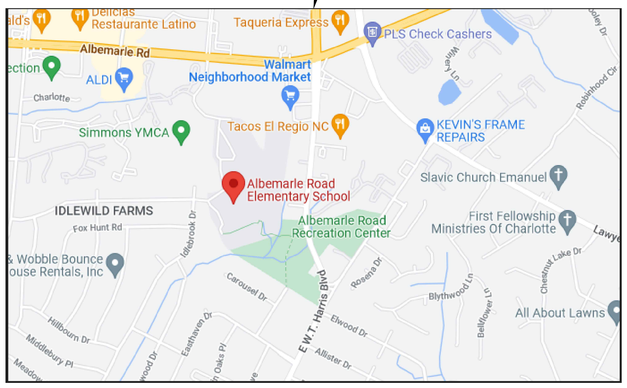
ALBEMARLE ROAD ELEMENTARY SCHOOL
BUILDING AUTOMATION SYSTEM RENOVATIONS
MECKLENBURG COUNTY SCHOOLS
7800 RIDING TRAIL RD, CHARLOTTE, NC 28212

SITE PLAN
N.T.S.

N

SHEET LIST

ALBEMARLE ROAD ELEMENTARY SCHOOL



VICINITY MAP
N.T.S.

N

McKNIGHT·SMITH WARD · GRIFFIN
ENGINEERS, INCORPORATED
4223 South Boulevard
Charlotte, NC 28209
704/527-2112

22-074

PROFESSIONAL ENGINEER 17236 NORTH CAROLINA
02-17-2023

REVISION DATES:	REVISION DESCRIPTION

JOB NUMBER	22-074
DRAWN BY	
CHECKED BY	
DATE	02/17/2023

JOB TITLE
ALBEMARLE ROAD ELEMENTARY
7800 RIDING TRAIL RD
CHARLOTTE, NC, 28212
BAS RENOVATIONS

SHEET TITLE
COVER SHEET

SHEET
C1
1 OF 2

2018 APPENDIX B
BUILDING CODE SUMMARY FOR ALL COMMERCIAL PROJECTS
(EXCEPT 1 AND 2-FAMILY DWELLINGS AND TOWNHOUSES)
(Reproduce the following data on the building plans sheet 1 or 2)

Name of Project: Albemarle Road Elementary School BAS Renovations
Address: 7800 Riding Trail Rd, Charlotte, NC Zip Code 28212
Owner/Authorized Agent: Yolanda S. Fergerson Phone # (980)-343-6580
E-Mail yolandas.fergerson@cms.k12.nc.us
Owned By: Charlotte Mecklenburg Board of Education
Code Enforcement Jurisdiction: Mecklenburg County

CONTACT:

DESIGNER	FIRM	NAME	LICENSE #	TELEPHONE #/E-MAIL
Mechanical	McKnight Smith Ward Griffin Engineers, Inc.	Craig Champion	17250	(704)-527-2112 ext:154 cchampion@mswg.com
Electrical	McKnight Smith Ward Griffin Engineers, Inc.	Matthew Knotts	036875	(704)-527-2112 ext:158 matthew@mswg.com

2018 NC BUILDING CODE: Renovation
2018 NC EXISTING BUILDING CODE: N/A Repair N/A
CONSTRUCTED: N/A **CURRENT OC**...
RENOVATED: N/A **PROPO**... N/A
RISK CATEGORY (Table 1604.5): **Current:** N/A ... **Proposed:** N/A

BASIC BUILDING DATA
Construction Type: Select one
Sprinklers: Select one
Standpipes: Select one
Primary F... **Flood Hazard Area:** Select one
Special In... Select one

NOT APPLICABLE

Gross Building Area Table

FLOOR	EXISTING (SQ FT)	NEW (SQ FT)	SUB-TOTAL
3rd Floor			
2nd Floor			
Mezzanine			
1st Floor			
Basement			
TOTAL			

ALLOWABLE AREA

NOT APPLICABLE

ALLOWABLE HEIGHT

FIRE PROTECTION REQUIREMENTS

NOT APPLICABLE

PERCENTAGE OF WALL OPENING CALCULATIONS

LIFE SAFETY SYSTEM REQUIREMENTS

NOT APPLICABLE

ACCESSIBLE DWELLING UNITS
(SECTION 1107)

ACCESSIBLE PARKING
(SECTION 1106)

NOT APPLICABLE

SPECIAL APPROVALS

Special approval: (Local Jurisdiction, Department of Insurance, OSC, DPI, DHHS, etc., describe below)

ENERGY SUMMARY

ENERGY REQUIREMENTS:

NOT APPLICABLE

2018 APPENDIX B
BUILDING CODE SUMMARY FOR ALL COMMERCIAL PROJECTS
STRUCTURAL DESIGN

NOT APPLICABLE

2018 APPENDIX B
BUILDING CODE SUMMARY FOR ALL COMMERCIAL PROJECTS
MECHANICAL DESIGN
(PROVIDE ON THE MECHANICAL SHEETS IF APPLICABLE)

MECHANICAL SYSTEMS ... EQUIPMENT

Thermal Z...

... conditions
winter dry bulb: 70 F
summer dry bulb: 75 F
relative humidity: 50%

Building heating load: N/A

Building cooling load:

Mechanical ... System

... unit: Air Cooled Chiller
... efficiency: Existing
... efficiency: 11.60 EER
size category of unit: 40 Tons

Boiler
Size category. If oversized, state reason.: N/A

Chiller
Size category. If oversized, state reason.: N/A

List equipment efficiencies:
Motor Horsepower: Comply w/ ...
Number of Phases: Comply ...
Minimum Efficiency: ...
Motor Type: ... Energy Code
Number of Poles: ... Energy Code

NOT APPLICABLE

2018 APPENDIX B
BUILDING CODE SUMMARY FOR ALL COMMERCIAL PROJECTS
ELECTRICAL DESIGN
(PROVIDE ON THE ELECTRICAL SHEETS IF APPLICABLE)

ELECTRICAL SUMMARY

ELECTRICAL SYSTEM AND EQUIPMENT

Method of Compliance: ASHRAE 90.1 - Prescriptive

Lighting schedule (each fixture type)
lamp type required in fixture – N/A
number of lamps in fixture – N/A
ballast type used in the fixture – N/A
number of ballasts in fixture – N/A
total wattage per fixture – N/A
total interior wattage specified vs. allowed (whole building or space by space) – N/A
total exterior wattage specified vs. allowed – N/A

Additional Efficiency Package Options
(When using the 2018 NCECC; not required for ASHRAE 90.1)
- ☐ C406.2 More Efficient HVAC Equipment Perf...
- ☐ C406.3 Reduced Lighting Power Density
- ☐ C406.4 Enhanced Digital Lighting C...
- ☐ C406.5 On-Site Renewable En...
- ☐ C406.6 Dedicated Outdo...
- ☐ C406.7 Reduced En... ...ating

Only electrica... ...chanical equipment.

NOT APPLICABLE

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704/527-2112

22-074

02-17-2023

REVISION DATES | REVISION DESCRIPTION

JOB NUMBER 22-074
DRAWN BY
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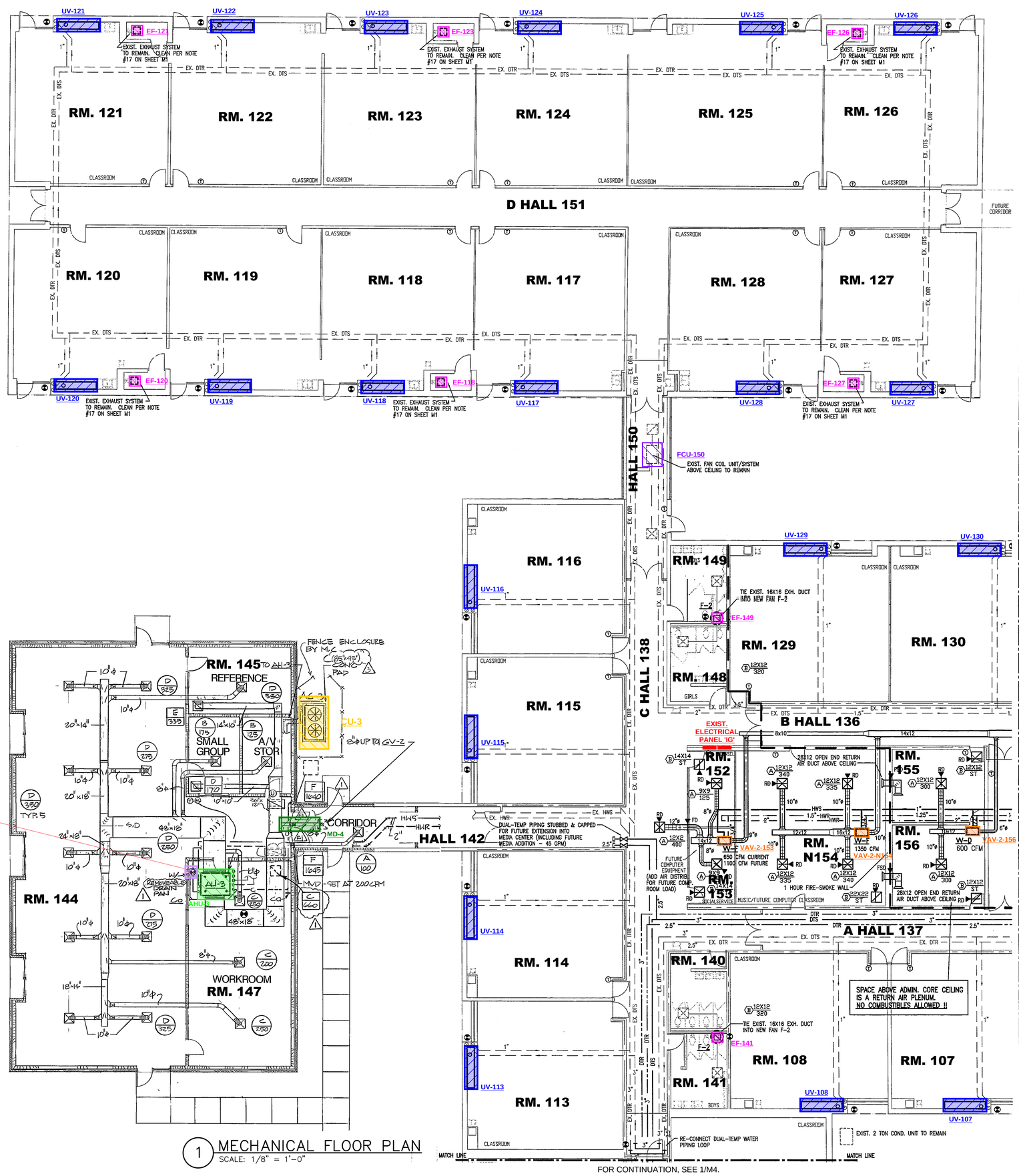
JOB TITLE
ALBEMARLE ROAD ELEMENTARY
7800 RIDING TRAIL RD
CHARLOTTE, NC, 28212
BAS RENOVATIONS

SHEET TITLE
APPENDIX B

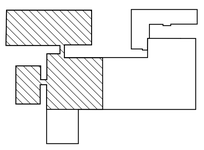
SHEET
C2
2 OF 2

Exhaust Fans — EF-X
VAV Boxes — VAV-AH-X
Air Handling Units — AH-X
Unit Ventilators — UV-X
Fan Coil Units — FCU-X
Rooftop Units — RTU-X
Chiller — CH-X
Pumps — P-X
Condensing Units — CU-X
Boilers — B-X
Motorized Dampers — MD-X

ELECTRICAL NOTE: UTILIZE EXISTING 120V CONTROLS CIRCUITS WHERE POSSIBLE. ADDITIONAL 120V CONTROLS CIRCUITS REQUIRED FOR THIS AREA MAY BE TAKEN FROM EXISTING PANEL 'IG'. EXISTING PANEL IG IS A TWO SECTION, 208V/120V, 3PH, 4W, 400A MLO FLUSH MOUNTED PANELBOARD



1 MECHANICAL FLOOR PLAN
SCALE: 1/8" = 1'-0"



KEY PLAN

SCOPE OF WORK

1) REPLACE CONTROLS FOR ALL MARKED EXISTING EQUIPMENT TO TIE INTO NEW BAS. SEE SPECIFICATIONS FOR FULL DESCRIPTION OF CONTROL WORK AND SEQUENCES.

2) REPLACE EXISTING THERMOSTATS WITH NEW TEMPERATURE SENSORS CONNECTED TO BAS. CONTRACTOR TO FIELD VERIFY ALL EXISTING LOCATIONS OF ALL EXISTING THERMOSTATS.

3) REPLACE EXISTING VALVES AND ACTUATORS LIKE-FOR-LIKE. SEE VALVE SCHEDULE ON SHEET M5.

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22-074

NORTH CAROLINA REGISTERED LANDSCAPE ARCHITECT 1250 ENDORSER LICENSE CHAMPION
02-17-2023

REVISION DESCRIPTION
REVISION DATES
JOB NUMBER 22-074
DRAWN BY
CHECKED BY
DATE 02/17/2023

JOB TITLE
ALBEMARLE ROAD ELEMENTARY
7800 RIDING TRAIL RD
CHARLOTTE, NC, 28212
BAS RENOVATIONS

SHEET TITLE
MECHANICAL FLOOR PLANS

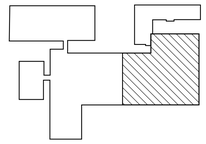
SHEET
M1

SCOPE OF WORK

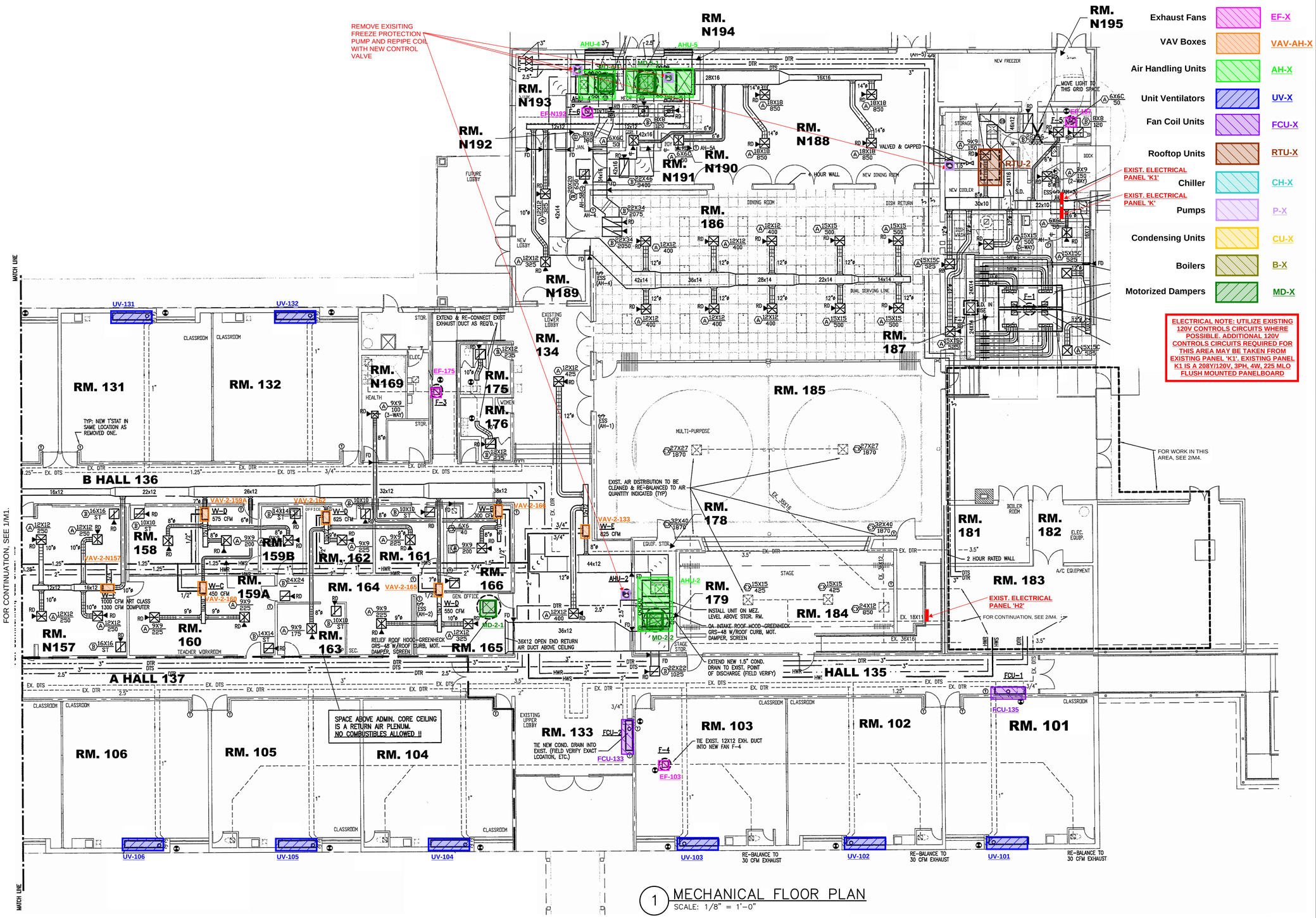
1) REPLACE CONTROLS FOR ALL MARKED EXISTING EQUIPMENT TO TIE INTO NEW BAS. SEE SPECIFICATIONS FOR FULL DESCRIPTION OF CONTROL WORK AND SEQUENCES.

2) REPLACE EXISTING THERMOSTATS WITH NEW TEMPERATURE SENSORS CONNECTED TO BAS. CONTRACTOR TO FIELD VERIFY ALL EXISTING LOCATIONS OF ALL EXISTING THERMOSTATS.

3) REPLACE EXISTING VALVES AND ACTUATORS LIKE-FOR-LIKE. SEE VALVE SCHEDULE ON SHEET M5.



KEY PLAN



ELECTRICAL NOTE: UTILIZE EXISTING 120V CONTROLS CIRCUITS WHERE POSSIBLE. ADDITIONAL 120V CONTROLS CIRCUITS REQUIRED FOR THIS AREA MAY BE TAKEN FROM EXISTING PANEL 'K1'. EXISTING PANEL K1 IS A 208Y/120V, 3PH, 4W, 225 MLO FLUSH MOUNTED PANELBOARD

1 MECHANICAL FLOOR PLAN
SCALE: 1/8" = 1'-0"

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22-074

NORTH CAROLINA
17250
ENGINEER
02-17-2023

REVISION DESCRIPTION
REVISION DATES

JOB NUMBER 22-074
DRAWN BY
CHECKED BY
DATE 02/17/2023

JOB TITLE
ALBEMARLE ROAD ELEMENTARY
7800 RIDING TRAIL RD
CHARLOTTE, NC, 28212
BAS RENOVATIONS

SHEET TITLE
MECHANICAL FLOOR PLANS

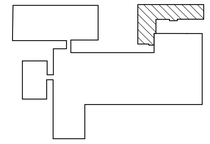
SHEET
M2

SCOPE OF WORK

1) REPLACE CONTROLS FOR ALL MARKED EXISTING EQUIPMENT TO TIE INTO NEW BAS. SEE SPECIFICATIONS FOR FULL DESCRIPTION OF CONTROL WORK AND SEQUENCES.

2) REPLACE EXISTING THERMOSTATS WITH NEW TEMPERATURE SENSORS CONNECTED TO BAS. CONTRACTOR TO FIELD VERIFY ALL EXISTING LOCATIONS OF ALL EXISTING THERMOSTATS.

3) REPLACE EXISTING VALVES AND ACTUATORS LIKE-FOR-LIKE. SEE VALVE SCHEDULE ON SHEET M5.



KEY PLAN

- Exhaust Fans — EF-X
- VAV Boxes — VAV-AH-X
- Air Handling Units — AH-X
- Unit Ventilators — UV-X
- Fan Coil Units — FCU-X
- Rooftop Units — RTU-X
- Chiller — CH-X
- Pumps — P-X
- Condensing Units — CU-X
- Boilers — B-X
- Motorized Dampers — MD-X

1 MECHANICAL FLOOR PLAN
SCALE: 1/8" = 1'-0"

2 PART PLAN BOILER ROOM
SCALE: 1/4" = 1'-0"

ELECTRICAL NOTE: UTILIZE EXISTING 120V CONTROLS CIRCUIT FOR ANY ADDITIONAL 120V CONTROL CIRCUIT REQUIRED IN THIS AREA

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22-074

NORTH CAROLINA PROFESSIONAL ENGINEER 17250 STEVEN C. CHAMPION
02-17-2023

REVISION DESCRIPTION	REVISION DATES

JOB NUMBER 22-074
DRAWN BY
CHECKED BY
DATE 08/12/22

JOB TITLE
ALBEMARLE ROAD ELEMENTARY
7800 RIDING TRAIL RD
CHARLOTTE, NC, 28212
BAS RENOVATIONS

SHEET TITLE
MECHANICAL FLOOR PLANS

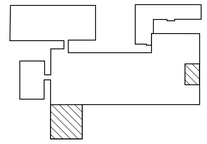
SHEET
M3

SCOPE OF WORK

1) REPLACE CONTROLS FOR ALL MARKED EXISTING EQUIPMENT TO TIE INTO NEW BAS. SEE SPECIFICATIONS FOR FULL DESCRIPTION OF CONTROL WORK AND SEQUENCES.

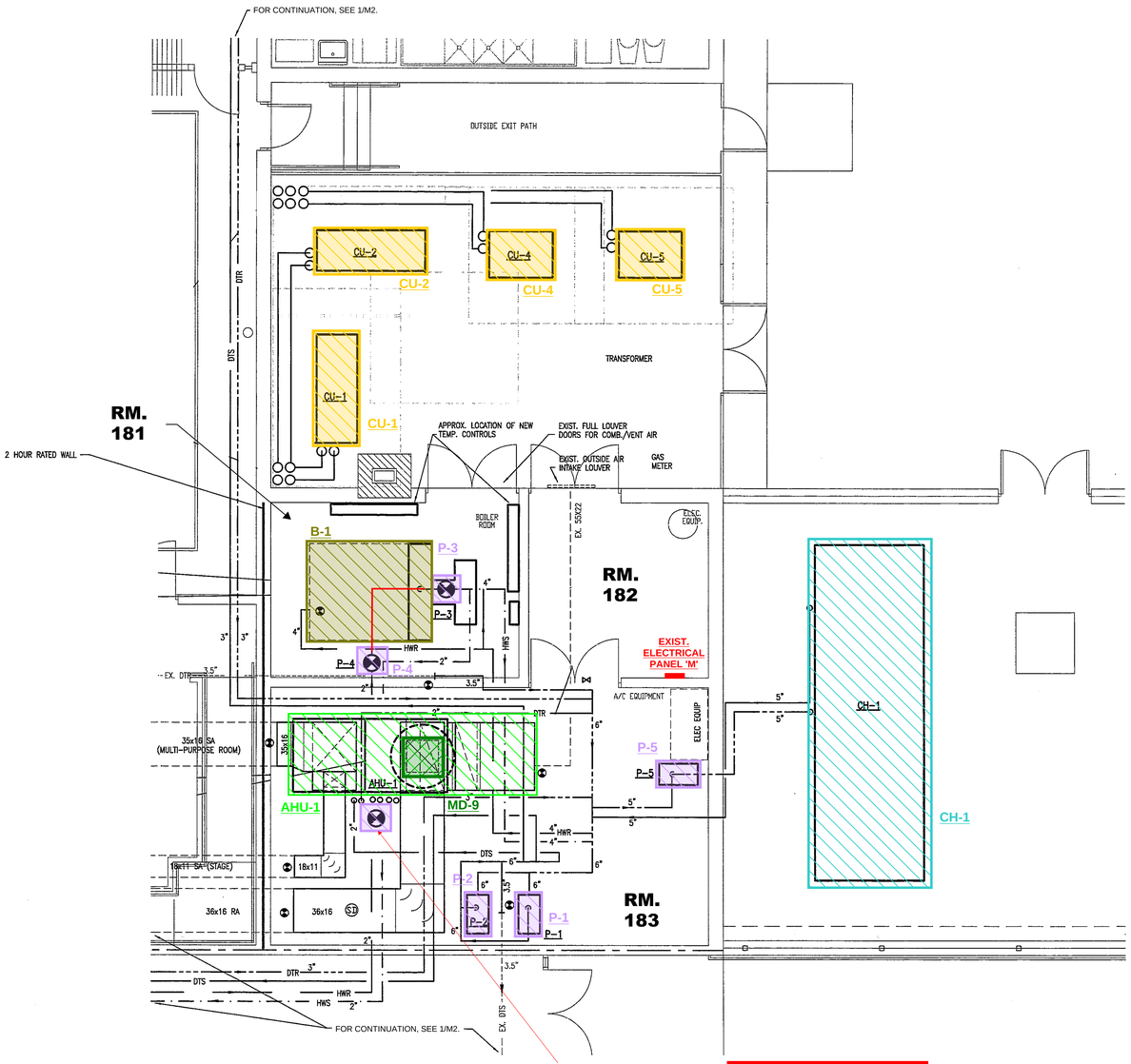
2) REPLACE EXISTING THERMOSTATS WITH NEW TEMPERATURE SENSORS CONNECTED TO BAS. CONTRACTOR TO FIELD VERIFY ALL EXISTING LOCATIONS OF ALL EXISTING THERMOSTATS.

3) REPLACE EXISTING VALVES AND ACTUATORS LIKE-FOR-LIKE. SEE VALVE SCHEDULE ON SHEET M5.



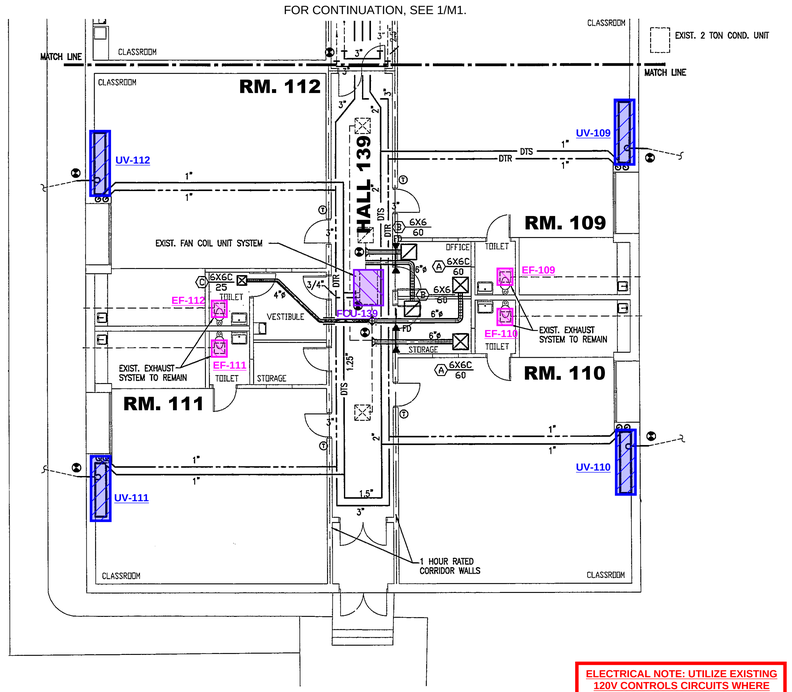
KEY PLAN

Exhaust Fans	EF-X
VAV Boxes	VAV-AH-X
Air Handling Units	AH-X
Unit Ventilators	UV-X
Fan Coil Units	FCU-X
Rooftop Units	RTU-X
Chiller	CH-X
Pumps	P-X
Condensing Units	CU-X
Boilers	B-X
Motorized Dampers	MD-X



2 PART PLAN MECH. ROOM
SCALE: 1/4" = 1'-0"

ELECTRICAL NOTE: UTILIZE EXISTING 120V CONTROLS CIRCUITS WHERE POSSIBLE. ADDITIONAL 120V CONTROLS CIRCUITS REQUIRED FOR THIS AREA MAY BE TAKEN FROM EXISTING PANEL 'M'. EXISTING PANEL M IS A 208Y/120V, 3PH, 4W, 60A MLO FLUSH MOUNTED PANELBOARD



1 MECHANICAL FLOOR PLAN
SCALE: 1/8" = 1'-0"

ELECTRICAL NOTE: UTILIZE EXISTING 120V CONTROLS CIRCUITS WHERE POSSIBLE. ADDITIONAL 120V CONTROLS CIRCUITS REQUIRED FOR THIS AREA MAY BE TAKEN FROM EXISTING PANEL 'IG'. EXISTING PANEL IG IS A TWO SECTION, 208Y/120V, 3PH, 4W, 400A MLO FLUSH MOUNTED PANELBOARD

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4223 South Boulevard
Charlotte, NC 28209
704/527-2112

22-074

NORTH CAROLINA REGISTERED 17756 ENGINEER A CLIMATE CHAMPION
02-17-2023

REVISION DESCRIPTION
REVISION DATES
JOB NUMBER 22-074
DRAWN BY
CHECKED BY
DATE 02/17/2023

JOB TITLE
ALBEMARLE ROAD ELEMENTARY
7800 RIDING TRAIL RD
CHARLOTTE, NC, 28212
BAS RENOVATIONS

SHEET TITLE
MECHANICAL FLOOR PLANS

SHEET
M4

EXISTING PUMPS TO REMAIN

Unit Tag	Service	GPM	HEAD (ft.)	RPM	HP (Watts)	Volts	Phase
P-1*	DUAL TEMP LOOP	574.79	574.79	1750	20	480	3
P-2*	DUAL TEMP LOOP	574.79	574.79	1750	20	480	3
P-3*	BOILER	276	28	1750	3	480	3
P-4	ADMIN. HOT WATER	20.58	73	1750	1.5	480	3
P-5	CHILLER	321.8	50	1750	75	480	3
P-7*	HOT WATER SYSTEM	34	45	1750	1.5	460	3
P-8*	HOT WATER SYSTEM BACKUP	34	45	1750	1.5	460	3

* New VFDs

EXISTING FANS TO REMAIN

Unit Tag	CFM	HP (Watts)	Volts	Phase	Type
EF-121	90	1/150	115	1	CABINET
EF-123	90	1/150	115	1	CABINET
EF-123	90	1/150	115	1	CABINET
EF-120	90	1/150	115	1	CABINET
EF-118	90	1/150	115	1	CABINET
EF-127	90	1/150	115	1	CABINET
EF-149	640	1/12	120	1	ROOF MOUNTED
EF-141	640	1/12	120	1	ROOF MOUNTED
EF-175	770	1/6	120	1	ROOF MOUNTED
EF-N192	420	1/20	120	1	ROOF MOUNTED
EF-103	150	1/30	120	1	ROOF MOUNTED
EF-187	125	1/60	120	1	ROOF MOUNTED
EF-A105	95	1/30	120	1	ROOF MOUNTED
EF-A110	200	1/25	120	1	ROOF MOUNTED
EF-A111	920	1/4	120	1	ROOF MOUNTED
EF-A115	1000	1/4	120	1	ROOF MOUNTED
EF-A117	300	1/20	120	1	ROOF MOUNTED
EF-112	200-250	(76)	120	1	CABINET
EF-111	50-85	(40)	120	1	CABINET
EF-109	200-250	(76)	120	1	CABINET
EF-110	50-85	(40)	120	1	CABINET

EXISTING UNIT VENTILATORS TO REMAIN

Unit Tag	CFM		Motor		
	Unit	Min. OA	HP	Volts	Phs.
UV-101	1200	300	1/4	120	1
UV-102	1200	300	1/4	120	1
UV-103	1200	300	1/4	120	1
UV-104	1200	300	1/4	120	1
UV-105	1200	300	1/4	120	1
UV-106	1200	300	1/4	120	1
UV-107	1200	300	1/4	120	1
UV-108	1200	300	1/4	120	1
UV-109	1200	300	1/4	120	1
UV-110	1200	300	1/4	120	1
UV-111	1200	300	1/4	120	1
UV-112	1200	300	1/4	120	1
UV-113	1200	300	1/4	120	1
UV-114	1200	300	1/4	120	1
UV-115	1200	300	1/4	120	1
UV-116	1200	300	1/4	120	1
UV-117	1200	300	1/4	120	1
UV-118	1200	300	1/4	120	1
UV-119	1200	300	1/4	120	1
UV-120	1200	300	1/4	120	1
UV-121	1200	300	1/4	120	1
UV-122	1200	300	1/4	120	1
UV-123	1200	300	1/4	120	1
UV-124	1200	300	1/4	120	1
UV-125	1200	300	1/4	120	1
UV-126	1200	300	1/4	120	1
UV-127	1200	300	1/4	120	1
UV-128	1200	300	1/4	120	1
UV-129	1200	300	1/4	120	1
UV-130	1200	300	1/4	120	1
UV-131	1200	300	1/4	120	1

EXISTING AIR COOLED CHILLER TO REMAIN

Unit Tag	Performance				Electrical Data	
	Tons	Evaporator			Unit	
		EWT (F)	LWT (F)	GPM	Volt	Phs.
CH-1	134.4	55	45	321.8	480	3

EXISTING FAN COIL UNITS TO REMAIN

Unit Tag	Supply Air CFM	Electrical Data		
		HP (Watts)	Volts	Phs
FC-150	300		120	1
FC-133	620	(120)	120	1
FC-135	525	(125)	120	1
FC-139	800	1/4	120	1

EXISTING AIR HANDLING UNITS TO REMAIN

UNIT TAG	FAN SPEED CONTROL	CFM		ELECTRICAL		
		SA	MIN. OA	HP (ea)	VOLTS	PHS
AHU-1	CAV	4,590	1500	5	480	3
AHU-2	VAV	7,185	750	7.5	480	3
AHU-3	CAV	3,000	750	3	480	3
AHU-4	CAV	4,125	1000	5	480	3
AHU-5	CAV	5,350	1500	5	480	3

EXISTING CONDENSING UNITS TO REMAIN

Unit Tag	Service	Volts	Phase
CU-1	AH-1	480	3
CU-2	AH-2	480	3
CU-3	AH-3	480	3
CU-4	AH-4	480	3
CU-5	AH-5	480	3

EXISTING BOILERS TO REMAIN

Unit Tag	Capacity (MBH)		Flowrate		Type
	Gross Input	Net Output	GPM	Delta T (F)	
B-1	3429	2763	980		
B-2	400	340	33.6	20	

EXISTING ROOF TOP UNITS TO REMAIN

Unit Tag	Type	S.A. Design	O.A. Min.	O.A. Max.	Indoor Fan Motor			
					HP	Volts/Ph.	Volts	Phase
RTU-1	VAV	16000	2360	2360	20	480/3	208	3
RTU-2	CAV	3000	750	750	24	480/3		

EXISTING VAVS TO REMAIN

Unit Tag	CFM	
	Cooling Maximum CFM	Cooling Minimum CFM
VAV-1-A101	1260	250
VAV-1-A103	1250	250
VAV-1-2/A106	1350	270
VAV-1-1/A106	1350	270
VAV-1-A108	1310	260
VAV-1-A118	1160	230
VAV-1-A120	1160	230
VAV-1-A122	1160	230
VAV-1-A123	1270	250
VAV-1-A124	1160	230
VAV-1-A126	1200	240
VAV-1-A113	400	80
VAV-1-A117	1450	290
VAV-1-A109	760	150
VAV-2-1	1500	300
VAV-2-2	1500	300
VAV-2-3	750	160
VAV-2-4	1500	300
VAV-2-5	475	100
VAV-2-6	750	160
VAV-2-7	750	160
VAV-2-8	750	160
VAV-2-9	300	60
VAV-2-10	1150	230

SPACE CO2 SENSORS:

In areas served by Air Terminal Units, a CO2 sensor shall be installed in the return air main of each air handler. A CO2 sensor shall also be installed outdoors. The CO2 differential between the return duct and outside levels shall be monitored.

In areas served by Single Zone Air Handling Units, a CO2 sensor shall be installed in the space served by each air handler. A CO2 sensor shall also be installed outdoors. The CO2 differential between the space and outside levels shall be monitored.

JANITOR CLOSET EXHAUST FANS:

EF shall energize on time of day schedule from BAS. Monitor status of EF's on BAS.

IDF/ELECTRICAL ROOM EXHAUST FANS:

EF shall be controlled by line-voltage thermostat and shall energize whenever the space temp rises above the setpoint (80 degrees F adj.). Monitor status of EF's on BAS.

TOILET EXHAUST FANS:

EF shall energize on time of day schedule from BAS. Monitor status of fans on BAS.

SMOKE DETECTOR OPERATION:

Existing smoke detectors shall remain. Monitor smoke detector status through the BAS.

Janitor Closet Exhaust Fans

Point Name	Hardware Points AI	AO	BI	BO	Software Points AV	BV	Loop	Sched	Trend	Alarm	Show On Graphic
Fan Status			x						x		x
Exhaust Air Damper				x					x		x
Fan Start/Stop				x					x		x
Schedule								x			
Fan Failure										x	x

Toilet Exhaust Fan

Point Name	Hardware Points AI	AO	BI	BO	Software Points AV	BV	Loop	Sched	Trend	Alarm	Show On Graphic
Fan Status			x						x		x
Exhaust Air Damper				x					x		x
Fan Start/Stop				x					x		x
Schedule								x			
Fan Failure										x	x

Smoke Detector Operation

Point Name	Hardware Points AI	AO	BI	BO	Software Points AV	BV	Loop	Sched	Trend	Alarm	Show On Graphic
Smoke Detector Status*			x						x	x	x
Smoke shutdown command						x			x	x	x

IDF/ELECTRICAL ROOM EXHAUST FANS

Point Name	Hardware Points AI	AO	BI	BO	Software Points AV	BV	Loop	Sched	Trend	Alarm	Show On Graphic
Fan Status			x						x		x
Fan Failure										x	x

Variable Frequency Drive Interface

Point Name	Hardware Points AI	AO	BI	BO	Software Points AV	BV	Loop	Sched	Trend	Alarm	Show On Graphic
Start / Stop*				x					x		x
Speed*		x							x		x
Motor Current Amps					x				x		x
Motor Frequency Hertz					x				x		x
Motor Runtime					x						x
Motor Speed RPM					x				x		x
In Fault Condition						x			x	x	x
VFD Status				x		x			x		x

*Note: All VFDs shall have Start/Stop, Status and Speed as **hardwired** direct contact points. Other listed points shall be pro- vided via a BACnet interface.

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22-074

PROFESSIONAL ENGINEER
02-17-2023

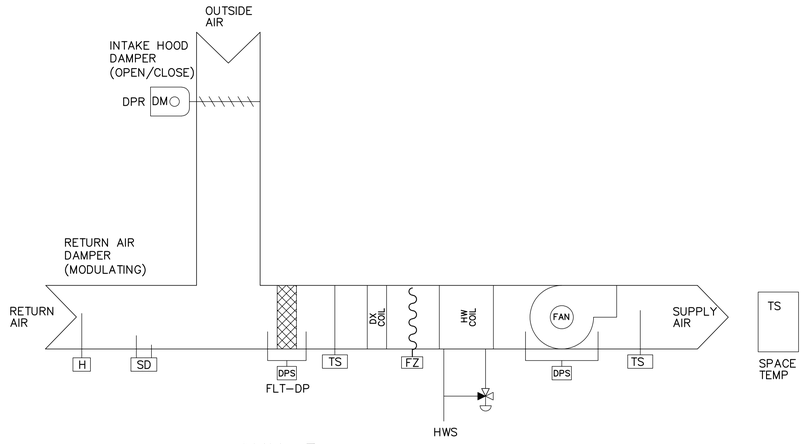
REVISION DESCRIPTION
REVISION DATES

JOB NUMBER 22-074
DRAWN BY
CHECKED BY
DATE 02/17/2023

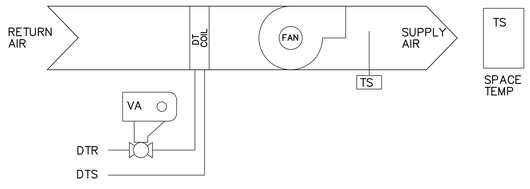
JOB TITLE
ALBEMARLE ROAD ELEMENTARY
7800 RIDING TRAIL RD
CHARLOTTE, NC, 28212
BAS RENOVATIONS

SHEET TITLE
MECHANICAL SCHEDULES

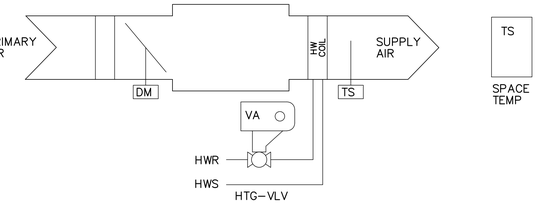
SHEET
M5



1 AHU–3 CONTROL SCHEMATIC
NTS



3 FAN COIL UNIT CONTROL SCHEMATIC
NTS



4 SINLGE INLET TERMINAL UNIT CONTROL SCHEMATIC
NTS

AIR HANDLING UNIT AH-3

THE BUILDING AUTOMATION SYSTEM (BAS) SHALL PERFORM THE FOLLOWING CONTROL STRATEGIES, APPROPRIATE TO THE GIVEN OCCUPANCY MODE OF THE SYSTEM, AS DETERMINED BY THE USER-ADJUSTABLE TIME-OF-DAY SCHEDULE FOR THE SYSTEM. OPTIMAL START AND UNOCCUPIED MODE APPLIES ONLY TO HVACU WITH TIME OF DAY SCHEDULED OPERATION. VERIFY TIME SCHEDULE DURING OWNER'S TRAINING.

OPTIMAL START MODE:

THE BAS SHALL INITIATE THE OPTIMAL START MODE SUCH THAT THE AIR HANDLER IS STARTED PRIOR TO WHEN THE SPACE BEING SERVED BY THE AHU IS SCHEDULED TO BE OCCUPIED, TO ALLOW THE ZONE TEMPERATURE TO REACH THE PENDING OCCUPIED HEATING OR COOLING SET-POINT. THE SYSTEM SHALL WAIT AS LONG AS POSSIBLE BEFORE STARTING, SO THAT THE TEMPERATURE IN EACH ZONE REACHES THE OCCUPIED SET-POINT JUST IN TIME FOR SCHEDULED OCCUPANCY. VENTILATION FUNCTIONS SHALL BE DISABLED WHEN THE AHU IS IN OPTIMAL START MODE AND OUTSIDE AIR DAMPERS SHALL BE CLOSED.

THE BAS SHALL USE A SELF-ADJUSTING ALGORITHM TO CALCULATE THE ACTUAL TIME TO INITIATE OPTIMAL START FOR THE AHU AIR SYSTEM BASED ON THE OCCUPIED SET-POINT, SPACE TEMPERATURE, OUTSIDE AIR TEMPERATURE, HISTORICAL OPTIMAL START PERFORMANCE DATA AND THE ASSOCIATED HEATING OR COOLING OPTIMAL START RATE.

AN EARLY START LIMIT SHALL BE PROVIDED TO PREVENT THE AHU FROM STARTING PRIOR TO 120 MINUTES (ADJUSTABLE) BEFORE SCHEDULED OCCUPANCY.

THE AHU SHALL TRANSITION FROM OPTIMAL START MODE TO OCCUPIED MODE WHEN THE CURRENT TIME IS EQUAL TO THE SCHEDULED START TIME.

1. COOLING:

THE BAS SHALL INITIATE THE OPTIMAL START – COOLING MODE WHEN OPTIMAL START MODE FOR THE AHU HAS BEEN INITIATED AND THE AVERAGE TEMPERATURE OF THE SPACE IS WARMER THAN ITS OCCUPIED COOLING SET-POINT. ALL VENTILATION FUNCTIONS ARE DISABLED WHILE OPERATING IN OPTIMAL START MODE AND THE OUTSIDE AIR DAMPERS SHALL BE CLOSED.

THE BAS SHALL DETERMINE THE LENGTH OF TIME REQUIRED TO LOWER THE SPACE TEMPERATURE TO THE OCCUPIED COOLING SET-POINT WHEN THE MODE OF THE AHU IS COOLING AND THE SPACE TEMPERATURE IS ABOVE THE OCCUPIED COOLING SET-POINT.

THE CONDENSING UNIT AND THE AIR HANDLER FAN SHALL CYCLE UNTIL THE SPACE TEMPERATURE IS SATISFIED.

HEATING:

THE BAS SHALL INITIATE THE OPTIMAL START – HEATING MODE WHEN OPTIMAL START MODE HAS BEEN INITIATED AND THE SPACE TEMPERATURE IS COOLER THAN ITS OCCUPIED HEATING SET- POINT.. ALL VENTILATION FUNCTIONS ARE DISABLED WHILE OPERATING IN OPTIMAL START MODE AND THE OUTSIDE AIR DAMPERS SHALL BE CLOSED.

THE BAS SHALL DETERMINE THE LENGTH OF TIME REQUIRED TO RAISE THE AVERAGE SPACE TEMPERATURE TO THE OCCUPIED HEATING SET-POINT WHEN THE MODE OF THE AHU IS HEATING AND THE SPACE TEMPERATURE IS ABOVE THE SET-POINT.

THE CIRCULATION PUMP SHALL CYCLE ON AND THE HOT WATER COIL CONTROL VALVE SHALL FULLY OPEN AND THE AIR HANDLER FAN SHALL OPERATE TO MAINTAIN SETPOINT.

UNOCCUPIED MODE:

THE BAS SHALL PLACE THE MEMBERS OF THE AHU SYSTEM INTO OFF/STANDBY MODE AS DETERMINED BY THE USER-ADJUSTABLE TIME-OF-DAY SCHEDULE FOR THE SYSTEM. ALL VENTILATION FUNCTIONS SHALL BE DISABLED AND OUTSIDE AIR DAMPERS SHALL BE CLOSED.

AFTER THE ZONE HAS BEEN COMMANDED TO UNOCCUPIED, THE BAS SHALL COMMAND THE ASSOCIATED AHU TO UNOCCUPIED MODE. SUPPLY FAN SHALL BE SHUT DOWN, HEATING COIL CONTROL VALVE SHALL CLOSE, CONDENSING UNIT OPERATION SHALL CEASE, OUTDOOR AIR DAMPER SHALL BE CLOSED, AND ALL VENTILATION FUNCTIONS SHALL BE DISABLED.

NIGHT SETBACK MODE:

DURING SCHEDULED UNOCCUPIED HOURS, THE AHU SHALL BE CONTROLLED BY THE BAS TO MAINTAIN THE UNOCCUPIED HEATING AND COOLING SET-POINTS, AS APPROPRIATE. VENTILATION FUNCTIONS ARE DISABLED, THE OUTDOOR AIR DAMPER SHALL REMAIN CLOSED, UNLESS OUTDOOR AIR IS USED FOR ECONOMIZING DURING UNOCCUPIED ZONE COOLING. UNLESS OTHERWISE STATED, THE AHU SUPPLY FAN SHALL OPERATE IN THE AUTOMATIC CONTROL MODE, CYCLING ON ONLY WHEN HEATING OR COOLING IS NEEDED.

1. HEATING:

AHU SUPPLY FAN ENERGIZED, HEATING COIL CONTROL VALVE SHALL FULLY OPEN AND CIRCULATION PUMP SHALL CYCLE ON.

THE BAS SHALL INITIATE THE NIGHT HEATING MODE WHEN THE TEMPERATURE FOR THE SPACE BEING SERVED BY THE AHU IS LESS THAN 55F (ADJ). NIGHT HEATING SHALL TERMINATE WHEN THE SPACE TEMPERATURE RISES ABOVE THE UNOCCUPIED HEATING SET-POINT PLUS THE UNOCCUPIED HEATING DIFFERENTIAL (4F, ADJ).

2. COOLING:

AHU SUPPLY FAN ENERGIZED; CONDENSING UNIT SHALL CYCLE.

THE BAS SHALL INITIATE THE NIGHT COOLING MODE WHEN THE TEMPERATURE FOR THE SPACE BEING SERVED BY THE AHU IS GREATER THAN 85F, (ADJ) NIGHT COOLING SHALL TERMINATE WHEN THE SPACE TEMPERATURE FALLS BELOW THE UNOCCUPIED COOLING SET-POINT PLUS THE UNOCCUPIED COOLING DIFFERENTIAL (4F, ADJ).

OCCUPIED MODE COOLING CONTROL:

THE CONDENSING UNIT SHALL CYCLE TO MAINTAIN THE SPACE TEMPERATURE SETPOINT.

OCCUPIED MODE HEATING CONTROL:

THE CIRCULATION PUMP AND HEAT COIL CONTROL VALVE SHALL MODULATE MAINTAIN THE SPACE TEMPERATURE.

FREEZE PROTECTION:

THE UNIT SHALL SHUT DOWN AND GENERATE AN ALARM UPON RECEIVING A FREEZESTAT STATUS.

THE OUTSIDE AIR DAMPER SHALL CLOSE.

THE HEATING COIL VALVE SHALL OPEN TO 100% (ADJ.).

THE UNIT SHALL ONLY BE RESET MANUALLY. THE MANUAL RESET BUTTON SHALL BE LOCATED AS SUCH TO BE EASILY ACCESSIBLE BY THE TECHNICIAN.

SAFETY INTERLOCK:

THE FOLLOWING SHALL DE-ENERGIZE THE AHU SUPPLY FAN: DUCT DETECTOR, LOW LIMIT THERMOSTAT ACTIVATION, HIGH PRESSURE SWITCH (4"-6" ADJUSTABLE).

DEMAND CONTROL VENTILATION:

OUTSIDE AIR INTAKE SHALL BE PROVIDED WITH A MOTORIZED DAMPER. ON UNIT START UP, THE OUTSIDE AIR INTAKE DAMPER SHALL REMAIN CLOSED UNTIL THE RETURN AIR TEMPERATURE RISES ABOVE 65° F (ADJ) OR FALLS BELOW 75° F. (ADJ). ONCE RETURN AIR TEMPERATURE IS SATISFIED, THE OUTSIDE AIR DAMPER SHALL OPEN TO THE OCCUPIED MINIMUM SETPOINT. OUTSIDE AIR DAMPERS AND SHALL MODULATE AS REQUIRED TO MAINTAIN MINIMUM OUTSIDE AIR FLOW. THE OUTSIDE AIR INTAKE DAMPER SHALL BE CLOSED WHILE UNIT IS IN THE UNOCCUPIED MODE. BAS SHALL BE CAPABLE OF OPENING AND CLOSING OUTSIDE AIR DAMPERS. CO2 SENSOR MOUNTED IN THE RETURN DUCT SHALL MODULATE THE OUTSIDE AIR DAMPER BASED ON CO2 LEVELS IN THE SPACE. DAMPER SHALL MODULATE OPEN FROM THE OCCUPIED MINIMUM SETPOINT OF 600 PPM ABOVE OA CO2 LEVEL, TO DESIGN MAXIMUM AT 1000 PPM ABOVE OA CO2 LEVEL. AN ALARM SHALL BE ACTIVATED IF THE SPACE CO2 LEVEL RISES ABOVE 1000 PPM ABOVE OA CO2 LEVEL.

AHU - 3

Point Name	Hardware Points AI	AO	BI	BO	Software Points AV	BV	Loop	Sched	Trend	Alarm	Show On Graphic
Mixed Air Temp	x								x		x
Return Air Carbon Dioxide PPM	x								x		x
Return Air Humidity	x								x		x
Space Humidity	x								x		x
Return Air Temp	x								x		x
Supply Air Temp	x								x		x
Zone Setpoint Adjust	x										x
Zone Temp	x								x		x
Condensing Unit - Cooling Output				x					x		x
Heating Coil Valve		x							x		x
Freezestat			x						x	x	x
Smoke Detector			x						x	x	x
Supply Fan Status			x						x		x
Zone Override			x						x		x
Supply Fan Fault			x							x	x
Heating Setpoint					x						
Cooling Setpoint					x				x		x
Supply Fan Start/Stop				x					x		x
Return Air Carbon Dioxide PPM Setpoint					x				x		x
High Return Air Carbon Dioxide Concentration										x	
High Return Air Humidity										x	
High Supply Air Temp										x	
High Supply Air Temp										x	
Supply Fan Failure										x	
Supply Fan in Hand										x	x

FAN COIL UNITS – SEQUENCE OF OPERATIONS

A PROGRAMMABLE CONTROLLER CAPABLE OF STAND–ALONE OPERATION WILL CONTROL THE UNIT. THE UNIT WILL BE STARTED VIA PRE–DETERMINED OPTIMUM START THROUGH THE BUILDING AUTOMATION SYSTEM (BAS). THE UNIT WILL BE DE–ENERGIZED IN ACCORDANCE WITH TIME SCHEDULES THROUGH THE BAS.

GENERAL: THE UNIT IS A TWO PIPE (DUAL TEMPERATURE) FAN COIL UNIT WITH A DUAL TEMPERATURE WATER COIL FOR COOLING AND HEATING, AND A SUPPLY FAN.

OCCUPIED MODE: IN OCCUPIED MODE, THE SUPPLY FAN WILL BE INDEXED ON AND WILL RUN CONTINUOUSLY.

UNOCCUPIED MODE: IN UNOCCUPIED MODE, THE FAN SHALL CYCLE ON AS REQUIRED TO MAINTAIN SPACE SET POINTS.

SPACE TEMPERATURE CONTROL: THE UNIT SHALL INDEX MODE BASED ON DUAL TEMPERATURE SYSTEM SETTING, IN COOLING MODE, ON A RISE IN SPACE TEMPERATURE ABOVE THE SETPOINT, THE CONTROLLER WILL MODULATE THE CONTROL VALVE AT THE COIL. ON A DROP IN SPACE TEMPERATURE, THE CONTROL VALVE WILL MODULATE CLOSED. IN HEATING MODE, ON A DROP IN SPACE TEMPERATURE BELOW THE HEATING SET POINT, THE CONTROLLER WILL MODULATE THE VALVE AT THE COIL. ON A RISE IN SPACE TEMPERATURE, THE REVERSE WILL OCCUR. UNIQUE TEMPERATURE SET POINTS SHALL BE PROVIDED FOR OCCUPIED AND UNOCCUPIED MODE.

FAN COIL POINT LIST;

Fan Coil - Dual Temp	Hardware Points AI	AO	BI	BO	Software Points AV	BV	Loop	Sched	Trend	Alarm	Show On Graphic
Supply Air Temp	x								x		x
Zone Setpoint Adjust	x										x
Zone Temp	x								x		x
Valve Position		x							x		x
Heating Setpoint					x				x		x
Cooling Setpoint					x				x		x
Schedule								x			

SYMBOL LEGEND	
SYMBOL	DESCRIPTION
TS	TEMPERATURE SENSOR
DM	MOTORIZED DAMPER
AF	AIRFLOW MONITORING STATION
DPS	DIFFERENTIAL PRESSURE SENSOR
SD	DUCT SMOKE DETECTOR
HPS	HIGH PRESSURE SENSOR
SP	STATIC PRESSURE SENSOR
H	HUMIDITY SENSOR
CS	CURRENT SENSOR

AIR TERMINAL UNIT OPERATION

DIRECT DIGITAL CONTROLS: DDC CONTROLS, ACTUATORS AND COSTS TO MOUNT, CALIBRATE AND TEST THE SYSTEM SHALL BE THE RESPONSIBILITY OF CONTROLS CONTRACTOR.

TERMINAL UNIT CONTROL:

THE TERMINAL BOX UNITS SHALL BE INDIVIDUALLY CONTROLLED BY A DDC TERMINAL CONTROLLER PER TERMINAL UNIT.

THE BAS SHALL PERFORM THE FOLLOWING TERMINAL UNIT CONTROL STRATEGIES AND PROVIDE THE POINTS AS LISTED ON THE DDC TERMINAL POINT LIST AND THE SPECIFIED MONITORING AND DIAGNOSTICS.

SET POINT CONTROL: THE BAS SHALL EDIT THE ZONE SPACE TEMPERATURE SET-POINT OF EACH TERMINAL BOX. THE ZONE TEMPERATURE SET-POINT SHALL BE OPERATOR ADJUSTABLE. INDIVIDUAL ZONE SET-POINT AND CONTROL LOGIC SHALL RESIDE AT THE ZONE LEVEL AND SHALL NOT BE DEPENDENT UPON THE BAS FOR CONTROL. IN THE EVENT OF COMMUNICATION LOSS, THE BOX SHALL CONTINUE TO CONTROL TO CURRENT SET-POINTS.

COOLING VALVE CONTROL: THE BAS SHALL CONTROL THE COOLING AIR VALVE TO A FULLY OPEN, FULLY CLOSED, MAXIMUM CFM OR MINIMUM CFM POSITION BASED ON OPERATOR COMMANDS. THE OPERATOR SHALL ALSO HAVE THE CAPABILITY TO ADJUST THE MAXIMUM AND MINIMUM AIRFLOW LIMITS OF THE AIR VALVE THROUGH THE BAS.

OPERATING MODE: THE BAS SHALL PLACE THE BOX IN EITHER THE OCCUPIED OR UNOCCUPIED MODE BASED ON AN OPERATOR ADJUSTABLE TIME SCHEDULE. SEPARATE HEATING AND COOLING SET-POINTS SHALL BE PROVIDED FOR EACH MODE THROUGH THE BAS. OTHER MODES AVAILABLE FOR SPECIAL APPLICATIONS SHALL INCLUDE FULL OPEN, FULL CLOSED, MAXIMUM FLOW AND MINIMUM FLOW.

OCCUPIED MODE: AS THE SPACE TEMPERATURE RISES ABOVE THE COOLING SET-POINT, THE TERMINAL UNIT SHALL MODULATE TO ITS MAXIMUM CFM SET-POINT. AS THE SPACE TEMPERATURE FALLS BELOW COOLING SET-POINT, THE TERMINAL UNIT SHALL MODULATE TO ITS MINIMUM CFM SET-POINT. UPON A FURTHER DECREASE IN SPACE TEMPERATURE, THE TERMINAL UNIT SHALL MODULATE TO HEATING CFM AND THE HEATING COIL (WHEN PROVIDED) SHALL MODULATE.

UNOCCUPIED MODE: DURING THIS MODE, THE AIR VALVE ON THE TERMINAL UNIT SHALL BE CLOSED. WHEN REQUIRED BY THE UNOCCUPIED SET-POINT, THE HEAT SHALL CYCLE TO MAINTAIN A REDUCED SPACE TEMPERATURE. UNIT SHALL BE AT MINIMUM HEATING CFM WHEN HEAT IS ENERGIZED.

MORNING WARM-UP MODE: THE AIR VALVE ON THE TERMINAL UNIT SHALL MODULATE TO THEIR MAXIMUM HEATING CFM AND THE HEATING COIL SHALL CYCLE TO MAINTAIN THE OCCUPIED HEATING SET-POINT.

THE BUILDING AUTOMATION SYSTEM SHALL PROVIDE THE ABILITY TO AUTOMATICALLY COMMISSION AND CALIBRATE THE TERMINAL AIR SYSTEM. THE FOLLOWING TESTS SHALL BE PERFORMED, AT A MINIMUM: CALIBRATION OF THE AIR VALVE/DAMPER, VERIFICATION OF AIR FLOW THROUGH THE TERMINAL BOX, VERIFICATION OF LOCAL REHEAT PERFORMANCE.

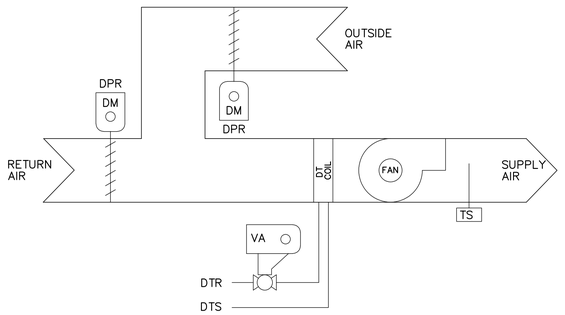
THE BUILDING AUTOMATION SYSTEM (BAS) SHALL PROVIDE THE ABILITY TO INITIATE THE AUTO- COMMISSIONING/AUTO-CALIBRATION COMMAND DIRECTLY FROM THE USER INTERFACE. SPECIAL SERVICE TOOLS SHALL NOT BE REQUIRED. THE TERMINAL BOXES SHALL ALLOW THE OPERATOR TO PERFORM ON AN INDIVIDUAL OR GROUP BASIS AUTO-COMMISSIONING REPORT FOR THE TERMINAL AIR SYSTEM WHICH CONTAINS THE RESULTS OF THE AUTO-COMMISSIONING/AUTO-CALIBRATION TESTS WHICH IS PRINTABLE AND REMAIN IN MEMORY UNTIL THE NEXT AUTO-COMMISSIONING TEST IS INITIATED. THIS REPORT SHALL CONTAIN, AT A MINIMUM, THE FOLLOWING INFORMATION FOR EACH TERMINAL BOX IN THE SYSTEM, NAME OF TERMINAL BOX, DATE AND TIME THE TERMINAL BOX WAS TESTED, PRESENCE OF ANY ALARMS, SPACE TEMPERATURE AND SET-POINT, ACTIVE AIRFLOW (IN CFM), AIR VALVE/DAMPER POSITION AT EVERY 5% INCREMENT, DISCHARGE AIR TEMPERATURE OF THE TERMINAL BOX WHEN THE HOT HEAT IS ACTIVE.

ZONE THERMOSTATS:

THE ZONE THERMOSTATS SHALL BE ACCURATE TO WITHIN 1.0 DEGREES F.

THE ZONE THERMOSTAT SHALL BE INSTALLED TO AVOID RELAYING FALSE TEMPERATURES (I.E. NOT CLOSE TO HEATING/COOLING SOURCES).

Air Terminal Unit	Hardware Points AI	AO	BI	BO	Software Points AV	BV	Loop	Sched	Trend	Alarm	Show On Graphic
Airflow	x								x		x
Discharge Air Temp	x								x		x
Zone Temp	x								x		x
Zone Setpoint Adjustment (where required)	x								x		x
Zone Override (where required)			x						x		x
Reheating Valve (when required)		x							x		x
Zone Damper		x							x		x
Airflow Setpoint					x				x		x
Cooling Setpoint					x				x		x
DAT Heating Limit					x						
Heating Setpoint					x				x		x
Percent of Time Satisfied					x				x		
Heating Mode						x			x		
Schedule								x			



2 UNIT VENTILATOR CONTROL SCHEMATIC
NTS

UNIT VENTILATORS – SEQUENCE OF OPERATIONS

A PROGRAMMABLE CONTROLLER CAPABLE OF STAND–ALONE OPERATION WILL CONTROL THE UNIT. THE UNIT WILL BE STARTED VIA PRE–DETERMINED OPTIMUM START THROUGH THE BUILDING AUTOMATION SYSTEM (BAS). THE UNIT WILL BE DE–ENERGIZED IN ACCORDANCE WITH TIME SCHEDULES THROUGH THE BAS.

GENERAL: THE UNIT IS A TWO PIPE (DUAL TEMPERATURE) UNIT VENTILATOR WITH A DUAL TEMPERATURE WATER COIL FOR COOLING AND HEATING, 2 DAMPERS FOR RETURN AIR/OUTSIDE AIR CONTROL, AND A SUPPLY FAN.

OCCUPIED MODE: IN OCCUPIED MODE, THE SUPPLY FAN WILL BE INDEXED ON AND WILL RUN CONTINUOUSLY.

UNOCCUPIED MODE: IN UNOCCUPIED MODE, THE FAN SHALL CYCLE ON AS REQUIRED TO MAINTAIN SPACE SET POINTS.

SPACE TEMPERATURE CONTROL: THE UNIT SHALL INDEX MODE BASED ON DUAL TEMPERATURE SYSTEM SETTING, IN COOLING MODE, ON A RISE IN SPACE TEMPERATURE ABOVE THE SETPOINT, THE CONTROLLER WILL MODULATE THE CONTROL VALVE AT THE COIL TO MAINTAIN TEMPERATURE SET POINT. ON A DROP IN SPACE TEMPERATURE, THE CONTROL VALVE WILL MODULATE CLOSED. IN HEATING MODE, ON A DROP IN SPACE TEMPERATURE BELOW THE HEATING SET POINT, THE CONTROLLER WILL MODULATE THE VALVE OPEN TO THE COIL. ON A RISE IN SPACE TEMPERATURE, THE REVERSE WILL OCCUR. UNIQUE TEMPERATURE SET POINTS SHALL BE PROVIDED FOR OCCUPIED AND UNOCCUPIED MODE.

UNIT VENTILATOR POINT LIST;

Unit Ventilator - Dual Temp	Hardware Points AI	AO	BI	BO	Software Points AV	BV	Loop	Sched	Trend	Alarm	Show On Graphic
Supply Air Temp	x								x		x
Zone Setpoint Adjust	x										x
Zone Temp	x								x		x
Valve Position		x							x		x
Mixed Air Dampers		x							x		x
Heating Setpoint					x						
Cooling Setpoint					x				x		x
Schedule								x			

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22-074

PROFESSIONAL ENGINEER
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REVISION DESCRIPTION	REVISION DATES

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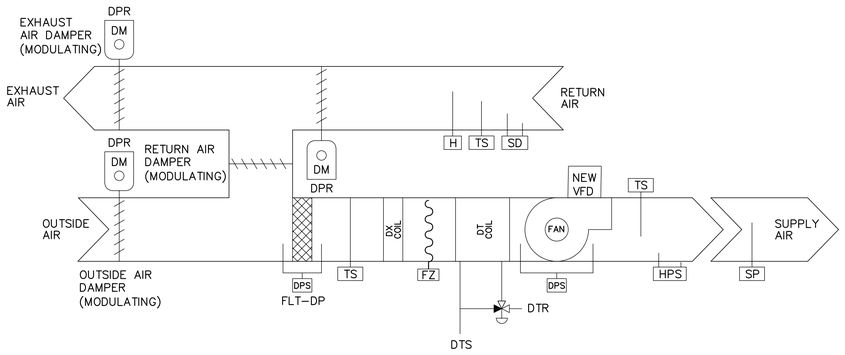
7800 RIDING TRAIL RD
CHARLOTTE, NC, 28212
BAS RENOVATIONS

SHEET TITLE
MECHANICAL CONTROL SCHEMATICS

SHEET
M6



1 AHU-2 CONTROL SCHEMATIC
NTS

AIR HANDLING UNIT AH-2

THE BUILDING AUTOMATION SYSTEM (BAS) SHALL PERFORM THE FOLLOWING VAV AIR SYSTEM (VAS) CONTROL STRATEGIES, APPROPRIATE TO THE GIVEN OCCUPANCY MODE OF THE SYSTEM, AS DETERMINED BY THE USER-ADJUSTABLE TIME-OF-DAY SCHEDULE FOR THE SYSTEM. OPTIMAL START AND UNOCCUPIED MODE APPLIES ONLY TO HVACU WITH TIME OF DAY SCHEDULED OPERATION. VERIFY TIME SCHEDULE DURING OWNER'S TRAINING.

OPTIMAL START MODE:

THE BAS SHALL INITIATE THE OPTIMAL START MODE SUCH THAT THE VAV AIR HANDLER IS STARTED AND AIR TERMINAL UNITS SERVING THE VAS ARE ENABLED PRIOR TO WHEN THE SPACE BEING SERVED BY THE VAS IS SCHEDULED TO BE OCCUPIED, TO ALLOW THE ZONE TEMPERATURE TO REACH THE PENDING OCCUPIED HEATING OR COOLING SET-POINT. THE SYSTEM SHALL WAIT AS LONG AS POSSIBLE BEFORE STARTING, SO THAT THE TEMPERATURE IN EACH ZONE REACHES THE OCCUPIED SET-POINT JUST IN TIME FOR SCHEDULED OCCUPANCY. VENTILATION FUNCTIONS SHALL BE DISABLED WHEN THE VAS IS IN OPTIMAL START MODE AND OUTSIDE AIR DAMPERS SHALL BE CLOSED.

THE BAS SHALL USE A SELF-ADJUSTING ALGORITHM TO CALCULATE THE ACTUAL TIME TO INITIATE OPTIMAL START FOR THE VAV AIR SYSTEM BASED ON THE OCCUPIED SET-POINT, SPACE TEMPERATURE, OUTSIDE AIR TEMPERATURE, HISTORICAL OPTIMAL START PERFORMANCE DATA AND THE ASSOCIATED HEATING OR COOLING OPTIMAL START RATE.

AN EARLY START LIMIT SHALL BE PROVIDED TO PREVENT THE VAS FROM STARTING PRIOR TO 120 MINUTES (ADJUSTABLE) BEFORE SCHEDULED OCCUPANCY.

THE VAS SHALL TRANSITION FROM OPTIMAL START MODE TO OCCUPIED MODE WHEN THE CURRENT TIME IS EQUAL TO THE SCHEDULED START TIME.

1. COOLING:

THE BAS SHALL INITIATE THE OPTIMAL START – COOLING MODE WHEN OPTIMAL START MODE FOR THE VAS HAS BEEN INITIATED AND THE AVERAGE TEMPERATURE OF THE SPACE IS WARMER THAN ITS OCCUPIED COOLING SET-POINT. ALL VENTILATION FUNCTIONS ARE DISABLED WHILE OPERATING IN OPTIMAL START MODE AND THE OUTSIDE AIR DAMPERS SHALL BE CLOSED.

THE BAS SHALL DETERMINE THE LENGTH OF TIME REQUIRED TO LOWER THE SPACE TEMPERATURE TO THE OCCUPIED COOLING SET-POINT WHEN THE MODE OF THE VAS IS COOLING AND THE SPACE TEMPERATURE IS ABOVE THE OCCUPIED COOLING SET-POINT.

EACH AIR TERMINAL UNIT IN THE VAV AIR SYSTEM SHALL CONTROL TO ITS OCCUPIED COOLING SET-POINT AND SHALL MODULATE BOX AIRFLOW TO MAINTAIN THE SPACE TEMPERATURE SET- POINT FOR THE ZONE BEING SERVED BY THE AIR TERMINAL UNIT. AUXILIARY HEAT IN THE AIR TERMINAL UNIT IS DISABLED.

THE AIR HANDLER SHALL MODULATE ITS AIRFLOW TO MAINTAIN THE DUCT STATIC PRESSURE SET- POINT.

2. HEATING:

THE BAS SHALL INITIATE THE OPTIMAL START – HEATING MODE, AIR TERMINAL UNIT LOCAL HEAT, WHEN OPTIMAL START MODE HAS BEEN INITIATED AND THE AVERAGE SPACE TEMPERATURE IS COOLER THAN ITS OCCUPIED HEATING SET-POINT. ALL VENTILATION FUNCTIONS ARE DISABLED WHILE OPERATING IN OPTIMAL START MODE AND THE OUTSIDE AIR DAMPERS SHALL BE CLOSED.

THE BAS SHALL DETERMINE THE LENGTH OF TIME REQUIRED TO RAISE THE AVERAGE SPACE TEMPERATURE TO THE OCCUPIED HEATING SET-POINT WHEN THE MODE OF THE VAS IS HEATING AND THE AVERAGE SPACE TEMPERATURE IS BELOW THE SET-POINT.

EACH AIR TERMINAL UNIT IN THE VAV AIR SYSTEM SHALL CONTROL TO ITS OCCUPIED HEATING SET-POINT AND SHALL MODULATE BOX AIRFLOW TO MAINTAIN THE SPACE TEMPERATURE SET- POINT FOR THE ZONE BEING SERVED BY THE AIR TERMINAL UNIT. AUXILIARY HEAT IN THE AIR TERMINAL UNIT IS ENABLED.

THE AIR HANDLER SHALL MODULATE ITS AIRFLOW TO MAINTAIN THE DUCT STATIC PRESSURE SET- POINT.

UNOCCUPIED MODE:

THE BAS SHALL PLACE THE MEMBERS OF THE VAV AIR SYSTEM INTO OFF/STANDBY MODE AS DETERMINED BY THE USER-ADJUSTABLE TIME-OF-DAY SCHEDULE FOR THE SYSTEM. THE AIR TERMINAL UNITS SHALL CONTROL TO THEIR INDIVIDUAL UNOCCUPIED TEMPERATURE SET-POINTS, AND ALL VENTILATION FUNCTIONS SHALL BE DISABLED AND OUTSIDE AIR DAMPERS SHALL BE CLOSED. AIR TERMINAL UNIT LOCAL REHEAT IS DISABLED WHILE THE VAS IS IN UNOCCUPIED MODE.

AFTER THE AIR TERMINAL UNITS HAVE BEEN COMMANDED TO UNOCCUPIED, THE VAS SHALL COMMAND THE ASSOCIATED AHU TO UNOCCUPIED MODE. SUPPLY FAN SHALL BE SHUT DOWN, DUAL TEMPERATURE WATER COIL CONTROL VALVE SHALL CLOSE, CONDENSING UNIT SHALL CYCLE OFF, OUTDOOR AIR DAMPER SHALL BE CLOSED, AND ALL VENTILATION FUNCTIONS SHALL BE DISABLED.

NIGHT SETBACK MODE:

DURING SCHEDULED UNOCCUPIED HOURS, THE VAV AIR SYSTEM SHALL BE CONTROLLED BY THE BAS TO MAINTAIN THE UNOCCUPIED HEATING AND COOLING SET-POINTS, AS APPROPRIATE. VENTILATION FUNCTIONS ARE DISABLED, THE OUTDOOR AIR DAMPER SHALL REMAIN CLOSED, UNLESS OUTDOOR AIR IS USED FOR ECONOMIZING DURING UNOCCUPIED ZONE COOLING. UNLESS OTHERWISE STATED, THE AHU SUPPLY FAN SHALL OPERATE IN THE AUTOMATIC CONTROL MODE, CYCLING ON ONLY WHEN HEATING OR COOLING IS NEEDED.

1. HEATING:

AHU SUPPLY FAN ENERGIZED, AIR TERMINAL UNIT LOCAL REHEAT IS USED.

THE BAS SHALL INITIATE THE NIGHT HEATING MODE WHEN THE TEMPERATURE FOR THE SPACE BEING SERVED BY THE VAS IS LESS THAN 55 DEGREES F (ADJUSTABLE) IN A MINIMUM OF 3 ROOMS, (ADJUSTABLE). NIGHT HEATING SHALL TERMINATE WHEN THE SPACE TEMPERATURE RISES ABOVE THE UNOCCUPIED HEATING SET-POINT PLUS THE UNOCCUPIED HEATING DIFFERENTIAL (4 DEGREES F, ADJUSTABLE).

EACH AIR TERMINAL UNIT THAT IS ASSOCIATED WITH THE VAS SHALL CONTROL TO ITS UNOCCUPIED HEATING SET-POINT, AND SHALL MODULATE BOX AIRFLOW TO MAINTAIN THE SPACE TEMPERATURE SET- POINT FOR THE ZONE BEING SERVED BY THE AIR TERMINAL UNIT.

THE AIR HANDLER SHALL OPERATE TO MAINTAIN DUCT STATIC PRESSURE WHILE IN NIGHT HEAT MODE.

THE AIR TERMINAL UNIT SHALL CONTROL ITS AIRFLOW TO ITS MAXIMUM HEAT SET-POINT.

2. COOLING:

AHU SUPPLY FAN ENERGIZED

THE BAS SHALL INITIATE THE NIGHT COOLING MODE WHEN THE TEMPERATURE FOR THE SPACE BEING SERVED BY THE VAS IS GREATER THAN 85 DEGREES F, (ADJUSTABLE) FOR A MINIMUM OF THREE ROOMS (ADJUSTABLE). NIGHT COOLING SHALL TERMINATE WHEN THE SPACE TEMPERATURE FALLS BELOW THE UNOCCUPIED COOLING SET-POINT PLUS THE UNOCCUPIED COOLING DIFFERENTIAL (4 DEGREES F, ADJUSTABLE).

EACH AIR TERMINAL UNIT THAT IS ASSOCIATED WITH THE VAS SHALL CONTROL TO ITS UNOCCUPIED COOLING SET-POINT, AND SHALL MODULATE BOX AIRFLOW TO MAINTAIN THE SPACE TEMPERATURE SET- POINT FOR THE ZONE BEING SERVED BY THE AIR TERMINAL UNIT.

THE AIR HANDLER SHALL OPERATE TO MAINTAIN DUCT STATIC PRESSURE WHILE IN NIGHT COOLING MODE.

STATIC PRESSURE OPTIMIZATION:

THE BUILDING AUTOMATION SYSTEM (BAS) SHALL CONTINUOUSLY MONITOR THE DAMPER POSITION OF ALL AIR TERMINAL UNITS. THE DISCHARGE DUCT STATIC PRESSURE SHALL BE SENSED 2/3 OF THE DISTANCE FROM THE DISCHARGE OF EACH ROOFTOP/AIR HANDLING UNIT. THE SENSOR MUST BE MOUNTED IN A NON-TURBULENT LOCATION. LABEL THE LOCATION OF THE SENSOR ON THE CEILING. THE BAS SHALL ALSO READ THE STATUS ON THE SUPPLY AIR SENSOR AND DISPLAY THE PRESSURE READING ON THE STATUS SCREEN. PROVIDE A HIGH-PRESSURE SWITCH AT THE UNIT WITH A SETPOINT BETWEEN 4" AND 6" (ADJUSTABLE).

THE BUILDING AUTOMATION SYSTEM SHALL MONITOR THE DAMPER POSITION OF ALL AIR TERMINAL UNITS AND DETERMINE EACH AIR TERMINAL CRITICAL ZONE VAV TERMINAL (CZ), WHICH IS THE AIR TERMINAL UNIT THAT IS THE WIDEST OPEN.

WHEN ANY AIR TERMINAL DAMPER IS MORE THAN 75 PERCENT (ADJ.) OPEN, THE SUPPLY FAN DISCHARGE DUCT STATIC PRESSURE SET-POINT SHALL BE RESET UPWARD BY 0.3 IN W.C. (ADJ.), AT A FREQUENCY OF 15 MINUTES (ADJ.), UNTIL NO DAMPER IS MORE THAN 75 PERCENT OPEN OR THE STATIC PRESSURE SET-POINT HAS RESET UPWARD TO THE SYSTEM MAXIMUM DUCT STATIC PRESSURE SET-POINT OR THE SUPPLY FAN VARIABLE-FREQUENCY DRIVE IS AT THE MAXIMUM SPEED SETTING.

WHEN ALL AIR TERMINAL DAMPERS ARE LESS THAN 65 PERCENT (ADJ.) OPEN, THE SUPPLY FAN DISCHARGE DUCT STATIC PRESSURE SET-POINT SHALL BE RESET DOWNWARD BY 0.3 IN W.C. (ADJ.), AT A FREQUENCY OF 15 MINUTES (ADJUSTABLE), UNTIL AT LEAST ONE DAMPER IS MORE THAN 65 PERCENT OPEN OR THE STATIC PRESSURE SET-POINT HAS RESET DOWNWARD TO THE SYSTEM MINIMUM DUCT STATIC PRESSURE SET-POINT.

AIR TERMINAL UNITS IN CALIBRATION OR AUTO COMMISSIONING MODE SHALL NOT IMPACT THE CRITICAL ZONE CALCULATION.

THE CONTROL BANDS, SET-POINT INCREMENT VALUES, SET-POINT DECREMENT VALUES AND ADJUSTMENT FREQUENCIES SHALL BE ADJUSTED TO MAINTAIN MAXIMUM STATIC PRESSURE OPTIMIZATION WITH STABLE SYSTEM CONTROL AND MAXIMUM COMFORT CONTROL.

OCCUPIED MODE COOLING CONTROL:

THE DUAL TEMPERATURE WATER VALVE SHALL MODULATE TO MAINTAIN THE DISCHARGE AIR TEMPERATURE AT THE DISCHARGE COOLING SET-POINT FOR THE AIR HANDLERS. THE VAV'S SHALL MODULATE THE AIR FLOW TO MAINTAIN THE ZONE TEMP PER THE COOLING SET POINT. IF THE DUAL TEMPERATURE WATER VALVE CANNOT MAINTAIN DISCHARGE AIR TEMPERATURE SETPOINT, THE CONTROL VALVE SHALL CLOSE AND THE CONDENSING UNIT SHALL BE INDEXED FOR OPERATION.

SUPPLY AIR TEMPERATURE RESET:

THE SUPPLY AIR TEMPERATURE SETPOINT SHALL RESET BASED ON OUTSIDE AIR TEMPERATURE.

AS OUTSIDE AIR TEMPERATURE RISES FROM 35F TO 57F, THE SUPPLY AIR TEMPERATURE SETPOINT SHALL RESET DOWNWARDS FROM 65F TO 55F.

IF RETURN AIR RELATIVE HUMIDITY EXCEEDS 65%, UNIT SHALL REVERT TO 55F SUPPLY AIR TEMPERATURE REGARDLESS OF RESET SCHEDULE.

OCCUPIED MODE HEATING CONTROL:

HEATING DURING OCCUPIED MODE SHALL BE CONTROLLED VIA THE AIR TERMINAL UNITS. THE DUAL TEMPERATURE COIL VALVE SHALL MODULATE TO MAINTAIN DISCHARGE AIR TEMPERATURE.

ECONOMIZER – ENTHALPY ENABLE:

THE MIXED AIR TEMPERATURE SET POINT SHALL BE 2°F (ADJ.) LESS THAN THE SUPPLY AIR TEMPERATURE SET POINT. THE CONTROLLER SHALL MEASURE THE MIXED AIR TEMPERATURE AND MODULATE THE ECONOMIZER DAMPERS IN SEQUENCE TO MAINTAIN THIS SET POINT.

THE OUTSIDE AIR DAMPER SHALL CLOSE AND THE RETURN AIR DAMPER SHALL OPEN WHEN THE UNIT IS OFF.

THE ECONOMIZER SHALL BE ENABLED WHENEVER OUTSIDE AIR TEMPERATURE IS LESS THAN 65°F (ADJ.) AND THE OUTSIDE AIR ENTHALPY IS LESS THAN 28BTU/LB (ADJ.) AND THE OUTSIDE AIR TEMPERATURE IS LESS THAN THE RETURN AIR TEMPERATURE AND THE OUTSIDE AIR ENTHALPY IS LESS THAN THE RETURN AIR ENTHALPY AND THE FAN STATUS IS ON.

THE ECONOMIZER SHALL CLOSE TO 0% (ADJ.) WHENEVER THE FREEZESTAT IS ON OR THE MIXED AIR TEMPERATURE IS LESS THAN 35°F (ADJ.) OR ON LOSS OF FAN STATUS.

1. ALARMS SHALL BE PROVIDED AS FOLLOWS:

HIGH MIXED AIR TEMP: IF THE MIXED AIR TEMPERATURE IS 5°F (ADJ.) GREATER THAN SET POINT.

LOW MIXED AIR TEMP: IF THE MIXED AIR TEMPERATURE IS 5°F (ADJ.) LESS THAN SET POINT.

DEHUMIDIFICATION:

PROVIDE ALL NECESSARY SENSORS FOR DEHUMIDIFICATION CONTROL AT EACH AIR HANDLER.

THE CONTROLLER SHALL MEASURE THE RETURN AIR HUMIDITY AND OVERRIDE THE COOLING SEQUENCE TO MAINTAIN A RETURN AIR HUMIDITY SETPOINT OF 60% RH (ADJ.). THE DEHUMIDIFICATION SHALL TURN OFF WHENEVER THE RETURN AIR HUMIDITY DROPS BELOW 55% RH (ADJ.).

WHEN DEHUMIDIFICATION MODE IS ENGAGED PER THE REQUIREMENTS ABOVE, THE UNIT SHALL GO TO COOLING MODE WITH THE TERMINAL UNITS PROVIDING SPACE TEMPERATURE CONTROL.

DEHUMIDIFICATION SHALL BE ENABLED WHENEVER FAN STATUS IS ON AND RETURN AIR HUMIDITY EXCEEDS 60% (ADJ.) RELATIVE HUMIDITY IN EITHER OCCUPIED OR UNOCCUPIED MODE.

1. ALARMS SHALL BE PROVIDED AS FOLLOWS:

HIGH RETURN AIR HUMIDITY: IF THE RETURN AIR HUMIDITY IS 10% RH (ADJ.) GREATER THAN SETPOINT.

LOW RETURN AIR HUMIDITY: IF THE RETURN AIR HUMIDITY IS 10% RH (ADJ.) LESS THAN SETPOINT.

FREEZE PROTECTION:

THE UNIT SHALL SHUT DOWN AND GENERATE AN ALARM UPON RECEIVING A FREEZESTAT STATUS.

THE OUTSIDE AIR DAMPER SHALL CLOSE.

THE DUAL TEMPERATURE COIL VALVE SHALL OPEN TO 100% (ADJ.).

THE UNIT SHALL ONLY BE RESET MANUALLY. THE MANUAL RESET BUTTON SHALL BE LOCATED AS SUCH TO BE EASILY ACCESSIBLE BY THE TECHNICIAN.

SAFETY INTERLOCK:

THE FOLLOWING SHALL DE-ENERGIZE THE AHU SUPPLY FAN: DUCT DETECTOR, LOW LIMIT THERMOSTAT ACTIVATION, HIGH PRESSURE SWITCH (4"-6" ADJUSTABLE).

BUILDING PRESSURIZATION:

THE OUTSIDE AIR DAMPERS AND RELIEF AIR DAMPERS SHALL MODULATE IN SEQUENCE TO MAINTAIN BUILDING PRESSURE. FOR EXAMPLE IF THE OA DAMPER IS OPEN 20% THE ASSOCIATED RELIEF AIR DAMPERS SHALL OPEN 20%

THERE SHALL BE ONE BUILDING PRESSURE SENSOR PER AIR HANDLER.

THERE SHALL BE AN ALARMED CONDITION FOR SPACE PRESSURIZATION RISING MORE THAN 25% (ADJ.) ABOVE THE SETPOINT AND FOR SPACE PRESSURIZATION FALLING MORE THAN 25% (ADJ.) BELOW THE SETPOINT.

DEMAND CONTROL VENTILATION:

OUTSIDE AIR INTAKE SHALL BE PROVIDED WITH A MOTORIZED DAMPER. ON UNIT START UP, THE OUTSIDE AIR INTAKE DAMPER SHALL REMAIN CLOSED UNTIL THE RETURN AIR TEMPERATURE RISES ABOVE 65° F (ADJ) OR FALLS BELOW 75° F. (ADJ). ONCE RETURN AIR TEMPERATURE IS SATISFIED, THE OUTSIDE AIR DAMPER SHALL OPEN TO THE OCCUPIED MINIMUM SETPOINT. OUTSIDE AIR DAMPERS AND SHALL MODULATE AS REQUIRED TO MAINTAIN MINIMUM OUTSIDE AIR FLOW. THE OUTSIDE AIR INTAKE DAMPER SHALL BE CLOSED WHILE UNIT IS IN THE UNOCCUPIED MODE. BAS SHALL BE CAPABLE OF OPENING AND CLOSING OUTSIDE AIR DAMPERS. CO2 SENSOR MOUNTED IN THE RETURN DUCT SHALL MODULATE THE OUTSIDE AIR DAMPER BASED ON CO2 LEVELS IN THE SPACE. DAMPER SHALL MODULATE OPEN FROM THE OCCUPIED MINIMUM SETPOINT OF 600 PPM ABOVE OA CO2 LEVEL, TO DESIGN MAXIMUM AT 1000 PPM ABOVE OA CO2 LEVEL. AN ALARM SHALL BE ACTIVATED IF THE SPACE CO2 LEVEL RISES ABOVE 1000 PPM ABOVE OA CO2 LEVEL.

AHU-2

	Hardware Points				Software Points						
Point Name	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm	Show On Graphic
Building Static Pressure	x								x		x
Mixed Air Temp	x								x		x
Outside Air Temp (*can be one for building)	x*				x*				x		x
Return Air Carbon Dioxide PPM	x								x		x
Return Air Humidity	x								x		x
Space Humidity	x								x		x
Return Air Temp	x								x		x
Supply Air Static Pressure	x								x	x	x
Supply Air Temp	x								x		x
Dual Temperature Water Valve		x							x		x
Exhaust Air Damper		x									x
Condensing Unit - Cooling Output				x					x		x
Mixed Air Dampers		x							x		x
Supply Fan VFD Speed		x							x		x
Freezestat			x						x	x	x
High Static Shutdown			x						x	x	x
Smoke Detector			x						x	x	x
Supply Fan Status			x						x		x
Supply Fan VFD Fault			x							x	x
Supply Fan Start/Stop				x					x		x
Building Static Pressure Set- point					x						x
Dehumidification Setpoint					x				x		x
Economizer Mixed Air Temp Setpoint					x				x		x
Return Air Carbon Dioxide PPM Setpoint					x				x		x
Supply Air Static Pressure Setpoint					x				x		x
Supply Air Temp Setpoint					x				x		x
Emergency Shutdown						x			x	x	x
High Return Air Carbon Dioxide Concentration										x	
High Return Air Humidity										x	
High Supply Air Temp										x	
High Supply Air Temp										x	
Supply Fan Failure										x	
Supply Fan in Hand										x	x

SYMBOL LEGEND

SYMBOL	DESCRIPTION
TS	TEMPERATURE SENSOR
DM	MOTORIZED DAMPER
AF	AIRFLOW MONITORING STATION
DPS	DIFFERENTIAL PRESSURE SENSOR
SD	DUCT SMOKE DETECTOR
HPS	HIGH PRESSURE SENSOR
SP	STATIC PRESSURE SENSOR
H	HUMIDITY SENSOR
CS	CURRENT SENSOR

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22-074

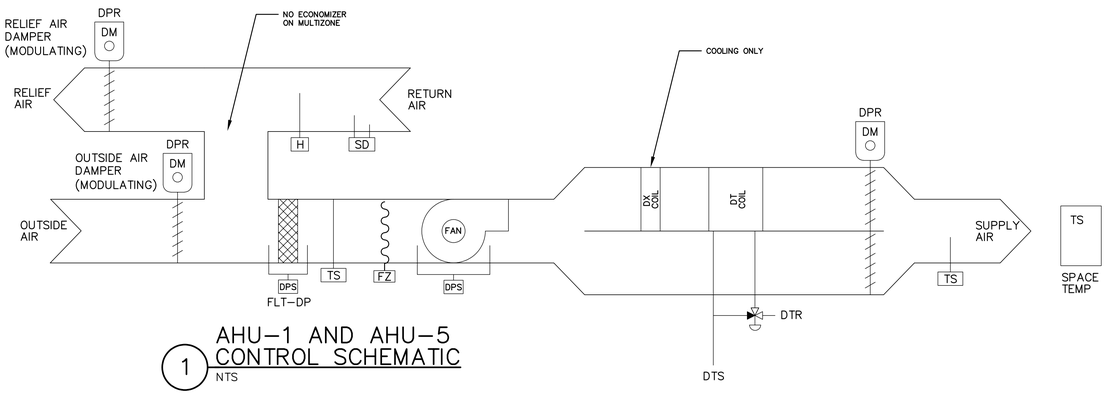
PROFESSIONAL ENGINEER
02-17-2023

REVISION DESCRIPTION
REVISION DATES
22-074
JOB NUMBER
DRAWN BY
CHECKED BY
02/17/2023
DATE

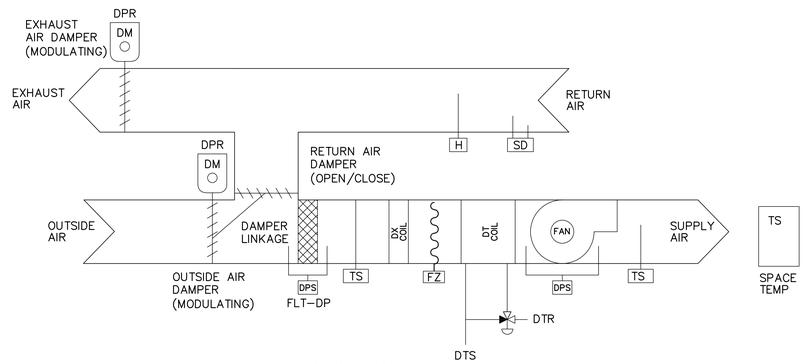
JOB TITLE
ALBEMARLE ROAD ELEMENTARY
7800 RIDING TRAIL RD
CHARLOTTE, NC, 28212
BAS RENOVATIONS

SHEET TITLE
MECHANICAL CONTROL SCHEMATICS

SHEET
M7



1 AHU–1 AND AHU–5 CONTROL SCHEMATIC
NTS



2 AHU–4 CONTROL SCHEMATIC
NTS

AIR HANDLING UNITS AH–1 AND AH–5

THE BUILDING AUTOMATION SYSTEM (BAS) SHALL PERFORM THE FOLLOWING CAV AIR SYSTEM (CAS) CONTROL STRATEGIES, APPROPRIATE TO THE GIVEN OCCUPANCY MODE OF THE SYSTEM, AS DETERMINED BY THE USER–ADJUSTABLE TIME–OF–DAY SCHEDULE FOR THE SYSTEM. OPTIMAL START AND UNOCCUPIED MODE APPLIES ONLY TO HVACU WITH TIME OF DAY SCHEDULED OPERATION. VERIFY TIME SCHEDULE DURING OWNER'S TRAINING.

OPTIMAL START MODE:

THE BAS SHALL INITIATE THE OPTIMAL START MODE SUCH THAT THE CAV AIR HANDLER IS STARTED WHEN THE SPACE BEING SERVED BY THE CAS IS SCHEDULED TO BE OCCUPIED, TO ALLOW THE ZONE TEMPERATURE TO REACH THE PENDING OCCUPIED HEATING OR COOLING SET–POINT. THE SYSTEM SHALL WAIT AS LONG AS POSSIBLE BEFORE STARTING, SO THAT THE TEMPERATURE IN EACH ZONE REACHES THE OCCUPIED SET–POINT JUST IN TIME FOR SCHEDULED OCCUPANCY. VENTILATION FUNCTIONS SHALL BE DISABLED WHEN THE CAS IS IN OPTIMAL START MODE AND OUTSIDE AIR DAMPERS SHALL BE CLOSED.

THE BAS SHALL USE A SELF–ADJUSTING ALGORITHM TO CALCULATE THE ACTUAL TIME TO INITIATE OPTIMAL START FOR THE CAV AIR SYSTEM BASED ON THE OCCUPIED SET–POINT, SPACE TEMPERATURE, OUTSIDE AIR TEMPERATURE, HISTORICAL OPTIMAL START PERFORMANCE DATA AND THE ASSOCIATED HEATING OR COOLING OPTIMAL START RATE.

AN EARLY START LIMIT SHALL BE PROVIDED TO PREVENT THE CAS FROM STARTING PRIOR TO 120 MINUTES (ADJUSTABLE) BEFORE SCHEDULED OCCUPANCY.

THE CAS SHALL TRANSITION FROM OPTIMAL START MODE TO OCCUPIED MODE WHEN THE CURRENT TIME IS EQUAL TO THE SCHEDULED START TIME.

1. COOLING:

THE BAS SHALL INITIATE THE OPTIMAL START – COOLING MODE WHEN OPTIMAL START MODE FOR THE CAS HAS BEEN INITIATED AND THE AVERAGE TEMPERATURE OF THE SPACE IS WARMER THAN ITS OCCUPIED COOLING SET–POINT. ALL VENTILATION FUNCTIONS ARE DISABLED WHILE OPERATING IN OPTIMAL START MODE AND THE OUTSIDE AIR DAMPERS SHALL BE CLOSED.

THE BAS SHALL DETERMINE THE LENGTH OF TIME REQUIRED TO LOWER THE SPACE TEMPERATURE TO THE OCCUPIED COOLING SET–POINT WHEN THE MODE OF THE CAS IS COOLING AND THE SPACE TEMPERATURE IS ABOVE THE OCCUPIED COOLING SET–POINT.

EACH MULTIZONE DAMPER IN THE CAV AIR SYSTEM SHALL CONTROL TO ITS OCCUPIED COOLING SET–POINT AND SHALL MODULATE TO MAINTAIN THE SPACE TEMPERATURE SET– POINT FOR THE ZONE BEING SERVED.

2. HEATING:

THE BAS SHALL INITIATE THE OPTIMAL START – HEATING MODE, , WHEN OPTIMAL START MODE HAS BEEN INITIATED AND THE AVERAGE SPACE TEMPERATURE IS COOLER THAN ITS OCCUPIED HEATING SET–POINT. ALL VENTILATION FUNCTIONS ARE DISABLED WHILE OPERATING IN OPTIMAL START MODE AND THE OUTSIDE AIR DAMPERS SHALL BE CLOSED.

THE BAS SHALL DETERMINE THE LENGTH OF TIME REQUIRED TO RAISE THE AVERAGE SPACE TEMPERATURE TO THE OCCUPIED HEATING SET–POINT WHEN THE MODE OF THE CAS IS HEATING AND THE AVERAGE SPACE TEMPERATURE IS BELOW THE SET–POINT.

EACH MULTIZONE DAMPER IN THE CAV AIR SYSTEM SHALL CONTROL TO ITS OCCUPIED HEATING SET–POINT AND SHALL MODULATE AIRFLOW TO MAINTAIN THE SPACE TEMPERATURE SET– POINT FOR THE ZONE BEING SERVED.

UNOCCUPIED MODE:

THE BAS SHALL PLACE THE MEMBERS OF THE CAV AIR SYSTEM INTO OFF/STANDBY MODE AS DETERMINED BY THE USER–ADJUSTABLE TIME–OF–DAY SCHEDULE FOR THE SYSTEM. THE MULTIZONE DAMPERS SHALL CONTROL TO THEIR INDIVIDUAL UNOCCUPIED TEMPERATURE SET–POINTS, AND ALL VENTILATION FUNCTIONS SHALL BE DISABLED AND OUTSIDE AIR DAMPERS SHALL BE CLOSED.

SUPPLY FAN SHALL BE SHUT DOWN, DUAL TEMPERATURE WATER COIL CONTROL VALVE SHALL CLOSE, CONDENSING UNIT SHALL CYCLE OFF, OUTDOOR AIR DAMPER SHALL BE CLOSED, AND ALL VENTILATION FUNCTIONS SHALL BE DISABLED.

NIGHT SETBACK MODE:

DURING SCHEDULED UNOCCUPIED HOURS, THE CAV AIR SYSTEM SHALL BE CONTROLLED BY THE BAS TO MAINTAIN THE UNOCCUPIED HEATING AND COOLING SET–POINTS, AS APPROPRIATE. VENTILATION FUNCTIONS ARE DISABLED, THE OUTDOOR AIR DAMPER SHALL REMAIN CLOSED, UNLESS OUTDOOR AIR IS USED FOR ECONOMIZING DURING UNOCCUPIED ZONE COOLING. UNLESS OTHERWISE STATED, THE AHU SUPPLY FAN SHALL OPERATE IN THE AUTOMATIC CONTROL MODE, CYCLING ON ONLY WHEN HEATING OR COOLING IS NEEDED.

1. HEATING:

AHU SUPPLY FAN ENERGIZED, DUAL TEMPERATURE CONTROL VALVE SHALL MODULATE TO MAINTAIN HEATING DECK TEMPERATURE.

THE BAS SHALL INITIATE THE NIGHT HEATING MODE WHEN THE TEMPERATURE FOR THE SPACE BEING SERVED BY THE CAS IS LESS THAN 55 DEGREES F (ADJUSTABLE) IN A MINIMUM OF 3 ROOMS, (ADJUSTABLE). NIGHT HEATING SHALL TERMINATE WHEN THE SPACE TEMPERATURE RISES ABOVE THE UNOCCUPIED HEATING SET–POINT PLUS THE UNOCCUPIED HEATING DIFFERENTIAL (4 DEGREES F, ADJUSTABLE).

EACH MULTIZONE DAMPER THAT IS ASSOCIATED WITH THE CAS SHALL CONTROL TO ITS UNOCCUPIED HEATING SET–POINT, AND SHALL MODULATE BOX AIRFLOW TO MAINTAIN THE SPACE TEMPERATURE SET– POINT FOR THE ZONE BEING SERVED BY THE AIR TERMINAL UNIT.

2. COOLING:

AHU SUPPLY FAN ENERGIZED, DUAL TEMPERATURE CONTROL VALVE SHALL MODULATE TO MAINTAIN COOLING DECK SUPPLY TEMPERATURE. CONDENSING UNIT SHALL OPERATE IF DUAL TEMP COIL CANNOT MAINTAIN SETPOINT.

THE BAS SHALL INITIATE THE NIGHT COOLING MODE WHEN THE TEMPERATURE FOR THE SPACE BEING SERVED BY THE CAS IS GREATER THAN 85 DEGREES F, (ADJUSTABLE). NIGHT COOLING SHALL TERMINATE WHEN THE SPACE TEMPERATURE FALLS BELOW THE UNOCCUPIED COOLING SET–POINT PLUS THE UNOCCUPIED COOLING DIFFERENTIAL (4 DEGREES F, ADJUSTABLE).

MODE OF OPERATION

COOLING OR HEATING MODE SHALL BE DETERMINED BY THE ZONE FURTHEST FROM SETPOINT.

OCCUPIED MODE COOLING CONTROL:

THE DUAL TEMPERATURE WATER VALVE SHALL MODULATE TO MAINTAIN THE MULTIZONE COLD DECK SETPOINT AIR TEMPERATURE. THE CAV'S SHALL MODULATE THE COLD DECK AND BYPASS DAMPERS TO MAINTAIN THE ZONE TEMP PER THE COOLING SET POINTS. IF THE DUAL TEMPERATURE WATER VALVE CANNOT MAINTAIN AIR TEMPERATURE SETPOINT, THE CONTROL VALVE SHALL CLOSE AND THE CONDENSING UNIT SHALL BE INDEXED FOR OPERATION.

SUPPLY AIR TEMPERATURE RESET:

THE SUPPLY AIR TEMPERATURE SETPOINT SHALL RESET BASED ON OUTSIDE AIR TEMPERATURE.

AS OUTSIDE AIR TEMPERATURE RISES FROM 35F TO 57F, THE SUPPLY AIR TEMPERATURE SETPOINT SHALL RESET DOWNWARDS FROM 65F TO 55F.

IF RETURN AIR RELATIVE HUMIDITY EXCEEDS 65%, UNIT SHALL REVERT TO 55F SUPPLY AIR TEMPERATURE REGARDLESS OF RESET SCHEDULE.

OCCUPIED MODE HEATING CONTROL:

THE DUAL TEMPERATURE WATER VALVE SHALL MODULATE TO MAINTAIN THE MULTIZONE HOT DECK SETPOINT AIR TEMPERATURE. THE CAV'S SHALL MODULATE THE HOT DECK AND BYPASS DAMPERS TO MAINTAIN THE ZONE TEMP PER THE HEATING SET POINTS.

1. ALARMS SHALL BE PROVIDED AS FOLLOWS:

HIGH MIXED AIR TEMP: IF THE MIXED AIR TEMPERATURE IS 5°F (ADJ.) GREATER THAN SET POINT.

LOW MIXED AIR TEMP: IF THE MIXED AIR TEMPERATURE IS 5°F (ADJ.) LESS THAN SET POINT.

DEHUMIDIFICATION:

PROVIDE ALL NECESSARY SENSORS FOR DEHUMIDIFICATION CONTROL AT EACH AIR HANDLER.

THE CONTROLLER SHALL MEASURE THE RETURN AIR HUMIDITY AND OVERRIDE THE COOLING SEQUENCE TO MAINTAIN A RETURN AIR HUMIDITY SETPOINT OF 60% RH (ADJ.). THE DEHUMIDIFICATION SHALL TURN OFF WHENEVER THE RETURN AIR HUMIDITY DROPS BELOW 55% RH (ADJ.).

WHEN DEHUMIDIFICATION MODE IS ENGAGED PER THE REQUIREMENTS ABOVE, THE UNIT SHALL GO TO COOLING MODE WITH THE TERMINAL UNITS PROVIDING SPACE TEMPERATURE CONTROL.

DEHUMIDIFICATION SHALL BE ENABLED WHENEVER FAN STATUS IS ON AND RETURN AIR HUMIDITY EXCEEDS 60% (ADJ.) RELATIVE HUMIDITY IN EITHER OCCUPIED OR UNOCCUPIED MODE.

1. ALARMS SHALL BE PROVIDED AS FOLLOWS:

HIGH RETURN AIR HUMIDITY: IF THE RETURN AIR HUMIDITY IS 10% RH (ADJ.) GREATER THAN SETPOINT.

LOW RETURN AIR HUMIDITY: IF THE RETURN AIR HUMIDITY IS 10% RH (ADJ.) LESS THAN SETPOINT.

FREEZE PROTECTION:

THE UNIT SHALL SHUT DOWN AND GENERATE AN ALARM UPON RECEIVING A FREEZESTAT STATUS.

THE OUTSIDE AIR DAMPER SHALL CLOSE.

THE DUAL TEMPERATURE COIL VALVE SHALL OPEN TO 100% (ADJ.).

THE UNIT SHALL ONLY BE RESET MANUALLY. THE MANUAL RESET BUTTON SHALL BE LOCATED AS SUCH TO BE EASILY ACCESSIBLE BY THE TECHNICIAN.

SAFETY INTERLOCK:

THE FOLLOWING SHALL DE–ENERGIZE THE AHU SUPPLY FAN: DUCT DETECTOR, LOW LIMIT THERMOSTAT ACTIVATION, HIGH PRESSURE SWITCH (4"–6" ADJUSTABLE).

BUILDING PRESSURIZATION:

THE OUTSIDE AIR DAMPERS AND RELIEF AIR DAMPERS SHALL MODULATE IN SEQUENCE TO MAINTAIN BUILDING PRESSURE. FOR EXAMPLE IF THE OA DAMPER IS OPEN 20% THE ASSOCIATED RELIEF AIR DAMPERS SHALL OPEN 20%.

THERE SHALL BE ONE SENSOR PER AIR HANDLER.

THERE SHALL BE AN ALARMED CONDITION FOR SPACE PRESSURIZATION RISING MORE THAN 25% (ADJ.) ABOVE THE SETPOINT AND FOR SPACE PRESSURIZATION FALLING MORE THAN 25% (ADJ.) BELOW THE SETPOINT.

DEMAND CONTROL VENTILATION:

OUTSIDE AIR INTAKE SHALL BE PROVIDED WITH A MOTORIZED DAMPER. ON UNIT START UP, THE OUTSIDE AIR INTAKE DAMPER SHALL REMAIN CLOSED UNTIL THE RETURN AIR TEMPERATURE RISES ABOVE 65° F (ADJ) OR FALLS BELOW 75° F. (ADJ). ONCE RETURN AIR TEMPERATURE IS SATISFIED, THE OUTSIDE AIR DAMPER SHALL OPEN TO THE OCCUPIED MINIMUM SETPOINT. OUTSIDE AIR DAMPERS AND SHALL MODULATE AS REQUIRED TO MAINTAIN MINIMUM OUTSIDE AIR FLOW. THE OUTSIDE AIR INTAKE DAMPER SHALL BE CLOSED WHILE UNIT IS IN THE UNOCCUPIED MODE. BAS SHALL BE CAPABLE OF OPENING AND CLOSING OUTSIDE AIR DAMPERS. CO2 SENSOR MOUNTED IN THE RETURN DUCT SHALL MODULATE THE OUTSIDE AIR DAMPER BASED ON CO2 LEVELS IN THE SPACE. DAMPER SHALL MODULATE OPEN FROM THE OCCUPIED MINIMUM SETPOINT OF 600 PPM ABOVE OA CO2 LEVEL, TO DESIGN MAXIMUM AT 1000 PPM ABOVE OA CO2 LEVEL. AN ALARM SHALL BE ACTIVATED IF THE SPACE CO2 LEVEL RISES ABOVE 1000 PPM ABOVE OA CO2 LEVEL.

AHU - 1 AND AHU-5

	Hardware Points				Software Points						
Point Name	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm	Show On Graphic
Building Static Pressure	x								x		x
Mixed Air Temp	x								x		x
Outside Air Temp (*can be one for building)	x*				x*				x		x
Return Air Carbon Dioxide PPM	x								x		x
Return Air Humidity	x								x		x
Space Humidity	x								x		x
Return Air Temp	x								x		x
Supply Air Temp	x								x		x
Dual Temperature Water Valve		x							x		x
Exhaust Air Damper		x									x
Condensing Unit - Cooling Output				x					x		x
Mixed Air Dampers		x							x		x
Zone Temperature Setpoint - Heating					x						
Zone Temperature Setpoint - Cooling					x						
Freezestat			x						x	x	x
High Static Shutdown			x						x	x	x
Smoke Detector			x						x	x	x
Supply Fan Status			x						x		x
Supply Fan Start/Stop				x					x		x
Building Static Pressure Set- point					x						x
Dehumidification Setpoint					x				x		x
Return Air Carbon Dioxide PPM Setpoint					x				x		x
Supply Air Temp Setpoint - Cooling					x				x		x
Supply Air Temp Setpoint - Heating					x				x		x
High Return Air Carbon Dioxide Concentration										x	
High Return Air Humidity										x	
High Supply Air Temp										x	
Supply Fan Failure										x	
Supply Fan in Hand										x	x

AIR HANDLING UNIT AH–4

THE BUILDING AUTOMATION SYSTEM (BAS) SHALL PERFORM THE FOLLOWNG CAV AIR SYSTEM (CAS) CONTROL STRATEGIES, APPROPRIATE TO THE GIVEN OCCUPANCY MODE OF THE SYSTEM, AS DETERMINED BY THE USER–ADJUSTABLE TIME–OF–DAY SCHEDULE FOR THE SYSTEM. OPTIMAL START AND UNOCCUPIED MODE APPLIES ONLY TO HVACU WITH TIME OF DAY SCHEDULED OPERATION. VERIFY TIME SCHEDULE DURING OWNER'S TRAINING.

OPTIMAL START MODE:

THE BAS SHALL INITIATE THE OPTIMAL START MODE SUCH THAT THE CAV AIR HANDLER IS STARTED WHEN THE SPACE BEING SERVED BY THE CAS IS SCHEDULED TO BE OCCUPIED, TO ALLOW THE ZONE TEMPERATURE TO REACH THE PENDING OCCUPIED HEATING OR COOLING SET–POINT. THE SYSTEM SHALL WAIT AS LONG AS POSSIBLE BEFORE STARTING, SO THAT THE TEMPERATURE REACHES THE OCCUPIED SET–POINT JUST IN TIME FOR SCHEDULED OCCUPANCY. VENTILATION FUNCTIONS SHALL BE DISABLED WHEN THE CAS IS IN OPTIMAL START MODE AND OUTSIDE AIR DAMPERS SHALL BE CLOSED.

THE BAS SHALL USE A SELF–ADJUSTING ALGORITHM TO CALCULATE THE ACTUAL TIME TO INITIATE OPTIMAL START FOR THE CAV AIR SYSTEM BASED ON THE OCCUPIED SET–POINT, SPACE TEMPERATURE, OUTSIDE AIR TEMPERATURE, HISTORICAL OPTIMAL START PERFORMANCE DATA AND THE ASSOCIATED HEATING OR COOLING OPTIMAL START RATE.

AN EARLY START LIMIT SHALL BE PROVIDED TO PREVENT THE CAS FROM STARTING PRIOR TO 120 MINUTES (ADJUSTABLE) BEFORE SCHEDULED OCCUPANCY.

THE CAS SHALL TRANSITION FROM OPTIMAL START MODE TO OCCUPIED MODE WHEN THE CURRENT TIME IS EQUAL TO THE SCHEDULED START TIME.

1. COOLING:

THE BAS SHALL INITIATE THE OPTIMAL START – COOLING MODE WHEN OPTIMAL START MODE FOR THE CAS HAS BEEN INITIATED AND THE TEMPERATURE OF THE SPACE IS WARMER THAN ITS OCCUPIED COOLING SET–POINT. ALL VENTILATION FUNCTIONS ARE DISABLED WHILE OPERATING IN OPTIMAL START MODE AND THE OUTSIDE AIR DAMPERS SHALL BE CLOSED.

THE BAS SHALL DETERMINE THE LENGTH OF TIME REQUIRED TO LOWER THE SPACE TEMPERATURE TO THE OCCUPIED COOLING SET–POINT WHEN THE MODE OF THE CAS IS COOLING AND THE SPACE TEMPERATURE IS ABOVE THE OCCUPIED COOLING SET–POINT.

2. HEATING:

THE BAS SHALL INITIATE THE OPTIMAL START – HEATING MODE, WHEN OPTIMAL START MODE HAS BEEN INITIATED AND THE SPACE TEMPERATURE IS COOLER THAN ITS OCCUPIED HEATING SET–POINT. ALL VENTILATION FUNCTIONS ARE DISABLED WHILE OPERATING IN OPTIMAL START MODE AND THE OUTSIDE AIR DAMPERS SHALL BE CLOSED.

THE BAS SHALL DETERMINE THE LENGTH OF TIME REQUIRED TO RAISE THE AVERAGE SPACE TEMPERATURE TO THE OCCUPIED HEATING SET–POINT WHEN THE MODE OF THE CAS IS HEATING AND THE SPACE TEMPERATURE IS BELOW THE SET–POINT.

UNOCCUPIED MODE:

THE BAS SHALL PLACE THE MEMBERS OF THE CAV AIR SYSTEM INTO OFF/STANDBY MODE AS DETERMINED BY THE USER–ADJUSTABLE TIME–OF–DAY SCHEDULE FOR THE SYSTEM. THE AIR TERMINAL UNITS SHALL CONTROL TO THEIR INDIVIDUAL UNOCCUPIED TEMPERATURE SET–POINTS, AND ALL VENTILATION FUNCTIONS SHALL BE DISABLED AND OUTSIDE AIR DAMPERS SHALL BE CLOSED.

AFTER THE UNITS HAVE BEEN COMMANDED TO UNOCCUPIED, THE CAS SHALL COMMAND THE ASSOCIATED AHU TO UNOCCUPIED MODE. SUPPLY FAN SHALL BE SHUT DOWN, DUAL TEMPERATURE WATER COIL CONTROL VALVE SHALL CLOSE, CONDENSING UNIT SHALL CYCLE OFF, OUTDOOR AIR DAMPER SHALL BE CLOSED, AND ALL VENTILATION FUNCTIONS SHALL BE DISABLED.

NIGHT SETBACK MODE:

DURING SCHEDULED UNOCCUPIED HOURS, THE CAV AIR SYSTEM SHALL BE CONTROLLED BY THE BAS TO MAINTAIN THE UNOCCUPIED HEATING AND COOLING SET–POINTS, AS APPROPRIATE. VENTILATION FUNCTIONS ARE DISABLED, THE OUTDOOR AIR DAMPER SHALL REMAIN CLOSED, UNLESS OUTDOOR AIR IS USED FOR ECONOMIZING DURING UNOCCUPIED ZONE COOLING. UNLESS OTHERWISE STATED, THE AHU SUPPLY FAN SHALL OPERATE IN THE AUTOMATIC CONTROL MODE, CYCLING ON ONLY WHEN HEATING OR COOLING IS NEEDED.

1. HEATING:

AHU SUPPLY FAN ENERGIZED, DUAL TEMPERATURE CONTROL VALVE INDEXED FOR HEATING.

THE BAS SHALL INITIATE THE NIGHT HEATING MODE WHEN THE TEMPERATURE FOR THE SPACE BEING SERVED BY THE CAS IS LESS THAN 55 DEGREES F (ADJUSTABLE). NIGHT HEATING SHALL TERMINATE WHEN THE SPACE TEMPERATURE RISES ABOVE THE UNOCCUPIED HEATING SET–POINT PLUS THE UNOCCUPIED HEATING DIFFERENTIAL (4 DEGREES F, ADJUSTABLE).

2. COOLING:

AHU SUPPLY FAN ENERGIZED, DUAL TEMPERATURE CONTROL VALVE INDEXED FOR HEATING.

THE BAS SHALL INITIATE THE NIGHT COOLING MODE WHEN THE TEMPERATURE FOR THE SPACE BEING SERVED BY THE CAS IS GREATER THAN 85 DEGREES F, (ADJUSTABLE). NIGHT COOLING SHALL TERMINATE WHEN THE SPACE TEMPERATURE FALLS BELOW THE UNOCCUPIED COOLING SET–POINT PLUS THE UNOCCUPIED COOLING DIFFERENTIAL (4 DEGREES F, ADJUSTABLE).

OCCUPIED MODE COOLING CONTROL:

THE DUAL TEMPERATURE WATER VALVE SHALL MODULATE TO MAINTAIN THE SPACE TEMPERATURE. IF THE DUAL TEMPERATURE WATER VALVE CANNOT MAINTAIN SPACE TEMPERATURE SETPOINT, THE CONTROL VALVE SHALL CLOSE AND THE CONDENSING UNIT SHALL BE INDEXED FOR OPERATION.

OCCUPIED MODE HEATING CONTROL:

THE DUAL TEMPERATURE COIL VALVE SHALL MODULATE TO MAINTAIN SPACE TEMPERATURE SETPOINT.

ECONOMIZER – ENTHALPY ENABLE:

THE MIXED AIR TEMPERATURE SET POINT SHALL BE 2°F (ADJ.) LESS THAN THE SUPPLY AIR TEMPERATURE SET POINT. THE CONTROLLER SHALL MEASURE THE MIXED AIR TEMPERATURE AND MODULATE THE ECONOMIZER DAMPERS IN SEQUENCE TO MAINTAIN THIS SET POINT.

THE OUTSIDE AIR DAMPER SHALL CLOSE AND THE RETURN AIR DAMPER SHALL OPEN WHEN THE UNIT IS OFF.

THE ECONOMIZER SHALL BE ENABLED WHENEVER OUTSIDE AIR TEMPERATURE IS LESS THAN 65°F (ADJ.) AND THE OUTSIDE AIR ENTHALPY IS LESS THAN 22BTU/LB (ADJ.) AND THE OUTSIDE AIR TEMPERATURE IS LESS THAN THE RETURN AIR TEMPERATURE AND THE OUTSIDE AIR ENTHALPY IS LESS THAN THE RETURN AIR ENTHALPY AND THE FAN STATUS IS ON.

THE ECONOMIZER SHALL CLOSE TO 0% (ADJ.) WHENEVER THE FREEZESTAT IS ON OR THE MIXED AIR TEMPERATURE IS LESS THAN 35°F (ADJ.) OR ON LOSS OF FAN STATUS.

1. ALARMS SHALL BE PROVIDED AS FOLLOWS:

HIGH MIXED AIR TEMP: IF THE MIXED AIR TEMPERATURE IS 5°F (ADJ.) GREATER THAN SET POINT.

LOW MIXED AIR TEMP: IF THE MIXED AIR TEMPERATURE IS 5°F (ADJ.) LESS THAN SET POINT.

FREEZE PROTECTION:

THE UNIT SHALL SHUT DOWN AND GENERATE AN ALARM UPON RECEIVING A FREEZESTAT STATUS.

THE OUTSIDE AIR DAMPER SHALL CLOSE.

THE DUAL TEMPERATURE COIL VALVE SHALL OPEN TO 100% (ADJ.).

THE UNIT SHALL ONLY BE RESET MANUALLY. THE MANUAL RESET BUTTON SHALL BE LOCATED AS SUCH TO BE EASILY ACCESSIBLE BY THE TECHNICIAN.

SAFETY INTERLOCK:

THE FOLLOWING SHALL DE–ENERGIZE THE AHU SUPPLY FAN: DUCT DETECTOR, LOW LIMIT THERMOSTAT ACTIVATION, HIGH PRESSURE SWITCH (4"–6" ADJUSTABLE).

BUILDING PRESSURIZATION:

THE OUTSIDE AIR DAMPERS AND RELIEF AIR DAMPERS SHALL MODULATE IN SEQUENCE TO MAINTAIN BUILDING PRESSURE. FOR EXAMPLE IF THE OA DAMPER IS OPEN 20% THE ASSOCIATED RELIEF AIR DAMPERS SHALL OPEN 20%.

THERE SHALL BE ONE SENSOR PER AIR HANDLER.

THERE SHALL BE AN ALARMED CONDITION FOR SPACE PRESSURIZATION RISING MORE THAN 25% (ADJ.) ABOVE THE SETPOINT AND FOR SPACE PRESSURIZATION FALLING MORE THAN 25% (ADJ.) BELOW THE SETPOINT.

DEMAND CONTROL VENTILATION:

OUTSIDE AIR INTAKE SHALL BE PROVIDED WITH A MOTORIZED DAMPER. ON UNIT START UP, THE OUTSIDE AIR INTAKE DAMPER SHALL REMAIN CLOSED UNTIL THE RETURN AIR TEMPERATURE RISES ABOVE 65° F (ADJ) OR FALLS BELOW 75° F. (ADJ). ONCE RETURN AIR TEMPERATURE IS SATISFIED, THE OUTSIDE AIR DAMPER SHALL OPEN TO THE OCCUPIED MINIMUM SETPOINT. OUTSIDE AIR DAMPERS AND SHALL MODULATE AS REQUIRED TO MAINTAIN MINIMUM OUTSIDE AIR FLOW. THE OUTSIDE AIR INTAKE DAMPER SHALL BE CLOSED WHILE UNIT IS IN THE UNOCCUPIED MODE. BAS SHALL BE CAPABLE OF OPENING AND CLOSING OUTSIDE AIR DAMPERS. CO2 SENSOR MOUNTED IN THE RETURN DUCT SHALL MODULATE THE OUTSIDE AIR DAMPER BASED ON CO2 LEVELS IN THE SPACE. DAMPER SHALL MODULATE OPEN FROM THE OCCUPIED MINIMUM SETPOINT OF 600 PPM ABOVE OA CO2 LEVEL, TO DESIGN MAXIMUM AT 1000 PPM ABOVE OA CO2 LEVEL. AN ALARM SHALL BE ACTIVATED IF THE SPACE CO2 LEVEL RISES ABOVE 1000 PPM ABOVE OA CO2 LEVEL.

SYMBOL LEGEND	
SYMBOL	DESCRIPTION
TS	TEMPERATURE SENSOR
DM	MOTORIZED DAMPER
AF	AIRFLOW MONITORING STATION
DPS	DIFFERENTIAL PRESSURE SENSOR
SD	DUCT SMOKE DETECTOR
HPS	HIGH PRESSURE SENSOR
SP	STATIC PRESSURE SENSOR
H	HUMIDITY SENSOR
CS	CURRENT SENSOR

AHU-4

	Hardware Points				Software Points						
Point Name	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm	Show On Graphic
Building Static Pressure	x								x		x
Mixed Air Temp	x								x		x
Outside Air Temp (*can be one for building)	x*				x*				x		x
Return Air Carbon Dioxide PPM	x								x		x
Return Air Humidity	x								x		x
Space Humidity	x								x		x
Return Air Temp	x								x		x
Supply Air Static Pressure	x								x	x	x
Supply Air Temp	x								x		x
Dual Temperature Water Valve		x							x		x
Exhaust Air Damper		x									x
Condensing Unit - Cooling Output				x					x		x
Mixed Air Dampers		x							x		x
Freezestat			x						x	x	x
Smoke Detector			x						x	x	x
Supply Fan Status			x						x		x
Supply Fan Start/Stop				x					x		x
Building Static Pressure Set- point					x						x
Dehumidification Setpoint					x				x		x
Economizer Mixed Air Temp Setpoint					x				x		x
Return Air Carbon Dioxide PPM Setpoint					x				x		x
High Return Air Carbon Dioxide Concentration										x	
High Return Air Humidity										x	
High Supply Air Temp										x	
Supply Fan Failure										x	
Supply Fan in Hand										x	x

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22–074

PROFESSIONAL ENGINEER
02-17-2023

JOB NUMBER	22–074
DRAWN BY	
CHECKED BY	
DATE	02/17/2023

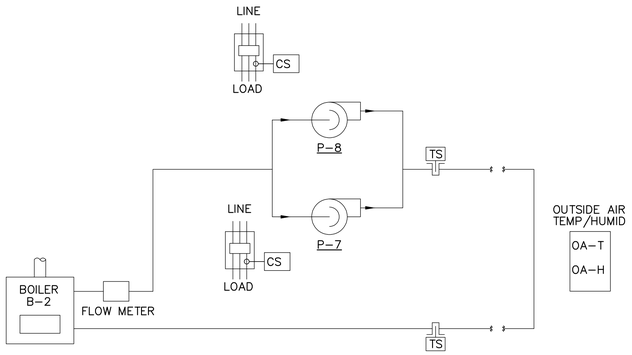
REVISION DATES

REVISION DESCRIPTION

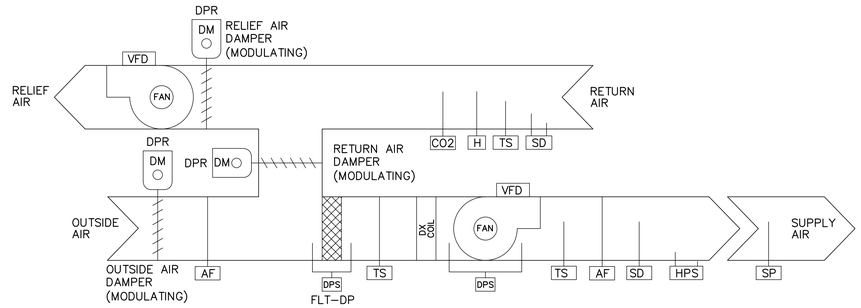
JOB TITLE
ALBEMARLE ROAD ELEMENTARY
7800 RIDING TRAIL RD
CHARLOTTE, NC, 28212
BAS RENOVATIONS

SHEET TITLE
MECHANICAL CONTROL SCHEMATICS

SHEET
M8



1 HOT WATER BOILER SYSTEM CONTROL SCHEMATIC
NTS



2 RTU-1 CONTROL SCHEMATIC
NTS

HEATING HOT WATER BOILER SYSTEM

THE HEATING SYSTEM SHALL BE ENABLED WHEN THERE IS A CALL FOR HEAT OR ON A COMMAND FOR DEHUMIDIFICATION. WHEN ENABLED, THE BAS CONTROLLER SHALL START THE LEAD HOT WATER DISTRIBUTION (SECONDARY) PUMP AND ENABLE THE BOILER. THE PUMP SHALL BE ENABLED BY A RELAY CONNECTED TO THE BOILER ENABLE CIRCUIT. THE BOILER FACTORY CONTROL SHALL OPERATE THE BOILER TO MAINTAIN ITS LOCAL SUPPLY SETPOINT.

HEATING SHALL BE DISABLED WHEN NO SPACE IS CALLING FOR HEAT AND THERE IS NO COMMAND FOR DEHUMIDIFICATION. WHEN HEATING IS DISABLED, THE HOT WATER PUMPS AND BOILER SHALL BE COMMANDED TO OFF. THE BAS CONTROLLER HUMAN-INTERFACE PANEL SHALL BE ABLE TO INDIVIDUALLY ENABLE THE HOT WATER DISTRIBUTION PUMPS, THE BOILER ISOLATION VALVES, THE BOILER CIRCULATING PUMPS, OR THE BOILERS.

UPON THE BOILERS CYCLING OFF, CONTINUE RUNNING THE HOT WATER PUMPS FOR 15 MINUTES (ADJ.).

HOT WATER DISTRIBUTION PUMP START/STOP:

THE BAS CONTROLLER SHALL START A HOT WATER PUMP THROUGH A CONTACT CLOSURE OF THE PUMP'S STARTER RUN-ENABLE CONTACTS.

HOT WATER DISTRIBUTION PUMP STATUS:

THE BAS CONTROLLER SHALL DETECT HOT WATER PUMP RUN STATUS BY A VFD CURRENT SWITCH.

HOT WATER DISTRIBUTION PUMP LEAD/LAG:

THE HOT WATER PUMP LEAD/LAG SEQUENCE SHALL BE BASED ON A WEEKLY SCHEDULE. FROM THE BAS CONTROLLER HUMAN-INTERFACE PANEL OR A BAS WORKSTATION, AN OPERATOR SHALL BE ABLE TO MANUALLY CHANGE THE LEAD/LAG SEQUENCE.

HOT WATER DISTRIBUTION PUMP FAILURE:

IF THE LEAD START/STOP RELAY IS ENABLED AND THE CURRENT SWITCH STATUS IS OFF FOR MORE THAN 30 SECONDS (ADJ.), THE BAS CONTROLLER SHALL ANNUNCIATE A HOT WATER PUMP FAILURE ALARM TO THE BAS WORKSTATION AND STARTS THE LAG PUMP. 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 FAILURE FROM THE BAS CONTROLLER OR BAS WORKSTATION. THIS ACTION SHALL RE-ENABLE THE LEAD/LAG SEQUENCE.

FREEZE PROTECTION:

WHEN THE OUTDOOR AIR TEMPERATURE FALLS BELOW 35.0 DEG. F (ADJ.), THE HOT WATER DISTRIBUTION PUMP SHALL OPERATE CONTINUOUSLY TO PROVIDE HOT WATER CIRCULATION TO ALL ASSOCIATED HOT WATER COILS. IF THE HOT WATER SUPPLY TEMPERATURE FALLS BELOW 130.0 DEG. F (ADJ.) DURING UNOCCUPIED PERIODS, THE BOILER SEQUENCE SHALL BE ENABLED TO SAFEGUARD AGAINST LOW WATER TEMPERATURE AND BOILER CONDENSATION. THE BAS SHALL AUTOMATICALLY ALTERNATE WHICH PUMP IS ENERGIZED EACH DAY IN ORDER TO EQUALIZE RUN TIME BETWEEN THE TWO PUMPS.

Heating Hot Water System

Point Name	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm	Show On Graphic
	Hardware Points				Software Points						
Boiler 2 Hot Water Return Temp	x								x		x
Boiler 2 Hot Water Supply Temp	x								x		x
Hot Water Return Temp	x								x		x
Hot Water Supply Temp	x								x		x
Secondary Hot Water Return Temp	x								x		x
Boiler 2 Alarm Status			x						x	x	x
Boiler 2 Status			x						x		x
Hot Water Pump P-7 Status			x						x		x
Hot Water Pump P-8 Status			x						x		x
Boiler 2 Enable				x					x		x
Hot Water Pump P-7 Start/Stop				x					x		x
Hot Water Pump P-8 Start/Stop				x					x		x
Hot Water Differential Pressure Setpoint					x				x		x
Outside Air Temp (alarm for out of range)					x				x	x	x
Boiler 2 Failure										x	
Boiler 2 High Hot Water Supply Temp										x	
Boiler 2 Low Hot Water Supply Temp										x	
Boiler 2 Running in Hand										x	
High Primary Hot Water Supply Temp										x	
Hot Water Pump P-7 Failure										x	
Hot Water Pump P-7 Running in Hand										x	
Hot Water Pump P-8 Failure										x	
Hot Water Pump P-8 Running in Hand										x	
Low Primary Hot Water Supply Temp										x	

ROOF TOP UNIT RTU-1

THE BUILDING AUTOMATION SYSTEM (BAS) SHALL PERFORM THE FOLLOWING VAV SYSTEM CONTROL STRATEGIES, APPROPRIATE TO THE GIVEN OCCUPANCY MODE OF THE SYSTEM, AS DETERMINED BY THE USER-ADJUSTABLE TIME-OF-DAY SCHEDULE FOR THE SYSTEM. OPTIMAL START AND UNOCCUPIED MODE APPLIES ONLY TO HVACU WITH TIME OF DAY SCHEDULED OPERATION. VERIFY TIME SCHEDULE DURING OWNER'S TRAINING.

OPTIMAL START MODE:

THE BAS SHALL INITIATE THE OPTIMAL START MODE SUCH THAT THE RTU IS STARTED AND ASSOCIATED AIR TERMINAL UNITS ARE ENABLED PRIOR TO WHEN THE SPACE BEING SERVED BY THE RTU IS SCHEDULED TO BE OCCUPIED, TO ALLOW THE ZONE TEMPERATURE TO REACH THE PENDING OCCUPIED HEATING OR COOLING SET-POINT. THE SYSTEM SHALL WAIT AS LONG AS POSSIBLE BEFORE STARTING, SO THAT THE TEMPERATURE IN EACH ZONE REACHES THE OCCUPIED SET-POINT JUST IN TIME FOR SCHEDULED OCCUPANCY. VENTILATION FUNCTIONS SHALL BE DISABLED WHEN THE VAS IS IN OPTIMAL START MODE AND OUTSIDE AIR DAMPERS SHALL BE CLOSED.

THE BAS SHALL USE A SELF-ADJUSTING ALGORITHM TO CALCULATE THE ACTUAL TIME TO INITIATE OPTIMAL START FOR THE SYSTEM BASED ON THE OCCUPIED SET-POINT, SPACE TEMPERATURE, OUTSIDE AIR TEMPERATURE, HISTORICAL OPTIMAL START PERFORMANCE DATA AND THE ASSOCIATED HEATING OR COOLING OPTIMAL START RATE.

AN EARLY START LIMIT SHALL BE PROVIDED TO PREVENT THE VAS FROM STARTING PRIOR TO 120 MINUTES (ADJUSTABLE) BEFORE SCHEDULED OCCUPANCY.

THE SYSTEM SHALL TRANSITION FROM OPTIMAL START MODE TO OCCUPIED MODE WHEN THE CURRENT TIME IS EQUAL TO THE SCHEDULED START TIME.

1. COOLING:

THE BAS SHALL INITIATE THE OPTIMAL START - COOLING MODE WHEN OPTIMAL START MODE FOR THE SYSTEM HAS BEEN INITIATED AND THE AVERAGE TEMPERATURE OF THE SPACE IS WARMER THAN ITS OCCUPIED COOLING SET-POINT. ALL VENTILATION FUNCTIONS ARE DISABLED WHILE OPERATING IN OPTIMAL START MODE AND THE OUTSIDE AIR DAMPERS SHALL BE CLOSED.

THE BAS SHALL DETERMINE THE LENGTH OF TIME REQUIRED TO LOWER THE SPACE TEMPERATURE TO THE OCCUPIED COOLING SET-POINT WHEN THE MODE OF THE SYSTEM IS COOLING AND THE SPACE TEMPERATURE IS ABOVE THE OCCUPIED COOLING SET-POINT.

EACH AIR TERMINAL UNIT IN THE VAV AIR SYSTEM SHALL CONTROL TO ITS OCCUPIED COOLING SET-POINT AND SHALL MODULATE BOX AIRFLOW TO MAINTAIN THE SPACE TEMPERATURE SET- POINT FOR THE ZONE BEING SERVED BY THE AIR TERMINAL UNIT. AUXILIARY HEAT IN THE AIR TERMINAL UNIT IS DISABLED.

THE RTU SHALL MODULATE ITS AIRFLOW TO MAINTAIN THE DUCT STATIC PRESSURE SET- POINT.

2. HEATING:

THE BAS SHALL INITIATE THE OPTIMAL START - HEATING MODE, AIR TERMINAL UNIT LOCAL HEAT, WHEN OPTIMAL START MODE HAS BEEN INITIATED AND THE AVERAGE SPACE TEMPERATURE IS COOLER THAN ITS OCCUPIED HEATING SET-POINT. ALL VENTILATION FUNCTIONS ARE DISABLED WHILE OPERATING IN OPTIMAL START MODE AND THE OUTSIDE AIR DAMPERS SHALL BE CLOSED.

THE BAS SHALL DETERMINE THE LENGTH OF TIME REQUIRED TO RAISE THE AVERAGE SPACE TEMPERATURE TO THE OCCUPIED HEATING SET-POINT WHEN THE MODE OF THE VAS IS HEATING AND THE AVERAGE SPACE TEMPERATURE IS BELOW THE SET-POINT.

EACH AIR TERMINAL UNIT IN THE SYSTEM SHALL CONTROL TO ITS OCCUPIED HEATING SET-POINT AND SHALL MODULATE BOX AIRFLOW TO MAINTAIN THE SPACE TEMPERATURE SET- POINT FOR THE ZONE BEING SERVED BY THE AIR TERMINAL UNIT. AUXILIARY HEAT IN THE AIR TERMINAL UNIT IS ENABLED.

THE RTU SHALL MODULATE ITS AIRFLOW TO MAINTAIN THE DUCT STATIC PRESSURE SET- POINT.

UNOCCUPIED MODE:

THE BAS SHALL PLACE THE MEMBERS OF THE SYSTEM INTO OFF/STANDBY MODE AS DETERMINED BY THE USER-ADJUSTABLE TIME-OF-DAY SCHEDULE FOR THE SYSTEM. THE AIR TERMINAL UNITS SHALL CONTROL TO THEIR INDIVIDUAL UNOCCUPIED TEMPERATURE SET-POINTS, AND ALL VENTILATION FUNCTIONS SHALL BE DISABLED AND OUTSIDE AIR DAMPERS SHALL BE CLOSED. AIR TERMINAL UNIT LOCAL REHEAT IS DISABLED WHILE THE SYSTEM IS IN UNOCCUPIED MODE.

AFTER THE AIR TERMINAL UNITS HAVE BEEN COMMANDED TO UNOCCUPIED, THE BAS SHALL COMMAND THE RTU TO UNOCCUPIED MODE. SUPPLY FAN SHALL BE SHUT DOWN, CONDENSING UNIT SHALL CYCLE OFF, OUTDOOR AIR DAMPER SHALL BE CLOSED, AND ALL VENTILATION FUNCTIONS SHALL BE DISABLED.

NIGHT SETBACK MODE:

DURING SCHEDULED UNOCCUPIED HOURS, THE SYSTEM SHALL BE CONTROLLED BY THE BAS TO MAINTAIN THE UNOCCUPIED HEATING AND COOLING SET-POINTS, AS APPROPRIATE. VENTILATION FUNCTIONS ARE DISABLED, THE OUTDOOR AIR DAMPER SHALL REMAIN CLOSED, UNLESS OUTDOOR AIR IS USED FOR ECONOMIZING DURING UNOCCUPIED ZONE COOLING. UNLESS OTHERWISE STATED, THE AHU SUPPLY FAN SHALL OPERATE IN THE AUTOMATIC CONTROL MODE, CYCLING ON ONLY WHEN HEATING OR COOLING IS NEEDED.

1. HEATING:

AHU SUPPLY FAN ENERGIZED, AIR TERMINAL UNIT LOCAL REHEAT IS USED.

THE BAS SHALL INITIATE THE NIGHT HEATING MODE WHEN THE TEMPERATURE FOR THE SPACE BEING SERVED BY THE RTU IS LESS THAN 55 DEGREES F (ADJUSTABLE) IN A MINIMUM OF 3 ROOMS, (ADJUSTABLE). NIGHT HEATING SHALL TERMINATE WHEN THE SPACE TEMPERATURE RISES ABOVE THE UNOCCUPIED HEATING SET-POINT PLUS THE UNOCCUPIED HEATING DIFFERENTIAL (4 DEGREES F, ADJUSTABLE).

EACH AIR TERMINAL UNIT THAT IS ASSOCIATED WITH THE VAS SHALL CONTROL TO ITS UNOCCUPIED HEATING SET-POINT, AND SHALL MODULATE BOX AIRFLOW TO MAINTAIN THE SPACE TEMPERATURE SET- POINT FOR THE ZONE BEING SERVED BY THE AIR TERMINAL UNIT.

THE AIR HANDLER SHALL OPERATE TO MAINTAIN DUCT STATIC PRESSURE WHILE IN NIGHT HEAT MODE.

THE AIR TERMINAL UNIT SHALL CONTROL ITS AIRFLOW TO ITS MAXIMUM HEAT SET-POINT.

2. COOLING:

AHU SUPPLY FAN ENERGIZED, DX COOLING INDEXED FOR OPERATION

THE BAS SHALL INITIATE THE NIGHT COOLING MODE WHEN THE TEMPERATURE FOR THE SPACE BEING SERVED BY THE RTU IS GREATER THAN 85 DEGREES F, (ADJUSTABLE) FOR A MINIMUM OF THREE ROOMS (ADJUSTABLE). NIGHT COOLING SHALL TERMINATE WHEN THE SPACE TEMPERATURE FALLS BELOW THE UNOCCUPIED COOLING SET-POINT PLUS THE UNOCCUPIED COOLING DIFFERENTIAL (4 DEGREES F, ADJUSTABLE).

EACH AIR TERMINAL UNIT THAT IS ASSOCIATED WITH THE VAS SHALL CONTROL TO ITS UNOCCUPIED COOLING SET-POINT, AND SHALL MODULATE BOX AIRFLOW TO MAINTAIN THE SPACE TEMPERATURE SET- POINT FOR THE ZONE BEING SERVED BY THE AIR TERMINAL UNIT.

THE AIR HANDLER SHALL OPERATE TO MAINTAIN DUCT STATIC PRESSURE WHILE IN NIGHT COOLING MODE.

STATIC PRESSURE OPTIMIZATION:

THE BUILDING AUTOMATION SYSTEM (BAS) SHALL CONTINUOUSLY MONITOR THE DAMPER POSITION OF ALL AIR TERMINAL UNITS. THE DISCHARGE DUCT STATIC PRESSURE SHALL BE SENSED 2/3 OF THE DISTANCE FROM THE DISCHARGE OF EACH ROOFTOP/AIR HANDLING UNIT. THE SENSOR MUST BE MOUNTED IN A NON-TURBULENT LOCATION. LABEL THE LOCATION OF THE SENSOR ON THE CEILING. THE BAS SHALL ALSO READ THE STATUS ON THE SUPPLY AIR SENSOR AND DISPLAY THE PRESSURE READING ON THE STATUS SCREEN. PROVIDE A HIGH-PRESSURE SWITCH AT THE UNIT WITH A SETPOINT BETWEEN 4" AND 6" (ADJUSTABLE).

THE BUILDING AUTOMATION SYSTEM SHALL MONITOR THE DAMPER POSITION OF ALL AIR TERMINAL UNITS AND DETERMINE EACH AIR TERMINAL CRITICAL ZONE VAV TERMINAL (CZ), WHICH IS THE AIR TERMINAL UNIT THAT IS THE WIDEST OPEN.

WHEN ANY AIR TERMINAL DAMPER IS MORE THAN 75 PERCENT (ADJ.) OPEN, THE SUPPLY FAN DISCHARGE DUCT STATIC PRESSURE SET-POINT SHALL BE RESET UPWARD BY 0.3 IN W.C. (ADJ.), AT A FREQUENCY OF 15 MINUTES (ADJ.), UNTIL NO DAMPER IS MORE THAN 75 PERCENT OPEN OR THE STATIC PRESSURE SET-POINT HAS RESET UPWARD TO THE SYSTEM MAXIMUM DUCT STATIC PRESSURE SET-POINT OR THE SUPPLY FAN VARIABLE-FREQUENCY DRIVE IS AT THE MAXIMUM SPEED SETTING.

WHEN ALL AIR TERMINAL DAMPERS ARE LESS THAN 65 PERCENT (ADJ.) OPEN, THE SUPPLY FAN DISCHARGE DUCT STATIC PRESSURE SET-POINT SHALL BE RESET DOWNWARD BY 0.3 IN W.C. (ADJ.), AT A FREQUENCY OF 15 MINUTES (ADJUSTABLE), UNTIL AT LEAST ONE DAMPER IS MORE THAN 65 PERCENT OPEN OR THE STATIC PRESSURE SET-POINT HAS RESET DOWNWARD TO THE SYSTEM MINIMUM DUCT STATIC PRESSURE SET-POINT.

AIR TERMINAL UNITS IN CALIBRATION OR AUTO COMMISSIONING MODE SHALL NOT IMPACT THE CRITICAL ZONE CALCULATION.

THE CONTROL BANDS, SET-POINT INCREMENT VALUES, SET-POINT DECREMENT VALUES AND ADJUSTMENT FREQUENCIES SHALL BE ADJUSTED TO MAINTAIN MAXIMUM STATIC PRESSURE OPTIMIZATION WITH STABLE SYSTEM CONTROL AND MAXIMUM COMFORT CONTROL.

OCCUPIED MODE COOLING CONTROL:

THE ROOF TOP UNIT CONDENSING UNIT SECTION SHALL BE INDEXED FOR OPERATION AND SHALL CYCLE THE COMPRESSORS AND EVAPORATOR FANS AS REQUIRED TO MAINTAIN DISCHARGE AIR TEMPERATURE SETPOINT.

SUPPLY AIR TEMPERATURE RESET:

THE SUPPLY AIR TEMPERATURE SETPOINT SHALL RESET BASED ON OUTSIDE AIR TEMPERATURE.

AS OUTSIDE AIR TEMPERATURE RISES FROM 35F TO 57F, THE SUPPLY AIR TEMPERATURE SETPOINT SHALL RESET DOWNWARDS FROM 65F TO 55F.

IF RETURN AIR RELATIVE HUMIDITY EXCEEDS 65%, UNIT SHALL REVERT TO 55F SUPPLY AIR TEMPERATURE REGARDLESS OF RESET SCHEDULE.

OCCUPIED MODE HEATING CONTROL:

HEATING DURING OCCUPIED MODE SHALL BE CONTROLLED VIA THE AIR TERMINAL UNITS.

ECONOMIZER - ENTHALPY ENABLE:

THE MIXED AIR TEMPERATURE SET POINT SHALL BE 2°F (ADJ.) LESS THAN THE SUPPLY AIR TEMPERATURE SET POINT. THE CONTROLLER SHALL MEASURE THE MIXED AIR TEMPERATURE AND MODULATE THE ECONOMIZER DAMPERS IN SEQUENCE TO MAINTAIN THIS SET POINT.

THE OUTSIDE AIR DAMPER SHALL CLOSE AND THE RETURN AIR DAMPER SHALL OPEN WHEN THE UNIT IS OFF.

THE ECONOMIZER SHALL BE ENABLED WHENEVER OUTSIDE AIR TEMPERATURE IS LESS THAN 65°F (ADJ.) AND THE OUTSIDE AIR ENTHALPY IS LESS THAN 22BTU/LB (ADJ.) AND THE OUTSIDE AIR TEMPERATURE IS LESS THAN THE RETURN AIR TEMPERATURE AND THE OUTSIDE AIR ENTHALPY IS LESS THAN THE RETURN AIR ENTHALPY AND THE FAN STATUS IS ON.

THE ECONOMIZER SHALL CLOSE TO 0% (ADJ.) WHENEVER THE FREEZESTAT IS ON OR THE MIXED AIR TEMPERATURE IS LESS THAN 35°F (ADJ.) OR ON LOSS OF FAN STATUS.

1. ALARMS SHALL BE PROVIDED AS FOLLOWS:

HIGH MIXED AIR TEMP: IF THE MIXED AIR TEMPERATURE IS 5°F (ADJ.) GREATER THAN SET POINT.

LOW MIXED AIR TEMP: IF THE MIXED AIR TEMPERATURE IS 5°F (ADJ.) LESS THAN SET POINT.

DEHUMIDIFICATION:

PROVIDE ALL NECESSARY SENSORS FOR DEHUMIDIFICATION CONTROL AT EACH AIR HANDLER.

THE CONTROLLER SHALL MEASURE THE RETURN AIR HUMIDITY AND OVERRIDE THE COOLING SEQUENCE TO MAINTAIN A RETURN AIR HUMIDITY SETPOINT OF 60% RH (ADJ.). THE DEHUMIDIFICATION SHALL TURN OFF WHENEVER THE RETURN AIR HUMIDITY DROPS BELOW 55% RH (ADJ.).

WHEN DEHUMIDIFICATION MODE IS ENGAGED PER THE REQUIREMENTS ABOVE, THE UNIT SHALL GO TO COOLING MODE WITH THE TERMINAL UNITS PROVIDING SPACE TEMPERATURE CONTROL.

DEHUMIDIFICATION SHALL BE ENABLED WHENEVER FAN STATUS IS ON AND RETURN AIR HUMIDITY EXCEEDS 60% (ADJ.) RELATIVE HUMIDITY IN EITHER OCCUPIED OR UNOCCUPIED MODE.

1. ALARMS SHALL BE PROVIDED AS FOLLOWS:

HIGH RETURN AIR HUMIDITY: IF THE RETURN AIR HUMIDITY IS 10% RH (ADJ.) GREATER THAN SETPOINT.

LOW RETURN AIR HUMIDITY: IF THE RETURN AIR HUMIDITY IS 10% RH (ADJ.) LESS THAN SETPOINT.

FREEZE PROTECTION:

THE UNIT SHALL SHUT DOWN AND GENERATE AN ALARM UPON RECEIVING A FREEZESTAT STATUS.

THE OUTSIDE AIR DAMPER SHALL CLOSE.

THE UNIT SHALL ONLY BE RESET MANUALLY. THE MANUAL RESET BUTTON SHALL BE LOCATED AS SUCH TO BE EASILY ACCESSIBLE BY THE TECHNICIAN.

SAFETY INTERLOCK:

THE FOLLOWING SHALL DE-ENERGIZE THE AHU SUPPLY FAN: DUCT DETECTOR, LOW LIMIT THERMOSTAT ACTIVATION, HIGH PRESSURE SWITCH (4"-6" ADJUSTABLE).

BUILDING PRESSURIZATION:

THE OUTSIDE AIR DAMPERS AND RELIEF AIR DAMPERS SHALL MODULATE IN SEQUENCE TO MAINTAIN BUILDING PRESSURE. FOR EXAMPLE IF THE OA DAMPER IS OPEN 20% THE ASSOCIATED RELIEF AIR DAMPERS SHALL OPEN 20%

THERE SHALL BE ONE SENSOR PER AIR HANDLER.

THERE SHALL BE AN ALARMED CONDITION FOR SPACE PRESSURIZATION RISING MORE THAN 25% (ADJ.) ABOVE THE SETPOINT AND FOR SPACE PRESSURIZATION FALLING MORE THAN 25% (ADJ.) BELOW THE SETPOINT.

DEMAND CONTROL VENTILATION:

OUTSIDE AIR INTAKE SHALL BE PROVIDED WITH A MOTORIZED DAMPER. ON UNIT START UP, THE OUTSIDE AIR INTAKE DAMPER SHALL REMAIN CLOSED UNTIL THE RETURN AIR TEMPERATURE RISES ABOVE 65° F (ADJ) OR FALLS BELOW 75° F. (ADJ). ONCE RETURN AIR TEMPERATURE IS SATISFIED, THE OUTSIDE AIR DAMPER SHALL OPEN TO THE OCCUPIED MINIMUM SETPOINT. OUTSIDE AIR DAMPERS AND SHALL MODULATE AS REQUIRED TO MAINTAIN MINIMUM OUTSIDE AIR FLOW. THE OUTSIDE AIR INTAKE DAMPER SHALL BE CLOSED WHILE UNIT IS IN THE UNOCCUPIED MODE. BAS SHALL BE CAPABLE OF OPENING AND CLOSING OUTSIDE AIR DAMPERS. CO2 SENSOR MOUNTED IN THE RETURN DUCT SHALL MODULATE THE OUTSIDE AIR DAMPER BASED ON CO2 LEVELS IN THE SPACE. DAMPER SHALL MODULATE OPEN FROM THE OCCUPIED MINIMUM SETPOINT OF 600 PPM ABOVE OA CO2 LEVEL, TO DESIGN MAXIMUM AT 1000 PPM ABOVE OA CO2 LEVEL. AN ALARM SHALL BE ACTIVATED IF THE SPACE CO2 LEVEL RISES ABOVE 1000 PPM ABOVE OA CO2 LEVEL.

RTU-1

Point Name	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm	Show On Graphic
	Hardware Points				Software Points						
Building Static Pressure	x								x		x
Mixed Air Temp	x								x		x
Outside Air Temp (*can be one for building)	x*				x*				x		x
Return Air Carbon Dioxide PPM	x								x		x
Return Air Humidity	x								x		x
Space Humidity	x								x		x
Return Air Temp	x								x		x
Supply Air Static Pressure	x								x	x	x
Supply Air Temp	x								x		x
Exhaust Air Damper		x									x
Integral Condensing Unit - Cooling Output				x					x		x
Mixed Air Dampers		x							x		x
Supply Fan VFD Speed		x							x		x
Freezestat			x						x	x	x
High Static Shutdown			x						x	x	x
Smoke Detector			x						x	x	x
Supply Fan Status			x						x		x
Supply Fan VFD Fault			x							x	x
Supply Fan Start/Stop				x					x		x
Building Static Pressure Set-point					x						x
Dehumidification Setpoint					x				x		x
Economizer Mixed Air Temp Setpoint					x				x		x
Return Air Carbon Dioxide PPM Setpoint					x				x		x
Supply Air Static Pressure Setpoint					x				x		x
Supply Air Temp Setpoint					x				x		x
High Return Air Carbon Dioxide Concentration										x	
High Return Air Humidity										x	
High Supply Air Temp										x	
High Supply Air Temp										x	
Supply Fan Failure										x	
Supply Fan in Hand										x	x

SYMBOL LEGEND	
SYMBOL	DESCRIPTION
TS	TEMPERATURE SENSOR
DM	MOTORIZED DAMPER
AF	AIRFLOW MONITORING STATION
DPS	DIFFERENTIAL PRESSURE SENSOR
SD	DUCT SMOKE DETECTOR
HPS	HIGH PRESSURE SENSOR
SP	STATIC PRESSURE SENSOR
H	HUMIDITY SENSOR
CS	CURRENT SENSOR

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22-074

PROFESSIONAL ENGINEER
02-17-2023

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DRAWN BY
CHECKED BY
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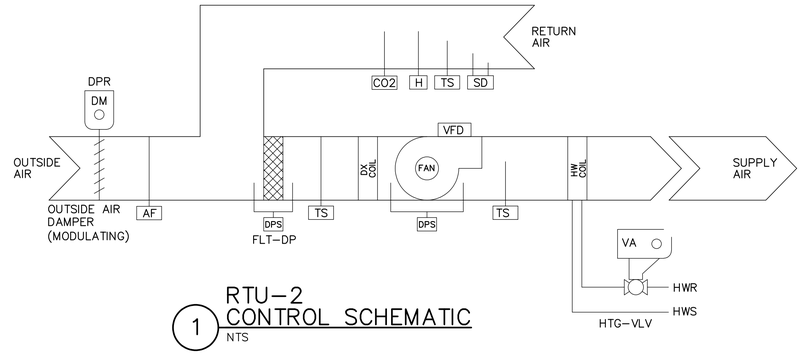
7800 RIDING TRAIL RD
CHARLOTTE, NC, 28212
BAS RENOVATIONS

SHEET TITLE
MECHANICAL CONTROL SCHEMATICS

SHEET
M9



1 RTU-2 CONTROL SCHEMATIC
NTS

SYMBOL LEGEND	
SYMBOL	DESCRIPTION
TS	TEMPERATURE SENSOR
DM	MOTORIZED DAMPER
AF	AIRFLOW MONITORING STATION
DPS	DIFFERENTIAL PRESSURE SENSOR
SD	DUCT SMOKE DETECTOR
HPS	HIGH PRESSURE SENSOR
SP	STATIC PRESSURE SENSOR
H	HUMIDITY SENSOR
CS	CURRENT SENSOR

RTU-2

THE BUILDING AUTOMATION SYSTEM (BAS) SHALL PERFORM THE FOLLOWING CONTROL STRATEGIES, APPROPRIATE TO THE GIVEN OCCUPANCY MODE OF THE SYSTEM, AS DETERMINED BY THE USER-ADJUSTABLE TIME-OF-DAY SCHEDULE FOR THE SYSTEM. OPTIMAL START AND UNOCCUPIED MODE APPLIES ONLY TO HVACU WITH TIME OF DAY SCHEDULED OPERATION. VERIFY TIME SCHEDULE DURING OWNER'S TRAINING.

OPTIMAL START MODE:

THE BAS SHALL INITIATE THE OPTIMAL START MODE SUCH THAT THE UNIT IS STARTED AND ENABLED PRIOR TO WHEN THE SPACE BEING SERVED BY THE UNIT IS SCHEDULED TO BE OCCUPIED, TO ALLOW THE ZONE TEMPERATURE TO REACH THE PENDING OCCUPIED HEATING OR COOLING SET-POINT. THE SYSTEM SHALL WAIT AS LONG AS POSSIBLE BEFORE STARTING, SO THAT THE TEMPERATURE REACHES THE OCCUPIED SET-POINT JUST IN TIME FOR SCHEDULED OCCUPANCY. VENTILATION FUNCTIONS SHALL BE DISABLED WHEN THE UNIT IS IN OPTIMAL START MODE AND OUTSIDE AIR DAMPERS SHALL BE CLOSED.

THE BAS SHALL USE A SELF-ADJUSTING ALGORITHM TO CALCULATE THE ACTUAL TIME TO INITIATE OPTIMAL START FOR THE UNIT BASED ON THE OCCUPIED SET-POINT, SPACE TEMPERATURE, OUTSIDE AIR TEMPERATURE, HISTORICAL OPTIMAL START PERFORMANCE DATA AND THE ASSOCIATED HEATING OR COOLING OPTIMAL START RATE.

AN EARLY START LIMIT SHALL BE PROVIDED TO PREVENT THE UNIT FROM STARTING PRIOR TO 120 MINUTES (ADJUSTABLE) BEFORE SCHEDULED OCCUPANCY.

THE UNIT SHALL TRANSITION FROM OPTIMAL START MODE TO OCCUPIED MODE WHEN THE CURRENT TIME IS EQUAL TO THE SCHEDULED START TIME.

COOLING:

THE BAS SHALL INITIATE THE OPTIMAL START – COOLING MODE WHEN OPTIMAL START MODE FOR THE UNIT HAS BEEN INITIATED AND THE AVERAGE TEMPERATURE OF THE SPACE IS WARMER THAN ITS OCCUPIED COOLING SET-POINT. ALL VENTILATION FUNCTIONS ARE DISABLED WHILE OPERATING IN OPTIMAL START MODE AND THE OUTSIDE AIR DAMPERS SHALL BE CLOSED.

THE BAS SHALL DETERMINE THE LENGTH OF TIME REQUIRED TO LOWER THE SPACE TEMPERATURE TO THE OCCUPIED COOLING SET-POINT WHEN THE MODE OF THE UNIT IS COOLING AND THE SPACE TEMPERATURE IS ABOVE THE OCCUPIED COOLING SET-POINT.

THE UNIT SHALL CONTROL TO ITS OCCUPIED COOLING SET-POINT, AND SHALL MODULATE COMPRESSOR(S) TO MAINTAIN THE SPACE TEMPERATURE SET-POINT FOR THE ZONE BEING SERVED.

HEATING:

THE BAS SHALL INITIATE THE OPTIMAL START – HEATING MODE, WHEN OPTIMAL START MODE HAS BEEN INITIATED AND THE AVERAGE SPACE TEMPERATURE IS COOLER THAN ITS OCCUPIED HEATING SET-POINT. ALL VENTILATION FUNCTIONS ARE DISABLED WHILE OPERATING IN OPTIMAL START MODE AND THE OUTSIDE AIR DAMPERS SHALL BE CLOSED.

THE BAS SHALL DETERMINE THE LENGTH OF TIME REQUIRED TO RAISE THE AVERAGE SPACE TEMPERATURE TO THE OCCUPIED HEATING SET-POINT WHEN THE MODE OF THE UNIT IS HEATING AND THE AVERAGE SPACE TEMPERATURE IS BELOW THE SET-POINT.

THE UNIT SHALL CONTROL TO ITS OCCUPIED HEATING SET-POINT, AND SHALL MODULATE THE HOT WATER CONTROL VALVE TO MAINTAIN THE SPACE TEMPERATURE SET-POINT FOR THE ZONE BEING SERVED.

UNOCCUPIED MODE:

THE BAS SHALL PLACE THE UNIT INTO OFF/STANDBY MODE AS DETERMINED BY THE USER-ADJUSTABLE TIME-OF- DAY SCHEDULE FOR THE SYSTEM. THE UNIT SHALL CONTROL TO THE UNOCCUPIED TEMPERATURE SET-POINT, AND ALL VENTILATION FUNCTIONS SHALL BE DISABLED AND OUTSIDE AIR DAMPERS SHALL BE CLOSED.

NIGHT SETBACK MODE:

DURING SCHEDULED UNOCCUPIED HOURS, THE UNIT SHALL BE CONTROLLED BY THE BAS TO MAINTAIN THE UNOCCUPIED HEATING AND COOLING SET-POINTS, AS APPROPRIATE. VENTILATION FUNCTIONS ARE DISABLED, THE OUTDOOR AIR DAMPER SHALL REMAIN CLOSED. UNLESS OTHERWISE STATED, THE SUPPLY FAN SHALL OPERATE IN THE AUTOMATIC CONTROL MODE, CYCLING ON ONLY WHEN HEATING OR COOLING IS NEEDED.

HEATING:

AHU SUPPLY FAN ENERGIZED, HOT WATER HEAT IS USED.

THE BAS SHALL INITIATE THE NIGHT HEATING MODE WHEN THE TEMPERATURE FOR THE SPACE BEING SERVED BY THE UNIT IS LESS THAN 55 DEGREES F (ADJUSTABLE). NIGHT HEATING SHALL TERMINATE WHEN THE SPACE TEMPERATURE RISES ABOVE THE UNOCCUPIED HEATING SET-POINT PLUS THE UNOCCUPIED HEATING DIFFERENTIAL (4 DEGREES F, ADJUSTABLE).

COOLING:

AHU SUPPLY FAN ENERGIZED

THE BAS SHALL INITIATE THE NIGHT COOLING MODE WHEN THE TEMPERATURE FOR THE SPACE BEING SERVED BY THE UNIT IS GREATER THAN 85 DEGREES F, (ADJUSTABLE). NIGHT COOLING SHALL TERMINATE WHEN THE SPACE TEMPERATURE FALLS BELOW THE UNOCCUPIED COOLING SET-POINT PLUS THE UNOCCUPIED COOLING DIFFERENTIAL (4 DEGREES F, ADJUSTABLE).

OCCUPIED MODE COOLING CONTROL: THE COMPRESSORS SHALL MODULATE TO MAINTAIN THE SPACE TEMPERATURE.

OCCUPIED MODE HEATING CONTROL: HEATING DURING OCCUPIED MODE SHALL BE CONTROLLED VIA THE HOT WATER COIL.

SAFETY INTERLOCK: THE FOLLOWING SHALL DE-ENERGIZE THE SUPPLY FAN: DUCT DETECTOR.

RTU-2

Hardware Points											
Point Name	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm	Show On Graphic
Outside Air Humidity	x								x		x
Outside Air Temp	x								x		x
Zone Setpoint Adjust	x										x
Smoke Detector			x						x	x	x
Zone Override			x						x		x
Supply Fan Start/Stop				x					x		x
Return Air Carbon Dioxide PPM Setpoint					x				x		x
High Return Air Carbon Dioxide Concentration										x	
High Return Air Humidity										x	
Supply Fan Failure										x	
Supply Fan in Hand										x	
Monitoring Points											
Mixed Air Temperature	x								x		x
Return Air Carbon Dioxide PPM	x								x		x
Return Air Humidity	x								x		x
Return Air Temp	x								x		x
Supply Air Temp	x								x		x
Zone Temp	x								x		x
Fan Status (depended on num- ber/type of fans)						x			x		x
Cooling Stage 1				x					x		x
Cooling Stage 2				x					x		x
Commanded Points											
Cooling Setpoint					x				x		x
Heating Setpoint					x				x		x

*Controls are by the unit manufacturer. EMS will monitor / control via the BACnet interface only. Red indicate monitoring points, Green are commanded points.

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Albemarle Road ES BAS CENTRAL PLANT SEQUENCE Rev 011923

CENTRAL PLANT – CONTROL SEQUENCES

THE BUILDING CONSISTS OF A TWO–PIPE HEATING SYSTEM WITH ONE BOILER AND ONE CHILLER AND AN RTU WITH A BOILER FOR VAV BOXES FOR THE BUILDING ADDITION;

BOILER B–1 FOR THE MAIN BUILDING IS IN OPERATION ALL SEASONS TO PROVIDE REHEAT TO THE VAV'S IN THE ADMIN AREAS IN SUMMER, AND ALL ZONES IN WINTER. EACH OF THE ZONES EQUIPMENT ARE AUTOMATICALLY STARTED AND STOPPED BY ON OPTIMIZED SCHEDULING PROGRAM VIA THE BUILDING AUTOMATION SYSTEM (BAS.)

ENABLING AHU'S GROUPED WITHIN EACH ZONE FROM "UNOCCUPIED" TO "OCCUPIED" SHALL BE SEQUENCED BY 3 SECOND (ADJ) INTERVALS TO MINIMIZE ELECTRICAL INRUSH CURRENT.

DURING "OCCUPIED" PERIODS, THE EQUIPMENT SHALL OPERATE CONTINUOUSLY, AND THE SPACE TEMPERATURE THERMOSTATS SHALL MAINTAIN SPACE TEMPERATURES OF 70F (ADJ) HEATING AND 74F COOLING.

DURING "UNOCCUPIED"PERIODS, THE BAS RESETS ALL SPACE TEMPERATURE SET POINTS TO 62F (ADJ) HEATING AND 80F (ADJ) COOLING AND SHALL SEQUENTIALLY CYCLE THE EQUIPMENT AS REQUIRED WHEN IN "OCCUPIED."

SEASONAL MODES SHALL REMAIN IN SUMMER OR WINTER WITH NO DEAD BANDS BASED ON DT MODE SELECTION. ALL PARAMETERS SHALL BE ADJUSTABLE (ADJ) FROM THE BAS. "OCCUPIED" AND "UNOCCUPIED" SET POINTS FOR AHU'S AND CASCADING VAV'S SHALL BE ADJUSTABLE AND SCHEDULED GLOBALLY AND AHU'S ALSO SUBSET INDIVIDUALLY.

MANUAL HEATING AND COOLING COMMANDS FROM THE BAS SHALL FOLLOW THE AUTOMATIC SEQUENCES OF THE SEASON AND REMAIN UNTIL RELEASED. AN ALARM AND INDICATION ON THE HOME PAGE OF THE BAS SHALL INDICATE WHEN IN MANUAL MODE.

LOWER–LEVEL DUAL TEMPERATURE SYSTEM

THE BUILDING AUTOMATION SYSTEM (BAS) SHALL PERFORM THE FOLLOWING CENTRAL PLANT DUAL TEMPERATURE SYSTEM (DTS) CONTROL STRATEGIES, APPROPRIATE TO THE GIVEN OCCUPANCY MODE OF AND ZONE, AS DETERMINED BY THE (ADJ) SCHEDULE FOR THE SYSTEM.

WHEN ANY OF THE AHU'S IN THE MAIN BUILDING ARE ENABLED "OCCUPIED," THE LEAD DUAL TEMPERATURE PUMP DTWP–1 OR DTWP–1A WILL ENABLE BY THE BAS TO SUPPLY THE SECONDARY DT LOOP.

THE LEAD DTW PUMP SHALL ALSO ENABLE FOR FREEZE PROTECTION WHEN OA IS BELOW 38F (ADJ) REGARDLESS OF OCCUPANCY.

DT PUMPS 1 & 1A SHALL ROTATE LEAD AND LAG ON A WEEKLY (ADJ) BASIS.

SHOULD THE LEAD DUAL TEMPERATURE PUMP FAIL, THE LAG PUMP SHALL START AND INDICATE THE FAILURE AT THE BAS.

THE OPERATING MODE OF THE DUAL TEMPERATURE SYSTEM SHALL BE SELECTABLE TO "WINTER," "SUMMER" OR "AUTOMATIC"OPERATION THROUGH BAS.

DT COOLING TO HEATING SWITCHOVER CHILLER 1 AND BOILER 1 AUTOMATIC SWITCHOVER SEQUENCE

WHEN THE SYSTEM MODE IS IN "AUTOMATIC"AND,

THE BUILDING MODE IS IN "OCCUPIED"AND,

THE OUTDOOR AIR TEMPERATURE IS BELOW THE OUTDOOR AIR SUMMER/WINTER CHANGEOVER SET POINT 50F (ADJ)) FOR A PERIOD OF ONE (2) HOUR (ADJ) AND,

THE MAIN BUILDING AVERAGE ZONE SPACE TEMPERATURES ARE BELOW THE WINTER HEATING OCCUPIED SETPOINT OF 70F (ADJ) FOR A PERIOD OF TWO (2) HOURS (ADJ).

THE SYSTEM SHALL AUTOMATICALLY INDICATE THE SWITCHOVER REQUEST ON THE BAS AND SWITCH FROM "SUMMER"MODE TO "WINTER"MODE IN THE FOLLOWING SEQUENCE;

THE MAIN CHILLER SHALL BE DISABLED AND SEQUENCED OFF.

AFTER 1 MINUTE (ADJ) THE CHILLER 3–WAY ANTISHOCK SHALL BE COMMANDED CLOSED TO THE DT LOOP.

THE CHILLER PUMP CHWP–1 WILL BE DISABLED FROM THE CHILLER AND SHALL ONLY OPERATE FOR FREEZE PROTECTION WHEN OA IS BELOW 38F (ADJ.)

STATUS OF THE CHILLER, PUMP, AND 3–WAY ANTISHOCK VALVE WILL BE MONITORED BY THE BAS TO ALERT FOR ANY MISMATCHED CONDITIONS AFTER 30 SEC. (ADJ)

THE AHU'S IN THE MAIN BUILDING SHALL SWITCH MODE TO "WINTER."

THE UNIT VENTILATORS AND FAN COIL UNITS IN THE MAIN BUILDING SHALL BE ENABLED IN "WINTER MODE" TO MAINTAIN SETPOINTS.

BOILER HWP–1 PUMP SHALL BE ENABLED "ON"

AFTER 1 MINUTE (ADJ) B–1 SHALL BE ENABLED "ON"AND THE SYSTEM WILL THEN RELY ON THE BOILER 3–WAY ANTI–SHOCK VALVE SETPOINT TO MODULATE TO THE PRIMARY LOOP WATER TO PREVENT SHOCKING THE BOILER AND MAINTAIN DT RESET TEMPERATURE.

CONTROLS ON BOILER B–1 SHALL STAGE THE BURNER AS REQUIRED TO ALWAYS MAINTAIN CONSTANT BOILER WATER TEMPERATURE AT 160F (ADJ.).

CONTROLS ON BOILER B–1 SHALL LOCKOUT THE BURNER ON THE BOILER IF IT SHOULD EXCEED 185F (ADJ) WITH A LOCAL MANUAL RESET.

BOILER ANTI– SHOCK SETPOINT PROCESS MODULATION (HEATING) SEQUENCE;

IF DUAL TEMPERATURE RETURN WATER IS BELOW <75F (ADJ) THE BOILER 3–WAY ANTI–SHOCK VALVE SHALL CIRCULATE WATER ONLY THROUGH PRIMARY LOOP OF THE BOILER B– 1.

ONCE BOILER 1 HOT WATER RETURN TEMPERATURE REACHES THE "BOILER ANTI–SHOCK SETPOINT 140F (ADJ,) THE BOILER 3–WAY ANTI–SHOCK VALVE SHALL MODULATE OPEN TO CIRCULATE TO THE BUILDING SECONDARY DT LOOP, MAINTAINING BOILER PRIMARY LOOP RETURN TEMPERATURE AT ANTISHOCK SETPOINT TEMPERATURE.

ONCE DUAL TEMPERATURE RETURN TEMPERATURE REACHES 140"F (ADJ.), THE BOILER 3–WAY SHALL MODULATE FULLY OPEN.

THE 3–WAY ANTISHOCK VALVE WILL RESET TEMPERATURE TO THE SECONDARY DT LOOP BASED ON OUTSIDE AIR TEMPERATURE ACCORDING TO THE FOLLOWING:

UPON OUTSIDE AIR TEMPERATURE RISING ABOVE 40" F (ADJ.), THE SECONDARY DT HOT WATER SUPPLY TEMPERATURE SHALL LINEARLY RESET FROM 160F (ADJ.) TO 110F (ADJ.) AT 60F OA AND ABOVE.

SYMBOL LEGEND	
SYMBOL	DESCRIPTION
TS	TEMPERATURE SENSOR
DM	MOTORIZED DAMPER
AF	AIRFLOW MONITORING STATION
DPS	DIFFERENTIAL PRESSURE SENSOR
SD	DUCT SMOKE DETECTOR
HPS	HIGH PRESSURE SENSOR
SP	STATIC PRESSURE SENSOR
H	HUMIDITY SENSOR
CS	CURRENT SENSOR

DT HEATING TO COOLING SWITCHOVER MAIN CHILLER AND BOILER AUTOMATIC SWITCHOVER SEQUENCE

WHEN THE SYSTEM MODE IS IN "AUTOMATIC"AND,

THE BUILDING MODE IS IN "OCCUPIED"AND,

THE OUTDOOR AIR TEMPERATURE IS ABOVE THE OUTDOOR AIR SUMMER/WINTER SET POINT 50F (ADJ) FOR A PERIOD OF ONE (2) HOUR AND,

THE LOWER–LEVEL AVERAGE ZONE SPACE TEMPERATURES ARE ABOVE THE SUMMER COOLING SETPOINT OF (74F ADJ) FOR A PERIOD OF TWO (2) HOURS (ADJ), THE SYSTEM SHALL AUTOMATICALLY SWITCH FROM "WINTER"MODE TO "SUMMER"MODE AND BE DISPLAYED ON THE BAS IN THE FOLLOWING SEQUENCE;

THE BOILER SHALL BE DISABLED.

THE BOILER 3–WAY ANTI–SHOCK SHALL BE COMMANDED CLOSED TO THE DT LOOP.

THE BOILER PUMP HWP–1 WILL BE DISABLED.

STATUS OF THE BOILER, PUMP, AND 3–WAY ANTISHOCK VALVE SHALL BE MONITORED BY THE BAS TO ALERT FOR ANY MISMATCHED CONDITIONS AFTER 30 SEC. (ADJ)

THE AHU'S IN THE LOWER LEVEL SHALL SWITCH MODE TO "SUMMER."

THE OA LOUVERS AND CORRESPONDING EXHAUST FANS IN LOWER LEVEL SHALL BE ENABLED.

THE UNIT HEATERS SHALL BE DISABLED.

CHILLER SHALL BE ENABLED "ON."

CHILLER 3–WAY ANTI–SHOCK VALVE SHALL REMAIN CLOSED TO THE SECONDARY DT LOOP AND FOLLOW THE ANTI–SHOCK SEQUENCE TO MODULATE TO THE PRIMARY LOOP WATER TO PREVENT SHOCKING THE CHILLER.

CONTROLS ON THE CHILLER SHALL STAGE THE COMPRESSORS AS NECESSARY TO ALWAYS MAINTAIN CONSTANT WATER SUPPLY TEMPERATURE FROM THE CHILLER AT 45F (ADJ.)

CHILLER ANTI– SHOCK SETPOINT PROCESS MODULATION (COOLING) SEQUENCE;

IF DUAL TEMPERATURE RETURN WATER TEMPERATURE IS ABOVE 80F> (ADJ) THE CHILLER 3–WAY ANTISHOCK VALVE SHALL CIRCULATE WATER ONLY THROUGH PRIMARY LOOP OF THE CHILLER.

ONCE THE CHILLER WATER RETURN TEMPERATURE REACHES 55"F, CHILLER 3–WAY ANTI–SHOCK VALVE SHALL SLOWLY MODULATE OPEN TO CIRCULATE TO THE BUILDING SECONDARY DT LOOP, MAINTAINING CHILLER PRIMARY LOOP RETURN TEMPERATURE AT CHILLER ANTI–SHOCK SETPOINT OF 55F (ADJ).

ONCE DUAL TEMPERATURE RETURN TEMPERATURE IS BELOW <75"F (ADJ.), CHILLER ANTI–SHOCK 3–WAY VALVE SHALL MODULATE FULLY OPEN.

CONTROLS ON THE CHILLER SHALL STAGE THE COMPRESSORS AS REQUIRED TO ALWAYS MAINTAIN CONSTANT WATER TEMPERATURE FROM THE CHILLER AT 45F (ADJ.)

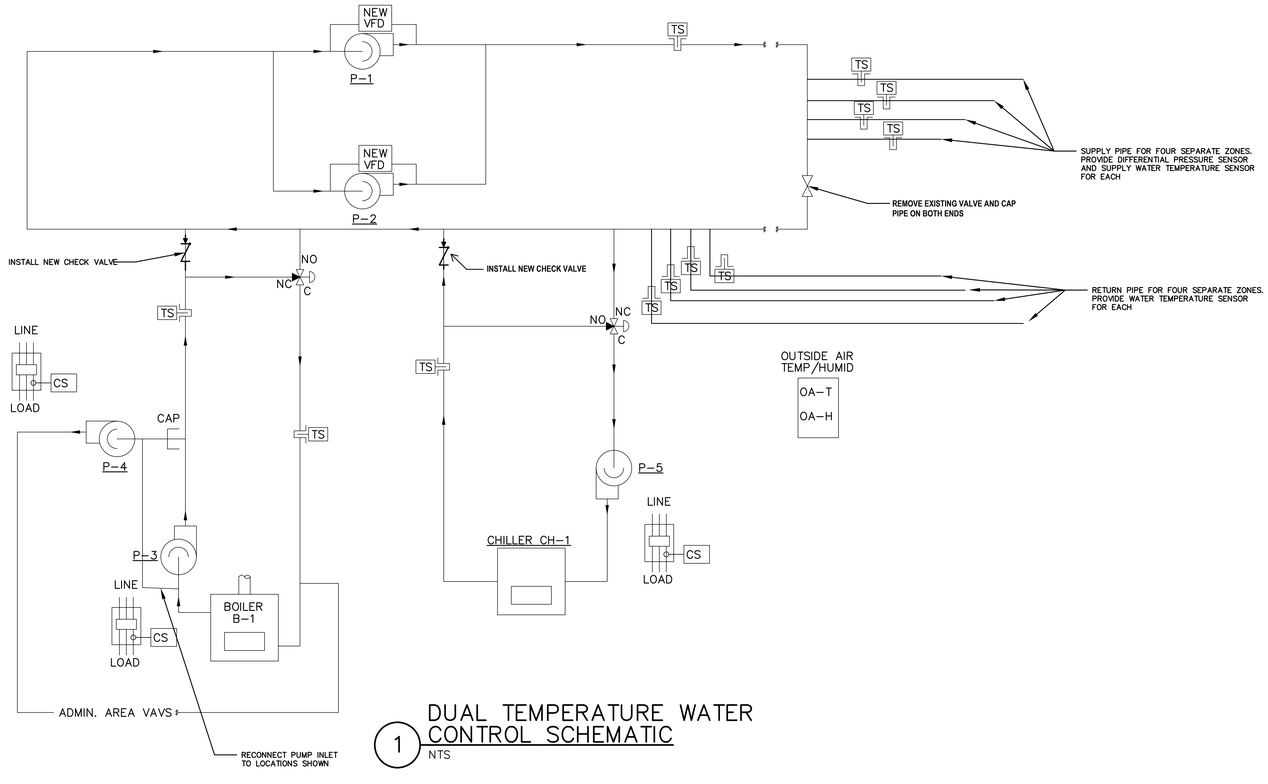
BUILDING ADDITION CONTROL

RTU – SHALL FOLLOW THE SEQUENCES AS SHOWN ON DRAWINGS AND VAV'S WILL BE SUPPLIED BY BOILER #2 AND PARALLEL BOILER PUMPS, 2 AND 2A WITH VFD'S SHALL FOLLOW THE SEQUENCES AS SHOWN ON DRAWINGS.

ENABLE RIB RELAY SHALL BE PROVIDED FOR THE BOILER AND BOILER PUMPS ALONG WITH A MEANS FOR HOA OPERATION. RUN STATUS FOR VFD'S SHALL BE FROM CONTACTS ON THE RUN CONTACTS ON THE VFD.

Dual Temperature Water System	Hardware Points				Software Points						
Point Name	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm	Show On Graphic
Dual Temperature Water Differential Pressure	x								x		x
Dual Temperature/Water Return Temp	x								x		x
Dual Temperature Water Supply Temp	x								x		x
Chiller 1 Water Return Temp	x								x		x
Chiller 1 Water Supply Temp	x								x		x
Chiller 1 Setpoint		x							x		x
Secondary Dual Temperature Water Pump P-1 VFD Speed		x							x		x
Secondary Dual Temperature Pump P-2 VFD Speed		x							x		x
Chiller 1 Status			x						x		x
Chiller 1 Fault			x						x	x	x
Primary Chilled Water Pump P-5 Status			x						x		x
Secondary Dual Temperature Water Pump P-1 Status			x						x		x
Secondary Dual Temperature Water Pump P-2 VFD Fault			x						x	x	x
Secondary Dual Temperature Water Pump P-1 Status			x						x		x
Secondary Dual Temperature Water Pump P-2 VFD Fault			x						x	x	x
Chiller 1 Enable/Disable				x					x		x
Secondary Dual Temperature Water Pump P-1 Start/Stop				x					x		x
Secondary Dual Temperature Water Pump P-2 Start/Stop				x					x		x
Outside Air Temp					x				x		x
High Main Chilled Water Return Temp										x	
High Main Chilled Water Supply Temp										x	
Chiller Failure										x	x
Low Main Chilled Water Return Temp										x	
Low Main Chilled Water Supply Temp										x	
Secondary Dual Temperature Water Pump P-1 Failure										x	
Secondary Dual Temperature Water Pump P-1 Running in Hand										x	
Secondary Dual Temperature Water Pump P-1 Failure										x	
Secondary Dual Temperature Water Pump P-2 Running in Hand										x	
High Dual Temperature Water Differential Pressure										x	
High Dual Temperature Water Supply Temp										x	
Low Dual Temperature Water Differential Pressure										x	
* Chiller 1 Operating Mode					x						x
* Chiller 1 Operating Status					x						x
* Chiller 1 RLA Percent					x						x
* Chiller 1 RLA (Amps)					x						x
* Chiller 1 Entering Water Temperature					x						x
* Chiller 1 Leaving Water Temperature					x						x
* Chiller 1 Evaporator Flow Rate					x						x
* Chiller 1 Evaporator Flow Status					x						x
* Chiller 1 kW					x						x
* Chiller 1 Tons					x						x
* Chiller 1 kW/Ton					x						x
Boiler 1 Hot Water Return Temp	x								x		x
Boiler 1 Hot Water Supply Temp	x								x		x
Primary Hot Water Return Temp	x								x		x
Primary Hot Water Supply Temp	x								x		x
Secondary Hot Water Supply Temp	x								x		x
Secondary Hot Water Return Temp	x								x		x
Hot Water Changeover Supply Temp Setpoint Reset		x							x		x
Chilled Water Changeover Supply Temp Setpoint Reset		x							x		x
Boiler 1 Alarm Status			x						x	x	x
Boiler 1 Status			x						x		x
Hot Water Pump P-3 Status			x						x		x
Hot Water Pump P-4 Status			x						x		x
Boiler 1 Enable				x					x		x
Hot Water Pump P-3 Start/Stop				x					x		x
Hot Water Pump P-4 Start/Stop				x					x		x
Boiler 1 Failure										x	
Boiler 1 High Hot Water Supply Temp										x	
Boiler 1 Low Hot Water Supply Temp										x	
Boiler 1 Running in Hand										x	
High Primary Hot Water Supply Temp										x	
Hot Water Pump P-3 Failure										x	
Hot Water Pump P-3 Running in Hand										x	
Hot Water Pump P-4 Failure										x	
Hot Water Pump P-4 Running in Hand										x	

* Manufacturer supplied points provided to the BAS via BACnet Interface



1 DUAL TEMPERATURE WATER CONTROL SCHEMATIC
NTS

McKNIGHT·SMITH WARD · GRIFFIN
ENGINEERS, INCORPORATED
4223 South Boulevard
Charlotte, NC 28209
704/527–2112
22–074

PROFESSIONAL ENGINEER
02-17-2023

REVISION DESCRIPTION
REVISION DATES
JOB NUMBER 22–074
DRAWN BY
CHECKED BY
DATE 02/17/2023

JOB TITLE
ALBEMARLE ROAD ELEMENTARY
7800 RIDING TRAIL RD
CHARLOTTE, NC, 28212
BAS RENOVATIONS

SHEET TITLE
MECHANICAL CONTROL SCHEMATICS

SHEET
M11

1-800-633-0405

For the latest prices, please check AutomationDirect.com.

ProSense® Relay Timers

TRS-TD Series Off-Delay Relay Timers

Overview

The TRS-TD series is designed to replace the functionality of pneumatic time delay relays which are very large, expensive and not very accurate. Unlike standard electronic off delay time relays, the TRS-TD does not require a trigger switch or continuous application of input voltage. With an on board power source, these units keep the logic circuit and relay energized during the off delay period.

Features

- 8 timing ranges built-in covering 0.05 seconds to 30 minutes
- Selecting a range is easy using a rotary switch
- 120 VAC/VDC and 24 VAC/VDC models available
- 8-pin octal socket
- 10A DPDT output contact

TRS-TD-D-120AD

Off-Delay Relay Timers

Part Number	Price	Timer Type	Timing Range	Voltage	Output Type	Drawing Links
TRS-TD-D	$63.00	Off-delay	0.05 seconds to 30 minutes selectable	120 VAC/VDC	(1) DPDT timed relay	PDF
TRS-TD-D-24AD	$63.00	Off-delay	0.05 seconds to 30 minutes selectable	24 VAC/VDC	(1) DPDT timed relay	PDF

Off-Delay Relay Timer Specifications

Part Number	TRS-TD-D-120AD	TRS-TD-D-24AD
Input Specifications		
Nominal Voltage	120 VAC/VDC	24 VAC/VDC
Nominal Consumption	Max 2VA	
Nominal Frequency	50/60 Hz	
Contact Specifications		
Type	(1) DPDT	
Switching Capacity	10A @ 240VAC, 30VDC 5A @ 28VDC 1/2 HP @ 240 VAC 1/4 HP @ 120 VAC B300 & R300	
Electrical Lifetime	Full Load: 100,000 operations	
Reset Time	0.1 seconds	
Mechanical Lifetime	2,000,000 operations	
Time Circuit Specifications		
Setting Accuracy	Maximum Setting (Adjustable): +5%, -2% Minimum Setting (Adjustable): +2%, -50%	
Start-up Time	Time from when power is applied until unit is timing : 0.05 seconds	
Maintain Function Time	Time unit continues to operate after power is removed: 0.01 seconds	
Repeat Accuracy	± 50ms	

Off-Delay Relay Timer Specifications

General Specifications	
Termination (Screw terminal)	Recommend 70169-D socket 1 or 2 #12-20 AWG Wire
Tightening Torque	12 in-lb
Allowable w/Ferrule Size	1 or 2 #12-20 AWG (Ferrule size: Stud size 6 with max overall width 0.30")
Storage Temperature	-40 to +85°C [-40 to +185°F]
Vibration Rating	IP20
Protection Resistance	10-55 Hz with 3G maximum and 0.5mm total displacement (+/-.25mm).
Mounting	Socket mount (8-pin required)
Weight	Any
	0.22 lbs
Agency Approvals and Standards *	cURus File E191059, cULus with appropriate socket CE EN60947-1, EN60947-5-1

*To obtain the most current agency approval information, see the Agency Approval Checklist section on the specific part number's web page.

Timing Ranges

Dial Setting	Timing Range
A	0.05 - 5 Sec
B	0.1 - 10 Sec
C	0.3 - 30 Sec
D	0.8 - 60 Sec
E	1.8 - 180 Sec
F	3 - 300 Sec
G	0.1 - 10 Min
H	0.3 - 30 Min

Wiring Diagram

1-800-633-0405

For the latest prices, please check AutomationDirect.com.

ProSense® Octal Sockets

Features

- Mounts on 35mm DIN rail
- Screw clamp wire termination

70169-D

70170-D

750-2C-SKT

Octal Sockets for Relays

Part Number	Price	Description	Qty	Wt (lb)	Drawing Links
70169-D	$5.00	Macromatic relay socket, 8-pin, 35mm DIN rail or panel mount. For use with ProSense octal relays.	1	0.1	PDF
70170-D	$6.00	Macromatic relay socket, 11-pin, 35mm DIN rail or panel mount. For use with ProSense octal relays.	1	0.1	PDF
750-2C-SKT	$4.75	AutomationDirect relay socket, 8-pin, 35mm DIN rail or panel mount. For use with 750-2C and H750-2C series octal relays.	1	0.1	PDF

Octal Sockets Specifications

Part Number	Number of Pins	Voltage	Current	Screw Size	Wire Size (capacity)	Screw Torque	Screw Chassis Mounting Torque	Agency Approval *
70169-D	8	600V	10A	6-32	1 or 2, 12-20 AWG	12 in-lb	7 in-lb	UL Recognized E169969, CSA, CE
70170-D	11	300V	10A	6-32	1 or 2, 12-20 AWG	12 in-lb	12 in-lb	
750-2C-SKT	8	600V	5A	M3.5	1-12 AWG / 1-14 AWG	9 in-lb	7 in-lb	UL Recognized E225080, CSA, CE

*To obtain the most current agency approval information, see the Agency Approval Checklist section on the specific part number's web page.

Socket Pinouts

70169-D

70170-D

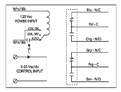
750-2C-SKT

RIB Functional Devices, Inc. (800) 888-3538 sales@functionaldevices.com www.functionaldevices.com

LOW COIL INPUT RELAY

RIBTE01P-S

Enclosed Relay Kit Low Separation 20 Amp DPDT
•Override, 120 Vac Power Input • 5-25 Vac/dc Control Input



SPECIFICATIONS

Power Input: 120 Vac, 50-60 Hz
Control Input: 5-25 Vac/dc, 50-60 Hz
 # Relays & Contact Type: One (1) DPDT Continuous Duty Coil
Expected Relay Life: 10 million cycles minimum mechanical
Operating Temperature: -30 to 140°F
Humidity Range: 5 to 95% (noncondensing)
Operate Time: 18ms
Relay Status: LED On = Activated
Dimensions: 4.00" x 4.50" x 1.82" with .50" NPT Nipple
Wires: 16", 600V Rated
Approvals: UL Listed, UL916, UL864, C-UL, California State Fire Marshal, CE, RoHS
Housing Rating: UL Accepted for Use in Plenum, NEMA 1
Gold Flash: Yes
Override Switch: Yes*

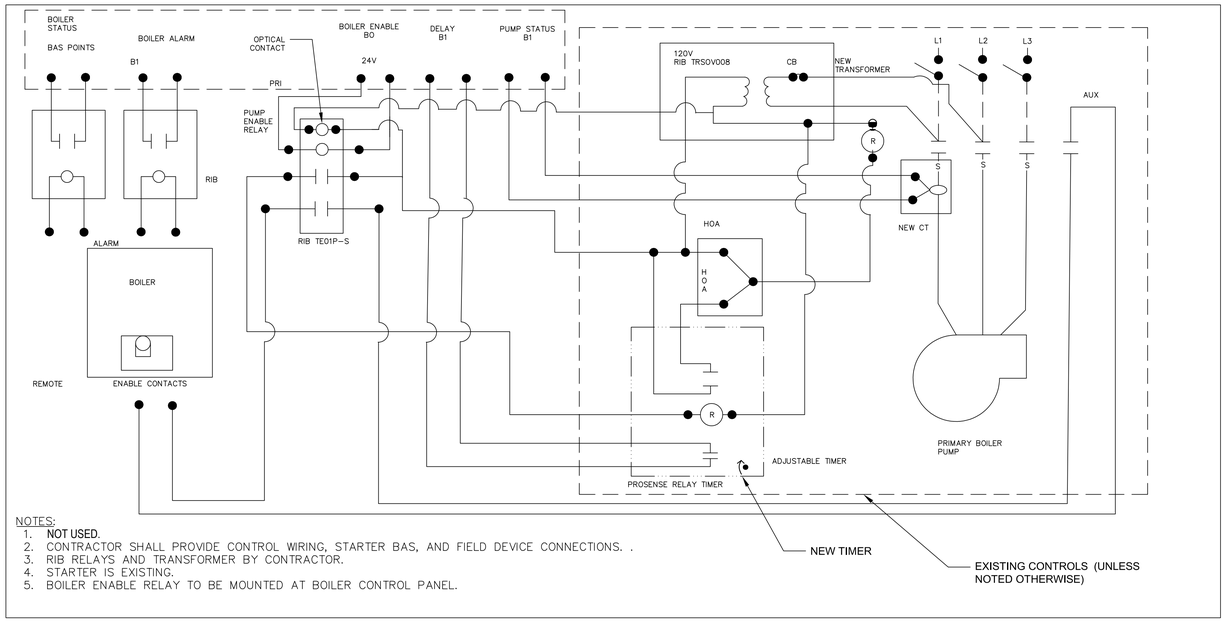
Contact Ratings:
20 Amp Resistive @ 300 Vac
20 Amp Resistive @ 28 Vdc
13 Amp Resistive @ 600 Vac
20 Amp Ballast @ 277-480 Vac
Not rated for Electronic Ballast
770 VA Pilot Duty @ 120 Vac
1158 VA Pilot Duty @ 240 Vac
1150 VA Pilot Duty @ 277 Vac
1840 VA Pilot Duty @ 480 Vac
3 HP @ 480-600 Vac
2 HP @ 240-277 Vac
1 HP @ 120 Vac

Control Input Ratings:
.6 mA @ 5 Vdc
.8 mA @ 10 Vdc
1 mA @ 12 Vdc
2 mA @ 24 Vdc
3 mA @ 24 Vac
(Non-Polarized)

Power Input Ratings:
105 mA @ 120 Vac

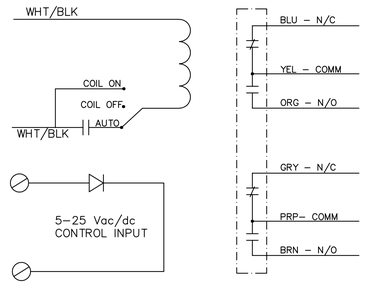
Notes:
• Override capability is made possible by supplying constant voltage on the Power Input. No Control Input Voltage is necessary to override the relay. *

20191117



NOTES:
1. NOT USED.
2. CONTRACTOR SHALL PROVIDE CONTROL WIRING, STARTER BAS, AND FIELD DEVICE CONNECTIONS. .
3. RIB RELAYS AND TRANSFORMER BY CONTRACTOR.
4. STARTER IS EXISTING.
5. BOILER ENABLE RELAY TO BE MOUNTED AT BOILER CONTROL PANEL.

1 BOILER INTEGRATION DETAIL
NTS



2 LOW COIL INPUT RELAY
NTS

McKNIGHT·SMITH WARD · GRIFFIN
ENGINEERS, INCORPORATED
4223 South Boulevard
Charlotte, NC 28209
704/527-2112

22-074

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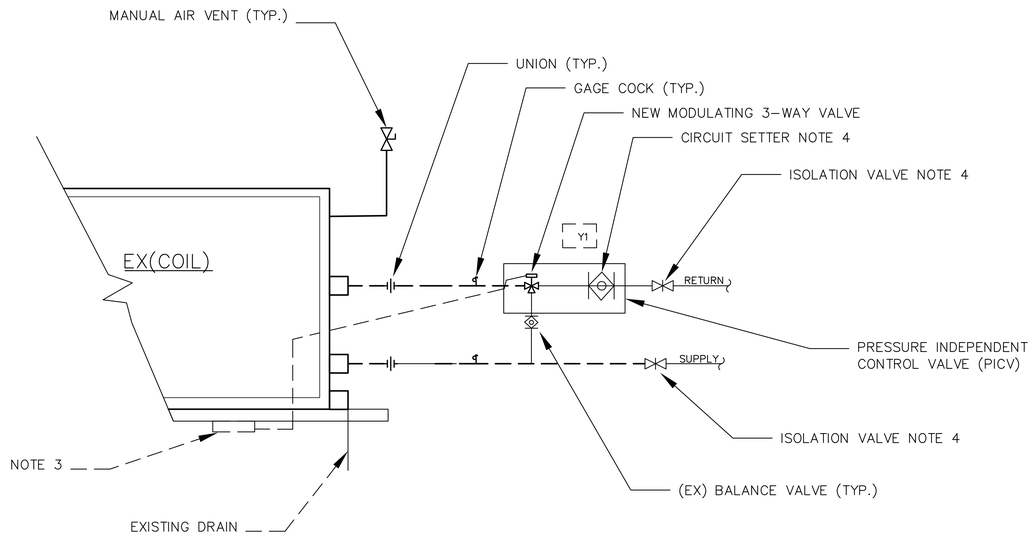
CHARLOTTE, NC, 28212
BAS RENOVATIONS

SHEET TITLE
MECHANICAL CONTROL SCHEMATICS - BOILER

SHEET
M12

NOTES:

1. REMOVE EXISTING 3-WAY CONTROL VALVE AND PNEUMATIC ACTUATOR COMPLETE.
2. INSTALL NEW 3-WAY CONTROL VALVE WITH ELECTRONIC ACTUATOR.
3. PROVIDE FLOAT SWITCH IN UNIT DRAIN PAN TO SHUT DOWN UNIT AND ALARM TO BAS.
4. REMOVE EXISTING ISOLATION VALVE AND CIRCUIT SETTER.
5. PROVIDE SEPERATE VALVES, NOT COMBINATION VALVE ASSEMBLIES.
6. PICV PROVIDED WITH UNION BETWEEN CIRCUIT SETTER AND CONTROL VALVE.



1 THREE-WAY CONTROL VALVE DETAIL
NTS

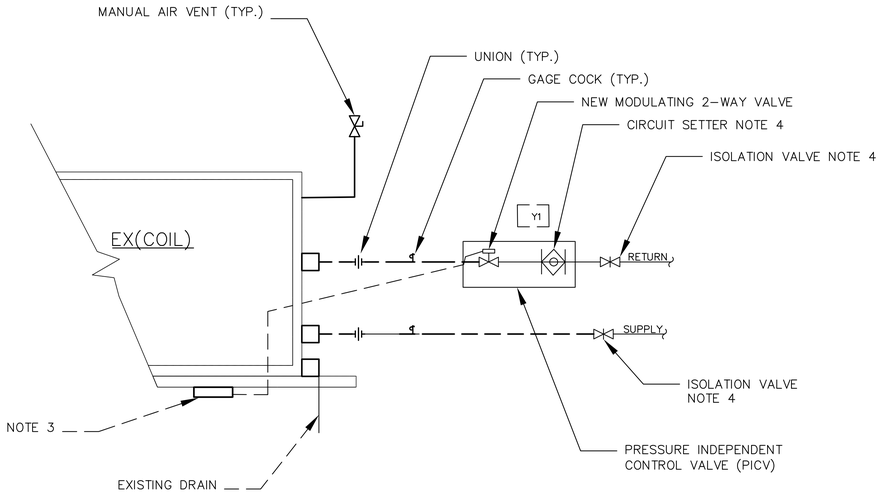
VALVE SCHEDULE

NEW VALVE TAG	ORIGINAL VALVE TAG	2-WAY OR 3-WAY	FLOW (GPM)	PIPE SIZE (IN.)	VALVE SIZE (IN.)	VALVE CV	ACTUAL PRESSURE DROP	NOTES
AHU-1	AHU-1	3-WAY	37.2	-	1.25	20	-	-
AHU-2	AHU-2	3-WAY	51.88	-	1.50	28	-	-
AHU-3	AHU-3	3-WAY	18.0	-	1.00	14	-	-
AHU-4	AHU-4	3-WAY	31.96	-	1.25	20	-	-
AHU-5	AHU-5	3-WAY	40.2	-	1.25	20	-	-
B-1	Boiler	3-WAY	98.0	-	4.0	-	-	-
CH-1	CH-1	3-WAY	321.8	-	5.0	-	-	-
VAV-1-A101	VAV-1	3-WAY	2.7	0.75	0.5	1.9	2.02	-
VAV-1-A103	VAV-2	3-WAY	2.7	0.75	0.5	1.9	2.02	-
VAV-1-2/A106	VAV-3	3-WAY	2.9	0.75	0.5	1.9	2.33	-
VAV-1-1/A106	VAV-4	3-WAY	2.9	0.75	0.5	1.9	2.33	-
VAV-1-A108	VAV-5	3-WAY	2.9	0.75	0.5	1.9	2.33	-
VAV-1-A118	VAV-6	3-WAY	2.5	0.75	0.5	1.9	1.73	-
VAV-1-A120	VAV-7	3-WAY	2.5	0.75	0.5	1.9	1.73	-
VAV-1-A122	VAV-8	3-WAY	2.5	0.75	0.5	1.9	1.73	-
VAV-1-A123	VAV-9	3-WAY	2.8	0.75	0.5	1.9	2.17	-
VAV-1-A124	VAV-10	3-WAY	2.5	0.75	0.5	1.9	1.73	-
VAV-1-A126	VAV-11	3-WAY	2.6	0.75	0.5	1.9	1.87	-
VAV-1-A113	VAV-12	3-WAY	0.9	0.75	0.5	0.8	1.27	-
VAV-1-A117	VAV-15	3-WAY	3.2	0.75	0.5	3.0	1.14	-
VAV-1-A109	VAV-16	3-WAY	1.6	0.75	0.5	1.2	1.78	-
VAV-2-153	W-F	2-WAY	3.3	-	0.5	1.9	-	-
VAV-2-N154	W-F	2-WAY	3.3	-	0.5	1.9	-	-
VAV-2-156	W-D	2-WAY	1.6	-	0.5	1.9	-	-
VAV-2-N157	W-F	2-WAY	3.3	-	0.5	1.9	-	-
VAV-2-160	W-C	2-WAY	1.05	-	0.5	1.9	-	-
VAV-2-159A	W-D	2-WAY	1.6	-	0.5	1.9	-	-
VAV-2-162	W-D	2-WAY	1.6	-	0.5	1.9	-	-
VAV-2-165	W-D	2-WAY	1.6	-	0.5	1.9	-	-
VAV-2-166	W-B	2-WAY	0.84	-	0.5	1.9	-	-
VAV-2-133	W-E	2-WAY	2.42	-	0.5	1.9	-	-
FCU-150	Trane Horiz. FCU	3-WAY	1.9	0.75	-	-	-	-
FCU-133	FC-2	3-WAY	4.41	1.00	0.5	3.0	-	-
FCU-135	FC-1	3-WAY	3.14	0.75	0.5	1.9	-	-
FCU-4	AH-2	3-WAY	2.0	-	-	-	-	-
UV-101	UV-2	3-WAY	8.4	1.25	0.5	4.7	-	-
UV-102	UV-2	2-WAY	8.4	1.25	0.5	4.7	-	-
UV-103	UV-2	3-WAY	8.4	1.25	0.5	4.7	-	-
UV-104	UV-2	3-WAY	8.4	1.25	0.5	4.7	-	-
UV-105	UV-2	2-WAY	8.4	1.25	0.5	4.7	-	-
UV-106	UV-2	2-WAY	8.4	1.25	0.5	4.7	-	-
UV-107	UV-2	2-WAY	8.4	1.25	0.5	4.7	-	-
UV-108	UV-2	3-WAY	8.4	1.25	0.5	4.7	-	-
UV-109	UV-1	2-WAY	8.4	1.25	0.5	4.7	-	-
UV-110	UV-1	3-WAY	8.4	1.25	0.5	4.7	-	-
UV-111	UV-1	3-WAY	8.4	1.25	0.5	4.7	-	-
UV-112	UV-1	2-WAY	8.4	1.25	0.5	4.7	-	-
UV-113	UV-2	2-WAY	8.4	1.25	0.5	4.7	-	-
UV-114	UV-2	2-WAY	8.4	1.25	0.5	4.7	-	-
UV-115	UV-2	2-WAY	8.4	1.25	0.5	4.7	-	-
UV-116	UV-2	3-WAY	8.4	1.25	0.5	4.7	-	-
UV-117	UV-2	2-WAY	8.4	1.25	0.5	4.7	-	-
UV-118	UV-2	2-WAY	8.4	1.25	0.5	4.7	-	-
UV-119	UV-2	2-WAY	8.4	1.25	0.5	4.7	-	-
UV-120	UV-2	3-WAY	8.4	1.25	0.5	4.7	-	-
UV-121	UV-2	3-WAY	8.4	1.25	0.5	4.7	-	-
UV-122	UV-2	2-WAY	8.4	1.25	0.5	4.7	-	-
UV-123	UV-2	2-WAY	8.4	1.25	0.5	4.7	-	-
UV-124	UV-2	2-WAY	8.4	1.25	0.5	4.7	-	-
UV-125	UV-2	2-WAY	8.4	1.25	0.5	4.7	-	-
UV-126	UV-2	3-WAY	8.4	1.25	0.5	4.7	-	-
UV-127	UV-2	3-WAY	8.4	1.25	0.5	4.7	-	-
UV-128	UV-2	2-WAY	8.4	1.25	0.5	4.7	-	-
UV-129	UV-2	3-WAY	8.4	1.25	0.5	4.7	-	-
UV-130	UV-2	2-WAY	8.4	1.25	0.5	4.7	-	-
UV-131	UV-2	2-WAY	8.4	1.25	0.5	4.7	-	-
UV-132	UV-2	3-WAY	8.4	1.25	0.5	4.7	-	-

1. CCV
2. BALL
3. ZONE
4. GLOBE
5. BUTTERFLY
6. 24 VAC
7. 120 VAC
8. ON-OFF
9. FLOATING POINT
10. MODULATING 2-10
11. MFT
12. MFT CODE
13. SPRING RETURN
14. SWITCHES

NOTES:

1. REMOVE EXISTING 3-WAY CONTROL VALVE AND PNEUMATIC ACTUATOR COMPLETE.
2. INSTALL NEW 3-WAY CONTROL VALVE WITH ELECTRONIC ACTUATOR.
3. PROVIDE FLOAT SWITCH IN UNIT DRAIN PAN TO SHUT DOWN UNIT AND ALARM TO BAS.
4. REMOVE EXISTING ISOLATION VALVE AND CIRCUIT SETTER.
5. PROVIDE SEPERATE VALVES, NOT COMBINATION VALVE ASSEMBLIES.
6. PICV PROVIDED WITH UNION BETWEEN CIRCUIT SETTER AND CONTROL VALVE.



2 TWO-WAY CONTROL VALVE DETAIL
NTS

McKNIGHT·SMITH WARD · GRIFFIN
ENGINEERS, INCORPORATED
423 South Boulevard
Charlotte, NC 28209
704/527-2112

22-074

PROFESSIONAL ENGINEER
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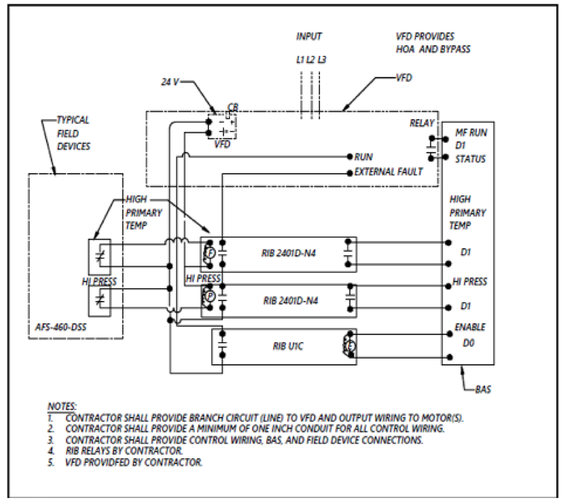
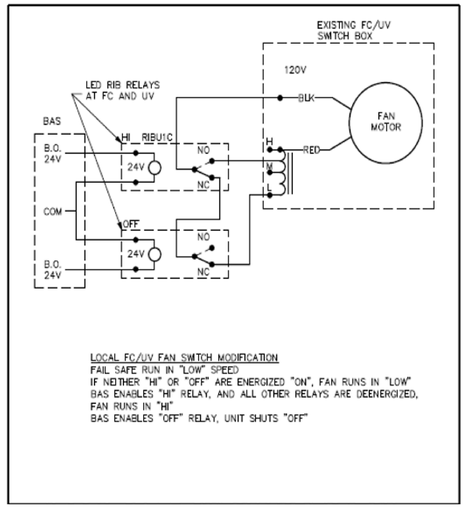
SHEET TITLE
MECHANICAL CONTROLS
VALVE DETAILS AND
SCHEDULE

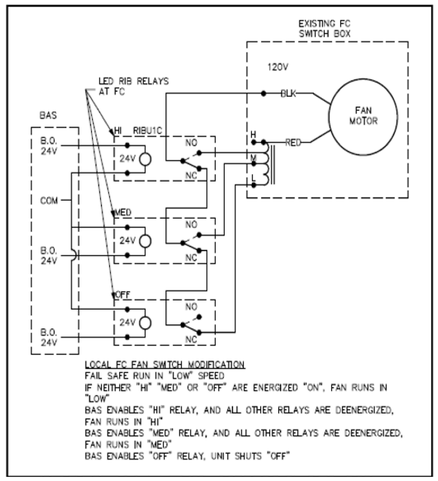
SHEET
M13



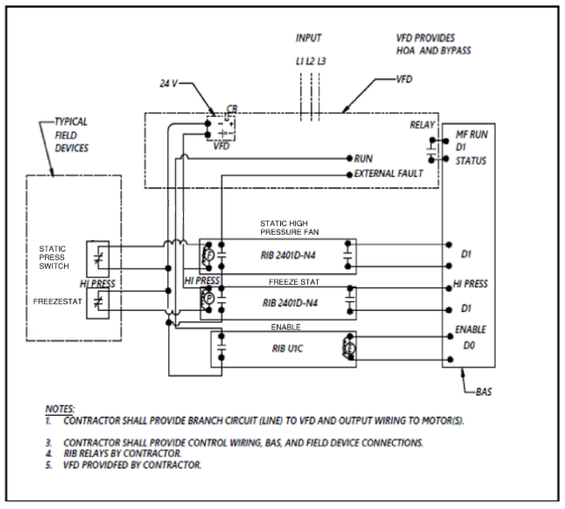
1 CMS TYPICAL MOTOR VFD BAS INTERFACE – PUMP
NTS



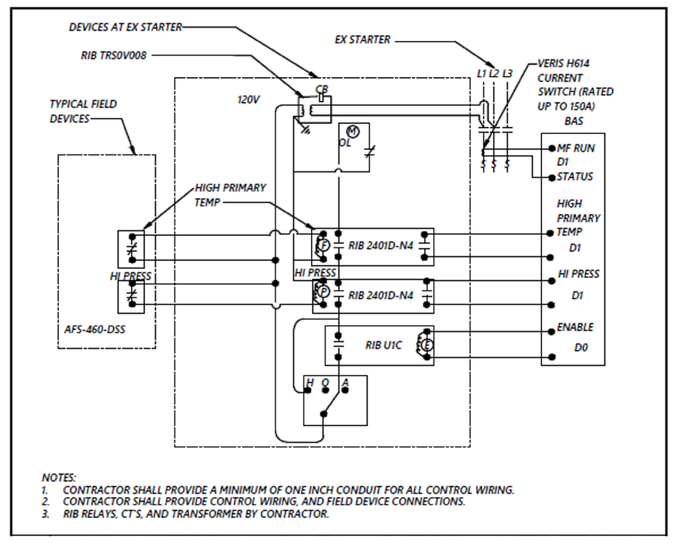
2 LOCAL SPEED SWITCH MODIFICATION
NTS



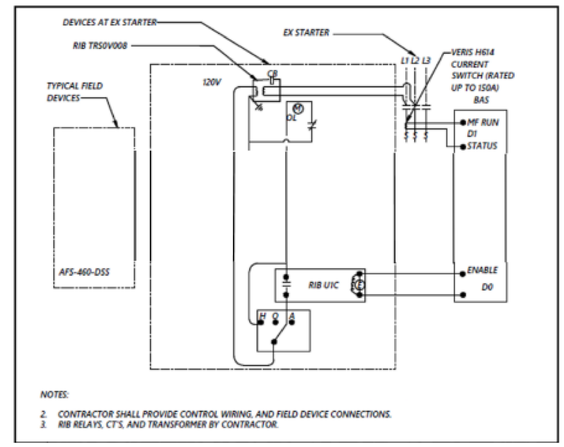
3 LOCAL SPEED SWITCH MODIFICATION
NTS



4 CMS TYPICAL MOTOR VFD BAS INTERFACE – FAN
NTS

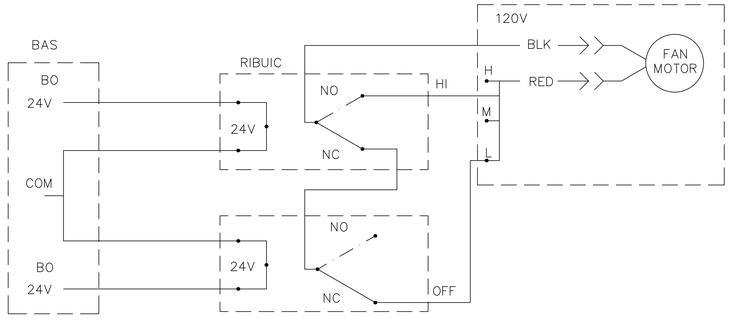


5 CMS TYPICAL MOTOR STARTER BAS INTERFACE – PUMP
NTS



6 CMS TYPICAL MOTOR STARTER BAS INTERFACE – FAN
NTS

NOTES:
1. EXTERIOR OF CABINET– ABOVE CEILING FOR LOCAL SPEED SWITCH MODIFICATION (2) AND (3).



7 LOCAL FC/UV FAN SWITCH MODIFICATION FAIL SAFE RUN IN "LOW" SPEED
NTS

McKNIGHT·SMITH
WARD · GRIFFIN
ENGINEERS, INCORPORATED
4223 South Boulevard
Charlotte, NC 28209
704/527-2112
22-074

REVISION DESCRIPTION	REVISION DATES

JOB NUMBER 22-074
DRAWN BY
CHECKED BY
DATE 02/17/2023

JOB TITLE
ALBEMARLE ROAD ELEMENTARY
7800 RIDING TRAIL RD
CHARLOTTE, NC, 28212
BAS RENOVATIONS

SHEET TITLE
MECHANICAL CONTROLS – LOCAL SWITCH MODIFICATIONS

SHEET
M14