

SERVICE MANUAL

007132 M-1 EN-EU

VIVO45
by Breas

VIVO45 **LS**
by Breas

NIPPY4
by Breas

NIPPY4+
by Breas

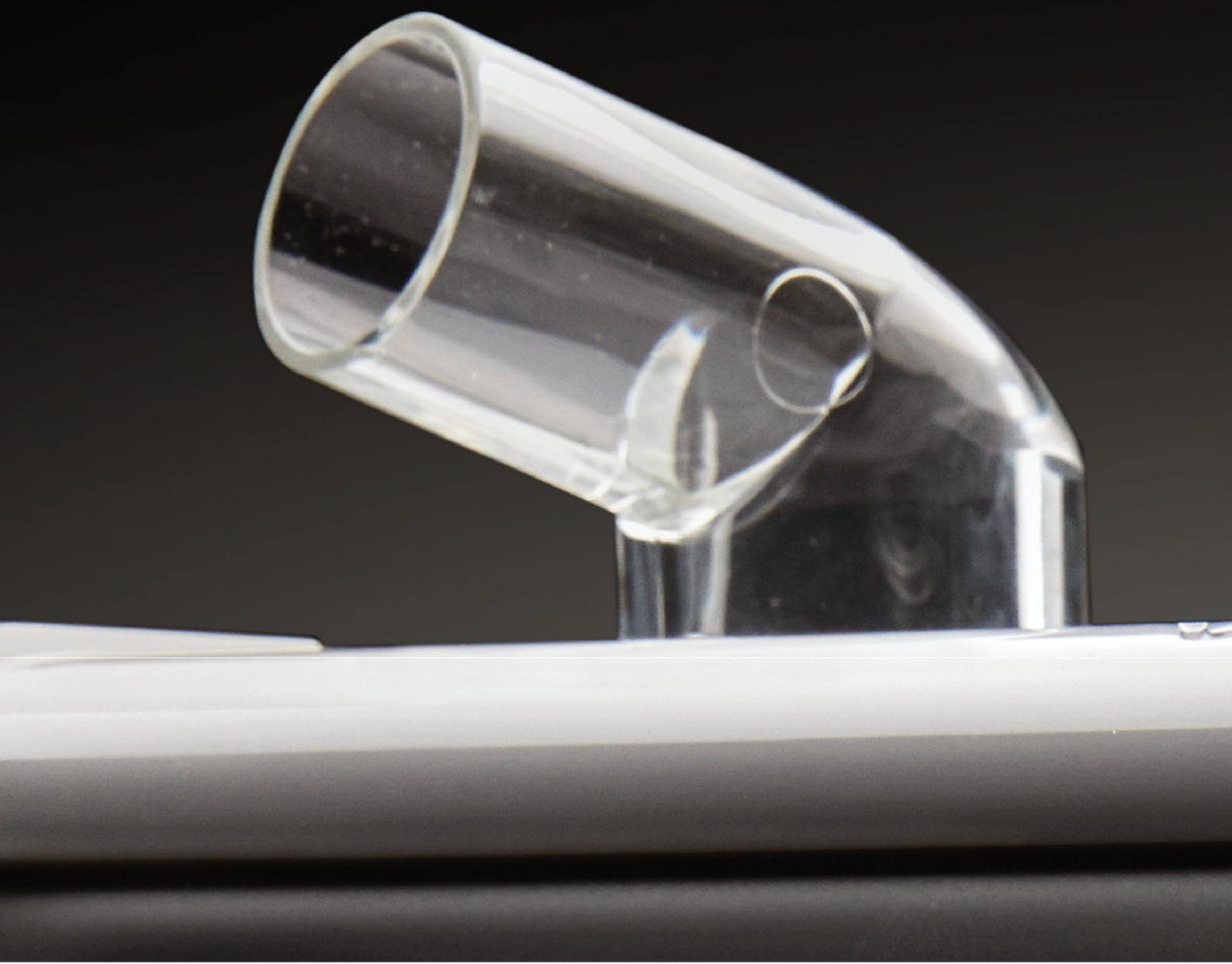


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1 Introduction

This chapter gives an overview of the ventilator and this service manual.



WARNING!

This product must be:

- Subjected to regular service, maintenance and control and any applicable upgrades, in accordance with Breas service instructions.
- Repaired and/or modified in accordance with Breas service manuals, technical bulletins, and any special service instructions, by service technicians that have been authorised after the Breas ventilator service training.

Deviation from these service instructions may lead to risk of personal injury!

1.1 Manufacturer Information

Legal Manufacturer



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Local Representatives Information

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1.2 About the Vivo 45 / Nippy 4 Series Ventilator

1.2.1 Function

The Vivo 45/Nippy 4 series are ventilators delivering ventilatory support for patients who require invasive or non-invasive mechanical ventilation. For detailed information about functions, settings and modes, see the ventilator's Clinician's Manual.

1.2.2 Intended Use



NOTE

For a detailed description on intended use, refer to the Clinician's manual.

1.2.2.1 Intended Audience

This service manual is intended for service technicians who have medical/technical training and who have a good knowledge of the construction and function of respiratory devices. Authorisation by Breas after service training is mandatory.



CAUTION!

Always contact your Breas representative if you have any questions or if training is required.

1.2.3 Design

The ventilator is designed around a blower assembly that delivers air to the patient.

The main processor monitors, for example, sensors for pressure and flow, and controls the blower to meet treatment settings and make breathing comfortable for the patient.

A number of various internal sensor readings are monitored to ensure that the ventilator functions correctly. Some of them are checked at power up, some at treatment start and some of them are monitored continuously.

1.2.4 Service Personnel's Training Requirements

Service personnel working with the ventilator shall have medical/technical training and a good knowledge of the construction and function of respiratory devices. Authorisation by Breas after service training is mandatory.



CAUTION!

Always contact your Breas representative if you have any questions or if training is required.

1.3 About this Manual

1.3.1 Scope

This manual describes all the routine maintenance checks and the additional service actions for the ventilator. The manual contains all the documentation that is required for the maintenance and the service of the ventilator, such as replacement parts lists, exploded drawings, cabling diagrams, component location guides and more.






NOTE

The service manual is to be used in conjunction with the User Manual and Clinician's Manual for the Vivo to be serviced.

1.3.2 Icons

In this manual, icons are used to highlight specific information. The meaning of each icon is explained in the table below.

Icon	Explanation
	Warning! Risk of death or serious personal injury.
	Caution! Risk of minor or moderate injury or risk of equipment damage, loss of data, extra work, or unexpected results.
	Note Information that may be valuable but is not of critical importance, tips.

1.4 Applicable Ventilators

This manual is applicable to the following ventilators:

- Vivo 45
- Vivo 45 LS
- Nippy 4
- Nippy 4+

2 Maintenance Instructions

This chapter describes all the routine maintenance checks and additional service instructions for the ventilator.



WARNING!

This product must be:

- Subjected to regular service, maintenance and control and any applicable upgrades, in accordance with Breas service instructions.
- Repaired and/or modified in accordance with Breas service manuals, technical bulletins, and any special service instructions, by service technicians that have been authorised after the Breas Vivo 45/Nippy 4 service training.

Deviation from these service instructions may lead to risk of personal injury!



NOTE

The patient and care provider should follow the checks that are described in the User manual/Clinician's manual.

2.1 Purpose

The ventilator is designed to give users many years of trouble-free breathing assistance, provided that the preventive maintenance is carried out at the intervals specified in this manual. Well-performed maintenance services will ensure the performance during its lifetime.

It is also important that any peripheral equipment is checked at the same time as the services are carried out

2.2 Service Software/Upgrade Tool

The Service Software/Upgrade Tool includes procedures for trained and authorized technical personnel to perform complete function tests, which shall be performed every second year. Also, this tool is used for calibrating units after repair in the field and upgrading firmware in the ventilator.

Functions:

- Complete function check of the ventilator
- Automatic/manual calibration of flow sensors and pressure sensors
- Battery health
- Super Cap capacity status
- Upgrade Firmware

2.3 Introduction

Before you start a maintenance service, read the safety precautions and make sure you have a new service record and all the necessary equipment, tools, and replacement parts at hand.

2.3.1 Safety Precautions

Follow the safety precautions below when working with the ventilator:

- Do not work on the ventilator with the casing removed and the power supply connected, unless the instructions in this manual, or other special service instructions sent out by Breas, clearly says so.
- Always use extreme caution when working with the ventilator connected to the mains or any other power source and the casing removed.

- Do not use explosive gases and/or fluids near the ventilator.
- Make sure that all precautions to prevent electrostatic discharge (ESD) have been taken. Follow all regulations regarding ESD.



NOTE

The Clinician's Manual contains extended lists of safety precautions.

2.3.2 Service Schedule

Product	Replace the Blower Assembly	Replace the Battery
Vivo 45		When necessary. The expected lifetime of the internal battery is 3 years.
Vivo 45 LS	20,000 hours	When the Battery Health parameter is below 80% (expected lifetime is approximately 3 years).
Nippy 4		When necessary. The expected lifetime of the internal battery is 3 years.
Nippy 4+	20,000 hours	When the Battery Health parameter is below 80% (expected lifetime is approximately 3 years).

2.3.3 Service Record

The Breas service record is found in Appendices below.

Copy the service record and use it for noting the service checks while performing service every second year.

2.3.4 Inspection Equipment and Tools

Before starting the service of the ventilator, make sure you have the following equipment at hand:

- Test lung (for example Breas part no 001917)
- Ventilator tester (for example, Fluke VT Plus, Fluke VT305, Fluke VT650/900, IMT Citrex H4/H5, IMT PF300)
- Or:
 - Flow meter
 - Pressure manometer
 - Measuring instrument for tidal volume and minute volume/rate
- Torque screwdrivers:
 - Torx TX3
 - Torx TX10
- PH1 screwdriver
- Pliers
- ODU tool
- Service Software, available for download from Breas Extranet. Contact Breas technical support for more information. Test connector kit, Breas part no 004829 (connectors and leakage ports used when testing).
- Vivo to PC communication cable, Breas part no 005757

2.3.5 Replacement Parts

The following replacement parts should be available when servicing the ventilator:

Item	Part No	Quantity
Air inlet filter, grey, washable	007104	5
Air inlet filter, white, disposable	007103	5
Cooling air filter	007105	1

If required:

Item	Part No	Quantity
Blower, complete	007271	1
Super capacitor/Clock battery	007260	2
Internal battery	007256	1

2.4 Preparing for Inspection

2.4.1 Initial Recording

- 1 Copy a new service record form (at the end of this manual).
- 2 Note the model and serial number and any inventory number on the service record.
- 3 Check any comments recorded on the previous service records.
- 4 Document the current patient settings. A form is found in the User Manual.

2.4.2 Checking Additional Services

- 1 Note the number of device operating hours on the service record.



NOTE

The operating hours are found at the “Device information” screen. Access the “Device information” using the menu as described in the Clinician’s manual.

- 2 Check the schedule in the service record to see whether the alarm/clock battery, the internal battery kit, or the complete blower assembly needs to be replaced.

2.4.3 Inspecting the Markings

Make sure that all markings on the ventilator’s information labels can be read:

- Model description, serial number
- Warning texts
- Any inventory marking
- Any other texts

For information about label placements, see the section on part location.

2.4.4 Information from the Patient/User

Check the following with the patient:

- Has the ventilator functioned without any problems? If not, what were they?
- How does the patient/care provider check the function of the ventilator? How often?
- How often is the filter replaced?
- How many filters will be required until the next service?
- Other observations?

2.4.5 Validity of the Documentation

- 1 Check the validity of the User Manual enclosed with the ventilator (see Breas extranet).
- 2 Check if any modification or upgrading of the ventilator needs to be done at the same time as the service (see Breas extranet).

2.5 External Inspection

2.5.1 Visual Inspection for External Damage and Wear

- 1 Clean the outside of the ventilator using a mild soap solution.
- 2 Check for any visible damage to the casing and the other components.
- 3 Check that nothing has become loose.
- 4 Check the oxygen low pressure/bleed-in inlet.

2.5.2 Checking the Power Connection

1. Check the plugs on the power cords, the two cords themselves, and the ventilator's power socket.
2. Check the click-in battery socket in the ventilator.
3. If used, check that the external DC power cord is not damaged.

2.5.3 Inspecting the Patient Circuit

Inspect the patient circuit and replace it if necessary.

2.5.4 Inspecting the Ventilator Accessories

Check any other accessories that are used with the ventilator.

2.5.5 Changing/Washing the Patient Filters

- 1 Change the white air filter.
- 2 If necessary, change the grey filter.
- 3 Make sure the patient has enough filters to last until the next service.

2.5.6 Changing the Cooling Air Inlet Filter

Open the cooling air filter holder and replace the filter. For detailed information about replacing filters, see the User Manual.

2.5.7 Minimum Function Check

- 1 Connect the power cord.
- 2 Connect the patient circuit.
- 3 Switch on the ventilator and make sure it operates normally.

2.6 Internal Inspection



WARNING!

Make sure to disconnect the power supply before opening the casing of the ventilator.



CAUTION!

Always perform an internal inspection after having opened the ventilator.

2.6.1 Cleaning the Inside of the Ventilator

- 1 Open the casing. See the section on opening the ventilator for instructions.
- 2 Remove any dirt or dust that has accumulated in the ventilator.

2.6.2 Checking the Cables

Inspect all the cables and their connectors. Make sure that the cables and the wires are not pinched or kinked.

2.6.3 Checking the Fastening of Components

- 1 Make sure that all the components, such as the pneumatic block, the circuit boards and the connectors are securely fastened.
- 2 Check that the blower assembly is placed correctly and that the vibration dampening pad is properly in place.
- 3 Check that the cooling fan is placed correctly.
- 4 Make sure that all tubes are properly fastened and not pinched or kinked. Do not forget the air inlet and outlet of the blower assembly.

2.6.4 Checking the Power Adapter

- 1 Check that the power adapter is undamaged.

2.6.5 Reassembling the Casing

See the section on opening the ventilator and replacing parts for instructions.

2.7 Power Failure Test

2.7.1 Checking the Power Failure Alarm



NOTE

The “Low Alarm Battery” alarm shall not be active prior to the test.

- 1 Remove the internal battery as in 5.1 *Replace the Internal Battery*, page 29.
- 2 Connect the ventilator to mains.
- 3 Turn the ventilator on and start treatment.
- 4 Disconnect mains power supply.
- 5 Make sure that the ventilator gives the power failure alarm. The power failure alarm is given with an audible signal and the red alarm LED flashing. The alarm shall be given for, at least, two minutes. If the power fail alarm stops within two minutes, change the super capacitors (see section 5.15 *Replace the Super Capacitors* , page 46).
- 6 Reconnect the internal battery as in 5.1 *Replace the Internal Battery*, page 29.

2.8 Complete Function Test



To perform the complete function test you need the Service Software, which can be downloaded from the Breas Extranet. Also, you will need the equipment listed in the section on tools above.

Contact Breas technical support for more information.

2.9 CO₂ Sensor Gas Span Check

If a CO₂ sensor is used with the ventilator it shall be checked once a year to verify the sensor readings.

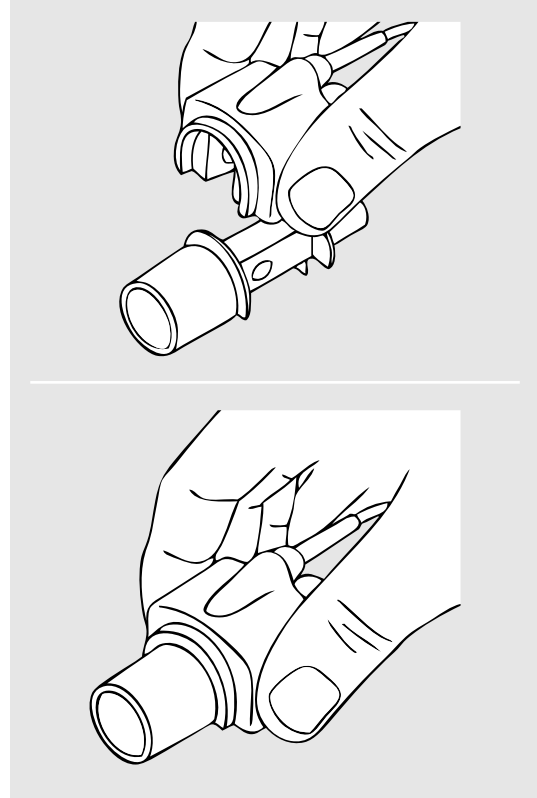
To perform the CO₂ gas span check you need CO₂ calibration gas consisting of:

- 5% CO₂ (carbon dioxide)
- 21% O₂ (oxygen)
- 74% N₂ (nitrogen)

You will also need a gas regulator.

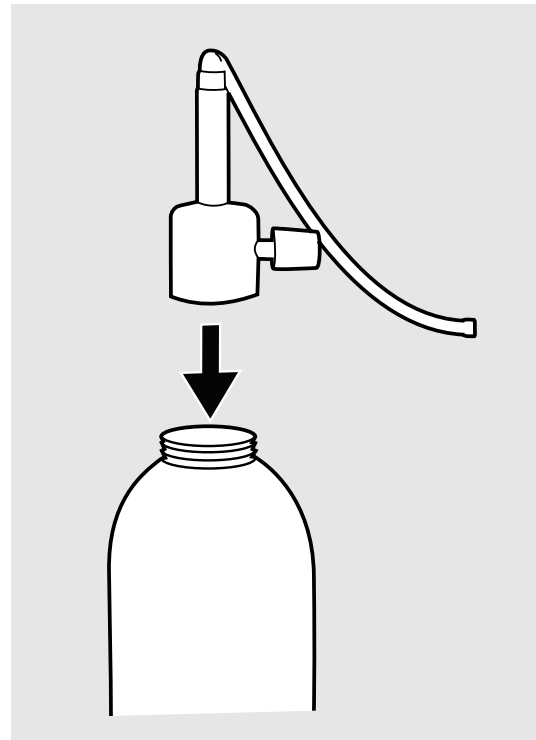
2.9.1 How to perform the CO₂ Gas Span Check

- 1 Snap on a new airway adapter to the CO₂ sensor probe.

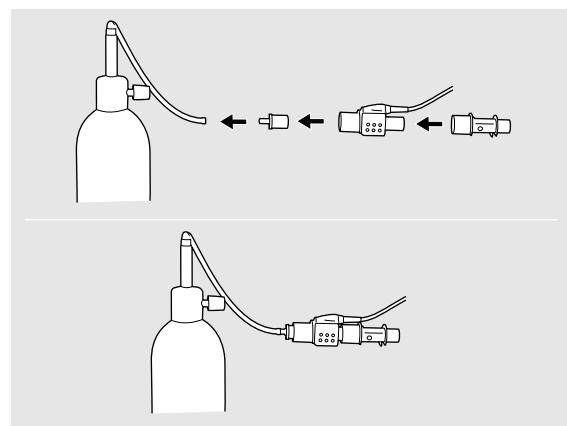


- 2 Perform a CO₂ zeroing procedure.
You will find the zeroing procedure under “FiO₂/CO₂ Calibration” in the “Others” section

- 3 Mount the gas regulator on the gas bottle.
Be careful not to damage the thread on the bottle.
Make sure that the pressure indicator is not within the red mark.



- 4 Connect the CO₂ sensor to the CO₂ calibration gas as below. The extra airway adapter mounted behind the CO₂ sensor is to make sure that no ambient air is present during the check.



- 5 Connect the CO₂ sensor to the ventilator.



For detailed information, see the Clinician's Manual, the Using Accessories chapter.

- 6 Change the ventilator device settings so that the CO₂ unit is set to percent (%).
Menu path:
Others > Device Settings > CO₂ Unit
- 7 Open the gas valve and adjust the flow so that the float of the rotameter lies above the first line (or 0.5 l/min if other equipment is used) and let it flow for 30 seconds.
The gas bottle must be in an upright position when performing the gas span check.
- 8 Check the "CO₂ Momentary" reading on the ventilator.
Menu path:
Others > FIO₂/CO₂ Calibration
If the Momentary value is not between 4.5-5.5%:
 - Be absolutely sure that the CO₂ sensor is in ambient air and perform the CO₂ zeroing procedure again.
 - Check the expiration date of the gas bottle and that the pressure indicator is not within the red mark.

- Make sure that you have attached an extra airway adapter behind the CO2 sensor and that the output from the second adapter is unconnected out in ambient air.
- Check that the luer lock plug on the side of the gas regulator is tightly connected.
- Do not use a sensor that fails the gas span check.

2.10 Electrical Safety Precautions

Electrical safety measurements must be made in accordance with IEC 60601-1 3rd edition.

Requirements

- Use an automatic electrical safety tester to make the measurements.
- All tests must be performed in accordance with class II type BF (IEC 60601-1).

2.10.1 Preparations

Supply Voltage Reading

Note the power voltage reading.

The voltage must be noted at each service check, as the currents measured are directly in relation to the supply voltage. This allows all measurements made on the same ventilator to be compared with measurements made on different occasions.

2.10.2 Insulation Check

The insulation resistance is measured using a 500 V DC power supply. The most suitable method is to connect the plus lead to the two ventilator power socket pins, and the minus lead to the casing or the patient air connector. The measurements made during the delivery inspection can be used as reference values for measurements made during future services. If no reference values are available, the value for the insulation resistance should be $\geq 70 \text{ MW}$.

2.10.3 Leakage Currents Check



NOTE

The leakage current check is optional.

The leakage current check is not necessary to ensure safe use of the Vivo.

The leakage currents are measured at different parts of the ventilator using an RC circuit to earth.

Make the measurements partly at normal case (NC) and at the single fault condition (SFC). Reverse the polarity of the power supply and note the highest value.

Leakage currents to earth must not exceed the stated limit values.

2.10.3.1 Leakage Currents from the Casing

The leakage current of the casing is measured at an unpainted point, for example, the head of a screw.

Limit values:

- NC $< 0.1 \text{ mA}$
- SFC $< 0.5 \text{ mA}$

Break neutral for SFC.

2.10.3.2 Patient Leakage Currents

The patient leakage current is measured between the patient connector and earth.

Limit values:

- NC $< 0.1 \text{ mA}$
- SFC $< 0.5 \text{ mA}$

Break neutral for SFC.

2.10.3.3 Leakage Currents with Mains Power Supply at the Patient-connected Part

This test must be done using an automatic electrical safety tester with this function. See the safety instructions for the tester.

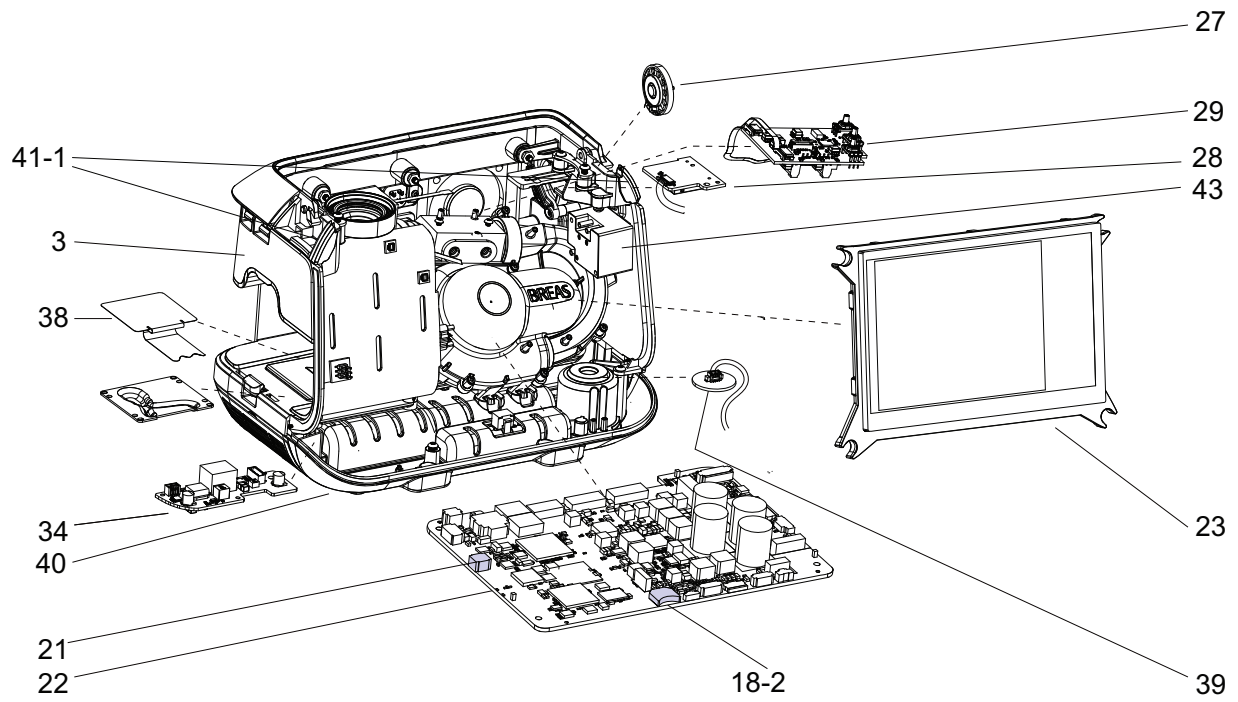
Limit value: SFC <5 mA

2.10.3.4 Leakage Currents with Mains Power Supply at the Patient-connected Part

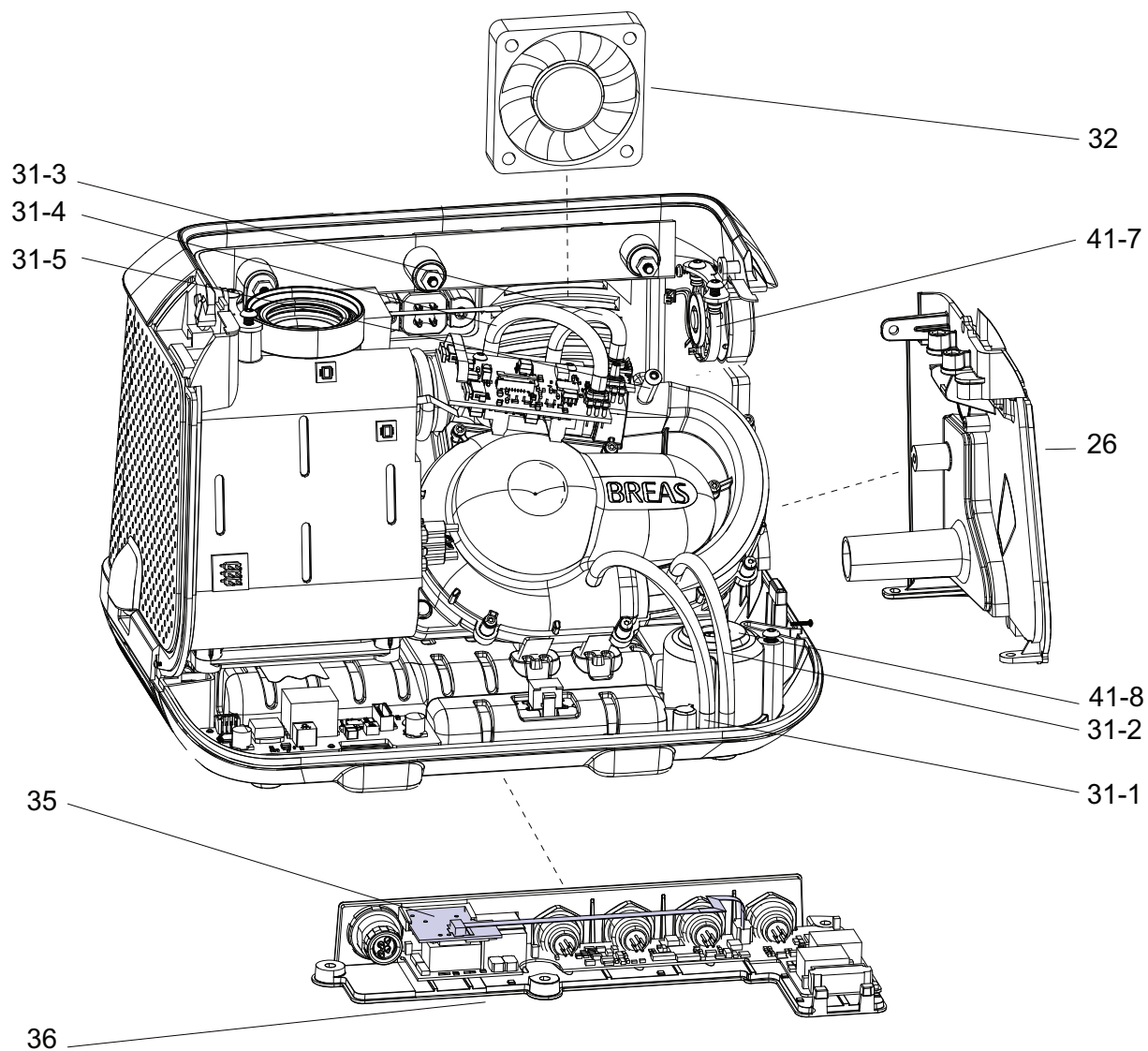
This test must be done using an automatic electrical safety tester with this function. See the safety instructions for the tester.

Limit value: SFC <5 mA

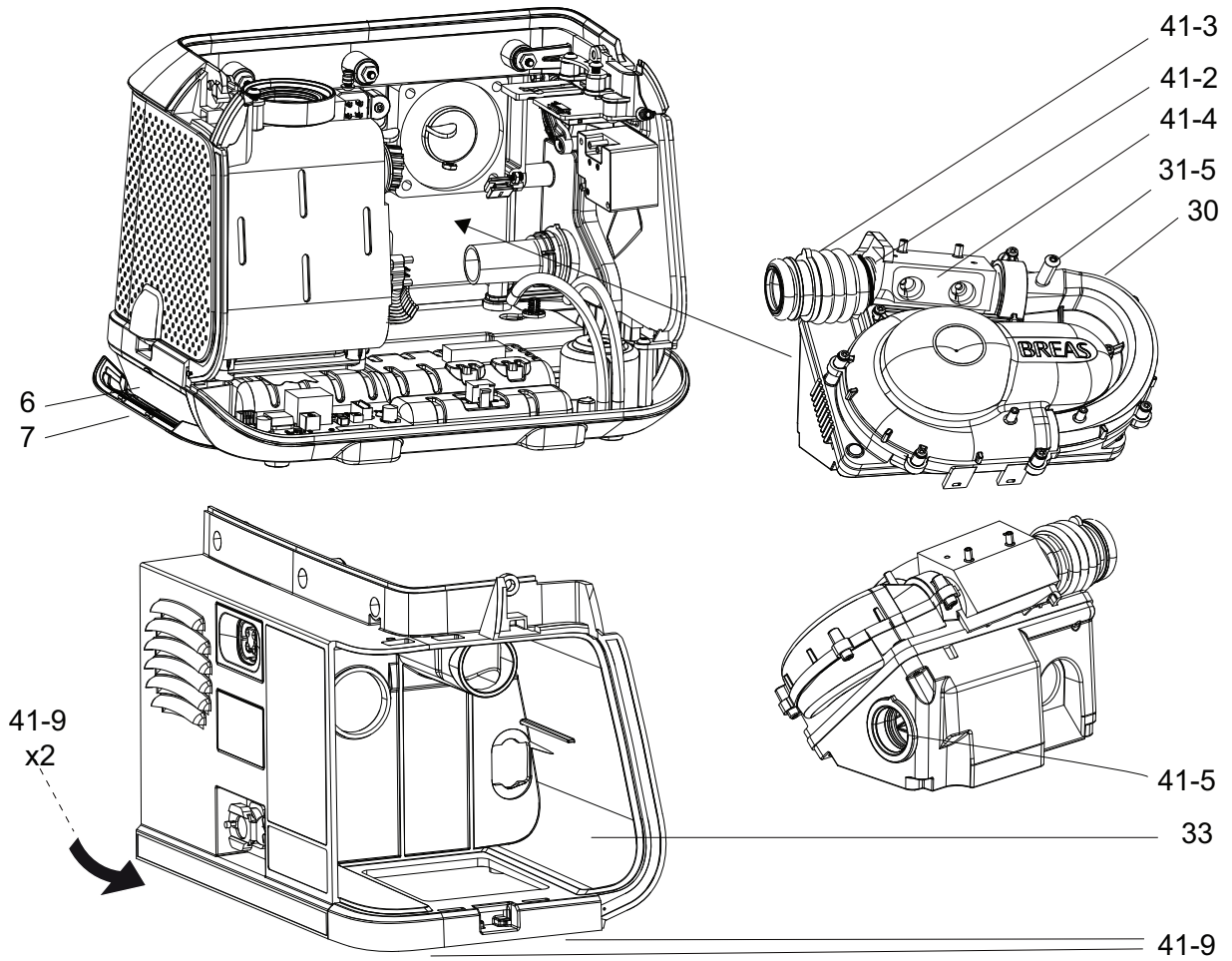
3.3 View C



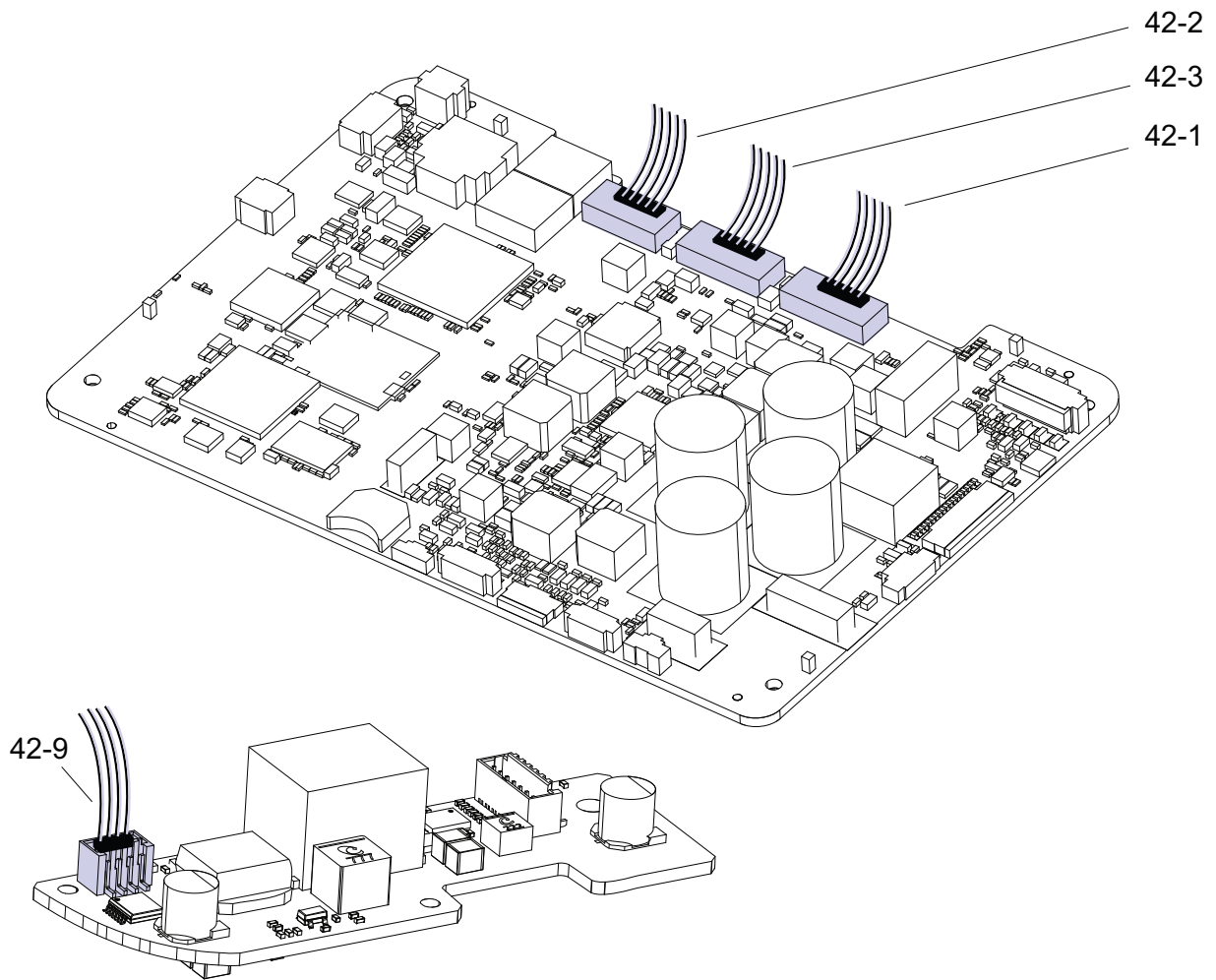
3.4 View D



3.5 View E

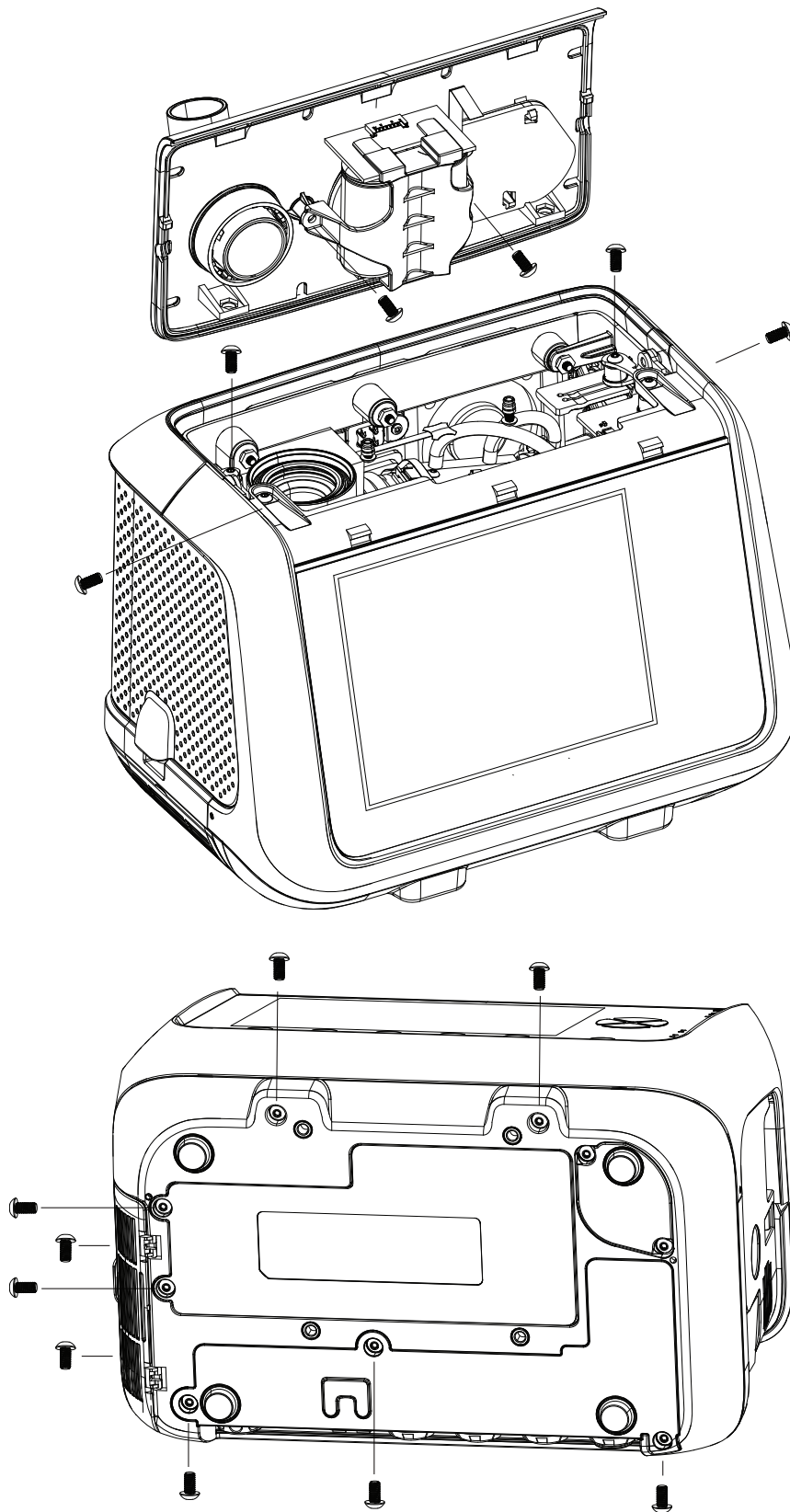


3.6 View F

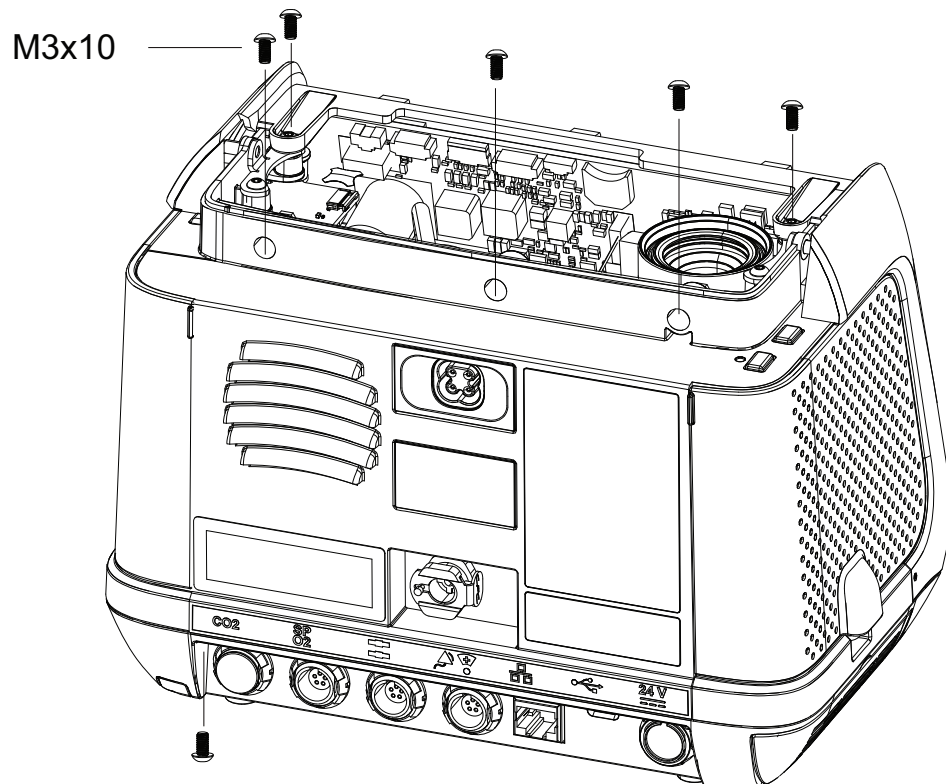


3.7 Screw Kits

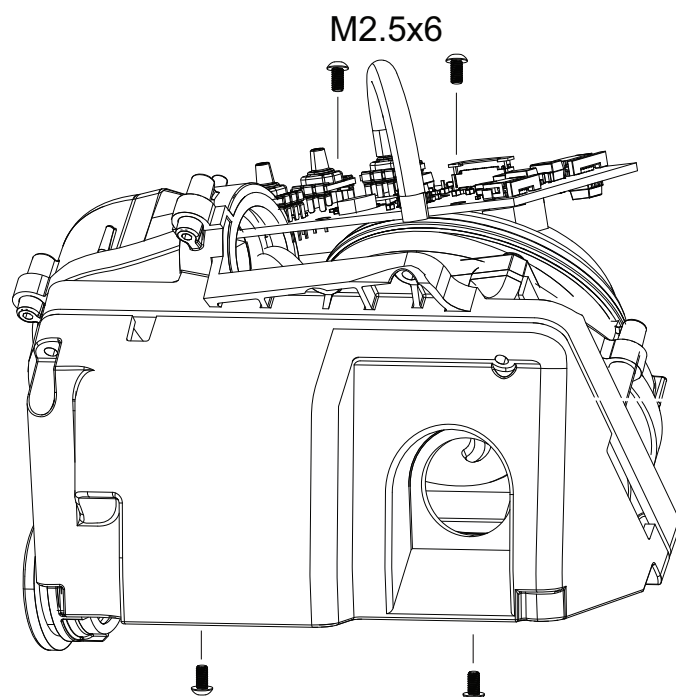
3.7.1 MRT M3x6 FZB



3.7.2 M3x8 and MRT 3x10 FZB



3.7.3 M2.5x6 and Isolation Screw Grommets



3.8 Part List

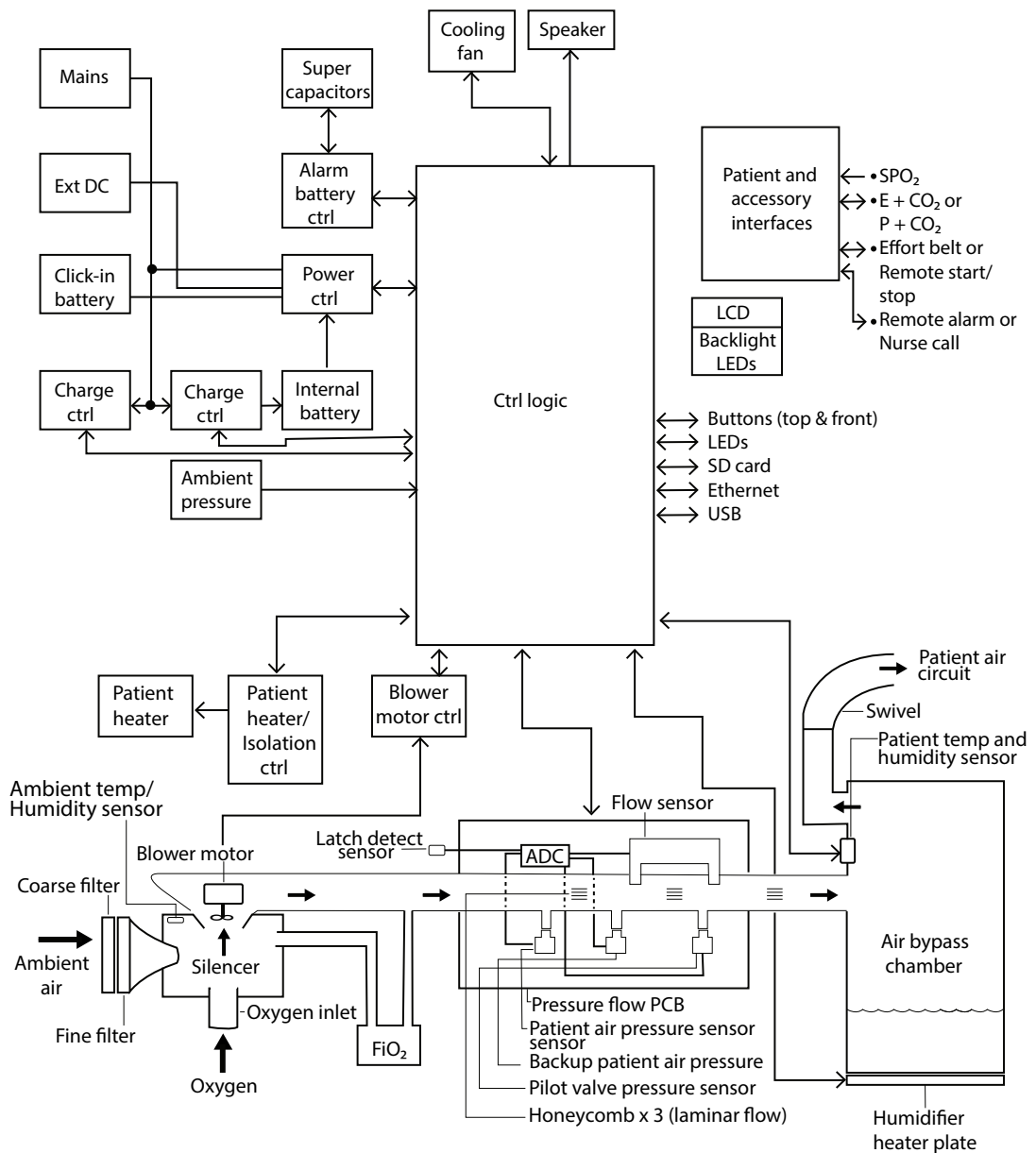
Kit No	Description	Breas Part No	Amount
1	Side panels	Vivo 45 and	
1-1		Nippy 4+:	1
1-2		007065	1
1	Side panels	Vivo 45 LS:	
1-1		007518	1
1-2			1
2	Side panels	Nippy 4: 007066	
2-1			1
2-2			1
3	Air bypass	007064	1
4	Air inlet filter, washable (grey)	007104	5
5	Air inlet filter, disposable (white)	007103	5
6	Cooling air filter	007105	1
7	Cooling air filter cover	007251	1
10	Feet/FiO2 cover	007252	
10-1	Feet		4
10-2	FiO2 cover		1
11	Handle kit	007253	
11-1	Handle assembly		1
11-2	Bracket handle hinge (METAL)		2
12	Label kit	Vivo 45: 007254	1 of each
	12-1 Label O2		
	12-2 Label, connector		
	12-3 Label, product		
	12-4 Label, Clear S/N		
13	Label kit	Nippy 4: 007255	1 of each
	13-1 Label O2		
	13-2 Label, connector		
	13-3 Label, product		
	13-4 Label, Clear S/N		
12	Label kit	Vivo 45 LS: 007649	1 of each
	12-1 Label O2		
	12-2 Label, connector		
	12-3 Label, product		
	12-4 Label, Clear S/N		
	12-5 Label, pilot pressure		
13	Label kit	Nippy 4+: 007650	1 of each
	12-1 Label O2		
	12-2 Label, connector		
	12-3 Label, product		
	12-4 Label, Clear S/N		
	12-5 Label, pilot pressure		
14	Internal battery	007256	1

Kit No	Description	Breas Part No	Amount
15	Screw kit 15-1 Screw MRT M3x6 FZB 15-2 Screw MRT 3x10 FZB 15-4 M2.5 x 12 Screw, Torx 15-6 M3 x 8 Screw, Torx 15-7 Screw, 1 mm, thread-forming 15-8 Nut, M3	007257	26 1 6 6 2 1
16	Top casing incl. swivel	Vivo 45: 007258	1
17	Top casing incl. swivel	Nippy 4: 007259	1
18	Super capacitor/Clock battery kit 18-1 Super cap 18-2 Clock battery	007260	1 1
19	Super capacitor cover	007261	1
20	Top buttons incl. cable	007262	1
21	PCB humidifier sensor	007263	1
22	CPU board (Specify model and language when ordering.)	005930	1
23	LCD display	007264	1
24	Front panel kit	Vivo 45: 007265	1
24	Front panel kit	Vivo 45 LS: 007651	1
25	Front panel kit	Nippy 4: 007266	1
25	Front panel kit	Nippy 4+: 007652	1
26	Right cover assembly	007267	1
27	Beeper	007268	1
28	SD card, PCB	007269	1
29	PTU board	007270	1
30	Blower, complete	007271	1
31	Tube kit 31-1 Air into the FiO ₂ sensor 31-2 Air out from the FiO ₂ sensor 31-3 Air into the measurement tube 31-4 Air out from the measurement tube Additional tubes for Vivo 45LS and Nippy4+ only 31-5 Transparent tube on blower 31-6 Piezo valve to T-connector 31-7 Piezo valve to blower 31-8 T-connector to PTU board 31-9 Exhalation valve to T-connector 31-10 T-connector	007272	1 of each

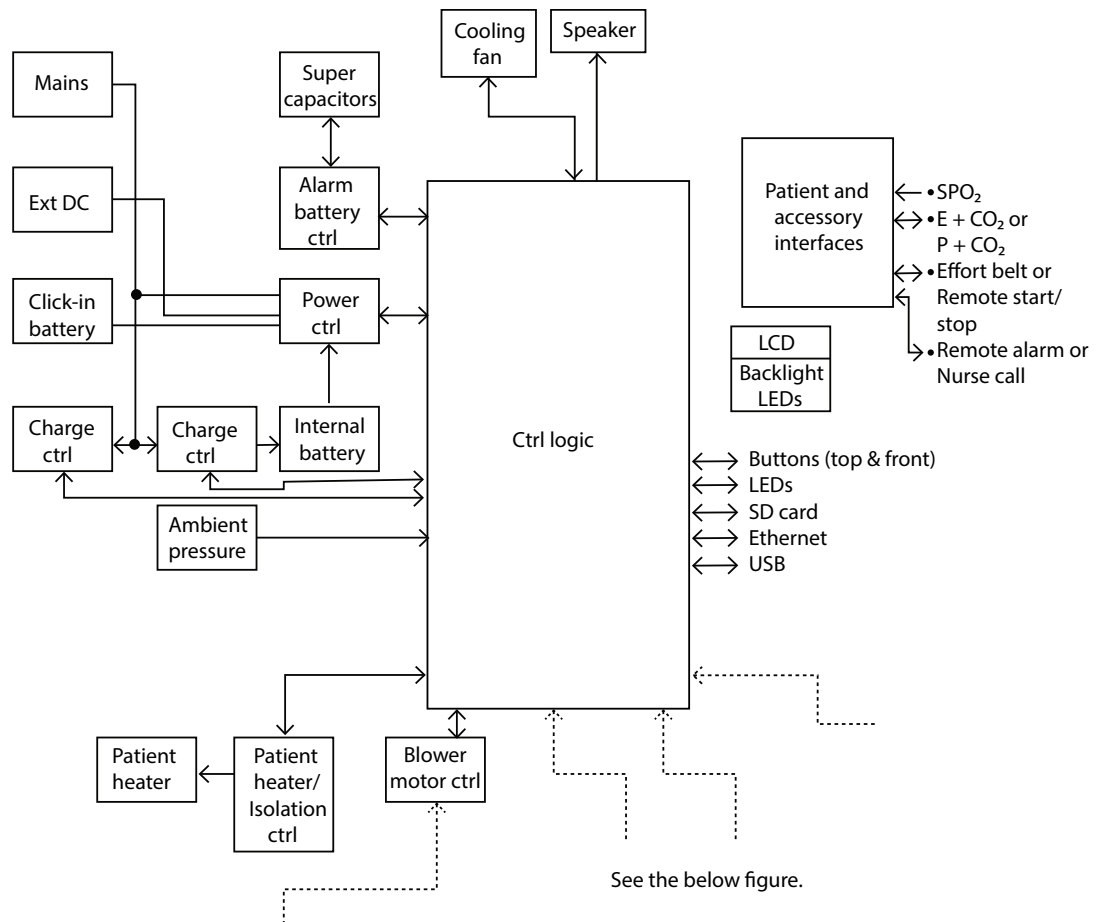
Kit No	Description	Breas Part No	Amount
32	Cooling fan	007273	1
33	Back casing assembly	007274	1
34	PCB, heated wire	007275	1
35	USB board	007276	1
36	Complete contact board	Vivo 45, 45 LS, Nippy 4+: 007277	1
37	Complete contact board	Nippy 4: 007278	1
38	Humidity plate	007279	1
39	FiO ₂ board	007280	1
40	Bottom casing	007281	1
41	Silicone parts kit	007282	
	41-1 Silicone sealing front		2
	41-2 O-ring, blower output		1
	41-3 Gasket, blower outlet		1
	41-4 Flow meter gasket		1
	41-5 Silencer inlet gasket		1
	41-7 Gasket, speaker		1
	41-8 Gasket, FiO ₂ PCB		1
	41-9 Seal plug		4
42	Cable kit	007283	
	42-1 Internal battery cable		1
	42-2 DC cable		1
	42-3 Click-in battery cable		1
	42-4 Display cable		1
	42-5 Cable super cap		1
	42-6 PTU/main flex cable		1
	42-7 FiO ₂ cable		1
	42-8 Contact/Main cable		1
	42-9 Heated wire/Main cable		1
43	Piezo valve (Vivo 45 LS and Nippy 4+ only)	007648	1

4 Functional Diagram

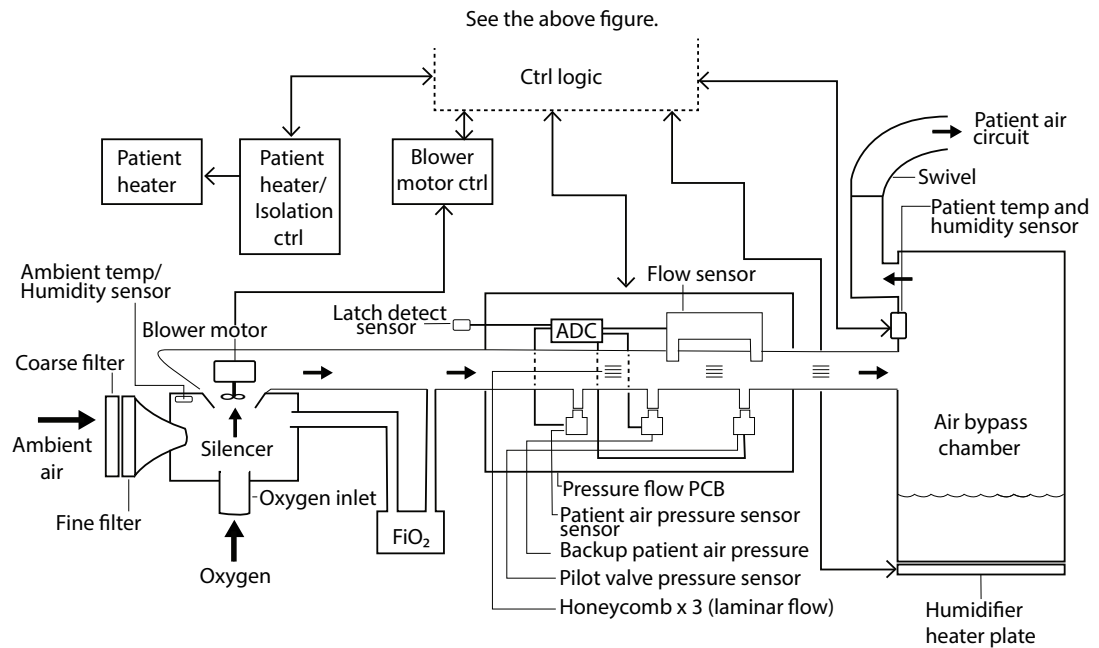
Complete Overview



Upper Part Details



Lower Part Details



5 Opening the Ventilator and Replacing the Main Components

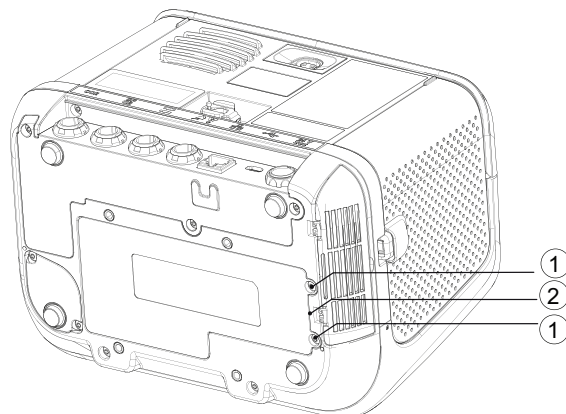
This chapter describes how to disassemble the main components of the ventilator. Assembly is done in the reverse order.

5.1 Replace the Internal Battery

- 1 Remove the two screws (1).

Torque: 0.7 Nm

Size: M3x6



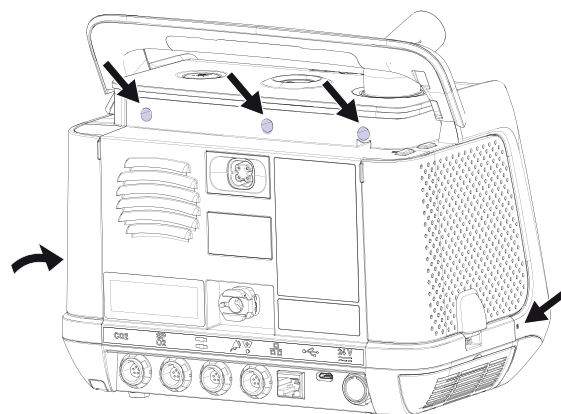
- 2 Pick up the cover using a screwdriver in the joint (2).
- 3 Take out the battery.

5.2 Open and Close the Ventilator

- 1 Remove the two screws, one on each side.

Torque: 0.7 Nm

Size: M3x10

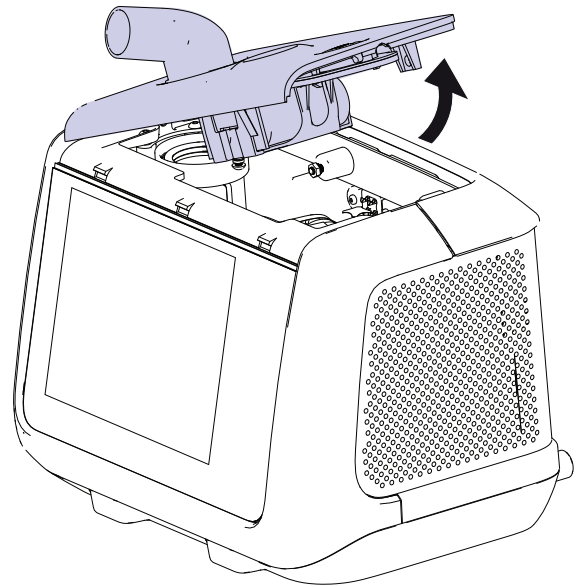


- 2 Remove the three top screws.

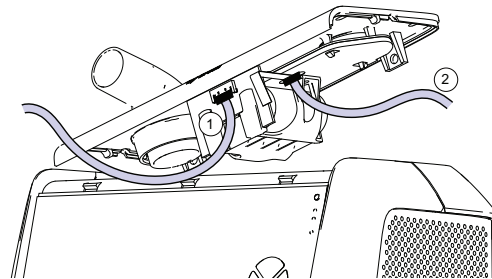
Torque: 0.7 Nm

Size: M3x6

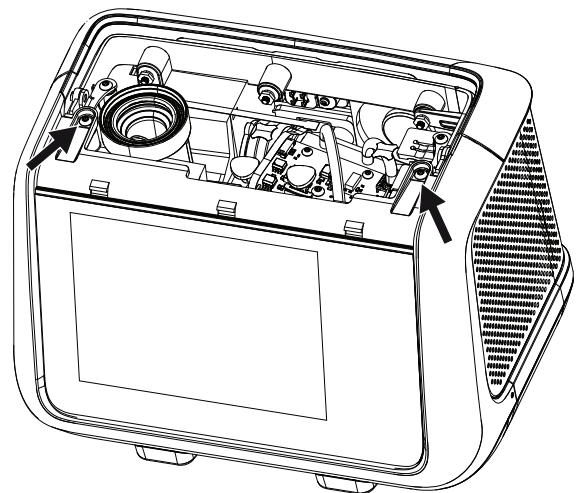
- 3 Open the cover.



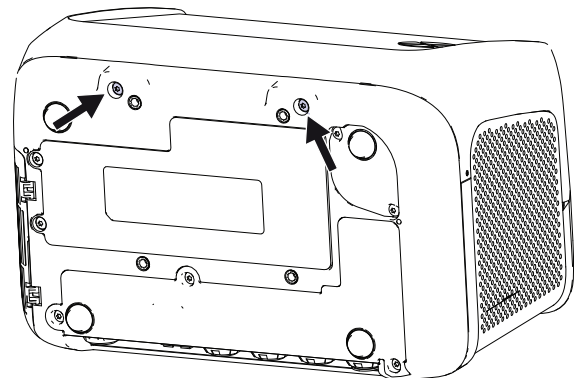
- 4 Remove these cables.
Be careful when loosening cable 1.
Cable 1 in the image shall be loosened from the cover. Cable 2 shall be loosened from the CPU board.



- 5 Remove the two screws at the top.
Torque: 0.7 Nm
Size: M3x6

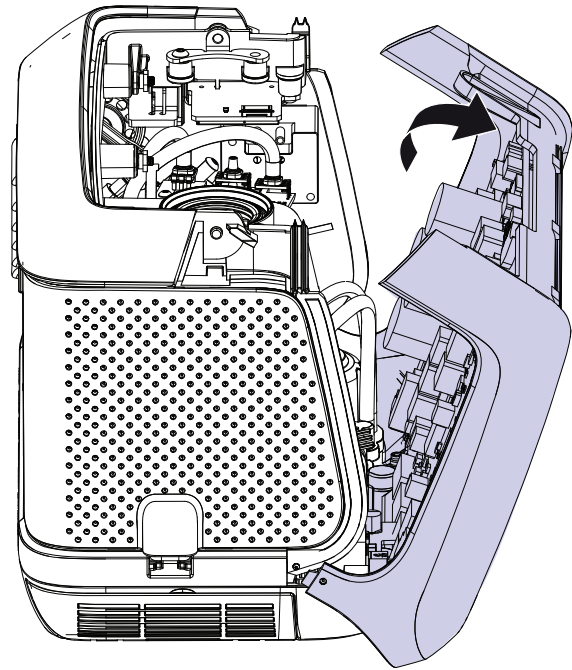


- 6 Remove the two screws at the bottom.
Torque: 0.7 Nm
Size: M3x6



- 7 Fold out the front and disconnect the cables.

When reassembling, see *Assembly Precautions for FiO₂ Tubes*, page 31 for making sure that the FiO₂ tubes don't get squeezed.



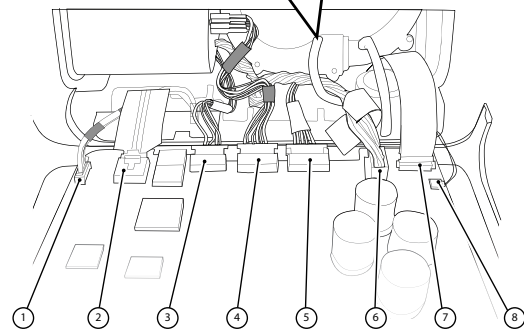
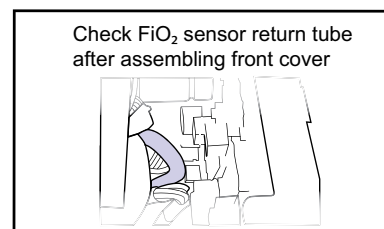
Assembly Precautions for FiO₂ Tubes

When connecting the blower wire trunk:

- Twist the wire trunk at least five turns.
- Make sure the wires trunk is placed between the FiO₂ sensor tubes.
- Place the excessive length at the left side, so it doesn't interfere with the FiO₂ sensor tubes.
- When the front is assembled, check that the FiO₂ sensor return tube is not squeezed.

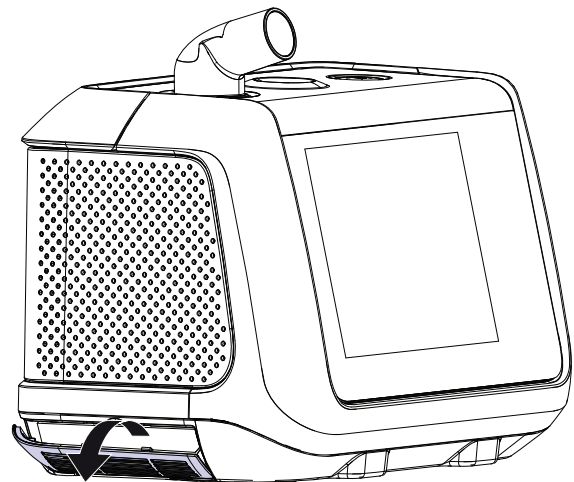
Wiring Layout:

1. Heated circuit
2. Humidifier heater plate
3. DC power
4. Click-in battery
5. Internal battery
6. Blower.
7. Connector board
8. FiO₂—sensor



5.3 Replace the Cooling Air Filter

- 1 Open the cover and replace the filter.

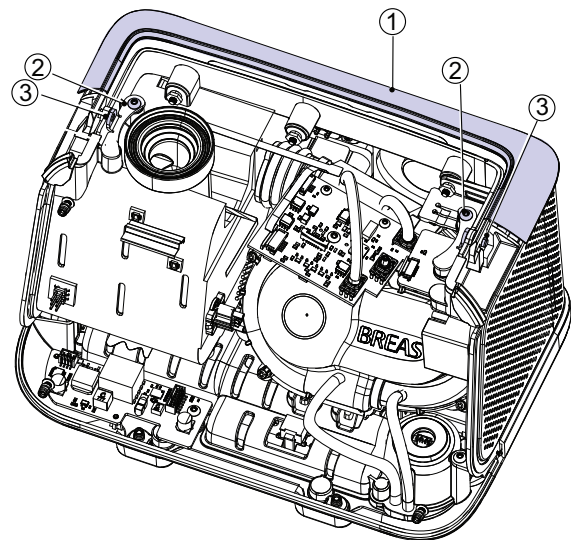


5.4 Replace the Blower Assembly

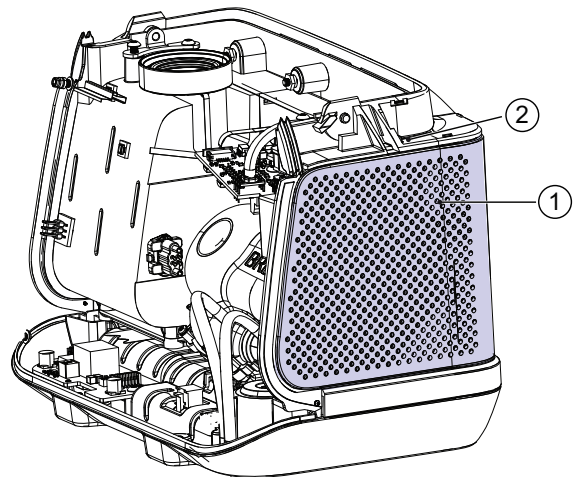
- 1 Dismount the top cover according to 5.19 *Replace the Top Cover*, page 49.
- 2 Dismount the front cover according to 5.17 *Replace the Front Cover*, page 47.
- 3 Dismount the handle (1) by removing the two screws (2).

Torque: 0.7 Nm

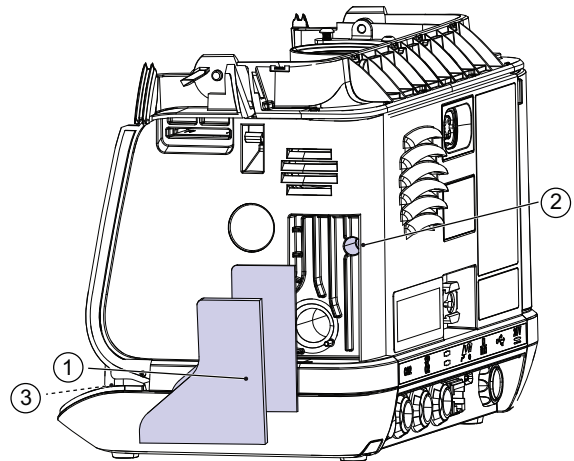
Size: M3x6



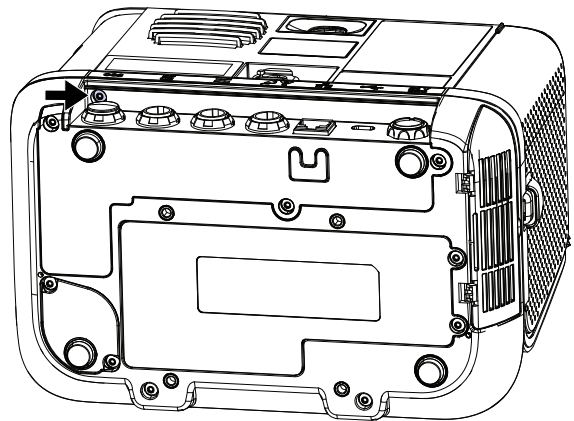
- 4 Pull out the two pins (3)
- 5 Remove the handle.
- 6 Remove the side panel (1) by pressing the button (2)



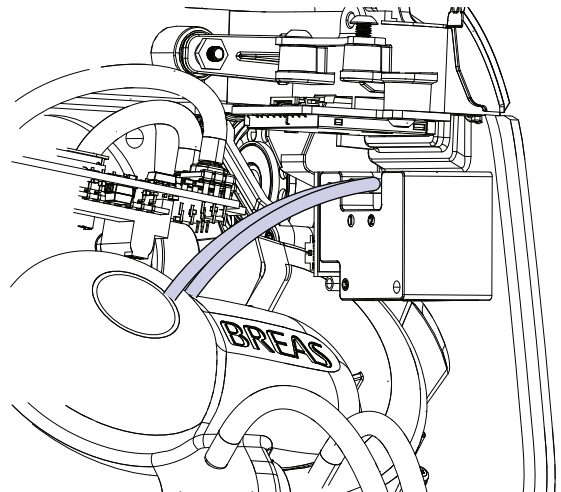
- 7 Remove the two filters (1). Then slightly loosen screw 2— without removing its nut — and finally remove screw 3 (screw 3 is not visible in this image).



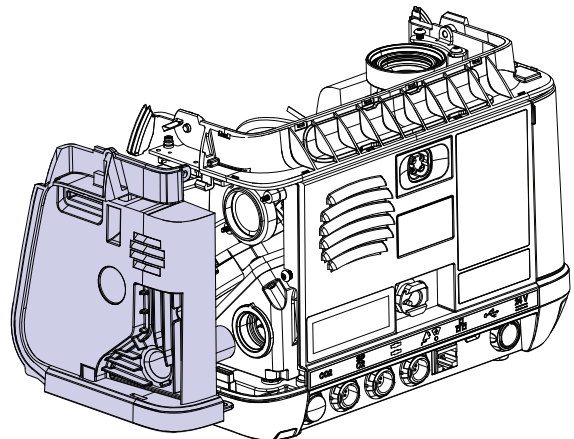
- 8 Loosen the screw.
Torque: 0.7 Nm
Size: M3x8



- 9 Remove the two tubes from the piezo valve (Vivo 45 LS and Nippy 4+ only)



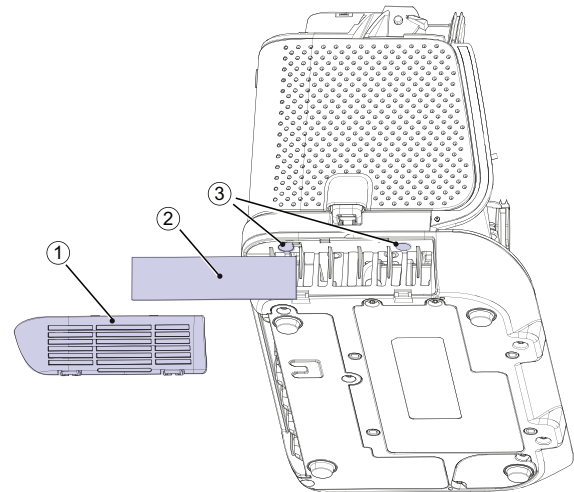
- 10 Remove the side panel.



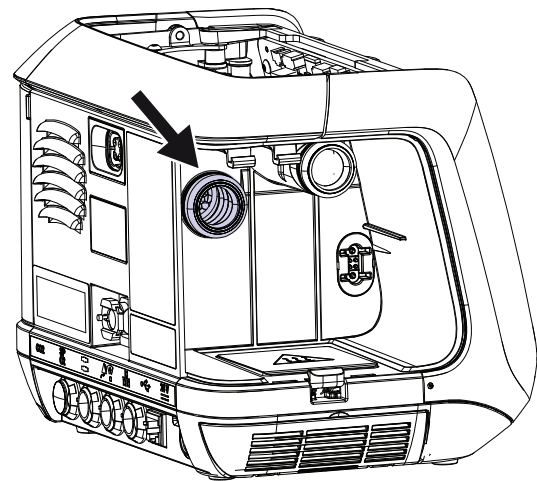
- 11** Dismount the filter cover (1, some coaxing is required), remove the filter (2) and loosen the two screws (3).

Torque: 0.7 Nm

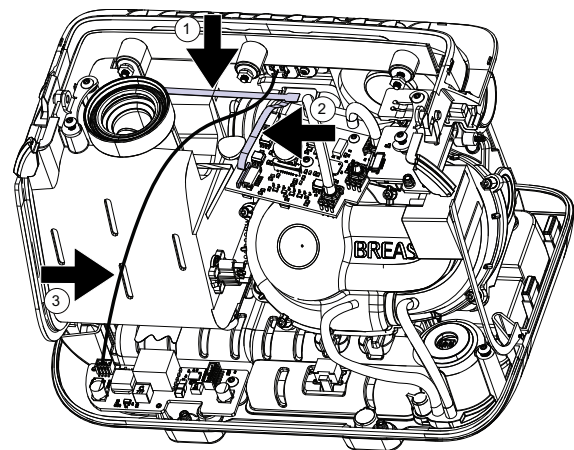
Size: M3x6



- 12** Press the tube into its hole.

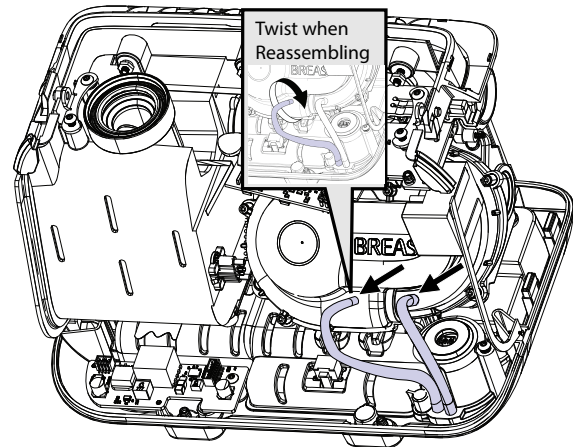


- 13** Remove cables 1 and 2. Then disconnect cable 3 from the heated wire board.



- 14 Disconnect the tubes between the FiO_2 sensor and the blower assembly. Disconnect at the blower.

Note: When reassembling, twist the return tube about one turn clockwise. This is for creating a bow on the tube that prevents it from being squeezed when assembling the front cover.

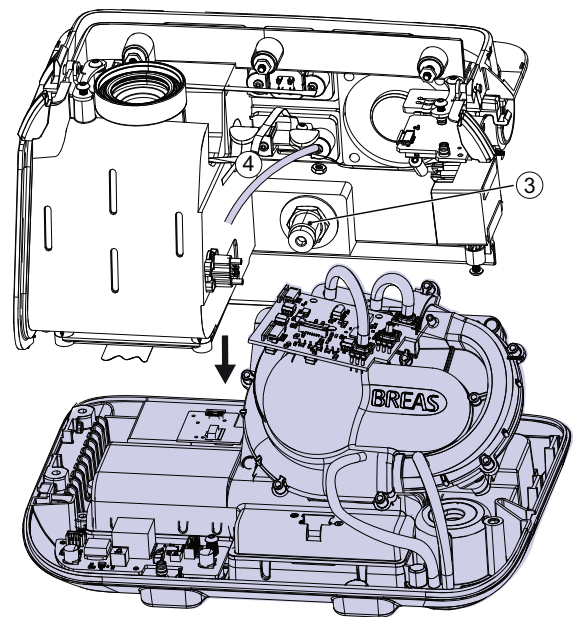


- 15 Vivo 45 LS and Nippy 4+ only:
Disconnect the exhalation valve tube (4).

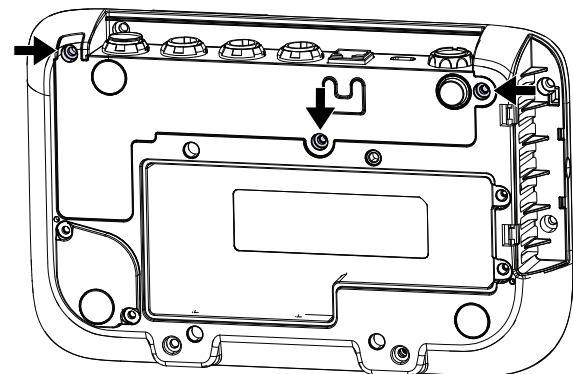


NOTE

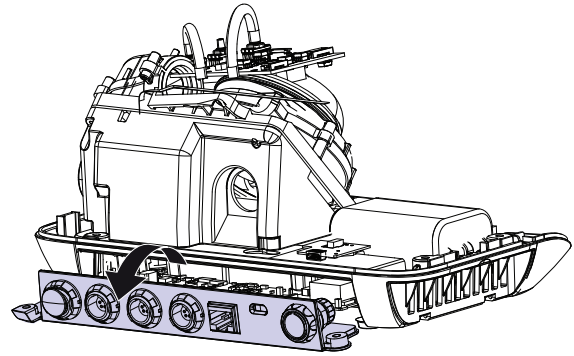
When assembling, the plastic tip (3) is to be inserted into the hole at the back of the blower. Ensure that its seal doesn't slide into the hole. Use a torch to check.



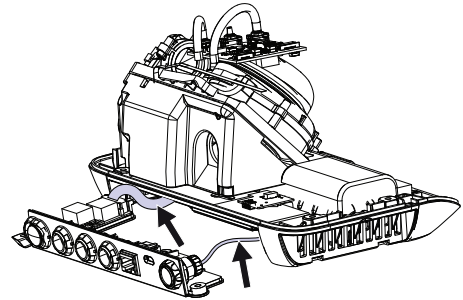
- 16 Loosen the three screws.
Torque: 0.7 Nm
Size: M3x6



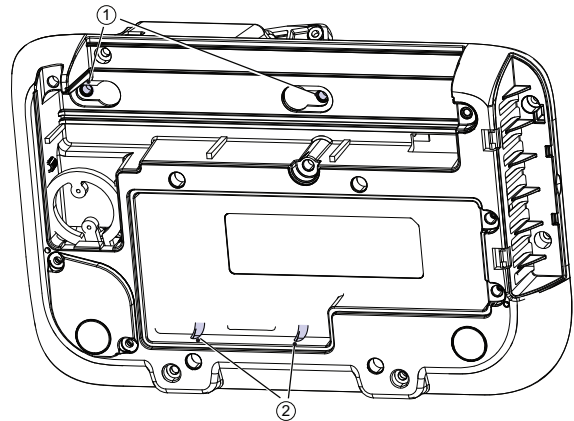
- 17 Coax the contact board loose.



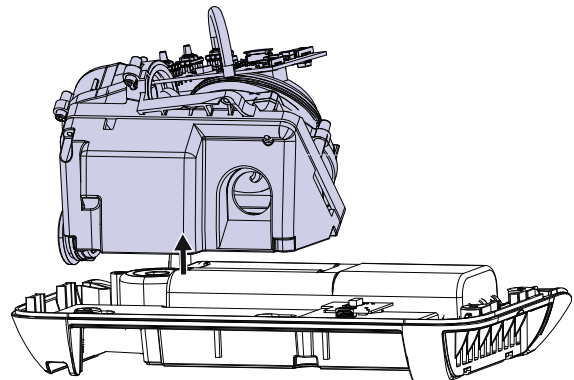
- 18 Thread these two cables through the bottom plate.



- 19 Loosen the two screws (1) and the two clasps (2).



- 20 Remove the blower unit.



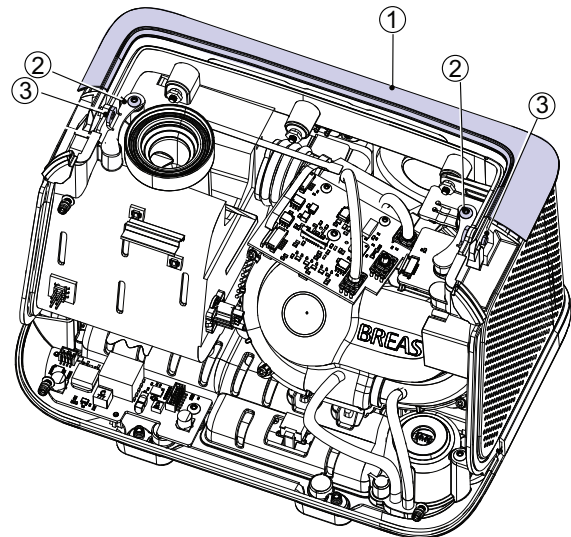
5.5 Replace the Cooling Fan

- 1 Dismount the top cover according to 5.19 *Replace the Top Cover*, page 49.
- 2 Dismount the front cover according to 5.17 *Replace the Front Cover*, page 47.

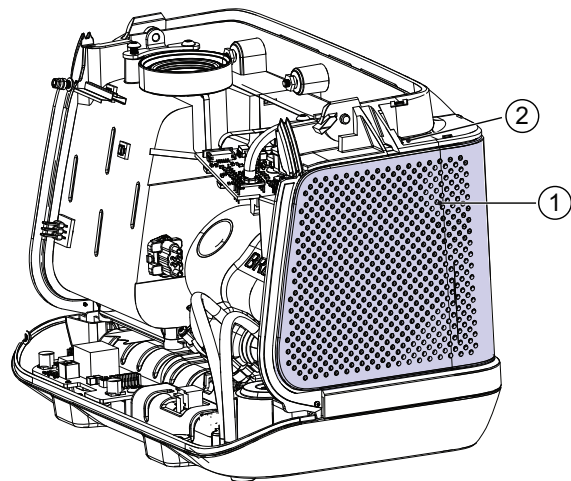
- 3** Dismount the handle (1) by removing the two screws (2).

Torque: 0.7 Nm

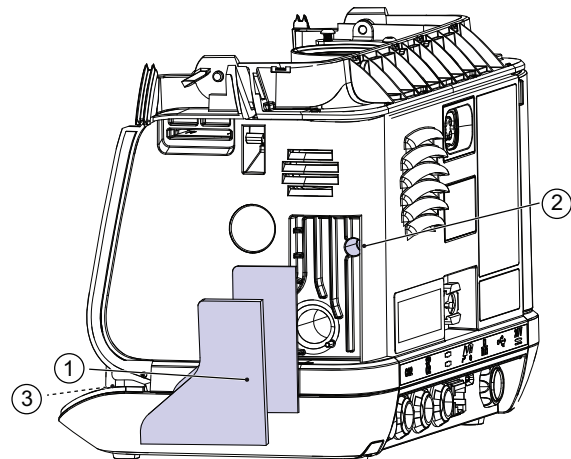
Size: M3x6



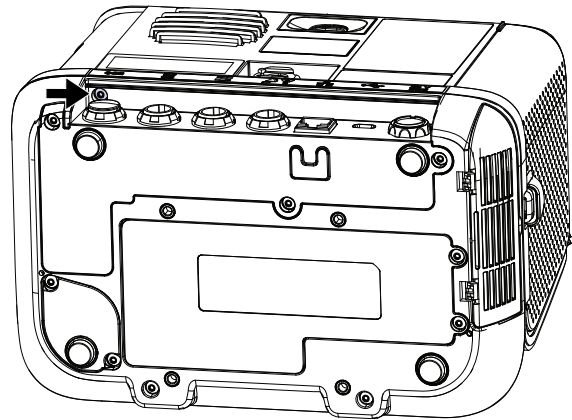
- 4** Pull out the two pins (3)
- 5** Remove the handle.
- 6** Remove the side panel (1) by pressing the button (2)



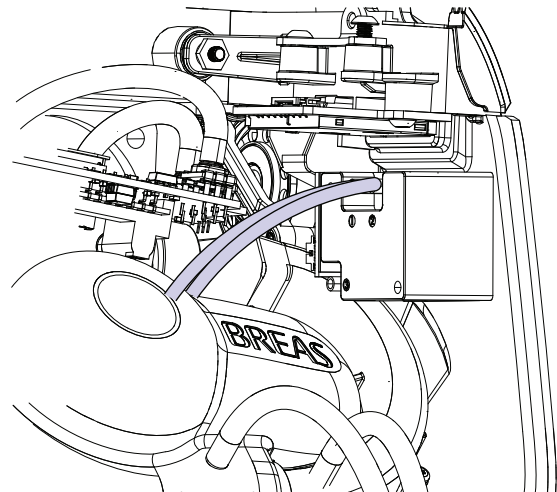
- 7** Remove the two filters (1). Then slightly loosen screw 2— without removing its nut — and finally remove screw 3 (screw 3 is not visible in this image).



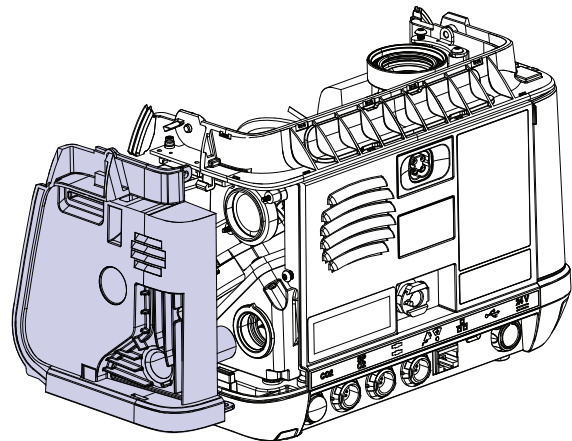
- 8** Loosen the screw.
Torque: 0.7 Nm
Size: M3x8



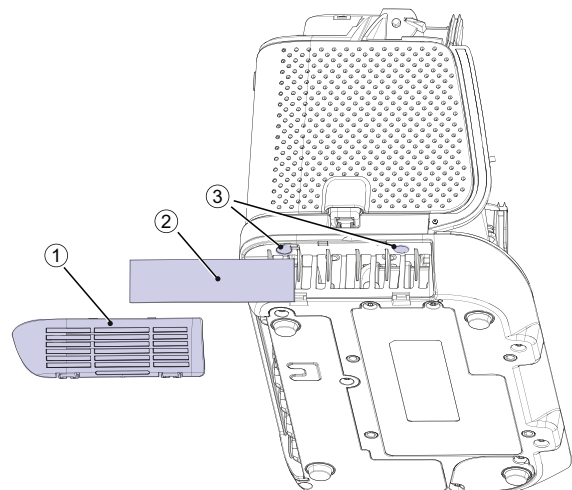
- 9** Remove the two tubes from the piezo valve (Vivo 45 LS and Nippy 4+ only)



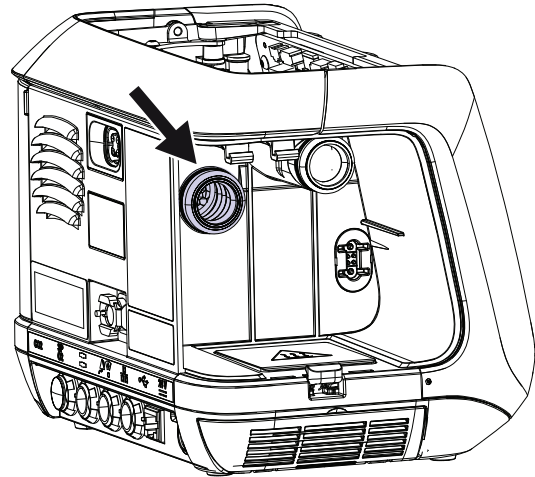
- 10** Remove the side panel.



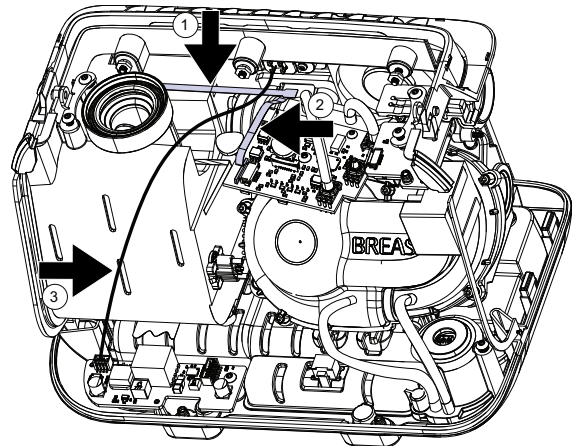
- 11** Dismount the filter cover (1, some coaxing is required), remove the filter (2) and loosen the two screws (3).
Torque: 0.7 Nm
Size: M3x6



- 12 Press the tube into its hole.



- 13 Remove cables 1 and 2. Then disconnect cable 3 from the heated wire board.

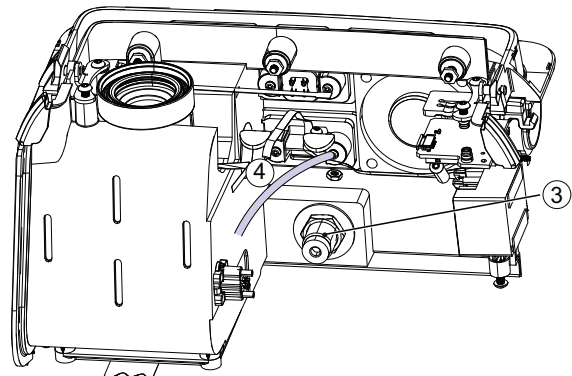


- 14 Vivo 45 LS and Nippy 4+ only:
Disconnect the exhalation valve tube (4).

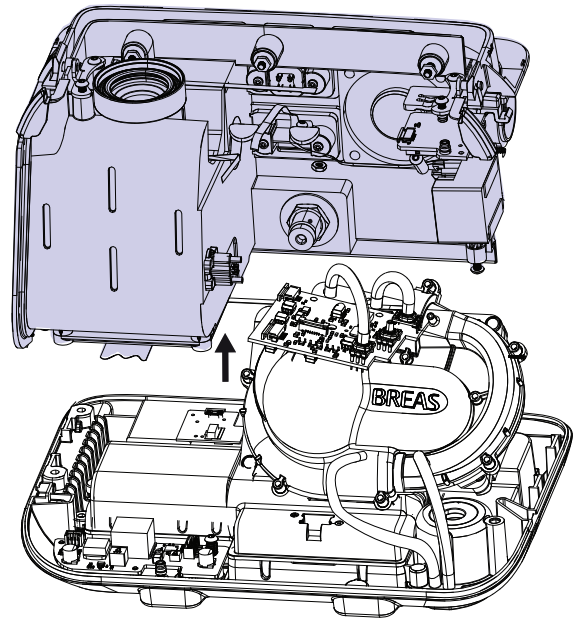


NOTE

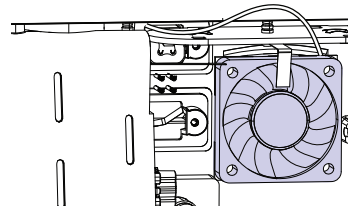
When assembling, the plastic tip (3) is to be inserted into the hole at the back of the blower. Ensure that its seal doesn't slide into the hole. Use a torch to check.



- 15 Lift the back casing.

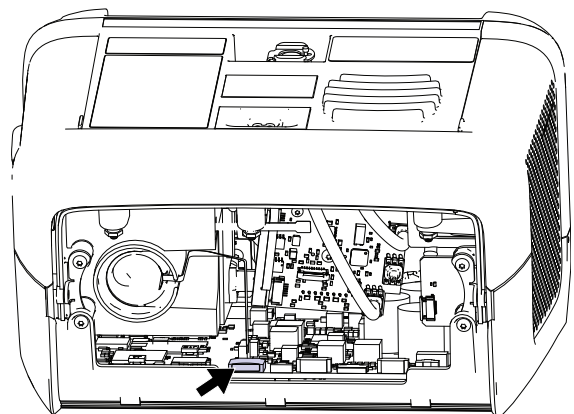


- 16 The cooling fan is fastened with tape. Carefully coax the cooling fan loose and then disconnect the fan cable.



5.6 Replace the Clock Battery

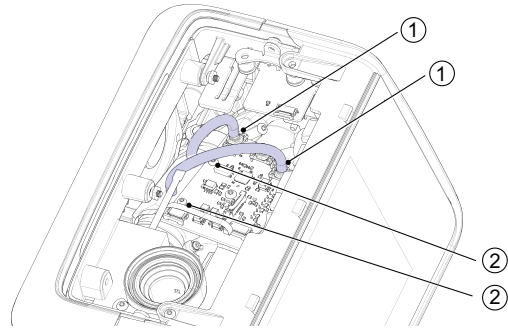
- 1 Dismount the top cover according to 5.19 *Replace the Top Cover*, page 49.
- 2 Replace the battery.



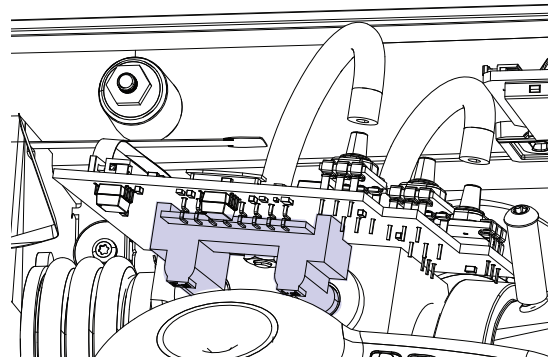
5.7 Replace the PTU Board

- 1 Dismount the top cover according to 5.19 *Replace the Top Cover*, page 49.

- 2 Disconnect the two tubes(1).
For Vivo 45 LS and Nippy 4+, there are additional tubes to be removed.

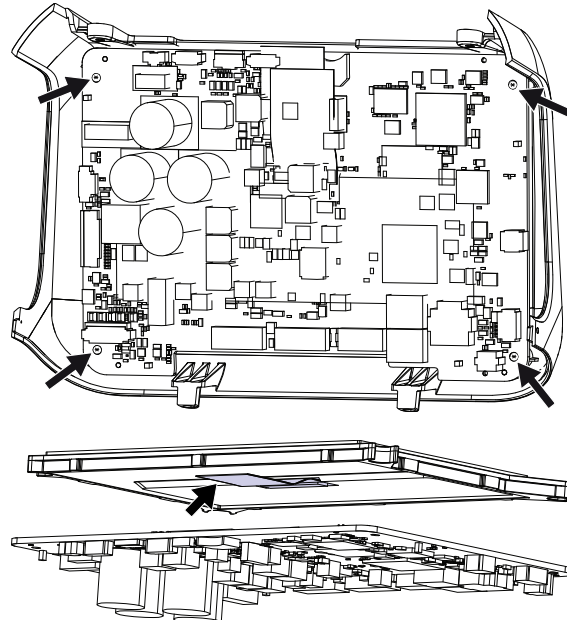


- 3 Loosen the two screws (2).
Torque: 0.4 Nm
Size: M2.5x6
- 4 Pull out the board's flow sensor out of its attachment.



5.8 Replace the CPU Board

- 1 Remove the top cover according to 5.19 *Replace the Top Cover*, page 49.
- 2 Remove the front cover according to 5.17 *Replace the Front Cover*, page 47.
The front, including the CPU board, is now separated from the ventilator.
- 3 Remove the four screws.
Torque: 0.7 Nm
Size: M3x6

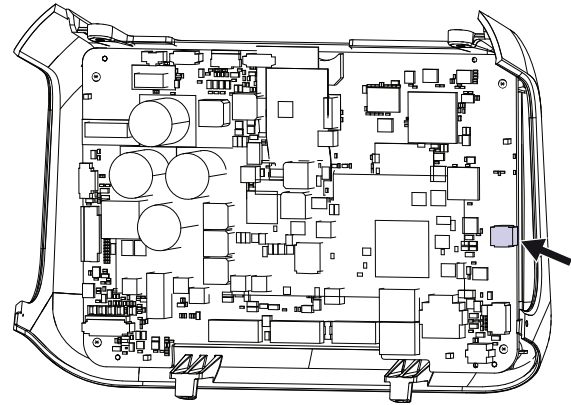


- 4 Disconnect the cable between the CPU board and the display.

5.8.1 Replace the Humidifier Sense Board

- 1 Remove the top cover according to 5.19 *Replace the Top Cover*, page 49.
- 2 Remove the front cover according to 5.17 *Replace the Front Cover*, page 47.
The front, including the CPU board, is now separated from the ventilator.

- 3 Remove the humidifier sense board.

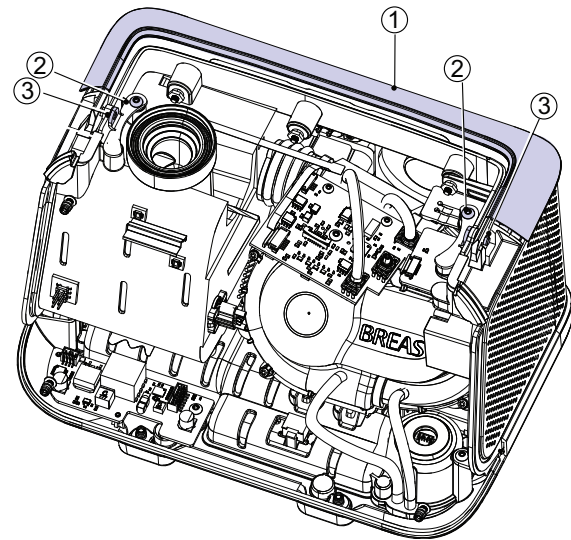


5.9 Replace the Beeper

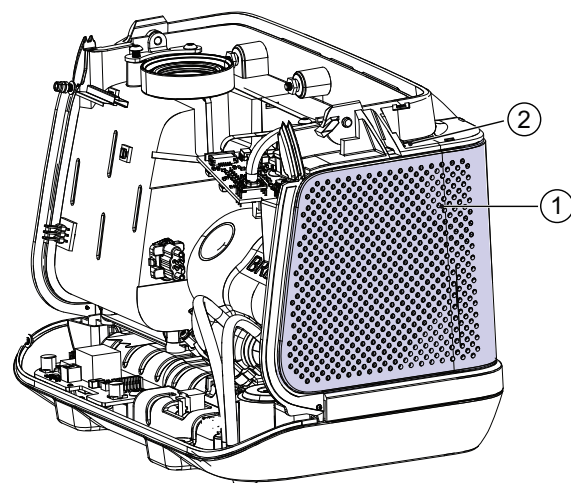
- 1 Dismount the top cover according to 5.19 *Replace the Top Cover*, page 49.
- 2 Dismount the front cover according to 5.17 *Replace the Front Cover*, page 47.
- 3 Dismount the handle (1) by removing the two screws (2).

Torque: 0.7 Nm

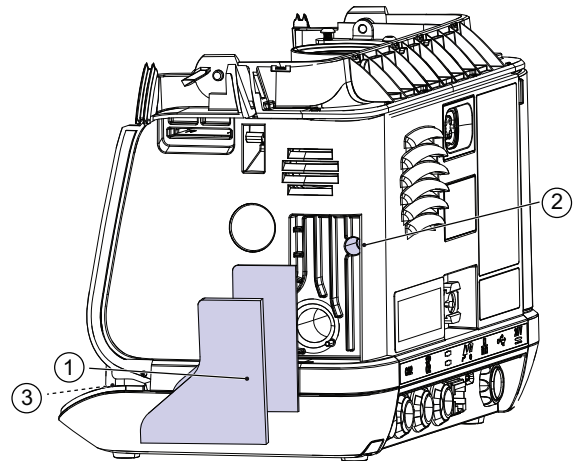
Size: M3x6



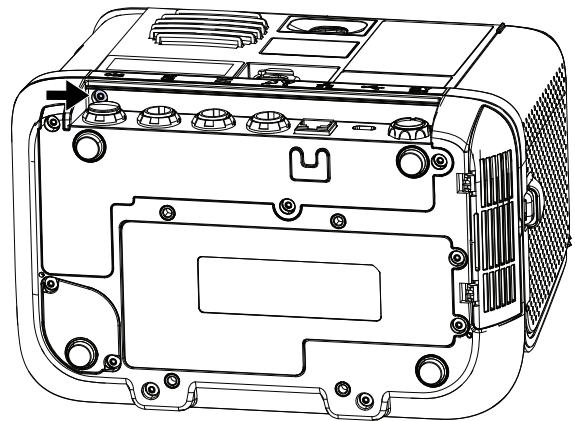
- 4 Pull out the two pins (3)
- 5 Remove the handle.
- 6 Remove the side panel (1) by pressing the button (2)



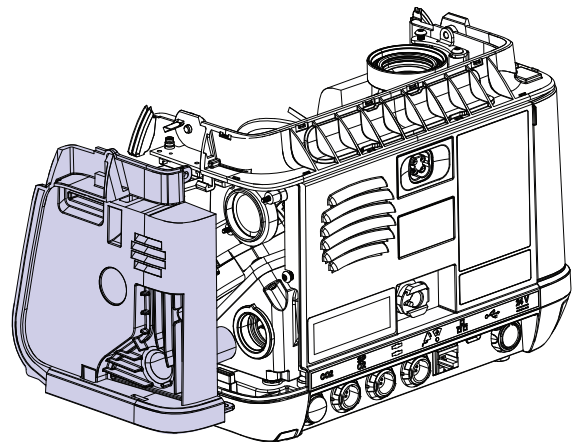
- 7 Remove the two filters (1) and then slightly loosen the screw (2) – without removing its nut — and finally remove screw 3 (screw 3 is not visible in this image).



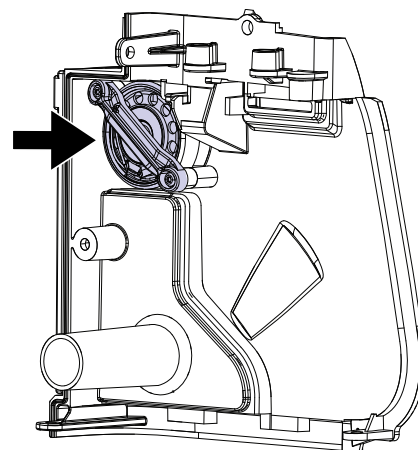
- 8 Loosen the screw.
Torque: 0.7 Nm
Size: M3x6



- 9 Remove the side panel.



- 10 Loosen the two screws and remove the beeper together with its cable.
Torque: 0.4 Nm
Size: M2.5x12

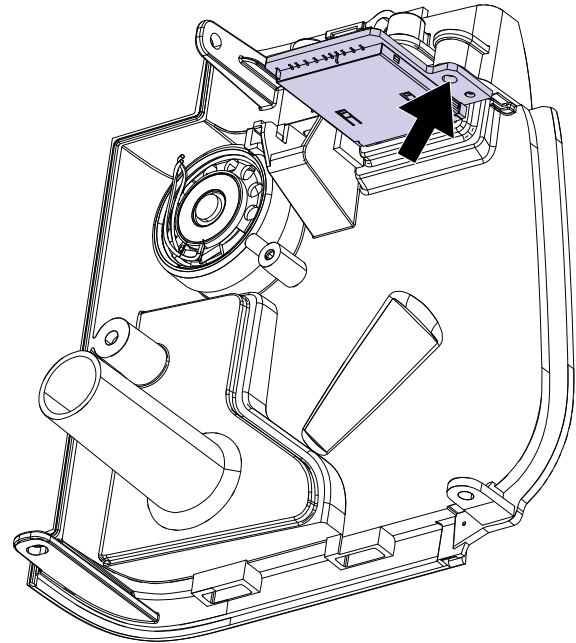


5.10 Replace the SD Board

- 1 Perform steps 1–9 in 5.9 *Replace the Beeper*, page 42.
- 2 Loosen the screw to remove the SD board.

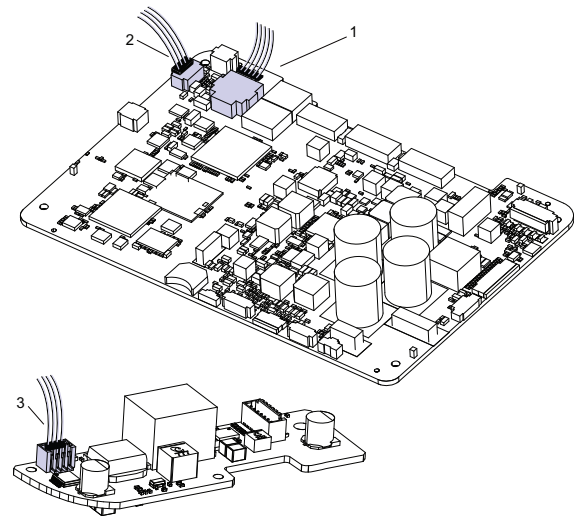
Torque: 0.7 Nm

Size: M3x6



5.11 Replace the Heated Wire Board

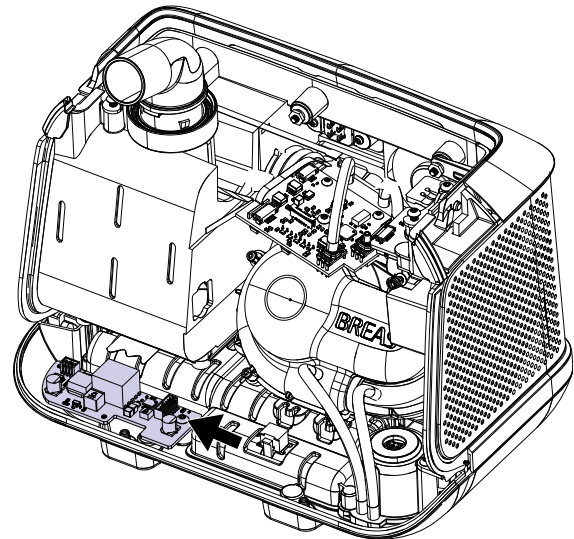
- 1 Dismount the top cover according to 5.19 *Replace the Top Cover*, page 49.
- 2 Dismount the front cover according to 5.17 *Replace the Front Cover*, page 47.
- 3 Loosen the humidity plate cable (1), and heated wire cable (2) on the main board and the other end of the heated wire cable (3) on the heated wire board.



- 4 Loosen the screw to remove the heated wire board.

Torque: 0.7 Nm

Size: M3x6



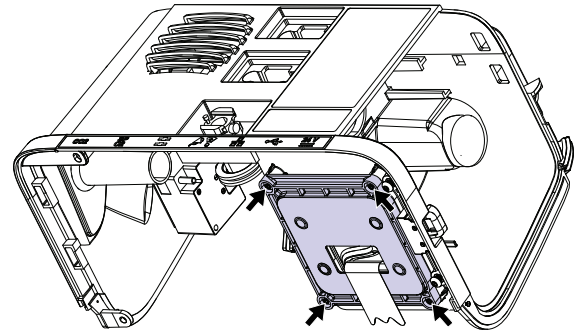
5.12 Replace the Humidity Plate

- 1 Perform steps 1–12 in 5.4 *Replace the Blower Assembly*, page 32.

- 2 Remove the four screws to dismount the humidity plate. Also, loosen its flat cable from the main board to remove the humidity plate.

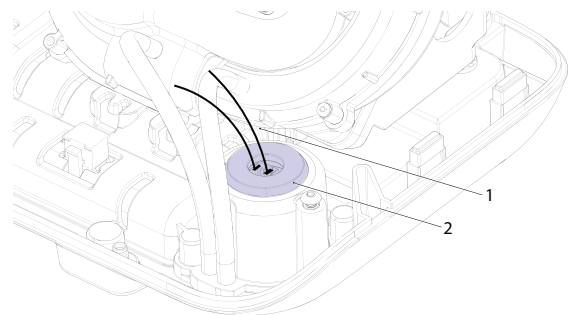
Torque: 0.7 Nm

Size: M3x6



5.13 Replace the FiO₂ Board

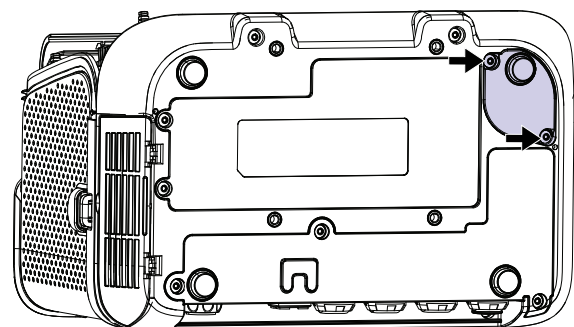
- 1 Dismount the top cover according to 5.19 *Replace the Top Cover*, page 49.
- 2 Dismount the front cover according to 5.17 *Replace the Front Cover*, page 47.
- 3 Loosen the two cables connected to the FiO₂ board (1).



- 4 Loosen the two screws to remove the FiO₂ cover.

Torque: 0.7 Nm

Size: M3x6



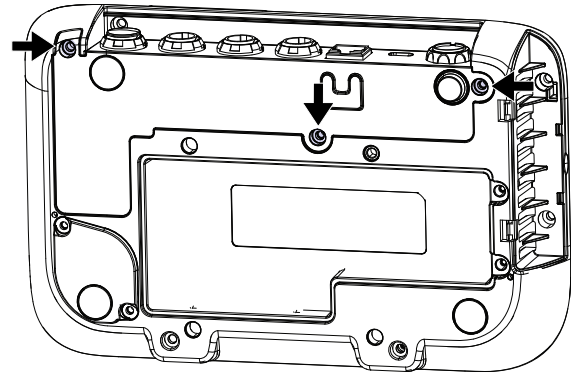
- 5 Ensuring that you don't touch the contacts on the bottom side of the board, push out the FiO_2 board with its silicone seal (2) from above.

5.14 Replace the Complete Contact Board

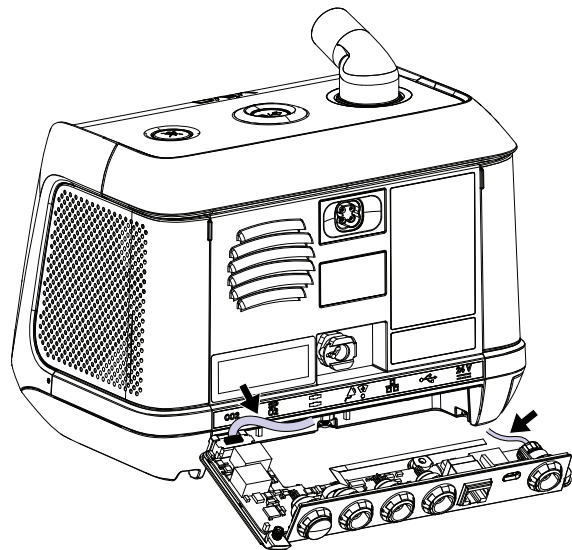
- 1 Loosen the three screws.

Torque: 0.7 Nm

Size: M3x6

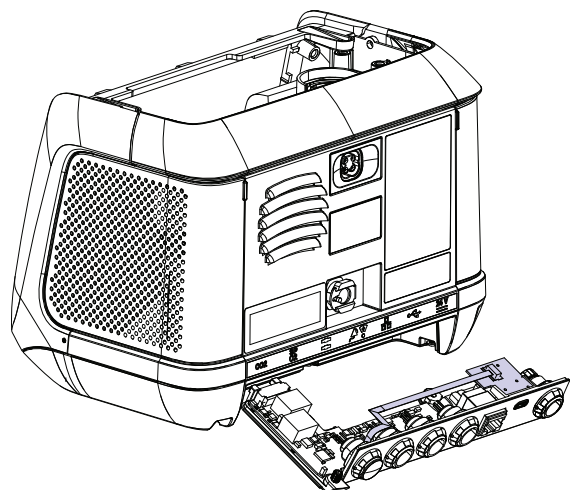


- 2 Lift out the contact board and disconnect the two cables. To be able to disconnect the right cable in this figure, its ODU contact must be disassembled.



5.14.1 Replace the USB Board

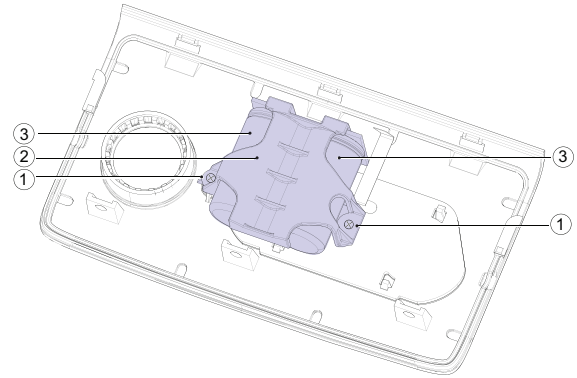
- 1 Remove the USB board together with its cable.



5.15 Replace the Super Capacitors

- 1 Remove the top cover according to 5.19 *Replace the Top Cover*, page 49

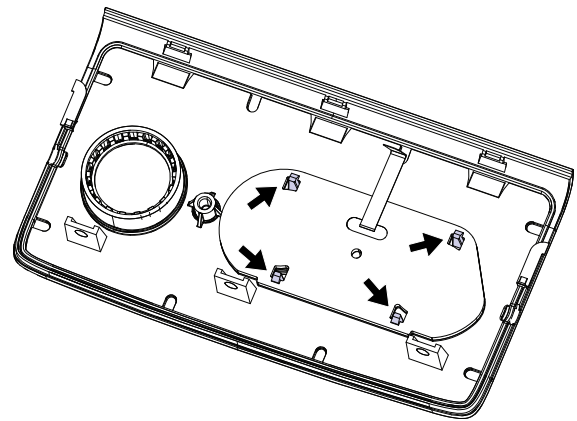
- 2 Remove the two screws (1).
Size: M3x6



- 3 Lift the fastener(2) and replace the super capacitors (3).

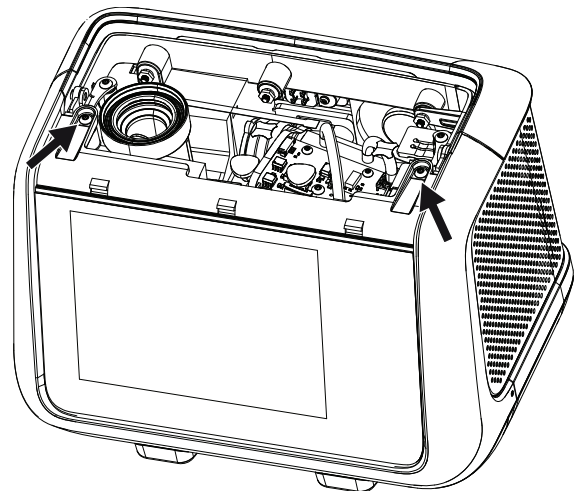
5.16 Replace the Button Board

- 1 Remove the super capacitors according to 5.15 *Replace the Super Capacitors* , page 46.
- 2 Loosen the four snap fasteners and remove the button board.

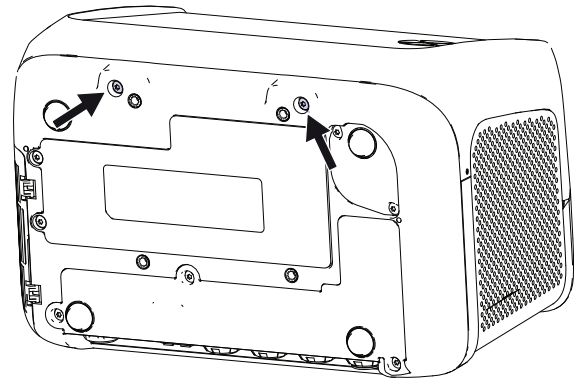


5.17 Replace the Front Cover

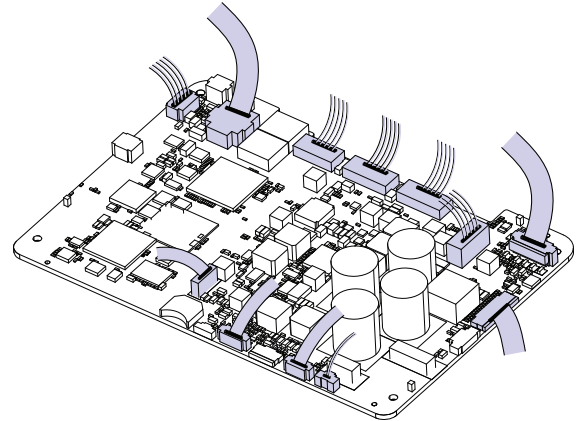
- 1 Remove the top cover according to 5.19 *Replace the Top Cover*, page 49.
- 2 Remove the two screws at the top.
Torque: 0.7 Nm
Size: M3x8



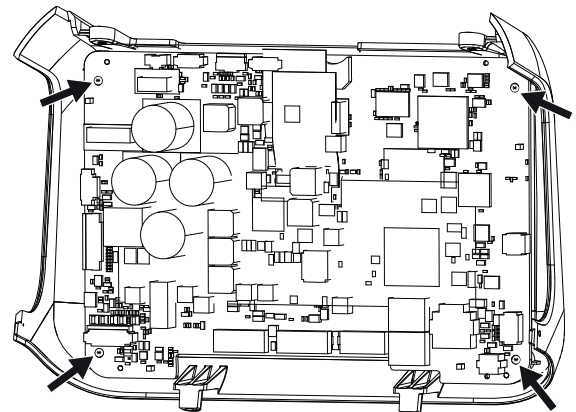
- 3** Remove the two screws at the bottom.
Torque: 0.7 Nm
Size: M3x6



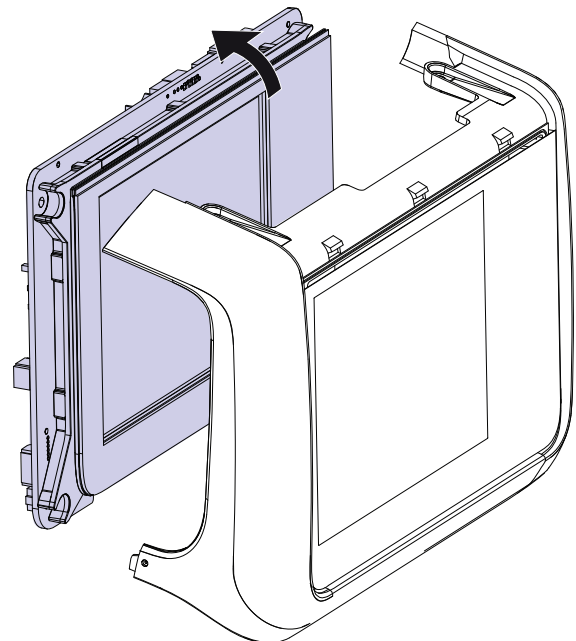
- 4** Remove these cables:



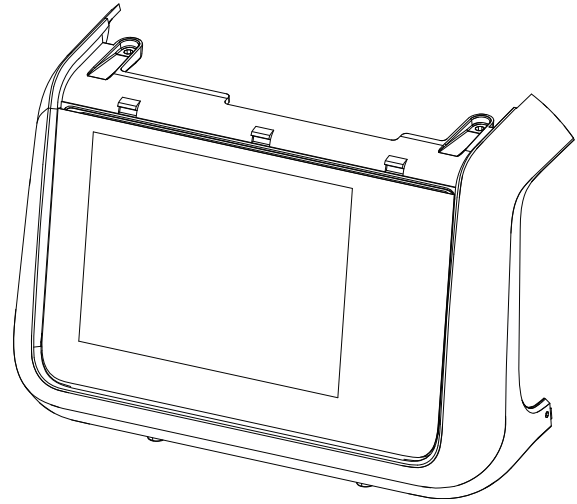
- 5** Remove the four screws.
Torque: 0.7 Nm
Size: M3x6



- 6** Lift out the board and the display.

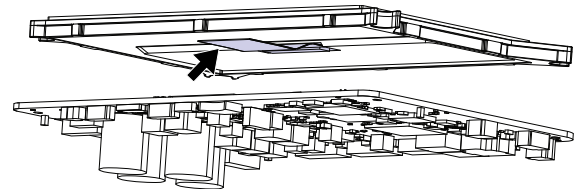


- 7 The front cover is now loose.
When reassembling, see *Assembly Precautions for FiO₂ Tubes*, page 31.



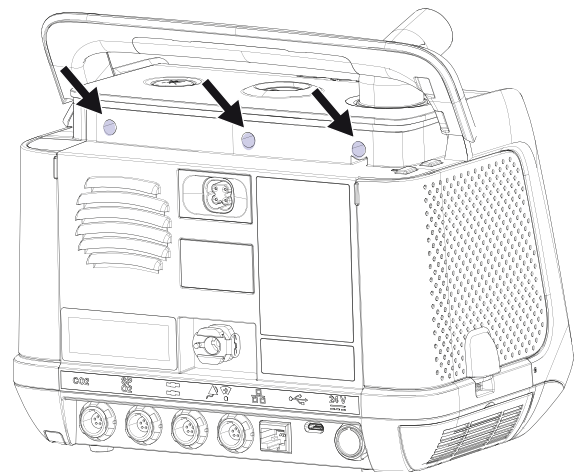
5.18 Replace the LCD Display

- 1 Remove the top cover according to 5.19 *Replace the Top Cover*, page 49.
- 2 Remove the front cover according to 5.17 *Replace the Front Cover*, page 47.
- 3 Remove the CPU board according to 5.8 *Replace the CPU Board*, page 41
- 4 Disconnect the cable between the CPU board and the display.

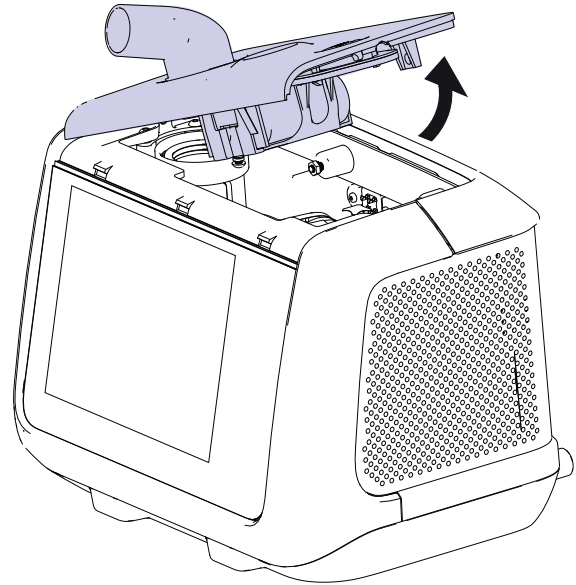


5.19 Replace the Top Cover

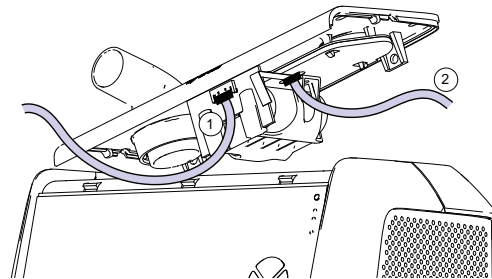
- 1 Remove the three screws.
Torque: 0.7 Nm
Size: 3x10



- 2 Open the cover.



- 3 Remove these cables.
Be careful when loosening cable 1.
Cable 1 in the image shall be loosened from the cover. Cable 2 shall be loosened from the CPU board.



- 4 The cover is now loose. Remove the super capacitors and the buttons.

6 Upgrade and Calibration

6.1 Firmware Upgrade

To upgrade the ventilator firmware you need the service software, which can be downloaded from the Breas extranet.

Contact Breas technical support for more information.

6.2 Pressure and Flow Calibration

To calibrate the ventilator you need the Service Software, which can be downloaded from the Breas extranet.

Contact Breas technical support for more information.

7 Electronics

7.1 Main Cabling Diagram of the Ventilator

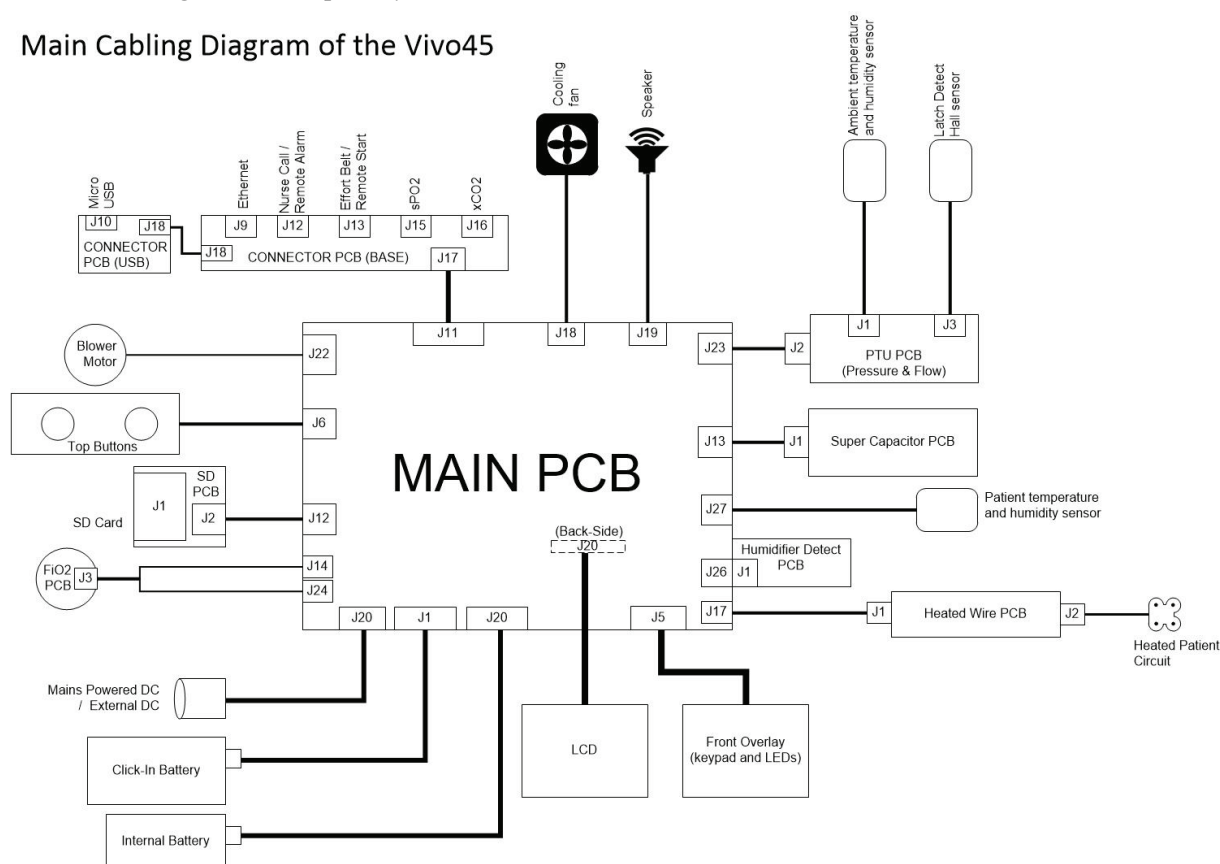


WARNING!

Always perform a complete function test after reassembling the ventilator.

The electronics, mechanics, and pneumatics of the ventilator are integrated. To fully understand the electronics of the ventilator, you must know how to use it, study the pneumatic diagram and acquaint yourself with the mechanical construction.

Main Cabling Diagram of the Vivo45



7.2 Circuit Board Descriptions

7.2.1 Main Board

Responsible for full system functionality through the utilization of accompanying PCBs and peripheral devices.

- Power handling and conversion for:
 - Treatment processor
 - Communications processor
 - Blower motor
 - Daughter PCBs and peripherals
- Blower motor speed control
- Sensors
- Accessories

- KeyPads/Buttons/LCD display

7.2.1.1 Main Board Power Handling

Four available power inputs:

- Mains powered DC uses included external AC adapter to provide 19 VDC (120 W).
- External DC. 12 VDC ~ 24 VDC input.
- Click-in battery
- Internal battery. Not intended for use during normal operation (backup only).

Input power selection is initially provided by the hardware. The hardware will enable input power if the hardware set threshold is exceeded.

Based on available power: Once booted, the treatment processor will determine which power to use.

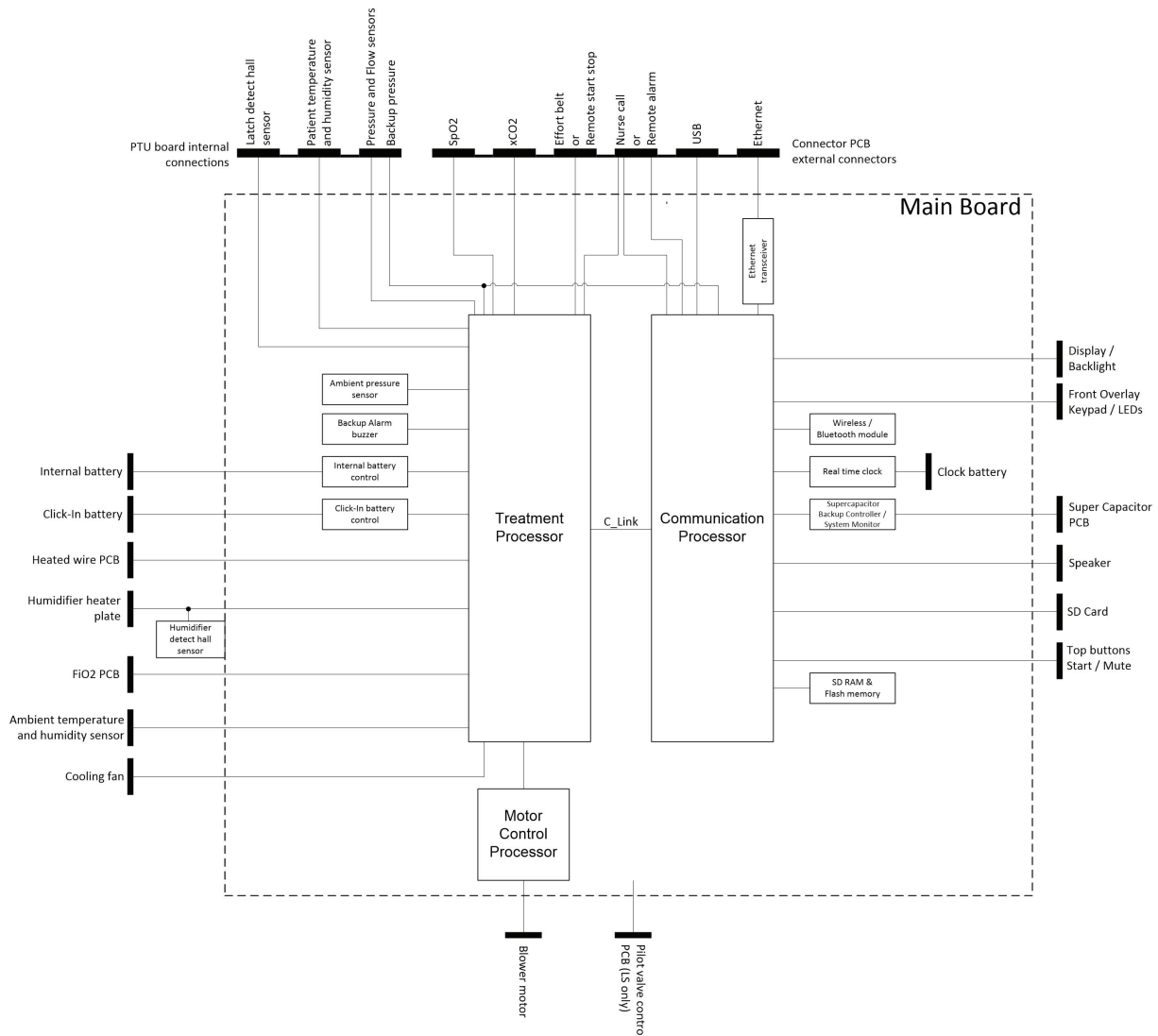
The input power is then used to generate the necessary voltages required for system functionality.

7.2.1.2 Main Board Processors

Three primary processors:

- Treatment processor
- Communication processor
- Motor control processor

7.2.1.3 Main Board — Assigned Processor Tasks



Main processor and UI Processor

The processing core of the main unit is two micro controllers. The main and UI processors are supplied with both +5 V and +3.3 V.

The processors are not operating when the ventilator is turned off and disconnected from mains.

SD Card Interface

The COMM processor can transfer the ventilator data memory to an SD memory card. The ventilator supports SD cards up to 32 GB.

USB Interface

The USB interface is for connecting the Vivo to a PC. When connected to a PC you can download memory data, upgrade firmware, perform calibration and more.

Display

The display used is a 5.7" graphic colour display, with a resolution of 800x480 pixels.

Alarm Beeper

The ventilator is equipped with an alarm beeper. The alarm beeper consists of a 25 mm plastic membrane loudspeaker, powered by a 2 W bridge-connected audio amplifier. The beeper is controlled by the main processor. The beeper can sound with adjustable volume.

Voltage Regulators

The CPU board contains regulators for these voltages:

- 1.2 V
- 1.375 V
- 1.5 V
- 1.8 V
- 2.5 V
- 3.0 V
- 3.3 V
- 12.0 V

Real Time Clock

The real time clock keeps track of time so that the clock is functioning and the memory data time is correct.

The real time clock is the only function that is running when the Vivo is turned off and disconnected from mains. When the Vivo is turned off and disconnected from mains the real time clock is powered by the clock battery.

Clock Battery

The clock battery powers the real time clock when the Vivo is not connected to mains or running from any battery power source. The only function of the clock battery is to power the real time clock.

Super Capacitors (Alarm Batteries)

In case of a power failure, the super capacitors will power the necessary components so that the Vivo is able to give the power fail alarm for two minutes.

7.2.2 PTU (Pressure Transducer Unit) Board

The PTU board contains sensors for air flow, and air outlet pressure. For redundancy there are two air outlet pressure sensors.

7.3 Ventilator Switch-over Operating Conditions

The ventilator can run from four different power sources. The priority of the power sources is:

- Mains DC
- External DC
- Click-in battery
- Internal battery

7.3.1 Mains DC Operation

If the Mains DC drops below 17.2 VDC, the ventilator will switch over to the next available power source.

7.3.2 External DC Battery Operation

If the external battery voltage drops below 12 V the ventilator will switch to the next available power source. The ventilator will also issue an information message stating that there has been a change of power source.

7.3.3 Click-In Battery Operation

The click-in battery has its own integrated processor and electronics that estimates the battery's state of charge and communicates with the ventilator main processor.

When the click-in battery is discharged it sends a signal to the ventilator main processor which switches to the internal battery and issues an information message stating that there has been a change of power source.

7.3.4 Internal Battery Operation

The internal battery has its own integrated processor and electronics that estimates the battery's state of charge and communicates with the ventilator main processor.

There will be an information message when the internal battery estimates that it has 50 percent of its capacity left.

When the internal battery estimates that it has 15 minutes of operation left, the ventilator will issue a last power source low alarm.

When the internal battery is fully discharged the ventilator will issue a power fail alarm and stop operation.

7.4 Battery Charging

7.4.1 Mains Power Supply Operation

When the ventilator is connected to mains, the internal and click-in batteries will be charged. Primarily the internal battery will be charged, then the click-in battery. Only if the click-in battery is completely discharged it will receive a short recharge before the ventilator switches to recharge the internal battery. This is to prevent the click-in battery from losing capacity due to draining (deep discharge). The internal and click-in batteries will only be charged when the internal temperature of the battery is within 0 to 45°C.

The super capacitors will be charged, as well, independently from the internal and click-in battery charging.

7.4.2 External Battery Operation

The super capacitors will be charged when the ventilator is running from an external battery.

7.4.3 Click-In Battery Operation

The super capacitors will be charged when the ventilator is running from the click-in battery.

7.4.4 Internal Battery Operation

The super capacitors will be charged when the ventilator is running from the internal battery.

7.5 Checking the Internal Battery

- 1 Make sure that the battery is fully charged.
- 2 Adjust the settings as follows:

Setting	Value
Ventilation Mode	Pressure
Breath Mode	Assist/Control
Insp. Pressure	20 cmH ₂ O
PEEP	8 cmH ₂ O
Breath Rate	15 bpm

Insp. Time	1.5 s
Rise Time	3
Insp. Trigger	Off
Target Volume	Off
Display Light	On
Light Intensity	5



Study the ventilator Clinician's Manual for how to adjust the settings.

- 3** Disconnect the power cord.
- 4** Connect a test lung and start the ventilator.
- 5** The ventilator should run for at least two hours before shutdown. If not, replace the internal battery.

8 Fault Tracing

This chapter contains a fault-tracing table and a table of error codes to use when troubleshooting the ventilator.

8.1 Fault Tracing Table

If the ventilator does not work properly try to identify the problem in the table below. Check the possible causes and carry out the suggested remedial actions.

Symptom	Possible Cause	Remedial Action	See Ref.
The ventilator does not start when connected to the mains supply.	The power supply is faulty.	1. Check the power supply. 2. Replace the power supply.	
The keys don't work.	1. The cabling for the front panel is disconnected or faulty. 2. The front panel is faulty.	1. Check the cabling for the front panel. 2. Replace the front panel.	Chapter 5.17 <i>Replace the Front Cover</i> , page 47
The clock has been reset.	The clock battery is discharged.	Replace the clock battery.	Chapter 5.6 <i>Replace the Clock Battery</i> , page 40
The Vivo does not show any flow during treatment.	1. The patient circuit type used is not the same as set on the Vivo. 2. The Vivo is not properly calibrated.	1. Make sure that the correct patient circuit type is set. 2. Calibrate the Vivo.	Chapter 6.2 <i>Pressure and Flow Calibration</i> , page 51
The Vivo does not give the adequate pressure.	1. External leaks from patient circuit or nasal mask. 2. Internal leaks from tubes. 3. The Vivo is not properly calibrated.	1. Check the tubes, connectors and mask for leaks. 2. Check the tubes. 3. Calibrate the Vivo.	1. Chapter 2.5 <i>External Inspection</i> , page 11 2. Chapter 2.6 <i>Internal Inspection</i> , page 11 3. Chapter 6.2 <i>Pressure and Flow Calibration</i> , page 51

8.2 Internal Error Codes

Alarm ID	Alarm Name	Description
73	AlarmTaskDown	One or more CPU tasks are not alive
74	AlarmPipeSendFail	Communication between CPU tasks fail
75	AlarmPipeReceiveFail	Communication between CPU tasks fail
76	AlarmMessageLost	One or more message doesn't get a response
77	AlarmMediatorMainPipeSendFail	Mediator task routes message fail

Alarm ID	Alarm Name	Description
78	AlarmMediatorMainPipeReceiveFail	Mediator task routes message fail
80	AlarmCPUComPrepareMsgFail	Fail to pack message
81	Alarm_SemaphoreErr	Fail to obtain semaphore
82	AlarRTCSyncFailed	Fail to sync time bewteen two CPUs
83	AlarmSerCommToTreat	Serial communication to treatment lost
84	AlarmCoolingFan	Cooling fan error
85	AlarmSerCommToUi	Serial communication to UI fail
86	AlarmRtcFail	Real time clock fail
87	Alarm_Q_ToComCpuFull	The message queue is full
88	AlarmInternalTempHigh	Internal temperature high
89	AlarmCPUTempHigh	CPU temperature high
93	Treatment CPU Fail	<p>The alarm is triggered if (any of):</p> <ul style="list-style-type: none"> • Communication with treatment CPU has been lost for > 30 sec. • 1 or more treatment threads stop running for > 60 sec. • The treatment CPU crashes or stops running for > 30 sec.

The actions should be performed in the order in which they are listed below. For example, if action no. 1 does not solve the problem you should continue with action no. 2, and so on.

Action for each error code:

1. Please turn off and power down the ventilator, then restart to restore full functionality.
2. Erase the internal memory.
3. Replace the CPU board.
4. If the fault persists, contact the service provider.

8.3 Function Failure Error Codes

8.3.1 Error Code Table

The table below lists each error code and the corresponding text that is shown on the display. The problem is explained together with the action that is necessary to correct the problem.

If more than one action is listed, the actions should be performed in the order in which they are listed. For example, if action no. 1 does not solve the problem you should continue with action no. 2, and so on.

See 5 *Opening the Ventilator and Replacing the Main Components*, page 29 for information about how to perform the necessary replacement procedures.

Error Code	Text on Display	Problem	Action
1	Int. Function Failure: 1	Treatment processor fails.	1. Restart the ventilator. 2. Replace the CPU board or send the ventilator for service.
2	Int. Function Failure: 2	Main pressure sensor fails.	1. Restart the ventilator. 2. Replace the PTU board. 3. Replace the CPU board or send the ventilator for service.
3	Int. Function Failure: 3	Back-up pressure sensor fails.	1. Restart the ventilator. 2. Replace the PTU board. 3. Replace the CPU board or send the ventilator for service.
4	Int. Function Failure: 4	Flow sensor fails.	1. Restart the ventilator. 2. Replace the PTU board. 3. Replace the CPU board or send the ventilator for service.
5	Int. Function Failure: 5	Treatment processor unable to stop the blower motor.	1. Restart the ventilator. 2. Replace the CPU board or send the ventilator for service.
6	Int. Function Failure: 6	UI processor unable to stop the blower motor.	1. Restart the ventilator. 2. Replace the CPU board or send the ventilator for service.
7	Int. Function Failure: 7	Treatment beeper fails.	1. Restart the ventilator. 2. Replace the beeper. 3. Replace the CPU board or send the ventilator for service.
8	Int. Function Failure: 8	Communication processor unable to communicate with alarm speaker volume control.	1. Restart the ventilator. 2. Replace alarm speaker. 3. Replace the CPU board. 4. Send ventilator for service.
9	Int. Function Failure: 9	5 V or 12 V on CPU board is out of range.	1. Restart the ventilator. 2. Replace the CPU board or send the ventilator for service.
10	Int. Function Failure: 10	Treatment processor unable to communicate with PTU board.	1. Restart the ventilator. 2. Check ribbon cable between CPU board and PTU board. 3. Replace the PTU board. 4. Replace the CPU board or send the ventilator for service.
11	Int. Function Failure: 11	Main and back-up pressure sensors does not match.	1. Restart the ventilator. 2. Replace the PTU board. 3. Replace the CPU board or send the ventilator for service.
12	Int. Function Failure: 12	PTU board temperature is above 80°C (176°F).	1. Let the ventilator cool off and restart. 2. Check the cooling air filter. 3. Check the cabling to the cooling fan. 4. Check that the cooling fan runs. It shall always run when the ventilator is connected to mains. If it is not running - replace the cooling fan. 5. Replace the PTU board. 6. Replace the CPU board or send the ventilator for service.

Error Code	Text on Display	Problem	Action
13	Int. Function Failure: 13	PTU board temperature is below -30°C (-22°F). Probable sensor failure.	<ol style="list-style-type: none"> 1. Place the ventilator in normal room temperature. Open the ventilator and make sure that there is no condensation inside. Reassemble the casing and restart. 2. Replace the PTU board. 3. Replace the CPU board or send the ventilator for service.
14	Int. Function Failure: 14	Blower temperature is above 105°C (221°F).	<ol style="list-style-type: none"> 1. Let the ventilator cool off and restart. 2. Check the cooling air filter. 3. Check the cabling to the cooling fan. 4. Check that the cooling fan runs. It shall always run when the ventilator is connected to mains. If it is not running - replace the cooling fan. 5. Replace the complete blower assembly. 6. Replace the CPU board or send the ventilator for service.
15	Int. Function Failure: 15	Blower temperature is below -30°C (-22°F).	<ol style="list-style-type: none"> 1. Place the ventilator in normal room temperature. Open the ventilator and make sure that there is no condensation inside. Reassemble the casing and restart. 2. Replace the complete blower assembly. 3. Replace the CPU board or send the ventilator for service.
16	Int. Function Failure: 16	The blower does not function properly.	<ol style="list-style-type: none"> 1. Restart the ventilator. 2. Check the cabling for the blower assembly. 3. Replace the complete blower assembly. 4. Replace the CPU board or send the ventilator for service.
17	Int. Function Failure: 17	The blower does not function properly.	<ol style="list-style-type: none"> 1. Restart the ventilator. 2. Check the cabling for the blower assembly. 3. Replace the complete blower assembly. 4. Replace the CPU board or send the ventilator for service.
18	Int. Function Failure: 18	The blower does not function properly.	<ol style="list-style-type: none"> 1. Restart the ventilator. 2. Check the cabling for the blower assembly. 3. Replace the complete blower assembly. 4. Replace the CPU board or send the ventilator for service.
19	Int. Function Failure: 19	The blower does not function properly.	<ol style="list-style-type: none"> 1. Restart the ventilator. 2. Check the cabling for the blower assembly. 3. Replace the complete blower assembly. 4. Replace the CPU board or send the ventilator for service.
20	Int. Function Failure: 20	Treatment processor cannot get saved sensor calibration data.	<ol style="list-style-type: none"> 1. Restart the ventilator 2. Re-calibrate the ventilator. 3. Send ventilator for service.
21	Int. Function Failure: 21	Treatment processor cannot get saved parameters.	<ol style="list-style-type: none"> 1. Restart the ventilator. 2. Send ventilator for service.

Error Code	Text on Display	Problem	Action
22	Int. Function Failure: 22	Reference temperature offset error.	1. Restart the ventilator. 2. Redo temperature compensation. 3. Replace PTU board or send ventilator for service.
23	Int. Function Failure: 23	Blower motor current offset problem.	1. Restart the ventilator. 2. Replace blower. 3. Replace CPU board or send ventilator for service.
24	Int. Function Failure: 24	Main pressure sensor calibration error.	1. Restart the ventilator. 2. Re-calibrate main pressure sensor. 3. Replace PTU board. 4. Send the ventilator for service.
25	Int. Function Failure: 25	Backup pressure sensor calibration error.	1. Restart the ventilator. 2. Re-calibrate backup pressure sensor. 3. Replace PTU board. 4. Send the ventilator for service.
26	Int. Function Failure: 26	Ambient pressure sensor calibration error.	1. Restart the ventilator. 2. Re-calibrate ambient pressure sensor. 3. Replace PTU board. 4. Send the ventilator for service.
27	Int. Function Failure: 27	Flow sensor calibration error.	1. Restart the ventilator. 2. Re-calibrate flow sensor. 3. Replace PTU board. 4. Send the ventilator for service.
28	Int. Function Failure: 28	Main pressure sensor temperature calibration error.	1. Restart the ventilator. 2. Re-calibrate main pressure sensor temperature. 3. Replace PTU board. 4. Send the ventilator for service.
29	Int. Function Failure: 29	Flow sensor temperature calibration error.	1. Restart the ventilator. 2. Re-calibrate flow sensor temperature. 3. Replace PTU board. 4. Send the ventilator for service.
30	Int. Function Failure: 30	Over pressure.	1. Restart the ventilator. 2. Calibrate the pressure sensor. 3. Replace PTU board. 4. Send ventilator for service.
31	Int. Function Failure: 31	CPU board temperature is above 85°C (185°F).	1. Let the ventilator cool off and restart. 2. Check the cooling air filter. 3. Check the cabling to the cooling fan. 4. Check that the cooling fan runs. It shall always run when the ventilator is connected to mains. If it is not running - replace the cooling fan. 5. Replace the CPU board or send the ventilator for service.

Error Code	Text on Display	Problem	Action
32	Int. Function Failure: 32	CPU board temperature is below -30°C (-22°F).	<ol style="list-style-type: none"> 1. Place the ventilator in normal room temperature. Open the ventilator and make sure that there is no condensation inside. Reassemble the casing and restart. 2. Replace the PTU board. 3. Replace the CPU board or send the ventilator for service.
33	Int. Function Failure: 33	Communication CPU temperature is above 150°C (302°F).	<ol style="list-style-type: none"> 1. Let the ventilator cool off and restart. 2. Check the cooling air filter. 3. Check the cabling to the cooling fan. 4. Check that the cooling fan runs. It shall always run when the ventilator is connected to mains. If it is not running - replace the cooling fan. 5. Replace the CPU board or send the ventilator for service.
34	Int. Function Failure: 34	Treatment parameter check fails.	<ol style="list-style-type: none"> 1. Restart the ventilator. 2. Replace the CPU board. 3. Send ventilator for service.
35	Int. Function Failure: 35	Open Log database fails.	<ol style="list-style-type: none"> 1. Restart the ventilator. 2. Replace the CPU board. 3. Send ventilator for service.
36	Int. Function Failure: 36	Open Calibration database fails.	<ol style="list-style-type: none"> 1. Restart the ventilator. 2. Replace the CPU board. 3. Send ventilator for service.
37	Int. Function Failure: 37	Parameter database fails.	<ol style="list-style-type: none"> 1. Restart the ventilator. 2. Replace the CPU board. 3. Send ventilator for service.
38 (Nippy 4, Nippy 4+ and Vivo 45 LS only)	Int. Function Failure: 38	Sensor for exhalation valve control pressure fails.	<ol style="list-style-type: none"> 1. Restart the ventilator. 2. Replace the PTU board. 3. Replace the CPU board or send the ventilator for service.

9 Disposal

This chapter describes how to disassemble and sort the device's parts at disposal.

The ventilator, any accessories and all replaced parts must be disposed of and recycled in accordance with the local environmental regulations regarding the disposal of used equipment and waste.

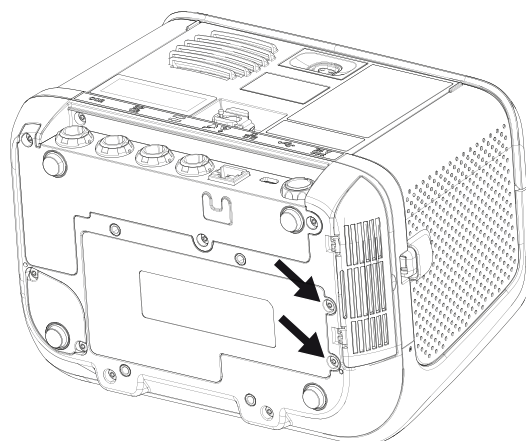
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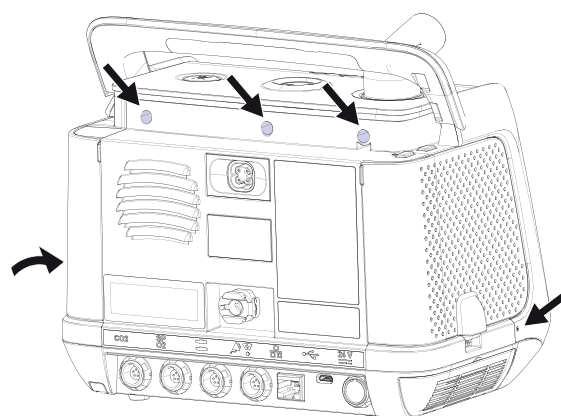
Batteries used with the ventilator shall be recycled in accordance with the local environmental regulations.

9.1 Disposal Procedure

- 1 Turn on the device.
- 2 Go to Others-> Device Memory -> Erase Memory Data.
- 3 Turn off the device.
- 4 Unscrew internal battery screws.

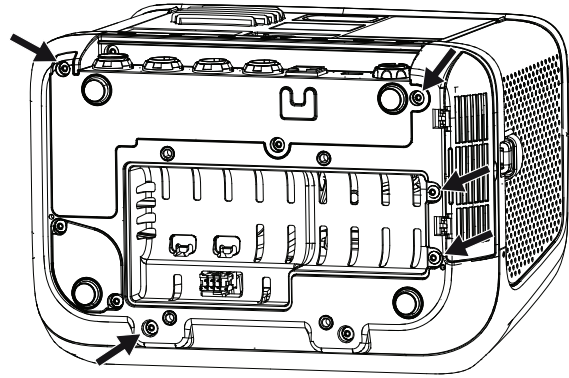


- 5 Detach the internal battery cable and disconnect the internal battery module.
- 6 Remove the two screws, one on each side.

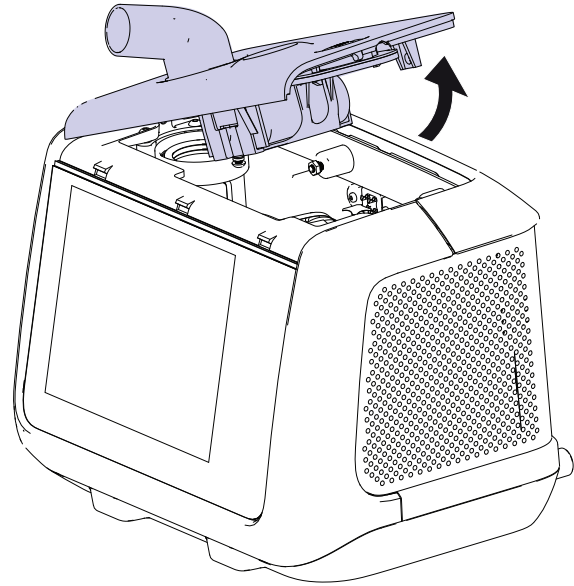


- 7 Remove the three top screws.

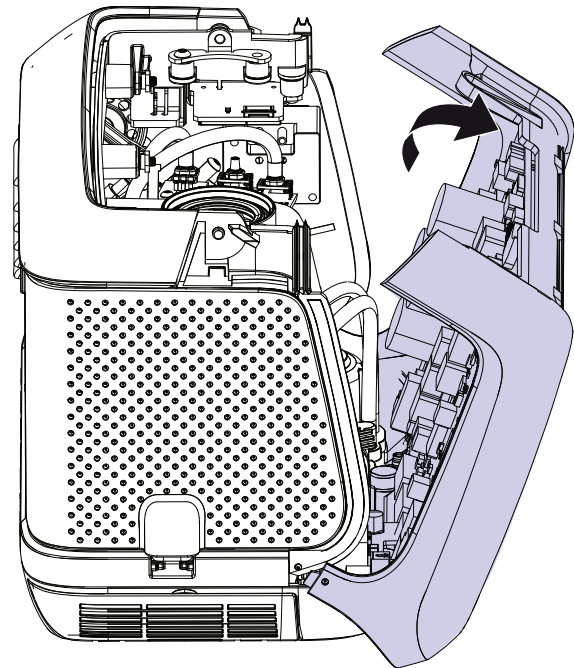
- 8 Remove the five screws in the bottom enclosure.



- 9 Remove the cover.



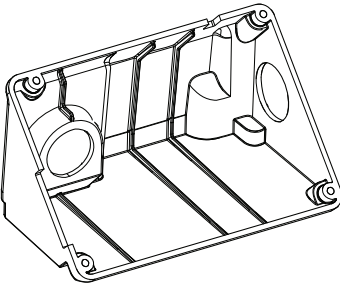
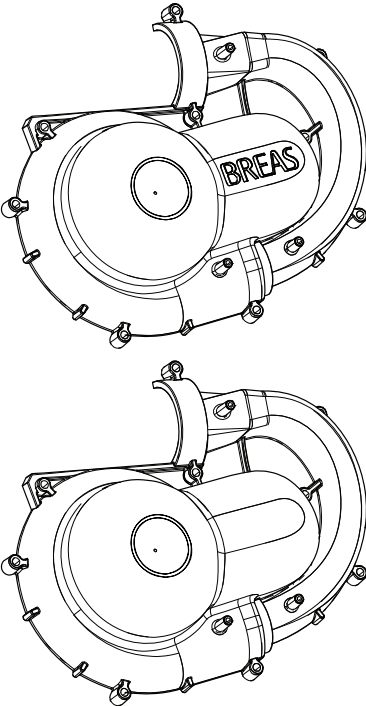
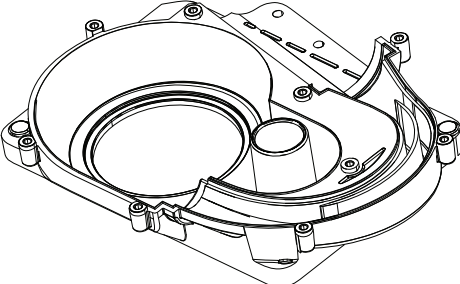
- 10 Open the device.
11 Disconnect cables that connects top cover and the rest of the device.
12 Disassemble the top cover.
13 Compare the top cover parts with the tables below.
14 Disassemble the front cover from the side enclosures and bottom enclosure. Disassemble any part that is connected to the enclosures.

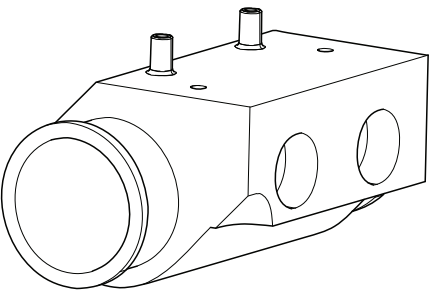
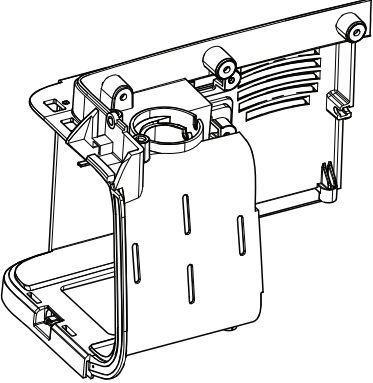
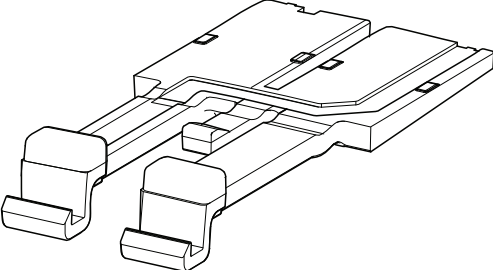
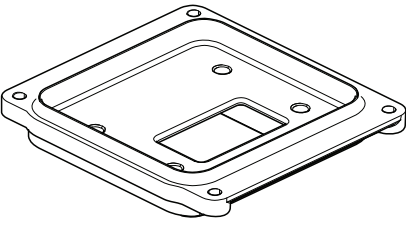
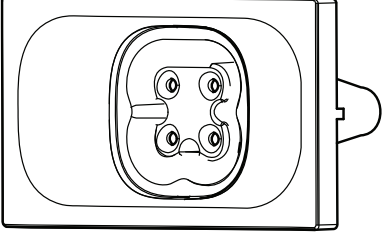
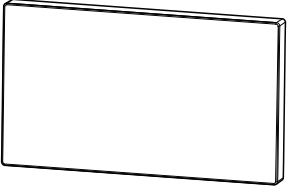


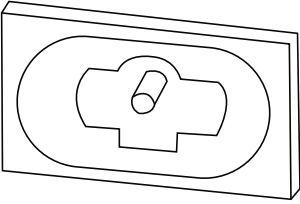
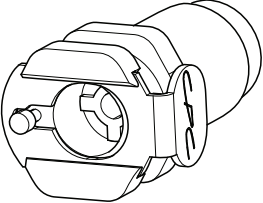
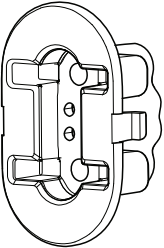
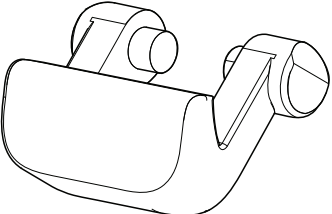
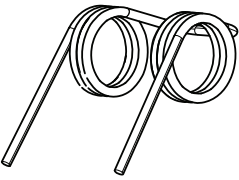
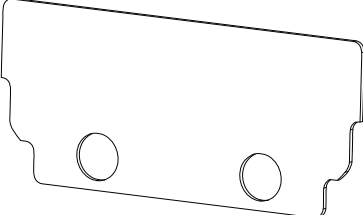
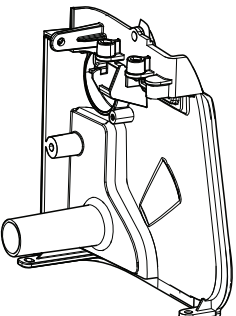
- 15 Compare the parts in the previous step with the table.

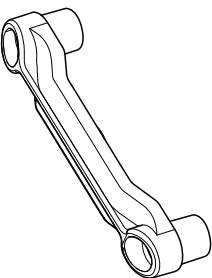
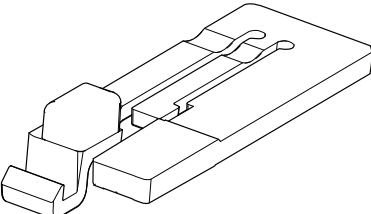
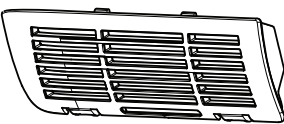
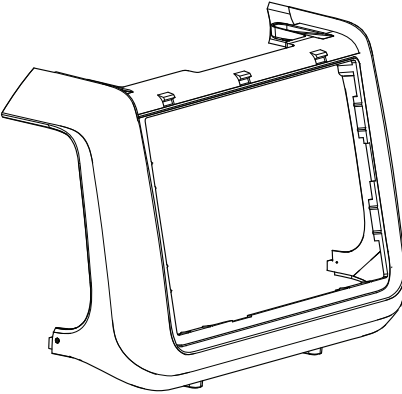
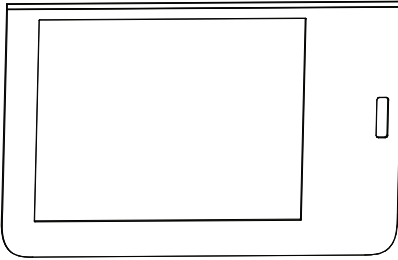
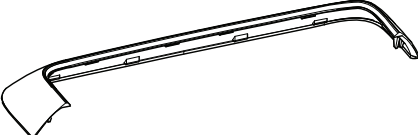
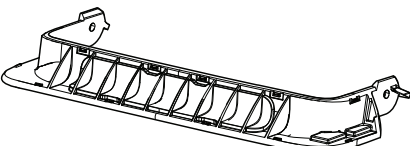
- 16 Disassemble the side enclosures from the bottom enclosure. Disassemble any part that is connected to the side enclosures.
- 17 Group the parts based on material. The below tables provide details about groups.
- 18 Disassemble the bottom enclosures and any parts connected to them.
- 19 Compare the bottom enclosure parts with the table.
- 20 Group the bottom enclosure parts based on material. The below tables provide details about groups.
- 21 Group the rest of the parts based on material.

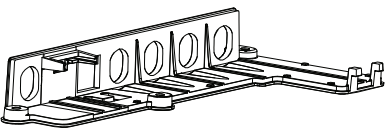
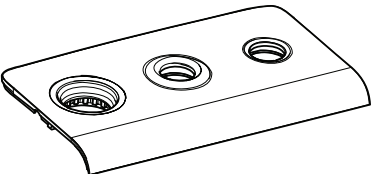
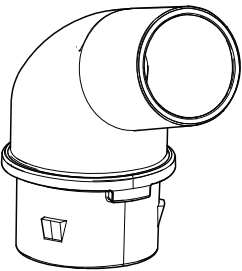
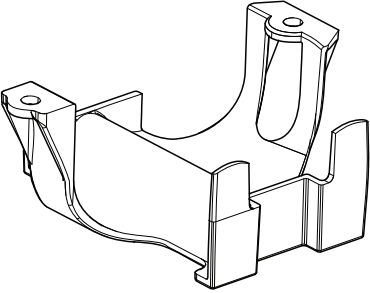
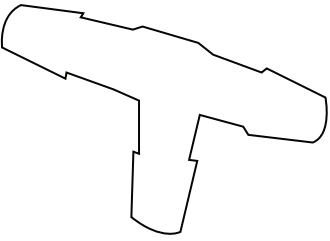
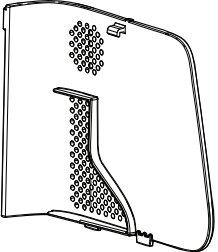
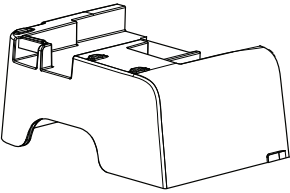
9.2 Parts and Materials

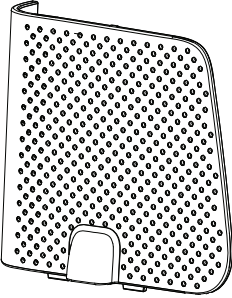
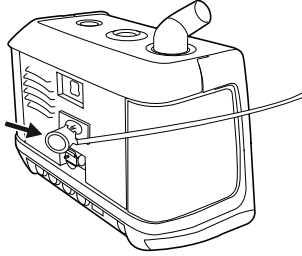
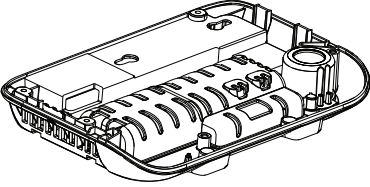
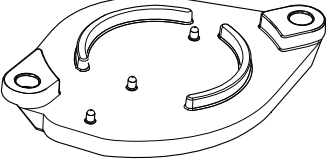
Plastic	
Part Name	Image
Blower Silencer	
Blower Chamber Top	
Blower Chamber Bottom	

Part Name	Image
Measuring Tube	 A line drawing of a measuring tube, which is a rectangular block with a large circular flange on one end and two smaller cylindrical ports on the top surface.
Back Enclosure	 A line drawing of a back enclosure, showing a rectangular frame with various mounting points, slots, and a central circular opening.
Latch Plate, Left	 A line drawing of a latch plate, left side, featuring a rectangular base with two prominent latching mechanisms on the left side.
Mount Tray, Heater Plate	 A line drawing of a mount tray, heater plate, which is a rectangular plate with a central rectangular cutout and several mounting holes around the perimeter.
Heated wire Panel, Connector Socket	 A line drawing of a heated wire panel, connector socket, showing a rectangular panel with a central circular socket containing four pins.
Pilot Pressure Panel, Dummy	 A line drawing of a pilot pressure panel, dummy, which is a simple rectangular plate with a slightly raised edge.

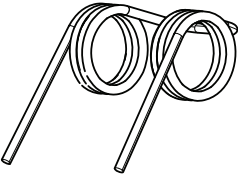
Part Name	Image
Assy, Connector Panel, Pilot Pressure	
Connector, CPC	
connector, Click-in battery	
Battery Latch	
Torsion Spring, Battery Latch	
Seal, Battery Latch Opening	
Side Enclosure	

Part Name	Image
Speaker Holder	 A line drawing of a speaker holder, which is a curved, L-shaped component with a circular opening at one end and a smaller circular opening at the other.
Latch Plate, Right	 A line drawing of a latch plate, which is a rectangular component with a small rectangular protrusion on one side and a small rectangular hole on the other.
Cooling Air Filter Cover	 A line drawing of a cooling air filter cover, which is a rectangular component with a grid of horizontal slats.
Front Cover	 A line drawing of a front cover, which is a large, rectangular component with a curved top and a small rectangular protrusion on the right side.
Overlay, Window, Nippy Overlay, Window, Vivo45	 A line drawing of a window overlay, which is a rectangular component with a small rectangular protrusion on the right side.
Handle Top	 A line drawing of a handle top, which is a long, curved component with a small rectangular protrusion at one end.
Handle Bottom	 A line drawing of a handle bottom, which is a long, curved component with a small rectangular protrusion at one end and a small rectangular hole at the other.

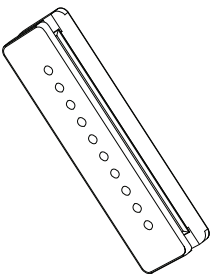
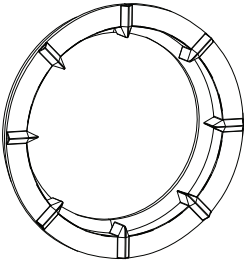
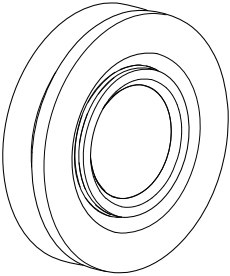
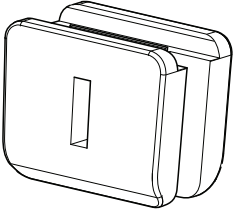
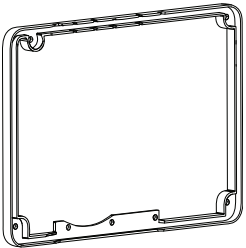
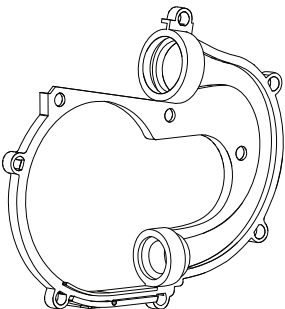
Part Name	Image
Connector Box	
Top Cover	
Air Outlet Swivel	
Bracket Supercap	
T-connector, Barbed, Black	
Side Cover, Right	
Air bypass Top	
Air bypass bottom	

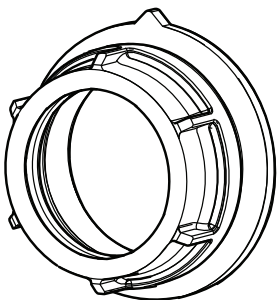
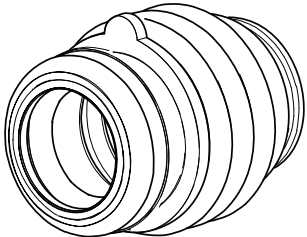
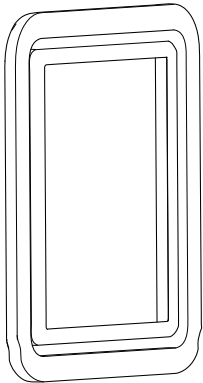
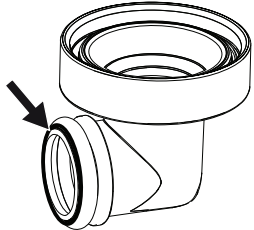
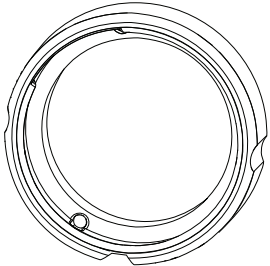
Part Name	Image
Side Cover, Left	
Assy, Pilot Pressure Plug	
Bottom Enclosure	
Oxygen Sensor cover	

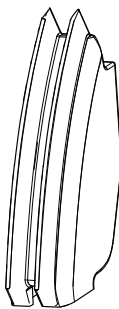
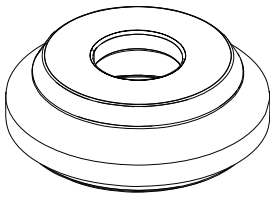
Metal

Part Name	Image
Torsion Spring, Battery Latch	

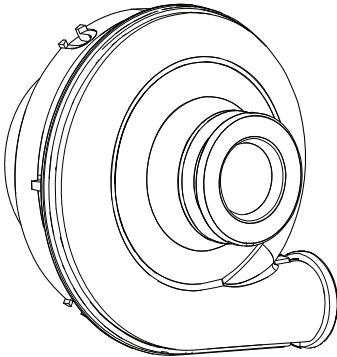
Silicone

Part Name	Image
Gasket, Blower Wire Seal	
Gasket, Blower Mount	
Gasket, O2 Inlet	
Ambient T/H sensor seal	
Gasket, Blower Silencer	
Gasket, Blower Top-Bottom	

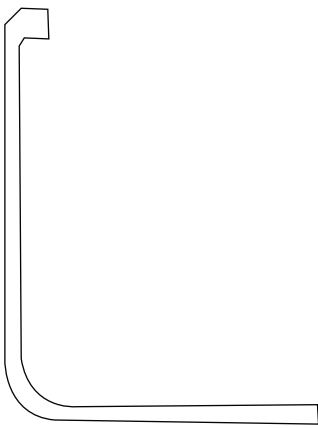
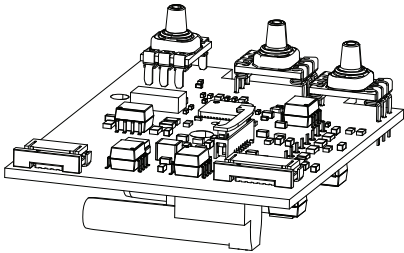
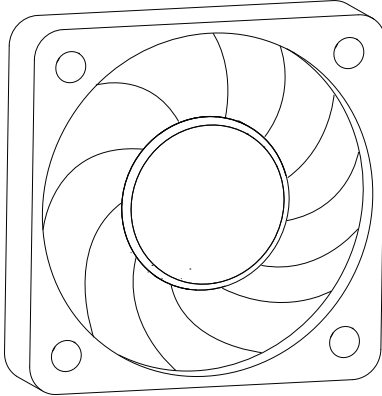
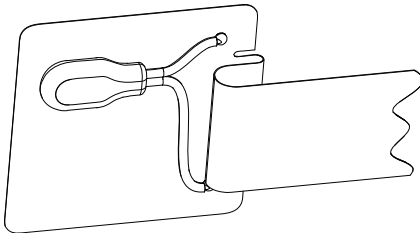
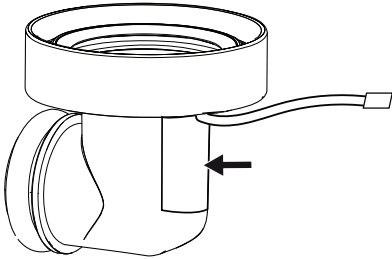

Part Name	Image
Gasket, Blower Inlet	
Gasket, Blower Outlet	
Tubing silicone, 2mm ID, 5mm OD	
Gasket, Heater Plate	
Swivel Seal	
Gasket, Speaker	

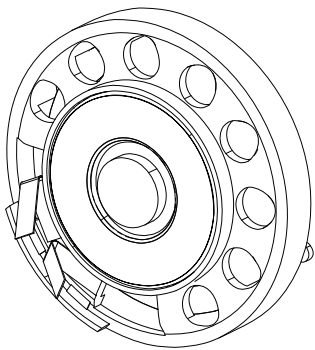
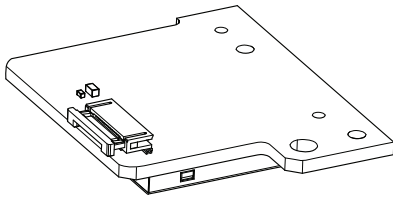
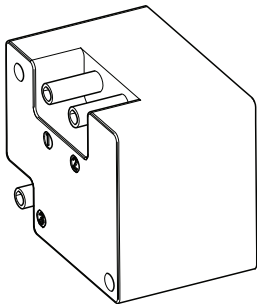
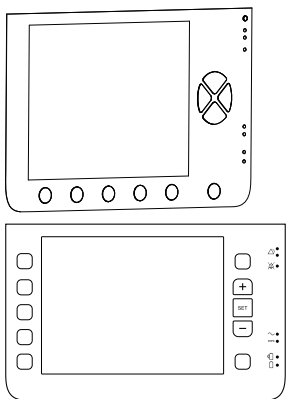
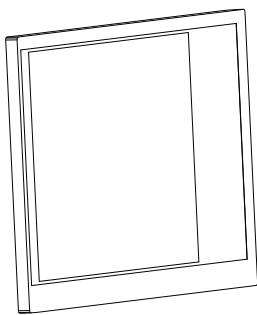
Part Name	Image
Gasket, Top seal	
Gasket, FiO2 PCB	

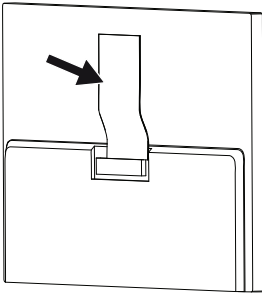
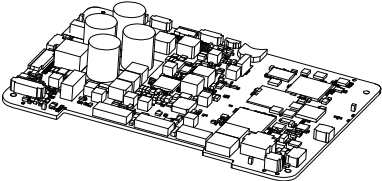
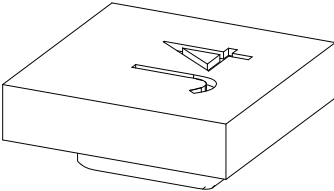
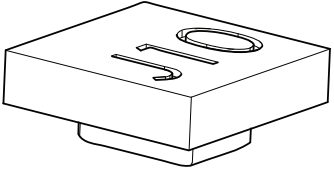
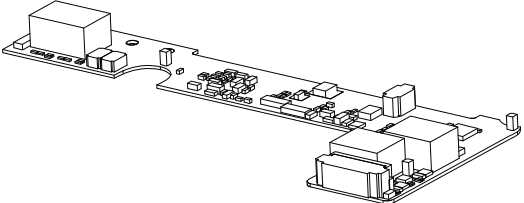
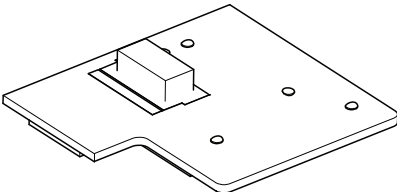
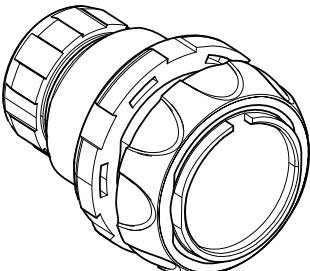
Motor

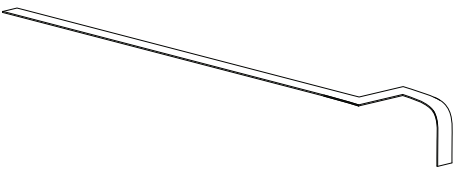
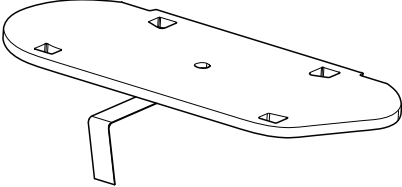
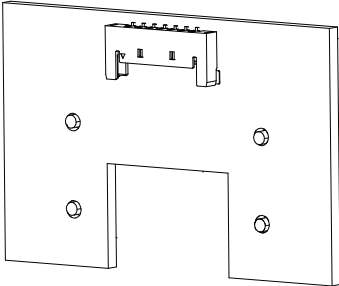
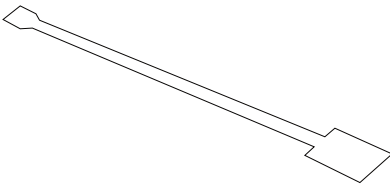
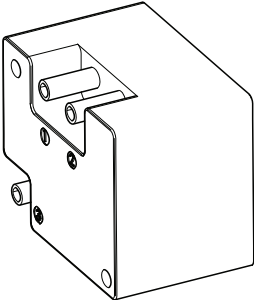
Part Name	Image
Radial blower and cable	

PCB and Electronics

Part Name	Image
Ambient temp and humidity cable	
Flow and pressure PCB	
Cooling fan	
Heater	
Patient Temp and Humidity sensor	
Chamber detection sensor	

Part Name	Image
Speaker with Cable	
V45 SD CARD PCB	
Piezo valve control	
Overlay Panel	
LCD display module	

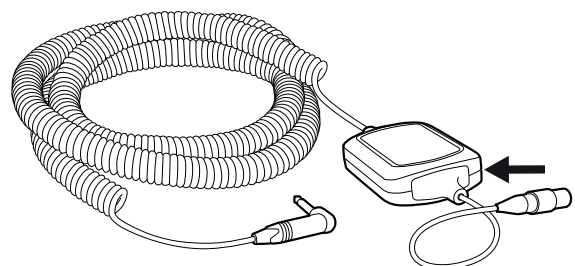
Part Name	Image
Cable, LCD display to main PCB	
Main Board	
Main board J4	
Main board J10	
Connector Board	
Connector Board (USB)	
DC in	

Part Name	Image
Connector Board Flex PCB	
Top button membrane switches including 70mm Flat Flex cable (FFC)	
Supercap PCB	
Cables	-
Sensor	
Assy, FiO2 sensor PCB	
Piezo valve control	

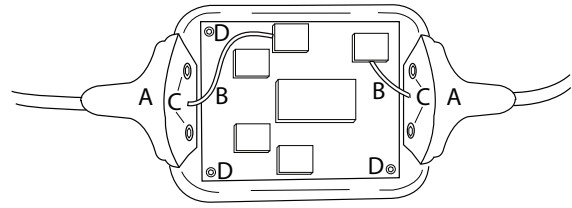
9.3 Disposal

This section describes the disposal procedure for the Remote start/stop accessory.

- 1 Insert a screwdriver into the groove to open the cover.



- 2 Remove the two grey cable connection covers (A).



- 3 Cut the cables (B).
- 4 Remove the screws on each connector (C).
- 5 Remove the three screws (D) and dismount the circuit board.
- 6 Dispose of the parts according to the local environmental regulations.

Material

Cover	ABS plastics
Circuit board	PCB/wire/electronics
Cable	PCB/wire/electronics

10 Appendices

10.1 Emission and Immunity Declaration

The Vivo 45/Nippy 4 is tested for electromagnetic emission and immunity according to IEC 60601-1-2 4th edition. See the Clinician's Manual for declarations and information about performed tests.

10.2 Returning Products to Breas



Use the RMA (return material authorisation) request on the Breas Extranet if you want to return any product to Breas.
Contact your Breas representative for more information.



NOTE

Product damage caused by poor packaging or during transportation is not covered by the factory warranty.

10.3 Service Record

Use a photocopy of this service record for the maintenance inspection described in 2 *Maintenance Instructions*, page 8. Use the Notes section below for comments and notes.

Service record no

Model **Serial no** **Inventory no**

Accessories

Delivery date	Device operating hours
Service started	Signature
Service completed	Signature
Product returned	Signature

General	See instruction ref.	Check OK
Open new service record and identify ventilator	2.3.3	
Note number of device operating hours	2.4.2	
Check all markings	2.4.3	
Check information from user	2.4.4	
Check validity of documentation	2.4.5	
External Checks		
Inspect for external damage and wear	2.5.1	
Check power connection	2.5.2	
Inspect patient circuit	2.5.3	
Inspect the ventilator accessories	2.5.4	
Change/wash the patient filters	2.5.5	
Perform minimum function check	2.5.7	

Vivo 45, Service



ENGLISH (EU)



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Fax +46 31 86 88 10 www.breas.com, Date: 2022-03-25 | 17571

