WINDSOR PARK ELEMENTARY SCHOOL
BUILDING AUTOMATION SYSTEM RENOVATIONS
MECKLENBURG COUNTY SCHOOLS
3910 Sudbury Road Charlotte, NC, 28205 Courier #587



SITE PLAN
N.T.S.

N

SHEET LIST

M1	COVER SHEET
M1.1	APPENDIX B
MECHANICAL PLANS	
M2	FLOOR PLANS
M3	FLOOR PLANS
M4	FLOOR PLANS
M5	FLOOR PLANS
M6	FLOOR PLANS
M7	FLOOR PLANS
M8	FLOOR PLANS
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M10	FLOOR PLANS
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M12	MECHANICAL SCHEDULES
M13	MECHANICAL CONTROLS
M14	MECHANICAL CONTROLS
M15	MECHANICAL CONTROLS
M16	MECHANICAL CONTROLS
M17	MECHANICAL CONTROL SCHEMATICS
M18	MECHANICAL CONTROL VALVE DETAILS & SCHEDULE
M19	MECHANICAL CONTROLS SCHEMATIC – BOILER

WINDSOR PARK ELEMENTARY SCHOOL



VICINITY MAP
N.T.S.

N

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

22-075

PROFESSIONAL ENGINEER
02-17-2023

JOB NUMBER	22-075
DRAWN BY	
CHECKED BY	
DATE	02-17-2023

REVISION DATES

REVISION DESCRIPTION

JOB TITLE
WINDSOR PARK ELEMENTARY
3910 SUDBURY RD
CHARLOTTE, NC, 28205
BAS RENOVATIONS

SHEET TITLE
COVER SHEET

SHEET
M1
1 OF 4

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: Windsor Park Elementary school BAS Renovations
Address: 3910 Suffolk Road Charlotte, NC Zip Code 28205
Owner/Authorized Agent: Yolanda S. Parmerson Phone # (980)-343-6580
E-Mail: yolandas.parmerson@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@mswgr.com
Electrical	McKnight Smith Ward Griffin Engineers, Inc.	Matthew Knotts	036875	(704)-527-2112 ext 158 matthew@mswgr.com

2018 NC BUILDING CODE: Renovation
2018 NC EXISTING BUILDING CODE: N/A P: N/A
CONSTRUCTED: N/A OCCUPANCY(S) (Ch. 3): N/A
RENOVATED: N/A ED OCCUPANCY(S) (Ch. 3): N/A
RISK CATEGORY (Table 1604.5): [illegible] **Proposed:** N/A

BASIC BUILDING
Construction: [illegible]
Sprinkler: Select one
Standpipes: [illegible].t one
Primary Fire District: Select one **Flood Hazard Area:** Select one
Special Inspections Required: Select one

Gross Building Area Table

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

NOT APPLICABLE

ALLOWABLE AREA

Primary Occupancy Classification(s): Select one Select one Select one Select one Select one Select one
Accessory Occupancy Classification(s): _____
Incidental Uses (Table 509): _____
Special Uses (Chapter 4 – List Code Sections): _____
Special Provisions (Chapter 5 – List Code Sections): _____
Mixed Occupancy: Select one Separation: Select one Exception: _____
Select one

$$\frac{\text{Actual Area of Occupancy A}}{\text{Allowable Area of Occupancy A}} + \frac{\text{Actual Area of Occupancy B}}{\text{Allowable Area of Occupancy B}} + \ldots \leq 1$$

_____ + _____ + ... = _____ ≤ 1.00

STORY NO.	DESCRIPTION AND USE	(A) BUILDING AREA PER STORY (ACTUAL)	(B) TABLE 506.2* AREA	(C) AREA FOR FRONTAGE INCREASE[1,2]	(D) ALLOWABLE AREA PER STORY OR UNLIMITED[3,4]

[1] Frontage area increases from Section 506.3 are c[illegible]
a. Perimeter which fronts a public wo[illegible] ing 20 feet minimum width = _____ (F)
b. Total Building Perimeter _____ (P)
c. Ratio (F/P) = _____
d. W = Minimum width of pub[illegible] _____ (W)
e. Percent of Frontage increase I[illegible] 100 (F/P – 0.25) x W/30 = _____ (%)
[2] Unlimited area applicable under conditions of Section 507.
[3] Maximum Building Area = total number of stories in the building x D (maximum 3 stories) (506.2).
* The maximum area of open parking garages must comply with Table 406.5.4.
[4] Frontage increase is based on the unsprinklered area value in Table 506.2.

NOT APPLICABLE

ALLOWABLE HEIGHT

	ALLOWABLE	SHOWN ON PLANS	CODE REFERENCE [1]
Building Height in Feet (Table 504.3) [2]			
Building Height in Stories (Table 504.4) [3]			

[1] Provide code reference if the "Shown on Plans" quantity is not based on Table 504.3 or 504.4.
[2] The maximum height of air traffic control towers must comply with Table 412.3.1.
[3] The maximum height of open parking garages must comply with Table 406.5.4.

FIRE PROTECTION REQUIREMENTS

BUILDING ELEMENT	FIRE SEPARATION DISTANCE (FEET)	RATING HOURS	RATING TYPE	[illegible]ATE #	DESIGN # FOR RATED ASSEMBLY	SHEET # FOR RATED PENETRATION	SHEET # FOR RATED JOINTS
Structural Frame, including columns, girders, trusses							
Bearing Walls							
Exterior							
North							
East							
West							
South							
Interior							
Nonbearing Walls and Partitions							
Exterior walls							
North							
East							
West							
South							
Interior walls and partitions							
Floor Construction including supporting beams and joints							
Floor Ceiling Assembly							
Columns Supporting Floors							
Roof Construction, including supporting beams and joints							
Roof Ceiling Assembly							
Columns Supporting Roof							
Shaft Enclosures - Exit							
Shaft Enclosures - Other							
Corridor Separation							
Occupancy/Fire Barrier Separation							
Party/Fire Wall Separation							
Smoke Barrier Separation							
Smoke Partition							
Tenant/Dwelling Unit/ Sleeping Unit Separation							
Incidental Use Separation							

* Indicate section number permitting reduction

NOT APPLICABLE

PERCENTAGE OF WALL OPENING CALCULATIONS

FIRE SEPARATION DISTANCE (FEET) FROM PROPERTY LINES	DEGREE OF OPENING PROTECTION (TABLE 705.8)	ALLOWABLE AREA (%)	ACTUAL SHOWN ON PLANS (%)

LIFE SAFETY SYSTEM REQUIREMENTS

Emergency Lighting: Select one
Exit Signs: Select one
Fire Alarm: Select one
Smoke Detection Systems: Select one
Carbon Monoxide Detection: Select one

NOT APPLICABLE

[illegible]TY PLAN REQUIREMENTS

Life Safety Plan Sheet #: _____

- ☐ Fire and/or smoke rated wall locations (Chapter 7)
- ☐ Assumed and real property line locations (if not on the site plan)
- ☐ Exterior wall opening area with respect to distance to assumed property lines (705.8)
- ☐ Occupancy Use for each area as it relates to occupant load calculation (Table 1004.1.2)
- ☐ Occupant loads for each area
- ☐ Exit access travel distances (1017)
- ☐ Common path of travel distances (Tables 1006.2.1 & 1006.3.2(1))
- ☐ Dead end lengths (1020.4)
- ☐ Clear exit widths for each exit door
- ☐ Maximum calculated occupant load capacity each exit door can accommodate based on egress width (1005.3)
- ☐ Actual occupant load for each exit door
- ☐ A separate schematic plan indicating where fire rated floor/ceiling and/or roof structure is provided for purposes of occupancy separation
- ☐ Location of doors with panic hardware (1010.1.10)
- ☐ Location of doors with delayed egress locks and the amount of delay (1010.1.9.7)
- ☐ Location of doors with electromagnetic egress locks (1010.1.9.9)
- ☐ Location of doors equipped with hold-open devices
- ☐ Location of emergency escape windows (1030)
- ☐ The square footage of each fire area (202)
- ☐ The square footage of each smoke compartment for Occupancy Classfication I-2 (407.5)
- ☐ Note any code exceptions or table notes that may have been utilized regarding the items above

NOT APPLICABLE

ACCESSIBLE DWELLING UNITS
(SECTION 1107)

TOTAL UNITS	ACCESSIBLE UNITS REQUIRED	ACCESSIBLE UNITS PROVIDED	TYPE A UNITS REQUIRED	TYPE A UNITS PROVIDED	TYPE B UNITS REQUIRED	TYPE B UNITS PROVIDED	TOTAL ACCESSIBLE UNITS PROVIDED

ACCESSIBLE PARKING
(SECTION 1106)

LOT OR PARKING AREA	TOTAL # OF PARKING SPACES		# OF ACCESSIBLE SPACES				TOTAL # ACCESSIBLE PROVIDED
	REQUIRED	PROVIDED	REGULAR WITH 5' ACCESS AISLE	VAN 132" ACCESS AISLE	[illegible] CESS AISLE		
TOTAL							

NOT APPLICABLE

P[illegible] FIXTURE REQUIREMENTS
(TABLE 2902.1)

USE		WATER CLOSETS			URINALS	LAVATORIES			SHOWERS	DRINKING FOUNTAINS	
		MALE	FEMALE	UNISEX		MALE	FEMALE	UNISEX	[illegible] TUBS	REGULAR	ACCESSIBLE
SPACE	EXIST'G										
	NEW										
	REQ'D										

SPECIAL APPROVALS

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

_____
_____
_____

ENERGY SUMMARY

ENERGY REQUIREMENTS:
The following data shall be considered minimums and any special attribute required to meet the energy code shall also be provided. Each Designer shall furnish the required portions of the project information for the plan data sheet. If performance method, state the annual energy cost for the standard reference design vs annual energy cost for the proposed design.

Existing building envelope complies with code: Select one

Exempt Building: Select one Provide code or statutory reference:

Climate Zone: Select one

Method of Compliance: Select one
(If "Other" specify source here)_____ _____

THERMAL ENVELOPE (Prescriptive method only)

Roof/ceiling Assembly (each assembly)
Description of assembly: _____
U-Value of total assembly: _____
R-Value of insulat[illegible]: _____
Skylights in each ass[illegible]: _____
U-Value of s[illegible]: _____
total square footage of skylights in each assembly: _____

Exterior Walls (each assembly)
Description of assembly: _____
U-Value of total assembly: _____
R-Value of insulation: _____
Openings (windows or doors with glazing)
U-Value of assembly: _____
Solar heat gain coefficient: _____
projection factor: _____
Door R-Values: _____

Walls below grade (each assembly)
Description of assembly: _____
U-Value of total assembly: _____
R-Value of insulation: _____

Floors over unconditioned space (each assembly)
Description of assembly: _____
U-Value of total assembly: _____
R-Value of insulation: _____

Floors slab on grad.
Description o[illegible]ply: _____
U-Value of tota[illegible] assembly: _____
R-Value of insulation: _____
Horizontal/vertical requirement: _____
slab heated: _____

NOT APPLICABLE

2018 APPENDIX B
BUILDING CODE SUMMARY FOR ALL COMMERCIAL PROJECTS
STRUCTURAL DESIGN
(PROVIDE ON THE STRUCTURAL SHEETS IF [illegible]PLICABLE)

DESIGN LOADS:

Importance Factors: Snow (Is) Select one
Seismic (Ie) Select one

Live Loads: Roof _____ psf
_____ psf
_____ psf

Ground Snow Lo[illegible] _____ psf

Wind Load: Ultimate Wind Speed _____
Exposure Category Select one (ASCE-7)

SEISMIC DESIGN CATEGORY: Select one
Provide the following Seismic Desi[illegible]:
Risk Category (Table[illegible] select one
Spectral Respon[illegible]: Ss_____ %g S1_____ %g
Site Classificatio[illegible]: Select one
[illegible]ata Source: Select one
Basic structural system Select one
Analysis Procedures: Select one
Architectural, Mechanical, Components anchored? Select one

LATERAL DESIGN CONTROL: Select one

SOIL BEARING CAPACITIES:
Select one _____ psf
File size, type, and capacity _____

NOT APPLICABLE

2018 APPENDIX B
BUILDING CODE SUMMARY FOR ALL COMMERCIAL PROJECTS
MECHANICAL DE[illegible]N
(PROVIDE ON THE MECHANIC[illegible]TS IF APPLICABLE)

MECH[illegible]ARY

MECHANICAL SYSTEMS, SER[illegible] [illegible]AND EQUIPMENT

Thermal Zone [illegible]
[illegible] Sq.ft
[illegible]ate 94 F

Interior c[illegible]gn conditions
winter dry bulb: 70 F
summer dry bulb: 75 F
relative humidity: 50%

Building heating l[illegible] [illegible]

Buildin[illegible] [illegible] Tons

Mech[illegible]cing Conditioning System
[illegible]ondary
description of unit: Air Cooled Chiller
heating efficiency: Existing
cooling 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 [illegible]: N/A

List equipment efficiencies:
Motor Horsepower: [illegible]omply w/ 2018 NC Energy Code
Number of Phases: Comply w/ 2018 NC Energy Code
Minimum Efficie[illegible] Comply w/ 2018 NC Energy Code
Motor Type: Comply w/ 2018 NC Energy Code
Namepl[illegible] Comply w/ 2018 NC 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 (w/site 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 9[illegible]
- ☐ C406.2 More Efficient HVAC Equipment P[illegible]
- ☐ C406.3 Reduced Lighting Power Densi[illegible]
- ☐ C406.4 Enhanced Digital Lighting
- ☐ C406.5 On-Site Renewable E[illegible]
- ☐ C406.6 Dedicated Ou[illegible]
- ☐ C406.7 Reduced [illegible]ce Water Heating

NOT APPLICABLE

Only electrical work is power for mechanical equipment.

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4223 South Boulevard
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PROFESSIONAL ENGINEER
02-17-2023

REVISION DATES	
JOB NUMBER	22-075
DRAWN BY	MP/MK
CHECKED BY	JCC/MPA
DATE	02-17-2023

JOB TITLE
Charlotte Mecklenberg Schools
Windsor Eleemtary School
BAS Renovations
Charlotte North Carolina

SHEET TITLE
APPENDIX B

SHEET
M1.1
2 OF 2

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.

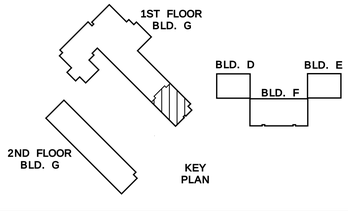
2) REPLACE EXISTING THERMOSTATS WITH NEW TEMPERATURE SENSORS CONNECTED TO BAS. CONTRACTOR TO FIELD VERIFY ALL EXISTING LOCATIONS OF ALL EXISTING THERMOSTATS.

3) REPLACE EXISTING VALVES AND ACTUATORS LIKE - FOR - LIKE. SEE VALVE SCHEDULE ON SHEET M12.

ELECTRICAL NOTE: UTILIZE EXISTING 120V CONTROLS CIRCUITS WHERE POSSIBLE. ADDITIONAL 120V CONTROLS CIRCUITS REQUIRED FOR THIS AREA MAY BE TAKEN FROM EXISTING PANEL 'PP152'. EXISTING PANEL PP152 IS A TWO SECTION, 208Y/120V, 3PH, 4W, 200A MCB SURFACE MOUNTED PANELBOARD

Unit Ventilators	UV-X	Chiller	CH-X	Unit Heater	UH-X
Fan Coil Units	FCU-X	Pumps	P-X		
Exhaust Fans	EF-X	Condensing Units	CU-X		
VAV Boxes	VAV-#-X	Boilers	B-X		
Air Handling Units	AH-X	Motorized Dampers	MD-X		
Makeup Air Units	MAU-X				
Heating Coil	HC-X				





1 MECHANICAL FLOOR PLAN
SCALE: 1/16" = 1'-0"

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

NORTH CAROLINA PROFESSIONAL ENGINEER 17250 CHAD CHAMPION
02-17-2023

22-075

REVISION DESCRIPTION	
REVISION DATES	
JOB NUMBER	22-075
DRAWN BY	
CHECKED BY	
DATE	02-17-2023

JOB TITLE
WINDSOR PARK ELEMENTARY
3910 SUDBURY RD
CHARLOTTE, NC, 28205
BAS RENOVATIONS

SHEET TITLE
MECHANICAL FLOOR PLANS

SHEET
M2

SCOPE OF WORK

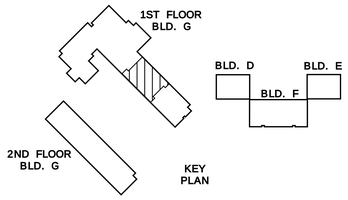
1) REPLACE CONTROLS FOR ALL MARKED EXISTING EQUIPMENT TO TIE INTO NEW BAS. SEE SPECIFICATIONS FOR FULL DESCRIPTION OF CONTROL WORK AND SEQUENCES.

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 M12.

ELECTRICAL NOTE: UTILIZE EXISTING 120V CONTROLS CIRCUITS WHERE POSSIBLE. ADDITIONAL 120V CONTROLS CIRCUITS REQUIRED FOR THIS AREA MAY BE TAKEN FROM EXISTING PANEL 'PP152'. EXISTING PANEL PP152 IS A TWO SECTION, 208V/120V, 3PH, 4W, 200A MCB SURFACE MOUNTED PANELBOARD

Unit Ventilators	UV-X
Fan Coil Units	FCU-X
Exhaust Fans	EF-X
VAV Boxes	VAV-#-X
Air Handling Units	AH-X
Makeup Air Units	MAU-X
Heating Coil	HC-X
Chiller	CH-X
Pumps	P-X
Condensing Units	CU-X
Boilers	B-X
Motorized Dampers	MD-X
Unit Heater	UH-X



MD-1-1 60X24 RELIEF LOUVER W/ M.O.D. FOR AHU-1 BOT=10'-8 TOP=12'-8

MD-1-2 60X24 RELIEF LOUVER W/ M.O.D. FOR AHU-1 BOT=10'-8 TOP=12'-8

MD-1-3 60X24 RELIEF LOUVER W/ M.O.D. FOR AHU-1 BOT=10'-8 TOP=12'-8

1ST GRADE CLASSROOM A10 / 158

1ST GRADE CLASSROOM 159

1ST GRADE CLASSROOM A6 / 161

VISUAL ARTS A4 / 165

TUTOR ROOM 160

CORRIDOR 163

KINDERGARTEN CLASSROOM A9 / 142

KINDERGARTEN CLASSROOM A7 / 141

KINDERGARTEN CLASSROOM A5 / 139

COMPUTER ROOM A3 / 136

VAV-1-158 VAV-1-159 VAV-1-161 VAV-1-165

VAV-1-142 VAV-1-141 VAV-1-139 VAV-1-138

SEALED, LOW LEAKAGE DAMPER W/24" SLEEVE SMOKE DETECTOR & SINGLE POINT CONN

SEALED, LOW LEAKAGE DAMPER W/24" SLEEVE, CONTROLLED BY SPOT SMOKE DETECTORS BY EC

FIRE/SMOKE DAMPER CONTROLLED BY FA SYSTEM

SEALED, LOW LEAKAGE DAMPER W/24" SLEEVE

SEALED, LOW LEAKAGE DAMPER W/24" SLEEVE, CONTROLLED BY SPOT SMOKE DETECTORS BY EC

1 MECHANICAL FLOOR PLAN
SCALE: 1/16" = 1'-0"

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ENGINEERS, INCORPORATED
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22-075

NORTH CAROLINA PROFESSIONAL ENGINEER 17250 JEFFREY A. CHANIN ACHING CHAMPION
02-17-2023

JOB NUMBER	22-075
DRAWN BY	
CHECKED BY	
DATE	02-17-2023

REVISION DESCRIPTION

REVISION DATES

JOB TITLE
WINDSOR PARK ELEMENTARY
3910 SUDBURY RD
CHARLOTTE, NC, 28205
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 M12.

ELECTRICAL NOTE: UTILIZE EXISTING 120V CONTROLS CIRCUITS WHERE POSSIBLE. ADDITIONAL 120V CONTROLS CIRCUITS REQUIRED FOR THIS AREA MAY BE TAKEN FROM EXISTING PANEL 'PP131'. EXISTING PANEL PP131 IS A THREE SECTION, 208Y/120V, 3PH, 4W, 400A MCB SURFACE MOUNTED PANELBOARD

ELECTRICAL NOTE: EXTEND EXISTING AHU CIRCUIT FROM JUNCTION BOX HIGH ON WALL DOWN TO 4' AFF. MATCH EXISTING WIRE AND CONDUIT SIZE. ASSUME 3#6,1#8G,3/4"C

Unit Ventilators	UV-X	Chiller	CH-X
Fan Coil Units	FCU-X	Pumps	P-X
Exhaust Fans	EF-X	Condensing Units	CU-X
VAV Boxes	VAV-#-X	Boilers	B-X
Air Handling Units	AH-X	Motorized Dampers	MD-X
Makeup Air Units	MAU-X	Unit Heater	UH-X
Heating Coil	HC-X		

1ST FLOOR BLD. G
BLD. D
BLD. E
BLD. F
2ND FLOOR BLD. G
KEY PLAN

1 MECHANICAL FLOOR PLAN
SCALE: 1/16" = 1'-0"

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Charlotte, NC 28209
704/527-2112

22-075

NORTH CAROLINA PROFESSIONAL ENGINEER 17250 CRAIG CHAMPION
02-17-2023

REVISION DESCRIPTION	REVISION DATES

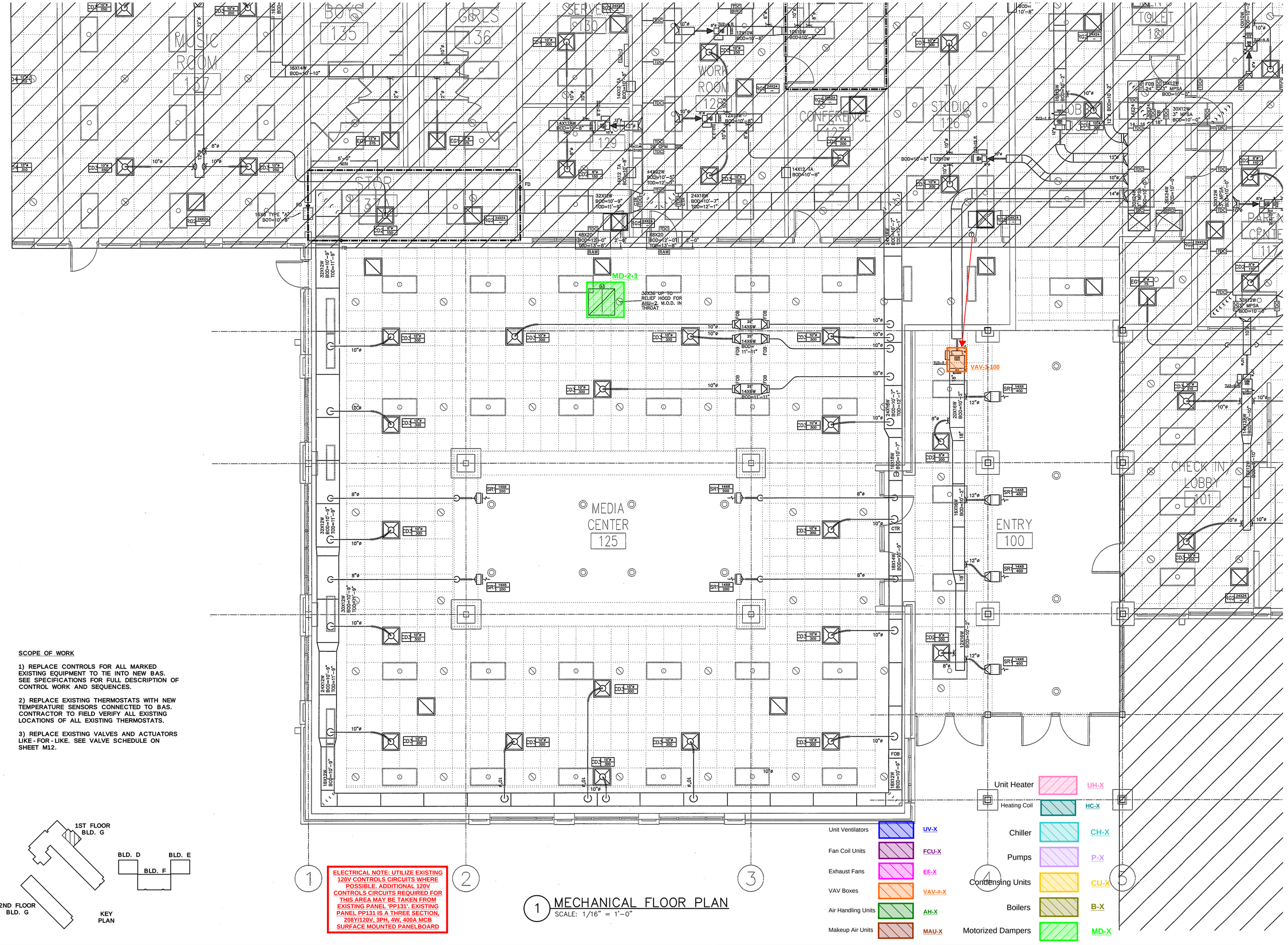
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WINDSOR PARK ELEMENTARY
3910 SUDBURY RD
CHARLOTTE, NC, 28205
BAS RENOVATIONS

SHEET TITLE
MECHANICAL FLOOR PLANS

SHEET
M4

Plotted: Jul 28, 2023 - 7:37pm Plotted By: julia_k \\263-dt04.STARCON.COM\23-059 Duct-Fuf.rvta .pltCfg
Scale: 1/8"=1'-0"
Modified By: julia



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 M12.

ELECTRICAL NOTE: UTILIZE EXISTING 120V CONTROLS CIRCUITS WHERE POSSIBLE. ADDITIONAL 120V CONTROLS CIRCUITS REQUIRED FOR THIS AREA MAY BE TAKEN FROM EXISTING PANEL 'PP131'. EXISTING PANEL PP131 IS A THREE SECTION, 208Y/120V, 3PH, 4W, 400A MCB SURFACE MOUNTED PANELBOARD

1 MECHANICAL FLOOR PLAN
SCALE: 1/16" = 1'-0"

Unit Ventilators	UV-X	Unit Heater UH-X
Fan Coil Units	FCU-X	Heating Coil HC-X
Exhaust Fans	EF-X	Chiller CH-X
VAV Boxes	VAV-#-X	Pumps P-X
Air Handling Units	AH-X	Condensing Units CU-X
Makeup Air Units	MAU-X	Boilers B-X
		Motorized Dampers MD-X

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Charlotte, NC 28209
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22-075

NORTH CAROLINA PROFESSIONAL ENGINEER CRAIG CHAMPION 17209 02-17-2023

JOB NUMBER	22-075
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REVISION DATES

REVISION DESCRIPTION

JOB TITLE
WINDSOR PARK ELEMENTARY
3910 SUDBURY RD
CHARLOTTE, NC, 28205
BAS RENOVATIONS

SHEET TITLE
MECHANICAL FLOOR PLANS

SHEET
M5



1 MECHANICAL FLOOR PLAN
SCALE: 1/16" = 1'-0"

Heating Coil	HC-X
Unit Ventilators	UV-X
Fan Coil Units	FCU-X
Exhaust Fans	EF-X
VAV Boxes	VAV-#-X
Air Handling Units	AH-X
Makeup Air Units	MAU-X
Chiller	CH-X
Pumps	P-X
Condensing Units	CU-X
Boilers	B-X
Motorized Dampers	MD-X
Unit Heater	UH-X

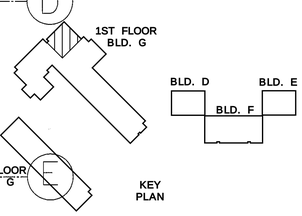
ELECTRICAL NOTE: UTILIZE EXISTING 120V CONTROLS CIRCUITS WHERE POSSIBLE. ADDITIONAL 120V CONTROLS CIRCUITS REQUIRED FOR THIS AREA MAY BE TAKEN FROM EXISTING PANEL 'PP131'. EXISTING PANEL PP131 IS A THREE SECTION, 208Y/120V, 3PH, 4W, 400A MCB SURFACE MOUNTED PANELBOARD

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 M12.



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704/527-2112

22-075

NORTH CAROLINA PROFESSIONAL ENGINEER 17250 CRAIG CHAMPION
02-17-2023

REVISION DESCRIPTION	REVISION DATES

JOB NUMBER 22-075
DRAWN BY
CHECKED BY
DATE 02-17-2023

JOB TITLE
WINDSOR PARK ELEMENTARY
3910 SUDBURY RD
CHARLOTTE, NC, 28205
BAS RENOVATIONS

SHEET TITLE
MECHANICAL FLOOR PLANS

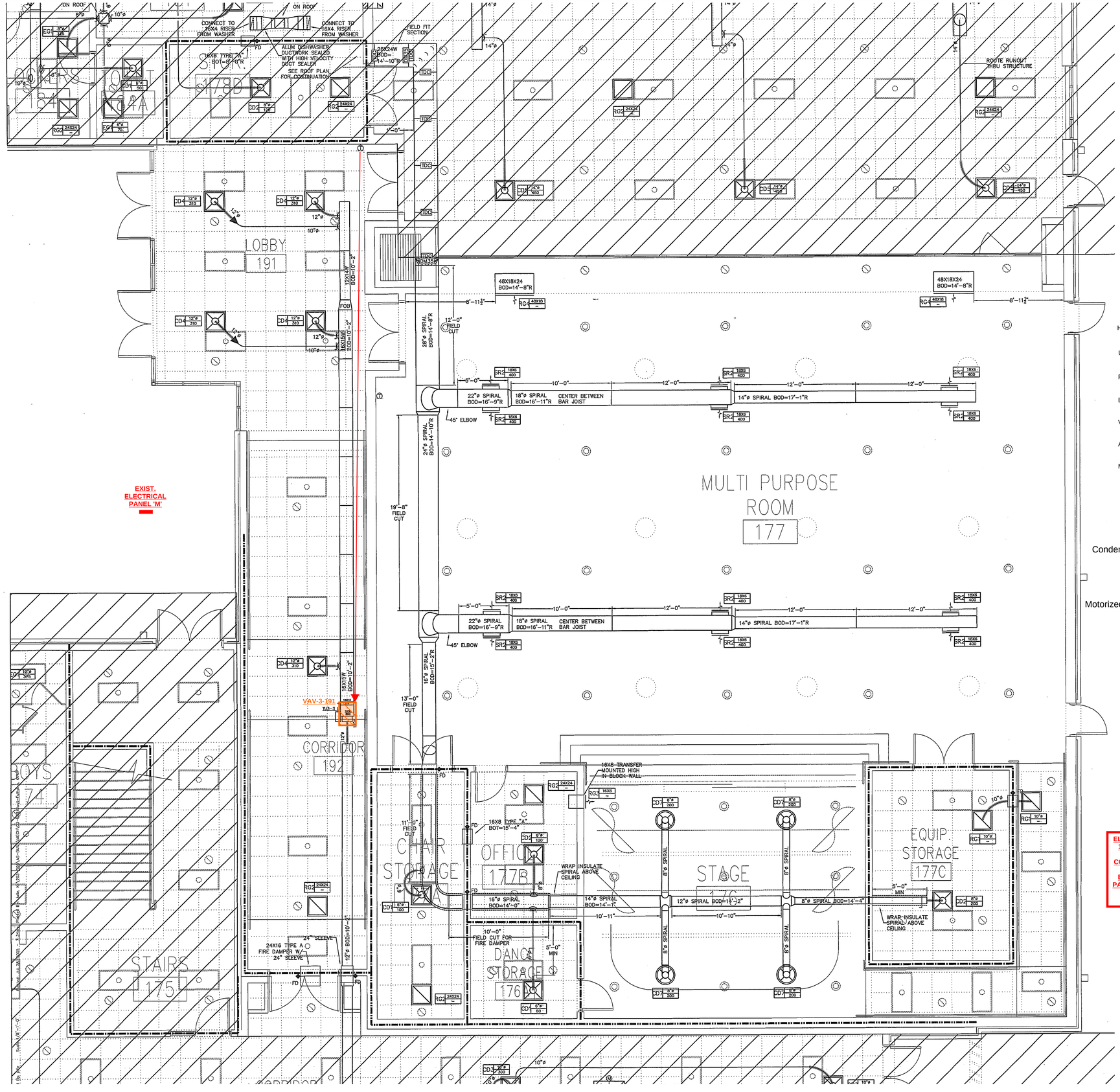
SHEET
M6

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.

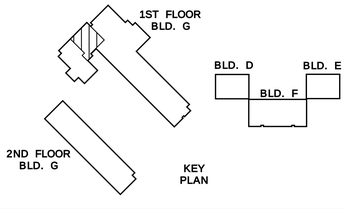
2) REPLACE EXISTING THERMOSTATS WITH NEW TEMPERATURE SENSORS CONNECTED TO BAS. CONTRACTOR TO FIELD VERIFY ALL EXISTING LOCATIONS OF ALL EXISTING THERMOSTATS.

3) REPLACE EXISTING VALVES AND ACTUATORS LIKE-FOR-LIKE. SEE VALVE SCHEDULE ON SHEET M12.



ELECTRICAL NOTE: UTILIZE EXISTING 120V CONTROLS CIRCUITS WHERE POSSIBLE. ADDITIONAL 120V CONTROLS CIRCUITS REQUIRED FOR THIS AREA MAY BE TAKEN FROM EXISTING PANEL 'PP189'. EXISTING PANEL PP189 IS A 208Y/120V, 3PH, 4W, 200A MCB SURFACE MOUNTED PANELBOARD

Heating Coil	HC-X
Unit Ventilators	UV-X
Fan Coil Units	FCU-X
Exhaust Fans	EF-X
VAV Boxes	VAV-#-X
Air Handling Units	AH-X
Makeup Air Units	MAU-X
Chiller	CH-X
Pumps	P-X
Condensing Units	CU-X
Boilers	B-X
Motorized Dampers	MD-X
Unit Heater	UH-X



1 MECHANICAL FLOOR PLAN
SCALE: 1/16" = 1'-0"

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NORTH CAROLINA PROFESSIONAL ENGINEER 17250 ALCRAIG CHAMPION
02-17-2023

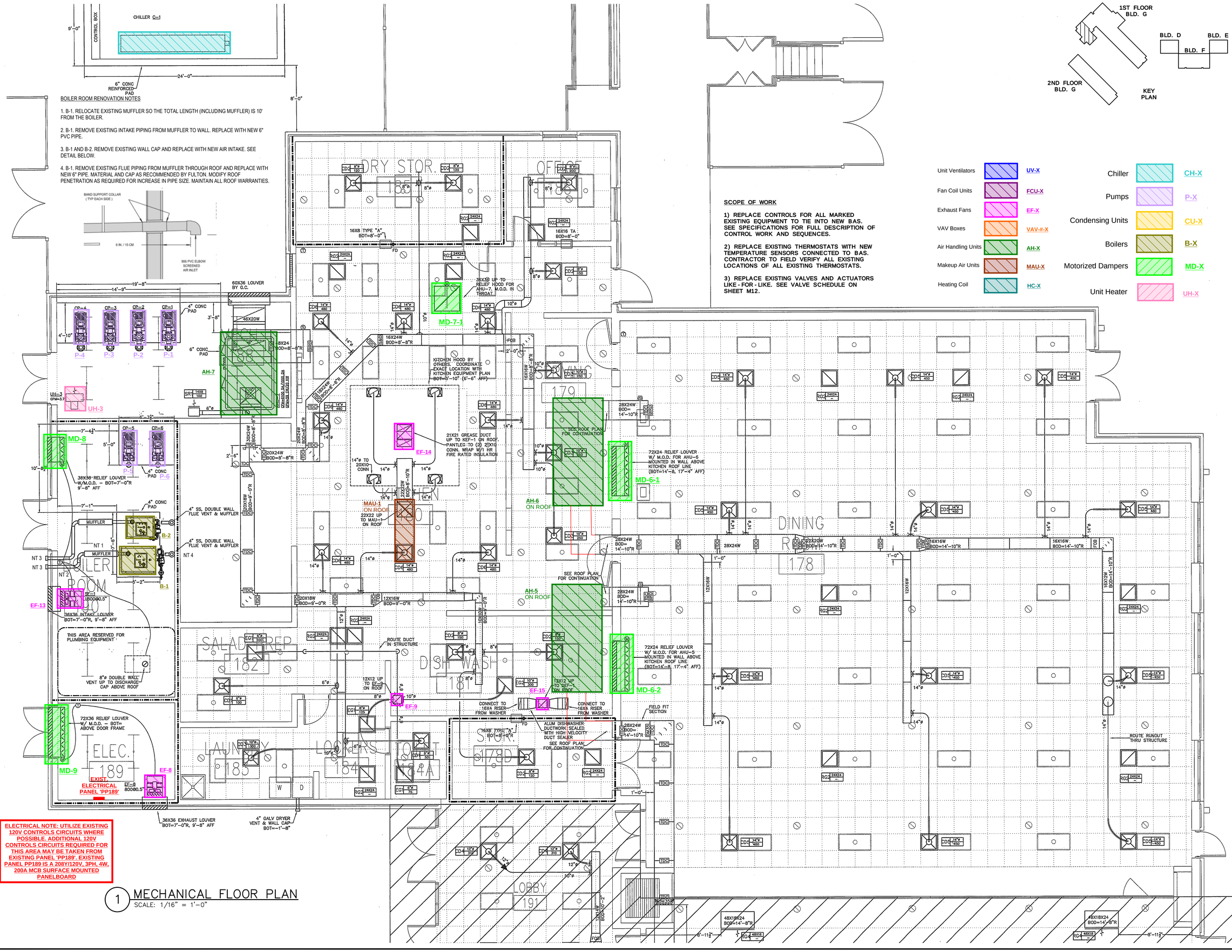
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SHEET TITLE
MECHANICAL FLOOR PLANS

SHEET
M7



1 MECHANICAL FLOOR PLAN
SCALE: 1/16" = 1'-0"

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22-075

NORTH CAROLINA 17250 ENGINEER CHRIS CHAMPION
02-17-2023

REVISION DESCRIPTION	REVISION DATES

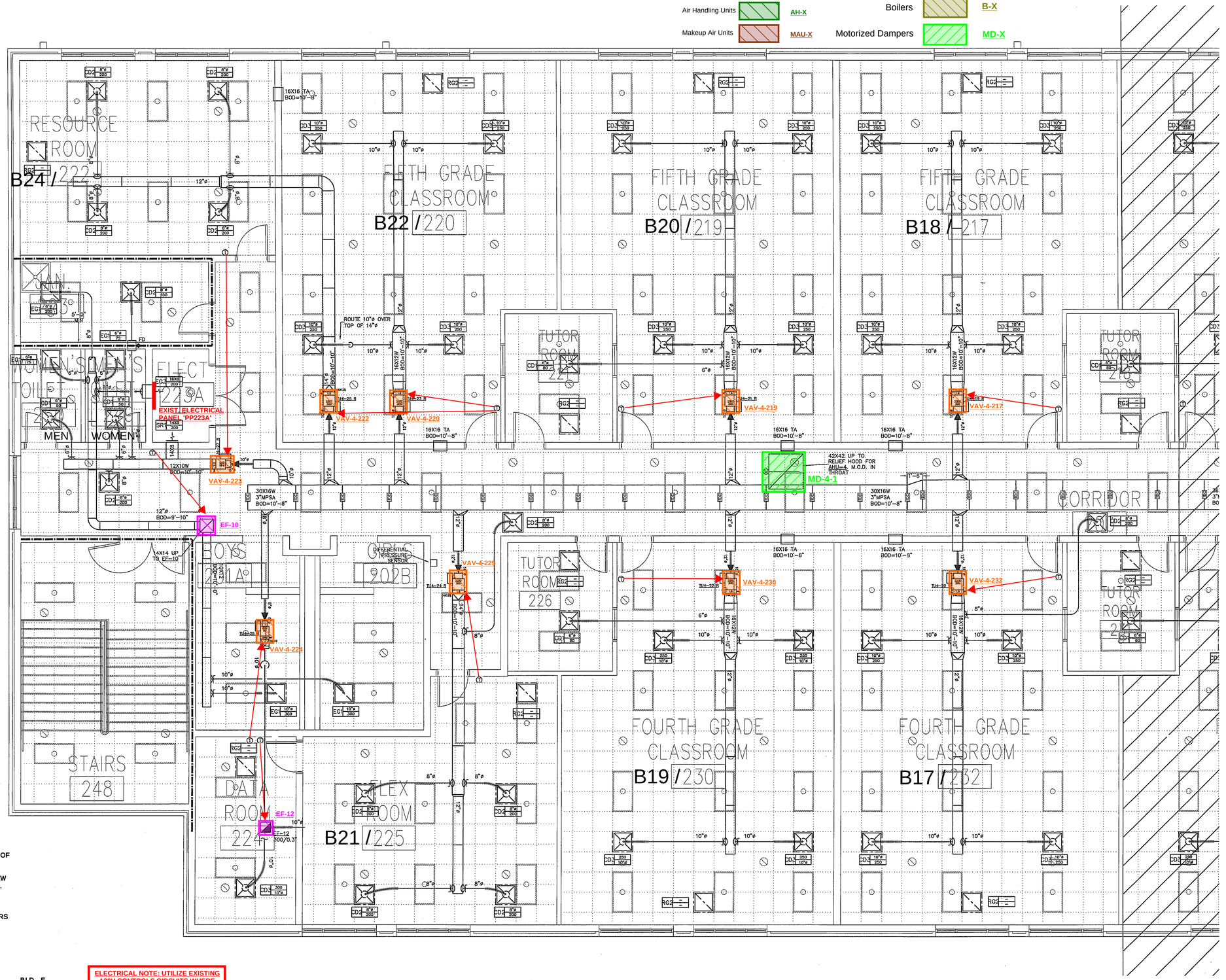
JOB NUMBER 22-075
DRAWN BY
CHECKED BY
DATE 02-17-2023

JOB TITLE
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BAS RENOVATIONS

SHEET TITLE
MECHANICAL FLOOR PLANS

SHEET
M8

Heating Coil — HC-X
Unit Heater — UH-X
Unit Ventilators — UV-X
Fan Coil Units — FCU-X
Exhaust Fans — EF-X
VAV Boxes — VAV-#-X
Air Handling Units — AH-X
Makeup Air Units — MAU-X
Chiller — CH-X
Pumps — P-X
Condensing Units — CU-X
Boilers — B-X
Motorized Dampers — MD-X

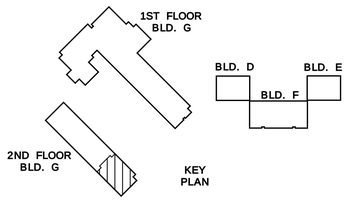


SCOPE OF WORK

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 M12.



ELECTRICAL NOTE: UTILIZE EXISTING 120V CONTROLS CIRCUITS WHERE POSSIBLE. ADDITIONAL 120V CONTROLS CIRCUITS REQUIRED FOR THIS AREA MAY BE TAKEN FROM EXISTING PANEL 'PP223A'. EXISTING PANEL PP223A IS A TWO SECTION, 208Y/120V, 3PH, 4W, 200A MCB SURFACE MOUNTED PANELBOARD

1 MECHANICAL FLOOR PLAN
SCALE: 1/16" = 1'-0"

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NORTH CAROLINA PROFESSIONAL ENGINEER 17250 CRAIG CHAMPION
02-17-2023

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JOB TITLE
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SHEET TITLE
MECHANICAL FLOOR PLANS

SHEET
M9

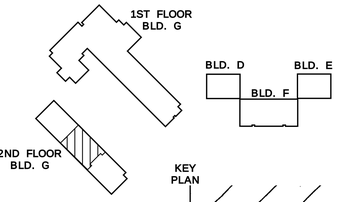
SCOPE OF WORK

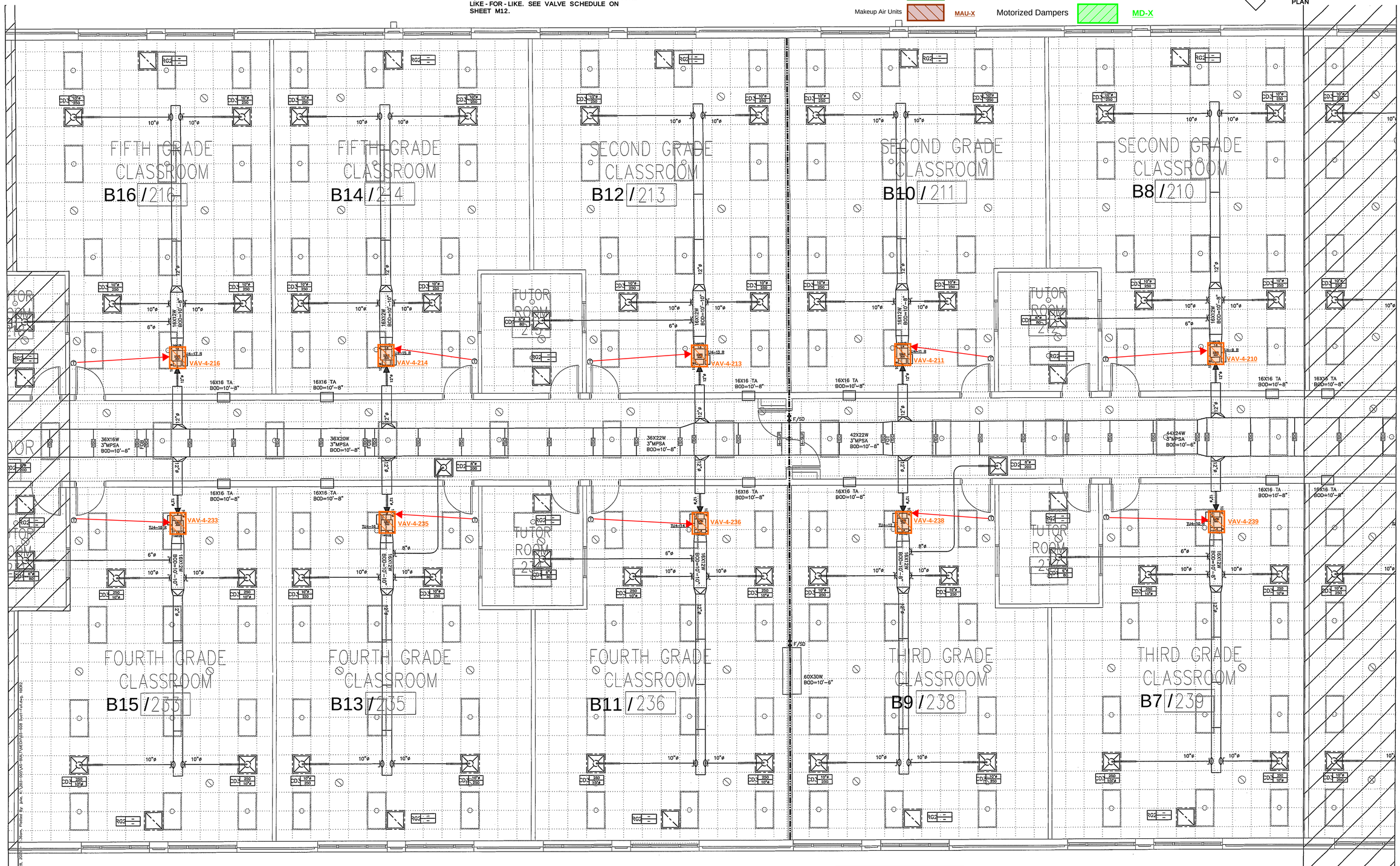
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2) REPLACE EXISTING THERMOSTATS WITH NEW TEMPERATURE SENSORS CONNECTED TO BAS. CONTRACTOR TO FIELD VERIFY ALL EXISTING LOCATIONS OF ALL EXISTING THERMOSTATS.

3) REPLACE EXISTING VALVES AND ACTUATORS LIKE-FOR-LIKE. SEE VALVE SCHEDULE ON SHEET M12.

Heating Coil	HC-X	Unit Ventilators	UV-X	Chiller	CH-X
Unit Heater	UH-X	Fan Coil Units	FCU-X	Pumps	P-X
		Exhaust Fans	EF-X	Condensing Units	CU-X
		VAV Boxes	VAV-#-X	Boilers	B-X
		Air Handling Units	AH-X	Motorized Dampers	MD-X
		Makeup Air Units	MAU-X		





1 MECHANICAL FLOOR PLAN
SCALE: 1/16" = 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 'PP223A'. EXISTING PANEL PP223A IS A TWO SECTION, 208Y/120V, 3PH, 4W, 200A MCB SURFACE MOUNTED PANELBOARD

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NORTH CAROLINA PROFESSIONAL ENGINEER 17250 CHANG CHAMPION
02-17-2023

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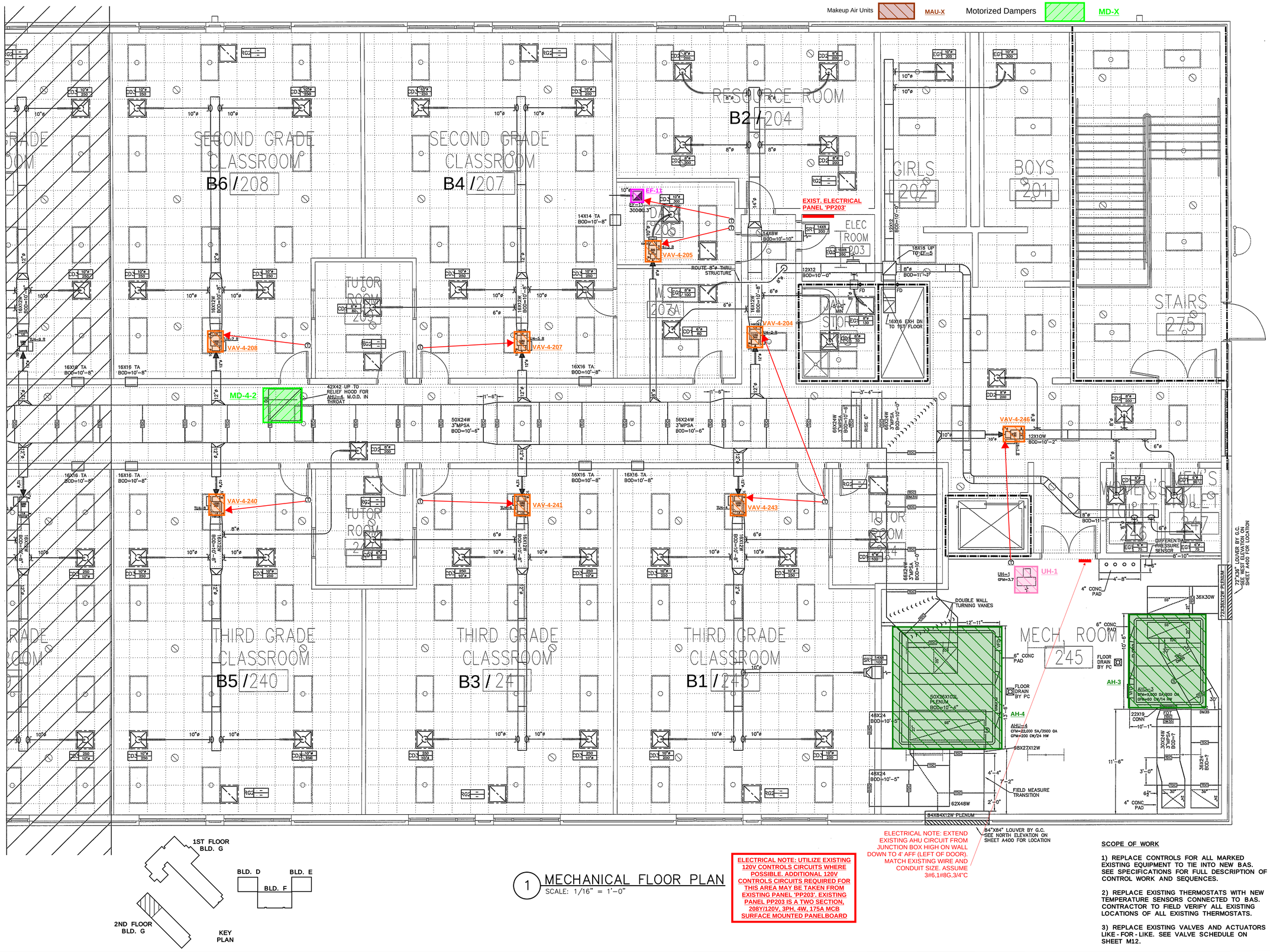
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JOB TITLE
WINDSOR PARK ELEMENTARY
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BAS RENOVATIONS

SHEET TITLE
MECHANICAL FLOOR PLANS

SHEET
M10

Heating Coil — HC-X
Unit Ventilators — UV-X
Fan Coil Units — FCU-X
Exhaust Fans — EF-X
VAV Boxes — VAV-#-X
Air Handling Units — AH-X
Makeup Air Units — MAU-X
Chiller — CH-X
Pumps — P-X
Condensing Units — CU-X
Boilers — B-X
Motorized Dampers — MD-X
Unit Heater — UH-X



1 MECHANICAL FLOOR PLAN
SCALE: 1/16" = 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 'PP203'. EXISTING PANEL PP203 IS A TWO SECTION, 208Y/120V, 3PH, 4W, 175A MCB SURFACE MOUNTED PANELBOARD

ELECTRICAL NOTE: EXTEND EXISTING AHU CIRCUIT FROM JUNCTION BOX HIGH ON WALL DOWN TO 4' AFF (LEFT OF DOOR). MATCH EXISTING WIRE AND CONDUIT SIZE. ASSUME 3#6,1#8G,3/4"C

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 M12.

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NORTH CAROLINA — JEFFREY S. CHANZA — 17250 — ENGINEER — ELECTRICAL — CHAMPION
02-17-2023

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JOB NUMBER 22-075
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BAS RENOVATIONS

SHEET TITLE
MECHANICAL FLOOR PLANS

SHEET
M11

HEATING HOT WATER BOILER PLANT (WITH PRIMARY PUMPS)

A. THE BOILER PLANT CONSISTS OF TWO (2) INDEPENDENT, BUT SYNCHRONIZED BOILERS.

B. 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 LEAD BOILER. THE LEAD BOILER CIRCULATING (PRIMARY) 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.

C. 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 BOILERS 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.

D. UPON THE BOILERS CYCLING OFF, CONTINUE RUNNING THE HOT WATER (PRIMARY) PUMPS FOR 15 MINUTES (ADJ.). AFTER THE HOT WATER (PRIMARY) PUMPS CYCLE OFF, CLOSE BOILER ISOLATION VALVES.

E. BOILER CONTROL BY BOILER MANUFACTURER:

1. THE BOILER LEAD/LAG SEQUENCE SHALL BE BASED ON NUMBER OF CYCLES. FROM THE BAS CONTROLLER HUMAN- INTERFACE PANEL OR A BAS WORKSTATION, AN OPERATOR SHALL BE ABLE TO MANUALLY CHANGE THE LEAD/LAG SEQUENCE.
2. UPON A CALL FOR HEAT, THE ISOLATION VALVE ON THE LEAD BOILER OPENS. AFTER THE VALVE IS PROVEN OPEN THE PUMPS START.
3. BOILERS SHALL RECEIVE A 4-20mA SETPOINT SIGNAL. 4Ma = 120F. 20mA = 160F.
4. COORDINATE BOILER SEQUENCE WITH BOILER MANUFACTURE (FULTON). ALL WIRING FOR BOILER CONTROL SYSTEM SHALL BE BY A QUALIFIED BOILER TECHNICIAN.

J. HOT WATER RESET:

1. UPON OUTSIDE AIR TEMPERATURE RISING ABOVE 40 DEG F (ADJ.), THE HOT WATER SUPPLY TEMPERATURE SETPOINT SHALL LINEARLY RESET FROM 160.0 DEG. F (ADJ.) TO 120.0 DEG. F (ADJ.) AT 60 DEG F (ADJ.) AND ABOVE,

K. HOT WATER DISTRIBUTION PUMP START/STOP:

1. THE BAS CONTROLLER SHALL START A HOT WATER PUMP THROUGH A CONTACT CLOSURE OF THE PUMP'S VARIABLE FREQUENCY DRIVE (VFD) RUN-ENABLE CONTACTS.

L. HOT WATER DISTRIBUTION PUMP STATUS:

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

M. HOT WATER DISTRIBUTION PUMP LEAD/LAG:

1. 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.
2. IF THE LEAD PUMP SPEED FALLS BELOW 40% (ADJ.) FOR FIVE MINUTES (ADJ.) THE LAG PUMP SHALL BE DISABLED.

N. HOT WATER DISTRIBUTION PUMP FAILURE:

1. 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.

O. HOT WATER DISTRIBUTION PUMP SPEED:

1. THE BAS CONTROLLER SHALL MONITOR THE HOT WATER SYSTEM DIFFERENTIAL PRESSURE SENSOR. WHEN THE PUMP VFD IS ENABLED, THE BAS CONTROLLER SHALL CONTROL THE ANALOG SPEED SIGNAL SENT TO THE PUMP VFD TO MAINTAIN A HOT WATER DIFFERENTIAL PRESSURE SETPOINT OF 15.0 PSIG (ADJ.).

P. FREEZE PROTECTION:

1. 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.

Q. A MINIMUM OF 2 PRESSURE DIFFERENTIAL SENSORS ARE REQUIRED.

R. PROVIDE A CARBON MONOXIDE/OXYGEN DEPLETION SENSOR IN BOILER ROOM AS INDICATED. SENSOR SHALL ACTIVATE AN AUDIBLE AND VISIBLE ALARM INSIDE THE BOILER ROOM, SHUT DOWN THE BOILERS, ACTIVATE THE VENTILATION FANS, AND SEND AN ALARM TO THE CENTRAL BAS IF ACTIVATED.

S. INTERLOCK FAN EF-13 TO START ANYTIME EITHER THE BOILERS OR THE DOMESTIC WATER HEATER IS IN OPERATION.

MOTORIZED DAMPERS

New Unit Tag	Original Tag	Serves	Volts	Phase
MD-1-1	MD-1-1	AHU-1	208-230	1
MD-1-2	MD-1-2	AHU-1	208-230	1
MD-1-3	MD-1-3	AHU-1	208-230	1
MD-2-1	MD-2-1	AHU-2	208-230	1
MD-3-1	MD-1-5	FCU-5	208-230	1
MD-6-1	MD-1-6	FCU-6	208-230	1
MD-6-2	MD-1-7	FCU-7	208-230	1
MD-7-1	MD-1-7	FCU-7	208-230	1
MD-8	MD-10	FCU-8	208-230	1
MD-9	MD-10	FCU-9	208-230	1
MD-4-1	MD-8	AHU-4	208-230	1
MD-4-2	MD-9	AHU-4	208-231	1

EXISTING BOILERS TO REMAIN

Unit Tag	Capacity (MBH)		Flowrate		Type
	Gross	Net (H2O)	GPM	Delta T (F)	
B-1	1400	1204	200	20	PULSE COMBUSTION
B-2	1000	930	200	20	PULSE COMBUSTION

EXISTING AIR HANDLING UNITS TO REMAIN

UNIT TAG	FAN SPEED CONTROL	CFM		FAN MOTOR			
		SA	MIN. OA	QTY	HP (ea)	VOLTS	PHS
AH-1	VAV	19,000	3,500	1	20	460	3
AH-2	VAV	8,000	600	1	15	460	3
AH-3	VAV	9,000	800	1	15	460	3
AH-4	VAV	22,000	3,500	1	25	460	3
AH-5	CAV	6,000	1,250	1	7.5	460	3
AH-6	CAV	5,400	1,000	1	7.5	460	3
AH-7	CAV	6,000	1,000	1	7.5	460	3

EXISTING PUMPS TO REMAIN

Unit Tag	Service	GPM	Head (ft.)	RPM	HP	Volts	Phase
P-1	CH-1	576	40	1750	7.5	460	3
P-2	CH-1	576	40	1750	7.5	460	3
P-3*	CHILLED WATER SYSTEM	288	45	1750	7.5	460	3
P-4*	CHILLED WATER SYSTEM	288	45	1750	7.5	460	3
P-5*	HOT WATER SYSTEM	100	80	1750	5	460	3
P-6*	HOT WATER SYSTEM	100	80	1750	5	460	3

* New VFDs

EXISTING FAN COIL UNITS TO REMAIN

Unit Tag	Supply Air CFM	Motor			
		Qty	HP (Watts)	Volts	Phs
FCU-1	550	1	1/30	208	1

EXISTING CHILLERS TO REMAIN

Unit Tag	Performance				Electrical Data	
	Tons	Evaporator		GPM	Unit	
		EWT (F)	LWT (F)		Volt	Phs.
CH-1	250	54	44	561	460	3

EXISTING CONDENSING UNITS TO REMAIN

Unit Tag	Serves	Volts	Phase
CU-1	FCU-1	208-230	1

EXISITING FANS TO REMAIN

Unit Tag	CFM	HP (Watts)	Volts	Phase	Type
EF-1	400	224	115	1	CEILING
EF-2	200	83	115	1	CEILING
EF-3	3,140	1.5	460	3	IN-LINE
EF-4	400	224	115	1	CEILING
EF-5	3,200	1	460	3	CENTRIFUGAL
EF-6	360	1/6	115	1	CENTRIFUGAL
EF-7	100	1/16	115	1	CENTRIFUGAL
EF-8	800	1/6	115	1	PROP.
EF-9	600	1/4	115	1	CENTRIFUGAL
EF-10	1,200	1/3	115	1	CENTRIFUGAL
EF-11	300	1/8	115	1	CENTRIFUGAL
EF-12	300	1/8	115	1	CENTRIFUGAL
EF-13	1,800	1/3	115	1	PROP.
EF-14	4,800	2	460	3	CENTRIFUGAL
EF-15	600	1/4	115	1	CENTRIFUGAL

EXISTING VAVs TO REMAIN

Unit Tag	CFM		HHW GPM
	Cooling Maximum CFM	Cooling Minimum CFM	
VAV-1-171	500	0	-
VAV-1-170	880	880	1.6
VAV-1-137	1,150	300	1.8
VAV-1-166	400	0	-
VAV-1-138	3,000	300	1.8
VAV-1-165	1,400	300	2.1
VAV-1-139	1,200	300	1.8
VAV-1-161	1,080	300	1.8
VAV-1-141	1,080	300	1.8
VAV-1-159	1,000	300	1.8
VAV-1-142	1,080	300	1.8
VAV-1-158	1,080	300	1.8
VAV-1-144	1,200	300	1.8
VAV-1-156	1,000	300	1.8
VAV-1-145	1,080	300	1.8
VAV-1-155	1,080	300	1.8
VAV-1-147	1,200	300	1.8
VAV-1-153	1,000	300	1.8
VAV-1-151	400	50	0.5
VAV-1-162	800	800	1.5
VAV-2-122	550	550	1
VAV-2-129	850	600	0.9
VAV-2-128	700	70	0.6
VAV-3-133	1,500	700	2.1
VAV-3-100	2,000	1000	2.9
VAV-3-191	1,600	800	2.4
VAV-3-118	300	50	0.3
VAV-3-119	300	50	0.3
VAV-3-113	330	50	0.3
VAV-3-112	730	100	1.2
VAV-3-101	1,100	200	1.8
VAV-3-117	500	100	0.5
VAV-3-105	550	100	0.9
VAV-3-103	200	40	0.2
VAV-3-115	450	50	0.4
VAV-3-110	760	100	1.2
VAV-3-106	550	100	0.9
VAV-3-126	600	60	-
VAV-4-246	500	500	1.5
VAV-4-204	1,150	300	1.8
VAV-4-205	300	50	-
VAV-4-243	1,100	300	1.8
VAV-4-207	1,080	300	1.8
VAV-4-241	1,080	300	1.8
VAV-4-208	1,000	300	1.8
VAV-4-240	1,200	300	1.8
VAV-4-210	1,080	300	1.8
VAV-4-239	1,080	300	1.8
VAV-4-211	1,000	300	1.8
VAV-4-238	1,200	300	1.8
VAV-4-213	1,080	300	1.8
VAV-4-236	1,080	300	1.8
VAV-4-214	1,200	300	1.8
VAV-4-235	1,000	300	1.8
VAV-4-216	1,080	300	1.8
VAV-4-233	1,080	300	1.8
VAV-4-217	1,200	300	1.8
VAV-4-232	1,000	300	1.8
VAV-4-219	1,080	300	1.8
VAV-4-230	1,080	300	1.8
VAV-4-220	1,200	300	1.8
VAV-4-225	800	300	1.8
VAV-4-222	800	300	1.5
VAV-4-224	300	50	0.4
VAV-4-223	650	400	1.2

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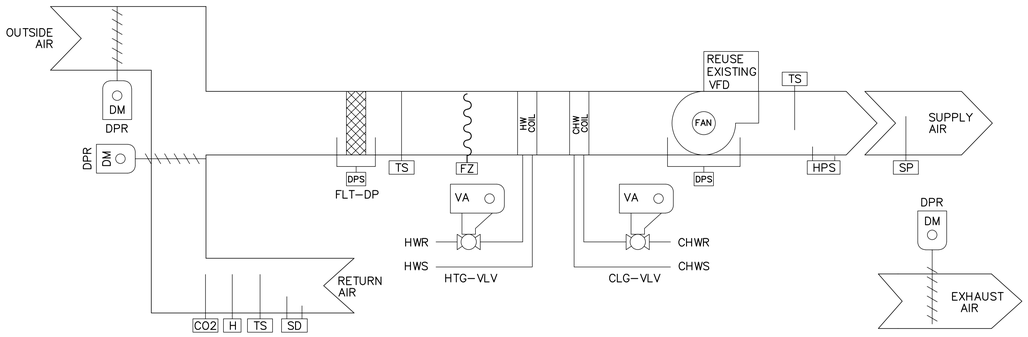
PROFESSIONAL ENGINEER
02-17-2023

REVISION DESCRIPTION
REVISION DATES
22-075
02-17-2023
JOB NUMBER
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DATE

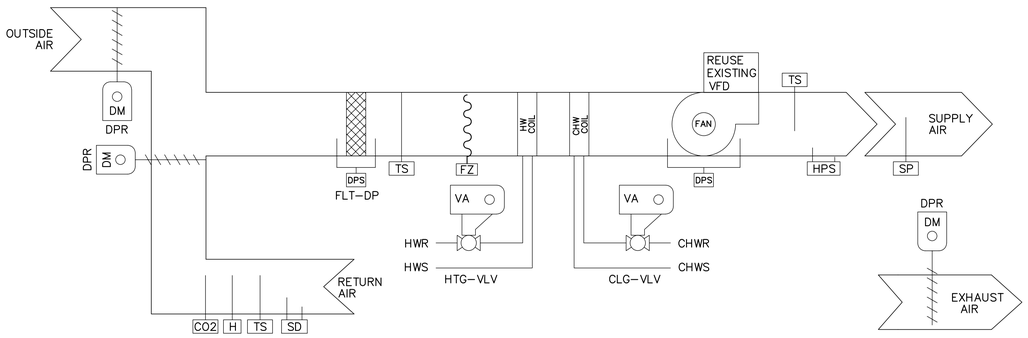
JOB TITLE
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BAS RENOVATIONS

SHEET TITLE
MECHANICAL SCHEDULES

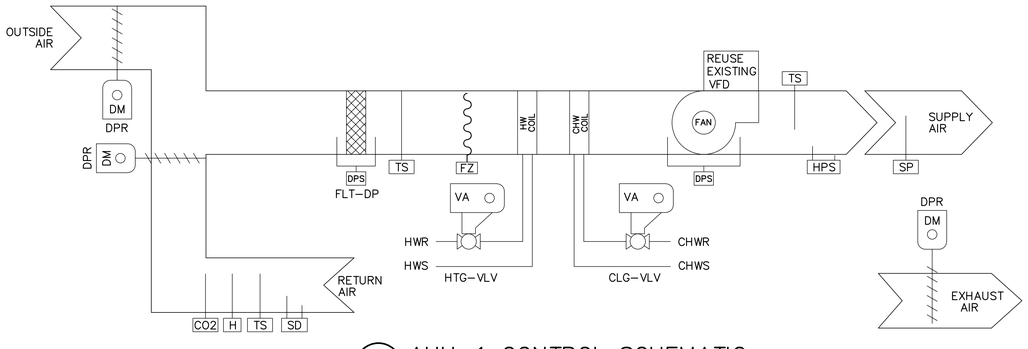
SHEET
M12



3 AHU–4 CONTROL SCHEMATIC
NTS



2 AHU–3 CONTROL SCHEMATIC
NTS



1 AHU–1 CONTROL SCHEMATIC
NTS

VARIABLE AIR VOLUME CHILLED WATER AIR HANDLING UNIT OPERATION

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, HEATING COIL CONTROL VALVE SHALL CLOSE, COOLING COIL CONTROL VALVE SHALL CLOSE, 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 COOLING 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.

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

THE COOLING COIL VALVE SHALL OPEN TO 50% (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.

Variable Air Volume - AHU - CH Water

	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
Cooling Valve		x							x		x
Exhaust Air Damper		x									x
Preheating Valve		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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PROFESSIONAL ENGINEER
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3910 SUDBURY RD
CHARLOTTE, NC, 28205
BAS RENOVATIONS

SHEET TITLE
MECHANICAL CONTROL SCHEMATICS

SHEET
M13

CONSTANT AIR VOLUME CHILLED WATER AIR HANDLING UNIT OPERATION

THE BUILDING AUTOMATION SYSTEM (BAS) SHALL PERFORM THE FOLLOWING SINGLE ZONE VAV AIR SYSTEM (SZVAS) 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 SZVAV AIR HANDLER IS STARTED PRIOR TO WHEN THE SPACE BEING SERVED BY THE SZVAS 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 SZVAS 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 SZVAV 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 SZVAS FROM STARTING PRIOR TO 120 MINUTES (ADJUSTABLE) BEFORE SCHEDULED OCCUPANCY.

THE SZVAS SHALL TRANSITION FROM OPTIMAL START MODE TO OCCUPIED MODE WHEN THE CURRENT TIME IS EQUAL TO THE SCHEDULED START TIME. DURING OPTIMAL START MODE, THE DAMPERS FOR VAV TERMINAL UNITS 2-122, 2-128 AND 2-129 SHALL BE FULLY OPEN.

1. COOLING:

THE BAS SHALL INITIATE THE OPTIMAL START - COOLING MODE WHEN OPTIMAL START MODE FOR THE SZVAS 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 SZVAS IS COOLING AND THE SPACE TEMPERATURE IS ABOVE THE OCCUPIED COOLING SET-POINT.

THE COOLING COIL CONTROL VALVE SHALL FULLY OPEN AND THE AIR HANDLER FAN SHALL OPERATE AT LOW SPEED UNTIL THE SPACE TEMPERATURE IN THE MEDIA CENTER IS SATISFIED. UPON A FURTHER RISE IN SPACE TEMPERATURE, FAN VARIABLE FREQUENCY DRIVE SHALL INCREASE AIR FLOW TO SATISFY SPACE TEMPERATURE. THE TERMINAL UNIT DAMPERS MAY MODULATE TO MINIMUM POSITION DURING OPTIMUM START IF THEY MEET SETPOINT PRIOR TO THE MEDIA CENTER.

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 SZVAS IS HEATING AND THE AVERAGE SPACE TEMPERATURE IS BELOW THE SET-POINT.

THE REHEAT COIL CONTROL VALVE FOR HC-2-1 AND THE HOT WATER COIL CONTROL VALVES FOR THE TERMINAL UNITS SHALL FULLY OPEN AND THE AIR HANDLER FAN SHALL OPERATE AT LOW SPEED DURING HEATING MODE.

UNOCCUPIED MODE:

THE BAS SHALL PLACE THE MEMBERS OF THE SZVAV 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 ZONE HAS BEEN COMMANDED TO UNOCCUPIED, THE SZVAS SHALL COMMAND THE ASSOCIATED AHU TO UNOCCUPIED MODE. SUPPLY FAN SHALL BE SHUT DOWN, HEATING COIL CONTROL VALVE SHALL CLOSE, COOLING COIL CONTROL VALVE SHALL CLOSE, OUTDOOR AIR DAMPER SHALL BE CLOSED, AND ALL VENTILATION FUNCTIONS SHALL BE DISABLED.

NIGHT SETBACK MODE:

DURING SCHEDULED UNOCCUPIED HOURS, THE SZVAV 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 AT LOW SPEED, TERMINAL UNIT DAMPERS SHALL OPEN, REHEAT COIL CONTROL VALVE SHALL FULLY OPEN.

THE BAS SHALL INITIATE THE NIGHT HEATING MODE WHEN THE TEMPERATURE FOR THE SPACE BEING SERVED BY THE SZVAS 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) IN THE MEDIA CENTER. VAV TERMINAL UNITS SHALL MODULATE DAMPER TO MINIMUM AND CLOSE CONTROL VALVE IF SPACES MEET HEATING CRITERIA.

2. COOLING:

AHU SUPPLY FAN ENERGIZED AT LOW SPEED, COOLING COIL CONTROL VALVE SHALL FULLY OPEN.

THE BAS SHALL INITIATE THE NIGHT COOLING MODE WHEN THE TEMPERATURE FOR THE SPACE BEING SERVED BY THE SZVAS 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). VAV TERMINAL UNITS SHALL MODULATE DAMPER TO MINIMUM AND CLOSE CONTROL VALVE IF SPACES MEET HEATING CRITERIA

OCCUPIED MODE COOLING CONTROL:

THE COOLING COIL CONTROL VALVE SHALL MODULATE OPEN, AND THE FAN VARIABLE FREQUENCY DRIVE SHALL MODULATE TO MAINTAIN THE SPACE TEMPERATURE IN THE MEDIA CENTER. THE VAV TERMINAL UNIT DAMPERS SHALL MODULATE TO MAINTAIN SPACE TEMPERATURE IN THEIR SPACES.

OCCUPIED MODE HEATING CONTROL:

THE FAN VARIABLE FREQUENCY DRIVE SHALL MODULATE TO MAXIMUM SPEED AND THE UNIT MIXED AIR DAMPERS SHALL MODULATE TO MAINTAIN 60F DISCHARGE AIR TEMPERATURE. THE MEDIA CENTER REHEAT COIL CONTROL VALVE SHALL MODULATE MAINTAIN THE SPACE TEMPERATURE. THE VAV TERMINAL UNITS SHALL MODULATE UNDER THEIR OWN CONTROL TO MAINTAIN SPACE 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 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.

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

THE COOLING COIL VALVE SHALL OPEN TO 50% (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 FOLLOWNG SHALL DE-ENERGIZE THE AHU SUPPLY FAN: DUCT DETECTOR, LOW LIMIT THERMOSTAT ACTIVATION, HIGH PRESSURE SWITCH (4"-6" ADJUSTABLE).

BUILDING PRESSURIZATION:

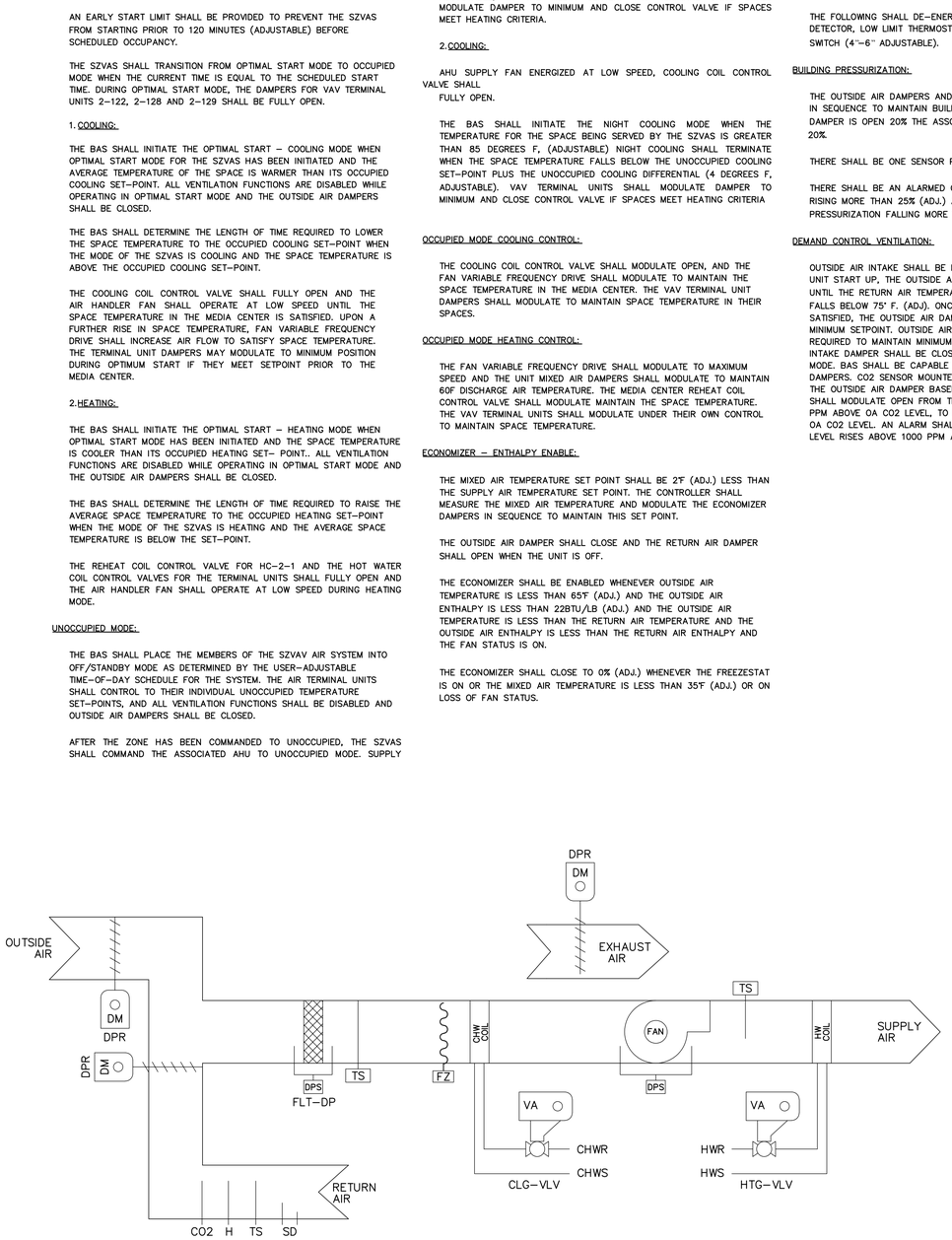
THE OUTSIDE AIR DAMPERS AND RELIEF AIR DAMPERS SHALL MODULATE IN SEQUENCE TO MAINTAIN BUILDING PRESSURE. FOR EXAMPLE IF THE OA DAMPER IS OPEN 20% THE ASSOCIATED RELIEF AIR DAMPERS SHALL OPEN 20%.

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.



1 AHU-2 CONTROL SCHEMATIC
NTS

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.

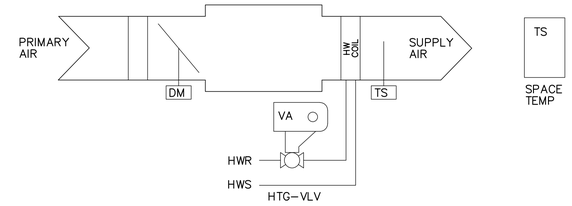
THE BUILDING AUTOMATION SYSTEM SHALL PROVIDE THE ABILITY TO AUTOMATICALLY COMMISSION AND CALIBRATE THE TERMINAL AIR SYSTEM. THE FOLLOWING TESTS SHALL BE PERFORMED, AT A MINIMUM: CALIBRATION OF THE AIR VALVE/DAMPER, VERIFICATION OF AIR FLOW THROUGH THE TERMINAL BOX, VERIFICATION OF LOCAL REHEAT PERFORMANCE.

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).



2 SINGLE INLET TERMINAL UNIT CONTROL SCHEMATIC
NTS

Air Terminal Unit	Hardware Points				Software Points						
Point Name	AI	AO	BI	BO	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			
Zone CO2	x									x	x

Constant Air Volume - AHU - CH Water	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 Humidity (*can be one for building)	x*				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
Zone 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
Cooling Valve		x							x		x
Mixed Air Dampers		x							x		x
Duct Mounted Coil Heating 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
Cooling Setpoint					x				x		x
Supply Fan Start/Stop				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	
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

McKNIGHT·SMITH WARD · GRIFFIN
ENGINEERS, INCORPORATED
4223 South Boulevard
Charlotte, NC 28209
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22-075

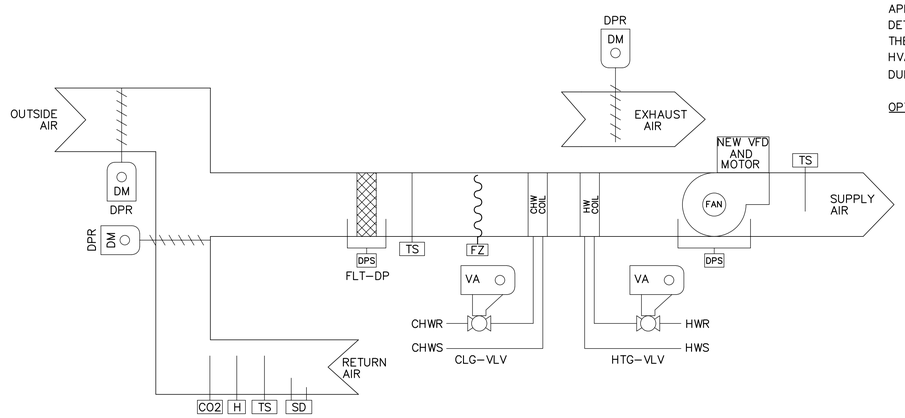
PROFESSIONAL ENGINEER
02-17-2023

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REVISION DATES
JOB NUMBER 22-075
DRAWN BY
CHECKED BY
DATE 02-17-2023

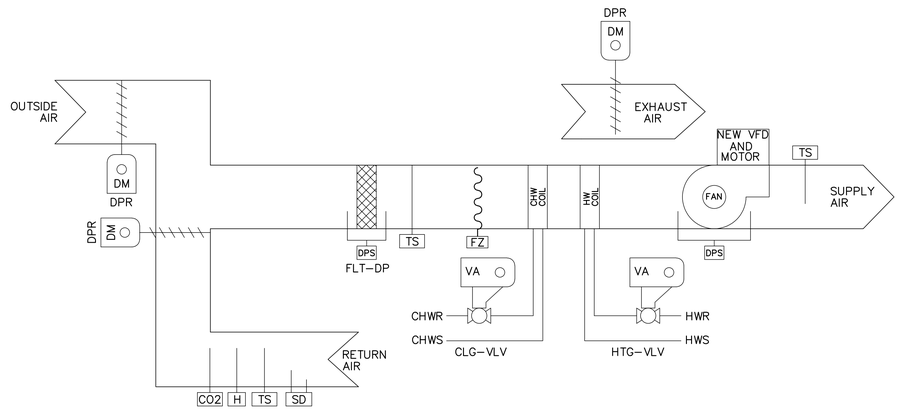
JOB TITLE
WINDSOR PARK ELEMENTARY
3910 SUDBURY RD
CHARLOTTE, NC, 28205
BAS RENOVATIONS

SHEET TITLE
MECHANICAL CONTROL SCHEMATICS

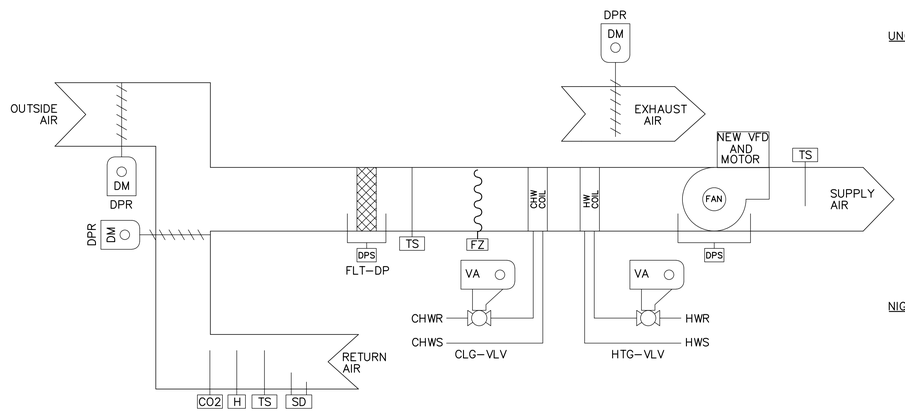
SHEET
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3 AHU–7 CONTROL SCHEMATIC
NTS



2 AHU–6 CONTROL SCHEMATIC
NTS



1 AHU–5 CONTROL SCHEMATIC
NTS

SINGLE ZONE VARIABLE AIR VOLUME CHILLED WATER AIR HANDLING UNIT OPERATION

THE BUILDING AUTOMATION SYSTEM (BAS) SHALL PERFORM THE FOLLOWING SINGLE ZONE VAV AIR SYSTEM (SZVAS) 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 SZVAV AIR HANDLER IS STARTED PRIOR TO WHEN THE SPACE BEING SERVED BY THE SZVAS 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 SZVAS 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 SZVAV 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 SZVAS FROM STARTING PRIOR TO 120 MINUTES (ADJUSTABLE) BEFORE SCHEDULED OCCUPANCY.

THE SZVAS 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 SZVAS 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 SZVAS IS COOLING AND THE SPACE TEMPERATURE IS ABOVE THE OCCUPIED COOLING SET–POINT.

THE COOLING COIL CONTROL VALVE SHALL FULLY OPEN AND THE AIR HANDLER FAN SHALL OPERATE AT LOW SPEED UNTIL THE SPACE TEMPERATURE IS SATISFIED. UPON A FURTHER RISE IN SPACE TEMPERATURE, FAN VARIABLE FREQUENCY DRIVE SHALL INCREASE AIR FLOW TO SATISFY SPACE TEMPERATURE.

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 SZVAS IS HEATING AND THE AVERAGE SPACE TEMPERATURE IS BELOW THE SET–POINT.

THE PREHEAT COIL CONTROL VALVE SHALL FULLY OPEN AND THE AIR HANDLER FAN SHALL OPERATE AT LOW SPEED DURING HEATING MODE. UPON A FURTHER DROP IN SPACE TEMPERATURE, THE REHEAT COIL CONTROL VALVE SHALL MODULATE OPEN.

UNOCCUPIED MODE:

THE BAS SHALL PLACE THE MEMBERS OF THE SZVAV 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 ZONE HAS BEEN COMMANDED TO UNOCCUPIED, THE SZVAS SHALL COMMAND THE ASSOCIATED AHU TO UNOCCUPIED MODE. SUPPLY FAN SHALL BE SHUT DOWN, HEATING COIL CONTROL VALVE SHALL CLOSE, COOLING COIL CONTROL VALVE SHALL CLOSE, OUTDOOR AIR DAMPER SHALL BE CLOSED, AND ALL VENTILATION FUNCTIONS SHALL BE DISABLED.

NIGHT SETBACK MODE:

DURING SCHEDULED UNOCCUPIED HOURS, THE SZVAV 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 AT LOW SPEED, PREHEAT COIL CONTROL VALVE SHALL FULLY OPEN.

THE BAS SHALL INITIATE THE NIGHT HEATING MODE WHEN THE TEMPERATURE FOR THE SPACE BEING SERVED BY THE SZVAS 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 AT LOW SPEED, COOLING COIL CONTROL VALVE SHALL FULLY OPEN.

THE BAS SHALL INITIATE THE NIGHT COOLING MODE WHEN THE TEMPERATURE FOR THE SPACE BEING SERVED BY THE SZVAS 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 COOLING COIL CONTROL VALVE SHALL MODULATE OPEN, AND THE FAN VARIABLE FREQUENCY DRIVE SHALL MODULATE TO MAINTAIN THE SPACE TEMPERATURE.

OCCUPIED MODE HEATING CONTROL:

THE FAN VARIABLE FREQUENCY DRIVE SHALL MODULATE TO MAXIMUM SPEED AND THE PREHEAT COIL CONTROL VALVE SHALL MODULATE MAINTAIN THE SPACE 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 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.

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

THE COOLING COIL VALVE SHALL OPEN TO 50% (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

Single Zone Variable Air Volume - AHU - CH Water

	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 Humidity (*can be one for building)	x*				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
Zone Setpoint Adjust	x										x
Zone Temp	x								x		x
Cooling Valve		x							x		x
Preheating Valve		x							x		x
Mixed Air Dampers		x							x		x
Supply Fan VFD Speed		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 VFD Fault			x							x	x
Cooling Setpoint					x				x		x
Supply Fan Start/Stop				x					x		x
Economizer Mixed Air Temp Setpoint					x				x		x
Return Air Carbon Dioxide PPM Setpoint					x				x		x
Emergency Shutdown						x			x	x	x
High Return Air Carbon Dioxde 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

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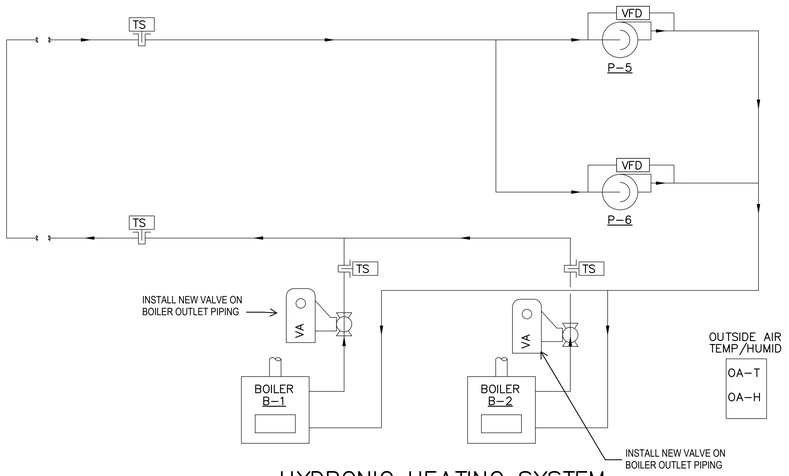
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02–17–2023

REVISION DESCRIPTION	REVISION DATES	JOB NUMBER	DRAWN BY	CHECKED BY	DATE
		22–075			02–17–2023

JOB TITLE
WINDSOR PARK ELEMENTARY
3910 SUDBURY RD
CHARLOTTE, NC, 28205
BAS RENOVATIONS

SHEET TITLE
MECHANICAL CONTROL SCHEMATICS

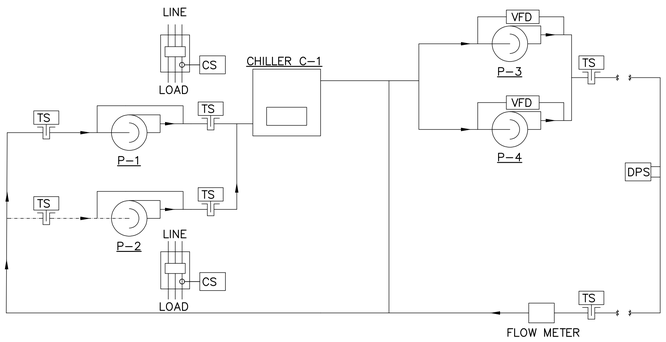
SHEET
M15



1 HYDRONIC HEATING SYSTEM CONTROL SCHEMATIC

NTS

SEE SHEET M12 FOR BOILER SEQUENCE



2 HYDRONIC COOLING SYSTEM 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

SINGLE AIR COOLED CHILLER WITH PRIMARY/SECONDARY FLOW

THE CHILLER PLANT CONTROL SYSTEM SHALL MONITOR AND CONTROL THE CHILLED WATER SYSTEM INCLUDING THE CHILLER, PUMPS, AND VARIABLE SPEED DRIVES AS APPROPRIATE.

THE CHILLER PLANT CONTROL SYSTEM SHALL HAVE A FULLY EDITABLE USER INTERFACE SET-UP VIA POINT AND CLICK ON A STANDARD WINDOWS SCREEN. IT SHALL NOT REQUIRE SPECIAL SOFTWARE TOOLS OR A BUILDING AUTOMATION SYSTEM TECHNICIAN TO OPERATE.

THE CHILLER PLANT CONTROL SYSTEM SHALL INCLUDE THE FOLLOWING FEATURES:

- OPERATOR INTERFACE.
- SYSTEM START/STOP.
- PUMP SEQUENCING.
- SYSTEM SOFT START.
- AUTOMATIC ROTATION OF PUMPS.
- FAILURE RECOVERY DIAGNOSTICS/PROTECTION.
- ENERGY OPTIMIZATION ROUTINES.
- SYSTEM AND CHILLER STATUS REPORTS.
- DEMAND LIMITING.

SYSTEM CONTROL CONFIGURATION OVERVIEW – CONTROL OF THE SYSTEM COMPONENTS SHALL BE AS FOLLOWS:

THE CHILLER SHALL RECEIVE ENABLE AND DISABLE SIGNALS THROUGH A COMMAND VIA A COMMUNICATION LINK WITH THE BAS.

A CHILLER BINARY OUTPUT SHALL CALL FOR PUMP OPERATION. THE CALL FOR PUMP OPERATION SHALL WORK IN CONJUNCTION WITH THE BAS FOR SMOOTH STARTUP OPERATION.

THE SECONDARY PUMP SPEED SHALL BE MODULATED TO CONTROL THE CHILLED WATER SYSTEM SUPPLY / RETURN PRESSURE DIFFERENTIAL TO THE REQUIRED SET-POINT. SEE PLANS FOR THE LOCATION OF DIFFERENTIAL PRESSURE SENSOR. THE PUMP SPEED SHALL BE CONTROLLED BY THE LOWEST PRESSURE READING.

OPERATOR INTERFACE – THE CHILLER PLANT CONTROL SYSTEM SHALL INCLUDE THE FOLLOWING OPERATOR INTERFACE ELEMENTS:

1. OPERATIONAL STATUS SCREEN TO INCLUDE:

CHILLER SYSTEM STATUS (OFF/SOFT, START/NORMAL/AMBIENT, LOCKOUT/SHUTDOWN, IN PROGRESS).
CHILLER PLANT SUPPLY WATER SET-POINT.
CHILLED WATER SYSTEM SUPPLY WATER TEMPERATURE.
CHILLED WATER SYSTEM RETURN WATER TEMPERATURE.
CHILLER FAILURE RESET (PUSH BUTTON).
SYSTEM PUMP FAILURE RESET (PUSH BUTTON).

2. SCREEN THAT ALLOWS EDITING OF THE FOLLOWING DATA (TO BE PERFORMED WITHOUT ENTERING PROGRAM CODE EDITOR):

SUPPLY WATER SET-POINT.
SYSTEM SOFT LOADING PARAMETERS.
AMBIENT LOCKOUT PARAMETERS.
PUMP AUTO ROTATION PARAMETERS.
ALARM HANDLING SETUP.
SECURITY SETUP.

3. INDIVIDUAL CHILLER GRAPHICS TO INCLUDE ALL DATA LISTED ON THE SUPPLEMENTARY CHILLER SYSTEM POINT LIST, INCLUDING:

CHILLER NAME.
CHILLER OPERATING MODE.
CHILLED WATER SET-POINT.
CHILLER RLA PERCENT.
ENTERING CHILLER WATER TEMPERATURE.
LEAVING CHILLED WATER TEMPERATURE.
EVAPORATOR FLOW RATE.
EVAPORATOR FLOW STATUS.

SYSTEM START/STOP: THE CHILLED WATER SYSTEM SHALL START IN RESPONSE THE BUILDING AUTOMATION SYSTEM OR THE CHILLED WATER SYSTEM SHALL START IN RESPONSE TO A NEED FOR CHILLED WATER FROM ANY SYSTEM LOAD, WITH THE OPTION TO USE OUTSIDE AMBIENT TEMPERATURE LOCKOUT.

UPON THE START OF THE CHILLED WATER SYSTEM THE CHILLER PLANT CONTROL SYSTEM SHALL AUTOMATICALLY START TREND LOG REPORTS TO INCLUDE 15 MINUTE LOGGING OF SYSTEM SHALL INCLUDE THE FOLLOWING POINTS:

OUTSIDE AIR DRY BULB.
OUTSIDE AIR WET BULB.
SYSTEM CHILLED WATER SET-POINT.
SYSTEM CHILLED WATER SUPPLY.
SYSTEM CHILLED WATER RETURN TEMPERATURE.
OPERATING STATUS OF THE CHILLER.
OPERATING STATUS OF SYSTEM PUMPS.

SEQUENCING: THE CHILLER PLANT CONTROL SYSTEM SHALL START AND STOP THE BUILDING AND CHILLED WATER PUMPS AND CHILLER BASED UPON SYSTEM LOAD. WHEN THE CHILLED WATER SYSTEM IS ENABLED THE CHILLER PLANT CONTROL SYSTEM SHALL:

THE CHILLED WATER SYSTEM SHALL BE ENABLED VIA A POINT CONTROLLED BY A HIGHER LEVEL BAS. THE CHILLER SHALL THEN START THE LEAD CHILLER PUMP. WHEN RUN STATUS FOR THAT PUMP IS PROVEN, THE BAS CONTROLLER SHALL REPORT THAT STATUS TO THE HIGHER LEVEL BAS. THE HIGHER LEVEL BAS SHALL THEN BEGIN MAKING REQUESTS FOR THE CHILLER TO RUN. THE CHILLER SHALL NOT ENERGIZE UNTIL 5 MINUTES AFTER THE BUILDING AND CHILLER PUMPS HAVE ENERGIZED AND FLOW IS CONFIRMED.

THE CHILLER PUMPS SHALL BE ENABLED ON A CONTACT CLOSURE FROM THE SYSTEM CHILLER.

WHEN THE CHILLED WATER SYSTEM IS DISABLED, THE BUILDING PUMPS SHALL BE OFF AND THE CHILLER PUMPS SHALL BE OFF UNLESS REQUESTED BY THE CHILLER.

THE BAS CONTROLLER SHALL DETECT CHILLER PUMP RUN STATUS BY A CURRENT SWITCH.

THE CHILLER PUMP LEAD/ STANDBY SEQUENCE SHALL BE ROTATED ON A WEEKLY SCHEDULE. THE SEQUENCE SHALL BE BASED ON CALCULATED RUN TIME WITH THE PUMP HAVING THE LEAST RUN TIME AS LEAD, THE PUMP WITH THE NEXT LOWEST RUN TIME WILL BE THE SECOND IN THE SEQUENCE AND SO ON. FROM THE BAS AN OPERATOR SHALL BE ABLE TO MANUALLY CHANGE THE LEAD/ STANDBY SEQUENCE.

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 CHILLER PUMP FAILURE ALARM TO THE BAS AND START THE NEXT PUMP IN THE SEQUENCE.

ONCE THE PROBLEM HAS BEEN CORRECTED, THE OPERATOR SHALL BE ABLE TO CLEAR THE ALARM FAILURE FROM THE BAS CONTROLLER, FROM A BAS OR BY MANUALLY OVERRIDING THE PUMP ON MOMENTARILY. THIS SHALL RE-ENABLE THE LEAD/STANDBY SEQUENCE.

THE BAS CONTROLLER SHALL START A BUILDING PUMP THROUGH A CONTACT CLOSURE OF THE PUMP'S VFD RUN-ENABLE CONTACTS.

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

THE BUILDING PUMP LEAD/ STANDBY 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/ STANDBY SEQUENCE.

IF THE CHILLED WATER SYSTEM DIFFERENTIAL PRESSURE FALLS 0.5 PSIG (ADJ.) BELOW SETPOINT AND THE LEAD PUMP IS AT 100% (ADJ.) FOR MORE THAN 5 MINUTES (ADJ.), THE NEXT PUMP IN THE SEQUENCE SHALL START. IF THE PUMP SPEED CONTROL OUTPUT IS BELOW 40% (ADJ.) FOR MORE THAN 5 MINUTES (ADJ.), THE LAST OPERATING PUMP IN THE SEQUENCE SHALL BE DISABLED.

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 BUILDING PUMP FAILURE ALARM TO THE BAS AND START THE STANDBY PUMP. WHEN A BUILDING PUMP FAILURE EXISTS, LEAD/STANDBY 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 SHALL RE-ENABLE THE LEAD/STANDBY SEQUENCE.

THE BAS CONTROLLER SHALL MONITOR THE CHILLED WATER SYSTEM DIFFERENTIAL PRESSURE SENSOR. WHEN THE PUMP VARIABLE FREQUENCY DRIVE IS ENABLED, THE BAS CONTROLLER SHALL CONTROL THE ANALOG SPEED SIGNAL THAT IS SENT TO THE VARIABLE FREQUENCY DRIVE TO MAINTAIN A CHILLED WATER SYSTEM DIFFERENTIAL PRESSURE SETPOINT OF 15.0 PSIG (ADJ.).

UPON THE START OF THE CHILLER THE CHILLER PLANT CONTROL SYSTEM SHALL AUTOMATICALLY START CHILLER SPECIFIC TREND LOG REPORTS TO INCLUDE 15 MINUTE LOGGING OF CHILLER:

UNIT CHILLED WATER SET-POINT.
COMPRESSOR(S) RLA.
EVAPORATOR ENTERING WATER TEMP.
EVAPORATOR LEAVING WATER TEMP.
EVAPORATOR FLOW RATE.
EVAPORATOR APPROACH TEMP.

THE CHILLER PLANT CONTROL SYSTEM SHALL CONTROL CHILLER SET-POINT TO MAINTAIN THE SYSTEM SUPPLY WATER TEMPERATURE AT SET-POINT.

THE DESIGN SYSTEM CHILLED WATER SET-POINT SHALL BE 44 DEGREES F (ADJUSTABLE) AND SHALL BE EDITABLE BY THE OPERATOR.

CHILLED WATER RESET:

UPON OUTSIDE AIR TEMPERATURE DROPPING BELOW 85 DEG F (ADJ.), THE CHILLED WATER SUPPLY TEMPERATURE SETPOINT SHALL LINEARLY RESET FROM 44.0 DEG. F (ADJ.) TO 60.0 DEG. F (ADJ.) AT 60 DEG F (ADJ). AND BELOW, BASED ON CHILLED WATER RETURN TEMPERATURE INCREASING.

IF ANY AHU IS IN DEHUMIDIFICATION MODE, THE CHILLED WATER SUPPLY TEMPERATURE SETPOINT SHALL BE DRIVEN TO 44.0 DEG. F UNTIL NO AHUS ARE IN DEHUMIDIFICATION MODE. ONCE ALL UNITS ARE OUT OF DEHUMIDIFICATION MODE, SUPPLY TEMPERATURE SETPOINT SHALL REVERT BACK TO RESET SCHEDULE.

AUTOMATIC ROTATION OF SECONDARY PUMPS:

PUMP ROTATION SHALL BE INITIATED BY THE BAS, 7 DAY CYCLE (ADJ.).

DIAGNOSTICS/PROTECTION:

THE BUILDING AUTOMATION SYSTEM SHALL BE ABLE TO ALARM FROM ALL SENSED POINTS AND DIAGNOSTIC ALARMS MONITORED BY THE CHILLER CONTROLLER.

CHILLER STATUS REPORT:

PROVIDE AN OPERATING STATUS REPORT FOR THE CHILLER. THE REPORT SHALL PROVIDE THE PRESET FOR THE FOLLOWING INFORMATION TO PROVIDE THE OPERATOR WITH CRITICAL CHILLER OPERATING DATA.

- COMPRESSOR ON/OFF STATUS.
- COMPRESSOR STARTS/RUN HOURS
- COMPRESSOR PHASE 1/2/3 PERCENT RLA – SEPARATE FOR EACH COMPRESSOR.
- COMPRESSOR CURRENT DRAW – RLA PERCENT.
- ACTIVE CHILLER DIAGNOSTICS OR ALARMS.
- LEAVING CHILLED WATER TEMPERATURE.
- ENTERING CHILLED WATER TEMPERATURE.
- EVAPORATOR FLOW RATE.
- CHILLED WATER SET-POINT.
- REFRIGERANT TEMPERATURE EVAPORATOR/CONDENSER – SEPARATE FOR EACH CIRCUIT.
- OPERATING MODE.
- CHILLER MODEL AND SERIAL NUMBER.
- OUTSIDE AIR DRY BULB.
- OUTSIDE AIR WET BULB.

Heating Hot Water System

Point Name	Hardware Points AI	AO	BI	BO	Software Points AV	BV	Loop	Sched	Trend	Alarm	Show On Graphic
Boiler 1 Hot Water Return Temp	x								x		x
Boiler 1 Hot Water Supply Temp	x								x		x
Boiler 2 Hot Water Return Temp	x								x		x
Boiler 2 Hot Water Supply Temp	x								x		x
Hot Water Differential Pressure 1	x								x		x
Hot Water Differential Pressure 2	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
Boiler 1 Hot Water Supply Temp Setpoint Reset		x							x		x
Boiler 2 Hot Water Supply Temp Setpoint Reset		x							x		x
Hot Water Pump CP-5 VFD Speed		x							x		x
Hot Water Pump CP-6 VFD Speed		x							x		x
Boiler 1 Alarm Status			x						x	x	x
Boiler 1 Status			x						x		x
Boiler 2 Alarm Status			x						x	x	x
Boiler 2 Status			x						x		x
Hot Water Pump CP-5 Status			x						x		x
Hot Water Pump CP-5 VFD Fault			x						x	x	x
Hot Water Pump CP-6 Status			x						x		x
Hot Water Pump CP-6 VFD Fault			x						x	x	x
Boiler 1 Enable				x					x		x
Boiler 2 Enable				x					x		x
Hot Water Pump CP-5 Start/Stop				x					x		x
Hot Water Pump CP-6 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
Carbon Monoxide Sensor	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	
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 Hot Water Differential Pressure										x	
High Primary Hot Water Supply Temp										x	
Hot Water Pump CP-5 Failure										x	
Hot Water Pump CP-5 Running in Hand										x	
Hot Water Pump CP-6 Failure										x	
Hot Water Pump CP-6 Running in Hand										x	
Lead Boiler Failure										x	x
Low Primary Hot Water Supply Temp										x	

Chilled Water System

Point Name	Hardware Points AI	AO	BI	BO	Software Points AV	BV	Loop	Sched	Trend	Alarm	Show On Graphic
Chilled Water Differential Pressure	x								x		x
Main Chilled Water Return Temp	x								x		x
Main Chilled 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 Chilled Water Pump P-3 VFD Speed		x							x		x
Secondary Chilled Water Pump P-4 VFD Speed		x							x		x
Chiller 1 Status			x						x		x
Chiller 1 Fault			x						x	x	x
Primary Chilled Water Pump P-1 Status			x						x		x
Primary Chilled Water Pump P-2 Status			x						x		x
Secondary Chilled Water Pump P-3 Status			x						x		x
Secondary Chilled Water Pump P-3 VFD Fault			x						x	x	x
Secondary Chilled Water Pump P-4 Status			x						x		x
Secondary Chilled Water Pump P-4 VFD Fault			x						x	x	x
Chiller 1 Enable/Disable				x					x		x
Secondary Chilled Water Pump P-3 Start/Stop				x					x		x
Secondary Chilled Water Pump P-4 Start/Stop				x					x		x
Chilled Water Differential Pressure Setpoint					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 Chilled Water Pump P-3 Failure										x	
Secondary Chilled Water Pump P-3 Running in Hand										x	
Secondary Chilled Water Pump P-4 Failure										x	
Secondary Chilled Water Pump P-4 Running in Hand										x	
High Chilled Water Differential Pressure										x	
High Chilled Water Supply Temp										x	
Low Chilled 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

* Manufacturer supplied points provided to the BAS via BACnet Interface

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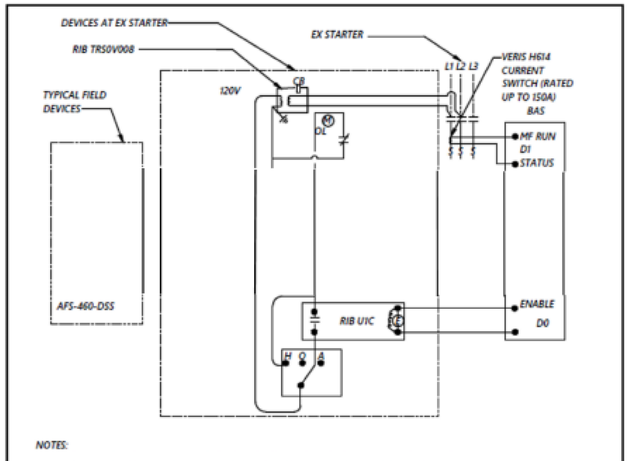
REVISION DESCRIPTION	REVISION DATES

JOB NUMBER 22-075
DRAWN BY
CHECKED BY
DATE 02-17-2023

JOB TITLE
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CHARLOTTE, NC, 28205
BAS RENOVATIONS

SHEET TITLE
MECHANICAL CONTROL SCHEMATICS

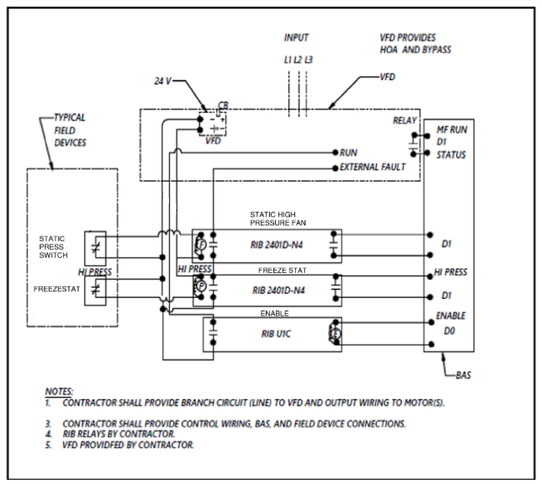
SHEET
M16



NOTES:

2. CONTRACTOR SHALL PROVIDE CONTROL WIRING, AND FIELD DEVICE CONNECTIONS.
3. RIB RELAYS, CT'S, AND TRANSFORMER BY CONTRACTOR.

4 CMS TYPICAL MOTOR STARTER BAS INTERFACE – FAN
NTS



NOTES:

1. CONTRACTOR SHALL PROVIDE BRANCH CIRCUIT (LINE) TO VFD AND OUTPUT WIRING TO MOTOR(S).
3. CONTRACTOR SHALL PROVIDE CONTROL WIRING, BAS, AND FIELD DEVICE CONNECTIONS.
4. RIB RELAYS BY CONTRACTOR.
5. VFD PROVIDFED BY CONTRACTOR.

5 CMS TYPICAL MOTOR VFD BAS INTERFACE – FAN
NTS

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.

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

Ductless Split Systems

Point Name	Hardware Points AI	AO	BI	BO	Software Points AV	BV	Loop	Sched	Trend	Alarm	Show On Graphic
Space Temperature	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

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

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

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.

DUCTLESS SPLIT SYSTEMS FCU–1/CU–1:

Ductless split system indoor unit fan shall be started and stopped with thermostat call for cooling. Upon a rise in space temperature above thermostat setpoint, unit compressor shall activate to satisfy space conditions. If space temperature rises above 78°, an alarm shall be sent to the central BAS. No occupied or unoccupied settings shall be used.

UNIT HEATERS:

Unit heaters shall be controlled by local thermostats only.

Upon the space temperature falling below the setpoint (60 deg (adj.)), the unit heater shall be energized (fan shall cycle on and the hot water coil valve shall open) and remain so until the space temperature has risen above the setpoint.

SMOKE DETECTOR OPERATION:

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

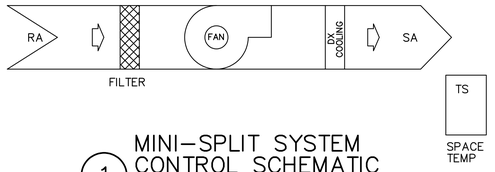
MINI–SPLIT SYSTEM HEAT PUMP – SEQUENCE OF OPERATION

MANUFACTURER'S FACTORY CONTROLLER AND THERMOSTAT (CAPABLE OF STANDALONE OPERATION) SHALL CONTROL EACH UNIT. A BAS SPACE TEMPERATURE SENSOR SHALL BE PROVIDED TO ALLOW FOR MONITORING THROUGH THE BAS.

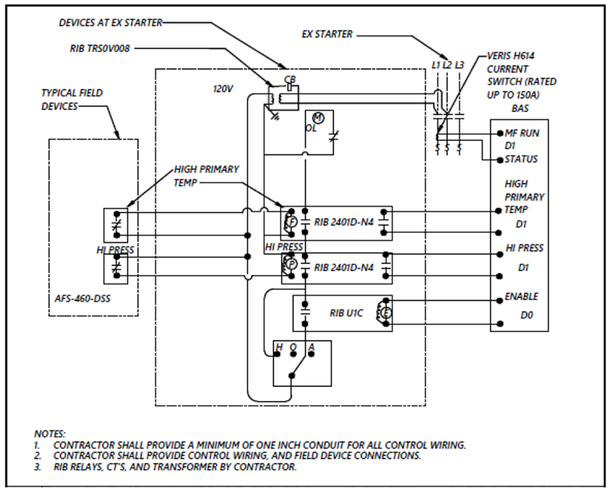
SPACE TEMPERATURE CONTROL: HEATING AND COOLING SIGNALS WILL BE GENERATED BASED ON THE DEVIATION OF THE SPACE TEMPERATURE FROM CURRENT SPACE TEMPERATURE HEATING AND COOLING SETPOINTS IN THE THERMOSTAT. THE SETPOINT SHALL BE ADJUSTED BY THE OCCUPANT WITHIN A USER DEFINABLE RANGE.

ALARMS: THE FOLLOWING SOFTWARE ALARMS WILL BE GENERATED AND DISPLAYED AT THE BAS OPERATOR'S WORKSTATION:

- SPACE TOO WARM (3°F GREATER THAN COOLING SETPOINT)
- SPACE TOO COLD (3°F LESS THAN HEATING SETPOINT)
- BAD SPACE TEMP SENSOR ALARM (GREATER THAN 120°F OR LESS THAN 40°F)



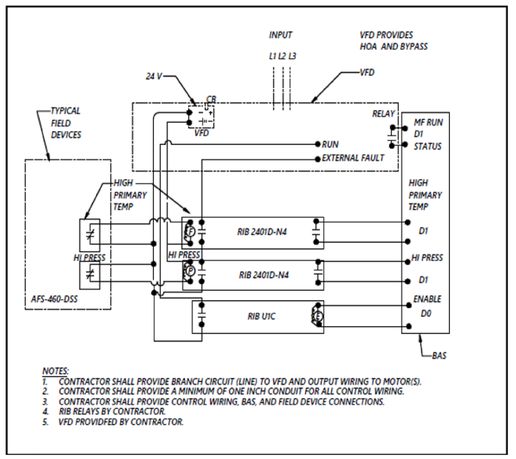
1 MINI–SPLIT SYSTEM CONTROL SCHEMATIC
NTS



NOTES:

1. CONTRACTOR SHALL PROVIDE A MINIMUM OF ONE INCH CONDUIT FOR ALL CONTROL WIRING.
2. CONTRACTOR SHALL PROVIDE CONTROL WIRING, AND FIELD DEVICE CONNECTIONS.
3. RIB RELAYS, CT'S, AND TRANSFORMER BY CONTRACTOR.

2 CMS TYPICAL MOTOR STARTER BAS INTERFACE – PUMP
NTS



NOTES:

1. CONTRACTOR SHALL PROVIDE BRANCH CIRCUIT (LINE) TO VFD AND OUTPUT WIRING TO MOTOR(S).
2. CONTRACTOR SHALL PROVIDE A MINIMUM OF ONE INCH CONDUIT FOR ALL CONTROL WIRING.
3. CONTRACTOR SHALL PROVIDE CONTROL WIRING, BAS, AND FIELD DEVICE CONNECTIONS.
4. RIB RELAYS BY CONTRACTOR.
5. VFD PROVIDFED BY CONTRACTOR.

3 CMS TYPICAL MOTOR VFD BAS INTERFACE – PUMP
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PROFESSIONAL ENGINEER
02-17-2023

REVISION DESCRIPTION | REVISION DATES

JOB NUMBER 22-075
DRAWN BY
CHECKED BY
DATE 02-17-2023

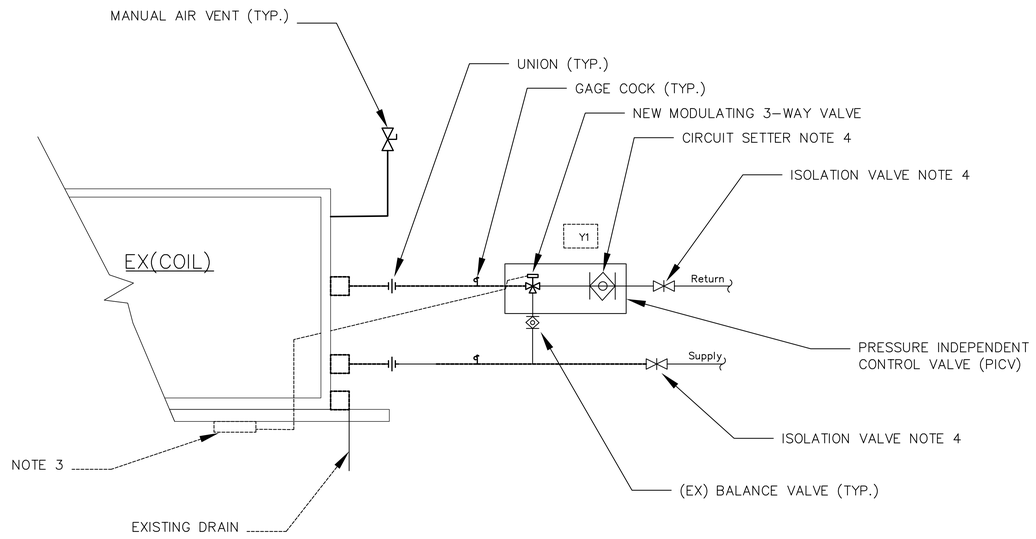
JOB TITLE
WINDSOR PARK ELEMENTARY
3910 SUDBURY RD
CHARLOTTE, NC, 28205
BAS RENOVATIONS

SHEET TITLE
MECHANICAL CONTROL SCHEMATICS

SHEET
M17

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

CONTROL 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 CHW	AHU-1 CHW	2-WAY	150.0	4.00	3.00	302.00	0.25	5,9,15
AHU-1 HW	AHU-1 HW	3-WAY	24.0	2.00	1.50	19.00	1.60	1,9,16
AHU-2 CHW	AHU-2 CHW	2-WAY	52.0	2.00	1.50	29.00	3.22	1,9,16
AHU-2 HW	AHU-2 HW	3-WAY	26.0	2.00	1.50	19.00	1.87	1,9,16
AHU-3 CHW	AHU-3 CHW	2-WAY	60.0	2.50	2.00	46.00	1.70	1,9,16
AHU-3 HW	AHU-3 HW	2-WAY	14.0	1.25	1.00	7.40	3.58	1,9,16
AHU-4 CHW	AHU-4 CHW	2-WAY	200.0	4.00	3.00	302.00	0.44	5,9,15
AHU-4 HW	AHU-4 HW	3-WAY	24.0	1.50	1.00	19.00	1.60	1,9,16
AHU-5 CHW	AHU-5 CHW	2-WAY	54.0	2.50	2.00	29.00	3.47	1,9,16
AHU-5 HW	AHU-5 HW	2-WAY	20.0	1.50	1.00	10.00	4.00	1,9,16
AHU-6 CHW	AHU-6 CHW	2-WAY	49.0	2.50	2.00	29.00	2.85	1,9,16
AHU-6 HW	AHU-6 HW	2-WAY	18.0	1.50	1.00	10.00	3.24	1,9,16
AHU-7 CHW	AHU-7 CHW	2-WAY	59.0	2.50	2.00	46.00	1.65	1,9,16
AHU-7 HW	AHU-7 HW	2-WAY	20.0	1.50	1.00	10.00	4.00	1,9,16
VAV-1-171	TU 1-1	2-WAY	-	0.75	0.50	0.80	-	1,6,10,16
VAV-1-170	TU 1-2	2-WAY	1.6	0.75	0.50	0.80	4.00	1,6,10,16
VAV-1-137	TU 1-3	2-WAY	1.8	0.75	0.50	1.20	2.25	1,6,10,16
VAV-1-166	TU 1-4	2-WAY	0.5	0.75	0.50	0.30	2.78	1,6,10,16
VAV-1-138	TU 1-5	2-WAY	1.8	0.75	0.50	1.20	2.25	1,6,10,16
VAV-1-165	TU 1-6	2-WAY	2.1	0.75	0.50	1.90	1.22	1,6,10,16
VAV-1-139	TU 1-7	2-WAY	1.8	0.75	0.50	1.20	2.25	1,6,10,16
VAV-1-161	TU 1-8	2-WAY	1.8	0.75	0.50	1.20	2.25	1,6,10,16
VAV-1-141	TU 1-9	2-WAY	1.8	0.75	0.50	1.20	2.25	1,6,10,16
VAV-1-159	TU 1-10	2-WAY	1.8	0.75	0.50	1.20	2.25	1,6,10,16
VAV-1-142	TU 1-11	2-WAY	1.8	0.75	0.50	1.20	2.25	1,6,10,16
VAV-1-158	TU 1-12	2-WAY	1.8	0.75	0.50	1.20	2.25	1,6,10,16
VAV-1-144	TU 1-13	2-WAY	1.8	0.75	0.50	1.20	2.25	1,6,10,16
VAV-1-156	TU 1-14	2-WAY	1.8	0.75	0.50	1.20	2.25	1,6,10,16
VAV-1-145	TU 1-15	2-WAY	1.8	0.75	0.50	1.20	2.25	1,6,10,16
VAV-1-155	TU 1-16	2-WAY	1.8	0.75	0.50	1.20	2.25	1,6,10,16
VAV-1-147	TU 1-17	2-WAY	1.8	0.75	0.50	1.20	2.25	1,6,10,16
VAV-1-153	TU 1-18	2-WAY	1.8	0.75	0.50	1.20	2.25	1,6,10,16
VAV-1-151	TU 1-19	2-WAY	0.5	0.75	0.50	0.30	2.78	1,6,10,16
VAV-1-162	TU 1-20	3-WAY	1.5	0.75	0.50	0.80	3.52	1,6,10,16
VAV-2-122	TU 2-1	2-WAY	1.0	0.75	0.50	0.80	1.56	1,6,10,16
VAV-2-129	TU 2-2	2-WAY	0.6	0.75	0.50	0.50	1.70	1,6,10,16
VAV-2-128	TU 2-3	2-WAY	0.6	0.75	0.50	0.50	1.70	1,6,10,16
VAV-3-133	TU 3-1	2-WAY	2.1	0.75	0.50	1.90	1.22	1,6,10,16
VAV-110	TU 3-2	2-WAY	2.9	0.75	0.50	1.90	2.33	1,6,10,16
VAV-3-191	TU 3-3	2-WAY	2.4	0.75	0.50	1.20	4.00	1,6,10,16
VAV-3-118	TU 3-4	2-WAY	0.3	0.75	0.50	0.30	1.00	1,6,10,16
VAV-3-119	TU 3-5	2-WAY	0.3	0.75	0.50	0.30	1.00	1,6,10,16
VAV-3-113	TU 3-6	2-WAY	0.3	0.75	0.50	0.30	1.00	1,6,10,16
VAV-3-111	TU 3-7	3-WAY	1.2	0.75	0.50	0.60	2.25	1,6,10,16
VAV-3-101	TU 3-8	2-WAY	1.8	0.75	0.50	1.20	2.25	1,6,10,16
VAV-3-117	TU 3-9	2-WAY	0.5	0.75	0.50	0.30	2.78	1,6,10,16
VAV-3-105	TU 3-10	2-WAY	0.9	0.75	0.50	0.46	3.83	1,6,10,16
VAV-3-103	TU 3-11	2-WAY	0.2	0.75	0.50	0.30	0.44	1,6,10,16
VAV-3-115	TU 3-12	2-WAY	0.4	0.75	0.50	0.30	1.78	1,6,10,16
VAV-3-110	TU 3-13	2-WAY	1.2	0.75	0.50	0.80	2.25	1,6,10,16
VAV-3-106	TU 3-14	3-WAY	0.9	0.75	0.50	0.80	1.27	1,6,10,16
VAV-126	TU 3-15	2-WAY	0.6	0.75	0.50	0.30	4.00	1,6,10,16
VAV-4-246	TU 4-1	2-WAY	1.5	0.75	0.50	0.80	3.52	1,6,10,16
VAV-4-204	TU 4-2	2-WAY	1.8	0.75	0.50	1.20	2.25	1,6,10,16
VAV-205	TU 4-3	2-WAY	0.4	0.75	0.50	0.30	1.78	1,6,10,16
VAV-4-243	TU 4-4	2-WAY	1.8	0.75	0.50	1.20	2.25	1,6,10,16
VAV-4-207	TU 4-5	2-WAY	1.8	0.75	0.50	1.20	2.25	1,6,10,16
VAV-4-241	TU 4-6	2-WAY	1.8	0.75	0.50	1.20	2.25	1,6,10,16
VAV-4-208	TU 4-7	2-WAY	1.8	0.75	0.50	1.20	2.25	1,6,10,16
VAV-4-240	TU 4-8	2-WAY	1.8	0.75	0.50	1.20	2.25	1,6,10,16
VAV-4-210	TU 4-9	2-WAY	1.8	0.75	0.50	1.20	2.25	1,6,10,16
VAV-4-239	TU 4-10	2-WAY	1.8	0.75	0.50	1.20	2.25	1,6,10,16
VAV-4-211	TU 4-11	2-WAY	1.8	0.75	0.50	1.20	2.25	1,6,10,16
VAV-4-238	TU 4-12	2-WAY	1.8	0.75	0.50	1.20	2.25	1,6,10,16
VAV-4-213	TU 4-13	2-WAY	1.8	0.75	0.50	1.20	2.25	1,6,10,16
VAV-4-236	TU 4-14	2-WAY	1.8	0.75	0.50	1.20	2.25	1,6,10,16
VAV-4-214	TU 4-15	2-WAY	1.8	0.75	0.50	1.20	2.25	1,6,10,16
VAV-4-235	TU 4-16	2-WAY	1.8	0.75	0.50	1.20	2.25	1,6,10,16
VAV-4-216	TU 4-17	2-WAY	1.8	0.75	0.50	1.20	2.25	1,6,10,16
VAV-4-233	TU 4-18	2-WAY	1.8	0.75	0.50	1.20	2.25	1,6,10,16
VAV-4-217	TU 4-19	2-WAY	1.8	0.75	0.50	1.20	2.25	1,6,10,16
VAV-4-232	TU 4-20	2-WAY	1.8	0.75	0.50	1.20	2.25	1,6,10,16
VAV-4-219	TU 4-21	2-WAY	1.8	0.75	0.50	1.20	2.25	1,6,10,16
VAV-4-230	TU 4-22	2-WAY	1.8	0.75	0.50	1.20	2.25	1,6,10,16
VAV-4-220	TU 4-23	2-WAY	1.8	0.75	0.50	1.20	2.25	1,6,10,16
VAV-4-225	TU 4-24	2-WAY	1.5	0.75	0.50	0.80	3.52	1,6,10,16
VAV-4-222	TU 4-25	2-WAY	1.5	0.75	0.50	0.80	3.52	1,6,10,16
VAV-4-224	TU 4-26	2-WAY	0.4	0.75	0.50	0.30	1.78	1,6,10,16
VAV-4-223	TU 4-27	3-WAY	1.2	0.75	0.50	0.80	2.25	1,6,10,16
UH-1	UH-1	2-WAY	3.7	0.75	0.50	1.90	3.79	1,6,10,16
UH-2	UH-2	2-WAY	3.7	0.75	0.50	1.90	3.79	1,6,10,16
UH-3	UH-3	2-WAY	3.7	0.75	0.50	1.90	3.79	1,6,10,16
HC-2-1	HC-2	2-WAY	26.0	0.75	0.50	1.90	3.79	1,6,10,17

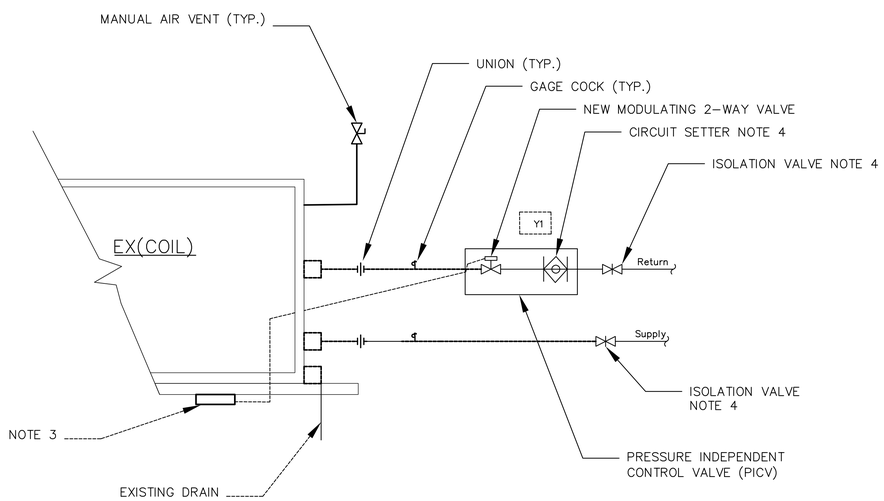
1. GCV
2. BALL
3. ZONE
4. GLOBE
5. BUTTERFLY
6. 24 VAC
7. 120 VAC
8. ON-OFF
9. FLOATING POINT
10. MODULATING 2-10
11. MFT
12. MFT CODE
13. SPRING RETURN
14. SWITCHES
15. 50 PSI CLOSE-OFF PRESSURE
16. 200 PSI CLOSE-OFF PRESSURE

NOTES:

1. HOT WATER THREE WAY VALVES ADD UP TO 63 GPM.
2. THE ORIGINAL AHU–1 HW , AHU–2 HW, AND AHU–4 HW WERE 2–WAY BUT NEW PIPE WITH 3–WAY VALVE.

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

22–075

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SHEET TITLE
MECHANICAL CONTROL VALVE DETAILS AND SCHEDULE

SHEET
M18

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-120AD	$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 8A @ 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%, -0% Minimum Setting (Adjustable): +0%, -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	
Connection (screw terminal)	Recommend 70169-D socket 1 or 2 #12-20 AWG Wire
Tightening Torque	12 in-lb
Wire/Ferrule Size	1 or 2 #12-20 AWG (Ferrule size: Stud size 6 with max overall width 0.30")
Ambient Temperature	-28 to +65°C [-18 to +150°F]
Storage Temperature	-40 to +85°C [-40 to +185°F]
Protection Rating	IP20
Vibration Resistance	10-55 Hz with 3G maximum and 0.5mm total displacement (+/- .25mm).
Mounting	Socket mount (8-pin required)
Mounting Orientation	Any
Weight	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	0.6 - 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 E169693, 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



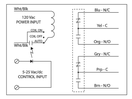
750-2C-SKT

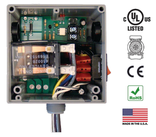
RIB Functional Devices, Inc. (800) 888-5538 sales@functionaldevices.com www.functionaldevices.com

LOW COIL INPUT RELAY

RIBTE01P-S

Enclosed Relay Hit 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: -40 to 140° F
Humidity Range: 5 to 95% (noncondensing)
Operate Time: 18ms
Relay Status: LED On = Activated
Dimensions: 4.00" x 4.00" x 1.80" 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*

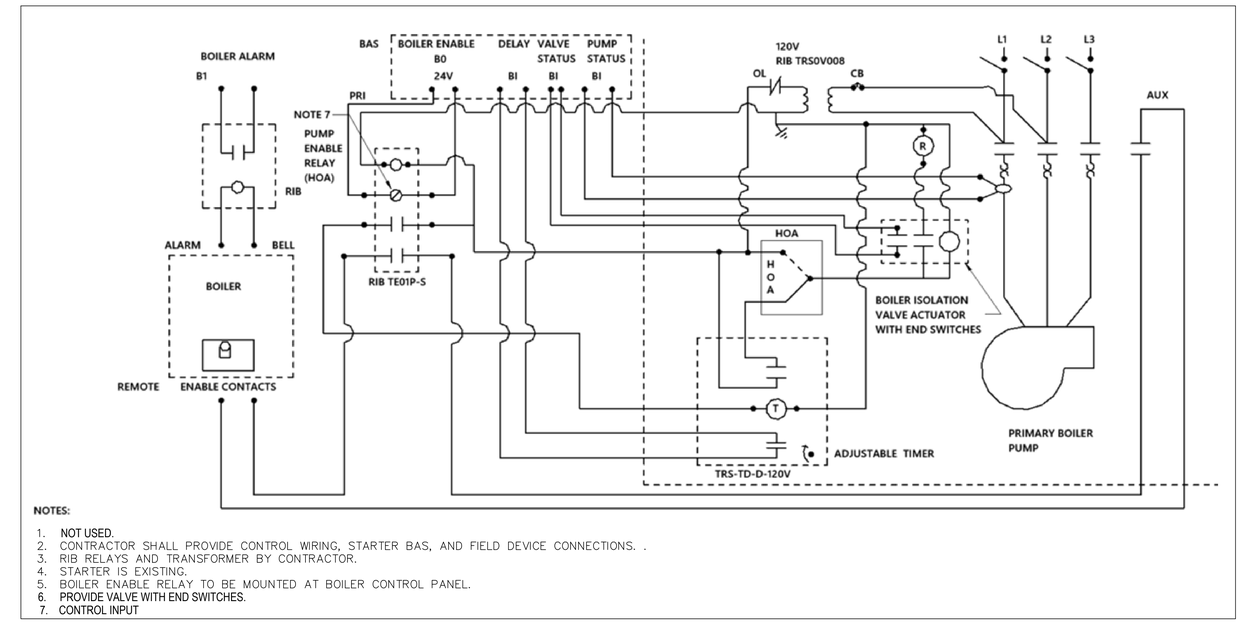
Contact Ratings:
20 Amp Resistive @ 300 Vac
20 Amp Resistive @ 28 Vdc
15 Amp Resistive @ 600 Vac
20 Amp Ballast @ 277-480 Vac
Not rated for Electronic Ballast
770 VA Pilot Duty @ 120 Vac
1158 VA Pilot Duty @ 240 Vac
1110 VA Pilot Duty @ 277 Vac
1640 VA Pilot Duty @ 480 Vac
3 HP @ 480-600 Vac
2 HP @ 240-277 Vac
1 HP @ 120 Vac

Control Input Ratings:
.4 mA @ 5 Vdc
.9 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.*

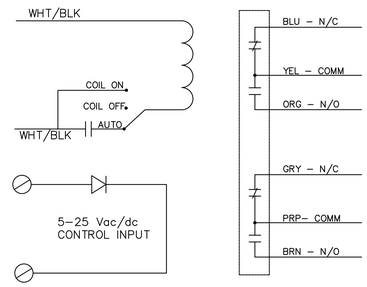
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NOTES:

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.
6. PROVIDE VALVE WITH END SWITCHES.
7. CONTROL INPUT

1 BOILER INTEGRATION DETAIL
NTS



2 LOW COIL INPUT RELAY
NTS

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SCHEMATIC - BOILER

SHEET
M19