING LOOP SIGNAL IS 51-100% (ADJ.) OR THE DEMAND CONTROLLED VENTILATION SEQUENCE REQUIRES INCREASED VENTILATION.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
FAN FAILURE: COMMANDED ON, BUT THE STATUS IS OFF.
FAN IN HAND: COMMANDED OFF, BUT THE STATUS IS ON.

DUAL TEMPERATURE WATER COIL VALVE:
THE CONTROLLER SHALL MEASURE THE DISCHARGE AIR TEMPERATURE AND MODULATE THE WATER COIL VALVE TO MAINTAIN A VARIABLE DISCHARGE AIR TEMPERATURE SETPOINT THAT WILL CHANGE IN RESPONSE TO SPACE TEMPERATURE CHANGES. (SEE DAT CONTROL SEQUENCE.)
THE CHW COOLING SHALL BE ENABLED WHENEVER:
THE CHANGEOVER SIGNAL FROM THE BAS INDICATES COOLING IS AVAILABLE FROM THE CENTRAL PLANT, AND THE SPACE TEMPERATURE IS ABOVE THE HEATING SETPOINT.
AND THE FAN STATUS IS ON.
THE HW HEATING SHALL BE ENABLED WHENEVER:
THE CHANGEOVER SIGNAL FROM THE BAS INDICATES HEATING IS AVAILABLE FROM THE CENTRAL PLANT, AND THE SPACE TEMPERATURE IS BELOW THE COOLING SETPOINT.
AND THE FAN STATUS IS ON.
THE WATER COIL VALVE SHALL CLOSE WHENEVER THE CHW COOLING OR THE HW HEATING ARE NOT ENABLED AND THE FREEZESTAT STATUS IS OFF. THE WATER COIL VALVE SHALL MODULATE OPEN AS REQUIRED BY FREEZE PROTECTION SEQUENCE.

DISCHARGE AIR TEMPERATURE (DAT) CONTROL:
THE SPACE TEMPERATURE SHALL BE CONTROLLED BY A CASCADING SEQUENCE THAT MODULATES THE CONTROL VALVE BASED ON A VARIABLE DAT SETPOINT. THE CONTROLLER SHALL MONITOR THE DISCHARGE AIR TEMPERATURE AND THE SPACE TEMPERATURE. THE DAT SETPOINT SHALL BE RESET BASED ON THE SPACE TEMPERATURE DEVIATION FROM SPACE TEMPERATURE SETPOINT.
WHEN CHW COOLING IS ENABLED:
THE CONTROLLER SHALL RESET THE DISCHARGE AIR TEMPERATURE DOWN TO A MINIMUM DAT SETPOINT OF 55°F (ADJ.) WHEN THE SPACE TEMPERATURE IS 2°F (ADJ.) ABOVE THE COOLING SETPOINT. CONVERSELY, AS SPACE TEMPERATURE DEVIATES BELOW THE COOLING SETPOINT, THE DAT SETPOINT IS RESET UP TO THE NEUTRAL DAT SETPOINT OF 70°F (ADJ.).
WHEN HW HEATING IS ENABLED:
THE CONTROLLER SHALL RESET THE DISCHARGE AIR TEMPERATURE UP TO A MAXIMUM DAT SETPOINT OF 85°F (ADJ.) WHEN THE SPACE TEMPERATURE IS 2°F (ADJ.) BELOW THE HEATING SETPOINT. CONVERSELY, AS SPACE TEMPERATURE DEVIATES ABOVE THE HEATING SETPOINT, THE DAT SETPOINT IS RESET DOWN TO THE NEUTRAL DAT SETPOINT OF 70°F (ADJ.).
ALARMS SHALL BE PROVIDED AS FOLLOWS:
HIGH DISCHARGE AIR TEMP: IF THE DISCHARGE AIR TEMPERATURE IS MORE THAN 10°F (ADJ.) ABOVE MAXIMUM DAT SETPOINT.
LOW DISCHARGE AIR TEMP: IF THE DISCHARGE AIR TEMPERATURE IS LESS THAN 10°F (ADJ.) BELOW MINIMUM DAT SETPOINT.

AIR PURIFICATION - IONIZATION SYSTEM:
THE IONIZATION SYSTEM SHALL BE AVAILABLE ANYTIME THE FAN STATUS IS ON. IT IS NOT STARTED BY BAS.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
IONIZATION SYSTEM FAULT: FAN IS COMMANDED ON AND IONIZATION DEVICE FAULT SIGNAL STATUS IS ON.

MINIMUM OUTSIDE AIR VENTILATION:
THE OUTSIDE AIR ISOLATION DAMPER SHALL OPEN WHENEVER THE UNIT RUNS IN OCCUPIED MODE.
TAB: THE BALANCING CONTRACTOR SHALL SET MINIMUM OUTSIDE AIR USING MANUAL VOLUME DAMPERS. THE (NON-ACTUATED) MIXED AIR DAMPERS SHALL BE MECHANICALLY FIXED-IN-PLACE AT THE UNIT.
NOTE: THE UV-288 MIXED AIR DAMPERS SHALL BE MECHANICALLY UNLINKED FROM EACH OTHER. ONLY THE OUTSIDE AIR DAMPER SHALL BE ACTUATED FOR CONTROLLED OPERATION AS AN ISOLATION DAMPER.
THE OUTSIDE AIR ISOLATION DAMPER SHALL CLOSE WHENEVER:
THE UNIT RUNS IN UNOCCUPIED MODE,
OR MIXED AIR TEMPERATURE DROPS FROM 45°F TO 40°F (ADJ.),
OR THE FAN STATUS IS OFF,
OR THE FREEZESTAT IS ON.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
HIGH MIXED AIR TEMP: IF THE MIXED AIR TEMPERATURE IS GREATER THAN 90°F (ADJ.).
LOW MIXED AIR TEMP: IF THE MIXED AIR TEMPERATURE IS LESS THAN 45°F (ADJ.).

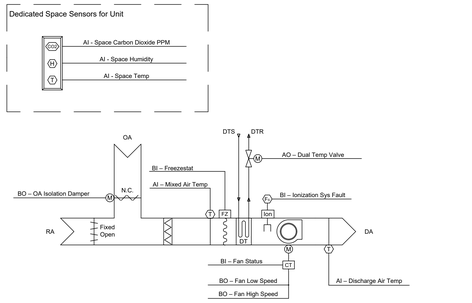
DEHUMIDIFICATION (LIMITED) - NO REHEAT AVAILABLE:
THE CONTROLLER SHALL MONITOR THE SPACE HUMIDITY AND MAINTAIN THE DEHUMIDIFICATION SETPOINT. IF THE SPACE HUMIDITY LEVEL IS ABOVE SETPOINT WHEN THE CHANGEOVER SIGNAL FROM THE BAS INDICATES COOLING IS AVAILABLE FROM THE CENTRAL PLANT, THE FOLLOWING SHALL OCCUR:
THE FAN SHALL BE COMMANDED TO RUN IN THE OCCUPIED OR UNOCCUPIED MODE.
THE DUAL TEMPERATURE WATER COIL VALVE SHALL MODULATE TO MAINTAIN A 55°F (ADJ.) DISCHARGE AIR TEMPERATURE SETPOINT UNTIL THE SPACE TEMPERATURE FALLS TO A LIMIT OF 2°F (ADJ.) BELOW THE SPACE COOLING SETPOINT. THE WATER COIL VALVE SHOULD THEN CLOSE, ALLOWING THE SPACE TEMPERATURE TO RISE TO A LIMIT OF 1°F ABOVE THE SPACE COOLING SETPOINT. THIS CYCLE SHALL CONTINUE UNTIL THE SPACE HUMIDITY SETPOINT IS SATISFIED.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
HIGH SPACE HUMIDITY: IF THE SPACE HUMIDITY IS GREATER THAN 70% (ADJ.).

DEMAND CONTROLLED VENTILATION:
THE CONTROLLER SHALL MEASURE THE SPACE CO2 CONCENTRATION AND INCREASE THE FAN SPEED TO MAINTAIN THE FOLLOWING CALCULATED CO2 SETPOINTS:
MINIMUM CO2 SETPOINT = OUTSIDE AIR CO2 + 600 PPM (ADJ.)
MAXIMUM CO2 SETPOINT = OUTSIDE AIR CO2 + 1000 PPM (ADJ.)
IF SPACE CO2 CONCENTRATION IS BELOW THE MINIMUM CO2 SETPOINT, THE FAN SHALL RUN AT THE CONFIGURED SPEED.
IF SPACE CO2 CONCENTRATION INCREASES ABOVE THE MINIMUM CO2 SETPOINT + 200 PPM (ADJ.), THE FAN SHALL RUN AT HIGH SPEED FOR INCREASED VENTILATION.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
HIGH SPACE CARBON DIOXIDE CONCENTRATION: IF THE SPACE CO2 CONCENTRATION IS GREATER THAN THE MAXIMUM CO2 SETPOINT WHEN IN THE OCCUPIED MODE.

UV TYPE C

POINT NAME	HARDWARE POINTS AI	AO	BI	BO	SOFTWARE POINTS AV	BV	LOOP	SCHED	TREND	ALARM	GRAPHIC
DISCHARGE AIR TEMP	x								x		x
MIXED AIR TEMP	x								x		x
SPACE CO2 PPM	x								x		x
SPACE HUMIDITY	x								x		x
SPACE TEMP	x								x		x
DT WATER VALVE		x							x		x
FAN STATUS			x						x		x
FREEZESTAT			x						x	x	x
IONIZATION SYS - FAULT			x						x	x	x
FAN HIGH SPEED				x					x		x
FAN LOW SPEED				x					x		x
OA ISOLATION DAMPER				x					x		x
COOLING SETPOINT					x				x		x
HEATING SETPOINT					x				x		x
DAT MAX SETPOINT					x				x		x
DAT MIN SETPOINT					x				x		x
DAT NEUTRAL SETPOINT					x				x		x
DEHUMID CLG OFFSET SP					x				x		x
DEHUMID SETPOINT					x				x		x
CO2 MAX SETPOINT					x				x		x
CO2 MIN SETPOINT					x				x		x
CHANGEOVER HTG/CLG						x					
SCHEDULE								x			
FAN FAILURE										x	x
FAN IN HAND										x	x
HIGH DISCHARGE TEMP										x	x
HIGH MIXED AIR TEMP										x	x
HIGH SPACE CO2 LEVEL										x	x
HIGH SPACE HUMIDITY										x	x
HIGH SPACE TEMP										x	x
LOW DISCHARGE TEMP										x	x
LOW MIXED AIR TEMP										x	x
LOW SPACE TEMP										x	x
TOTALS	**5**	**1**	**3**	**3**	**9**	**1**	**0**	**1**	**21**	**12**	**31**

TOTAL HARDWARE (12) **TOTAL SOFTWARE (44)**

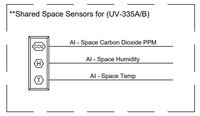


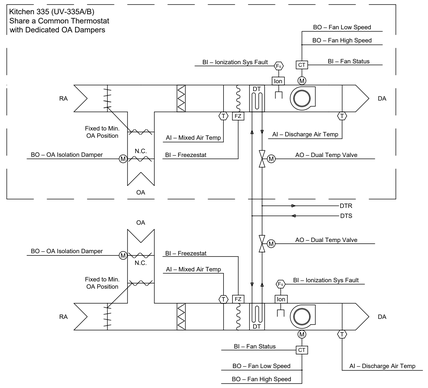
C UNIT VENTILATOR – MINIMUM OUTSIDE AIR WITH UNLINKED OA DAMPER
(UV-288) MACHINE ROOM
TYPICAL FOR (1) UNIT

UV TYPE D

POINT NAME	HARDWARE POINTS AI	AO	BI	BO	SOFTWARE POINTS AV	BV	LOOP	SCHED	TREND	ALARM	GRAPHIC
DISCHARGE AIR TEMP	x								x		x
MIXED AIR TEMP	x								x		x
**SPACE CO2 PPM	x								x		x
**SPACE HUMIDITY	x								x		x
**SPACE TEMP	x								x		x
DT WATER VALVE		x							x		x
FAN STATUS			x						x		x
FREEZESTAT			x						x	x	x
IONIZATION SYS - FAULT			x						x	x	x
FAN HIGH SPEED				x					x		x
FAN LOW SPEED				x					x		x
OA ISOLATION DAMPER				x					x		x
COOLING SETPOINT					x				x		x
HEATING SETPOINT					x				x		x
DAT MAX SETPOINT					x				x		x
DAT MIN SETPOINT					x				x		x
DAT NEUTRAL SETPOINT					x				x		x
DEHUMID CLG OFFSET SP					x				x		x
DEHUMID SETPOINT					x				x		x
CO2 MAX SETPOINT					x				x		x
CO2 MIN SETPOINT					x				x		x
CHANGEOVER HTG/CLG						x					
SCHEDULE								x			
FAN FAILURE										x	x
FAN IN HAND										x	x
HIGH DISCHARGE TEMP										x	x
HIGH MIXED AIR TEMP										x	x
HIGH SPACE CO2 LEVEL										x	x
HIGH SPACE HUMIDITY										x	x
HIGH SPACE TEMP										x	x
LOW DISCHARGE TEMP										x	x
LOW MIXED AIR TEMP										x	x
LOW SPACE TEMP										x	x
TOTALS	**5**	**1**	**3**	**3**	**9**	**1**	**0**	**1**	**21**	**12**	**31**

TOTAL HARDWARE (12) **TOTAL SOFTWARE (44)**



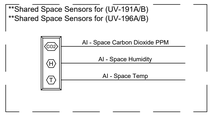


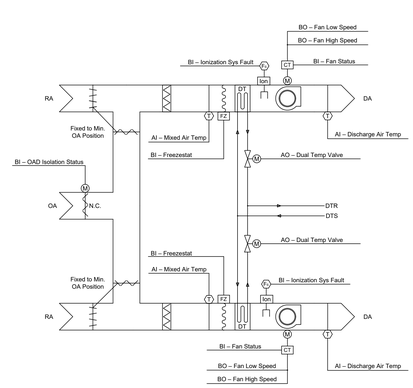
D UNIT VENTILATORS – MINIMUM OUTSIDE AIR WITH DEDICATED OA DAMPER IN DUCT
(UV-227, 231) ART CLASROOMS / (UV-282) CAREER GUIDANCE / (UV-335A, 335B) KITCHEN
TYPICAL FOR (5) UNITS

UV TYPE E

POINT NAME	HARDWARE POINTS AI	AO	BI	BO	SOFTWARE POINTS AV	BV	LOOP	SCHED	TREND	ALARM	GRAPHIC
DISCHARGE AIR TEMP	x								x		x
MIXED AIR TEMP	x								x		x
**SPACE CO2 PPM	x								x		x
**SPACE HUMIDITY	x								x		x
**SPACE TEMP	x								x		x
DT WATER VALVE		x							x		x
FAN STATUS			x						x		x
FREEZESTAT			x						x	x	x
IONIZATION SYS - FAULT			x						x	x	x
FAN HIGH SPEED				x					x		x
FAN LOW SPEED				x					x		x
*OA ISOLATION DAMPER				x					x		x
COOLING SETPOINT					x				x		x
HEATING SETPOINT					x				x		x
DAT MAX SETPOINT					x				x		x
DAT MIN SETPOINT					x				x		x
DAT NEUTRAL SETPOINT					x				x		x
DEHUMID CLG OFFSET SP					x				x		x
DEHUMID SETPOINT					x				x		x
CO2 MAX SETPOINT					x				x		x
CO2 MIN SETPOINT					x				x		x
CHANGEOVER HTG/CLG						x					
SCHEDULE								x			
FAN FAILURE										x	x
FAN IN HAND										x	x
HIGH DISCHARGE TEMP										x	x
HIGH MIXED AIR TEMP										x	x
HIGH SPACE CO2 LEVEL										x	x
HIGH SPACE HUMIDITY										x	x
HIGH SPACE TEMP										x	x
LOW DISCHARGE TEMP										x	x
LOW MIXED AIR TEMP										x	x
LOW SPACE TEMP										x	x
TOTALS	**5**	**1**	**3**	**3**	**9**	**1**	**0**	**1**	**21**	**12**	**31**

TOTAL HARDWARE (12) **TOTAL SOFTWARE (44)**





E UNIT VENTILATORS – MINIMUM OUTSIDE AIR WITH *SHARED OA DAMPER IN DUCT
(UV-191A, 191B) DANCE / (UV-196A, 196B) CHORUS / (UV-285) LIFE SKILLS / (UV-287) TECHNOLOGY LAB
TYPICAL FOR (6) UNITS

1

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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 033629 ENGINEER CLEMENT T. MILBOURNE

01.25.2023

ISSUED FOR CONSTRUCTION

CHARLOTTE-MECKLENBERG SCHOOLS

NORTHRIDGE MIDDLE SCHOOL
HVAC CONTROLS

CHARLOTTE-MECKLENBERG SCHOOLS
7601 THE PLAZA
CHARLOTTE, NC 28215

REVISIONS

NO.	DESCRIPTION	DATE
1	ISSUED FOR CONSTRUCTION	9/27/22
2	REVISION 1	1/13/23
3	REVISION 2	1/25/23

SHEET INFORMATION

DATE	09/27/2022
JOB NUMBER	2202-01-002
DRAWN	LCB
APPROVED	CTM

HVAC CONTROLS
UNIT VENTILATORS
C - E

M-809

SHEET 22 OF 28

SEQUENCE OF OPERATIONS

UNIT VENTILATORS – ECONOMIZER (SCHEMATIC TYPE F & G)
(UV-185A, 185B) INSTRUMENT / (UV-293) CLASSROOM / (UV-182A, 182B) THEATER ARTS /
(UV-276A, 276B) COMPUTER LAB / (UV-277B, 277C) BUSINESS/KEYBOARD

RUN CONDITIONS - SCHEDULED BY BUILDING ZONE:
THE UNIT SHALL RUN ACCORDING TO A USER DEFINABLE TIME SCHEDULE IN THE FOLLOWING MODES:
OCCUPIED MODE: THE UNIT SHALL CONTINUOUSLY RUN TO MAINTAIN
A 74°F (ADJ.) COOLING SETPOINT
A 70°F (ADJ.) HEATING SETPOINT.
A 60% RH (ADJ.) DEHUMIDIFICATION SETPOINT.
UNOCCUPIED MODE (NIGHT SETBACK): THE UNIT SHALL CYCLE TO MAINTAIN
A 80°F (ADJ.) COOLING SETPOINT.
A 62°F (ADJ.) HEATING SETPOINT.
A 60% RH (ADJ.) DEHUMIDIFICATION SETPOINT.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
HIGH SPACE TEMP: IF THE SPACE TEMPERATURE IS GREATER THAN THE COOLING SETPOINT BY A USER DEFINABLE AMOUNT (ADJ.).
LOW SPACE TEMP: IF THE SPACE TEMPERATURE IS LESS THAN THE HEATING SETPOINT BY A USER DEFINABLE AMOUNT (ADJ.).

FREEZE PROTECTION:
THE UNIT SHALL SHUT DOWN AND GENERATE AN ALARM UPON RECEIVING A FREEZESTAT STATUS, WHENEVER THE FREEZESTAT IS ON, THE WATER COIL VALVE SHALL MODULATE OPEN TO MAINTAIN THE MIXED AIR TEMPERATURE AT 70°F (ADJ.). THE RETURN AIR DAMPER SHALL FULLY OPEN. THE OA ISOLATION AND OUTSIDE AIR CONTROL DAMPERS SHALL FULLY CLOSE.

FAN:
THE FAN SHALL RUN ANYTIME THE UNIT IS COMMANDED TO RUN, UNLESS SHUTDOWN ON SAFETIES. TO PREVENT SHORT CYCLING, THE FAN SHALL HAVE A USER DEFINABLE (ADJ.) MINIMUM RUNTIME. THE CONTROLLER SHALL MONITOR THE STATUS OF EACH FAN.
THE FAN SPEEDS SHALL BE INDEXED AS FOLLOWS:
LOW SPEED SHALL RUN WHENEVER THE COOLING OR HEATING LOOP SIGNAL IS 0-50% (ADJ.) AND THE DEMAND CONTROLLED VENTILATION SEQUENCE DOES NOT REQUIRE INCREASED VENTILATION.
HIGH SPEED SHALL RUN WHENEVER THE COOLING OR HEATING LOOP SIGNAL IS 51-100% (ADJ.) OR THE DEMAND CONTROLLED VENTILATION SEQUENCE REQUIRES INCREASED VENTILATION.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
FAN FAILURE: COMMANDED ON, BUT THE STATUS IS OFF.
FAN IN HAND: COMMANDED OFF, BUT THE STATUS IS ON.

DUAL TEMPERATURE WATER COIL VALVE:
THE CONTROLLER SHALL MEASURE THE DISCHARGE AIR TEMPERATURE AND MODULATE THE WATER COIL VALVE TO MAINTAIN A VARIABLE DISCHARGE AIR TEMPERATURE SETPOINT THAT WILL CHANGE IN RESPONSE TO SPACE TEMPERATURE CHANGES. (SEE DAT CONTROL SEQUENCE.)
THE CHW COOLING SHALL BE ENABLED WHENEVER:
THE CHANGEOVER SIGNAL FROM THE BAS INDICATES COOLING IS AVAILABLE FROM THE CENTRAL PLANT, AND THE SPACE TEMPERATURE IS ABOVE THE HEATING SETPOINT.
AND THE FAN STATUS IS ON.
THE HW HEATING SHALL BE ENABLED WHENEVER:
THE CHANGEOVER SIGNAL FROM THE BAS INDICATES HEATING IS AVAILABLE FROM THE CENTRAL PLANT, AND THE SPACE TEMPERATURE IS BELOW THE COOLING SETPOINT.
AND THE FAN STATUS IS ON.
THE WATER COIL VALVE SHALL CLOSE WHENEVER THE CHW COOLING OR THE HW HEATING ARE NOT ENABLED AND THE FREEZESTAT STATUS IS OFF. THE WATER COIL VALVE SHALL MODULATE OPEN AS REQUIRED BY FREEZE PROTECTION SEQUENCE.

DISCHARGE AIR TEMPERATURE (DAT) CONTROL:
THE SPACE TEMPERATURE SHALL BE CONTROLLED BY A CASCADING SEQUENCE THAT MODULATES THE CONTROL VALVE BASED ON A VARIABLE DAT SETPOINT. THE CONTROLLER SHALL MONITOR THE DISCHARGE AIR TEMPERATURE AND THE SPACE TEMPERATURE. THE DAT SETPOINT SHALL BE RESET BASED ON THE SPACE TEMPERATURE DEVIATION FROM SPACE TEMPERATURE SETPOINT.
WHEN CHW COOLING IS ENABLED:
THE CONTROLLER SHALL RESET THE DISCHARGE AIR TEMPERATURE DOWN TO A MINIMUM DAT SETPOINT OF 55°F (ADJ.) WHEN THE SPACE TEMPERATURE IS 2°F (ADJ.) ABOVE THE COOLING SETPOINT. CONVERSELY, AS SPACE TEMPERATURE DEVIATES BELOW THE COOLING SETPOINT, THE DAT SETPOINT IS RESET UP TO THE NEUTRAL DAT SETPOINT OF 70°F (ADJ.).
WHEN HW HEATING IS ENABLED:
THE CONTROLLER SHALL RESET THE DISCHARGE AIR TEMPERATURE UP TO A MAXIMUM DAT SETPOINT OF 85°F (ADJ.) WHEN THE SPACE TEMPERATURE IS 2°F (ADJ.) BELOW THE HEATING SETPOINT. CONVERSELY, AS SPACE TEMPERATURE DEVIATES ABOVE THE HEATING SETPOINT, THE DAT SETPOINT IS RESET DOWN TO THE NEUTRAL DAT SETPOINT OF 70°F (ADJ.).
ALARMS SHALL BE PROVIDED AS FOLLOWS:
HIGH DISCHARGE AIR TEMP: IF THE DISCHARGE AIR TEMPERATURE IS MORE THAN 10°F (ADJ.) ABOVE MAXIMUM DAT SETPOINT.
LOW DISCHARGE AIR TEMP: IF THE DISCHARGE AIR TEMPERATURE IS LESS THAN 10°F (ADJ.) BELOW MINIMUM DAT SETPOINT.

AIR PURIFICATION - IONIZATION SYSTEM:
THE IONIZATION SYSTEM SHALL BE AVAILABLE ANYTIME THE FAN STATUS IS ON. IT IS NOT STARTED BY BAS.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
IONIZATION SYSTEM FAULT: FAN IS COMMANDED ON AND IONIZATION DEVICE FAULT SIGNAL STATUS IS ON.

MINIMUM OUTSIDE AIR VENTILATION:
THE OUTSIDE AIR ISOLATION DAMPER SHALL OPEN AND THE MIXED AIR DAMPERS SHALL MAINTAIN A MINIMUM OUTSIDE AIR DAMPER POSITION (ADJ.) WHENEVER THE UNIT RUNS IN OCCUPIED MODE. THE MINIMUM OUTSIDE AIR DAMPER POSITION (DETERMINED BY BALANCING CONTRACTOR) SHALL BE CONFIGURED IN THE CONTROLLER.
THE OUTSIDE AIR DAMPERS SHALL FULLY CLOSE AND THE RETURN AIR DAMPER SHALL OPEN WHENEVER:
THE UNIT RUNS IN UNOCCUPIED MODE,
OR MIXED AIR TEMPERATURE DROPS FROM 45°F TO 40°F (ADJ.),
OR THE FAN STATUS IS OFF,
OR THE FREEZESTAT IS ON.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
HIGH MIXED AIR TEMP: IF THE MIXED AIR TEMPERATURE IS GREATER THAN 90°F (ADJ.).
LOW MIXED AIR TEMP: IF THE MIXED AIR TEMPERATURE IS LESS THAN 45°F (ADJ.).

ECONOMIZER:
THE CONTROLLER SHALL MEASURE THE MIXED AIR TEMPERATURE AND MODULATE THE ECONOMIZER DAMPERS IN SEQUENCE, AS A FIRST STAGE OF COOLING, TO MAINTAIN A MIXED AIR SETPOINT THAT IS 3°F (ADJ.) LESS THAN THE DISCHARGE AIR SETPOINT. IF THE DISCHARGE AIR TEMPERATURE REMAINS ABOVE DISCHARGE AIR SETPOINT AFTER THE ECONOMIZER REACHES 100%, THE WATER COIL VALVE SHALL MODULATE OPEN IN SEQUENCE, AS A SECOND STAGE OF COOLING.
THE ECONOMIZER SHALL BE ENABLED WHENEVER:
OUTSIDE AIR ENTHALPY IS LESS THAN 28 BTU/LB (ADJ.),
AND OUTSIDE AIR ENTHALPY IS LESS THAN THE SPACE AIR ENTHALPY.
AND THE FAN STATUS IS ON.

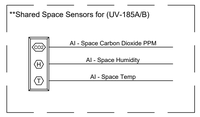
DEHUMIDIFICATION (LIMITED) - NO REHEAT AVAILABLE:
THE CONTROLLER SHALL MONITOR THE SPACE HUMIDITY AND MAINTAIN THE DEHUMIDIFICATION SETPOINT. IF THE SPACE HUMIDITY LEVEL IS ABOVE SETPOINT WHEN THE CHANGEOVER SIGNAL FROM THE BAS INDICATES COOLING IS AVAILABLE FROM THE CENTRAL PLANT, THE FOLLOWING SHALL OCCUR:
THE FAN SHALL BE COMMANDED TO RUN IN THE OCCUPIED OR UNOCCUPIED MODE.
THE DUAL TEMPERATURE WATER COIL VALVE SHALL MODULATE TO MAINTAIN A 55°F (ADJ.) DISCHARGE AIR TEMPERATURE SETPOINT UNTIL THE SPACE TEMPERATURE FALLS TO A LIMIT OF 2°F (ADJ.) BELOW THE SPACE COOLING SETPOINT. THE WATER COIL VALVE SHOULD THEN CLOSE, ALLOWING THE SPACE TEMPERATURE TO RISE TO A LIMIT OF 1°F ABOVE THE SPACE COOLING SETPOINT. THIS CYCLE SHALL CONTINUE UNTIL THE SPACE HUMIDITY SETPOINT IS SATISFIED.
ONLY FOR UV-276A&B AND UV-277B&C - THE WATER COIL VALVE SHALL CLOSE, ALLOWING THE SPLIT SYSTEM UNIT VENTILATORS SERVING THE SAME SPACE TO PROVIDE DEHUMIDIFICATION UNTIL THE SPACE HUMIDITY SETPOINT IS SATISFIED.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
HIGH SPACE HUMIDITY: IF THE SPACE HUMIDITY IS GREATER THAN 70% (ADJ.).

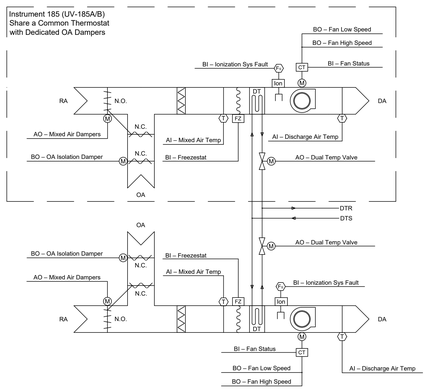
DEMAND CONTROLLED VENTILATION:
THE CONTROLLER SHALL MEASURE THE SPACE CO2 CONCENTRATION AND INCREASE THE FAN SPEED AND MINIMUM OUTSIDE AIR DAMPER POSITION TO MAINTAIN THE FOLLOWING CALCULATED CO2 SETPOINTS:
MINIMUM CO2 SETPOINT = OUTSIDE AIR CO2 + 600 PPM (ADJ.)
MAXIMUM CO2 SETPOINT = OUTSIDE AIR CO2 + 1000 PPM (ADJ.)
IF SPACE CO2 CONCENTRATION IS BELOW THE MINIMUM CO2 SETPOINT, THE FAN SHALL RUN AT THE CONFIGURED SPEED AND THE OUTSIDE AIR DAMPER SHALL OPEN TO THE MINIMUM POSITION.
IF SPACE CO2 CONCENTRATION INCREASES ABOVE THE MINIMUM CO2 SETPOINT + 200 PPM (ADJ.), THE FAN SHALL RUN AT HIGH SPEED FOR INCREASED VENTILATION.
AS SPACE CO2 CONCENTRATION INCREASES ABOVE THE MINIMUM CO2 SETPOINT, THE OUTSIDE AIR DAMPER SHALL PROPORTIONALLY MODULATE OPEN UNTIL THE DAMPER IS FULLY OPEN AT, OR ABOVE, THE MAXIMUM CO2 SETPOINT.
AS SPACE CO2 CONCENTRATION DECREASES BELOW THE MAXIMUM CO2 SETPOINT, THE OUTSIDE AIR DAMPER SHALL PROPORTIONALLY MODULATE CLOSED UNTIL THE DAMPER IS AT THE MINIMUM POSITION AT, OR BELOW, THE MINIMUM CO2 SETPOINT.
THE MINIMUM OUTSIDE AIR DAMPER POSITION REQUIRED FOR VENTILATION WILL NOT PREVENT THE OUTSIDE AIR DAMPER FROM OPENING FURTHER IF REQUIRED FOR ECONOMIZER OPERATION.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
HIGH SPACE CARBON DIOXIDE CONCENTRATION: IF THE SPACE CO2 CONCENTRATION IS GREATER THAN THE MAXIMUM CO2 SETPOINT WHEN IN THE OCCUPIED MODE.

UV TYPE F

POINT NAME	HARDWARE POINTS AI	AO	BI	BO	SOFTWARE POINTS AV	BV	LOOP	SCHED	TREND	ALARM	GRAPHIC
DISCHARGE AIR TEMP	x								x		x
MIXED AIR TEMP	x								x		x
**SPACE CO2 PPM	x								x		x
**SPACE HUMIDITY	x								x		x
**SPACE TEMP	x								x		x
DT WATER VALVE		x							x		x
MIXED AIR DAMPERS		x							x		x
FAN STATUS			x						x		x
FREEZESTAT			x						x	x	x
IONIZATION SYS - FAULT			x						x	x	x
FAN HIGH SPEED				x					x		x
FAN LOW SPEED				x					x		x
OA ISOLATION DAMPER				x					x		x
COOLING SETPOINT					x				x		x
HEATING SETPOINT					x				x		x
DAT MAX SETPOINT					x				x		x
DAT MIN SETPOINT					x				x		x
DAT NEUTRAL SETPOINT					x				x		x
DEHUMID CLG OFFSET SP					x				x		x
DEHUMID SETPOINT					x				x		x
CO2 MAX SETPOINT					x				x		x
CO2 MIN SETPOINT					x				x		x
OAD MINIMUM POSITION					x				x		x
CHANGEOVER HTG/CLG						x					
SCHEDULE								x			
FAN FAILURE										x	x
FAN IN HAND										x	x
HIGH DISCHARGE TEMP										x	x
HIGH MIXED AIR TEMP										x	x
HIGH SPACE CO2 LEVEL										x	x
HIGH SPACE HUMIDITY										x	x
HIGH SPACE TEMP										x	x
LOW DISCHARGE TEMP										x	x
LOW MIXED AIR TEMP										x	x
LOW SPACE TEMP										x	x
TOTALS	**5**	**2**	**3**	**3**	**10**	**1**	**0**	**1**	**23**	**12**	**33**

TOTAL HARDWARE (13) **TOTAL SOFTWARE (47)**



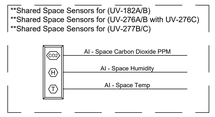


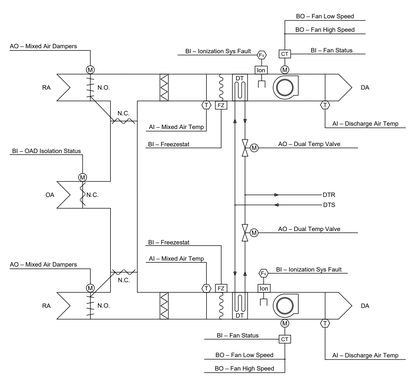
F UNIT VENTILATORS – ECONOMIZER WITH DEDICATED OA DAMPER IN DUCT
(UV-185A, 185B) INSTRUMENT / (UV-293) CLASSROOM
TYPICAL FOR (3) UNITS

UV TYPE G

POINT NAME	HARDWARE POINTS AI	AO	BI	BO	SOFTWARE POINTS AV	BV	LOOP	SCHED	TREND	ALARM	GRAPHIC
DISCHARGE AIR TEMP	x								x		x
MIXED AIR TEMP	x								x		x
**SPACE CO2 PPM	x								x		x
**SPACE HUMIDITY	x								x		x
**SPACE TEMP	x								x		x
DT WATER VALVE		x							x		x
MIXED AIR DAMPERS		x							x		x
FAN STATUS			x						x		x
FREEZESTAT			x						x	x	x
IONIZATION SYS - FAULT			x						x	x	x
FAN HIGH SPEED				x					x		x
FAN LOW SPEED				x					x		x
*OA ISOLATION DAMPER				x					x		x
COOLING SETPOINT					x				x		x
HEATING SETPOINT					x				x		x
DAT MAX SETPOINT					x				x		x
DAT MIN SETPOINT					x				x		x
DAT NEUTRAL SETPOINT					x				x		x
DEHUMID CLG OFFSET SP					x				x		x
DEHUMID SETPOINT					x				x		x
CO2 MAX SETPOINT					x				x		x
CO2 MIN SETPOINT					x				x		x
OAD MINIMUM POSITION					x				x		x
CHANGEOVER HTG/CLG						x					
SCHEDULE								x			
FAN FAILURE										x	x
FAN IN HAND										x	x
HIGH DISCHARGE TEMP										x	x
HIGH MIXED AIR TEMP										x	x
HIGH SPACE CO2 LEVEL										x	x
HIGH SPACE HUMIDITY										x	x
HIGH SPACE TEMP										x	x
LOW DISCHARGE TEMP										x	x
LOW MIXED AIR TEMP										x	x
LOW SPACE TEMP										x	x
TOTALS	**5**	**2**	**3**	**3**	**10**	**1**	**0**	**1**	**23**	**12**	**33**

TOTAL HARDWARE (13) **TOTAL SOFTWARE (47)**





G UNIT VENTILATORS – ECONOMIZER WITH *SHARED OA DAMPER IN DUCT
(UV-182A, 182B) THEATER ARTS / (UV-276A, 276B) COMPUTER LAB / (UV-277B, 277C) BUSINESS/KEYBOARD
TYPICAL FOR (6) UNITS

SEQUENCE OF OPERATIONS

UNIT VENTILATORS – SPLIT-SYSTEM SUPPLEMENTAL COOLING (SCHEMATIC TYPE H)
(UV-276C) COMPUTER LAB / (UV-277A, 277D) BUSINESS/KEYBOARD

RUN CONDITIONS - SCHEDULED BY BUILDING ZONE:
THE UNIT SHALL RUN ACCORDING TO A USER DEFINABLE TIME SCHEDULE IN THE FOLLOWING MODES:
OCCUPIED MODE: THE UNIT SHALL CONTINUOUSLY RUN TO MAINTAIN
A 74°F (ADJ.) COOLING SETPOINT.
A 70°F (ADJ.) HEATING SETPOINT.
A 60% RH (ADJ.) DEHUMIDIFICATION SETPOINT.
UNOCCUPIED MODE (NIGHT SETBACK): THE UNIT SHALL CYCLE TO MAINTAIN
A 80°F (ADJ.) COOLING SETPOINT.
A 62°F (ADJ.) HEATING SETPOINT.
A 60% RH (ADJ.) DEHUMIDIFICATION SETPOINT.

FAN:
THE FAN SHALL RUN ANYTIME THE UNIT IS COMMANDED TO RUN, UNLESS SHUTDOWN ON SAFETIES. TO PREVENT SHORT CYCLING, THE FAN SHALL HAVE A USER DEFINABLE (ADJ.) MINIMUM RUNTIME. THE CONTROLLER SHALL MONITOR THE STATUS OF EACH FAN.
THE FAN SPEEDS SHALL BE INDEXED AS FOLLOWS:
LOW SPEED SHALL RUN WHENEVER THE COOLING OR HEATING LOOP SIGNAL IS 0-50% (ADJ.).
HIGH SPEED SHALL RUN WHENEVER THE COOLING OR HEATING LOOP SIGNAL IS 51-100% (ADJ.).
ALARMS SHALL BE PROVIDED AS FOLLOWS:
FAN FAILURE: COMMANDED ON, BUT THE STATUS IS OFF.
FAN IN HAND: COMMANDED OFF, BUT THE STATUS IS ON.

SPLIT-SYSTEM COOLING - DIRECT EXPANSION REFRIGERANT COIL:
THE CONTROLLER SHALL MEASURE THE SPACE TEMPERATURE AND STAGE THE COOLING TO MAINTAIN ITS COOLING SETPOINT. TO PREVENT SHORT CYCLING, THE STAGE SHALL HAVE A USER DEFINABLE (ADJ.) MINIMUM RUNTIME. THE SPLIT-SYSTEM UNITS SHALL PROVIDE A SECOND STAGE OF SUPPLEMENTARY COOLING WHEN THE UNIT VENTILATORS USING DUAL TEMPERATURE COILS DO NOT SATISFY THE COOLING SETPOINT.
THE DX COOLING SHALL BE ENABLED WHENEVER:
THE UNIT VENTILATORS GROUPED IN THE SAME SPACE THAT USE DUAL TEMPERATURE WATER VALVES ARE FULLY OPEN WITH CENTRAL PLANT COOLING AVAILABLE OR THE WATER COIL VALVES ARE FULLY CLOSED WITH CENTRAL PLANT HEATING AVAILABLE,
AND OUTSIDE AIR TEMPERATURE IS GREATER THAN 60°F (ADJ.).
AND THE SPACE TEMPERATURE IS ABOVE THE HEATING SETPOINT.
AND THE FAN STATUS IS ON.

DISCHARGE AIR TEMPERATURE:
THE CONTROLLER SHALL MONITOR THE DISCHARGE AIR TEMPERATURE.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
HIGH DISCHARGE AIR TEMP: IF THE DISCHARGE AIR TEMPERATURE IS GREATER THAN 120°F (ADJ.).
LOW DISCHARGE AIR TEMP: IF THE DISCHARGE AIR TEMPERATURE IS LESS THAN 40°F (ADJ.).

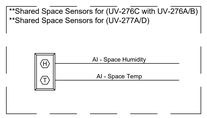
AIR PURIFICATION - IONIZATION SYSTEM:
THE IONIZATION SYSTEM SHALL BE AVAILABLE ANYTIME THE FAN STATUS IS ON. IT IS NOT STARTED BY BAS.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
IONIZATION SYSTEM FAULT: FAN IS COMMANDED ON AND IONIZATION DEVICE FAULT SIGNAL STATUS IS ON.

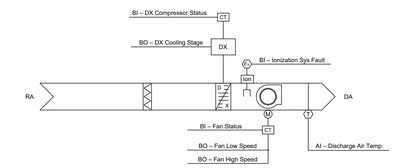
DEHUMIDIFICATION (LIMITED) - NO REHEAT AVAILABLE:
THE CONTROLLER SHALL MONITOR THE SPACE HUMIDITY AND MAINTAIN THE DEHUMIDIFICATION SETPOINT. IF THE SPACE HUMIDITY LEVEL IS ABOVE SETPOINT WHEN THE CHANGEOVER SIGNAL FROM THE BAS INDICATES COOLING IS AVAILABLE FROM THE CENTRAL PLANT, THE FOLLOWING SHALL OCCUR:
THE FAN SHALL BE COMMANDED TO RUN IN THE OCCUPIED OR UNOCCUPIED MODE.
THE DX COOLING SHALL BE ENABLED WITH THE COMPRESSOR COMMANDED ON UNTIL THE SPACE TEMPERATURE FALLS TO A LIMIT OF 2°F (ADJ.) BELOW THE SPACE COOLING SETPOINT. THE COMPRESSOR SHOULD THEN BE COMMANDED OFF, ALLOWING THE SPACE TEMPERATURE TO RISE TO A LIMIT OF 1°F ABOVE THE SPACE COOLING SETPOINT. THIS CYCLE SHALL CONTINUE UNTIL THE SPACE HUMIDITY SETPOINT IS SATISFIED.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
HIGH SPACE HUMIDITY: IF THE SPACE HUMIDITY IS GREATER THAN 70% (ADJ.).

UV TYPE H

POINT NAME	HARDWARE POINTS AI	AO	BI	BO	SOFTWARE POINTS AV	BV	LOOP	SCHED	TREND	ALARM	GRAPHIC
DISCHARGE AIR TEMP	x								x		x
**SPACE HUMIDITY	x								x		x
**SPACE TEMP	x								x		x
FAN STATUS			x						x		x
IONIZATION SYS - FAULT			x						x	x	x
FAN HIGH SPEED				x					x		x
FAN LOW SPEED				x					x		x
COOLING SETPOINT					x				x		x
HEATING SETPOINT					x				x		x
DEHUMID CLG OFFSET SP					x				x		x
DEHUMID SETPOINT					x				x		x
CHANGEOVER HTG/CLG						x					
SCHEDULE								x			
FAN FAILURE										x	x
FAN IN HAND										x	x
HIGH DISCHARGE TEMP										x	x
HIGH SPACE HUMIDITY										x	x
HIGH SPACE TEMP										x	x
LOW DISCHARGE TEMP										x	x
LOW SPACE TEMP										x	x
TOTALS	**3**	**0**	**2**	**2**	**4**	**1**	**0**	**1**	**11**	**8**	**18**

TOTAL HARDWARE (7) **TOTAL SOFTWARE (25)**





H UNIT VENTILATORS – SPLIT-SYSTEM SUPPLEMENTAL COOLING
(UV-276C) COMPUTER LAB / (UV-277A, 277D) BUSINESS/KEYBOARD
TYPICAL FOR (3) UNITS

TMG CONSULTING ENGINEERS
The Mitchell Group Consulting Engineers INC
dba TMG Consulting Engineers
401 Hawthorne Lane
Suite 110-77
Charlotte, NC 28204
704.895.1921 Phone
704.895.1931 Fax
Website: WWW.TMG-CE.COM

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL C-3646 CHARLOTTE, NC

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 033629 ENGINEER CLEMENT T. MILBOURNE

01.25.2023

ISSUED FOR CONSTRUCTION

CHARLOTTE-MECKLENBERG SCHOOLS

NORTHRIDGE MIDDLE SCHOOL
HVAC CONTROLS

CHARLOTTE-MECKLENBERG SCHOOLS
7601 THE PLAZA
CHARLOTTE, NC 28215

REVISIONS

NO.	DESCRIPTION	DATE
1	ISSUED FOR CONSTRUCTION	9/27/22
2	REVISION 1	1/13/23
3	REVISION 2	1/25/23

SHEET INFORMATION

DATE	09/27/2022
JOB NUMBER	2202-01-002
DRAWN	LCB
APPROVED	CTM

HVAC CONTROLS
UNIT VENTILATOR
F - H

M-810

SHEET 23 OF 28

SEQUENCE OF OPERATIONS

PACKAGED VERTICAL HEAT PUMPS (SCHEMATIC TYPE A)
(PVHP-107 to 115, PVHP-120 to 124) CLASSROOMS – AREA F

RUN CONDITIONS - SCHEDULED BY BUILDING ZONE:
THE UNIT SHALL RUN ACCORDING TO A USER DEFINABLE TIME SCHEDULE IN THE FOLLOWING MODES:
OCCUPIED MODE: THE UNIT SHALL CONTINUOUSLY RUN TO MAINTAIN
- A 74°F (ADJ.) COOLING SETPOINT
- A 70°F (ADJ.) HEATING SETPOINT.
- A 60% RH (ADJ.) DEHUMIDIFICATION SETPOINT.

UNOCCUPIED MODE (NIGHT SETBACK): THE UNIT SHALL CYCLE TO MAINTAIN
- A 80°F (ADJ.) COOLING SETPOINT
- A 62°F (ADJ.) HEATING SETPOINT
- A 60% RH (ADJ.) DEHUMIDIFICATION SETPOINT.

ALARMS SHALL BE PROVIDED AS FOLLOWS:
- HIGH SPACE TEMP: IF THE SPACE TEMPERATURE IS GREATER THAN THE COOLING SETPOINT BY A USER DEFINABLE AMOUNT (ADJ.).
- LOW SPACE TEMP: IF THE SPACE TEMPERATURE IS LESS THAN THE HEATING SETPOINT BY A USER DEFINABLE AMOUNT (ADJ.).

FAN:
THE FAN SHALL RUN ANYTIME THE UNIT IS COMMANDED TO RUN, UNLESS SHUTDOWN ON SAFETIES. TO PREVENT SHORT CYCLING, THE FAN SHALL HAVE A USER DEFINABLE (ADJ.) MINIMUM RUNTIME. THE CONTROLLER SHALL MONITOR THE STATUS OF EACH FAN.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
- FAN FAILURE: COMMANDED ON, BUT THE STATUS IS OFF.
- FAN IN HAND: COMMANDED OFF, BUT THE STATUS IS ON.

ENERGY RECOVERY VENTILATOR (ERV) - FIXED:
THE CONTROLLER SHALL ENABLE THE ERV WITH ENTHALPY WHEEL WHENEVER THE UNIT IS IN OCCUPIED MODE. THE FACTORY CONTROLLER SHALL BE USED TO INDEPENDENTLY ADJUST THE OUTSIDE AIR INTAKE AND EXHAUST AIRFLOW RATES. IN UNOCCUPIED MODE, THE ERV VENTILATION SHALL BE DISABLED AND THERE SHALL BE POSITIVE SHUTOFF OF THE OUTSIDE AIR INTAKE AND EXHAUST.

HEATING AND COOLING - 2 COMPRESSOR STAGES:
THE CONTROLLER SHALL MEASURE THE SPACE TEMPERATURE AND STAGE THE COMPRESSORS TO MAINTAIN ITS SETPOINT. TO PREVENT SHORT CYCLING, THERE SHALL BE A USER DEFINABLE (ADJ.) DELAY BETWEEN STAGES, AND EACH STAGE SHALL HAVE A USER DEFINABLE (ADJ.) MINIMUM RUNTIME. THE COMPRESSOR SHALL RUN SUBJECT TO ITS OWN INTERNAL SAFETIES AND CONTROLS. THE CONTROLLER SHALL MONITOR THE STATUS OF THE COMPRESSOR.
THE DX COOLING SHALL BE ENABLED WHENEVER:
- OUTSIDE AIR TEMPERATURE IS GREATER THAN 60°F (ADJ.),
- AND THE SPACE TEMPERATURE IS ABOVE THE HEATING SETPOINT.
- AND THE FAN STATUS IS ON.
- AND THE THE REVERSING VALVE IS IN COOL MODE.

THE DX HEATING SHALL BE ENABLED WHENEVER:
- OUTSIDE AIR TEMPERATURE IS LESS THAN 65°F (ADJ.),
- AND THE SPACE TEMPERATURE IS BELOW THE COOLING SETPOINT.
- AND THE FAN STATUS IS ON.
- AND THE THE REVERSING VALVE IS IN HEAT MODE.

ON MODE CHANGE, THE COMPRESSOR SHALL BE DISABLED AND REMAIN OFF UNTIL AFTER THE REVERSING VALVE HAS CHANGED POSITION.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
- COMPRESSOR RUNTIME EXCEEDED: COMPRESSOR RUNTIME EXCEEDS A USER DEFINABLE LIMIT (ADJ.).

ELECTRIC HEATING STAGE:
THE CONTROLLER SHALL MEASURE THE SPACE TEMPERATURE AND STAGE THE HEATING TO MAINTAIN ITS HEATING SETPOINT. TO PREVENT SHORT CYCLING, THE STAGE SHALL HAVE A USER DEFINABLE (ADJ.) MINIMUM RUNTIME.
THE ELECTRIC HEATING SHALL BE ENABLED WHENEVER:
- OUTSIDE AIR TEMPERATURE IS LESS THAN 65°F (ADJ.),
- AND THE SPACE TEMPERATURE IS BELOW THE HEATING SETPOINT.
- AND THE FAN STATUS IS ON.
- AND THE COOLING IS NOT ACTIVE.

DISCHARGE AIR TEMPERATURE:
THE CONTROLLER SHALL MONITOR THE DISCHARGE AIR TEMPERATURE.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
- HIGH DISCHARGE AIR TEMP: IF THE DISCHARGE AIR TEMPERATURE IS GREATER THAN 120°F (ADJ.).
- LOW DISCHARGE AIR TEMP: IF THE DISCHARGE AIR TEMPERATURE IS LESS THAN 40°F (ADJ.).

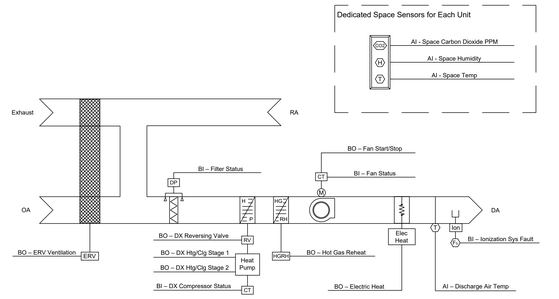
AIR PURIFICATION - IONIZATION SYSTEM:
THE IONIZATION SYSTEM SHALL BE AVAILABLE ANYTIME THE FAN STATUS IS ON. IT IS NOT STARTED BY BAS.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
- IONIZATION SYSTEM FAULT: FAN IS COMMANDED ON AND IONIZATION DEVICE FAULT SIGNAL STATUS IS ON.

DEHUMIDIFICATION - HOT GAS AND ELECTRIC REHEAT:
THE CONTROLLER SHALL MEASURE THE SPACE HUMIDITY AND OVERRIDE THE COOLING SEQUENCE TO MAINTAIN THE DEHUMIDIFICATION SETPOINT. THE DEHUMIDIFICATION MODE SHALL BE ENABLED FOR THE HOT GAS REHEAT AND THE COMPRESSOR STAGING TO RUN SUBJECT TO ITS OWN INTERNAL SAFETIES AND CONTROLS.
DURING DEHUMIDIFICATION, THE ELECTRIC HEATING SHALL BE STAGED ON TO MAINTAIN 1°F (ADJ.) LESS THAN THE SPACE COOLING SETPOINT. TO PREVENT SHORT CYCLING, THE STAGE SHALL HAVE A USER DEFINABLE (ADJ.) MINIMUM RUNTIME.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
- HIGH SPACE HUMIDITY: IF THE SPACE HUMIDITY IS GREATER THAN 70% (ADJ.).

VENTILATION MONITORING:
THE CONTROLLER SHALL MONITOR THE SPACE AIR CO2 CONCENTRATION.
MAXIMUM CO2 SETPOINT = OUTSIDE AIR CO2 + 1000 PPM (ADJ.)
ALARMS SHALL BE PROVIDED AS FOLLOWS:
- HIGH SPACE CARBON DIOXIDE CONCENTRATION: IF THE SPACE CO2 CONCENTRATION IS GREATER THAN THE MAXIMUM CO2 SETPOINT WHEN IN THE OCCUPIED MODE.

PVHP TYPE A

POINT NAME	HARDWARE POINTS AI	AO	BI	BO	SOFTWARE POINTS AV	BV	LOOP	SCHED	TREND	ALARM	GRAPHIC
DISCHARGE AIR TEMP	x								x		x
SPACE AIR CO2 PPM	x								x		x
SPACE HUMIDITY	x								x		x
SPACE TEMP	x								x		x
FUTURE - ERV MODULATE		x							x		x
DX COMPRESSOR STATUS			x						x		x
FAN STATUS			x						x		x
FILTER DP STATUS			x						x	x	x
IONIZATION SYS - FAULT			x						x	x	x
DEHUMIDIFICATION MODE				x					x		x
DX HTG/CLG STAGE 1				x					x		x
DX HTG/CLG STAGE 2				x					x		x
DX REVERSING VALVE				x					x		x
ELECTRIC HEAT STAGE				x					x		x
ERV VENTILATION				x					x		x
FAN START/STOP				x					x		x
COOLING SETPOINT					x				x		x
HEATING SETPOINT					x				x		x
DEHUMID SETPOINT					x				x		x
SCHEDULE								x			
COMP RUNTIME EXCEED										x	x
FAN FAILURE										x	x
FAN IN HAND										x	x
HIGH DISCHARGE TEMP										x	x
HIGH RETURN CO2 LEVEL										x	x
HIGH SPACE HUMIDITY										x	x
HIGH SPACE TEMP										x	x
LOW DISCHARGE TEMP										x	x
LOW SPACE TEMP										x	x
TOTALS	**4**	**1**	**4**	**7**	**3**	**0**	**0**	**1**	**19**	**11**	**28**
	TOTAL HARDWARE (16)				**TOTAL SOFTWARE (34)**						



A PACKAGED VERTICAL HEAT PUMPS
(PVHP-107 to 115, PVHP-120 to 124) CLASSROOMS – AREA F
TYPICAL FOR (14) UNITS

1

TMG CONSULTING ENGINEERS, PLLC
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NORTH CAROLINA PROFESSIONAL ENGINEERING SEAL C-3646 CHARLOTTE, NC

NORTH CAROLINA PROFESSIONAL ENGINEERING SEAL 033629 ENGINEER CLEMENT T. MILDRUM

01.25.2023

ISSUED FOR CONSTRUCTION

CHARLOTTE-MECKLENBERG SCHOOLS

NORTHRIDGE MIDDLE SCHOOL HVAC CONTROLS

CHARLOTTE-MECKLENBERG SCHOOLS
7601 THE PLAZA
CHARLOTTE, NC 28215

REVISIONS

NO.	DESCRIPTION	DATE
	ISSUED FOR CONSTRUCTION	9/27/22
1	REVISION 1	1/13/23
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SHEET INFORMATION

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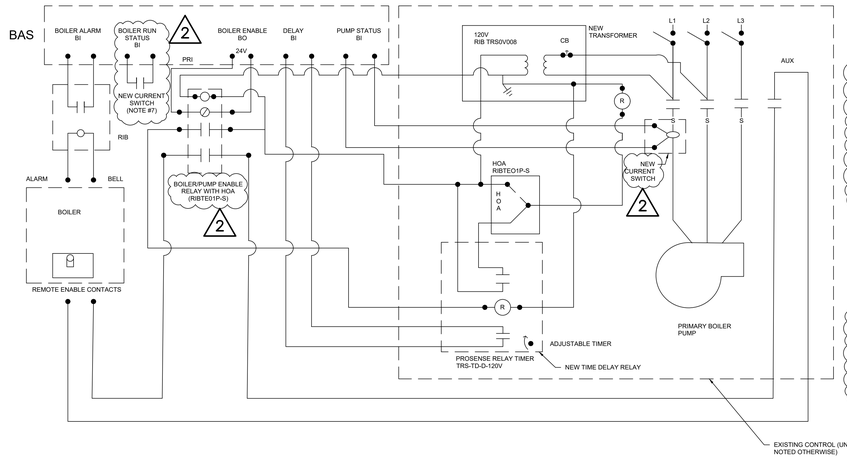
DRAWN	LCB
APPROVED	CTM

HVAC CONTROLS
PACKAGED VERTICAL
HEAT PUMP A

M-811

SHEET 24 OF 28

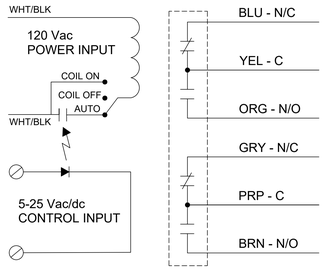


NOTES:

1. FOR ALL CONTROL WIRING, CONTRACTOR SHALL PROVIDE A MINIMUM OF 1/2 INCH CONDUIT WITH NO MORE THAN 40 PERCENT FILL.
2. CONTRACTOR SHALL PROVIDE ALL CONTROL WIRING, BAS AND FIELD DEVICE CONNECTIONS.
3. NEW TIME DELAY RELAY, RIB RELAYS, CURRENT SWITCHES, AND TRANSFORMER BY CONTRACTOR.
4. MOTOR STARTER IS EXISTING.
5. BOILER/PUMP ENABLE RELAY TO BE MOUNTED AT BOILER CONTROL PANEL.
6. HOA SWITCH SHOWN IS INTEGRAL TO THE BOILER/PUMP ENABLE RELAY. SEE DETAIL THIS SHEET.
7. BOILER RUN STATUS CURRENT SWITCH TO BE INSTALLED ON COMBUSTION AIR FAN LOAD-SIDE POWER WIRING. CONTRACTOR TO FIELD-VERIFY FAN ELECTRICAL REQUIREMENTS AND SUBMIT PRODUCT DATA AND EXACT INSTALLATION LOCATION TO ENGINEER FOR APPROVAL.

1 BOILER INTEGRATION DETAIL

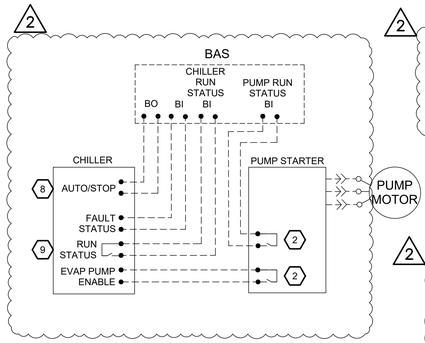
SCALE: NTS



RIBTE01P-S LOW COIL INPUT RELAY

2

SCALE: NTS

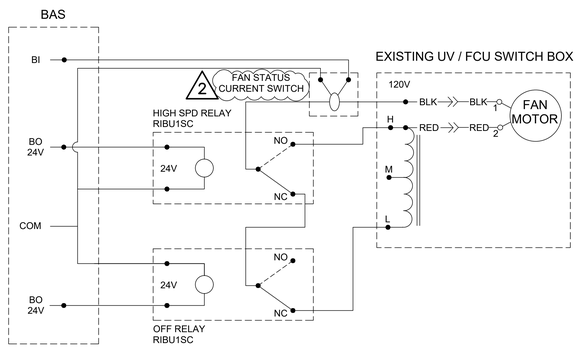


3 CHILLER INTEGRATION DETAIL

SCALE: NTS

NOTES:

1. EXISTING MOTOR STARTER TO REMAIN.
2. SEE TYPICAL MOTOR STARTER BAS INTERFACE - PUMP ON THIS SHEET FOR CONNECTION DETAILS, RELAY, AND CURRENT SWITCH REQUIREMENTS.
3. FOR ALL CONTROL WIRING, CONTRACTOR SHALL PROVIDE A MINIMUM OF 1/2 INCH CONDUIT WITH NO MORE THAN 40 PERCENT FILL.
4. ALL CONTROL WIRING SHALL BE INSTALLED IN SEPARATE CONDUIT(S) FROM POWER WIRING.
5. CONTRACTOR SHALL PROVIDE ALL CONTROL WIRING, BAS AND FIELD DEVICE CONNECTIONS.
6. CONTRACTOR TO FIELD-VERIFY ALL CHILLER TERMINATION POINTS AND SUBMIT TO ENGINEER FOR APPROVAL.
7. CONTRACTOR SHALL CONTACT OWNER FOR ANY CHILLER PROGRAMMING CHANGES.
8. CONTRACTOR TO INSTALL INTERFACING RELAY TO CONTROL AUTO/STOP FUNCTION OF CHILLER. RELAY SHALL BE INSTALLED IN CHILLER CONTROL CABINET. RELAY TO HAVE LED INDICATION OF COIL STATUS AND HAND-OFF-AUTO (HOA) SWITCH FOR MANUAL OPERATION, PER SPECIFICATIONS. CONTRACTOR SHALL SUBMIT RELAY SELECTION TO ENGINEER FOR APPROVAL.
9. CONTRACTOR TO FIELD-VERIFY IF CHILLER HAS AN EXISTING RUN STATUS OUTPUT. IF CHILLER HAS A RUN STATUS OUTPUT, CONTRACTOR TO PROVIDE WIRING TO BAS INPUT AS SHOWN. IF CHILLER DOES NOT HAVE A RUN STATUS OUTPUT, CURRENT SWITCHES SHALL BE INSTALLED ON EACH COMPRESSOR'S LOAD-SIDE POWER WIRING. CONTRACTOR TO FIELD-VERIFY COMPRESSOR ELECTRICAL REQUIREMENTS AND SUBMIT PRODUCT DATA AND EXACT INSTALLATION LOCATION(S) TO ENGINEER FOR APPROVAL. IF CURRENT SWITCHES ARE TO BE INSTALLED ON EACH COMPRESSOR, CENTRAL PLANT CONTROLS HARDWARE AND SOFTWARE POINTS SHALL BE INCREASED, AND CHILLER STATUS ALARMING SEQUENCE OF OPERATION ADJUSTED ACCORDINGLY.

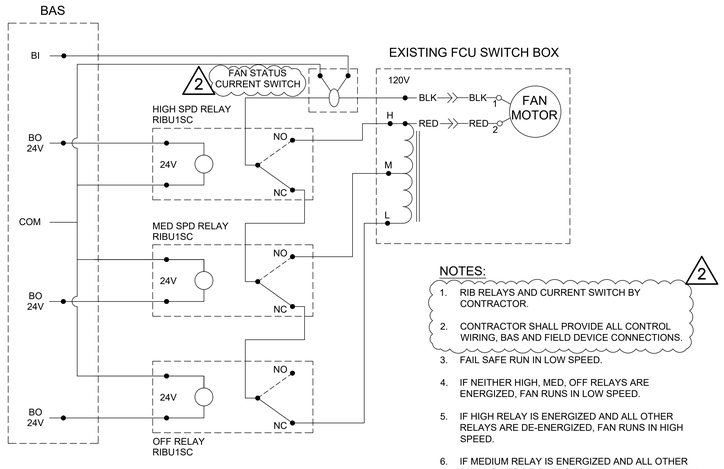


NOTES:

1. RIB RELAYS AND CURRENT SWITCH BY CONTRACTOR.
2. CONTRACTOR SHALL PROVIDE ALL CONTROL WIRING, BAS AND FIELD DEVICE CONNECTIONS.
3. FAIL SAFE RUN IN LOW SPEED.
4. IF NEITHER HIGH OR OFF RELAYS ARE ENERGIZED, FAN RUNS IN LOW SPEED.
5. IF HIGH RELAY IS ENERGIZED AND ALL OTHER RELAYS ARE DE-ENERGIZED, FAN RUNS IN HIGH SPEED.
6. IF OFF RELAY IS ENERGIZED, FAN SHUTS OFF.

4 UV/FCU 2-SPEED FAN SPEED CONTROL

SCALE: NTS

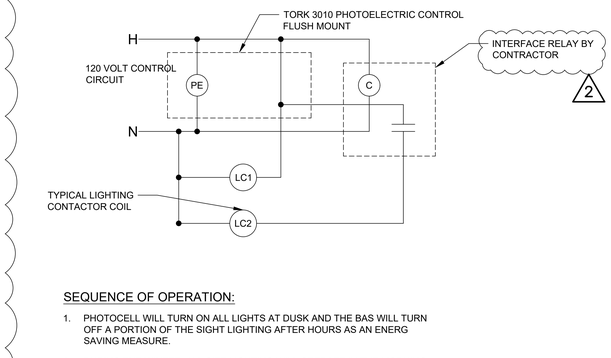


NOTES:

1. RIB RELAYS AND CURRENT SWITCH BY CONTRACTOR.
2. CONTRACTOR SHALL PROVIDE ALL CONTROL WIRING, BAS AND FIELD DEVICE CONNECTIONS.
3. FAIL SAFE RUN IN LOW SPEED.
4. IF NEITHER HIGH, MED, OFF RELAYS ARE ENERGIZED, FAN RUNS IN LOW SPEED.
5. IF HIGH RELAY IS ENERGIZED AND ALL OTHER RELAYS ARE DE-ENERGIZED, FAN RUNS IN HIGH SPEED.
6. IF MEDIUM RELAY IS ENERGIZED AND ALL OTHER RELAYS ARE DE-ENERGIZED, FAN RUNS IN MEDIUM SPEED.
7. IF OFF RELAY IS ENERGIZED, FAN SHUTS OFF.

5 FCU 3-SPEED FAN CONTROL

SCALE: NTS

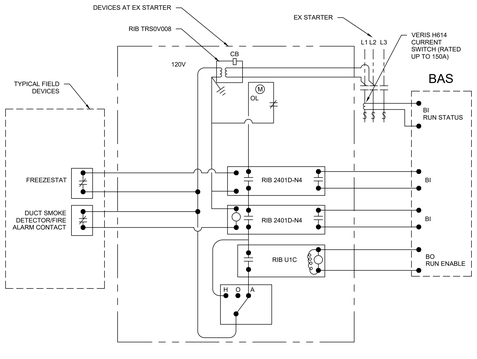


SEQUENCE OF OPERATION:

1. PHOTOCELL WILL TURN ON ALL LIGHTS AT DUSK AND THE BAS WILL TURN OFF A PORTION OF THE SIGHT LIGHTING AFTER HOURS AS AN ENERG SAVING MEASURE.
2. DURING THE WINTER, ALL SITE LIGHTING WILL OPERATE IN THE MORNING FOR EARLY ARRIVING EMPLOYEES.
3. PHOTOCELL OVER-RIDES THE BAS AND WILL NOT ALLOW SITE LIGHTING OR DOWN LIGHTS TO OPERATE DURING DAYLIGHT HOURS.
4. INTERFACE RELAY TO INCLUDE HAND-OFF AUTO (HOA) SWITCH FOR MANUAL OVERRIDE.

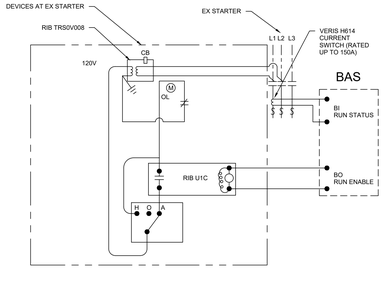
6 LIGHTING CONTROLS DIAGRAM

SCALE: NTS



7 TYPICAL MOTOR STARTER BAS INTERFACE - AHU

SCALE: NTS

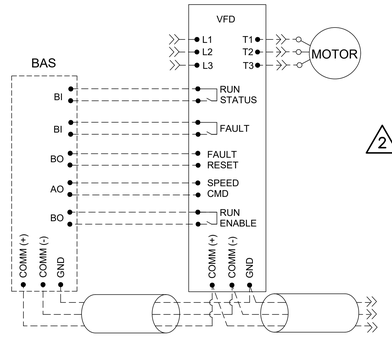


NOTES:

1. FOR ALL CONTROL WIRING, CONTRACTOR SHALL PROVIDE A MINIMUM OF 1/2 INCH CONDUIT WITH NO MORE THAN 40 PERCENT FILL.
2. CONTRACTOR SHALL PROVIDE ALL CONTROL WIRING, BAS AND FIELD DEVICE CONNECTIONS.
3. RIB RELAYS, CURRENT SWITCH, AND TRANSFORMER BY CONTRACTOR.

8 TYPICAL MOTOR STARTER BAS INTERFACE - PUMP

SCALE: NTS



NOTES:

1. ELECTRICAL CONTRACTOR SHALL PROVIDE VFD.
2. ELECTRICAL CONTRACTOR SHALL PROVIDE BRANCH CIRCUIT (LINE) TO VFD AND FINAL TERMINATION.
3. FOR ALL CONTROL WIRING, CONTRACTOR SHALL PROVIDE A MINIMUM OF 1/2 INCH CONDUIT WITH NO MORE THAN 40 PERCENT FILL.
4. ALL CONTROL WIRING TO VFD SHALL BE INSTALLED IN SEPARATE CONDUIT(S) FROM POWER WIRING.
5. CONTROLS CONTRACTOR SHALL PROVIDE ALL CONTROL WIRING, BAS AND FIELD DEVICE CONNECTIONS.
6. CONTROLS CONTRACTOR TO FIELD-VERIFY ALL VFD TERMINATION POINTS AND SUBMIT TO ENGINEER FOR APPROVAL.

9 TYPICAL VFD BAS INTERFACE

SCALE: NTS

TMG CONSULTING ENGINEERS
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401 Hawthorne Lane
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Website: www.tmg-cc.com

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 033629 CLEMENT T. MILDEBRANDT ENGINEER 01.25.2023

ISSUED FOR CONSTRUCTION

CHARLOTTE-MECKLENBERG SCHOOLS

NORTHRIDGE MIDDLE SCHOOL HVAC CONTROLS

CHARLOTTE-MECKLENBERG SCHOOLS
7601 THE PLAZA
CHARLOTTE, NC 28215

NO	DESCRIPTION	DATE
1	ISSUED FOR CONSTRUCTION	9/27/22
2	REVISION 1	1/13/23
3	REVISION 2	1/25/23

SHEET INFORMATION

DATE	09/27/2022
JOB NUMBER	2202-01-002
DRAWN	LCB
APPROVED	CTM

HVAC CONTROLS DETAILS

M-812

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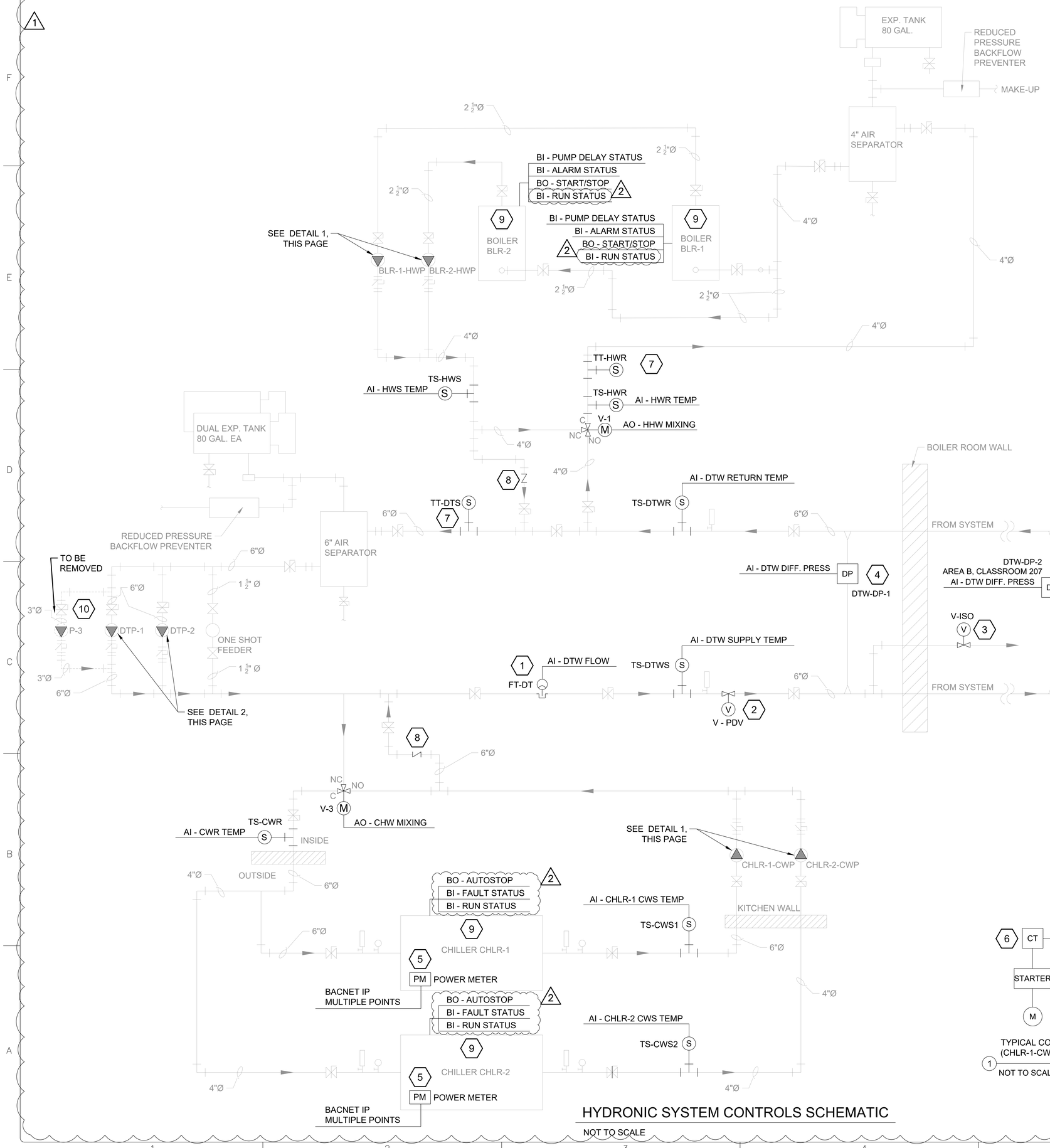


HYDRONIC SYSTEM CONTROLS SCHEMATIC

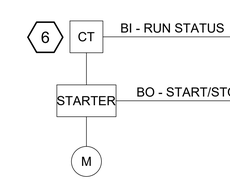
NOT TO SCALE

KEY NOTES

1. EXISTING WATER FLOW METER TO BE COMPLETELY REMOVED FROM PIPING. PIPING SHALL BE REPLACED AS NEEDED AND RE-INSULATED PER SPECIFICATIONS. INSTALL NEW FLOW METER PER SPECIFICATIONS AS CLOSE AS POSSIBLE TO EXISTING LOCATION. REFER TO MANUFACTURERS INSTALLATION GUIDELINES FOR REQUIRED UPSTREAM AND DOWNSTREAM PIPING DISTANCES AND PROPER PIPE ORIENTATION. ANY SIGNIFICANT LOCATION DEVIATIONS MUST BE SUBMITTED TO THE ENGINEER FOR APPROVAL PRIOR TO INSTALLATION.
2. CONTRACTOR TO FIELD VERIFY LOCATION OF VALVE "V-PDV" NEAR MER 324/160 AND REMOVE. REPLACE WITH PIPING AND RE-INSULATE PER SPECIFICATIONS.
3. CONTRACTOR TO FIELD VERIFY LOCATION OF VALVE "V-ISO" NEAR MER 324/160 AND REMOVE. REPLACE WITH PIPING AND RE-INSULATE PER SPECIFICATIONS.
4. EXISTING DTW DIFFERENTIAL PRESSURE TRANSMITTER IN MECHANICAL EQUIPMENT 324 TO BE REPLACED PER SPECIFICATIONS AND DESIGN DETAILS. CONTRACTOR TO SELECT PRESSURE RANGE AND SUBMIT TO ENGINEER FOR APPROVAL. REMOVE ALL PNEUMATIC CONTROLS AND REPAIR INSULATION PER SPECIFICATIONS. NEW TRANSMITTER TO BE TAGGED: DTW-DP-1.
5. EXISTING CHILLER CURRENT TRANSDUCERS TO BE REMOVED FROM MAIN ELECTRICAL SWITCHBOARD. INSTALL NEW POWER METERS PER SPECIFICATIONS AND MANUFACTURER GUIDELINES.
6. EXISTING CURRENT TRANSDUCERS OR PRESSURE SWITCHES TO BE REMOVED FROM PUMPS AND MOTOR STARTERS. INSTALL NEW CURRENT TRANSDUCERS PER SPECIFICATIONS AND MANUFACTURER GUIDELINES.
7. EXISTING TEMPERATURE SENSOR TO BE REMOVED. PIPE INSULATION TO BE REPAIRED OR REPLACED PER SPECIFICATIONS.
8. EXISTING MOTORIZED ISOLATION VALVE TO BE REMOVED. CONTRACTOR TO INSTALL CHECK VALVE PER SPECIFICATIONS IN THIS LOCATION WITH FLOW DIRECTION ORIENTED AS SHOWN. PIPE INSULATION TO BE REPAIRED OR REPLACED PER SPECIFICATIONS.
9. CONTRACTOR TO CONFIRM IF EXISTING BOILERS AND CHILLERS CAN COMMUNICATE VIA BACNET INTERFACE OR GATEWAY AND SUBMIT A LIST OF AVAILABLE POINTS FOR ENGINEER APPROVAL. IF BACNET COMMUNICATION IS NOT POSSIBLE, CONTRACTOR TO SUBMIT A LIST OF ALL AVAILABLE POINTS FROM THE EXISTING BOILER AND CHILLER MANUFACTURER CONTROLLERS.
10. REMOVE PUMP P-3, SUCTION STRAINER, AND 3-INCH PIPING BACK TO ISOLATION VALVES ON ADJACENT PUMP. REMOVE ALL ELECTRICAL WIRING AND CONDUIT BACK TO MOTOR CONTROL CENTER. PLUG OR CAP 3-INCH ISOLATION VALVES AND RE-INSULATE PER SPECIFICATIONS.

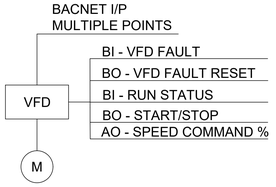
GENERAL NOTES

1. ALL EXISTING CENTRAL PLANT INSTRUMENTATION AND CONTROL VALVES SHALL BE REPLACED WITH NEW DEVICES IN THE SAME LOCATIONS PER SPECIFICATIONS, UNLESS OTHERWISE NOTED. ANY DEVIATIONS MUST BE SUBMITTED TO THE ENGINEER FOR APPROVAL PRIOR TO PROCUREMENT AND INSTALLATION.
2. EXISTING INSTRUMENTATION TAGS PROVIDED FOR REFERENCE ONLY. ALL INSTRUMENTATION AND BAS POINTS TO BE TAGGED AND NAMED PER SPECIFICATIONS.



1 TYPICAL CONSTANT SPEED PUMP DETAIL (CHLR-1-CWP, CHLR-2-CWP, BLR-1-HWP, BLR-2-HWP)

NOT TO SCALE



2 TYPICAL VARIABLE SPEED PUMP DETAIL (DTP-1, DTP-2)

NOT TO SCALE

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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 033629 CLEMENT T WILSON III

01.25.2023

ISSUED FOR CONSTRUCTION

CHARLOTTE-MECKLENBERG SCHOOLS

NORTHRIDGE MIDDLE SCHOOL
HVAC CONTROLS

CHARLOTTE-MECKLENBERG SCHOOLS
7601 THE PLAZA
CHARLOTTE, NC 28215

REVISIONS		
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DRAWN	LCB
APPROVED	CTM

CENTRAL PLANT CONTROLS SCHEMATICS

M-813

SHEET 26 OF 28

		HARDWARE POINTS				SOFTWARE POINTS									
											ALARMS				
EXISTING TAG	POINT NAME	AI	AO	BI	BO	AV	BV	LOOP	SCHED	TREND	HI LIMIT	LO LIMIT	BINARY	SENSOR FAIL	GRAPHIC
	GENERAL / MISCELLANEOUS														
	SYSTEM MODE						X								X
	BUILDING MODE						X		X						X
	OUTSIDE AIR TEMPERATURE	X								X				X	X
	OUTSIDE AIR HUMIDITY	X								X				X	X
	OUTSIDE AIR ENTHALPY					X				X					X
	OUTSIDE AIR CARBON DIOXIDE	X								X				X	X
	FIRE ALARM SYSTEM CONTACT			X									X		X
	EXTERIOR LIGHTING TIME CLOCK RELAY				X				X						X
	EXTERIOR LIGHTING TIME CLOCK RELAY				X				X						X
	EXTERIOR LIGHTING TIME CLOCK RELAY				X				X						X
	AVERAGE SPACE TEMPERATURE					X				X					X
	DUAL TEMPERATURE WATER SYSTEM														
	DTW CHANGEOVER						X			X					X
	DTP-1-VFD START/STOP				X										X
	DTP-1-VFD RUN STATUS			X									X		X
	DTP-1-VFD SPEED COMMAND (%)		X												X
	DTP-1-VFD SPEED (Hz)					X									X
	DTP-1-VFD FAULT			X											X
	DTP-1-VFD FAULT RESET				X										
	DTP-1-VFD FAULT CODE					X									X
	DTP-2-VFD START/STOP				X										X
	DTP-2-VFD RUN STATUS			X									X		X
	DTP-2-VFD SPEED COMMAND (%)		X												X
	DTP-2-VFD SPEED (Hz)					X									X
	DTP-2-VFD FAULT			X											X
	DTP-2-VFD FAULT RESET				X										
	DTP-2-VFD FAULT CODE					X									X
TS-DTWS	DTW SUPPLY TEMPERATURE	X								X	X	X		X	X
TS-DTWR	DTW RETURN TEMPERATURE	X								X	X	X		X	X
FT-DT	DTW FLOW	X								X	X	X		x	X
DT??	DTW DIFF. PRESS., DTW-DP-1 (AREA E, MER 324)	X								X	X	X		X	X
DPS-1	DTW DIFF. PRESS., DTW-DP-2 (AREA B, CLASSROOM 207)	X								X	X	X		X	X
DPS-2	DTW DIFF. PRESS., DTW-DP-3 (AREA A, MEZZANINE MER)	X									X	X		X	X
	DTW BYPASS, DTW-V-1 (AREA A, MECH 113)		X												X
	HHW ISOLATION, HHW-V-1 (AREA A, GENERAL STORAGE 330)				X								X		X
	HHW ISOLATION, HHW-V-2 (AREA A, GENERAL STORAGE 330)				X								X		X
	HHW ISOLATION, HHW-V-3 (AREA A, MEZZANINE MER)				X								X		X
	HHW ISOLATION, HHW-V-4 (AREA A, MEZZANINE MER)				X								X		X
	CHILLED WATER SYSTEM														
	CHLR-1 AUTO/STOP				X										X
2	CHLR-1 FAULT STATUS			X									X		X
	CHLR-1 RUN STATUS			X									X		X
	CHLR-1-CWP RUN STATUS			X									X		X
TS-CWS1	CHLR-1 CWS TEMPERATURE	X								X	X	X		X	X
	CHLR-1 POWER METER - CURRENT KW DEMAND					X									X
	CHLR-1 POWER METER - KW PEAK TODAY					X									X
	CHLR-1 POWER METER - KWH TODAY					X				X					X
	CHLR-1 POWER METER - MWH MONTH-TO-DATE					X				X					X
	CHLR-1 POWER METER - MWH YEAR-TO-DATE					X				X					X
	CHLR-1 POWER METER - FAILURE						X							X	X
	CHLR-2 AUTO/STOP				X										X
2	CHLR-2 FAULT STATUS			X									X		X
	CHLR-2 RUN STATUS			X									X		X
	CHLR-2-CWP RUN STATUS			X									X		X
TS-CWS2	CHLR-2 CWS TEMPERATURE	X								X	X	X		X	X
	CHLR-2 POWER METER - CURRENT KW DEMAND					X									X
	CHLR-2 POWER METER - KW PEAK TODAY					X									X
	CHLR-2 POWER METER - KWH TODAY					X				X					X
	CHLR-2 POWER METER - MWH MONTH-TO-DATE					X				X					X
	CHLR-2 POWER METER - MWH YEAR-TO-DATE					X				X					X
	CHLR-2 POWER METER - FAILURE						X							X	X
TS-CWR	CWR TEMPERATURE	X									X			X	X
V-3	CHW MIXING		X												X
	HEATING HOT WATER SYSTEM														
2	BLR-1 START/STOP				X										X
	BLR-1 RUN STATUS			X									X		X
	BLR-1 ALARM STATUS			X									X		X
	BLR-1 PUMP DELAY STATUS			X											X
2	BLR-2 START/STOP				X										X
	BLR-2 RUN STATUS			X									X		X
	BLR-2 ALARM STATUS			X									X		X
	BLR-2 PUMP DELAY STATUS			X											X
TS-HWS	HWS TEMPERATURE	X								X	X	X		X	X
TS-HWR	HWR TEMPERATURE	X								X	X	X		X	X
V-1	HHW MIXING		X												X
	BOILER GAS METER	X								X					X
	GYM GAS METER	X								X					X
	TOTALS	**16**	**5**	**17**	**15**	**16**	**3**	**0**	**3**	**23**	**11**	**10**	**17**	**16**	**70**

TOTAL HARDWARE (79) **TOTAL SOFTWARE (168)**

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NORTH CAROLINA PROFESSIONAL SEAL 033629 ENGINEER CLEMENT T. MILBOURNE

01.25.2023

ISSUED FOR CONSTRUCTION

CHARLOTTE-MECKLENBERG SCHOOLS

NORTHRIDGE MIDDLE SCHOOL HVAC CONTROLS

CHARLOTTE-MECKLENBERG SCHOOLS
7601 THE PLAZA
CHARLOTTE, NC 28215

REVISIONS

NO.	DESCRIPTION	DATE
1	ISSUED FOR CONSTRUCTION	9/27/22
2	REVISION 1	1/13/23
	REVISION 2	1/25/23

SHEET INFORMATION

DATE	09/27/2022
JOB NUMBER	2202-01-002
DRAWN	ALG
APPROVED	CTM

CENTRAL PLANT CONTROLS POINTS

M-814

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CENTRAL PLANT CONTROLS - GENERAL

SYSTEM OVERVIEW:
THE BUILDING IS SERVED BY A VARIABLE VOLUME TWO-PIPE DUAL TEMPERATURE WATER (DTW) SYSTEM. HEATING HOT WATER IS SUPPLIED TO THE DTW SYSTEM BY BOILERS BLR-1 AND BLR-2 AND PUMPS BLR-1-HWP AND BLR-2-HWP. CHILLED WATER IS SUPPLIED TO THE DTW SYSTEM BY CHILLERS CHLR-1 AND CHLR-2 AND PUMPS CHLR-1-CWP AND CHLR-2-CWP.

SYSTEM MODE:
THE SYSTEM MODE SHALL NORMALLY BE SET TO "AUTOMATIC" BY THE BUILDING AUTOMATION SYSTEM (BAS). MANUAL SELECTION OF "HEATING" OR "COOLING" MODE BY AN OPERATOR SHALL BE PERMITTED VIA A POINT ON THE CENTRAL PLANT GRAPHIC SCREEN AND THE CURRENT MODE SHALL BE DISPLAYED. MANUAL HEATING AND COOLING MODE COMMANDS SHALL FOLLOW THE AUTOMATIC SEQUENCES DESCRIBED BELOW AND SHALL REMAIN UNTIL RELEASED BY AN OPERATOR. ALL SETPOINTS AND PARAMETERS SHALL BE ADJUSTABLE FROM THE BAS GRAPHIC SCREENS.

BUILDING MODE:
EACH AIR-HANDLING UNIT (AHU), FAN COIL UNIT (FCU), OR UNIT VENTILATOR (UV) SHALL BE AUTOMATICALLY STARTED AND STOPPED BY AN OPTIMIZED SCHEDULING PROGRAM VIA THE BAS. THE "OCCUPIED" AND "UNOCCUPIED" BUILDING MODES SHALL BE USED FOR THE AUTOMATIC SEQUENCES DESCRIBED BELOW. TERMINALS MAY ALSO OPERATE DURING UNOCCUPIED PERIODS TO MAINTAIN THEIR INDIVIDUAL UNOCCUPIED HEATING, COOLING, AND DEHUMIDIFICATION SETPOINTS.

DUAL TEMPERATURE WATER (DTW) DISTRIBUTION SYSTEM

DTW SYSTEM CHANGEOVER - COOLING TO HEATING:
WHEN THE SYSTEM MODE IS IN "AUTOMATIC", AND THE BUILDING MODE IS "OCCUPIED", AND THE OUTSIDE AIR TEMPERATURE IS BELOW 50°F (ADJ.) FOR A PERIOD OF ONE HOUR (ADJ.), AND THE AVERAGE SPACE TEMPERATURE IS BELOW THE HEATING SETPOINT FOR A PERIOD OF TWO HOURS (ADJ.), THE DTW SYSTEM SHALL CHANGEOVER FROM COOLING TO HEATING. THE BAS SHALL INDICATE ON THE CENTRAL PLANT GRAPHIC SCREEN THAT HEATING HOT WATER IS CURRENTLY AVAILABLE.

DTW SYSTEM CHANGEOVER - HEATING TO COOLING:
WHEN THE SYSTEM MODE IS IN "AUTOMATIC", AND THE BUILDING MODE IS "OCCUPIED", AND THE OUTSIDE AIR TEMPERATURE IS ABOVE 50°F (ADJ.) FOR A PERIOD OF ONE HOUR (ADJ.), AND THE AVERAGE SPACE TEMPERATURE IS ABOVE THE COOLING SETPOINT FOR A PERIOD OF TWO HOURS (ADJ.), THE DTW SYSTEM SHALL CHANGEOVER FROM HEATING TO COOLING. THE BAS SHALL INDICATE ON THE CENTRAL PLANT GRAPHIC SCREEN THAT CHILLED WATER IS CURRENTLY AVAILABLE.

PUMP START/STOP:
WHEN ANY TERMINAL (AHU, FCU, UV) IS OPERATING, THE BAS SHALL START THE LEAD PUMP, DTP-1 OR DTP-2. THE BAS STARTS EACH PUMP THROUGH A CONTACT CLOSURE OF THE RUN-ENABLE RELAY IN THE PUMP VFD. WHEN THE OUTSIDE AIR TEMPERATURE IS BELOW 38°F (ADJ.), THE BAS SHALL ENABLE THE LEAD PUMP FOR FREEZE PROTECTION, REGARDLESS OF OCCUPANCY STATE. AN OPERATOR SHALL BE ABLE TO INDIVIDUALLY ENABLE AND DISABLE THE PUMPS VIA THE BAS.

PUMP STATUS AND LEAD/LAG CONTROL:
THE BAS DETECTS PUMP STATUS VIA THE VFD RUN STATUS OUTPUT. IF A PUMP IS COMMANDED ON AND THE VFD RUN STATUS IS OFF FOR MORE THAN 60 SECONDS (ADJ.), A "DTP-X FAILURE" ALARM SHALL BE ANNUNCIATED AT THE BAS. IF A PUMP IS COMMANDED OFF AND THE VFD RUN STATUS IS ON FOR MORE THAN 60 SECONDS (ADJ.), A "DTP-X IN HAND" ALARM SHALL BE ANNUNCIATED AT THE BAS.

THE BAS SHALL CONTROL PUMPS DTP-1 AND DTP-2 IN A LEAD/LAG CONFIGURATION AND ROTATE THE LEAD PUMP ON A WEEKLY (ADJ.) BASIS. IF THE LEAD PUMP FAILS, A "DTP-X FAILURE" ALARM SHALL BE ANNUNCIATED AT THE BAS AND THE LAG PUMP SHALL BE COMMANDED ON. WHEN A PUMP FAILURE EXISTS, LEAD/LAG AUTOMATION SHALL BE DISABLED AND THE CURRENTLY RUNNING PUMP BECOMES THE LEAD PUMP. ONCE THE PROBLEM HAS BEEN CORRECTED, THE OPERATOR SHALL BE ABLE TO CLEAR THE ALARM FROM THE BAS. THIS ACTION SHALL RE-ENABLE THE LEAD/LAG SEQUENCE. THE BAS SHALL DISPLAY THE RUNTIME FOR EACH PUMP. AN OPERATOR SHALL BE ABLE TO MANUALLY ROTATE LEAD AND LAG PUMPS VIA THE BAS.

DIFFERENTIAL PRESSURE (DP) CONTROL:
TWO (2) DP TRANSMITTERS ARE LOCATED ACROSS THE DTW SUPPLY AND RETURN PIPING IN AREAS A AND B. THE BAS SHALL CONSTANTLY MONITOR THESE TWO TRANSMITTERS AND CONTROL THE SPEED OF THE LEAD PUMP TO MAINTAIN THE AVERAGE SYSTEM DP AT THE SETPOINT. THE INITIAL BUILDING DP SETPOINT SHALL BE 10.0 PSID (ADJ.). FINAL SETPOINT SHALL BE OPTIMIZED DURING COMMISSIONING BASED ON TEST AND BALANCE RESULTS. A THIRD DP TRANSMITTER, LOCATED IN MECHANICAL ROOM 324 BETWEEN THE MAIN DTW SUPPLY AND RETURN PIPING, SERVES AS A FAIL-SAFE IN THE EVENT OF BUILDING DP TRANSMITTER FAILURE OR BAS FAILURE.

IF THE LEAD PUMP IS UNABLE TO MAINTAIN THE DP SETPOINT FOR 5 MINUTES (ADJ), THE LAG PUMP SHALL BE COMMANDED ON BY THE BAS. BOTH PUMPS SHALL MODULATE TO THE SAME SPEED TO MAINTAIN THE DP SETPOINT. THE LAG PUMP SHALL BE COMMANDED OFF WHEN BOTH PUMPS ARE OPERATING BELOW 35% SPEED (ADJ.) FOR 5 MINUTES (ADJ.).

WHEN THERE IS LIMITED DEMAND FOR DTW AT THE TERMINALS, BYPASS VALVE, DTW-V-1, SHALL MODULATE TO MAINTAIN A MINIMUM BYPASS FLOW. WHENEVER THE LEAD DTW PUMP IS OPERATING, THE MINIMUM FLOW RATE SHALL BE 52 GPM (ADJ.), AS MEASURED AT THE DTW FLOW METER IN THE CENTRAL PLANT. IF THE TOTAL SYSTEM FLOW IS BELOW THE MINIMUM REQUIRED BYPASS FLOW, THE VALVE SHALL SLOWLY MODULATE OPEN TO MAINTAIN 52 GPM (ADJ.). AS TOTAL SYSTEM FLOW EXCEEDS THE MINIMUM REQUIRED BYPASS FLOW, THE VALVE SHALL SLOWLY MODULATE CLOSED. WHEN THE DTW PUMPS ARE DISABLED, THE BAS SHALL CLOSE THE BYPASS VALVE. FINAL SETPOINTS SHALL BE OPTIMIZED DURING COMMISSIONING BASED ON TEST AND BALANCE RESULTS.

IF COMMUNICATION IS LOST TO ANY OF THE THREE DP TRANSMITTERS, A "DTW-DP-X FAILURE" ALARM SHALL BE ANNUNCIATED AT THE BAS. IF COMMUNICATION IS LOST TO EITHER OF THE BUILDING DP TRANSMITTERS, THE BAS SHALL CONTINUE CONTROLLING THE DP BASED ON THE REMAINING COMMUNICATING TRANSMITTER. IF COMMUNICATION IS LOST TO BOTH BUILDING DP TRANSMITTERS, THE CENTRAL PLANT DP TRANSMITTER SHALL MAINTAIN THE BUILDING DP SETPOINT UNTIL COMMUNICATION IS RESTORED. THE CENTRAL PLANT DP TRANSMITTER SHALL BE WIRED DIRECTLY TO THE SAME CONTROL PANEL THAT IS CONTROLLING THE PUMP SPEED TO ACT AS A FAIL-SAFE. IF COMMUNICATION IS LOST TO ALL THREE DP TRANSMITTERS, THE BAS SHALL CONTROL TO THE LAST KNOWN DP READING UNTIL COMMUNICATION IS RESTORED.

CONTRACTOR SHALL DETERMINE THE MINIMUM VFD SPEED REQUIRED TO PROTECT THE PUMP MOTOR. VFD ACCELERATION AND DECELERATION TIMES SHALL BE A MINIMUM OF 30 SECONDS (ADJ.). ALL PARAMETERS SHALL BE INITIALLY PROGRAMMED BY THE CONTRACTOR AND OPTIMIZED DURING COMMISSIONING.

HEATING HOT WATER (HHW) BOILER SYSTEM

HHW SYSTEM ENABLE:
THE HHW SYSTEM IS ENABLED TO PROVIDE SPACE HEATING. NO DEHUMIDIFICATION REHEAT IS PROVIDED. WHEN THE SYSTEM MODE IS IN "AUTOMATIC", AND THE BUILDING MODE IS "OCCUPIED", AND THE OUTSIDE AIR TEMPERATURE IS BELOW 50°F (ADJ.) FOR A PERIOD OF ONE HOUR (ADJ.), AND THE AVERAGE SPACE TEMPERATURE IS BELOW THE HEATING SETPOINT FOR A PERIOD OF TWO HOURS (ADJ.), THE BAS SHALL SWITCHOVER THE DTW SYSTEM FROM COOLING TO HEATING MODE AND ENABLE THE HHW SYSTEM. WHEN THE OUTSIDE AIR TEMPERATURE IS LESS THAN 38°F (ADJ.), THE BAS SHALL ENABLE THE HHW SYSTEM TO RUN CONTINUOUSLY FOR FREEZE PROTECTION, REGARDLESS OF TERMINAL OCCUPANCY STATE. WHEN THE SYSTEM MODE IS MANUALLY SET TO "HEATING", THE BAS SHALL ENABLE THE HHW SYSTEM REGARDLESS OF OUTSIDE AIR TEMPERATURE OR TERMINAL OCCUPANCY STATE. AN OPERATOR SHALL BE ABLE TO ENABLE OR DISABLE THE HHW SYSTEM, OR COMMAND THE BOILERS AND MIXING VALVE VIA THE BAS.

WHEN THE HHW SYSTEM IS ENABLED, THE BAS SHALL DISABLE THE CHILLED WATER SYSTEM. AFTER ONE MINUTE (ADJ.) THE CHILLED WATER THREE-WAY MIXING VALVE SHALL BE COMMANDED CLOSED TO THE DTW SYSTEM. IF THE MIXING VALVE IS COMMANDED TO THE DEFAULT CLOSED POSITION AND THE ACTUATOR END SWITCH DOES NOT INDICATE THE CORRECT POSITION WITHIN 120 SECONDS (ADJ.), A "CHW MIXING VALVE FAILURE" ALARM SHALL BE ANNUNCIATED AT THE BAS.

BOILER AND PUMP START/STOP:
THE BAS SHALL ENABLE THE LEAD BOILER, BLR-1 OR BLR-2, AND ITS ASSOCIATED CIRCULATING PUMP, BLR-1-HWP OR BLR-2-HWP, TO START VIA THE BAS RUN-ENABLE RELAY LOCATED AT THE BOILER. LOCALLY MOUNTED FACTORY CONTROLS ON EACH BOILER SHALL STAGE THE BURNER AS REQUIRED TO MAINTAIN THE BOILER PRIMARY LOOP TEMPERATURE AT 160°F (ADJ.). THE LOCAL CONTROLS SHALL LOCKOUT THE BURNER IF THE BOILER PRIMARY LOOP TEMPERATURE EXCEEDS 185°F (ADJ.) AND SHALL REQUIRE A MANUAL RESET. ANY BOILER FAULT DETECTED BY THE FIREYE BOILER CONTROLLER SHALL BE ANNUNCIATED AT THE BAS AS A "BLR-X-FAULT" ALARM. WHEN A BOILER IS DISABLED, A TIME DELAY RELAY SHALL PREVENT THE PUMP FROM TURNING OFF FOR 15 MINUTES (ADJ.).

2
THE BAS DETECTS BOILER RUN STATUS VIA CURRENT SENSING RELAYS. IF A BOILER IS COMMANDED ON AND THE CURRENT SWITCH STATUS IS OFF FOR MORE THAN 120 SECONDS (ADJ.), A "BLR-X FAILURE" ALARM SHALL BE ANNUNCIATED AT THE BAS.

THE BAS DETECTS PUMP RUN STATUS VIA CURRENT SENSING RELAYS. IF A BOILER AND PUMP IS COMMANDED ON AND THE PUMP CURRENT SWITCH STATUS IS OFF FOR MORE THAN 60 SECONDS (ADJ.), A "BLR-X-HWP FAILURE" ALARM SHALL BE ANNUNCIATED AT THE BAS. IF A BOILER AND PUMP IS COMMANDED OFF AND THE PUMP CURRENT SWITCH STATUS IS ON FOR MORE THAN 60 SECONDS (ADJ.), A "BLR-X-HWP IN HAND" ALARM SHALL BE ANNUNCIATED AT THE BAS.

IN THE EVENT OF A BAS FAILURE, THE BAS RUN-ENABLE RELAY ON EACH BOILER SHALL HAVE A HAND-OFF-AUTO (HOA) SWITCH FOR MANUAL OPERATION. DURING MANUAL OPERATION, THE ADJUSTABLE TIME DELAY RELAY SHALL CONTINUE TO ALLOW THE BOILER PUMP TO RUN FOR THE FIELD-SELECTED DELAY PERIOD AFTER BOILER SHUTDOWN. AN OPERATOR SHALL ALSO BE ABLE TO MANUALLY OVERRIDE AND POSITION THE THREE-WAY MIXING VALVE.

BOILER LEAD/LAG:
THE BAS SHALL CONTROL BOILER BLR-1 AND BLR-2 IN A LEAD/LAG CONFIGURATION AND ROTATE THE LEAD BOILER ON A WEEKLY (ADJ.) BASIS. AN OPERATOR SHALL BE ABLE TO CHANGE THE LEAD/LAG SEQUENCE VIA THE BAS. THE BAS SHALL DISPLAY THE RUNTIME FOR EACH BOILER.

IF THE LEAD BOILER IS OPERATING AND THE MIXING VALVE IS FULLY OPEN TO THE DTW SYSTEM AND THE HHW SUPPLY TEMPERATURE FALLS MORE THAN 5.0°F (ADJ.) BELOW SETPOINT FOR 15 MINUTES (ADJ.), THE BAS SHALL ENABLE THE LAG BOILER. THE BOILERS SHALL EACH MODULATE TO MAINTAIN THE LOCAL SUPPLY SETPOINT OF 160°F (ADJ.). IF THE HWS SUPPLY TEMPERATURE RISES TO 5.0°F (ADJ.) ABOVE SETPOINT FOR 15 MINUTES (ADJ.), THE BAS SHALL DISABLE THE LAG BOILER. IF THE LEAD BOILER FAULTS, THE BAS SHALL ENABLE THE LAG BOILER. A LEAD BOILER "BLR-X FAULT" ALARM SHALL BE ANNUNCIATED AT THE BAS. WHEN A BOILER FAULT OCCURS, LEAD/LAG AUTOMATION SHALL BE DISABLED AND THE CURRENTLY RUNNING BOILER SHALL BECOME THE LEAD BOILER. ONCE THE PROBLEM HAS BEEN CORRECTED, AN OPERATOR SHALL BE ABLE TO CLEAR THE ALARM FROM THE BAS. THIS ACTION SHALL RE-ENABLE THE LEAD/LAG SEQUENCE.

BOILER ANTI-SHOCK AND TEMPERATURE CONTROL:
WHENEVER THE HHW SYSTEM IS DISABLED, THE THREE-WAY MIXING VALVE SHALL REMAIN CLOSED TO THE DTW SYSTEM. UPON BOILER STARTUP, IF THE DTW SYSTEM RETURN TEMPERATURE IS BELOW 75°F (ADJ.), THE THREE-WAY MIXING VALVE SHALL REMAIN CLOSED AND ONLY CIRCULATE WATER THROUGH THE BOILER PRIMARY LOOP. ONCE THE BOILER PRIMARY LOOP RETURN TEMPERATURE REACHES 110°F (ADJ.), THE THREE-WAY VALVE SHALL BEGIN TO MODULATE OPEN TO THE DTW SYSTEM.

IN HEATING MODE, THE BAS SHALL RESET THE DTW SUPPLY TEMPERATURE SETPOINT LINEARLY FROM 160°F (ADJ.) AT 40°F (ADJ.) OUTSIDE AND BELOW, TO 110°F (ADJ.) AT 60°F (ADJ.) OUTSIDE AND ABOVE. THE MIXING VALVE SHALL BE MODULATED AS REQUIRED TO MAINTAIN THE DTW SUPPLY SETPOINT AND MAINTAIN THE BOILER PRIMARY LOOP RETURN TEMPERATURE AT 110°F (ADJ.).

IF THE THREE-WAY VALVE IS COMMANDED TO THE FULLY CLOSED OR FULLY OPEN POSITION AND THE ACTUATOR POSITION FEEDBACK DOES NOT INDICATE THE CORRECT POSITION WITHIN 120 SECONDS (ADJ.), A "HHW MIXING VALVE FAILURE" ALARM SHALL BE ANNUNCIATED AT THE BAS.

AREAS "B" AND "E" HHW ISOLATION VALVES
WHEN THE DTW SYSTEM IS IN HEATING MODE, THE BAS SHALL COMMAND THE FOUR HHW ISOLATION VALVES IN THE AREA B MEZZANINE MER AND AREA E GENERAL STORAGE [330] TO OPEN. WHEN THE DTW SYSTEM IS IN COOLING MODE, THE BAS SHALL COMMAND ALL FOUR VALVES TO CLOSE.

NATURAL GAS METERS

MONITORING AND TRENDING:
THE BAS SHALL MONITOR THE (2) GAS METERS FOR CURRENT CONSUMPTION ON A CONTINUAL BASIS. THESE VALUES SHALL BE DISPLAYED AT THE BAS WORKSTATION ON DEDICATED GRAPHIC SCREEN. IF EITHER METER FAILS, AN GAS METER FAILURE ALARM SHALL BE ANNUNCIATED AT THE BAS WORKSTATION.

PEAK DEMAND HISTORY: THE BAS SHALL MONITOR AND TREND THE PEAK DEMAND READINGS FROM EACH METER ON A DAILY BASIS.

USAGE HISTORY: THE BAS SHALL MONITOR AND TREND GAS METER READINGS TO PROVIDE A GAS CONSUMPTION HISTORY. USAGE READINGS SHALL BE RECORDED ON A DAILY, MONTH-TO-DATE, AND YEAR-TO-DATE BASIS.

CHILLED WATER (CHW) SYSTEM

CHW SYSTEM ENABLE:
WHEN THE SYSTEM MODE IS IN "AUTOMATIC", AND THE BUILDING MODE IS "OCCUPIED", AND THE OUTSIDE AIR TEMPERATURE IS ABOVE 50°F (ADJ.) FOR A PERIOD OF ONE HOUR (ADJ.), AND THE AVERAGE SPACE TEMPERATURES ARE ABOVE THE COOLING SETPOINT FOR A PERIOD OF TWO HOURS (ADJ.), THE BAS SHALL SWITCHOVER THE DTW SYSTEM FROM HEATING TO COOLING MODE AND ENABLE THE CHW SYSTEM. BELOW 36°F (ADJ.) OUTSIDE AIR TEMPERATURE, THE CHILLER INTERNAL CONTROLLER OPERATES THE CHILLER PUMPS CONTINUOUSLY FOR FREEZE PROTECTION. NO CHW SHALL BE PROVIDED TO THE DTW SYSTEM DURING FREEZE PROTECTION OPERATION. WHEN THE SYSTEM MODE IS MANUALLY SET TO "COOLING", THE BAS SHALL ENABLE THE CHW SYSTEM REGARDLESS OF OUTSIDE AIR TEMPERATURE OR TERMINAL OCCUPANCY STATE. AN OPERATOR SHALL BE ABLE TO ENABLE OR DISABLE THE CHW SYSTEM, OR COMMAND THE CHILLERS AND MIXING VALVE VIA THE BAS.

WHEN THE CHW SYSTEM IS ENABLED, THE BAS SHALL DISABLE THE HHW SYSTEM. AFTER ONE MINUTE (ADJ.) THE HHW THREE-WAY MIXING VALVE SHALL BE COMMANDED CLOSED TO THE DTW SYSTEM. IF THE MIXING VALVE IS COMMANDED TO THE CLOSED POSITION AND THE ACTUATOR END SWITCH DOES NOT INDICATE THE CORRECT POSITION WITHIN 120 SECONDS (ADJ.), A "HHW MIXING VALVE FAILURE" ALARM SHALL BE ANNUNCIATED AT THE BAS.

WHEN THE CHW SYSTEM IS DISABLED, THE CHILLERS ARE COMMANDED OFF BY THE BAS. UPON THE CHILLER(S) BEING COMMANDED OFF, THE EVAPORATOR PUMP RELAY ON THE CHILLER IS OPENED BASED ON A PROGRAMMED TIME DELAY (ADJ.). COORDINATE WITH OWNER TO DETERMINE TIME DELAY SETTING. IN THE EVENT OF A BAS FAILURE, EACH CHILLER'S AUTO/STOP ENABLE RELAY SHALL HAVE A HAND-OFF-AUTO (HOA) SWITCH FOR MANUAL OPERATION. AN OPERATOR SHALL ALSO BE ABLE TO MANUALLY OVERRIDE AND POSITION THE THREE-WAY MIXING VALVE.

CHILLER COOL-DOWN AND TEMPERATURE CONTROL:
WHENEVER THE CHW SYSTEM IS DISABLED, THE THREE-WAY MIXING VALVE SHALL REMAIN CLOSED TO THE DTW SYSTEM. UPON CHILLER STARTUP, IF THE DTW SYSTEM RETURN TEMPERATURE IS ABOVE 80°F (ADJ.), THE THREE-WAY MIXING VALVE SHALL REMAIN CLOSED AND ONLY CIRCULATE WATER THROUGH THE CHILLER PRIMARY LOOP. ONCE THE CHILLER PRIMARY LOOP RETURN TEMPERATURE REACHES 55°F (ADJ.), THE THREE-WAY VALVE SHALL SLOWLY BEGIN TO MODULATE OPEN TO THE DTW SYSTEM. ONCE THE DTW SYSTEM RETURN TEMPERATURE IS BELOW 75°F (ADJ.), THE THREE-WAY VALVE SHALL MODULATE FULLY OPEN.

IF THE MIXING VALVE IS COMMANDED TO THE CLOSED OR OPEN POSITION AND THE ACTUATOR END SWITCH DOES NOT INDICATE THE CORRECT POSITION WITHIN 120 SECONDS (ADJ.), A "CHW MIXING VALVE FAILURE" ALARM SHALL BE ANNUNCIATED AT THE BAS.

CHILLER AND PUMP START/STOP AND STAGING:
THE BAS CONTINUOUSLY CALCULATES AND DISPLAYS THE CURRENT SYSTEM LOAD IN TONS OF COOLING BASED ON INPUTS FROM THE DTW SUPPLY AND RETURN SENSORS AND THE DTW FLOW METER.

STAGE 1: CHILLER CHLR-2 IS THE SMALLER OF THE TWO CHILLERS AND OPERATES AS THE FIRST STAGE OF COOLING. WHEN THE CHW SYSTEM IS ENABLED, THE BAS SHALL COMMAND CHLR-2 TO RUN VIA THE CHILLER REMOTE ENABLE CONTACTS. THE CHILLER COMMANDS PUMP CHLR-2-CWP TO RUN THROUGH A CONTACT CLOSURE OF THE RUN-ENABLE RELAY IN THE PUMP MOTOR STARTER CABINET. ONCE THE CHLR-2 FLOW SWITCH PROVES FLOW, THE CONTROL CIRCUIT IS ENERGIZED AND THE CHILLER STARTS. THE CHILLER'S INTERNAL CAPACITY CONTROL MODULATES TO MAINTAIN A CONSTANT SUPPLY WATER SETPOINT OF 45°F (ADJ.).

STAGE 2: CHILLER CHLR-1 IS THE LARGER OF THE TWO CHILLERS AND OPERATES AS THE SECOND STAGE OF COOLING. IF CHLR-2 IS OPERATING AND THE DTW SUPPLY TEMPERATURE IS GREATER THAN 3°F (ADJ.) ABOVE SETPOINT FOR 30 MINUTES (ADJ.), THE BAS SHALL COMMAND CHLR-1 TO RUN VIA THE CHILLER REMOTE ENABLE CONTACTS. THE CHILLERS SHALL MODULATE CAPACITY IN PARALLEL TO MAINTAIN A CONSTANT SUPPLY WATER SETPOINT OF 45°F (ADJ.). ONCE CHLR-1 IS OPERATING, THE BAS COMMANDS CHLR-2 TO STOP.

STAGE 3: IF CHLR-1 IS OPERATING AND THE DTW SUPPLY TEMPERATURE IS GREATER THAN 3°F (ADJ.) ABOVE SETPOINT FOR 30 MINUTES (ADJ.), THE BAS SHALL COMMAND CHLR-2 TO RUN VIA THE CHILLER REMOTE ENABLE CONTACTS. THE CHW SYSTEM SHALL MODULATE CAPACITY IN PARALLEL TO MAINTAIN A CONSTANT SUPPLY WATER SETPOINT OF 45°F (ADJ.). AS SYSTEM LOAD DECREASES BELOW 90% (ADJ.) OF THE CHLR-2 RATED CAPACITY (144 TONS), CHLR-1 SHALL BE COMMANDED OFF. CHLR-2 WILL CONTINUE TO OPERATE TO MEET THE SYSTEM LOAD. IF THE DTW SUPPLY TEMPERATURE RISES AGAIN, THE BAS SHALL INITIATE STAGE 2 OR 3 AS NEEDED TO MAINTAIN THE SETPOINT OF 45°F (ADJ.).

2
THE BAS DETECTS CHILLER RUN STATUS VIA CURRENT SENSING RELAYS. IF A CHILLER IS COMMANDED ON AND THE CURRENT SWITCH STATUS IS OFF FOR MORE THAN 120 SECONDS (ADJ.), A "CHLR-X FAILURE" ALARM SHALL BE ANNUNCIATED AT THE BAS.

IF EITHER CHILLER SHUTS DOWN ON AN INTERNAL FAULT, A "CHLR-X FAULT" ALARM SHALL BE ANNUNCIATED AT THE BAS. IF ONLY ONE CHILLER IS OPERATING AND SHUTS DOWN ON A FAULT, THE BAS SHALL ATTEMPT TO START THE OTHER CHILLER. ONCE THE FAULT HAS BEEN CLEARED AND THE FAULTED CHILLER IS ABLE TO RUN, AN OPERATOR SHALL BE ABLE TO SELECT WHICH CHILLER TO OPERATE VIA THE BAS.

THE BAS SHALL DETECT PUMP RUN STATUS VIA CURRENT SENSING RELAYS. IF A CHILLER AND PUMP IS COMMANDED ON AND THE PUMP CURRENT SWITCH STATUS IS OFF FOR MORE THAN 60 SECONDS (ADJ.), A "CHLR-X-CWP FAILURE" ALARM SHALL BE ANNUNCIATED AT THE BAS. IF A CHILLER AND PUMP IS COMMANDED OFF AND THE PUMP CURRENT SWITCH STATUS IS ON FOR MORE THAN 60 SECONDS (ADJ.), A "CHLR-X-CWP IN HAND" ALARM SHALL BE ANNUNCIATED AT THE BAS.

CHILLER POWER MONITORING AND TRENDING:
THE BAS SHALL MONITOR THE CHILLER ELECTRIC POWER METERS FOR CURRENT POWER CONSUMPTION ON A CONTINUAL BASIS. THESE VALUES SHALL BE DISPLAYED AT THE BAS ON THE CHILLER GRAPHIC SCREEN. IF A METER FAILS, A "CHLR-X POWER METER FAILURE" ALARM SHALL BE ANNUNCIATED AT THE BAS.

PEAK DEMAND HISTORY: THE BAS SHALL MONITOR AND TREND THE PEAK DEMAND READINGS ON A DAILY BASIS.

USAGE HISTORY: THE BAS SHALL MONITOR AND TREND POWER METER READINGS TO PROVIDE A POWER CONSUMPTION HISTORY. USAGE READINGS SHALL BE RECORDED ON A DAILY, MONTH-TO-DATE, AND YEAR-TO-DATE BASIS.

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NORTH CAROLINA, LICENSED, SEAL 033629, ENGINEER, CLEMENT T. MILBOURNE
01.25.2023

ISSUED FOR CONSTRUCTION

CHARLOTTE-MECKLENBERG SCHOOLS

NORTHRIDGE MIDDLE SCHOOL HVAC CONTROLS

CHARLOTTE-MECKLENBERG SCHOOLS
7601 THE PLAZA
CHARLOTTE, NC 28215

REVISIONS

NO.	DESCRIPTION	DATE
1	ISSUED FOR CONSTRUCTION	9/27/22
2	REVISION 1	1/13/23
3	REVISION 2	1/25/23

SHEET INFORMATION

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CENTRAL PLANT SEQUENCES OF OPERATION

M-815

SHEET 28 OF 28