SECTION 233714 - INTEGRATED LAMINAR CEILING SYSTEM INTEGRATION WITH UNISTRUT WITH HEPA-FILTERED DIFFUSER TYPE

1. GENERAL

1.1 SUMMARY

1. Section includes integrated laminar ceiling systems coordinated and provided by a single manufacturer which includes laminar flow diffusers, fill-in/blank panels, and integrated ceiling grid with gasketing to support all components within system, and light fixtures (supplied by Division 26).
2. Coordinate with Architectural, Structural and MEP drawings.

1.2 Description of Work

1. Provide Integrated Laminar Ceiling System(s) as specified herein and as shown on the Contract Drawings.

1.3 Reference Codes and Standards

1. ANSI/ASHRAE 70-1991: Method of Testing for Rating the Performance of Air Outlets and Inlets.
2. ANSI/ASHRAE 113-1990: Method of Testing for Room Air Diffusion.
3. ASHRAE Fundamentals and Applications Handbooks - Chapters on Sound and Vibration Control Fundamentals and Control.
4. ANSI/ASHRAE/ASHE Standard 170-2013 - Ventilation of Health Care Facilities.
5. FGI (Facilities Guidelines Institute) Guidelines for Design and Construction of Hospitals and Outpatient Facilities – 2014.

1.4 Quality Assurance

1. The manufacturer shall have published acoustical data for specified air terminal within range of operating conditions. NC level by octave band to be available upon request.
2. Air terminal NC ratings shall be based on a room effect of 10 dB maximum.

1.5 Submittals

1. A line item confirmation of compliance with the spec must be included with submittal.
2. Shop Drawings shall include construction materials, fabrication details, finishes, dimensions, outlet design, air pattern settings, and installation details. Submit dimensioned shop drawings including reflected ceilings detailing locations of diffusers, diffuser air volumes specific to each room, blank-off panels, grid style lights and all ceiling-mounted booms (surgical light(s), equipment booms, anesthesia column(s)/boom(s)) and ceiling-mounted imaging equipment rails, ceiling-level Unistrut lengths and locations relative to imaging system isocenter.) Shop drawings to include framing system suspension details including project-specific substrate attachment details, framing section details, elevation views, dimensioned rough hard gypsum ceiling opening(s), equipment boom centerlines as required for trade coordination with Division 5 supplied structural boom supports and Owner-supplied imaging system.
3. Submit CAD file of coordinated ceiling plan including all ceiling-mounted equipment to GC for review and trade coordination.
4. Coordination and Review of Related Submittals:
5. Integrated Laminar Ceiling System (ICS) Manufacturer shall review lighting submittals sent by GC for fit/function of grid style lights and downlights (if applicable) within ceiling system and advise GC and/or Architect of any issues with light style or dimensions which would prohibit fit/function within the ICS as shown on plans.
6. Manufacturer to review project-specific imaging system drawings and coordinate locations of all ceiling-mounted electrical boxes, intercoms, any required penetrations within blank-off panels of sufficient size to accept ceiling-mounted components.
7. If booms are located within the Integrated Laminar Ceiling System (ICS), ICS Manufacturer shall review surgical light, anesthesia column, and equipment boom submittals and Pre-Installation Instructions to coordinate best fit of boom soffits or covers within the ICS. GC shall coordinate with ICS Manufacturer’s local manufacturer’s rep providing ICS Manufacturer with documents for review.
8. ICS Manufacturer shall review Unistrut support system submittals provided by GC and advise of conflicts which prohibit installation of ceiling-mounted components and advise GC and/or Architect of conflicts which would prohibit installation of ceiling-mounted components.
9. Product Data - Submit schedule and manufacturer’s data for air outlets and inlets including type, size, location; neck size, velocity profile, and noise level (NC) chart.

1.6 DELIVERY, STORAGE AND HANDLINGs

1. Deliver ceiling components to project site in original, unopened packages and store them in fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination or other causes.
2. HEPA filters shall be stored in conditions as detailed and specified herein under 3.2.
3. Handle ceiling components carefully to avoid damaging components in any way.

1.7 JOB CONDITIONS

1. Space Enclosure: Do not install ceilings until space is enclosed and weatherproof, and until wet-work in space is completed and nominally dry, and until work above ceilings is completed, and until ambient conditions of temperature and humidity will be continuously maintained at values near those indicated for final occupancy.
2. PRODUCTS

### ACCEPTABLE MANUFACTURER

1. Precision Air. No exceptions or alternates will be accepted without prior pre-submittal approval by engineer.  Contractors offering manufacturers other than basis of specification, whether listed as acceptable equal or not, shall submit a line item comparison stating specific deviations from specification at time of bid. Contractor shall be responsible for any cost difference to meet above specification even if alternates are approved by engineer.
2. Manufacturer must be able to clearly demonstrate a minimum of 10 years of applying integrated ceiling systems to critical environment rooms requiring ceiling-mounted imaging equipment.
3. Refer to 1.5 for special submittal requirements.

### Integrated Ceiling System wITH HEPA DIFFUSERS for Unistrut Integration

1. Integrated Ceiling System shall be an integrated system coordinated and provided by a single manufacturer. Each system (ICS) shall consist of laminar flow diffusers with room-side replaceable HEPA filters, blank panels, and integrated ceiling grid with ceiling level Unistrut Integration to support system components including adjacent light fixtures (supplied by Division 26).
2. Refer to Integrated Laminar Ceiling System Ventilation Schedule within Mechanical Schedule Sheet for reference to Integrated Ceiling System Type by room number including diffuser type, total supply air volume, and coordination notes.

2.3 HEPA-FILTERED DIFFUSERS

1. Diffuser shall be ASHRAE Group E, non-aspirating laminar flow type in accordance with ASHRAE Standard 170 for Operating Rooms.
2. The upper plenum, or pressure chamber, shall be constructed of 0.063” aluminum with all mating surfaces continuously welded and internally sealed. The upper plenum shall form a knife edge seal with the filter’s gel. Manufacturer shall provide four (4) aluminum support lugs on the sides of diffuser plenum for independent suspension from above.
3. Top inlet collar with air balancing mechanism shall be internal and room-side adjustable. Internal or external opposed blade or butterfly dampers are not allowed.
4. The face frame assembly shall be constructed of extruded aluminum with mitered continuously welded and internally-sealed corners.
5. The face frame assembly shall align with upper plenum’s knife edge to form a dual knife edge seal with the filter’s gel to ensure an airtight seal, allowing no air to bypass around the filter media. A design whereby the “knife edge” is mechanically fastened or otherwise attached to the plenum box is not allowed. Installed filters shall be held firmly in place by means of hardware assemblies consisting of stainless steel filter clips, nuts, and bolts as provided by diffuser manufacturer.
6. Assembly shall allow HEPA filter installation and service from room side of diffuser. Diffuser design must allow 2.25” min. clearance between filter media and faceplate in order to minimize risk of room-side filter contamination.
7. Perforated faceplate shall be .050" aluminum and perforations to be 16% open area. Manufacturer shall provide vinyl-coated stainless steel cable safety retainers on two opposite sides to prevent accidental dropping of faceplate. The diffuser perforated faceplate shall be installed in an extruded aluminum mounting frame with mitered back-welded corners.
8. All exposed surfaces including border trim shall have finish of white baked enamel of suitable quality to withstand typical cleaning solutions and normal scrubbing commonly used in hospital operating rooms.***OPTIONAL FINISH:*** 204-R1 clear anodized aluminum.
9. Inlet collar and faceplate shall be covered with removable self-adhesive protective film to prevent construction dust from entering diffuser prior to installation.

***OPTIONAL FACTORY INSULATION ($):***

1. Manufacturer shall insulate the laminar flow diffuser with 1-1/2" duct wrap FSK-backed insulation of 0.75lb/c. ft. density to prevent heat gain and condensation.

***optional FILTER LOAD INDICATOR LIGHT ON DIFFUSER FACEPLATE, add ($):***

K. One diffuser per room shall include a red LED indicator light factory-mounted in corner of perforated faceplate. Indicator light shall be connected to factory-preset pressure switch with project-specific setpoint to be calculated by manufacturer. 24VAC power supply required shall be furnished and connected by others.

***OR, optional PORTS FOR ACCEPTANCE OF A PRESSURE TRANSDUCER WIRED TO BAS, ADD ($):***

L. Manufacturer shall factory install (2) ports in diffuser plenum to accept pressure monitoring tubing, one above filter, one below filter. Provide ports in only one diffuser per room. Ports shall be installed in the side of the diffuser plenum and be coordinated with other diffusers and components in the ceiling array to be accessible for ¼” tubing connection in the field. Pressure transducer to be supplied and wired to BAS by Division 26 Low-Voltage Controls Contractor.

***OPTIONAL DIFFUSERS WITH SIDE (or end) oval inletS ($), replace OR ADD TO 2.3, C.:***

1. Air shall be admitted through an oval inlet collar located on side (or end) of the upper plenum. ***SPECIFIER/DESIGNER NOTE:*** This option does not allow space within diffuser for internal volume adjustment valve. Elongated oval inlet reduces inlet area. Contact manufacturer for assistance with sizing flexible duct according to project-specific air volumes so as to avoid neck velocities which exceed 750 fpm based on oval inlet area**.**

***optional stainless steel faceplate, replace 2.3. G. with the following:***

1. Perforated faceplate shall be 22 ga. 304 stainless steel with No. 4 polished finish and shall extend over and wrap around plate frame on all four sides to assure continuous perforated surface appearance between ceiling tee frames. Perforations to be 16% open. Manufacturer shall provide vinyl-coated stainless steel cable safety retainers on two opposite sides to prevent accidental dropping of faceplate.

2.4 HEPA FILTERS

1. HEPA filters shall be individually tested to IEST-P-CC001 “Type J” test requirements meeting minimum efficiency of 99.99% on 0.3 micron size particles and bear a label which includes filter size, lot number, unique serial number, part number, minimum rated and actual efficiency, and target and actual pressure drop. Filter shall also have traceable Certification of Conformance (COC) available upon request.
2. Filter media shall be pleated to 53mm pack thickness and the pressure drop across the filter shall not exceed 0.45" w.g. at a filter face velocity of 100 ft./min. All materials used shall be in accordance with UL900 classification.
3. Filter frame shall have integral channel filled with cleanroom grade, low outgassing non-flowing urethane gel. Gel shall not shrink, craze, bubble, swell or show significant changes in physical properties when directly exposed to common challenge agents, and common antimicrobial or decontamination agents. Filter shall have a center-board with removable well-nut plug to allow volume adjustment valve access.
4. Diffuser manufacturer shall provide HEPA filters in order to guarantee fit to plenum body and laminar flow performance of diffuser.

***FUTURE HEPA FILTER OPTION (NO FILTERS REQUIRED WITH INITIAL PURCHASE) DELETE 2.4, 3.2. and 3.4. M., AND replace 2.3, F. WITH:***

E. The diffuser shall be capable of functioning as a laminar flow diffuser with or without a HEPA filter. Manufacturer shall provide removable diffusion baffle within each diffuser in order to guarantee laminar flow performance of diffuser until future HEPA filter is installed. Diffusion components attached to the faceplate are not acceptable. Assembly shall allow future HEPA filter installation and service from room side of diffuser. Diffuser design must allow 2.25” min. clearance between filter media and faceplate in order to minimize risk of room-side filter contamination. No HEPA filters are required at this time.

2.5 Blank-Off Panels

1. For any boom or access locations within the system, the ICS manufacturer shall furnish solid face blank-off panels where indicated on the drawings and where structural supports may penetrate the ceiling or where interstitial access is required. Panel to have solid plate installed within extruded aluminum perimeter frame with mitered corners, providing a seal between the room and interstitial space.
2. For all surgical light, equipment or anesthesia boom locations within ICS, before any boom with articulating arms are attached to the structural plates, the installing contractor shall field cut panels as required for installation of booms. Do not cut blank-off panels in half.
3. All narrow blank panels located behind equipment rails shall be factory-welded to the framing and silicone sealed to the anterior surface of framing system at factory.

***OPTIONAL FLUSH FILL-IN PANELS AT ALL BOOM LOCATIONS, REPLACE 2.5 B. ABOVE WITH THE FOLLOWING:***

B. For all surgical light and boom locations, the blank-off panels shall be dropped style with bottom of panel to be flush with bottom of gasketed ceiling framing system. Before any articulating arm booms are attached to the structural plates, the installing contractor shall field cut panels as required to allow installation of booms. Do not cut blank-off panels in half.

* 1. Integrated Ceiling Framing System for integration with unistrut
1. Laminar flow diffuser manufacturer shall furnish extruded aluminum tee and angle frame assembly suspension system to support laminar diffusers, blank-off panels and light fixtures. The tee shall be 1-1/2" wide x 1-7/16" high and angles shall be ¾” wide x 1-7/16” high. Minimum wall thickness of the tees and angles shall be 0.125".
2. The suspension system shall be factory-welded in sub-assemblies. Where framing sub-assemblies butt together, the adjoining surfaces shall be gasketed and mechanically-fastened with self-tapping wafer head screws.
3. Factory-welded ceiling framing sections shall be custom-engineered to fit between ceiling-level Unistrut channels. Aluminum mounting brackets shall be factory welded to framing sections for attachment to Unistrut and designed to be self-leveling when attached to the ceiling level Unistrut. ICS manufacturer shall supply Unistrut spring nuts, bolts and washers as required to attach framing to Unistrut supplied by Division 5 Unistrut subcontractor.
4. ICS manufacturer to furnish 2.5” wide extruded aluminum Unistrut closure strips. Closure strips shall be finish matched to ceiling framing.
5. ICS manufacturer shall supply lengths ¾” wide x 1-7/16” high trim angles on entire perimeter of system as required to be field cut by installing contractor if necessary to cover rough hard ceiling opening.
6. All tees shall be pre-punched on 6" centers for independent suspension from above for all framing not located between ceiling-level Unistrut channels.
7. ICS manufacturer shall furnish 1/8" thick closed-cell polyethylene gasket tape to be field installed on the frame assembly to provide seal between diffuser/tee grid or blank-off panel/tee grid interface.
8. The ceiling framing system shall be finished to match laminar flow diffuser modules (LM) and blank-off panels.
	1. light fixtures
9. Any light fixtures within ICS shall be supplied, installed and wired by Division 26. The ceiling grid shall allow light fixture working parts to allow for maintenance access and proper functionality.
10. Coordinate with GC or Division 26 Electrical Contractor to obtain submittal cuts including overall and lens door dims, for review by ICS manufacture. Notify General Contractor and Architect promptly of any fit or function issues.
11. EXECUTION

3.1 INSPECTION/EXAMINATION

1. Integrated Ceiling System manufacturer’s factory service team member, not local representative, shall perform on-site inspection and interference assessment of above-ceiling spaces including the structural support system prior to release of custom-engineered materials to fabrication.
2. Local manufacturer’s representative shall be available for coordination meetings.
3. Verify balancing dampers are installed on all duct take-off to diffusers, despite whether dampers are specified as part of the diffuser assembly.
4. The installing contractor shall examine all openings, mechanical and electrical work, and adjoining and adjacent construction to receive ICS prior to commencing this work.
5. The installing contractor shall field verify that the rough hard ceiling opening dimensions are as indicated within ICS manufacturer’s submittals. Hard ceiling conditions shall be plumb and level with square corners at required elevation detail (1/4” above the bottom of the finish level Unistruts) as shown in manufacturer’s submittals ,and ready to receive the ICS. Openings or ceiling height not acceptable for ICS installations shall be corrected by the appropriate contractor until conditions are satisfactory to installing contractor.
6. The General Contractor shall coordinate corrective/remedial work promptly.
7. Proceeding with the installation of the ICS indicates the installing contractor accepts the openings and conditions.

3.2 STORAGE OF HEPA FILTERS

1. HEPA filters shall be handled and stored in accordance with manufacturer’s instructions.
2. Storage location for HEPA filters shall be indoors, under roof and enclosed, and absolutely protected from moisture. Storage space be climate controlled such that temperature limits are within range of 32oF (0oC) min. and 150oF (65oC) transient, and 100oF (38oC) steady state, maximum.
3. HEPA filters shall remain in sealed packages until just before they are inspected and installed under direct supervision by manufacturer’s factory personnel.

3.3 INSTALLATION

1. Install diffusers where shown in accordance with manufacturer's instructions and reviewed submittals.
2. Hang diffusers independently of the ceiling construction from hanger wires as may be required by diffuser weight in accordance with plan details.
3. Connect diffusers to air plenum branch supply ducts in accordance with plan details.
4. Provide balancing dampers on duct take-off to diffusers.

3.4 Installation oF ceilinG FRAMING SYSTEM

1. Verify location of all components as shown on the ICS manufacturer’s approved submittals.
2. The ICS manufacturer's factory service team member, not local representative, shall be scheduled to be on site at commencement of framing and ceiling-level Unistrut installation. Technician shall provide installation supervision. Service shall be scheduled to take place after installing contractor assures ICS manufacturer that room construction is at a stage compatible with the supervision services to be provided.
3. Using hardware supplied by ICS manufacturer (spring nuts, bolts and washers), attach framing to Unistrut as per manufacturer’s installation supervisor’s project-specific instructions based on site conditions.
4. Where any adjacent welded framing sub-assemblies butt together with half-tees, the adjoining surfaces shall be gasketed and mechanically-fastened with self-tapping wafer head screws.
5. Gasket tape provided by ICS manufacturer shall be field installed on the top side of all horizontal ceiling grid surfaces as shown in ICS manufacturer’s submittal. Gasketing to be installed after framing surfaces have been wiped clean, free from any construction dust.
6. Provide inserts, power-driven type anchors, hangers or other Architect / Engineer approved hanger anchoring and suspension system devices and methods.
7. Install suspended ceiling hangers plumb and free from contact with insulation or other objects within ceiling plenum not part of supporting structural or ceiling suspension systems. Splay hangers only where required to avoid obstructions and offset resulting horizontal forces by bracing, counter splaying, or other Architect / Engineer approved methods.
8. Where width of ducts, cable trays and other construction within ceiling plenums causes hanger spacing to interfere with the location of hangers required to support suspension system members, install supplemental suspension members and hangers in the form of trapeze or equivalent Architect / Engineer approved devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
9. Secure wire hangers to structure by looping and wire-tying, either directly to structures or to inserts, eye screws, or other devices and fasteners appropriate for the substrates.
10. Hanger wires for framing sections not attached to ceiling-level Unistrut shall be installed a maximum 2’-0” on center in both directions and a maximum 6 inches from framing ends.
11. Hangers shall not penetrate ductwork, ductwork insulation or piping insulation. Integrated Ceiling System shall not be suspended from ductwork, conduit, pipes or plumbing equipment. Hangers shall not interfere with heating and ventilating equipment and their maintenance.
12. Blank-off panels for equipment penetrations within the ICS shall be field cut and installed by contractor before booms are attached to structural plates. Blank-off panels shall not be cut in half.
13. HEPA filters shall be installed into diffusers after the ducts are cleaned and the room has been thoroughly cleaned and sterilized. HEPA filters shall remain in sealed packages and stored in a controlled environment until they are installed into the diffusers.
14. The Electrical Contractor will utilize the ICS for lay-in type lighting fixtures. The Electrical Contractor shall provide any separate primary support or secondary frame members required to anchor and support lighting fixtures and equipment and to supplement and strengthen the standard suspension system in conformance with N.E.C. requirements. Provide openings for flush down- lighting fixtures located within blank-off panels as shown on Electrical Drawings and reflected ceiling plans.
15. After the medical equipment rails have been installed, contractor shall be responsible to field measure exposed ceiling-level Unistrut areas and field cut the 2.5” wide strut closure strips to required sizes in accordance with manufacturer’s installation instructions.. Before installation onto exposed Unistrut, contractor shall apply 3/8” wide PSA-backed gasketing provided by ICS manufacturer to closure strips as per manufacturer’s instructions. Contractor shall not install strips until medical equipment rails have been installed into final positions or damage to strips may occur in removal for rail attachment.

***OPTIONAL FACTORY INSTALLATION SUPERVISION OF HEPA FILTERS ($$):***

3.5 MANUFACTURER’S SUPERVISION OF INSTALLATION OF HEPA FILTERS

1. ICS manufacturer’s direct personnel shall supervise the installation of HEPA filters including supervising the unpacking of filters, visual inspection of filters, and supervision of the installation of HEPA filters into diffusers by contractor’s personnel.
2. Upon completion of installation, manufacturer shall complete a non-challenge scan of filter face with particle counter for detection of pinhole leaks. Entire perimeter of filter frame shall also be scanned to assure seal of filter to diffuser’s knife edge. ICS manufacturer shall repair any minor leaks and coordination the repair of major leaks.

END