

BREEZE MECHANICAL- VENTILATOR



ASSEMBLY GUIDE
2020

BLOCK DIAGRAM: SUB-ASSEMBLY IDENTIFICATION

Subassembly names in CAD Files:

- **Breeze-S01 → Frame Assembly**
- **Breeze-S02 → Housing Assembly**
- **Breeze- S03 → Air Inlet Assembly**
- **Breeze- S04 → Oxygen Control Assembly**
- **Breeze-S05→ Impeller Assembly**
- **Breeze-S06→ Outlet Assembly**
- **Breeze-S07→ Exhaust Assembly**
- **Breeze-S08 → Electrical Assembly**

ASSEMBLY NOTE

Note: The full assembly as well as the sub-assemblies are found in the provided CAD files. It is highly recommended to consult each of these sub-assemblies while assembling the ventilator. In this document we have provided an overview of the steps required to build the device, for clear schematics of the steps described in this guide please consult the individual CAD files and CAD drawings and the respective assemblies.

While not always shown in the CAD, provisions have been added to all connecting parts to accommodate o-rings. The full list of o-rings is included in the BOM. Wherever a connection occurs, the appropriate o-ring should be used.

FRAME-ASSEMBLY

CAD Component	Description	Image	Quantity
BREEZE-M01	Long Frame Member (200.05 mm)		8
BREEZE-M03	Short Frame Member (130.5 mm)		5
BREEZE-M04	Bracket		1
Frame Corner	McM 5537T289		8
Frame Bracket	McM 5587T810		2
M5 T-Slot Fastener	McM 5537T651		43
M5x14mm Button	INCL with frame connector		24
M5x8mm Flanged Button	McM 90909A721		7

Step 1: Frame Member Preparation

The first step of the FRAME-ASSEMBLY is to gather 8 long frame members (200.5 mm) and 4 short frame members (130.5 mm). You will need to insert M5 T-Slot Fasteners into the frame members. These will serve as attachment points for the housing as well as the bracket and the fifth structural short frame member. The location of the M5 T-Slot Fasteners is indicated in the following figure. We recommend, browsing through the frame assembly in order to ensure you have not neglected a M5 T-Slot Fastener.

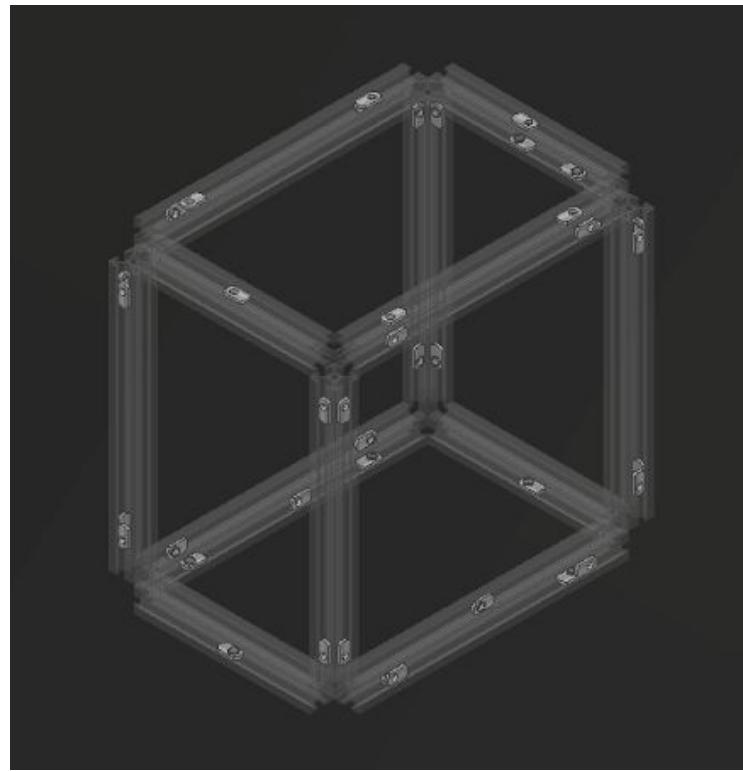


Figure 1: Basic frame with location of M5 T-Slot Fasteners

Step 2: Joining the Members

Proceed to obtain 8 frame corners and use them to fasten the frame members together. To fasten the corners to the members, you can use M5 x 14 mm button head screws. Each corner requires 3 screws and can be drilled directly into the frame members. Figure 2 shows the location of the screws.

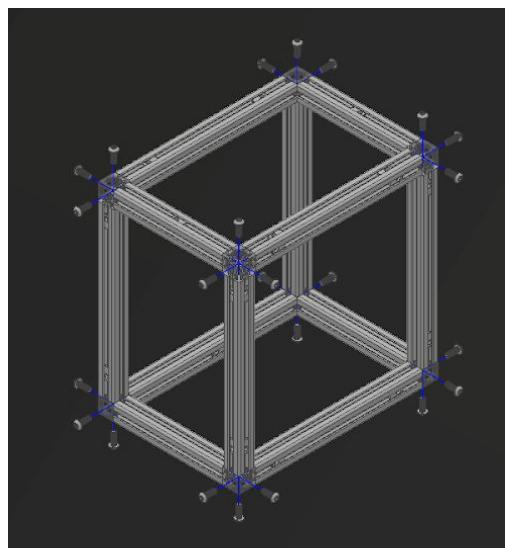


Figure 2: Assembly of the main, frame unit using frame corners

Step 3: Adding the Fifth Structural Support Member

You can now add the fifth structural support member (short) to the frame. Before doing so, you must add T-Slots into the member as seen in figure 3.

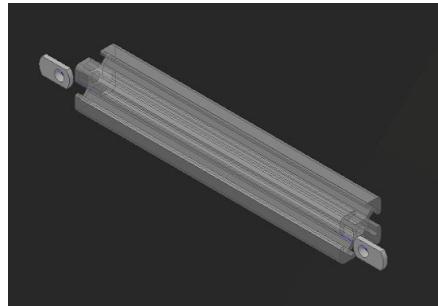


Figure 3: Addition of T-Slot fasteners to the fifth short member

To fasten the fifth short member to the base of the frame, you will need two corner brackets and four M5 x 8 mm Flanged Button Head screws. The fastening of the member is shown in figure 4. The screws pass through the corner brackets directly into the T-Slot fasteners which were inserted into the members in the first step of the assembly.

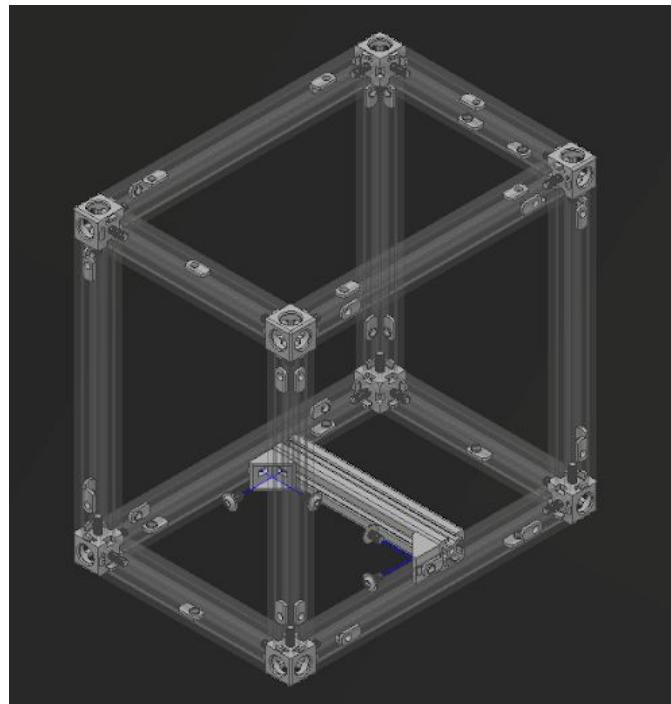


Figure 4: Addition of the fifth short member to the frame

Step 4: Adding the Bracket

The bracket is mounted to the frame in the orientation shown in figure 5 using three M5 x 8 mm Flanged Button Head screws which pass through the holes in the bracket directly into the T-Slot fasteners which were added in the first step.

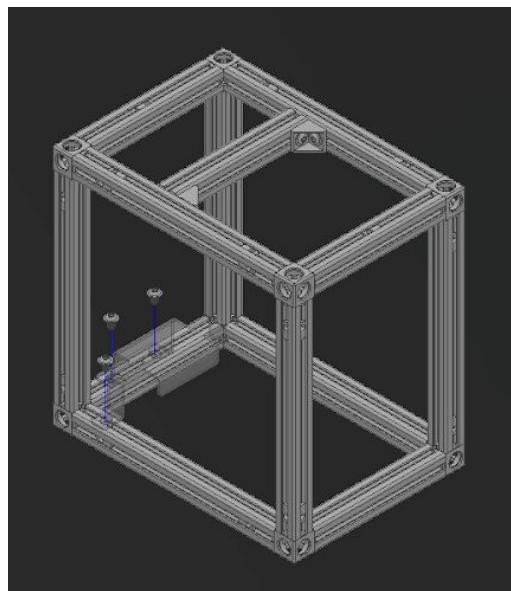


Figure 5: Addition of the bracket

HOUSING-ASSEMBLY

CAD Component	Description	Image	Quantity
Breeze-M05	Bottom Panel		1
Breeze-M10	Top Panel		1
Breeze-M06	Screen Panel		1
Breeze-M07	Side Panel		1
Breeze-M08	Air Inlet Panel		1
Breeze-M09	O2 Panel		1
M5X10mm Nylon Screw	McM 94879A320		39

Foot	McM 9540K59		4
M4x16mm Nylon Screw	McM 94879A226		8
M4 Nylon Washer	McM 95610A150		8
Webbing Guide			2
M5x16mm Nylon Screw			4
Handle			2
M4 Lock Nut			8

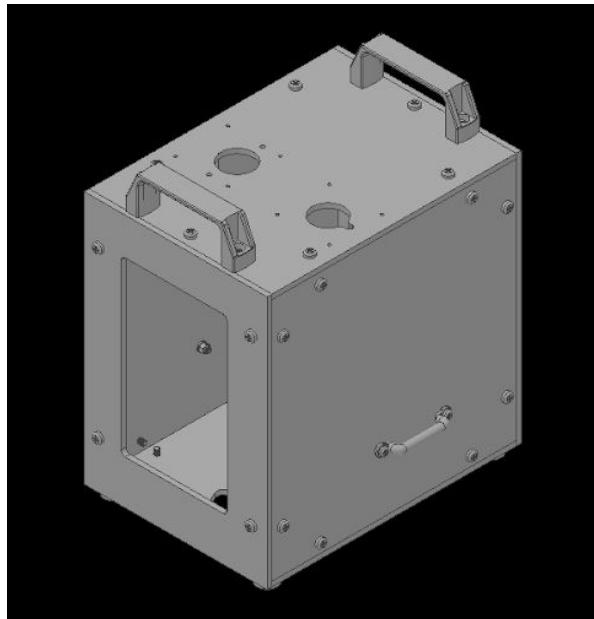


Figure 1: Housing assembly

All the side panels mount to the frame using M5 x 10 mm nylon screws which fasten to the T-Slot fasteners already added to the frame in the first sub-assembly. Also add the top handles using M5 x 16 mm screws. Finally add the side handles using M4 x 16 mm screws mounted to the frame using M4 washers and M4 lock nuts. Add feet to the frame using M4 x 16 mm screws mounted to the housing and the frame using M4 washers and M4 lock nuts.

Air Inlet Assembly

CAD Component	Description	Image	Quantity
Breeze-M11	Inlet Body		1
Breeze-M12	PEEP Nozzle/Emergency Valve Barb		1
M5 Insert	McM 94510A045		3
M4 Insert	McM 94510A040		4
M3 Insert	McM 94510A030		6
Breeze-M13	McM 9470K36/ Check Valve Seal		1
Breeze-M14	Butterfly Valve		1
Servo Motor	HS-322HD		1
Dust Filter	N95 Canister Filter		1
M3x5mm Nylon Screw	McM 94879A116		1
M5x10mm Socket	McM 91292A124		4

M4x8mm Socket	McM 91292A108		4
M3x8mm Socket	McM 91292A112		8
M3x10mm Socket	McM 91292A113		1

Step 1: Assembling the air intake valve

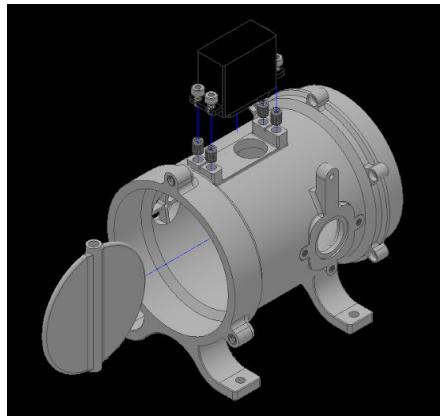


Figure 1: Assembly of the butterfly valve MISSING

First obtain the main housing and slide the butterfly valve inside. There is a hole on the top of the butterfly valve which fits into the servo motor. The servo motor attaches to the top of the main housing using four M4 x 8 mm Sockets. The M4 screws fasten into four M4 inserts which can press fit into the servo mounting holes. An additional M3 screw mounts through the housing onto a press fit M3 insert as shown in figure 2.

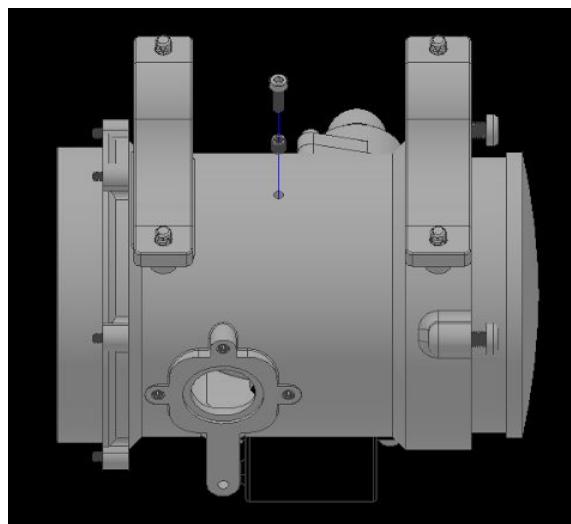


Figure 2: Adding the locking screw on the butterfly valve

Step 2: Adding the bard connector

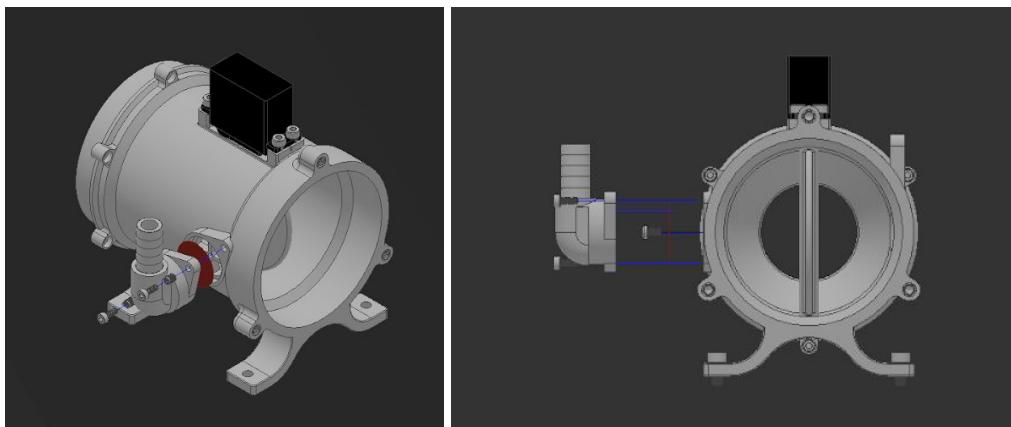


Figure 3: Adding the barb connector

First cut out a 22 mm diameter circle from the gasket material outlined in the above BOM. Then slot this material into the opening shown in figure 2. The gasket can be attached to the housing using an M3 x 8 mm screw (figure 3, left). Proceed to mount the barb to the main housing using two M3 x 8 mm screws which mount to two M3 press fit inserts.

Step 3: Inserting Final Inserts and Screws

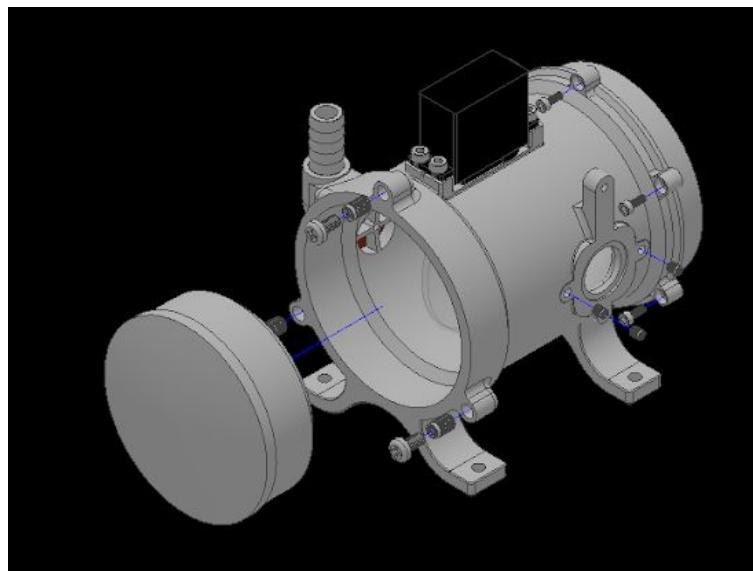


Figure 4: Adding the barb connector

First press fit the air filter into the body of the housing as shown in figure 3. Proceed to mount three M5 inserts on the same face, these screws will serve to mount to the acrylic panelling. Then add three M3 inserts into the exposed oxygen inlet on the right side of the housing as shown in figure 3. Finally add M4 x 8 mm screws onto the opposing face of the housing. These will serve as the mounting points for the impeller assembly.

Step 4: Add Base Mounting Screws

Finally add M5 screws to the bottom of the housing in preparation for mounting to the base of the frame.

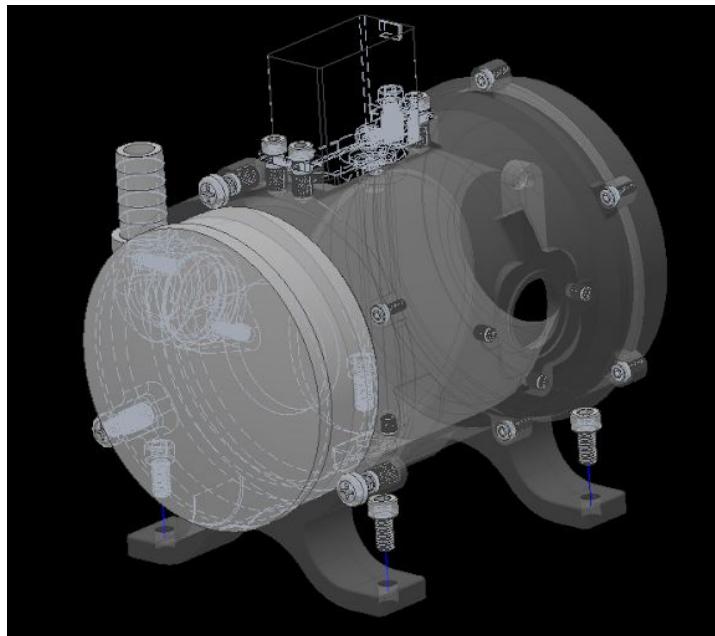


Figure 5: Adding the mounting screws

Oxygen Control Assembly

CAD Component	Description	Image	Quantity
Needle Valve	McM 4891K720		1
Breeze-M15			1
Breeze-M17	Needle Valve Mount		1
Breeze-M16	Needle Valve Adapter		1
M3 Insert	Mcm 94510A30		5
Stepper Motor	NEMA 17		1
M3x8mm Socket	McM 91292A112		12

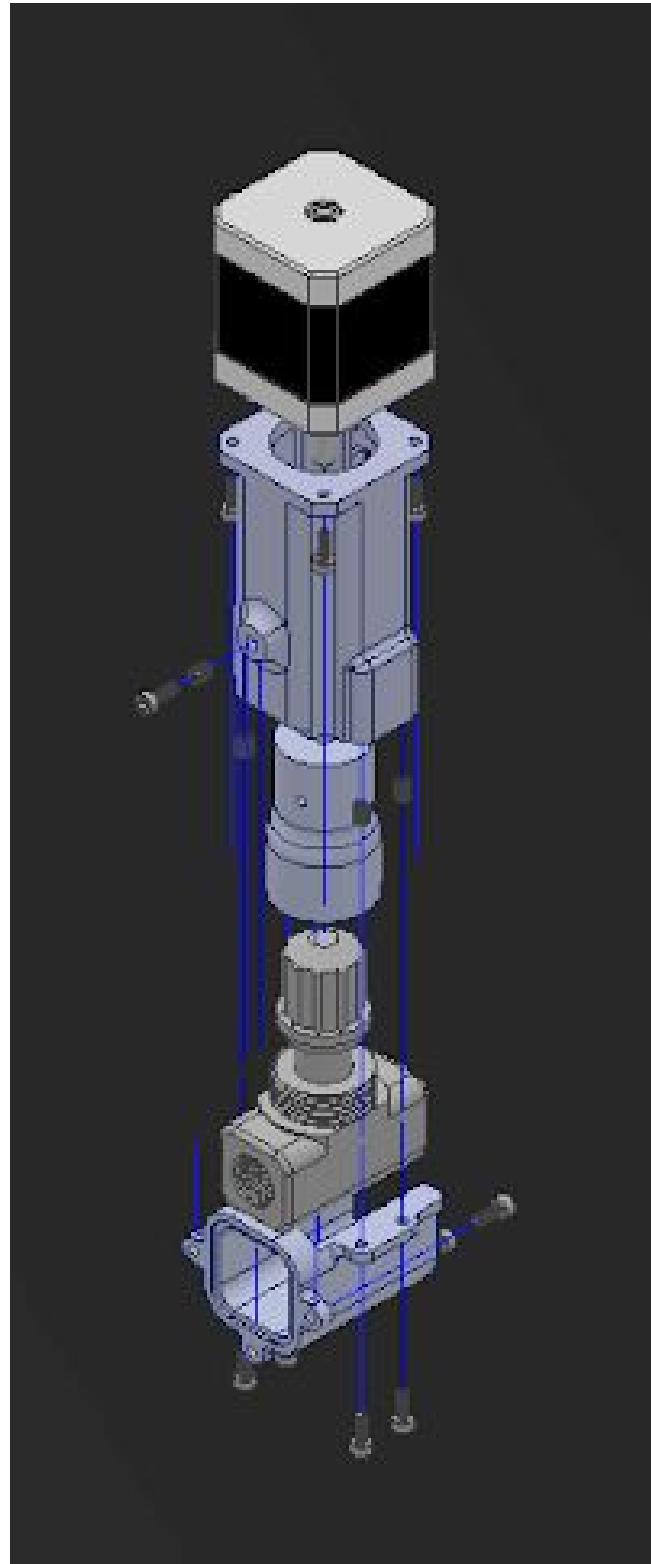


Figure 1: Oxygen valve assembly

The assembly of the oxygen valve is straightforward. All holes require the use of an M3 insert and all fasteners are M3 screws. The mounting procedure for the oxygen control valve to the main housing will be described at the end of the document.

Impeller Assembly

CAD Component	Description	Image	Quantity
Breeze-M18	Impeller Housing		1
Breeze-M19	Impeller		1
Breeze-M20	Motor Mount		1
Bushing Flanged Nylon	McM 6389K234		1
M3 Insert	McM 94510A030		10
Brushless Motor	2212 2450kv		1
93mm O-ring	Mcm 1302N088		1
O ring-18	McM 9452K72		1
M3x8mm Socket	McM 91292A112		8

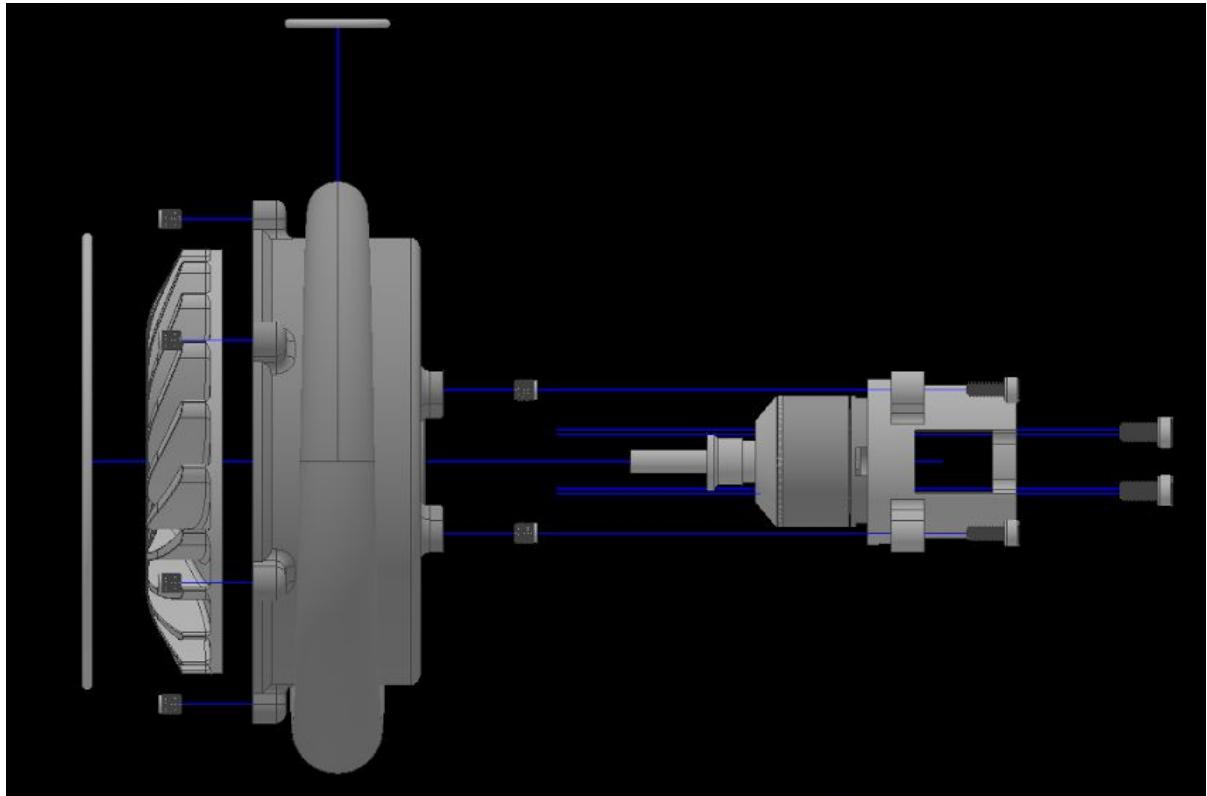


Figure 1: The impeller assembly

To assemble the impeller assembly, first insert the DC motor into the motor housing using M3 screws which fasten to the back of the motor. Then fasten the motor mount to the impeller housing using M3 inserts in the body and M3 screws passing through them. Add M3 inserts into the body to accommodate the attachment to the main housing. Insert the brass bushing over the motor shaft and slip the impeller through the shaft. Lock the impeller in place using the collet lock (not shown here, included in the brushless motor package). Proceed to add o-rings to the assembly as shown in figure 1.

Outlet Assembly

CAD Component	Description	Image	Quantity
Breeze M-22	Outlet Base		1
Breeze M-23			1
Breeze M-24	Outlet/Exhaust Top		1
Breeze M-13	Check Valve Seal		1
Clip			1
M3 Insert	McM 94510A030		2
Flow Sensor	DK SFM3300-250-D		1
Breeze M-21	Quad Adaptor		1
M3x8mm Socket	McM 91292A112		4
M3x6mm Nylon Screw	McM 94879A116		3
O-Ring-034	McM9452K122		1
M4x35mm Nylon Screw	McM 94879A234		1

Pressure Relief Vent	McM 1093K100		1
Oxygen Sensor	PSR-11-39-MD		1

Step 1: Assemble Main Unit

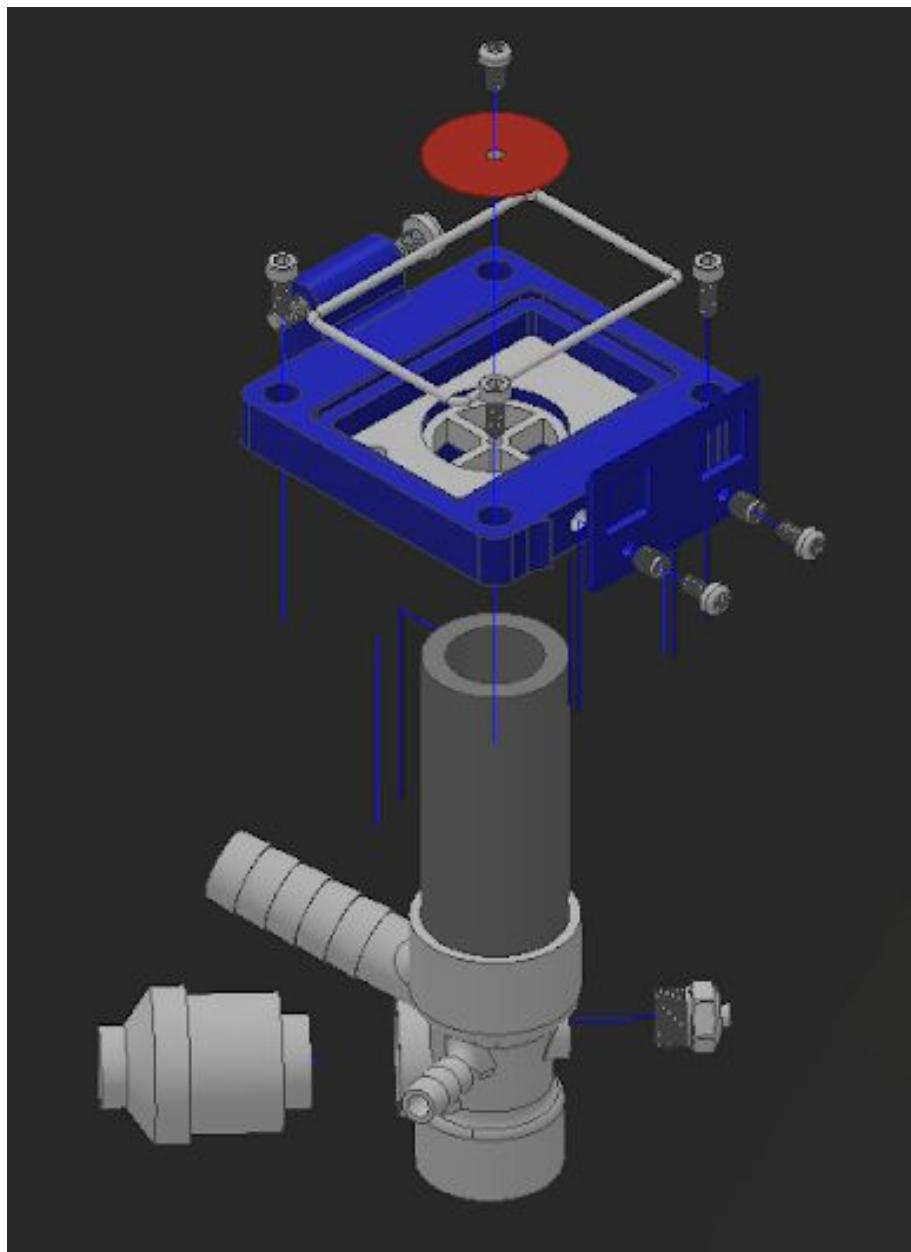


Figure 1: Assembly of main unit

To assemble the main unit first connect the oxygen sensor and the pressure relief valves in their respective holes in the curved adapter. Then mount the flow sensor (seen in grey on the figure). Then cut out a 22 mm gasket. Fasten the gasket to the filter bottom using an M3 screw. Also create an o-ring using the material specified in the BOM and insert it in the groove on the filter bottom. Attach the M3 inserts into the filter bottom and mount the clip using M3 screws. Proceed to add M3 screws at the four corners of the filter bottom, these will eventually mount to the acrylic housing. Using the M4 x 40 mm socket, attach the filter top to the filter bottom. The final assembly should look like this.

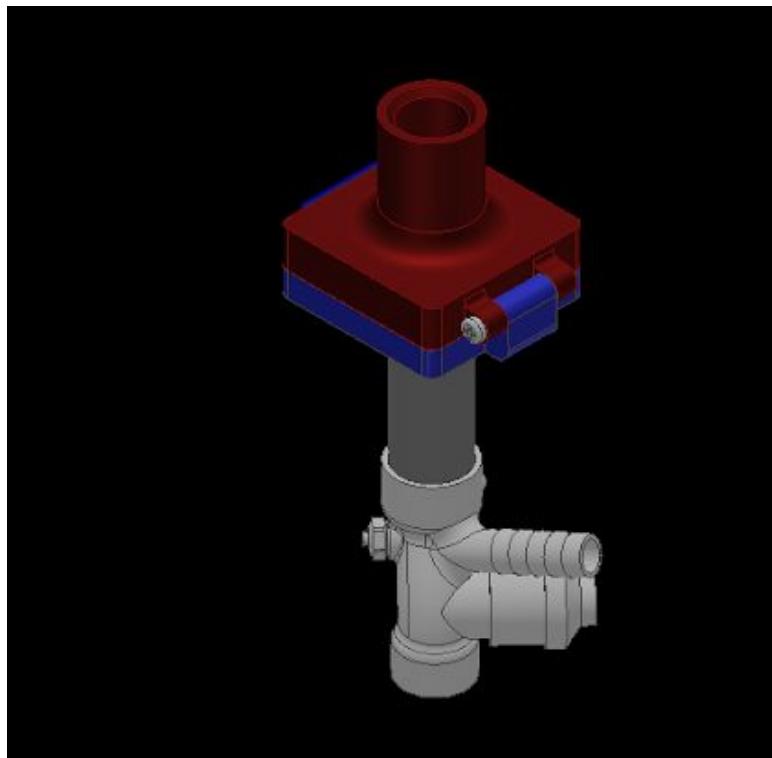


Figure 2: Full outlet assembly

Exhaust Assembly

CAD Component	Description	Image	Quantity
Breeze M-26B	Outlet Base		1
Breeze M-28			1
Breeze M-29			1
Breeze M-27			1
Breeze M-24			1
Clip			1
M3x8mm Socket	McM 91292A112		4
M3x6mm NYLON SCREW	McM 94879A116		2
M4x35mm Nylon Screw	McM 94879A234		1
M3 Insert	McM 94510A030		2
O-Ring Dash 34	McM 9454K122		1

M3x20mm Socket	McM91292A123		2
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Step 1: Assemble the Bottom Half of the Unit

First cut out a 50 mm diameter rubber gasket. Then assemble the base of the exhaust unit according to figure 1. According to this figure, you must first insert the gasket, then the second half of the exhaust base shown in white. The white component screws onto the blue part. Then insert two M3 inserts into the holes shown in the figure.

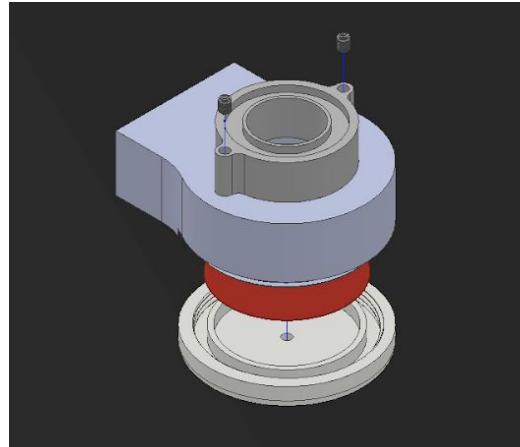


Figure 1: Assemble the bottom of the exhaust unit

Step 2: Assemble the Top-Half of the Unit

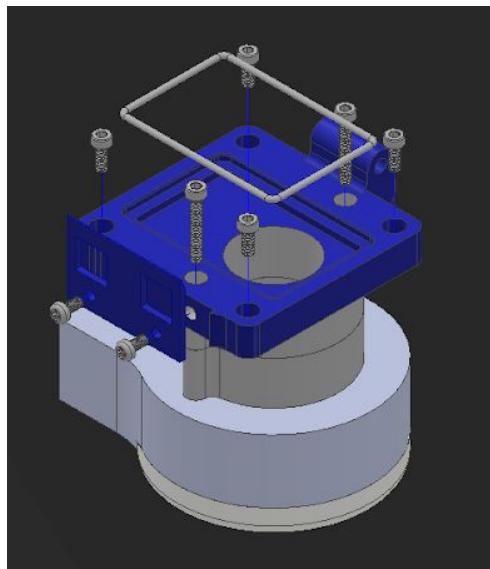


Figure 2: Assemble the Top-Half of the Unit

You can now add the outlet base, using M3 x 20 mm fasteners to screw it into the bottom of the exhaust assembly. You can also add four M3 x 8 mm screws to the outlet base which will allow you to mount the assembly directly to the acrylic housing. Proceed to cut-out an o-ring of the appropriate size to fit within the filter housing and insert it in the slot on the outlet base. To attach the clip, you can use two M3 x 6 mm screws.

Step 3: Final Assembly of the Housing Unit

You can now add the top of the filter housing (red) and mount it to the bottom of the filter housing (blue) using an M4 x 35 mm screw.

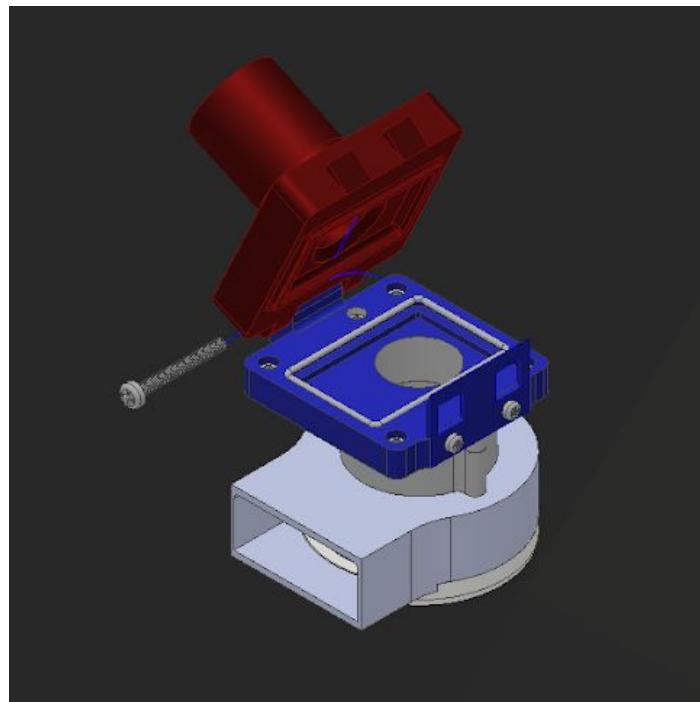


Figure 3: Assemble the Top-Half of the Unit

Electrical Assembly

CAD Component	Description	Image	Quantity
Toggle Switch	McM 80002K530		1
Switch Cover			1
Power Connector	DK 719W-00		1
Battery	1,4AH SLA		1
Chassis Fan	80x80x25mm		1
Power Supply	RPS-120-12		1
Raspberry PI LCD	Touchscreen		1
M4x16mm Nylon Screw	McM 94879A226		4
M4 Lock Nut	McM93625A150		4

FINAL CONNECTIONS

Step 1: Assembly of the Internal Components (1)

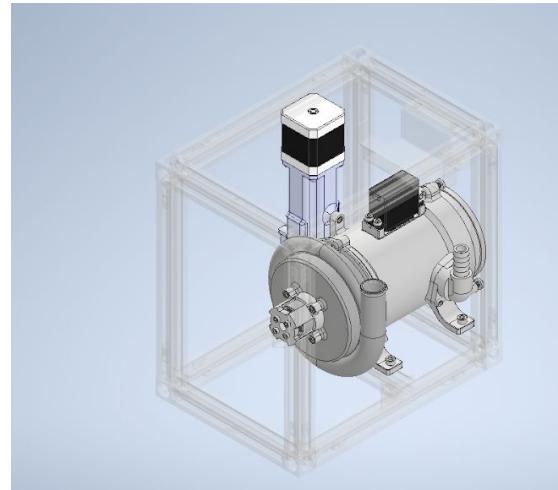


Figure 1: First assembly of the internal components

First mount the impeller assembly to the main housing using the fasteners described in the impeller assembly. Then mount the oxygen assembly to the main housing. Finally mount the main housing to the frame. Then attach the panels to the frame using the screws which were pre-installed on the main housing.

Step 2: Assembly of the Internal Components (2)

In order to mount the outlet assembly, first detach the barb connector and the flow sensor from the assembly. Attach this sub-assembly to the turbine outlet. Then, mount the top of the outlet assembly to the acrylic top using the locating screw holes. As before, the flow sensor and curved adapter will mount to the bottom of the filter housing when mounting the lid to the frame.

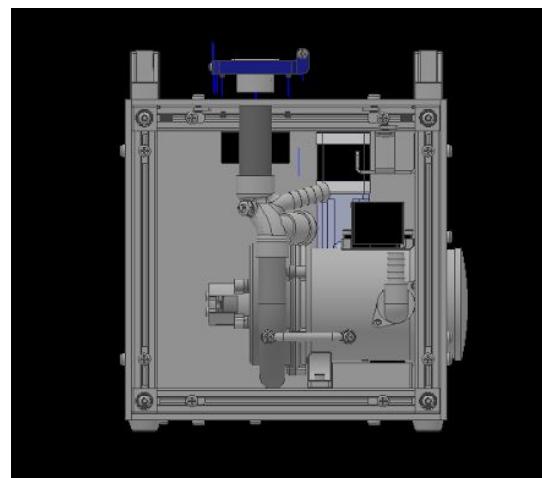


Figure 2: Mounting the outlet assembly

Similarly disconnect the outlet base from the PEEP valve. Mount the outlet base to the acrylic top using the locating holes and then attach the PEEP valve from the bottom using the two M3 screw holes. Make sure that the exhaust is facing out of the box. Before mounting the PEEP valves, you should remove the side panel. This will also give you access to attach the internal tubing.

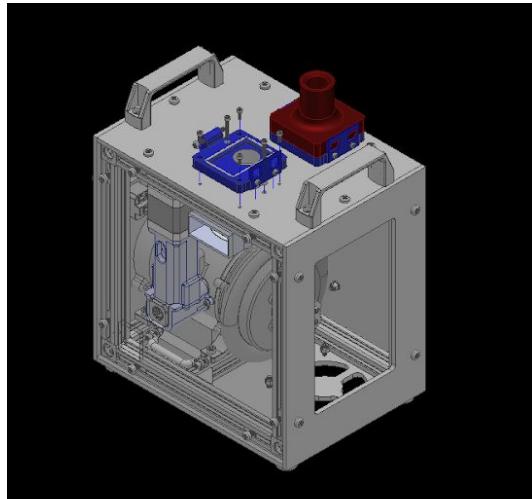


Figure 3: Mounting the exhaust assembly

Step 3: Internal Tubing

Connect the PEEP barb to the PEEP valve. The barbs are indicated in blue.

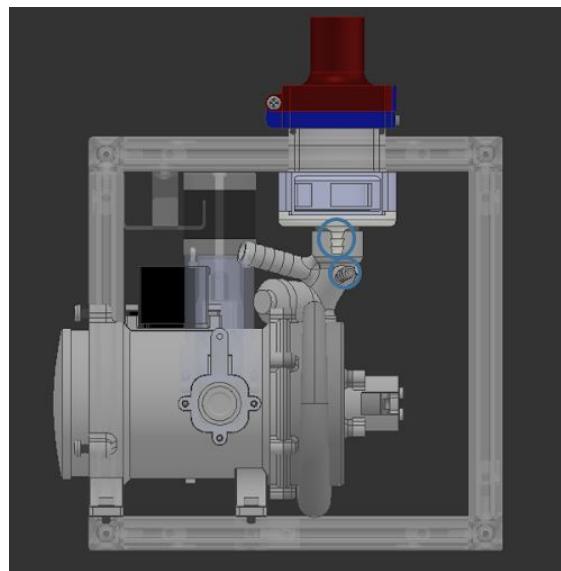


Figure 4: PEEP Connections

Then attach the emergency barb on the main housing to the larger barb on the curved adapter as shown in figure 5.

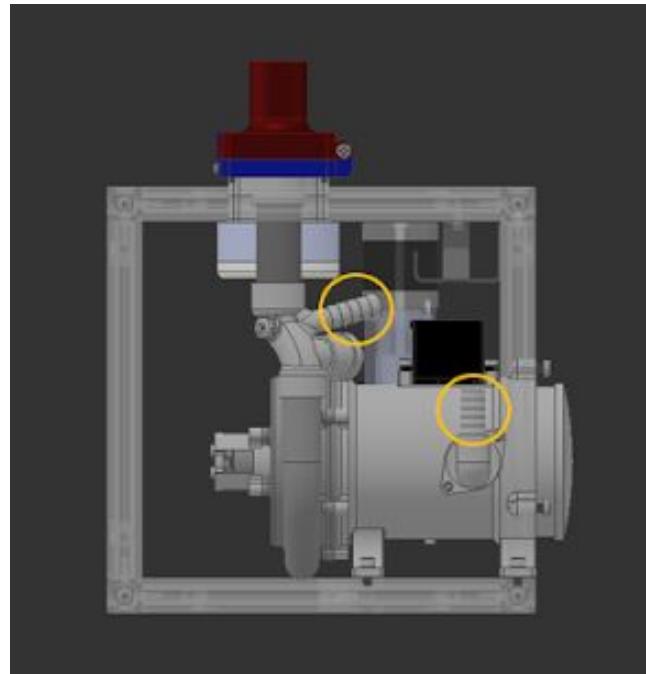


Figure 5: Barb connections for the emergency valve

Finally connect the barb to the underside of the outlet assembly as shown in figure 6. Then attach an appropriately sized tube from this barb to the pressure sensor.

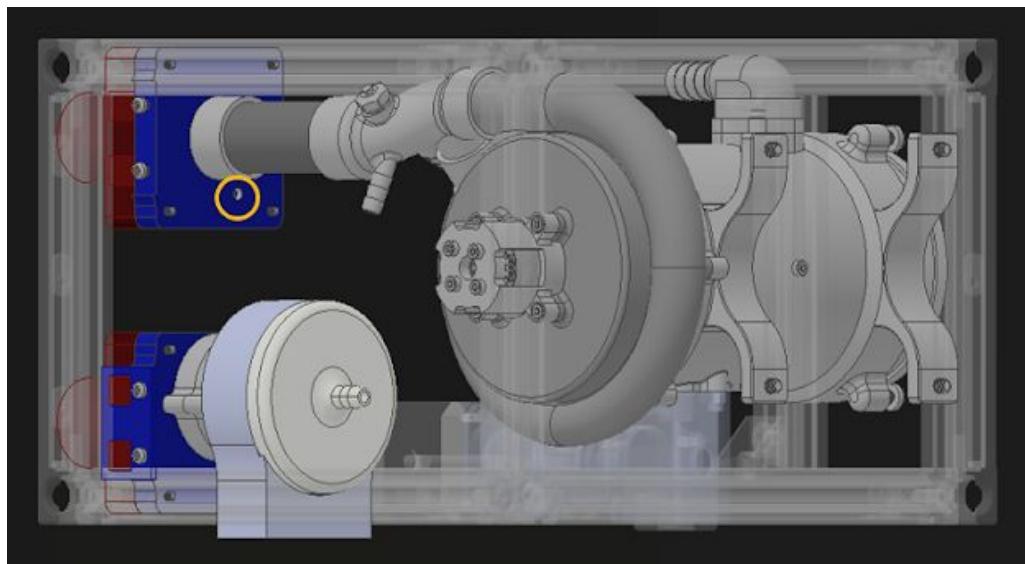


Figure 6: Location of the pressure sensor barb

Step 4: Final Components

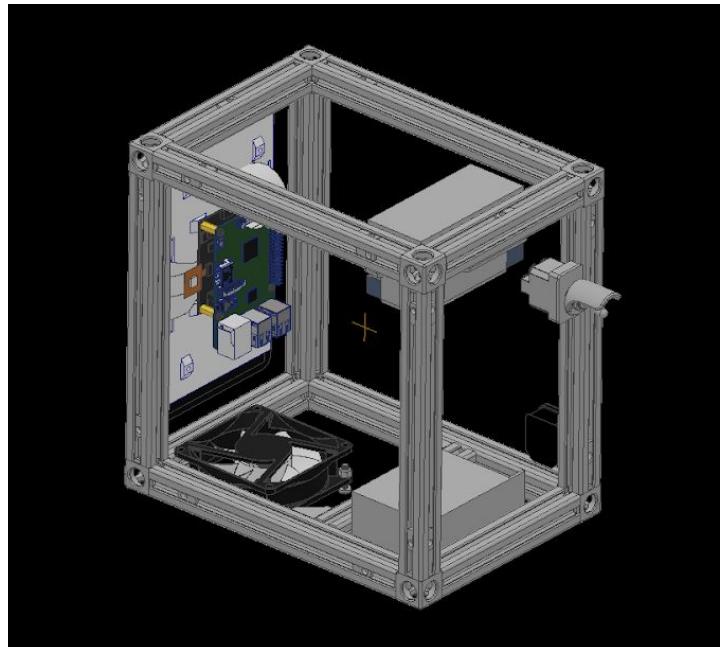


Figure 6: Mounting the exhaust assembly

With the exhaust panel still uncovered you can mount the fan to the bottom panel using M4 x 16 mm screws and locknuts. You can also mount the switch to the side panel by screwing the components together from either side. You can also add the power supply which nestles comfortably in the area after the short member on the floor. You can also mount the battery in the bracket on the frame. Finally you can mount the Raspberry Pi screen to the screen panel using M3 screws which fastenn from the back.