



# Monmouth Scientific

Operating & Maintenance Manual

## Clean Tent

CT675/CT750/CT1700



**THE MARKET LEADER IN *CLEAN AIR SOLUTIONS***  
**[www.monmouthscientific.co.uk](http://www.monmouthscientific.co.uk)**

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# Thank you

On behalf of everyone at Monmouth Scientific Ltd, thank you for choosing to purchase your Clean Tent from us.

We are committed to providing you with the highest level of customer satisfaction possible. If for any reason you are unhappy with your Clean Tent or have any questions or comments regarding your Clean Tent, or our company we would love to hear from you.

Our telephone number is +44 (0)1278 555173 or you can email [sales@monmouthscientific.co.uk](mailto:sales@monmouthscientific.co.uk)

We truly appreciate your business and hope our business relationship will continue to be successful in years to come.

## Introduction

**IMPORTANT: PLEASE READ AND UNDERSTAND THESE INSTRUCTIONS IN FULL BEFORE STARTING ANY ASSEMBLY.**

Welcome to the Clean Tent installation guide. This document will take you through the set-up and installation of your clean tent.

Please check all the parts are present and familiarise yourself with them.

Assembly of the room is a two-person process – do not attempt to install the room on your own. Significant injury can occur when lifting or moving heavy parts. Please do not rush and ensure you understand the process at each stage. If in doubt, ask!

Start with a clear area and make sure you have enough space to install the clean tent including enough height.

Tools that you will need:

- 2 off 4mm Allen Keys
- Appropriate PPE should be always worn
- Suitable ladders
- Tape Measure
- IPA alcohol solution or similar



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# Safety

## Safety & Disclaimer Notice



In order to assemble this room you must be fully competent in all tasks associated with assembly.

All personnel must be suitably trained in the use of any equipment used during the installation of this Clean tent. It is the customer's responsibility to ensure the safety of all colleagues and personnel carrying out this task. Monmouth Scientific Limited does not accept responsibility for any injury or damage howsoever caused.

Any electrical work necessary should be carried out by a qualified electrician.



If at any time, you are not comfortable with any aspect of the installation then STOP and seek professional assistance.

Monmouth Scientific can provide free of charge support on the telephone by calling +44 1278 458090 during normal office hours or will happily provide an installation service. Please contact us for a quotation if you wish to use the installation service.

All Monmouth Scientific systems have been designed to assure operator safety providing the following rules are observed and proper usage is made of the equipment. Refer to ALL appropriate instructions and manuals BEFORE using the equipment.

**DO NOT**

Perform installation unless qualified to do so

**DISCONNECT**

All input power supplies before attempting to service or repair the equipment. Before disconnecting a unit, switch off and wait a few minutes for components to discharge.

**DO NOT**

Modify equipment - check with Monmouth Scientific before doing so.

**CHECK DAILY**

HEPA air supply is delivering the correct amount of air.

**FIRE & ELECTRIC SHOCK**

Safety equipment must be available.

**MAINS ELECTRICITY**

Check that the local mains electricity supply conforms to local safety standards. Ensure that a good ground (earth) connection exists between the HEPA speed controller and the laboratory safety earth.

## Processes

Monmouth Scientific do not recommend processes undertaken within the Clean Tent involve the production or use of heat, toxic materials including liquids or gases, or radiation. Please check with your Health and Safety Officer as to the suitability of the Clean Tent for your application.

Any processes that involve the extraction of air from within the Clean Tent may impair/ violate the operating conditions required to maintain the Clean Tents working integrity. It is important that any extract requirements are discussed with Monmouth Scientific staff prior to such requirements being invoked.



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# Installation

## CT675, CT750 and CT1700

This section covers instruction for installation by others i.e., non-Monmouth Scientific staff.

Check that the shipping list and parts delivered are identified and present. Any discrepancies should be notified to Monmouth Scientific or its agents as soon as possible.

Although these tents are different sizes, the installation is very similar.

If the frame structure option is being used for secondary support, then build this 1<sup>st</sup> as described in [Frame structure section](#).



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## Groundsheet

- Identify the two tent components – the ground sheet and the tent. The groundsheet is grey in colour and has a zipper around the outside perimeter.
- Take the groundsheet and spread it over a clean, flat surface (the installation site) with the zipper facing upwards. - **Figure 1**
- Take care not to walk on the groundsheet as any contamination will have to be wiped down later from inside the tent.
- Note the zipper that goes across the width of the groundsheet towards one end. This is the gowning room end and should be oriented towards the personnel entrance for the installation site. i.e., don't put it up against a wall! The HEPA FFU and stand should be placed at the opposite end with its front 'Partition' feet aligned with the edge of the groundsheet.
- Clean the groundsheet with IPA alcohol solution or similar.



Figure 1

View our ceiling clip training video at:

<https://cleanenvironments.co.uk/videos/clean-tent-training-video/>

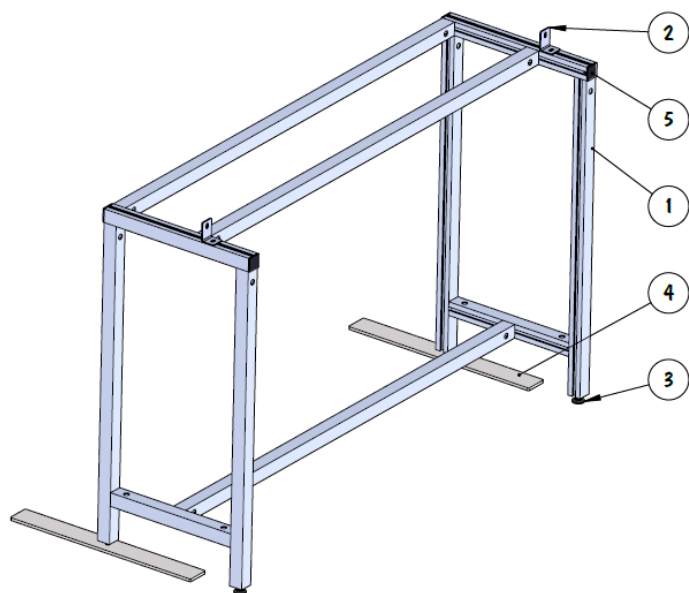
## HEPA fan filter unit (FFU) frame

Identify the FFU frame components.

### Self-assembly flat pack

The frame is made from 30mm aluminium section joined with union connectors. Assemble the frame as shown below. The HEPA FFU stand is made up of two A-Frames and 3 joining cross bars. Ensure that the two CAM Brackets are facing out, ready to bolt into the FFU. The rear feet are adjustable to ensure a steady base for the FFU. The front 'Partition' feet extend to meet the edge of the groundsheet and give the stand additional stability. Ensure all union connectors are correctly fitted and tightened.

Now place the FFU onto the frame with the pre-filter to the rear and the HEPA filter to the front of the frame. Align the front of the FFU with the front of the frame. Adjust CAM bracket position as required to ensure they meet the rear of the FFU and line up with the holes on the rear of the HEPA. Ensure the pre-filter is fitted into the intake flange. Power up and check that the fan is working then disconnect.



ITEM NO.	DESCRIPTION	PART NO	QTY.
1	FFU SUPPORT STAND	MW-07839	1
2	CAM BRACKET	MW-07848	2
3	LEVELLING FOOT 250D M8X52 ELESA 431017	GS-04058	2
4	FREESTANDING PARTITION FOOT	MW-06497	2
5	30X30 END CAP	PP-03862	4



## Tent top section

- Take the top section of the tent and lay it out on top of the groundsheet. Check for the FFU skirt (large rectangular hole in the end wall), this is to be placed at the FFU end - opposite end of the groundsheet to the gowning room. Now locate the perimeter zipper starting point – usually on the left-hand corner of the FFU wall as viewed from behind the FFU. **-Figure 2**
- Zip the tent and the groundsheet together around the perimeter. Be careful not to trap the tent material in the zipper. **-Figure 3**
- At the FFU end, locate the sides and top of the FFU skirt. These 3 sections have Velcro attached. Fold the Velcro outwards to avoid it connecting to the Velcro on the FFU until you are ready.
- Locate the bottom FFU skirt. This is part of the skirt nearest the ground with no Velcro attached.
- Two people should take hold of the bottom FFU skirt. This needs to sit between the FFU unit and the FFU frame (no Velcro required – this arrangement acts as a pressure relief in the event of accidental over-inflation). Carefully lift the front edge of the FFU off the frame, push the bottom skirt underneath the Filter so that it becomes sandwiched between the FFU and the frame the FFU when it is lowered back down (Keeping a foot on the cross leg of the frame whilst undertaking this procedure helps to steady the frame).
- Fix the HEPA to the stand with the supplied ¼-20 screws through the CAM brackets on the stand.
- Take the top corner of the FFU skirt. With the Velcro still folded back, position the two corners of the FFU Skirt onto the FFU. Then simply fold back the top and sides so that the Velcro connects. Apply pressure evenly all the way around to ensure a firm connection is made.

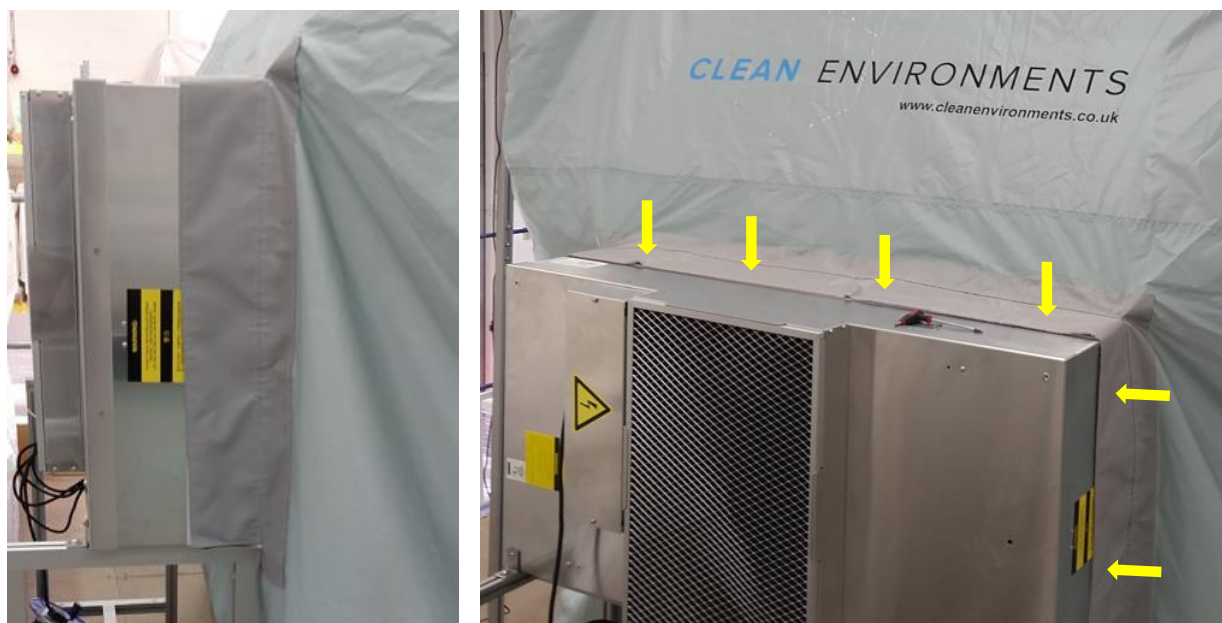




Figure 2



Figure 3

At the personnel entrance end of the tent, there are two outer zips for the entrance / exit. There are also two inner zips within gowning room for cleanroom entrance. Ensure that these inner zips are fully open. It is advised these remain open to allow airflow into the gowning room.

- Close the outer zips are closed for a faster inflation.
- Power up the fan with the fan control set to Full (Marked “High” on the FFU). The tent will start to inflate.

**NOTE** - Be aware of over-inflation as this could damage the fabric or the FFU. There are two ways to control the airflow; The fan control and the zips. Balance the air coming into the Clean Tent with the air exiting through the entry zips.

- As the inflation can happen quickly, it is advised to have one person at the entrance end (to open the zips) and one person to control the FFU.
- Whilst inflating, regularly check that material is free from obstructions or external objects which could result in damage.
- As soon as the gowning room has half inflated, open the two entry zips by 300mm (to the Velcro tabs) and turn the dial of the fan control to Low - the corners of the Clean Tent should be flat on the floor and you should be able to push the clear side of the Clean Tent in by 100m with little resistance.

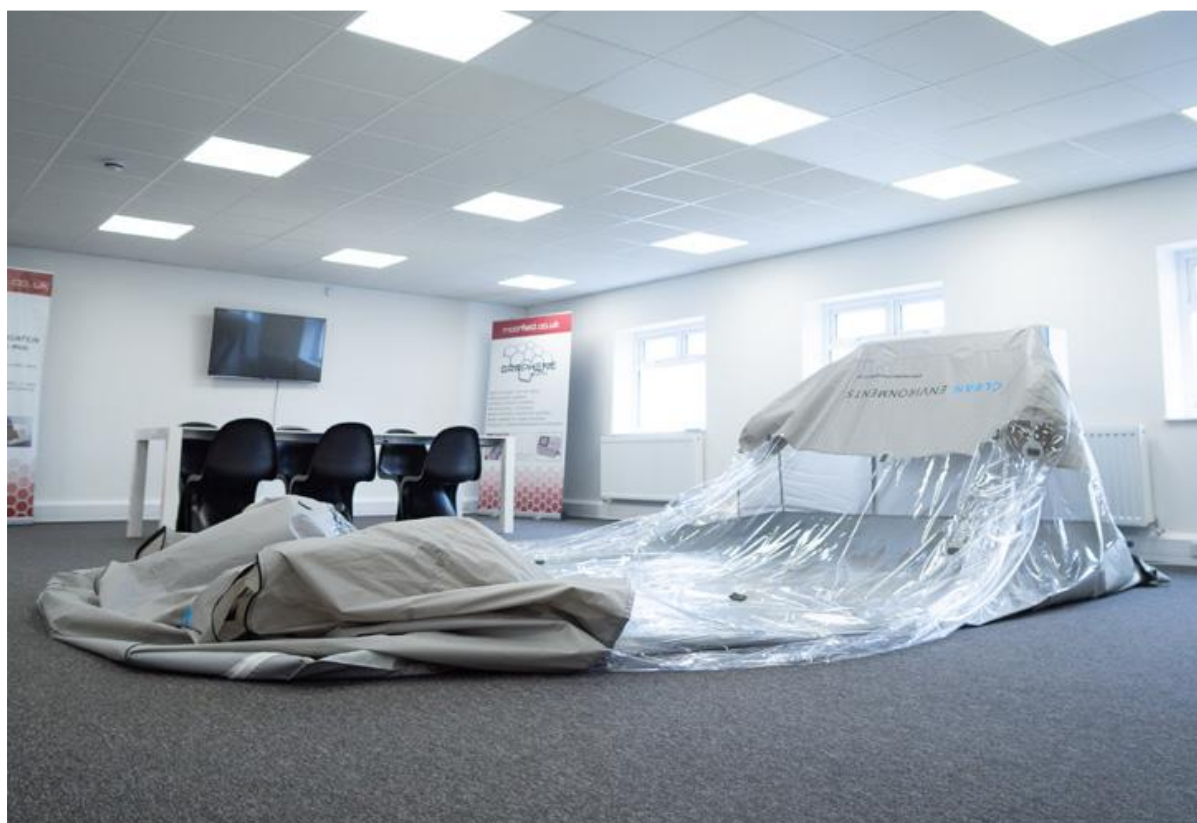
**IMPORTANT** - For safety reasons (for instance in the event of a power failure), a secondary means of support is essential. We provide a suspension cord system that should be attached to a suspended ceiling or other suitable structure. If suitable suspension is not readily available, an optional frame structure can be supplied.

Please note that the ceiling/structure should be capable of carrying a load a shown in the table below.

	CLT675	CLT750	CLT1700
Qty of suspension points provided on Tent	16	18	20
Load per suspension point (All points used)	0.5kg	0.66kg	0.75kg
Total load	8kg	12kg	15kg



FFU fan speed control



*Clean Tent inflating*



## Suspended ceiling

*View our ceiling clip video at:*

<https://cleanenvironments.co.uk/videos/clean-tent-ceiling-clips/>

Ceiling clips are the standard method of adding the secondary support with the benefit of not impinging on floor space.

Anchor points are placed onto the ceiling grid between the support loops on the tent roof/ wall seams.

Tie the Bungee off at a corner loop and then thread through alternating ceiling anchors and tent loops. Tie off allowing for some tension in the bungee.



## Frame structure

The frame structure offers an alternative option for secondary support if the tent is positioned in an area without an accessible suspended ceiling.

Assembly of the frame structure should be carried out before positioning and inflating the tent as it is difficult to move once fully assembled.

Follow the instructions in the following sections for [assembly](#) and [erecting](#) of the frame.

With the frame structure complete follow the instructions in the previous sections for the [tent](#) assembly and inflation.

Take one end of the black bungee cord and tie it off on one of the top corner loops at the FFU end of the tent.

Pass the cord between the tent loops and over the frame structure until you have completed the two sides and front of the Clean Tent. Tie off the bungee on the final loop.



*Tents utilising a frame structure*

## Frame structure assembly



Assemble the 30x30mm legs with an adjustable foot at one end. With the four screws in the T-Bars loosened, slide the T-bars across so half is inserted in each section. With sections held tight together tighten the screws.



Assemble the 50x30mm end and side bars in the same way. The lengths of the 50x30mm sections may vary – the shorter lengths are used for the end bars and the longer lengths used for the side bars. Lengths with Union connectors pre-fitted should be at the end of each assembled side and end bar.



Fit legs to the end bars to form a goal post. The assembled top bar should have a union fitted at either end. Loosen the union enough to allow it to slide into the leg. Ensure the sections are aligned and tighten the union.





Fit the corner braces. With the T-Nut on the angle bracket loosened, rotate the T-nut and insert it into the slot in the section. With the T-nut in the slot, loosen it further, then tighten gradually, and at the correct depth the T-nut should rotate 90 degrees in the slot and form a secure connection. Take care to ensure the T-nuts are fully rotated and firmly locked in-place after tightening.



Correct positioning of the angle brackets will ensure a tight fit without gaps between the brace and adjoining sections



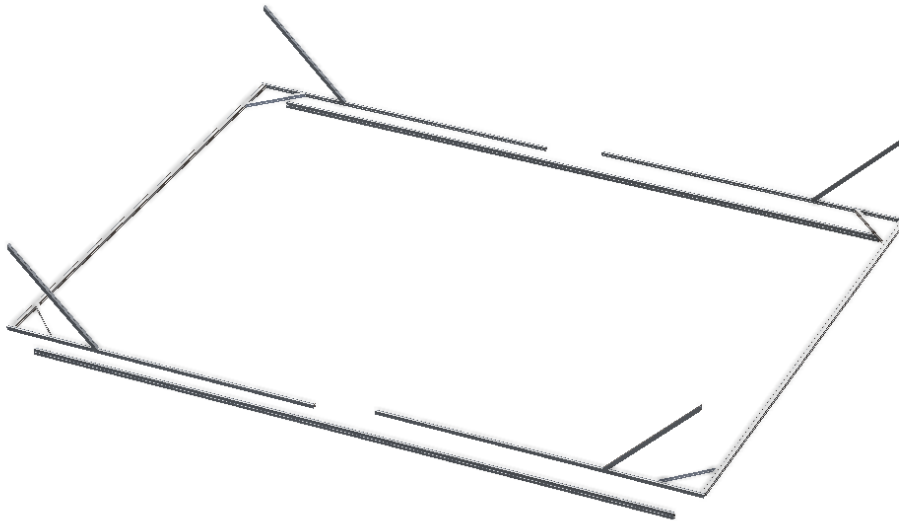
Fit the next corner brace at the correct height to make fitting of the side bars easier.

Be aware the larger frame structure used with the CT1700 has longer cross braces to increase support for the longer side bars (not shown here)

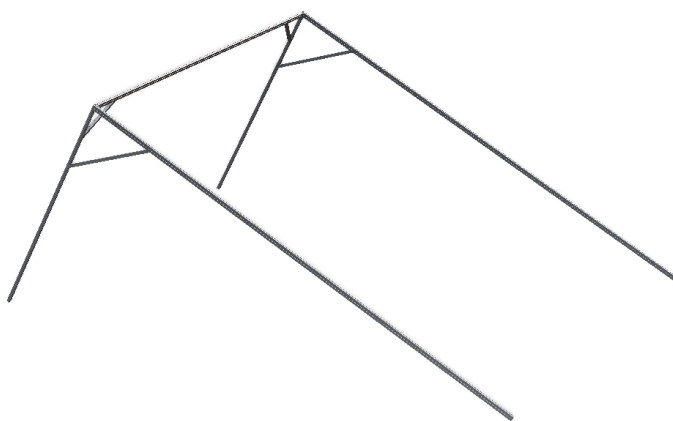


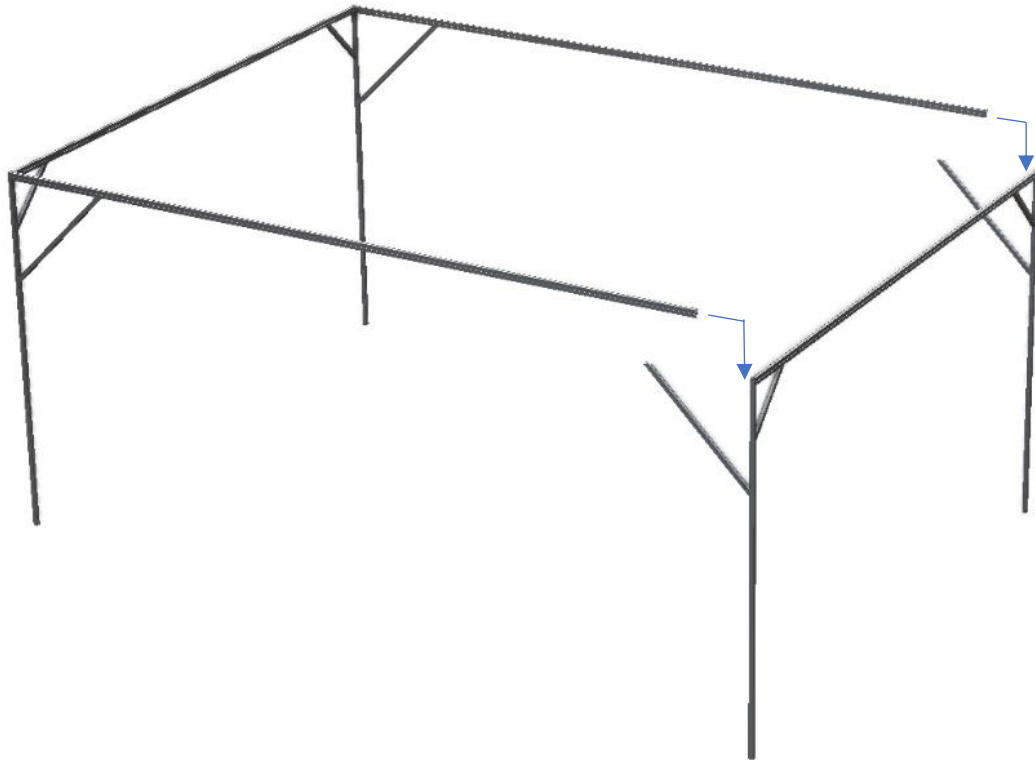
## Erecting the Frame structure

With the end goal posts and side bars assembled and laid out as shown here you are ready to begin erecting the frame. Minimise the need to move the assembled frame structure by erecting it in the final location of the clean tent. This process will require a minimum of two people, each with a step ladder and 4mm hex key



With a person either side of one of the end goal posts, carefully both lift the goal post and side bars together. Slide the union connections into the legs, tighten, then make the T-nut connections between the corner brace and the side bars. Take care to ensure all these connections are correctly made before carefully laying the frame down to rest. Pay attention to ensure the corner brace T-nuts are fully rotated and secure.





Now both move to the other end, with the aid of a step ladder and 4mm hex key, carefully both lift the other goal post and part assembled frame together. Slide the union connections into the T-slot section of the vertical legs, tighten, then make the T-nut connections between the corner brace and the long horizontal side bars. Take care to ensure all these connections are correctly aligned and pay close attention to ensure the corner brace T-nuts are fully rotated and secure.

# Using Clean Tent

## Getting in and out of the tent

**Note** – The section below is intended as a typical working practice suggestion only and does not constitute specific working practice guidance which may not be suitable for your application. It is advised and expected that the user will carry out independent risk-assessments and working practice guidance assessments prior to utilising the cleanroom.

Where possible, do not carry equipment in – have it passed to you  
Only allow one person into or out of the tent at any one time unless there is an emergency.

- Fully open the zip.
- Part the opening with both hands.
- Look at the floor inside the tent. Lift and then place your leading foot inside.
- Transfer your weight to this foot.
- Lift and then place the trailing foot inside.
- Turn around and close the zip to the exhaust position.
- The tent will then re-inflate the gowning chamber to maximum.

**Note** - The tent is not designed to be structural i.e. personnel cannot use the tent to lean against for support as they get in and out. The tent will start to slowly deflate whilst the entry zipper is fully opened but will re-inflate once the zip is returned to the exhaust position.

## Gowning room layout

There are 2 entry / exit zips in both the end wall and the bulkhead wall of the tent. This is designed so that the user has 2 options to get into the tent if, for example, there was an external obstruction to one zipper door e.g., a column.

Decide which entry zipper you will use.

After entering the tent through this zipper, you are in the “black” area of the Clean Tent

A small step over bench can be placed in the middle of the gowning chamber to effectively create two halves of the chamber. The other side of the step over bench is in the “grey” area of the Clean Tent.

The chamber where the HEPA filtered air enters is known as the “Cleanroom”.

A small coat stand can be placed in the black area. Here personnel can change into/ out of clean room clothing.

Personnel should always move from outside to black then grey then into the cleanroom which is the white area. The procedure is reversed for exiting.

**WARNING** It is possible to go from outside to the grey area if the wrong zipper is opened from outside, similarly from white to black on exit. All users should be aware that this possibly breaks protocol and should be avoided.



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## Getting equipment into the Work Cabin

We strongly recommend that heavy / bulky equipment is not taken through the gowning chamber. It is better to break the protocol and put the equipment directly into the cleanroom. To do this the floor zipper has to be opened.

Turn off the fan. Allow the tent to deflate and come onto the bungee safety cord. Unzip the perimeter and bulkhead zippers. Lift the tent walls up on one side and using the tapes on the bottom section of the Clean Tent corners, tie off to the cross-member of the pole structure or ceiling point. Place a small ramp set on either side of the groundsheet zipper if equipment is to be wheeled in, this protects the zipper from damage.

Once the equipment is in, assemble the tent per the install instructions and proceed to the [Housekeeping](#) in the maintenance section of this manual for clean down procedures.

## Services into the work cabin

It is very easy to add services to the Clean Tent. There are two options to entry: at the zipper joint in the corner of the FFU end wall or via a through wall gland. There are many different options but here are a few examples:

**Power** Place an extension cable through the zip joint.

**Water** If for cooling of equipment we recommend a closed loop chiller, externally sited with hoses led through the zip joint. If mains is required, it is advised to use reinforced hose. Drain via PVC waste through the zip joint.

**Air conditioning** Ensure that the unit air intake is from inside the cabin and place the unit in the cleanroom with the heat dump tube outside to ambient via the zip joint.

*If the user needs to retro fit a through wall gland, please get in touch with your Monmouth Scientific or your agent.*



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## Air supply and calibration

Different applications may require the user to experiment with higher / lower levels of air changes per hour. The more air changes per hour, the cleaner the work cabin. During the installation procedure we explained how to set the FFU and exhaust by inflation levels of the tent. This is a simple way of getting to a starting point without the use of anemometers, differential pressure meters and particle counters. For many users this simple setup is all that is required for their application. For more complex situations here are a few methods:

As the fan speed is increased, the airflow through the tent will increase. To prevent over-inflation of the tent, the vents / zippers will need to be opened further. It is better to establish the HEPA flow rate first and then amend the exhaust level via the zipper. Note that the HEPA should not be over-driven. It is designed for a face velocity of 0.3 to 0.45 M/Sec. Above this upper limit, the particulate that the filter is arresting will start to penetrate through the filter and potentially degrade its performance.

*Let us assume we want to set up for maximum throughput of the HEPA.*

Whilst the FFU is on test the average face velocity reading from 5 points. The anemometer should be 100mm from the HEPA face. One reading is taken from each corner and one in the middle of the HEPA filter face.

With the fan speed set to Low the average reading should be just <0.45M/sec.

Now set the exhaust zippers as in the installation guide i.e., by checking the sidewall inflation levels. Mark the zipper positions.

Over time the filter will become less efficient as it fills with particulate, so the fan speed will have to be adjusted. If the exhaust zippers are left on their mark, it is quite easy to judge the increase in fan speed required by looking at the sidewall inflation levels as the speed is increased.

From tests at the factory, we have found that the differential pressure can be visibly judged to approximately 1Pa.using this method. Since the pressure delivered is proportional to the airflow for a given volume, we can use this as a guide to the face velocity of the HEPA.

## Placing equipment & workstation location within the cleanroom

The cleanest area inside the work cabin is within the laminar flow boundary directly in front of the HEPA. Let us assume that only one HEPA is fitted (the volume scales for more HEPAs), if a table were placed inside the cleanroom with one end of it next to the HEPA, there would be unidirectional (Laminar flow) air flowing from the HEPA down the length of the table to the other end of it.

The height of this Laminar flow would be as tall as the HEPA at its face i.e., 600mm but as the air moves forward this laminar flow starts to break down at the edges. At approximately 2mtrs away from the HEPA face the height of the flow has degraded to approximately 300mm i.e., 50%. The same is true for the width of the laminar flow. The envelope where laminar flow is present is known as the "point of use" envelope and it is the cleanest part of the cleanroom. Clearly, this is the preferred location for the most sensitive work (to particulate).

**Do** Put the most sensitive work into this envelope if possible.

**Don't** Place less sensitive work upstream (i.e., towards the HEPA) as it will contaminate work downstream.

**Do** Avoid personnel entering the envelope particularly upstream of any work. Try to work from the sides of the envelope.

**Don't** Place equipment in areas that restrict the exhaust vents as it changes the pressure in the tent and blocks personnel exits.

## Particulate levels

Personnel clothing, traffic in and out of the tent, pre-filter changes, and frequent wipe downs, all make the difference to the quality of the environment.

# Maintenance

## Filters

The pre filters will need to be replaced every periodically depending on the quality of your air source environment.

The pre-filter is designed to take out the majority of airborne particulate from the new make-up air. It is important that this is changed on a regular basis. If the pre-filter is not changed, it will slowly block the air supply to the fan, resulting in fan overheating (due to the increased negative pressure behind the fan) and potential failure.

Low air velocity even when the fan speed is increase is a sign that the HEPA needs replacing. This normally indicates polluted air at the intake or poor pre-filter maintenance.

When the Cleanroom is not in use, the airflow need not be at 100% of operating conditions. To preserve the filters, the motor, and energy costs, the user could reduce the fan speed to a minimal level during these times.

## FFU specification

The FFU is a self-contained fan filter module, designed for use in turbulent mixing and laminar airflow cleanroom areas. See separate MAC10 installation, operation, & maintenance manual.

## Housekeeping

**Suspension cords:** Make sure that the bungee cord is checked on a regular basis. This maintains the integrity of the structure, which is important for safety reasons.

### **Cleaning:**

**Note** - Cleaning protocols below are provided as a typical example only. It is expected that the user will have specific protocols in-place tailored specifically for their needs.

Regular cleaning is critical to maintaining your ISO level. The chemicals used will vary according to application. Please get in touch for a sample of the Clean Tent materials which can be used to test their resistance to your chemical cleaner.

*View our example wipe-down video at:*

<https://cleanenvironments.co.uk/videos/cleanroom-wipe-down/>

### **At the start of the week:**

Use a cleanroom wipe on a cleanroom mop impregnated with IPA (alcohol spirit). Start at the cleanest surface, usually the HEPA wall and work towards the dirty surface, usually the floor.

Use a search pattern technique to wipe over each surface. Replace the wipe for every surface or more frequently if particulate is visible.

**1 hour before operation:** Dry wipe in a search pattern as above.

**At the end of each day:** Dry wipe in a search pattern as above.

**At the end of the week** Repeat the wet wipe down.

Upon installation or decommissioning of the Clean Tent for equipment removal etc. Repeat the wet wipe down procedure.

All cleaning must be done with the HEPA turned on at maximum velocity and the exhaust vents open for maximum throughput.



# Questions and Support

We want to ensure you are happy with your purchase. Therefore, should you have any questions or require any support on the assembly or operation of your new cleanroom please contact Monmouth Scientific by any of the methods below:

**Telephone:**        **UK 01278 458090**  
**International +44 1278 458090**

**Office Hours:**    **8.45am to 5.00pm**

**Email:**            **[info@monmouthscientific.co.uk](mailto:info@monmouthscientific.co.uk)**

**Alternatively, please contact your sales agent.**



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# Monmouth+ Scientific

## Monmouth Scientific Limited

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