TERRA UNIVERSAL.COM
Critical Environment Solutions

Installation and Operating Guide *Document No. 1788-30*

Hardwall Modular Cleanroom

 Rev. March 2021

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Hardwall Modular Cleanroom

Proprietary Notice

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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.

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 Description

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.

Designed to combine economy and versatility, this system features ceiling HEPA Fan Filter Units that direct a continuous flow of HEPA or ULPA-filtered air through the enclosure. The continuous positive pressure created by this laminar air-flow helps to control particles generated inside the enclosure by forcing them out the air vents. This design also helps to prevent contaminants from entering the cleanroom when an access door is opened.

The Modular Hardwall Cleanroom is supported by a rigid frame structure consisting of powder-coated 2" - square steel upright members and horizontal cross members. Joists supported by the frame form 2' x 4' ceiling grids that accommodate the interchangeable ceiling modules. All of these ceiling modules rest against the ceiling grid frame to form a tight seal along the perimeters.

Fan Filter Units

Fan Filter Units (FFUs) direct a vertical laminar flow of filtered air downward through the enclosed cleanroom area.

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 microporous polyurethane minipleats held in place by strong, rigid plastic separators that keep the medium from nesting. 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.

Light Panels

Light Panels are mounted on the ceiling grid to ensure effective illumination of the work area without interfering with the controlled air stream. Each light panel is controlled by the power supply unit.

Power Requirements
USA: 115VAC/60Hz, 1.50A Each
International: 277VAC/50Hz, 0.65A Each

Blank Ceiling Panels

All remaining ceiling grids are covered with blank panels, which can be removed to allow installation of additional fan filter units or illuminator modules. Panels are made of white polypropylene, clear acrylic, clear static-dissipative PVC, vinyl-coated gypsum or steel depending on customer selection

Power Distribution Modules (PDMs)

FFUs and lights draw their power from Power Distribution Modules (PDMs) mounted on the ceiling grid, which can power up to five FFUs and five lights. Each includes a step-down transformer for the Control Panel and status indicator circuits, as well as relays and circuit breakers for overload protection of all connected devices, AC contactors, and NEC-compliant quick-connect fittings. Each PDM requires a dedicated 35A power circuit.

Side Panels

Rigid side panels of the Modular Cleanroom are made of light-weight, transparent polymer (typically acrylic, static-dissipative PVC, or polycarbonate). The walls are attached to the support frame with stainless steel braces and fasteners.

Control Panel

A control panel includes ON/OFF switches for lights and FFUs, a Magnehelic Gauge, which monitors pressure inside the room, and low-voltage Operation Status Indicator (OSI) lights located at each corner of the cleanroom. These lights give off a steady glow when FFUs are operating, but flash when FFUs are turned off, providing a clear visual indication of cleanroom operation status.

Entrance Options

1. **Access Door:** An access door, made of rigid static-dissipative PVC or acrylic mounted in an aluminum frame, affords entrance to the enclosure. The door is 36"W x 80"H and includes inside and outside handles and a pneumatic self-closing damper.

> NOTE **This room is not sealed airtight. Because it is designed to operate under positive pressure, small gaps around the doors or in the panel structure will not compromise clean conditions.**

2. **Antechamber/Gowning Area:** The modular cleanroom can be configured to include an antechamber, which can function as a gowning area, isolated from the main cleanroom enclosure. This buffer zone between the outside environment and the cleanroom can be configured to include fan filter units and other equipment to meet specific customer requirements.

2.0 Installation

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

Site Preparation

Refer to Terra installation contract for details of work to be performed by Terra Universal technicians.

A. Facility area where the cleanroom is to be installed must provide 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.

B. Customers must provide permanent electrical connection from supply panel to Power Distribution Modules (one 35A power line per PDM) in conformance with local electrical code, as well as any vacuum, air, H20, sprinkler, or nitrogen connections required for the cleanroom.

C. If Terra is performing the installation, 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.

D. Customers are to provide utilities, installation power and removal of any packing material.

E. 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.

F. 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.

G. Prior to shipping, all frame and ceiling members are stamped and then labeled at each end. Refer to the attached drawings for detailed information on how your cleanroom is numbered.

H. 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.

Required Installation Equipment

A. 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.

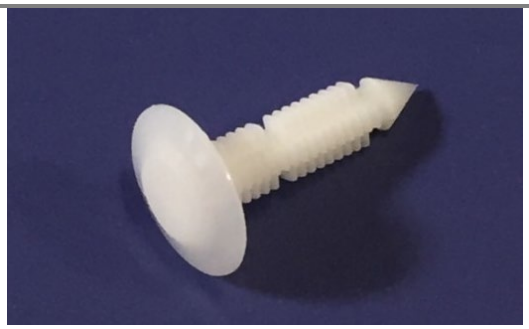
B. Unloading crates from the truck is much easier if you have a truck-high loading dock. Without such a dock, you will need at least one forklift and a support to brace one end while the forklift is positioned beneath the center of each crate. Several people are required to unload individual components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

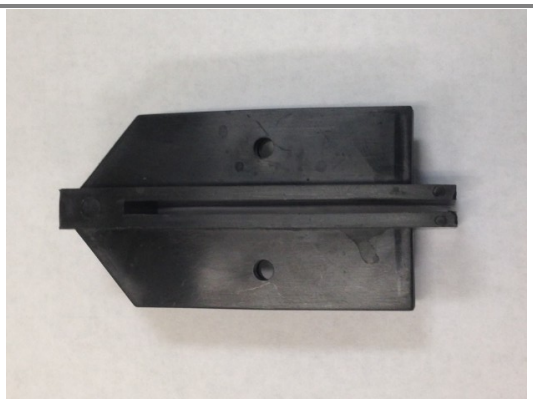
C. You'll need heavy rubber hammers, good portable drills/screwdrivers, measuring tapes (to make sure everything's square) and six to ten 11" locking C-Clamps used to hold beams in place as you insert fasteners. Another tool that will be needed is an 8" – 12" shaft extension for the screwdriver bits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

Standard Component List

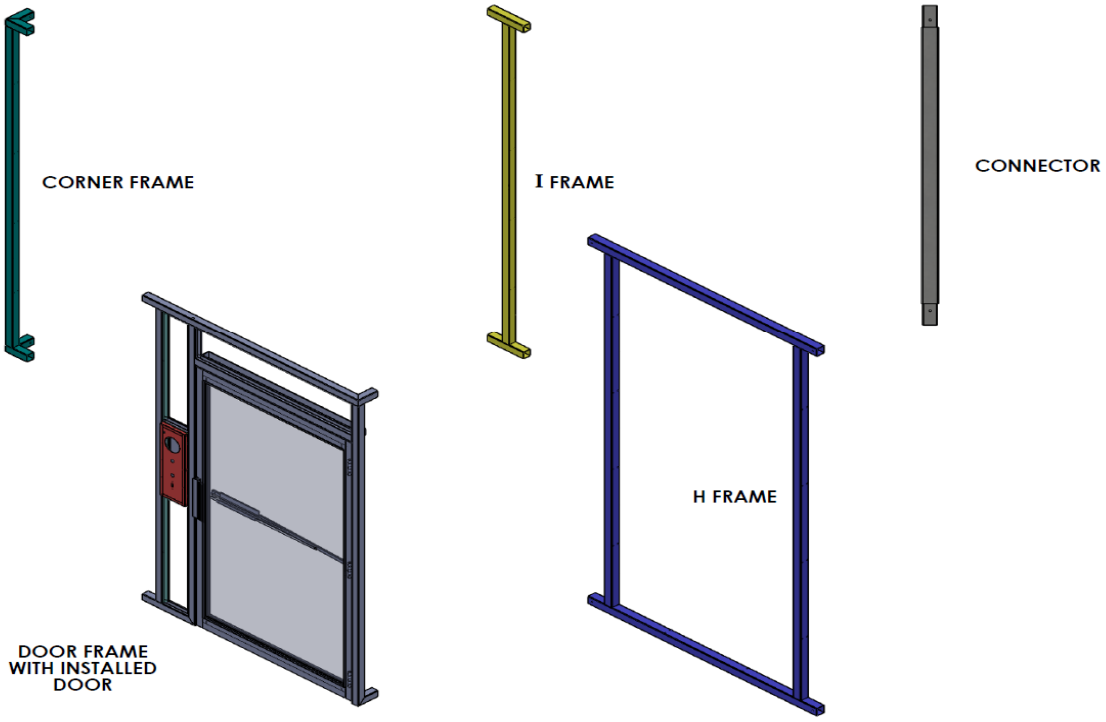
List and quantities may vary, depending on the order:

- Upright Frame Supports
- Power Distribution Modules and electrical service lines
- Control Panel
- Fan/filter units
- Light fixtures
- Polymer Side Panels (acrylic, static-dissipative PVC or polycarbonate)
- Mirror-finish stainless steel trimming (for side panels)
- Access door(s)

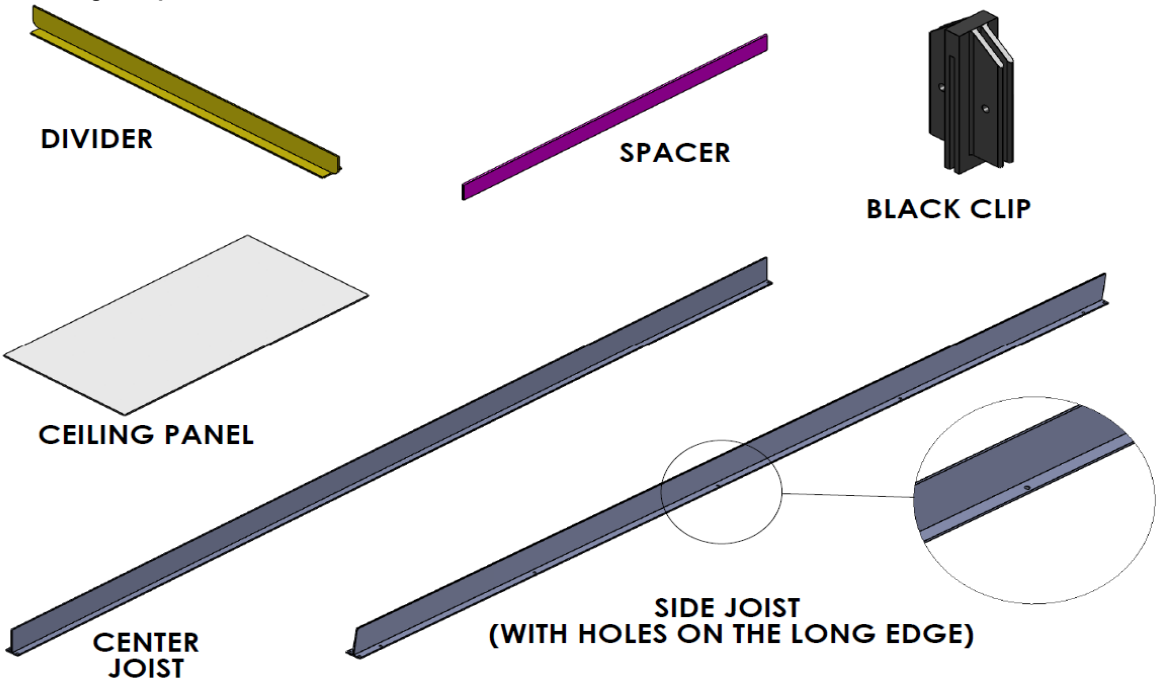
Hardware Reference Table	
Part	**Used For**
 **#12 – ¾" Stainless Steel Self-Tapping Hex Head Screw**	**Ceiling Joists** **Top Trimming** **Wall Panel Mounting Brackets**
 **Christmas Tree Clip**	**Frame Assembly**
 **¼"-20 x 1" Phillip Flat Head Screw**	**Swing Door Hinge** **Swing Door Closer Housing**

 **#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**

Cleanroom Frame Components

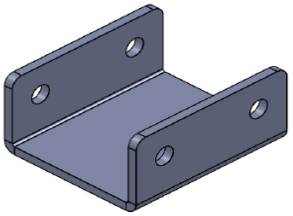


Ceiling Components



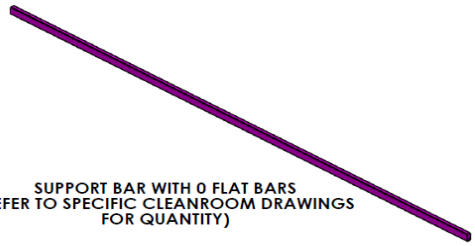
Support Bar Components

SUPPORT BAR WITH 2 FLAT BARS
(FOR ROOMS FROM 10 FT TO 12 FT)



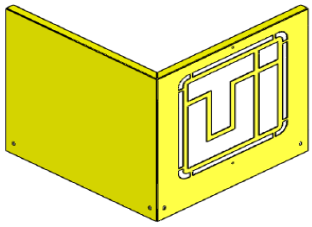
SUPPORT BAR BRACKET
(FOR ROOMS OVER 12 FT)

2 SUPPORT BARS WITH 1 FLAT BARS
(FOR ROOMS OVER 12 FT)

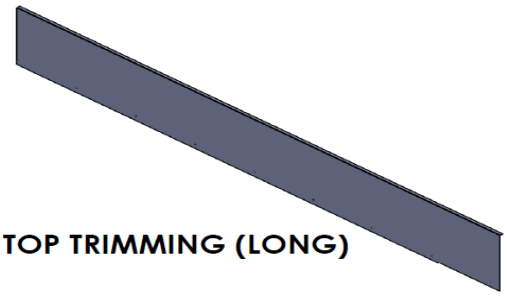


SUPPORT BAR WITH 0 FLAT BARS
(REFER TO SPECIFIC CLEANROOM DRAWINGS
FOR QUANTITY)

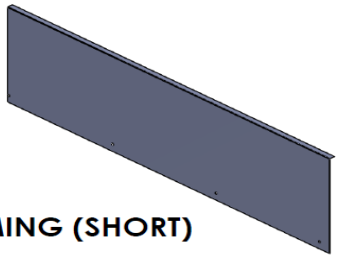
Top Trimming Components



CORNER TRIMMING

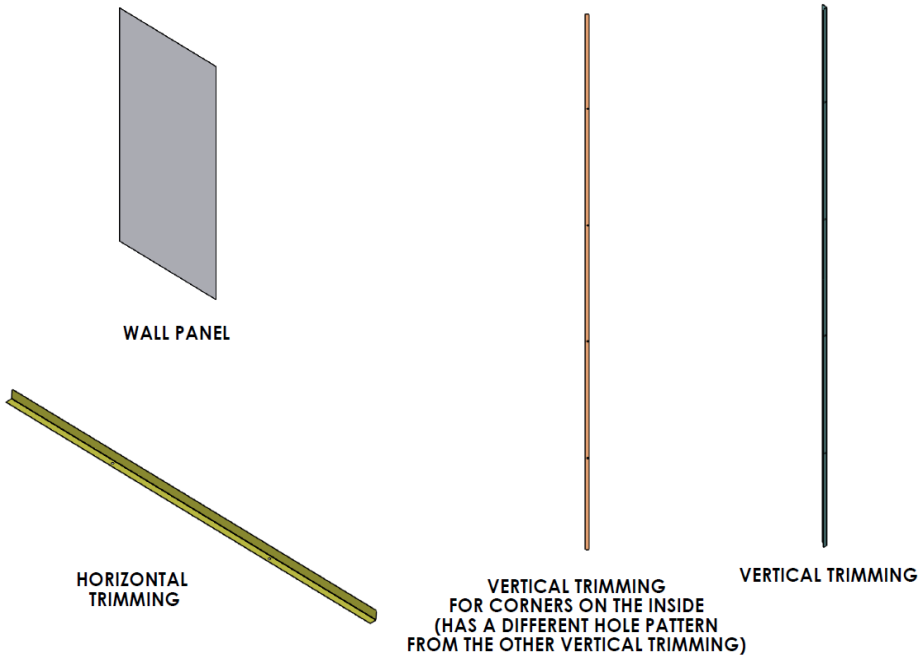


TOP TRIMMING (LONG)



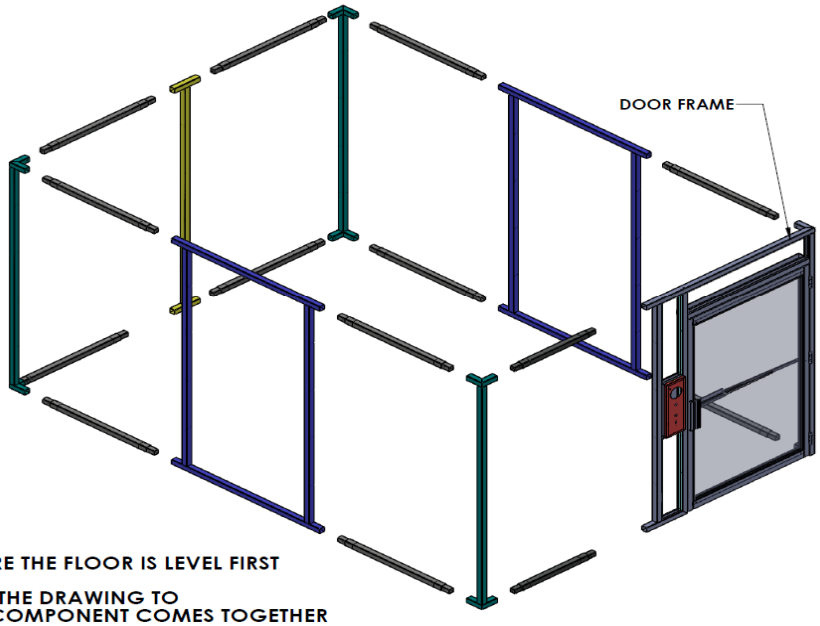
TOP TRIMMING (SHORT)

Wall Panel Components



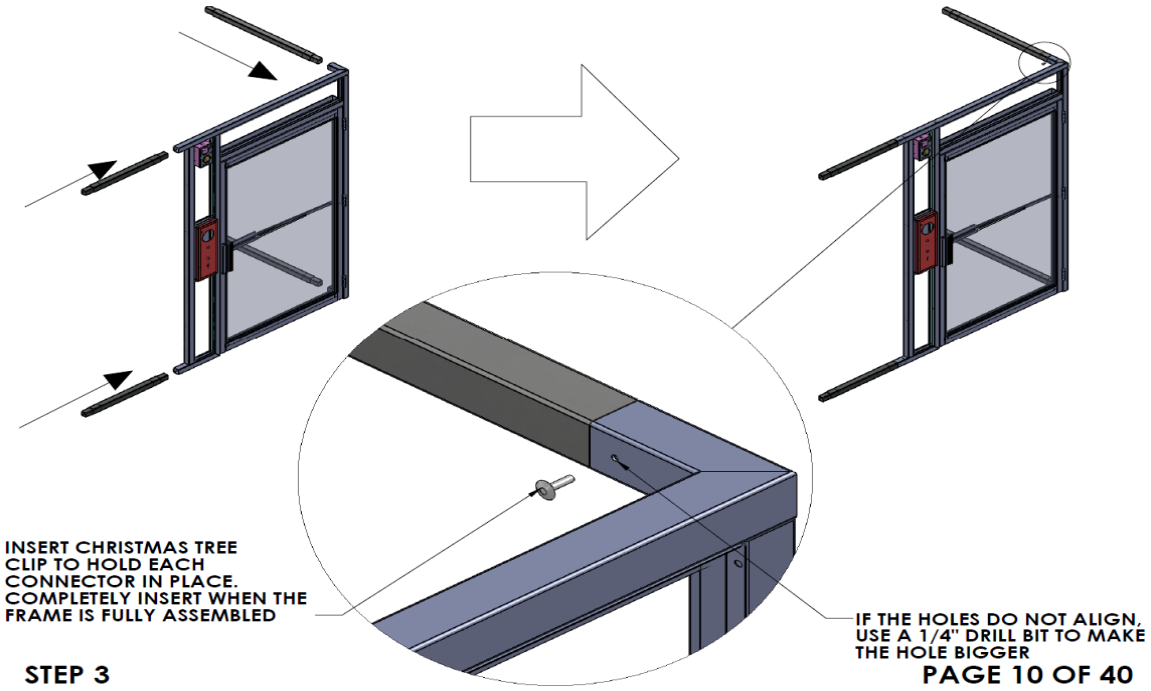
Frame Assembly

All frame members are stamped and labeled prior to shipping. The drawings attached at the end of this manual include diagrams showing the locations of each labeled component. Be sure to familiarize yourself with the placement of the frame members and joists before beginning assembly. Beginning with the frame member labeled "#1" (typically the door frame), assemble the horizontal frame members according to their labels

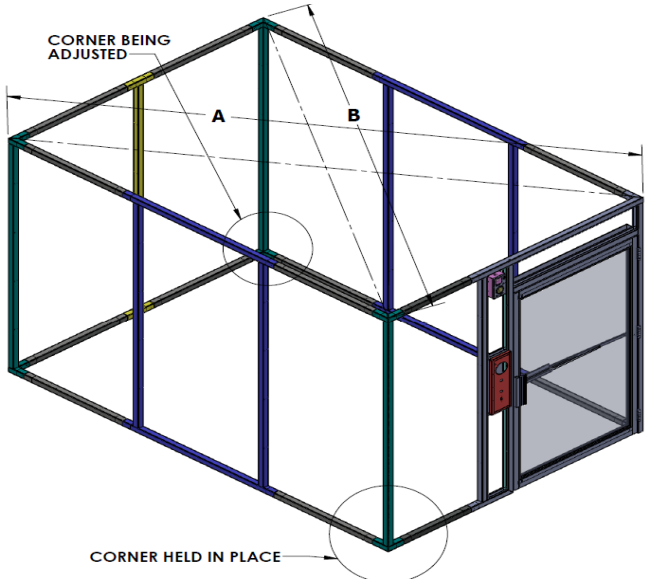


STEP 1: MAKE SURE THE FLOOR IS LEVEL FIRST

STEP 2: REFER TO THE DRAWING TO SEE HOW EACH COMPONENT COMES TOGETHER STARTING WITH THE DOOR FRAME



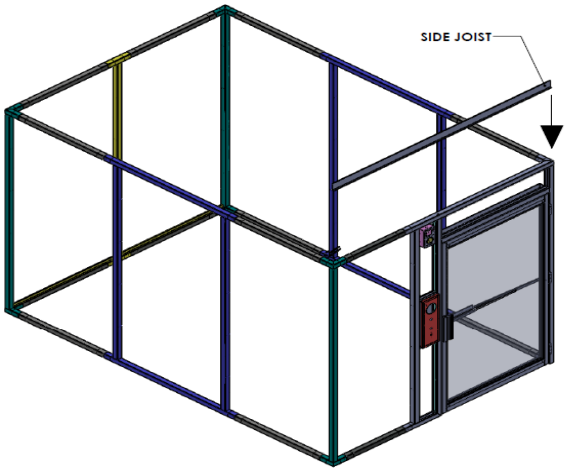
STEP 3



STEP 4

After the frame has been completely assembled, square the structure by measuring the length of A and B are not equal, adjust the frame, by having someone hold one of the corners down and another person move the opposite corner either in or out until length A and B are equal. Also, check to make sure that the overall dimensions match the drawing.

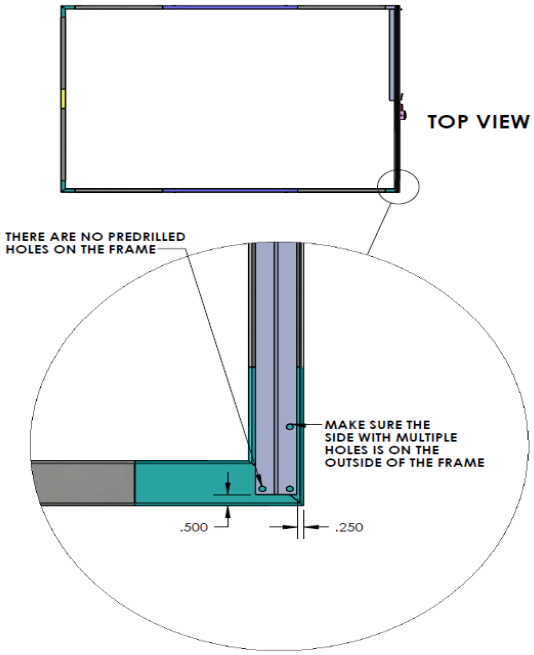
Joist and Divider Installation



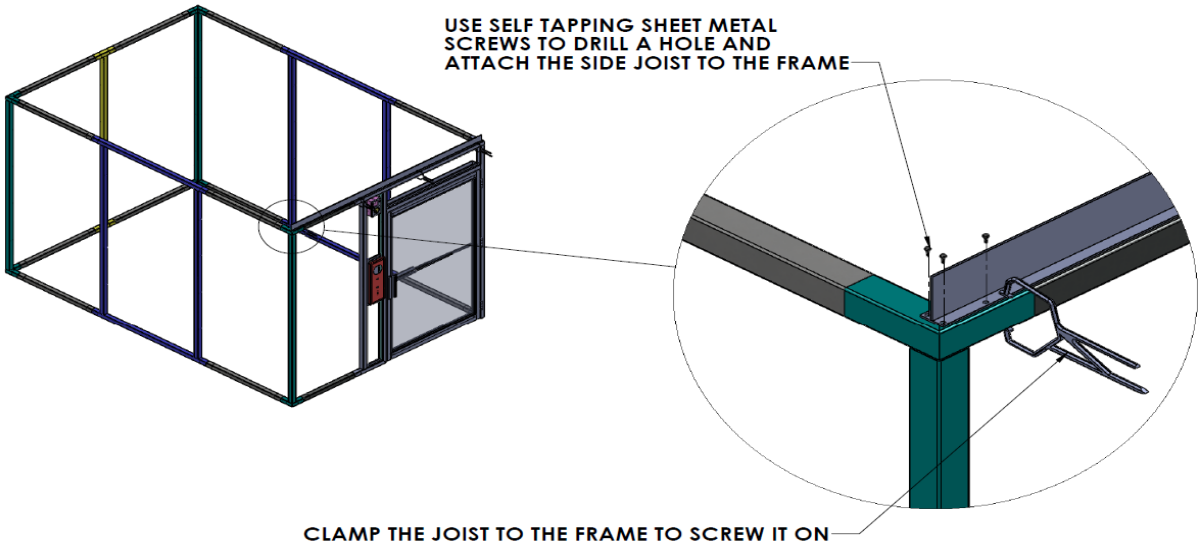
JOISTS ARE BOWED TO COMPENSATE FOR THE WEIGHT OF ALL THE FFUS, LIGHTS, PDMS, AND OTHER CEILING ACCESSORIES

NOTE: ONLY SIDE JOISTS HAVE EXTRA FASTENING HOLES

STEP 1



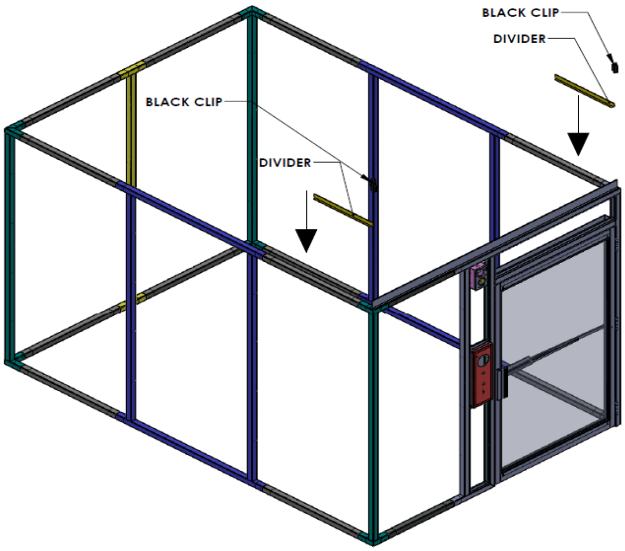
STEP 2



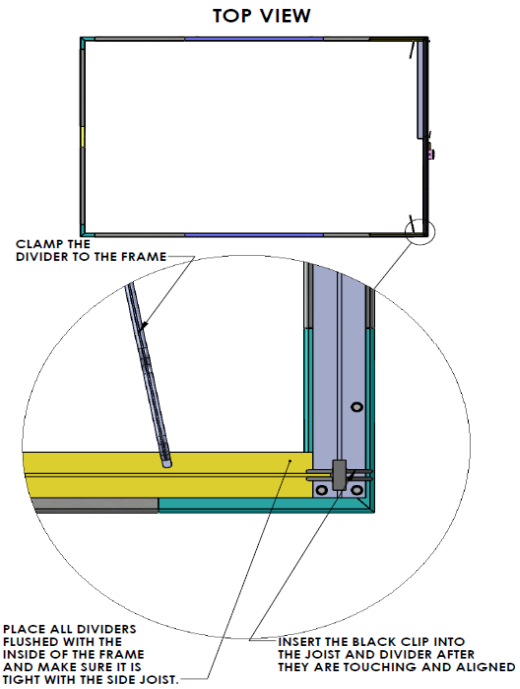
REMOVE THE CLAMPS AFTER SCREWING THE JOIST TO THE FRAME

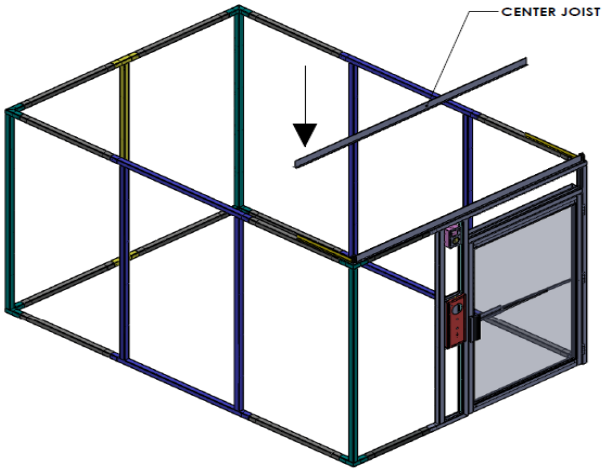
STEP 3

Make sure to fasten the side joist along its entire length.



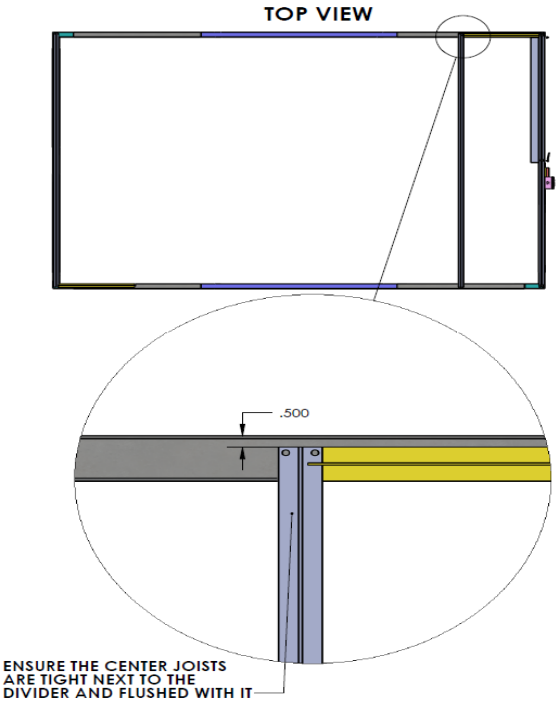
STEP 4

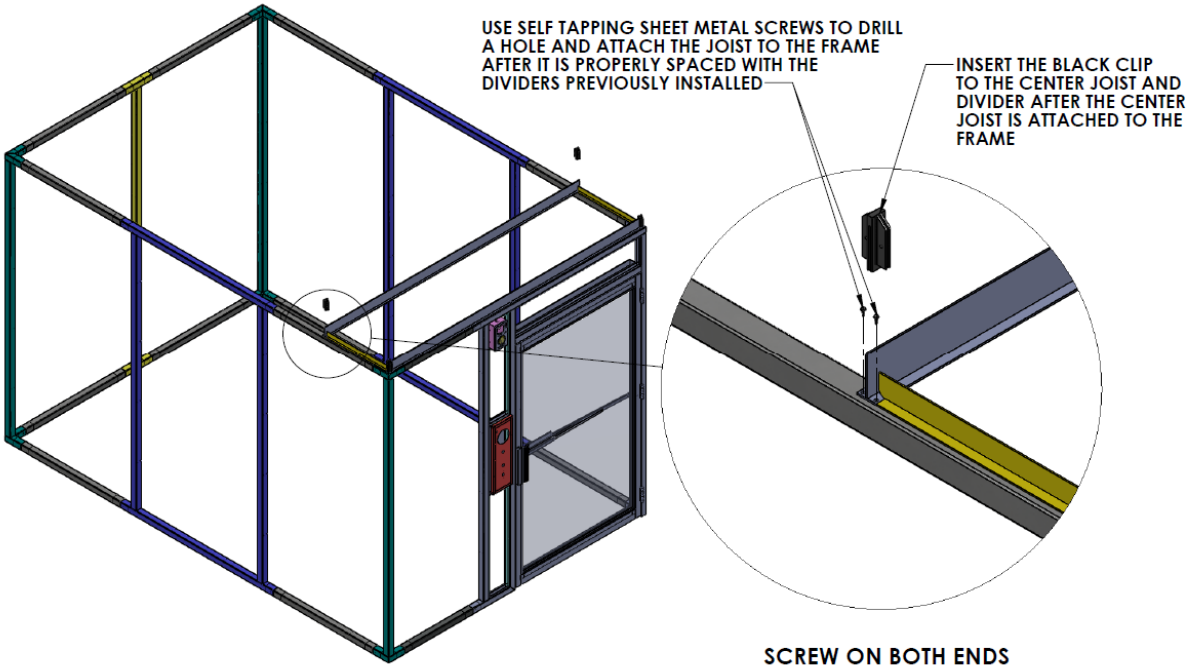




NOTE: CENTER JOISTS DO NOT HAVE HOLES ALONG THE LONG EDGE

STEP 5





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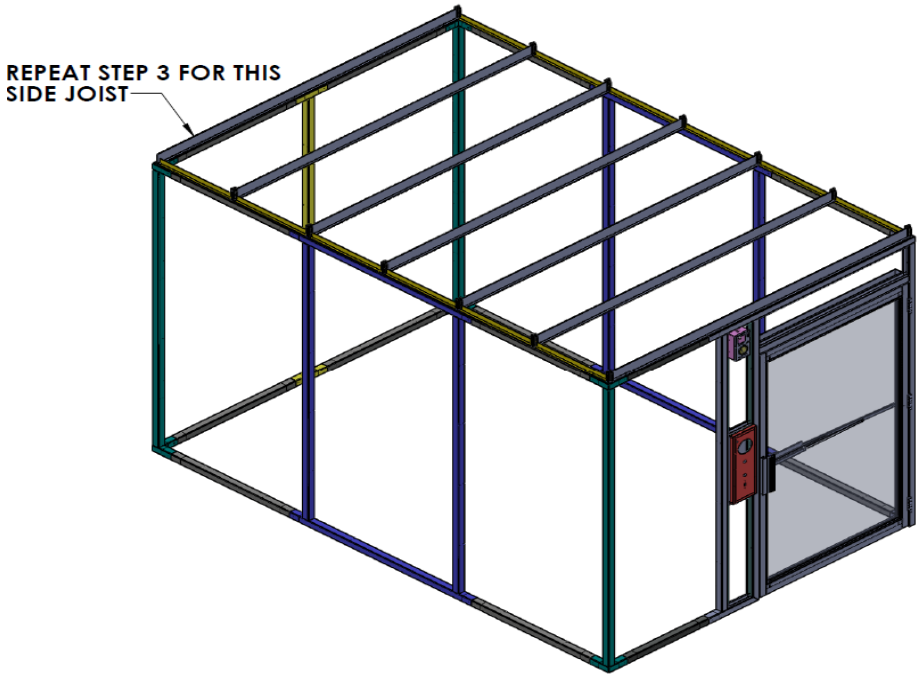
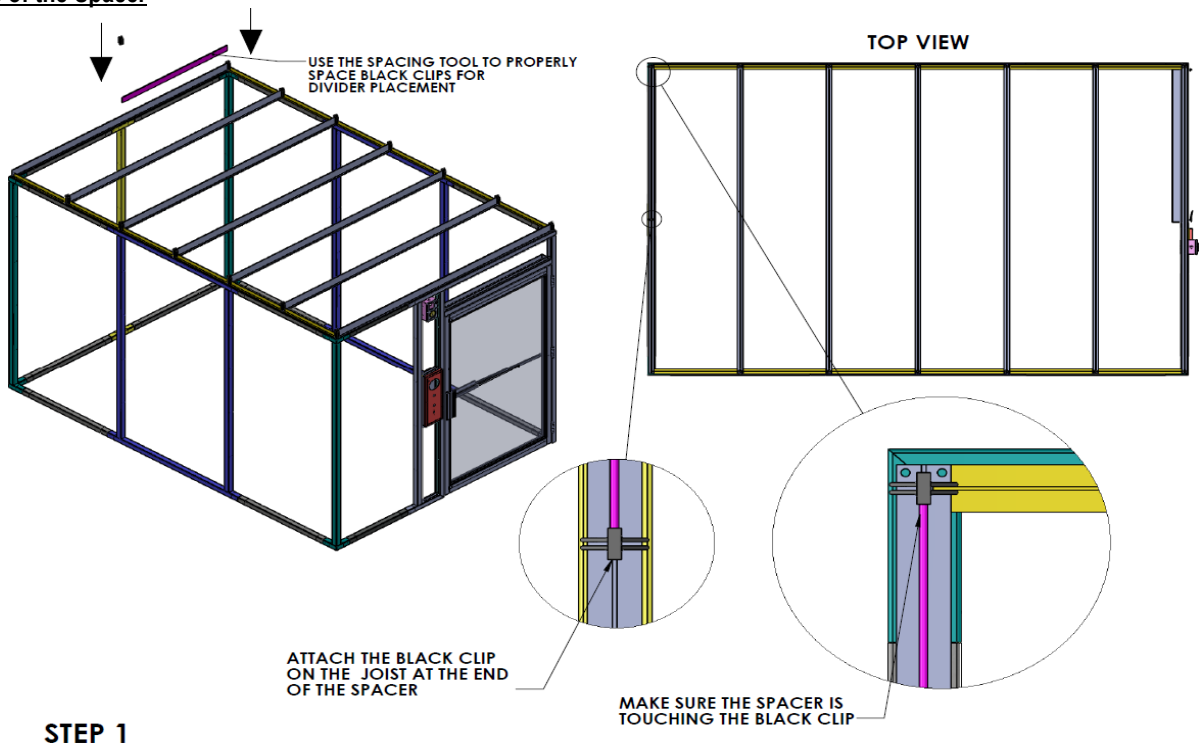
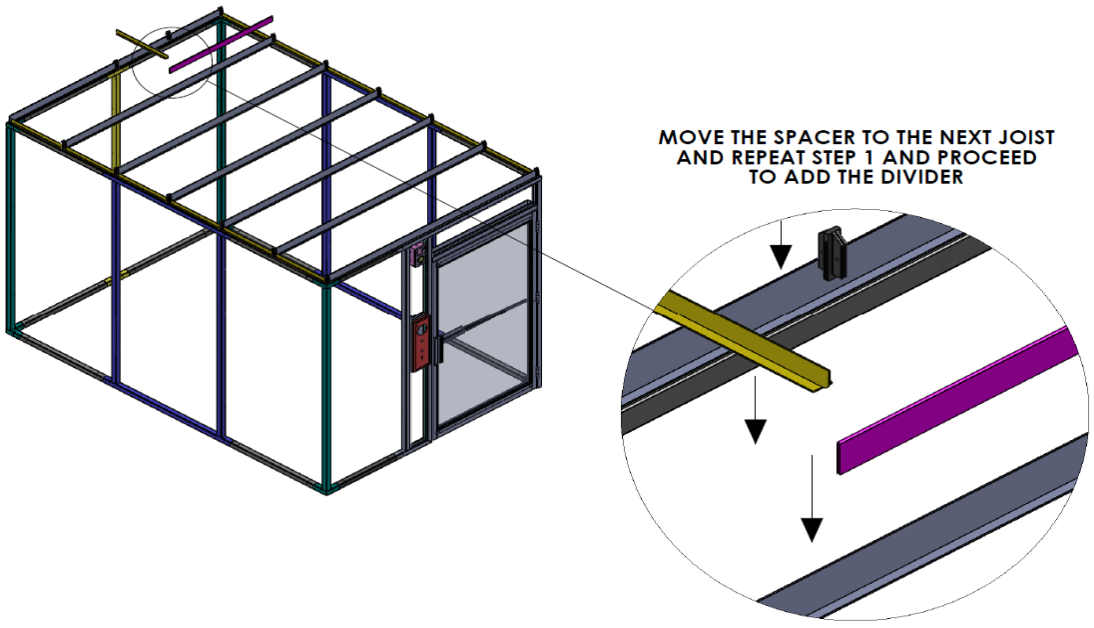


REPEAT STEPS 4-6 TO COMPLETE THE INSTALLATION OF THE CENTER JOISTS AND OUTER DIVIDERS

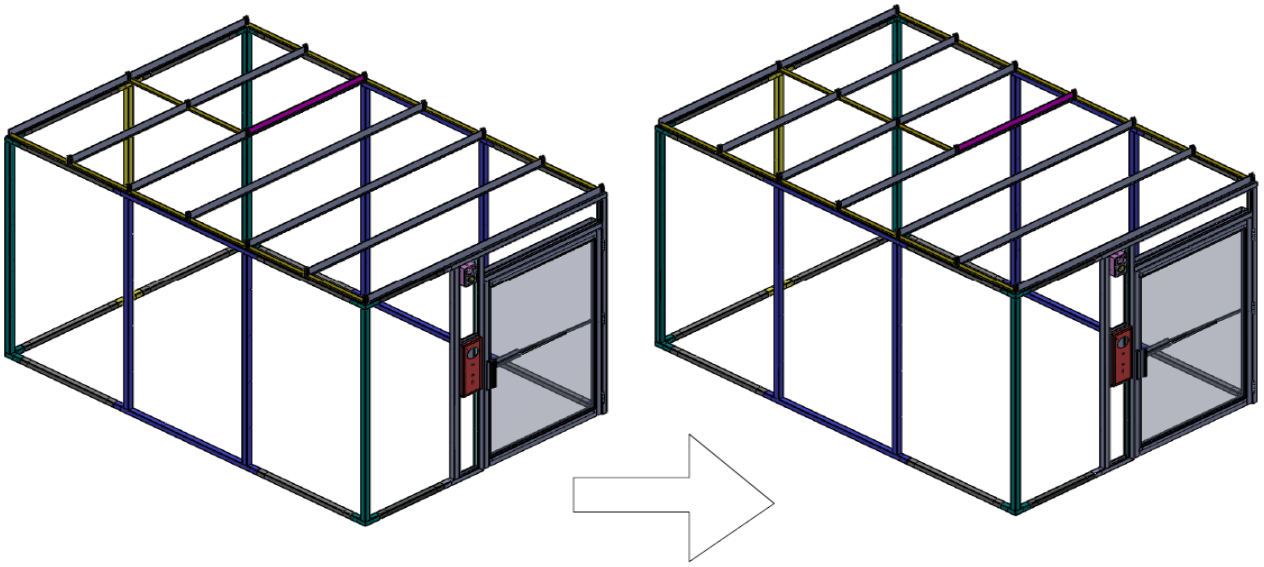
Use of the Spacer



STEP 1

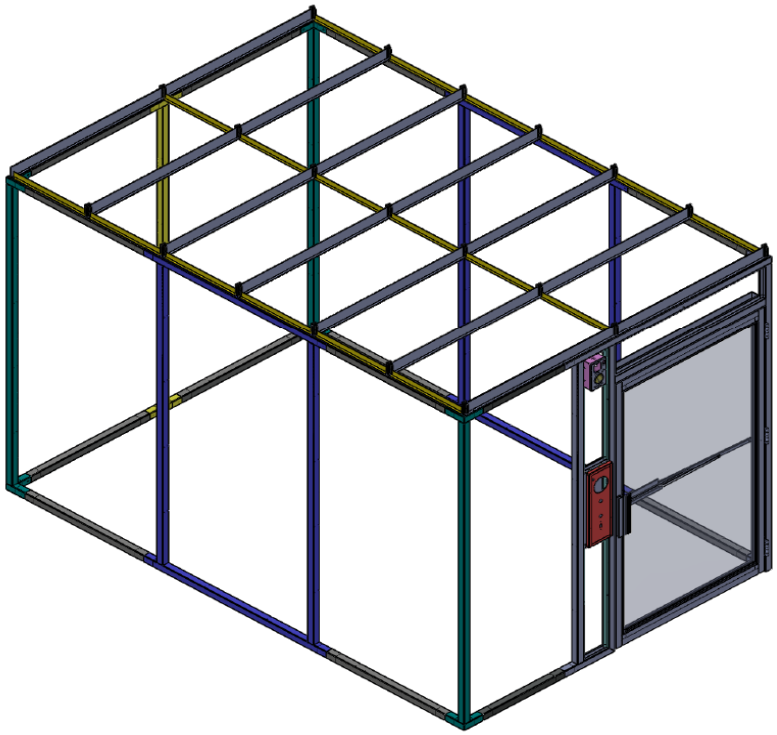


STEP 2

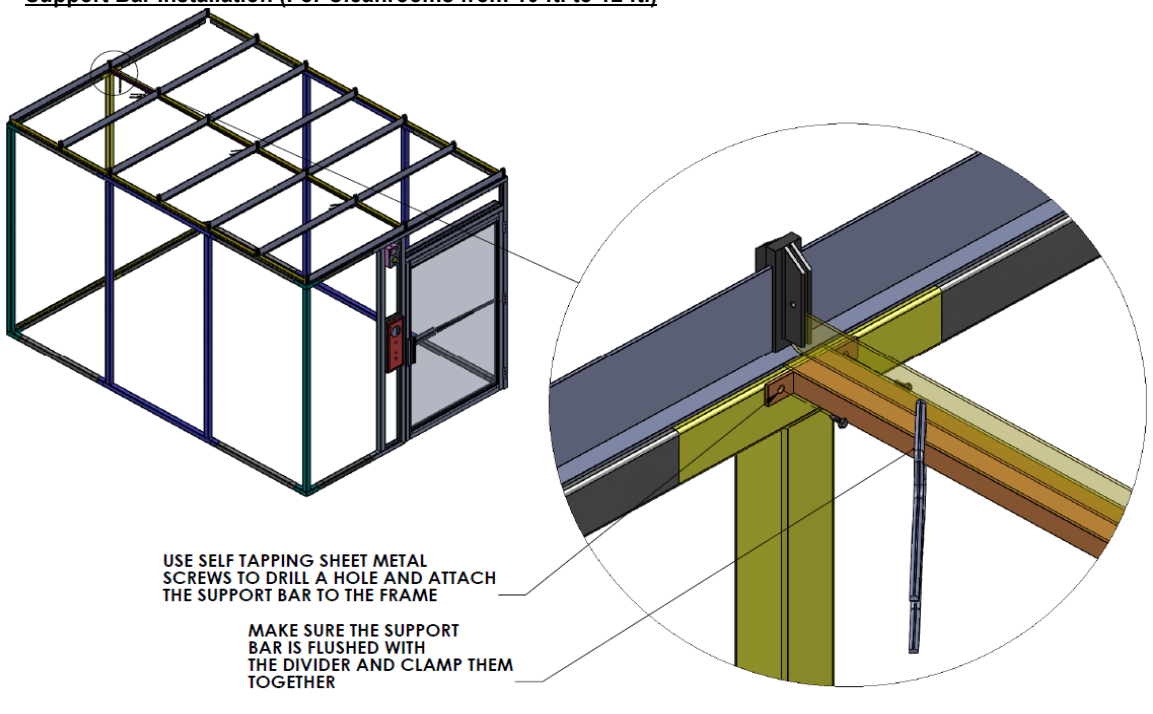


REPEAT STEPS 1-2 UNTIL CEILING GRID IS COMPLETE

STEP 3

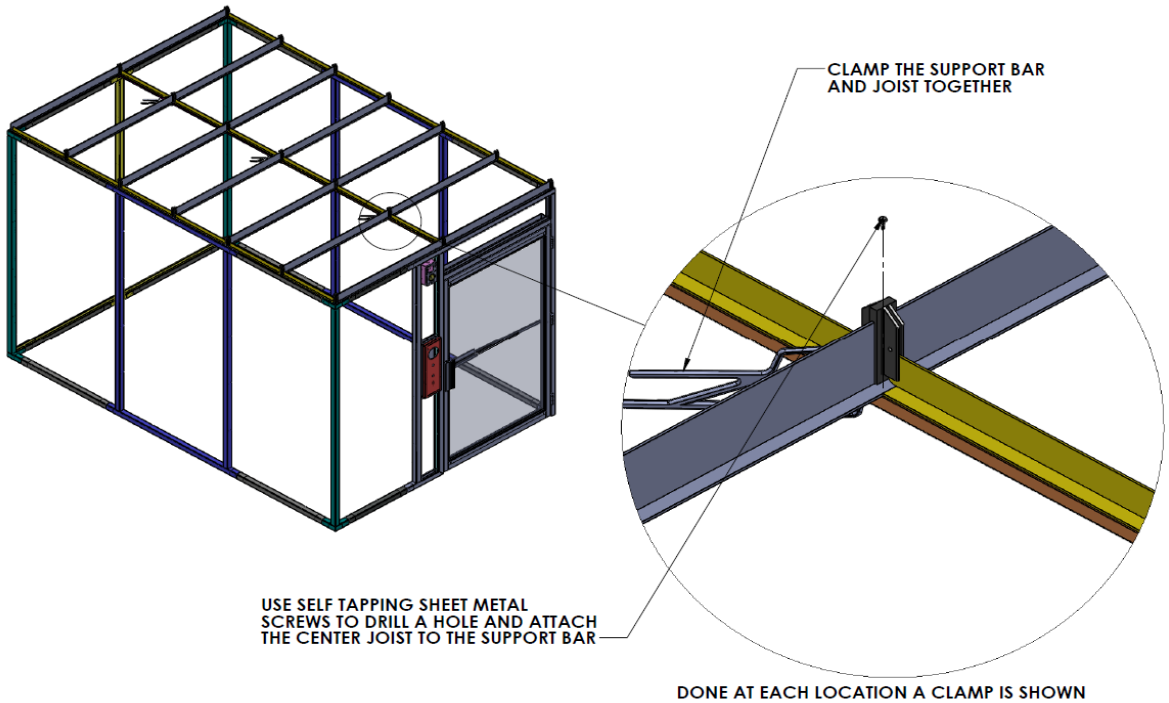


Support Bar Installation (For Cleanrooms from 10 ft. to 12 ft.)



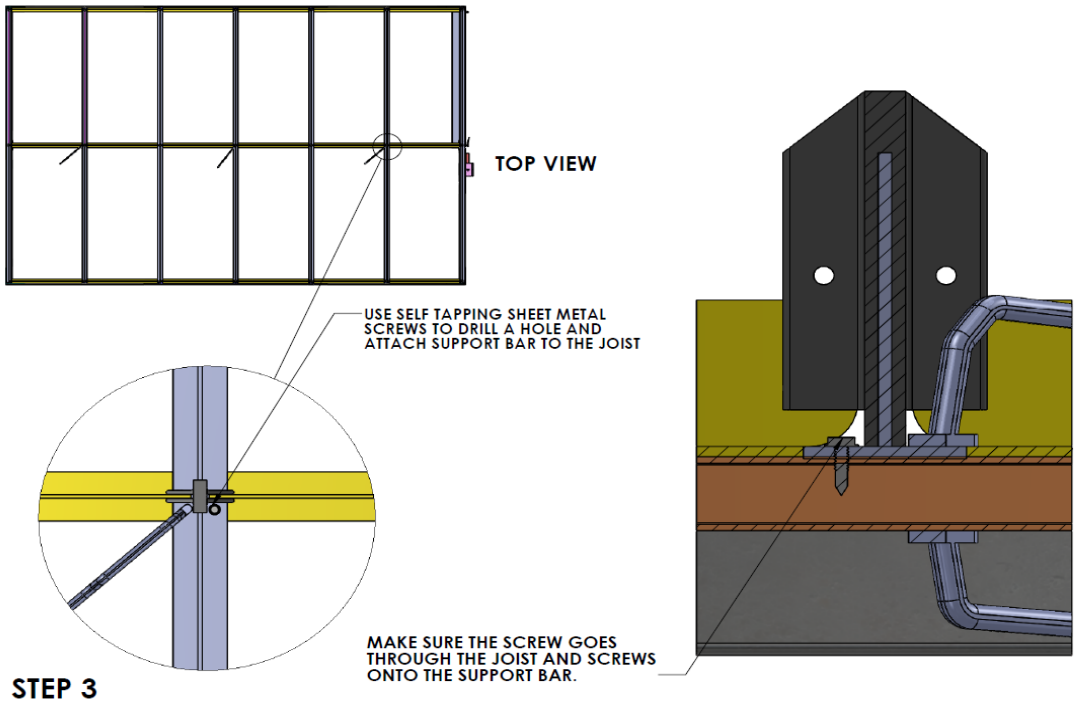
REPEAT THIS STEP FOR THE OPPOSITE END OF THE ROOM

STEP 1



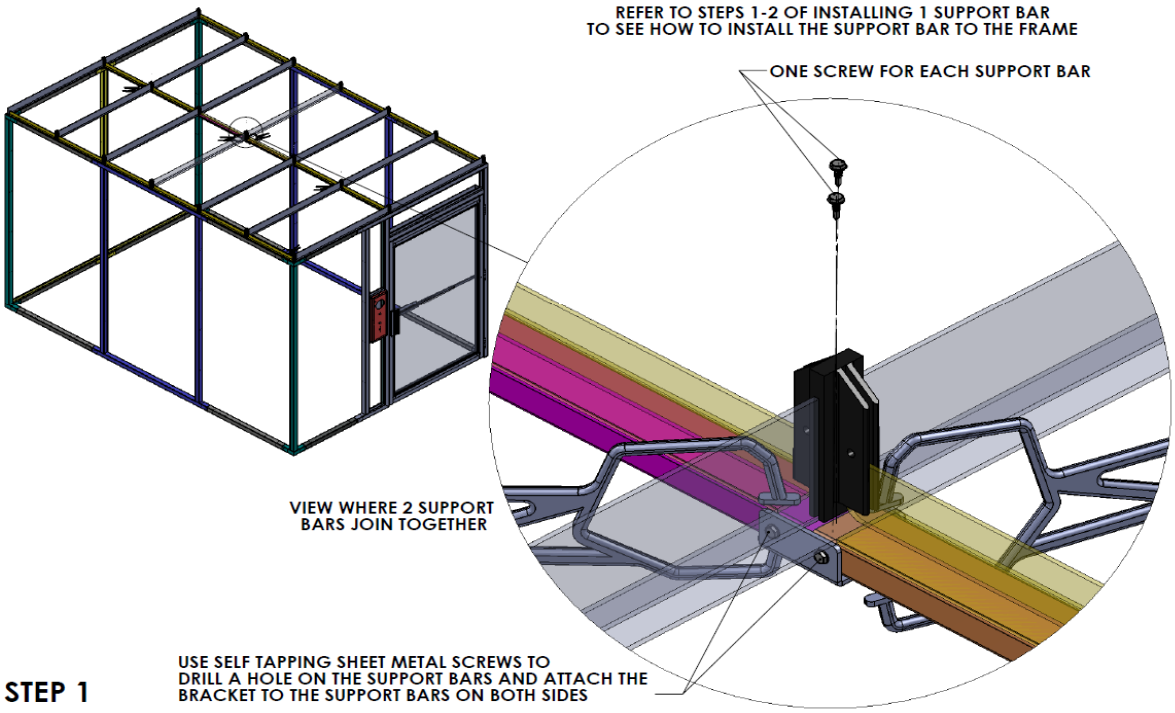
DONE AT EACH LOCATION A CLAMP IS SHOWN

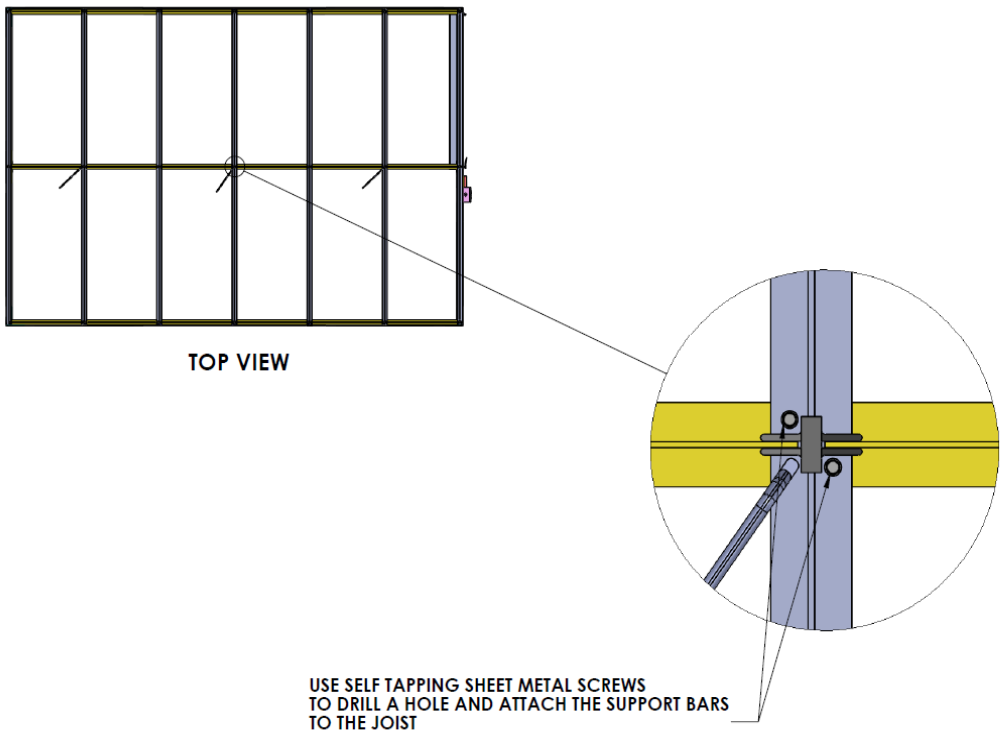
STEP 2



Recheck the frame assembly to ensure that the structure is square.

Installing 2 Support Bars (For Rooms Bigger Than 12 ft.)





STEP 1

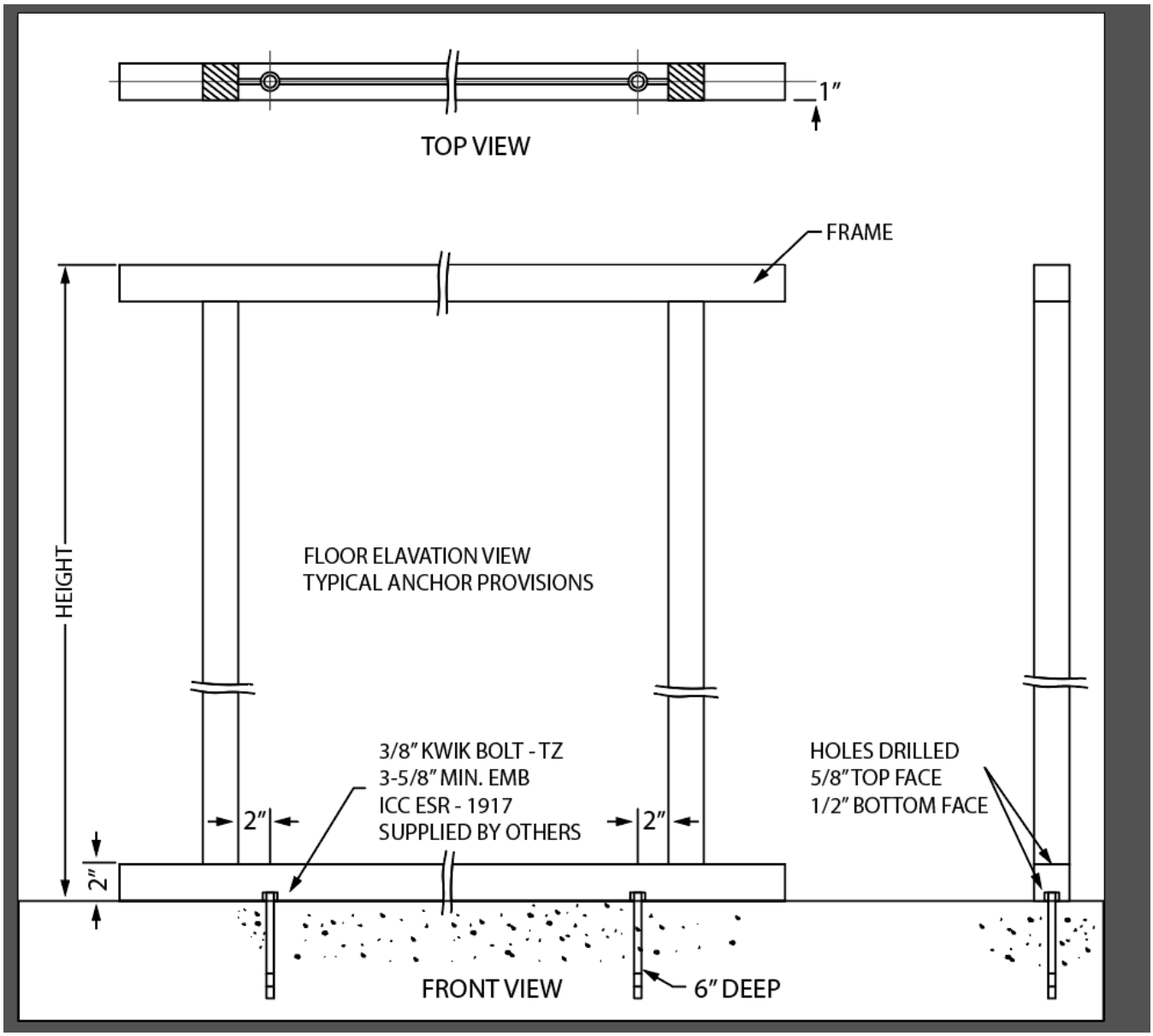
Recheck the frame assembly to ensure that the structure is square.

Hardwall Modular Cleanroom

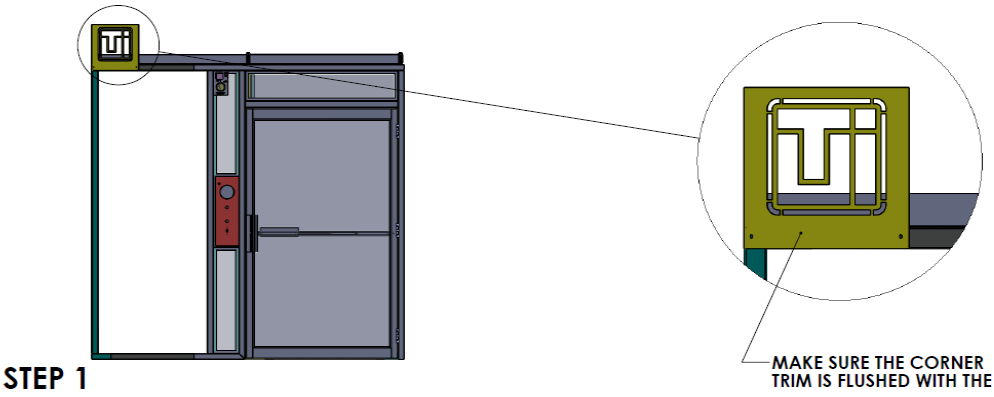
NOTE

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

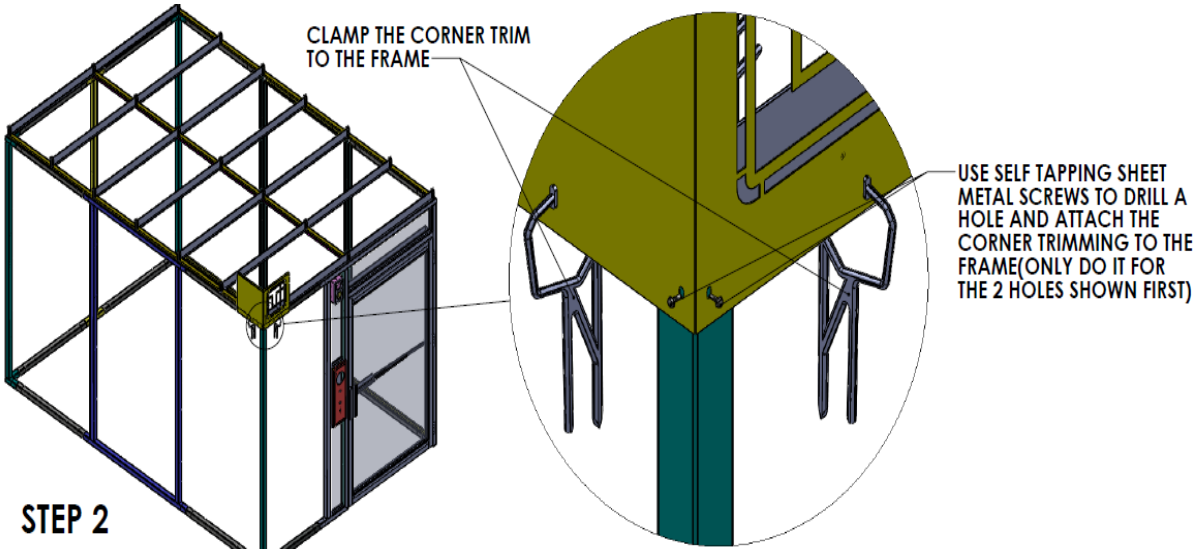
For example:
Prior to installing wall panels, drill and install an anchor every 4' along the base frame about 2" from the vertical frame, and one into the base of the door frame underneath the control panel. The holes should be drilled into the base frame approximately 2" away from the vertical frame 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 ½" 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.



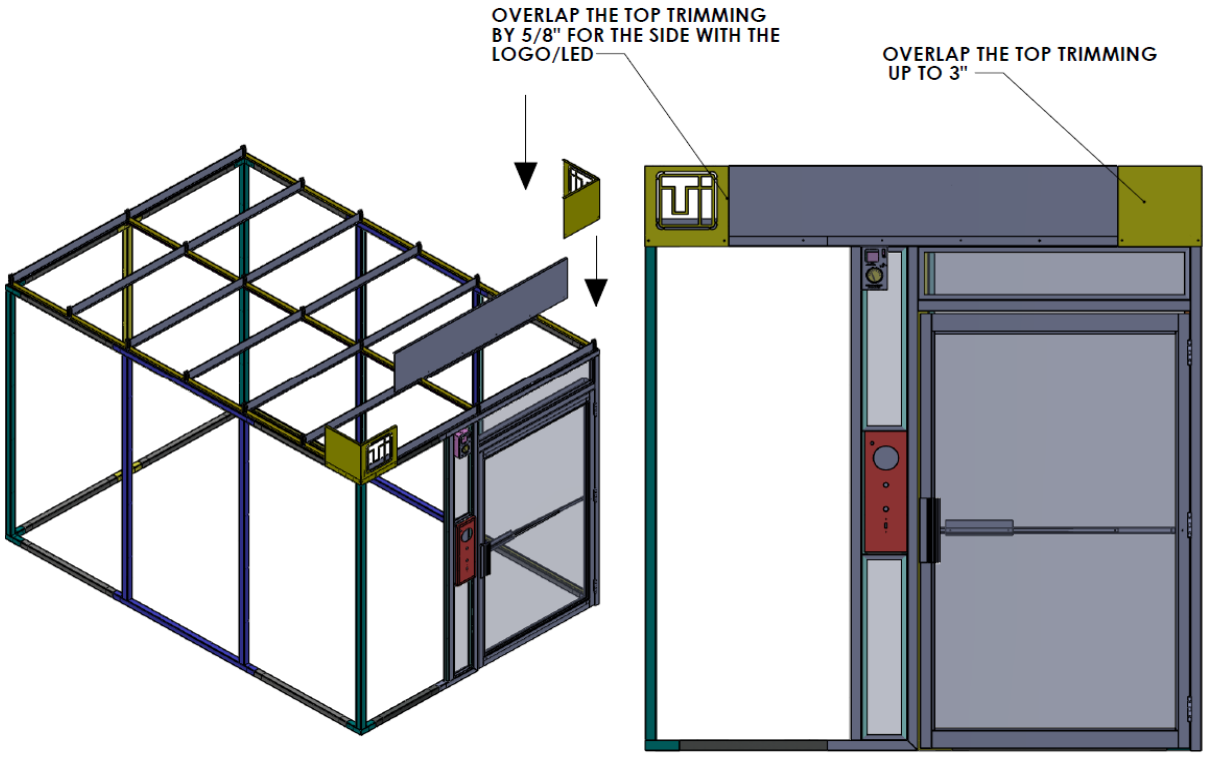
Installing the Top Trimming



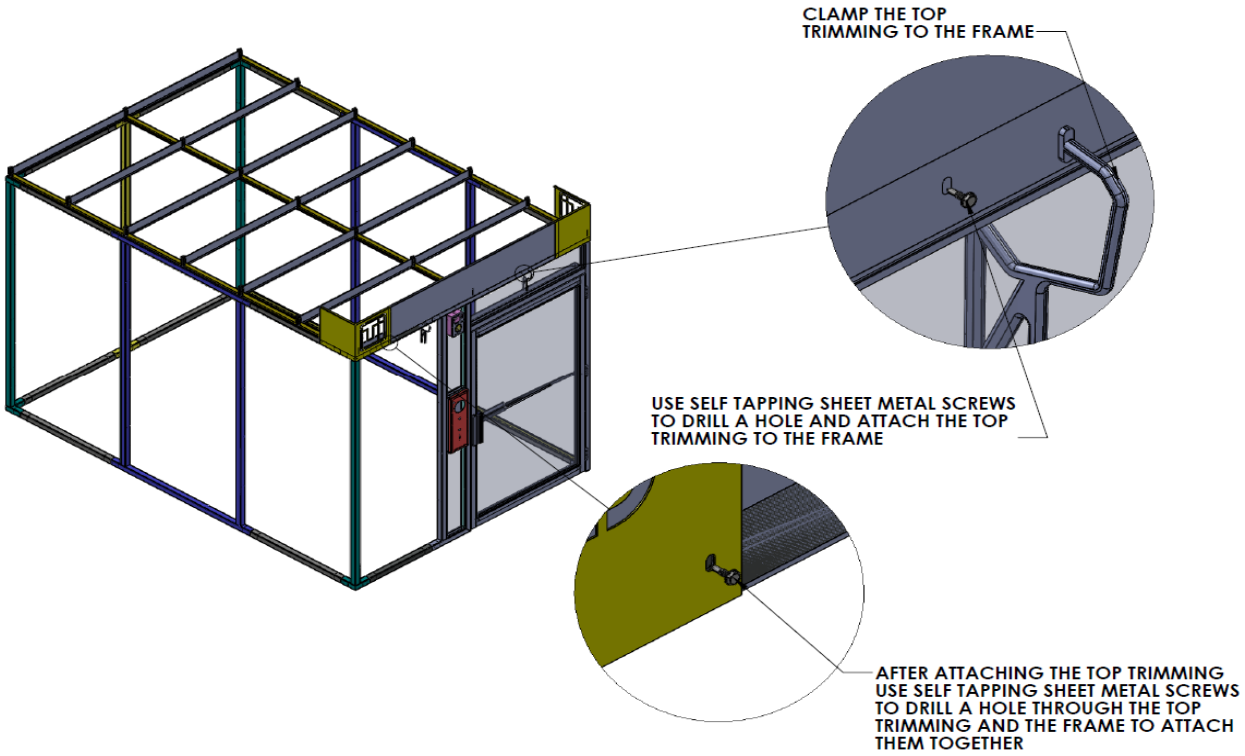
STEP 1



STEP 2



STEP 3



STEP 4

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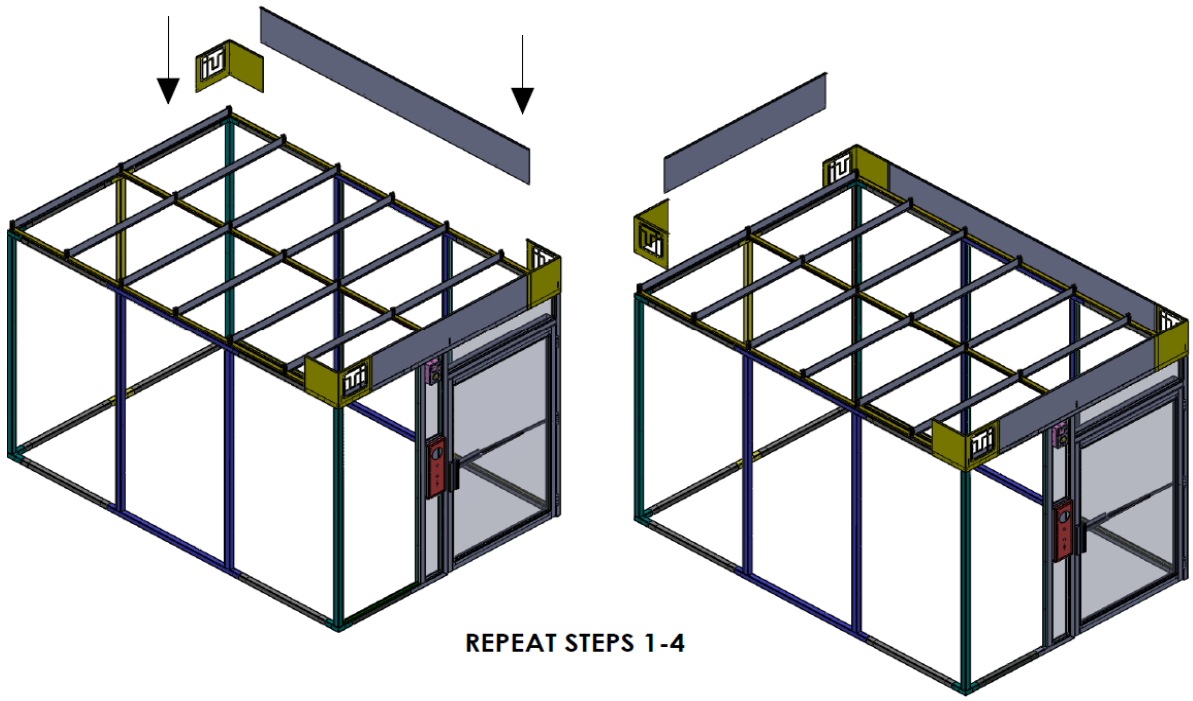

STEP 5

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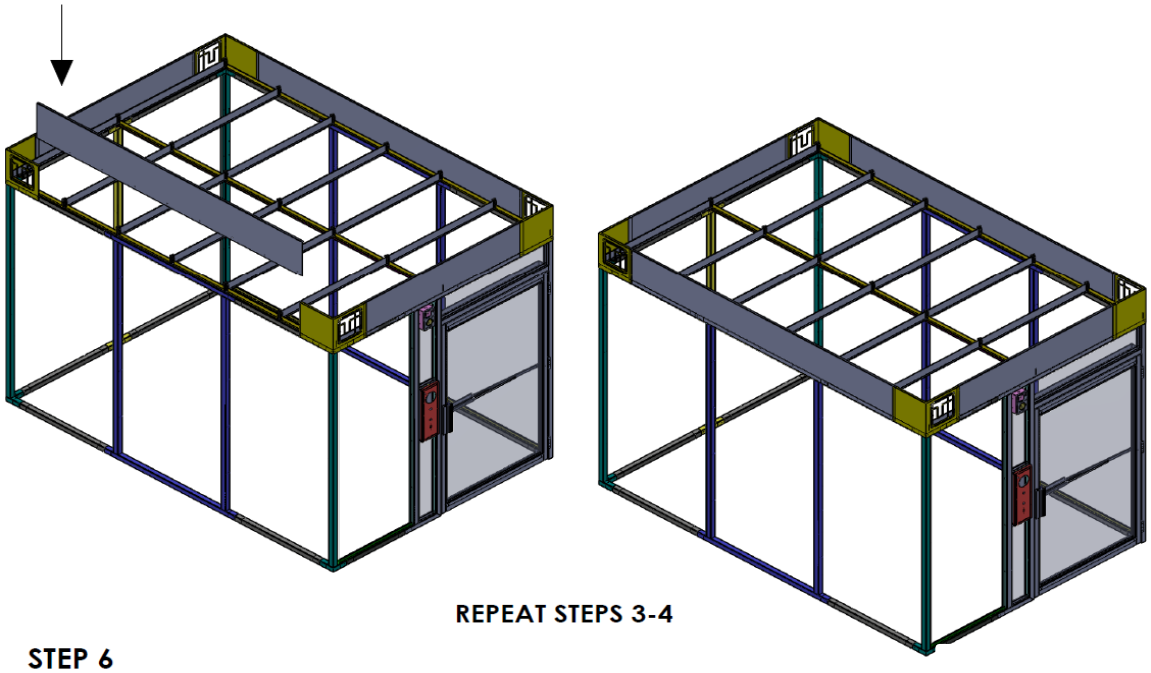
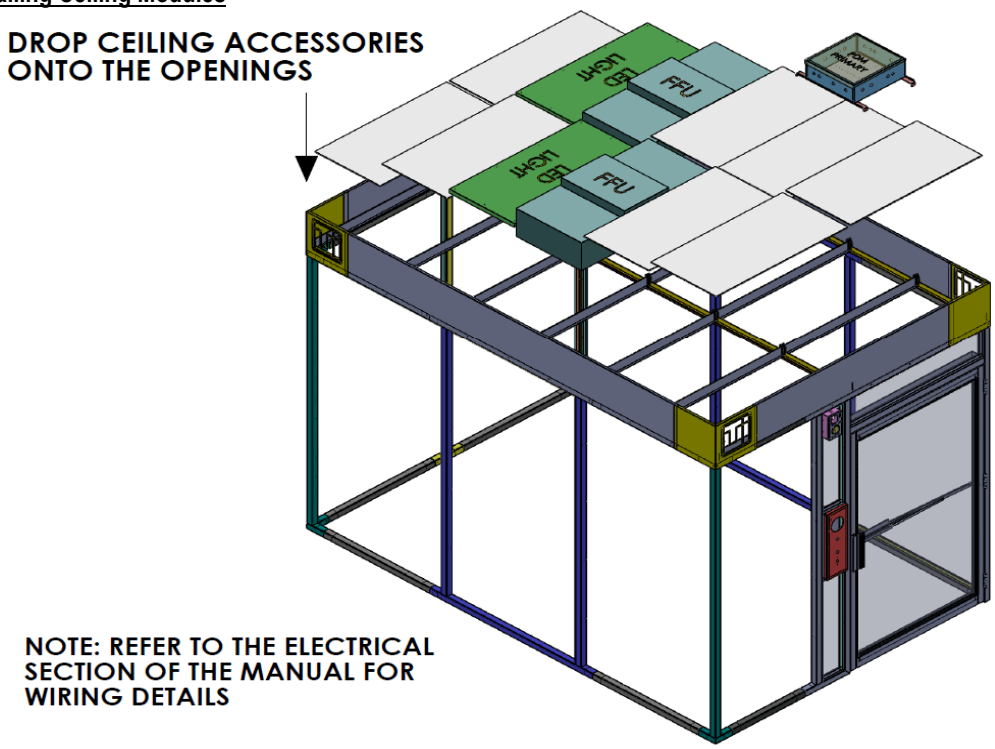


STEP 6

Refer to the electrical section of the manual to see the wiring configuration for the Operation Status Indicator lights.

Installing Ceiling Modules



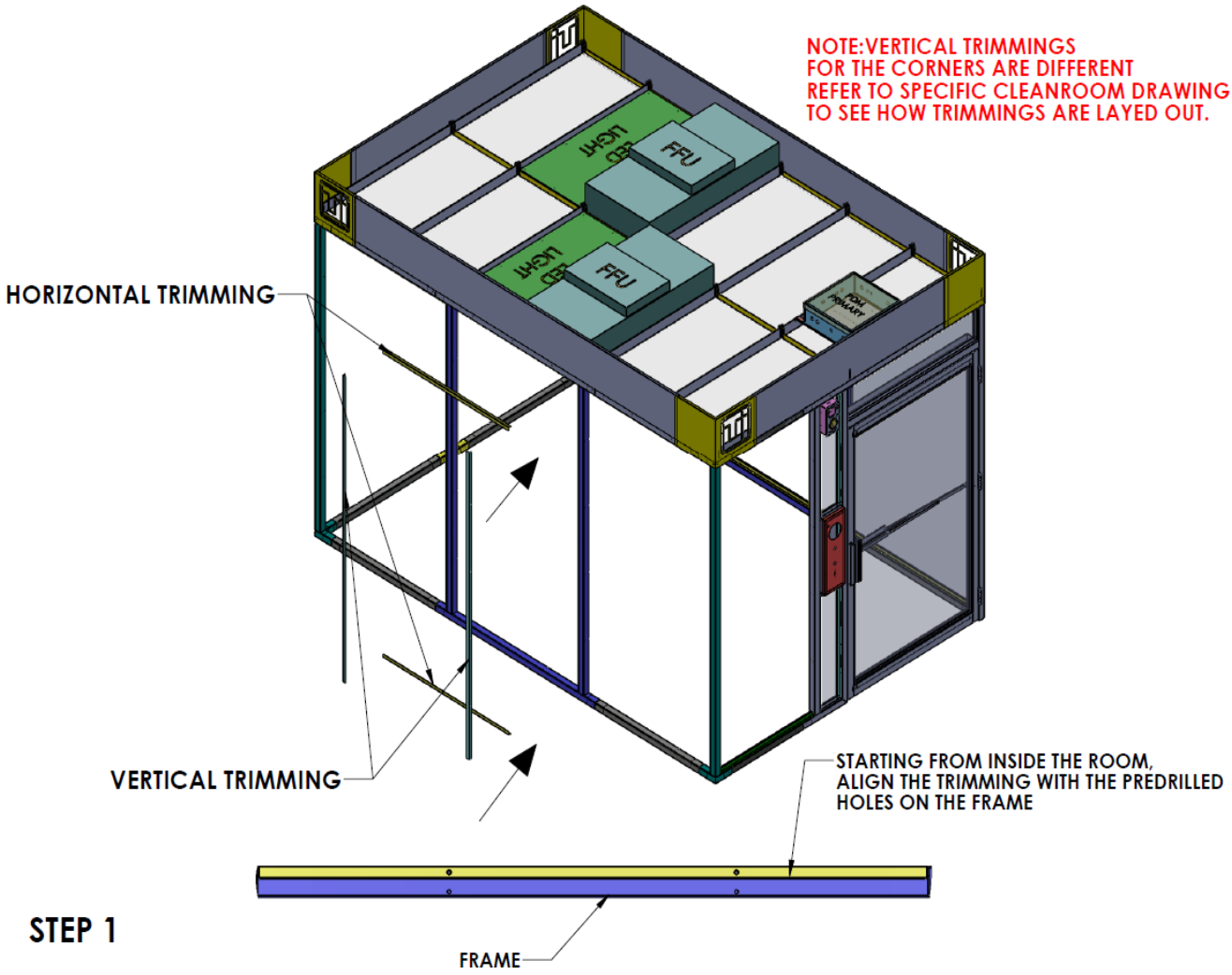
Use blank ceiling panels to fill any empty ceiling bays, including any ceiling bays occupied by a PDM. The modules and ceiling panels simply rest on the flange of the ceiling joists and dividers. No fasteners are required. Refer to the electrical section at the end of the manual to see the wiring details and how to attach the PDM.

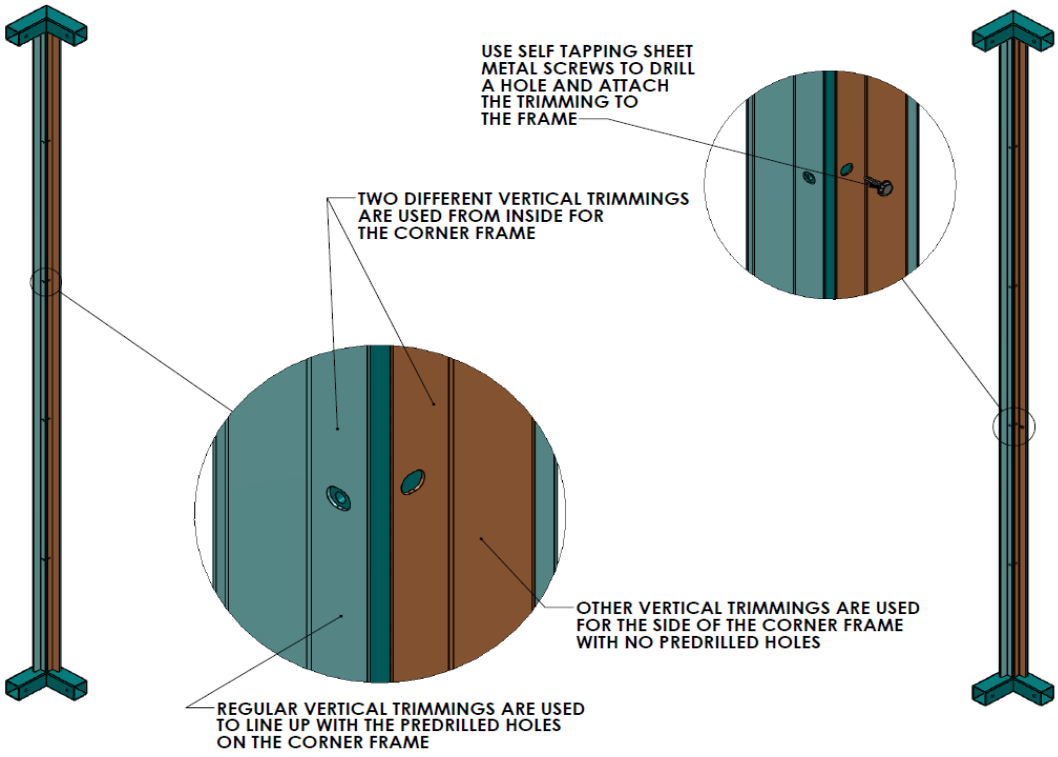
NOTE **If blank ceiling panels lift when the cleanroom is pressurized, special clips are available to hold the panels down. Please call Terra for assistance.**

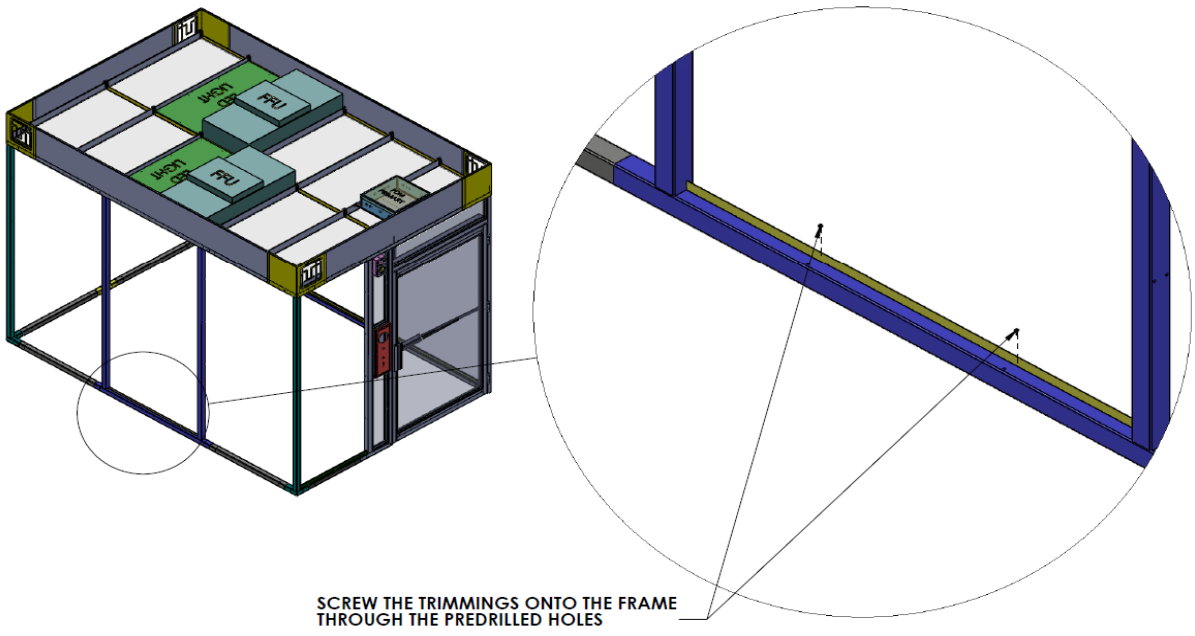
Installing the Wall Panels

NOTE **Wall panels are shipped with a protective, peel-off sheet of plastic. The edges of the plastic are cut to allow the panels to be installed with the protective covering intact.**

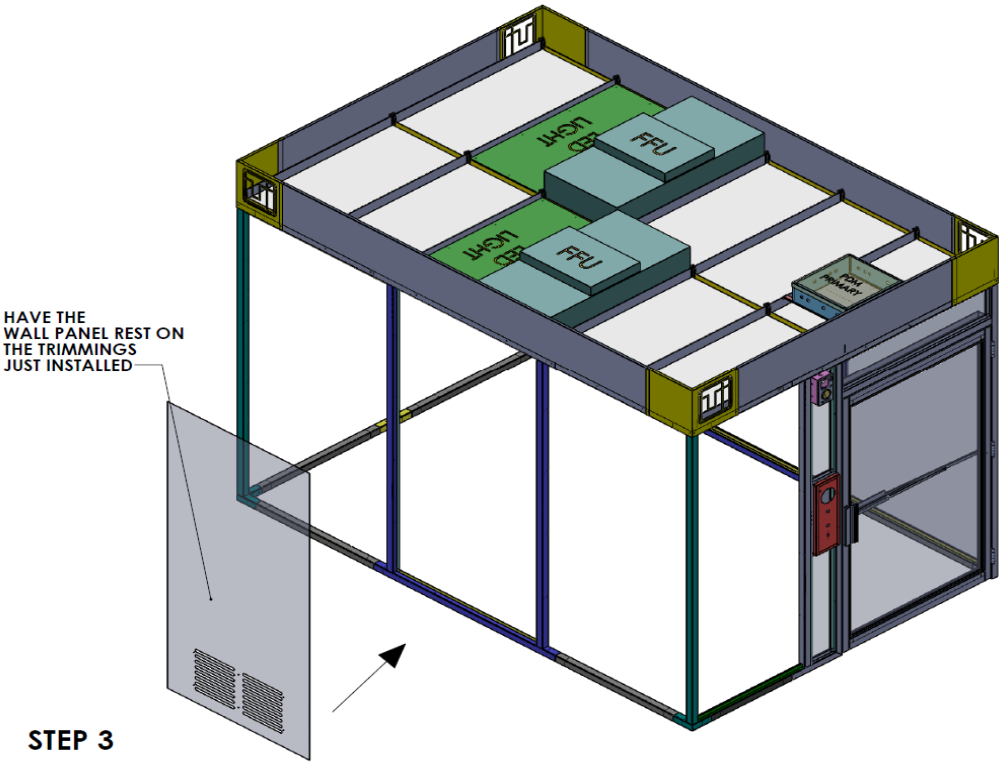
The wall panels are held in place by pairs of opposing stainless steel trim strips that are attached to the inside edge of the frame.



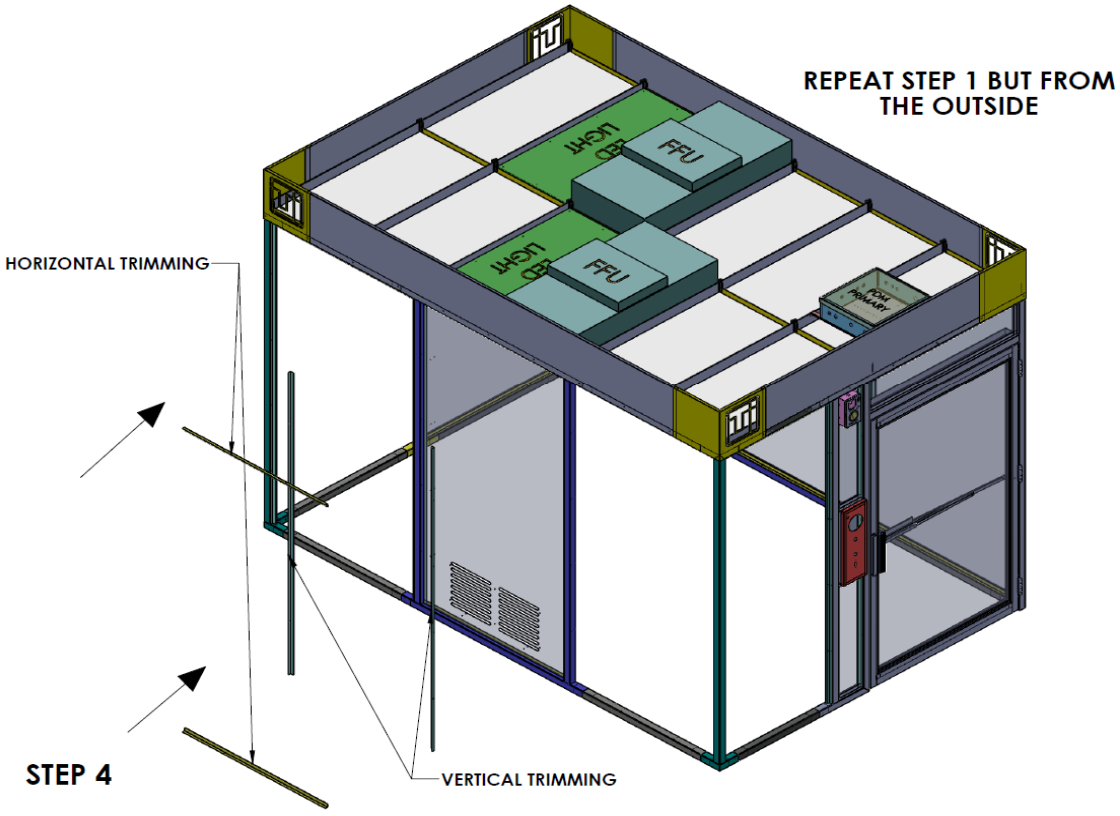




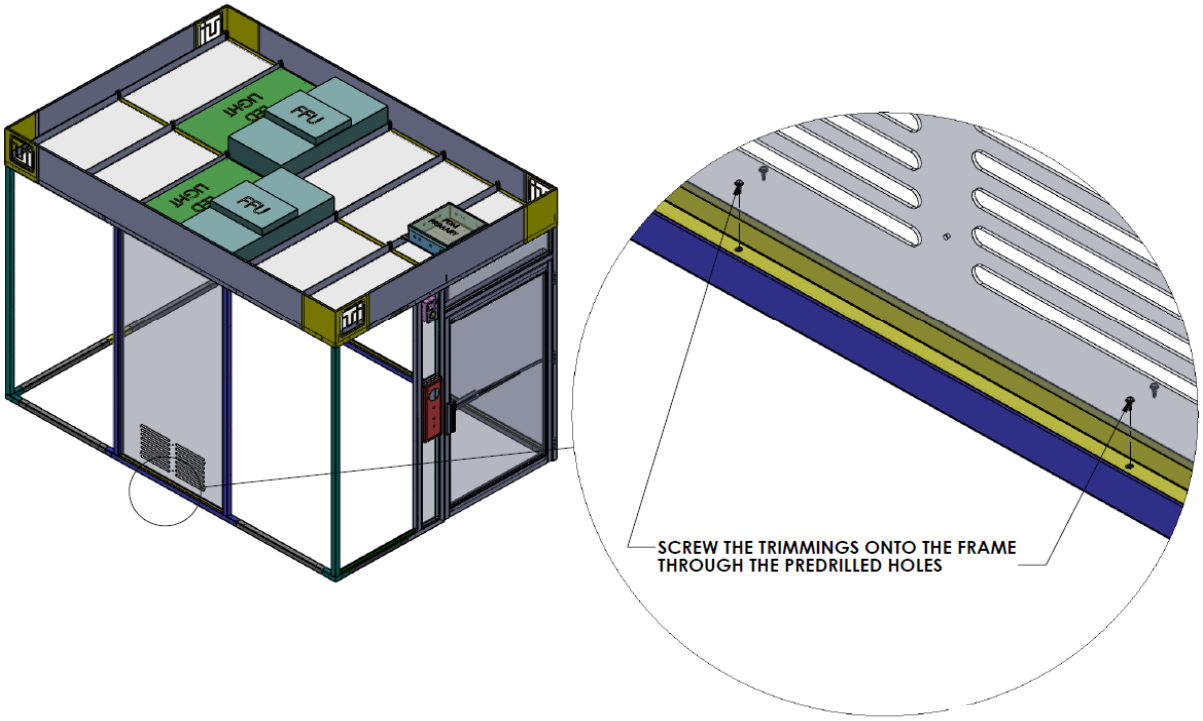
STEP 2



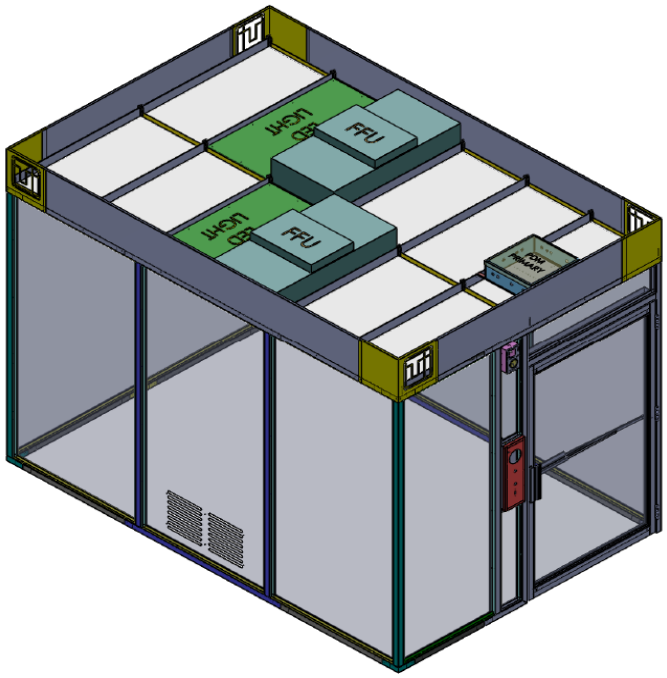
STEP 3



STEP 4



STEP 5



REPEAT STEPS 1-5 FOR THE REMAINING WALL PANELS

NOTE **In most applications, the positive pressure generated by the fan/filter units will prevent any outside air from entering the cleanroom. If an air-tight seal is required, seams may be sealed with a suitable caulking or other sealant.**

Installing a Swing Door

Swing doors are typically shipped preinstalled in the door frame.

To remove the door, unscrew the bolt that connects the door closer to the frame using an Allen wrench. Remove the screws bolting the hinges to the door frame.

Installation is the reverse of removal.

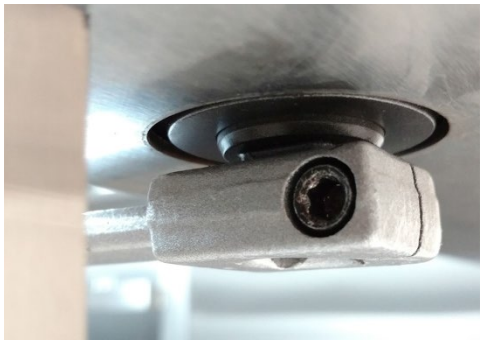


Figure 1: Door closer bolt

Installing a Sliding Door

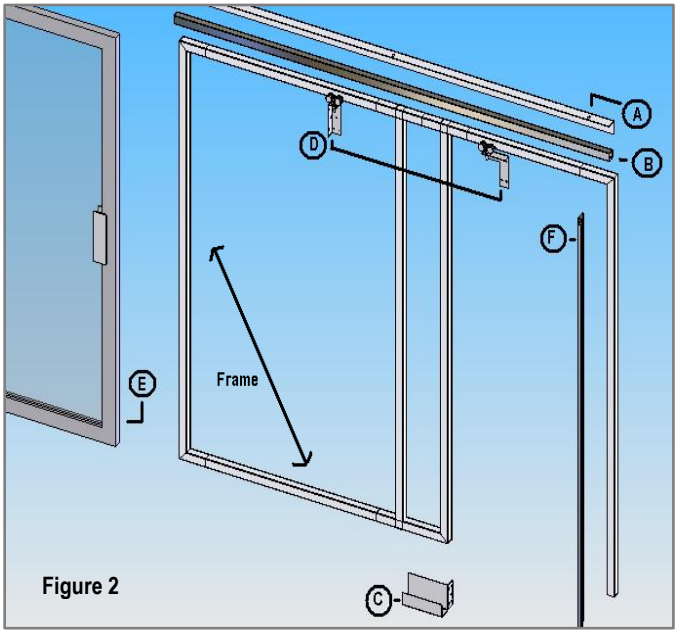
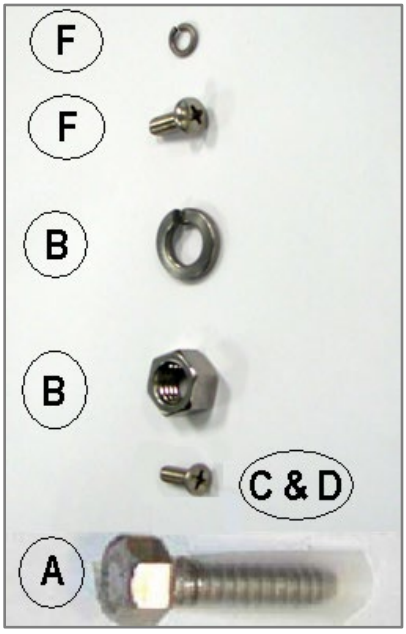


Figure 2



Parts List	Corresponding Hardware
Mounting Support Bracket	5/16" x 1" Hex Head Screw
Roller Track Bracket	5/16" Lock Washer and Nut
Door Guide	#10-32 x ½" Undercut Phillip Flat Head Screw
Roller Frame & Rollers	#10-32 x ½" Undercut Phillip Flat Head Screw
Door Stopper	#10-32 x ½" Phillip Pan Head Screw and Lock Washer

A) Begin by positioning the Mounting Support Bracket alongside the cleanroom frame, insert the 5/16" x 1" Hex Head Screws and tighten.

B) The Roller track bracket (B) is pre-soldered to the Mounting support bracket (A). Secure the Roller Track Bracket to the top of the Mounting Support bracket with the 5/16" Lock Washers and Nuts.

C) Install the Door Guide to the bottom of the cleanroom frame using #10-32 x ½" Undercut Phillip Flat Head Screws.

D) Install the Roller Frame onto the Door using #10-32 x ½" Undercut Phillip Flat Head Screws. Insert the rollers into the frame.

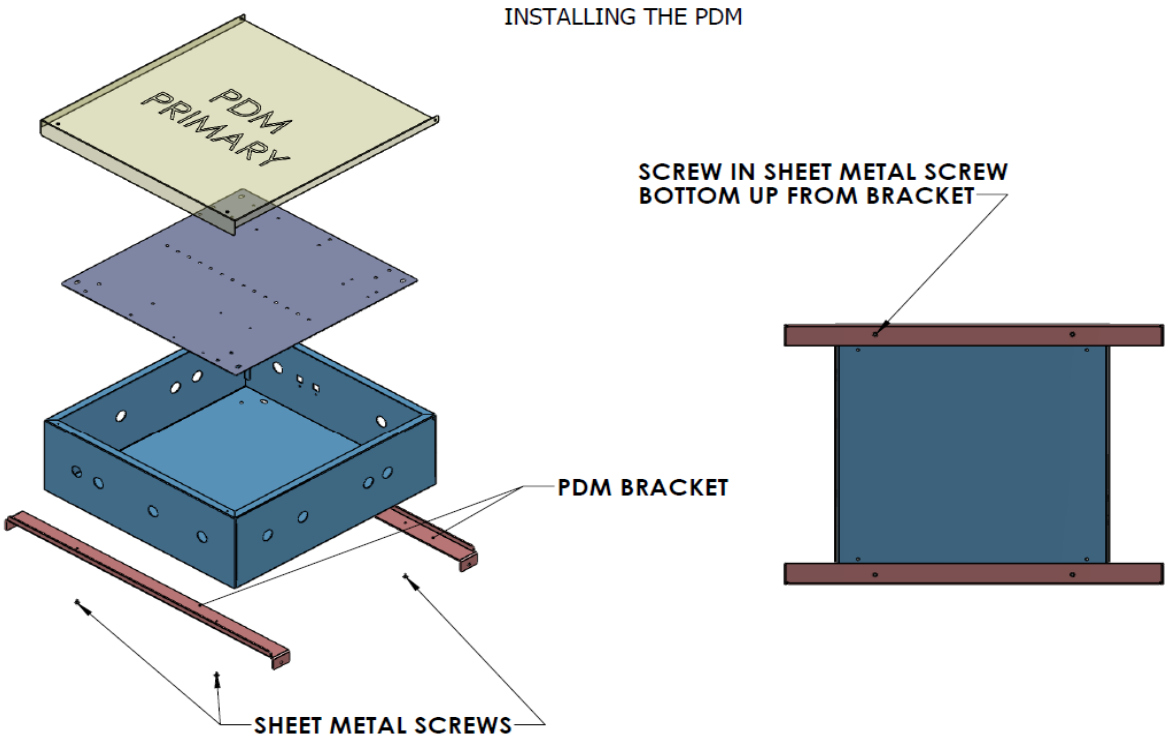
E) After the rollers have been attached to the door, install the door by positioning it in between the Roller Track Bracket and the Door Guide and sliding it from left to right.

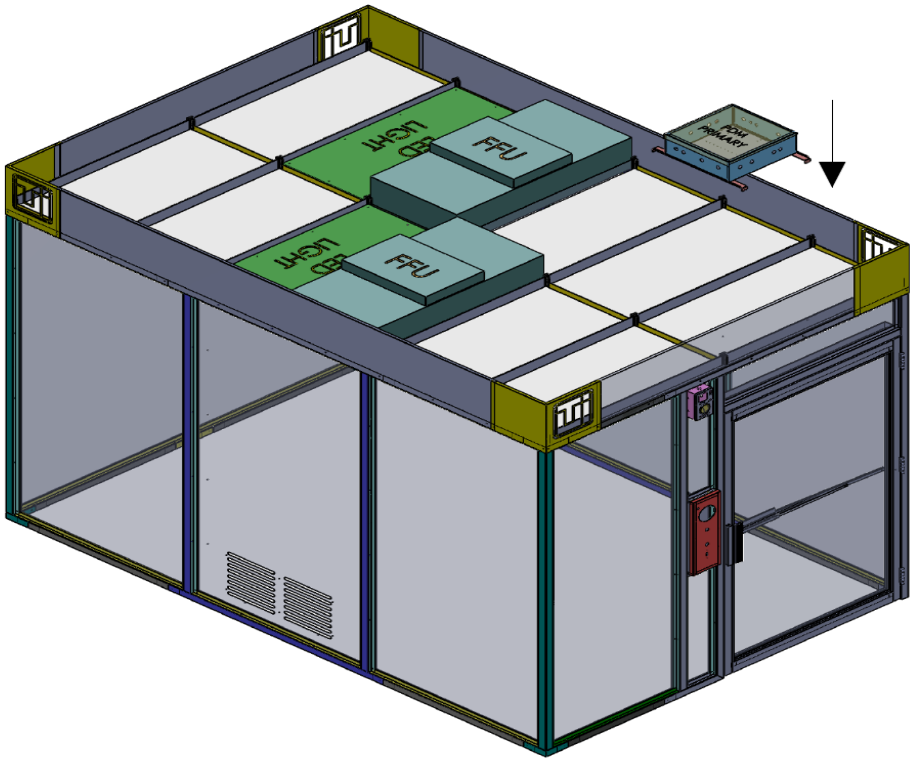
F) Attach the front door stopper to the cleanroom frame using #10-32 x ½" Phillip Pan Head Screws and Lock Washers.

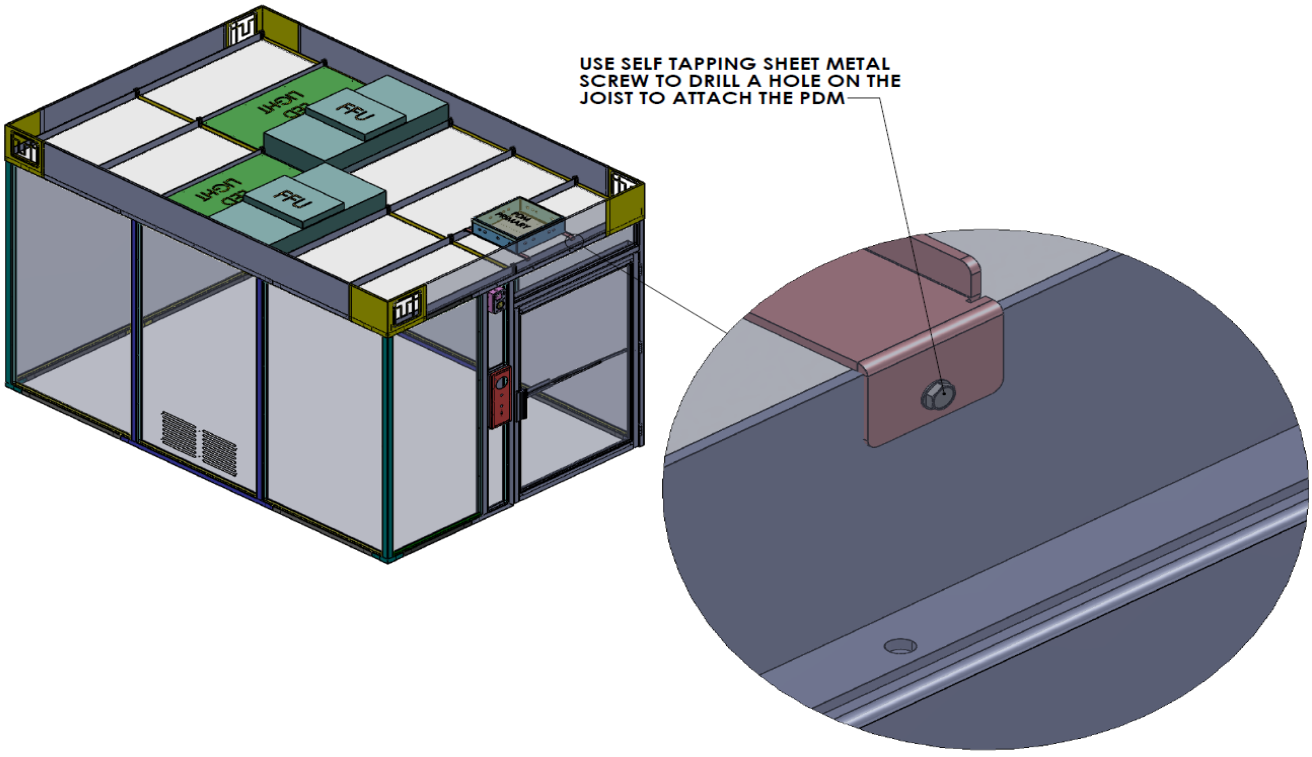
G) Install the rear door-stopper by positioning it in between the roller track bracket and tightening screws.

3.0 Electrical Wiring

Installing the PDM







Fasten the Power Distribution Module(s) to the corresponding ceiling joists with #12 x ¾" self-tapping screws. Each PDM features external fittings for fan/filter units, lights, and duplex power boxes. Use the provided yellow power cables to connect the components according to the labels on the PDM. 4-pin yellow cables are for the FFUs and 3-pin yellow cables are for the light fixtures.

Figure 3: PDM connection for the Control Panel

Figure 4: PDM connection for light fixtures

Figure 5: PDM connections for the fan/filter units

Figure 6: Cord grip on fan/filter unit housing

Operation Status Indicator Lights Wiring

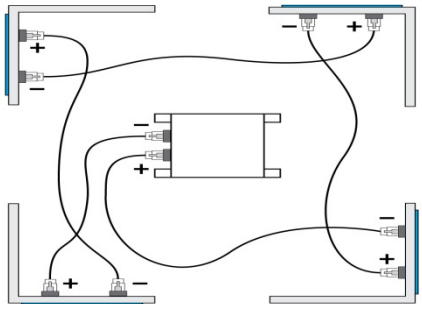


Figure 7: Wiring Schematic for Operation Status Indicator Lights.

Use the provided low-voltage phone cable for connections

NOTE **To preserve the UL listing of the fan/filter units, they must be hard-wired to the yellow power cables (see next page for wiring instructions).**

To test for proper operation, hard wire the unit to a grounded 115VAC/60Hz (or 220VAC/50Hz, where applicable) power source and turn the switches ON. All electrical modules should come on.

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 pre-filter, which rests on top of the fan/filter unit (**Figure 8**).
2. Unscrew metal top panel of the electrical housing (**Figure 9**) to expose wiring junction (**Figure 10**).
3. Install cord grip as shown (**Figure 11** and **Figure 12**) into appropriate opening.
4. Thread the AC power chord through the cord grip and match the wires according to color as shown in **Figure 13**. 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 pre-filter.


Figure 8


Figure 9

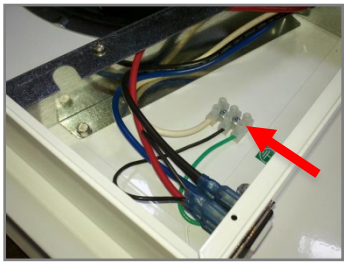


Figure 10


Figure 11

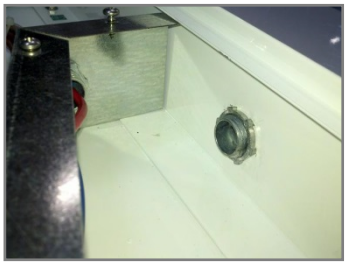


Figure 12

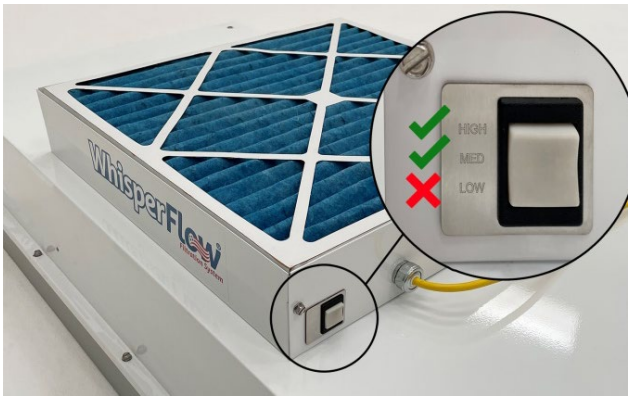

Figure 13

Fan Filter Unit Speed Configuration with PDM

WARNING

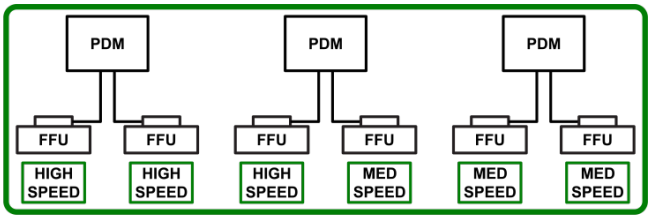
To avoid thermal overload on FFU's with Permanent Split Capacitor (PSC) motors, do not use LOW speed switch when the FFU is connected to a PDM.

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.

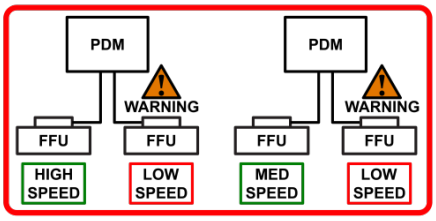


NOTES:

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 accidently 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.

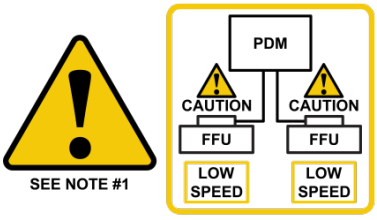


2. "Night service" mode from the control panel is unaffected and operates correctly when all individual FFU's are switched to HIGH or MEDIUM speed settings.



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 Service and Maintenance

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

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 100 fpm air speed typically required for cleanroom operation.

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. 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.

Replacing Light Fixtures

Disconnect system power. Disconnect the power supply cables and lift the light fixture out of the ceiling grid. Carefully lower the new light fixture into the ceiling bay and reconnect the wiring (refer to **Section 2.0 Installation**). See **Section 7.0** for replacement parts.

Filter Replacement

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.

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.

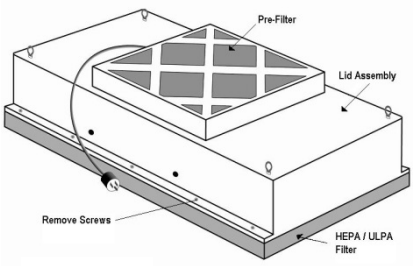


Figure 14

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

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

Step 6: Position the unit back in the ceiling grid and reconnect the unit to the PDM.

NOTE

Carefully inspect the new filter for any visible damage prior to replacing.

Removing the Fan/Filter Unit

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

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 at right.
3. Place the polypropylene panel over the filter screen, making sure that it only adheres to the screen without overlapping the edges.
4. Push one side of the FFU up, rotate it 90° and lower it through the ceiling grid.
5. After replacing the filter, reverse these steps to reinstall the fan/filter unit in the ceiling grid.

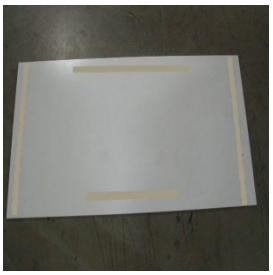


Figure 15


Figure 16


Figure 17


Figure 18


Figure 19

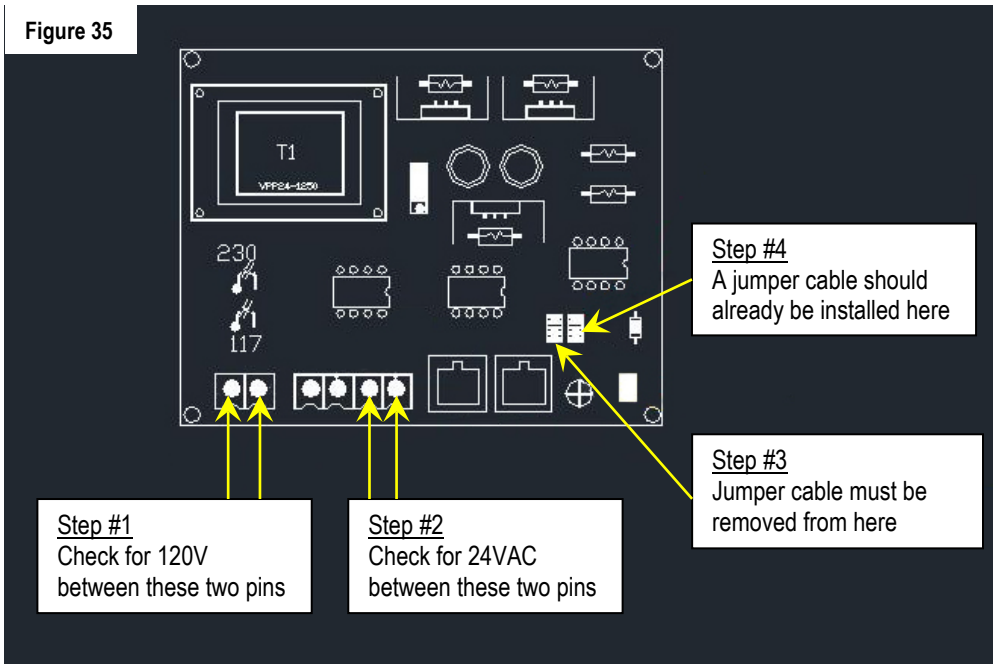

Figure 20

Troubleshooting

A blinking TUI 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.

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

Figure 35



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

5.0 Specifications

NOTE **Refer to the original order form for the exact specifications/configuration of your cleanroom.**

Component Specifications

Acrylic

Operating Temperature: 32°F to 104°F

Acrylic is more rigid than acetates or vinyls, and is much more resistant than glass to thermal shock. The tensile strength of this material is 10,000 PSI at room temperature; however, when continuously loaded, imposed loading should not be allowed to exceed 750 PSI. These panels are rated for operation in an environment with a relative humidity of up to 92%. Exposure to direct sunlight may cause the material to warp and distort.

The self-ignition temperature is 830 degrees Fahrenheit (443 degrees Celsius) measured in accordance with ASTM D–1929. The products of combustion, when sufficient air is present, are water and carbon dioxide. However, as with many other common combustible materials, when sufficient air is not present during combustion, toxic carbon monoxide will be produced.

Static-Dissipative PVC

Operating Temperature: 32°F to 100°F

Static-dissipative PVC features surface resistance between 106 and 108 ohms/square—much less than that of other treated plastics. Tests show that when 10KV is applied to the surface, electrostatic potential remains less than 15V, and static decay time is less than 1 second. And because this plating offers such effective static dissipation, it will not attract dust or other contaminating particles that could damage sensitive microelectronic components.

In a test conducted in accordance with Mil-B-81705B, the plating was conditioned for 24 hours at a relative humidity of 12% and a temperature of 70 degrees F. The sample exceeded the 2.0 second static decay requirement to zero as specified; in fact, it had a decay time of 0.01 seconds for each measurement taken! It had a surface resistivity of 1.7 x 107 ohms per square on one side and 2.8 x 107 on the other.

This plating is also durable. It features superb resistance to UV radiation; tests have indicated no loss of static protection after 500 hours of continuous exposure to a fadeometer. In temperature tests, it maintained its dissipative properties after 100 cycles of temperature fluctuations from –5°C to 60°C. It is also completely noncombustible.

The plating also offers all of the chemical-resistance of standard PVC plating. It remains unaffected by a wide range of chemical solutions.

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

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.

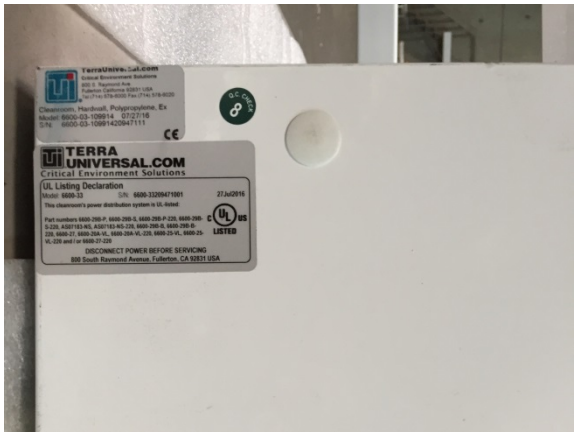


Figure 35: View of labels on the back of the Control Panel

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."

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")	TUI # PA04599
Lighting	
Light Panel (2' x 4')	TUI # 3800-41B
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 (For Light Panels)
3-Pin Yellow Power Cable