3.14 SHOP DRAWINGS

- A. Shop drawings per the submittal requirements shall be submit to the Design Team with adequate time for multiple rounds of review. Shop drawings shall show "As—Built" conditions including elevations, offsets, transitions, and accessories. Shop drawings shall indicate all code and manufacturer's recommended clearances, access, and coordinate the clearance and access requirements with all other trades.
- B. Shop drawings that use keynotes direct from the Design Documents shall not be acceptable as they do not demonstrate coordination with all other trades, necessary transitions, etc.
- C. Shop drawings shall be provided as complete packages in parallel with all trades to document coordination. Floor-by-floor or otherwise piecemeal shop drawings are generally not acceptable.

3.17BID REQUIREMENTS

- A. The Contractor shall include all systems, equipment and accessories shown on the plans and specifications.
- B. The Contractor is responsible for providing all design documents to all SubContractors. All systems, equipment and accessories shall be included in the bid, whether shown on the SubContractor applicable plans or other design
- C. Should any discrepancy occur in the Design Documents, the Contractor shall provide a request for clarification prior to bid or note the discrepancy in the bid and provide an appropriate cost allowance in the bid.
- D. The Contractor shall acknowledge that the Design Documents are diagrammatic and shall provide all systems, equipment and accessories required for a complete facility. Any areas that appear to be void of systems or inappropriate systems shall be noted in the bid. No post bid change order shall be considered for areas or discrepancies not noted in the bid.
- E. All installation coordination and means and methods and labor and materials required for proper system installation shall be included.
- F. These requirements are in addition to bid procedures and requirements of the RFP or general specifications.

END OF SECTION

TESTING, ADJUSTING, AND BALANCING FOR HVAC

SECTION 23 05 93

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 05 93 and the accompanying drawings cover the provision of all labor, equipment, appliances, and materials and performing all operations in connection with the testing and balancing (T&B) of the heating, ventilating and air conditioning (HVAC) systems as specified herein and as shown. These systems include, but are not limited to, the following:
 - 1. Supply distribution systems
 - 2. Return and exhaust air systems
- 3. Heating, ventilating and air conditioning equipment (all scheduled equipment as a minimum)

4. Hydronic systems

- A. It is the intent of this Section of the specifications to provide a complete
- operable and balanced HVAC system as shown and specified which is reasonably airtight, comfortable and free of objectionable noise and vibration. 1.03SCOPE OF WORK

1.02 INTENT

- A. HVAC test and balance shall be performed by an Independent Agency certified by the Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB) under direct contract to the General Contractor. All work performed by this Agency shall be performed by qualified Technicians under the direct supervision of an AABC or NEBB Certified Test and Balance Engineer. The Agency shall be independent and shall not be associated in any way with the installing HVAC SubContractor.
- of the AABC National Standards. 2016 for Total System Balance or the NEBB Procedural Standards for TAB of Environmental Systems, 8th Edition, 2015 together with the NEBB TAB Manual for Technicians, 2nd Edition.

C. HVAC Test and Balance shall be performed in accordance with the 7th edition

- D. The final Test and Balance report shall serve to substantiate compliance with the intent of the Contract Documents, specifically the HVAC systems.
- E. HVAC Test and Balance shall not begin until the systems are substantially
- F. Upon the completion of the Test and Balance work, the Agency shall submit four (4) copies of the complete HVAC Test and Balance Report directly to the Architect.
- G. The Agency, as a part of its contract with the General Contractor, shall act as an Authorized Inspection Agency, responsible to the General Contractor and the Architect and shall, during the test and balance, list those items which require correction or have not been installed in accordance with the Contract Documents.

H. The Agency shall plainly mark the settings of all valves, dampers and other

- adjustable devices. If a balancing device is provided with a memory stop, it shall be set, locked and marked. I. The Agency shall record all of the final set points on all variable speed

1.04 SUBMITTALS

- A. The name and certification of the Agency, along with the name and certification of the Certified Test and Balance Engineer, shall be submitted to the Architect for review within 30 days after the award of the General
- B. The selected Agency shall submit to the Owner:
- 5. Procedural Manual 6. Report Forms
- 7. AABC or NEBB Performance Guaranty
- 8. Instrument List and Calibration Dates
- 9. Schedule
- 10.Floorplans as Needed to Uniquely Identify Device Locations
- C. A reviewed copy of each of the above shall be returned to the Agency before the HVAC Test and Balance begins.
- D. If a complete submittal in accordance with these requirements is not received within 60 days from award of the General Contract, then the Architect reserves the right to select the Agency.

2.0 PRODUCTS

- 2.01 (Not applicable)
- 3.0 EXECUTION 3.01 GENERAL CONTRACTOR'S DUTIFS
- A. The General Contractor shall provide the following, within 10 days after his receipt, to the Agency:
- 1. Contract Drawings
- 2. Contract applicable specification Division 23 (others as applicable)

3. Addenda

- 4. Change orders
- 5. Reviewed submittals
- 3. The General Contractor shall start—up and maintain the HVAC systems and shall continue the operation of the HVAC systems during each day of testing and balancing. Start—up and operation shall include, as a minimum, the
- 1. All equipment operable and in safe condition.
- 2. Temperature control system complete.
- 3. Proper thermal overload protection in place for electrical equipment.
- 4. Ductwork leakage rates not exceeding those specified and all duct systems clean of debris.
- 5. Air transfer systems shall have:
- a. Correct fan rotation and RPM.
- b. Coil fins cleaned and combed.
- c. Filters clean and in place.
- d. Access doors closed. e. All dampers in place and open.
- f. All grilles, registers and diffusers installed.
- C. Provide sufficient time before final completion date so that testing and balancing can be accomplished. Coordinate the submitted T&B schedule.
- D. Provide immediate labor and tools to make required corrections and repairs without undue delay.
- E. The General Contractor and his SubContractors shall cooperate fully with the Agency to provide the following:
 - 1. Access to HVAC system components.
 - 2. The right to adjust the systems.
- F. Any conditions which prevent a proper HVAC Test and Balance shall be reported by the Agency to the General Contractor and Architect within 7 days of their discovery.
- G. If it is determined by the Agency and confirmed by the Architect that drive changes or additional balancing dampers are required, the Contractor shall obtain and install all necessary components.
- H. The Agency shall cooperate with the Architect and the Contractor and all his SubContractors to perform the work in such a manner as to meet the job
- I. The Agency shall verify that all system components are in place and in proper working order prior to leaving the project.
- J. All reported and recorded data shall represent true measured conditions.
- K. Where equipment uses variable speed drives, and where feasible, VFDs shall be used as the primary balancing method prior to adjustment or balancing of

valves, dampers, etc.

SECTION 23 07 13

DUCT INSULATION

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 07 13 and the accompanying drawings cover the provisions of all labor, equipment, appliances, and materials and performing all operations in connection with the construction of the ductwork systems as specified herein and as shown. These systems include, but are not limited to, the
- 1. Insulation for typical ductwork

I.02INTENT

Duct liner

A. It is the intent of this Section of the specifications to provide a complete operable duct system as shown and specified which is reasonably airtight, free of noise, vibration and sweating, and fabricated so as to fit into the space allotted and to exhibit a minimum resistance to airflow.

2.0 PRODUCTS

- 2.01 DUCT LINER
- A. Duct liner shall be one inch thick, 1 ½ lb. density (3 lb. density on medium and high—pressure supply air systems except that 1 $\frac{1}{2}$ lb. density is acceptable if the liner is at least R £4.2 and NRC £0.65) fibrous glass with one face coated with a black fire retardant compound. The permanent composite fire and smoke hazard rating of the liner shall be stenciled on the liner face and shall be:
- 1. Maximum Flame Spread 25
- 2. Maximum Smoke Developed 50

2.02 TYPICAL DUCT INSULATION

- A. Duct insulation shall be 2" thick, minimum 3/4 lb. density fiberglass with an FSKL 0.00035" thick aluminum foil jacket, reinforced with fiberglass scrim. Thermal conductivity shall be a maximum of K = 0.29 at 75°F mean temperature, or a maximum of K=0.27 at 25% compression.
- B. Insulation adhesive shall be Benjamin Foster 85-20. Tape shall be aluminum foil and shall be SMACNA listed and labeled.
- C. The composite NFPA 90A and 90B, ASTM E84, UL rating of the installed insulation shall not exceed 25/50.
- D. The grease exhaust ductwork shall have zero-clearance to combustibles wrap from the hood connection to discharge termination. Coordinate the insulation with all required access panels, drains, etc. as required by NFPA 96.

2.03 INSULATION FOR DUCTWORK OUTSIDE

with 180% elongation factor.

- A. See specification 23 31 00 for duct construction installed outside the building and exposed to weather. Note requirement for soldered or welded duct. Ductwork installed outside shall be shall be provided with a cover as noted below with water-proof coating and seams. Seams shall be located so as to not be subject to water flow. Cover shall be painted a light colour as selected by the Owner. All ductwork installed outside shall be constructed with sloped top "watershed" design with a slope of not less than 2% to avoid ponding water. Any ductwork supports connected directly to the ductwork shall also abide by the insulation requirements below.
- 1. Ductwork conveying conditioned air shall, in addition, have minimum R—12 insulation of one of following options:
- a. 3" thick, 3 PCF density rigid fiberglass board insulation with foil-kraft facing with Venture Clad, or equal, vinyl cover.
- b. 3" thick, 3 PCF density rigid fiberglass board insulation with foil-kraft facing with Polyguard, or equal, self-adhesive, self-healing membrane
- c. 2" thick polyisocyanurate board insulation with vinyl cover or membrane per the options above.
- 2. As an alternate to single wall duct and exterior insulation, ductwork installed outside may be double-walled meeting SMACNA requirements, R-12 insulation between walls, and the exterior wall shall be corrosion—coated for outside installation. Ductwork shall be weathertight.
- 3. Access into ductwork installed outside shall be located inside the building where feasible. Where outside access is required, access shall be through removable cover and insulation to match the above requirements. Removable areas shall be permanently labeled on the outside and shall be insulated to minimize exposure to water infiltration.

3.0 EXECUTION

3.01 INSTALLATION

- A. Ductwork shall be installed in strict accordance with SMACNA, UL, and NFPA
- B. Duct liner shall be provided throughout all return air, transfer and plenums. Duct liner shall also be provided for the following minimum distances,
- whichever is greater, downstream of each unit indicated below:
- through the first elbow(s), or as otherwise indicated on the drawings,
- 1. Packaged rooftop unit 25 ft
- 2. Split system air handling unit 5 ft
- 3. Terminal unit 5 ft
- C. Straight runs only shall be factored into the above distance requirements. Elbows, etc. within the length shall be lined but shall not count towards the length requirement.
- D. Duct liner shall not be installed within six inches of a damper, including fire and/or smoke dampers. Metal nosings are required on the downstream side of the exposed insulation. Where lining has been interrupted, external insulation is required.
- E. Duct liner shall be cut to provide overlapped and compressed longitudinal corner joints. Liner shall be installed with the coated surface facing the air stream. Duct liner shall be adhered to the ductwork with a 100% coverage of the sheet metal surfaces using a fire retardant adhesive applied by spraying. Coat all exposed leading edges and all transverse joints with fire retardant adhesive. The liner shall be additionally secured using metal pins welded to the duct and speed washers. All leading edges shall be secured with sheet metal airfoils.
- . Inside the vapor barrier of the building all supply air ductwork which is not lined shall be insulated. All supply air ductwork which is on the top floor, downstream of a PIU serving an exterior exposure or is within 25 feet of an exterior door shall be insulated. All outside air ductwork shall be insulated. Insulation shall be cut slightly longer than circumference of duct to insure full thickness at corners. All insulation shall be applied with edges tightly banded. Insulation shall be adhered to duct with fire resistant adhesive. Adhesive shall be applied so that insulation conforms to duct surfaces uniformly and firmly. In addition to the adhesive, the insulation shall be additionally secured to the bottom of all ducts 18" or wider by means of welded pins and speed clips. The protruding end of the pins shall be cut off flush after the speed clips have been applied. The vapor barrier facing shall be thoroughly sealed with tape where the pins have pierced through. All joints shall be sealed with 2" wide SMACNA tape. Any cuts or tears shall be sealed with SMACNA tape.
- G. All outside air ductwork located in conditioned or semi-conditioned spaces shall be externally insulated similar to supply ductwork.
- H. All conditioned air ductwork, including partially conditioned energy recovery ventilator outside air supply to the building and exhaust ductwork, installed in spaces that are ventilated only, i.e. penthouses, shall be insulated.

END OF SECTION

SECTION 23 07 19 HVAC PIPING INSULATION

<u>1.0 GENERAL</u>

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 07 19 and the accompanying drawings cover the provisions of all labor, equipment, appliances, and materials and performing all operations in connection with the insulation of the HVAC piping systems as specified herein and as shown for the heating, ventilating and air conditioning (HVAC) systems. These insulated piping systems include, but are not limited to, the following:
- 1. Refrigerant suction and liquid (RS&L)
- 2. Condensate drains (indoors only)
- C. All insulation products installed indoors shall meet NFPA 90A, 90B and 255 requirements for Flame Spread Rating 25 and Smoke Developed Rating 50.
- D. Inserts for all piping which is specified to have hangers outside the insulation shall be provided at such hangers and supports for all piping 2" and larger. Inserts shall be Foamglas insulation, and shall be at least 2" longer than the length of the associated pipe shields.

1.02 INTENT

- A. It is the intent of this Section of the specifications to provide a complete piping insulation system which is free of gaps and tears, properly fitted and finished, free of sweating, and fabricated so as to fit the space allotted and to exhibit a negligible heat transfer.
- B. The word "piping" is defined to mean all piping, fittings, joints, hangers, coatings, valves, cocks, test and sensor wells and accessories necessary for the HVAC piping systems described, shown and specified.

Manville, Certainteed, Dow, Armacell, or Armstrong.

A. Insulation products shall be as manufactured by Owens Corning, Knauf,

03ACCEPTABLE MANUFACTURERS

PRODUCTS 2.01 PIPING INSULATION

- A. Piping insulation installed inside the building, except for the refrigerant suction and liquid service, shall be fiberglass preformed pipe insulation with a white all—service jacket/vapor barrier. Insulation shall have a maximum K of 0.27 BTU/In/Hr/SF/°F, at a mean temperature of 75°F. For pipe sizes larger than 1.5", 2" thick insulation shall be used; and for pipe sizes 1.5" and smaller,
- 1.5" thick insulation shall be used. B. Piping insulation installed outside the building, except for the refrigerant suction service, shall be prefabricated 2 lb/ft³ density polyisocyanurate insulation (Trymer 2000 XP or approved equal) with waterproof mastic and glass fiber jacket finished with an aluminum jacket with waterproof silicone caulk joints and seams. Outside the building, insulation with a maximum K of 0.19 BTU/In/Hr/SF/°F at a mean temperature of 75°F shall be used. Outdoor piping 1.5" and smaller shall be insulated with 1.5" thick insulation; outdoor
- piping larger than 1.5" shall be insulated with 2" thick insulation. C. Piping insulation installed underground, either inside or outside the building, shall be prefabricated 2 lb/ft³ density polyisocyanurate insulation (Tymer 2000 XP or approved equal) with HDPE jacket. Jacket shall conform to ASTM D1248 and D3350, be extruded, have a minimum thickness of 175 mils.
- D. Closed-cell insulation shall be provided over all refrigerant suction piping and other services as specified or noted. Closed—cell piping insulation shall be 1-1/2" thick 25/50 Armaflex or Rubatex. All glues and coatings shall be products of the same Manufacturer as the insulation.
- E. Insulation shall be continuous over all valve bodies, fittings, and wall and floor penetrations. Do not insulate unions on hot water piping; nor instruments, gauges, valve handwheels, etc. on any piping.
- F. All piping insulation covering water—carrying piping which is exposed to the weather and subject to bursting from freezing temperatures shall have oversized insulation to accommodate heating cable. See Section 23 05 33.
- G. Provide a continuous watertight aluminum jacket and fitting covers for all polyisocyanurate insulation piping exposed to the weather.

3.01 INSTALLATION OF PREFORMED PIPE INSULATION

A. Indoors

1. Preformed pipe insulation with all—service jackets shall have all longitudinal joints lapped by a minimum of 2" and sealed with fire retardant adhesive. Butt joints shall be sealed with 3" wide tape similar to the insulation vapor barrier jacket and secured with adhesive.

2. All elbows shall be insulated with preformed fitted insulation equal to the

thickness specified for the adjacent piping insulation. As an alternative,

provide fitting covers meeting NFPA/UL 25/50 ratings; stuff all covers

with fiberglass insulation having characteristics equal to adjacent pipe

2.02 VALVES

2.0 PRODUCTS

2.01 PIPE AND FITTINGS

Material Type 4:

6. Material Type 6:

A. All valves shall have the Manufacturer's name or trademark and the workina pressure cast or stamped on the valve body.

c. Joints — Soldered with a solder meeting ASTM B32.

B. All valves utilizing packing shall be designed and constructed to allow repacking while under pressure.

- C. All valves shall be provided by a domestic Manufacturer.
- D. All valves 3/4" and smaller shall be "full-port" type, and greater than 3/4" may be "reduced-port" type.
- Valves on insulated lines shall be provided with stem extensions to provide clearance for specified pipe insulation. Provide preformed insulation to encase valve assembly in insulated piping systems.
- F. Valves shall be suitable for 125 psig and 40°F to 250°F or the system operating conditions, whichever is greater, UON.
- J. Check Valves:

1. Preformed pipe insulation for exterior water—carrying pipe shall have

insulation secured on with copper wire with ends twisted and turned into

thickness and draw in. while mastic is wet, alass fiber cloth. Finish with

the insulation. Over the insulation, apply mastic to a minimum 1/4"

aluminum jacket with waterproof silicone caulk joints and seams. All

2. All elbows shall be insulated with preformed fitted insulation equal to the

self-regulating electric heat tracing installed as specified in Section 23

seams shall be overlapped in the direction of rainfall, as practical.

thickness specified for the adjacent piping insulation.

3.02 CLOSED-CELL PIPING INSULATION INSTALLATION

protective coating applied in two coats.

be tightly made and glued.

for HVAC Section 23 05 00.

2. Drains (DR)

1.03GENERAL REQUIREMENTS

insulating type.

whenever feasible.

3. Valves and Accessories

1. Refrigerant suction and liquid (RS&RL)

3.03 MISCELLANEOUS REQUIREMENTS

END OF SECTION

1.0 GENERAL

1.02 INTENT

1.01 DESCRIPTION

3. All water—carrying piping subject to freezing weather shall have

A. Insulation shall be provided on all refrigerant suction and indoor cooling coil

condensate drain lines. The insulation shall be installed by the slip-on

method; slitting of the insulation is prohibited and shall be cause for

A. Where insulation is installed over pipe hangers, supports, etc., seal vapor

SECTION 23 21 00

HYDRONIC PIPING

A. All work specified in this Section is governed by the Common Work Results

and as shown for the heating, ventilating and air conditioning (HVAC)

A. It is the intent of this Section of the specifications to provide complete and

operable piping systems as shown and specified which are free of leaks,

fit the space allotted and to exhibit a minimum resistance to fluid flow.

B. The word "piping" is defined to mean all piping, fittings, joints, hangers,

A. Provide all reducing fittings, flanges, couplings and unions of the size and

B. Union joints or flanges shall be provided in each pipeline connected to each

1. Unions or flanges shall be provided between all copper to steel

C. All changes in direction and branches shall be made with manufactured

D. In all water piping systems, changes in horizontal pipeline sizes shall be made

E. In refrigerant, drain, steam and condensate piping systems, eccentric reducers

pipe flush for proper condensate and oil drainage. Reducing tees, reducing

elbows and concentric reducers shall only be allowed for changing pipe sizes

in vertical risers and for making connections to equipment and accessories

. Each pump shall be provided with a straight run of piping into the suction of

shall be equipped with a suction diffuser. Straight runs shall be provided

J. Open ends of pipelines not currently being handled shall be plugged during

installation to keep dirt, water and foreign material out of the system.

K. Horizontal water supply and return piping shall be installed level or, where

space permits, slope up in the direction of flow at 1/2 to 1 percent of the

Horizontal **steam, condensate return, refrigerant and drain piping shall slope

down in the direction of flow at a minimum slope of 1/8" per foot of run.

M. All Welders employed at this project shall be qualified under the requirements

A. All pipe and fittings shall be products of a domestic Manufacturer.

b. Fittings - Wrought copper meeting ANSI B16.22.

c. Joints — Silver brazed with sil—fos or silver solder.

a. Pipe — Copper drainage tube DWV meeting ASTM B306.

of ANSI Specification B31.1.0, Section 127.5. Evidence of Welders' qualifications

a. Pipe — Type L hard drawn copper tubing meeting ASTM B88 or ASTM

b. Fittings - Wrought copper solder-joint drainage fittings meeting ANSI

a length not less than five (5) times the suction pipe size indicated and/or

F. All pipe joints shall be cut square and all burrs shall be removed.

H. Fabrication of a bullhead tee connection is strictly prohibited.

shall be installed with the flat side on bottom to maintain the bottom of the

tees, reducing elbows and concentric reducers shall only be allowed for

changing pipe sizes in vertical risers and for making connections to

with eccentric reducers installed flat on top for proper air venting. Reducing

piece of equipment and elsewhere as indicated and specified. Unions shall

connections in water-carrying piping. These unions shall be dielectric,

the HVAC piping systems described, shown and specified.

match the piping system in which they are installed.

equipment and accessories from vertical risers.

G. All butt-weld pipe elbows shall be long radius type.

shall be submitted before any welds are made.

B. Pipe and fittings shall be as listed and outlined below:

C. The pipe, fittings and joints shall be as outlined below:

3. All other drains, All Sizes: Material 6

2. Refrigerant Suction and Liquid, All Sizes: Material 4

properly vented, free of noise, vibration and sweating, and fabricated so as to

coatings, valves, cocks, test and sensor wells and accessories necessary for

type of material to match the piping to each piece of equipment, valve and

B. This Section 23 21 00 and the accompanying drawings cover the provisions of

all labor, equipment, appliances, and materials and performing all operations

in connection with the construction of the piping systems as specified herein

systems. These piping systems include, but are not limited to, the following:

the pipe. Apply white mastic to all end seals over jacket.

rejection. All elbows shall be mitered and all such joints and butt joints shall

B. All insulation installed outdoors shall be coated with a glossy white, ultraviolet

barrier at all penetrations. Also seal all end joints at unions and points of

termination by bevel cutting the end and drawing jacket over until secured at

- 1. Check valves 2-1/2" and larger shall be non-slam type with iron body, globe-type silent checks with bronze trim, stainless steel spring and flanged end connections. Flow area through the valve shall exceed the cross sectional area of the pipe in which the valve is installed by not less than 10%. Valves shall be Apollo Valves 910F up to 200 psi or 2" and under, 169T up to 600 psi or equal by Mueller Co., APCO, Metraflex Globe Style Silent Check Valve, Hammond IR 9354, or Milwaukee 1800. In grooved piping systems, valves shall be Victaulic 716, 779, or W715 as
- 2. Check valves 2" and smaller shall be y-pattern, swing-type with brass body, renewable bronze seat disc, and be MSS SP-80 factory—tested. Valves shall be Apollo Valves 164T for up to 200 psi CWP and 168T for up to 400 psi CWP or equal by Hammond, or Milwaukee.
- 3. All check valves on pump discharges shall be non-slam type.
- 4. All check valves shall be installed in an orientation allowed by the manufacturer's recommendations.
- 5. All check valves installed in insulated piping systems shall have the check valve location explicitly labeled on the outside of the insulation.
- Control valves shall meet the requirements of the appropriate valve sections. Control valves shall be provided with electric operator/actuators which shall provide full modulation from closed to open and positive closure. Operators/actuators and all components shall be plenum-rated in return air
- M. Relief valves shall be sized to have the pressure and temperature relief capacities indicated by their service, including any piped discharge sizes and lengths. Relief valves shall be ASME rated and labeled.

2.03 FLEXIBLE PIPE CONNECTIONS

- N. Flexible piping connections for individual small HVAC units such as fan coil units, water—source heat pumps, and water coils shall be provided with each unit or coil. Flexible supply and return hoses shall be a minimum of 24" and complete with service shut-off valves. Hose assembly shall be stainless steel outer braid and EPDM inner tube. Hoses shall have insulation to match insulation specification requirements. Hoses shall be rated for the system pressure and temperature in which they are installed and not less than 40°F to 250°F, 300 psig.
- O. Flexible piping connections are for vibration isolation only and shall not be used to align piping connections, for thermal expansion, or any other purpose.

under normal operating conditions. Gauges provided on pumps shall be

Thermometers and pressure gauges shall be products of Trerice, Weksler or Weiss. Select all devices to operate within 20% of the midpoint of their scales

2.08 THERMOMETERS AND PRESSURE GAUGES

compound type.

- 2.09 PRESSURE AND TEMPERATURE (P&T) TEST PLUGS A. Plugs shall be constructed of brass with two (2) self-closing Nordel cores
- and be complete with cap and gasket. B. Plugs shall be as manufactured by Peterson or Lancaster.
- C. Provide a complete test kit to the Owner at the time of final inspection. Test kit shall be complete with pressure gauge, thermometer, probes and carrying

3.0 EXECUTION

3.01 ARRANGEMENT

- A. Follow the general piping layout, arrangement, schematics, and details. Provide all offsets, air vents, drains and connections necessary to accomplish the installation. Automatic air vents shall be provided at all high points. Manual air vents shall be installed as required for system fill, troubleshooting, and testing. Fabricate piping accurately to measurements established at the project Site to avoid interference with ductwork, other piping, equipment,
- openings, electrical conduits and light fixtures. Make suitable provision for expansion and contraction with expansion loops and offsets. With Engineer approval, Victaulic Style 177, 77, or W77, as appropriate, flexible couplings or Style 155 expansion joint may be used to accommodate expansion and contraction. **Victaulic shall be consulted to ensure proper application and design. Victaulic shall provide details and
- calculations where required. Pressure gauges and thermometers called to be permanently installed shall be

easily visible from a standing position on the ground.

3.02 UNDERGROUND PIPING

A. All underground piping shall have a minimum cover of 3'-0".

B. Provide concrete thrust blocks at all changes of direction and secure all C. All underground water lines shall be protected from corrosion with a continuous plastic sheathing or coating and wrapping. This sheathing or

coating and wrapping shall be extended 6" to 12" above finished floor. See Section 23 07 19 for HVAC piping insulation.

a lintless, dry cloth.

- 3.03 REFRIGERANT PIPING INSTALLATION A. All refrigerant piping shall be sized in accordance with the Air Conditioning
- Equipment Manufacturer's written instructions. Provide charging ports, solenoid valves, service valves, dryers, etc. at each piece of equipment.
- nitrogen, or other inert gases. C. The inside of all tubing shall be thoroughly cleaned and internally wiped with

B. All brazing shall be done while the line is being flushed with carbon dioxide,

- D. Suction lines shall drop below their coils before any horizontal run.
- E. Provide oil traps at least every ten feet for extended vertical risers. F. All oil traps shall be constructed from close—radius type fittings.
- G. Dryer cores shall be installed to remove horizontally or downward. H. Install external equalizer downstream of its expansion valve sensing bulb.

I. Install expansion sensing valve bulb on top centerline of piping up to 5/8"

size; install 45 degrees down from the horizontal centerline on pipe sizes

7/8" and larger.

END OF SECTION

SECTION 23 31 00

HVAC DUCTS, ACCESSORIES, AND CASINGS 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 31 00 and the accompanying drawings cover the provisions of all labor, equipment, appliances, and materials and performing all operations in connection with the construction of the ductwork systems as specified herein and as shown. These systems include, but are not limited to, the
 - 1. Supply air ductwork
 - 2. Return, transfer and relief air ductwork
- 3. Exhaust ductwork

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&A Barrett, Woodyard and Associates, Inc.

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DRAWING NO. CFD-XXX-M-0003-XXXXXX 4. Ductwork accessories 2. Smoke dampers shall be appropriate for the installation location and 1.01 DESCRIPTION A. Variable air volume units (VAV) shall consist of primary air damper, 3. CD Ceiling diffusers (CD) shall be square, plaque face diffusers capable of application. All fire dampers in supply, return, exhaust, etc. shall be attenuator section and noise shroud (if required to meet listed sound providing one-way, two-way, two-way corner, three-way, and four-way 1.02INTENT A. All work specified in this Section is governed by the Common Work Results dynamic-type. air patterns; Nailor UNI with directional blow clips. The diffuser shall have pressure levels), primary air damper actuator, primary air controller and any for HVAC Section 23 05 00. other items required to perform as indicated and specified. a 22 gauge steel face panel that captures a secondary 22-gauge panel. A. It is the intent of this Section of the specifications to provide a complete 3. Smoke dampers shall be as manufactured by Prefco, Louvers & Dampers, The face panel shall be removable by means of four hanger brackets. The operable duct system as shown and specified which is reasonably airtight, B. This Section 23 34 00 and the accompanying drawings cover the provision of Inc., Pottorff, Greenheck, Nailor, Ruskin, or an approved equal. exposed surface of the face panel shall be smooth, flat, and free of B. The maximum acceptable NC at the VAV unit discharge is 40 at 1.0" inlet all labor, equipment, appliances and materials, and performing all operations free of noise, vibration and sweating, and fabricated so as to fit into the visible fasteners. The back pan shall be one piece precision die-stamped static pressure; the maximum acceptable radiated NC is 35 at 1.0" inlet space allotted and to exhibit a minimum resistance to airflow. in connection with the construction and installation of the fans as specified E. Fire/Smoke Dampers and shall be constructed of 22-quage steel. Diffuser performance data static pressure. The maximum static pressure drop through the unit shall be herein and as shown. These fans include, but are not limited to the following: shall be in accordance with ANSI/ASHRAE Standard 70—1991. The 0.45" WC. The maximum inlet velocity shall be 2200 FPM. All NC ratings are .03DESIGN AND CONSTRUCTION - DUCTWORK 1. Fire/smoke dampers may be combined into a combination fire/smoke maximum NC level at design airflow shall not exceed 35 when measured based on AHRI 880. 1. Roof-mounted centrifugal exhaust fans in a direct field 5'-0" from the face of the device. Diffusers to be dampers. All provisions of the above shall apply. Fire/smoke dampers A. Ductwork shall be provided in strict accordance with the third edition — 2005 shall be UL—listed. 24"x24" unless noted on drawings. The finish shall be baked enamel C. The unit housing shall be constructed of galvanized steel sheets, reinforced to - of the SMACNA HVAC Duct Construction Standards - Metal and Flexible. 2. Inline fans eliminate excessive flexing. Housing shall be internally lined with acoustical white, unless directed otherwise by the Architect. Provide plaster frames NFPA No. 90A, 90B, 91 and 96, and UL 181. Where SMACNA tables have an F. Backdraft Dampers fibrous glass liner with exposed face coated with a black fire retardant and round neck damper (operable from face of diffuser) for diffusers MAILING ADDRESS: option between different gauges and supports, the heavier gauge shall be 3. Ceiling/cabinet fans compound, conforming to NFPA requirements. Liner shall meet the installed in hard ceilings. P.O. BOX 1007 1. Backdraft dampers shall be sized according to their installation location requirements of Section 23 07 13. Service to internal parts shall be through CHARLOTTE, NC 28201 1.02INTENT and noted pressure setting. Damper pressure setting shall be adjustable an access door in the bottom or side of the housing. B. Return Air Grilles (RAG) B. Ductwork dimensions shown are net, clear, inside dimensions with no and shall be accessible from outside ductwork or via access hatch, as allowance shown for duct liner. All ductwork specified to be lined shall be 2" A. It is the intent of this Section of the specifications to provide complete, D. Controls shall be low-voltage electronic type with electrical actuators. All 2. Retun air grilles shall be hollow core, 24"x24" plague face, lay—in type, operable, adjusted fans as shown and specified which are free of excessive larger than shown in each dimension to compensate for the liner. Ductwork actuators shall be 24-volt. selected to match the CDs; Nailor UNI. Provide with 15" neck open to noise, vibration and airflow fluctuations. shall be square, rectangular, round, spiral or flat oval as noted. Conversion of Safety Expectations: 2.09 LOW-PRESSURE DUCT BRANCHES the plenum for return. All other characteristics shall be equal to the duct shapes and sizes shown shall be accomplished without increasing air E. A pressure independent primary air volume controller shall control the supply 1.03BASIS OF DESIGN ceiling diffusers. velocities or friction losses and is subject to prior approval by the Architect A. Splitter dampers shall be provided at all low-pressure ductwork branches. All air quantity within 5% of the air volume required to satisfy the thermostat, and Engineer. ILLNESS low-pressure ductwork branches shall be radiused or 45 degree take-offs; regardless of changes in system static pressure. Each unit shall be factory A. The basis of design is as scheduled. Any proposed substitutions shall be C. Exhaust Grilles (EG) straight taps are unacceptable. The length of the damper blade shall be the set for maximum and minimum CFM. The VAV valves shall be normally closed proven equal in all aspects to the equipment specified as the basis of design. C. Elbows shall be either full radius type (inside radius equal to duct width), same as the width of the widest duct section at the split, but in no case on a loss of control power. Remove Exposures to Hazards Particular attention is called to the requirements of Section 23 05 00. 1. Exhaust grilles shall be the same as the return air grilles except the EGs five-gore radiused flat-oval type or, in low pressure systems only, mitered shall blade length be less than 12". Each operator rod shall have a locking shall have an opposed blade damper for balancing. INJURY with double—thickness turning vanes. swivel joint. F. Powered induction units (PIUs) shall be factory fabricated complete with 1.04 ACCEPTABLE SUBSTITUTE MANUFACTURERS Reinforce Safe Behavior variable air volume section, fan powered induction section, disposable filter, E. Slot Diffusers D. Abrupt changes in duct sizes and shapes shall not be permitted. The total .10FLEXIBLE DUCT backdraft damper for fan section, acoustically lined plenum section. A. Acceptable substitute manufacturers are Carnes, Cook, Acme, PennBarry, Twin angle of diverging transitions shall be not more than 15 degrees; converging factory—mounted heating coil (installed downstream of the fan section) and City, Price, and Greenheck. Acceptable manufacturers for kitchen grease transitions shall be not more than 30 degrees unless otherwise noted or A. Flexible ductwork shall be Class 1, UL 181 air duct and meet NFPA 90A and all electrical contactors, P.E. switches and controls. PIU shall have variable air exhaust fans are Captive—Aire, Viking, and Greenheck. 1. Supply (SD) required due to structural constraints. 90B Standards. volume unit (VAV) for primary air with fan discharge perpendicular to the VAV unit. See Paragraphs 2.01 A through E for VAV units. E. Offsets, transitions, rises and drops are not individually called out on the B. The internal duct surface shall be acoustically rated, black CPE bonded to a 2.0 PRODUCTS Design Drawings. They shall be provided as required to fit the ductwork into a. Each slot diffuser shall be equipped with an individually adjustable coated steel wire helix. The external jacket shall be a fiberglass, G. Intermittent operation fan powered induction section shall consist of: the allocated spaces. pattern controller for each slot to insure full 180 degree air pattern; bi-directionally reinforced, metallized vapor barrier with a standing, triple ply 2.01 GENERAL REQUIREMENTS Nailor 5710l, with two (2) 1" slots unless otherwise noted. The seam. Fiberglass insulation shall be provided between the duct surface and F. Transition rectangular ductwork on bottom and sides. Maintain top of diffuser shall be constructed of 24 gauge galvanized steel with inlet the jacket to achieve a maximum thermal conductance of 0.24 BTU/Hr./sq. 1. An acoustically lined sheetmetal housing and centrifugal direct drive fan A. All non-filtered fans shall be factory tested, rated and certified in accordance ductwork level and as high as possible. size and length as indicated. Each SD shall be provided with a lined ft./°F at 75°F mean. with the requirements of AMCA Standard No. 210 and shall be labeled steel plenum with tappings for round duct connections as indicated. accordingly. Filtered fans may be non—labeled but must be rated in an AMCA G. "Medium pressure ductwork" shall be constructed for 3" WC static pressure Maximum NC level shall not exceed 35 at design airflow. Liner shall C. Flexible ductwork shall be suitable for 10" W.G. positive pressure and 1" W.G. 2. Resiliently mounted, vibration—isolated, permanently lubricated, ECM fan approved laboratory in accordance with 210. class at 4000 FPM velocity with Class A seals. Applications shall include: conform to NFPA 90A 25/50 requirements. negative pressure in sizes 4" through 12" ID, and 6" W.G. positive pressure motor of the voltage shown on the electrical drawings. 1. All supply air ductwork between the VAV self—contained air handling, and 0.5" W.G. negative pressure in sizes 14-16" ID. B. All roof-mounted fans shall be constructed such that water cannot enter the packaged rooftop unit, and the terminal units J. Transfer Grilles (TG) 3. Backdraft damper to prevent reverse flow through blower. building through the fan regardless of whether or not the fan is operating. D. Flexible ductwork, insulation and insulation cover shall be suitable for ceiling Fans shall be provided with drain connection and piped to the nearest roof 2. All ductwork between central ventilation fans (such as outside air, toilet 1. Transfer grilles shall be similar to return air grilles (RAG). return air plenum installation and shall comply with all applicable codes and H. The plenum section shall be acoustically lined and shall receive air from drain as applicable. exhaust, pressure relief, energy recovery units, 100% outdoor air units) standards regarding such ceiling plenum installations. either the primary VAV unit or the induction fan, and distribute the air and their terminal units. I. Linear Slot Diffusers (LSD) through the low pressure duct system. Parallel (side by side) discharge is **&A** Barrett, Woodyard and Associates, Inc. C. Fans installed outside or otherwise subject to weather shall have a E. Flexible duct shall be Thermaflex M-KE or an approved equal. weatherproof enclosure over the motor compartment. All components, unacceptable. License # C-2226 3. All ductwork in systems subject to more than 1" WC. 1. Supply (LSD) including VFDs, shall have enclosures and be appropriate for the installation 420 Minuet LN. F. The maximum allowable installed length of flexible ductwork shall be as . Each PIU, when operating in the fan powered, 100% induced air mode, shall locations. Charlotte, North Carolina 28217 H. All other ductwork shall be constructed for standard 1" WC static pressure a. Linear slot diffusers shall be Nailor 5010. Diffusers shall be of be selected to operate against a minimum external static pressure of 0.35" (p) 704-357-9333 (f) 704-357-9385 class at 2500 FPM with Class C seals and is herein defined as "low pressure D. All roof-mounted fans shall be provided complete with roof curbs. Roof curbs aluminum construction with one or more parallel slot(s). Diffusers with a maximum NC level of 35 at the discharge. At the same operating ductwork". 1. 8'-0" on low-pressure supply air systems limited to short runouts and shall have two (2) slots unless otherwise indicated. Each slot shall © This drawing is copyrighted. It may not shall be of aluminum construction, insulated, canted and complete with wood condition, the radiated noise shall be a maximum NC level of 35. All NC be reproduced nor used in any other end of runs connected to round neck supply diffusers and registers. contain pattern controls, adjustable from the face of the diffuser. nailer strips. Insulation shall meet NFPA 25/50 flame spread/smoke developed ratings are based on AHRI 880. . Provide the following types of ductwork material for the services indicated: form or on any other project. Each LSD shall be continuous length as indicated on the drawings, BWA JOB # 2022-0632 2. 4'-0" on medium and high-pressure supply air systems limited to the complete with finished ends, mitered corners and splined joints. All J. The PlUs shall have intermittent fan operation except those serving toilets, 1. Galvanized sheetmetal: supply, return, exhaust, and relief of conditioned runouts from the sheetmetal ductwork to each terminal unit. inactive sections of the LSD considered as LRS devices. Plenums shall E. All belt-drive assemblies shall be mounted on vibration isolators. lobbies and other core areas, which shall be constant volume units. and outside air have round collars for connection of flexible duct. Performance data K. There shall be <u>only one</u> electrical power connection required to each PIU 3. 2'-0" on connections from round neck arilles to sheetmetal ductwork on F. All motors on belt-drive assemblies shall be mounted on slide bases to shall be per ADC with a maximum NC of 35. Border option to be 2.0 PRODUCTS return, exhaust and transfer ductwork. provide adjustment of belt tension. assembly to provide electrical power to both the fan and the electric heater. selected by Architect and shall be appropriate for the installation *Unit shall operate on 460-volt, 3-phase unless otherwise scheduled. Provide location. Borders in drywall ceiling shall have mud—in flange unless 2.01 GALVANIZED SHEETMETAL G. Provide a spin-in fitting with integral scoop and volume damper at all flexible a separate fused wiring for the fan motor only. The fan motor shall draw not G. All belts in belt drives shall be rated for not less than 150% of the otherwise directed. run-out connections in low-pressure supply air ductwork only, except more than 4 amperes at high speed when connected to 277 volts, single connected motor horsepower. A. Galvanized sheetmetal shall be lock-forming grade G90-ASTM A 525 hot dip locations where spin-in fittings would project more than 50% into the phase. Coordinate which phase the motor is to be connected to (A, B, or C) F. Supply Registers (SR) galvanized steel sheets. Sheetmetal shall be galvanized on each side with not projecting ductwork dimension. **Adhesive fittings are acceptable provided H. All belt-drives driven by a 5 HP or larger motor shall be multiple belt with the electrical drawings. less than 1.25 ounces of zinc per square foot. they are also screwed to the ductwork and sealed with mastic. 1. Supply registers shall be surface mounted, steel with aluminum blades, L. There shall be <u>only one</u> electrical power connection required to each VAV adjustable double—deflection type complete with opposed blade dampers 3. Galvanized sheetmetal installed outside the building and subject to weather I. All belt-drives shall be adjustable to a minimum speed variation of plus or H. Flexible ductwork shall not pass through wall, floors, or ceilings. for balancing purposes. The outermost set of deflection blades shall be assembly to provide electrical power to both the actuator and controls, as shall be soldered or welded. See Section 23 07 13 for additional information minus 20% of the design RPM. applicable. Unit connection shall be 24-volt. Submittal shall indicate specific parallel to the long dimension of the SR and the innermost set of about covering and insulation. 2.11 TERMINAL UNIT RUNOUTS compliance with this item. deflection blades shall be parallel to the short dimension of the SR. The J. All centrifugal fan wheels shall be statically and dynamically balanced. registers shall be tested in accordance with ADC standards and shall be C. Galvanized sheetmetal installed outside the building and not exposed to A. Medium and high-pressure runouts to terminal units shall be connected to 3.0 EXECUTION selected to provide design airflow at a maximum NC of 35. SRs shall be weather, such as in covered loading docks and parking decks, may match the the trunk duct with factory—welded laterals, conical tees or bellmouth fittings; K. All electric motors and equipment shall be UL labeled. construction of ductwork inside the building. abrupt round to rectangular taps are strictly prohibited and shall be rejected. 3.01 INSTALLATION L. Refer to Division 26 of these specifications and to the electrical Contract 3.0 EXECUTION D. Galvanized sheetmetal ductwork outside the building within 20 miles of the B. Terminal unit runouts shall be the larger of the associated terminal unit inlet Drawings for electrical characteristics and connections to all equipment. A. Units shall be installed as indicated and in conformance with the seacoast shall have corrosion coating appropriate to the installation location. size or the size noted on the drawings. Coordinate all electric motors and other equipment with these electrical 3.01 INSTALLATION manufacturer's recommendations. Coordinate the actual units to be provided with all trades. 2.02 SPIRAL DUCT 2.12 FLEXIBLE CONNECTIONS L. Air distribution devices shall be installed as indicated and in conformance with M. Fans with variable—frequency drives (VFDs) shall have shaft grounding ring and the manufacturer's recommendations. The color, frame, and border types shall B. The wiring of all VAVs shall be performed by the Installer of the VAVs under A. Spiral duct shall be utilized for all flat-oval and round ductwork in medium A. Provide flexible duct connections at the inlet and outlet of each belt-driven be coordinated with Architectural requirements and shall be selected to install appropriate insulation class and high-pressure systems. fan, indoor unit, fan coil unit, air handling unit, etc., and at all other in the finished surface indicated. locations indicated. Flexible connections shall be fabricated from a glass N. All exposed motors and belts shall be protected with enclosures or guards in 3.02 ADJUSTMENT **DUNN OPERATIONS** B. Spiral duct shall be the product of United McGill Corporation, R.V. Monev. fabric coated on both sides with neoprene. Minimum weight shall be 30 oz. accordance with OSHA requirements. M. All air distributions devices to be reused shall be installed the same way as Eastern Sheet Metal, or an approved equal. per sq. yard. Flexible connections shall be used for vibration isolation only and A. The units shall be tested and adjusted after installation to provide the indicated for new devices. All existing color, frame, and border types shall **CENTER** shall not be used to correct connection misalignment. O. Life safety fans (i.e. stair pressurization, elevator hoistway pressurization, capacities indicated. modified as required to match new device requirements. C. Spiral duct with internal ribs is not acceptable. smoke control, etc. shall have 1.5 times the number of belts necessary for 2.13DUCT HARDWARE END OF SECTION N. All air distribution devices with blade orientations shall be coordinated with the scheduled performance with no less than two (2) belts. D. Spiral duct shall conform to SMACNA 2005 Standards. Lighter gauges, etc. Architect. Specific attention is called to devices in exposed ceiling areas, due to standing ribs are not acceptable. A. Duct hardware shall be as manufactured by Young Regulator or an approved including wall—mounted. 2.02 ROOF-MOUNTED CENTRIFUGAL EXHAUST FANS 1269 JONESBORO RD. SECTION 23 37 13 2.03 DOUBLE-WALL DUCTWORK HARNETT COUNTY, NC 28334 3.02 ADJUSTMENT A. Roof-mounted centrifugal exhaust fans shall be Greenheck Model G for direct DIFFUSERS, REGISTERS, AND GRILLES 2.14 ACCESS DOORS drive fans and Greenheck Model GB for belt-drive fans, or an approved equal, A. See Section 23 07 13 for insulation. Insulation shall be sandwiched between A. Grilles, registers, diffusers, etc. shall be tested and adjusted to provide the as scheduled. two (2) layers of sheetmetal in accordance with SMACNA standards. All joints A. A duct access door shall be provided at each fire and smoke damper. Access 1.0 GENERAL scheduled air flow capacities. **OPERATIONS** shall be permanently sealed airtight. doors shall be designed for 1.5 times the pressure of the duct in which they 2.05 CEILING/CABINET EXHAUST FANS 1.01 DESCRIPTION are mounted. Access doors shall be of sufficient size to provide access to B. All devices shall have adjustable and accessible volume dampers. Where BUILDING 2.08 DAMPERS the dampers for resetting the blades and replacing the links. Access doors in dampers are not or will not be accessible without access panels, provide and A. Ceiling/cabinet exhaust fans shall be Greenheck Model CSP (inline/cabinet) or A. All work specified in this Section is governed by the Common Work Results medium and high-pressure ductwork shall be installed downstream of fire install remote balancing cable control system, Young Regulator or equal. Greenheck Model SP (ceiling) with integral grille, or an approved equal. A. Manual Volume Dampers for HVAC Section 23 05 00. dampers and shall be implosion type. Where access is provided through Adjustment shall be from the face of the air distribution device, coordinated gypsum board walls or ceilings, furnish access door for installation under with the Air Distribution Manufacturer. Coordinate the location and size of the 3.0 EXECUTION B. This Section 23 37 13 and the accompanying drawings cover the provisions of 1. Single blade butterfly dampers are acceptable up to 12" round or 12" x Division 09. Coordinate with Division 09 and Architect. Each door shall match damper with the installation. 12" square. Dampers larger than these dimensions shall be multi-blade all labor, equipment, appliances and materials, and performing all operations the fire-rating of the wall or ceiling indicated. 3.01 INSTALLATION type. Single blade dampers shall be constructed of 16 gauge or heavier in connection with the construction and installation of air distribution devices C. In all slot diffuser applications, the inactive sections of the slot shall be B. Access shall be provided to duct—mounted smoke detector locations. Access as specified herein and as shown. These units include, but are not limited to finished with perforated steel, painted flat black, selected to match the SDs. A. Fans shall be installed as indicated and in conformance with the the following: shall allow inspection and maintenance of all aspects of the detector. Access These sections shall be open to the plenum as a return air path. Inactive manufacturer's recommendations. Coordinate the actual units to be provided doors shall meet the requirements of A, above, as needed. 2. No multi-blade damper blade shall exceed 8" in width. All multiple blade sections shall have an insulated light shield. with all trades. 1. Ceiling Diffusers (CD) dampers shall be constructed of 16 gauge galvanized steel or heavier. 3.0 EXECUTION END OF SECTION The damper frame shall be 16 gauge or heavier. The damper action shall 3.02 ADJUSTMENT 2. Return Air Grilles (RAG) be opposed-blade type. 3.01 INSTALLATION A. The fans shall be tested and adjusted after installation to provide the 3. Each blade shall pivot on a 1/2" cadmium plated, cold—rolled steel axle 3. Exhaust Grilles (EG) capacities indicated. A. Ductwork shall be installed in strict accordance with SMACNA, UL, and NFPA which pivots within self-lubricating, Oilite bronze bearings. 4. Slot Diffusers (SD) END OF SECTION 4. The top and bottom edges of each rectangular damper blade shall be B. All ductwork installed outside the building shall be secured to the structure. crimped for stiffness. 5. Tansfer Grilles (TG) Coordinate with the Structural Engineer as needed. It is the Contractor's SECTION 23 36 00 responsibility to design and coordinate all supports. All supports shall be 5. The operating rod for all dampers shall be extended outside the damper 6. Linear Slot Diffusers (LSD) designed to withstand all code—required wind and seismic loads. frame for attachment of an operator. Each operator shall have a position AIR TERMINAL UNITS indicator and locking quadrant. 7. Supply Registers (SR) C. Flexible ducts utilized in the low-pressure ductwork systems shall be installed 1.0 GENERAL SECTION 23 74 00 without kinks or bends which are less than a centerline radius equal to or 6. All dampers utilized for introduction of outside air shall have flexible, 1.02 INTENT greater than twice the diameter of the flexible duct being installed. Also, in gasketed edge and end seals. The leakage rate shall be less than 4 CFM 1.01 DESCRIPTION PACKAGED OUTDOOR HVAC EQUIPMENT the runouts from the medium or high—pressure ductwork to the terminal per SF of face area against a 1" WC differential pressure, based on a G. It is the intent of this Section of the specifications to provide complete. units, the flexible ducts shall be installed with a variance of no more than 1" A. All work specified in this Section is governed by the Common Work Results nominal 48" x 48" damper size. 1.0 GENERAL operable, adjusted air distribution devices as shown and specified which are per foot of installed length off a straight and level line from the centerline of for HVAC Section 23 05 00. free of excessive noise, vibration and airflow fluctuations. the sheetmetal ductwork runout or tap to the centerline of the terminal unit 7. All dampers utilized for exhaust or relief air shall have flexible, gasketed 1.01 DESCRIPTION inlet. The size of the flexible ductwork connected to each terminal unit shall edge and end seals. The leakage rate shall be less than 4 CFM per SF of B. This Section 23 36 00 and the accompanying drawings cover the provisions 1.03 SELECTION CRITERIA be the equivalent size of the larger of the following: face area against a 1" WC differential pressure, based on a nominal 48" of all labor, equipment, appliances and materials, and performing all A. All work specified in this Section is governed by the Common Work Results operations in connection with the construction and installation of the terminal for HVAC Section 23 05 00. x 48" damper size. A. All air distribution devices shall be selected in accordance with the following 1. The inlet size of the terminal unit units as specified herein and as shown. These units include, but are not minimum criteria unless otherwise noted below or on the drawings: 2. The runout size indicated on the drawings limited to the following: B. This Section 23 74 00 and the accompanying drawings cover the provisions 8. Dampers to be installed in insulated ductwork shall have standoffs PROJECT NO: of all labor, equipment, appliances and materials, and performing all sufficient to allow for insulation and vapor barrier integrity. 1. Method of mounting shall be compatible with the ceiling, wall or duct Should the runout size indicated on the drawings differ from the inlet size of 1. Variable air volume (VAV) units operations in connection with the construction and installation of the surface which it mounts on or in; i.e. lay-in, surface mounting, plaster DRAWING NUMBER the terminal unit, or where the inlet to the terminal unit is rectangular, the packaged rooftop units as specified herein and as shown. This work includes, 9. Manual volume dampers shall be as manufactured by Louvers & Dampers, frame, duct collar, etc. The architectural drawings shall be referenced to transition shall be made with sheetmetal and shall occur at the inlet to the Inc., Pottorff, Greenheck, Nailor, Ruskin, or an approved equal. 2. Powered induction units (PIU) but is not limited to, the following: CFD-XXX-M-0003-XXXXXX determine the mounting method for each device. All flanges on surface mounted devices shall be provided with a gasket. B. Control Dampers 3. Associated control systems 1. Packaged rooftop units including curbs and accessories D. All low pressure ductwork downstream of VAV units shall be left uncapped for 2. Finish of all ceiling mounted devices shall be selected to match the color ELECTRONIC FILE NAME: M0001.DWG balancing until tenant fit—up affects the units. 1.02 INTENT 1. Control dampers shall be of the same construction as manual volume 2. Control system (interlocked to the units) of the adjacent ceiling. Finish of all wall mounted devices shall be primer which is compatible with the finish coating specified for the adjacent wall; dampers, except that no manual operator and quadrant is required. The E. All intersections (crossing) of low—pressure and medium—pressure ductwork DRAWN BY: TAYLOR SUBER A. It is the intent of this Section of the specifications to provide complete. finish coat will be applied under Division 9. C. Units shall be self-contained, rooftop curb-mounted, single package type. The operating rod shall be suitable for operation by an automatic pneumatic shall be made with offsets in the low-pressure ductwork only. The medium operable, adjusted terminal units as shown and specified, which are free of rooftop units shall be completely factory—assembled as a unitary package or electric operator. pressure ductwork shall be ran straight and level. DAVID Q**OANTE**ON excessive noise, vibration and airflow fluctuations. 1.04BASIS OF DESIGN complete with operating controls and shall be completely piped, internally CHK'D BY: C. Fire Dampers wired and fully charged with R-410A refrigerant. Only one electrical power F. Electric duct heaters shall be installed as indicated and in conformance with .03BASIS OF DESIGN connection shall be required. A. The basis of design is Nailor. Any proposed substitutions shall be proven DCONDON@barrettwoodyard.com E-MAIL: the manufacturer's recommendations. Coordinate the actual units to be equal in all respects to the equipment specified as the basis of design. Any 1. Fire dampers shall be UL-listed and labeled for $1 \frac{1}{2}$ or 3 hours, in provided with all trades. The heater shall be tested and adjusted after accordance with the installation location, and shall be provided with 160°F A. The basis of design is Trane or as scheduled. Any proposed substitutions shall 1.02INTENT modifications to ductwork, controls, ceilings, building structure, etc., that THIS DESIGN DRAWING IS THE EXCLUSIVE PROPERTY OF DUKE installation to provide the capacities indicated. ENERGY CORPORATION AND IS CONSIDERED CONFIDENTIAL. IT SHALL NOT BE MODIFIED, COPIED, OR DISTRIBUTED WITHOUT PRIOR APPROVAL. THIS INFORMATION SHOULD ONLY BE USED FOR THE SPECIFIC PROJECT INTENDED. be proven equal in all aspects to the equipment specified as the basis of result from any substitution shall be coordinated with all trades. This links or linkages appropriate for the service. Dampers installed within A. It is the intent of this Section of the specifications to provide complete, coordination shall occur before delivery of equipment and any modifications ducts shall be Type B or Type C with the blades out of the air stream. G. Ductwork labels, including factory labels, tags, etc. except equipment shall be performed without incurring additions to the Contract. operable, adjusted single package rooftop units, as shown and specified which Areas indicated shall be net, clear, open areas. nameplates shall be removed to the satisfaction of the Architect in all 1.04 ACCEPTABLE SUBSTITUTE MANUFACTURERS SHEET TITLE: are free of excessive noise and vibration. exposed areas. 1.05 ACCEPTABLE MANUFACTURERS 2. Fire dampers shall be appropriate for the installation location and **SPECIFICATIONS** A. Acceptable substitute manufacturers are Trane, Nailor, Price, Carrier, Titus, .03BASIS OF DESIGN application. All fire dampers in supply, return, exhaust, etc. shall be END OF SECTION A. Acceptable manufacturers are Price, Carnes, Metal Aire, Krueger, Nailor, and dynamic-type. A. The basis of design is as scheduled. Any proposed substitutions or equals by - MECHANICAL Titus UON, provided that their units, performance, appearance and physical 2.0 PRODUCTS characteristics are equal in all respects for this specific project. other manufacturers shall be proven equal in all respects to the equipment 3. Fire dampers shall be as manufactured by Louvers & Dampers, Inc., SECTION 23 34 00 specified as the basis of design. Particular attention is called to the Pottorff, Greenheck, Nailor, Ruskin, or an approved equal. 2.01 DESCRIPTION requirements of Section 23 05 00. 2.0 PRODUCTS HVAC FANS D. Smoke Dampers SHEET NO. Acceptable substitute manufacturers are Trane, Carrier, and Daikin. 2.01 DESCRIPTION 1. Smoke dampers shall be UL—listed as Class 1 low—leakage smoke 1.0 GENERAL M-0003 .0 PRODUCTS dampers. Smoke dampers shall be 24V and wired under this Division. A. Ceiling Diffusers (CD)

1	2		3		4	
3.3 SEQUENCES OF OPERATION — This sequence is an	n outline of the major equipment basic operation.	F. Floorplans for any o meters, BTU meters	and all plumbing and mechanical meters, includes, etc.	ling water meters, irrigation		
	led through the control panels and thermostats to the temperature and time controls provided	G. Provide sketches of	f proposed graphics for review by the owner to sting Owner system graphics shall be used if re			
by these panels, the following interlocks sha introduced thru each unit.	all be made to control the amount of outside air	Lighting control gra floorplan. Similar to	ghting control shall be independent of the mech aphics shall include lighting control zones shown to the mechanical graphic, the lighting control fl	n on an Architectural Ioorplan graphic shall be		
measure, and record the amount of ou operator adjustable outside air CFM set the rooftop unit OA damper/actuator o	e outside air dampers shall open and shall control, utside air entering thru the OA damper. An t—point shall be passed from the building EMS to assembly. The rooftop unit OA damper/actuator	with the BAS for m	enant as appropriate. The lighting control systenonitoring and control, as required by the lighti	ng control package.		
	he operator on the Rooftop unit graphic and ace for adjustment. Measured CFM shall be visible	approval. 3.6 SCHEDULES				
4. During differential enthalpy economizer modulate the OA/RA dampers and pow building/floor pressure setpoint (adjusto	operation, the rooftop unit controls shall vered exhaust fan, as applicable, to satisfy able). The maximum OA CFM scheduled will not be	breakdowns with the	<u>be able to be individually scheduled. Coordinate Owner, including for future tenant occupancy</u>	_		
shall be held closed until the morning	cupied to Occupied, the Rooftop unit OA dampers start—up sequence is completed. In terminal unit air valves shall be driven to		t up all initial schedules and setpoints in coorc nt. Schedules and setpoint adjustment shall be			
maximum. The rooftop unit supply fan available, shall be enabled. All PIU syst including heat as needed, to allow fan	shall run and rooftop unit heating functions, as term terminal unit controls shall be enabled, operation to satisfy heating set—points. Interior—off as their space heating set—points are	3.7 OWNER TRAINING A. Refer to the genero	al specifications for training requirements. At a	minimum, provide the		
reached. 7. The warm—up cycle shall conclude wher terminal units shall be released to day	n the morning warm—up sensor is satisfied. All time occupied set—points. Interior cooling—only ling operation. The supply fan shall be released to	service of a qualifie The two (2) days s	ed BAS system technician for two (2), 8—hour shall be non—consecutive and shall be coordinatesioning Agent, as applicable.	days for Owner training.		
modulate to satisfy static pressure set OA CFM setpoint provided by the buildi B. Supply Pressure Reset: The BAS shall identif	tpoint. The outside air damper shall modulate to ing EMS. fy the system critical VAV zone using damper	3.8 COMMISSIONING TESTS	/equipment specified in this Section shall be co	aardiaatad aabadulad aad		
below:	ed in ASHRAE Standard 90.1 and as restated e damper position of all VAV terminal units served		ordance with the requirements of commissioning			
static pressure set—point at a frequenc	adjustable) open, the supply fan duct static ord by 5% (adjustable) of the maximum system cy of 10 minutes (adjustable) until no damper is ssure set—point has reset upward to the system	of systems/equipme	peration and training of Owner's personnel in c ent specified in this Section is required. Coordi	nation of the		
maximum setting for the supply fan VF 3. When all dampers are less than 85% (c static pressure set-point shall be rese	FD. adjustable) open, the supply fan discharge duct et downward by 5% (adjustable) of the maximum	Commissioning Auth herein and approval	ning by qualified, factory authorized representat nority. Instruction shall include a minimum num I of the formal training program is required by commissioning specifications.	ber of hours as specified		
damper is more than 85% open or the the system minimum setting for the su 4. The control bands, set—point increment	t values, set—point decrement values and		END OF SECTION			
optimization with stable system control	tify the current critical zone by tag and display					
	able) increments. terminal served by the air handling unit. If 90%					
	ed by the air handling unit are at set point ure shall be raised by 1°F (adjustable) up to a					
(adjustable) to avoid continual fluctuati 3. The supply air set point shall return to handling unit reaches 95% (adjustable)	o the original supply air set point if the air of full capacity.					
	supply temperature that shall not be exceeded unit graphic shall display the original system set point.					
unit) may be operated independently when the control of the contro	ch zone (terminal unit, heat pump, or air handling henever the HVAC system is in setback or					
floor, etc. to operate in occupied mode	occupied mode the associate unit on the selected					
operate to maintain its thermostat set being adjusted by the Owner. As a min units in the associated quadrant of the	tings. Terminal unit grouping shall be capable of nimum, if no other direction is given all terminal					
selected mode. E. Powered Induction Units (PIU)	ermittent fan operation (except units serving					
lobbies, core areas and toilets) and shi scheduled minimum) to 100% to mainto 30% to 40% primary airflow, the fan sh to modulate down to shut off; thereby space. After the VAV valve completely demand. Upon a further call for heat,	all modulate primary airflow from 0% (or ain the cooling set point (75°F, adjustable). Below hall be energized, and primary air shall continue delivering mixed primary and plenum air to the closes, plenum air shall be used to meet heating the heating coil shall be energized to maintain le). See terminal unit schedule for minimum and					
maximum design conditions. 2. Powered induction units serving lobbies, constant fan operation and shall deliver	, core areas and toilets shall be series type with er a constant air quantity to these areas. The the cooling set point of the thermostat and the					
 Split systems shall be controlled by a 70°F, adjustable). Units shall be engage or 24 hours a day if no direction is gi Space temperature of the machine and 	d controller rooms and run status of the split					
systems shall be monitored by the BAS H. Electric Heaters 1. Unit heaters shall be controlled by unit Thermostats shall be set to energize the	t—mounted thermostats unless noted otherwise.					
2. Wall heaters shall be controlled by an i set to energize the unit at a 60°F set	integral electric thermostat. Thermostats shall be					
shall be energized during occupied hour 2. Unless otherwise noted, all ventilation f	fans serving electrical and miscellaneous rooms et at 80°F, adjustable). Interlock the associated					
Provide the services of a factory trained the BAS manufacturer who shall inspections.	ed and qualified service technician employed by ct the installation including external interlock and nitial operation and calibration of these operating					
2. This service technician shall forward a BAS is in safe and proper operating control settings, during start and run,	report in four (4) copies to the Owner when the ondition. This report shall include all pressure and and shall list minor discrepancies to be corrected One additional copy of the report shall be left in					
the central control panel. One copy of and parts brochures, including applicabl	bound installation, operation, maintenance service le serial numbers and parts ordering sources, panel at the time of startup; four (4) additional					
3.4 CONTROL SYSTEM WIRING						
A. All control system wiring shall be provided a Coordinate with all trades. This includes line voltage wiring shall be installed by a license SubContractor or contracted through the Div	voltage (120V) and low voltage wiring. Line ed Electrician employed by the Control					
B. Coordinate with Division 26 for available circ	,					
C. Coordinate with the Fire Alarm Contractor for required alarms, shut down, fire control pando. D. All control wiring shall be installed in strict	el interface, etc.					
·	pe plenum rated cable and shall be installed in					
3.5 GRAPHICS A Graphics shall be provided for each mechanic	ical system including the all HVAC accident.					
show each point that is monitored. Graphics its name. Additional graphics shall show each	ical system including the all HVAC equipment the hot water recirculating pump. Graphics shall s for each piece of equipment shall be indexed by ch floor with zone temperatures. If one graphic is ystem or floor then it shall be logically separated					
B. A graphic for each piece of equipment shall monitored or required for system function a	and user interface.					
thermostat locations. Floor plans served by zone and the current self—contained unit SF shall be demonstrated to the Engineer's sat						
D. System schematics, risers, flow diagrams, et parameters.E. Electrical risers and floorplans for any and of the parameters.	tc. shall be included showing overall system all electrical meters. Coordinate with Division 26.					
1	2	<u> </u>	2] 	
1	2		3		4	

	LEGEND
\boxtimes	CEILING DIFFUSER
	CEILING RETURN AIR GRILLE or EXHAUST GRILLE
	SIDE—WALL or DUCT MOUNTED REGISTER
	SLOT DIFFUSER
	MANUAL VOLUME DAMPER
	FIRE DAMPER
①	THERMOSTAT
\oplus	HUMIDISTAT
()	NIGHT SET-BACK
M-	MOTOR OPERATED DAMPER
	EXISTING WORK
	NEW WORK
<i>'///////</i>	WORK TO BE REMOVED
Ø	FLOOR DRAIN
4	HOSE BIBB
0	FLOOR CLEAN-OUT
=	WALL CLEAN-OUT
+	DUCT ACCESS PANEL

LECENID MECHANICAL SUMMARY MECHANICAL SYSTEMS, SERVICE SYSTEMS AND EQUIPMENT Method of Compliance: □ Prescriptive □ Energy cost Budget Thermal Zone winter dry bulb: 18 deg F summer dry bulb: 94 deg F Interior design conditions winter dry bulb: 70 deg F summer dry bulb: 75 deg F relative humidity: 50% Total tenant heating load Total tenant cooling load N/A Mechanical Spacing Conditioning System description of unit N/A heating efficiency cooling efficiency heat output of unit N/A cooling output of unit N/A total boiler output N/A total chiller capacity N/A List equipment efficiencies

motor type # of poles **COMMISSIONING NOTES:** THE 2018 NC ENERGY CODE REQUIRES THE MECHANICAL AND SERVICE WATER HEATING SYSTEMS IN BUILDINGS WITH A FLOOR AREA IN EXCESS OR 10,000 SQ. FT TO BE COMMISSIONED BY A REGISTERED DESIGN PROFESSIONAL. THE CONTRACTOR SHALL OBTAIN THE SERVICES OF A NC LICENSED ENGINEERING PROFESSIONAL TO PERFORM ALL REQUIRED COMMISSIONING. PRIOR TO ISSUANCE OF CERTIFICATE OF OCCUPANCY

Equipment schedules with motors (mechanical systems)

motor horsepower number of phases minimum efficiency

A SIGNED <u>STATEMENT OF SYSTEM COMMISSIONING</u> (SEE APPENDIX C1) SHALL BE PROVIDED TO CODE OFFICIAL AND FACILITY OWNER. 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

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.

. 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

. 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 STATES'S ENERGY CONSERVATION CODES AND/OR AHJ REQUIREMENTS, THE DOCUMENT SHALL BE SIGNED BY THE CONTRACTOR'S LICENSED PROFESSIONAL ENGINEER

REPRESENTATIVE.

ABBREVIATIONS

A/C ABOVE CEILING

A/C	ABOVE CEILING ACCESS DOOR	ID IN	INCHES
AD ADJ	ACCESS DOOR ADJUSTABLE		
AFF	ABOVE FINISHED FLOOR	1.014	IZII OWATTO
	AUTOMATIC	KW	KILOWATTS
AC			
AHU	AIR HANDLING UNIT	LAT	LEAVING AIR TEMPERATURE
		LB	POUNDS
BAL	BALANCING	LG	LINEAR GRILLE
	BACKDRAFT DAMPER	LRG LWR	
B/F	BELOW FLOOR BELOW GRADE	LWS	
B/G B'FLY		25	
BHP	BRAKE HORSEPOWER		
BCO	BASE CLEANOUT	MIN MAX	MINIMUM MAXIMUM
		MD	
CFM	CUBIC FEET PER MINUTE	MOD	
CBCR	CURVED BLADE CEILING REGISTER	MFR	MANUFACTURER
CD	CEILING DIFFUSER		
CU	CONDENSING UNIT	NC	NORMALLY CLOSED
CW CHWS		NG	NATURAL GAS
CHWR		NFWH	NON-FREEZE WALL HYDRANT
CWS	CONDENSER WATER SUPPLY	NO	
	CONDENSER WATER RETURN	NOM	NOMINAL
	CONCENTRIC CLEANOUT		
CO	CONDENSATE	OA	OUTSIDE AIR
COND	OONDENSATE	OD	
		OBD	OPPOSED BLADE DAMPER
db	DRY BULB		
DN DR	DOWN DRAIN	PIU	POWERED INDUCTION UNIT
do	DITTO	PSI	POUNDS PER SQUARE INCH
dB	DECIBELS		
DWG	DRAWING	RA	RETURN AIR
		RAD	RADIUS
EA	EACH	RAG RED	RETURN AIR GRILLE
EAT	ENTERING AIR TEMPERATURE	RED RL	REDUCER
ECC	ECCENTRIC	RL RS	REFRIGERANT LIQUID REFRIGERANT SUCTION
EF EOD	EXHAUST FAN EMERGENCY OVERFLOW DRAIN	RTU	ROOFTOP UNIT
EOD ER	EXHAUST REGISTER	RAR	RETURN AIR REGISTER
ESP	EXTERNAL STATIC PRESSURE		
EWT	ENTERING WATER TEMPERATURE	CD.	STATIC PRESSURE
EXH	EXHAUST EFFICIENCY	SP SPS	STATIC PRESSURE SENSOR
EFF	EFFICIENCI	SA	
		SAN	SANITARY
F	FAHRENHEIT	SD	
FCO	FLOOR CLEANOUT	SEN SQ	
FCU FSD	FAN COIL UNIT FIRE/SMOKE DAMPER	SR	SUPPLY REGISTER
FD		ST	STORM
FL DR	FLOOR DRAIN (only)	SS	SPLIT SYSTEM
FLR	FLOOR		
	FLAT ON BOTTOM FUEL OIL RETURN	TEMP	TEMPERATURE
	FUEL OIL KETURN FUEL OIL SUPPLY	TG	TRANSFER GRILLE
FOT	FLAT ON TOP	TYP	TYPICAL
FPM	FEET PER MINUTE		
	FEET PER SECOND	UON	UNLESS OTHERWISE NOTED
FT	FEET	OON	SHEESS OFFICIANISE NOTED
G	GATE	V VA	
GA GPM	GAUGE GALLONS PER MINUTE		VENT THRU ROOF
GPM GL	GLOBE	VAV	VARIABLE AIR VOLUME
ĞČO	GRADE CLEANOUT		
		wb	WET BULB
HD	HUB DRAIN	WD WC	WATER COLUMN
HP	HORSEPOWER	WHA	WATER HAMMER ARRESTOR
HTG	HEATING	WT	WEIGHT
HW	HOT WATER (DOMESTIC)	W	WASTE
HWR	HOT WATER RETURN HOT WATER REVERSE RETURN		
HWRR HWS	HOT WATER SUPPLY		
Hz	HERTZ		
1			

GENERAL NOTES (APPLY TO ALL SHEETS)

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.

REFER TO THE ARCHITECTURAL DRAWINGS FOR EXACT PARTITION LAYOUTS, REFLECTED CEILING PLANS, DIMENSIONS, ETC.

B. 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'-6" 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 NOTED OTHERWISE SHALL BE BALANCED TO THEIR PRIOR 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

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-DEVELOPEMENT INDEX OF NOT MORE THAN 50 AS DETERMINED IN ACCORDANCE WITH ASTM E 84.

ID INSIDE DIMENSION

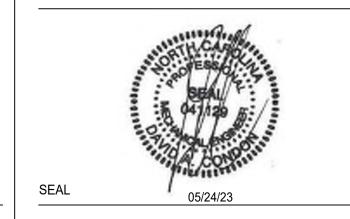
	1 1	
LEAVING AIR TEMPERATURE POUNDS LINEAR GRILLE LINEAR RETURN GRILLE LOOP WATER RETURN LOOP WATER SUPPLY		MAILING ADDRESS: P.O. BOX 1007 CHARLOTTE, NC 28201
MINIMUM MAXIMUM MANUAL DAMPER MOTOR OPERATED DAMPER MANUFACTURER		Safety Expectations: Reduce Risk
NORMALLY CLOSED NATURAL GAS NON-FREEZE WALL HYDRANT NORMALLY OPEN NOMINAL	G	Remove Exposures to Haza Reinforce Safe Behavior
OUTSIDE AIR OUTSIDE DIMENSION OPPOSED BLADE DAMPER		
POWERED INDUCTION UNIT POUNDS PER SQUARE INCH		
RETURN AIR		

DRAWING NO.

CFD-XXX-M-0005-XXXXXX

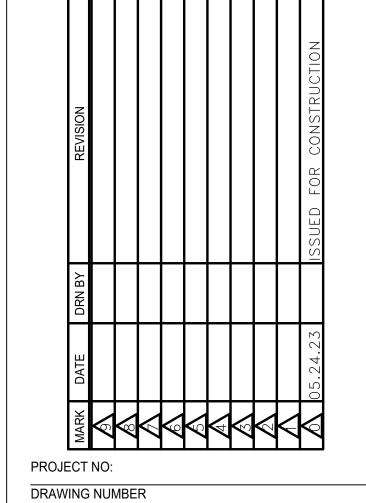


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DUNN OPERATIONS CENTER

1269 JONESBORO RD. HARNETT COUNTY, NC 28334



CFD-XXX-M-0005-XXXXXX

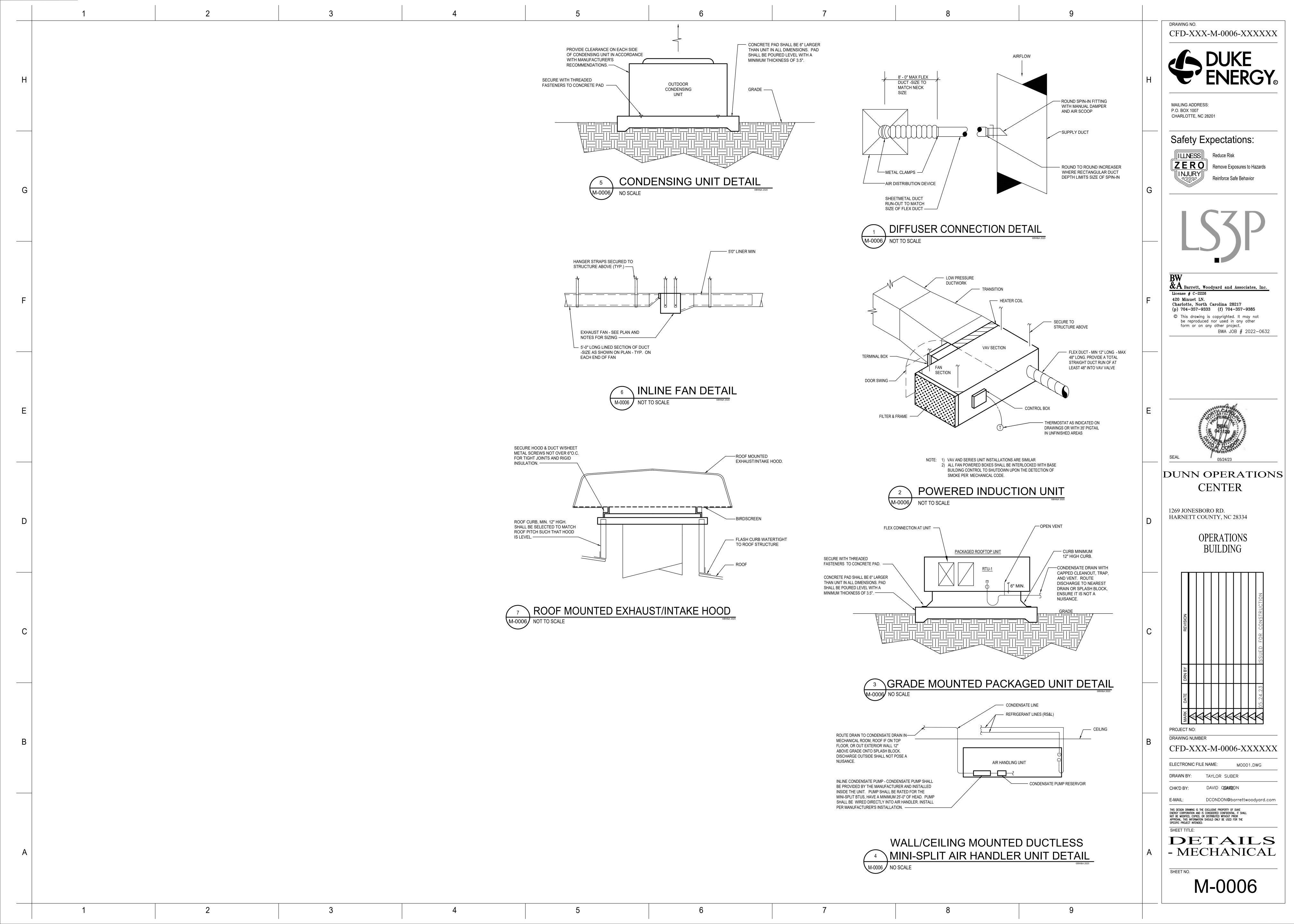
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DAVID ODDANITEON

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SPECIFICATIONS NOTES & ABBEVIATIONS - MECHANICAL

M-0005



Project Name: 2022-0632 DUNN OPS (Ve	ntilation S	izing Sum	mary for F	RTU-1			
Prepared by: Barrett Woodyard & Assoc	ciales									
Ventilation Sizing Method		Minimo	im flow (he:	iting)						
Occupant Diversity (D) Uncorrected Outdoor Air Intake (Vou) System Ventilation Efficiency (Ev)				0.200	\					
Outdoor Air Intake (Vot)				1635 CFM	J					
Space Ventilation Analysis				Area Outdoor	Time Averaged	People Outdoor Air	Air	Space	Breathing Zone	Space
one Name / Space Name	Mult	(CFM) (Vpz)	Area (ft¹) (Az)	Air Rate (CFM/ht') (Ra)	Occupancy (Occupants) (Pz)	Rate (CFM/person) (Rp)	Distribution Effectiveness (Ez)	Outdoor Air (CFM) (Voz)	Outdoor Air (CFM) (Vbz)	Ventilation Efficiency (Evz)
EXT_3 CREW	1	102	530.0	0.06	10.0	5.00	0.8	102	82	0.800
EXT_5 CORRIDOR INT 32 STORAGE	1	5	72.0 70.0	0.06	0.0	0.00	0.8	5	4	0.800
INT 33 AV INT 29 CORRIDOR	1	33	35.0 446.0	0.06	0.0	0.00	0.8	3 33	27	0.800
INT 30 CORRIDOR INT 38 CORRIDOR	1	36 39	485.0 525.0	0.06	0.0	0.00	8.0 8.0	36 39	29 32	0.800
EXT_7 TOWNHALL	1	496	1116.0	0.06	66.0	5.00	0.8	496	397	0.800
EXT_6 STORAGE one 4 EXT_8 PANTRY	1	232	670.0	0.06	21.0	5.00	8.0	232	185	0.800
EXT_9 ENTRY	1	6	74.0	0.06	0.0	0.00	0.8	6	4	0.800
EXT 10 LARGE CONFERENCE cone 6	1	89	357.0	0.06	10.0	5.00	0.8	89	71	0.800
EXT 11 OFFICE EXT 12 OPEN OFFICE	1	16 24	124.0 152.0	0.06	1.0 2.0	5.00 5.00	0.8 0.8	16 24	12 19	0.800 0.800
EXT 13 OPEN OFFICE EXT 14 PRINTERIOOPY	1	48 10	307.0 139.0	0.06	4.0	5.00	8.0	48	38	0.800
EXT 15 OFFICE EXT 16 OFFICE	1	15	122.0	0.06	1.0	5.00	0.8	15	12	0.800
EXT 17 CORRIDOR one 8	- 1	5	72.0			5.00	0.8	1	d	0.800
EXT 18 CREW	1	148	721.0	0.06	15.0	5.00	0.8	148	118	0.800
INT 23 CREW	1	104	550.0	0.06	10.0	5.00	0.8	104	83	0.800
INT 24 CREW: Zone 11 INT 25 WELLNESS;	. 1	104	550.0 106.0			5.00		:	83	0.800
INT 26 JANITOR INT 27 UNISEX/SHOWER	1	10	130.0	0.06	0.0	5.00 0.00		10		0.800 0.800
INT 28 CORRIDOR:	1	33 36	439.0 485.0	0.06	0.0	0.00	0.8	36	29	0.800 0.800
INT 34 WOMEN RR INT 35 MEN RR Cone 12	1	0	220,0 413.0			0,00				0,800 0,800
INT 36 MED CONF	1	. 72 .	292.0	0.06	8.0	5.00	0.8	72		0.800
INT 37 FOCUS: INT 39 CORRIDOR	1	12 18	75.0 243.0		 	5.00 0.00	0.8	12 18		0.800 0.800
INT 41 OFFICE INT 42 OFFICE	1	15 15	120.0 120.0	0.06	1.0	5.00 5.00	0:8	15	12	0.800 0.800
INT 43 OFFICE: INT 44 OFFICE: INT 45 CORRIDOR:	1 1	15 15 25	120.0 120.0 334.0	0.06	1.0	5.00 5.00 0.00	0.8		30 32 32	008.0 008.0 008.0
INT 40 PHONE: Totals (Incl. Space Multipliers)	1	10 :	55,0		_	5.00			8 6/4/4/4 1468	0.800
Project Name: 2022-0632 DUNN OPS 0	CAITED		Ve	ntilation S	izing Sum	mary for I	RTU-2			
Prepared by: Barrett Woodyard & Assoc										
Summary Ventilation Sizing Method		ASHR	AE Std 62.1	-2016						
Design Condition Occupant Diversity (D) Uncorrected Outdoor Air Intake (Vou) System Ventilation Efficiency (Ev) Outdoor Air Intake (Vot)		b	leating oper	1,000 172 CEM						
System Ventilation Efficiency (Ev) Outdoor Air Intake (Vot)				0.970 177 CFM 1	\rangle					
Space Ventilation Analysis										
	s	supply Air	Area	Area Outdoor Air Rate	Time Averaged Occupancy	People Outdoor Air Rate	Air Distribution	Space Outdoor Air	Breathing Zone Outdoor Air	Space Ventilation
Cone Name / Space Name	Mult.	(CFM) (Vpz)	(ft²) (Az)	(CFM/ft²) (Ra)	(Occupants) (Pz)	(CFM/person) (Rp)	Effectiveness (Ez)	(CFM) (Voz)	(CFM) (Vbz)	Efficiency (Evz)
EXT_1 CORRIDOR EXT_2 STORAGE	1	58 368	78.0 532.0	0.06	0.0	0.00	8.0	6	5	0.990
INT 21 STORAGE INT 22 STORAGE	1	299 299	483.0 483.0	0.06	0.0	5.00	0.8	36 36	29	0.970
EXT 19 STORAGE EXT 20 CORIDOR	1	352 60	476.0 73.0	0.06	0.0	5.00	8.0 8.0	36 5	29	0.989
INT 46 CORRIDOR	- 1	460 1895	743.0	0.06	0.0	0.00	0.8	56	45 172	0.970

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	<u> </u>
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.

	OIL EAT AIRFLOW	FXT. S.P. MAX	OUTCIDE AL	D (OC)					`		,
TAG CAP. (MBH) CAP. (MBH) TEMP (°F) °F db		EXT. S.P. ① MAX BHP.	MINIMUM	R (CFM) HEATING MAX TYPE	SECTION CAPACITY	VOLTS/ PHASE	MCA MOCP	BASIS OF DESIGN		APPROX. UNIT WEIGHT (LBS)	REMARKS
RTU-1 320.50 234.88 95.0 76.0		2.5 13.45		2,000 ELEC	54 kW	460/3	103.02 110.0	TRANE_TEH360C4B	11.3 EER	4,800	245678900
		 									

- 1 THIS IS THE STATIC PRESSURE EXTERNAL TO THE UNIT. IT DOES NOT INCLUDE COIL, CASING, FILTER 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.

_		····	·····	~~~~~	 	~~~~~	~~~~~	~~~~	·····	*******	~~~~~~	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Έ	R OR HEATER L	_OSSE			POWERED EXHA							

(12) PROVIDE WITH DUAL COMPRESSORS. (13) PROVIDE WITH HOT-GAS BYPASS HUMIDITY CONTROL.

(1) PROVIDE UNIT WITH HOT GAS BYPASS.

ON SHALL BE HED INTO ECONOMIZEN AND MODULATE	
TO OA TABLE.	
TO OA TABLE.	

										SP	LIT S	SYSTEM	SCH	EDULE	_ - -					
									FAN C	OIL UNIT	Γ DATA					CONDENSING	UNIT DAT	A		
		MINIMUM SENSIBLE	AIRFLOW	OUTSIDE	EXT. S.P. (IN. W.C.)	MAX		EAT	VOLTS/	DRIVE	MAX FAN	TYPE OF UNIT	HEATING	SECTION	AMBIENT	VOLTS/ PHASE	CTACEC	MIN. SEER	BASIS OF DESIGN	DE144 D140
TAG	CAP. (BTUH)	CAP. (BTUH)	(CFM)	AIR (CFM)	(IN. W.C.) [⊕]	H.P.	°F db	°F wb	PHASÉ	2	RPM	I THE OF UNIT	TYPE	CAPACITY ③	TEMP.(°F)	PHASÉ	SIAGES	SEER	BASIS OF DESIGN	REMARKS
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-A24NHA7	
AHU-2/CU-2	24,000		775				80	67	208/1	D	1075	WALL MOUNTED			95	208/1	VFD	21.4	MITSUBISHI PKA-A24KA7/PUY-A24NHA7	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.) 5) PROVIDE WITH CONDENSATE PUMP, PER MANUFACTURERS RECOMMENDATIONS.

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.

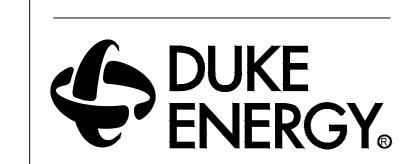
		ELECTRI	C HE	EATE	ER S	SCHEDUL	E.
	I.D. TAG	DESCRIPTION	CAPACITY KW	MIN CFM	VOLTS/ PHASE	BASIS OF DESIGN	REMARKS
Λ	UH-A	FAN FORCED HEATER	13.0	800	460/3	REDDI UH	①
	UH-B	FAN FORCED HEATER	5.0	400	460/3	REDDI UH	① }
¥				~~~~			<i></i>
-	1 PROVIDE	HEATER WITH UNIT MOU	JNTED THER	MOSTAT A	ND INTEG	RAL DISCONNECT.	

Equipr	nent Info		Air Val	ve Data				Fan	Data			Heating Coll Data		ta	***************************************		I	
TAG	Туре	Cooling CFM	Inlet Size	Valve Min	Мах ДР	Fan Min	Fan %	Fan CFM	Max SP (In WC)	Motor HP	Voltage/ Phase	LAT	Design KW	Voltage/ Phase	Max	Weight Lbs (1)	1	Remarks
1st Floor		1			*******						***************************************	····		······································				
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°E~	~4Q~~	~~277/1~~	40~	~130~	Trane VPEE	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~	<del>~~625~</del>	~~~8~~~	~~ <del>105</del> ~~	~9:45~	~~ <del>128</del> ~~	~~70%~~	440~~	~~ <del>0.45</del> ~~	~~ <del>1/3</del> ~~	~277/1~	~98*F~	mean	~~ <del>2</del> 97/1~~	~40~	~ <del>138</del> ~	Traine 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	14"	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

6 PROVIDE WITH LOW AMBIENT CONTROLS.

(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 MANUFACTUER'S RECOMMENDATIONS FOR SERVICE AND ELECTRICAL CLEARANCES.

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



MAILING ADDRESS: P.O. BOX 1007 CHARLOTTE, NC 28201

Safety Expectations:





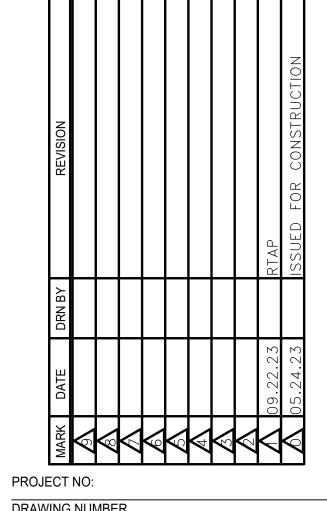
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DUNN OPERATIONS CENTER

1269 JONESBORO RD. HARNETT COUNTY, NC 28334



DRAWING NUMBER

CFD-XXX-M-0007-XXXXXX

ELECTRONIC FILE NAME:

DRAWN BY: JFETAYLOR SUBER CHK'D BY: JSL DAVID QOANTEON

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SCHEDULES - MECHANICAL

M-0007

