SECTION 23 41 33

CLEANROOM FILTRATION

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\*\* NOTE TO SPECIFIER \*\* Terra Universal, Inc.; Cleanroom doors and accessory products.  
.  
This section is based on the products of Terra Universal, Inc., which is located at:800 S. Raymond Ave.Fullerton, CA 92831Tel: 714-578-6000Fax: 714-578-6020Email: [request info (info@TerraUniversal.com)](https://arcat.com/rfi?action=email&company=Terra%252BUniversal%252C%252BInc.&message=RE%253A%2520Spec%2520Question%2520(15860ter)%253A%2520&coid=43448&spec=15860ter&rep=&fax=714-578-6020)  
Web: <https://www.terrauniversal.com>   
 [ [Click Here](https://arcat.com/company/terra-universal-inc-43448) ] for additional information.  
Terra Universal is the leading manufacturing expert in critical environment applications, with over 30 years of design and fabrication experience in cleanroom-related industries.  
In addition to standard manufactured products, Terra customizes to unique requirements. Installation and certification services for modular cleanrooms, filtration, windows and glove box isolators are also available.  
This specification includes Cleanroom Doors and accessories.

1. GENERAL
   1. SECTION INCLUDES

\*\* NOTE TO SPECIFIER \*\* Delete items below not required for project.

* + 1. Cleanroom Fan Filter Units with Topside and Roomside Replacement Access
    2. Explosion Proof Cleanroom Fan Filter Units
    3. Smart ECM Cleanroom Fan Filter Units
    4. Reverse-Flow Fan/Filter Units
    5. Vapor Removal and Sanitizing Modules
    6. Ducted Filter Modules
    7. Narrow Fan/Filter Units
    8. Heated Fan Filter Units
    9. Cleanroom Control Units
  1. RELATED SECTIONS

\*\* NOTE TO SPECIFIER \*\* Delete any sections below not relevant to this project; add others as required.

* + 1. Section 05 50 00 - Metal Fabrications [05 50 00] - Metal Fabrications.
    2. Section 07 90 00 - Joint Protection [07 92 00] - Joint Sealants.
    3. Section 11 98 21 - Detention Windows [08 56 00] - Cleanroom Windows.
    4. Section 08 30 00 - Specialty Doors and Frames [08 34 00] - Cleanroom Doors.
    5. Section 13 21 13 - Clean Rooms [13 20 00] - Cleanroom Pass Thru Chamber.
    6. Section 28 18 00 - Security Access Detection Equipment [28 10 00] - Cleanroom Access Control and Interconnecting devices.
    7. Section 23 70 00 - Central HVAC Equipment [23 70 00] - Air Handling Units.
    8. Section 26 05 23 - Control-Voltage Electrical Power Cables [26 05 23] - Control Voltage Electrical Power Cables and conduit.
    9. Section 48 00 00 - Electrical Power Generation [26 05 13] - Electrical Power, service conduit and distribution.
  1. REFERENCES

\*\* NOTE TO SPECIFIER \*\* Delete references from the list below that are not actually required by the text of the edited section.

* + 1. FS 209E - Cleanroom and Workstation Requirements, Controlled Environments.
    2. IEST Recommended Practice (RP): IEST-RP-CC001: HEPA and ULPA Filters
    3. ISO 146744-1 - Cleanrooms and associated controlled environmentsPart 1: Classification of air cleanliness
    4. UL (Underwriters Laboratories, Inc.) - Electrical Appliance and Utilization Equipment Directory.
    5. ULC (UL Canada) - Electrical Appliance and Utilization Equipment Directory.
    6. FDA/cGMP Requirements - 21 CFR Section 211 and Proposed Guidelines 21 CFR Section 212.
  1. PERFORMANCE REQUIREMENTS

\*\* NOTE TO SPECIFIER \*\* Edit the following paragraphs as required for the project.

* + 1. Cleanroom Filtration shall be capable of maintaining the following cleanroom performance requirements when installed as follows.
       1. Capable of maintaining Class 100 to 10,000 (ISO 5 to ISO 8) conditions in accordance with FS 209E and ISO 146744-1.
       2. Capable of meeting validation requirements of FDA/cGMP and the following requirements.
          1. Nonviability Particle Count: Maximum of 10,000 per cf, 0.5 micron or larger measured 6 inches above work surface (Class 10,000/ISO 7). Other permissible counts accord with nominal cleanliness rating (1000 per cf. for ISO 6, 100 per cf. for ISO 5).
          2. Viable Count: Less than 1.5 colony forming units per 10 cubic feet. Other permissible counts in accord with nominal cleanliness rating.
       3. Capable of maintaining a passive pressure differential of:
          1. Area outside room: balance condition
          2. Air lock: 0.05 inch w.g.
          3. Cleanroom: 0.1 inch w.g.
  1. SUBMITTALS
     1. Submit under provisions of Section 01 30 00 - Administrative Requirements.
     2. Product Data: Manufacturer's catalog cuts and data sheets on each product to be used, including:
        1. Preparation instructions and recommendations.
        2. Storage and handling requirements and recommendations.
        3. Installation methods.
     3. Shop Drawings: Submit drawings indicating layout for all areas to receive work of this section, including locations of light fixtures, ceiling diffusers, and grilles. Indicate junctions with other work or finishes and interrelation of mechanical and electrical items related to system.
     4. Manufacturer's Certificates: Certify products meet or exceed specified requirements.
     5. Closeout Submittals: Provide manufacturer's maintenance instructions that include recommendations for periodic checking and maintenance of all components.
  2. QUALITY ASSURANCE
     1. Manufacturer Qualifications: Company specializing in the manufacture of products specified in this section with minimum 10 years documented experience.
     2. Installer Qualifications: Company specializing in performing work of this section with minimum 5 years documented experience.

\*\* NOTE TO SPECIFIER \*\* Include a mock-up if the project size and/or quality warrant taking such a precaution. The following is one example of how a mock-up on a large project might be specified. When deciding on the extent of the mock-up, consider all the major different types of work on the project.

* + 1. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
       1. Locate where designated by Architect.
       2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
       3. Refinish mock-up area as required to produce acceptable work.
       4. Accepted mock-ups shall be comparison standard for remaining Work
    2. Preinstallation Meetings: Conduct meeting to verify project requirements, substrate conditions, utility connections, manufacturer's installation instructions.
  1. PRE-INSTALLATION MEETINGS
     1. Section 01 30 00 - Administrative Requirements [01 30 00] - Administrative Requirements: Pre-installation meeting.
  2. DELIVERY, STORAGE, AND HANDLING
     1. Mark products with Architect's opening number on all doors, frames, misc. parts and cartons
     2. Store products in manufacturer's unopened packaging until ready for installation.
     3. Do not deliver materials or assemblies to site until installation spaces are ready to receive units.
  3. SEQUENCING
     1. Ensure that locating templates and other information required for installation of products of this section are furnished to affected trades in time to prevent interruption of construction progress.
     2. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.
  4. PROJECT CONDITIONS
     1. Do not install integrated ceiling until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead mechanical work is completed, tested, and approved.
     2. Permit wet work to dry prior to commencement of installation.
     3. Maintain uniform temperatures of minimum 60 degrees F prior to, during, and after installation.

1. PRODUCTS
   1. MANUFACTURERS
      1. Acceptable Manufacturer: Terra Universal, Inc., which is located at:800 S. Raymond Ave.Fullerton, CA 92831Tel: 714-578-6000Fax: 714-578-6020Email: [request info (info@TerraUniversal.com)](https://arcat.com/rfi?action=email&company=Terra%252BUniversal%252C%252BInc.&message=RE%253A%2520Spec%2520Question%2520(15860ter)%253A%2520&coid=43448&spec=15860ter&rep=&fax=714-578-6020);Web: <https://www.terrauniversal.com>

\*\* NOTE TO SPECIFIER \*\* Delete one of the following two paragraphs; coordinate with requirements of Division 1 section on product options and substitutions.

* + 1. Substitutions: Not permitted.
    2. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

\*\* NOTE TO SPECIFIER \*\* Select the Cleanroom Fan Filter Units with Top Side or Roomside replacement as required from the following paragraphs. Delete the paragraphs that are not applicable.

* 1. CLEANROOM FAN FILTER UNITS
     1. Laminar Fan Filter Units; WhisperFlow, 2 foot by 4 foot, HEPA/ULPA. Provides a uniform flow of microfiltered air to meet cleanliness standards down to Class 10 (ISO 4).
        1. Material:

\*\* NOTE TO SPECIFIER \*\* Select one of the following two paragraphs and delete the one not required.

* + - * 1. Powder-Coated White CR Steel frame with aluminum filter face grille.
        2. Type 304 Stainless Steel BioSafe frame with stainless steel filter face grille.
      1. Diffuser Grille:

\*\* NOTE TO SPECIFIER \*\* Select one of the following two paragraphs and delete the one not required.

* + - * 1. Powder-Coated White CR Steel frame with aluminum filter face grille.
        2. Stainless Steel
      1. Provided with 1/4 inch (6 mm) threaded holes in top corners to accommodate eyebolts to facilitate installation using suspended guy wires (order eye bolt package separately)
      2. Includes AC 3-speed blower motor with three-setting switch that simplifies air balancing.
      3. Internal baffling plates and diffuser panel provide uniform air speed across the filter face
      4. Includes FDA approved Acrylic urethane sealant.
      5. Filter:
         1. HEPA Filter: 99.99% efficient High-Efficiency Particular Air, rated at particles 0.3&#181;m diameter
         2. ULPA Filter: 99.999% efficient Ultra-Low Penetration Air, rated at particles 0.12&#181;m diameter.
      6. Sound level approximately 49 dBA, Average air flow velocity 90 FPM (0.46 m/s)
      7. Operating Ratings (High Speed/Medium Speed/Low Speed): (measured 6 inches (132 mm) below filter face)
         1. Average CFM: High 800, Medium 720, Low 590
      8. Filter Replacement Access:

\*\* NOTE TO SPECIFIER \*\* Select one of the following two paragraphs and delete the one not required.

* + - * 1. Top Side
        2. Room Side: Easy-open clips with Gel-sealed filter seats securely against blower housing to form a tight seal.
      1. Marks and Listings:
         1. UL, ULC.
         2. Meets IEST Recommended Practices
      2. Weight: 71 Lbs
      3. Power:

\*\* NOTE TO SPECIFIER \*\* Select the Power required from the following paragraphs and delete those not required.

* + - * 1. 120VAC, 60 Hz
        2. 220VAC, 60 Hz
        3. 230VAC, 50/60 Hz
        4. 240VAC, 50/60 Hz
      1. Options:

\*\* NOTE TO SPECIFIER \*\* Select the options required from the following paragraphs and delete those not required.

* + - * 1. Challenge Port to simplifies leak testing
        2. Eye bolt package.
        3. EnergySaver remote control system
        4. Drop-In Prefilter
        5. Yellow power cord with 4-pin connector for easy installation (connector may be removed and replaced with plug for connection to wall outlet)
    1. Laminar Fan Filter Units; WhisperFlow, 2 foot by 3 foot, HEPA/ULPA. Provides a uniform flow of microfiltered air to meet cleanliness standards down to Class 10 (ISO 4).
       1. Material:

\*\* NOTE TO SPECIFIER \*\* Select one of the following two paragraphs and delete the one not required.

* + - * 1. Powder-Coated White CR Steel frame with aluminum filter face grille.
        2. Type 304 Stainless Steel BioSafe frame with stainless steel filter face grille.
      1. Diffuser Grille:

\*\* NOTE TO SPECIFIER \*\* Select one of the following two paragraphs and delete the one not required.

* + - * 1. Anodized aluminum
        2. Stainless Steel
      1. Includes AC 3-speed blower motor with three-setting switch that simplifies air balancing.
      2. Provided with 1/4 inch (6 mm) threaded holes in top corners to accommodate eyebolts to facilitate installation using suspended guy wires (order eye bolt package separately)
      3. Internal baffling plates and diffuser panel provide uniform air speed across the filter face
      4. Includes FDA approved Acrylic urethane sealant.
      5. Filter:
         1. HEPA Filter: 99.99% efficient High-Efficiency Particular Air, rated at particles 0.3&#181;m diameter.
         2. ULPA Filter: 99.999% efficient Ultra-Low Penetration Air, rated at particles 0.12&#181;m diameter.
      6. Sound level approximately 49 dBA, Average air flow velocity 90 FPM (0.46 m/s)
      7. Operating Ratings (High Speed/Medium Speed/Low Speed): (measured 6 inches (132 mm) below filter face)
         1. Average CFM: High 675, 630, Low 560
      8. Filter Replacement Access:
         1. Top Side
         2. Room Side: Easy-open clips with Gel-sealed filter seats securely against blower housing to form a tight seal.
      9. Marks and Listings:
         1. UL, ULC
         2. Meets IEST Recommended Practices
      10. Weight: 53 Lbs
      11. Power:

\*\* NOTE TO SPECIFIER \*\* Select the Power required from the following paragraphs and delete those not required.

* + - * 1. 120VAC, 60 Hz
        2. 220VAC, 60 Hz
        3. 230VAC, 50/60 Hz
        4. 240VAC, 50/60 Hz
      1. Options:

\*\* NOTE TO SPECIFIER \*\* Select the options required from the following paragraphs and delete those not required.

* + - * 1. Challenge Port to simplifies leak testing
        2. Eye bolt package.
        3. Includes yellow power cord with 4-pin connector for easy installation (connector may be removed and replaced with plug for connection to wall outlet)
        4. EnergySaver remote control system
        5. Drop-In Prefilter
    1. Laminar Fan Filter Units; WhisperFlow, 2 foot by 2 foot, HEPA/ULPA. Provides a uniform flow of microfiltered air to meet cleanliness standards down to Class 10 (ISO 4).
       1. Material:

\*\* NOTE TO SPECIFIER \*\* Select one of the following two paragraphs and delete the one not required.

* + - * 1. Powder-Coated White CR Steel frame with aluminum filter face grille.
        2. Type 304 Stainless Steel BioSafe frame with stainless steel filter face grille..
      1. Diffuser Grille:

\*\* NOTE TO SPECIFIER \*\* Select one of the following two paragraphs and delete the one not required.

* + - * 1. Anodized aluminum
        2. Stainless Steel
      1. Includes AC 3-speed blower motor with three-setting switch that simplifies air balancing.
      2. Provided with 1/4 inch (6 mm) threaded holes in top corners to accommodate eyebolts to facilitate installation using suspended guy wires (order eye bolt package separately)
      3. Internal baffling plates and diffuser panel provide uniform air speed across the filter face
      4. Includes FDA approved Acrylic urethane sealant.
      5. Filter:
         1. HEPA Filter: 99.99% efficient High-Efficiency Particular Air, rated at particles 0.3&#181;m diameter.
         2. ULPA Filter: 99.999% efficient Ultra-Low Penetration Air, rated at particles 0.12&#181;m diameter.
      6. Sound level approximately 49 dBA, Average air flow velocity 90 FPM ( 0.46 m/s)
      7. Operating Ratings (High Speed/Medium Speed/Low Speed): (measured 6 inches (132 mm) below filter face)
         1. Average CFM: High 557, Medium 558, Low 544
      8. Filter Replacement Access:
         1. Top Side
         2. Room Side: Easy-open clips with Gel-sealed filter seats securely against blower housing to form a tight seal.
      9. Marks and Listings:
         1. UL, ULC
         2. Meets IEST Recommended Practices
      10. Weight: 25 Lbs
      11. Power:

\*\* NOTE TO SPECIFIER \*\* Select the Power required from the following paragraphs and delete those not required.

* + - * 1. 120VAC, 60 Hz
        2. 220VAC, 60 Hz
        3. 230VAC, 50/60 Hz
        4. 240VAC, 50/60 Hz
      1. Options:

\*\* NOTE TO SPECIFIER \*\* Select the options required from the following paragraphs and delete those not required.

* + - * 1. Challenge Port to simplifies leak testing
        2. Eye bolt package
        3. Includes yellow power cord with 4-pin connector for easy installation (connector may be removed and replaced with plug for connection to wall outlet)
        4. EnergySaver remote control system
        5. Drop-In Prefilter
  1. EXPLOSION PROOF CLEANROOM FAN FILTER UNITS
     1. Explosion Proof Fan Filter Units; WhisperFlow, 2 foot by 4 foot, HEPA/ULPA Fan-Filter Unit is UL-listed for safe operation in Class I or Class II, Division 1 as specified by the National Electrical Code (NEC).
        1. Material:
           1. Type 304 Stainless Steel BioSafe frame with stainless steel filter face grille.
        2. Easy-open clips with Gel-sealed filter seats securely against blower housing to form a tight seal.
        3. Provided with 1/4 inch (6 mm) threaded holes in top corners to accommodate eyebolts to facilitate installation using suspended guy wires (order eye bolt package separately)
        4. Includes 0.25HP fan-cooled motor is designed for continuous-duty operation. Non-sparking motor, mounted in a cast-iron, explosion-proof housing, and particle filter provide uniform flow of filtered air at an average speed of 90 ft/min (0.458 m/sec).
        5. Blower: Forward curved centrifugal type factory balanced. Internal baffling plates and diffuser panel provide uniform air speed across the filter face
        6. Includes FDA approved Acrylic urethane sealant.
        7. Filter:

\*\* NOTE TO SPECIFIER \*\* Select one of the following two paragraphs and delete the one not required.

* + - * 1. HEPA Filter: 99.99% efficient @ 0.3 &#181;m particles
        2. ULPA Filter: 99.999% efficient @ 0.12 &#181;m particles.
      1. Sound level approximately 49 dBA,
      2. Operating Rating: With pre-filter and HEPA/ULPA filter installed.
         1. Average CFM: 717
         2. Air Speed FPM (m/s): 102 (0.51) measured 6 inches (132 mm) below filter face.
      3. Filter Replacement Access:
         1. Top Side
         2. Room Side: Easy-open clips with Gel-sealed filter seats securely against blower housing to form a tight seal.
      4. Marks and Listings:
         1. UL, ULC
         2. Meets IEST Recommended Practices
      5. Weight: 75 Lbs
      6. Includes wiring in filled rigid conduit, and modification of Power Distribution Module(s) and Control Panel switches to meet NEC requirements for Class I/Class II, Division 1 Hazardous Locations
      7. Power:

\*\* NOTE TO SPECIFIER \*\* Select the Power required from the following paragraphs and delete those not required.

* + - * 1. 120VAC, 60 Hz
        2. 220VAC, 60 Hz
      1. Options:

\*\* NOTE TO SPECIFIER \*\* Select the options required from the following paragraphs and delete those not required.

* + - * 1. Challenge Port to simplifies leak testing
        2. Eye bolt package.
    1. Explosion Proof Fan Filter Units: WhisperFlow, 2 foot by 3 foot, HEPA/ULPA Fan-Filter Unit is UL-listed for safe operation in Class I or Class II, Division 1 as specified by the National Electrical Code (NEC).
       1. Material:
          1. Type 304 Stainless Steel BioSafe frame with stainless steel filter face grille.
       2. Easy-open clips with Gel-sealed filter seats securely against blower housing to form a tight seal.
       3. Provided with 1/4 inch (6 mm) threaded holes in top corners to accommodate eyebolts to facilitate installation using suspended guy wires (order eye bolt package separately)
       4. Includes 0.25HP fan-cooled motor is designed for continuous-duty operation. Non-sparking motor, mounted in a cast-iron, explosion-proof housing, and particle filter provide uniform flow of filtered air at an average speed of 90 ft/min (0.458 m/sec).
       5. Blower: Forward curved centrifugal type factory balanced. Motor/blower assembly is removable from top of housing for service Internal baffling plates and diffuser panel provide uniform air speed across the filter face
       6. Includes FDA approved Acrylic urethane sealant.
       7. Filter:

\*\* NOTE TO SPECIFIER \*\* Select one of the following two paragraphs and delete the one not required.

* + - * 1. HEPA Filter: 99.99% efficient @ 0.3 &#181;m particles
        2. ULPA Filter: 99.999% efficient @ 0.12 &#181;m particles.
      1. Sound level approximately 49 dBA,
      2. Operating Rating: With pre-filter and HEPA/ULPA filter installed.
         1. Average CFM: 602
         2. Air Speed FPM (m/s): 116 (0.50) measured 6 inches (132 mm) below filter face.
      3. Filter Replacement Access:
         1. Top Side
         2. Room Side: Easy-open clips with Gel-sealed filter seats securely against blower housing to form a tight seal.
      4. Marks and Listings:
         1. UL, ULC
         2. Meets IEST Recommended Practices
      5. Weight: 53 Lbs
      6. Includes wiring in filled rigid conduit, and modification of Power Distribution Module(s) and Control Panel switches to meet NEC requirements for Class I/Class II, Division 1 Hazardous Locations
      7. Power:

\*\* NOTE TO SPECIFIER \*\* Select the Power required from the following paragraphs and delete those not required.

* + - * 1. 120VAC, 60 Hz
        2. 220VAC, 60 Hz
      1. Options:

\*\* NOTE TO SPECIFIER \*\* Select the options required from the following paragraphs and delete those not required.

* + - * 1. Challenge Port to simplifies leak testing
        2. Eye bolt package.
    1. Explosion Proof Fan Filter Units: WhisperFlow, 2 foot by 2 foot, HEPA/ULPA Fan-Filter Unit is UL-listed for safe operation in Class I or Class II, Division 1 as specified by the National Electrical Code (NEC).
       1. Material:
          1. Type 304 Stainless Steel BioSafe frame with stainless steel filter face grille
       2. Easy-open clips with Gel-sealed filter seats securely against blower housing to form a tight seal.
       3. Provided with 1/4 inch (6 mm) threaded holes in top corners to accommodate eyebolts to facilitate installation using suspended guy wires (order eye bolt package separately)
       4. Includes 0.25HP fan-cooled motor is designed for continuous-duty operation. Non-sparking motor, mounted in a cast-iron, explosion-proof housing, and particle filter provide uniform flow of filtered air at an average speed of 90 ft/min (0.458 m/sec).
       5. Blower: Forward curved centrifugal type factory balanced. Motor/blower assembly is removable from top of housing for service Internal baffling plates and diffuser panel provide uniform air speed across the filter face
       6. Includes FDA approved Acrylic urethane sealant.
       7. Filter:

\*\* NOTE TO SPECIFIER \*\* Select one of the following two paragraphs and delete the one not required.

* + - * 1. HEPA Filter: 99.99% efficient @ 0.3 &#181;m particles
        2. ULPA Filter: 99.999% efficient @ 0.12 &#181;m particles.
      1. Sound level approximately 49 dBA,
      2. Operating Rating: With pre-filter and HEPA/ULPA filter installed.
         1. Average CFM: 558
         2. Air Speed FPM (m/s): 166 (0.84) measured 6 inches (132 mm) below filter face.
      3. Filter Replacement Access:
         1. Top Side
         2. Room Side: Easy-open clips with Gel-sealed filter seats securely against blower housing to form a tight seal.
      4. Marks and Listings:
         1. UL, ULC
         2. Meets IEST Recommended Practices
      5. Weight: 44 Lbs
      6. Includes wiring in filled rigid conduit, and modification of Power Distribution Module(s) and Control Panel switches to meet NEC requirements for Class I/Class II, Division 1 Hazardous Locations
      7. Power:

\*\* NOTE TO SPECIFIER \*\* Select the Power required from the following paragraphs and delete those not required.

* + - * 1. 120VAC, 60 Hz
        2. 220VAC, 60 Hz
      1. Options:

\*\* NOTE TO SPECIFIER \*\* Select the options required from the following paragraphs and delete those not required.

* + - * 1. Challenge Port to simplifies leak testing
        2. Eye bolt package.
  1. SMART ECM CLEANROOM FAN FILTER UNITS
     1. General Characteristics:
        1. Low-energy, electrically-commutated (EC) fan/filter units comply with energy-efficiency standards including California's Title 24 and the European Union's ErP 2015 Directive. Brushless DC motors have internal micro-processors, and lower decibel levels than mechanical AC motors. At medium setting, the sound level are 40 dBA.
        2. Units use a smart control system, that consume only 280W/2.4A @109 FPM (0.55 m/s) and greatly reducing cleanroom operating costs. Smart ECM units can help earn LEED points, further reducing operating cost. ECM units generate less heat than AC FFUs, and provide a much wider flow range, from 110 to 1117 CFM, and are ideal for applications involving high static pressure.
        3. Smart ECM low-energy DC units can be incorporated into Building Management Systems to allow remote monitoring and control. Units can also be adjusted via IR transmitters from inside the room, or via a remote touchscreen PLC console. Off-hour set-back feature puts the entire cleanroom in low-energy mode, saving additional energy costs when the room is not in use.
     2. Smart ECM Fan Filter Units; WhisperFlow, 2 foot by 4 foot, HEPA/ULPA. Fan Filter Units with low-energy, electronically commutated (EC) motors and backward-inclined fans to reduce operating costs.
        1. Material:

\*\* NOTE TO SPECIFIER \*\* Select one of the following two paragraphs and delete the one not required.

* + - * 1. Powder-Coated White CR Steel frame with aluminum filter face grille.
        2. Type 304 Stainless Steel frame with stainless steel filter face grille.
      1. Easy-open clips with Gel-sealed filter seats securely against blower housing to form a tight seal.
      2. Diffuser Grille:

\*\* NOTE TO SPECIFIER \*\* Select one of the following two paragraphs and delete the one not required.

* + - * 1. Anodized aluminum
        2. Stainless Steel
      1. Internal baffling plates and diffuser panel provide uniform air speed across the filter face, ensuring laminar airflow.
      2. Provided with 1/4 inch (6 mm) threaded holes in top corners to accommodate eyebolts to facilitate installation using suspended guy wires (order eye bolt package separately)
      3. Electrically commutated, high-efficiency DC motor
      4. Includes FDA approved Acrylic urethane sealant.
      5. Prefilter: MERV 7 Pre-filter, 30% ASHRAE rated.
      6. Filter:

\*\* NOTE TO SPECIFIER \*\* Select one of the following two paragraphs and delete the one not required.

* + - * 1. HEPA Filter: 99.99% efficient @ 0.3 &#181;m particles
        2. ULPA Filter: 99.999% efficient @ 0.12 &#181;m particles.
      1. Sound level approximately 40 dBA,
      2. Operating Rating:
         1. Maximum CFM: 900 at 180W
      3. Filter Replacement Access:
         1. Top Side
         2. Room Side: Easy-open clips with Gel-sealed filter seats securely against blower housing to form a tight seal.
      4. Motor control panel includes diagnostic indicator lights, manual speed adjustment, test probe jacks, CAT5e ports, control mode switch, and MODBUS address DIP switch bank.
      5. Marks and Listings:
         1. UL, ULC

\*\* NOTE TO SPECIFIER \*\* Include the following paragraph if CE approval is required . Delete if not required.

* + - * 1. CE approved, requires Safety Cover.
      1. Weight: 71 Lbs
      2. Power:

\*\* NOTE TO SPECIFIER \*\* Select the Power required from the following paragraphs and delete those not required.

* + - * 1. 120VAC, 60 Hz
        2. 220VAC, 60 Hz
      1. Options:

\*\* NOTE TO SPECIFIER \*\* Select the options required from the following paragraphs and delete those not required.

* + - * 1. Challenge Port to simplifies leak testing
        2. Eye bolt package
        3. Includes yellow power cord with 4-pin connector for easy installation (connector may be removed and replaced with plug for connection to wall outlet)
    1. Smart ECM Fan Filter Units; WhisperFlow, 2 foot by 3 foot, HEPA/ULPA. Fan Filter Units with low-energy, electronically commutated (EC) motors and backward-inclined fans to reduce operating costs.
       1. Material:

\*\* NOTE TO SPECIFIER \*\* Select one of the following two paragraphs and delete the one not required.

* + - * 1. Powder-Coated White CR Steel frame with aluminum filter face grille.
        2. Type 304 Stainless Steel frame with stainless steel filter face grille.
      1. Easy-open clips with Gel-sealed filter seats securely against blower housing to form a tight seal.
      2. Diffuser Grille:

\*\* NOTE TO SPECIFIER \*\* Select one of the following two paragraphs and delete the one not required.

* + - * 1. Anodized aluminum
        2. Stainless Steel
      1. Internal baffling plates and diffuser panel provide uniform air speed across the filter face, ensuring laminar airflow.
      2. Provided with 1/4 inch (6 mm) threaded holes in top corners to accommodate eyebolts to facilitate installation using suspended guy wires (order eye bolt package separately)
      3. Electrically commutated, high-efficiency DC motor
      4. Includes FDA approved Acrylic urethane sealant.
      5. Prefilter: MERV 7 Pre-filter, 30% ASHRAE rated.
      6. Filter:

\*\* NOTE TO SPECIFIER \*\* Select one of the following two paragraphs and delete the one not required.

* + - * 1. HEPA Filter: 99.99% efficient @ 0.3 &#181;m particles
        2. ULPA Filter: 99.999% efficient @ 0.12 &#181;m particles.
      1. Sound level approximately 40 dBA,
      2. Operating Rating:
         1. Maximum CFM: 780 at 110W
      3. Filter Replacement Access:
         1. Top Side
         2. Room Side: Easy-open clips with Gel-sealed filter seats securely against blower housing to form a tight seal.
      4. Motor control panel includes diagnostic indicator lights, manual speed adjustment, test probe jacks, CAT5e ports, control mode switch, and MODBUS address DIP switch bank.
      5. Marks and Listings:
         1. UL, ULC

\*\* NOTE TO SPECIFIER \*\* Include the following paragraph if CE approval is required . Delete if not required.

* + - * 1. CE approved, requires Safety Cover.
      1. Weight: 53 Lbs
      2. Power:

\*\* NOTE TO SPECIFIER \*\* Select the Power required from the following paragraphs and delete those not required.

* + - * 1. 120VAC, 60 Hz
        2. 220VAC, 60 Hz
      1. Options:

\*\* NOTE TO SPECIFIER \*\* Select the options required from the following paragraphs and delete those not required.

* + - * 1. Challenge Port to simplifies leak testing
        2. Eye bolt package
      1. Includes yellow power cord with 4-pin connector for easy installation (connector may be removed and replaced with plug for connection to wall outlet)
    1. Smart ECM Fan Filter Units; WhisperFlow, 2 foot by 2 foot, HEPA/ULPA. Fan Filter Units with low-energy, electronically commutated (EC) motors and backward-inclined fans to reduce operating costs.
       1. Material:

\*\* NOTE TO SPECIFIER \*\* Select one of the following two paragraphs and delete the one not required.

* + - * 1. Powder-Coated White CR Steel frame with aluminum filter face grille.
        2. Type 304 Stainless Steel frame with stainless steel filter face grille.
      1. Easy-open clips with Gel-sealed filter seats securely against blower housing to form a tight seal.
      2. Diffuser Grille:

\*\* NOTE TO SPECIFIER \*\* Select one of the following two paragraphs and delete the one not required.

* + - * 1. Anodized aluminum
        2. Stainless Steel
      1. Internal baffling plates and diffuser panel provide uniform air speed across the filter face, ensuring laminar airflow.
      2. Provided with 1/4 inch (6 mm) threaded holes in top corners to accommodate eyebolts to facilitate installation using suspended guy wires (order eye bolt package separately)
      3. Electrically commutated, high-efficiency DC motor
      4. Includes FDA approved Acrylic urethane sealant.
      5. Filter:

\*\* NOTE TO SPECIFIER \*\* Select one of the following two paragraphs and delete the one not required.

* + - * 1. HEPA Filter: 99.99% efficient @ 0.3 &#181;m particles
        2. ULPA Filter: 99.999% efficient @ 0.12 &#181;m particles.
      1. Sound level approximately 49 dBA,
      2. Operating Rating:
         1. Maximum CFM (m3/hr):475 at 100W
      3. Filter Replacement Access:
         1. Top Side
         2. Room Side: Easy-open clips with Gel-sealed filter seats securely against blower housing to form a tight seal.
      4. Motor control panel includes diagnostic indicator lights, manual speed adjustment, test probe jacks, CAT5e ports, control mode switch, and MODBUS address DIP switch bank.
      5. Marks and Listings:
         1. UL, ULC

\*\* NOTE TO SPECIFIER \*\* Include the following paragraph if CE approval is required . Delete if not required.

* + - * 1. CE approved, requires Safety Cover.
      1. Weight: 44 Lbs
      2. Power:

\*\* NOTE TO SPECIFIER \*\* Select the Power required from the following paragraphs and delete those not required.

* + - * 1. 120VAC, 60 Hz
        2. 220VAC, 60 Hz
      1. Options:

\*\* NOTE TO SPECIFIER \*\* Select the options required from the following paragraphs and delete those not required.

* + - * 1. Challenge Port to simplifies leak testing
        2. Eye bolt package
      1. Includes yellow power cord with 4-pin connector for easy installation (connector may be removed and replaced with plug for connection to wall outlet)
  1. REVERSE-FLOW FAN/FILTER UNIT
     1. Reverse-Flow Fan/Filter Units; 2 foot by 4 foot, HEPA/ULPA. Low-profile exhaust FFUs remove sub-micron particles, aerosols and fine dust allowing safe release of HEPA- or ULPA-filtered air without an exhaust system. Low-profile design allows installation on cleanrooms with standard 9 foot ceiling,
        1. Material:

\*\* NOTE TO SPECIFIER \*\* Select one of the following two paragraphs and delete the one not required.

* + - * 1. Powder-Coated White CR Steel frame with aluminum filter face grille.
        2. Type 304 Stainless Steel frame with stainless steel filter face grille.
      1. Internal baffling plates and diffuser panel provide uniform air speed across the filter face, ensuring laminar airflow.
      2. Provided with 1/4 inch (6 mm) threaded holes in top corners to accommodate eyebolts to facilitate installation using suspended guy wires (order eye bolt package separately)
      3. Includes AC 3-speed blower motor with three-setting switch that simplifies air balancing.
      4. Includes FDA approved Acrylic urethane sealant.
      5. Prefilter: MERV 7 Pre-filter, 30% ASHRAE rated.
      6. Filter:

\*\* NOTE TO SPECIFIER \*\* Select one of the following two paragraphs and delete the one not required.

* + - * 1. HEPA Filter: 99.99% efficient @ 0.3 &#181;m particles
        2. ULPA Filter: 99.999% efficient @ 0.12 &#181;m particles.
      1. Sound level approximately 40 dBA,
      2. Operating Rating:
         1. Maximum CFM: 900 at 170W
      3. Motor control panel includes diagnostic indicator lights, manual speed adjustment, test probe jacks, CAT5e ports, control mode switch, and MODBUS address DIP switch bank.
      4. Marks and Listings:
         1. UL, ULC
      5. Weight: 71 Lbs
      6. Power:

\*\* NOTE TO SPECIFIER \*\* Select the Power required from the following paragraphs and delete those not required.

* + - * 1. 120VAC, 60 Hz
        2. 220VAC, 60 Hz
      1. Options:

\*\* NOTE TO SPECIFIER \*\* Select the options required from the following paragraphs and delete those not required.

* + - * 1. Challenge Port to simplifies leak testing
        2. Eye bolt package
        3. Includes yellow power cord with 4-pin connector for easy installation (connector may be removed and replaced with plug for connection to wall outlet)
    1. Reverse Flow Fan Filter Units; WhisperFlow, 2 foot by 3 foot, HEPA/ULPA. Low-profile exhaust FFUs remove sub-micron particles, aerosols and fine dust allowing safe release of HEPA- or ULPA-filtered air without an exhaust system. Low-profile design allows installation on cleanrooms with standard 9 foot ceiling,
       1. Material:

\*\* NOTE TO SPECIFIER \*\* Select one of the following two paragraphs and delete the one not required.

* + - * 1. Powder-Coated White CR Steel frame with aluminum filter face grille.
        2. Type 304 Stainless Steel frame with stainless steel filter face grille.
      1. Internal baffling plates and diffuser panel provide uniform air speed across the filter face, ensuring laminar airflow.
      2. Provided with 1/4 inch (6 mm) threaded holes in top corners to accommodate eyebolts to facilitate installation using suspended guy wires (order eye bolt package separately)
      3. Includes AC 3-speed blower motor with three-setting switch that simplifies air balancing.
      4. Includes FDA approved Acrylic urethane sealant.
      5. Prefilter: MERV 7 Pre-filter, 30% ASHRAE rated.
      6. Filter:

\*\* NOTE TO SPECIFIER \*\* Select one of the following two paragraphs and delete the one not required.

* + - * 1. HEPA Filter: 99.99% efficient @ 0.3 &#181;m particles
        2. ULPA Filter: 99.999% efficient @ 0.12 &#181;m particles.
      1. Sound level approximately 40 dBA.
      2. Operating Rating:
         1. Maximum CFM:780 at 325W
      3. Motor control panel includes diagnostic indicator lights, manual speed adjustment, test probe jacks, CAT5e ports, control mode switch, and MODBUS address DIP switch bank.
      4. Marks and Listings:
         1. UL, ULC
      5. Weight: 71 Lbs
      6. Power:

\*\* NOTE TO SPECIFIER \*\* Select the Power required from the following paragraphs and delete those not required.

* + - * 1. 120VAC, 60 Hz
        2. 220VAC, 60 Hz
      1. Options:

\*\* NOTE TO SPECIFIER \*\* Select the options required from the following paragraphs and delete those not required.

* + - * 1. Challenge Port to simplifies leak testing
        2. Eye bolt package
        3. Includes yellow power cord with 4-pin connector for easy installation (connector may be removed and replaced with plug for connection to wall outlet
    1. Reverse Flow Fan Filter Units; WhisperFlow, 2 foot by 2 foot, HEPA/ULPA. . Low-profile exhaust FFUs remove sub-micron particles, aerosols and fine dust allowing safe release of HEPA- or ULPA-filtered air without an exhaust system. Low-profile design allows installation on cleanrooms with standard 9 foot ceiling,
       1. Material:

\*\* NOTE TO SPECIFIER \*\* Select one of the following two paragraphs and delete the one not required.

* + - * 1. Powder-Coated White CR Steel frame with aluminum filter face grille.
        2. Type 304 Stainless Steel frame with stainless steel filter face grille.
      1. Internal baffling plates and diffuser panel provide uniform air speed across the filter face, ensuring laminar airflow.
      2. Provided with 1/4 inch (6 mm) threaded holes in top corners to accommodate eyebolts to facilitate installation using suspended guy wires (order eye bolt package separately)
      3. Includes AC 3-speed blower motor with three-setting switch that simplifies air balancing.
      4. Includes FDA approved Acrylic urethane sealant.
      5. Filter:

\*\* NOTE TO SPECIFIER \*\* Select one of the following two paragraphs and delete the one not required.

* + - * 1. HEPA Filter: 99.99% efficient @ 0.3 &#181;m particles
        2. ULPA Filter: 99.999% efficient @ 0.12 &#181;m particles.
      1. Sound level approximately 40 dBA.
      2. Operating Rating:
         1. Maximum CFM: 400 at 130W
      3. Motor control panel includes diagnostic indicator lights, manual speed adjustment, test probe jacks, CAT5e ports, control mode switch, and MODBUS address DIP switch bank.
      4. Marks and Listings:
         1. UL, ULC
      5. Weight: 71 Lbs
      6. Power:

\*\* NOTE TO SPECIFIER \*\* Select the Power required from the following paragraphs and delete those not required.

* + - * 1. 120VAC, 60 Hz
        2. 220VAC, 60 Hz
      1. Options:

\*\* NOTE TO SPECIFIER \*\* Select the options required from the following paragraphs and delete those not required.

* + - * 1. Challenge Port to simplifies leak testing
        2. Eye bolt package
        3. Includes yellow power cord with 4-pin connector for easy installation (connector may be removed and replaced with plug for connection to wall outlet.
  1. VAPOR REMOVAL AND SANITIZING MODULES
     1. Vapor Removal and Sanitizing Module; 2 foot by 4 foot, adapter adds capabilities to the WhisperFlow Fan/Filter Units including Carbon Prefilter that removes volatile organic compounds (VOCs) to ensure a safe, clean process environment and a prefilter that also helps compensate for VOC spikes that might occur during certain operations.
        1. Photo-Catalytic Oxidation Panel (PCO) removes volatile organic compounds (VOCs) remaining in the air stream after they pass the carbon filter. The PCO panel is highly efficient at vapor removal, yet imposes no restriction on air speed, allowing the Fan/Filter Module to maintain air speeds consistent with ISO cleanliness requirements (typically 80-100 feet/minute).
        2. UV Sanitizer kills most bacteria, viruses and molds to eliminate biological hazards inside the cleanroom. It also energizes the PCO, boosting its vapor-adsorption efficiency.
        3. Requires an adapter module for each 2 foot by 4 foot (610 mm by 1219 mm) FFU. Includes adapter housing, one charcoal pre-filter, two sanitizing modules, and one PCO panel. Adapter must be ordered together with Terra WhisperFlow FFU.
  2. DUCTED FILTER MODULES
     1. Ducted Filter Modules; WhisperFlow 2 foot by 4 foot, HEPA/ULPA. Low-profile modules provide ducted HEPA or ULPA filtered air when connected to an air handler or other air source.
        1. Material:

\*\* NOTE TO SPECIFIER \*\* Select one of the following two paragraphs and delete the one not required.

* + - * 1. Powder-Coated White CR Steel frame with aluminum filter face grille.
        2. Type 304 Stainless Steel frame with stainless steel filter face grille.
      1. Type:

\*\* NOTE TO SPECIFIER \*\* Select one of the following paragraphs and delete those not required.

* + - * 1. Standard.
        2. Room Side: Easy-open clips with Gel-sealed filter seats securely against blower housing to form a tight seal.
      1. Includes 12 inch diameter by 2 inch H collar for connection to air supply; Airflow performance depends on flow of supplied air handler
      2. Diffuser Grille:

\*\* NOTE TO SPECIFIER \*\* Select one of the following two paragraphs and delete the one not required.

* + - * 1. Anodized aluminum
        2. Stainless Steel
      1. Provided with 1/4 inch (6 mm) eyebolts in all (4) corners for hangwire support (order eye bolt package separately)
      2. Includes FDA-approved silicone sealant. Acrylic urethane or other required sealant type is available.
      3. Filter:

\*\* NOTE TO SPECIFIER \*\* Select one of the following two paragraphs and delete the one not required.

* + - * 1. HEPA Filter: 99.99% efficient @ 0.3 &#181;m particles
        2. ULPA Filter: 99.999% efficient @ 0.12 &#181;m particles.
      1. Weight: 71 Lbs
    1. Ducted Filter Modules; WhisperFlow, 2 foot by 3 foot, HEPA/ULPA. Low-profile modules provide ducted HEPA or ULPA filtered air when connected to an air handler or other air source.
       1. Material:

\*\* NOTE TO SPECIFIER \*\* Select one of the following two paragraphs and delete the one not required.

* + - * 1. Powder-Coated White CR Steel frame with aluminum filter face grille.
        2. Type 304 Stainless Steel frame with stainless steel filter face grille.
      1. Type:

\*\* NOTE TO SPECIFIER \*\* Select one of the following paragraphs and delete those not required.

* + - * 1. Standard.
        2. Room Side: Easy-open clips with Gel-sealed filter seats securely against blower housing to form a tight seal.
      1. Includes 12 inch diameter by 2 inch H collar for connection to air supply; Airflow performance depends on flow of supplied air handler
      2. Diffuser Grille:

\*\* NOTE TO SPECIFIER \*\* Select one of the following two paragraphs and delete the one not required.

* + - * 1. Anodized aluminum
        2. Stainless Steel
      1. Provided with 1/4 inch (6 mm) eyebolts in all (4) corners for hangwire support (order eye bolt package separately)
      2. Includes FDA-approved silicone sealant. Acrylic urethane or other required sealant type is available.
      3. Filter:

\*\* NOTE TO SPECIFIER \*\* Select one of the following two paragraphs and delete the one not required.

* + - * 1. HEPA Filter: 99.99% efficient @ 0.3 &#181;m particles
        2. ULPA Filter: 99.999% efficient @ 0.12 &#181;m particles.
      1. Weight: 53 Lbs
    1. Ducted Filter Modules; WhisperFlow, 2 foot by 2 foot, HEPA/ULPA. Low-profile modules provide ducted HEPA or ULPA filtered air when connected to an air handler or other air source.
       1. Material:

\*\* NOTE TO SPECIFIER \*\* Select one of the following two paragraphs and delete the one not required.

* + - * 1. Powder-Coated White CR Steel frame with aluminum filter face grille.
        2. Type 304 Stainless Steel frame with stainless steel filter face grille.
      1. Type:

\*\* NOTE TO SPECIFIER \*\* Select one of the following paragraphs and delete those not required.

* + - * 1. Standard.
        2. Room Side: Easy-open clips with Gel-sealed filter seats securely against blower housing to form a tight seal.
      1. Includes 12 inch diameter by 2 inch H collar for connection to air supply; Airflow performance depends on flow of supplied air handler
      2. Diffuser Grille:

\*\* NOTE TO SPECIFIER \*\* Select one of the following two paragraphs and delete the one not required.

* + - * 1. Anodized aluminum
        2. Stainless Steel
      1. Provided with 1/4 inch (6 mm) eyebolts in all (4) corners for hangwire support (order eye bolt package separately)
      2. Includes FDA-approved silicone sealant. Acrylic urethane or other required sealant type is available.
      3. Filter:

\*\* NOTE TO SPECIFIER \*\* Select one of the following two paragraphs and delete the one not required.

* + - * 1. HEPA Filter: 99.99% efficient @ 0.3 &#181;m particles
        2. ULPA Filter: 99.999% efficient @ 0.12 &#181;m particles.
      1. Weight: 25 Lbs
  1. NARROW FAN/FILTER UNITS
     1. Narrow Fan/Filter Units; WhisperFlow 48 inch by 16 inch by 13 inch (1219 by 406 by 330), HEPA/ULPA. Unit fits in space-saving enclosures for a smaller footprint.
        1. Material:
           1. Powder-Coated White CR Steel frame with aluminum filter face grille.
        2. Diffuser Grille:
           1. Anodized aluminum
        3. Provided with 1/4 inch (6 mm) eyebolts in all (4) corners for hangwire support (order eye bolt package separately)
        4. Includes AC 3-speed blower motor with three-setting switch that simplifies air balancing.
        5. Blower: Forward curved centrifugal type factory balanced. Motor/blower assembly is removable from top of housing for service Internal baffling plates and diffuser panel provide uniform air speed across the filter face
        6. Includes FDA approved silicone sealant. Acrylic urethane or other required sealant type is available.
        7. Drop-In Prefilter.
        8. Filter:

\*\* NOTE TO SPECIFIER \*\* Select one of the following two paragraphs and delete the one not required.

* + - * 1. HEPA Filter: 99.99% efficient @ 0.3 &#181;m particles
        2. ULPA Filter: 99.999% efficient @ 0.12 &#181;m particles.
      1. Sound level approximately 49 dBA,
      2. Operating Rating: With pre-filter and HEPA/ULPA filter installed.
         1. Average CFM (m3/hr):High 734 (1248), Medium 650 (1105), Low 632 (1074),
         2. Air Speed FPM (m/s): High 163 (0.83), Medium 144 (0.73), Low 140 (0.71).
      3. Filter Replacement Access: Top Side
      4. Marks and Listings:
         1. UL, ULC
         2. Meets IEST Recommended Practices
      5. Weight: 50 Lbs
      6. Power:

\*\* NOTE TO SPECIFIER \*\* Select the Power required from the following paragraphs and delete those not required.

* + - * 1. 120VAC, 60 Hz
        2. 220VAC, 60 Hz
      1. Options:

\*\* NOTE TO SPECIFIER \*\* Select the options required from the following paragraphs and delete those not required.

* + - * 1. Provide with yellow power cord with 4-pin connector for easy installation.
    1. Narrow Fan/Filter Units; WhisperFlow 36 inch by 16 inch by 13 inch (914 by 406 by 330), HEPA/ULPA. Unit fits in space-saving enclosures for a smaller footprint.
       1. Material:

\*\* NOTE TO SPECIFIER \*\* Select one of the following two paragraphs and delete the one not required.

* + - * 1. Powder-Coated White CR Steel frame with aluminum filter face grille.
        2. Type 304 Stainless Steel frame with stainless steel filter face grille.
      1. Diffuser Grille:

\*\* NOTE TO SPECIFIER \*\* Select one of the following two paragraphs and delete the one not required.

* + - * 1. Anodized aluminum
        2. Stainless Steel
      1. Provided with 1/4 inch (6 mm) eyebolts in all (4) corners for hangwire support (order eye bolt package separately)
      2. Includes AC 3-speed blower motor with three-setting switch that simplifies air balancing.
      3. Blower: Forward curved centrifugal type factory balanced. Motor/blower assembly is removable from top of housing for service Internal baffling plates and diffuser panel provide uniform air speed across the filter face
      4. Includes FDA approved silicone sealant. Acrylic urethane or other required sealant type is available.
      5. Drop-In Prefilter.
      6. Filter:

\*\* NOTE TO SPECIFIER \*\* Select one of the following two paragraphs and delete the one not required.

* + - * 1. HEPA Filter: 99.99% efficient @ 0.3 &#181;m particles
        2. ULPA Filter: 99.999% efficient @ 0.12 &#181;m particles.
      1. Sound level approximately 49 dBA,
      2. Operating Rating: With pre-filter and HEPA/ULPA filter installed..
         1. Average CFM (m3/hr): High 587.2 (998), Medium 520 (884), Low 506 (860),
         2. Air Speed FPM (m/s): High 130 (0.663), Medium 115 (0.58), Low 112 (0.56).
      3. Filter Replacement Access: Top Side
      4. Marks and Listings:
         1. UL, ULC
         2. Meets IEST Recommended Practices
      5. Weight: 50 Lbs
      6. Power:

\*\* NOTE TO SPECIFIER \*\* Select the Power required from the following paragraphs and delete those not required.

* + - * 1. 120VAC, 60 Hz
        2. 220VAC, 60 Hz
      1. Options:

\*\* NOTE TO SPECIFIER \*\* Select the options required from the following paragraphs and delete those not required.

* + - * 1. Provide with yellow power cord with 4-pin connector for easy installation.
    1. Narrow Fan/Filter Units; WhisperFlow 24 inch by 16 inch by 13 inch (610 by 406 by 330), HEPA/ULPA. Unit fits in space-saving enclosures for a smaller footprint.
       1. Material:
          1. Powder-Coated White CR Steel frame with aluminum filter face grille.
       2. Diffuser Grille:
          1. Anodized aluminum
       3. Provided with 1/4 inch (6 mm) eyebolts in all (4) corners for hangwire support (order eye bolt package separately)
       4. Includes AC 3-speed blower motor with three-setting switch that simplifies air balancing.
       5. Blower: Forward curved centrifugal type factory balanced. Motor/blower assembly is removable from top of housing for service Internal baffling plates and diffuser panel provide uniform air speed across the filter face
       6. Includes FDA approved silicone sealant. Acrylic urethane or other required sealant type is available.
       7. Drop-In Prefilter.
       8. Filter:

\*\* NOTE TO SPECIFIER \*\* Select one of the following two paragraphs and delete the one not required.

* + - * 1. HEPA Filter: 99.99% efficient @ 0.3 &#181;m particles
        2. ULPA Filter: 99.999% efficient @ 0.12 &#181;m particles.
      1. Sound level approximately 49 dBA,
      2. Operating Rating: With pre-filter and HEPA/ULPA filter installed.
         1. Average CFM (m3/hr): High 470 (799), Medium 416 (7075), Low 404 (688),
         2. Air Speed FPM (m/s): High 104 (0.53), Medium 92 (0.46), Low 89 (0.45).
      3. Filter Replacement Access: Top Side
      4. Marks and Listings:
         1. UL, ULC
         2. Meets IEST Recommended Practices
      5. Weight: 50 Lbs
      6. Power:

\*\* NOTE TO SPECIFIER \*\* Select the Power required from the following paragraphs and delete those not required.

* + - * 1. 120VAC, 60 Hz
        2. 220VAC, 60 Hz
      1. Options:

\*\* NOTE TO SPECIFIER \*\* Select the options required from the following paragraphs and delete those not required.

* + - * 1. Provide with yellow power cord with 4-pin connector for easy installation.
  1. HEATED CLEANROOM FAN FILTER UNITS
     1. Heated Fan Filter Units; WhisperFlow, 2 foot by 4 foot, HEPA/ULPA. Integrated heating element warms micro-filtered air for fast, efficient parts drying and other elevated processing.
        1. Material:

\*\* NOTE TO SPECIFIER \*\* Select one of the following two paragraphs and delete the one not required.

* + - * 1. Powder-Coated White CR Steel frame with aluminum filter face grille.
        2. Type 304 Stainless Steel frame with stainless steel filter face grille.
      1. Diffuser Grille:

\*\* NOTE TO SPECIFIER \*\* Select one of the following two paragraphs and delete the one not required.

* + - * 1. Anodized aluminum
        2. Stainless Steel
      1. Includes heating element to provide safe, controlled heating up to 100 degrees F maximum.
      2. Provided with 1/4 inch (6 mm) eyebolts in all (4) corners for hangwire support (order eye bolt package separately)
      3. Includes AC 3-speed blower motor with three-setting switch that simplifies air balancing.
      4. Blower: Forward curved centrifugal type factory balanced. Motor/blower assembly is removable from top of housing for service Internal baffling plates and diffuser panel provide uniform air speed across the filter face.
      5. Includes FDA-approved silicone sealant. Acrylic urethane or other required sealant type is available.
      6. Prefilter: 20 inches by 20 inches by 1 inch (508 mm by 508 mm by 25 mm) UL classified for Class 1; rated 80% efficient on linty dusts.
      7. Filter:

\*\* NOTE TO SPECIFIER \*\* Select one of the following two paragraphs and delete the one not required.

* + - * 1. HEPA Filter: 99.99% efficient @ 0.3 &#181;m particles
        2. ULPA Filter: 99.999% efficient @ 0.12 &#181;m particles.
      1. Sound level approximately 49 dBA,
      2. Operating Rating: With pre-filter and HEPA/ULPA filter installed.
         1. Average CFM (m3/hr):High 808 (1372.8), Medium 717 (1218.19), Low 654 (1111.15).
         2. Air Speed FPM (m/s): High 115 (0.58), Medium 102 (0.52), Low 93 (0.47), measured 6 inches (132 mm) below filter face.
      3. Filter Replacement Access:
         1. Top Side
         2. Room Side: Easy-open clips with Gel-sealed filter seats securely against blower housing to form a tight seal.
      4. Marks and Listings:
         1. UL, ULC
         2. Meets IEST Recommended Practices
      5. Weight: 71 Lbs
      6. Includes yellow power cord with 4-pin connector for easy installation (connector may be removed and replaced with plug for connection to wall outlet)
      7. Power:

\*\* NOTE TO SPECIFIER \*\* Select the Power required from the following paragraphs and delete those not required.

* + - * 1. 120VAC, 60 Hz
        2. 220VAC, 60 Hz
    1. Heated Fan Filter Units; WhisperFlow, 2 foot by 3 foot, HEPA/ULPA. Integrated heating element warms micro-filtered air for fast, efficient parts drying and other elevated processing.
       1. Material:

\*\* NOTE TO SPECIFIER \*\* Select one of the following two paragraphs and delete the one not required.

* + - * 1. Powder-Coated White CR Steel frame with aluminum filter face grille.
        2. Type 304 Stainless Steel frame with stainless steel filter face grille.
      1. Diffuser Grille:

\*\* NOTE TO SPECIFIER \*\* Select one of the following two paragraphs and delete the one not required.

* + - * 1. Anodized aluminum
        2. Stainless Steel
      1. Includes heating element to provide safe, controlled heating up to 100 degrees F maximum.
      2. Provided with 1/4 inch (6 mm) eyebolts in all (4) corners for hangwire support (order eye bolt package separately)
      3. Includes AC 3-speed blower motor with three-setting switch that simplifies air balancing.
      4. Blower: Forward curved centrifugal type factory balanced. Motor/blower assembly is removable from top of housing for service Internal baffling plates and diffuser panel provide uniform air speed across the filter face.
      5. Includes FDA-approved silicone sealant. Acrylic urethane or other required sealant type is available.
      6. Prefilter: 20 inches by 20 inches by 1 inch (508 mm by 508 mm by 25 mm) UL classified for Class 1; rated 80% efficient on linty dusts.
      7. Filter:

\*\* NOTE TO SPECIFIER \*\* Select one of the following two paragraphs and delete the one not required.

* + - * 1. HEPA Filter: 99.99% efficient @ 0.3 &#181;m particles
        2. ULPA Filter: 99.999% efficient @ 0.12 &#181;m particles.
      1. Sound level approximately 49 dBA,
      2. Operating Rating: With pre-filter and HEPA/ULPA filter installed.
         1. Average CFM (m3/hr): High 628 (1066.98), Medium 602 (1022.8), Low 550 (934.46).
         2. Air Speed FPM (m/s): High 121 (0.62), Medium 116 (0.59), Low 160 (0.50), measured 6 inches (132 mm) below filter face.
      3. Filter Replacement Access:
         1. Top Side
         2. Room Side: Easy-open clips with Gel-sealed filter seats securely against blower housing to form a tight seal.
      4. Marks and Listings:
         1. UL, ULC
         2. Meets IEST Recommended Practices
      5. Weight: 53 Lbs
      6. Includes yellow power cord with 4-pin connector for easy installation (connector may be removed and replaced with plug for connection to wall outlet)
      7. Power:

\*\* NOTE TO SPECIFIER \*\* Select the Power required from the following paragraphs and delete those not required.

* + - * 1. 120VAC, 60 Hz
        2. 220VAC, 60 Hz
    1. Heated Fan Filter Units; WhisperFlow, 2 foot by 2 foot, HEPA/ULPA. Integrated heating element warms micro-filtered air for fast, efficient parts drying and other elevated processing.
       1. Material:

\*\* NOTE TO SPECIFIER \*\* Select one of the following two paragraphs and delete the one not required.

* + - * 1. Powder-Coated White CR Steel frame with aluminum filter face grille.
        2. Type 304 Stainless Steel frame with stainless steel filter face grille.
      1. Diffuser Grille:

\*\* NOTE TO SPECIFIER \*\* Select one of the following two paragraphs and delete the one not required.

* + - * 1. Anodized aluminum
        2. Stainless Steel
      1. Includes heating element to provide safe, controlled heating up to 100 degrees F maximum.
      2. Provided with 1/4 inch (6 mm) eyebolts in all (4) corners for hangwire support (order eye bolt package separately)
      3. Includes AC 3-speed blower motor with three-setting switch that simplifies air balancing.
      4. Blower: Forward curved centrifugal type factory balanced. Motor/blower assembly is removable from top of housing for service Internal baffling plates and diffuser panel provide uniform air speed across the filter face.
      5. Includes FDA-approved silicone sealant. Acrylic urethane or other required sealant type is available.
      6. Prefilter: 20 inches by 20 inches by 1 inch (508 mm by 508 mm by 25 mm) UL classified for Class 1; rated 80% efficient on linty dusts.
      7. Filter:

\*\* NOTE TO SPECIFIER \*\* Select one of the following two paragraphs and delete the one not required.

* + - * 1. HEPA Filter: 99.99% efficient @ 0.3 &#181;m particles
        2. ULPA Filter: 99.999% efficient @ 0.12 &#181;m particles.
      1. Sound level approximately 49 dBA,
      2. Operating Ratings (High Speed/Medium Speed/Low Speed): (measured 6 inches (132 mm) below filter face)
         1. Average CFM (m3/hr): High 578 (982.03, Medium 558 (848.05, Low 544 (924.26).
         2. Air Speed FPM (m/s): High 172 (.87), Medium 166 (.84), Low 162 (.82);
      3. Filter Replacement Access:
         1. Top Side
         2. Room Side: Easy-open clips with Gel-sealed filter seats securely against blower housing to form a tight seal.
      4. Marks and Listings:
         1. UL, ULC
         2. Meets IEST Recommended Practices
      5. Weight: 44 Lbs
      6. Includes yellow power cord with 4-pin connector for easy installation (connector may be removed and replaced with plug for connection to wall outlet)
      7. Power:

\*\* NOTE TO SPECIFIER \*\* Select the Power required from the following paragraphs and delete those not required.

* + - * 1. 120VAC, 60 Hz
        2. 220VAC, 60 Hz

\*\* NOTE TO SPECIFIER \*\* Versatile control systems provide traceable process conditions for cGMP, FDA, and USP compliance. Select the Cleanroom Controls required from the following paragraphs and delete those not required. Contact Terra for more information on systems configured to your room design and FFU quantity.

* 1. CLEANROOM CONTROL UNITS
     1. Power Distribution Modules and Control Panels: Control Panel with Operation Status Indicators provides convenient access to all control and a visual confirmation of cleanroom operation
        1. Description:
           1. Plug-and-play, modular design for Terra-furnished modular cleanroom or Terra cleanroom components used in your own cleanroom structure
           2. Power Distribution Modules (PDMs) provides connection of fan/filter modules (FFUs) and ceiling lights, while providing low-voltage power for one or more Control Panels
        2. Control Panel:
           1. Control Panel integrates control of all system components in a single, easy-clean panel mounted at the main entry.
           2. Night Setting maintains cleanroom conditions with a 25 percent savings in energy consumption during non-work hours
        3. PDM: Each PDM accommodates up to 5 lights and 5 FFUs wired to a dedicated 35A fused 120V circuit or a 30A fused 240V circuit. Select among four PDM types.

\*\* NOTE TO SPECIFIER \*\* Select one or more of the following paragraphs and delete those not required.

* + - * 1. Primary PDM: contains low-voltage control circuit required for a Control Panel and distributes power safely to up to 5 FFUs and 5 lights. Additional FFUs and lights require alternating Secondary and Booster PDMs connected in series.

Marks and Listings: UL, ULC

Electrical Specifications:

120 V, 28 A, 4,200 W, 50/60 Hz

240 V, 24 A, 7,200 W, 50/60 Hz

Dimensions, Product: 17.5 jnches W by 18.5 inches D by 6.25 inches H

Weight, Product: 35 Lbs

* + - * 1. Secondary PDM: Provides power to up to 5 FFUs and 5 lights and connects to either a Primary or a Booster PDM.

Marks and Listings: UL, ULC

Electrical Specifications:

120 V, 28 A, 4,200 W, 50/60 Hz

240 V, 24 A, 7,200 W, 50/60 Hz

Dimensions, Product: 17.5 jnches W by 18.5 inches D by 6.25 inches H

Weight, Product: 20 Lbs

* + - * 1. Booster PDM: is required if your system includes FFUs beyond what a Secondary PDM controls. Each Booster PDM is connected in series from a Secondary PDM to an additional Secondary PDM (if required).

Marks and Listings: UL, ULC

Electrical Specifications:

120 V, 28 A, 4,200 W, 50/60 Hz

240 V, 24 A, 7,200 W, 50/60 Hz

Dimensions, Product: 17.5 jnches W by 18.5 inches D by 6.25 inches H

Weight, Product: 45 Lbs

* + - 1. Power Outlet PDM: Provides a single power connection for up to five duplex outlets, each box requires a dedicated 20A fused circuit.
         1. Marks and Listings: UL, ULC
         2. Electrical Specifications:

120 V, 28 A, 4,200 W, 50/60 Hz

240 V, 24 A, 7,200 W, 50/60 Hz

* + - * 1. Dimensions, Product: 9.5 jnches W by 9.5 inches D by 5 inches H
      1. Options:

\*\* NOTE TO SPECIFIER \*\* Select the options required from the following paragraphs and delete those not required. Specify custom modifications for multiple pressure gauges.

* + - * 1. Standard models include:

on/off switch for Fan/Filter

on/off switch for light on/off switch,

Night Service Switch

Magnehelic Differential Pressure Gauge.

* + - * 1. Digihelic gauges.
        2. Thermo-hygrometer.
        3. Filter Replacement Alarm System
    1. Smart Cleanroom Fan/Filter Unit Control Systems:

\*\* NOTE TO SPECIFIER \*\* Select the Smart Fan/Filter Unit Control System required from the following paragraphs and delete those not required. Contact the Manufacturer for more information

* + - 1. Tier 1 Individual FFU and Room Control with Sensor Feedback (Cat# 6702-83):
         1. Console Type: LCD Panel, Field Configured
         2. LAN Supported: 1
         3. Maximum Number of FFU Supported: 50
         4. Maximum Number of Groups Supported: 5
         5. Functions Monitored:

Fan Performance Alarm

Communications Alarm

Set Speed-Units/Global

Pressure, Temperature, Humidity: 3 inputs

* + - 1. Tier 2: Individual FFU and Room Control with environmental Monitoring and Data Logging (Cat# 6702-84)
         1. Console Type: 3.5 inch Graphic Display, Field Configured
         2. LAN Supported: 1
         3. Maximum Number of FFU Supported: 1000
         4. Maximum Number of Groups Supported: 8
         5. Functions Monitored:

Alarm Output to BMS

Clock Calendar

Remote Setback

Remote Shutdown

Fan Performance Alarm

EC (RPM) Monitoring

Communications Alarm

Set Speed-Units/Global

Pressure, Temperature, Humidity: 6 inputs

Data Logging: Local

Ethernet: Optional

* + - 1. Tier 3: Fully Automated FFU Control with Environmental Monitoring and Datalogging
         1. Console Type: 7 inch Touchscreen Display, Field Configured
         2. LAN Supported: 1
         3. Maximum Number of FFU Supported: 100
         4. Maximum Number of Groups Supported: 8
         5. Functions Monitored:

Alarm Output to BMS

Clock Calendar

Remote Setback

Remote Shutdown

Fan Performance Alarm

EC (RPM) Monitoring

Communications Alarm

Set Speed-Units/Global

Pressure, Temperature, Humidity: 6 inputs

Data Logging: Remote

Ethernet: Yes

1. EXECUTION
   * 1. Do not begin installation until openings and substrates have been properly prepared.
     2. Verify exact location of clean room fan filter units for installation.
     3. Verify that supports, rough openings and surfaces are ready to receive work.
     4. If opening and substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
   1. PREPARATION
      1. Clean surfaces thoroughly prior to installation.
      2. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
      3. Provide templates and rough-in measurements as required.
   2. INSTALLATION
      1. Install in accordance with manufacturer's written instructions and recommendations and in proper relationship with adjacent work.
      2. Rigidly mount FFUs level and plumb with fasteners recommended by the manufacturer.
      3. Record any necessary changes to the system design.
      4. Seal the perimeter of both sides of the openings as required.
      5. Startup equipment in accordance with manufacturer's instructions.
   3. ADJUST AND CLEAN
      1. After installation FFUs, clean all dirty or discolored surfaces, using cleaning materials and methods acceptable to manufacturer. Replace damaged components as directed by the Architect.
      2. Remove debris caused by work of this section on a daily basis. At completion of installation, remove all crates, cartons, packages, and debris from the project site.
   4. CLOSEOUT ACTIVITIES
      1. Demonstrate operational system to Owner representative.
      2. Instruct Owner's representative to maintain system and use any occupant controls or interfaces, as required.
      3. Review service and support contacts.
   5. PROTECTION
      1. Protect installed products until completion of project.
      2. Touch-up, repair or replace damaged products before Substantial Completion.
   6. SCHEDULES

\*\* NOTE TO SPECIFIER \*\* Retain Paragraph below if required to suit project requirements. Identify products by Door Number on the Drawings and use this paragraph to define the location of each type of Door Type to be used. Edit as required to suit project or delete and identify products on the Drawings.

* + 1. :
    2. :

END OF SECTION