SECTION 233714 – INTEGRATED O.R. HEPA-FILTERED PLENUM SYSTEM

1. GENERAL

1.1 SUMMARY

1. Section includes integrated laminar ceiling plenum systems coordinated and provided by a single manufacturer which includes air plenums, 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 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, and installation details. Submit dimensioned shop drawings including reflected ceilings detailing locations of plenums with diffusers, 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)). 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.
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. If booms are located within the ICS, ICS Manufacturer shall review surgical light, anesthesia column, and equipment boom submittals and Pre-Installation Instructions to coordinate best possible 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.
7. ICS Manufacturer shall review structural support system submittals from GC and advise GC and/or Architect of conflicts which would prohibit installation of ceiling-mounted components.
8. 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. Handle ceiling components carefully to avoid damaging components in any way.
3. HEPA filters shall be stored in conditions as detailed and specified herein under 3.2

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 Products. 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 plenum ceiling systems to operating rooms.
3. Any costs associated with non-compliance of the specification will be borne by the Contractor.
4. Refer to 1.4 for special submittal requirements.

2.2INTEGRATED O.R. PLENUM SYSTEM WITH HEPA-FILTERED DIFFUSERS

1. Integrated Ceiling System (ICS) shall consist of air plenums to accept room-side replaceable HEPA filters, blank panels, and integrated ceiling grid to support components within system 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 and total supply air volume requirement by room number.

2.3 INTEGRATED PLENUMS FOR HEPA FILTERS

1. Integrated diffuser plenum system shall be dual-chamber, non-aspirating, unidirectional laminar flow type.
2. Integrated diffuser plenums shall utilize two separate chambers, upper chamber to delivering air from the supply duct(s) to multiple air plenums and lower chamber to deliver air downward into the space through HEPA filters.
3. The quantity of inlet connections and plenum height are reduced through the common pressurized plenum. The rectangular integrated plenum inlet collars shall be sized based on airflow requirements for the intended space.
4. Plenums shall be constructed of 0.063” aluminum. Plenum seams shall be internally sealed with silicone-based antimicrobial caulk. Plenums shall include P-4000 Unistrut channels welded to the interior, top side of plenum for suspension from above by means of multiple threaded rods. Installation hardware and rods for suspension of plenum shall be supplied by installing contractor.
5. Ceiling framing shall be factory-welded and sealed to the plenums, ready for attachment to adjacent perimeter ceiling framing for support of other ceiling-mounted blank panels or lights.
6. Diffuser face frame assemblies shall be constructed of extruded aluminum with mitered continuously welded corners. Diffuser face frame assemblies with integral knife edge for acceptance of HEPA filters shall be sealed to framing system, allowing no air to bypass around the filter media. Assembly shall allow installation and service of HEPA filters 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 with a wrap around plate frame on all four sides to assure continuous perforated surface appearance between ceiling tee frames.
8. Inlet collars and faceplates shall be covered with removable self-adhesive protective film to prevent construction dust from entering diffuser prior to installation.
9. 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 stainless steel faceplate, replace 2.3. G. with the following:***

G. 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 supply 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, AND 3.2, 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.

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

1. 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.

2.6 Integrated Ceiling Framing System

1. Manufacturer shall furnish extruded aluminum tee and angle frame system to support integrated plenum sections and framing openings for other non-plenum components such as fill-in panels and light fixtures. For all perimeter framing beyond the air plenums, the face of 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" with a minimum weight of 0.43 lbs. per linear ft. Centerline to centerline dimension of each framing section shall be 0.125” per lineal foot added to the nominal size of the diffuser. Verify exact locations of plenums, lights, fill-in panels & framing with architectural reflected ceiling plans.
2. The suspension system shall be factory-welded in sub-assemblies not larger than 6' x 12'. Where framing sub-assemblies butt together for field assembly, the butting angles shall be half tees mechanically-fastened with self-tapping wafer head screws.
3. For framing located beyond the air plenums, all tees shall be pre-punched on 6" centers for attachment to suspending hanger wires attached on 2’-0” centers at minimum in two directions to structural support members. Systems shall be designed for minimum weight of 10 lbs. per square ft.
4. Manufacturer shall furnish 1/8" thick closed cell polyethylene gasket tape to be field installed on the frame assembly to provide an airtight seal between diffuser/tee grid or blank-off panel/tee grid interface. Gasket tape shall be field installed by contractor after framing surfaced have been wiped clean, free from any construction dust.
5. The ceiling framing system shall be finished to match plenums, diffusers and blank-off panels.

2.7 Light Fixtures

1. 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.
2. 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.
3. EXECUTION

#### Inspection/Examination

1. Local manufacturer’s representative shall be available for coordination meetings.
2. Verify balancing dampers are installed within supply ducting for rough balancing. assembly.
3. The installing contractor shall examine all openings, mechanical and electrical work, and adjoining and adjacent construction to receive ICS prior to commencing this work.
4. 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 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.
5. The General Contractor shall coordinate corrective/remedial work promptly.
6. 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. Verify location of all components as shown on the ICS manufacturer’s approved submittals. Coordinate with other work, including ductwork and duct accessories, lighting plan, and architectural features as necessary to interface installation of plenums and framing system.
2. Provide balancing dampers on supply duct takeoffs feeding diffuser plenum array in order to adjust air volume to the plenum assembly.
3. Install integrated plenums level and flush in accordance with manufacturer’s instructions, details within approved submittal package, and in accordance with recognized industry practices to ensure that products serve intended function. Plenum sections shall be supported by threaded rods attached through the integrated plenum’s Unistrut located on interior, top side of plenum. Installation hardware and rods for suspension of plenum shall be supplied by installing contractor.
4. Connect each plenum to supply ductwork in accordance with manufacturer’s written instructions and in accordance with recognized industry standards.
5. Where any adjacent welded framing sub-assemblies butt together with half-tees, at plenum perimeter or other mating sections, the adjoining surfaces shall be gasketed and mechanically-fastened with self-tapping wafer head screws.
6. Gasket tape with PSA-backing 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 and in strict accordance with manufacturer’s installation instructions included. Gasketing to be installed after framing surfaces have been wiped clean, free from any construction dust.
7. Provide inserts, power-driven type anchors, hangers or other Architect / Engineer approved hanger anchoring and suspension system devices and methods.
8. 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.
9. 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.
10. 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.
11. Hanger wires for framing sections beyond perimeter of plenums shall be installed a maximum 2’-0” on center in both directions and a maximum 6 inches from framing ends.
12. 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.
13. HEPA filters shall be installed into plenums 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. 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.
15. 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.

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