

THIS SHEET IS TO BE USED IN CONJUNCTION WITH THE MECHANICAL GENERAL SYMBOLS SHEET.

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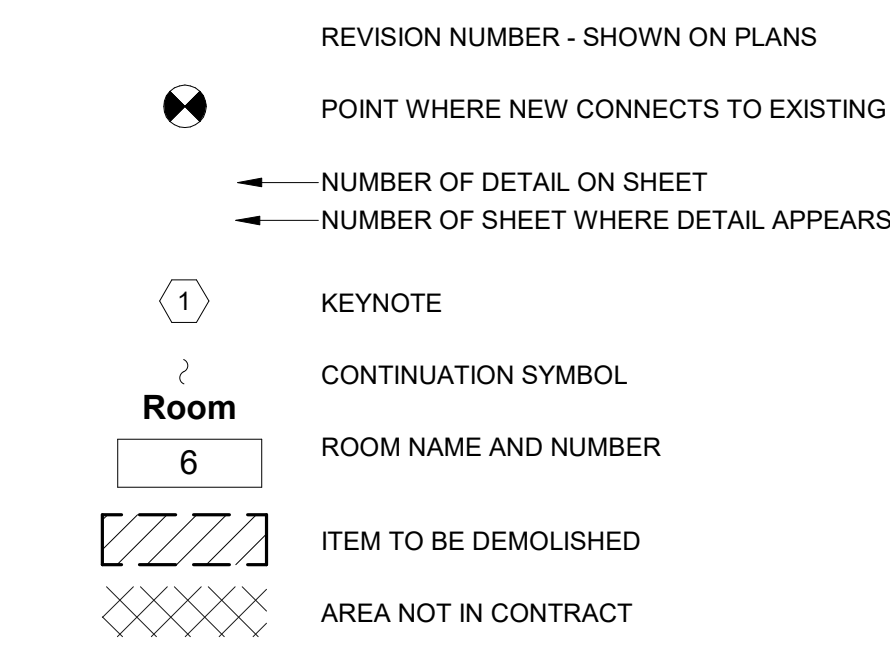
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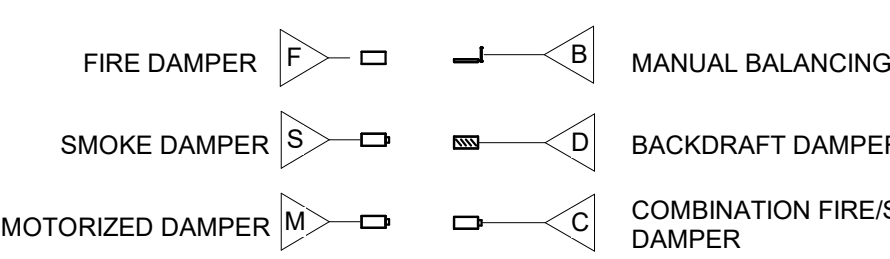
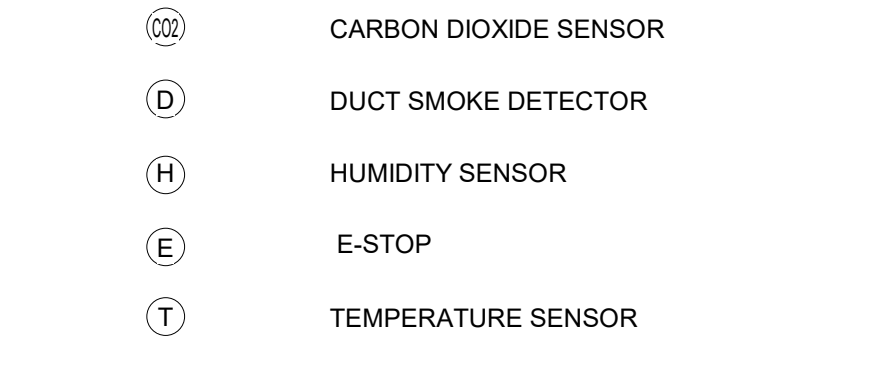
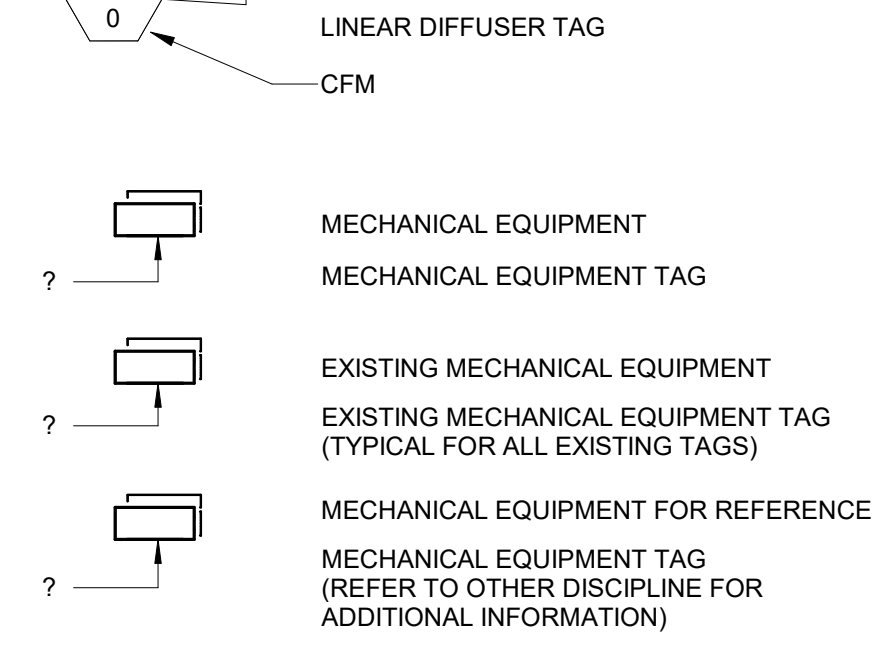
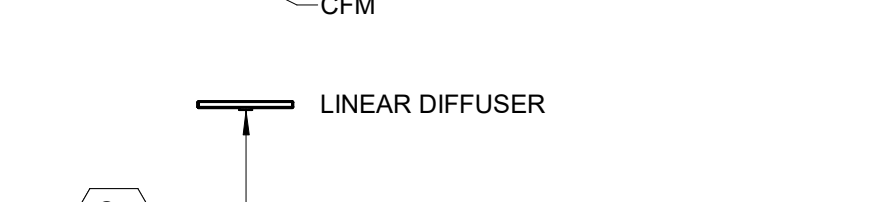
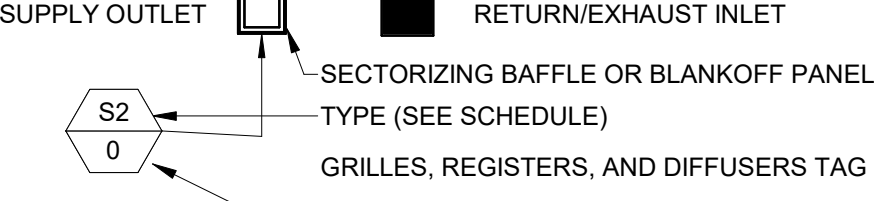
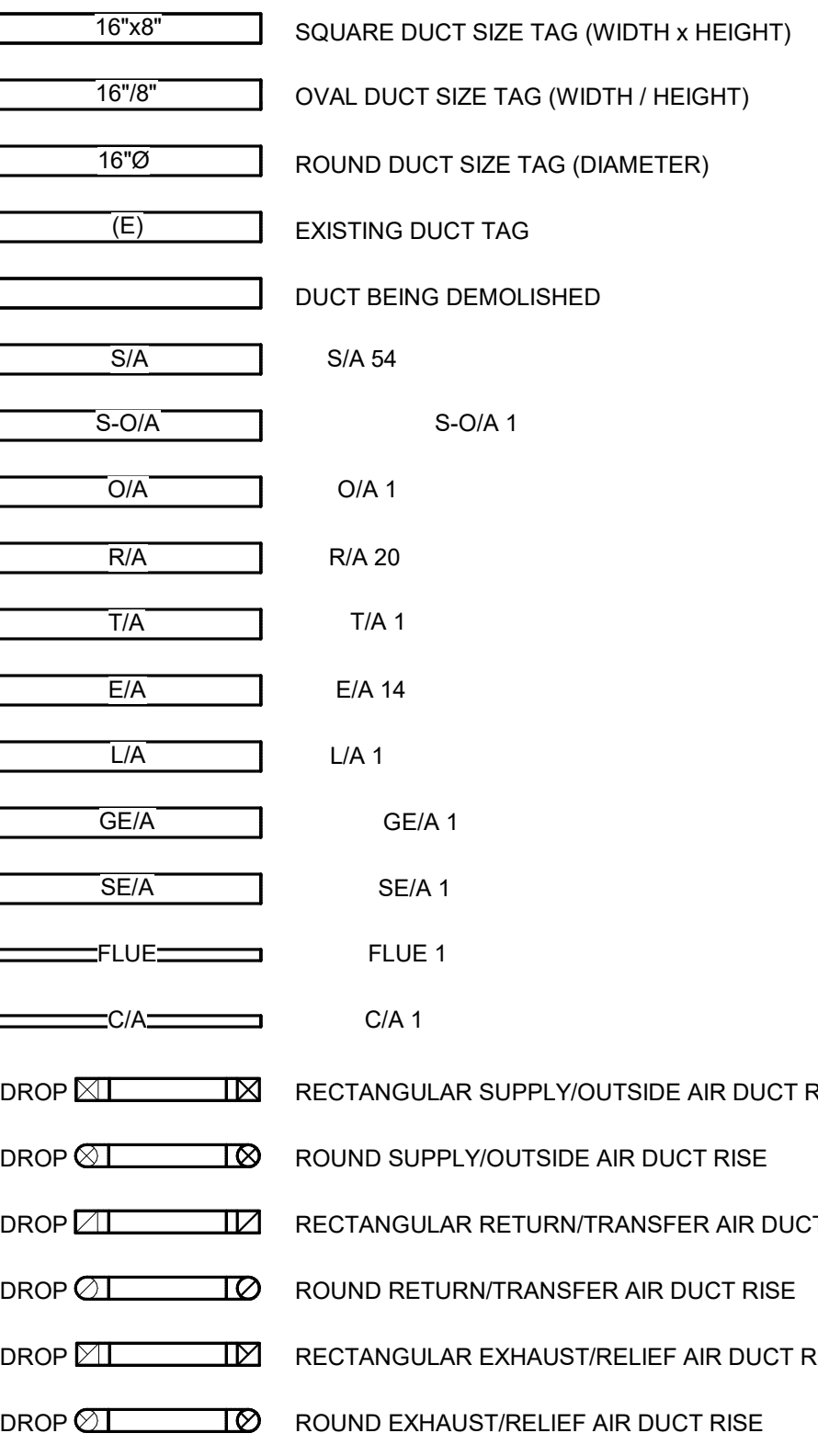
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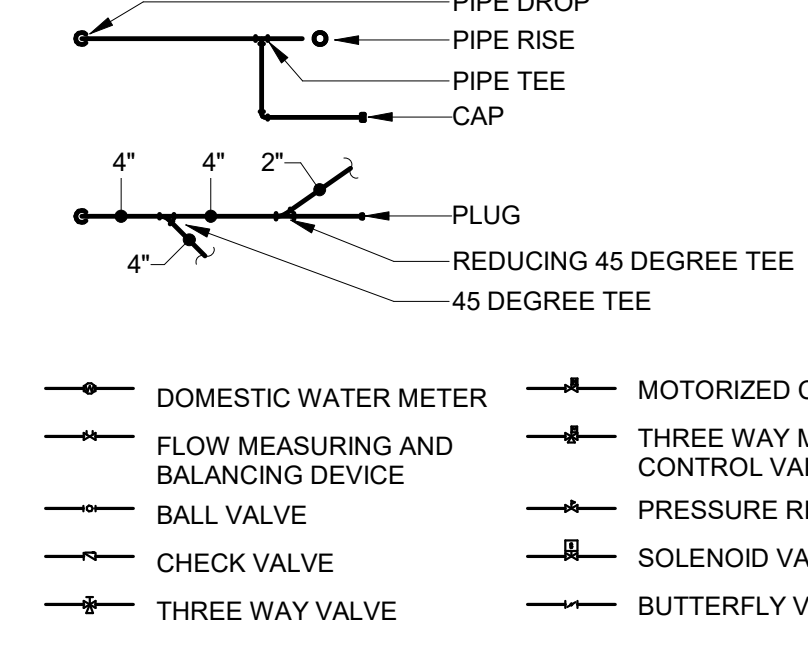
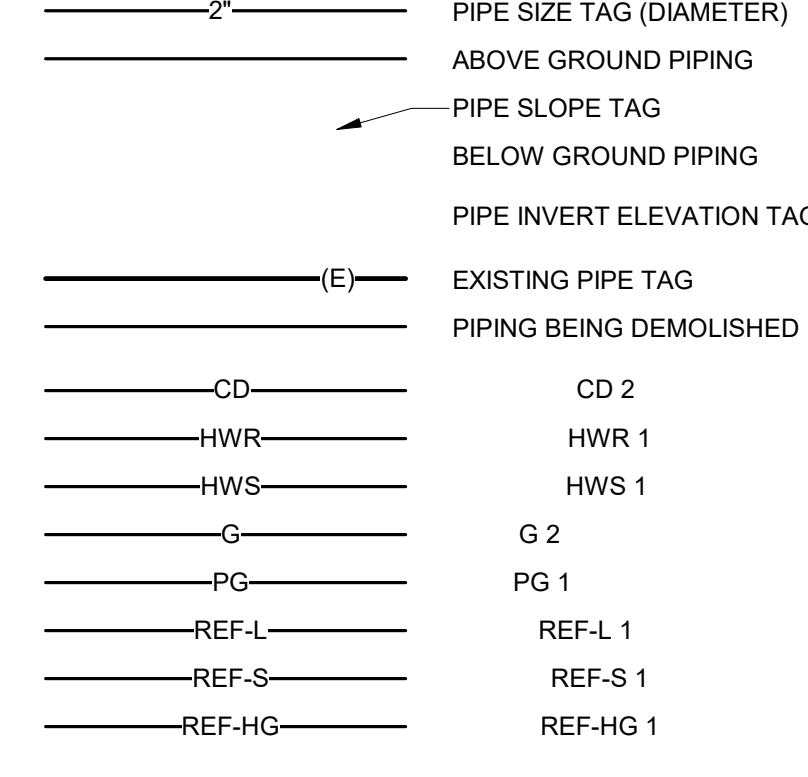
GENERAL MECHANICAL SYMBOLS



HVAC SYMBOLS



PIPING SYMBOLS



EQUIPMENT ABBREVIATIONS

Table of equipment abbreviations including AC, ACC, AFMS, AHU, AS, B, CF, CFP, CH, CRU, CUH, CWP, DHP, DCP, EDC, ET, EWH, FCU, FP, GI, GRV, H, HWP, HX, HPJ, HRJ, ILC, IFC, JFC, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z.

ABBREVIATIONS

Comprehensive list of abbreviations for materials, units, and components such as AND, AIR, ABOVE, AREA, ADD, ADDL, AFF, AFUE, AG, ALT, ALUM, AP, APPROX, ARCH, AV, AW, AUTO, BLDG, BLW, BM, BO, BOT, BSMT, BTU, BTUH, BTWIN, CAP, CB, CCW, CFCV, CFM, CIRC, CI, CLG, CLM, CO, COL, CONC, CONCD, CONF, CONN, CONST, CONT, CONTR, COORD, CUFT, CV, CW, CWK, DB, DET, DIA, DIAG, DISCH, DIVISION, DI, DMPR, DN, DWG, DW, EAT, EL, ELEC, ELEV, EP, EQ, EQIP, EWC, EWT, E/A, EXH, EXIST, EXP, EXPJT, EXT, F, FCO, FD, FDS, FDV, FHC, FL, FLEX, FNG, FOS, FPM, FRP, FS, FT, FTG, FTR, FUT, GAGE, GAL, GALV, GEN, GENL, GPH, GR, GW, HB, HD, HORZ, HP, HTG, HTR, HW, HYD.

MECHANICAL GENERAL NOTES

- 1. SCOPE OF WORK: THESE DRAWINGS AND SPECIFICATIONS DESCRIBE THE SCOPE OF WORK REQUIRED FOR INSTALLATION, HEATING, VENTILATING AND AIR CONDITIONING SYSTEMS. CONTRACTOR SHALL PROVIDE ALL LABOR AND MATERIAL REQUIRED FOR COMPLETE, FULLY FUNCTIONING MECHANICAL SYSTEMS...
2. CONTRACTOR: THE WORD "CONTRACTOR" AS USED HEREIN SHALL MEAN THE HVAC INSTALLER UNLESS OTHERWISE QUALIFIED.
3. DRAWINGS: DRAWINGS ARE DIAGRAMMATIC AND MAY NOT COMPLETELY DESCRIBE EVERY DETAIL OF THE INSTALLATION...
4. CODE COMPLIANCE: COMPLY WITH THE LATEST EDITIONS OF THE FOLLOWING STANDARDS AND CODES, IN SO FAR AS THEY APPLY.
A. NORTH CAROLINA STATE BUILDING CODE, LATEST EDITION AND REVISIONS
B. LOCAL JURISDICTION REQUIREMENTS
5. PERMITS AND INSPECTIONS: OBTAIN ALL PERMITS, LICENSES, INSPECTIONS, ETC. REQUIRED FOR THE WORK AND PAY FOR SAME...
6. MANUFACTURER'S RECOMMENDATIONS: INSTALL ALL EQUIPMENT IN STRICT ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.
7. WORKMANSHIP: UTILIZE SKILLED MECHANICS TO OBTAIN A HIGH QUALITY PROFESSIONAL FINISH...
8. SUPERVISION: PROVIDE SKILLED SUPERINTENDENTS TO SUPERVISE THE WORK FROM THE BEGINNING TO COMPLETION...
9. PROGRESS OF WORK: PERFORM WORK IN ACCORDANCE WITH SCHEDULE AND REQUIREMENTS OF THE OWNER...
10. COORDINATION: COORDINATE MECHANICAL WORK WITH THE WORK OF OTHER TRADES...
11. EQUIPMENT LOCATIONS: DETERMINE EXACT EQUIPMENT AND MATERIALS LOCATIONS TO PROVIDE BEST ARRANGEMENT AND TO FACILITATE PROPER MAINTENANCE...
12. LISTING AND LABELING: ALL EQUIPMENT SHALL BE LABELED OR LISTED BY UL OR OTHER APPROVED TESTING AGENCY WHERE REQUIRED.
13. STORAGE SPACE: CONSULT WITH THE OWNER REGARDING JOB SITE STORAGE FOR MECHANICAL MATERIALS...
14. CLEANUP: REMOVE ALL DEBRIS GENERATED IN THE ACCOMPLISHMENT OF WORK UNDER THIS PROJECT...
15. ELECTRICAL WORK:
A. PERFORM ELECTRICAL WORK FOR MECHANICAL EQUIPMENT IN COMPLIANCE WITH PROJECT ELECTRICAL REQUIREMENTS...
B. ELECTRICAL DRAWINGS ARE BASED ON ELECTRICAL CHARACTERISTICS INDICATED IN DRAWING MECHANICAL EQUIPMENT SCHEDULES...
C. LOW VOLTAGE CONTROL WIRING FOR MECHANICAL SYSTEMS SHALL BE FURNISHED BY THE MECHANICAL CONTRACTOR.
16. SUBMITTALS: SUBMIT FOUR (4) COPIES OF DESCRIPTIVE DATA FOR MECHANICAL EQUIPMENT AND MATERIALS...
17. OPERATING AND MAINTENANCE MANUALS: SUBMIT TWO COPIES OF COMPLETE OPERATING AND MAINTENANCE INSTRUCTIONS...
18. RECORD DRAWINGS: MAINTAIN ONE SET OF "RED-LINE" RECORD DRAWINGS ON SITE AT ALL TIMES...
19. WARRANTY: WARRANTY THE MATERIALS AND WORKMANSHIP COVERED BY THESE DRAWINGS AND SPECIFICATIONS FOR A PERIOD OF ONE YEAR...

RATED WALL COORDINATION: REFER TO ARCHITECTURAL DRAWINGS FOR FIRE-RATED WALL ASSEMBLY TYPE DESIGNATIONS AND DETAILS.

MECHANICAL SUMMARY

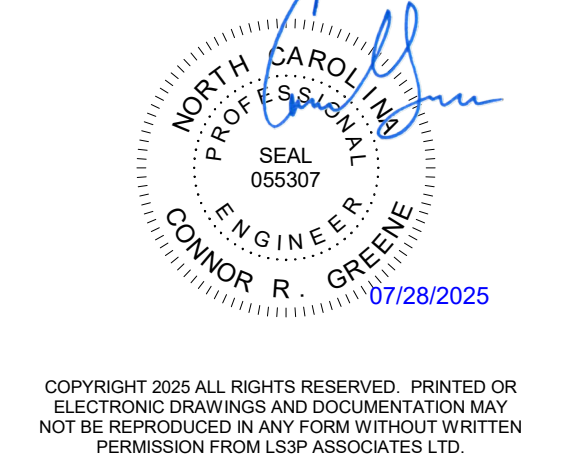
Table with columns for MECHANICAL SYSTEMS, SERVICE SYSTEMS AND EQUIPMENT, CLIMATE ZONE, INTERIOR DESIGN CONDITIONS, BUILDING HEATING LOAD, BUILDING COOLING LOAD, MECHANICAL SPACING CONDITIONING, and LIST EQUIPMENT EFFICIENCIES.

ENERGY SUMMARY

Table detailing energy requirements, climate zone, method of compliance, thermal envelope, roof ceiling assembly, exterior walls, openings, floors over unconditioned space, and floors slab on grade.

Remedy Medical Properties logo, Columbus Regional Healthcare System logo, Patient First, Technology Forward slogan, and LSP logo.

CBHF Engineers, PLLC logo and contact information: 2246 Yaupon Drive, Wilmington, NC 28401, Phone: 910.791.4000, Fax: 910.791.5266.



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LELAND MOB logo and address: PROVISION PARKWAY, LELAND, NORTH CAROLINA 28451. LSP PROJECT: 9403-240731.

Table with columns for DATE and DESCRIPTION, showing a permit set on 07/28/25.

SHEET NAME: MECHANICAL ABBREV. LEGEND, & SUMMARY

ORIG SUBMISSION: 07/28/25

SHEET: M-001 PERMIT SET

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THESE DRAWINGS ARE IN PART
FROM AN EXISTING SET
USING THE SAME SIZE

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FLOOR PLAN SHEET NOTES

1. MAINTAIN MANUFACTURER'S CLEARANCE REQUIREMENTS FOR INDOOR EQUIPMENT.
2. MECHANICAL CONTRACTOR TO COORDINATE WITH OTHER TRADES PRIOR TO BEGINNING WORK.
3. REFER TO ARCHITECTURAL DRAWINGS FOR RATED ASSEMBLY UL NUMBERS (WALLS, FLOOR / CEILING, ETC).
4. COORDINATED CONDENSATE PIPE ROUTING WITH GENERAL CONTRACTOR AND OWNER, TYPICAL.
5. CONCERNING DIFFUSER LAYOUT AND CEILING TYPE, REFER TO ARCHITECTURAL PLANS FOR FURTHER INFORMATION.
6. IN GENERAL, LOCATE VAV TERMINALS ABOVE DOOR SWING TO ASSURE CONTINUED ACCESS.



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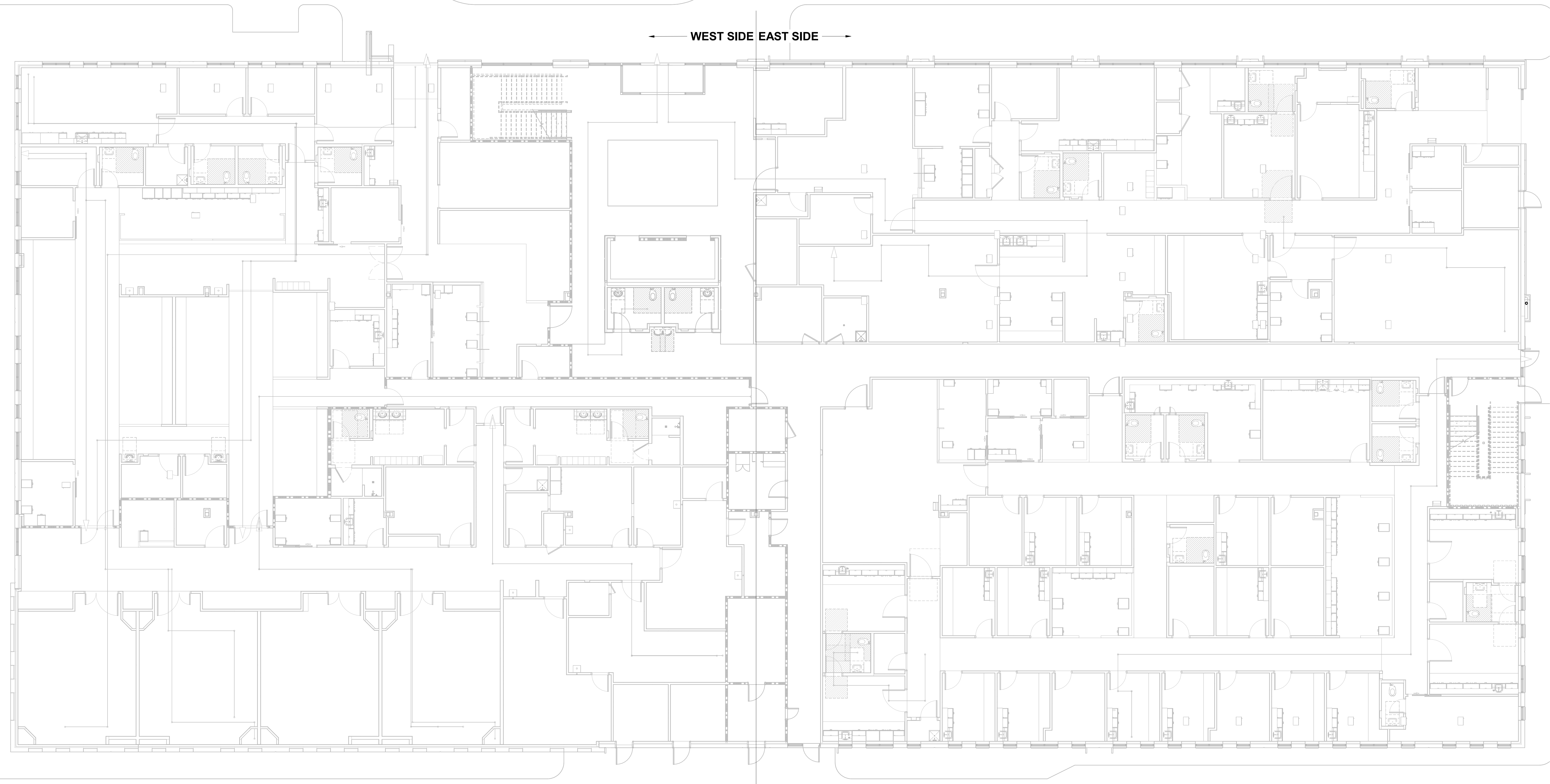
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← WEST SIDE EAST SIDE →



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PROVISION PARKWAY
LELAND, NORTH CAROLINA 28451
LSP PROJECT: 9403-240731

Δ	DATE	DESCRIPTION
0	07-28-25	PERMIT SET

SHEET NAME:
LEVEL 1 FLOOR
PLAN - HVAC

ORIG SUBMISSION: 07/28/25

SHEET: **MH101**

PERMIT SET

A1 LEVEL 1 FLOOR PLAN OVERALL - HVAC

1/8" = 1'-0"

RATED WALL COORDINATION:
REFER TO ARCHITECTURAL DRAWINGS FOR FIRE-RATED WALL ASSEMBLY TYPE DESIGNATIONS AND DETAILS.

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USING THESE DRAWINGS

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FLOOR PLAN SHEET NOTES

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4. COORDINATED CONDENSATE PIPE ROUTING WITH GENERAL CONTRACTOR AND OWNER, TYPICAL CONDENSING DIFFUSER LAYOUT AND CEILING TYPE, REFER TO ARCHITECTURAL PLANS FOR FURTHER INFORMATION.
5. IN GENERAL, LOCATE VAV TERMINALS ABOVE DOOR SWING TO ASSURE CONTINUED ACCESS.



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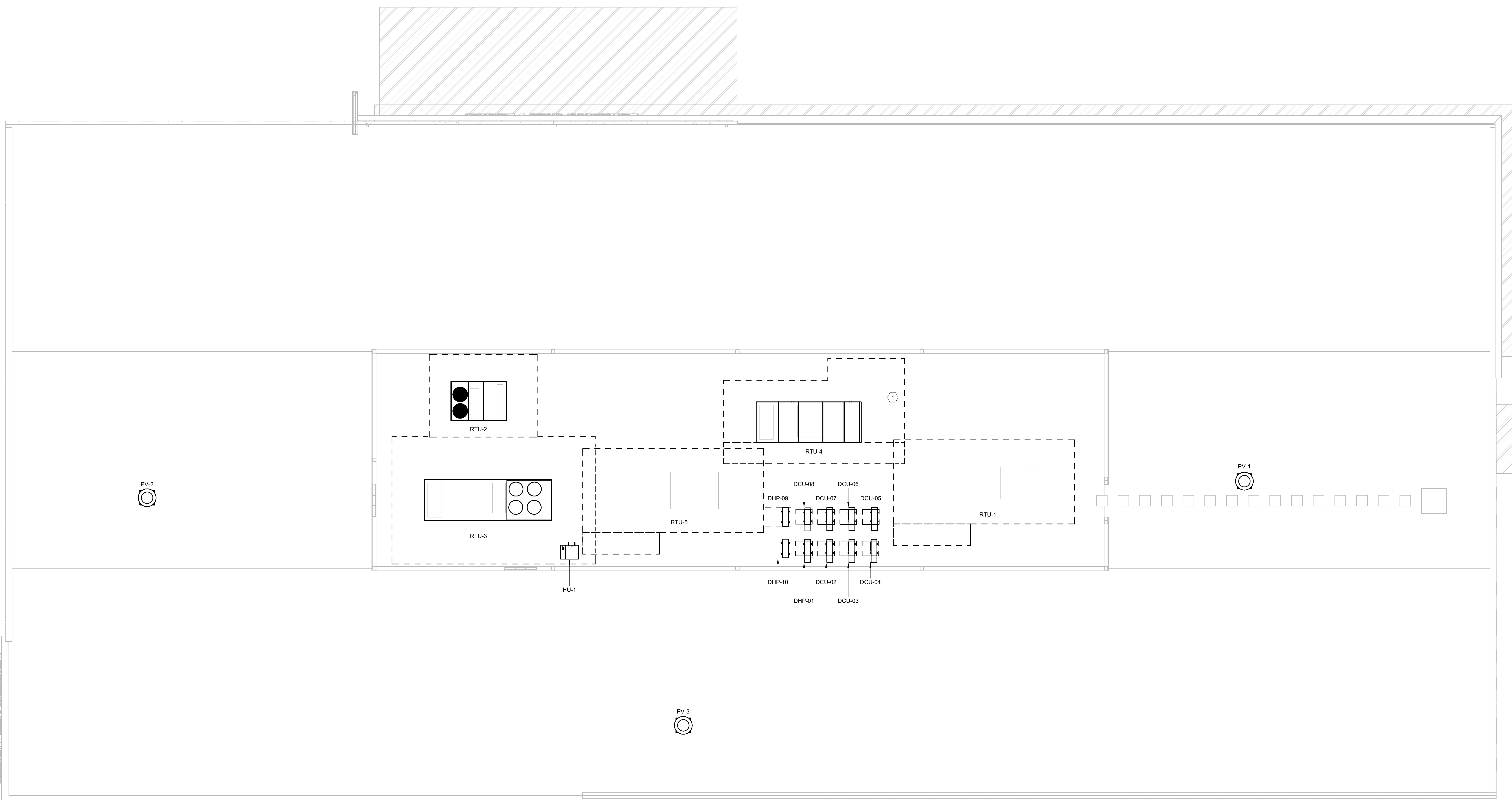
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LELAND, NORTH CAROLINA 28451
LSP PROJECT: 9403-240731

DATE	DESCRIPTION
07-28-25	PERMIT SET

SHEET NAME:
ROOF PLAN - HVAC

ORIG SUBMISSION: 07/28/25

SHEET: **MH103**

PERMIT SET

A1 ROOF PLAN - HVAC
1/8" = 1'-0"

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THESE DRAWINGS ARE TO BE PRINTED AT THE ORIGINAL SIZE

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FLOOR PLAN SHEET NOTES

1. MAINTAIN MANUFACTURER'S CLEARANCE REQUIREMENTS FOR INDOOR EQUIPMENT.
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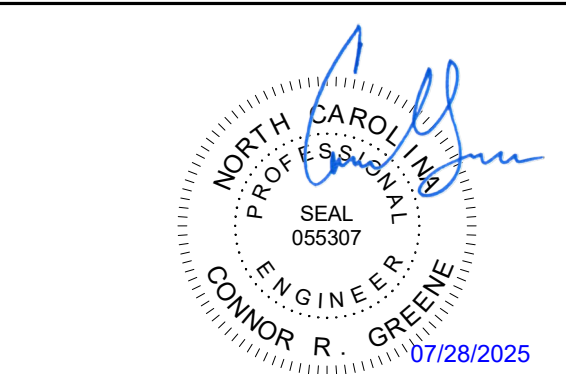


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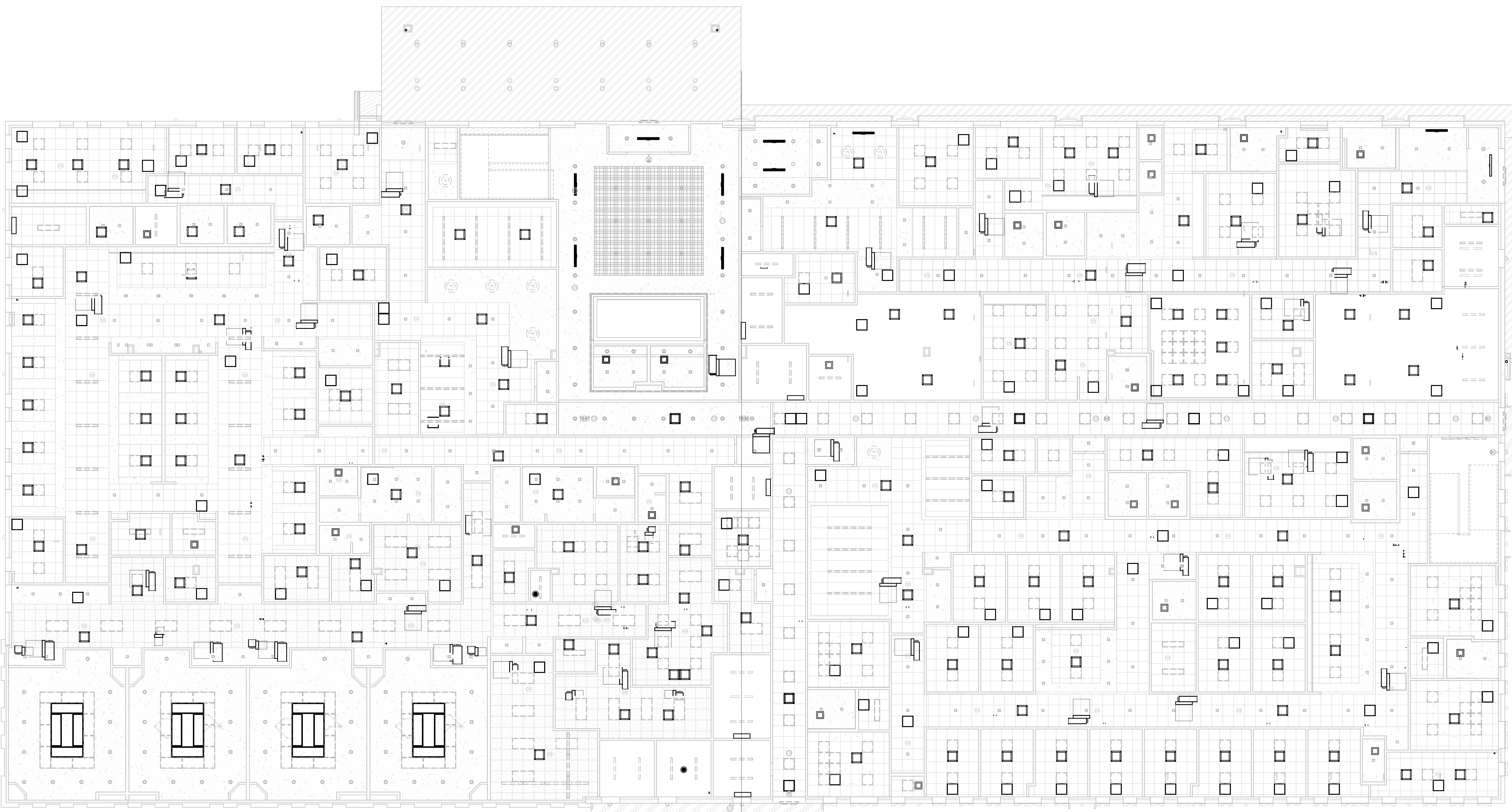
Δ	DATE	DESCRIPTION
0	07-28-25	PERMIT SET

SHEET NAME:
LEVEL 1 FLOOR PLAN - HVAC RCP

ORIG SUBMISSION: 07/28/25

SHEET: **MH201**

PERMIT SET



A1 LEVEL 1 FLOOR PLAN - HVAC RCP
 1/8" = 1'-0"

RATED WALL COORDINATION:
 REFER TO ARCHITECTURAL DRAWINGS FOR FIRE-RATED WALL ASSEMBLY TYPE DESIGNATIONS AND DETAILS.

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FLOOR PLAN SHEET NOTES

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6. IN GENERAL, LOCATE VAV TERMINALS ABOVE DOOR SWING TO ASSURE CONTINUED ACCESS.



Columbus Regional HEALTHCARE SYSTEM
Patient First. Technology Forward.



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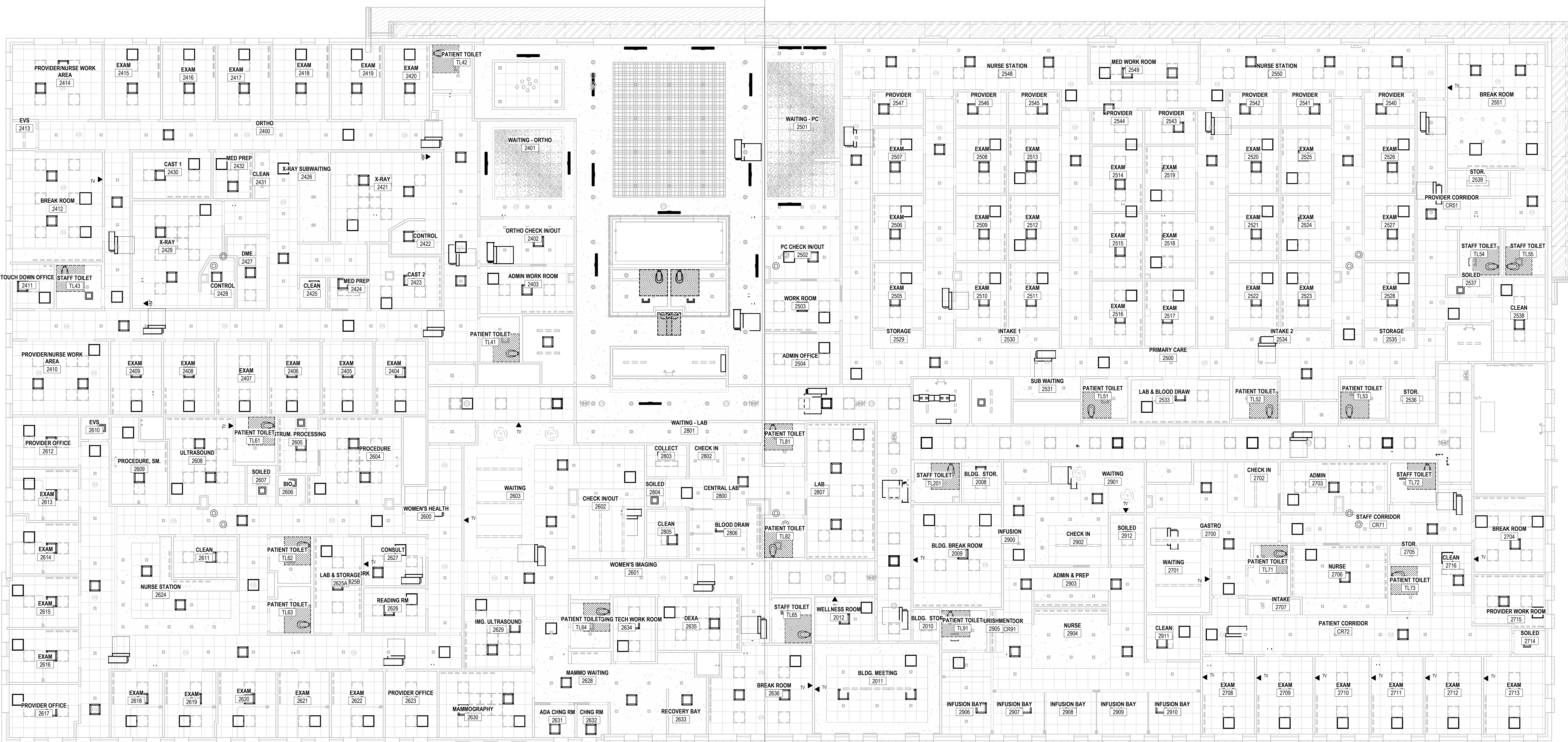
DATE	DESCRIPTION
07/28/25	PERMIT SET

SHEET NAME:
LEVEL 2 FLOOR PLAN - HVAC RCP

ORIG SUBMISSION: 07/28/25

SHEET: MH202

PERMIT SET



A1 LEVEL 2 FLOOR PLAN - HVAC RCP
1/8" = 1'-0"

RATED WALL COORDINATION:
REFER TO ARCHITECTURAL DRAWINGS FOR FIRE-RATED WALL ASSEMBLY TYPE DESIGNATIONS AND DETAILS.

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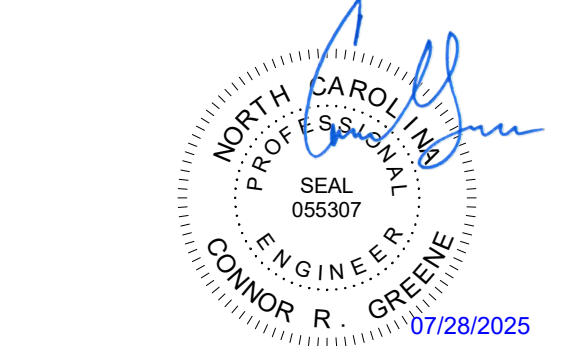
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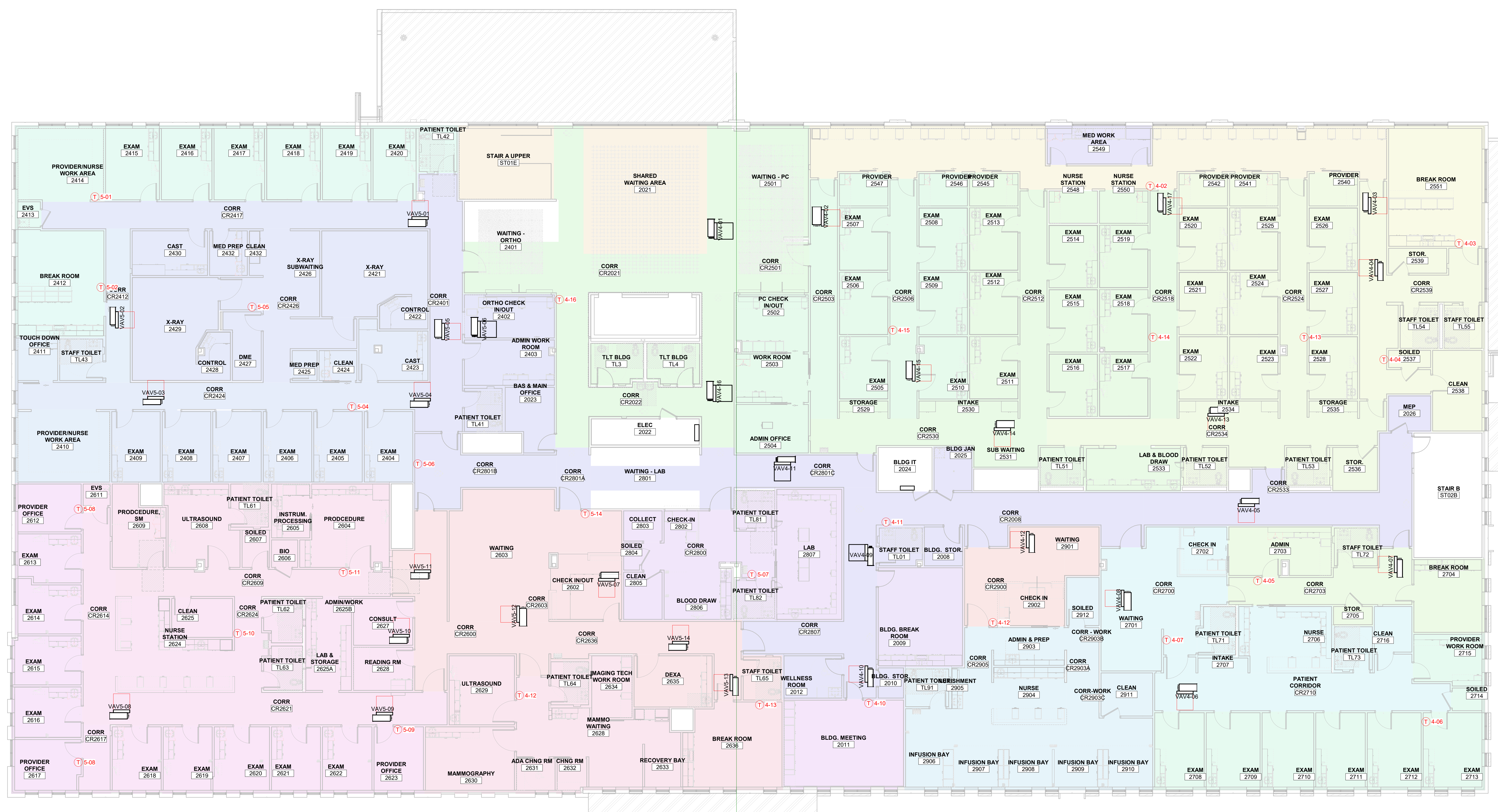
DATE	DESCRIPTION
07/28/25	PERMIT SET

SHEET NAME:
LEVEL 2 FLOOR
PLAN - HVAC
ZONING

ORIG SUBMISSION: 07/28/25

SHEET: MH302

PERMIT SET



A1 LEVEL 2 FLOOR PLAN - HVAC ZONING

1/8" = 1'-0"

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SINGLE DUCT TERMINAL UNIT SCHEDULE

Table with columns: DRAWING CODE, BASIS OF DESIGN, BASIS OF MODEL, PRIMARY AIRFLOW, HEATING COIL, NOISE CRITERIA, OPERATING WEIGHT, UNIT SERVED, NOTES, ACCESSORIES. Contains multiple rows of unit specifications.

NOTES: 1 REFER TO SPECIFICATIONS FOR FURTHER INFORMATION. 2 CONTROLS BY DDC CONTRACTOR... ACCESSORIES: A 1" DUAL WALL INSULATION ON UNIT...

362.0

POWER VENTILATOR SCHEDULE

Table with columns: DRAWING CODE, BASIS OF DESIGN, BASIS OF MODEL, FAN WHEEL, SERVICE, DRIVE TYPE, SPEED CONTROL, NOMINAL IMPELLER SIZE, CURB HEIGHT, DAMPER, MOTOR ENCLOSURE, FAN ENERGY INDEX, CAPACITIES, ELECTRICAL, SONES, WEIGHT, NOTES, ACCESSORIES.

MINI-SPLIT SYSTEM SCHEDULE

Table with columns: DRAWING CODE (IDU / ODU), BASIS OF DESIGN, BASIS OF MODEL (IDU / ODU), INDOOR UNIT CONFIGURATION, SYSTEM TYPE, ARI COOLING, ARI HEATING, MIN SEER2, MIN HSPF 2, INDOOR UNIT, ELECTRICAL, WEIGHT, OUTDOOR UNIT, ELECTRICAL, WEIGHT, REFRIGERANT PIPING, INDOOR UNIT LOCATION, NOTES, ACCESSORIES.

ELECTRIC STEAM HUMIDIFIER SCHEDULE

Table with columns: DRAWING CODE, LOCATION, DESIGN BASIS, MODEL NUMBER, HUMIDIFICATION RATE, AIR TEMPERATURE, NUMBER OF MANIFOLDS, ABSORPTION DISTANCE, MAKEUP WATER SUPPLY PRESSURE, ELECTRIC RESISTANCE HEATER CONTAINER, ELECTRICAL, WEIGHT, NOTES, ACCESSORIES.

1 REFER TO SPECIFICATIONS FOR FURTHER INFORMATION. 2 HUMIDIFIER SHALL BE DESIGNED FOR EXTERIOR INSTALLATION WITH FREEZE PROTECTION SYSTEM. 3 PROVIDE DUCT MOUNTED ABSORPTION TUBE WITH REQUIRED MINIMUM ABSORPTION DISTANCE IN THE SUPPLY AIRSTREAM DOWNSTREAM OF DX COIL.

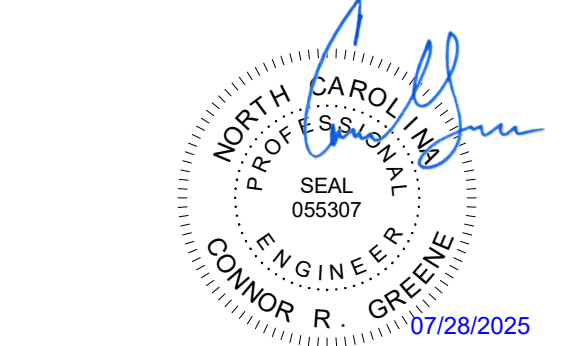


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LELAND MOB PROVISION PARKWAY LELAND, NORTH CAROLINA 28451 LSSP PROJECT: 9403-240731

Table with columns: DATE, DESCRIPTION. Row 1: 07-28-25 PERMIT SET

SHEET NAME: MECHANICAL SCHEDULES

ORIG SUBMISSION: 07/28/25

SHEET: M-601

PERMIT SET

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LOW DEWPOINT VAV PACKAGED UNIT SCHEDULE

Table with columns: DRAWING CODE, BASIS OF DESIGN, BASIS OF DESIGN MODEL, SYSTEM TYPE, COOLING (AMBIENT @ 95°F), EVAPORATOR FAN, ELECTRICAL, REFRIG. TYPE, WEIGHT (LBS.), NOTES, ACCESSORIES. Includes data for RTU-3 and detailed notes.

STANDARD VAV PACKAGED UNIT SCHEDULE

Table with columns: DRAWING CODE, BASIS OF DESIGN, BASIS OF DESIGN MODEL, SYSTEM TYPE, COOLING (AMBIENT @ 95°F), EVAPORATOR FAN, ELECTRICAL, REFRIG. TYPE, WEIGHT (LBS.), NOTES, ACCESSORIES. Includes data for RTU-1, RTU-4, and RTU-5.

UNITARY VAV PACKAGED UNIT SCHEDULE

Table with columns: DRAWING CODE, BASIS OF DESIGN, BASIS OF DESIGN MODEL, SYSTEM TYPE, COOLING (AMBIENT @ 95°F), EVAPORATOR FAN, ELECTRICAL, REFRIG. TYPE, WEIGHT (LBS.), NOTES, ACCESSORIES. Includes data for RTU-2 and detailed notes.

DIFFUSERS, REGISTERS AND GRILLES SCHEDULE

Table with columns: DRAWING CODE, BASIS OF DESIGN, BASIS OF DESIGN MODEL, ALTERNATE APPROVED MANUFACTURERS, TYPE, SERVICE, NECK SIZE (IN.), MODULE, MATERIAL, FINISH, MOUNTING, NOTES, ACCESSORIES. Lists various diffuser types and specifications.



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LELAND MOB PROVISION PARKWAY LELAND, NORTH CAROLINA 28451 LSP PROJECT: 2403-240731

Table with columns: DATE, DESCRIPTION. Row 0: 07-28-25 PERMIT SET.

SHEET NAME: MECHANICAL SCHEDULES

ORIG SUBMISSION: 07/28/25

SHEET: M-602

PERMIT SET

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2

3

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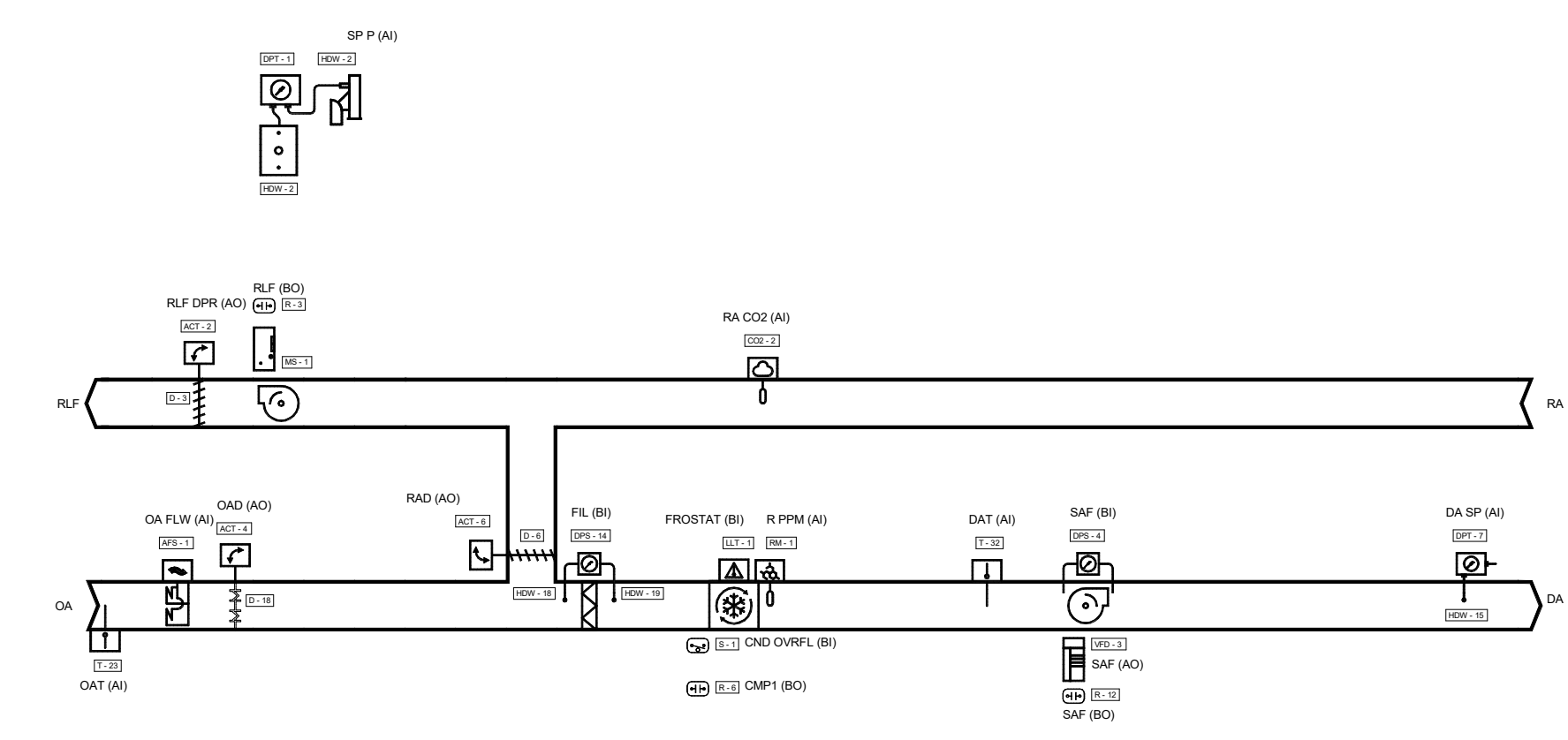
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PRELIMINARY CONTROL DRAWING NOTE:
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Flow Diagram: PACKAGED RTU



- COMP1 (BO)
COMP2 (BO)
COMP3 (BO)
COMP4 (BO)
COMP5 (BO)

SEQUENCE OF OPERATION: PACKAGED RTU

BUILDING AUTOMATION SYSTEM INTERFACE:
THE BUILDING AUTOMATION SYSTEM (BAS) SHALL SEND THE CONTROLLER OCCUPIED BYPASS, PRE-COOL, OCCUPIED UNOCCUPIED AND HEAT/COOL MODES. THE BAS SHALL ALSO SEND THE DISCHARGE AIR TEMPERATURE SETPOINT AND THE DUCT STATIC PRESSURE SETPOINT. IF A BAS IS NOT AVAILABLE, THE UNIT CONTROLLER SHALL OPERATE USING DEFAULT MODES AND SETPOINTS.

OCCUPIED:
DURING OCCUPIED PERIODS, THE SUPPLY FAN SHALL RUN CONTINUOUSLY AND THE MIXED AIR DAMPERS SHALL OPEN TO MAINTAIN MINIMUM VENTILATION REQUIREMENTS. THE UNIT CONTROLLER SHALL CONTROL THE SUPPLY FAN SPEED TO MAINTAIN THE CURRENT SUPPLY DUCT STATIC PRESSURE SETPOINT (ADJ.). UPON A CALL FOR DX COOLING, THE UNIT CONTROLLER SHALL ENABLE THE FIRST FIXED SPEED COMPRESSOR. IF THE FIXED SPEED COMPRESSOR CANNOT SATISFY THE LOAD CONDITIONS, THE UNIT CONTROLLER SHALL START THE NEXT FIXED SPEED COMPRESSOR IN SEQUENCE TO ADD TO THE TOTAL UNIT COOLING LOAD PERCENTAGE. THIS PROCESS SHALL REPEAT UNTIL ALL OF THE FIXED SPEED COMPRESSORS HAVE BEEN STARTED OR UNTIL THE ACTIVE DISCHARGE AIR TEMPERATURE SETPOINT IS SATISFIED. IF ECONOMIZING IS ENABLED, THE OUTDOOR AIR OR MIXED AIR DAMPERS SHALL MODULATE TO MAINTAIN THE DISCHARGE AIR TEMPERATURE SETPOINT AND THE RELIEF AIR DAMPER SHALL TRACK THE MIXED AIR DAMPERS. IF THE DISCHARGE AIR TEMPERATURE SENSOR FAILS, THE DX COOLING SHALL BE DISABLED AND AN ALARM SHALL ANNUNCIATE AT THE BAS.

UNOCCUPIED:
WHEN THE SPACE TEMPERATURE IS ABOVE THE UNOCCUPIED COOLING SETPOINT OF 85.0 DEG. F (ADJ.) THE SUPPLY FAN SHALL BE COMMANDED ON. THE OUTSIDE AIR DAMPER SHALL OPEN IF ECONOMIZING IS ENABLED AND REMAIN CLOSED IF ECONOMIZING IS DISABLED AND THE DX COOLING SHALL BE ENABLED. WHEN THE SPACE TEMPERATURE FALLS BELOW THE UNOCCUPIED COOLING SETPOINT OF 85.0 DEG. F MINUS THE UNOCCUPIED DIFFERENTIAL OF 4.0 DEG. F (ADJ.) THE SUPPLY FAN SHALL STOP, THE DX COOLING SHALL BE DISABLED AND THE OUTSIDE AIR DAMPER SHALL CLOSE.

OPTIMAL START:
THE BAS SHALL MONITOR THE SCHEDULED OCCUPIED TIME, OCCUPIED SPACE SETPOINTS AND SPACE TEMPERATURE TO CALCULATE WHEN THE OPTIMAL START OCCURS.

OPTIMAL STOP:
THE BAS SHALL MONITOR THE SCHEDULED UNOCCUPIED TIME, OCCUPIED SETPOINTS AND SPACE TEMPERATURE TO CALCULATE WHEN THE OPTIMAL STOP OCCURS. WHEN THE OPTIMAL STOP MODE IS ACTIVE THE UNIT CONTROLLER SHALL MAINTAIN THE SPACE TEMPERATURE TO THE SPACE TEMPERATURE OFFSET SETPOINT. OUTSIDE AIR DAMPER SHALL REMAIN ENABLED TO PROVIDE MINIMUM VENTILATION.

PRE-COOL MODE:
DURING OPTIMAL START, IF THE AVERAGE SPACE TEMPERATURE IS ABOVE THE OCCUPIED COOLING SETPOINT, PRE-COOL MODE SHALL BE ACTIVATED. WHEN PRE-COOL IS INITIATED THE UNIT SHALL ENABLE THE FAN AND COOLING OR ECONOMIZER. THE OUTSIDE AIR DAMPER SHALL REMAIN CLOSED, UNLESS ECONOMIZING. WHEN THE SPACE TEMPERATURE REACHES OCCUPIED COOLING SETPOINT (ADJ.), THE UNIT SHALL TRANSITION TO THE OCCUPIED MODE.

OCCUPIED BYPASS:
THE BAS SHALL MONITOR THE STATUS OF THE ON AND CANCEL BUTTONS OF THE SPACE TEMPERATURE SENSORS. WHEN AN OCCUPIED BYPASS REQUEST IS RECEIVED FROM A SPACE SENSOR, THE UNIT SHALL TRANSITION FROM ITS CURRENT OCCUPANCY MODE TO OCCUPIED BYPASS MODE AND THE UNIT SHALL MAINTAIN THE SPACE TEMPERATURE TO THE OCCUPIED SETPOINTS (ADJ.).

HEAT/COOL MODE:
COOLING: THE UNIT CONTROLLER SHALL USE THE DISCHARGE AIR TEMPERATURE SENSOR AND DISCHARGE AIR TEMPERATURE COOLING SETPOINT TO DETERMINE WHEN TO INITIATE REQUESTS FOR COOLING. DISCHARGE AIR SETPOINT SHALL BE MAINTAINED BY CONTROLLING THE COOLING AS REQUIRED.

DISCHARGE AIR TEMPERATURE RESET CONTROL:
THE DISCHARGE AIR TEMPERATURE SETPOINT, 55.0 DEG. F - 65.0 DEG. F (ADJ.) SHALL BE RESET BASED ON EITHER THE OUTSIDE AIR TEMPERATURE OR SPACE AVERAGE TEMPERATURE (ADJ.). THE MINIMUM DISCHARGE AIR SETPOINT SHALL BE SET AT 55.0 DEG. F (ADJ.). THE DISCHARGE TEMPERATURE SENSOR SHALL PREVENT THE DISCHARGE AIR TEMPERATURE FROM FALLING BELOW THE MINIMUM DISCHARGE AIR SETPOINT (ADJ.). IF THE DISCHARGE AIR TEMPERATURE CONTINUES TO FALL, THE DISCHARGE TEMPERATURE SENSOR SHALL ACT AS A LOW DISCHARGE TEMPERATURE LIMIT. A LOW TEMPERATURE ALARM SHALL ANNUNCIATE, AND THE UNIT SHALL SHUT DOWN. IF THE DISCHARGE TEMPERATURE RISES ABOVE THE HIGH LIMIT SETPOINT THE SENSOR SHALL ACT AS A HIGH DISCHARGE TEMPERATURE LIMIT AND SHALL KEEP THE UNIT RUNNING. A HIGH TEMPERATURE ALARM SHALL ANNUNCIATE.

OUTDOOR AIR TEMPERATURE RESET: THE DISCHARGE AIR TEMPERATURE SETPOINT SHALL BE ADJUSTED BASED ON THE OUTSIDE AIR TEMPERATURE AND THE COOLING AND HEATING LOAD OF THE BUILDING.

SPACE TEMPERATURE RESET: THE DISCHARGE AIR TEMPERATURE SETPOINT SHALL BE ADJUSTED BASED ON THE TEMPERATURE OF THE CRITICAL SPACE(S).

ECONOMIZER:
ENABLE (REFERENCE DRY BULB): OUTSIDE AIR (OA) TEMPERATURE SHALL BE COMPARED WITH A REFERENCE DRY BULB SETPOINT. THE ECONOMIZER SHALL ENABLE WHEN THE OA TEMPERATURE IS LESS THAN REFERENCE DRY BULB SETPOINT. THE ECONOMIZER SHALL BE DISABLED WHEN OA TEMPERATURE IS GREATER THAN REFERENCE DRY BULB SETPOINT + 2.0 DEG. F.

OPERATION: THE SUPPLY AIR SENSOR SHALL MEASURE THE DRY BULB TEMPERATURE OF THE AIR LEAVING THE EVAPORATOR COIL WHILE ECONOMIZING. WHEN ECONOMIZING IS ENABLED AND THE UNIT IS OPERATING IN THE COOLING MODE, THE ECONOMIZER DAMPER SHALL BE MODULATED BETWEEN ITS MINIMUM POSITION AND 100% TO MAINTAIN THE DISCHARGE AIR TEMPERATURE SETPOINT. THE ECONOMIZER DAMPER SHALL MODULATE TOWARD MINIMUM POSITION IN THE EVENT THE DISCHARGE AIR TEMPERATURE FALLS BELOW THE DISCHARGE LOW LIMIT TEMPERATURE SETPOINT. COMPRESSORS SHALL BE DELAYED FROM OPERATING UNTIL THE ECONOMIZER HAS OPENED TO 100%.

VENTILATION CONTROL:
WHEN THE SPACE CO2 LEVEL IS GREATER THAN OR EQUAL TO THE DESIGN MINIMUM CO2 SETPOINT, THE OUTDOOR AIR DAMPER SHALL OPEN TO THE DESIGN MINIMUM OUTDOOR AIR DAMPER SETPOINT. WHEN THE SPACE CO2 LEVEL IS LESS THAN OR EQUAL TO THE DESIGN MINIMUM CO2 SETPOINT, THE OUTDOOR AIR DAMPER SHALL CLOSE TO THE DESIGN MINIMUM OUTDOOR AIR DAMPER SETPOINT. IF THERE IS A CALL FOR ECONOMIZER COOLING, THE DAMPER SHALL BE OPENED FURTHER TO SATISFY THE COOLING REQUEST.

SUPPLY FAN:
THE SUPPLY FAN SHALL BE ENABLED WHILE IN THE OCCUPIED MODE AND CYCLED ON DURING THE UNOCCUPIED MODE.

SUPPLY DUCT STATIC PRESSURE CONTROL:
DURING THE OCCUPIED MODE THE UNIT CONTROLLER SHALL MODULATE THE OUTPUT TO THE VARIABLE FREQUENCY DRIVE AS REQUIRED TO MAINTAIN THE SUPPLY DUCT STATIC PRESSURE SETPOINT OF 1.5 INCHES OF W.C. (ADJ.). IF THE SUPPLY DUCT STATIC PRESSURE FALLS BELOW 1.3 INCHES OF W.C. (ADJ.) THE UNIT CONTROLLER SHALL INCREASE THE OUTPUT TO THE VARIABLE FREQUENCY DRIVE TO MAINTAIN SETPOINT. IF THE SUPPLY DUCT STATIC PRESSURE RISES ABOVE 1.7 INCHES OF W.C. (ADJ.) THE UNIT CONTROLLER SHALL DECREASE THE OUTPUT TO THE VARIABLE FREQUENCY DRIVE TO MAINTAIN SETPOINT. UPON A CALL FOR HEATING OR COOLING IN THE UNOCCUPIED MODE THE UNIT CONTROLLER SHALL MODULATE THE SPEED OF THE VARIABLE FREQUENCY DRIVE TO 100%.

STATIC PRESSURE HIGH LIMIT:
IF FOR ANY REASON THE SUPPLY AIR PRESSURE EXCEEDS THE SUPPLY AIR PRESSURE HIGH LIMIT, THE SUPPLY FAN SHALL SHUT DOWN. THE UNIT SHALL BE ALLOWED TO RESTART THREE TIMES AFTER A 15 MINUTE OFF PERIOD. IF THE OVERPRESSURIZATION CONDITION OCCURS ON THE FOURTH RESTART, THE UNIT SHALL SHUT DOWN AND A MANUAL RESET DIAGNOSTIC IS DISPLAYED AT THE REMOTE PANEL AND/OR THE BAS SYSTEM. IF FOR ANY REASON THE SUPPLY AIR PRESSURE EXCEEDS THE FIXED SUPPLY AIR PRESSURE LIMIT OF 3.5 INCHES OF W.C. THE SUPPLY FAN SHALL SHUT DOWN. THE UNIT SHALL BE ALLOWED TO RESTART THREE TIMES. IF THE OVER PRESSURIZATION CONDITION OCCURS ON THE FOURTH RESTART, THE UNIT SHALL SHUT DOWN AND A MANUAL RESET DIAGNOSTIC IS DISPLAYED AT THE REMOTE PANEL AND/OR THE BAS SYSTEM.

RELIEF AIR AND BUILDING PRESSURE CONTROL:

A DIFFERENTIAL PRESSURE TRANSDUCER SHALL ACTIVELY MONITOR THE DIFFERENCE IN PRESSURE BETWEEN THE BUILDING (INDOORS) AND OUTDOORS. IF THE BUILDING PRESSURE INCREASES ABOVE THE DIFFERENTIAL PRESSURE SETPOINT, THE UNIT CONTROLLER SHALL OPEN THE RELIEF AIR DAMPER, TURN ON THE RELIEF FAN AND MODULATE THE RELIEF AIR DAMPER TO CONTROL BUILDING PRESSURE TO THE DIFFERENTIAL PRESSURE SETPOINT. IF THE BUILDING PRESSURE DECREASES BELOW THE DIFFERENTIAL PRESSURE SETPOINT, THE ASSOCIATED CONTROLLER SHALL DEACTIVATE THE RELIEF FAN AND CLOSE THE RELIEF AIR DAMPER.

A DIFFERENTIAL PRESSURE SWITCH SHALL MONITOR THE DIFFERENTIAL PRESSURE ACROSS THE RELIEF AIR FAN. IF THE SWITCH IS DETECTED TO BE OPEN FOR 40 CONSECUTIVE SECONDS AFTER A REQUEST FOR RELIEF FAN OPERATION A FAN FAILURE ALARM SHALL ANNUNCIATE AT THE BAS AND THE RELIEF FAN SHALL STOP. A MANUAL RESET SHALL BE REQUIRED.

FILTER STATUS:
A DIFFERENTIAL PRESSURE SWITCH SHALL MONITOR THE DIFFERENTIAL PRESSURE ACROSS THE FILTER(S) WHEN THE FAN IS RUNNING. IF THE SWITCH CLOSURES DURING NORMAL OPERATION A DIRTY FILTER ALARM SHALL ANNUNCIATE AT THE BAS.

CONDENSATE OVERFLOW SHUTDOWN:
THE UNIT SHALL SHUT DOWN IN RESPONSE TO A SIGNAL FROM THE CONDENSATE OVERFLOW SENSOR. THE SENSOR SHALL BE INTERLOCKED TO THE UNIT COOLING CONTROLLER FOR IMMEDIATE SHUTDOWN OF COOLING.

REFRIGERANT MITIGATION MODE:
THE UNIT CONTROLLER WILL MONITOR THE LEAK DETECTION SYSTEM. WHEN A LEAK IS DETECTED, AN ALARM WILL PROMPTLY ALERT THE BAS VIA BACNET CHANGE-OF-VALUE (COV) AND MITIGATION WILL BE ACTIVATED. THE COMPRESSOR(S), ELECTRIC HEATING, FUEL-FIRED HEATING, AND OTHER IGNITION DEVICE STARTERS SHALL BE DISABLED, AND ACTIVATE MECHANICAL VENTILATION (IF IT IS REQUIRED BY SECTION 7.6.4 OF THE ASRAE STANDARD). FOR THE DURATION OF THE MITIGATION PROCESS PLUS AN ADDITIONAL 5 MINUTES. OPERATIONAL, AND THE COMPRESSOR(S), ELECTRIC HEATING, FUEL-FIRED HEATING, AND OTHER IGNITION DEVICE STARTERS SHALL BE DISABLED, AND ACTIVATE MECHANICAL VENTILATION (IF IT IS REQUIRED BY SECTION 7.6.4 OF THE ASRAE STANDARD). FOR THE DURATION OF THE MITIGATION PROCESS PLUS AN ADDITIONAL 5 MINUTES.

GUIDE SPECIFICATION: PACKAGED RTU

1.1 APPLICATION CONTROLLER FOR PACKAGED ROOFTOP UNITS
A. THE ROOFTOP UNIT (RTU) APPLICATION CONTROLLER SHALL BE A MICROPROCESSOR-BASED DDC CONTROLLER WHICH, THROUGH HARDWARE OR FIRMWARE DESIGN, CONTROLS SPECIFIED EQUIPMENT. THE CONTROLLER IS NOT USER PROGRAMMABLE, BUT IS CUSTOMIZED FOR OPERATION WITHIN THE CONFINES OF THE EQUIPMENT IT IS DESIGNED TO SERVE.
B. THE APPLICATION CONTROLLER SHALL BE CAPABLE OF OPERATING AS A STAND-ALONE CONTROLLER OR AS A MEMBER OF A BUILDING AUTOMATION SYSTEM (BAS).

C. WHEN THE APPLICATION CONTROLLER IS OPERATING AS A MEMBER OF A BUILDING AUTOMATION SYSTEM (BAS), THE APPLICATION CONTROLLER SHALL OPERATE AS FOLLOWS:
1. APPLICATION CONTROLLER WILL RECEIVE OPERATION MODE COMMANDS FROM THE BAS NETWORK CONTROLLER. THE BAS COMMANDS SHALL INCLUDE BUT NOT BE LIMITED TO THE FOLLOWING: OCCUPIED HEAT/COOL, UNOCCUPIED HEAT/COOL, MORNING WARM-UP, / PRE-COOL, OCCUPIED BYPASS).

2. APPLICATION CONTROLLER WILL PROVIDE EQUIPMENT STATUS PARAMETERS TO THE BAS THROUGH BACNET COMMUNICATION.
3. APPLICATION CONTROLLER WILL OPERATE AS A STAND-ALONE CONTROLLER IN THE EVENT OF COMMUNICATION FAILURE WITH THE BAS.

4. IN CASE OF COMMUNICATIONS FAILURE STAND-ALONE OPERATION SHALL USE DEFAULT VALUES OR LAST KNOWN VALUES FOR REMOTE SENSORS READ OVER THE NETWORK SUCH AS OUTDOOR AIR TEMPERATURE.

D. SOFTWARE
1. TO MEET THE SEQUENCE OF OPERATION FOR EACH ZONE CONTROL, THE CONTROLLER SHALL USE PROGRAMS DEVELOPED AND TESTED BY THE CONTROLLER MANUFACTURER THAT ARE EITHER FACTORY LOADED OR CUSTOMIZED WITH USE OF SERVICE TOOL NATIVE TO THE CONTROLLER.

E. ENVIRONMENT: CONTROLLER HARDWARE SHALL BE SUITABLE FOR THE ANTICIPATED AMBIENT CONDITIONS.

1. STORAGE: -55° TO 203° F (-48° TO 95° C) AND 5 TO 95% RH, NON-CONDENSING.

2. OPERATING: -40° TO 158° F (-40 TO 70° C) AND 5 TO 95% RH, NON-CONDENSING.

3. CONTROLLERS USED INDOORS SHALL BE MOUNTED IN A NEMA 1 ENCLOSURE AT A MINIMUM.

4. CONTROLLERS USED OUTDOORS AND/OR IN WET AMBIENT SHALL BE MOUNTED WITHIN NEMA 4 TYPE WATERPROOF ENCLOSURES, AND SHALL BE RATED FOR OPERATION AT -40° TO 158° F [-40° TO 70° C].

F. CONTROLLER INPUT/OUTPUT: THE CONTROLLER SHALL HAVE ON BOARD CAPABLE OF PERFORMING ALL FUNCTIONALITY NEEDED FOR THE APPLICATION. CONTROLS PROVIDED BY THE EQUIPMENT MANUFACTURE MUST SUPPLY THE REQUIRED I/O FOR THE EQUIPMENT.

1. FOR FLEXIBILITY IN SELECTION AND REPLACEMENT OF VALVES, THE CONTROLLERS SHALL BE CAPABLE OF SUPPORTING ALL OF THE FOLLOWING OUTPUT TYPES: 0-10VDC, 0-5VDC, 4-20MA, BINARY.

2. FOR FLEXIBILITY IN SELECTION AND REPLACEMENT OF SENSORS, THE CONTROLLERS SHALL BE CAPABLE OF READING SENSOR INPUT RANGES OF 0 TO10V, 0 TO 20MA, PULSE COUNTS, AND 200 TO 20KOHM.

G. SERVICEABILITY - THE CONTROLLER SHALL PROVIDE THE FOLLOWING IN ORDER TO IMPROVE SERVICEABILITY OF THE CONTROLLER:

1. DIAGNOSTIC LEDS SHALL INDICATE CORRECT OPERATION OR FAILURES/FAULTS FOR ALL OF THE FOLLOWING: POWER, SENSORS, BACNET COMMUNICATIONS, AND I/O COMMUNICATIONS BUS.

2. ALL BINARY OUTPUT SHALL HAVE LED'S INDICATING THE OUTPUT STATE.

3. ALL WIRING CONNECTORS SHALL REMOVABLE WITHOUT THE USE OF A TOOL.

4. SOFTWARE SERVICE TOOL CONNECTION THROUGH THE FOLLOWING METHODS: DIRECT CABLE CONNECTION TO THE CONTROLLER, CONNECTION THROUGH ANOTHER CONTROLLER ON BACNET LINK.

H. SOFTWARE RETENTION: ALL ZONE CONTROLLER OPERATING PARAMETERS, SETPOINTS, BIOS, AND SEQUENCE OF OPERATION CODE MUST BE STORED IN NON-VOLATILE MEMORY IN ORDER TO MAINTAIN SUCH INFORMATION FOR MONTHS WITHOUT POWER.

1. CONTROLLER SHALL MEET THE FOLLOWING AGENCY COMPLIANCE:

1. UL916 PAKZ, OPEN ENERGY MANAGEMENT EQUIPMENT

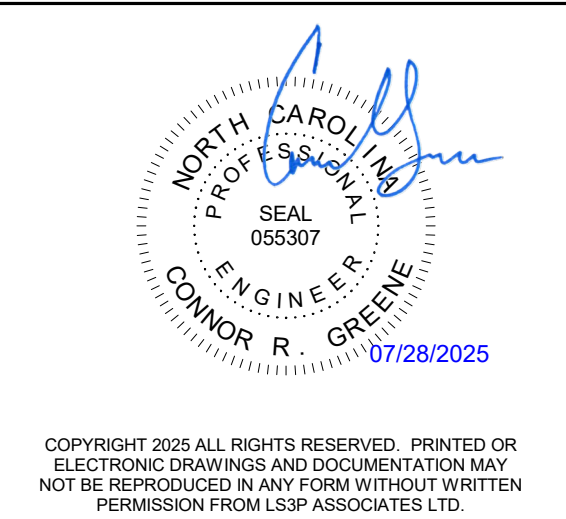
2. UL94-5V, FLAMMABILITY

3. FCC PART 15, SUBPART B, CLASS B LIMIT

4. BACNET TESTING LABORATORY (BTL) LISTED

Points List: PACKAGED RTU

Table with columns: System Point Description, POINTS, ALARMS. Rows include: BUILDING STATIC PRESSURE LOCAL SP P, COMPRESSOR 1 COMMAND CMP1, COMPRESSOR 2 COMMAND CMP2, COMPRESSOR 3 COMMAND CMP3, COMPRESSOR 4 COMMAND CMP4, COMPRESSOR 5 COMMAND CMP5, CONDENSATE OVERFLOW DETECTION LOCAL CND OVRFL, COOLING OUTPUT COMMAND CLG, DISCHARGE AIR STATIC PRESSURE LOCAL DA SP, DISCHARGE AIR TEMPERATURE DAT, DX COIL FROST STAT FROST, REFRIGERANT AIR DAMPER MAD, MIXED AIR DAMPER COMMAND OAD, OUTSIDE AIR FLOW LOCAL OA FLW, OUTSIDE AIR TEMPERATURE LOCAL OAT, PRIMARY FILTER STATUS LOCAL FL, REFRIGERANT LFL CONCENTRATION ALARM THRESHOLD SENSOR A R ALM A, REFRIGERANT LFL CONCENTRATION ALARM THRESHOLD SENSOR B R ALM B, REFRIGERANT LFL CONCENTRATION ALARM THRESHOLD SENSOR C R ALM C, REFRIGERANT LFL CONCENTRATION ALARM THRESHOLD SENSOR D R ALM D, REFRIGERANT MITIGATION ACTIVE R MIT, REFRIGERANT TYPE R TYP, RELIEF AIR DAMPER COMMAND RLF DPR, RETURN AIR CO2 LOCAL RA CO2, RETURN AIR DAMPER COMMAND RAD, SUPPLY FAN SPEED SAF, SUPPLY FAN START/STOP SAF, SUPPLY FAN STATUS LOCAL SAF, APPLICATION MODE APP MODE, BAS COMMUNICATION STATE BAS COM, COMPRESSOR ENABLE CMP ENA, COMPRESSOR LOCKOUT STATUS CMP LCK, COOL OUTPUT CLG, DISCHARGE AIR STATIC PRESSURE SETPOINT DA SP SPT, ECONOMIZER ENABLE ECON ENA, ECONOMIZER MINIMUM POSITION SETPOINT ECON MIN POS SP, FAN MODE COMMAND FAN MODE, FILTER TIMER HOURS FIL HRS, HEAT / COOL MODE REQUEST HIC REQ, OCCUPANCY OCC, OCCUPIED COOLING SETPOINT OCC CLG SP, SPACE CO2 HIGH LIMIT SP CO2 HL, TIMED OVERRIDE STATUS TOV, UNOCCUPIED COOLING SETPOINT UNOCC CLG SP.



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PROVISION PARKWAY
LELAND, NORTH CAROLINA 28451
LSP PROJECT: 9403-240731

Table with columns: DATE, DESCRIPTION. Row 1: 07/28/25, PERMIT SET.

SHEET NAME: MECHANICAL CONTROLS

ORIG SUBMISSION: 07/28/25

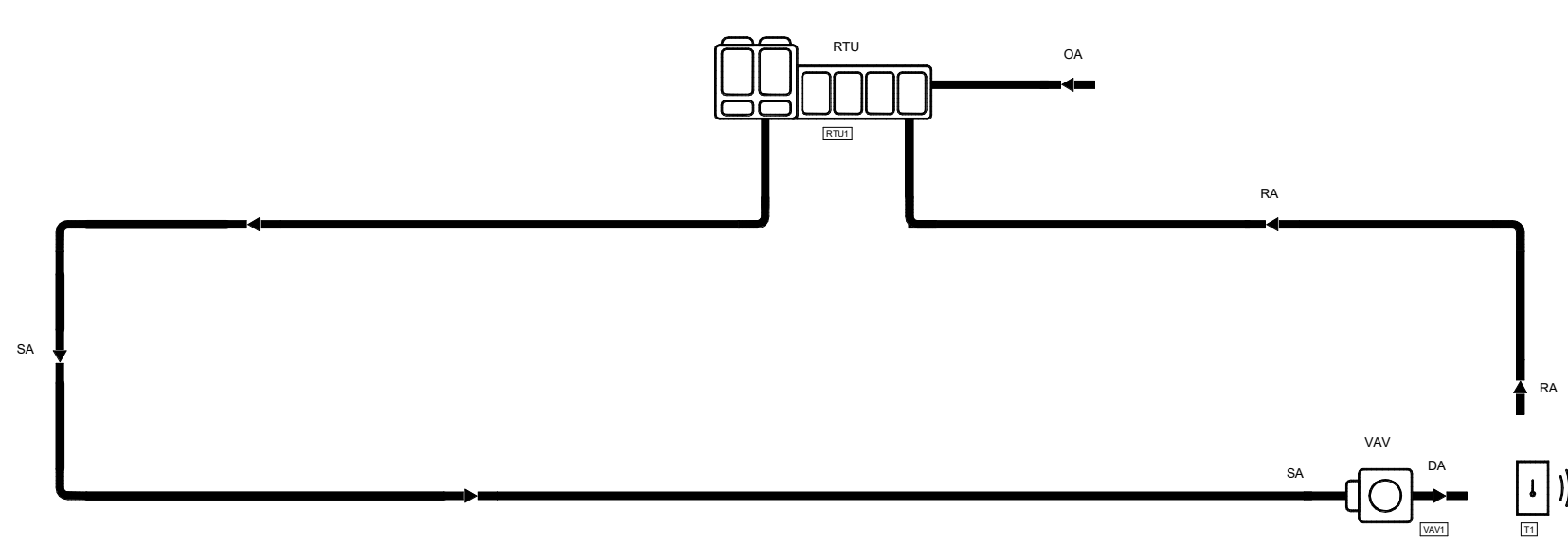
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Flow Diagram: VARIABLE AIR VOLUME SYSTEM



Points List: VARIABLE AIR VOLUME SYSTEM

Table with columns: System Point Description, POINTS, ALARMS. Lists various system points like 'AIRSIDE ECONOMIZER ENABLE', 'DISCHARGE AIR TEMPERATURE ACTIVE SETPOINT', etc.

Sequence of Operation: VARIABLE AIR VOLUME SYSTEM

ROOFTOP UNIT VAV AIR SYSTEM:
NOTE:
SYSTEM OPERATING MODES:
OCCUPIED HEAT/COOL:
UNOCCUPIED HEAT/COOL:
REFRIGERANT MITIGATION MODE:
UNOCCUPIED ECONOMICIZING (NIGHT PURGE):
OPTIMIZED CONTROL OF SUPPLY DUCT STATIC PRESSURE (FAN-PRESSURE OPTIMIZATION):
ALL VALUES BELOW ARE ADJUSTABLE:
OPTIMIZED CONTROL OF DISCHARGE AIR TEMPERATURE (DAT RESET):
OPTIMIZED CONTROL OF VENTILATION (DEMAND-CONTROLLED VENTILATION) WITH RTU RETURN AIR CO2:

Guide Specification: VARIABLE AIR VOLUME SYSTEM

1.1 VARIABLE AIR SYSTEM - CONTROL SYSTEM DESCRIPTION
A. PROVIDE A NEW AIR SYSTEM CONTROLLER OR BUILDING AUTOMATION SYSTEM (BAS) TO INTEGRATE AND CONTROL ALL MECHANICAL EQUIPMENT ASSOCIATED WITH THE VARIABLE AIR SYSTEM.
1.2 VARIABLE AIR SYSTEM - APPROVED CONTROL SYSTEM MANUFACTURERS
1.3 VARIABLE AIR SYSTEM - COMMUNICATIONS
1.4 VARIABLE AIR SYSTEM - OPERATOR INTERFACE

Pages for All Equipment and Applications

1. CONTROLS MANUFACTURER SHALL PROVIDE A PHONE/TABLET INTERFACE WITH THE ABILITY TO VIEW/OVERRIDE STATUS AND SETPOINTS, VIEW CHANGE SCHEDULES, VIEW/ACKNOWLEDGE COMMENT ON ALARMS, AND VIEW GRAPHICS FOR ALL SPACES AND EQUIPMENT.
2. PROVIDE MOBILE (SMART PHONE OR TABLET) INTERFACES TO THE BUILDING AUTOMATION SYSTEM, COMPATIBLE WITH IOS AND ANDROID OPERATING SYSTEMS.
3. CONTROLS MANUFACTURER SHALL PROVIDE A PHONE/TABLET INTERFACE WITH THE ABILITY TO VIEW/OVERRIDE STATUS AND SETPOINTS, VIEW/ACKNOWLEDGE COMMENT ON ALARMS, AND VIEW GRAPHICS FOR ALL SPACES AND EQUIPMENT.
4. THIS PHONE/TABLET INTERFACE SHALL RESIZE ITSELF APPROPRIATELY FOR THE SIZE OF THE INTERFACE (I.E. NO "PINCHING AND ZOOMING" REQUIRED).

The Air System Application Status Screens

THE AIR SYSTEM APPLICATION STATUS SCREENS SHALL EXPLAIN WHAT OPTIMIZATION CALCULATIONS ARE OCCURRING, CRITICAL PARAMETERS, AND SOURCE EQUIPMENT MEMBERS.
E. THE AIR SYSTEMS APPLICATIONS SHALL PROVIDE A USER INTERFACE THAT ENABLES CONFIGURATION CHANGES MADE BY SWIPE AND TYPE FIELDS, SELECTION LIST, AND CHECK BOX ENTRY FOR FEATURE DEFINITION:
1) VAV AUXILIARY NIGHT HEAT
2) VAV SOURCE TEMPERATURE DISTRIBUTION
3) START/STOP DELAY OPERATION
4) ENABLE/DISABLE OPTIMIZATION STRATEGIES

System Calculations

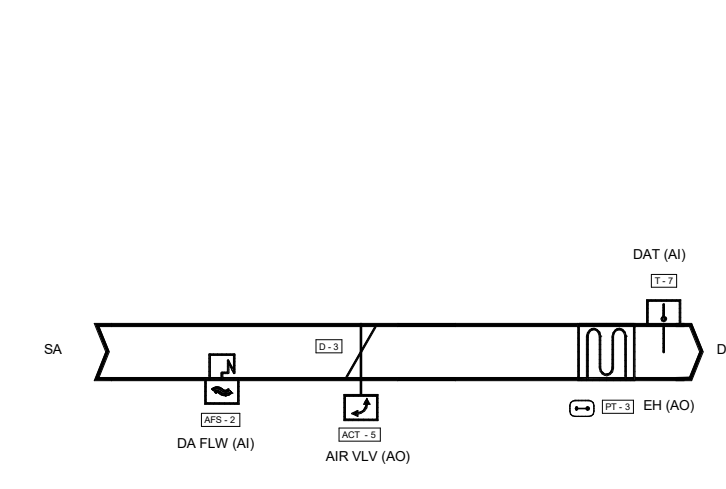
1) SYSTEM CALCULATIONS (MIN, MAX, AVERAGE)
2) DUCT PRESSURE OPTIMIZATION
3) VENTILATION OPTIMIZATION
4) DRIVE TO MAXIMUM OVERRIDE
5) COMMON SOURCE TEMPERATURE
6) COMMON SPACE
7) DISCHARGE AIR TEMPERATURE OPTIMIZATION

Remedy Medical Properties, Columbus Regional Healthcare System, CBHF Engineers, PLLC, Leland Mob, SHEET NAME: MECHANICAL CONTROLS, M-802

THESE DRAWINGS ARE PRELIMINARY AND INTENDED FOR PRICING AND GENERAL COORDINATION PURPOSES ONLY. FINAL CONTROL DESIGN, DETAILED SEQUENCES, AND INTEGRATION REQUIREMENTS WILL BE FURTHER DEVELOPED AND REFLECTED IN THE CONSTRUCTION DRAWING SET.

PRELIMINARY CONTROL DRAWING NOTE:
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Flow Diagram: VAV TERMINAL UNIT



Points List: VAV TERMINAL UNIT

System Point Description	POINTS								ALARMS						
	GRAPHIC	ANALOG HARDWARE INPUT (AI)	BINARY HARDWARE INPUT (BI)	BINARY HARDWARE OUTPUT (AO)	BINARY HARDWARE OUTPUT (BO)	SOFTWARE POINT (SFT)	HARDWARE INTERLOCK (HWI)	WIRELESS (WLS)	NETWORK (NET)	HIGH ANALOG LIMIT	LOW ANALOG LIMIT	BINARY	LATCH DIAGNOSTIC	SENSOR FAIL	COMMUNICATION FAIL
AIR VALVE MODULATION COMMAND AIR VLV	X														
DISCHARGE AIR TEMPERATURE DAT	X	X											X	X	X
LOCAL HEAT ELECTRIC SCR OUTPUT EH				X											
SPACE OCCUPANCY INPUT SP OCC	X	X													
SPACE TEMPERATURE LOCAL SPT	X	X													
SPACE TEMPERATURE SETPOINT LOCAL SPT SP	X	X													
SUPPLY AIRFLOW DA FLW	X	X							X	X					
BAS COMMUNICATION STATE BAS COM															X
DESIGN HEAT DISCHARGE AIR TEMP SETPOINT DSNG HT DAT SP						X									
MAXIMUM COOLING AIRFLOW SETPOINT MAX CLG FLW SP						X									
MINIMUM COOLING AIRFLOW SETPOINT MIN CLG FLW SP						X									
MAXIMUM HEATING AIRFLOW SETPOINT MAX HTG FLW SP						X									
MINIMUM HEATING AIRFLOW SETPOINT MIN HTG FLW SP						X									
OCCUPIED BYPASS TIMER OCC TMR	X					X									
OCCUPIED COOLING SETPOINT OCC CLG SP	X					X									
OCCUPIED HEATING SETPOINT OCC HTG SP	X					X									
UNOCCUPIED COOLING SETPOINT UNOCC CLG SP	X					X									
UNOCCUPIED HEATING SETPOINT UNOCC HTG SP	X					X									

Sequence of Operation: VAV TERMINAL UNIT

BUILDING AUTOMATION SYSTEM INTERFACE:
 THE BUILDING AUTOMATION SYSTEM (BAS) SHALL SEND THE CONTROLLER OCCUPIED, AND UNOCCUPIED COMMANDS. THE BAS MAY ALSO SEND A HEAT/COOL MODE, PRIORITY SHUTDOWN COMMANDS, SPACE TEMPERATURE AND/OR SPACE TEMPERATURE SETPOINT. IF COMMUNICATION IS LOST WITH THE BAS, THE CONTROLLER SHALL OPERATE USING ITS LOCAL SETPOINTS.

OCCUPIED:
 THE OCCUPANCY MODE SHALL BE COMMUNICATED OR HARDWIRED TO THE CONTROLLER VIA A BINARY INPUT. WHEN THE UNIT IS IN THE OCCUPIED MODE THE VAV SHALL MAINTAIN THE SPACE TEMPERATURE AT THE ACTIVE OCCUPIED HEATING OR COOLING SETPOINT. APPLICABLE VENTILATION AND AIRFLOW SETPOINTS SHALL BE ENFORCED. THE OCCUPIED MODE SHALL BE THE DEFAULT MODE OF THE VAV. APPLICABLE VENTILATION AND AIRFLOW SETPOINTS SHALL BE ENFORCED. THE OCCUPIED MODE SHALL BE THE DEFAULT MODE OF THE VAV.

OCCUPIED STANDBY:
 THE OCCUPANCY MODE SHALL BE COMMUNICATED OR HARDWIRED TO THE CONTROLLER VIA A BINARY INPUT. EVEN THOUGH THE BAS HAS SCHEDULED THE SPACE AS OCCUPIED, IN THE OCCUPIED STANDBY MODE, THE ACTIVE COOLING AND HEATING SETPOINTS SHALL BE RELAXED (SEE COOLING AND HEATING MODE) AND BOTH THE VENTILATION AIRFLOW AND MINIMUM AIRFLOW SETPOINTS SHALL BE LOWERED (SEE VAV SCHEDULE).

UNOCCUPIED:
 NORMAL OPERATING MODE FOR UNOCCUPIED SPACES OR NIGHTTIME OPERATION. WHEN THE UNIT IS IN UNOCCUPIED MODE THE VAV CONTROLLER SHALL MAINTAIN THE SPACE TEMPERATURE AT THE STORED UNOCCUPIED HEATING OR COOLING SETPOINT REGARDLESS OF THE PRESENCE OF A HARDWIRED OR COMMUNICATED SETPOINT. WHEN THE SPACE TEMPERATURE DROPS BELOW ITS UNOCCUPIED HEATING SETPOINT, THE CONTROLLER SHALL MODULATE THE AIR DAMPER AND THE HOT WATER VALVE UNTIL THE ZONE TEMPERATURE RISES BACK TO 2.0 DEG. F ABOVE THE UNOCCUPIED HEATING SETPOINT. WHEN THE SPACE TEMPERATURE EXCEEDS THE ACTIVE UNOCCUPIED SETPOINT THE HOT WATER VALVE SHALL UNOCCUPIED HEATING SETPOINT SHALL BE LOWERED (SEE VAV SCHEDULE).

OCCUPIED BYPASS:
 MODE USED TO TEMPORARILY PLACE THE UNIT INTO THE OCCUPIED OPERATION. TENANTS SHALL BE ABLE TO OVERRIDE THE UNOCCUPIED MODE FROM THE SPACE SENSOR. THE OVERRIDE SHALL LAST FOR A MAXIMUM OF 4 HOURS (ADJ.). THE TENANTS SHALL BE ABLE TO CANCEL THE OVERRIDE FROM THE SPACE SENSOR AT ANY TIME. DURING THE OVERRIDE THE UNIT SHALL OPERATE IN OCCUPIED MODE.

HEAT/COOL MODE:
 THE HEAT/COOL MODE SHALL BE SET BY A COMMUNICATED VALUE OR AUTOMATICALLY BY THE VAV. IN STANDALONE OR AUTO MODE THE VAV SHALL COMPARE THE PRIMARY AIR TEMPERATURE WITH THE CONFIGURED AUTO CHANGE-OVER SETPOINT TO DETERMINE IF THE AIR IS "HOT" OR "COLD". HEATING MODE IMPLIES THE PRIMARY AIR TEMPERATURE IS HOT. COOLING MODE IMPLIES THE PRIMARY AIR TEMPERATURE IS COLD.

COOLING MODE:
 WHEN THE UNIT IS IN COOLING MODE, THE VAV CONTROLLER SHALL MAINTAIN THE SPACE TEMPERATURE AT THE ACTIVE COOLING SETPOINT BY MODULATING THE AIRFLOW BETWEEN THE ACTIVE COOLING MINIMUM AIRFLOW SETPOINT TO THE MAXIMUM COOLING AIRFLOW SETPOINT. THE VAV SHALL USE THE MEASURED SPACE TEMPERATURE AND THE ACTIVE COOLING SETPOINT TO DETERMINE THE REQUESTED COOLING CAPACITY OF THE UNIT. THE OUTPUTS SHALL BE CONTROLLED BASED ON THE UNIT CONFIGURATION AND THE REQUESTED COOLING CAPACITY.

BASED ON THE VAV CONTROLLER OCCUPANCY MODE, THE ACTIVE COOLING SETPOINT SHALL BE ONE OF THE FOLLOWING:

SETPOINT	DEFAULT VALUE
OCCUPIED COOLING SETPOINT	74.0 DEG. F
UNOCCUPIED COOLING SETPOINT	65.0 DEG. F
OCCUPIED STANDBY COOLING SETPOINT	78.0 DEG. F
OCCUPIED MIN COOLING AIRFLOW SETPOINT	SEE VAV SCHEDULE
OCCUPIED MAX COOLING AIRFLOW SETPOINT	SEE VAV SCHEDULE

HEAT/COOL SETPOINT:
 THE SPACE TEMPERATURE SETPOINT SHALL BE DETERMINED EITHER BY A LOCAL (E.G. THERMISTOR) SETPOINT, THE VAV DEFAULT SETPOINT OR A COMMUNICATED VALUE. THE VAV SHALL USE THE LOCALLY STORED DEFAULT SETPOINTS WHEN NEITHER A LOCAL SETPOINT NOR COMMUNICATED SETPOINT IS PRESENT. IF BOTH A LOCAL SETPOINT AND COMMUNICATED SETPOINT EXIST, THE VAV SHALL USE THE COMMUNICATED VALUE.

REHEAT CONTROL MODE:
 REHEAT SHALL ONLY BE ALLOWED WHEN THE SUPPLY AIR TEMPERATURE IS 5.0 DEG. F BELOW THE CONFIGURED REHEAT ENABLE SETPOINT OF 70.0 DEG. F (ADJ.). THE REHEAT SHALL BE ENABLED WHEN THE SPACE TEMPERATURE DROPS BELOW THE ACTIVE HEATING SETPOINT AND THE MINIMUM AIRFLOW REQUIREMENTS ARE MET. DURING REHEAT THE VAV SHALL OPERATE AT ITS MINIMUM HEATING AIRFLOW SETPOINT AND ENERGIZE THE HEAT AS FOLLOWS:

SETPOINT	DEFAULT VALUE
OCCUPIED HEATING SETPOINT	71.0 DEG. F
UNOCCUPIED HEATING SETPOINT	60.0 DEG. F
OCCUPIED STANDBY HEATING SETPOINT	67.0 DEG. F
OCCUPIED MIN HEATING AIRFLOW SETPOINT	SEE VAV SCHEDULE
OCCUPIED MAX HEATING AIRFLOW SETPOINT	SEE VAV SCHEDULE

ELECTRIC SILICON CONTROLLED RECTIFIER REHEAT (SCR):
 IF THE SPACE TEMPERATURE IS AT THE HEATING SETPOINT, THE ELECTRIC HEATER SHALL MODULATE AS REQUIRED TO MAINTAIN SPACE TEMPERATURE AT THE ACTIVE HEATING SETPOINT WHILE THE VAV OPERATES AT ITS MINIMUM HEATING AIRFLOW SETPOINT. IF THE DISCHARGE AIR TEMPERATURE REACHES THE DESIGN HEATING DISCHARGE AIR TEMPERATURE SETPOINT (ADJ.), THE VAV SHALL MODULATE AIRFLOW BETWEEN THE MINIMUM HEATING AIRFLOW SETPOINT AND THE MAXIMUM HEATING AIRFLOW SETPOINT AS REQUIRED TO MAINTAIN SPACE TEMPERATURE AT THE ACTIVE HEATING SETPOINT, WHILE THE ELECTRIC HEATER MODULATES TO MAINTAIN DISCHARGE AIR TEMPERATURE AT THE DESIGN HEATING DISCHARGE AIR TEMPERATURE SETPOINT. IF THE AIRFLOW REACHES THE MAXIMUM HEATING AIRFLOW SETPOINT, THE VAV SHALL MODULATE THE ELECTRIC HEATER AS REQUIRED TO MAINTAIN SPACE TEMPERATURE AT THE ACTIVE HEATING SETPOINT, WHILE THE VAV OPERATES AT ITS MAXIMUM HEATING AIRFLOW SETPOINT.

SPACE SENSOR FAILURE:
 IF THERE IS A FAULT WITH THE OPERATION OF THE ZONE SENSOR AN ALARM SHALL BE ANNUNCIATED AT THE BAS. SPACE SENSOR FAILURE SHALL CAUSE THE VAV TO DRIVE THE DAMPER TO MINIMUM AIR FLOW IF THE VAV IS IN THE OCCUPIED MODE, OR DRIVE IT CLOSED IF THE VAV IS IN THE UNOCCUPIED MODE.

Guide Specification: VAV TERMINAL UNIT

1.1 VARIABLE AIR VOLUME TERMINAL UNIT CONTROLLERS
 A. GENERAL DESCRIPTION

- VARIABLE AIR VOLUME (VAV) CONTROLLERS SHALL BE MICROPROCESSOR-BASED DDC CONTROLLERS WHICH, THROUGH HARDWARE OR FIRMWARE DESIGN, CONTROL SPECIFIED EQUIPMENT. THEY ARE TYPICALLY NOT USER PROGRAMMABLE, BUT ARE CONFIGURABLE FOR OPERATION OF VAV TERMINAL UNITS.
- VARIABLE AIR VOLUME (VAV) CONTROLLERS ARE CONTROLLERS THAT OPERATE EQUIPMENT THAT CONTROL THE SPACE TEMPERATURE OF SINGLE ZONE.
- WHEN THE VAV CONTROLLER IS OPERATING AS A MEMBER OF A BUILDING AUTOMATION SYSTEM (BAS), THE APPLICATION CONTROLLER SHALL OPERATE AS FOLLOWS:
 - THE VAV CONTROLLER WILL RECEIVE OPERATION MODE COMMANDS FROM THE BAS NETWORK CONTROLLER. THE BAS COMMANDS SHALL INCLUDE BUT NOT BE LIMITED TO THE FOLLOWING: OCCUPIED HEAT/COOL, UNOCCUPIED HEAT/COOL, MORNING WARM-UP, / PRE-COOL, OCCUPIED BYPASS).
 - THE VAV CONTROLLER WILL PROVIDE EQUIPMENT STATUS PARAMETERS TO THE BAS THROUGH BACNET COMMUNICATION.
 - THE VAV CONTROLLER WILL OPERATE AS A STAND-ALONE CONTROLLER IN THE EVENT OF COMMUNICATION FAILURE WITH THE BAS.
 - IN CASE OF COMMUNICATIONS FAILURE STAND-ALONE OPERATION SHALL USE DEFAULT VALUES OR LAST KNOWN VALUES FOR REMOTE SENSORS READ OVER THE NETWORK SUCH AS OUTDOOR AIR TEMPERATURE.
 - STAND-ALONE OPERATION: EACH VAV TERMINAL UNIT SHALL BE CONTROLLED BY A SINGLE CONTROLLER AND PROVIDE STAND-ALONE CONTROL IN THE EVENT THAT A BAS IS NOT PRESENT.

E. THE VAV CONTROLLER SHALL COMMUNICATE TO THE BUILDING AUTOMATION SYSTEM VIA ONE OF THE FOLLOWING PROTOCOLS: BACNET™ MS/TP, BACNET™ ZIGBEE OR BACNET™ IP AS DEFINED IN ANSI/ASHRAE® STANDARD 135-2020.

- BACNET™ MS/TP
 - TO ALLOW MAXIMUM COMMUNICATIONS SPEED AND CO-EXISTENCE WITH OTHER CONTROLLERS, THE CONTROLLER SHALL SUPPORT AT A MINIMUM THE FOLLOWING BACNET MS/TP MANAGER BAUD RATES: 9600, 19200, 38400, 76800.
- BACNET™ IP
 - BACNET IP CONTROLLERS PROVIDE BACNET COMMUNICATIONS OVER INTERNET PROTOCOL VIA ETHERNET NETWORKS AND/OR WIRELESS NETWORKS. CONNECTIONS TO OTHER BUILDING AUTOMATION SYSTEMS AND CONTROLLERS.
- BACNET™ ZIGBEE
 - VAV CONTROLLER WIRELESS COMMUNICATION INTERFACE SHALL SELF-FORM AND SELF-HEAL TO MAINTAIN OPERATION IN THE EVENT OF NETWORK COMMUNICATION FAILURE.
 - IEEE 802.15.4 RADIOS TO MINIMIZE RISK OF INTERFERENCE, RELIABILITY, AND RANGE.
 - OPERATING RANGE SHALL BE A MINIMUM OF 200 FEET; OPEN RANGE SHALL BE 2,500 FT. (762 M) WITH LESS THAN 2% PACKET ERROR RATE.
 - TO PROTECT AGAINST HARMFUL INTERFERENCE, CERTIFICATIONS SHALL INCLUDE ENERGY MANAGEMENT EQUIPMENT FCC CFR47, SECTION 15.247 & SUBPART E, DIGITAL MODULATION TRANSMISSION WITH NO SAR (FCC ID: TPF-251701)
 - EACH VAV TERMINAL UNIT SHALL USE A SPACE ZONE SENSOR(S) TO MEASURE THE SPACE CONDITION IT IS SERVING.

G. SOFTWARE
 1. TO MEET THE SEQUENCE OF OPERATION FOR EACH ZONE CONTROL, THE CONTROLLER SHALL USE PROGRAMS DEVELOPED AND TESTED BY THE CONTROLLER MANUFACTURER THAT ARE EITHER FACTORY LOADED OR DOWNLOADED WITH SERVICE TOOL TO THE CONTROLLER.

2. FOR CONTROLLING ANCILLARY DEVICES AND FOR FLEXIBILITY TO CHANGE THE SEQUENCE OF OPERATION IN THE FUTURE, THE CONTROLLER SHALL BE CAPABLE OF RUNNING CUSTOM PROGRAMS WRITTEN IN A GRAPHICAL PROGRAMMING LANGUAGE.

H. ENVIRONMENT: CONTROLLER HARDWARE SHALL BE SUITABLE FOR THE ANTICIPATED AMBIENT CONDITIONS.

- STORAGE: -55° TO 203° F (-48° TO 95° C) AND 5 TO 95% RH, NON-CONDENSING.
- OPERATING: -40° TO 158° F (-40 TO 70° C) AND 5 TO 95% RH, NON-CONDENSING.
- CONTROLLERS USED INDOORS SHALL BE MOUNTED IN A NEMA 1 ENCLOSURE AT A MINIMUM.
- CONTROLLERS USED OUTDOORS AND/OR IN WET AMBIENT SHALL BE MOUNTED WITHIN NEMA 4 TYPE WATERPROOF ENCLOSURES, AND SHALL BE RATED FOR OPERATION AT -40° TO 158° F (-40° TO 70° C).

I. INPUT/OUTPUT:
 1. FOR FLEXIBILITY IN SELECTION AND REPLACEMENT OF VALVES, THE CONTROLLERS SHALL BE CAPABLE OF SUPPORTING ALL OF THE FOLLOWING VALVE CONTROL TYPES 0-10VDC, 0-5VDC, ±20mA, 24VAC FLOATING POINT, 24VAC - 2 POSITION (NORMALLY OPEN OR NORMALLY CLOSED).

2. FOR FLEXIBILITY IN SELECTION AND REPLACEMENT OF SENSORS, THE CONTROLLERS SHALL BE CAPABLE OF READING SENSOR INPUT RANGES OF 0 TO10V, 0 TO 20MA, AND 20 TO 20KOHM.

3. FOR FLEXIBILITY IN SELECTION AND REPLACEMENT OF BINARY DEVICES, THE CONTROLLER SHALL SUPPORT DRY AND WETTED (24VAC) BINARY INPUTS.

4. FOR FLEXIBILITY IN SELECTION AND REPLACEMENT DEVICES, THE CONTROLLER SHALL HAVE BINARY OUTPUT WHICH ARE ABLE TO DRIVE AT LEAST 12VA EACH.

5. FOR FLEXIBILITY IN SELECTION AND REPLACEMENT OF MOTORS, THE CONTROLLER SHALL BE CAPABLE OF OUTPUTTING 24VAC (BINARY OUTPUT), DC VOLTAGE (0 TO 10VDC MINIMUM RANGE) AND PWM (IN THE 80 TO 100 HZ RANGE).

J. SERVICEABILITY – THE CONTROLLER SHALL PROVIDE THE FOLLOWING IN ORDER TO IMPROVE SERVICEABILITY OF THE CONTROLLER.

1. DIAGNOSTIC LEDS SHALL INDICATE CORRECT OPERATION OR FAILURES/FAULTS FOR ALL OF THE FOLLOWING: POWER, SENSORS, BACNET COMMUNICATIONS, AND I/O COMMUNICATIONS BUS.

2. ALL BINARY OUTPUT SHALL HAVE LED'S INDICATING THE OUTPUT STATE.

3. ALL WIRING CONNECTORS SHALL REMOVABLE WITHOUT THE USE OF A TOOL.

4. SOFTWARE SERVICE TOOL CONNECTION THROUGH ALL OF THE FOLLOWING METHODS: DIRECT CABLE CONNECTION TO THE CONTROLLER, CONNECTION THROUGH ANOTHER CONTROLLER ON BACNET LINK AND THROUGH THE CONTROLLER'S ZONE SENSOR.

5. FOR SAFETY PURPOSES, THE CONTROLLER SHALL BE CAPABLE OF BEING POWERED BY A PORTABLE COMPUTER FOR THE PURPOSES OF CONFIGURATION, PROGRAMMING, AND TESTING PROGRAMS SO THAT THIS WORK CAN BE ACCOMPLISHED WITH THE POWER OFF TO THE EQUIPMENT.

6. CAPABILITIES TO TEMPORARILY OVERRIDE OF BACNET POINT VALUES WITH BUILT-IN TIME EXPIRATION IN THE CONTROLLER.

7. BACNET MAC ADDRESS SHALL BE SET USING DECIMAL (0-9) BASED ROTARY SWITCHES.

A. CONFIGURATION CHANGE SHALL NOT BE MADE IN A PROGRAMMING ENVIRONMENT, BUT RATHER BY A CONFIGURATION PAGE UTILIZING DROPDOWN LIST, CHECK BOXES, AND NUMERIC BOXES.

8. FOR EASE OF TROUBLESHOOTING, THE CONTROLLER SHALL SUPPORT BACNET DATA TREND LOGGING.

A. TRENDS SHALL BE CAPABLE OF BEING COLLECTED AT A MINIMUM SAMPLE RATE OF ONCE EVERY SECOND.

B. SHALL BE CAPABLE OF TRENDED ALL BACNET POINTS USED BY CONTROLLER

C. TRENDS SHALL BE CAPABLE OF BEING SCHEDULED OR TRIGGERED

K. SOFTWARE RETENTION: ALL ZONE CONTROLLER OPERATING PARAMETERS, SETPOINTS, BIOS, AND SEQUENCE OF OPERATION CODE MUST BE STORED IN NON-VOLATILE MEMORY IN ORDER TO MAINTAIN SUCH INFORMATION FOR MONTHS WITHOUT POWER.

L. CONTROLLER SHALL MEET THE FOLLOWING AGENCY COMPLIANCE:
 1. UL916 PAZZ, OPEN ENERGY MANAGEMENT EQUIPMENT
 2. UL94-V, FLAMMABILITY
 3. FCC PART 15, SUBPART B, CLASS B LIMIT
 4. AS/NZS CISPR 32:2016
 5. VCCI-CSPR 32:2016
 6. CAN ICES-003(B)/NMB-003(B)

7. TO ENSURE INTEGRATION TO THE BUILDING AUTOMATION SYSTEM THE CONTROLLER MUST BE BTL (BACNET TESTING LAB) LISTED. THE FOLLOWING BACNET PROFILES ARE IN ORDER OF MOST FUNCTIONALITY (B-BC) TO LEAST FUNCTIONALITY (B-ASC):

- BACNET BUILDING CONTROLLER (B-BC)
- BACNET ADVANCE APPLICATIONS CONTROLLER (B-AAC)
- BACNET APPLICATION SPECIFIC CONTROLLER (B-ASC)



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