TERRA UNIVERSAL.COM
Critical Environment Solutions

Installation and Operating Guide   Document No. 1788-30

Hardwall Modular Cleanroom

Your Comprehensive Equipment Source

Particle Filtration

Laminar Flow Control

Ultra-Clean Materials

Vibration Isolation

Ergonomics

Process Gas Generation

Temperature Control

Biohazard Containment

Sterilization

Static Control

Chemical Vapor Removal

Anti-Microbial Treatments

Humidification/ Dehumidification

Vacuum Control

Exhaust Fume Ventilation

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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.

Terra Universal makes no warranties applying to information contained in this manual or its suitability for any implied or inferred purpose. Terra Universal shall not be held liable for any errors this manual contains or for any damages that result from its use.

⚠ 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 installing and operating your Terra Universal Hardwall Modular Cleanroom.

⚠

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 these cleanrooms, individual orders may vary in dimensions and other design specifics. Refer to any attached drawings and/or parts lists for information specific to your order.

2.0 Description

The Modular Hardwall Cleanroom is supported by a rigid frame structure consisting of powder-coated 2"-square steel upright members and horizontal cross members. Wall panels are mounted in between the frame members using mirror-finished stainless steel brackets. Ceiling joists are attached to the top of the frame and dividers are inserted to create a ceiling grid made up of 2' x 4' bays for installation of Terra's fan/filter units and light fixtures. The fan/filter units (FFUs) provide a uniform, downward flow of HEPA- or ULPA-filtered air through the enclosed cleanroom, oftentimes in order to meet specific a specific ISO classification.

Each FFU 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 minipleats 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. 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.

2.1 Standard Component List

List and quantities may vary, depending on the order:

- Upright frame supports
- Horizontal frame members
- Ceiling joists and dividers
- Ceiling panels (polypropylene)
- Perimeter ceiling trim (powder-coated steel)
- Power Distribution Modules (PDM) and electrical service lines
- Control Panel
- Fan/filter units
- Light fixtures
- Wall panels (acrylic, static-dissipative PVC, or polycarbonate)
- Mirror-finish stainless steel brackets
- Access doors (typically preinstalled on the door frame)

See **Section 8.0: Hardware Reference Table** for additional components included with your cleanroom order.

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 (see Warranty). Please notify Terra immediately in the event of missing parts.

3.1 Required Tools

- Heavy rubber hammers
- Portable drills/screwdrivers
- Measuring tapes
- Up to ten 11" locking C-Clamps (used to hold beams and panels in place as you insert fasteners)
- 8" – 12" extension for the screwdriver bits (to drive screws in narrow gaps between parts)

3.2 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. 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 top of the FFUs and ceiling.

B. Each Power Distribution Module requires a separate connection to the building's power supply panel in conformance with local electrical code, as well as any vacuum, air, H_2O, sprinkler, or nitrogen connections required for the cleanroom.

C. Prior to shipping, all frame and ceiling members are stamped and labeled to aid assembly. Refer to the attached drawings for details on how your components are labeled (may be numbers, letters, or any combination thereof).

D. 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.

3.3 Installing the Support Frame

> **NOTE**
>
> **Refer to the drawings attached at the back of this manual throughout the installation of the cleanroom for guidance on assembly and custom components specific to your cleanroom.**

> **⚠ CAUTION**
>
> **The floor must be smooth and level before beginning assembly. Failure to level the floor may result in the inability to complete the assembly of the cleanroom.**

This operation will require at least two installers to hold the frame members upright until enough of the unit is complete for it to become self-supporting.

Beginning with the frame member labeled "1" (typically the door frame), insert the horizontal frame members labeled "2" and "A" into the appropriate openings. As you install each horizontal member, align the predrilled holes and loosely insert a Christmas Tree Clip to hold the frame members in place. Do not fully insert these clips until you have all horizontal supports in the correct position. Continue assembly to the right, following the order of the labels.
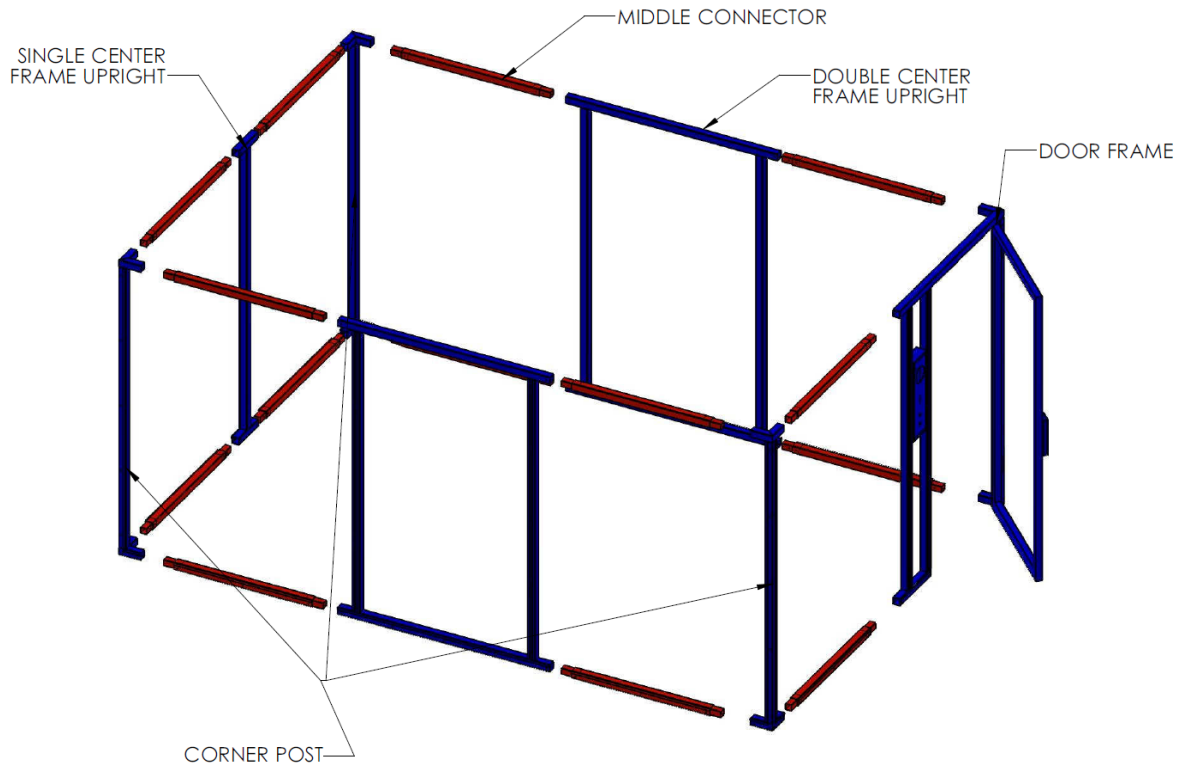

Figure 1. Diagram showing general assembly of frame members

Figure 2. The horizontal frame member slides into the upright

Figure 3. Loosely insert a Christmas Tree Clip to hold them in place

After the frame has been completely assembled, square the structure by measuring the diagonal distances from corner-to-corner. If they are not equal, adjust the frame (by pushing on the appropriate corner) until they are.

3.4 Installing the Ceiling Grid

NOTE	**Before installing the ceiling joists, identify the joists that will support the Power Distribution Module(s) by referring to the attached drawings. Look for holes drilled in the vertical flange of the joist. These joists must be oriented so that the predrilled mounting holes align and each PDM will be supported by two joists as shown in the drawings.**

A. Begin by installing the long "T" joists as shown in the drawings at the back of the manual. Each joist is labeled to help with identification and to indicate order of assembly. Attach the joists by fastening #12 x ¾" self-tapping screws into the predrilled holes on top of the wall panels (see **Figure 5**).

Figure 4. First and last joists rest fully on the frame

Figure 5. Fasten joists according to the predrilled holes

B. Next, insert the joist dividers to form 2' by 4' ceiling bays (see attached drawings for reference) and secure them with the black plastic divider clips. If necessary, lightly tap the divider clip with a rubber mallet until it is completely seated against the flange of the joist. No other fasteners are required.

Figure 6. Place joist dividers in between the joists

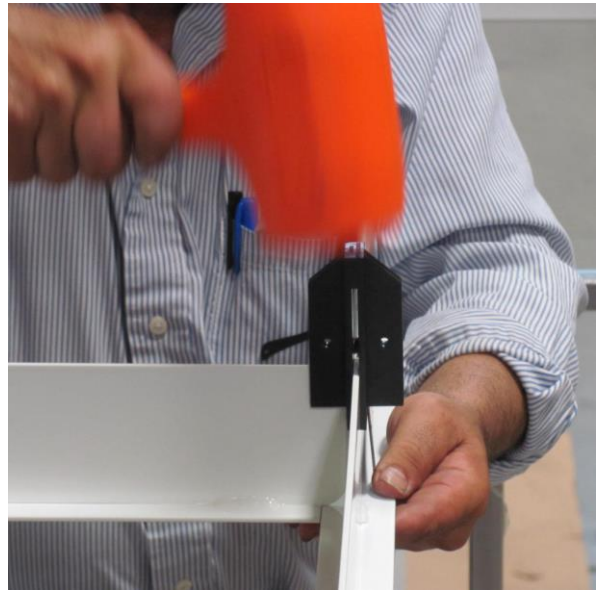*Figure 7. Use the black clips to connect each junction point*

C. Install any Support Bars (if included) using #12-14 x 1-1/4" stainless steel self-tapping screws. Refer to the attached drawings for the location and orientation of the Support Bar.

Figure 8. Position the Support Bar below the joists

Figure 9. Fasten the support bar to the frame

D. Check the frame again for squareness by measuring diagonally.

3.5 Installing Ceiling Components

A. Carefully lower each FFU and light fixture into the ceiling bays indicated in the attached drawings. The modules and ceiling panels simply rest on the flange of the ceiling joists and dividers. No fasteners are required.

Figure 10. Typical ceiling grid during installation with PDM, three FFUs, and three Fluorescent Light Fixtures visible (blank ceiling tiles have not been installed yet)

B. Fasten the Power Distribution Module(s) to the corresponding ceiling joists (identified earlier by the predrilled holes) with #12 x ¾" self-tapping screws.

C. Use blank ceiling panels to fill any empty ceiling bays, including underneath the PDM.

3.6 Wiring and Connections for Ceiling Components

A. Connect the yellow FFU power cables to any of the 4-pin outlets on the PDM that are labeled "FFU".

Figure 11. FFUs should arrive with the power cables pre-wired
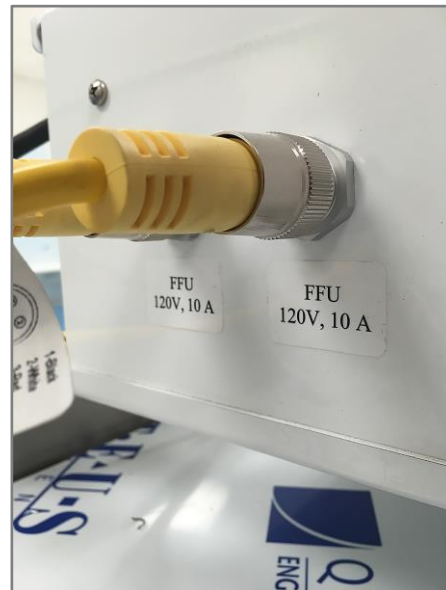
Figure 12. PDM connections for the FFUs

B. Use the 3-pin yellow power cables to connect the light fixtures to any of the 3-pin outlets on the PDM labeled "Light".

Figure 13. PDM connections for light fixtures
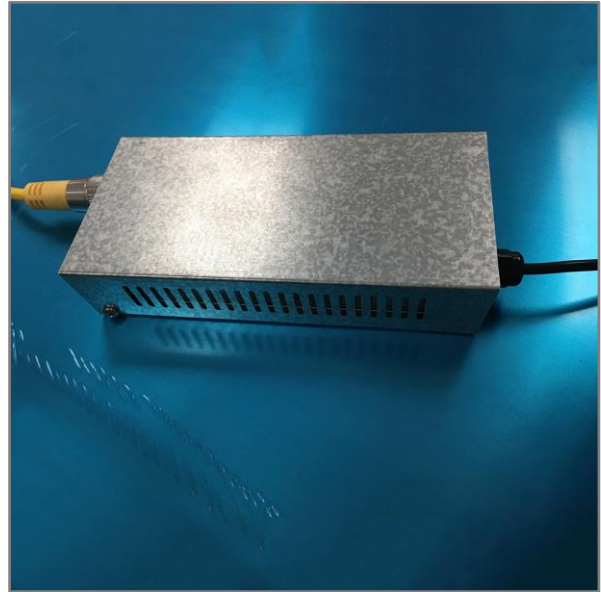
Figure 14. Optional LED light panels connect to the PDM through a power supply box

C. Have a licensed electrician open the PDM box and connect the wiring for the duplex outlet(s). A wiring diagram is provided inside of the PDM box for reference.

If a secondary PDM is used to supply power for multiple duplex outlets, a dedicated circuit and separate power cable (not provided) will be required for hard-wiring the secondary PDM to the building power supply.

Figure 15. Wiring inlet for outlets on standard PDMs

Figure 16. Secondary PDM for multiple outlets

D.   Connect the 5-pin power/signal cable from the control panel to the 5-pin outlet on the PDM labeled "Switch Connection".

E.   Connect the ¼" tubing from the control panel to the fittings preinstalled in the ceiling panels. In general, one reference point is needed per ISO-classified area.

Figure 17. *Connect ¼" tubing to the pre-fitted reference points in the blank ceiling panels*

Figure 18. *PDM connection for the Control Panel*

3.7 Installing the Wall Panels

> **NOTE** Wall panels are shipped with a protective plastic that can be peeled off when installation is complete. The edges of the plastic are cut to allow the panels to be installed with the protective covering intact.
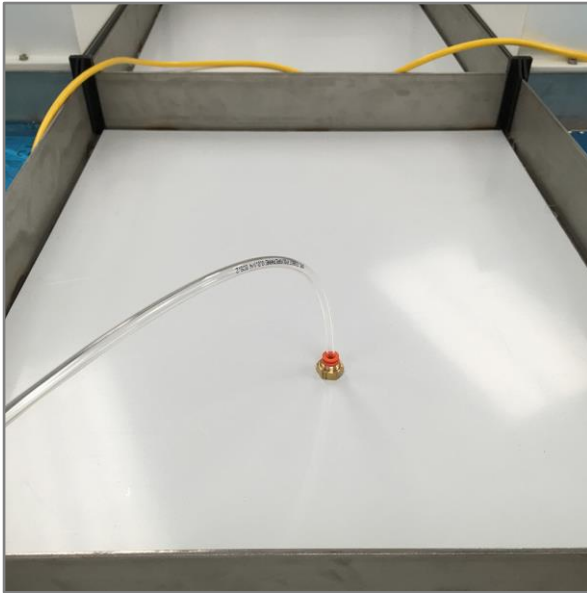
Each wall panel is held in place by two sets of opposing stainless steel brackets that are fastened along the openings in the frame. Most trim strips will be loosely fastened in their proper location prior to leaving the factory. Any trim strips removed will be labeled to indicate their location on the frame. Holes for fastening the brackets are predrilled into the frame. Refer to the attached drawings for exact locations of these brackets.

For preinstalled brackets:

A.   For each opening in the frame, remove one set of brackets (either the internal or external set).
B.   Position the corresponding wall panel in the opening and have one person press the panel against the installed brackets.
C.   Reinstall the second set of brackets to clamp the wall panel in place.

For brackets removed prior to shipping:

A.   Install one set of brackets (either the internal or external set).
B.   Position the corresponding wall panel in the opening and have one person press the panel against the installed brackets.
C.   Install the second set of brackets to clamp the wall panel in place.

Repeat these steps until all wall panels are installed. It is recommended to leave the protective plastic in place until the installation of the cleanroom is complete and the unit is ready for initial cleaning.

Figure 19. Two sets of brackets (an internal set and external set), made up of 4 brackets each, are used to mount the wall panels in the frame openings.

> **NOTE**
> In most applications, the positive pressure differential created by the fan/filter units will prevent any outside air from entering the cleanroom. If an airtight seal is required, seams may be sealed with an appropriate caulking or other sealant.

3.8 Installing the Ceiling Trim

Like the frame members, each section of the top trimming is labeled before shipping. Refer to the attached drawings for the location of each trim section. There are predrilled holes for fastening the trim sections to the faces of the corresponding frame members.

Loosely fasten the corner

Slide in the next trim piece behind the corner, line up the holes and fasten
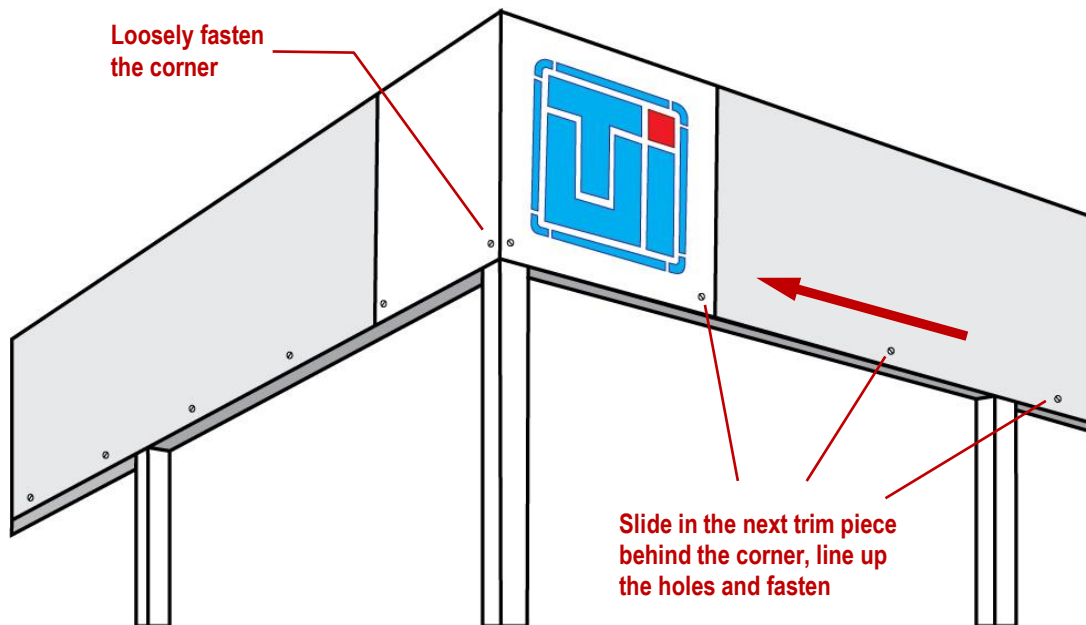
Figure 20. Loosely fasten all corner trimming in place and then slide the long trim sections underneath the corners until the holes align

A. Begin by positioning the corner trim pieces so that all holes are aligned. Loosely fasten the two holes near the apex of each corner with #12 x ¾" sheet metal screws.

B. Moving to the right around the perimeter of the frame, install the next trim section by sliding one end partially underneath the corner trim until the predrilled holes are aligned. Loosely fasten the two pieces of trimming to the frame using #12 x ¾" sheet metal screws.

C. Continue installing the rest of the top trimming following the pattern above.

D. Once all trimming is in place, fully tighten all fasteners.

E. Connect the Status Indicator Lights on each corner using the provided low-voltage cables (See **Figure 22**)
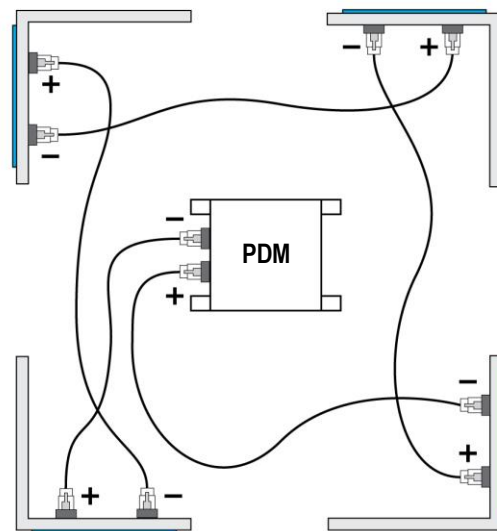
Figure 21. Diagram showing wiring pattern for Status Indicator LEDs

3.9 Initial Start-Up

To complete the installation, plug the PDM power supply cable(s) into a grounded 115/230 VAC power source. The TUI indicator lights will flash intermittently, indicating that the cleanroom is receiving power and the FFU's are off. Turn the key-switch labeled "Blowers" to the ON position. The TUI indicator lights should now stop flashing and emit a solid glow.

Allow the cleanroom to ventilate for 30 minutes and perform a thorough decontamination of the cleanroom. Depending on the processes involved, the cleanroom may need to be certified by an independent third party or approved for a particular use by regulatory authorities before commencing operations. Be sure to follow all applicable codes and regulations when operating the cleanroom.

3.10 Troubleshooting: Flashing Status Indicator Light

A blinking LED logo notifies personnel that the Power Distribution Module (PDM) is receiving power, but the fan/filter units are not operating. Before proceeding with the troubleshooting procedures below, verify that all FFUs have been correctly wired according to the instructions in the Fan Filter Unit Hard Wiring section of the manual and the "Blowers" key-switch is ON.

If the LED logo continues to flash after checking all wiring and switches, remove the cover from the PDM and follow the steps in the diagram below to find the source of the fault:

Figure 22. Wiring diagram of standard cleanroom PDM

After performing all of the steps above, if the TUI logo remains flashing, please contact Terra Universal.

4.0 Operation and Maintenance

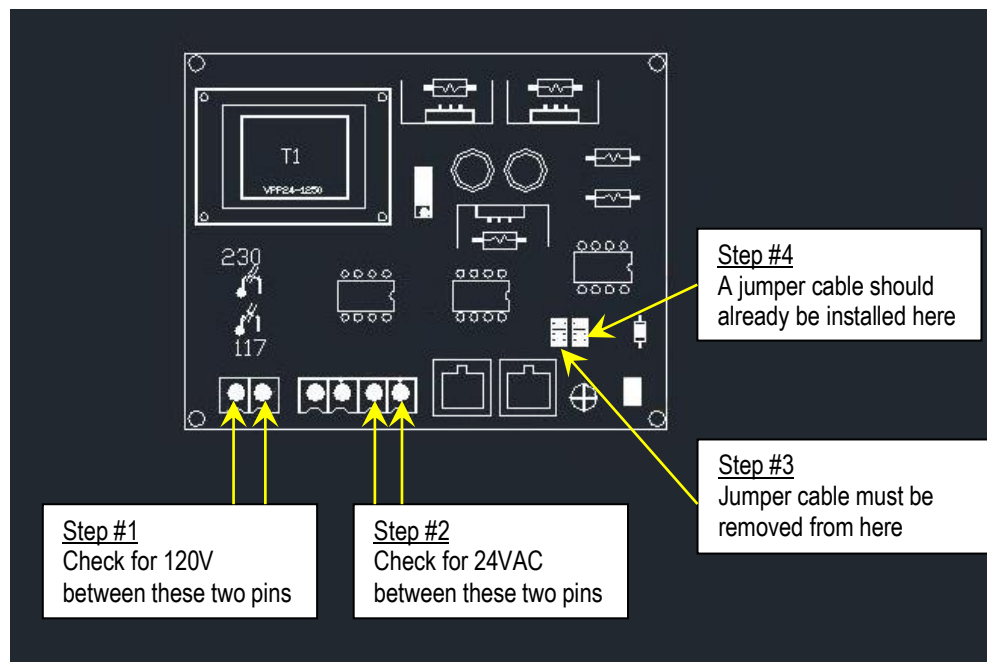> **!** **WARNING** **Disconnect the unit from the electrical power source before attempting any repairs or service.**

4.1 Control Panel Operation

An on/off switch controls the lights and key-switches control the fan/filter units. Both controls are located on the control panel adjacent to the front access door.

Fan/filter units feature 3-position speed controls. All FFUs are factory-set at medium speed, which provides the 90 fpm air speed typically required for cleanroom operation.

4.2 Cleaning and Sterilization

Use a clean, non-shedding 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.

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. Wipe in one direction from left to right. Use slightly overlapping strokes. Remove surface spots with commercial cleaner and woven polyester wipes.

> **!** **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.

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.

4.3 Replacing LED Light Fixtures

Disconnect system power. Disconnect the LED power supply box and lift the LED light panel out of the ceiling grid. Carefully lower the new LED light panel into the ceiling bay and reconnect the wiring (refer to Section 3.0 Installation). See Section 7.0 for replacement parts.

4.4 Removing the Fan/Filter Unit

> ⚠ **WARNING** **Disconnect the cleanroom from the electrical power source before servicing the FFUs.**

1. Disconnect the fan/filter unit from the PDM and roll up the power cord.

2. Attach double stick tape to all four sides of a polypropylene panel, as shown in **Figure A**.

3. Place the polypropylene panel over the filter screen, making sure that it only adheres to the screen without overlapping the edges (**Figure B – C**).

4. Push one side of the FFU up (**Figure D**), rotate it 90° and lower it through the ceiling grid (**Figure E – F**).

5. After replacing the filter, reverse these steps to reinstall the fan/filter unit in the ceiling grid.

Figure A

Figure B

Figure C

Figure D
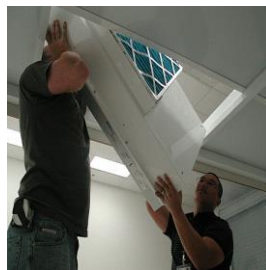
Figure E

Figure F

4.5   Replacing the HEPA Filter

> ⚠️ **CAUTION**
>
> **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 the filter only by the frame.**

Pre-filter

Remove screws along both sides of the FFU
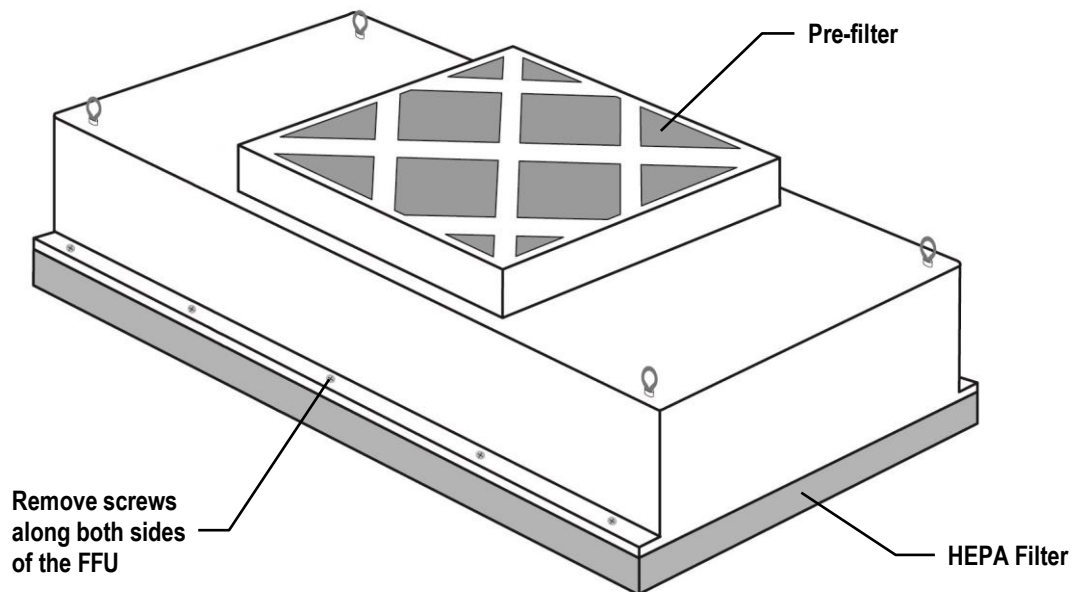
HEPA Filter

Figure 23. *Standard Fan/Filter Unit*

1.   Disconnect the yellow power cable and remove the unit from the ceiling.

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

3.   Lift the lid assembly off the HEPA / ULPA filter. Discard the used filter as per applicable regulations.

4.   Carefully attach the new filter, being sure not to touch or otherwise damage the filter face.

5.   Lift out the old pre-filter and drop in the new one.

6.   Position the unit back in the ceiling grid and reconnect the unit to its power supply

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> 📄 **NOTE**
>
> **Carefully inspect the new filter for any visible damage prior to replacing.**

5.0 Specifications

5.1 Fan Filter Units

Dimensions	23.63"W x 47.63"D x 13"H
Weight	71 lbs. (32 kg)
Avg. Airflow	717 CFM
Airflow Speed	115 fpm @ High 102 fpm @ Medium 93 fpm @ Low
Run Amps	4.3 amps @ High 3.5 amps @ Medium 3.3 amps @ Low
Power Requirements	120VAC, 60Hz
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 (0.45 m/s)
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 Screen	Perforated stainless steel
Fan	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

5.2 UL-Listed Components

If your order included UL documentation (Cat. # 6600-33), labels indicating UL-listed components can be found on the rear of the Control Panel.

Figure 24. *View of labels on back of Control Panel*

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 and Accessories

Filters	
HEPA Filter (for 2' x 4' FFUs)	TUI # 6601-25
ULPA Filter (for 2' x 4' FFUs)	TUI # 6601-28
MERV 7 Pre-filter (20" x 20")	PA04599
LED Lighting	
LED Light Panel (2' x 4')	TUI # 3800-41
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)

TUI # EL01298 (Fan/Filter Units)
4-Pin Yellow Power Cable

TUI # EL01297 (LED Lights)
3-Pin Yellow Power Cable

8.0 Hardware Reference Table	
Part	**Used For**
  #12 – ¾" Stainless Steel Self-Tapping Hex Head Screw	**Ceiling Joists** **Top Trim** **Wall Panel Mounting Brackets**
  Christmas Tree Clip	**Frame Assembly**
  ¼"-20 x 1" Phillip Flat Head Screw	**Swing Door Hinge** **Swing Door Closer Housing**

#10-32 x 3/8" Phillip Pan Head Screw	**Swing Door Closer Housing**
Joist Divider Clip	**Ceiling Joists and Dividers**
#6-32 x ½" Phillip Pan Head Screw	**Control Panel** **Swing Door Frame Stopper**
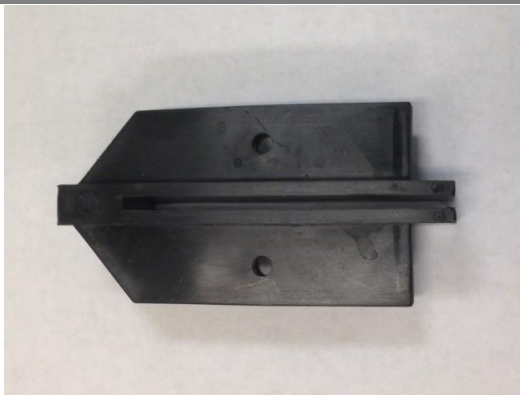
FILTER/FAN UNIT
HEPA, 120VAC/60Hz
10 PLACES
6601-24-HR

POWER DISTRIBUTION
MODULE, DUPLEX
2 PLACES
6600-27

LIGHT PANEL, LED
6 PLACES
3800-41

POWER DISTRIBUTION
MODULE, FFU/LIGHT
6600-29B-P

POWER DISTRIBUTION
MODULE, SECONDARY,
6600-29B-S

CEILING PANEL
POLYPRO
6704-20

10'-33"

20'

ACCESS DOOR SD-PVC
36"x81"H SINGLE
2 PLACES
6710-15A

TO TOP OF FAN/ FILTER UNIT
9'-1"

FROM FILTER FACE TO FLOOR
8'

FILTER REPLACEMENT
ALARM SYSTEM FOR FFU
2625-54A

CONTROL PANEL
6600-23-NS

DUPLEX
POWER OUTLET 120VAC
36" AWAY FROM FLOOR
10 PLACES
6704-33

MAGNEHELIC GAUGE
6600-86

SD-PVC CENTER
MOUNT PANELS

REVISIONS				MATERIAL SPEC.	FINISH SPEC.	UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES		
RV#	DESCRIPTION	DATE	BY	HRS	POWDER-COATED	TOLERANCES ON:		
NC	INITIAL RELEASE	7/28/17	SV			.XX DECIMALS ± .03	X°± 1	
P	Production drawing	8/14/17	KT			.XXX DECIMALS ± .010	X/X ± 1/64	
						SIGNATURE		DATE
						ISSUED BY: VEGA		7/28/17
						REF #: 223753		

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TITLE
CLEANROOM HARDWALL
SD-PVC CENTER MOUNT
PANELS FOR 8'H

A 6600-73A-117528

SCALE: NONE   CR   SHEET 2 OF 18

FFU LIGHT FFU LIGHT FFU LIGHT FFU LIGHT PDM PRIMARY PDM SECONDARY

20'

10' 10'

10'-3 3/4"

| FFU | | DUPLEX BOX | FFU | DUPLEX BOX |

4'-0 3/8" CENTERS

1'-10" CENTERS   1'-10" CENTERS

| LIGHT | FFU | | LIGHT | FFU |

2'-0 5/16" CENTERS

| FFU | LIGHT | | FFU | LIGHT |

| LIGHT | FFU | | LIGHT | FFU |

| FFU | SECONDARY BOX | | FFU | PRIMARY BOX |

POWER DISTRIBUTION MODULE, DUPLEX 2 PLACES 6600-27

FILTER/FAN UNIT HEPA, 120VAC/60Hz 10 PLACES 6601-24-HR

LIGHT PANEL, LED 6 PLACES 3800-41

DUPLEX POWER OUTLET 120VAC 36" AWAY FROM FLOOR 10 PLACES 6704-33

CEILING PANEL POLYPRO 6704-20

POWER DISTRIBUTION MODULE, FFU/LIGHT 6600-29B-P

ACCESS DOOR SD-PVC 36"x81"H SINGLE 2 PLACES 6710-15A

POWER DISTRIBUTION MODULE, SECONDARY, 6600-29B-S

FILTER REPLACEMENT ALARM SYSTEM FOR FFU 2625-54A

CONTROL PANEL 6600-23-NS

MAGNEHELIC GAUGE 6600-86

REVISIONS				MATERIAL SPEC.	FINISH SPEC.	UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES
RV#	DESCRIPTION	DATE	BY	HRS	POWDER-COATED	TOLERANCES ON:
NC	INITIAL RELEASE	7/28/17	SV			.XX DECIMALS ± .03 X°± 1
P	Production drawing	8/14/17	KT			.XXX DECIMALS ± .010 X/X ± 1/64

SIGNATURE | DATE
ISSUED BY: VEGA | 7/28/17
REF #: 223753

Terra Universal

TITLE
CLEANROOM HARDWALL
SD-PVC CENTER MOUNT
PANELS FOR 8'H

A   6600-73A-117528

SCALE: NONE | CR | SHEET 1 OF 18

TOP FRAME 1-27
BOTTOM FRAME A-N

FROM FILTER FACE TO FLOOR 8'

CONTROL PANEL
6600-23-NS

REVISIONS			
RV#	DESCRIPTION	DATE	BY
NC	INITIAL RELEASE	8/14/17	KT

MATERIAL SPEC.
HRS

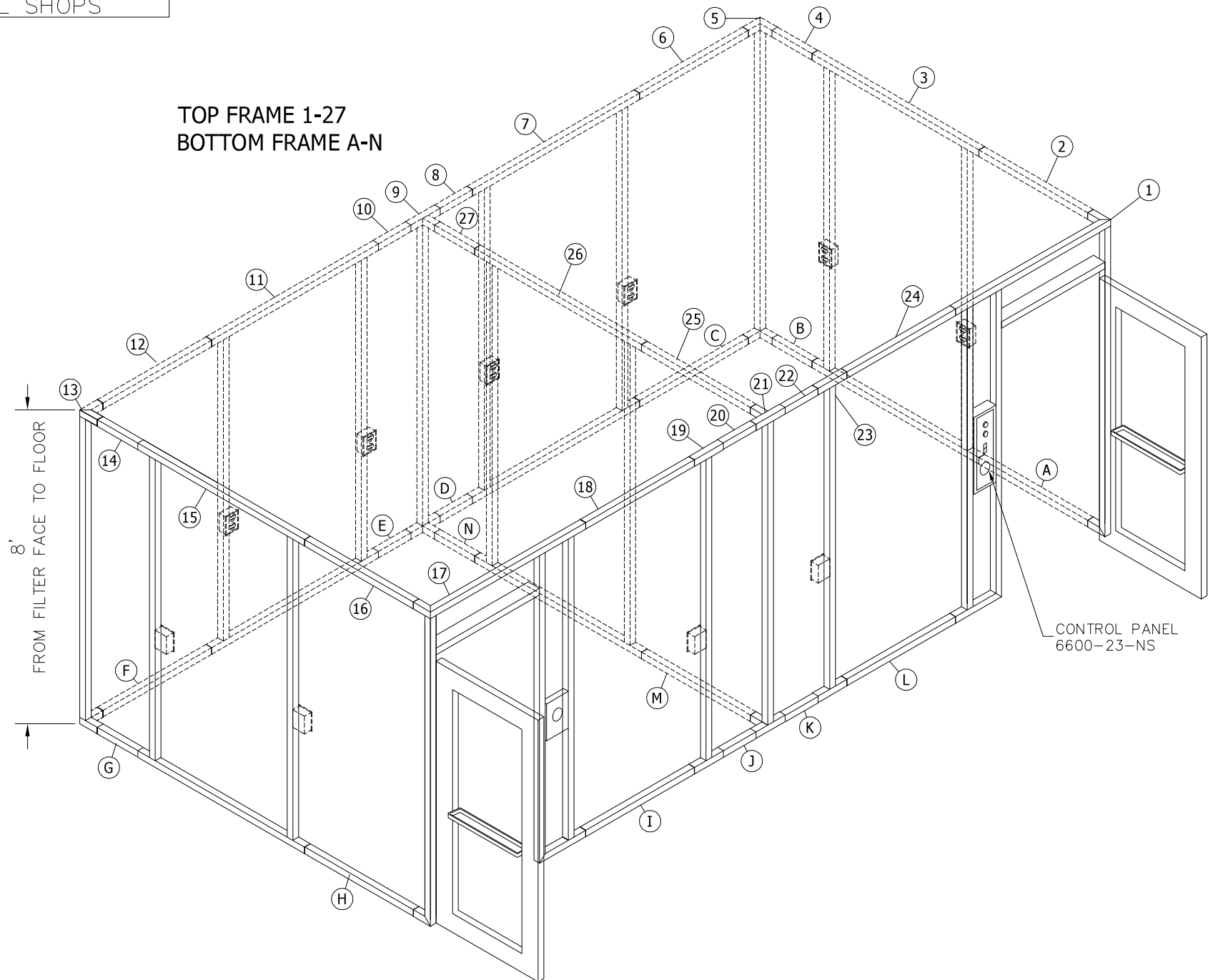FINISH SPEC.
POWDER-COATED

UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES

TOLERANCES ON:

.XX DECIMALS ± .03   X°± 1

.XXX DECIMALS ± .010   X/X ± 1/64

SIGNATURE		DATE
ISSUED BY:	Khanh Tran	8/14/17
REF #:	223753	

Terra Universal

TITLE
CLEANROOM HARDWALL
SD-PVC CENTER MOUNT
PANELS FOR 8'H

A   6600-73A-117528

SCALE: NONE   CR   SHEET 4 OF 18

#-JOIST 1-6
◯-SUPPORT BAR 1-8

#6
#5
#4
#3
#2
#1

CUSTOM DIVIDER #2
CUSTOM DIVIDER #1

② ④ ⑥ ⑧ ① ③ ⑤ ⑦

FROM FILTER FACE TO FLOOR

8'

CONTROL PANEL
6600-23-NS

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TITLE
CLEANROOM HARDWALL
SD-PVC CENTER MOUNT
PANELS FOR 8'H

A   6600-73A-117528

SCALE: NONE   CR   SHEET 5 OF 18

SHOP: MANUAL

◯-TOP TRIMMING 1-10

8' FROM FILTER FACE TO FLOOR

CONTROL PANEL
6600-23-NS

REVISIONS				MATERIAL SPEC.	FINISH SPEC.
RV#	DESCRIPTION	DATE	BY	SDPVC	
NC	INITIAL RELEASE	8/14/17	KT		
⬡					
⬡					
⬡					

UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES
TOLERANCES ON:
.XX DECIMALS ± .03   X°± 1
.XXX DECIMALS ± .010   X/X ± 1/64

SIGNATURE	DATE
ISSUED BY: Khanh Tran	8/14/17
REF #: 223753	

Terra Universal

TITLE
CLEANROOM HARDWALL
SD-PVC CENTER MOUNT
PANELS FOR 8'H

A   6600-73A-117528

SCALE: NONE   CR   SHEET TT OF

PANELS 1-23

FROM FILTER FACE TO FLOOR 8'

CONTROL PANEL
6600-23-NS
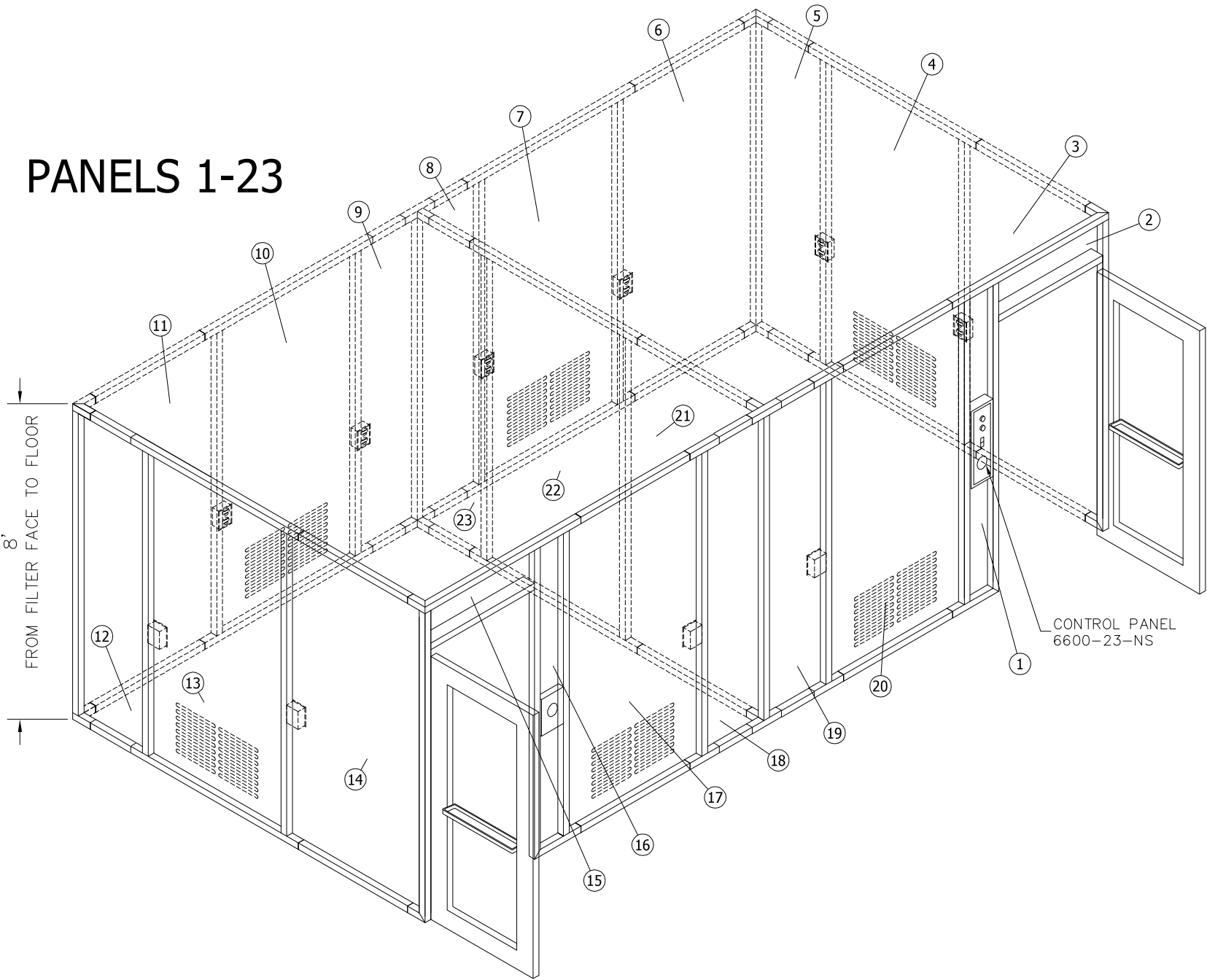
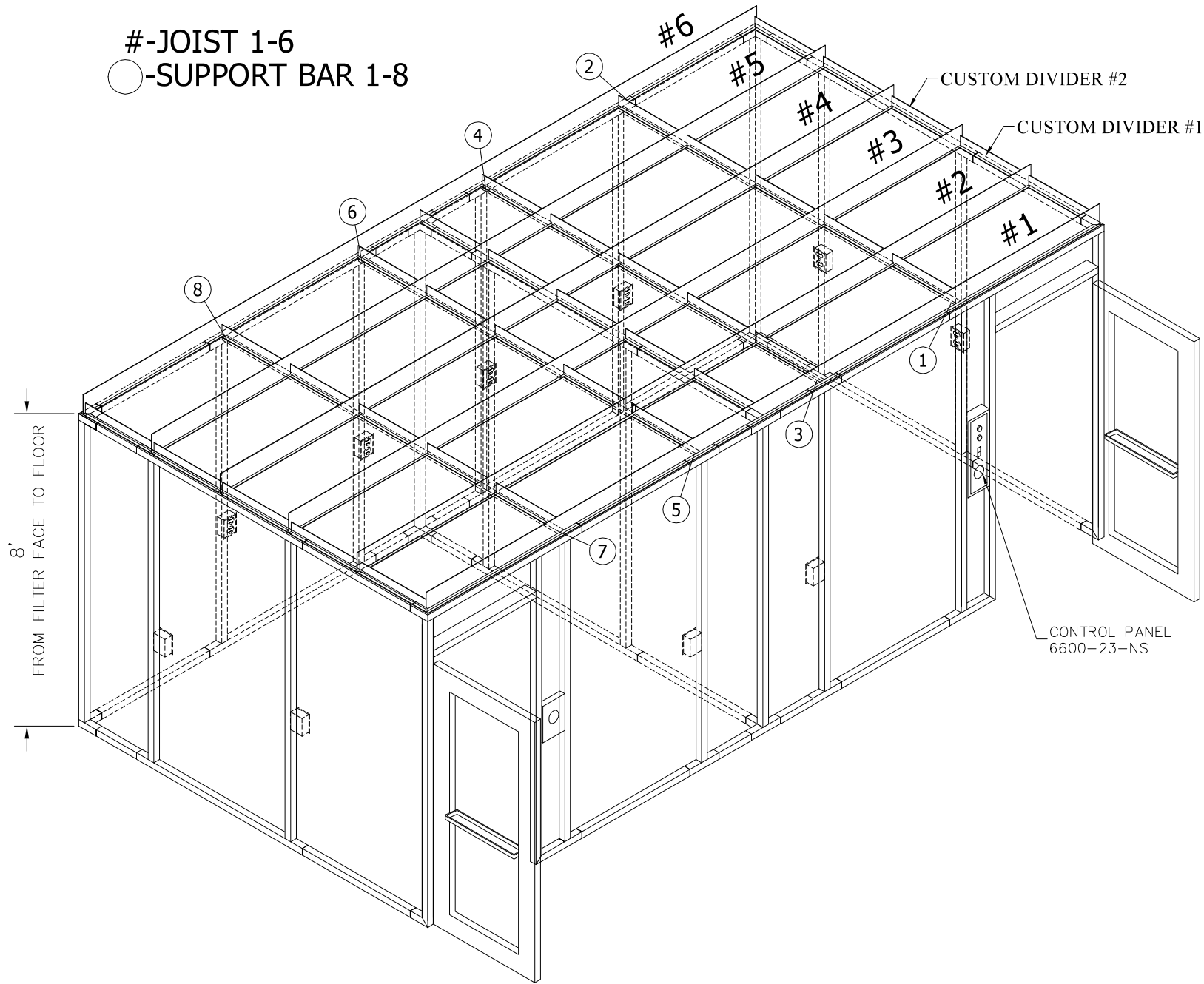| REVISIONS			
RV#	DESCRIPTION	DATE	BY
NC	INITIAL RELEASE	8/14/17	KT

MATERIAL SPEC.
HRS
SDPVC

FINISH SPEC.
POWDER-COATED

UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES
TOLERANCES ON:

.XX DECIMALS ± .03   X°± 1

.XXX DECIMALS ± .010   X/X ± 1/64

SIGNATURE		DATE
ISSUED BY:	Khanh Tran	8/14/17
REF #:	223753	

Terra Universal

TITLE
CLEANROOM HARDWALL
SD-PVC CENTER MOUNT
PANELS FOR 8'H

A   6600-73A-117528

SCALE: NONE   CR   SHEET 17 OF 18

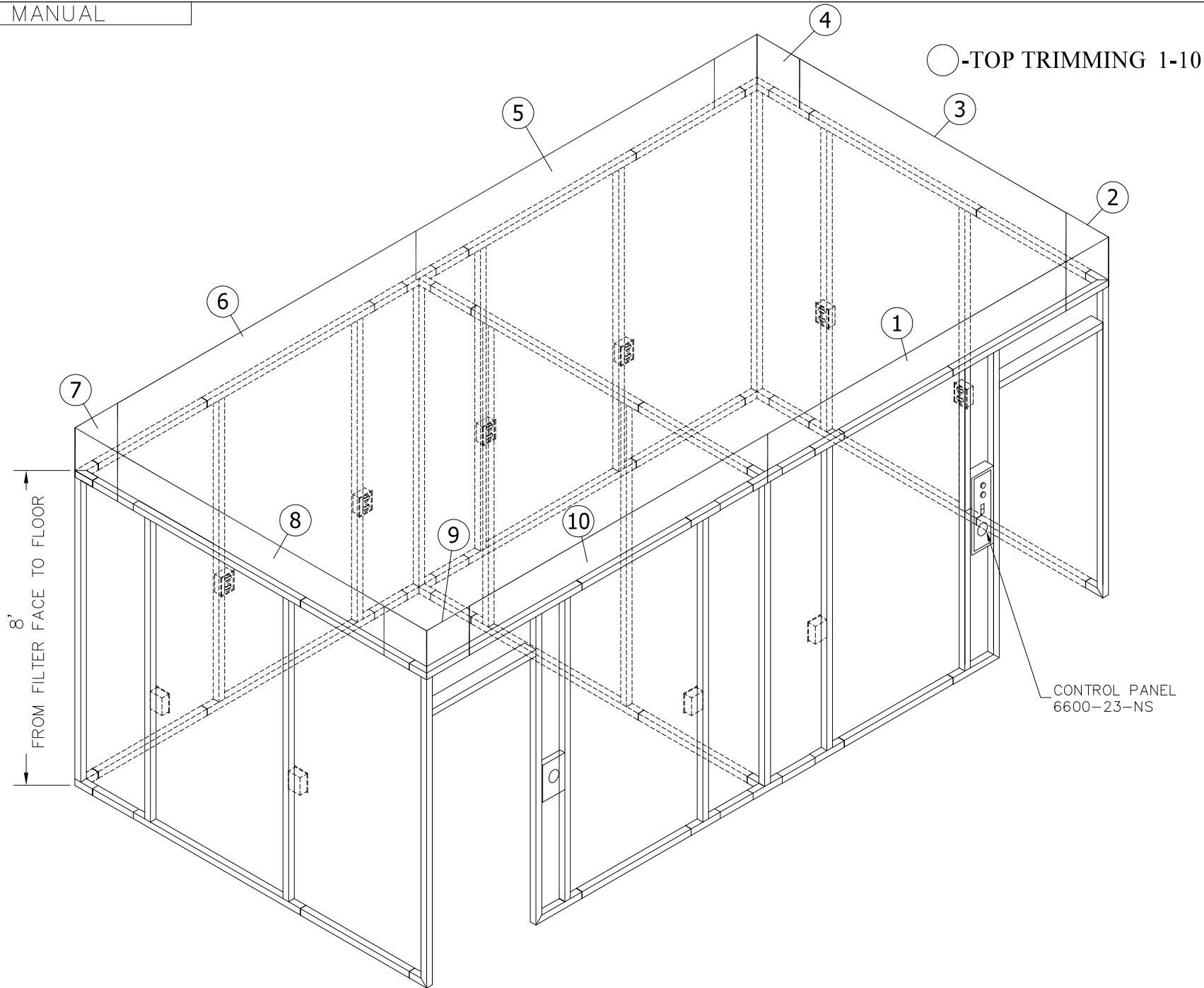# Modular Hardwall Cleanroom Power Requirements

TERRA UNIVERSAL.COM
Critical Environment Solutions

Work Order: 223753	Date: 8/31/2017

Electrical Summary: Total System

120V 60Hz ⊠	1 Phase ⊠	No of FFUs: 10	No of Duplex Outlets: 10	No of Data Jacks: 0
220V 60Hz ☐	3 Phase ☐	No of Lights: 6	No of Exhaust Fans: 0	No of Phone Jacks: 0
220V 50Hz ☐	*No. of PDMs (Power Distribution Modules)*	*for FFUs/Lights:* __2__	*for Duplex Outlets:* __2__	*for Exhaust Fans:* __0__

Power Connection Summary: No. of Fused Electrical Lines

For Fan/Filter Units/Lights: __2__	Lines at __28__ Amps each
For Duplex Outlets: __2__	Lines at __20__ Amps each

Power Distribution Modules (PDMs): Details

PDM # 1 (Primary)	*No of FFUs:* 5	*No of Lights:* 3	*No. of Breakers : 5*
Circuit Breakers (FFUs): __15__ Amps		Transformer Size: __75__ VA
Circuit Breaker (Lights): __8__ Amps		FFU Start-Up Amps (Total): __30__ Amps
		FFU Run Amps (Total): __20.5__ Amps
		Light Amps (Total): __4.5__ ADC
		PDM #1 Total: __25__ *Amps*

PDM # 2 (Secondary)	*No of FFUs:* 5	*No of Lights:* 3	*No. of Breakers : 5*
Circuit Breakers (FFUs): __15__ Amps		FFU Start-Up Amps (Total): __30__ Amps
Circuit Breaker (Lights): __8__ Amps		FFU Run Amps (Total): __20.5__ Amps
		Light Amps (Total): __4.5__ ADC
		PDM # 2 Total: __25__ *Amps*

| **PDM # 3 (Booster)**	*No of FFUs:*	*No of Lights:*	*No. of Breakers :*
Circuit Breakers (FFUs): ____ Amps		Transformer Size: ____ VA
Circuit Breaker (Lights): ____ Amps		FFU Start-Up Amps (Total): ____ Amps
		FFU Run Amps (Total): ____ Amps
		Light Amps (Total): ____ ADC
		PDM # 3 Total: ____ *Amps*

*Outlet circuits do not have a breaker; they must be protected by an externally fused line (provided by customer).

POWER INPUT HARD WIRE
DEDICATED BCP BY OTHERS
220/240V/1PH/24AMP
115/120/1PH/28AMPS

FILTER FAN UNIT
FILTER FAN UNIT

FFU CABLE ELO4962
(1 PER FFU)

POWER INPUT HARD WIRE
DEDICATED BCP BY OTHERS
220/240V/1PH/24AMP
115/120/1PH/28AMPS

FILTER FAN UNIT
FILTER FAN UNIT

FFU CABLE ELO4962
(1 PER FFU)

POWER INPUT HARD WIRE
DEDICATED BCP BY OTHERS
220/240V/1PH/24AMP
115/120/1PH/28AMPS

FILTER FAN UNIT
FILTER FAN UNIT

FFU CABLE ELO4962
(1 PER FFU)

TUI LOGO X4

6600-29B-P(-220)
PRIMARY PDM
c UL us LISTED FILE E472687

FILTER FAN UNIT
FILTER FAN UNIT
FILTER FAN UNIT

6600-29B-S(-220)
SECONDARY PDM
c UL us LISTED FILE E472687

FILTER FAN UNIT
FILTER FAN UNIT
FILTER FAN UNIT

6600-29B-B(-220)
BOOSTER PDM
c UL us LISTED FILE E472687

FILTER FAN UNIT
FILTER FAN UNIT
FILTER FAN UNIT

LIGHT 2X4 OR LED
LIGHT 2X4 OR LED

LIGHT 2X4 OR LED
LIGHT 2X4 OR LED

LIGHT 2X4 OR LED
LIGHT 2X4 OR LED

COMMUNICATION CABLE ELO3581
(SIGNAL FOR SWITCH ONLY)

COMMUNICATION CABLE ELO3581
(SIGNAL FOR SWITCH ONLY)

CABLE FOR COMMUNICATION
CONTROL PANEL TO PRIMARY PDM
ELO3580

LIGHT 2X4 OR LED
LIGHT 2X4 OR LED
LIGHT 2X4 OR LED

LIGHT CABLE ELO1291
(1 PER LIGHT)

LIGHT 2X4 OR LED
LIGHT 2X4 OR LED
LIGHT 2X4 OR LED

LIGHT CABLE ELO1291
(1 PER LIGHT)

LIGHT 2X4 OR LED
LIGHT 2X4 OR LED
LIGHT 2X4 OR LED

LIGHT CABLE ELO1291
(1 PER LIGHT)

6600-23-NS(-220) HARD WALL
6600-25-NS(-220) SOFT WALL

ADDITIONAL ALTERNATING
SECONDARY AND BOOSTER
DISTRIBUTION MODULES AS
REQUIRED

ADDITIONAL OUTLETS (6 TO 10)
REQUIRE ADDITIONAL PDMS
6600-27(-220)
115/120V /1 PH/50/60Hz 20AMP
220/240/1PH/50/60Hz 20AMP

6600-27(-220)
DUPLEX PDM
c UL us LISTED FILE E472687

POWER INPUT HARD WIRE
DEDICATE BCP BY OTHERS
220/240V/1PH/20AMP (NEMA 6-2OR)
115/220V/1PH/20AMP (NEMA 5-15R)
(X5 DUPLEX OUTLETS)
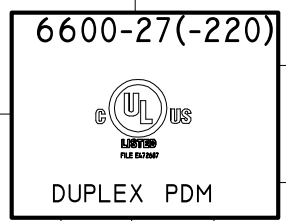
16A MAX
PER OUTLET (5)
TYPE NEMA 6-2OR (220V)
5-15R (120V)

c UL us LISTED
FILE E472687

TUI PART NUMBER	DESCRIPTION	UL FILE
6600-29B-P (-220)	PRIMARY PDM	E472687
6600-29B-S (-220)	SECONDARY PDM	E472687
6600-29B-B (-220)	BOOSTER PDM	E472687
6600-29B-S (-220)	SECONDARY PDM	E472687
LIGHTS MULTIPLE MODELS		E79111
FAN FILTER UNIT MULTIPLE MODELS		E326560
FAN FILTER EXPLOSION PROOF MULTIPLE MODELS		E472687
ELO3581	CABLE SIGNAL TO SECONDARY	CYJV.E149111
ELO3580	CABLE FOR SW CONNECTION	CYJVE218656
ELO4962	CABLE FOR FILTER FAN 4 PIN	CYJV.E149111
ELO1297	CABLE FOR LIGHT 3 PIN	CYJV.E149111
FFU CABLE EXTENSION, MULTIPLE LENGTHS		CYJV.E149111
LIGHT CABLE EXTENSION, MULTIPLE LENGTHS		CYJV.E149111

REVISIONS			
RV#	DESCRIPTION	DATE	BY
NC	INITIAL RELEASE	2/10/2016	CATALAN

MATERIAL SPEC.

FINISH SPEC.

UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES
TOLERANCES ON:
.XX DECIMALS ± .03   X°± 1
.XXX DECIMALS ± .010   X/X ±

SIGNATURE   DATE
ISSUED BY: CATALAN   2/10/16
REF #: ALL PDM'S 91423

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TITLE
UL APROVED POWER
DISTRIBUTION SYSTEM
FOR MODULAR CLEANROOMS

A   6600-33

SCALE: NONE   CR   SHEET 1 OF 1

Date: 9-20-17   **REF:** 223753

USED FOR	DESCRIPTION	PART #	QTY
Ceiling Joist	Screw SS # 12 x 3/4 "Sheet Metal"	FA01665	80
Trimming	Top Trim Screw SS # 12 x 3/4 "Sheet Metal "	FA01665	140
"	Bottom Trim Screw SS # 12 x 3/4 "Sheet Metal"	FA01665	160
"	Vertical Trim Screw SS # 12 x3/4 "Sheet Metal"	FA01665	180
"	Internal Screw SS # 12 x 3/4 "Sheet Metal"	FA01665	80
Frame	Clip Christmas Tree	PA01224	60
Pass-Through	Screw SS 8/32 x 5/8" Phillip Pan	FA01694	12
Door/ Hinge	Screw SS 1/4-20 x 1" Phillip Flat (8 per each)	FA01637	72
Support Bar	Screw SS # 12-14 x 1-1/4 Self Drilling	FA04231	40
Plenum	Drill 11/14	SU01733	Ø
	Tab	SU01757	Ø
	Screw SS 10-32 x 3/4 Phillip Pan	EL02012	
Door Closer Holder	Screw 1/4-20 x 1" Flat Head (4 each)	FA01637	
	Screw 10-32 x 3/8 Phillip Pan (2 each)	FA01695	
Door Stopper Sliding	Screw SS 1/4-20 x 5/8 Phillip Pan (5 per each)	FA01645	
Joist and Divider Clips	"3 Inches	PA03462	42
	"6 Inches	PA03405	6
Air Conditioning	Bolt SS 1/4-20 x 1" Slotted Hex Wash	FA01638	Ø
	Washer SS 1/4" Split Lock	FA01603	Ø
	Washer SS 1/4" Flat	FA01611	Ø
	Nut SS 1/4-20 Cap	FA01631	Ø
Cover Control Switch	Screw SS 6/32 x 1/2 Phillip Pan	FA01692	Ø
Anchor	Screw SS # 14 3/4" Hex Washer	FA03646	10
Bit for Trimming	Phillip Power Bit Drill	PA03553	
Bit for Anchors	Bit Drill 3/8"	3UU50	1
Pass-Through Frame	Screw SS 1/4-20 x 5/8 Phillip Pan (8 per each)	FA01645	Ø
Sliding Door Brackets	Bolt SS 5/16 x 34" Hex	FA01648	Ø
	Washer SS 5/16 Flat	FA01601	Ø
	Washer SS 5/16 Split Lock	FA01610	Ø
Sliding Door Support	Nut SS 3/8" Hex	FA01415	Ø
	Washer SS Split Lock	FA01600	Ø
	Flat Washer SS 3/8"	FA01599	Ø
Swing Door Frame Stopper	Screw SS 6-32 x 1/2 Phillip Pan (14 for Each)	FA01692	2
Blowers			3
Light Fixtures			6
To Connect Blowers & Light	Yellow Cord, 3 Pins, 12ft, Male/Female	EL01297	
	Yellow Cord, 4 Pins, 12ft (Installed on FFU)	EL04962	
FFU Connection	Cord Grip W/ Lock Nut (Installed on FFU)	EL01336	
FFU Extension Cable	Yellow Cord, 4 Pins, Male/Female	EL01298	Ø
FFU Extension Coupling	Coupling, Aluminum, 3/4" I.D 7/8" O.D.	PL04214	Ø
Control Panel	Mini Yellow Cord, 5 Pins	EL03580	Ø
Box To Box Connection	Mini Yellow Cord, 4 Pins	EL03581	Ø
Logo, Corner Connection	Telephone Cables White (custom length)	N/A	
Nitrogen Connection 3/8"	Nitrogen (Male & Female Makes 1)	6704-36	Ø
Vacuum Connection 3/8"	Vacuum (Male & Female Makes 1)	6704-35	Ø
Nitrogen/Vacuum Connection	Tubing Polyethylene 3/8	PA01954	Ø
Plastic Union For Long Panels	Strip Polycarbonate, "H" profile	CR05557	Ø
VARS			Ø
Ceiling	Warning Label, Yellow	SU03576	Ø

HARDWALL CLEANROOM

Ref #   223753   Date: 09/22/17

Crate #   1   Of   6

Description:		Qty:
1	TOP FRAME #'s 1,2,3,4,5,6,7,8,9,10,11,12,13,14 15	15
2	BOTTOM FRAME #'s D, E , B, G, L, A, C, H, K J, I , F, M , N,	15
3	DOOR //	1
4	CONTROL PANEL	1

HARDWALL CLEANROOM

Ref # 223753   Date: 01/11/17

Crate #   **2**   OF   **6**

0

Description: _____ Qty:

1   FRAME #'s 16,17,18,19,20,21,22,23,24,25,26,27   12

![Terra Universal logo - TERRA UNIVERSAL.COM Critical Environment Solutions]

HARDWALL CLEANROOM

Ref # 223753   Date: 01/11/17

Crate #   3   OF   6

Description:	Qty:
1 CEILING JOIST #'s	6
2 DIVIDERS	35
3 TOP TRIMMING #'s 12,14,7,3,4,11,8,10	8
4 TOP TRIMMING CORNERS	4
5 LIGHT PANEL // L E D	6
6 BAR SUPPORTS	4
7 PDM /// PRIMARY	1
8 PDM /// SECONDARY	1

HARDWALL CLEANROOM

Ref # 223753   Date: 01/11/17

Crate #   4   OF   6

Description: **Qty:**

1   FILTER FAN UNITS   /// 2 X 4 ROOM SIDE REP/   6

HARDWALL CLEANROOM

Ref # 223753   Date: 01/11/17

Crate #   5   OF   6

Description:	Qty:
1 WALL PANELS	24

HARDWALL CLEANROOM

Ref # 223753   Date: 01/11/17

Crate #   **3**   OF   **6**

Description:	Qty:
9 PDM /// DUPLEX	2
10 LIGHT PANEL // L E D	7
11 CEILING PANELS	9

HARDWALL CLEANROOM

Ref # 223753   Date: 01/11/17

Crate #   6   OF   6

Description:	Qty:
1 FILTER FAN UNITS /// ROOM SIDE REP //	4