

## **SECTION 23 37 13 - AIR DISTRIBUTION DEVICES**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS:**

- A. The Conditions of the Contract and applicable requirements of Division 1, "General Requirements", and Section 23 01 00, "Mechanical General Provisions", govern this Section.

#### **1.2 DESCRIPTION OF WORK:**

- A. Work Included: Provide air distribution devices and accessories as specified, scheduled, and shown on the Drawings.
- B. Types: The types of air distribution devices required for the project include, but are not limited to:
  - 1. Ceiling diffusers.
  - 2. Registers and grilles.
  - 3. Light troffer boots.
  - 4. Linear slot diffusers.
  - 5. Perimeter supply/return slot diffusers.

#### **1.3 QUALITY ASSURANCE:**

- A. Manufacturers: Devices manufactured by Metal-Aire, Titus, Krueger, Anemostat/Waterloo, Aeronca, Carnes, or Barber-Coleman will be acceptable if the devices furnished comply with these Specifications, the conditions scheduled and are similar in appearance and performance to the units scheduled.
- B. NFPA Compliance: Comply with National Fire Protection Association (NFPA) Standard NFPA 90, as applicable to air diffuser construction and installation.
- C. Design Compliance: When directed by the Engineer, test air outlets to verify compliance with these Specifications. Perform all revisions required to comply with terminal velocity, noise level or maximum temperature variation requirements at no cost to the Owner or Engineer.
- D. Air Distribution Equipment: Maximum space temperature variation shall not exceed 2°F through the conditioned area from 2' above the floor, to 7' above the floor. The air outlets shall be selected by the manufacturer to suit the volume, throw and noise level scheduled as shown on the Drawings and maintain maximum terminal velocities of 50 fpm, unless otherwise indicated.

#### **1.4 SUBMITTALS:**

- A. Shop Drawing submittals shall include, but not be limited to, the following:
  - 1. Submit cutsheets on air devices clearly indicating all features, accessories, mounting provisions, throw, pressure drop, noise criteria, and other pertinent performance data clearly indicated.
  - 2. Submit dimensioned drawings for all custom and special dimension linear slot diffusers and air devices.
  - 3. Submit test data and results as specified herein. Test results shall be certified by an authorized officer of the company.
  - 4. Additional information as required in Section 23 01 00.

#### **1.5 PRODUCT DELIVERY, STORAGE AND HANDLING:**

- A. Deliver air distribution devices in factory-fabricated water-resistant wrapping.
- B. Handle air distribution devices carefully to avoid damage to material component, enclosure, and finish.
- C. Store air distribution devices in a clean, dry space and protect from the weather.

### **PART 2 - PRODUCTS**

#### **2.1 AIR DISTRIBUTION DEVICE GENERAL REQUIREMENTS:**

- A. General: Provide air distribution devices of the size, shape, and type, constructed of materials and components and with finishes as scheduled and shown on the Drawings. Grilles, registers and ceiling outlets shall be provided with sponge rubber or soft felt gaskets. If a manufacturer other than the one scheduled is used, the sizes shown on the Drawings shall be checked for performance, noise level, face velocity, throw, pressure drop, etc., before the submittal is made. Selections shall meet the manufacturer's own published data for the above performance criteria. The throw shall be such that the velocity at the end of the throw in the five foot occupancy zone will be not more than 50 fpm nor less than 25 fpm. Noise levels shall not exceed those published in the ASHRAE Guide for the type of space being served (NC level).
- B. Compatibility: Air distribution devices shall be fully compatible with the surfaces in which they are installed and shall be provided with all required mounting accessories for installation in the actual construction at the installation location.
- C. Finishes: All ceiling and wall mounted air devices shall be painted white or off white unless specified otherwise and all air devices shall be the same color. Where the factory finish on all devices is not the same as determined by the Architect/Engineer, then the Division 15 Contractor shall be responsible for coordinating field painting of air devices by the Division 9 Contractor. The Division 15 Contractor shall be responsible for all costs associated with painting of white or off white air devices. Special color painting of air devices shall be the responsibility of the Division 9 Contractor. The Architect/Engineer's decision on white color compatibility is final.
- D. Ceiling Diffusers: Provide diffusers with corrosion resistant treated surfaces and finished in off-white baked enamel unless otherwise specified, scheduled, or shown on the Drawings. Provide opposed volume control dampers with supply air diffusers where scheduled. Where applicable, provide adapters with diffusers to permit connection to round supply duct. Perforated diffuser may be used in retrofit installations only; beveled (step-down) style diffuser shall be used in new construction. The interior of all perforated plate diffusers shall be painted flat black. Perforated plate supply air diffusers shall have pattern control blades installed in the diffuser neck. Pattern controllers attached to the perforated plate are **not** acceptable. Provide concealed fastening on all ceiling diffusers.
- E. Registers and Grilles: Provide registers which contain a key-operated multilouvered opposed blade damper operable from the face side, unless scheduled otherwise. Supply air registers shall be of the double deflection type, unless scheduled. Return air grilles and registers shall have fixed face blades and match the face of the supply air registers, unless scheduled otherwise. Provide concealed fastening for all registers and grilles.
- F. Double-sided Light Troffer Boots (not allowed in new construction):
1. Troffer slot type diffusers shall consist of nominal 48" long supply plenums on each side of the lighting fixture, a cross-over duct connecting the two plenums, and a single oval duct side entry connection. The air volume shall be as scheduled or shown on the Drawings.
  2. The troffer boot manufacturer shall coordinate the attachment, shape, height, and similar features of the supply plenum with the manufacturer of the air handling troffer type lighting fixture specified in Division 23. The maximum combined height of the light and boot shall be 8" above finished ceiling. Each air troffer shall include an air pattern control device, if required, to coordinate with the lighting fixtures furnished. The lighting fixture and troffer boot assembly shall be designed to direct the supply air horizontally at the ceiling.
  3. The lighting fixture and troffer boot assembly shall be tested as a unit at the diffuser manufacturer's laboratory. Certified copies of the test results shall be delivered to the Engineer for review. The test data shall include AK factors for an Alnor velometer, diffuser static pressure drop, horizontal airflow, spread, sound data, and velocity profile for horizontal airflow at rates in 20 cfm increments from 60 to 200 cfm. Test data shall be based on a 55°F supply air temperature and 20°F temperature differential. Maximum leakage of the assembly shall not exceed 10% of design flow rate. Upon review of certified test results, the Engineer may require additional tests which will be witnessed by the Engineer, at no additional cost to the Owner or Engineer.
  4. The plenum shall be painted flat black on exposed and inner surfaces as viewed from below the ceiling system. Plenum shall be constructed of at least 26 gauge galvanized steel and shall be

substantially airtight, supported, and reinforced as required. **[The entire troffer shall be externally insulated with ductwrap insulation with a continuous vapor barrier.]**

5. The performance shall equal or exceed the following when mounted on the 2 x 4 light fixture specified in Division 16.

<u>CFM</u>	<u>PRESSURE DROP INCHES W.C.</u>	<u>THROW @ 50 FPM TERMINAL VELOCITY</u>	<u>N.C.*</u>
60	0.04	4'	Less than 20
100	0.07	6'	Less than 20
120	0.10	7'	Less than 20
160	0.17	8'	Less than 25
200	0.28	10'	Less than 35

\* Based on 10 dB room absorption.

G. Single Side Light Troffer (not allowed in new construction)::

- The single side troffer shall be similar to the double-sided light troffer boot, but shall have one supply plenum on the side of a light fixture, with a single 6" oval duct side entry connection. The maximum combined height shall not exceed 7" above finished ceiling.
- Test data shall be similar to that specified for the boot, except between 40 and 120 cfm. Performance shall equal or exceed the following when mounted on the 2 x 4 light fixture specified in Division 16.

<u>CFM</u>	<u>PRESSURE DROP INCHES W.C.</u>	<u>THROW @ 50 FPM TERMINAL VELOCITY</u>	<u>N.C.*</u>
40	0.04	3'	Less than 20
60	0.08	6'	Less than 20
80	0.14	8'	Less than 20
120	0.34	17'	Less than 40

\* Based on 10 dB room absorption.

H. High Induction Perimeter Supply/Return Slot Diffuser:

- Provide slot-type supply/return (where scheduled) diffuser with length and width scheduled or shown on the Drawings. The supply/return diffuser shall be installed above the ceiling and located as indicated on the Architectural and Mechanical Drawings. **[The perimeter supply linear boot diffusers shall have an internal, fixed, curved, aerodynamically shaped outlet designed to provide the maximum amount of induced secondary room air.]** The return air slot (where scheduled) shall be located so that the supply air pattern will not be affected. The supply air shall be discharged horizontally along the ceiling with a down discharge center section (where scheduled).
- 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. Diffuser shall be constructed of at least 24 gauge galvanized steel and shall be reinforced as required. The air volume, length and duct connection size shall be as scheduled or shown on the Drawings. The diffuser manufacturer shall coordinate the attachment, support, tee spacing, and similar features of the diffuser with the ceiling Subcontractor.
- The entire assembly shall be tested as a unit at the manufacturer's laboratory. Submit certified copies of the test results to the Engineer for review. The test data shall include AK factors for an Alnor velometer, sound data, diffuser static pressure drop, horizontal air throw, and drop for the air supply rates per lineal foot of diffusers indicated below. The test data shall be based on a 55°F air supply temperature, a 20°F temperature differential and an 85°F heating supply air temperature.

4. The diffuser shall be painted flat black on interior surfaces and the exposed surfaces as viewed from below the ceiling system shall be painted flat black **[the entire diffuser assembly shall be externally insulated with ductwrap insulation with a continuous vapor barrier]**.
5. The perimeter ceiling supply/return linear boot diffuser shall be similar to the Titus Model scheduled and detailed on the Drawings and shall be designed to equal or exceed the following performance characteristics:

<u>CFM/ LIN. FT. DIFFUSER</u>	<u>MAX. DIFFUSER STATIC PRESSURE LOSS - IN W.C.</u>	<u>THROW @ 50 FPM TERMINAL VELOCITY</u>	<u>NC LEVEL*</u>
<u>Titus Nova Model - N1/N1D (R with Return Slot)</u>			
30	0.1	7'	Less than 20
40	0.1	14'	Less than 23
50	0.1	17'	Less than 30
60	0.15	19'	Less than 34
70	0.20	21'	Less than 38
<u>Titus Nova Model - N4/N4D (R with Return Slot)</u>			
30	0.010	16'	Less than 20
40	0.15	19'	Less than 26
50	0.20	22'	Less than 33

\* Based on 10 dB room absorption.

6. The Engineer will have the option to witness additional tests after receipt of certified test results to verify compliance with these Specifications.

## 2.2 AIR DISTRIBUTION DEVICES:

- A. Perforated Plate Type [ ] Supply Air Devices (retrofit only): Devices shall be aluminum/steel construction with an aluminum face and aluminum or steel pans. Frames shall have mitered corners and be suitable for lay-in installation. Perforated faces shall have a concealed hinge mechanism such that the plate remains attached to the frame when opened. Exposed external parts shall have a factory applied white or off-white baked enamel finish. Visible internal parts shall be factory painted flat black. All steel components shall be fully phosphatized prior to painting and there shall be no unpainted steel parts. Diffusers shall incorporate internal pattern control louvers. The use of pattern control devices attached to the perforated plate is not acceptable. Air devices shall be 4-way diffusion pattern unless noted otherwise on the drawings. An opposed blade balancing damper shall be provided where scheduled. Device neck size shall be as shown on the drawings. Air device frame shall be suitable for use with the ceiling in which the device is installed. Metal-Aire Series 7000 PCS-AB-6, J and J Model 1200 or Krueger Model 1100.
- B. Perforated Plate Type [ ] Supply Air Devices (retrofit only): Devices shall be aluminum/steel construction with an aluminum face and aluminum or steel pans. Frames shall have mitered corners and be suitable for concealed fastener surface installation. Perforated faces shall have a concealed hinge mechanism such that the plate remains attached to the frame when opened. Exposed external parts shall have a factory applied white or off-white baked enamel finish. Visible internal parts shall be factory painted flat black. All steel components shall be fully phosphatized prior to painting and there shall be no unpainted steel parts. Diffusers shall incorporate internal pattern control louvers. The use of pattern control devices attached to the perforated plate is not acceptable. Air devices shall be 4-way diffusion pattern unless noted otherwise on the drawings. An opposed blade balancing damper shall be provided where scheduled. Device neck size shall be as shown on the drawings. Air device frame shall be suitable for use with the ceiling in which the device is installed. Metal-Aire Series 7000 PCS-AB-1, J and J Model 1200 Series or Krueger Model 1100 Series.
- C. Perforated Plate Type [ ] Supply Air Devices (retrofit only): Devices shall be aluminum/steel construction with an aluminum face and aluminum or steel pans. Frames shall have mitered corners. Perforated faces shall have a concealed hinge mechanism such that the plate remains attached to the

frame when opened. Exposed external parts shall have a factory applied white or off-white baked enamel finish. Visible internal parts shall be factory painted flat black. All steel components shall be fully phosphatized prior to painting and there shall be no unpainted steel parts. Diffusers shall use deflectors attached to the perforated plate in a secure manner to control pattern. Air devices shall be 4-way diffusion pattern unless noted otherwise on the drawings. An opposed blade balancing damper shall be provided where scheduled. Device neck size shall be as shown on the drawings. Air device frame shall be suitable for use with the ceiling in which the device is installed. Titus Type PAS, Metal-Aire Series 7500 or J and J Model 1235.

- D. Perforated Plate Type [ ] Exhaust and Return Air Devices (retrofit only): Devices shall be aluminum/steel construction with an aluminum face and aluminum or steel pans. Frames shall have mitered corners. Perforated faces shall have a concealed hinge mechanism such that the plate remains attached to the frame when opened. Exposed external parts shall have a factory applied white or off-white baked enamel finish. Visible internal parts shall be factory painted flat black. All steel components shall be fully phosphatized prior to painting and there shall be no unpainted steel parts. An opposed blade balancing damper shall be provided where scheduled. Device neck size shall be as shown on the drawings. Air device frame shall be suitable for use with the ceiling in which the device is installed. Titus Type PAR, Metal-Aire Series 7000 PCR-AB-6, J and J Model AL-1290 Series or Krueger Model 1190 Series.
- E. Perforated Plate Type [ ] Exhaust and Return Air Devices (retrofit only): Devices shall be aluminum/steel construction with an aluminum face and aluminum or steel pans. Frames shall have mitered corners and be suitable for concealed fastener surface installation. Perforated faces shall have a concealed hinge mechanism such that the plate remains attached to the frame when opened. Exposed external parts shall have a factory applied white or off-white baked enamel finish. Visible internal parts shall be factory painted flat black. All steel components shall be fully phosphatized prior to painting and there shall be no unpainted steel parts. An opposed blade balancing damper shall be provided where scheduled. Device neck size shall be as shown on the drawings. Air device frame shall be suitable for use with the ceiling in which the device is installed. Metal-Aire Series 7000 PCR-AB-1, J and J Model AL-1290 Series or Krueger Model 1190 Series.
- F. Louver Face Type [ ] Square Ceiling Supply Diffusers: Diffusers shall be all aluminum construction with mitered corner V-bevel border style surface frames suitable for use with the ceiling in which it is installed. The entire grille shall have a factory applied white or off-white baked enamel finish. Air devices shall be 4-way diffusion pattern unless noted otherwise on the drawings. An opposed blade balancing damper shall be provided where scheduled. Device neck size shall be as shown on the Drawings. Metal-Aire Series 5000 M-2, J and J Model 1100 (aluminum), Krueger Series SH or Titus Model TDC-AA Series.
- G. Louver Face Type [ ] Square Ceiling Supply Diffusers: Diffusers shall be all aluminum construction with mitered corner frames suitable for lay-in mounting. The entire grille shall have a factory applied white or off-white baked enamel finish. Air devices shall be 4-way diffusion pattern unless noted otherwise on the drawings. An opposed blade balancing damper shall be provided where scheduled. Device neck size shall be as shown on the drawings. Metal-Aire Series 5000 M-6, J and J Model 1100 Series (aluminum), Krueger Series SH or Titus Model TDC-AA Series.
- H. Linear Slot Type [ ] Air Devices: Devices shall be continuous, extruded aluminum slot diffusers with mitered corners. Diffusers shall have 3/4" slots as scheduled and shall have extruded aluminum pattern control blades (supply slots only). Diffuser mounting frames shall be suitable for use with the ceiling in which the diffuser is installed. The entire diffuser (except pattern control blades) shall have a factory applied **[clear anodized aluminum] [white or off-white baked enamel]** finish. The pattern control blades shall have a factory applied flat black baked enamel finish. Slot diffusers shall have concealed mounting hardware. Provide insulated supply air plenums as shown on the Drawings. Titus Type ML-38 (supply slot)/MLR-38 (return slot), Metal-Aire Model 6075 (supply and return slots) or J and J Model 2070 (supply and return slots).
- I. Linear Slot Type [ ] Air Devices: Devices shall be continuous, extruded aluminum slot diffusers with mitered corners. Diffusers shall have 1/2" slots with 0 degrees or 15 degrees deflection as scheduled and shall be suitable for use the ceiling, wall or floor type in which the diffuser is installed. The entire diffuser shall have a factory applied **[clear anodized aluminum] [white or off-white baked**

**enamel**] finish. The pattern control blades shall have a factory-applied flat black baked enamel finish. Slot diffusers shall have concealed mounting hardware and mitered corners. Provide insulated supply **[and return]** air plenums as shown on the Drawings. Titus **[CMT-15] [CT-25]** (0 degrees deflection)/ **[CMT-16] [CT-26]** 15 degrees deflection), Metal Air Series 2100 or J and J Model 2500.

- J. Linear Slot Type [ ] **Air Devices:** Devices shall be high induction, side inlet slot diffusers with length and neck size as scheduled or shown on the Drawings. The diffusers shall have an aerodynamically designed, venturi-shaped air outlet designed to direct supply air horizontally across the ceiling and to provide maximum aspiration and entrainment of room air. The supply air shall maintain a ceiling pattern with varying volumes of air to minimum flow. The diffuser shall have a maximum height of 9" and shall be completely supported by two ceiling tee's on nominal 2-3/4" centers. The diffuser shall be constructed of minimum 24 gauge nonrusting steel and all surfaces exposed to view below the ceiling shall be painted flat black. **[Diffusers shall be factory-insulated with external ductwrap insulation with a continuous vapor barrier.]** Titus Nova **[N-1-8] [N-1-9] [N-4-8]** Series.
- K. Linear Slot Type [ ] **Air Devices:** Devices shall be high induction, side inlet, supply/return air slot diffusers with length and neck size as shown on the drawings. The diffusers shall have an aerodynamically designed, venturi shaped air outlet designed to direct supply air horizontally across the ceiling and to provide maximum aspiration and entrainment of room air and 2" outside return air slot to draw return air over the back and top of the diffuser to improve induction and minimize outside wall effect. The supply air shall maintain a ceiling pattern with varying volumes of air to minimum flow. The diffuser shall have a maximum height of 9" and shall be completely supported on two ceiling tee's on nominal 5-1/4" centers. The diffuser shall be constructed of minimum 24 gauge nonrusting steel and all surfaces exposed to view below the ceiling shall be painted flat black. **[Diffusers shall be factory-insulated with external ductwrap insulation with a continuous vapor barrier.]** Titus Nova **[N-1-8R] [N-1-9R] [N-4-8R]** Series.
- L. Linear Slot Type [ ] **Air Devices:** Devices shall be high induction, side inlet slot diffusers with length and neck size as shown on the drawings. The diffusers shall have an aerodynamically designed, venturi shaped air outlet designed to direct supply air from the ends of the diffuser horizontally across the ceiling and to provide maximum aspiration and entrainment of room air. The supply air shall maintain a ceiling pattern with varying volumes of air to minimum flow. Supply air from the center section shall be in a downward vertical throw pattern. The diffuser shall have a maximum height of 9" and shall be completely supported by two ceiling tee's on nominal 2-3/4" centers. The diffuser shall be constructed of minimum 24 gauge nonrusting steel and all surfaces exposed to view below the ceiling shall be painted flat black. **[Diffusers shall be factory-insulated with external ductwrap insulation with a continuous vapor barrier.]** Titus Nova **[N-1-D] [N-4-D]** Series.
- M. Linear Slot Type [ ] **Air Devices:** Devices shall be high induction, side inlet slot diffusers with length and neck size as shown on the drawings. The diffusers shall have an aerodynamically designed, venturi shaped air outlet designed to direct supply air from the ends of the diffuser horizontally across the ceiling and to provide maximum aspiration and entrainment of room air and a 2" outside return air slot to draw return air over the back and top of the diffuser to improve induction and minimize outside wall effect. The supply air shall maintain a ceiling pattern with varying volumes of air to minimum flow. Supply air from the center section shall be in a downward vertical throw pattern. The diffuser shall have a maximum height of 9" and shall be completely supported by two ceiling tee's on nominal 5-1/4" centers. The diffuser shall be constructed of minimum 24 gauge nonrusting steel and all surfaces exposed to view below the ceiling shall be painted flat black. **[Diffusers shall be factory-insulated with external ductwrap insulation with a continuous vapor barrier.]** Titus Nova **[N-1-DR] [N-4-DR]** Series. Linear slot Type [ ] air devices shall be Tee bar mounted adjustable pattern, side inlet slot diffusers with length and neck size as shown on the drawings. Slots shall be constructed of galvanized steel with exposed surfaces painted flat black. **[Diffusers shall be factory-insulated with internal duct liner insulation.]** Slot diffusers shall be designed to deliver scheduled cfm directed horizontally across the ceiling with a maximum pressure drop of 0.25" while not exceeding NC30 based upon a room absorption of 10 dB, RE 10<sup>-12</sup> watts. Slot performance shall be certified by independent lab testing. Titus Style TBD, Metal-Aire Series PD, Krueger Model TBS or J and J Series PSD.

- N. Type [ ] Troffer Supply Boots: Boots shall be low leakage dual outlet type with suitable for use with the light troffers installed on the project. Troffer boot inlet neck size shall be as shown on the drawings. Each troffer boot shall consist of a supply plenum on each side of the light fixture with a crossover plenum and duct connection. The plenums shall be **externally** insulated at the factory and shall be factory painted flat black on exposed and inner surfaces visible from below the ceiling. Plenums shall be minimum 24 gauge galvanized steel and shall be airtight, with alignment tabs and a stiffening flange on each side. The troffer boot manufacturer shall coordinate attachment and design of the troffer boot with the furnished light fixtures such that the troffer and boot combination will direct the supply air horizontally across the ceiling with minimum leakage. **[A sample troffer supply boot shall be tested in an independent lab in Houston, Texas to verify proper supply air performance and distribution with the light troffers actually furnished on the project.]** Titus LTTI/LPTI Type or approved equal.
- O. Type [ ] Troffer Supply Boots: Boots shall be low leakage single outlet type with suitable for use with the light troffers installed on the project. Troffer boot inlet neck size shall be as shown on the drawings. Each troffer boot shall consist of a supply plenum on one side of the light fixture with a duct connection. The plenums shall be **[internally] [externally]** insulated at the factory and shall be factory-painted flat black on exposed and inner surfaces visible from below the ceiling. Plenum shall be minimum 24 gauge galvanized steel and shall be airtight, with alignment tabs and a stiffening flange. The troffer boot manufacturer shall coordinate attachment and design of the troffer boot with the furnished light fixtures such that the troffer and boot combination will direct the supply air horizontally across the ceiling with minimum leakage. **[A sample troffer supply boot shall be tested in an independent lab in Houston, Texas to verify proper supply air performance and distribution with the light troffers actually furnished on the project.]** Titus LTTI/LPTI Type or approved equal.
- P. Louver Face Type [ ] Wall Supply Grilles: Grilles shall be all aluminum construction with 3/4" airfoil double deflection blades, mitered frames and an opposed blade balancing damper where scheduled or shown on the Drawings. Grilles shall be suitable for mounting in the wall type in which it is installed. The entire grille shall have a factory applied white or off-white baked enamel finish. Grilles shall have concealed mounting hardware and shall be provided with flush mounting frames where scheduled or required for the installation detailed on the Architectural Drawings. Titus 272-FS5-B-C-25, Metal-Aire Series 4000 VHD, J and J Model 990V-OB-ALuminum or Krueger Series 5880-V-OB.
- Q. Louver Face Type [ ] Wall Return Grilles: Grilles shall be all aluminum construction with 3/4" airfoil double deflection blades, mitered frames and an opposed blade balancing damper where scheduled or shown on the Drawings. Grilles shall be suitable for mounting in the wall type in which it is installed. The entire grille shall have a factory-applied white or off-white baked enamel finish. Grilles shall have concealed mounting hardware and be provided with flush mounting frames where required. Titus 3-FL, Metal-Aire Series 4000 Series, J and J 900 Aluminum Series or Krueger Series 5800.
- R. Lay-in Slot Diffuser Type [ ] Return Air Devices: Devices shall be aluminum/steel construction painted to match ceiling tee's and with perimeter slots as scheduled and provisions for installation of a ceiling tile in the center of the device. Donn Air Diffuser with plenum.
- S. Type [ ] Slot Return Air Boots: Boots shall be minimum 24 gauge galvanized sheet metal, constructed as detailed on the Drawings. The entire boot shall be painted flat black and shall have an appearance similar to the project supply air slot diffusers when installed.
- T. Type [ ] Slot Blankoff: Blankoff shall be minimum 24 gauge galvanized sheet metal, constructed as detailed on the Drawings. The entire blankoff shall be painted flat black and shall have an appearance similar to the project supply air slot diffusers when installed.
- U. Type [ ] Light Cove Supply Air Boot: Insulated 4'supply air boot for use with the Light Cove System supply/exhaust slot system provided for the project. Anemostat or approved equal.
- V. Type [ ] Light Cove Exhaust Boot: 4'exhaust boot for use with the Light Cove System supply/exhaust slot system provided for the project. Anemostat or approved equal.
- W. Type [ ] Garage Supply/Exhaust Grilles: Grille shall consist of a framed mesh grille in the CMU wall opening as detailed on the Architectural Drawings and furnished under another Division. This

Division to provide a framed sliding blade guillotine type damper with screw stops on the plenum side of each CMU opening.

- X. Louver Face Type [ ] Wall and Ceiling Return/Exhaust Grilles: Grilles shall be all aluminum construction with 45° louvers on 1/2" centers, mitered frames and an opposed blade balancing damper where scheduled. Grilles shall be suitable for mounting in the wall or ceiling type in which it is installed. The entire grille shall have a factory applied white or off-white baked enamel finish. Grilles shall have concealed mounting hardware. Titus Core 4-FL5-B-C-25, Metal-Aire Model RHD, J and J Model 590-H-OBd or Krueger Model S585-H-OBd.
- Y. Louver Face Type [ ] Wall and Ceiling Return/Exhaust Grilles: Grilles shall be all steel construction with 30 degree curved blades on 1/2" centers, mitered frames and an opposed blade balancing damper where scheduled. Grilles shall be suitable for mounting in the wall or ceiling type in which it is installed. The entire grille shall have a factory applied white or off-white baked enamel finish. Grilles shall have concealed mounting hardware. Titus Core 25-RL5-B-C025 or an approved equal.
- Z. Grid Face Type [ ] Wall and Ceiling Supply, Return and Exhaust Grilles: Grilles shall all aluminum construction with a 1/2" x 1/2" x 1" grid face, mitered frame and an opposed blade balancing damper where specified. Grilles shall be suitable for mounting in the wall or ceiling type in which it is installed. The entire grille shall have a factory applied white or off-white baked enamel finish. Grilles shall have exposed screw mounting hardware. Titus Core 51F05-O-A-25, Metal-Aire Model CC-5-D, J and J Model ALEC-5-OBd or Krueger Model EGC-5-OBd.
- AA. Perforated Plate Type [ ] Supply Air Devices: Devices shall be all steel construction and shall be UL listed for use in the floor/ceiling and roof/ceiling assemblies specified for the project. Frames shall have mitered corners. Perforated faces shall have a concealed hinge mechanism such that the plate remains attached to the frame when opened. Exposed external parts shall have a factory applied white or off-white baked enamel finish. Visible internal parts shall be factory painted flat black. All steel components shall be fully phosphatized prior to painting and there shall be no unpainted steel parts. Diffusers shall use deflectors attached to the perforated plate in a secure manner to control pattern. Air devices shall be 4-way diffusion pattern unless noted otherwise on the drawings. Air devices shall be provided with all required dampers, thermal links and ceramic fiber blankets. Ceramic fiber blankets shall be enclosed in an approved mesh material to allow easy handling of the blankets. Device neck size shall be as shown on the drawings. Air device frame shall be suitable for use in the ceiling in which the device is installed and shall be supported in accordance with UL requirements. Refer to Radiation Damper requirements hereinbelow for additional requirements. Titus Type PAS with Ruskin CFD5 Diffuser Radiation Damper, or J and J Model 1235 with Ruskin CFD5 Diffuser Radiation Damper.
- BB. Perforated Plate Type [ ] Exhaust and Return Air Devices: Devices shall be all steel construction and shall be UL-listed for use in the floor/ceiling and roof/ceiling assemblies specified for the project. Frames shall have mitered corners. Perforated faces shall have a concealed hinge mechanism such that the plate remains attached to the frame when opened. Exposed external parts shall have a factory applied white or off-white baked enamel finish. Visible internal parts shall be factory painted flat black. All steel components shall be fully phosphatized prior to painting and there shall be no unpainted steel parts. Air devices shall be provided with all required dampers, thermal links and ceramic fiber blankets. Ceramic fiber blankets shall be enclosed in an approved mesh material to allow each handling of the blankets. Device neck size shall be as shown on the drawings. Air device frame shall be suitable for use with the ceiling and which the device is installed and shall be supported in accordance with UL requirements. Refer to Radiation Damper requirements hereinbelow for additional requirements. Titus Type PAR with Ruskin CFD5 Diffuser Radiation Damper or J and J Model AL-1290 with Ruskin CFD5 Diffuser Radiation Damper.
- CC. Linear Slot Type [ ] Air Devices: Devices shall be Tee bar mounted adjustable pattern, side inlet slot diffusers and shall be UL-listed for use in the floor/ceiling and roof/ceiling assemblies specified for the project. Slot length and neck size shall be as shown on the drawings. Slot diffusers shall be constructed of galvanized steel and shall be provide with required thermal links and ceramic fiber blankets. All exposed diffusers surfaces shall be painted flat black. **[Diffusers shall be factory-insulated with internal duct liner insulation.]** Ceramic fiber blankets shall be enclosed in a



approved mesh material to allow easy handling of the blankets. Slot diffusers shall be designed to deliver scheduled cfm directed horizontally across the ceiling with a maximum pressure drop of 0.25" while not exceeding NC30 based upon a room absorption of 10 dB, RE 10<sup>-12</sup> watts. Slot performance shall be certified by independent lab testing. Slot diffusers shall be installed and supported in accordance with UL requirements. Continental **[UAN]** **[UDN]** or Nailor-Hart **[5591]** **[5592]**.

- DD. Type [ ] Security Grilles: Grilles shall be all aluminum construction with mitered frames, concealed fastenings and rectangular bar louvers. Grilles shall be factory modified for proper mounting in the ceiling or wall type in which they are installed. Grille shall have an clear anodized finish. Grilles shall be directly supported from the building structure where the mounting surface does not provide an adequate structure to properly install the grille. Titus SG-15500, Metal-Aire Model 2000 SG-1 or J and J Model S590-3H-SG.
- EE. Type [ ] Operating Room Ceiling Supply Laminar Flow Diffusers: Diffusers shall be all aluminum construction using aluminum extrusions for framing. Framing shall be of a design such that through the application of solid plates, two separate plenums shall be formed. Air shall be admitted to the initial plenum through a side mounted oval collar. The inlet collar shall have a control mechanism, accessible behind the faceplate, to meter the air volume admitted to the upper plenum chamber. Air shall then pass through air diffusion devices in a secondary plate into the lower plenum where it is forced by pressure displacement through the diffuser perforated faceplate. The housing shall have an extruded aluminum frame with all corners continuous heli-arc welded to form an air tight shell. The perforated final diffusion faceplate shall be 14 gauge aluminum, perforated with 16% free area in a square pattern. The faceplate shall be held in place in the housing frame with an aluminum mounting with mitered and backwelded corners. The faceplate shall be attached with flush quarter-turn fasteners to allow access for balancing and filter changeout. Vinyl coated stainless steel cable safety retainers shall be provided to prevent dropping of the faceplate assembly during disassembly. The housing frame shall be suitable for use with a plaster/drywall or lay-in ceiling as shown on the Drawings. The actual mounting type shall be coordinated with the ceiling type as shown on the Architectural Drawings. The entire diffuser housing shall be finished with a white baked glass epoxy enamel. During operation of the diffuser assembly there shall be zero aspiration at the face of the perforated plate and velocities in the plane of the perforated plate shall vary no more than 10% when tested with a velometer directly to the face of the plate, to establish a uniformity of air discharge. Operating room ceiling supply laminar flow diffuser shall be Precision Air Products Series PATQ or an approved equal.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION:**

- A. General: Install air distribution devices in accordance with manufacturer's written instructions and recognized industry practices to ensure that products serve intended functions.
- B. Coordination: Coordinate with other trades, including ductwork, and ductwork accessories, as necessary to interface air distribution devices properly with other work.
- C. Locations: Locations of air distribution devices shown on Drawings are approximate and shall be coordinated with other trades to make symmetrical patterns and shall be governed by the established pattern of the lighting fixtures. Where air distribution devices are installed in acoustical tile and other ceilings they shall be either centered on tile or ceiling joints as directed by Architect at job site. Coordinate location of all ceiling air devices with Architectural reflected ceiling plans. **[All devices installed in UL floor/ceiling or roof/ceiling assemblies shall be compatible with the assembly specified on the Architectural Drawings.]**
- D. Mounting Provisions: Coordinate mounting provisions and accessories required for proper installation of air devices in finish and construction at the point of installation. Refer to details on the Mechanical and Architectural Drawings for special installation details and provide all mounting accessories shown or required for the complete and proper installation of each air device.
- E. Accessories: Where scheduled, the grilles, registers and ceiling outlets shall be provided with deflecting devices and manual balancing damper. These devices shall be the standard product of the manufacturer, subject to review by the Architect, and equal to brand scheduled.

- F. Insulation: Refer to Section 23 07 00, "System Insulation", for field insulation of air devices, where required.
- G. Security Air Devices: Tamper resistant air devices in Secure Areas shall be installed in accordance with Manufacturer's recommendations for the construction types used on the project. In all cases, tamper resistant air devices shall be securely mounted to the building construction.

3.2 BALANCING ACCESSORIES:

- A. General: Employ factory-calibrated balancing cones for use in air balancing all types of ceiling outlets, linear diffusers or any other special outlet. All cones shall be calibrated for use with Alnor velometer and identified with airflow factors permanently indicated on the sides of the cones.

3.3 FIELD QUALITY CONTROL:

- A. Test: Test installed devices to demonstrate satisfactory compliance with specified and indicated requirements.
- B. Adjustment: Adjust air distribution devices to provide air distribution patterns shown on the drawings or required.
- C. Air Balancing: Balance the airflow through each air device to the volumes shown on the Drawings. Refer to Section 23 05 93 for additional balancing requirements.

**END OF SECTION 23 37 13**