

2.01 CURB

A. Each unit shall be provided with a full perimeter roof curb. The roof curb shall be of the same Manufacturer as the unit, shall support the unit and provide a watertight enclosure to protect ductwork and utility services. Curbs shall comply with National Roofing Contractors Association requirements. Supply/return air opening gasketing shall be provided. Channel shall be provided allowing for adjustment of return air opening location to match the building structural frame indicated.

B. All duct and utility connections shall be routed through bottom of unit within the curb perimeter.

2.02 UNIT CABINETS

A. Rooftop unit cabinets shall be formed, galvanized steel construction with welded base assembly. Galvanized steel surfaces shall be bonded and painted with baked acrylic enamel for complete weather protection. All sheet metal screws shall be stainless steel. The outside air dampers shall be low leak gasketed dampers which must match unit interlock with the single package rooftop units. Cabinets shall be fully insulated.

B. Unit cabinets shall be designed for curb mounting and mate with the full perimeter roof curb for a complete weather-tight seal. Unit sides shall overhang the curb to form protective drip lip.

C. Access doors for the filter section and the fan section of all units sized 20 nominal tons and larger shall be hinged, walk-in type.

2.03 COMPRESSOR SECTION

A. Compressor section refrigeration system shall be factory charged, ready for operation, providing minimum two stage cooling capacity (50% and 100%) on units of over 5 tons capacity, minimum of three stages on units of nominal 20 and 25 tons and minimum of four stages on units larger than 25 nominal tons. Compressor protection shall include high and low pressure control, outdoor ambient protection, compressor pump heat, three-phase overload protection, anticycling timer providing a minimum five (5) minute time shut down of unit on interruption of power or automatic control shutdown. Compressors shall have factory-installed service valves, vibration isolators, crankcase heaters, liquid line sight glasses, filter driers, and liquid line service valves.

2.04 EVAPORATOR COILS

A. Coils shall be aluminum plate fins mechanically bonded to copper tubes. They shall be of an interlaminar design for equal circuit loading and to ensure a fully active coil on part-load operation to provide evenly conditioned air. Aluminum tubes shall not be acceptable.

2.05 FANS

A. Fans shall be either single or double wheels, forward-curved, Class 1 type, and mounted on a common shaft with adjustable sheave drive. All fans shall be statically and dynamically balanced and tested in the factory. Fan shall not pass through its first critical speed in order to meet the scheduled performance. Fan shaft shall be mounted on not less than two grease-lubricated ball bearings with all fan wheels mounted inboard of the bearings. The fan and motor assembly shall be mounted on a common base; on units with motor sizes larger than five (5) HP, the entire assembly shall be isolated from the rest of the unit by double deflection vibration isolators.

B. Variable air volume (VAV) units shall be complete with variable frequency inverter drives and matched inverter-duty motors.

C. Motors on VFDs shall have shaft-grounding rings.

2.06 ELECTRIC HEATING SECTIONS

A. Electric heating sections shall be furnished with nickel-chromium open coil resistance heating elements with each element protected by an automatic reset high-limit thermostat and manual reset high-limit thermostat for the primary and secondary overcurrent/thermal protection. Controls shall provide for multiple stage start-up and operation.

2.07 GAS HEATING SECTION

A. Gas heating sections shall be mounted downstream of evaporator coils and shall be certified by AGA for use on natural gas. Heating shall be accomplished with a minimum of two stages on units 7.5 tons nominal and larger.

B. Heat exchanger shall be fabricated from aluminum steel, stress-relieved and free-floating.

C. The unit shall utilize an electronic, spark-ignition pilot light; not a standing pilot.

D. Each heating system shall include an induced draft combustion air exhaust fan protected by centrifugal switches, heat limit switches, time-delay relay, flame roll-out switches and pilot sensors. Heating controls shall consist of a redundant gas valve, intermittent pilot ignition with electric spark ignition system. Each unit shall be AGA certified.

2.09 CONTROLS AND ACCESSORIES - ALL SYSTEMS

A. All operating and safety controls shall be factory-installed and shall include solid state compressor overload protection, magnetic contactors, thermostatic expansion valve, refrigerant line drier and automatic damper motors.

B. Controls on electric heat section shall meet NEMA specifications and requirements.

C. During night setback operation, morning warm-ups after night setbacks and whenever the unit is off, the outside air dampers shall be fully closed and admit no outside air.

D. Interlocks shall be made to the duct-mounted smoke detectors in each unit's supply and return ductwork to shut the unit off and fully close the return air dampers to prevent migration of smoke upon its detection.

E. Provide a factory mounted disconnect and integral powered duplex GFI convenience outlet on all units. Coordinate with Division 26.

F. Provide downflow units with accessory condensate overflow switch in the primary drain pan. Switch shall be interlocked to shut the unit off in an overflow situation.

2.10 CONTROLS - non-VVT systems

A. A 24 volt transformer shall be provided to accommodate controls and accessories. Each unit shall be complete with an indoor thermostat and control panel complete with the following minimum list of features and capabilities:

- 1. Seven day programmable electronic thermostat for programming heating and cooling temperatures as well as night setback times and temperatures.
2. Battery back-up to protect the programs for up to 24 hours after a power failure.
3. Manual overrides and a failsafe program.

2.12 FILTERS

A. Units shall have high-efficiency, 2-inch thick, low velocity throwaway filters in commercially available sizes. Filters shall be not less than 30%/30% average dust spot efficient when tested in accordance with ASHRAE Test Standard 52.2-2007; or 30/30 or an approved equal.

2.13 AIRSIDE ECONOMIZER

A. An airside economizer shall be provided with each unit equal to or greater than 65 MBH nominal. The economizer shall be factory-assembled complete with dampers, electrical actuators, exhaust fans and all controls.

B. The outside air dampers shall be low-leakage type, with a maximum leakage of 3% at 3" WC static pressure. The dampers shall be spring operated to close during power failure.

C. The airside economizer shall provide "free" cooling whenever the outside air enthalpy is less than the set point of the outside air enthalpy sensor and cooling is required. The enthalpy sensor shall be adjustable for temperature and humidity setpoints.

D. If the cooling load is discharged by the airside economizer alone, no mechanical refrigeration shall be initiated and the economizer dampers shall be modulated to maintain the desired discharge air temperature. The economizer shall modulate up to its full open position to meet the cooling load. When the economizer is at its maximum outside air position and further cooling is required, mechanical refrigeration shall be utilized. When the enthalpy of the outside air is above its setpoint and during normal heating cycles, the outside air damper shall be at its minimum outdoor air position.

E. The position of the return and outside air dampers shall also be controlled as specified elsewhere in response to unit and external controls.

3.0 EXECUTION

3.01 INSTALLATION

A. The packaged rooftop units and associated controls shall be installed in strict accordance with the manufacturer's recommendations.

B. The control system shall be completely wired under this Division 23. Wiring shall be in accordance with the NEC and shall meet all requirements for this installation.

3.02 STARTUP

A. Provide the services of a factory-trained and qualified Service Technician employed by the Unit Manufacturer who shall inspect the installation including external control interlock and electrical power connections; supervise leak testing, initial operation, calibration of operating and safety controls and supervise electrical testing including insulation resistance of motors and voltage balance between phases during starting and running.

B. This Service Technician shall forward a report in four (4) copies to the Owner when the unit is in safe and proper operating condition. This report shall include all pressure and control settings, meg readings, voltage readings per phase during start and run, and shall list minor discrepancies to be corrected that affect safe and reliable operation. One additional copy of the report shall be left in the unit control panel. One copy of bound installation, operation, maintenance service and parts brochures, including applicable serial numbers, full unit description and parts ordering sources, shall be placed in the unit control panel at the time of startup; four (4) additional copies shall be forwarded to the Owner.

END OF SECTION

SECTION 23 81 26 SPLIT-SYSTEM AIR-CONDITIONERS

1.0 GENERAL

1.01 DESCRIPTION

A. All work specified in this Section is governed by the Common Work Results for HVAC Section 23 05 00.

B. This Section 23 81 26 and the accompanying drawings cover the provision of all labor, equipment, appliances and materials, and performing all operations in connection with the construction and installation of the split systems as specified herein and as shown. This work includes, but is not limited to, the following:

- 1. Split system fan coil, heating section and condensing units
2. Control system (interlocked to all split system components)
3. Split system units shall be self-contained, automatic, packaged units. These units shall be completely factory-assembled as unitary packages complete with operating controls, internal wiring and piping and fully charged with R-410A refrigerant. Only one electrical power connection shall be required for each unit.

D. Units shall be UL listed and cooling capacities shall be certified in accordance with ANSI/AHRI 210/240.

1.02 INTENT

A. It is the intent of this Section of the specifications to provide complete, operable, adjusted split systems, as shown and specified, which operate efficiently and automatically, and are free of excessive noise and vibration.

1.03 BASIS OF DESIGN

A. The basis of design is as scheduled. Acceptable alternate manufacturers include Trane, Carrier, Mitsubishi, Lennox, and Daikin for ducted systems except Liebert systems are also acceptable for Server/IT spaces, and Carrier, Mitsubishi, LG, Hitachi, and Daikin for ductless mini-splits. Any proposed substitutions shall be submitted in accordance with the prior approval requirements.

2.0 PRODUCTS

2.01 UNIT CASINGS

A. Unit casings shall be formed, galvanized steel construction with welded assembly. Galvanized steel surfaces shall be bonded and painted with baked acrylic enamel for complete weather protection. Accessories and components shall match and interlock with all other split system components. Fan coil unit casings shall be fully internally insulated with liner which meets NFPA 25/50 flame spread/smoke developed ratings.

2.02 CONDENSING UNITS

A. Condensing unit refrigeration systems shall be factory-charged and ready for operation. All units with capacities greater than five (5) tons shall be provided with minimum 2-stage (50% and 100%) cooling. Compressor(s) shall be direct drive, 3600 RPM, hermetic reciprocating type with centrifugal oil pump, crankcase heater and internal pressure relief valve. Compressor(s) shall have internal spring isolation and sound muffling and exhibit minimum vibration transmission and noise. Anti-recycle timers shall be provided to prevent excessive cycling of compressors thru utilization of a minimum five (5) minute time shutdown of unit on interruption of power or controlled shutdown.

B. Condensing unit condenser fans shall be direct-driven, propeller blade type. Condensing unit heat rejection shall be vertically upward.

2.03 COILS

A. Evaporator and condenser coils shall be copper tubing mechanically bonded to heavy duty aluminum fins. Aluminum tubes shall not be acceptable.

2.07 CONTROLS AND ACCESSORIES

A. All operating and safety controls which are internal to each unit shall be factory-installed and shall include, as a minimum, solid state compressor overload protection, magnetic contactors, thermostatic expansion valve(s), refrigerant line drier(s), outdoor fan and compressor cycling thermostats, high and low limit protection against excessive temperatures or pressures.

B. A 24 volt transformer shall be provided to accommodate an accessory 24 volt indoor thermostat complete with an electronic programmable night setback, separate automatic heat/cool settings, auto/manual fan control and seasonal selector. Thermostat shall provide staging of the cooling and heating to match the stages of each component.

C. Automatic shutdown controls shall be provided on units <2,000 CFM to meet local Codes (or NFPA 90A as a minimum) and shall consist of fire/smoke detectors and duct-mounted smoke detectors interlocked to the fan coil unit for shutdown on the detection of fire or smoke.

3.0 EXECUTION

3.01 INSTALLATION

A. The split systems and associated controls shall be installed in strict accordance with the manufacturer's recommendations.

B. The control system shall be completely wired under this Division 23. Wiring shall be in accordance with the NEC and shall meet all requirements for this installation.

3.02 STARTUP

A. Provide the services of a factory-trained and qualified Service Technician employed by the Unit Manufacturer who shall inspect the installation including external interlock and power connections; supervise leak testing, initial operation, calibration of operating and safety controls and supervise electrical testing including insulation resistance of motors and voltage balance between phases during starting and running.

B. This Service Technician shall forward a report in four (4) copies to the Owner when the unit is in safe and proper operating condition. This report shall include all pressure and control settings, meg readings, voltage readings per phase during start and run, and shall list minor discrepancies to be corrected that affect safe and reliable operation. One additional copy of the report shall be left in the unit control panel. One copy of bound installation, operation, maintenance service and parts brochures, including applicable serial numbers, full unit description and parts ordering sources, shall be placed in the unit control panel at the time of startup; four (4) additional copies shall be forwarded to the Owner.

END OF SECTION

SECTION 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 GENERAL

1.1 DESCRIPTION

A. All work specified in this Section is governed by the Common Work Results for HVAC Section 23 05 00.

B. This Section 23 09 00 and the accompanying drawings cover the provision of all labor, equipment, appliances, and materials, and performing all operations in connection with the construction and installation of the Building Automation System (BAS) as specified herein and as shown. This work includes, but is not limited to the following:

- 1. Web enabled access platform
2. Remote network access capability
3. System software and graphics (on Owner central server)
4. Control panels (main and remote)
5. Space thermostats
6. HVAC system sensors
7. Control valves and dampers with actuators
8. Life safety shutdowns and interlock wiring
9. Relays, contactors, and transformers
10. Wiring (24 and 120 volt)
11. Point capacity for future interior fit-up
12. Point capacity for lighting control including future exterior and tenant fit-up
13. Point capacity for future Owner use
14. Computer for Owner control and access

1.2 SCOPE OF WORK

A. The scope of work includes, but is not limited to, provision of all equipment, hardware, software, programming, and graphics for a complete system of automatic temperature and pressure control, energy management and integrated life safety functions. The BAS shall be performed by a central operating system (program software) installed on a central server provided under this scope and by separate control and remote panels, controllers, relays, etc.

B. The control system shall be a 100% electronic DDC system.

C. The BAS shall include control panels and interlocks for the following as a minimum. Additional points shall be provided as required to implement the sequence of control and code required control functions. Any necessary sensors, probes, etc. shall be installed to implement the sequence of control and noted points:

- 1. All VAV Rooftop Units
a. Start/Stop Control with positive status indication
b. Supply Air Temperature
c. Return Air Temperature
d. Mixed Air Temperature
e. Dirty Filter Alarm
f. All Control Dampers
g. All Wiring for above
h. Interlock w/Fire Alarm System
i. Supply air static pressure
j. Adjustable point for supply air static pressure set point
k. Adjustable point for supply temperature control
l. Adjustable point for outside air flowrate
m. Compressor statuses
n. Heating status
o. Outdoor air humidity
p. Return air humidity
r. Adjustable point for differential enthalpy airside economizer
s. Supply and exhaust fan VFDs, status, speed, and motor current
t. Building pressurization setpoint
u. Current measured building pressure
2. VAV and PIU Systems:
a. Sensors and all associated wiring
b. Thermostat set point and space temperature
c. Tenant override control
d. Night setback, Morning warm up/cool down control
e. Discharge air temperature
f. Primary airflow CFM
g. Fan status
3. All Split Systems
a. Start/Stop Control with positive status indication
b. Space Temperature
c. Dirty Filter Alarm
d. All Wiring for above
e. Interlock w/Fire Alarm System
f. Compressor status
g. Mini-Split System Air Conditioning Units
a. Space temperature
b. Toilet and Tenant Exhaust Fans
a. Start/Stop control with positive status indication
b. Space Temperature
c. Dirty Filter Alarm
d. All Wiring for above
e. Interlock w/Fire Alarm System
f. Compressor status
g. Mini-Split System Air Conditioning Units
a. Space temperature
b. Toilet and Tenant Exhaust Fans

5. Sensors and all associated wiring
6. Thermostat set point and space temperature
7. Tenant override control
8. Night setback, Morning warm up/cool down control
9. Discharge air temperature
10. Primary airflow CFM
11. Fan status
12. All Split Systems
a. Start/Stop Control with positive status indication
b. Space Temperature
c. Dirty Filter Alarm
d. All Wiring for above
e. Interlock w/Fire Alarm System
f. Compressor status
g. Mini-Split System Air Conditioning Units
a. Space temperature
b. Toilet and Tenant Exhaust Fans

13. Sensors and all associated wiring
14. Thermostat set point and space temperature
15. Tenant override control
16. Night setback, Morning warm up/cool down control
17. Discharge air temperature
18. Primary airflow CFM
19. Fan status
20. All Split Systems
a. Start/Stop Control with positive status indication
b. Space Temperature
c. Dirty Filter Alarm
d. All Wiring for above
e. Interlock w/Fire Alarm System
f. Compressor status
g. Mini-Split System Air Conditioning Units
a. Space temperature
b. Toilet and Tenant Exhaust Fans

21. Sensors and all associated wiring
22. Thermostat set point and space temperature
23. Tenant override control
24. Night setback, Morning warm up/cool down control
25. Discharge air temperature
26. Primary airflow CFM
27. Fan status
28. All Split Systems
a. Start/Stop Control with positive status indication
b. Space Temperature
c. Dirty Filter Alarm
d. All Wiring for above
e. Interlock w/Fire Alarm System
f. Compressor status
g. Mini-Split System Air Conditioning Units
a. Space temperature
b. Toilet and Tenant Exhaust Fans

29. Sensors and all associated wiring
30. Thermostat set point and space temperature
31. Tenant override control
32. Night setback, Morning warm up/cool down control
33. Discharge air temperature
34. Primary airflow CFM
35. Fan status
36. All Split Systems
a. Start/Stop Control with positive status indication
b. Space Temperature
c. Dirty Filter Alarm
d. All Wiring for above
e. Interlock w/Fire Alarm System
f. Compressor status
g. Mini-Split System Air Conditioning Units
a. Space temperature
b. Toilet and Tenant Exhaust Fans

37. Sensors and all associated wiring
38. Thermostat set point and space temperature
39. Tenant override control
40. Night setback, Morning warm up/cool down control
41. Discharge air temperature
42. Primary airflow CFM
43. Fan status
44. All Split Systems
a. Start/Stop Control with positive status indication
b. Space Temperature
c. Dirty Filter Alarm
d. All Wiring for above
e. Interlock w/Fire Alarm System
f. Compressor status
g. Mini-Split System Air Conditioning Units
a. Space temperature
b. Toilet and Tenant Exhaust Fans

45. Sensors and all associated wiring
46. Thermostat set point and space temperature
47. Tenant override control
48. Night setback, Morning warm up/cool down control
49. Discharge air temperature
50. Primary airflow CFM
51. Fan status
52. All Split Systems
a. Start/Stop Control with positive status indication
b. Space Temperature
c. Dirty Filter Alarm
d. All Wiring for above
e. Interlock w/Fire Alarm System
f. Compressor status
g. Mini-Split System Air Conditioning Units
a. Space temperature
b. Toilet and Tenant Exhaust Fans

53. Sensors and all associated wiring
54. Thermostat set point and space temperature
55. Tenant override control
56. Night setback, Morning warm up/cool down control
57. Discharge air temperature
58. Primary airflow CFM
59. Fan status
60. All Split Systems
a. Start/Stop Control with positive status indication
b. Space Temperature
c. Dirty Filter Alarm
d. All Wiring for above
e. Interlock w/Fire Alarm System
f. Compressor status
g. Mini-Split System Air Conditioning Units
a. Space temperature
b. Toilet and Tenant Exhaust Fans

61. Sensors and all associated wiring
62. Thermostat set point and space temperature
63. Tenant override control
64. Night setback, Morning warm up/cool down control
65. Discharge air temperature
66. Primary airflow CFM
67. Fan status
68. All Split Systems
a. Start/Stop Control with positive status indication
b. Space Temperature
c. Dirty Filter Alarm
d. All Wiring for above
e. Interlock w/Fire Alarm System
f. Compressor status
g. Mini-Split System Air Conditioning Units
a. Space temperature
b. Toilet and Tenant Exhaust Fans

69. Sensors and all associated wiring
70. Thermostat set point and space temperature
71. Tenant override control
72. Night setback, Morning warm up/cool down control
73. Discharge air temperature
74. Primary airflow CFM
75. Fan status
76. All Split Systems
a. Start/Stop Control with positive status indication
b. Space Temperature
c. Dirty Filter Alarm
d. All Wiring for above
e. Interlock w/Fire Alarm System
f. Compressor status
g. Mini-Split System Air Conditioning Units
a. Space temperature
b. Toilet and Tenant Exhaust Fans

77. Sensors and all associated wiring
78. Thermostat set point and space temperature
79. Tenant override control
80. Night setback, Morning warm up/cool down control
81. Discharge air temperature
82. Primary airflow CFM
83. Fan status
84. All Split Systems
a. Start/Stop Control with positive status indication
b. Space Temperature
c. Dirty Filter Alarm
d. All Wiring for above
e. Interlock w/Fire Alarm System
f. Compressor status
g. Mini-Split System Air Conditioning Units
a. Space temperature
b. Toilet and Tenant Exhaust Fans

85. Sensors and all associated wiring
86. Thermostat set point and space temperature
87. Tenant override control
88. Night setback, Morning warm up/cool down control
89. Discharge air temperature
90. Primary airflow CFM
91. Fan status
92. All Split Systems
a. Start/Stop Control with positive status indication
b. Space Temperature
c. Dirty Filter Alarm
d. All Wiring for above
e. Interlock w/Fire Alarm System
f. Compressor status
g. Mini-Split System Air Conditioning Units
a. Space temperature
b. Toilet and Tenant Exhaust Fans

93. Sensors and all associated wiring
94. Thermostat set point and space temperature
95. Tenant override control
96. Night setback, Morning warm up/cool down control
97. Discharge air temperature
98. Primary airflow CFM
99. Fan status
100. All Split Systems
a. Start/Stop Control with positive status indication
b. Space Temperature
c. Dirty Filter Alarm
d. All Wiring for above
e. Interlock w/Fire Alarm System
f. Compressor status
g. Mini-Split System Air Conditioning Units
a. Space temperature
b. Toilet and Tenant Exhaust Fans

101. Sensors and all associated wiring
102. Thermostat set point and space temperature
103. Tenant override control
104. Night setback, Morning warm up/cool down control
105. Discharge air temperature
106. Primary airflow CFM
107. Fan status
108. All Split Systems
a. Start/Stop Control with positive status indication
b. Space Temperature
c. Dirty Filter Alarm
d. All Wiring for above
e. Interlock w/Fire Alarm System
f. Compressor status
g. Mini-Split System Air Conditioning Units
a. Space temperature
b. Toilet and Tenant Exhaust Fans

109. Sensors and all associated wiring
110. Thermostat set point and space temperature
111. Tenant override control
112. Night setback, Morning warm up/cool down control
113. Discharge air temperature
114. Primary airflow CFM
115. Fan status
116. All Split Systems
a. Start/Stop Control with positive status indication
b. Space Temperature
c. Dirty Filter Alarm
d. All Wiring for above
e. Interlock w/Fire Alarm System
f. Compressor status
g. Mini-Split System Air Conditioning Units
a. Space temperature
b. Toilet and Tenant Exhaust Fans

117. Sensors and all associated wiring
118. Thermostat set point and space temperature
119. Tenant override control
120. Night setback, Morning warm up/cool down control
121. Discharge air temperature
122. Primary airflow CFM
123. Fan status
124. All Split Systems
a. Start/Stop Control with positive status indication
b. Space Temperature
c. Dirty Filter Alarm
d. All Wiring for above
e. Interlock w/Fire Alarm System
f. Compressor status
g. Mini-Split System Air Conditioning Units
a. Space temperature
b. Toilet and Tenant Exhaust Fans

125. Sensors and all associated wiring
126. Thermostat set point and space temperature
127. Tenant override control
128. Night setback, Morning warm up/cool down control
129. Discharge air temperature
130. Primary airflow CFM
131. Fan status
132. All Split Systems
a. Start/Stop Control with positive status indication
b. Space Temperature
c. Dirty Filter Alarm
d. All Wiring for above
e. Interlock w/Fire Alarm System
f. Compressor status
g. Mini-Split System Air Conditioning Units
a. Space temperature
b. Toilet and Tenant Exhaust Fans

133. Sensors and all associated wiring
134. Thermostat set point and space temperature
135. Tenant override control
136. Night setback, Morning warm up/cool down control
137. Discharge air temperature
138. Primary airflow CFM
139. Fan status
140. All Split Systems
a. Start/Stop Control with positive status indication
b. Space Temperature
c. Dirty Filter Alarm
d. All Wiring for above
e. Interlock w/Fire Alarm System
f. Compressor status
g. Mini-Split System Air Conditioning Units
a. Space temperature
b. Toilet and Tenant Exhaust Fans

141. Sensors and all associated wiring
142. Thermostat set point and space temperature
143. Tenant override control
144. Night setback, Morning warm up/cool down control
145. Discharge air temperature
146. Primary airflow CFM
147. Fan status
148. All Split Systems
a. Start/Stop Control with positive status indication
b. Space Temperature
c. Dirty Filter Alarm
d. All Wiring for above
e. Interlock w/Fire Alarm System
f. Compressor status
g. Mini-Split System Air Conditioning Units
a. Space temperature
b. Toilet and Tenant Exhaust Fans

149. Sensors and all associated wiring
150. Thermostat set point and space temperature
151. Tenant override control
152. Night setback, Morning warm up/cool down control
153. Discharge air temperature
154. Primary airflow CFM
155. Fan status
156. All Split Systems
a. Start/Stop Control with positive status indication
b. Space Temperature
c. Dirty Filter Alarm
d. All Wiring for above
e. Interlock w/Fire Alarm System
f. Compressor status
g. Mini-Split System Air Conditioning Units
a. Space temperature
b. Toilet and Tenant Exhaust Fans

157. Sensors and all associated wiring
158. Thermostat set point and space temperature
159. Tenant override control
160. Night setback, Morning warm up/cool down control
161. Discharge air temperature
162. Primary airflow CFM
163. Fan status
164. All Split Systems
a. Start/Stop Control with positive status indication
b. Space Temperature
c. Dirty Filter Alarm
d. All Wiring for above
e. Interlock w/Fire Alarm System
f. Compressor status
g. Mini-Split System Air Conditioning Units
a. Space temperature
b. Toilet and Tenant Exhaust Fans

C. The BAS shall be installed by technicians who are either directly employed by the manufacturer or are properly trained technicians in the direct employ of an authorized dealer and installer for the manufacturer.

1.8 OPEN PROTOCOL REQUIREMENTS

A. The new BAS shall utilize an open protocol communication system (BACnet, LonTalk) and shall be an open platform for interface by multiple component suppliers and integrators.

B. The open protocol access shall be to the extent that any control system integrator may access and interface with the BAS without the need for proprietary controller, hardware, software, etc.

C. Common access and integration tools shall be able to be utilized to interface with the system.

D. The system shall not require sole source or proprietary device suppliers.

E. The BAS installer shall indicate any and all proprietary devices in their package that may not meet this requirement in the proposal response. Should proprietary devices or software limit the open protocol concept, that system shall be removed from consideration for this project.

1.9 NEW SYSTEM SOFTWARE UPGRADES

A. Control system software updates shall be included with no additional future cost, annual maintenance agreement, etc. This includes routine program updates for improvements, maintenance, etc. It is not intended to include a major upgrade to a new platform. The intent is to allow for indefinite system operation without required upgrade to a new platform.

B. Project pricing and scope of work descriptions shall be provided to the Owner. The scope description should refer to this specification and state the complete scope included comprehensively. Items excluded shall be outlined in the pricing.

C. Provide unit pricing for terminal unit integration on a per terminal unit basis (PIU and VAV boxes).

D. Provide unit pricing for installation of additional controllers (all included).

E. Provide confirmation of point capacity as required in this specification. Confirmation shall be based on all known projects, including future project upgrades. It is the intent that adequate point capacity be included for reasonable flexibility without the need to add network controllers or other devices on an ongoing basis.

F. The control system shall be submitted to the Owner and Engineer for approval. The submittal shall include all hardware, point list summaries, wiring diagrams, control diagrams, sequence of operation, etc. for the entire system. The submittal shall be a supplement to this specification and included as an attachment to represent the project as-built condition.

PART 2 PRODUCTS

2.1 WEB ACCESSIBLE FACILITY MANAGEMENT SYSTEM

A. The BAS shall be fully accessible from a secure user computer workstation on the Owner network or any station with secured internet connection via a standard web.

B. Software installation and setup shall be by the Controls Contractor on a PC workstation, laptop, or server located as directed by the Owner.

C. Control communication shall be on an independent LonTalk or BACnet network. Control contractor shall review and interface and communication protocol with the Owner's IT representative to gain a full understanding of any communication parameters or interface required to the Owner's network.

D. Any access to the Owner's network shall be coordinated before and during construction.

2.2 MINIMUM STANDARDS

A. BAC Net or Lon compliant per ASHRAE / ANSI standard 135.

B. The BAS shall be capable of controlling multiple building functions such as lighting, alarm systems and HVAC equipment.

C. The BAS shall be modular and shall permit modular expansion of both capacity and functionality through the addition of sensors, actuators, stand-alone DDC panels.

D. The system architecture shall eliminate dependence on any single device for alarm reporting and control execution.

E. The system shall provide global setpoint and schedule modifications and pop-up operation sequence for any device shown by graphic.

F. This Division 23 scope shall include all integration, coordination, programming, etc. for systems and equipment installed as part of the base building scope, as well as pre-programming and integration of typical future systems.

2.3 CENTRAL CONTROL PANEL (CCP)

A. The function of the Central Control Panel (CCP) shall be to provide global commands and data for the Remote Control Panels (RCP) and to allow for remote communication with central server software (see 2.1 above). Provide all required data communication devices for communication between CCP and the server system. Communication between the server system and CCP is via the Owner's communication network.

B. The CCP shall contain the complete building operating system so that continuous connection to the user workstation is not required for normal operation.

C. The CCP shall contain the system scheduling functions subject to central system software.

D. The CCP battery backed by a self-charging battery system for uninterrupted operation upon power outage. This system shall be capable of all system functions for a minimum of 7 days. The control contractor shall reprogram CCPs should

3.3 SEQUENCES OF OPERATION - This sequence is an outline of the major equipment basic operation.

- A. Rooftop Units
The packaged rooftop units shall be controlled through the control panels and thermostats provided with the rooftop units.
1. During Un-Occupied Mode of operation, and whenever the RTU is off, the outside air dampers shall be closed and admit no outside air.
2. During Occupied Mode of operation, the outside air dampers shall open and shall control, measure, and record the amount of outside air entering thru the OA damper.
3. OA CFM set-point shall be visible to the operator on the Rooftop unit graphic and accessible through the graphical interface for adjustment.
4. During differential enthalpy economizer operation, the rooftop unit controls shall modulate the OA/RA dampers and powered exhaust fan, as applicable, to satisfy building/floor pressure setpoint (adjustable).
5. When the BAS transitions from Un-Occupied to Occupied, the Rooftop unit OA dampers shall be held closed until the morning start-up sequence is completed.
6. During morning warm-up, all P/U system terminal unit air valves shall be driven to maximum.
7. The warm-up cycle shall conclude when the morning warm-up sensor is satisfied.
B. Supply Pressure Reset: The BAS shall identify the system critical VAV zone using damper position and following the procedure described in ASHRAE Standard 90.1 and as restated below:
1. The BAS shall continuously monitor the damper position of all VAV terminal units served by the rooftop system.
2. When any damper is more than 95% (adjustable) open, the supply fan duct static pressure set-point shall be reset upward by 5% (adjustable) of the maximum system static pressure set-point at a frequency of 10 minutes (adjustable) until no damper is more than 95% open or the static pressure set-point has reset upward to the system maximum setting for the supply fan VFD.
3. When all dampers are less than 85% (adjustable) open, the supply fan discharge duct static pressure set-point shall be reset downward by 5% (adjustable) of the maximum system static pressure set-point at a frequency of 10 minutes (adjustable) until any damper is more than 85% open or the static pressure set-point has reset downward to the system minimum setting for the supply fan VFD.
4. 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.
5. Each rooftop system graphic shall identify the current critical zone by tag and display the critical zone primary air damper percent open.
C. Supply Air Temperature Reset: A supply air temperature reset routine shall be provided to adjust temperature set-point in 1F (adjustable) increments
1. The COP shall poll each VAV and PIU terminal served by the air handling unit. If 90% (adjustable) of the terminal units served by the air handling unit are at set point temperature, the duct supply temperature shall be raised by 1F (adjustable) up to a high limit of 65F (adjustable).
2. This routine shall occur at a frequency no more than once every fifteen minutes (adjustable) to avoid continual fluctuations in space temperature.
3. The supply air set point shall return to the original supply air set point if the air handling unit reaches 95% (adjustable) of full capacity.
4. There shall be a User input maximum supply temperature that shall not be exceeded under any condition. The air handling unit graphic shall display the original system set point and the currently operating set point.
D. Zone Overrides
1. Overrides shall be provided so that each zone (terminal unit, heat pump, or air handling unit) may be operated independently whenever the HVAC system is in setback or unoccupied mode.
2. Zone override shall be via a pushbutton on the associated system thermostat.
3. Activation of any override shall enable occupied mode the associate unit on the selected floor, etc. to operate in occupied mode.
4. The activated terminal unit and adjacent terminal units selected by the Owner only shall operate to maintain its thermostat settings. Terminal unit grouping shall be capable of being adjusted by the Owner. As a minimum, if no other direction is given all terminal units in the associated quadrant of the floor shall be activated.
5. The air-handling units and terminal units not activated shall remain in the prior selected mode.
E. Powered Induction Units (PIU)
1. Powered induction units shall have intermittent fan operation (except units serving lobbies, core areas and toilets) and shall modulate primary airflow from 0% (or scheduled minimum) to 100% to maintain the cooling set point (75F, adjustable).
2. Powered induction units serving lobbies, core areas and toilets shall be series type with constant fan operation and shall deliver a constant air quantity to these areas.
3. The VAV valve shall modulate to maintain the cooling set point of the thermostat and the electric heater shall energize to maintain the heating set point.
F. Split Systems
1. Split systems shall be controlled by a programmable heating/cooling thermostat (set at 70F, adjustable). Units shall be engaged as programmed in coordination with the Owner or 24 hours a day if no direction is given.
2. Space temperature of the machine and controller rooms and run status of the split systems shall be monitored by the BAS system.
G. Electric Heaters
1. Unit heaters shall be controlled by unit-mounted thermostats unless noted otherwise. Thermostats shall be set to energize the unit at 65F set point (adjustable).
2. Wall heaters shall be controlled by an integral electric thermostat. Thermostats shall be set to energize the unit at a 60F set point (adjustable).
3. Duct heaters shall be interlocked with supply fans and shall be controlled by thermostat provided with the supply fan.
H. Fans
1. The toilet exhaust fans shall be energized by the DDC controller. The toilet exhaust fan shall be energized during occupied hours.
2. Unless otherwise noted, all ventilation fans serving electrical and miscellaneous rooms shall be controlled by a thermostat (set at 80F, adjustable), interlock the associated motor operated dampers to open when the fan is running.
I. Startup
1. Provide the services of a factory trained and qualified service technician employed by the BAS manufacturer who shall inspect the installation including external interlock and power connections; supervise testing, initial operation and calibration of these operating and safety controls.
2. This service technician shall forward a report in four (4) copies to the Owner when the BAS is in safe and proper operating condition. This report shall include all pressure and control settings, during start and run, and shall list minor discrepancies to be corrected that affect safe and reliable operation. One additional copy of the report shall be left in the central control panel. One copy of bound installation, operation, maintenance service and parts brochures, including applicable serial numbers and parts ordering sources, shall be placed in the central control panel at the time of startup; four (4) additional copies shall be forwarded to the Owner.

3.4 CONTROL SYSTEM WIRING

- A. All control system wiring shall be provided and installed by the Controls SubContractor. Coordinate with all trades. This includes line voltage (120V) and low voltage wiring. Line voltage wiring shall be installed by a licensed Electrician employed by the Control SubContractor or contracted through the Division 26 SubContractor, under this scope.
B. Coordinate with Division 26 for available circuits for control system power.
C. Coordinate with the Fire Alarm Contractor for life safety system interface including all code required alarms, shut down, fire control panel interface, etc.
D. All control wiring shall be installed in strict compliance with Division 26 specifications.
E. Low voltage wiring in ceiling plenums shall be plenum rated cable and shall be installed in compliance with intended Interior Design Finish throughout all tenant spaces.

3.5 GRAPHICS

- A. Graphics shall be provided for each mechanical system including the all HVAC equipment controlled or monitored by this system and the hot water recirculating pump. Graphics shall show each point that is monitored. Graphics for each piece of equipment shall be indexed by its name. Additional graphics shall show each floor with zone temperatures. If one graphic is not sufficiently large to capture an entire system or floor then it shall be logically separated into two graphics.
B. A graphic for each piece of equipment shall be provided and include all system points monitored or required for system function and user interface.
C. Floor plan graphics shall show all ductwork, diffusers, interior walls, equipment locations, and thermostat locations. Floor plans served by VAV systems shall identify the current critical zone and the current self-contained unit SP setpoints. Functionality of the critical zone reset shall be demonstrated to the Engineer's satisfaction prior to building acceptance.
D. System schematics, risers, flow diagrams, etc. shall be included showing overall system parameters.
E. Electrical risers and floorplans for any and all electrical meters. Coordinate with Division 26.

F. Floorplans for any and all plumbing and mechanical meters, including water meters, irrigation meters, BTU meters, etc.

- G. Provide sketches of proposed graphics for review by the owner to coordinate the design of these graphics. Existing Owner system graphics shall be used if required by the Owner.
H. Graphics for the lighting control shall be independent of the mechanical system floorplans. Lighting control graphics shall include lighting control zones shown on an Architectural floorplan. Similar to the mechanical graphic, the lighting control floorplan graphic shall be updated by each Tenant as appropriate. The lighting control system shall have full integration with the BAS for monitoring and control, as required by the lighting control package.
I. All graphics are subject to the approval of the Owner and shall be submit for review and approval.

3.6 SCHEDULES

- A. All equipment shall be able to be individually scheduled. Coordinate all schedules and breakdowns with the Owner, including for future tenant occupancy.
B. Contractor shall set up all initial schedules and setpoints in coordination with Owner and Commissioning Agent. Schedules and setpoint adjustment shall be included with Owner training.

3.7 OWNER TRAINING

- A. Refer to the general specifications for training requirements. At a minimum, provide the service of a qualified BAS system technician for two (2), 8-hour days for Owner training. The two (2) days shall be non-consecutive and shall be coordinated and scheduled with the Owner and Commissioning Agent, as applicable.

3.8 COMMISSIONING TESTS

- A. Testing of systems/equipment specified in this Section shall be coordinated, scheduled, and documented in accordance with the requirements of commissioning specifications.

3.9 COMMISSIONING DEMONSTRATION

- A. Demonstration of operation and training of Owner's personnel in operation and maintenance of systems/equipment specified in this Section is required. Coordination of the demonstration/training by qualified, factory authorized representatives is required with the Commissioning Authority. Instruction shall include a minimum number of hours as specified herein and approval of the formal training program is required by the Commissioning Authority. Refer to commissioning specifications.

END OF SECTION

LEGEND

Table with 2 columns: Symbol and Description. Includes items like CEILING DIFFUSER, CEILING RETURN AIR GRILLE, SIDE-WALL or DUCT MOUNTED REGISTER, SLOT DIFFUSER, MANUAL VOLUME DAMPER, FIRE DAMPER, THERMOSTAT, HUMIDISTAT, NIGHT SET-BACK, MOTOR OPERATED DAMPER, EXISTING WORK, NEW WORK, WORK TO BE REMOVED, FLOOR DRAIN, HOSE BIBB, FLOOR CLEAN-OUT, WALL CLEAN-OUT, DUCT ACCESS PANEL.

MECHANICAL SUMMARY

Table with 2 columns: Item and Value. Includes Thermal Zone (3A), Interior design conditions (winter dry bulb: 18 deg F, summer dry bulb: 94 deg F), Total tenant heating load (N/A), Total tenant cooling load (N/A), Mechanical Spacing Conditioning System (Unitary), Equipment schedules with motors (mechanical systems) (motor horsepower, number of phases, minimum efficiency, motor type, # of poles).

COMMISSIONING NOTES:

- 1. THE 2018 NC ENERGY CODE REQUIRES THE MECHANICAL AND SERVICE WATER HEATING SYSTEMS IN BUILDINGS WITH A FLOOR AREA IN EXCESS OF 10,000 SQ. FT. TO BE COMMISSIONED BY A REGISTERED DESIGN PROFESSIONAL.
2. THE CONTRACTOR SHALL OBTAIN THE SERVICES OF A NC LICENSED ENGINEERING PROFESSIONAL TO PERFORM ALL REQUIRED COMMISSIONING. PRIOR TO ISSUANCE OF CERTIFICATE OF OCCUPANCY A SIGNED STATEMENT OF SYSTEM COMMISSIONING (SEE APPENDIX C1) SHALL BE PROVIDED TO CODE OFFICIAL AND FACILITY OWNER.
3. COMMISSIONING HAS BEEN EXCLUDED FROM BARRETT, WOODYARDS DESIGN SCOPE. HOWEVER, WE CAN PERFORM SAID SERVICES UNDER THE CONTRACTORS SCOPE.
4. COMMISSIONING SHALL BE DONE IN ACCORDANCE WITH SECTION C408 OF THE 2018 NC ENERGY CODE. COMMISSIONING SHALL INCLUDE:
4.1. A COMMISSIONING PLAN WITH:
A) A NARRATIVE OF THE ACTIVITIES TO BE PERFORMED AND BY WHO.
B) A LIST OF EQUIPMENT TO BE COMMISSIONED.
C) FUNCTIONS TO BE TESTED.
D) CONDITIONS UNDER WHICH TESTS SHALL BE PERFORMED.
E) MEASURABLE CRITERIA FOR PERFORMANCE.
4.2. HVAC SYSTEMS SHALL BE TESTED AND BALANCED. REFER TO SPEC SECTION 23043 FOR TEST AND BALANCE REQUIREMENTS.
4.3. HYDRONIC SYSTEMS SHALL BE BALANCED ACCORDING TO THE REQUIREMENTS SET FORTH IN C408.2.2.2.
4.4. ALL CONTROLS SHALL BE COMMISSIONED TO ENSURE ALL SYSTEM ARE OPERATING IN ACCORDANCE WITH APPROVED PLANS AND SPECIFICATIONS.
4.5. FUNCTIONAL TESTING TO ENSURE SYSTEMS ARE OPERATING IN ACCORDANCE WITH APPROVED PLANS AND SPECIFICATIONS.
5. CONTRACTOR SHALL PROVIDE TO THE OWNER AND SYSTEM COMMISSIONING AGENT, ALL INSTRUCTIONS ON MAINTENANCE AND OPERATION OF ALL SYSTEMS AND EQUIPMENT. THE DOCUMENTATION SHALL INCLUDE THE FOLLOWING, AT A MINIMUM:
A) SUBMITTAL DATA
B) OPERATION AND MAINTENANCE MANUALS FROM MANUFACTURER.
C) NAME AND ADDRESS OF AT LEAST ONE SERVICE AGENCY.
D) CONTROL SYSTEM MAINTENANCE AND CALIBRATION INFORMATION.
E) TEST & BALANCE REPORT
6. CONTRACTOR TO PROVIDE AT PROJECT COMPLETION, PRIOR TO OBTAINING CERTIFICATE OF OCCUPANCY, PRESENT AT FINAL INSPECTION TO THE JURISDICTION'S AHJ A SIGNED AND DATED STATEMENT OF SYSTEM COMMISSIONING FOR ALL MECHANICAL & HYDRONIC SYSTEMS. THE FORMAT OF THE STATEMENT OF SYSTEMS COMMISSIONING SHALL BE IN THE FORM REQUIRED BY THE STATE'S ENERGY CONSERVATION CODES AND/OR AHJ REQUIREMENTS. THE DOCUMENT SHALL BE SIGNED BY THE CONTRACTOR'S LICENSED PROFESSIONAL ENGINEER REPRESENTATIVE.

ABBREVIATIONS

Table with 2 columns: Abbreviation and Full Name. Includes A/C ABOVE CEILING ACCESS DOOR ADJUSTABLE, AFF ABOVE FINISHED FLOOR, AUTO AUTOMATIC, AC AIR CONDITIONING, AHU AIR HANDLING UNIT, BAL BALANCING, BOD BACKDRAFT DAMPER, B/F BELOW FLOOR, B/G BELOW GRADE, B'FLY BUTTERFLY, BHP BRAKE HORSEPOWER, BCD BASE CLEANOUT, CFM CUBIC FEET PER MINUTE, CBRV CURVED BLADE CEILING REGISTER, CD CEILING DIFFUSER, CU CONDENSING UNIT, CW COLD WATER (DOMESTIC), CHWS CHILLED WATER SUPPLY, CHWR CHILLED WATER RETURN, CON CONDENSER WATER SUPPLY, CWR CONDENSER WATER RETURN, CON CONCENTRIC CLEANOUT, CO CONDENSATE, db DRY BULB, DN DOWN, DR DRAIN, dt DITO, db DECIBELS, DWG DRAWING, EA EACH, EAT ENTERING AIR TEMPERATURE, ECC ECCENTRIC, EF EXHAUST FAN, EOD EMERGENCY OVERFLOW DRAIN, ER EXHAUST REGISTER, ESP EXTERNAL STATIC PRESSURE, EWP ENTERING WATER TEMPERATURE, EXH EXHAUST EFFICIENCY, EFF EFFICIENCY, G GATE, GA GAUGE, GPM GALLONS PER MINUTE, GL GLOBE, GCO GRADE CLEANOUT, HD HUB DRAIN, HP HORSEPOWER, HTG HEATING, HW HOT WATER (DOMESTIC), HWR HOT WATER RETURN, HWRR HOT WATER REVERSE RETURN, HWS HOT WATER SUPPLY, HZ HERTZ, V VENT, VALVE, VTR VENT THRU ROOF, VAV VARIABLE AIR VOLUME, wb WET BULB, WC WATER COLUMN, WHA WATER HAMMER ARRESTOR, WT WEIGHT, W WASTE, SP STATIC PRESSURE, SPS STATIC PRESSURE SENSOR, SA SUPPLY AIR, SAN SANITARY, SD SMOKE DAMPER, SEN SENSIBLE, SQ SQUARE, SR SUPPLY REGISTER, ST STORM, SS SPLIT SYSTEM, TEMP TEMPERATURE, TG TRANSFER GRILLE, TYP TYPICAL, UON UNLESS OTHERWISE NOTED.

GENERAL NOTES (APPLY TO ALL SHEETS)

- 1. THESE DRAWINGS ARE SCHEMATIC IN NATURE AND ARE NOT INTENDED TO SHOW ALL POSSIBLE CONDITIONS. IT IS INTENDED THAT A COMPLETE TENANT MECHANICAL SYSTEM BE PROVIDED WITH ALL NECESSARY EQUIPMENT, ACCESSORIES, OPTIONS AND CONTROLS, COMPLETELY COORDINATED WITH ALL DISCIPLINES. ALL ITEMS AND LABOR REQUIRED FOR A COMPLETE TENANT MECHANICAL SYSTEM IN ACCORDANCE WITH ALL APPLICABLE CODES, STANDARDS AND THE BASE BUILDING CONTRACT DOCUMENTS SHALL BE FURNISHED WITHOUT INCURRING ADDITIONS TO THE CONTRACT.
2. REFER TO THE ARCHITECTURAL DRAWINGS FOR EXACT PARTITION LAYOUTS, REFLECTED CEILING PLANS, DIMENSIONS, ETC.
3. COORDINATE THE LOCATION OF ALL TERMINAL UNITS (NEW & EXISTING) CLOSELY WITH ALL WALLS THAT GO TO STRUCTURE, COLUMNS, DUCTWORK, ETC. THE UNIT SHALL EITHER BE RELOCATED OR THE WALL OFFSET TO PROVIDE CLEARANCE THE UNIT SHALL HAVE THE GREATER OF 2'-0" OF SERVICE CLEARANCE ALL AROUND OR AS REQUIRED BY CODE.
4. REFER TO THE ARCHITECTURAL REFLECTED CEILING PLANS FOR EXACT LOCATIONS OF ALL CEILING MOUNTED AIR DISTRIBUTION DEVICES IF ANY ITEMS ARE NOT SHOWN ON THE REFLECTED CEILING PLANS, PREPARE A DRAWING OF THE PROPOSED LOCATION AND PRESENT IT TO THE ARCHITECT FOR APPROVAL PRIOR TO INSTALLATION.
5. ALL ROUND AND FLEXIBLE DUCTWORK EXTENDING TO DIFFUSERS SHALL BE SIZED FULL SIZE OF DISTRIBUTION DEVICE INLET, AND TAPS TO THE EXISTING LOW-PRESSURE DUCTWORK SHALL BE MADE WITH SPIN-IN FITTINGS HAVING INTEGRAL SCOOPS AND VOLUME DAMPERS. ALL NEW RECTANGULAR DUCTWORK TAPS SHALL BE MADE WITH SPLITTERS OR EXTRACTORS. ALL DUCTWORK SHALL BE CONSTRUCTED AND INSTALLED IN ACCORDANCE WITH SMACNA DUCT STANDARDS. NEW LOW PRESSURE SPIN-IN FITTINGS AND TAPS SHALL NOT BE MADE WITHIN 5 FT OF OUTLET OF EQUIPMENT. NEW LOW PRESSURE SPIN-IN FITTINGS SHALL BE MADE NO CLOSER THAN 2'-0" ON CENTER.
6. FLEXIBLE DUCTS SHALL BE INSTALLED FREE OF SAGS AND KINKS, SUPPORTED AT NOT MORE THAN 48" O.C.
7. TEST AND BALANCE ALL DIFFUSERS, BOXES, FANS, ETC. TO THE AIRFLOWS AND CONDITIONS INDICATED. ALL EXISTING DIFFUSERS, BOXES, FANS, ETC. WHICH ARE NOT THEIR OTHER DESIGN AIRFLOWS, REFERENCE THE EXISTING RECORD DRAWING AVAILABLE FROM THE OWNER. TESTING AND BALANCING OF HVAC SYSTEM SHALL BE PERFORMED IN ACCORDANCE WITH THE STANDARDS OF AABC OR NEBB AND SHALL BE PERFORMED UNDER THE DIRECT SUPERVISION OF AN AABC OR NEBB CERTIFIED TEST AND BALANCE ENGINEER. SUBMIT 4 COPIES OF THE REPORT TO THE OWNER.
8. NEW PERIMETER SLOT DIFFUSERS SHALL BE PROVIDED AS REQUIRED, AND SELECTED IN ACCORDANCE WITH BASE BUILDING STANDARD.
9. PORTIONS OF DUCTWORK VISIBLE THROUGH GRILLES AND REGISTERS IN FINISHED AREA SHALL BE PAINTED FLAT BLACK.
10. ALL CONTROL WIRING AND TUBING INSTALLED ABOVE THE CEILING SHALL BE LOCATED AS HIGH ABOVE THE CEILING AS POSSIBLE AND SHALL FOLLOW THE DESIGNATED GENERAL ROUTING OF THE DUCTWORK. DO NOT HANG WIRING OR TUBING FROM DUCTWORK; RATHER, SUSPEND FROM THE STRUCTURE. ALL NEW TERMINAL UNITS SHALL BE TIED INTO THE BASE BUILDING CONTROL SYSTEM. SEE BASE BUILDING SPECIFICATIONS FOR REQUIREMENTS.
11. SPRINKLER HEADS AND ASSOCIATED BRANCH PIPING SHALL BE PROVIDED AND RELOCATED IN ACCORDANCE WITH NFPA 13 AND ALL PREVAILING LOCAL CODES AS REQUIRED TO PROTECT ALL SPACES IN THIS TENANT AREA. SPRINKLER HEADS SHALL BE SEMI-RECESSED SPRINKLER HEADS IN TENANT AREAS AND CONCEALED FULLY RECESSED TYPE IN PUBLIC CORRIDORS.
12. COORDINATE ALL WORK IN OCCUPIED AREAS WITH THE TENANT IN THAT AREA. COORDINATE ALL WORK IN UNOCCUPIED AREAS AND COMMON AREAS WITH LANDLORD.
13. ALL MATERIALS IN PLENUM SHALL BE PLENUM-RATED.
14. THERMOSTATS SHALL BE LOCATED IN EACH ZONE AS SHOWN. THE EXACT LOCATION ON THE WALL INDICATED SHALL BE AS DIRECTED BY THE ARCHITECT. NEW THERMOSTATS SHALL BE SELECTED TO MATCH EXISTING BASE BUILDING THERMOSTATS AND SHALL BE COMPATIBLE WITH EQUIPMENT SERVED. THERMOSTATS ON EXTERIOR WALLS SHALL BE PROVIDED WITH INSULATED BACKING.
15. MATERIALS EXPOSED WITHIN THE PLENUM SHALL BE NONCOMBUSTIBLE OR HAVE A FLAME SPREAD INDEX OF NOT MORE THAN 25 AND A SMOKE-DEVELOPMENT INDEX OF NOT MORE THAN 50 AS DETERMINED IN ACCORDANCE WITH ASTM E 84.

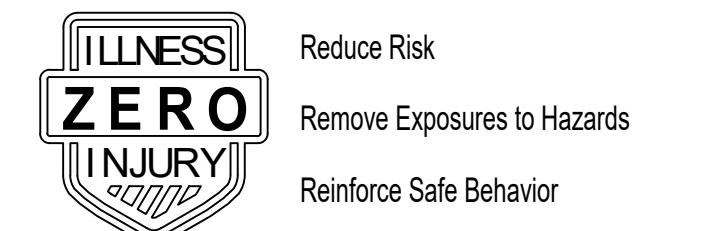
DRAWING NO.

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Safety Expectations:



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DUNN OPERATIONS CENTER

1269 JONESBORO RD. HARNETT COUNTY, NC 28334

OPERATIONS BUILDING

Table with 4 columns: MARK, DATE, REVISION, and ISSUED FOR CONSTRUCTION. Includes a grid for tracking revisions and a date stamp of 05-24-23.

PROJECT NO:

DRAWING NUMBER CFD-XXX-M-0005-XXXXXX

ELECTRONIC FILE NAME: M0001.DWG

DRAWN BY: TAYLOR SUBER

CHK'D BY: DAVID DUNN

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SHEET TITLE: SPECIFICATIONS NOTES & ABBREVIATIONS - MECHANICAL

SHEET NO.

M-0005

H
G
F
E
D
C
B
A

FAN SCHEDULE

I.D. TAG	CAPACITY (CFM)	S.P. (IN. WG)	MOTOR H.P.	DRIVE	VOLTS/PHASE	MAXIMUM FAN RPM	MAXIMUM NOISE	TYPE OF FAN	BASIS OF DESIGN	REMARKS
BAF-A	-	-	1.0	DIRECT	460/3	110	< 55 dBA	BIG CEILING FAN	BIG ASS FAN BASIC 6 (10 FOOT)	⑤
EF-A	6,000	0.3	2.0	DIRECT	460/3	1,175	13.7 SONES	INLINE EXHAUST	GREENHECK SQ-20-07-0700-VG	②③④
TEF-1	1,050	0.5	0.25	DIRECT	115/1	1566	9.2 SONES	INLINE FAN	GREENHECK SQ-100-VG	①②
EF-B	2,200	0.3	.25	DIRECT	115/1	1,160	18.9 SONES	AXIAL FAN	GREENHECK AER-24	②③④

- ① INTERLOCK FAN WITH RESTROOM LIGHTS.
- ② PROVIDE FAN WITH A SPEED CONTROLLER AND BACKDRAFT DAMPER.
- ③ FAN TO BE TIED INTO CARBON MONOXIDE/NITROGEN DIOXIDE DETECTOR.
- ④ PROVIDE FAN WITH A WALL MOUNTED SWITCH.
- ⑤ PROVIDE FAN WITH STANDARD WALL MOUNTED ON/OFF SWITCH/SPEED CONTROLLER.

PACKAGED (GROUND BASED) ROOF TOP UNIT SCHEDULE

I.D. TAG	MINIMUM TOTAL CAP. (MBH)	MINIMUM SENSIBLE CAP. (MBH)	AMBIENT TEMP. (°F)	COIL EAT		AIRFLOW (CFM) ③	EXT. S.P. (IN. W.C.) ①	MAX BHP.	OUTSIDE AIR (CFM)		HEATING SECTION		VOLTS/PHASE	MCA	MOCP	BASIS OF DESIGN	EER	APPROX. UNIT WEIGHT (LBS)	REMARKS
				°F db	°F wb				MINIMUM	MAX	TYPE	CAPACITY							
RTU-1	320.50	234.88	95.0	76.0	64.0	12,000	2.5	13.45	1,850	2,000	ELEC	54 kW	460/3	103.02	110.0	TRANE TEH360C4B	11.3 EER	4,800	②③④⑤⑥⑦⑧⑨⑩⑪

- ① THIS IS THE STATIC PRESSURE EXTERNAL TO THE UNIT. IT DOES NOT INCLUDE COIL, CASING, FILTER OR HEATER LOSSES.
- ② PROVIDE UNIT COMPLETE FACTORY DISCONNECT W/ LOCKOUT PROTECTION CAPABILITY.
- ③ SUPPLY FAN SHALL BE CAPABLE OF SUPPLYING AIRFLOW AT CFM & E.S.P. (IN. W.C.) AS INDICATED ON SCHEDULED ABOVE.
- ④ PROVIDE WITH HAIL GUARD.
- ⑤ PROVIDE SMOKE DETECTOR IN RETURN. INSTALLATION SHALL BE IN ACCORDANCE WITH NFPA 72E. COORD. W/ DIVISION 16.
- ⑥ POWERED WEATHERPROOF GFI DEDICATED CONVENIENCE OUTLET TO BE PROVIDED, COORDINATE WITH ELECTRICAL.
- ⑦ PROVIDE UNIT WITH FULLY MODULATING DIFFERENTIAL ENTHALPY ECONOMIZER.
- ⑧ PROVIDE UNIT WITH CO2 SENSOR LOCATED IN THE RETURN OF THE UNIT. SENSOR SHALL BE TIED INTO ECONOMIZER AND MODULATE THE OUTSIDE AIR BETWEEN MINIMUM AND MAXIMUM OUTSIDE AIR VALUES. REFER TO OA TABLE.
- ⑨ PROVIDE UNIT WITH POWERED EXHAUST FAN.
- ⑩ PROVIDE UNIT WITH VAV CONTROLS.
- ⑪ PROVIDE UNIT WITH HOT GAS BYPASS.
- ⑫ PROVIDE WITH DUAL COMPRESSORS.
- ⑬ PROVIDE WITH HOT-GAS BYPASS HUMIDITY CONTROL.

SPLIT SYSTEM SCHEDULE

I.D. TAG	MINIMUM TOTAL CAP. (BTUH)	MINIMUM SENSIBLE CAP. (BTUH)	AIRFLOW (CFM)	OUTSIDE AIR (CFM)	EXT. S.P. (IN. W.C.) ①	MAX H.P.	FAN COIL UNIT DATA		TYPE OF UNIT	HEATING SECTION TYPE	CAPACITY	CONDENSING UNIT DATA			BASIS OF DESIGN	REMARKS			
							°F db	°F wb				AMBIENT TEMP. (°F)	VOLTS/PHASE	STAGES			MIN. SEER		
AHU-1/CU-1	24,000	---	775	---	---	---	80	67	208/1 D	1075	WALL MOUNTED	HP	26,000	95	208/1	VFD	21.4	MITSUBISHI PKA-A24KA7/PUZ-A24NHAT	④⑤⑥
AHU-2/CU-2	24,000	---	775	---	---	---	80	67	208/1 D	1075	WALL MOUNTED	---	---	95	208/1	VFD	21.4	MITSUBISHI PKA-A24KA7/PUZ-A24NHAT	④⑤⑥

- ① THIS IS THE SP EXTERNAL TO THE ENTIRE FAN COIL UNIT ASSEMBLY (WET COIL, CASING, CLEAN FILTERS, AND FURNACE LOSSES ARE NOT INCLUDED IN THIS EXT. SP.)
- ② B = BELT DRIVE, D = DIRECT
- ③ HP STANDS FOR HEAT PUMP AND CAPACITY IS GIVEN IN MBH, ELEC STANDS FOR ELECTRIC HEAT AND VALUES ARE GIVEN IN KW.
- ④ PROVIDE WITH REMOTE WALL MOUNTED FULLY PROGRAMMABLE THERMOSTAT LOCATED AS SHOWN ON PLANS.
- ⑤ PROVIDE WITH CONDENSATE PUMP, PER MANUFACTURERS RECOMMENDATIONS.
- ⑥ PROVIDE WITH LOW AMBIENT CONTROLS.

ELECTRIC HEATER SCHEDULE

I.D. TAG	DESCRIPTION	CAPACITY KW	MIN CFM	VOLTS/PHASE	BASIS OF DESIGN	REMARKS
UH-A	FAN FORCED HEATER	13.0	800	460/3	REDDI UH	①
UH-B	FAN FORCED HEATER	5.0	400	460/3	REDDI UH	①

- ① PROVIDE HEATER WITH UNIT MOUNTED THERMOSTAT AND INTEGRAL DISCONNECT.

1ST FLOOR TERMINAL UNIT SCHEDULE

Equipment Info		Air Valve Data			Fan Data		Heating Coil Data					Basis of Design	Remarks				
TAG	Type	Cooling CFM	Inlet Size	Valve Min	Max ΔP	Fan Min	Fan %	Fan CFM	Max SP (IN W.C.)	Motor HP	Voltage/Phase			LAT	Design KW	Voltage/Phase	Max NC
1st Floor																	
P-1	Parallel	640	8"	105	0.45	120	70%	450	0.45	1/3	277/1	90°F	4.0	277/1	40	130	Trane VPEF 2.3
P-2	Parallel	625	8"	105	0.45	120	70%	440	0.45	1/3	277/1	90°F	4.0	277/1	40	130	Trane VPEF 2.3
P-3	Parallel	980	10"	165	0.45	120	70%	690	0.45	1/2	277/1	90°F	6.5	460/3	40	130	Trane VPEF 2.3
P-4	Parallel	825	8"	105	0.45	120	70%	490	0.45	1/3	277/1	90°F	4.0	277/1	40	130	Trane VPEF 2.3
P-5	Parallel	895	10"	165	0.45	120	70%	630	0.45	1/2	277/1	90°F	6.0	460/3	40	130	Trane VPEF 2.3
P-6	Parallel	930	10"	165	0.45	120	70%	655	0.45	1/2	277/1	90°F	6.0	460/3	40	130	Trane VPEF 2.3
P-7	Parallel	430	6"	60	0.45	120	70%	305	0.45	1/3	277/1	90°F	2.5	277/1	40	130	Trane VPEF 2.3
P-8	Parallel	720	10"	165	0.45	120	70%	505	0.45	1/3	277/1	90°F	5.0	460/3	40	130	Trane VPEF 2.3
P-9	Parallel	870	10"	165	0.45	120	70%	610	0.45	1/2	277/1	90°F	5.5	460/3	40	130	Trane VPEF 2.3
P-10	Parallel	350	6"	60	0.45	120	70%	245	0.45	1/3	277/1	90°F	2.0	277/1	40	130	Trane VPEF 2.3
P-11	Parallel	2,225	12"	320	0.45	330	70%	1560	0.45	1	277/1	90°F	14.0	460/3	40	200	Trane VPEF 2.3, 4
P-12	Parallel	1,300	12"	240	0.45	250	70%	910	0.45	1	277/1	90°F	8.0	460/3	40	130	Trane VPEF 2.3
P-13	Parallel	1,300	12"	240	0.45	250	70%	910	0.45	1	277/1	90°F	8.0	460/3	40	130	Trane VPEF 2.3

- (1) WEIGHTS ARE APPROXIMATE. COORDINATE ACTUAL EQUIPMENT WEIGHT WITH STRUCTURAL SUPPORT.
- (2) MAX INLET VELOCITY SHALL BE 2200 FEET PER MINUTE.
- (3) PROVIDE UNIT WITH SINGLE ELECTRICAL CONNECTION, UNIT DISCONNECT AND MERV 8 FILTERS. INSTALL PER MANUFACTURERS RECOMMENDATIONS FOR SERVICE AND ELECTRICAL CLEARANCES.

Ventilation Sizing Summary for RTU-1

Project Name: 2022-0632 DUNN OPS CENTER
Prepared by: Barnett Woodyard & Associates

1. Summary
 Ventilation Sizing Method: ASHRAE Std 62.1-2016
 Design Condition: Heating operation
 Occupant Diversity (D): 1.000
 Uncorrected Outdoor Air Intake (V_{ou}): 1468 CFM
 System Ventilation Efficiency (E_v): 0.800
 Outdoor Air Intake (V_{oi}): 1835 CFM ①

2. Space Ventilation Analysis

Zone Name / Space Name	Mult.	Supply Air (CFM) (Vsz)	Space Floor Area (A _f) (A _z)	Area Outdoor Air Rate (CFM/ft²) (Ra)	Time Averaged Occupancy (Occupants) (Pz)	People Outdoor Air Rate (CFM/person) (Rp)	Air Distribution Effectiveness (Ez)	Space Outdoor Air (CFM) (Voz)	Breathing Zone Outdoor Air (CFM) (Vbz)	Space Ventilation Efficiency (Evz)
Zone 1										
EXT_3 CREW	1	102	530.0	0.06	10.0	5.00	0.8	102	80	0.800
Zone 2										
EXT_5 CORRIDOR	1	5	72.0	0.06	0.0	0.00	0.8	5	4	0.800
INT_32 STORAGE	1	5	70.0	0.06	0.0	0.00	0.8	5	4	0.800
INT_33 AV	1	3	35.0	0.06	0.0	0.00	0.8	3	2	0.800
INT_29 CORRIDOR	1	33	446.0	0.06	0.0	0.00	0.8	33	27	0.800
INT_30 CORRIDOR	1	36	485.0	0.06	0.0	0.00	0.8	36	29	0.800
INT_38 CORRIDOR	1	39	525.0	0.06	0.0	0.00	0.8	39	32	0.800
Zone 3										
EXT_7 TOWNHALL	1	496	1116.0	0.06	66.0	5.00	0.8	496	397	0.800
EXT_6 STORAGE	1	6	83.0	0.06	0.0	0.00	0.8	6	0	0.800
Zone 4										
EXT_8 PANTRY	1	232	670.0	0.12	21.0	5.00	0.8	232	183	0.800
EXT_9 ENTRY	1	6	74.0	0.06	0.0	0.00	0.8	6	4	0.800
Zone 5										
EXT_10 LARGE CONFERENCE	1	89	357.0	0.06	10.0	5.00	0.8	89	71	0.800
Zone 6										
EXT_11 OFFICE	1	16	124.0	0.06	1.0	5.00	0.8	16	12	0.800
EXT_12 OPEN OFFICE	1	24	152.0	0.06	2.0	5.00	0.8	24	18	0.800
Zone 7										
EXT_13 OPEN OFFICE	1	48	307.0	0.06	4.0	5.00	0.8	48	38	0.800
EXT_14 PRINTER/COPY	1	10	139.0	0.06	0.0	0.00	0.8	10	8	0.800
EXT_15 OFFICE	1	15	122.0	0.06	1.0	5.00	0.8	15	12	0.800
EXT_16 OFFICE	1	15	122.0	0.06	1.0	5.00	0.8	15	12	0.800
EXT_17 CORRIDOR	1	5	72.0	0.06	0.0	0.00	0.8	5	4	0.800
Zone 8										
EXT_18 CREW	1	148	721.0	0.06	15.0	5.00	0.8	148	118	0.800
Zone 9										
INT_23 CREW	1	104	550.0	0.06	10.0	5.00	0.8	104	83	0.800
Zone 10										
INT_24 CREW	1	104	550.0	0.06	10.0	5.00	0.8	104	83	0.800
Zone 11										
INT_25 WELLNESS	1	14	106.0	0.06	1.0	5.00	0.8	14	11	0.800
INT_26 JANITOR	1	10	130.0	0.06	0.0	0.00	0.8	10	8	0.800
INT_27 UNISEX SHOWER	1	0	112.0	0.06	0.0	0.00	0.8	0	0	0.800
INT_28 CORRIDOR	1	33	439.0	0.06	0.0	0.00	0.8	33	26	0.800
INT_30 CORRIDOR	1	36	485.0	0.06	0.0	0.00	0.8	36	29	0.800
INT_34 WOMEN RR	1	0	220.0	0.06	0.0	0.00	0.8	0	0	0.800
INT_35 MEN RR	1	0	413.0	0.06	0.0	0.00	0.8	0	0	0.800
Zone 12										
INT_36 MED CONF	1	72	292.0	0.06	8.0	5.00	0.8	72	59	0.800
Zone 13										
INT_37 FOCUS	1	12	75.0	0.06	1.0	5.00	0.8	12	10	0.800
INT_39 CORRIDOR	1	18	243.0	0.06	0.0	0.00	0.8	18	15	0.800
INT_41 OFFICE	1	15	120.0	0.06	1.0	5.00	0.8	15	12	0.800
INT_42 OFFICE	1	15	120.0	0.06	1.0	5.00	0.8	15	12	0.800
INT_43 OFFICE	1	15	120.0	0.06	1.0	5.00	0.8	15	12	0.800
INT_44 OFFICE	1	15	120.0	0.06	1.0	5.00	0.8	15	12	0.800
INT_45 CORRIDOR	1	25	334.0	0.06	0.0	0.00	0.8	25	20	0.800
INT_40 PHONE	1	10	50.0	0.06	1.0	5.00	0.8	10	8	0.800
Totals (incl. Space Multipliers)		1835						1468	0.800	

Ventilation Sizing Summary for RTU-2

Project Name: 2022-0632 DUNN OPS CENTER
Prepared by: Barnett Woodyard & Associates

1. Summary
 Ventilation Sizing Method: ASHRAE Std 62.1-2016
 Design Condition: Heating operation
 Occupant Diversity (D): 1.000
 Uncorrected Outdoor Air Intake (V_{ou}): 172 CFM
 System Ventilation Efficiency (E_v): 0.970
 Outdoor Air Intake (V_{oi}): 177 CFM ①

2. Space Ventilation Analysis

Zone Name / Space Name	Mult.	Supply Air (CFM) (Vsz)	Space Floor Area (A _f) (A _z)	Area Outdoor Air Rate (CFM/ft²) (Ra)	Time Averaged Occupancy (Occupants) (Pz)	People Outdoor Air Rate (CFM/person) (Rp)	Air Distribution Effectiveness (Ez)	Space Outdoor Air (CFM) (Voz)	Breathing Zone Outdoor Air (CFM) (Vbz)	Space Ventilation Efficiency (Evz)
Zone 1										
EXT_1 CORRIDOR	1	58	78.0	0.06	0.0	0.00	0.8	6	5	0.990
EXT_2 STORAGE	1	366	532.0	0.06	0.0	0.00	0.8	40	32	0.982
INT_21 STORAGE	1	299	483.0	0.06	0.0	0.00	0.8	36	29	0.970
INT_22 STORAGE	1	299	483.0	0.06	0.0	0.00	0.8	36	29	0.970
EXT_19 STORAGE	1	352	476.0	0.06	0.0	0.00	0.8	36	29	0.989
EXT_20 CORRIDOR	1	60	73.0	0.06	0.0	0.00	0.8	6	5	1.000
INT_46 CORRIDOR	1	462	743.0	0.06	0.0	0.00	0.8	56	45	0.970
Totals (incl. Space Multipliers)		1895						172	0.970	

① BALANCE OUTSIDE AIR SYSTEM SERVING THE SPACE TO PROVIDE, AT A MINIMUM, THE OUTSIDE AIR RATE INDICATED. THE ASHRAE 2016 OA CALCULATION USED ABOVE IS CALCULATED THE SAME WAY AS FOUND IN THE NC MECHANICAL CODE.

DRAWING NO.
CFD-XXX-M-0007-XXXXXX

MAILING ADDRESS:
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CHARLOTTE, NC 28201

Safety Expectations:
 Reduce Risk
 Remove Exposures to Hazards
 Reinforce Safe Behavior

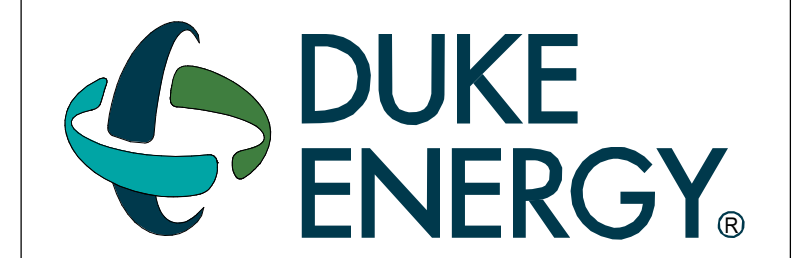
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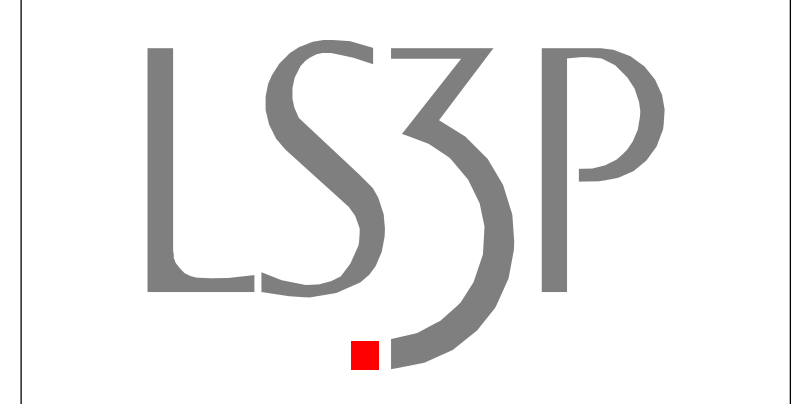
DUNN OPERATIONS CENTER
 1269 JONESBORO RD.
 HARNETT COUNTY, NC 28334

OPERATIONS BUILDING

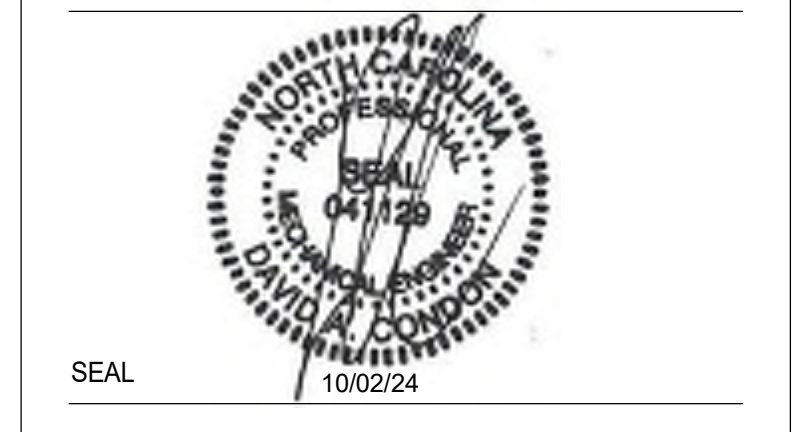


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Safety Expectations:
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 Remove Exposures to Hazards
 Reinforce Safe Behavior



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DUNN OPERATIONS CENTER

1269 JONESBORO RD.
HARNETT COUNTY, NC 28334

OPERATIONS BUILDING

MARK	DATE	DRN BY	REVISION	PERMIT COMMENTS	ISSUED FOR CONSTRUCTION
9					
8					
7					
6					
5					
4					
3	10.02.24				
2	09.22.23				
1	05.24.23				

PROJECT NO: 9900019.00
DRAWING NUMBER

CFD-XXX-M-101-XXXXX

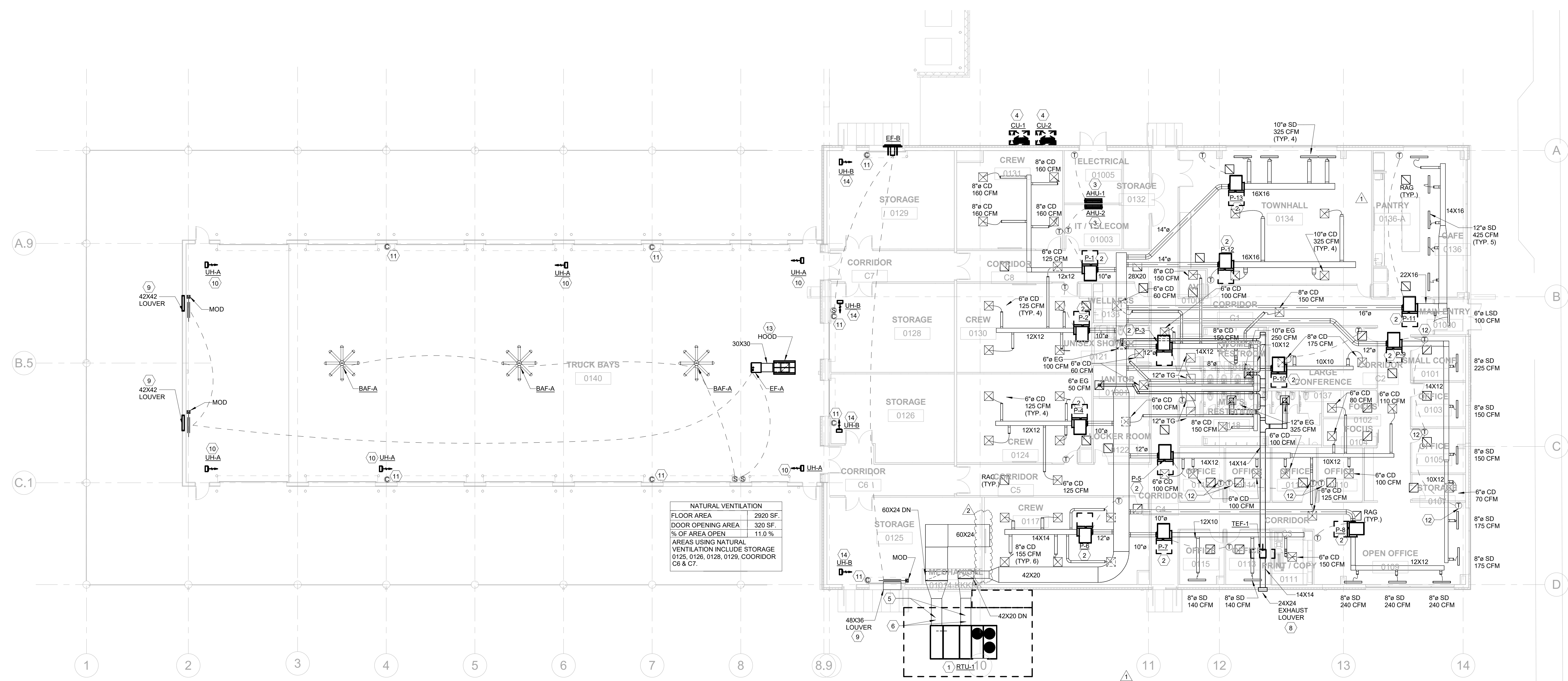
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SHEET TITLE:
FIRST FLOOR PLAN - MECHANICAL

SHEET NO.
M-101



NATURAL VENTILATION

FLOOR AREA	2920 SF.
DOOR OPENING AREA	320 SF.
% OF AREA OPEN	11.0 %
AREAS USING NATURAL VENTILATION INCLUDE STORAGE 0125, 0126, 0129, CORRIDOR C6 & C7.	

1 FIRST FLOOR PLAN - MECHANICAL
M-101 / 3/32" = 1'-0"

GENERAL NOTES
(APPLY TO ALL SHEETS)

- EXACT LOCATION OF ALL AIR DISTRIBUTION DEVICES SHALL BE COORDINATED WITH THE ARCHITECTURAL RCP.
- MATERIALS EXPOSED WITHIN THE PLENUM SHALL BE NONCOMBUSTIBLE OR HAVE A FLAME SPREAD INDEX OF NOT MORE THAN 25 AND A SMOKE-DEVELOPMENT INDEX OF NOT MORE THAN 50 AS DETERMINED IN ACCORDANCE WITH ASTM E 84.
- REPAIR AND REPLACE ANY DUCTWORK THAT DOES NOT MEET SPECIFICATION SECTION 23840. SEAL ANY HOLES IN DUCTWORK AIRTIGHT WITH SHEET METAL AND "HARDCAST."
- COORDINATE THE EXACT LOCATION OF ALL THERMOSTATS WITH FINAL FURNITURE LAYOUT. EQUIPMENT LAYOUT, ARCH AND OWNERS REPRESENTATIVE. CONTRACTOR SHALL TIE NEW T'S INTO BUILDING EMS AND UPDATE ACCORDINGLY.
- PROVIDE ALL MANUFACTURER AND NEC REQUIRED CLEARANCE FOR ALL EQUIPMENT.
- RELOCATE ALL SPRINKLER AND PLUMBING PIPING AS REQUIRED TO ACCOMMODATE NEW EQUIPMENT.
- AIR QUANTITIES AS SHOWN SHALL BE USED TO BALANCE SYSTEM PER NEW LAYOUT. CONTRACTOR SHALL VERIFY ACTUAL CAPACITY (CFMs) OF THE EXISTING UNIT AND DISTRIBUTE THEM PROPORTIONALLY TO CFMs SHOWN TO ALL DIFFUSERS.
- ALL THERMOSTATS LOCATED ON EXTERIOR WALLS SHALL BE PROVIDED WITH INSULATED BACKING.
- CONTRACTOR SHALL COORDINATE FINAL LOCATION OF BUILDING EMS WITH OWNERS REP. CURRENTLY DESIGNED TO GO IN THE JANITOR'S CLOSET.

KEY NOTES:
(APPLY THIS SHEET ONLY)

- REFER TO 3M-0006 FOR RTU INSTALLATION DETAIL.
- REFER TO 2M-0006 FOR INSTALLATION DETAIL. NEW UNIT SHALL MAINTAIN ALL MANUFACTURER & NEC REQUIRED CLEARANCES. COORDINATE UNIT TAGGING WITH OWNER/BUILDING REPRESENTATIVE. COORDINATE WITH DIV. 26.
- AHU SHALL BE INSTALLED AS HIGH AS POSSIBLE. ROUTE REFRIGERANT LINES TO CORRESPONDING CONDENSING UNIT LOCATED OUTSIDE. SIZE PER MANUFACTURERS RECOMMENDATIONS. 1" CONDENSATE SHALL BE RUN TO GRADE. REFER TO 4M-0006 FOR INSTALLATION DETAIL.
- COORDINATE FINAL LOCATION OF CU WITH ARCHITECT. AND OWNERS REP. ROUTE REFRIGERANT PIPING BETWEEN INDOOR AND ASSOCIATED OUTDOOR UNIT. SIZE IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS. INSULATE IN ACCORDANCE WITH MECHANICAL SPECIFICATIONS. REFER TO DETAIL 5M-0006.
- DUCT WORK SHALL BE FULL SIZE OF RTU OPENING.
- ALL OUTDOOR DUCTWORK CONVEYING CONDITIONED AIR SHALL BE WATER-PROOFED, INSULATED AND PROVIDED WITH A PROTECTIVE COVER PER SPEC SECTION 230713-2.03.
- RETURN AIR OPENING TO BE COVERED WITH HARDWARE CLOTH.
- CONTRACTOR TO RUN 14X14" EXHAUST DUCT TO STORM-PROOF LOUVER WITH BIRDSCREEN SIZED AS INDICATED. COORDINATE FINAL SIZING, LOCATION, AND FINISH WITH ARCHITECT AND DIV. 26. OPENING SHALL BE LOCATED NO CLOSER THAN 15'-0" TO ANY OUTSIDE AIR INTAKES.
- PROVIDE A STORM PROOF LOUVER WITH BIRD SCREEN SIZED AS INDICATED. COORDINATE FINAL SIZING AND LOCATION WITH ARCHITECT AND ELECTRICAL. LOUVER TO BE INSTALLED UNDER CANOPY COORDINATE FINISH WITH ARCHITECT. INTERLOCK MOD WITH FAN SUCH THAT MOD IS FULLY OPEN PRIOR TO FAN ENERGIZING.
- UNIT HEATER TO BE INSTALLED 13'-0" AFF PER MANUFACTURERS INSTRUCTIONS.
- CONTRACTOR TO PROVIDE CARBON MONOXIDE DETECTOR TIED IN TO EXHAUST FAN SHOWN ON PLANS TO ENERGIZE AT 25 PPM. COORDINATE WITH ARCHITECT FOR EXACT LOCATION, STYLE, AND FINISH.
- CONTRACTOR TO INTERCONNECT THERMOSTATS. VAV TO MAINTAIN AN AVERAGE TEMPERATURE OF ALL THERMOSTATS.
- ROUTE DUCT UP THROUGH ROOF. PROVIDE WITH A GREENHECK FABRA HOOD AND BIRDSCREEN. REFER TO DETAIL 7M-0006 FOR HOOD DETAIL.
- UNIT HEATER TO BE INSTALLED PER MANUFACTURERS INSTRUCTIONS. COORDINATE MOUNTING HEIGHT WITH ARCHITECT PRIOR TO INSTALLATION.