

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

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

END OF SECTION SECTION 15800
AIR DISTRIBUTION DEVICES

1.0 GENERAL

1.01 DESCRIPTION

A. All work specified in this section is governed by the Mechanical General Section 15010.

B. This Section 15800 and the accompanying drawings cover the provisions of all labor, equipment, appliances and materials, and performing all operations in connection with the construction and installation of air distribution devices as specified herein and as shown. These units include, but are not limited to the following:

1. Ceiling Diffusers (CD)
2. Return Air Grilles (RAG)
3. Exhaust Grilles (EG)
4. Slot Diffusers (SD)
5. Supply Registers (SR)
6. Return Air Registers (RAR)
7. Transfer Grilles (TG)

1.02 INTENT

A. It is the intent of this Section of the specifications to provide complete, operable, adjusted air distribution devices as shown and specified which are free of excessive noise, vibration and airflow fluctuations.

1.03 SELECTION CRITERIA

A. All air distribution devices shall be selected in accordance with the following minimum criteria unless otherwise noted below or on the drawings:

1. Method of mounting shall be compatible with the ceiling, wall or duct surface which it mounts on or in; i.e. lay-in, surface mounting, plaster frame, duct collar, etc. The architectural drawings shall be referenced to determine the mounting method for each device. All flanges on surface mounted devices shall be provided with a gasket.
2. Finish of all ceiling mounted devices shall be selected to match the color 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; finish coat will be applied under Division 9.

1.04 BASIS OF DESIGN

A. The basis of design is Carnes. Any proposed substitutions shall be proven equal in all respects to the equipment specified as the basis of design. Any modifications to ductwork, controls, ceilings, building structure, etc. that result from any substitution shall be coordinated with all trades. This coordination shall occur before delivery of equipment and any modifications shall be performed without incurring additions to the Contract.

1.05 ACCEPTABLE MANUFACTURERS

A. Acceptable manufacturers are Price, Carnes, Metal Aire, Nallor and Titus, provided that their units, performance, appearance and physical characteristics are equal in all respects for this specific project.

2.0 GENERAL

2.01 DESCRIPTION

A. Ceiling Diffuser (CD)

1. *Ceiling diffusers shall be 24"x24" plaque face ceiling diffusers, Price ASD. Diffusers shall consist of a precision formed back code of one-piece seamless construction that incorporates a round inlet collar of sufficient length for connecting rigid or flexible duct. An inner plaque assembly shall be incorporated and shall drop no more than 1/4" in. below the ceiling plane to assure proper air distribution performance. The inner plaque assembly shall be completely removable from the diffuser face to allow for full access to any dampers or other ductwork components located near the diffuser neck. The maximum NC level at the design airflow shall not exceed 35 when measured in a grid field 5'-0" from the face of the device.

E. Return Air Grilles (RAG)

1. *Return air grilles shall be hollow core 24"x24" rectangular, lay-in type, selected to match the CDC Price RAGDR. Provide weight shield option L.S. Performance data shall be in accordance with ADC 1062R4. All other characteristics shall be equal to the listed grilles.

I. Exhaust Grilles (EG)

Exhaust grilles shall be surface mounted, fixed curved blade **aluminum** exterior grilles with louvers spaced at 0.750 inches on center. Ede shall be Carnes RALA (aluminum) Carnes RSLA (steel) sized as indicated.

J. Slot Diffuser

1. Supply (SD)
 - a. Each slot diffuser shall be equipped with an individually adjustable pattern controller for each slot to insure full 180 degree air pattern; Carnes DASC. The diffuser shall be constructed of 24 gauge galvanized steel with inlet size and length as indicated. Each SD shall be provided with a lined steel plenum with tappings for round duct connections as indicated. Maximum NC level shall not exceed 35 at design airflow. Liner shall conform to NFPA 90A 25/50 requirements.

L. Supply Registers (SR)

1. Supply registers shall be surface mounted, steel, adjustable double-deflection type complete with opposed blade dampers for balancing purposes. The outermost set of deflection blades shall be parallel to the long dimension of the SR and the innermost set of deflection blades shall be parallel to the short dimension of the SR. The registers shall be tested in accordance with ADC standards and shall be selected to provide design airflow at a maximum NC of 35. SRs shall be Carnes RTDB Series, sized as indicated.

O. Return Air Registers (RAR)

1. Return air registers shall be surface mounted, **steel, **aluminum registers with curved hemmed edge blades with an opposed blade damper. Damper blades shall be gong operated by means of a key which can be removed after balancing. RARs shall be Carnes **RTLA (steel)** RRLA (aluminum), sized as indicated.

3.0 EXECUTION

3.01 INSTALLATION

A. Air distribution devices shall be installed as indicated and in conformance with the manufacturer's recommendations. The color, frame and border types shall be coordinated with Architectural requirements and shall be selected to install in the finished surface indicated.

3.02 ADJUSTMENT

A. Grilles, registers and diffusers shall be tested and adjusted to provide the scheduled air flow capacities.

B. All adjustable air distribution devices located within three feet of any wall shall be set to blow directly away from, or parallel to, the wall.

C. In all slot diffuser applications, the inactive sections of the slot shall be finished with perforated steel, painted flat black, selected to match the CDCs. These sections shall be open to the plenum as a return air path.

END OF SECTION SECTION 23840
DUCTWORK

1.0 GENERAL

1.01 DESCRIPTION

A. All work specified in this Section is governed by the HVAC General Section 23010.

B. This Section 23840 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 following:

1. Supply air ductwork
2. Return, transfer and relief air ductwork
3. Exhaust ductwork
4. Outside air ductwork

1.02 INTENT

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.

1.03 DESIGN AND CONSTRUCTION

A. Ductwork shall be provided in strict accordance with the first edition - 1985 - of the SMACNA HVAC Duct Construction Standards - Metal and Flexible, NFPA No. 90A, 90B, 91 and 96, and UL 181.

B. Ductwork dimensions shown are net, clear, inside dimensions with no allowance shown for duct liner. All ductwork specified to be lined shall be 2" larger than shown in each dimension to compensate for the liner. Ductwork shall be square, rectangular, round, spiral or flat oval as noted. Conversion of duct shapes and sizes shown shall be accomplished without increasing air velocities or friction losses and is subject to prior approval by the Architect.

C. Elbows shall be either full radius type (inside radius equal to duct width), five-gang radiused flat-oval type or, in low pressure systems only, mitered with double-thickness turning vanes.

D. Abrupt changes in duct sizes and shapes shall not be permitted. The total angle of elbows/ transitions shall be not more than 15 degrees; converging transitions shall be not more than 30 degrees unless otherwise noted or required due to structural constraints.

E. Offsets, transitions, rises and drops are not individually called out on the design drawings. They shall be provided as required to fit the ductwork into the allocated spaces.

F. Transition rectangular ductwork on bottom and sides. Maintain top of ductwork level and as high as possible.

G. All supply air ductwork between the VAV self-contained *** air handling *** conditioning units** packaged rooftop** fan coil** unit and the terminal units shall be constructed for 3" WC static pressure class at 4000 FPM velocity with Class A seals and is herein defined as "medium-pressure" ductwork. All other ductwork shall be constructed for standard 1" WC static pressure class at 2500 FPM with Class C seals and is herein defined as "low pressure" ductwork.

H. Provide the following types of ductwork material as indicated:

TYPE OF MATERIAL SERVICE

1. Galvanized sheetmetal Supply, return, exhaust and relief air ductwork and outside air.

2.0 PRODUCTS

2.01 GALVANIZED SHEETMETAL

A. Galvanized sheetmetal shall be high-forming grade G90-ASTM A 525 hot dip galvanized steel sheets. Sheets shall be galvanized on each side with no less than 1.25 ounces of zinc per square foot.

2.02 SPIRAL DUCT

- a. Spiral duct shall be utilized for all flat-oval and round ductwork in medium and high pressure systems.
- b. Spiral duct shall be the product of United McGill Corporation, R.V. Money or approved equal.
- c. Spiral ribbed duct that reduces the metal thickness is not acceptable.

2.06 DAMPERS

A. Manual Volume Dampers

1. Single blade butterfly dampers are acceptable up to 12" round or 12" x 12" square. Dampers larger than these dimensions shall be multi-blade type. Single blade dampers shall be constructed of 16 gauge or heavier galvanized sheetmetal.
2. No multi-blade damper blade shall exceed 8" in width. All multiple blade dampers shall be constructed of 16 gauge galvanized steel or heavier. The damper frame shall be 16 gauge or heavier. The damper action shall be opposed-blade type.
3. Each blade shall pivot on a 1/2" cadmium plated, cold-rolled steel axle which pivots within self-lubricating, oilite bronze bearings.
4. The top and bottom edges of each rectangular damper blade shall be crimped for stiffness.
5. The operating rod for all dampers shall be extended outside the damper frame for attachment of an operator. Each operator shall have a position indicator and locking quadrant.
6. All dampers utilized for introduction of outside air shall have flexible, gasketed edge and end seals. The leakage rate shall be less than 4 CFM per sq. ft. of face area against a 1" W.G. differential pressure, based on a nominal 48" x 48" damper size.
7. Manual volume dampers shall be as manufactured by Louvers & Dampers, Inc. or an approved equal.

B. Control Dampers

1. Control dampers shall be of the same construction as manual volume dampers, except that no manual operator and quadrant is required. The operating rod shall be suitable for operation by an automatic pneumatic or electric operator.

C. Fire Dampers

1. Fire dampers shall be UL-listed and labelled for 1 1/2 hours and shall be provided with 160 degrees F. links. Dampers installed within ducts shall be Type B or Type C with the blades out of the airstream. Areas indicated shall be net, clear, open areas.

D. Smoke Dampers

1. Smoke dampers shall be UL-listed as Class 1 low-leakage smoke dampers and shall be products of Prefco.

2.07 LOW-PRESSURE DUCT BRANCHES

A. Splitter dampers shall be provided at all low-pressure ductwork branches. All low-pressure ductwork branches shall be radiused at 45 degree take-offs, straight tapers are unacceptable. The length of the damper blade shall be the same as the width of the widest duct section at the split, but in no case shall blade length be less than 12". Each operator rod shall have a locking swivel joint.

2.08 FLEXIBLE DUCT

A. Flexible ductwork shall be Class 1, UL 181 air duct and meet NFPA 90A and 90B Standards.

B. The internal duct surface shall be acoustically rated, black CPE bonded to a coated steel wire helix. The external jacket shall be a fiberglass, bi-directionally reinforced, metallized vapor barrier with a standing, triple ply seam. Fiberglass insulation shall be provided between the duct surface and the jacket to achieve a maximum thermal conductance of 0.23 BTU/Hr./sq. ft./degree F. at 75 degrees F. mean.

C. Flexible ductwork shall be suitable for 10" W.G. positive pressure and 1" W.G. negative pressure.

D. Flexible ductwork, insulation and insulation cover shall be suitable for ceiling return air plenum installation and shall comply with all applicable codes and standards regarding such ceiling plenum installations.

E. Flexible duct shall be Thermaxflex M-KE or an approved equal.

F. The maximum allowable installed length of flexible ductwork shall be as follows:

1. 8'-0" on low-pressure supply air systems limited to short runs and end of runs connected to round neck supply diffusers and registers.
2. 4'-0" on medium and high-pressure supply air systems limited to the runouts from the sheetmetal ductwork to each terminal unit.
3. 2'-0" on connections from round neck grilles to sheetmetal ductwork on return, exhaust and transfer ductwork.

G. Provide a spin-in fitting with integral scoop and volume damper at all flexible run-out connections in low-pressure supply air ductwork only.

2.09 TERMINAL UNIT RUNOUTS

A. Medium and high-pressure runouts to terminal units shall be connected to the trunk duct with factory-welded laterals, conical tees or bellmouth fittings; abrupt round to rectangular taps are strictly prohibited and shall be rejected.

2.10 FLEXIBLE CONNECTIONS

A. Provide flexible duct connections at the inlet and outlet of each belt-driven fan, indoor unit, fan coil unit, air handling unit, etc., and at all other locations indicated. Flexible connections shall be fabricated from a glass fabric coated on both sides with neoprene. Minimum weight shall be 30 oz. per sq. yard.

2.11 DUCT HARDWARE

A. Duct hardware shall be as manufactured by Young Regulator or an approved equal.

2.12 ACCESS DOORS

A. A duct access door shall be provided at each VAV terminal. Access doors shall be designed for 1.5 times the pressure of the duct, which they are mounted. Access doors shall be of a unit size to permit access to the dampers for resetting the blades and loosening the links. Access doors in medium and high-pressure ductwork shall be installed downstream of the dampers and shall be implosion type. Where access is provided through gypsum board walls or ceilings, furnish access door for inspection under Division 9. Each door shall match the fire rating of the wall or ceiling indicated.

2.13 DUCT LINER

A. Duct liner shall be one inch thick, 1 1/2 lb. density (3 lb. density on medium- and high-pressure supply air systems) 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 as follows:

1. Maximum flame spread 25
2. Maximum smoke developed 50

2.14 INSULATION

A. Duct insulation shall be 2" thick, minimum 3/4 lb. density fiberglass with an FSKL 0.00335" thick aluminum foil jacket, reinforced with fiberglass scrim. Thermal conductivity shall be a maximum of K = 0.24 at 75 degrees F. mean temperature.

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.

3.0 EXECUTION

3.01 INSTALLATION

A. Ductwork shall be installed in strict accordance with SMACNA, UL and NFPA standards.

B. Duct liner shall be provided for the following minimum distances or through the first elbow(s) or as otherwise indicated on the drawings, whichever is greater, downstream of each unit indicated below:

1. Packaged rooftop unit 25 feet
2. Air handling unit 25 feet

Duct liner shall also be provided throughout all return air, transfer and plenums.

C. 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.

D. 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 bonded. 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.

E. Flexible ducts utilized in the low-pressure ductwork systems shall be installed without kinks or bends which are less than a centerline radius equal to or greater than twice the diameter of the flexible duct being installed. Also, in the runouts from the medium or high-pressure ductwork to the terminal units, the flexible ducts shall be installed with a variance of no more than 1" per foot of installed length off a straight and level line from the centerline of the sheetmetal ductwork runout or top to the centerline of the terminal unit inlet. The size of the flexible ductwork connected to each terminal unit shall be the equivalent size of the larger of the following:

1. The inlet size of the terminal unit.
2. The runout size indicated on the drawings.

Should the runout size indicated on the drawings differ from the inlet size of the terminal unit or where the inlet to the terminal unit is rectangular, the transition shall be made with sheetmetal and shall occur at the inlet to the terminal unit.

F. All low pressure ductwork downstream of VAV units shall be left uncapped for balancing until tenant fit-up affects the units.

G. All intersections (crossing) of low-pressure and medium-pressure ductwork shall be made with offsets in the low-pressure ductwork only. The medium pressure ductwork shall be ran straight and level.

END OF SECTION

COMMISSIONING NOTES:

1. THE 2018 NC ENERGY CODE REQUIRES THE MECHANICAL AND SERVICE WATER HEATING SYSTEMS IN BUILDINGS WITH A FLOOR AREA IN EXCESS OF 10,000 SQ. FT. TO BE COMMISSIONED BY A REGISTERED DESIGN PROFESSIONAL.
2. THE CONTRACTOR SHALL OBTAIN THE SERVICES OF A NC LICENSED ENGINEERING PROFESSIONAL TO PERFORM ALL REQUIRED COMMISSIONING. PRIOR TO ISSUANCE OF CERTIFICATE OF OCCUPANCY A SIGNED STATEMENT OF SYSTEM COMMISSIONING (SEE APPENDIX C1) SHALL BE PROVIDED TO CODE OFFICIAL AND FACILITY OWNER.
3. COMMISSIONING HAS BEEN EXCLUDED FROM BARRETT, WOODYARDS DESIGN SCOPE. HOWEVER, WE CAN PERFORM SAID SERVICES UNDER THE CONTRACTORS SCOPE.
4. COMMISSIONING SHALL BE DONE IN ACCORDANCE WITH SECTION 15010 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 WHOM.
 - 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 PROCEDURES.
 - 4.3. HYDRONIC SYSTEMS SHALL BE BALANCED ACCORDING TO THE REQUIREMENTS SET FORTH IN 0408.2.2 OF THE NC ENERGY CODE.
 - 4.4. ALL SYSTEMS SHALL BE COMMISSIONED TO ENSURE ALL SYSTEM ARE OPERATING IN ACCORDANCE WITH APPROVED PLANS AND SPECIFICATIONS. FUNCTIONAL TESTING TO ENSURE SYSTEMS ARE OPERATING IN ACCORDANCE WITH APPROVED PLANS AND SPECIFICATIONS.
5. CONTRACTOR SHALL PROVIDE TO THE OWNER AND SYSTEM COMMISSIONING AGENT, ALL INSTRUCTIONS ON MAINTENANCE AND OPERATION OF ALL SYSTEMS AND EQUIPMENT. THE DOCUMENTATION SHALL INCLUDE THE FOLLOWING, AT A MINIMUM:
 - A) SUBMITTAL DATA
 - B) OPERATION AND MAINTENANCE MANUALS FROM MANUFACTURER.
 - C) NAME AND ADDRESS OF AT LEAST ONE SERVICE AGENCY.
 - D) CONTROL SYSTEM MAINTENANCE AND CALIBRATION INFORMATION.
 - E) TEST & BALANCE REPORT
6. CONTRACTOR TO PROVIDE AT PROJECT COMPLETION, PRIOR TO OBTAINING CERTIFICATE OF OCCUPANCY, PRESENT AT FINAL INSPECTION TO THE JURISDICTION'S A.H.U. A SIGNED AND DATED STATEMENT OF SYSTEM COMMISSIONING FOR ALL MECHANICAL & HYDRONIC SYSTEMS. THE FORMAT OF THE STATEMENT OF SYSTEM COMMISSIONING SHALL BE IN THE FORM REQUIRED BY THE STATE'S ENERGY CONSERVATION CODES AND/OR A.H.U. REQUIREMENTS. THE DOCUMENT SHALL BE SIGNED BY THE CONTRACTOR'S LICENSED PROFESSIONAL ENGINEER REPRESENTATIVE.



1950 ABBOTT STREET, STE 605
CHARLOTTE, NC 28203
704-373-3101
FAX 704-373-3103
WWW.NOVUSARCHITECTS.COM

carrie frye interior design
2126 CHARLOTTE DR.
CHARLOTTE, NC 28203
704-995-7705
WWW.CFDSTUDIO.COM

BW & A Barrett, Woodyard and Associates, Inc.
License # C-2228

420 Minnet Ln.
Charlotte, North Carolina 28217
(p) 704-357-9333 (f) 704-357-9385

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BR+A
300 West Summit
Office Bldg

300 West Summit Ave.
Suite #310
Charlotte, NC 28203

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SPECIFICATIONS - MECHANICAL
SCALE: AS NOTED
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