



Quick-Start Operating Guide

Document No. 1800-80

BioSafe™ Modular Cleanroom

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Your Comprehensive
 Equipment Source

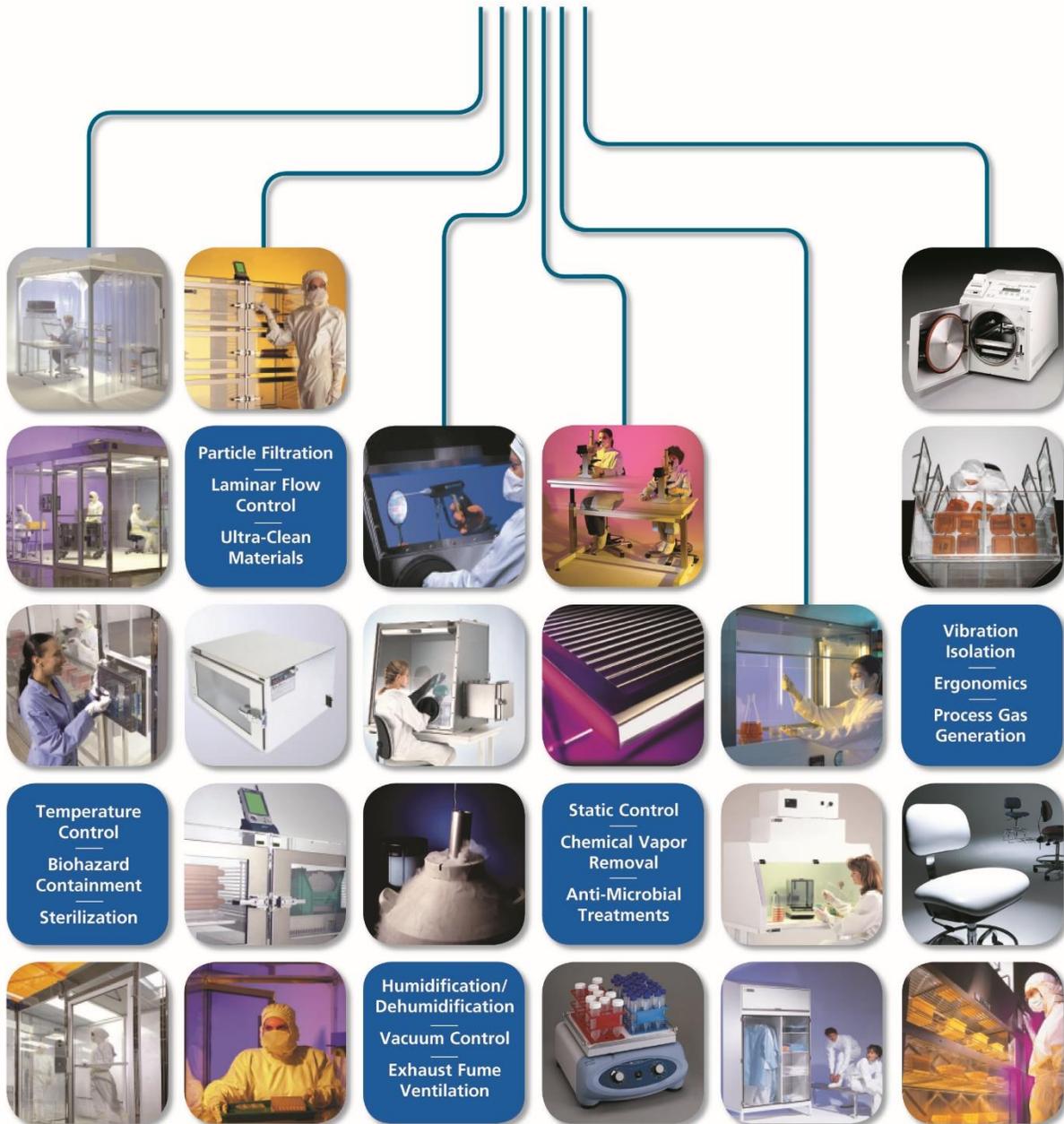




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Proprietary Notice

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Safety Notice

A thorough familiarity with all operating guidelines is essential to safe operation of the product. Failure to observe safety precautions could result in poor performance, damage to the system or other property, or serious bodily injury or death.

The following symbols are intended to call your attention to two levels of hazard involved in operation:

The information presented here is subject to change without notice.



CAUTION

Cautions are used when failure to observe instructions could result in significant damage to equipment.



WARNING

Warnings are used when failure to observe instructions or precautions could result in injury or death.

1.0 Introduction

This manual provides information on operating your Terra Universal BioSafe Modular Cleanroom. By studying it carefully, you can be assured of a long, efficient service life from the unit.



IMPORTANT SAFETY NOTICE

Terra Universal Cleanrooms are not designed to support more weight than the blower modules and lighting fixtures originally installed. In particular, the ceiling grid beams are not load-bearing and will not support personnel or other additional loads. Placing added weight on the ceiling grid may result in serious damage to the cleanroom and its occupants.

Safety notices supplied by Terra Universal must be affixed at appropriate places on each side of the cleanroom grid.

Although this installation/operation manual accurately describes the general design of TUI modular Cleanroom, individual orders may vary in dimensions and other design specifics. Refer to the Appendix for information specific to your order.



Designed to combine economy with versatility, this system features options such as ceiling-mounted filtration and illumination systems, and a variety of access options.

2.0 Equipment Description

Terra’s all-steel BioSafe Modular Cleanroom creates a rigid, self-supporting structure without a separate frame or external bracing, a key advantage over other designs that require special permitting and contractor installation. Its smooth internal and external surfaces stand up to standard disinfectants and sterilization procedures, making it ideal in bio/pharmaceutical applications. The module design of these rooms makes them easy to assemble, disassemble and reconfigure as needs change.

The ceiling grid creates standard 2’ x 4’ bays for installation of Terra’s standard HEPA or ULPA fan filter units and lights. These rooms accommodate the full range of cleanroom configuration options, including air conditioning, dehumidification modules, and ventilation equipment. In most application, the room is designed to provide a continuous positive pressure of filtered air to remove particles and meet specified cleanliness requirement, per FED-STD 209E or ISO requirements (see table below for correlation of cleanliness rating and FFU configurations and air change rate).

**Table 1:
Recommended Air Velocity Rates**

Class	Average Airflow Velocity	Air Changes Per Hour
ISO 14644-1 (Standard 209E)		
ISO 8 (Class 100,000)	0.005 - 0.041 m/sec (1 - 8 ft/min)	5 - 60
ISO 7 (Class 10,000)	0.051 - 0.076 m/sec (10 - 15 ft/min)	60 - 150
ISO 6 (Class 1,000)	0.127 - 0.203 m/sec (25 - 40 ft/min)	150 - 240
ISO 5 (Class 100)	0.203 - 0.406 m/sec (40 - 80 ft/min)	240 - 600
ISO 4 (Class 10)	0.254 - 0.457 m/sec (50 - 90 ft/min)	400 - 750
ISO 3 (Class 1)	0.305 - 0.457 m/sec (60 - 90 ft/min)	500 - 750
ISO 1-2	0.305 - 0.508 m/sec (60 - 100 ft/min)	500 - 750

Note: Actual average velocity and air changes required may vary depending on the application and floor plan.

**Table 2:
Recommended Ceiling Filter Coverage**

Class	Ceiling Coverage
ISO 8 (Class 100,000)	5 - 15%
ISO 7 (Class 10,000)	15 - 20%
ISO 6 (Class 1,000)	25 - 40%
ISO 5 (Class 100)	35 - 70%
ISO 4 (Class 10)	50 - 90%
ISO 3 (Class 1)	60 - 100%*
ISO 1-2	80 - 100%*

Note: Actual average velocity and air changes required may vary depending on the application and floor plan.
* ULPA filters required in Class 1/10 applications. HEPA filters required for all others.

NOTE: The BioSafe Cleanroom consists of the following modules (configurations vary depending on the application):

Double-Wall Steel Panels

The double-wall panels, available in 304/316 stainless or powder-coated steel, create a grid, freestanding structure. Each panel consists of an inside and outside portion, which are joined by a compression ball-and-socket fastener. Once joined, the walls can be detached by means of magnetic-grip handles (not included).

The hollow space created by these panels provides a convenient installation zone for electrical conduit, gas and vacuum service line enhancing systems, cleanliness and appearance. In controlled temperature applications, this void may be insulated to optimize thermal stability and reduce energy costs.

Ceiling Grid

The ceiling grid is created by a network of “T” joists that span the distance between vertical steel panels. In most applications, the longer joists lie across the shorter span of the room. Two-or four-foot divider joints connect these span joists to create the standard 2’ x 4’ bays required for mounting the fan filter units, lights or ceiling panels. Bar supports across the shorter span of the room are installed to provide stabilization to the frame.



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Gaskets are pre-installed along the perimeter of these ceiling bays for form tight seals when these ceiling modules are set in place. See system drawing for our particular grid configuration.

Fan Filter Units (FFUs)

FFUs direct a vertical laminar flow of filtered air downward through the enclosed cleanroom workspace to meet specified cleanliness levels.

Each includes a 700 CFM impeller blower (average flow at 100 FPM with filter load) mounted in a powder-coated steel housing with a plenum design that optimizes uniform air velocity across the entire face of the filter. A HEPA (high efficiency particulate air) filter installed inside the housing is rated 99.99% efficient at 0.3um particles. The filtration medium consists of micro porous polyurethane miniplates held in place by strong, rigid plastic separators that keep the medium from nesting. This design channels airflow with optimal efficiency to reduce resistance. The filter is sealed into the sturdy aluminum frame with a fire-retardant, non-outgassing adhesive. On an optional basis, an ULPA (ultra-low penetration air) filter, rated 99.9995% efficient at 0.12um particles, may be substituted for the HEPA filter.



This design channels airflow with optimal efficiency to reduce resistance. The filter is sealed into the sturdy aluminum frame with a fire-retardant, non-outgassing adhesive. On an optional basis, an ULPA (ultra-low penetration air) filter, rated 99.9995% efficient at 0.12um particles, may be substituted for the HEPA filter. Power to the Fan Filter Units is controlled by a master ON/OFF switch located on the cleanroom control panel.

All 120VAC units and 220VAC, 60Hz units are UL listed. CE-marked models are available for 220VAC, 50Hz operations.

Filter Fan Units (HP: high speed; MS: medium speed; LS: low speed)											
Model	Dimensions Inches (mm)	Wt. Lbs. (Kg)	Avg. CFM @ MS	Airflow ft/min (m/s)			Run Amps Watts @ 60Hz			Power	
				HS	MS	LS	HS	MS	LS		
2 x 4	23.63 x 47.63 x 12.51 (600 x 1210 x 318)	71 (32)	717 (1218)	115 (.58)	102 (.51)	93 (.47)	4.3A (512W)	3.5A (416W)	3.3A (393W)	120VAC, 60 Hz 220VAC, 50/60 Hz	
	23.63 x 35.63 x 12.51 (600 x 905 x 318)	53 (24)	602 (1023)	121 (.61)	116 (.59)	106 (.54)	4.1A (500W)	3.1A (378W)	2.7A (329W)	120VAC, 60 Hz 220VAC, 50/60 Hz	
2 x 2	23.63 x 23.63 x 12.51 (600 x 600 x 318)	44 (20)	558 (948)	172 (.87)	166 (.84)	162 (.82)	3.9W (472W)	2.8A (339W)	2.4A (290W)	120VAC, 60 Hz 220VAC, 50/60 Hz	

Recommended Fan Filter Configurations							
Nominal Dimensions	No. of Ceiling Bays	No. of Filter Modules to meet Fed Std 209 Class Standards					
		1	10	100	1,000	10,000	100,000
8' x 8'	8	5 - 8	4 - 8	3 - 6	2 - 3	1 - 2	1
8' x 12'	12	7 - 12	6 - 12	4 - 8	3 - 5	2 - 3	1 - 2
8' x 16'	16	10 - 16	8 - 16	6 - 11	4 - 6	2 - 4	1 - 3
12' x 12'	18	11 - 18	9 - 18	6 - 13	5 - 7	3 - 5	1 - 3
12' x 16'	24	14 - 24	12 - 24	8 - 17	6 - 10	4 - 6	2 - 4
16' x 16'	32	19 - 32	16 - 32	11 - 22	8 - 13	5 - 8	2 - 5



Configurations (based on less)

20' x 20'	50	30 - 50	25 - 50	18 - 35	13 - 20	8 - 13	3 - 8
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Recommended Fan Filter ceiling height of 8 feet or

Fluorescent Illumination Modules

Each fluorescent light module incorporates four low-energy T8 light tubes, providing an average illumination of 4,560 foot-candles. They are interconnected by means of Power Distribution Modules mounted on the ceiling grid, which allows ON/OFF operation by means of a centralized control panel.

Specialty lighting, including teardrop fixtures mounted between FFUs, are also available. See separate documentation for special lighting modules (UV sterilization modules, fluorescence-detection modules, etc).

Blank Ceiling Panels

All remaining ceiling bays are covered with blank panels, which can be removed to allow installation of additional FFUs or lights. Standard panels are white polypropylene; clear acrylic or white powder-coated steel are available up on request. All of these ceiling modules rest against closed-cell, extruded foam gasketing to form a tight seal along the ceiling grid perimeters.

Entrance Options

Standard access doors feature a transparent static-dissipative PVC panel mounted in an aluminum frame. Standard swing is outward (away from the cleanroom). Sliding manual doors are also available. Door options include roll-up doors are air showers; refer to separate operating guides.





3.0 Installation

⚠ WARNING: Handling cleanroom shipping crates, which generally measure over 300 inches long and weigh well over 1,000 pounds, requires at least one forklift or pallet jack. If crates must be moved through narrow aisles or entrances, two forklifts or pallet jacks are recommended, one to support each end.

Unloading crates from the truck is much easier if you have a truck-high loading dock. Without such a dock, you will need at least one forklift and a support to brace one end while the forklift is positioned beneath the center of each crate. Several men are required to unload individual components from crates.

Before proceeding, carefully lay out all system components in staging area adjacent to the installation site. All system crates include packing lists; uncrate and inspect each component. Any damage should be reported immediately to the shipping company (refer to the Warranty below for further instructions). Please notify Terra immediately in the event of missing parts.

Required Tools:

You'll need heavy rubber hammers, good portable drills/screwdrivers, measure tapes (to make sure everything's square) and six to ten 11" locking C-Clamps used to hold beams and panels in place as you insert fasteners. Panel brackets (weighted "L" members) hold panels vertically during installation. Another tool that will be needed is an 8" – 12" shaft extension for the screwdriver bits (to drive screws in narrow gaps between parts).

Standard Component List:

List and quantities may vary, depending on order.

- Steel Panels (inside and outside portions)
- Perimeter ceiling "T" joists (gasket pre-installed)
- Ceiling span "T" joists
- Ceiling "T" joists dividers
- Ceiling joist plastic connectors
- 12 x 3/4 self-tapping sheet metal screws
- Perimeter ceiling trim (mirror-finished steel); flat & corner pieces
- Power distribution modules and electrical service lines
- Power Control Panel (mounts next to the access door)
- Fan Filter Units
- Light Modules
- Access Door(s)

USED FOR	DESCRIPTION	PICTURE
Ceiling Joist / Top Trimming / Main Frame Panel / Support Bar	Screw SS # 12 X 3/4" 1" Long HEX Self Tapping Screw	





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To Attach the Ducting to the Room	Nut, SS Nylon, 6-32"	
Clip inside the main panel	Clip Lead Panel Mount	
To the Clip	Screw SS 4 – 40 X 3/8" Phillip	
External Cover Panel	Ball Stud, Zinc Plated, 6-32 – V	
To the Ball Stud	Nut, SS 6-32, Nylon	
To the Swing Door Hinge	Screw SS ¼ - 20" X 5/8" Phillip Flat Head	
Stainless Steel Passthrough	Screw SS 10 -32 X ½" Phillip	
Stainless Steel Passthrough	Washer SS # 10, Flat	
Joining Top Trimming	Screw SS 8-32 X ½" Phillip	
Joining Top Trimming	Nut SS Nylon 8-32"	
To Mount Top Cover Ducting	Screw SS 6-32 X ½"	
To Mount the Over Head Support Frame for Door Clearance	Screw, Stainless Steel ¼ 20 X 1" Flat Head	





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Mount Support Bar Ends	Screw, Hex Stainless Steel, 1/4, 20 X 3/4	
Mount Support Bar Ends	Nut, SS 1/4 - 20 Nylon Lock	
Mount Support Bar Ends	Washer SS 1/4 - 20	
Cover Switch Control	Screw SS 3-32 X 1/2	

Site Preparation

Component Inspection: Unpack all system components and check for damaged or missing parts (refer to component list/chart on the previous page). Any damage should be reported to the shipping company immediately. Contact Terra Universal if any parts are missing.

- A. Site preparation requirements should be observed for any installation performed by Terra Universal Technicians.
- B. Customer facility area where the cleanroom is to be installed must afford a minimum clearance of one foot (including fixtures ducts and pipes) on all sides and at least two feet of vertical clearance between the FFU inlet and ceiling. Refer to drawing for Fan Filter Unit (FFU) system inlet height.
- C. Customers must provide permanent electrical connection from supply panel to Terra Cleanroom Power Distribution Modules (one power line per PDM) in conformance with local electrical code, as well as any vacuum, air, H2O, sprinkler, or nitrogen connections required for the cleanroom.
- D. Customers must give advance notice of dates and times for Terra personnel to perform the installation. Short notice may result in higher fees for travel and accommodations.
- E. Customers are to provide utilities, installation power and removal of any packing material.
- F. Because installation requires unpacking and assembling components, customers are to ensure an adequate staging area for parts and equipment adjacent to the assembly area, clear and ready for work.





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- G. Customers are to inform Terra Universal in advance of any requirements for security, escorts, special training, badges, work hours, parking areas or special identification and how to obtain all such required permissions and related items.
- H. Prior to shipping, all frame and ceiling members are stamped and then labeled at each end. Refer to the appendix for detailed information on how your cleanroom is numbered.
- I. Before you start assembly, it is mandatory that the floor is level to assure the completed room will fit properly and be rectangular. Failure to level the floor may result in the inability to complete the assembly of the room or the insertion of the blowers, lights or ceiling. For vertical alignment measure with the leveler before assembly.

Note: Optional bolts or L brackets can be used to anchor the cleanroom frame to the floor in accordance with local seismic code.

If your cleanroom requires seismic anchoring, be sure to adhere to local seismic codes.

For example:

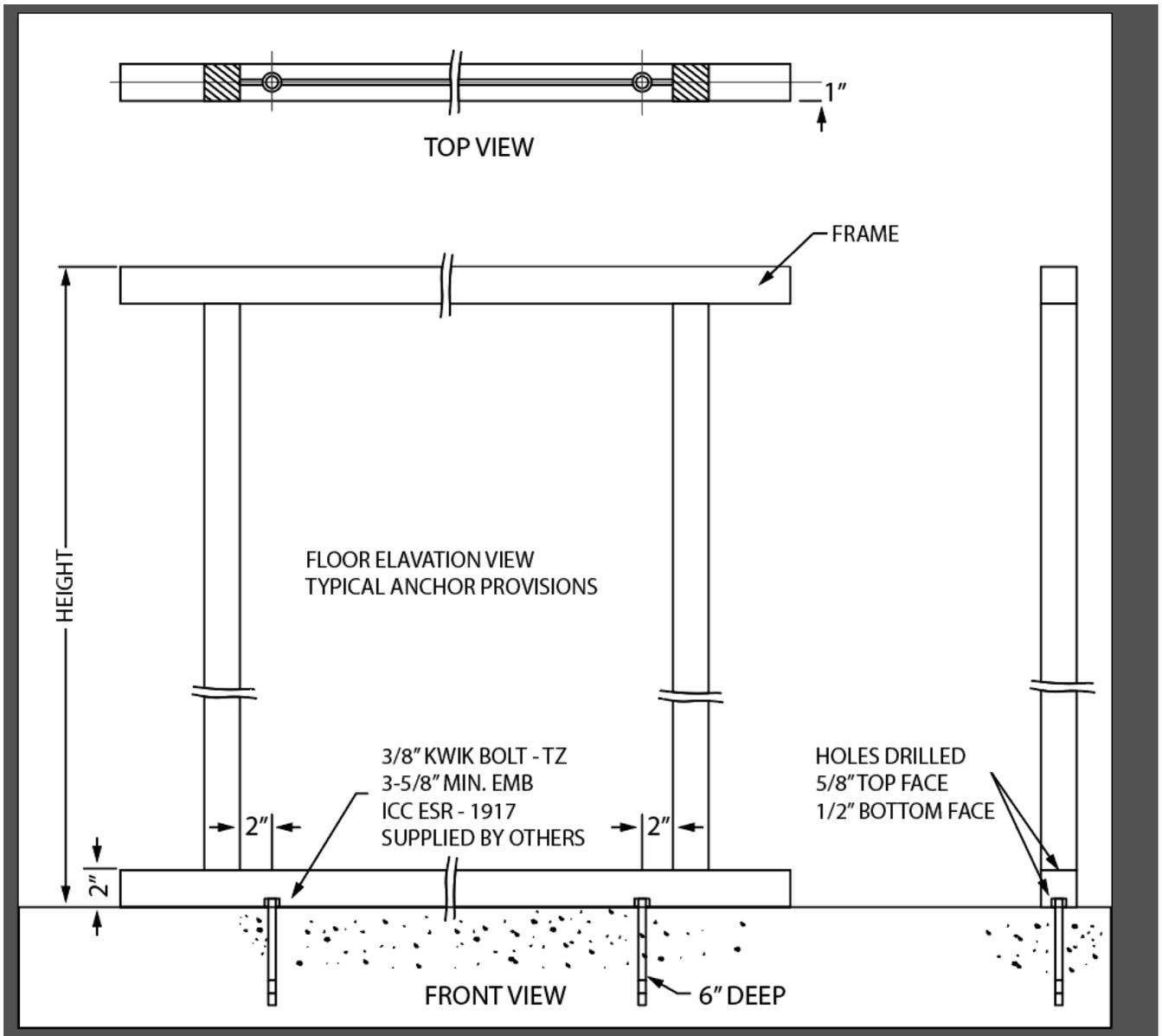


NOTE

Prior to installing wall panels, drill and install an anchor every 4' along the base frame about 2" from the vertical frame, and one into the base of the door frame underneath the control panel. The holes should be drilled into the base frame approximately 2" away from the vertical frame posts. Avoid drilling through the corner inserts or through the connector pieces; drill only through the H-frames. For the top face of the base frame, drill a 5/8" hole to fit the anchor. Directly beneath it, drill a 1/2" hole. The concrete should be a minimum of 6" deep and field verified. Use 3/8" Kwik Bolt TZ (not included) for a minimum embedment of 3-5/8". The diagram below is an example, local seismic codes may vary.



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Installing the Steel Panels

Begin installation of the room by assembling the steel panels that form the perimeter of the room. This operation will require at least two installers and panel braces to hold the panels' upright until enough of the unit is complete for it to become self-supporting.

Each panel consists of a 1.75" – thick inside sheet (with welded socket attachments) and a .75"-thick outside sheet (with ball attachments). DO NOT attach the outside sheets until the room is otherwise complete, as you may require access to the inside of each panel to complete wiring and other connections.



All inside and outside panel members are labeled with peel-off stickers to simplify installation. Beginning with inside panel #1 (located to the right of the main access door). Attach adjoining inside panels using self-tapping sheet metal screws. Make sure the panels are correctly oriented, with the pre-drilled holes for ceiling joists facing up and corner holes for floor anchors facing down. As screws are tightened, the closed-cell PVC gaskets mounted on the edge of one panel sheet will seal against the adjoining sheet. Continue connection of the internal panel sheets until the entire perimeter is completed. Then, connect the inside sheets of any internal or antechamber walls. Refer to the enclosed drawing, “Inside Panels,” for panel layout.

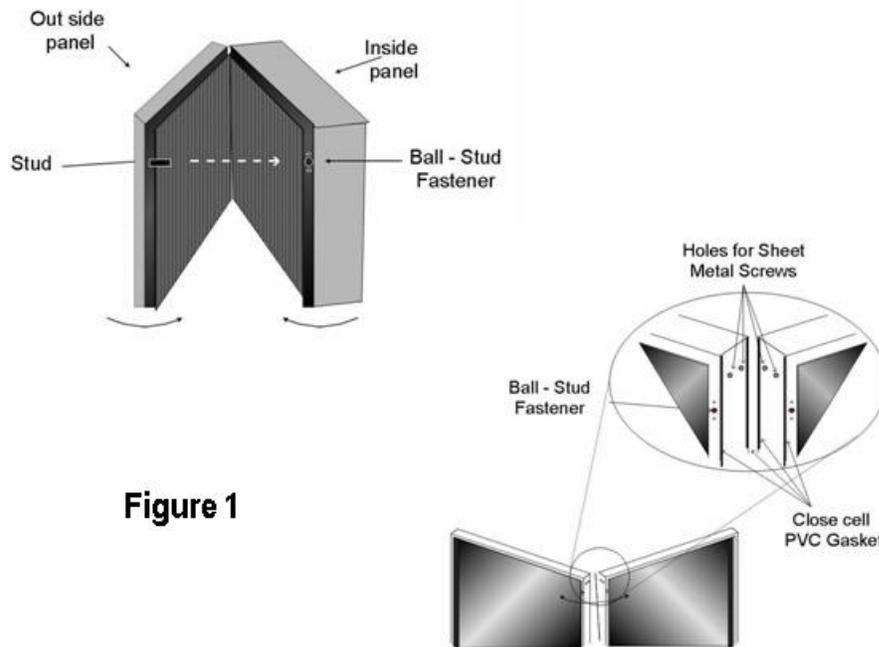


Figure 1

Installing the Ceiling Grid

Installation Note: Before beginning installation of the support frame, familiarize yourself with the placement of the frame members and ceiling “T” joists.

- A. Begin the ceiling grid by installing the long span “T” – joists across the smaller width of your cleanroom. (See Figure 2). All joists are labeled with adhesive stickers; refer to system drawing for joist location. Joists are mounted to the tops of panels using 12 X 3/4” self-tapping sheet metal screws, which attach to the pre-drilled holds on the top of the panels.

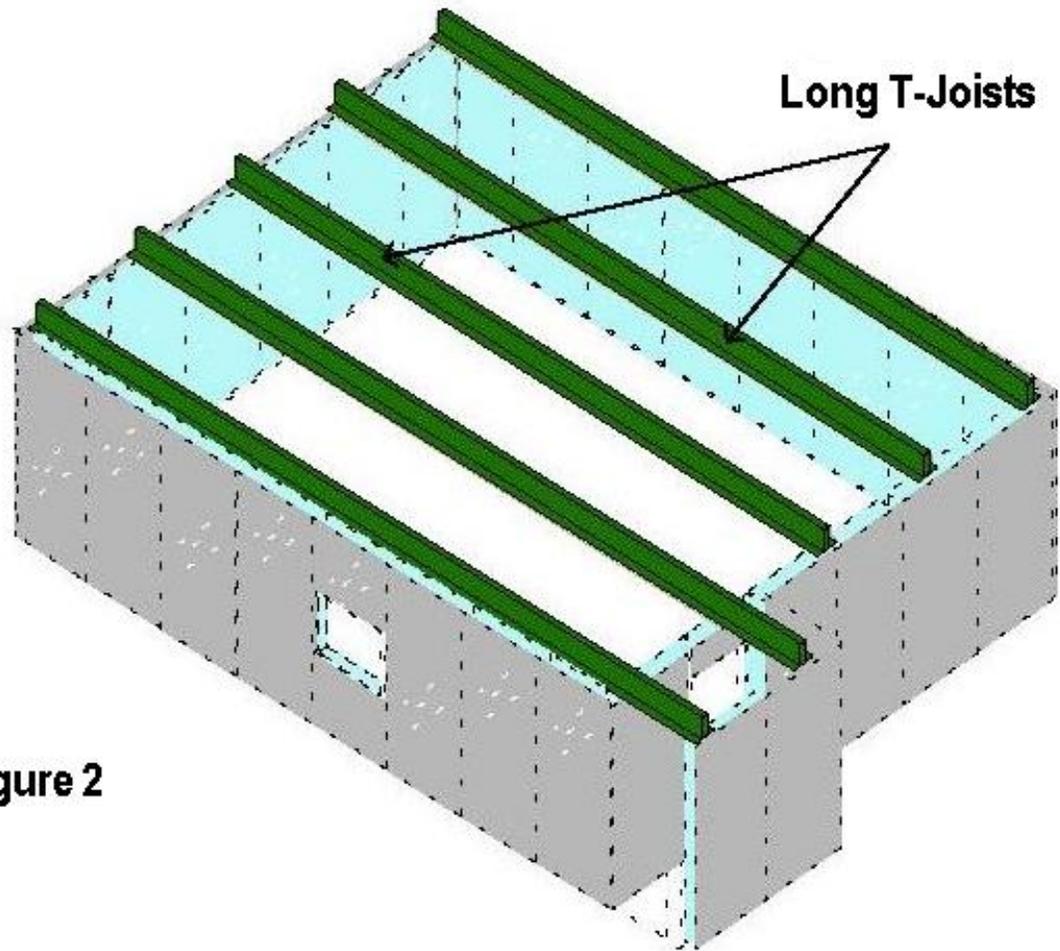
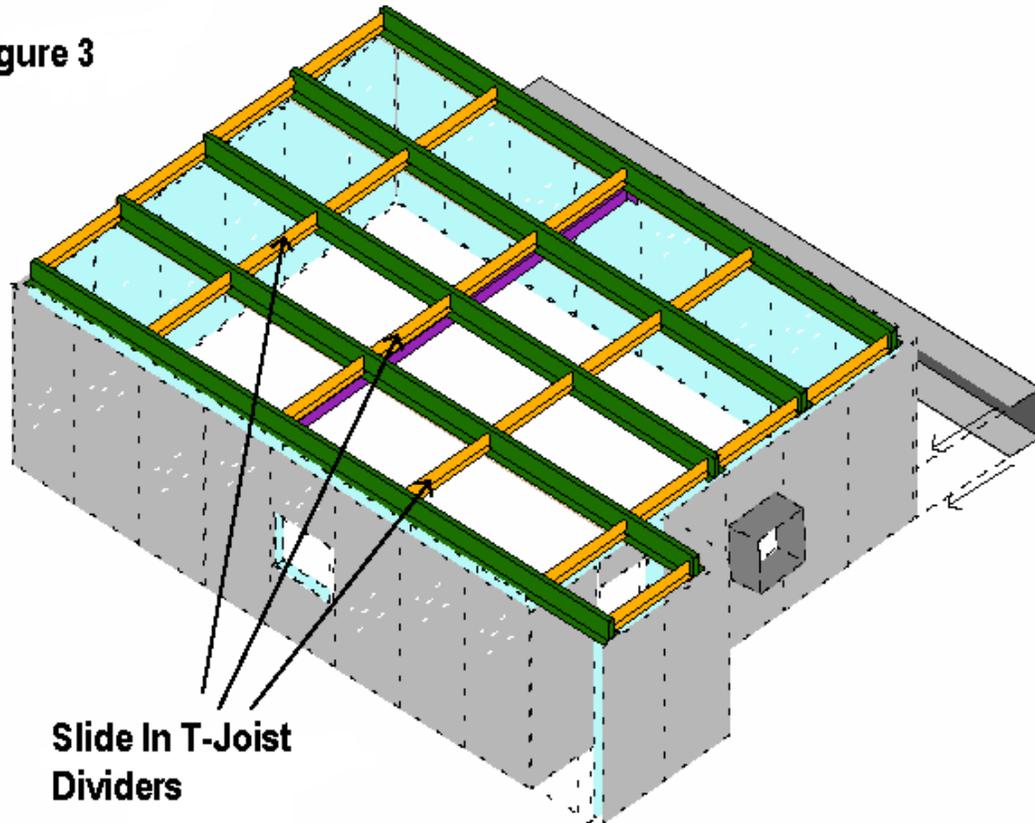


Figure 2

- B. The joists that lie at the ends of the cleanroom are mounted with gaskets on the inside of the room, and are predrilled to accommodate the Power Distribution Modules (junction boxes) that are positioned so that these predrilled holes are in opposing locations.
- C. Next, install the shorter (typically 2-foot) divider “T” – joists that form the 2' x 4' ceiling bays. These connect to the span joists by means of plastic clips – span joists should be marked to indicate the position of these clips (See Figure 3).



Figure 3



Installing Ceiling Modules

Refer to your specific system drawings for locations of Fan Filter Units, lights, and ceiling panels. Carefully lower each module in place, making sure that the module perimeter sits against the gaskets installed along the ceiling joists to form a tight seal.

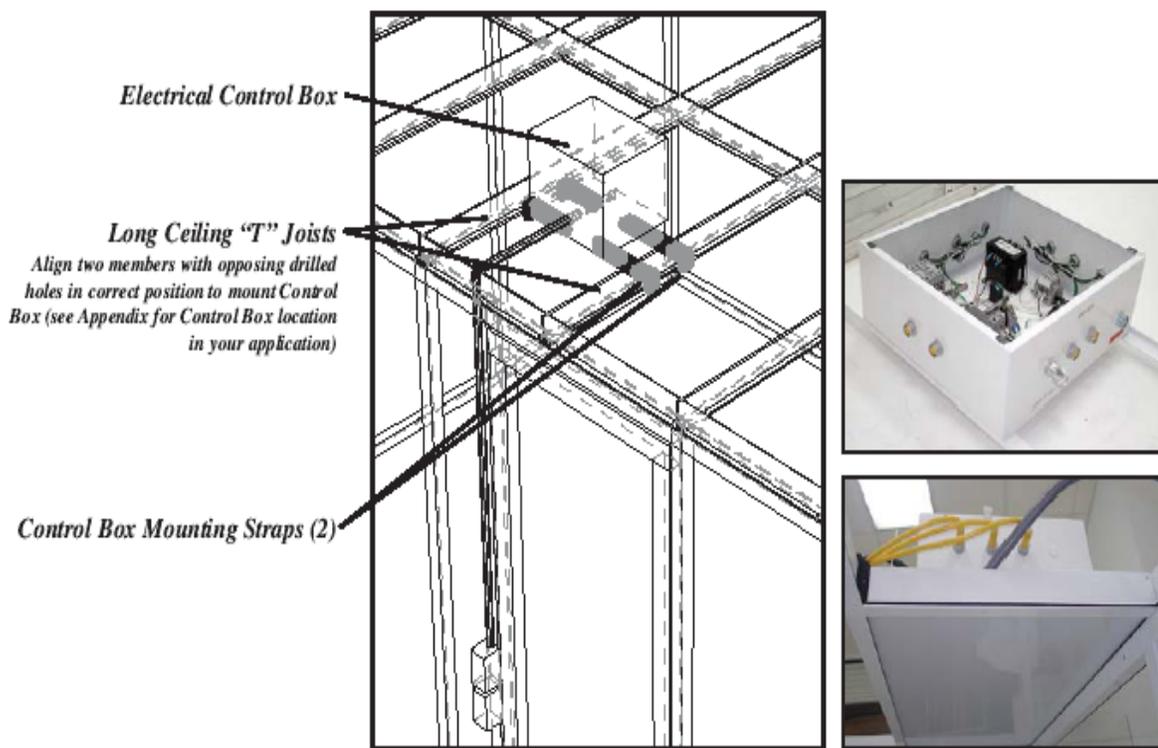
Refer to your specific system drawings for location of ceiling power distribution module(s) (electrical control box), which attach to the corresponding ceiling joists with 12 x 3/4" self-tapping screws. Install the Control Panel(s) and any duplex power boxes to the inside panel sheets.



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Each distribution module features external fittings for Fan Filter Units, Lights, and Duplex Power Boxes. Refer to system drawings for details on how to make these connections using the provided yellow 6-pin cables. To preserve the UL listing of the Terra Fan Filter Units, Terra must configure them to be hard-wired to the yellow power cables. Refer to page 15 for wiring instructions.

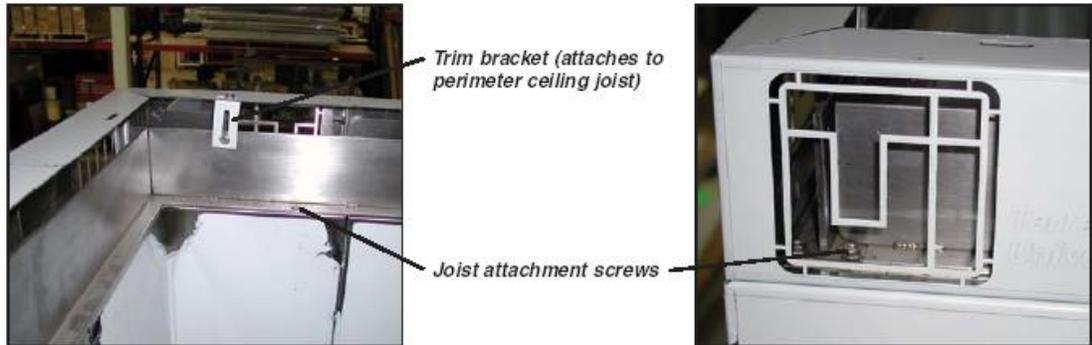
To test for proper operation, hard wire the unit to a grounded 115/230 VAC power source and turn the switches ON to activate the lights and FFUs.



Power Distribution Module Installation
(shown mounted above a polypropylene ceiling panel)

Installing the Ceiling Trim

Refer to your specific system drawings for layout of the mirror-finish ceiling trim pieces, which attach to the outside of the perimeter ceiling “T” – joists. Brackets are included for reinforcing the top of the trim (see photo).



Trim Installation (shown before powder coating, with protective film still in place)

The Outer Panel Sheets

Attach each outer panel sheet to the corresponding inner sheet. Carefully align the male fastener welded to each outside sheet to corresponding socket welded to the inside sheet and press firmly to engage the clip.

Note: Outside sheets may be removed by means of suction handles (not included).

Installing the Access Door(s)

Refer to your specific system drawings for locations of access doors and door closures. Attach each door to the corresponding door jam by means of fasteners included.

Installing A/C Modules (system options)

Refer to separate operating guide for any air conditioning modules included with your system. System integration generally requires that an air make-up plenum and ceiling return ducts be attached at the appropriate locations. Refer to your specific system drawings for more information.

Installing Pass-Through Chamber (system option)

Pass-Through Chambers are attached to special panel cut-outs that include pre-drilled holes for attachment using 12 X 3/4" sheet metal screws. Please refer to system drawing for chamber locations.



Fan Filter Unit Hard Wiring

! WARNING: Disconnect the unit from the electrical power source before attempting any service.

To preserve the UL listing of Terra Fan Filter Units, Terra must configure them for hard-wiring. Cords are dressed to simplify this operation, which typically does not require an electrician.

1. Remove the blue prefilter, which rests on top of the fan filter unit (Figure 1).
2. Unscrew metal top panel of the electrical housing (Figure 2) to expose wiring junction (Figure 3).
3. Install cord grip as shown (Figures 4, 5) into appropriate opening.
4. Thread the AC power chord through the cord grip and connect to wire port as shown (Figure 6). Match the colors of the wiring, as shown in the charts below. Tighten retaining screws to fasten wires.
5. Tighten cord grip to secure AC power chord.
6. Replace the metal panel on top of the electrical housing.
7. Replace the blue prefilter.



Fig 1



Fig 2

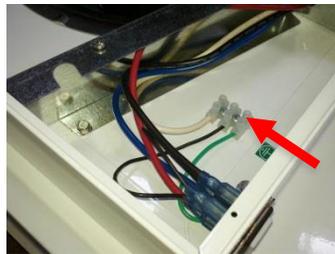


Fig 3



Fig 4



Fig 5



Fig 6

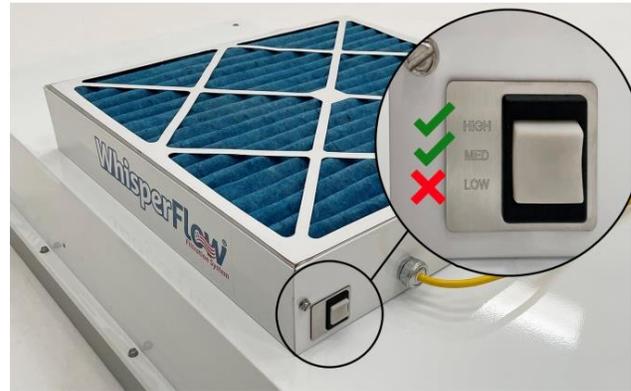


Speed Configuration with PDM



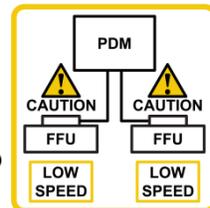
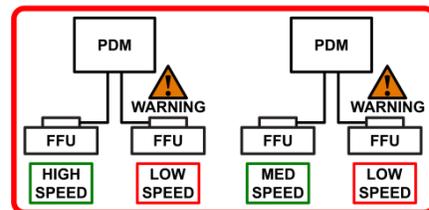
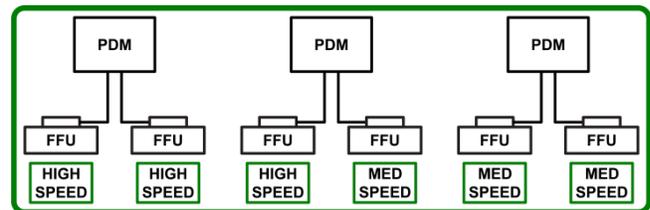
To avoid thermal overload on FFU's with Permanent Split Capacitor (PSC) motors, do not use LOW speed switch when the FFU is connected to a PDM.

The electric circuit design of the PDM limits speed configurations of FFU's with PSC motors. All FFU's with PSC motors should be switched to MEDIUM or HIGH speed setting when connected to a PDM. Thermal overload can occur when one FFU is set to LOW, and the others are set to MEDIUM or HIGH speed settings. The FFU motor set to LOW can draw excess current from the PDM which can lead to thermal overload on the motor, motor failure, and/or electrical hazards.



NOTES:

1. Setting all FFU's with PSC motors to LOW does not cause an immediate problem. However, it is not advised as there is a risk of accidentally adjusting one FFU's speed setting to HIGH or MEDIUM, which could lead to thermal overload on a FFU motor that is still on LOW speed.
2. "Night service" mode from the control panel is unaffected and operates correctly when all individual FFU's are switched to HIGH or MEDIUM speed settings.
3. This limitation does not apply if the FFU with PSC motor is used individually without a PDM, and powered directly from a standard wall outlet.
4. This limitation does not apply to Smart® FFU's with Electronically Commutated (EC) motors. Smart® FFU's do not use PSC motors.





4.0 Operation & Maintenance

An on/off switch for lights and push buttons for the Fan Filter Units control operation of the BioSafe Modular Cleanroom. Both controls are located on a control panel adjacent to the front access door.

Ceiling Fan Filter Units feature 3-position speed controls. All FFUs are factory-set at medium speed, which provides the 100 fpm air speed typically required for cleanroom operation.

The BioSafe Cleanroom typically requires minimal maintenance. Side Panels may require occasional cleaning or disinfection using alcohol/DI water or hydrogen peroxide solutions. Use a clean, non-lining cloth (polyester wipers are recommended) and wipe surfaces in slow, unidirectional motions, folding the soiled surface of the cloth portion to trap contaminant's after each pass. Avoid circular motions when cleaning.



The filters provide effective operation for years under typical operating conditions. In fact, filter efficiency increases as the filter captures more and more particles. The filter does not require replacement until the backpressure it generates increases to the point that the system can no longer provide an adequate airflow velocity to maintain required particle counts. To monitor this condition, periodic testing with a particle counter is recommended.

Replacement Filters for Terra WhisperFlow™ Fan Filter Units		
Type	Size	TUI Part #
HEPA	2 X 2	6601-27
	2 X 3	6601-26
	2 X 4	6601-25
ULPA	2 X 2	6601-30
	2 X 3	6601-29
	2 X 4	6601-28

Replacing the Fluorescent Light

Turn OFF system power. Rotate the fluorescent tube inside the fixture until it disengages and slides free. Replace with tube below (typical life: two years of continuous operation). See Appendix for replacement parts.





Filter Replacement

To replace the filter, disconnect system power and remove the fan filter unit from the top of the structure. Then position it to come through the 2' x 4' opening and into the cleanroom. See chart below for ordering information. Detailed replacement instructions on the next page.

⚠ WARNING: Never attempt to service or replace the filter without first disconnecting system power to the fan filter unit!

Removal and Replacement of the HEPA / ULPA Filter (Standard Unit)

⚠ WARNING: Disconnect the unit from the electrical power source before attempting any service.

⚠ WARNING: The Standard Filter is protected with an expanded metal face screen. This is never to be used to handle the filter. It is only for protection against an accidental touch of the filter. Handle filter only by the frame.

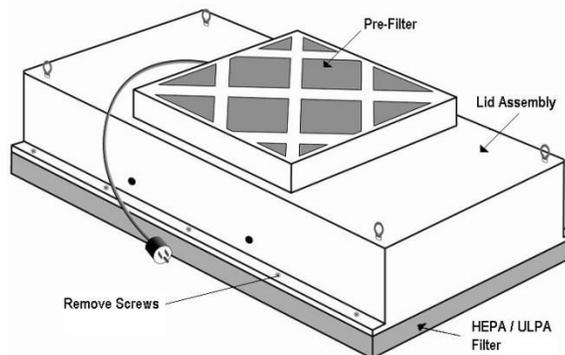
Tools Required: Phillips Head Driver

Step 1: Disconnect the yellow power cable and remove unit from ceiling (see next page for recommended procedure).

Step 2: Remove the 10 screws holding the HEPA / ULPA filter to the lid assembly.

Step 3: Lift the lid assembly off the HEPA / ULPA filter (see figure below). Discard the used filter as per applicable regulations.

Note: Before replacing with a new HEPA / ULPA filter, carefully inspect the new filter for any visible damage. Also, inspect the gasket in the “T” bar ceiling joists to insure a tight seal.





Instructions for removing the Fan Filter Unit from the cleanroom ceiling grid

2 installers minimum
2 ladders or step stool.

1. Disconnect the fan/filter unit from the PDM.
2. Attach double stick tape to a polypropylene panel – place on all four sides. The panel protects the HEPA filter from damage (See Figure 1).
3. Place the polypropylene panel over the filter screen, making sure that it only adheres to the screen without overlapping the edges (See Figure 2).
4. Push one side of the FFU up (See Figure 3), rotate it 90° (See Figures 5 and 6) and lower through the ceiling grid.
5. Place the unit on a flat work surface and remove the 10 sheet metal screws that hold the HEPA/ULPA filter to the case (See Figure 7).
6. Replace with a new HEPA/ULPA filter carefully handling edges only.
7. Secure filter to the case with the same screws used previously.
8. Place unit back onto the ceiling grid.



Figure 1: Polypropylene panel with tape



Figure 2: Panel attaching to exposed HEPA filter



Figure 3: Panel fully attached to filter screen without overlapping edges



Figure 4: FFU pushed up on one side for removal



Figure 5: Personnel rotating FFU to remove from ceiling grid



Figure 6: FFU rotated 90° and lowered completely from ceiling grid

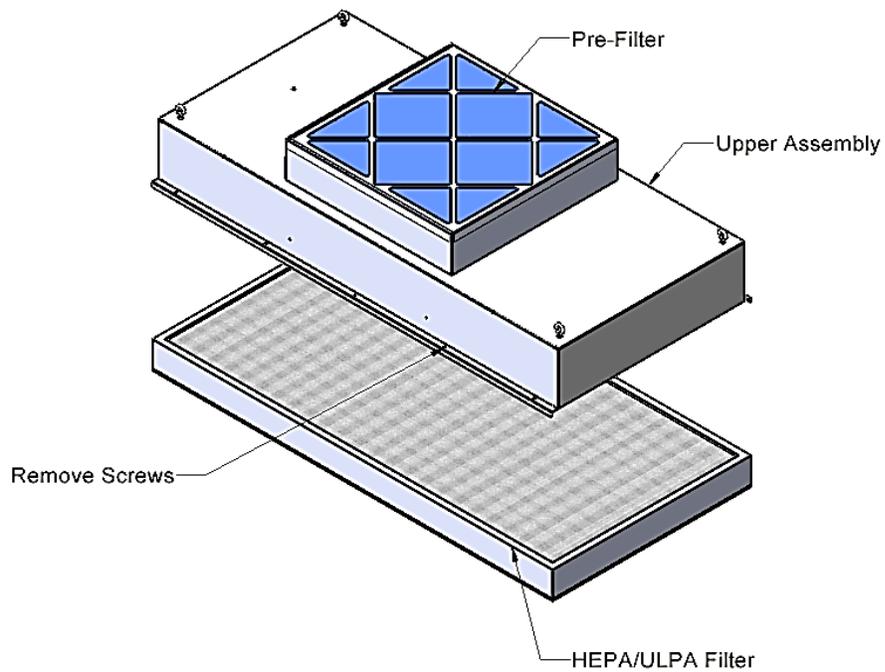


Figure 7: Diagram of FFU assembly



Cleanroom Cleaning: See Appendix for ordering information

Wipes

Wipes are used more frequently than any other cleaning product or tool. Selection of wipes should be based on intended usage. When selecting wipes you should consider things such as particle-shedding properties, chemical residue of the wiper content, static properties, absorbency and size. When using wipes, wipe in one direction from top to bottom or left to right. Use only slight overlapping strokes. Remove surface spots with commercial cleaner and woven polyester wipes. If cleaning with isopropyl alcohol or a similar cleaning agent, perform a full wipe-down of the sanitized area with deionized water.

Cavicide, Caviwipes and similar products contain ethylene glycol and benzethonium chloride, which are caustic chemicals that corrode stainless steel if not rinsed with water. After disinfecting with ethylene glycol or benzethonium chloride products, the affected area must be fully wiped down with deionized water and dried.

 **CAUTION: Always check chemical compatibility before cleaning plastic surfaces. Although vinyl and polyurethane withstand exposure to a wide range of common cleaning agents, repeated exposure to strong chemicals can cause damage.**

Vacuums

There are a variety of different Vacuums available for your cleanroom. Selection of a vacuum will depend heavily on the application and the type of cleanroom you have. With all different types of sizes and filtration systems, select the one you feel would best suit the cleaning needs of your room. Refer to the Parts & Accessories section. For more information log on to our website at Terrauniversal.com

Mini-Environment Cleaning Kits

The ITW Tex wipe Mini Environment Cleaning Kits are ideal for cleaning corners and difficult-to-reach locations inside the cleanroom. The kits include a cleaning tool (18" and 24" handles, 1 polyester foam pad, and 6 mop covers), one production bag of dry and pre-wetted wipers and an informational brochure with instructions on how to clean your equipment.

Designed to facilitate cleaning, the mop head has a low, flat profile with rounded corners and is totally autoclave able. The swivel joint allows the user to reach inaccessible areas and replaceable foam pad ensures that the mop cover conforms to the surfaces that are being cleaned. The polyester knit fabrics used for the wipers and mop covers will not contaminate isolator surfaces when used in cleaning and disinfection operations.



5.0 Specifications

Construction: General

BioSafe Cleanrooms are fabricated of 18-Gauge 304/316 or powder-coated steel panels. Ceiling joists are 1.5" x 3" powder-coated steel T-bars.

Fan Filter Units:

Filter Fan Units (HP: high speed; MS: medium speed; LS: low speed)											
Model	Dimensions Inches (mm)	Wt. Lbs. (Kg)	Avg. CFM @ MS	Airflow ft/min (m/s)			Run Amps Watts @ 60Hz			Power	
				HS	MS	LS	HS	MS	LS		
2 x 4	23.63 x 47.63 x 12.51	71	717	115	102	93	4.3A	3.5A	3.3A	120VAC, 60 Hz	
	(600 x 1210 x 318)	(32)	(1218)	(.58)	(.51)	(.47)	(512W)	(416W)	(393W)	220VAC, 50/60 Hz	
2 x 3	23.63 x 35.63 x 12.51	53	602	121	116	106	4.1A	3.1A	2.7A	120VAC, 60 Hz	
	(600 x 905 x 318)	(24)	(1023)	(.61)	(.59)	(.54)	(500W)	(378W)	(329W)	220VAC, 50/60 Hz	
2 x 2	23.63 x 23.63 x 12.51	44	558	172	166	162	3.9W	2.8A	2.4A	120VAC, 60 Hz	
	(600 x 600 x 318)	(20)	(948)	(.87)	(.84)	(.82)	(472W)	(339W)	(290W)	220VAC, 50/60 Hz	

Sound Level: Approximately 50 dBA on low speed measure at 30 in. from the filter face, with the fan delivering an average airflow velocity of 90 FPM (.45 m/s). Ambient sound level less than 35 dBA.

Housing: Both the fan plenum and filter housing have a powder-coated steel exterior.

Pre-Filter: 20" x 20" x 1" MERV 7 pleated cotton/synthetic fibers

HEPA filter: Factor tested and rated 99.99% efficient in removal of particles 0.3 micron and larger; leak free in accordance with the latest I.E.S.T. Recommended Practices.

Filter Media: Micro-glass fiber with hot melt separators, sealed to the aluminum housing.

Filter Face Guard: Anodized aluminum perforated plate

Fan/Motor: Direct Drive; forward curve centrifugal type with permanently lubricates sealed ball bearings.

Motor: Permanent split capacitor type rated for continuous duty furnished with thermal overload protection and a three-speed switch.

Full-Load Amp: 4.3 (for 120V, 60Hz, 1 Phase); 2.1 (for 220V, 50/60Hz, 1 Phase)

To Calculate sensible heat (in BTUH), multiply watts by 3.412 (e.g. for a 2' X 4' unit, at low speed, 170W X 3.412 = 580 BTUH)



6.0 Warranty

Products Manufactured by Terra: Terra Universal, Inc., warrants products that it manufactures to be free from defects for a period of 12 months for parts and 90 days for labor, commencing from the date of shipment. Terra's sole responsibility is to repair or replace, at its option, any part of the product that proves defective or malfunctioning during this time limit. In some cases, components incorporated in Terra Universal products are covered by additional warranties from component manufacturers; obtain specific information from Terra sales representatives. This warranty is void if the equipment is abused or modified by the customer, is operated outside Terra's operating instructions or specifications, or is used in any application other than that for which it is specified. This warranty does not include routine maintenance or service procedures, breakage of quartz baths after 60 days, shipping damage, nor damage from misuse, intentional or unintentional abuse, neglect, natural disasters, or acts of God.

Products Manufactured by Others: Terra Universal, Inc., warrants that, to the best of its ability, Terra's representations of products that are manufactured by others reflect the manufacturer's representations, subject to change without notice. Sole warranty for these products is the original manufacturer's warranty that is passed forward to the purchaser and constitutes the customer's sole remedy for these products. Detailed warranties for distributed products are available through Terra sales representatives.

Freight Shortage or Damage: Upon receipt of any equipment from Terra Universal, Inc., customer shall immediately unpack and inspect for damage or shortage. The customer shall not accept a damaged package or a short shipment until the carrier makes a "damage or shortage" notation on both the carrier's and customer's copy of the freight bill or delivery receipt. Service title passes when the shipment is loaded, so customer is responsible for filing and collecting a freight claim. Any replacement products must be ordered and paid for separately. For Terra's "Policy and Procedures for Returning Goods," see Terra's Internet site: www.TerraUniversal.com.

Generally, customers can improve the chance of collecting on a freight claim by following these procedures: 1) formally requesting that the carrier inspect the shipment immediately upon suspecting damage or shortage to verify condition; 2) notifying the carrier upon discovery of concealed damage and requesting an inspection within 15 days of receipt, both in person or phone and following up via mail; 3) keeping the shipment as intact as possible, including retaining original packaging materials and keeping the product as close to the original receiving location as possible; 4) holding salvage for disposition by the carrier.

All Claims: Terra Universal expressly disclaims all other warranties, expressed or implied or implied by statute, including the warranties of merchantability or fitness for intended use. Terra Universal is not responsible for consequential or incidental damages arising out of the purchase or use of the products supplied by Terra Universal. Terra Universal is not liable for damage to facilities, other equipment, products, property or personnel of others, or of their agents, suppliers, or affiliated parties, which is caused or alleged to have been caused by products supplied by Terra Universal. In any event or series of events, Terra Universal's total liability for any and all damages whatsoever is limited to the lesser of the actual damages or the original invoice cost of the items alleged to have caused the damage. The customer's sole and exclusive remedy for any cause of action whatsoever is repair or replacement of the non-conforming products or refund of the actual purchase price, at the sole option of Terra Universal. All claims must be made in writing within 90 days of the date the product was shipped. Any claims not made within this time limit shall be deemed waived by the customer. Terra Universal is not responsible for any additional costs of repair caused by poor packaging or in-shipment damage during return.

Warranty Returns: All warranty returns must be authorized in advance by Terra Universal and approved under an RMA. Unless approved in advance for good reason, all returns must be in original condition, including all manuals, and must be packaged in original packaging materials. All returned goods are to be shipped to Terra Universal, freight prepaid at customer's expense. See Terra's "Policy and Procedure for Returned Goods."

**Thank You for ordering from
Terra Universal!**



7.0 Spare Parts & Accessories

For replacement parts and accessories for your cleanroom order at Terra Universal.com

Filter Replacement

Replacement Filters for Terra WhisperFlow™ Fan Filter Units		
Type	Size	TUI Part #
HEPA	2 X 2	6601-27
	2 X 3	6601-26
	2 X 4	6601-25
ULPA	2 X 2	6601-30
	2 X 3	6601-29
	2 X 4	6601-28



Fluorescent Illuminator

2 X 4 Ceiling Module 115VAC / 60Hz	TUI # 3800-80	Replacement Ballast: TUI #6704-12
2 X 4 Flow – Through Module 115VAC / 60Hz	TUI # 6704-77	
2 X 4 Ceiling Module 277 VAC / 60Hz	TUI # 3800-80-277	
2 X 4 Flow - Through Module 277 VAC / 60Hz	TUI # 6704-77-277	

Yellow 12-foot Power Cables

For connection of light or fan filter unit to Power Distribution Module (electrical box)



No. EL01298: for Fan Filter Units
4 Pin – up to 600 VAC



No. EL01297: for Fluorescent Illuminator
3 Pin – Up to 600 VAC



Wipes

Cotton Wipes 9" X 9"	TUI # 5605-07
Cotton Wipes 12" X 12"	TUI # 5605-02
Polyester Wipes 9" X 9"	TUI # 5605-00
Polyester Wipes 12" X 12"	TUI # 5605-08



Vacuums

MicroVac – Portable Vacuum Cleaner	TUI # 5100-00 TUI # 5100-00-220 (220 VAC)
HEPA – Filtered Vacuum Cleaner	TUI # 1001-00
ULPA – Filtered Vacuum Cleaner	TUI # 1764-00 TUI # 1764-00-220 (220 VAC)