PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The requirements of the General Conditions, Supplementary Conditions and the following Specification sections apply to all Work herein:
1. Section 23 00 10 - General Requirements
2. Section 23 00 20 - HVAC Scope of Work
3. Section 23 05 07 - Design Conditions
4. Section 23 05 93 - Testing, Balancing, and Adjusting
5. Section 23 31 00 - Ductwork and Sheet Metal

1.2 SUMMARY

A. Furnish and install all air devices, grilles, registers, diffusers and ceiling outlets as indicated on the Drawings and as required for proper distribution of conditioned air within the conditioned space and for return of conditioned air from the conditioned space to the various air conditioning systems. Exhaust grilles and registers shall also be provided where indicated on the Drawings.

1.3 REFERENCE STANDARDS

A. All air distribution equipment shall be designed, manufactured and tested in accordance with the latest applicable industry standards including the following:
1. ANSI/ASHRAE Standard 70-1991.
2. NFPA 90A
3. UL 723
4. UL 181

B. All equipment and material to be furnished and installed on this Project shall be UL or ETL listed, in accordance with the requirements of the authorities having jurisdiction and suitable for its intended use on this Project.

1.4 SUBMITTALS

A. The following submittal data shall be furnished according to the General Conditions and Section 23 00 10 and shall include, but not be limited to:
1. Grilles, Registers, and Diffusers shall include manufacturer's catalog data indicating capacities, performance, sound power levers at rated capacity, and pressure drop at rated capacity, for the specific operating conditions for each type and size grille, register, and diffuser shown on the Drawings. Provide color samples for standard and custom colors for approval by the Architect and Owner.
2. Slot Diffusers* shall include manufacturer's catalog data indicating capacities, performance, sound power levers at rated capacity, and pressure drop at rated capacity, for the specific operating conditions for each size and type slot diffuser shown on the Drawings. Include laboratory test data for air performance and acoustics as specified.
3. Troffer Diffusers shall include manufacturer's catalog data indicating capacities, performance, sound power levers at rated capacity, and pressure drop at rated capacity, for the specific operating conditions for each size and type troffer diffuser shown on the Drawings.
4. Round Raised Floor Diffusers* shall include manufacturer's catalog data indicating capacities, performance, laboratory air performance test data, velocity profile, temperature profile, sound power levers at rated capacity, and pressure drop at rated capacity, for the specific operating conditions for floor diffusers shown on the Drawings. Provide color samples for standard and custom colors for approval by the Architect and Owner. Provide installation instructions indicating step-by-step details for proper installation.
5. Flow Hood and carrying case to be furnished to Owner including operating instructions.
6. Testing Laboratory information for review and approval by the Owner, Project Acoustical Consultant, and Engineer.
7. Prior to execution of factory testing and lab testing, submit test procedures, recording forms, and test equipment cut sheets to Engineer for review. Refer to Section 23 00 20 titled "Scope of Work" for "Scheduling Procedures".

8. Factory Test Schedule.
9. Factory Test Reports.
10. Lab Test Schedule.
11. Lab Test Reports.

B. All items or equipment listed above with asterisks (*) shall be certified by the manufacturer using Manufacturer Certification "MCA" as set forth in Section 23 00 10. See Section 23 00 10 for certification requirements.

1.5 WARRANTY

A. Comply with the requirements of the General Conditions and Section 23 00 10.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. If it complies with these Specifications, ceiling supply and return diffusers manufactured by one of the following manufacturers will be acceptable:
1. Barber-Coleman
2. Carnes
3. Krueger
4. Metal*Aire
5. Nailor Industries
6. Price Industries
7. Titus
8. Tuttle and Bailey

B. If it complies with these Specifications, manual or automated floor supply air diffuser assemblies manufactured by one of the following manufacturers will be acceptable:
1. Krantz
2. Nailor Industries
3. Price Industries
4. Titus
5. Trox

C. If it complies with these Specifications, "SD-A", "SD-B", or"SD-C" perimeter ceiling supply diffusers manufactured by one of the following manufacturers will be acceptable:
1. Nailor Industries
2. Price Industries
3. Titus

D. If it complies with these Specifications, air troffer and linear supply diffusers manufactured by one of the following manufacturers will be acceptable:
1. Barber-Coleman
2. Krueger
3. Metal*Aire
4. Nailor Industries
5. Price Industries
6. Titus
7. Tuttle and Bailey

2.2 GENERAL

A. The air distribution outlets shall be sized as shown on the Drawings to accommodate the air volume and throw indicated so as to maintain a maximum terminal velocity of 50' per minute in the occupied area. The overall noise level produced by all of the supply air outlets and return air inlets in various rooms shall not exceed specified limits. In Section 23 00 10 see the Subsection titled "Equipment Noise and Vibration" for requirements. The conditioned air shall be distributed in such a manner that the space temperature shall not

vary more than 2ºF over the entire conditioned area, which shall be defined as the area 2'-0" above the floor to 7'-0" above the floor, inclusive.

B. At the discretion of the Engineer, air outlets may be smoke tested to determine their compliance with these Specifications. See Section 23 05 93 titled "Testing, Balancing, and Adjusting" for testing requirements. Any revisions required for compliance with terminal velocity requirements, noise level requirements or maximum temperature variation requirements shall be made at no cost to the Owner.

C. The air outlet manufacturer, through the Subcontractor, shall furnish the Owner with a flow hood kit identical to that used by the Air Balance Contractor complete with all hood sizes if air troffer diffusers "TD-A", "TD-B" or "TD-C" are utilized on this Project. See Section 23 05 93 titled "Testing, Balancing, and Adjusting". The flow hood kit shall be complete with carrying case. The flow hood accuracy and the instrument calibration for measuring the air flow from the troffer diffusers specified for this Project shall be verified in an independent testing laboratory acceptable to the Owner and Engineer. These instruments shall be new and unused and delivered to the Owner three (3) months prior to the start of the air balancing. Refer to Section 23 05 93 titled "Testing, Balancing, and Adjusting".

2.3 GRILLES, REGISTERS, DIFFUSERS, CEILING OUTLETS AND RAISED FLOOR SUPPLY OUTLETS

A. All grilles, registers, ceiling outlets and floor outlets shall be similar and approved equal to the types indicated on the Drawings and specified herein.
   1. Square Ceiling Outlet "SCO-A": Nailor UNI or Titus OMNI panel face supply diffuser, all steel construction with frame suitable for the scheduled ceiling type. Refer to the Architectural Specifications and Drawings for ceiling type and construction details. The faceplate shall have an aerodynamically shaped, hemmed edge. A single metal thickness on the edges of the faceplate is not acceptable. See Drawings for neck sizes. Face area shall be approximately 24" x 24". Furnish with volume damper or spin in type damper at the flexible duct connection to trunk duct. Baked enamel off white finish. Refer to special finish specifications hereinafter.
   2. Square Ceiling Outlet "SCO-B": Nailor UNI or Titus OMNI panel face supply diffuser, all steel construction with frame suitable for the scheduled ceiling type. Refer to the Architectural Specifications and Drawings for ceiling type and construction details. The faceplate shall have an aerodynamically shaped, hemmed edge. A single metal thickness on the edges of the faceplate is not acceptable. See Drawings for neck sizes. Face area shall be approximately 12" x 12". Furnish with volume damper or spin in type damper at the flexible duct connection to trunk duct. Baked enamel off white finish. Refer to special finish specifications hereinafter.
   3. Variable Air Volume Floor Diffuser "VAV-B"
      a. Rectangular raised floor supply and return air linear bar grilles shall consist of a nominal 16" x 8" or 12" x 12" or 10" x 10" rectangular linear bar grille core, and an aluminum 1" wide trim ring for use with carpet, a dirt basket and an optional integral volume control device. The linear bar grille and frame shall be constructed of aluminum extrusions and designed to fit floor panels as shown on the drawings. The flanged frame is to be constructed so that the visible width is 1 inch and the grille bars are to be constructed so that their visible width is 1-1/4 inch. Bars shall be spaced on 1/4 inch centers. Each grille crossbar shall be constructed of extruded aluminum and contain channels to support the individual bars of the grille. Crossbars shall be 5/8 inch tall with 3/8 inch deep channels to fit each bar. The bars shall be pressed permanently into the crossbars. Each crossbar shall be spaced on nominal 6 inch centers and include an additional internal load bearing truss mounted to the extrusion using heavy duty bolts for strength. The truss shall be 1 inch tall, 5/16 inch thick and 3-1/4 inch wide too ensure a high load capacity along the length of the primary crossbeam. Each supply grille assembly shall include adjustable deflection vanes below the face of the diffuser on each end to ensure proper spread and coverage of the facade. Both return and supply grilles shall be identical in construction and appearance except for the deflection vanes that are not necessary for the return grille. Each grille shall be assembled as one (1) piece that is removable from the raised floor tile. Where indicated on the plans, the volume control device on the supply air grilles shall be an analog control 24 volt actuator controlled by a 0-10 volt dc signal either from the BAS or from a remote room thermostat equipped with proportional and integral control algorithms. The actuator shall attach directly to the damper shaft so as to fit through the hole in the floor and carpet for mounting. The actuator shall not interfere with the mounting mechanism of the diffuser. The actuator shall be equipped with a clutch to release the motor for manual stroking. The actuator shall be supplied with jacks to receive the wire harnesses for connections to thermostat, power supply or daisy chain connections to other diffusers. The diffusers shall be supplied complete with power supplies and interconnecting harnesses in 12 foot lengths. All plastic parts, shall be

constructed of flame resistant material in accordance with Underwriters Laboratories, UL Standard 94 and shall comply with local code and regulations of the authorities having jurisdiction for use in supply air distribution systems.

b. The floor diffuser double deflection design shall produce a rapid spreading discharge with high induction of room air and low vertical discharge for use at the perimeter wall. The diffuser manufacturer shall submit for review and approval laboratory air performance test data at air flow rates of 80, 100, and 125 cfm for the assembly specified above. The performance data shall include the date listed below for a supply air temperature range of 62 to 65ºF and a room temperature of 74 to 75ºF.
   1) Plenum pressure: inches water gauge.
   2) Complete velocity profile (fpm) of discharge air at 1 foot intervals above the raised floor surface to a height of 9 feet. Velocity readings shall be recorded on opposite sides of the supply diffuser at inch intervals from the diffuser centerline.
   3) Complete temperature profile to indicate the diffuser induction capabilities. Temperature readings in degrees F at the same locations listed above for velocity readings.

4. Non-Rated Raised Floor Supply Air Diffusers and Service Outlet:
   a. Round assemblies shall consist of a nominal 8” diameter swirl diffuser core, 3/4” wide trim ring for use with carpet, dirt basket, integral volume control device with an adjustable minimum stop, external volume control position indicator, and adjustable mounting clamps to secure the assembly in at least three (3) locations to the raised floor panel specified in the Architectural Specifications. All plastic parts shall be constructed of flame resistant material in accordance with Underwriters Laboratories UL Standard 94 and shall comply with local code and regulations of the authorities having jurisdiction for use in supply air distribution systems.
   b. The floor diffuser core design shall produce a rapid swirling discharge with high induction of room air and low vertical discharge. The diffuser manufacturer shall submit for review and approval laboratory air performance test data conducted in accordance with ANSI/ASHRAE Standard 70-1991 at air flow rates of 80, 100 and 125 cfm for the assembly specified above. The pressure drop trough the diffuser with the basket installed shall not exceed 0.10” WG at a flow rate of 100 cfm. The vertical projection at the centerline of the diffuser shall not exceed 5.5 feet at a terminal velocity of 50 fpm with a 10ºF temperature differential. The performance data shall include the data listed below for a supply air temperature range of 62 to 65°F and a room temperature of 74 to 75°F.
      1) Plenum pressure: inches water gauge.
      2) Complete velocity profile (fpm) of discharge air at 1 (one) foot intervals above the raised floor surface to a height of 9 (nine) feet. Velocity readings shall be recorded on opposite sides of the supply diffuser at 6 (six) inch intervals from the diffuser centerline.
      3) Complete temperature profile to indicate the diffuser assembly swirl induction capabilities. Temperature readings in degrees F at the same locations listed above for velocity readings.
   c. For Manual Volume Control: The air volume adjustment shall be through use of the diffuser face and a sleeve within the dirt basket. The volume adjustment shall have an external volume position indicator at the diffuser face and shall be easily adjustable after the diffuser core has been removed or adjustable with the diffuser core in place. The diffuser volume device shall have a minimum stop which is easily field adjustable to permit a minimum setting as required for the ASHRAE ventilation standard ANSI/ASHRAE 62-2001. The volume adjustment sleeve shall be equipped with a spider or cross bar to permit sleeve rotation or vertical sleeve displacement. Vertical sleeves shall be a friction fit with at least two positive locking features. The swirl diffuser face elevation shall be the same when installed with or without the dirt basket and volume control device installed.
   d. For Automatic Control: The air volume adjustment shall be through the use of an analog control 24 volt actuator controlled by a 0-10 volt dc signal from the Division 25 BMCS unitary controller (UC). The actuator shall fit to the bottom of the dirt basket and be shaped similar to the basket so as to fit through the hole in the floor and carpet for mounting. The actuator shall not interfere with the mounting mechanism of the diffuser. The actuator shall be equipped with a clutch to release the motor for manual stroking. The actuator shall be supplied with RJ12 jacks to receive the wire cables for connections to the power supply or daisy chain connections to other diffusers. The group of swirl diffusers shall be supplied with 120 volt / 24 volt power supplies and interconnecting cables in 12 foot or 20 foot lengths. Each power supply shall have the capacity to power 12 automated VAV diffusers when using 12 foot long cables, or 8 automated VAV diffusers when using 20 foot length cables. Rooms with diffuser groups indicating the installation of more automated VAV diffusers than allowed connected to one power supply, either due to quantity or length of cables, shall be provided with additional power supplies.
      1) Supply air diffusers, 24 volt actuators, and 120 volt / 24 volt power supplies shall be provided and installed by the Division 23 Subcontractor. Coordinate Division 23 UC power

requirements and automated VAV diffuser requirements with 120 volt / 24 volt transformer sizing.

2) 12 foot or 20 foot actuator wiring cables shall be provided by the Division 23 Subcontractor and installed by the Division 25 BMCS Subcontractor.
3) 120 volt power source to actuator power supply J-box shall be provided and installed by the Division 26 Subcontractor. Refer to Contract Documents for additional electrical circuiting information. Final connection from 120 volt J-box to automated VAV diffuser power supply (or multiple power supplies for a group) shall be by Division 25.
4) Unitary controller (UC), wall mounted room thermostat (and CO2 sensor where shown on the drawings), field level communication F-LAN, power connection from UC to 24 volt power supply, communication connection from UC to master VAV diffuser in each group and wiring from UC to wall mounted thermostat shall be provided and installed by the Division 25 BMCS Subcontractor. Additional communication wiring between the Division 25 UC and multiple master VAV diffusers in rooms requiring multiple power supplies shall be provided and installed by the Division 25 BMCS Subcontractor.

e. The floor diffuser assembly shall be coordinated by the Subcontractor with the round cutouts in the raised floor panels furnished under an Architectural Division. Raised floor panels will be furnished with proper sized holes to accommodate the floor diffuser assemblies.
f. The service outlet assembly shall consist of a 3/4" wide trim ring and clamping device identical to the supply air diffuser and an adjustable flat face with three (3) U-shaped openings to allow electrical and communication cabling to pass through. The service outlet shall be designed to expose one (1), two (2), or three (3) openings and can be completely closed when not in use. The service outlet face elevation shall be flush with the trim ring and be designed to withstand office and equipment loadings. Service outlets shall be similar to Nailor Model NFA, Titus TAF-G, or approved equal.
g.

Round raised floor air diffuser core element and trim ring and service outlet shall be furnished in a custom color selected by the Architect or Owner. Submit a Sample 8" round diffuser assembly complete with dirt basket and volume adjustment device in each standard color to the Owner for color approval.

Round raised floor supply air diffusers shall be similar to Nailor NFD, Titus TAF-R, or approved equal.

5. Exposed Duct Supply Register "SWR-A": Nailor 71 DV-O or Titus Model 272FS extruded aluminum register with front vertical and rear horizontal adjustable air foil type blades on 0.75" centers, aluminum opposed blade volume control damper and volume extractor. Galvanized volume extractors shall have 1" spacing on blades through size 18" x 12" and 2" spacing through sizes 36" x 18" with gear operator accessible through the diffuser face. Bakes enamel finish. Refer to special finish specifications hereinafter.
6. Sidewall Supply Register "SWR-B": Nailor 71 DV-O or Titus Model 272FS extruded aluminum register, with gasketed frame, front vertical and rear horizontal adjustable air foil type blades on 0.75" centers, aluminum opposed blade volume control damper and volume extractor. Galvanized volume extractors shall have 1" spacing on blades through size 18" x 12" and 2" spacing through sizes 36" x 18" with gear operator accessible through the diffuser face. Bakes enamel finish. Refer to special finish specifications hereinafter.
7. Sidewall Supply Register "SWR-C": Nailor 81SH-OA or Titus Model 111 RL register with vertical rear aluminum airfoil fixed blades on 1-1/4" or 1-1/2" spacing, aluminum opposed blade volume control damper and gasketed frame. Baked enamel finish. Refer to special finish specifications hereinafter.
8. Sidewall Linear Bar Supply Register "SWR-D": Nailor 49-241 or Titus CT-541 extruded aluminum linear bar diffuser for ceiling or sidewall application with 15 degree deflection, ½" bar spacing, ¾" border, concealed fastening. The diffuser length, width and air volume shall be as indicated on the Drawings. Air discharge shall be horizontal. Clear anodized finish.
9. Exposed Duct Supply Register "SWR-A": Nailor 71 DV-O or Titus Model 272FS extruded aluminum register with front vertical and rear horizontal adjustable air foil type blades on 0.75" centers, aluminum opposed blade volume control damper and volume extractor. Galvanized volume extractors shall have 1" spacing on blades through sizes 18" x 12" and 2" spacing through sizes 36" x 18" with gear operator accessible through the diffuser face. Baked enamel finish. Refer to special finish specifications hereinafter.
10. Sidewall Supply Register "SWR-B": Nailor 71 DV-O or Titus Model 272FS extruded aluminum register, with gasketed frame, front vertical and rear horizontal adjustable air foil type blades on 0.75" centers, aluminum opposed blade volume control damper and volume extractor. Galvanized volume extractors shall have 1" spacing on blades through sizes 18" x 12" and 2" spacing through sizes 36" x 18" with

gear operator accessible through the diffuser face. Baked enamel finish. Refer to special finish specifications hereinafter.

11. Sidewall Supply Register "SWR-C": Nailor 81SH-OA or Titus Model 111 RL register with vertical rear aluminum airfoil fixed blades on 1-1/4" or 1-1/2" spacing, aluminum opposed blade volume control damper and gasketed frame. Baked enamel finish. Refer to special finish specifications hereinafter.
12. Sidewall Linear Bar Supply Register "SWR-D": Nailor 49-241 or Titus CT-541 extruded aluminum linear bar diffuser for ceiling or sidewall application with 15º deflection, 1/2" bar spacing, 3/4" border, concealed fastening. The diffuser length, width and air volume shall be as indicated on the Drawings. Air discharge shall be horizontal. Clear anodized finish.
13. Sidewall Linear Bar Supply Register "SWR-E": Nailor 49-240 Titus CT-540 extruded aluminum linear bar diffuser for ceiling or sidewall application with 0º deflection, 1/2" bar spacing, 3/4" border, concealed fastening. The diffuser length, width and air volume shall be as indicated on the Drawings. Air discharge shall be horizontal. Clear anodized finish.
14. Linear Slot Ceiling Supply Diffusers "LCO-A": Nailor 5075 or Titus ML-38 extruded aluminum linear slot diffuser for ceiling application with full 180º pattern control adjustment. Border flanged frame shall be narrow pattern 7/8" designed for concealed mounting. Provide alignment strips as required. The diffuser length, number of slots, air volume and air pattern shall be as indicated on the Drawings. The sheet metal supply plenum shall have an airtight factory installed barrier at each end attached to the frame flange to prevent supply air from internally bypassing directly to the return or inactive section of the diffuser. Shop Drawings shall clearly indicate this condition. Refer to special finish specifications hereinafter.
15. Sidewall Stair Pressurization Register "SWR-F": Titus 1700 RL extruded aluminum register with horizontal blades (no vertical adjustable rear blades), aluminum opposed blade damper for volume control, gasketed frame with concealed screw fastening, baked enamel finish.
16. Linear Slot Ceiling Supply Diffusers "LCO-AR": Nailor 5075 R or Titus MLR-38 extruded aluminum linear slot identical to "LCO-A" except for the omission of the pattern controllers. The linear slot length, width and air volume shall be as indicated on the Drawings. Refer to special finish specifications hereinafter.
17. Sidewall Exhaust Air Register and Return Air Register "EXR-A": Nailor 5145H-OA or Titus 350FL extruded aluminum sidewall register with one (1) set of fixed aluminum horizontal louvers on 3/4" centers, set at 35º or 45º down deflection and aluminum opposed blade volume control damper. Baked enamel finish. Refer to special finish specifications hereinafter.
18. Perforated Plate Ceiling Return Air Register "RAR-A": Nailor 4360-0 or Titus Model PAR steel construction perforated flush faces lay in register with opposed blade volume control damper. Refer to Architectural Specifications and Drawings for ceiling type and construction details. Neck sizes as indicated on the Drawings. Baked enamel off-white finish and black inner finish. Refer to special finish specifications hereinafter.
19. Perforated Plate Ceiling Return Air Register "RAR-B": Same as "RAR-A", except provide separate surface mount frame.
20. Sidewall Return Air Grille "RAGR-D": Same as "EXR-A", except without opposed blade volume damper.

B. All slot diffusers, linear diffusers shall be similar and approved equal to the types indicated on the Drawings and specified herein.
   1. Perimeter Ceiling Combination Supply/Return Slot Diffuser "SD-A":
      a. Uninsulated slot type diffuser 2" wide with length and nominal diffuser width and height as indicated on the Drawings. Provide an 8" round inlet for all diffuser lengths inlet. The extended inlet collar connection shall be at least 2-1/2" long with a 1/8" high raised bead located approximately 1" from the inlet connection. The supply diffuser shall be installed above the ceiling between the ceiling tee bars as indicated on the Architectural Drawings. The perimeter supply slot diffuser shall have an internal fixed curved aerodynamic shaped extruded aluminum outlet designed to provide the maximum amount of induced secondary room air. The aerodynamic supply deflector shall be constructed of extruded aluminum and held in position by set screws at both ends of the diffuser. No spot welding shall be visible on the face when installed. The supply air shall be discharged horizontally along the ceiling toward the interior and vertically downward along the curtain wall with the supply inlet positioned as indicated on the Drawings. The diffuser shall be designed, tested and constructed in a manner so as to comply with the performance and sound level requirements specified hereinafter. The integral return air section shall be constructed as indicated on the Drawings. Plenum shall be constructed of at least 24 gauge galvanized steel and shall be substantially supported and reinforced as required. The air volume, length and duct connection size shall be as indicated on the Drawings. The Outlet Manufacturer shall coordinate the

attachment, support, etc., of the supply plenum with the Ceiling Subcontractor. The entire assembly shall be completely laboratory tested for air performance and acoustics as a unit at a laboratory in accordance with the procedures of ANSI/ASHRAE Standard 70-1991 using cold air as specified herein. The acceptability of the testing laboratory is subject to review by the Owner, Project Acoustical Consultant and the Engineer. All tests may be witnessed by the Owner, Project Acoustical Consultant and the Engineer. Six (6) certified copies of the air performance and acoustical performance test results shall be delivered to the Engineer and Project Acoustical Consultant for review. The test data shall be based on a 51ºF cooling air supply temperature and a 24ºF temperature differential. The unit tests are not required if previous tests were done and acceptable test data is available for the Engineer's review. The plenum and integral return air section shall be painted flat black on interior surfaces and the exposed surfaces viewed from below the ceiling system shall be painted flat black.

b. The "SD-A" perimeter ceiling supply slot diffuser shall be with a 15" or 18" wide 1" to 1-5/8" opening, center downblow section for 60" long diffusers, with a 12" or 15" wide, 1" to 1-5/8" opening, center downblow section for 48" long diffusers, with a 12" wide, 1" to 1-5/8" opening, center downblow section for 36" long diffusers and with a 8" wide, 1" to 1-5/8" opening, center downblow section for 24" long diffusers. See Drawings for location of 24", 36", 48" and 60" SD-A diffusers.

c. The "SD-A" diffuser shall be manufactured by one of the following:
   1) Nailor Model 59NDR
   2) Price Industries Model TBRV675
   3) Titus Model N-1-DR

d. The "SD-A" diffuser shall be designed to equal or exceed the performance and sound level characteristics listed below:
   1) 60" Long Diffuser - 15" or 18" Opening Center Downblow:

Cfm/ft. Diffuser	Maximum Diffuser S.P. Loss (In. W.C.)	Maximum Horizontal Throw @ Vt=50 PM	Maximum NC Level*	Maximum Return S.P. Loss (In. W.C.)
30	0.031	13 ft.	<20	0.010
40	0.058	16 ft.	<20	0.018
50	0.090	18 ft.	23	0.027
60	0.130	20 ft.	25	0.038
70	0.182	21 ft.	30	0.050

   2) 48" Long Diffuser - 12" or 15" Wide Center Downblow:

Cfm/ft. Diffuser	Maximum Diffuser S.P. Loss (In. W.C.)	Maximum Horizontal Throw @ Vt=50 PM	Maximum NC Level*	Maximum Return S.P. Loss (In. W.C.)
30	0.029	13 ft.	<20	0.011
40	0.053	15 ft.	<20	0.018
50	0.087	16 ft.	<20	0.027
60	0.123	19 ft.	24	0.038
70	0.170	20 ft.	30	0.050

   3) 36" Long Diffuser - 12" Wide Center Downblow:

Cfm/ft. Diffuser	Maximum Diffuser S.P. Loss (In. W.C.)	Maximum Horizontal Throw @ Vt=50 PM	Maximum NC Level*	Maximum Return S.P. Loss (In. W.C.)
30	0.020	13 ft.	<20	0.011
40	0.036	13 ft.	<20	0.018
50	0.056	17 ft.	<20	0.027
60	0.081	19 ft.	21	0.038
70	0.110	21 ft.	25	0.050

   4) 24" Long Diffuser - 8" Wide Center Downblow:

Cfm/ft. Diffuser	Maximum Diffuser S.P. Loss (In. W.C.)	Maximum Horizontal Throw @ Vt=50 PM	Maximum NC Level*	Maximum Return S.P. Loss (In. W.C.)

Cfm/ft. Diffuser	Maximum Diffuser S.P. Loss (In. W.C.)	Maximum Horizontal Throw @ Vt=50 PM	Maximum NC Level*	Maximum Return S.P. Loss (In. W.C.)
30	0.016	10 ft.	<20	0.011
40	0.029	12 ft.	<20	0.018
50	0.047	15 ft.	<20	0.027
60	0.068	18 ft.	20	0.038
70	0.094	19 ft.	25	0.050

*See Section 23 00 10 Paragraph titled "Equipment Noise and Vibration" for sound testing requirements.

2. Ceiling Supply Slot Diffuser "SD-B" (without center downblow or return section):
   a. Uninsulated 11" high side inlet slot type diffuser with length and nominal diffuser width as indicated on the Drawings. Provide an 8" round inlet for all diffuser lengths except 2' long diffusers shall have a 6" round inlet. The extended inlet collar shall be at least 2-1/2" long with a 1/8" high raised bead located approximately 1" from the inlet connection. The supply diffuser shall be installed above the ceiling between the ceiling tee bars as indicated on the Architectural Drawings. The supply slot diffuser shall have an internal fixed curved aerodynamic shaped outlet designed to provide the maximum amount of induced secondary room air. The aerodynamic supply air deflector shall be constructed of extruded aluminum and held in position by set screws at both ends of diffuser. No spot welding shall be visible on the face when installed. The supply air shall be discharged only horizontally along the ceiling toward the interior with the supply inlet positioned as indicated on the Drawings. The diffuser shall be designed, tested and constructed in a manner so as to comply with the performance criteria and sound level requirements specified hereinafter. The supply plenum shall be constructed of at least 24 gauge galvanized steel and shall be substantially supported and reinforced as required. The air volume, length and duct connection size shall be as indicated on the Drawings. The Outlet Manufacturer shall coordinate the attachment, support, etc., of the supply plenum with the Ceiling Subcontractor. The entire assembly shall be completely laboratory tested for air performance and acoustics as a unit at a laboratory in accordance with the procedures of ANSI/ASHRAE Standard 70-1991 using cold air as specified herein. The acceptability of the testing laboratory is subject to review by the Owner, Project Acoustical Consultant and the Engineer. All tests may be witnessed by the Owner, Project Acoustical Consultant and the Engineer. Six (6) certified copies of the air performance and acoustical performance test results shall be delivered to the Engineer and Project Acoustical Consultant for review. The test data shall be based on a 51ºF cooling air supply temperature and a 24ºF temperature differential. The unit tests are not required if previous tests were done and acceptable test data is available for the Engineer's review. The supply plenum shall be painted flat black on all interior surfaces and the exposed surfaces viewed from below the ceiling system shall be painted flat black.
   b. The "SD-B" diffuser shall be manufactured by one of the following:
      1) Nailor Model 59ND
      2) Price Industries Model TBD675
      3) Titus Model N-1
   c. The "SD-B" ceiling supply slot diffuser shall be designed to equal or exceed the following performance characteristics:
      1) 60" Long Diffuser:

Cfm/ft. Diffuser	Maximum Diffuser S.P. Loss (In. W.C.)	Maximum Horizontal Throw @ Vt=50 PM	Maximum NC Level*
30	0.031	13 ft.	<20
40	0.058	16 ft.	<20
50	0.090	18 ft.	23
60	0.130	20 ft.	25
70	0.182	21 ft.	30

      2) 48" Long Diffuser:

Cfm/ft. Diffuser	Maximum Diffuser S.P. Loss (In. W.C.)	Maximum Horizontal Throw @ Vt=50 PM	Maximum NC Level*

Cfm/ft. Diffuser	Maximum Diffuser S.P. Loss (In. W.C.)	Maximum Horizontal Throw @ Vt=50 PM	Maximum NC Level*
30	0.029	13 ft.	<20
40	0.053	15 ft.	<20
50	0.087	16 ft.	<20
60	0.123	19 ft.	24
70	0.170	20 ft.	30

3) 36" Long Diffuser:

Cfm/ft. Diffuser	Maximum Diffuser S.P. Loss (In. W.C.)	Maximum Horizontal Throw @ Vt=50 PM	Maximum NC Level*
30	0.020	13 ft.	<20
40	0.036	13 ft.	<20
50	0.056	17 ft.	<20
60	0.081	19 ft.	21
70	0.110	21 ft.	25

4) 24" Long Diffuser:

Cfm/ft. Diffuser	Maximum Diffuser S.P. Loss (In. W.C.)	Maximum Horizontal Throw @ Vt=50 PM	Maximum NC Level*
30	0.016	10 ft.	<20
40	0.029	12 ft.	<20
50	0.047	15 ft.	<20
60	0.068	18 ft.	20
70	0.094	19 ft.	25

*See Section 23 00 10 Paragraph titled "Equipment Noise and Vibration" for sound testing requirements.

3. Perimeter Ceiling Combination Supply/Return Slot Diffuser "SD-C" (downblown only):
   a. Uninsulated 11" high side inlet slot type diffuser with 2" wide top or side return section in rear of unit unless noted other-wise on the Drawings with length and nominal diffuser width as indicated on the Drawings. Provide an 8" round inlet for all diffuser lengths except 2' long diffusers shall have a 6" round inlet. The extended Inlet collar shall be at least 2-1/2" long with a 1/8" high raised bead located approximately 1" from the inlet connection. The supply diffuser shall be installed above the ceiling between the ceiling tee bars as indicated on the Architectural Drawings. The supply slot diffuser shall have an internal defector blade to blow only downward toward the floor. No spot welding shall be visible on the face when installed. The diffuser shall be designed, tested and constructed in a manner so as to comply with the performance criteria and sound level requirements specified hereinafter. The supply plenum shall be constructed of at least 24 gauge galvanized steel and shall be substantially supported and reinforced as required. The air volume, length and duct connection size shall be as indicated on the Drawings. The Outlet Manufacturer shall coordinate the attachment, support, etc., of the supply plenum with the Ceiling Subcontractor. The entire assembly shall be completely laboratory tested for air performance and acoustics as a unit at a laboratory in accordance with the procedures of ANSI/ASHRAE Standard 70-1991 using cold air as specified herein. The acceptability of the testing laboratory is subject to review by the Owner, Project Acoustical Consultant and the Engineer. All tests may be witnessed by the Owner, Project Acoustical Consultant and the Engineer. Six (6) certified copies of the air performance and acoustical performance test results shall be delivered to the Engineer and Project Acoustical Consultant for review. The test data shall be based on a 51ºF cooling air supply temperature and a 24ºF temperature differential. The unit tests are not required if previous tests were done and acceptable test data is available for the Engineer's review. The supply plenum shall be painted flat black on all interior surfaces and the exposed surfaces viewed from below the ceiling system shall be painted flat black.
   b. The "SD-C" diffuser shall be manufactured by one of the following:
      1) Nailor Model 59BSR
      2) Price Industries

3) Titus Model N-1-D

c. The "SD-C" ceiling supply slot diffuser shall be designed to equal or exceed the following performance characteristics:

1) 48" Long Diffuser:

Cfm/ft. Diffuser	Maximum Diffuser S.P. Loss (In. W.C.)	Maximum Horizontal Throw @ Vt=50 PM	Maximum NC Level*
30	0.015	7 ft.	<20
40	0.027	9 ft.	<20
50	0.043	10 ft.	<20
60	0.062	11 ft.	<20
70	0.087	12 ft.	20

*See Section 23 00 10 Paragraph titled "Equipment Noise and Vibration" for sound testing requirements.

4. Combination Plenum and Linear Slot "SD-D":
   a. Continuous linear slot diffusers shall fully integrate with the ceiling system and be constructed of 1/16-inch minimum extruded aluminum with continuous bar volume and deflection control damper for each slot. Provide continuous 26-gauge steel plenums with 1/2-inch acoustical lining sized as per manufacturer's recommendation above diffusers with supply air connections as indicated on the Drawings.
   b. Slot widths shall be as scheduled on the drawings.
   c. The slot diffusers shall have pattern controllers supported with spacer channels in 24-inch (nominal) increments the entire length of the slot. The pattern controllers shall allow infinite adjustments to the air stream at 24-inch intervals relative to the direction of the air stream as well as extending or reducing the air throw as may be required to satisfy job conditions and to provide draft-free air distribution. The slot diffuser shall maintain airflow across the ceiling and shall not "dump" even when airflow is reduced to 10 percent of design air quantities. Fixed of blade type pattern controllers are not acceptable.
   d. The slot diffusers and air plenum shall be tested as a composite assembly for air distribution and noise level performance in both the horizontal and vertical throw applications. All tests shall be conducted in accordance with ASHRAE 70, Edition 02, in a laboratory certified by the AHRI.
   e. Type "SD-D" Titus Model FlowBar JT

PART 3 EXECUTION

3.1 INSTALLATION

A. All air distribution equipment shall be installed in accordance with the latest industry standards, per the manufacturer's recommendations and as indicated on the Drawings.

3.2 FACTORY TESTING

A. All air distribution equipment shall be tested in accordance with the latest applicable industry standards and as specified herein.

B. The Owner and/or Engineer may observe the air distribution equipment for this Project under manufacture at the factory prior to shipment, if he so desires. The Mechanical Subcontractor shall notify the Owner and Engineer in writing at three (3) weeks prior to the production date.

3.3 FIELD TESTING

A. Prior to execution of field testing, submit test procedures, recording forms, and test equipment cut sheets to Engineer for review. Refer to Section 23 00 20 titled "Scope of Work" for "Scheduling Procedures".

B. Refer to Section 23 05 93 for additional testing requirements for air distribution equipment.

END OF SECTION