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	Rev Work Instruction V1.1
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TITLE: SUB-ASSEMBLY #10 – COMPONENT CONNECTION	

Revision	Date	Modifications	Author
V1.0	20-04-2020	Setup first version (images and elaboration)	Jeroen Roest / Bart Spel
V1.1	27-04-2020	Translation Dutch to English	Jim Smit

This manual described how the parts of the different sub-assemblies (mainly the parts where air flows through) need to be attached to each other. Furthermore, it describes how all the parts need to be attached to the AIRone bottom plate. In the figures, gaskets are included. For the attachment of the parts to the bottom plate, these should be toothed lock gaskets. So this holds for the metal gaskets, not for the plastic ones. The pressure relief valve needs to be calibrated on 70 mbar. Some figures contain parts where the flow sensor is not turned whereas this should be turned.

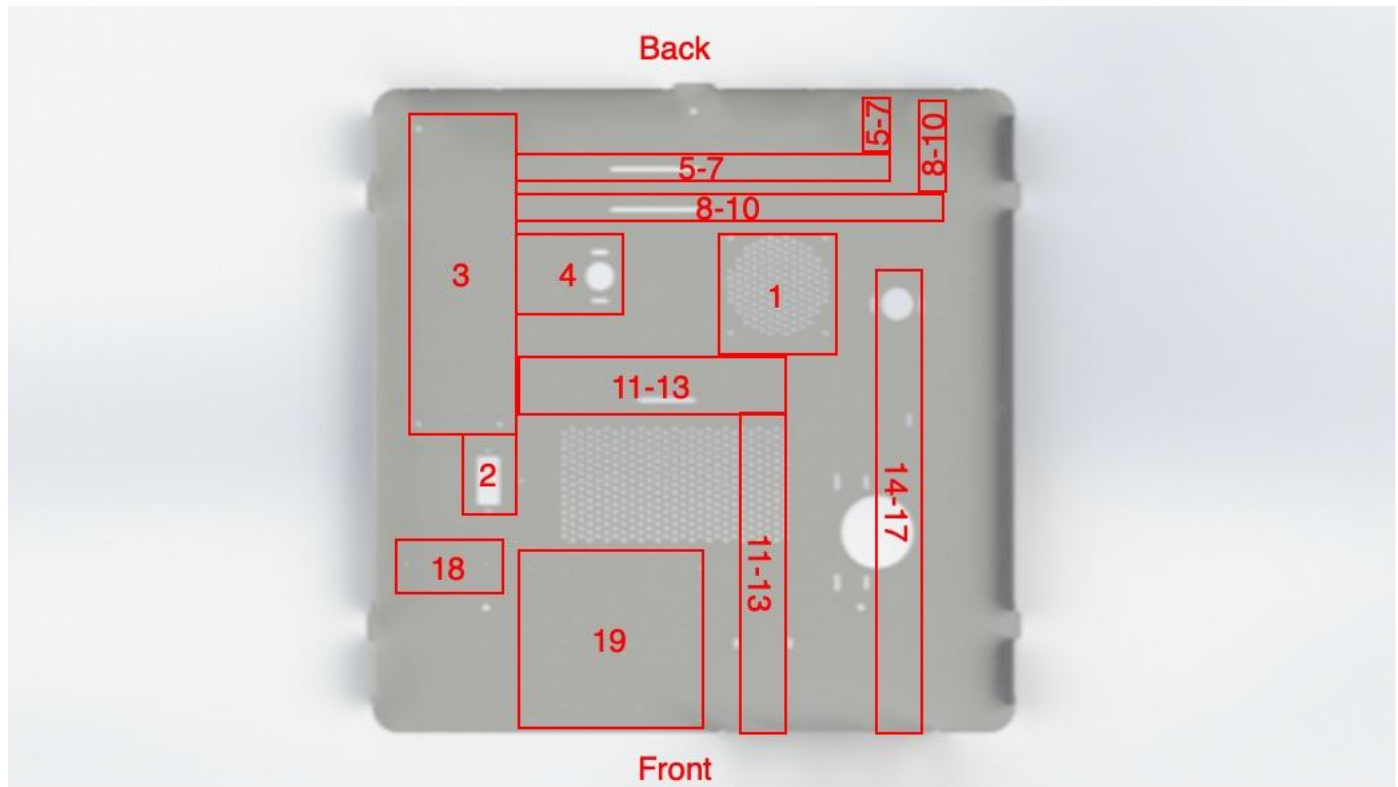
Part	Supplier	Quantity
Ventilator (Noctura): - Plugs - Ventilator - USB connection + eventuele extension	HighFlow	1
Bottom plate UPS chassis	NS	1
Result of sub-assembly 3 (Mixing chamber)		1
M5 bolt, 12 mm		5
M5 nut		3
M5 toothed lock gasket		5
3D-printed, tankout	Oceanz	1
Plastic: M4 bolt, 10 mm	Fabory	10
Plastic: M4 nut	EOO	10
Plastic: M4 gasket	Fabory	10
Result sub-assembly 1 – MFC (Air)		1
M4 bolt, 6 mm		4
M4 toothed lock gasket		5
Result sub-assembly 2 – MFC (O ₂)		1
Result sub-assembly 4 – Inspiratory tract		1
Uplifting Inspiratory tract	OperationAIR (TU-Delft)	1
Result sub-assembly 5 - Expiratory tract		1
3D-printed endtube	Oceanz	1
3D-printed plate attachment Pressure relief valve	MTB3D	1

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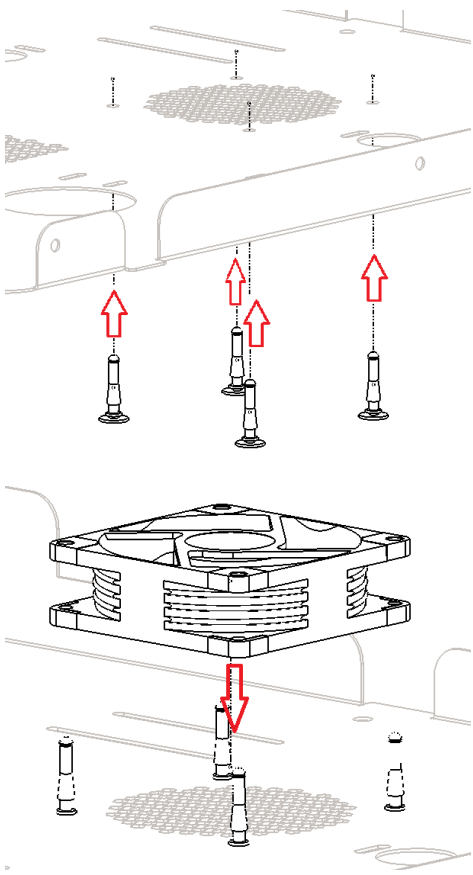
Pressure Relief Valve (PRV) (calibrated on 70 mbar)	Demaco	1
Plastic: M4 bolt, 16 mm	Fabory	2
M4 bolt, 16 mm	-	1
Result sub-assembly extra - Speaker	-	1
Push-in Rivet 3mm	Essentra components	6
Result sub-assembly 6 - PCB	-	1
3D - printed PCB housing	MTB3D	1
3D – printed elektronika roof	MTB3D	1
Bolt M2.5, 10 mm	Farnell	7
Toothed lock gasket M2.5	-	7
High pressure hose 4 mm, 12 cm (insp. tract)	Landefeld	1
High pressure hose 4 mm, 22 cm (exp. tract)	Landefeld	1
High pressure hose 4 mm, 20 cm (mixing chamber)	Festo	1

This figure below shows the bottom plate with indicated the place on the bottom plate where the different steps need to be attached (for the sake of orientation).



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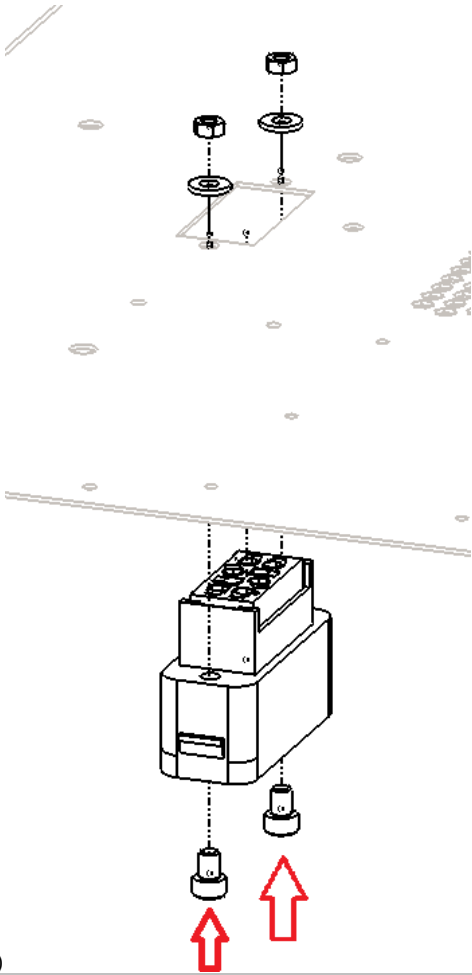
- For the ventilator, first the push-in rivets need to be pushed through the gaps (Figure 1.1)
- Then, the ventilator needs to be placed upon the push-in rivets (Figure 1.2). Please note that the side of the ventilator with the logo is facing the downwards (facing the bottom plate) so the air will be flowing outwards.



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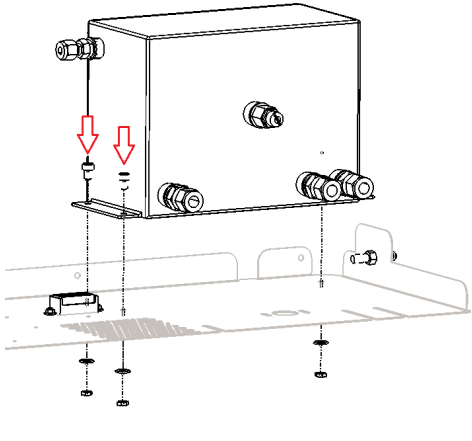
2.

- The UPS has a cable which needs to be attached on the bottom plate.
- The Push-in rivet contains 2 bolts (M4). These need to go through the bottom plate and attached with the nuts and gaskets (M4).



3.

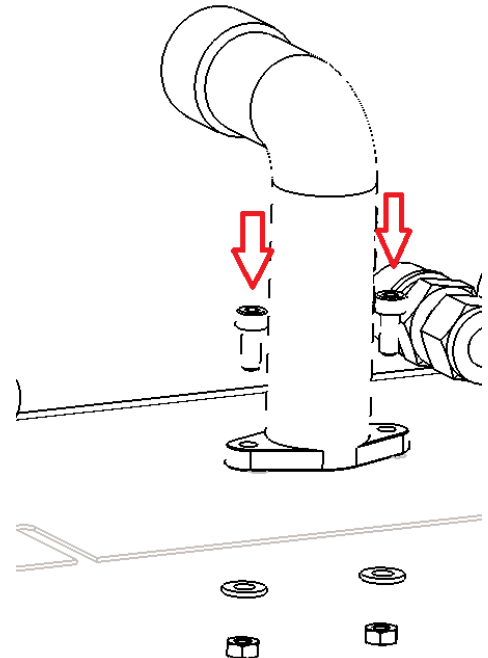
- The mixing chamber needs to be attached to the bottom plate. Therefore, 3 bolts (M5, 12 mm) need to go through the bottom plate and the openings of the mixing chamber (Figure 3). A toothed lock gasket (M5) needs to be placed in between.



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4.

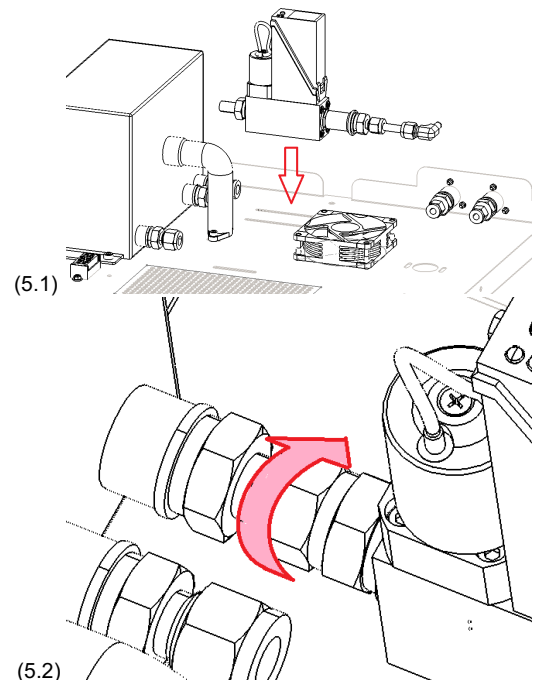
- The PRV which is attached to the mixing chamber needs to be attached to the bottom plate. Therefore, place the 3D-printed plate attachment over the PRV. This needs to be attached to the bottom plate with 2 **plastic** bolts (M4, 10 mm), as can be seen in Figure 4.



(4)

5.

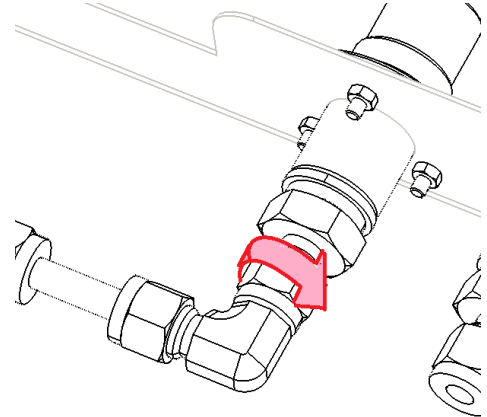
- The MFC (air) from sub-assembly 1 needs to be attached to the mixing chamber. Therefore, a G1/4" to 3/8" fitting is used, which is already attached to the mixing chamber (Figure 5.1).
- Disconnect the 2 parts of the fitting and connect the 3/8" tube (remaining from sub-assembly 1) with the mixing chamber (Figure 5.2). Do not forget to add the rubber gasket again.



(5.2)

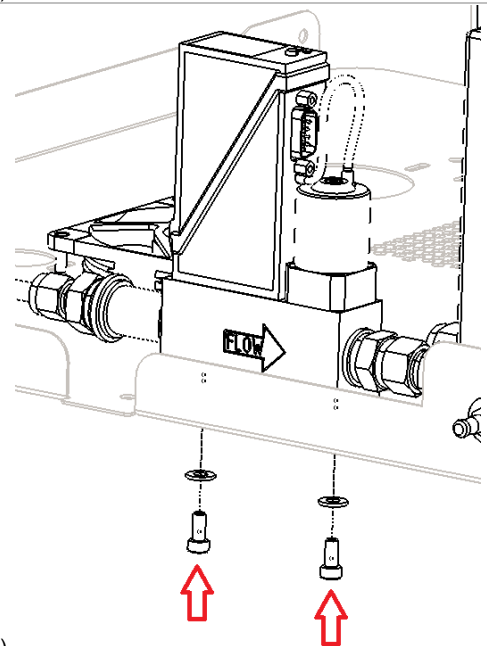
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- The MFC (air) from sub-assembly 1 needs to be connected to the NIST fitting (G1/4" to 1/4" tube). This is already attached to the NIST fitting.
- Disconnect the 2 parts of the fitting and connect the 1/4 " pin of the metal tube remaining from the elbow part to the NIST fitting (Figure 6). Do not forget to add the rubber gasket again.



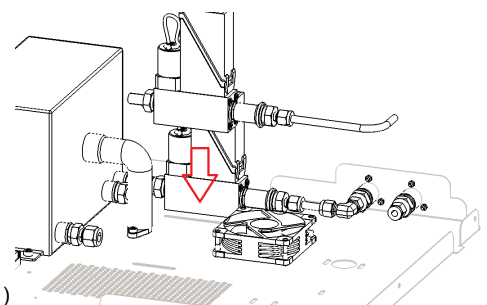
(6)

- The MFC (air) is now fixed in the system. The MFC itself needs to be aligned with the gaps and therefore 2 M4 bolts, 6mm need to be put in (Figure 7). In between, a M4 toothed lock gasket needs to be placed.



(7)

- The MFC (O₂) from sub-assembly 2 needs to be connected to the mixing chamber (Figure 8.1). Therefore, a G 1/4" to 3/8" fitting needs to be connected. This one is already attached to the mixing chamber.

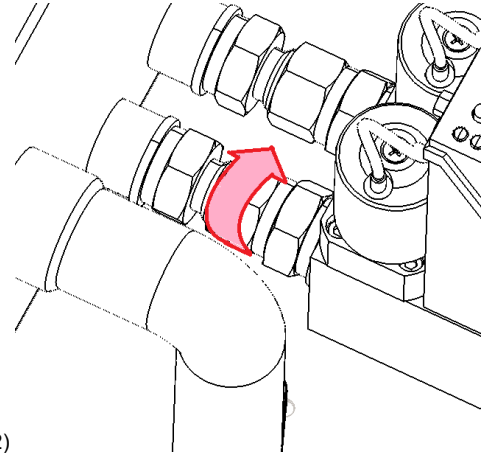


(8.1)

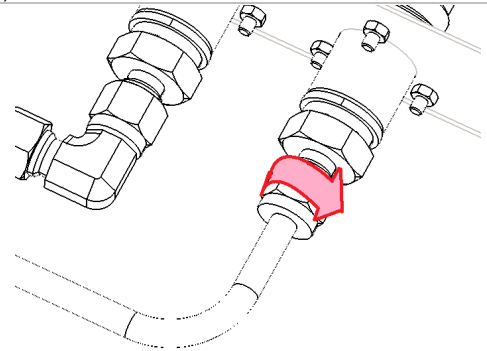
- Disconnect the 2 parts of the fitting and connect the 3/8 " tube, remaining from sub-

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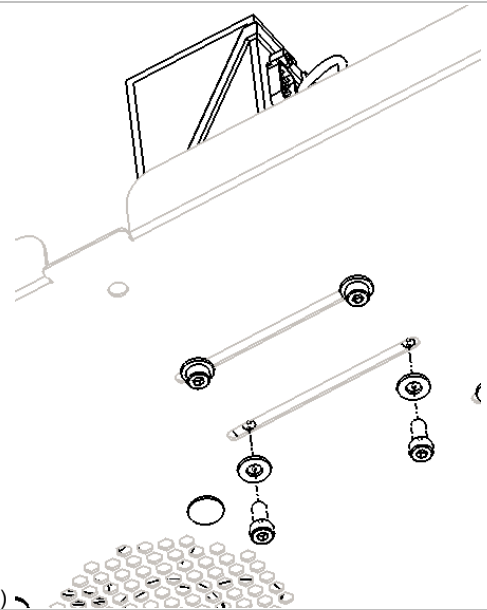
assembly 2, with the mixing chamber (Figure 8.2). Do not forget to add the rubber gasket again.



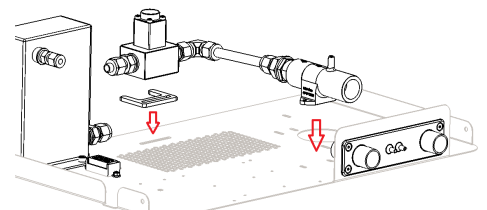
(8.2)



(9)



(10)



(11.1)

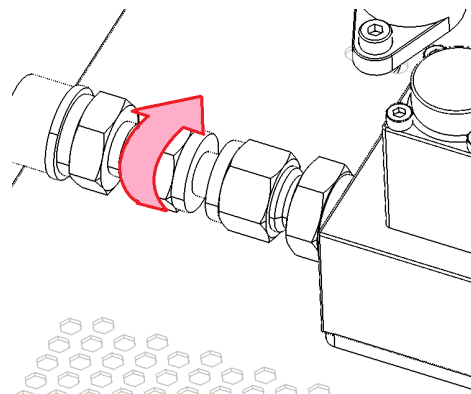
9.
 - The MFC (air) from sub-assembly 1 needs to be connected to the NIST fitting (G1/4 " to 1/4" tube). This is already attached to the NIST fitting.
 - Disconnect the 2 parts of the fitting and connect the 1/4 " pin of the metal tube remaining from the elbow part to the NIST fitting (Figure 9). Do not forget to add the rubber gasket again.

10.
 - The MFC (O₂) is now fixed in the system. The MFC itself needs to be aligned with the gaps and therefore 2 M4 bolts, 6mm need to be put in (Figure 10). In between, a M4 toothed lock gasket needs to be placed.

11.
 - The inspiratory tract from sub-assembly 4 needs to be connected to the mixing chamber. Therefore, the G1/4 " to 3/8 " fitting needs to be connected. This is already attached to the mixing chamber.
 - Disconnect the 2 parts of the fitting and connect the 3/8 " tube, remaining from sub-

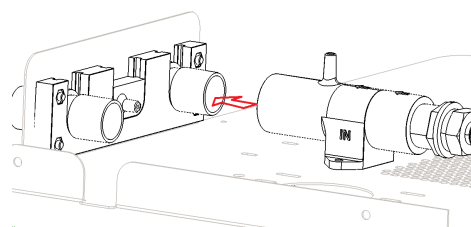
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assembly 4, to the mixing chamber (Figure 11). Do not forget to add the rubber gasket again.



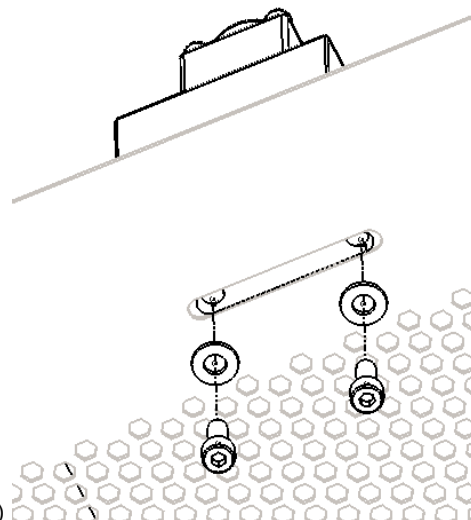
(11.2)

- 12.
- The other side of the inspiratory tract needs to be connected to the tube mounting side. Therefore, the 22mm fitting in the tube mounting needs to be connected with the 22mm opening of the 3D-complex (Figure 12).



(12)

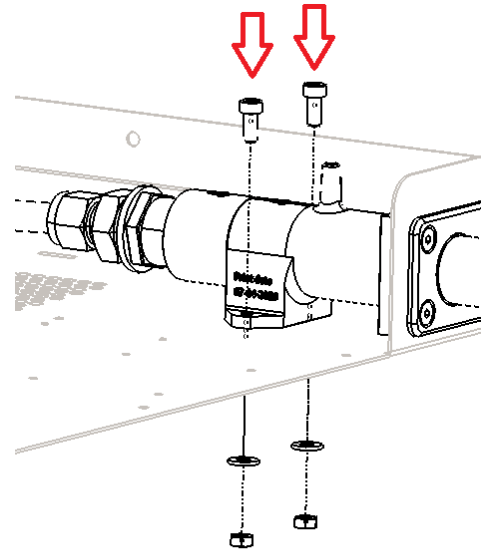
- 13.
- In this section, the inspiratory valve and the 3D-complex need to be fixed.
 - The valve needs to be provided with a uplifting plate (3D printed). Add
 - De klep dient voorzien te worden van een ophogingsplaat (3D-geprint). Voeg deze onder de inspiratoire proportionele klep en lijn de openingen uit. Vervolgens kunnen hier 2 bouten (M5, 12 mm lang) ingedraaid worden. Zie figuur 13.1. Hierbij dient een kartelring toegevoegd te worden.



(13.1)

- Het 3D complex dient uitgelijnd te worden met de gaten in de bodemplaat. 2 **kunststof** bouten (M4, 10 mm lang) dienen hier doorheen gehaald te worden een kunststof moer en een kunststof ring (zie figuur 13.2).

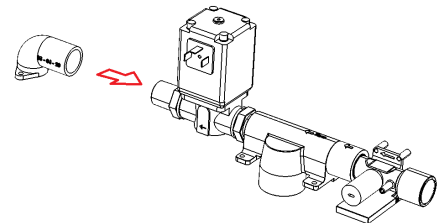
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(13.2)

14.

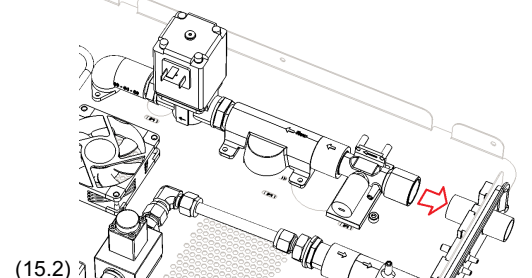
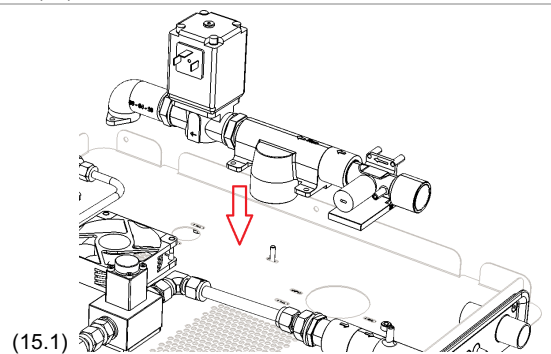
- The expiratory tract from sub-assembly 5 needs to be connected to the 3D printed elbow piece which will let the air flow through the bottom plate. Therefore, this needs to be connected to the 22 mm fitting by placing the 2 parts over each other (Figure 14).



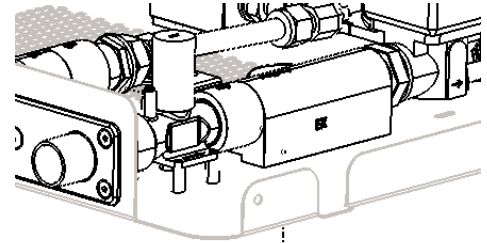
(14)

15.

- The expiratory tract will now be placed between the tube mounting and the exit through the bottom plate. The 3D complex needs to be connected to the tube mounting side. Therefore, the 22 mm fitting of the tube mounting and the 22 mm opening in the 3D complex need to be placed into each other (Figure 15.1 and 15.2).



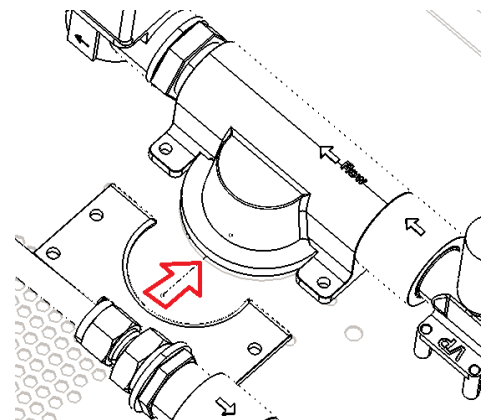
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- 16.
- Thereafter, the pressure relief valve needs to be added through the corresponding opening in the bottom plate.
 - Add the pressure relief valve (70 mbar) via the opening in the bottom plate in the 3D complex (Figure 16.1).
 - Add the 3D-printed plate, in order = to clamp the pressure relief valve (Figure 16.2).

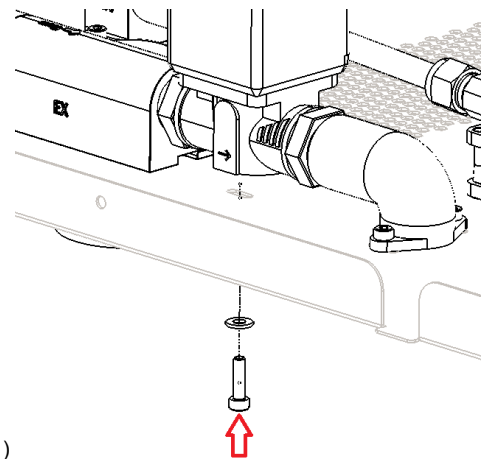
(16.1)

(16.2)



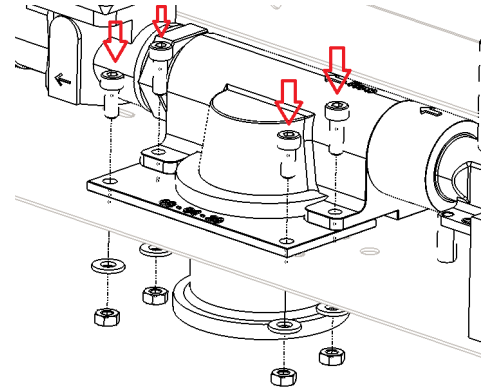
- 17.
- In the expiratory tract, the valve, 3D complex with the PRV and the connection need to be attached to the bottom plate.
 - For the expiratory valve, a M4 bolt 16 mm is used. If everything is right, the valve should not be placed on the bottom plate directly, but some space in between is left. Make sure that the bolt is actually turned into the (one of the) screw thread of the valve (Figure 17.1).
 - The 3D complex needs to be attached by the PRV. Therefore, another 3D printed plate needs to be added under the edge of the PRV, so this will be clamped (Figure 17.2). Thereafter, this needs to be attached to the bottom plate with 4 **plastic** bolts (M4, 2x10 mm and 2x 16 mm). As well, the plastic

(17.1)

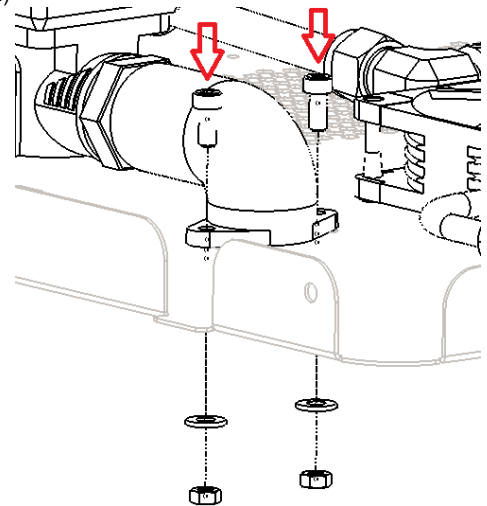


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- gaskets and nuts need to be used (Figure 17.2).
- The connection between the bottom plate and the outflowing air needs to be attached with 2 **plastic** bolts (M4, 10 mm). As well, the plastic gaskets and nuts need to be used (Figure 17.3).



(17.2)

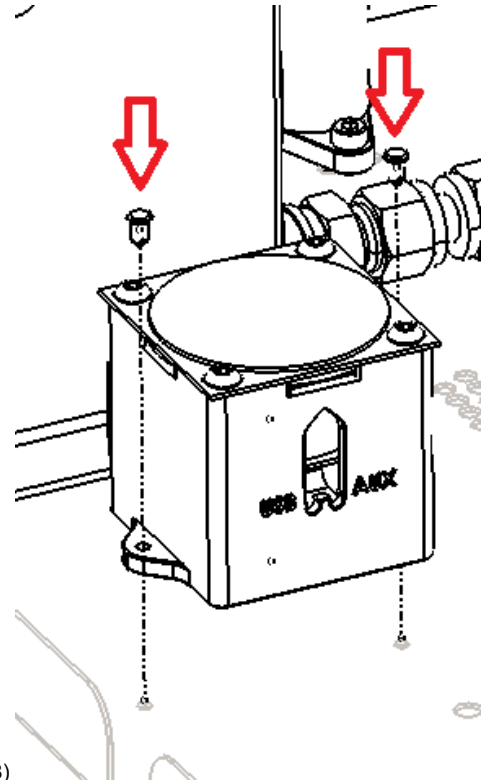


(17.3)

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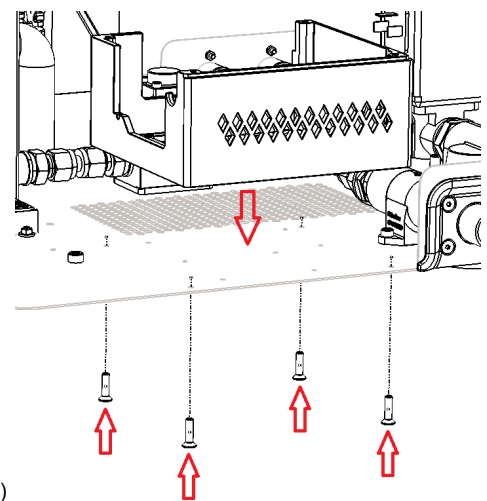
18.

- The speaker needs to be attached to the bottom plate. The speaker itself needs to be pointing upwards. Outline the gaps in the bottom plate with the gaps of the speaker housing. This needs to be pushed using a push-in rivet (3mm diameter), see Figure 18.
- Make sure that the volume button on the backside of the speaker is fully turned on (turned clockwise).



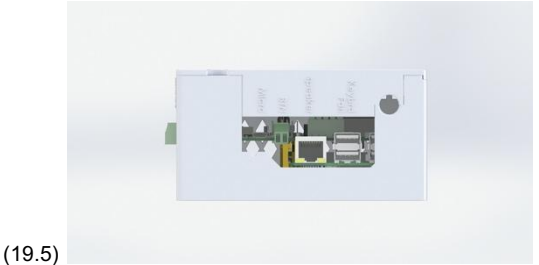
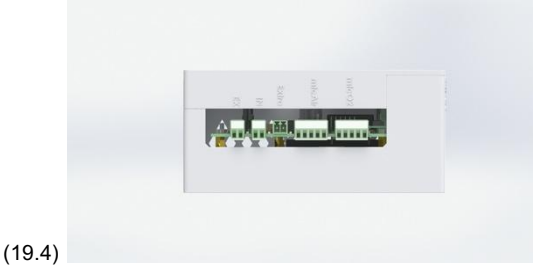
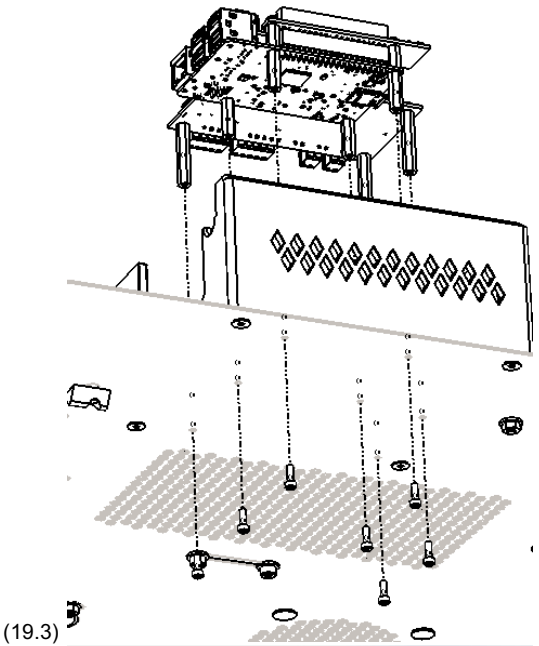
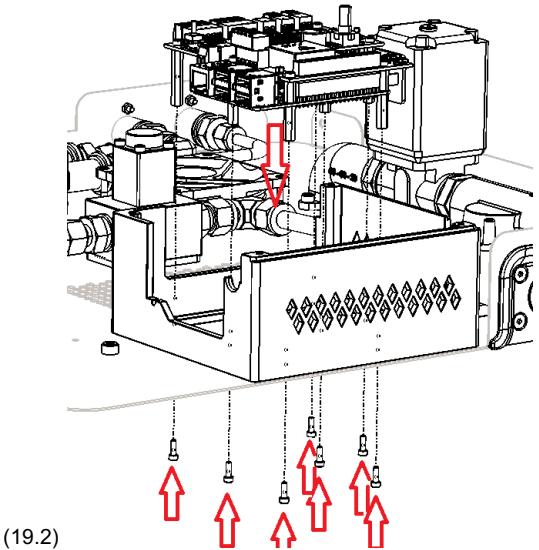
19.

- The PCB with the Raspberry Pi will be placed on the bottom plate altogether.
- First, the housing needs to be attached to the bottom plate (Figure 19.1). The will be attached by push-in rivets (3 mm diameter).
- **Now, connect the AUX cable and the USB cable of the speaker with the Raspberry Pi.**

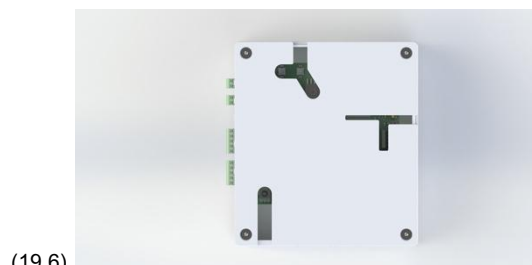


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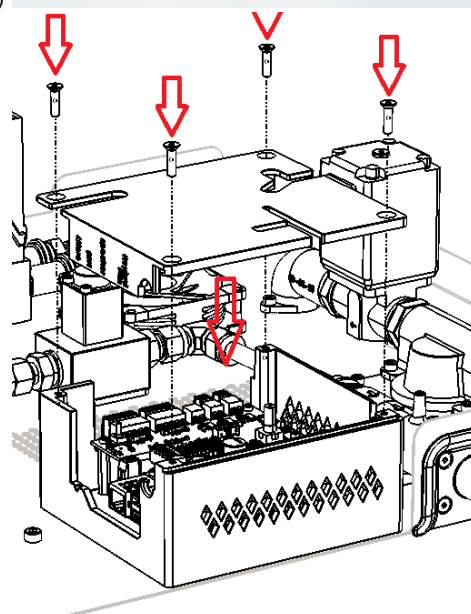
- Then, the PCB and Raspberry Pi will be placed in the housing. Therefore, cutouts are made in the housing. They need to be attached by 7 bolts (M2.5, 10 mm), see Figure 19.2 and 19.3.
- Make sure all the high pressure hoses and cables coming from the PCB complex are directed through the right openings (highlighted in the housing, Figure 19.4-19.6).
- Then, add the lid to the housing. Also here, some outcoming high pressure hoses and cables need to be let through.
- Finally, the lid need to be fastened with 4 countersunk self-tapping screws M4 (Figure 19.7).



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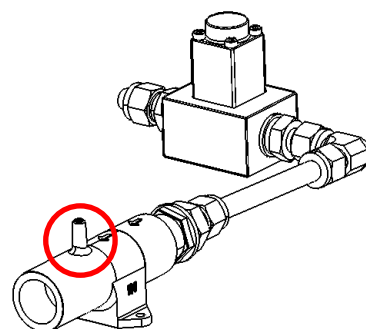


(19.6)

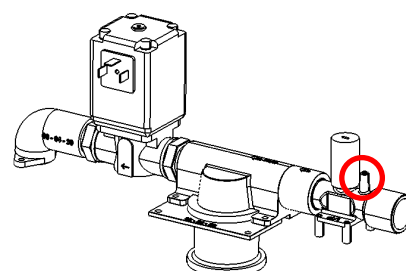


(19.7)

- Connect a high pressure hose (4 mm ID, 12 cm) to the inspiratory 3D-printed complex. This needs to be done with the high pressure hose from Landefeld, which can be recognized by its transparency (Figure 20.1).
- Connect a high pressure hose (4 mm ID, 22 cm) to the expiratory 3D-printed complex.



(20.1)



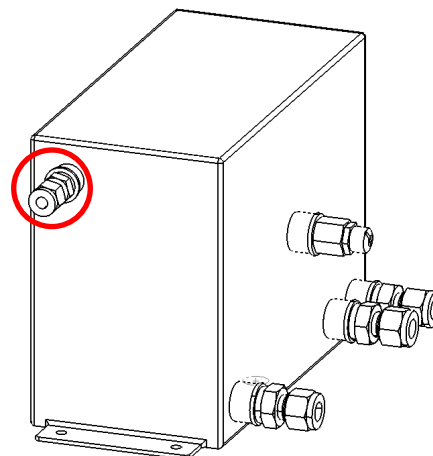
(20.2)

20.

- Connecteer een slang (4 mm binnendiameter, 22 cm lengte) aan het expiratoire 3D-geprinte complex. This needs to be done with the high pressure hoses from Landefeld, which can be recognized by its transparency (Figure 20.2).

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- Connect a high pressure hoses (4 mm ID, 20 cm) from the mixing chamber G $\frac{1}{8}$ " to the 6 mm (OD) fitting. This needs to be done with the high pressure hoses from Festo, which can be recognized by its opacity (Figure 20.3).

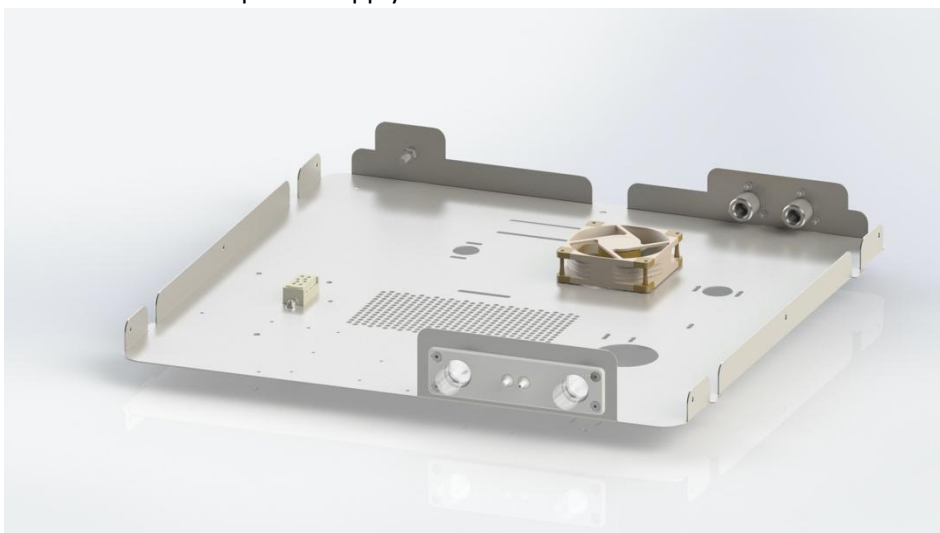


(20.3)

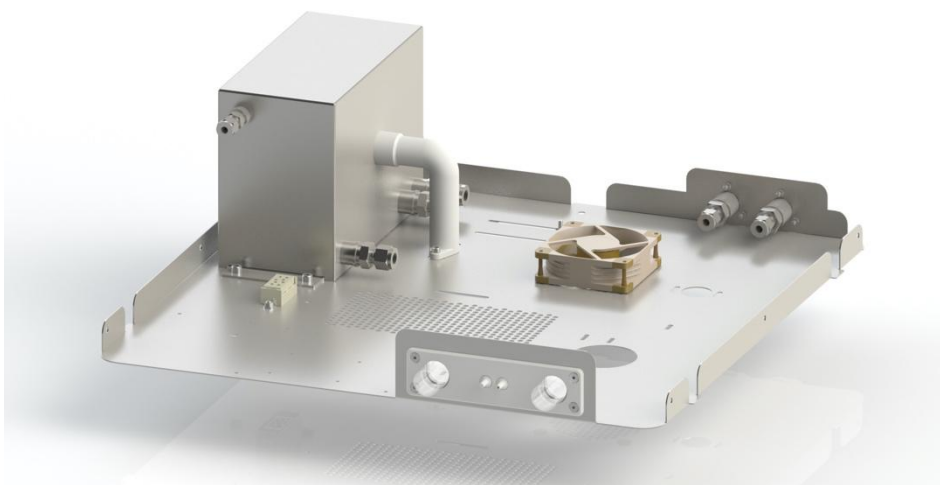
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If the assembly process is carried out correctly, the result should look like the Figures given below.

After attachment of the ventilator and power supply connector:

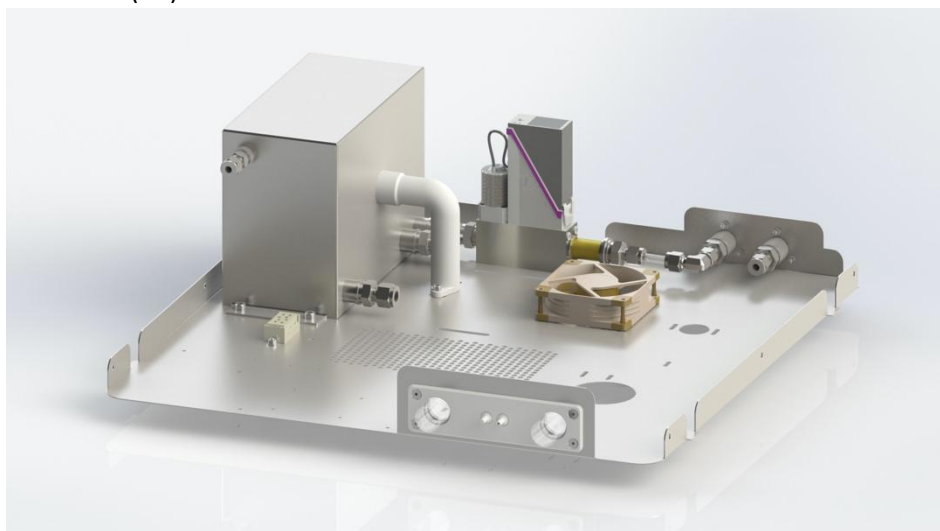


After attachment of the mixing chamber.

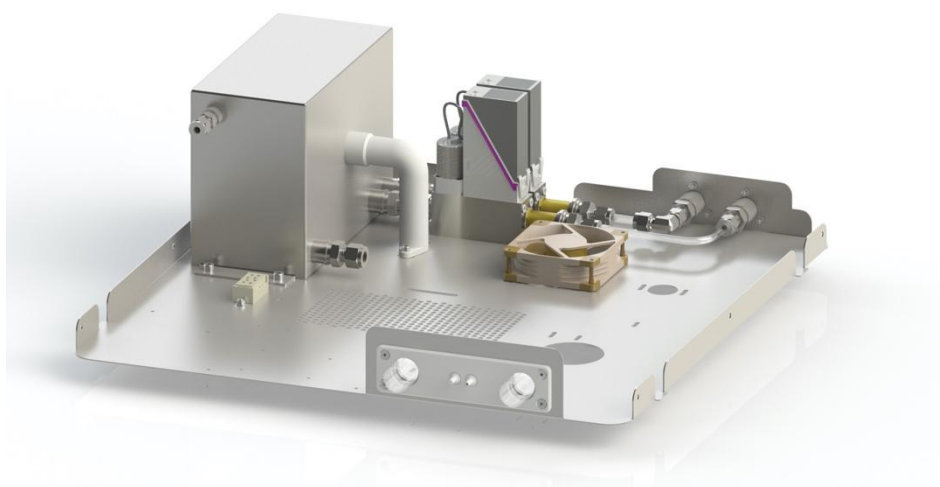


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After attachment of the MFC (air)

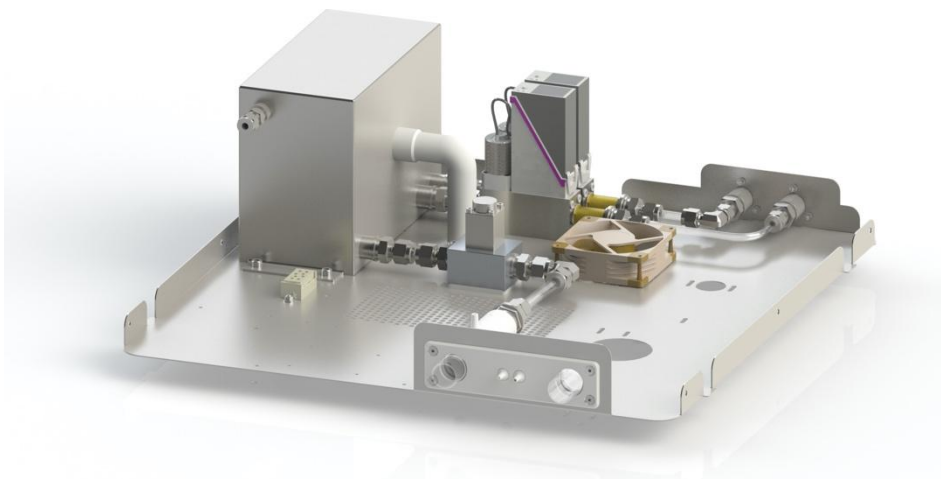


After attachment of the MFC (O₂)

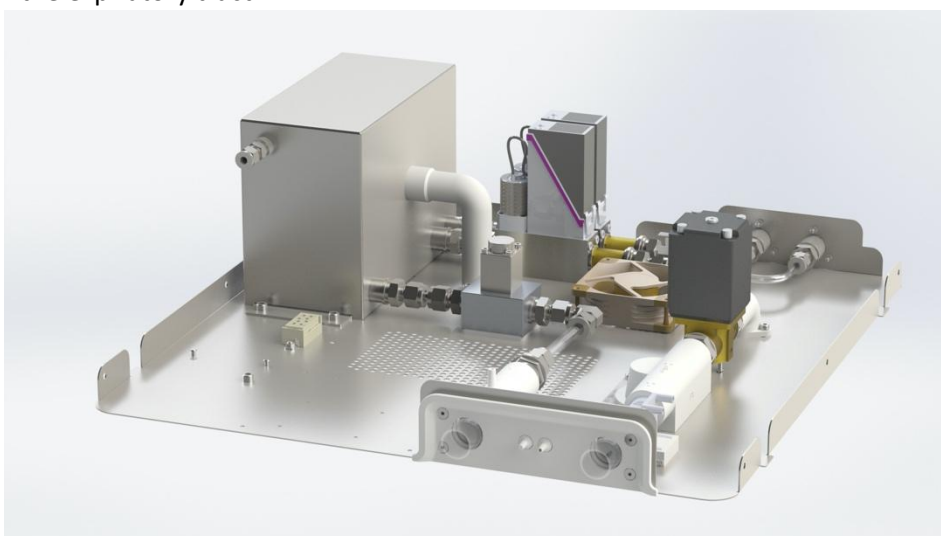


After attachment of the inspiratory tract.

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After attachment of the expiratory tract



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After attachment of the PCB components and the speaker.

