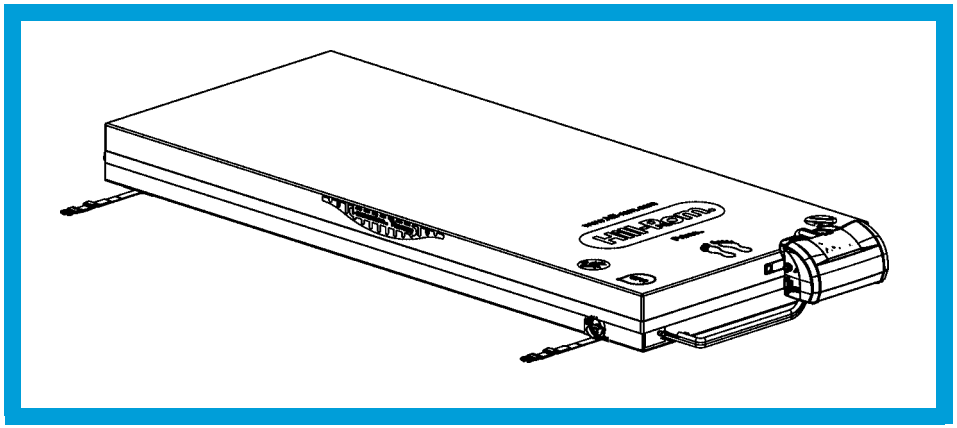
Service Manual



Primo™

P02033 / P02034 / P02044 / P02047

Hill-Rom

171636

Rev.001

EN

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001	Original	September 2012

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Chapter 1 Introduction

Introduction

This manual contains the information required for the normal operation and maintenance of the Hill-Rom Primo™. The part numbers of the spares can be found in the catalog P/N 171353.

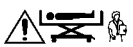
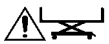
This manual is intended for use by facility-authorized personnel. Use by unauthorized personnel may result in damage to the equipment and/or serious injury to staff or users.

Typographical conventions used in this manual

This manual contains different typefaces and icons designed to improve readability and increase understanding of its content. Note the following examples:

- Standard text: used for regular information.
- **Bold text**: emphasizes a word or phrase.
- **NOTE**: sets apart special information or important instruction clarification.

The symbols below represent different risks or hazards:

Symbol	Description
	**WARNING** • This symbol indicates that the failure to follow the associated recommendation can put the patient or the user in danger, or damage the equipment.
	**CAUTION** • This symbol indicates that the failure to follow the associated recommendation can result in damage to the equipment.
	Electric Shock Hazard

Precautions for use

Before using, it is essential to read the User Manual of the Primo™ and this Service Manual and to strictly follow all the safety instructions in these manuals.

Caregivers must be informed of the risks that may be encountered in the use of electric devices.

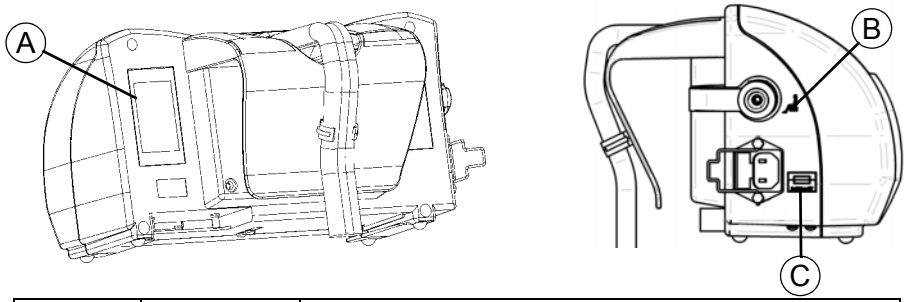
Glossary of abbreviations

Table 1-1. Glossary of abbreviations

Abbreviations	Definition
CPR	Return the head section to the flat position for cardio-pulmonary reanimation
I-mmersion™	Trade mark: pressure control system
EV	Electro valve
RAP	Repair Analysis Procedure
P/N	Part number

Warning labels:

Figure 1-1. Control unit



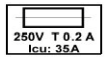
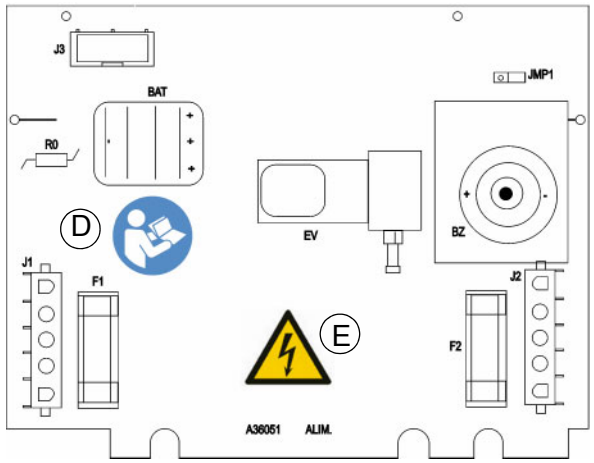
A		Identification labels
B		Seat cushion inflation port
C		Fuses for 220-240 VAC
		Fuses for 120 VAC

Figure 1-2. Power PCB



D		Refer to the user manual. (if the battery fails, replace the power supply PCB - follow procedure 3.6 page 3-5).
E		Warning: High voltage!

Model identification

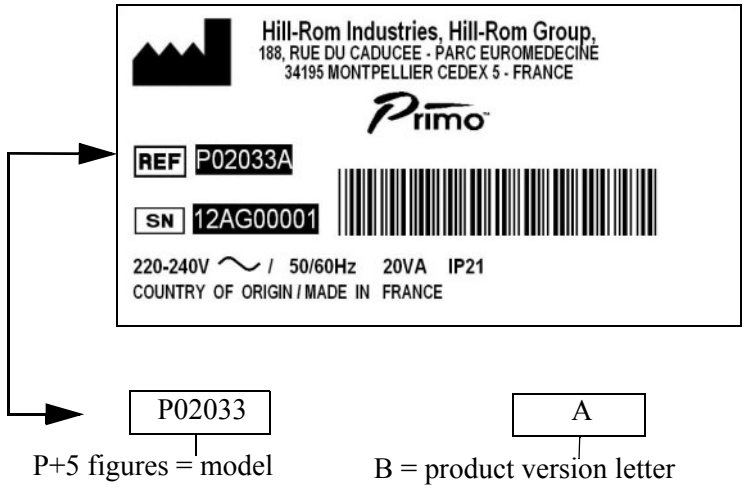
Refer to the table below to identify the models of the Primo™ Therapeutic Mattress.

Table 1-2. Model Identification

Name	Part number	Technical characteristics
Primo 85x200	P02033	220 - 240V ~, 50/60Hz
Primo 85x200	P02034	120V ~, 60Hz
Primo 77x200	P02044	220 - 240V ~, 50/60Hz
Primo 85x200 FIRE	P02047	220 - 240V ~, 50/60Hz

Identification label

Figure 1-3. Identification label



NOTE:
This procedure applies to class II* models which are identified by a P, followed by five numbers, from version A onwards (see figure 1-3 page 1-3). For all earlier versions, refer to the Service Manual P/N W10006.

Class II devices are identified by the symbol ⧈ on the label.

General description

The Primo™ helps to prevent and treat pressure ulcers in all adult patients, exposed to low to moderate risks.

The pressure in the air bladders is automatically regulated by the innovative I-mmersion™ pressure control system.
This patented technology permanently detects the weight and position of the patient's body and dynamically adjusts the pressure in the mattress.

Figure 1-4. Exploded view of the Primo™

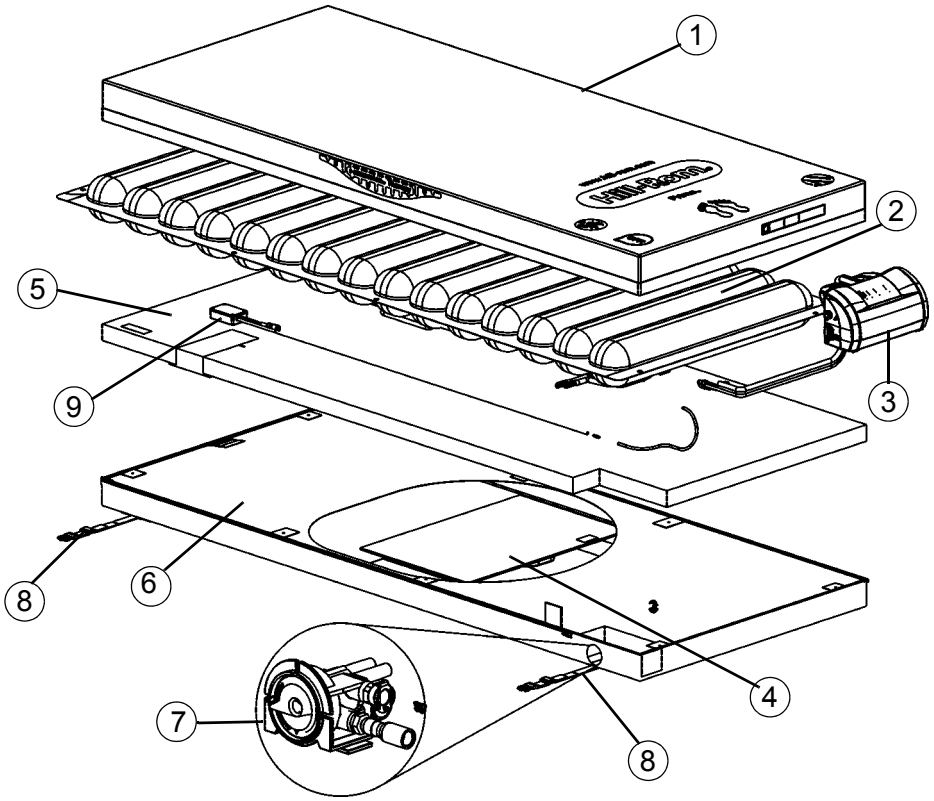


Table 1-3. Description

Item	Name
1	Upper cover
2	Air mattress
3	Control unit
4	Sensor
5	Foam sub-mattress
6	Bottom cover
7	CPR valve
8	Straps
9	Sensor unit

Technical specifications

Table 1-4. Control unit

Characteristics	Description			
Model	**P02033**	**P02047**	**P02034**	**P02044**
Dimensions	15x29x12 cm / 6x11.5x5"			
Weight	3,5 kg / 8 lb			
Power supply	220-240V 50/60 Hz	220-240V 50/60 Hz	120V 60Hz	220-240V 50/60 Hz
Apparent power	20 VA	20 VA	32 VA	20 VA
Maximum energy consumption	16.4 Wh	16.4 Wh	16.4 Wh	16.4 Wh
Operation of the device	Continuous			
Sleeve material	ABS PC V0			
Device: Acoustic pressure / power (ISO 3744)	41 dB(A) / 52 dB(A)			
Alarm: Acoustic pressure / power (IEC60601-1-8)	56 dB(A) / 67 dB(A)			
Fuse	T160 mA	T160 mA	T200 mA	T160 mA
Compression	0-180 mBar	0-180 mBar	0-215 mBar	0-180 mBar
Maximum compressor flow rate	10 l/min	10 l/min	12 l/min	10 l/min
IEC 60601-1 classification	Class II			
Degree of protection provided by the unit (IEC 60529)	IP21: protected against access to dangerous parts with fingers and vertically dripping water			
Protection against inflammable anesthetic mixtures	Not for use with flammable anesthetics			
Battery life	1 hour			

Table 1-5. Therapeutic Mattress

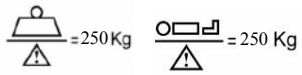
Characteristics	Values	
Model	**P02033/P02047/P02034**	**P02044**
Length (inflated)	200 cm / 79"	
Width (inflated)	85 cm / 33.5"	77 cm / 30.5"
Height (inflated)	16 cm / 6"	
Weight	8,4 kg / 18.5 lb	
Operation in transport mode	2 hours	
Upper cover	Polyurethane coating on polyester material Low-friction, stretchable in both directions, breathing, bacteriostatic, fungistatic and antimicrobial. Can be wiped and washed.	
Bladders	Polyurethane	
	Safe working load, including the total weight of the patient, accessories (if they are supported by the support system of the medical bed) and the load supported by these accessories (excluding the weight of the patient).	
Maximum pressure of the safety valve	1 psi / 69 mBar	
Degree of protection against electric shock	Type BF applied parts protected against defibrillation shocks (items 1 and 6 page 1-3)	
Degree of protection provided by the cover (IEC 60529)	IP24: protected against access to dangerous parts with fingers and splashes of water	

Table 1-6. Conditions for transport, storage and use

Symbol	Features	Use	Transport/storage15[a]
	Temperature	+5°C - +40°C	-25°C - +70°C
	Humidity	15% - 93%	0% - 93%
	Atmospheric pressure	700 mbar - 1,060 mbar	700 mbar - 1,060 mbar

a. Applicable only if the device is stored in its original packaging.

Operating principle

The operation of the Primo™ can be split into three categories or subsystems:

- Mechanical subsystem
- Electric subsystem
- Pneumatic subsystem

The device operates thanks to the combined functions of these three subassemblies.

These three subassemblies must operate correctly with one another for the device to function correctly.

Each of these subassemblies is described separately in the following sections.

Figure 1-5. Overview

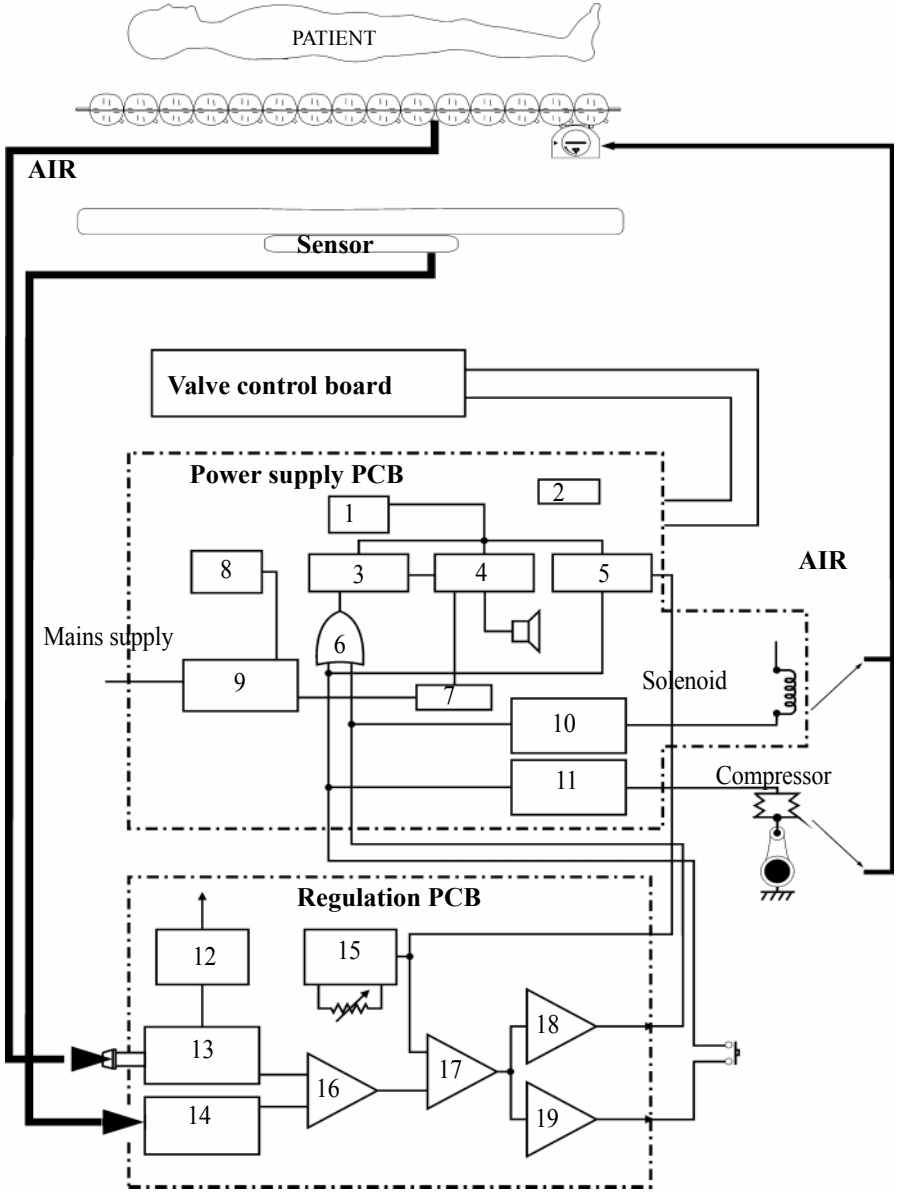


Table 1-7. General description

Item	Name
1	Clock
2	Battery
3	Malfunction alarm time delay
4	Alarm silence time delay
5	Compressor override time delay
6	Alarm
7	Mains power alarm
8	On/Off switch
9	+12V power
10	Leak control
11	Compressor control
12	Power supply
13	Air pressure transducer
14	Sensor signal conditioning
15	Set point adjustment
16	Amplifier
17	Integrator
18	High comparator
19	Low comparator

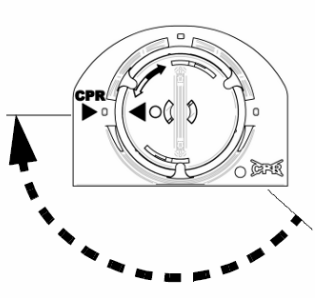
Mechanical subsystem

CPR valve

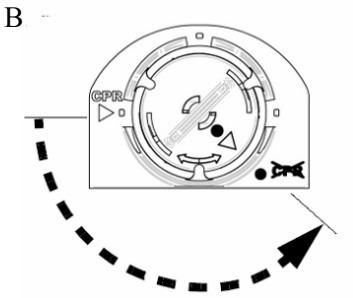
The CPR valve is at the foot of the mattress. Turn the yellow valve clockwise (A) to activate the CPR. Activating the CPR deflates the mattress in less than 20 seconds.

Turn the yellow valve (B) anti-clockwise to its original position to deactivate the CPR.

A



B



Seat cushion connector

The seat cushion connector used to inflate the cushion is on the left-hand side of the control unit. It is available as an option.

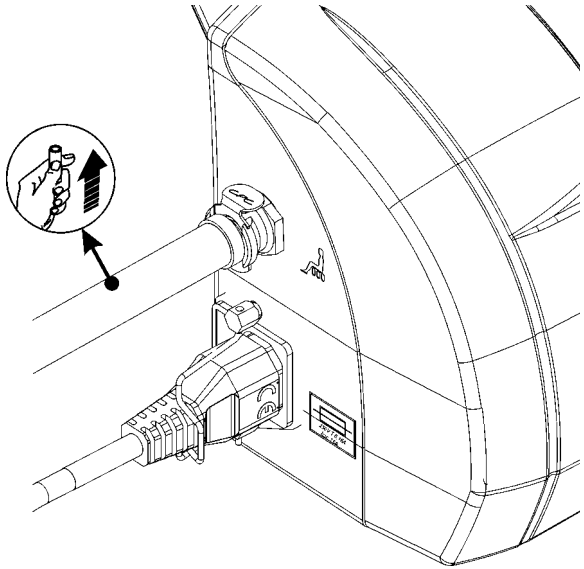
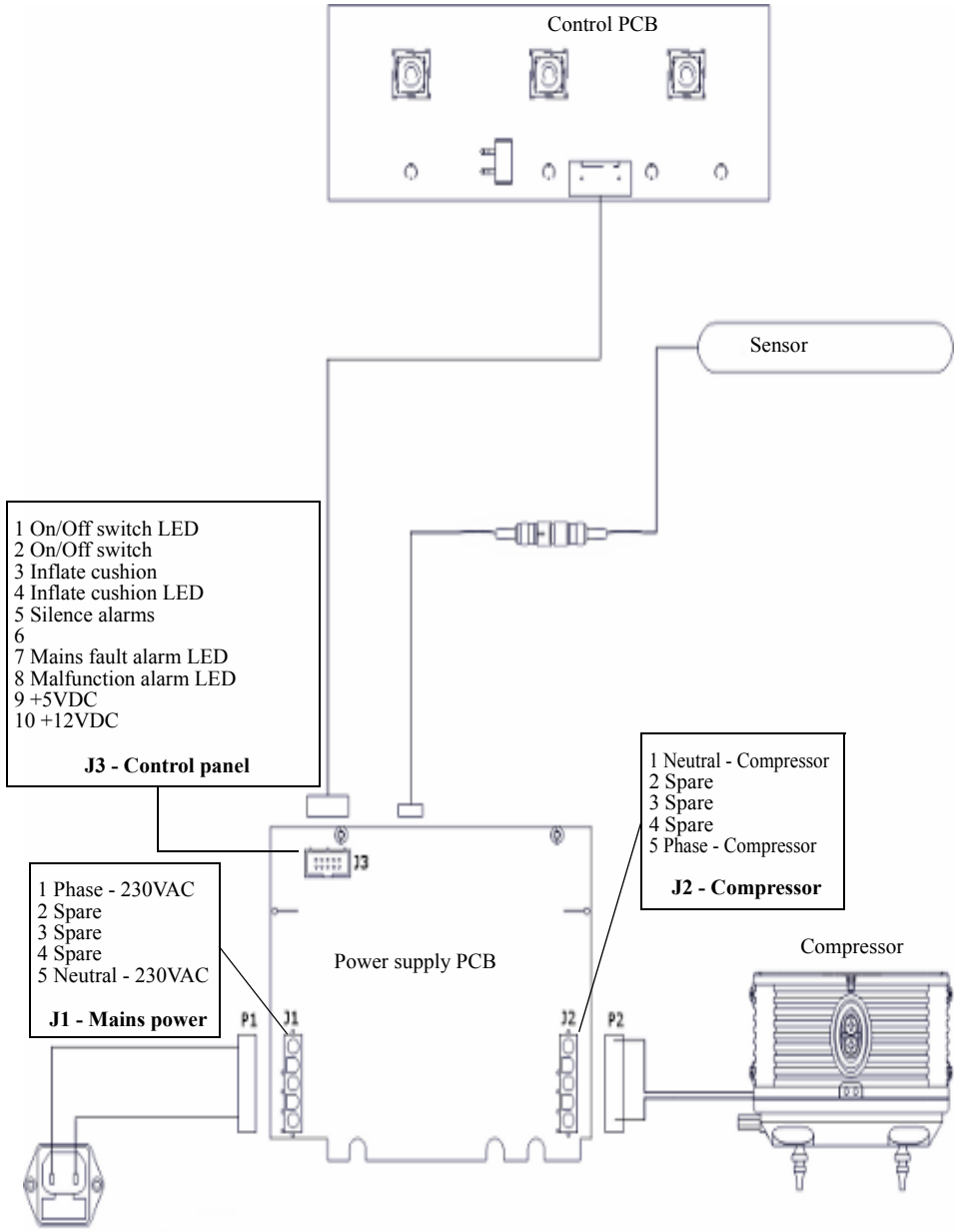


Figure 1-6. Wiring and electrical distribution



Electric subsystem

All the major systems are protected by fuses.

The fuses are located:

- on the mains power socket (See “Replacing the mains socket fuse” page 3 - 2);
- at input of mains transformer, marked F1 on the power PCB (See “Replacing the power PCB fuses” page 3 - 5);
- at output of solid-state relay of the compressor, marked F2 on the power PCB (See “Replacing the power PCB fuses” page 3 - 5).

The I-mmersion™ control circuit constitutes the heart of the system:

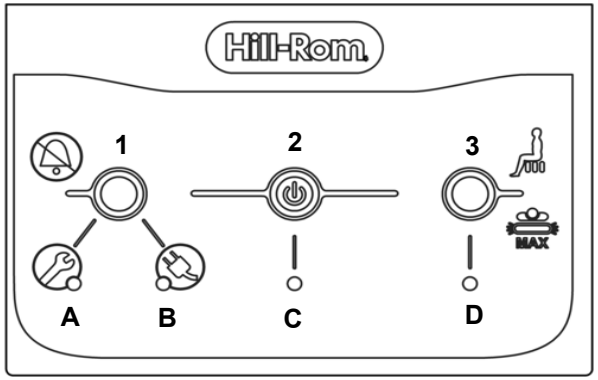
- It automatically compensates for patient/bed position changes and supports the patient at the optimal pressure.
- It automatically corrects the pressure in the bladders.
- It automatically compensates most variations due to external parameters.

Control unit

The control unit contains a rechargeable battery on the power PCB. It powers the mains supply alarm in the event of a power cut.

The control unit panel is the main means of controlling the Primo™. It contains the minimal functions and provides the user with feedback on the status of the device and any malfunctions that may occur.

Figure 1-7. Control unit panel



Buttons and indicator lights

Buttons

1 - Audio alarm silence:
deactivates the Mains fault and Malfunction audio alarms.

2 - On/Off.

NOTE:
To switch off the mains power supply:
press to cut out the battery. In this case, no mains power supply fault alarms will be raised;
Unplug the device from the wall socket.

3 - Maximum inflate:
increases the pressure in the mattress to the maximum value for 5 minutes and automatically returns to therapeutic mode.
Is also used to inflate the seat cushion.

Indicators / alarms

(see figure 1-7 page 1-8)

A - Malfunction alarm:
the audio alarm sounds and the yellow visual alarm lights up after about 10 minutes, when:

- the sensor is faulty;
- the sensor is disconnected;
- CPR mode is active;
- the mattress is damaged (tears, leaks, damaged couplings, etc).

The audio alarm sounds and the yellow visual alarm lights up after about 20 minutes, when:

- the pressure in the mattress drops below 4″H_2O +/- 0.8"H_2O (10 mbar +/- 2 mbar);

B - Mains power fault alarm:
The audio alarm sounds and the yellow visual alarm lights up immediately, in the event of:

- electric power cut;
- damaged power supply cable;
- accidental disconnection of the power supply cable;
- fuse on the mains power supply socket, or fuse F1 on the power supply PCB damaged;
- transport.

C - On/Off indicator light:
the green light comes on when the control unit is on.

D - Inflation indicator:
the green light flashes for 5 minutes as the mattress is inflated.

I-mmersion™ sensor

The I-mmersion™ sensor, which has its own PCB, uses resistive variation due to the applied force. When the patient's sacrum presses against the mattress, this pressure is transmitted to the sensor as a force. The variation in the resistivity of the sensor is measured. A signal is then sent to the control unit to deflate or inflate the mattress, until the pressure in the mattress is equal to the pressure of the sensor.
By calibrating the balance of the I-mmersion™ sensor, the servo-control always optimizes the support of the patient, irrespective of their weight or position (within the limits specified in page 1-5).

CPR valve

In CPR mode, the regulation functions normally, the compressor remains under control, but not the leak solenoid. The yellow visual alarm lights up to indicate that that the pressure is low. A low-priority alarm sounds immediately, intermittently and at a moderate volume.

Pneumatic subsystem

The air is drawn into the control unit through the air filter. The air filter limits the ingress of dust, which could clog the pneumatic circuit. The air then flows into the compressor inlet.
When the air leaves the compressor, it is distributed between the bladders in the mattress, the mattress/seat cushion coupling and the pressure relief valve on the electric power supply PCB.

Two-tier mattress

The mattress is made up of two levels:

- a therapeutic mattress;
- a foam sub-mattress, which includes the sensor unit, and a lower cover that includes the sensor.

The therapeutic mattress is a single piece made up of a series of 15 airtight bladders. The air pressure in these bladders is the same as the pressure in the sensor in the lower cover.

The I-mmersion™ detector is located beneath the sacrum zone of the therapeutic mattress.

Regulatory requirements

CE 0459 The Primo™ is a class IIa medical device that complies with the requirements of Directive 93/42/EC and its amendments.

The CE mark was applied in 1998.

The Primo™ is designed and manufactured in accordance with the following standards and classifications:

Quality standards:

- ISO 9001: 2008 - ISO 13485: 2012 - ISO 14001: 2004

Technical standards:

Name	P02033/P02034/ P02044	P02047
EN IEC 60601-1: 2006	YES	YES
EN IEC 60601-1-2: 2007	YES	YES
EN IEC 60601-1-6: 2010	YES	YES
EN IEC 60601-1-8: 2007	YES	YES
EN IEC 60601-1-11: 2010	YES	YES
EN ISO 14971: 2012	YES	YES
EN ISO 10993-1: 2009	YES	YES
EN ISO 10993-5: 2010	YES	YES
EN ISO 10993-10: 2009	YES	YES
EN ISO 980: 2009	YES	YES
EN 597-1: 1995	YES	YES
EN 597-2: 1995	YES	YES
SS 876 00 01 (NT FIRE 037)	YES	YES
UNI 9175: 2008 (Class 1 IM)	NO	YES
BS 6807: 2006, Clause 9, Ignition/5	NO	YES
BS 7177: 1996 (Medium hazard)	NO	YES

End-of-life equipment

The Primo™ and its accessories should be cleaned and disinfected before de-commissioning.

Decommissioned equipment materials (plastics, electrical components, etc.) must be recycled in accordance with local recycling regulations. Always meet the applicable demands and local rules relating to environmental protection, in particular for waste from medical devices.

Do not dispose of electric and electronic equipment in the waste bin (as per directive 2012/19/EC).

Never discard the batteries or accumulators of your device. They may contain substances and metals that are hazardous for the environment and health (as per Directive 2006/96/EC).

Chapter 2
Troubleshooting Procedures

Safety recommendations

Never modify this device without Hill-Rom's prior written consent.
Only facility-authorized personnel should perform maintenance.
Changes made by unauthorized personnel may result in damage to the equipment and/or serious injury to staff or users.

Before maintenance or servicing works:

- Check that the brakes are applied on the bed on which the mattress is installed.
- Lock out all electrical functions.
- Unplug the device.
- Secure the mattress support platform and take whatever steps are necessary to prevent any movement.

Required tools

The following tools are required to troubleshoot the Primo™ therapeutic mattress:

- clamping pliers (P/N: G01008);
- digital pressure gauge kit (P/N G05003);
- diagnostic tester (P/N G05002);
- 25kg test load (P/N G02004).

For details of the list of tools, refer to the spare parts catalog (P/N: 169854).

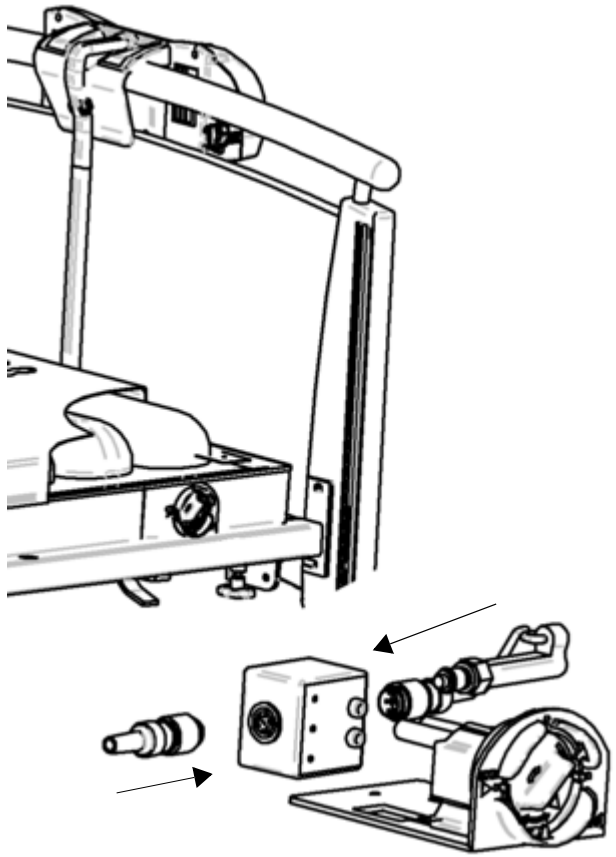
NOTE:
Refer to the following at the start of each RAP if necessary:

- "Glossary of abbreviations" page 1-1 for the meaning of the abbreviations used in this manual.

Diagnostic tester

The diagnostic tester is used to detect fault signals between the control unit and the sensor. Connector on the normal connection of the CPR valve (see figure below).

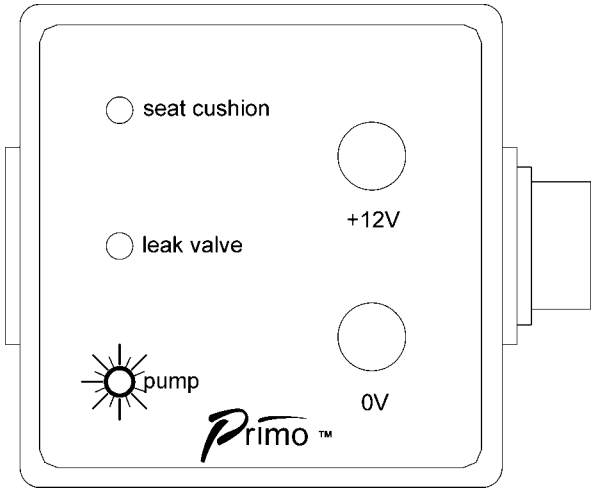
Figure 2-1. Connection of the diagnostic tester to the CPR valve



The diagnosis tester is used to:

- measure the 12 V DC supply voltage of the I-mmersion sensor;
- check the inflation signal sent by the I-mmersion sensor;
- check the deflation signal sent by the I-mmersion sensor;
- check the temporary inflation signal sent by the power PCB when the seat cushion inflate function is activated.

Figure 2-2. Indicator lights (LED) on the diagnostic tester



Getting Started

Start all of the procedures in this Chapter at step 1. Follow the indicated order. Each step assumes that the preceding steps have been correctly completed. Each step corresponds to the normal operation of the product. Please answer "Yes" or "No" to the question. If more than one component is listed, replace them in the given order, and re-install the original component that was found to be OK.

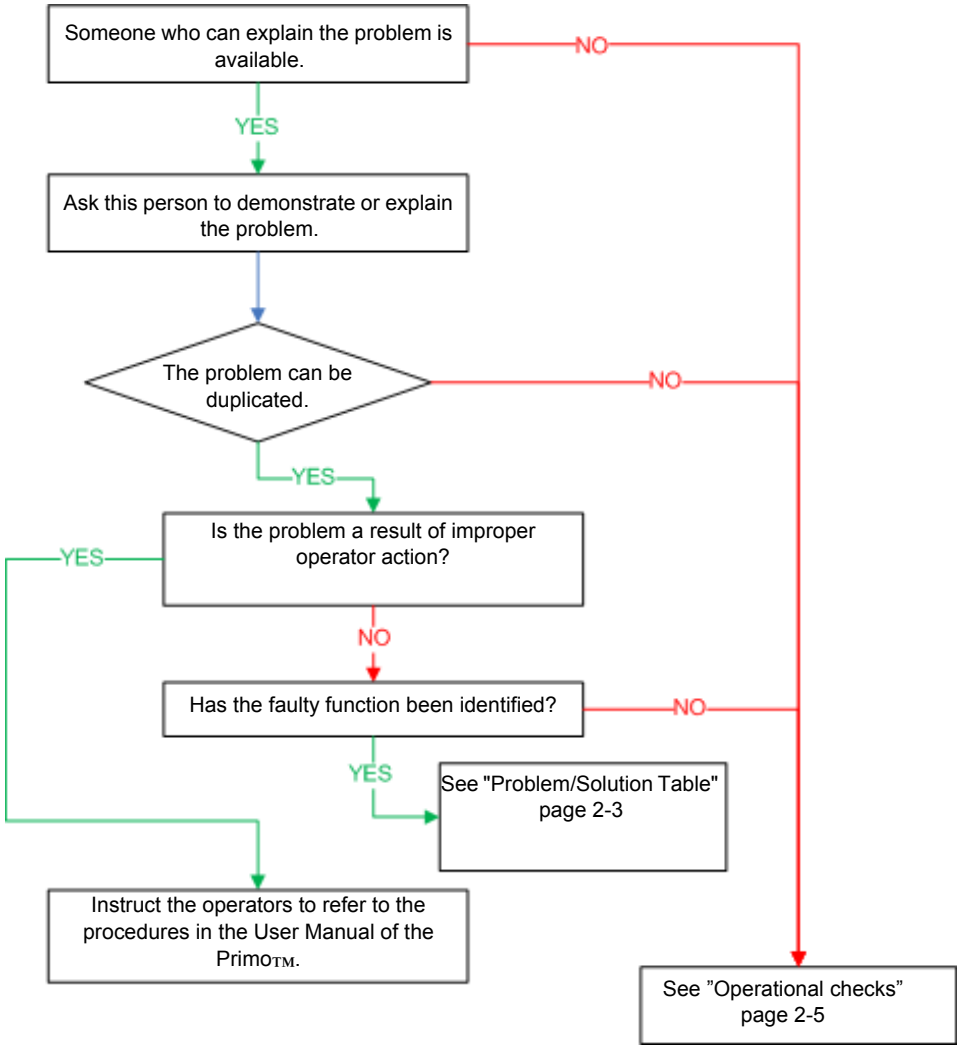
1. To begin gathering information about the problem, start with the initial actions.
2. Perform functional checks to locate/identify a problem and check the repair after every corrective action (e.g., replacing or adjusting a part, installing a cable).
3. To verify the repair, perform the final actions after the function checks.

If the troubleshooting procedures do not isolate the problem, call your national Hill-Rom Technical Support (see back cover) for assistance.

NOTE:
The purpose of the proposed troubleshooting method is to limit as much as possible the number of spare parts required and costs when analyzing the failure.

Initial Actions

Use the initial actions to gather information from operators concerning problems with the Primo™. Note the symptoms and all other information concerning the problem that the operator describes. This information helps identify the probable cause.



Problem/Solution Table

If the problem can be easily identified, use the following tables to determine the appropriate troubleshooting procedure.

Table 2-1. Problem/Solution Table

Problem	Solution
The system does not start	"RAP 2.1 Electric power supply fault", page 6
The audible mains fault alarm does not sound	"RAP 2.2 Mains power supply alarm fault", page 7
The compressor does not start	"RAP 2.3 Compressor fault", page 8
The compressor does not stop	"RAP 2.4 Leak", page 9
The audible malfunction alarm does not sound	"RAP 2.5 Malfunction alarm fault", page 10

Final actions

1. Perform the required preventive maintenance procedures. Refer to the "Preventive maintenance form" in the PM-PDI manual (P/N: 172559).
2. Complete all required administrative tasks.

Preventive maintenance instructions

Refer to the “Preventive maintenance and Pre-Delivery Inspection Instructions” (P/N: 172559).

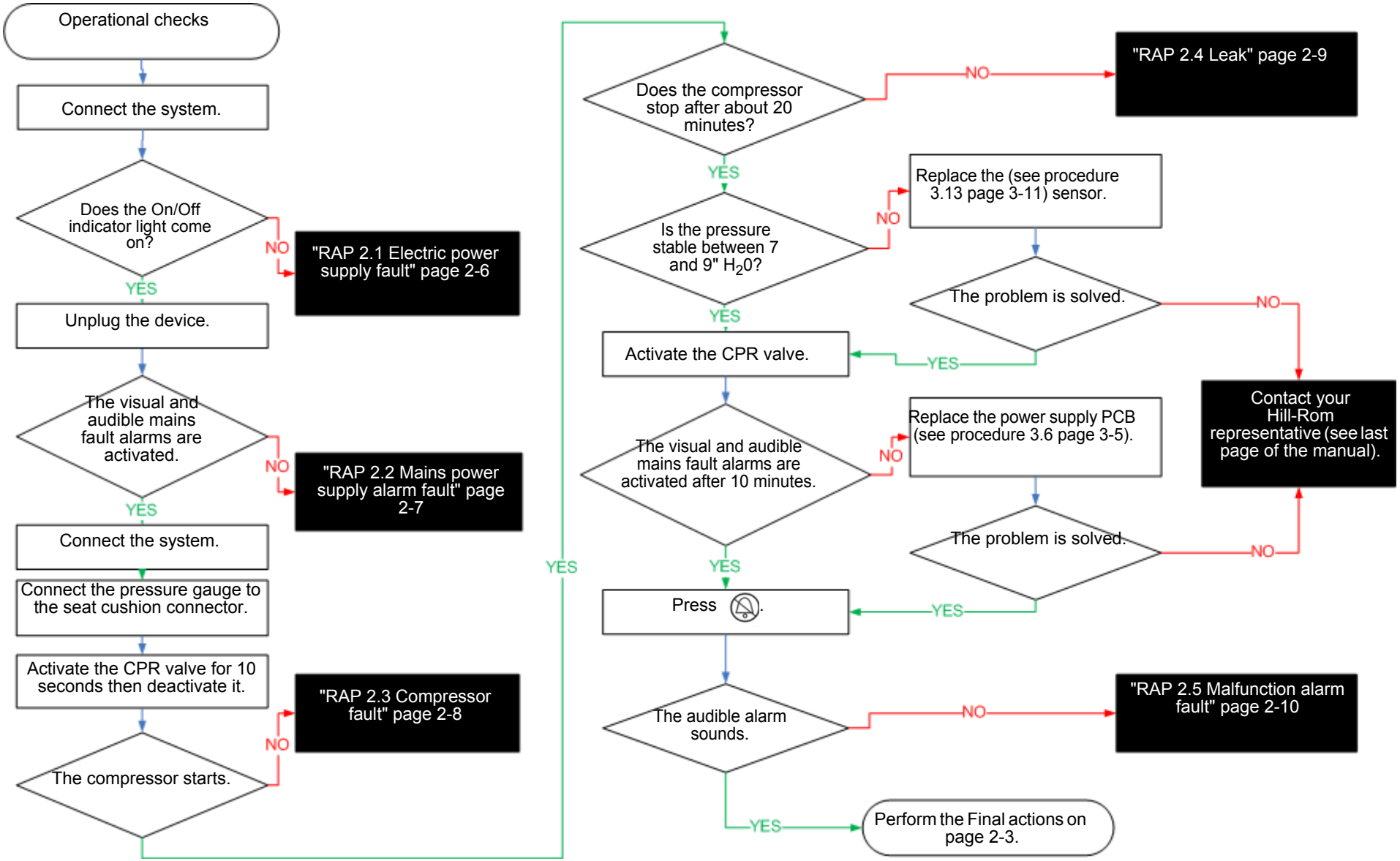
The frequency of inspections must be adapted to the general condition of the product and its use, for example, if the overlay is used by heavy patients. It is the responsibility of the facility to implement a preventive maintenance program for the mattress functions under its conditions of use.

The mattress and accessories should be inspected at least once a year to keep them in good condition and working properly.

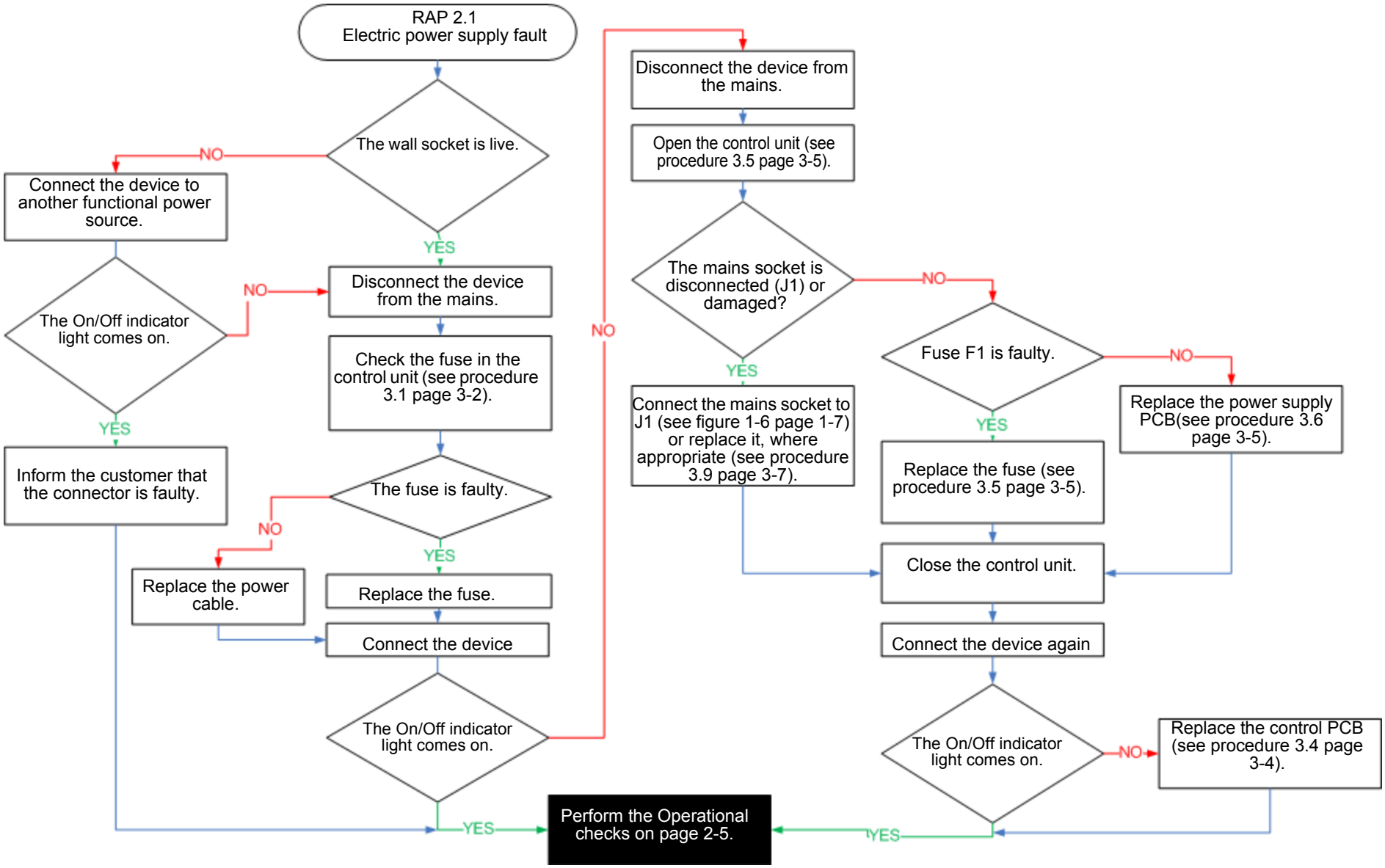
Every three years, it is preferable to ask Hill-Rom After-Sales Service or a Hill-Rom approved supplier to inspect the device in order to keep it in safe and good working order over time. Depending on the maintenance operations and observations, the date of the next inspection must be recommended every time the bed is serviced.

In order to benefit from optimal and rapid service when calling Hill-Rom about your Primo™, provide the serial number of the system about which you are calling.

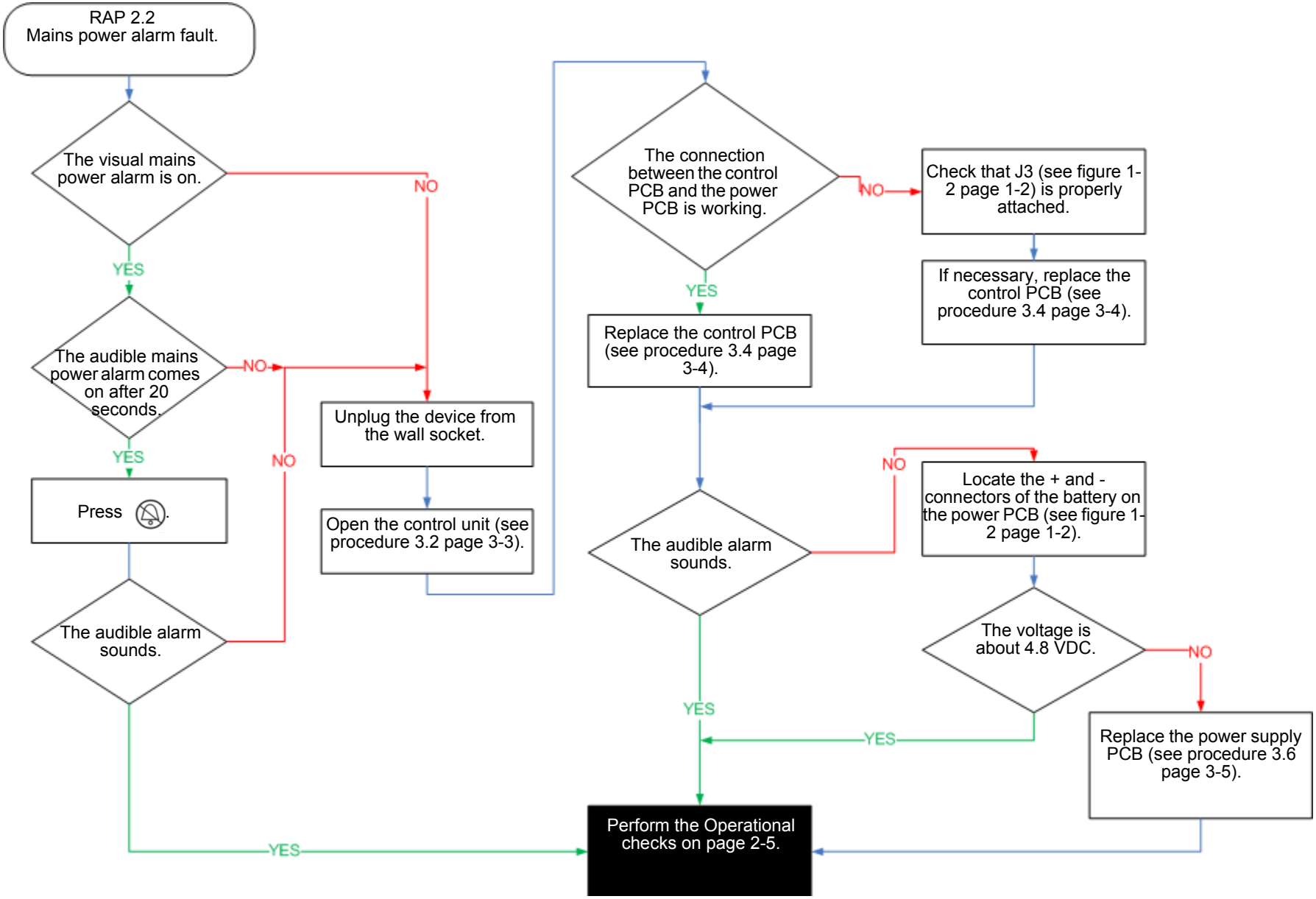
Operational checks



RAP 2.1 Electric power supply fault

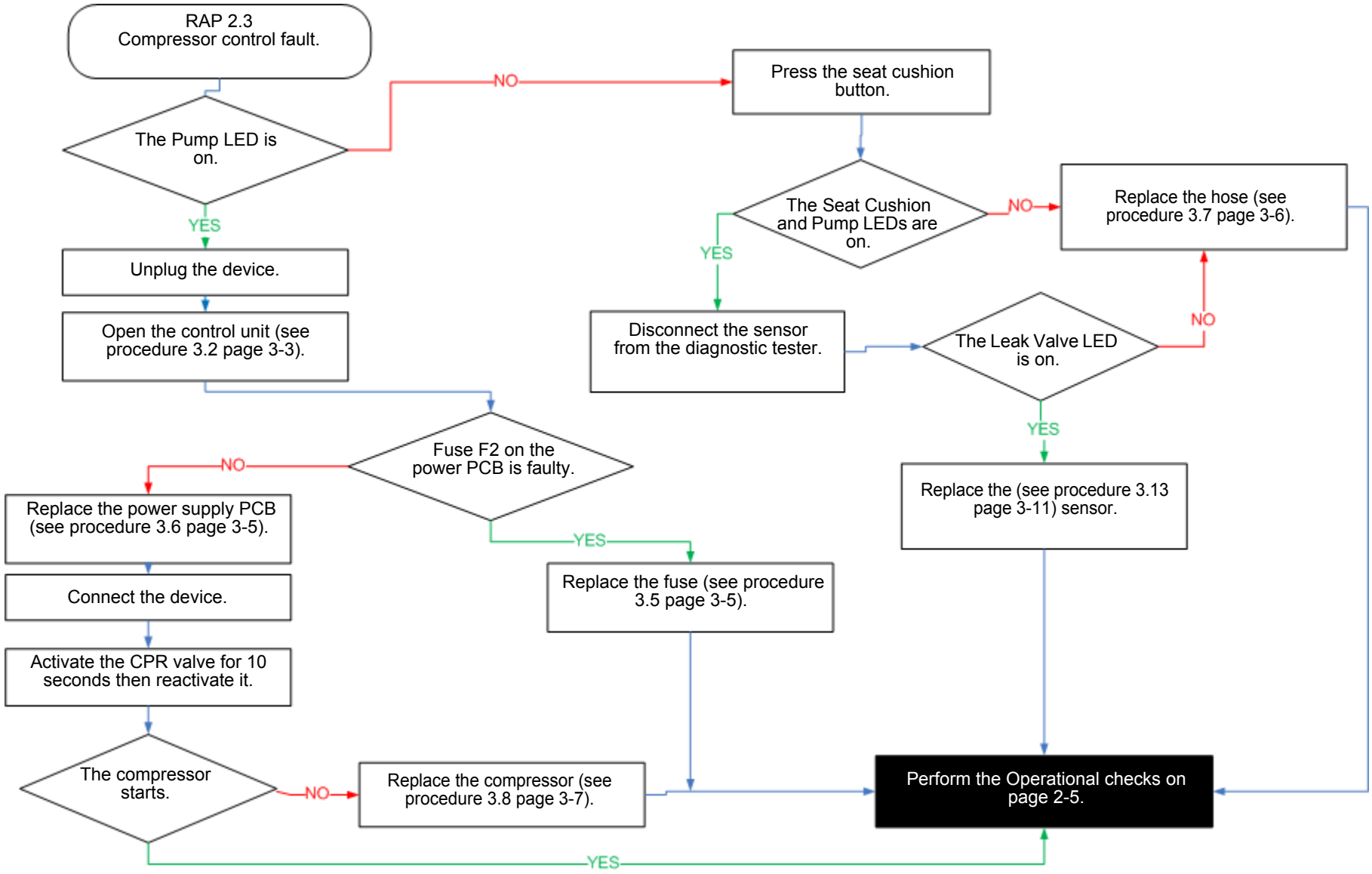


RAP 2.2 Mains power supply alarm fault



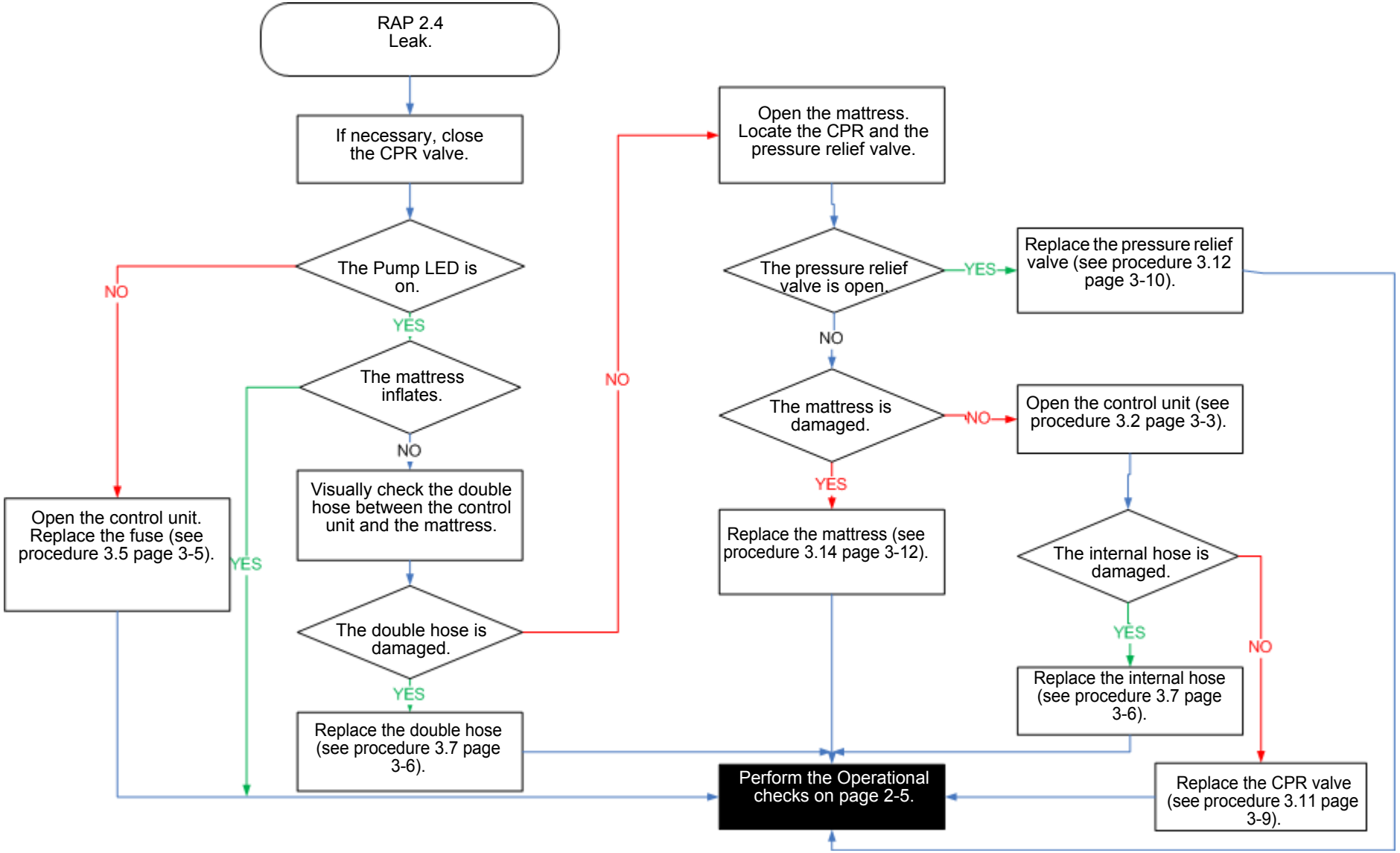
RAP 2.3 Compressor fault

NOTE:
The diagnostic tester must be connected to the CPR valve for this PAR (See ”Diagnostic tester” page 2-1).

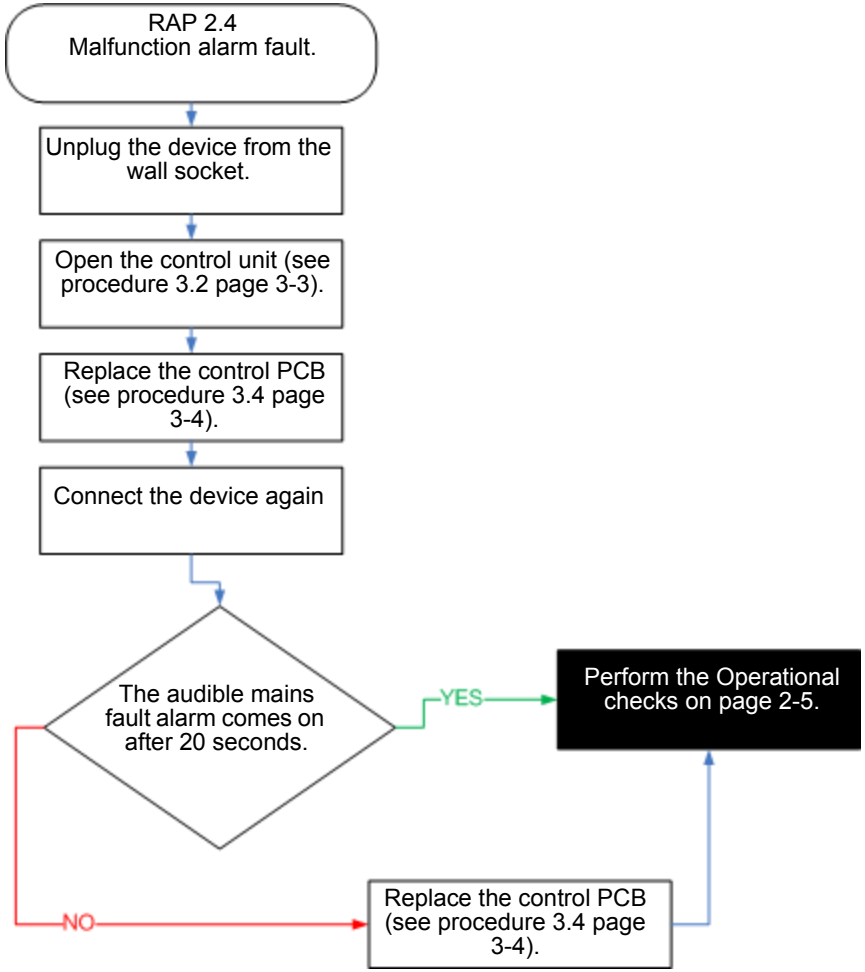


RAP 2.4 Leak

NOTE:
The diagnostic tester must be connected to the CPR valve for this PAR (See ”Diagnostic tester” page 2-1).



RAP 2.5 Malfunction alarm fault



Chapter 3
Procedures for the removal, replacement and adjustment of parts

Preamble

Before replacing a part on the device, check that the new part performs the same functions and that the safety of the device will not be affected. Using parts that are not included in the list of spares cancels the warranty conditions.

When re-installing, it is advisable to use the new parts contained in the replacement kit.

NOTE:
The time shown at the start of each procedure is an estimate under optimal operating conditions.

The current flows through the connectors when the device is switched on. Staff may be injured if the device is not disconnected from the power source when working on an electric part.

Only the power cords referred to in the spare parts catalog can be used with the Primo™. Using other cords may compromise the compliance and safety of the device.

Do not use silicone-based lubricants.
Make sure your hands are clean, and only handle the PCB by its edges.
When handling components, wear an antistatic strap (DES) to prevent damaging them.
For shipping and storage, place the control board in an antistatic protective bag.

Required tools

The following tools are required to service the Primo™ therapeutic mattress:

- One Torx® screwdriver, e.g. 610
- One small flat screwdriver
- One pair of needle nose pliers
- One pair of long nose pliers
- One 7 mm open end wrench
- One 21 mm or 13/16 mm open end wrench

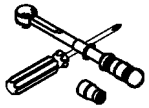
Prerequisites for all operations

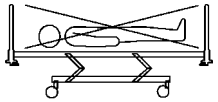
1. Lock all moving parts of the bed on which the Primo™ is installed.
2. Place all the parts of the bed chassis in the horizontal position.
3. Remove the head and foot posts.
4. Lower the safety siderails.
5. Fully raise the sleep surface.
6. Turn the device off.

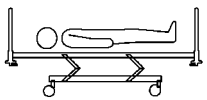
Symbols

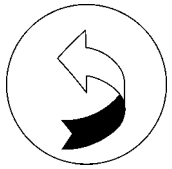

Time required for repairs

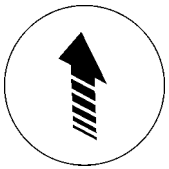

Number of technicians

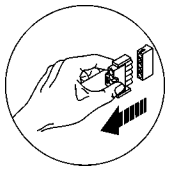

Required tools

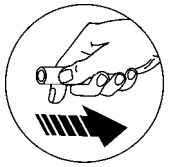

Patient on the bed: NO

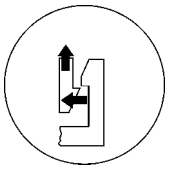

Patient on the bed: YES

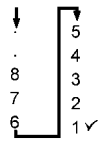

Unscrew


Remove


Electrical disconnection


Air disconnection

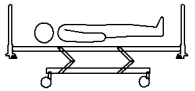
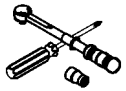

Unclip



Perform the removal procedure in the reverse order

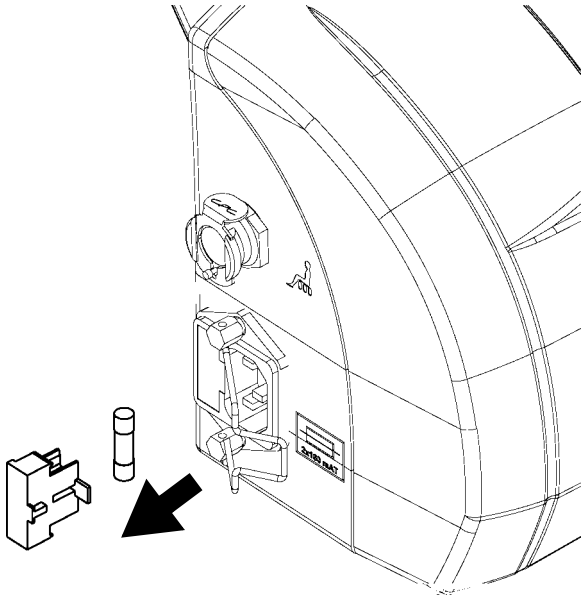

Perform the operating checks

3.1 Replacing the mains socket fuse

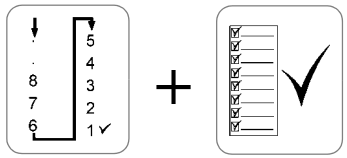


One flat screwdriver

Removal

1. Remove the power cord from the connector.



Installation

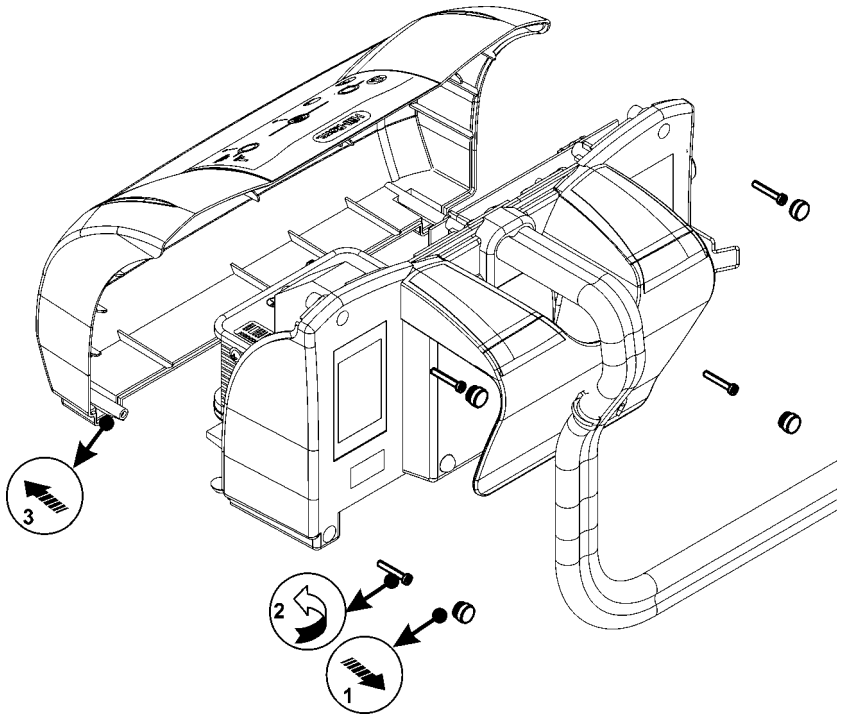


3.2 Opening the control box

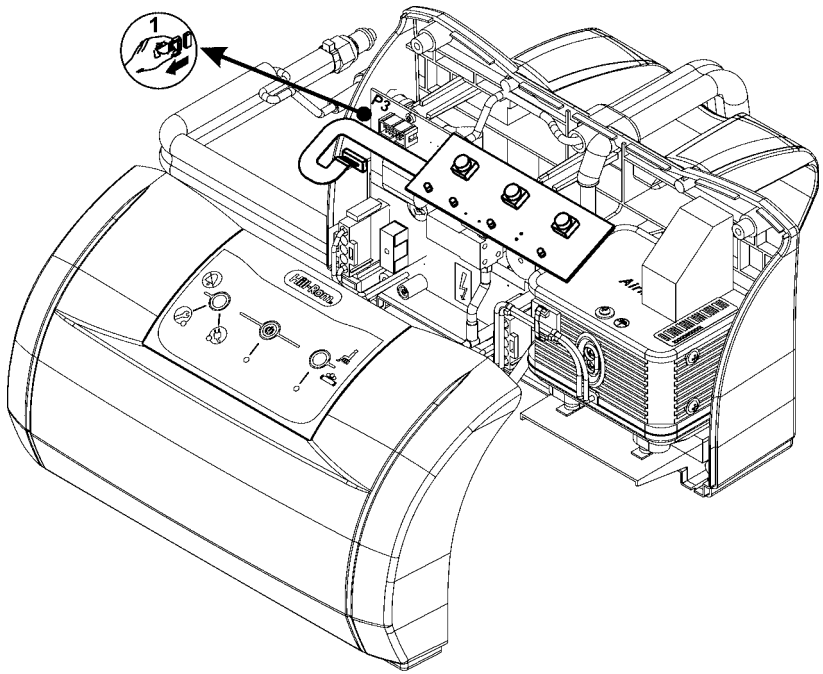
x1	5 min		Torx® screwdriver, e.g. 610

Removal

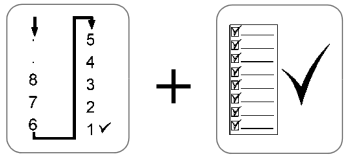
1.



2.



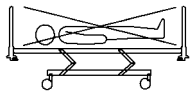
Installation

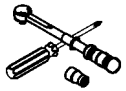


3.3 Replacing the front unit


x1


15 min

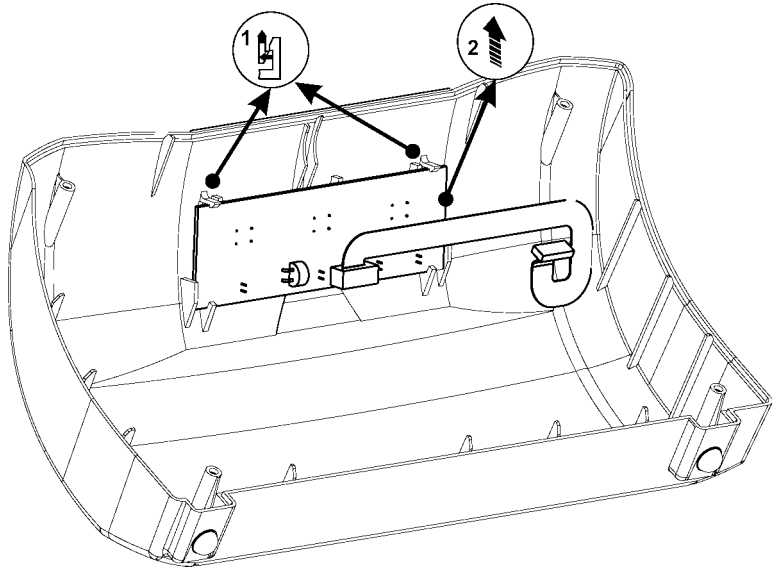



Torx® screwdriver, e.g. 610

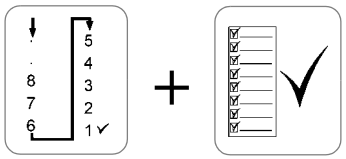
Removal

1. Go to procedure 3.2
Put the front unit to one side.

2.



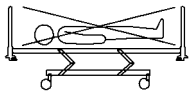
Installation

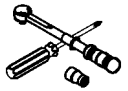


3.4 Replacing the control PCB


x1


15 min

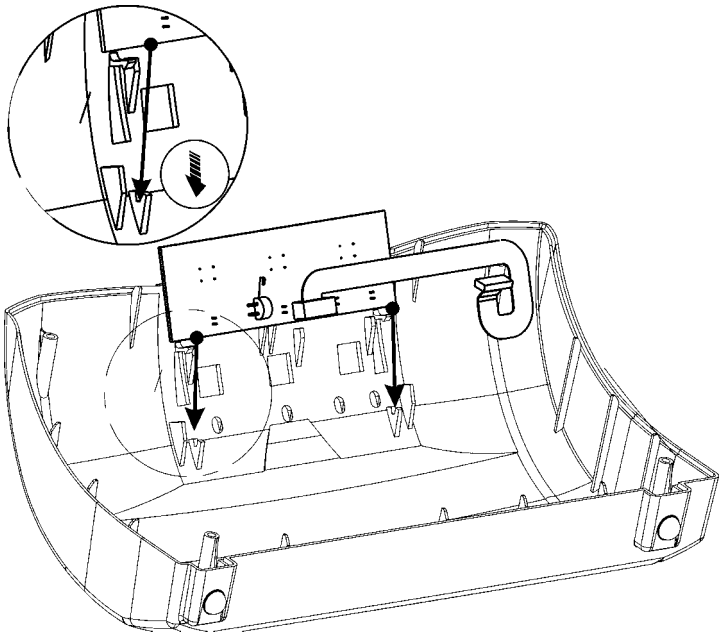



Torx® screwdriver, e.g. 610

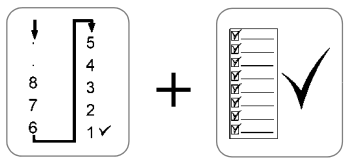
Removal

1. Go to procedure 3.3

2.



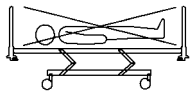
Installation

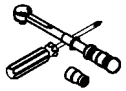


3.5 Replacing the power PCB fuses


x1


5 min

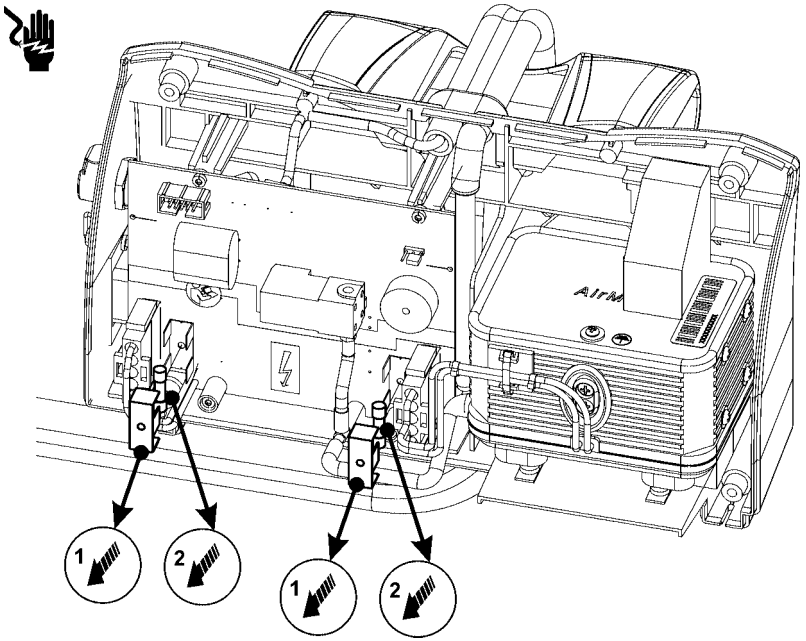



One flat screwdriver

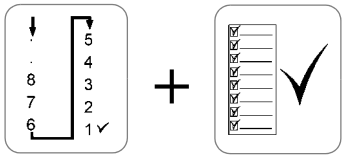
Removal

1. Go to procedure 3.2
Put the front unit to one side.

3.



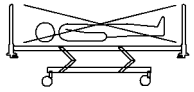
Installation

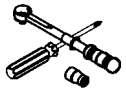


3.6 Replacing the power supply PCB


x1


15 min

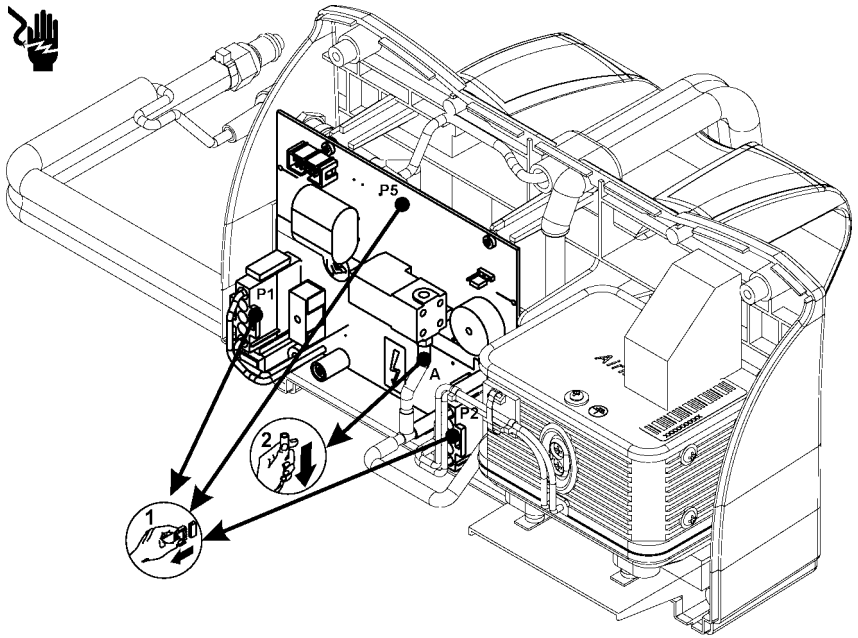



Torx® screwdriver, e.g. 610

Removal

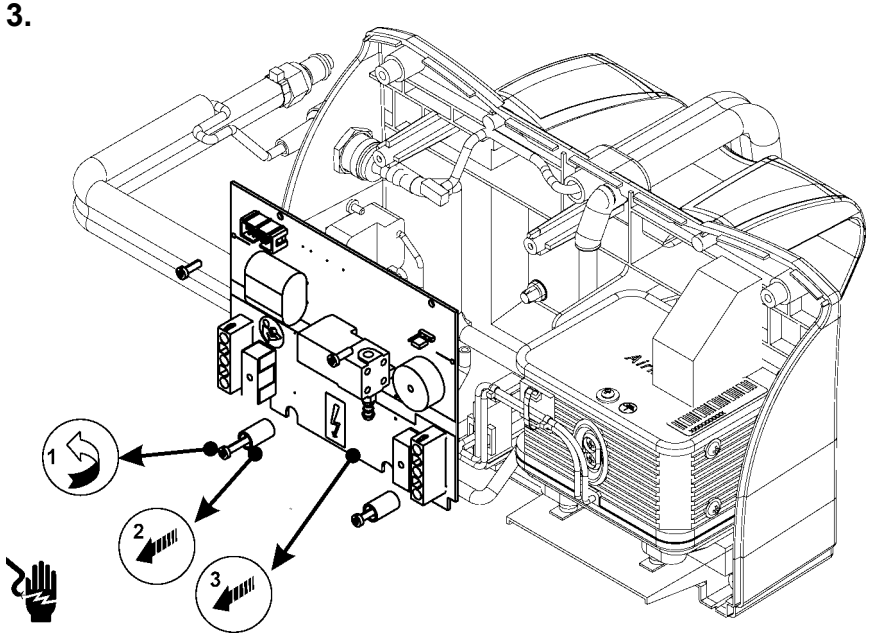
1. Go to procedure 3.2
Put the front unit to one side.

2.

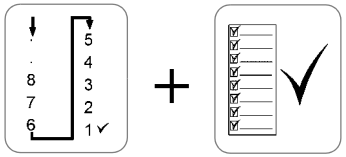


3

3.



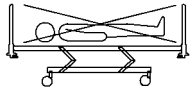
Installation

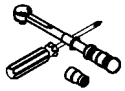


3.7 Replacing the hoses


x1


15 min



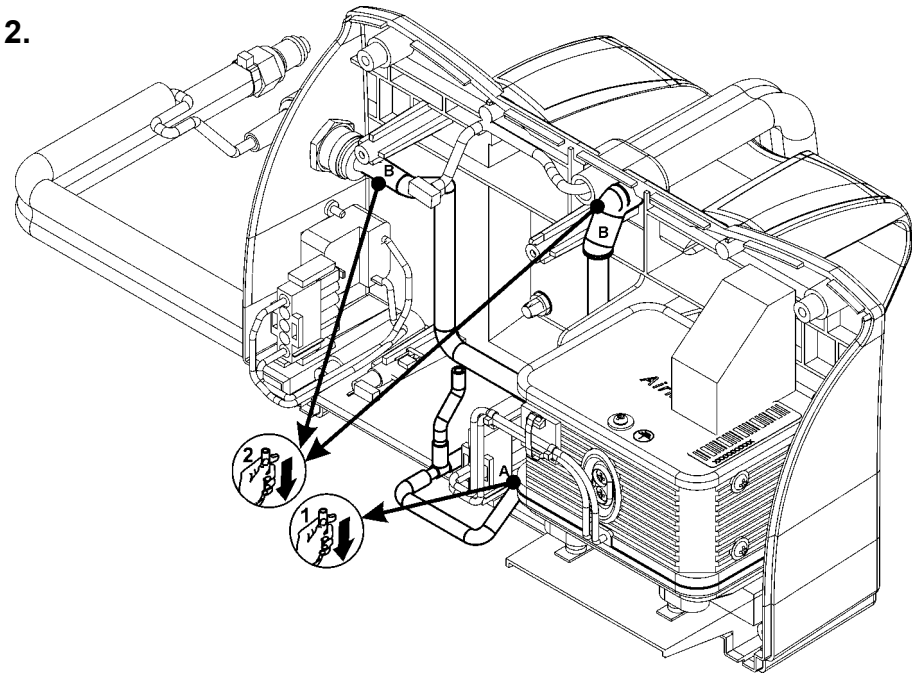


Torx® screwdriver, e.g. 610
Long nose pliers

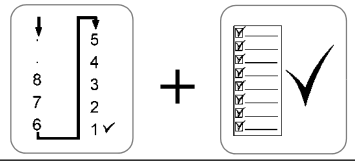
Removal

1. Go to procedure 3.6

2.



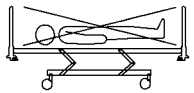
Installation

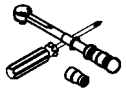


3.8 Replacing the compressor


x1


15 min



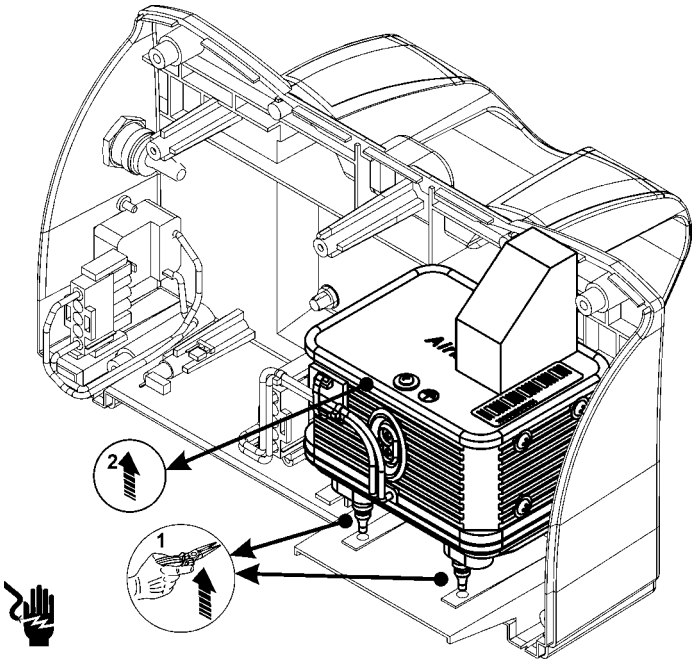


Torx® screwdriver, e.g. 610
Flat nose pliers

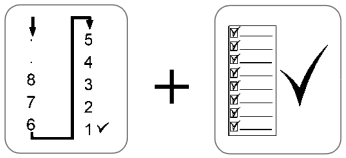
Removal

1. Go to procedure 3.7

2.



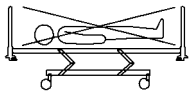
Installation

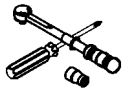


3.9 Replacing the mains socket


x1


10 min



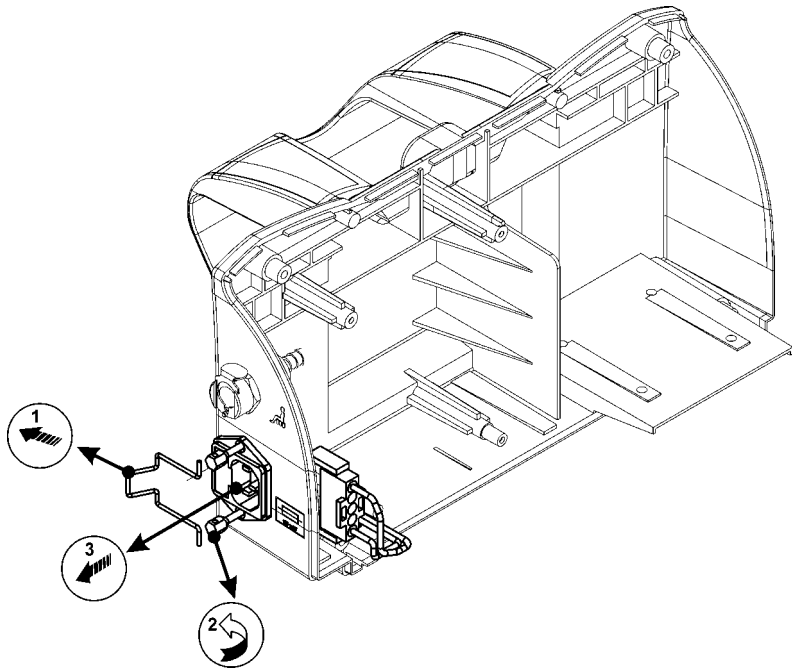


Torx® screwdriver, e.g. 610

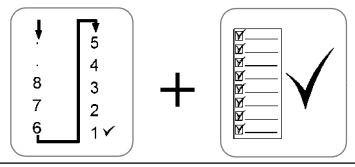
Removal

1. Go to procedure 3.8

2.



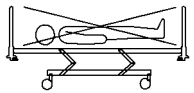
Installation

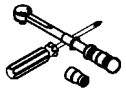


3.10 Replacing the unit at the back of the control unit


x1


20 min



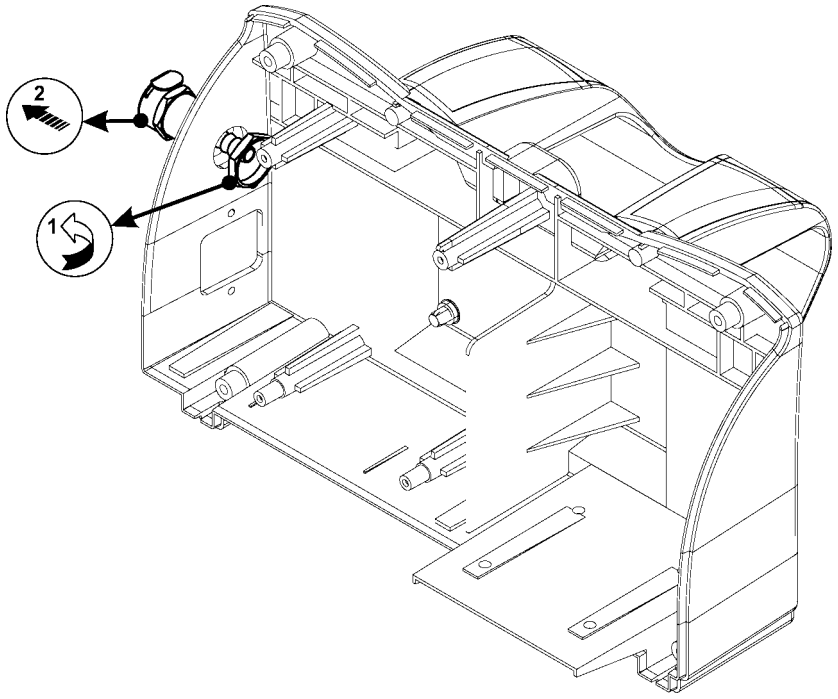


Torx® screwdriver, e.g. 610
Long nose pliers
7 mm open end wrench
21 mm open end wrench

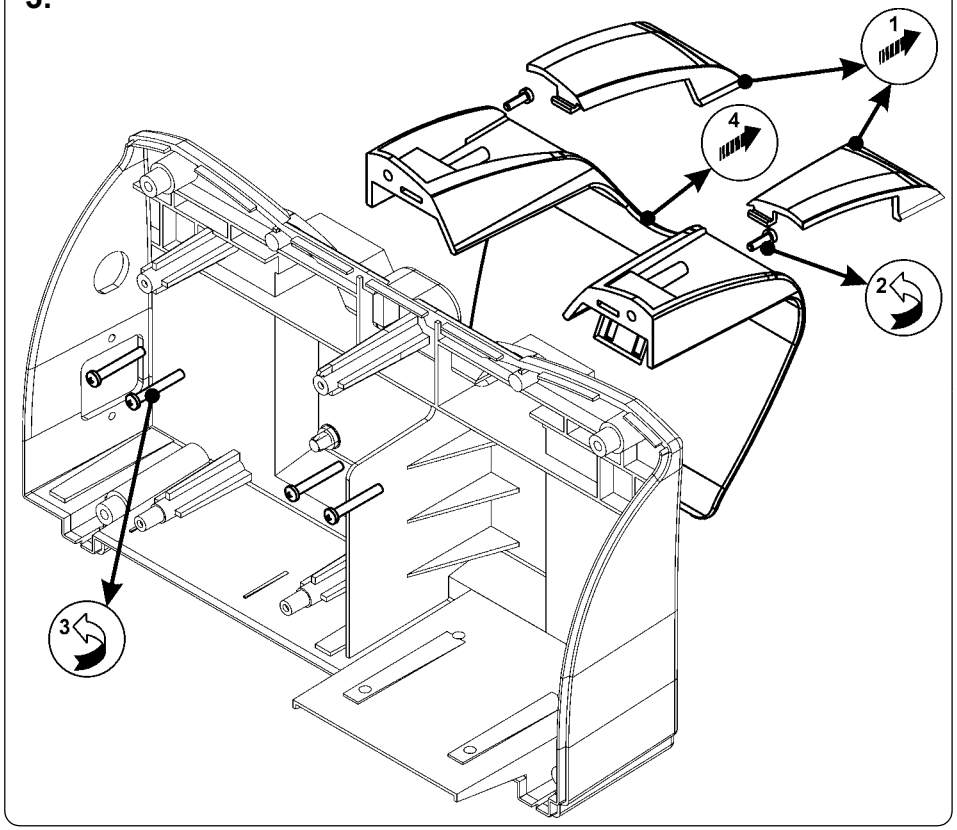
Removal

1. Go to procedure 3.8

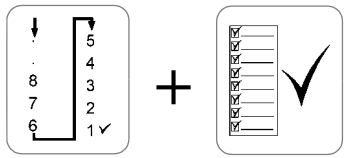
2.



3.



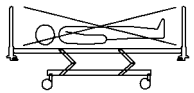
Installation

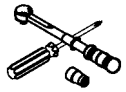


3.11 Replacing the CPR valve


x1

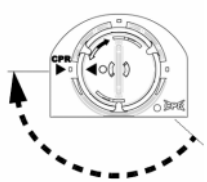

10 min



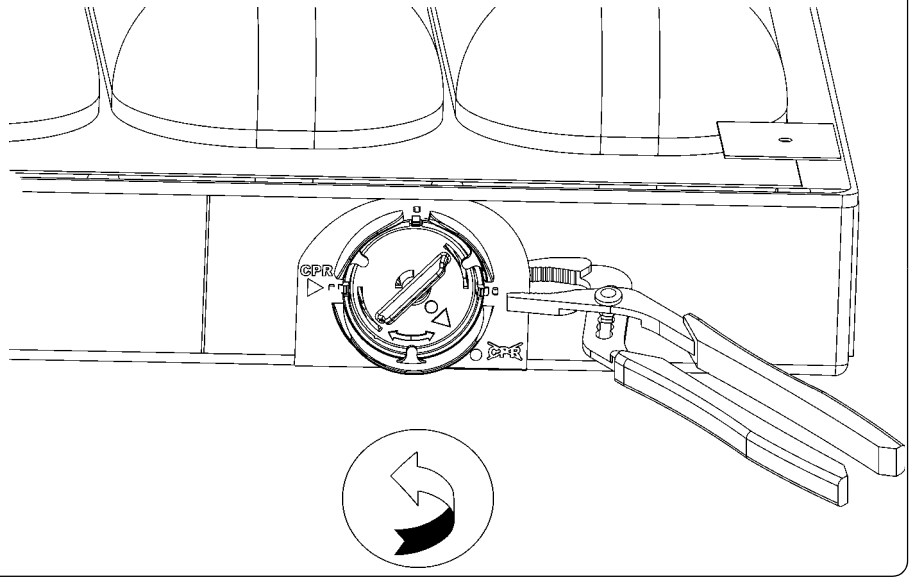

Long nose pliers

Removal

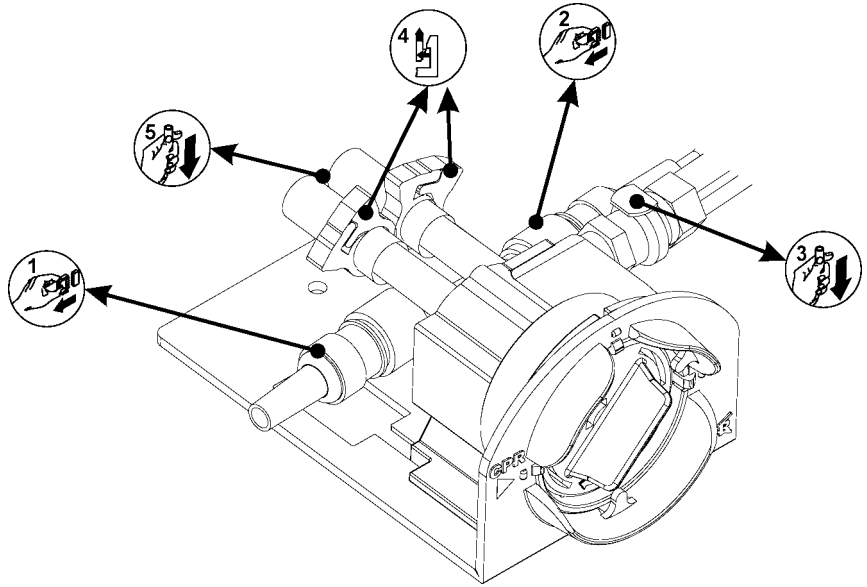
1.



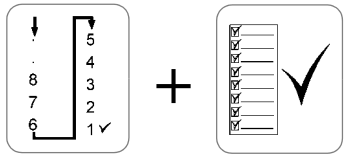
2.



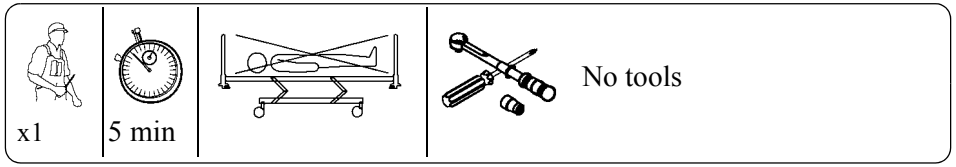
3.



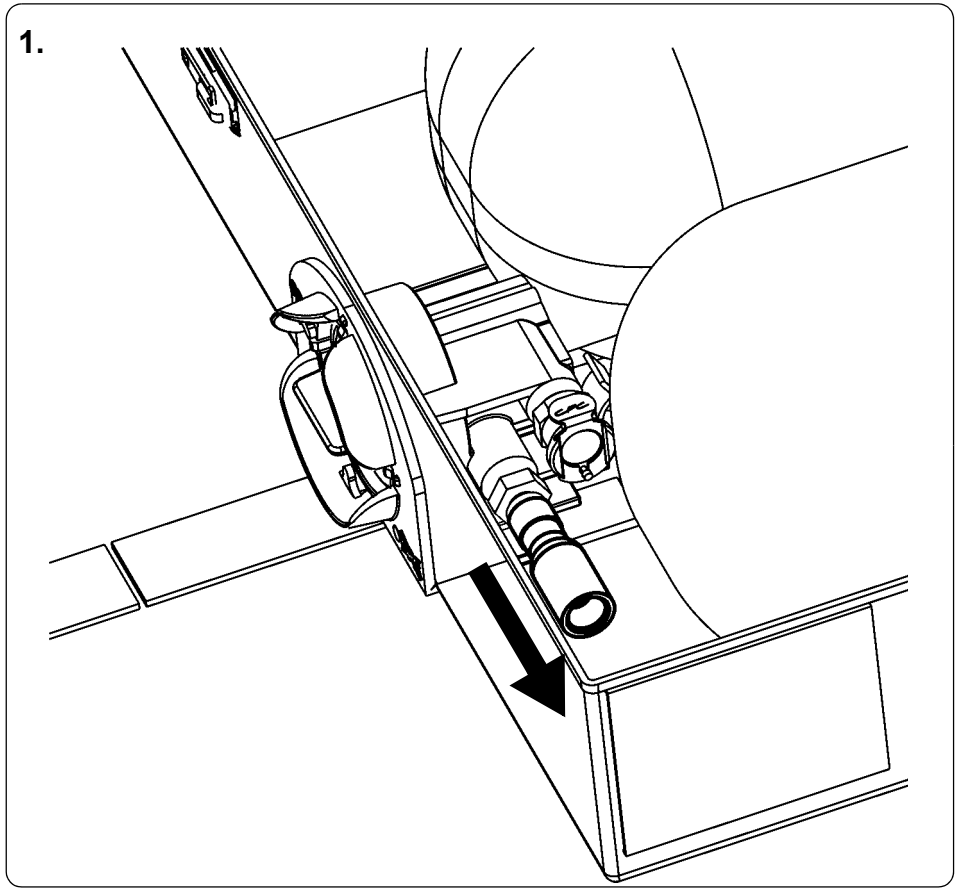
Installation



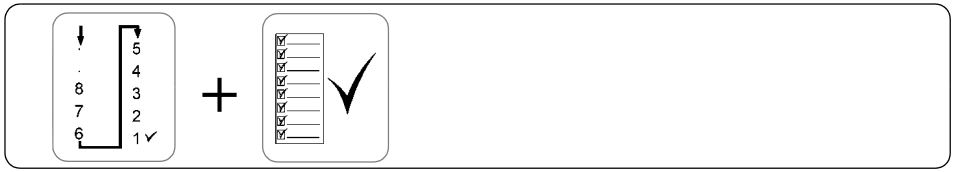
3.12 Replacing the CPR valve on the pressure relief valve



Removal



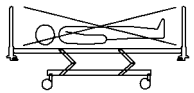
Installation

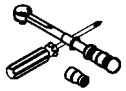


3.13 Replacing the sensor


x1

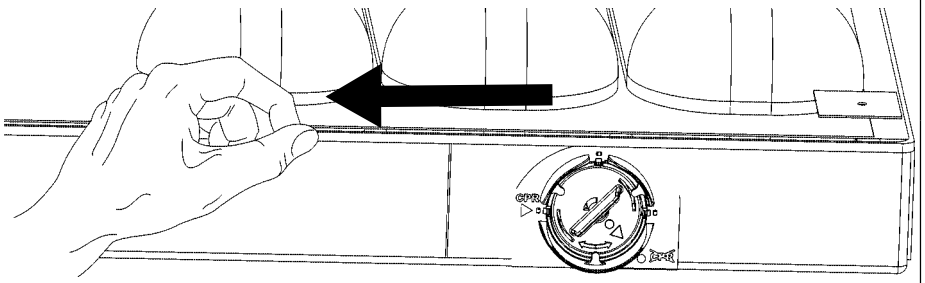

10 min



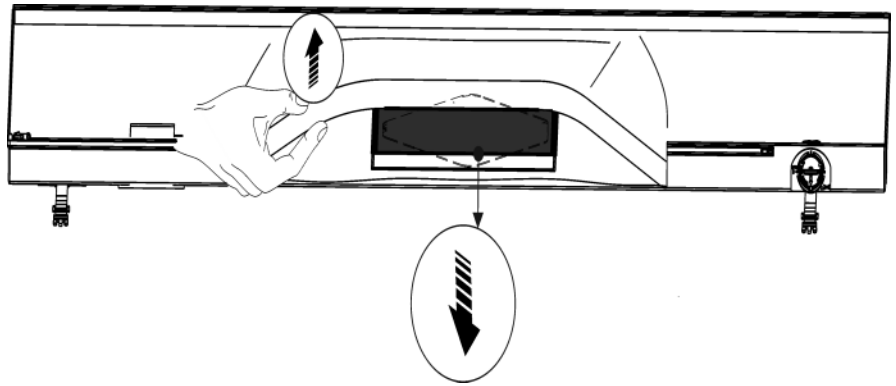

No tools

Removal.

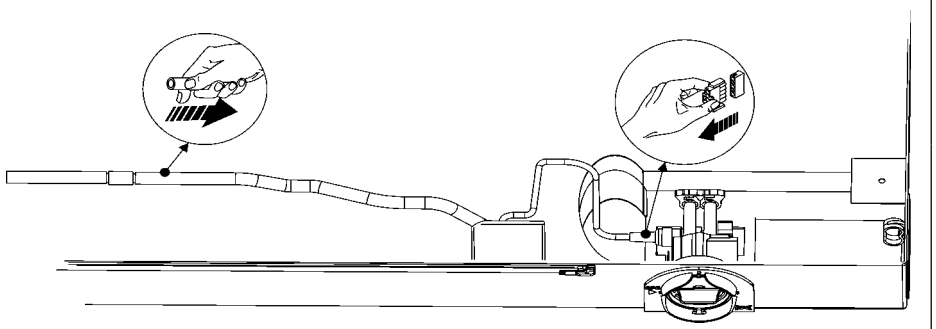
1.



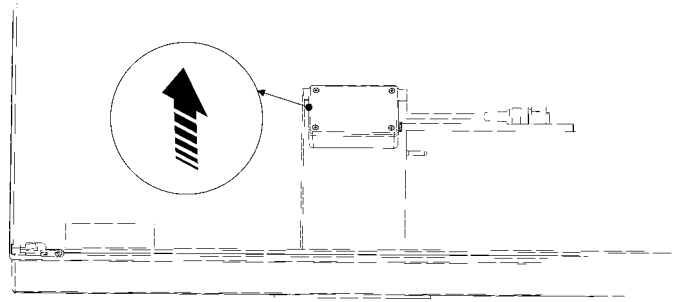
2.



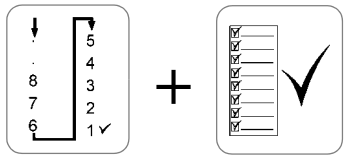
3.



4.



Installation



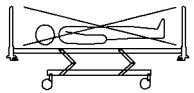
NOTE:
Inspect the air hose for knots. They can result in excess pressure in the mattress.

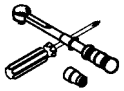
NOTE:
Keep the sensor flat during transport.

3.14 Replacing the mattress


x1

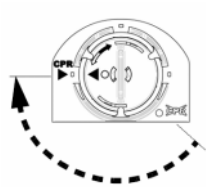

10 min



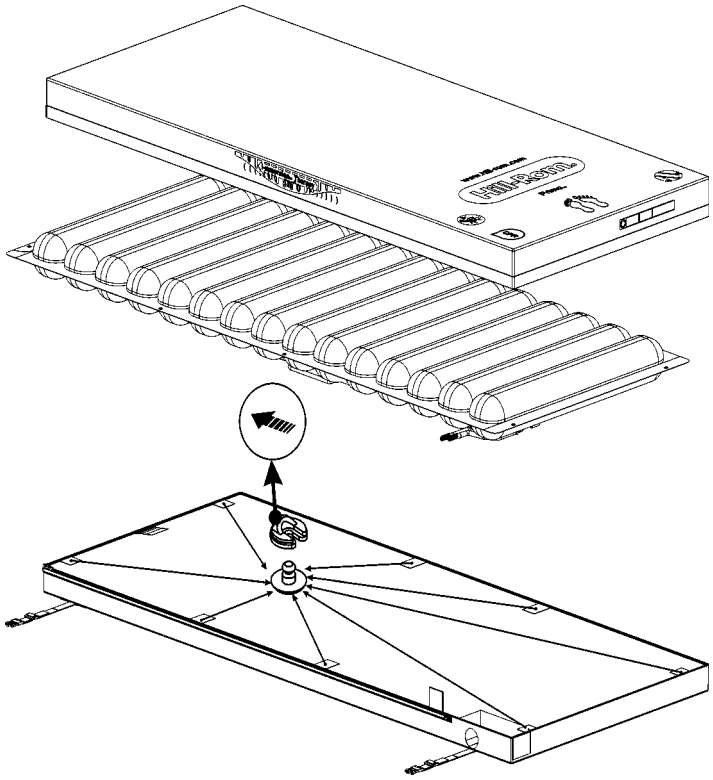

No tools

Removal.

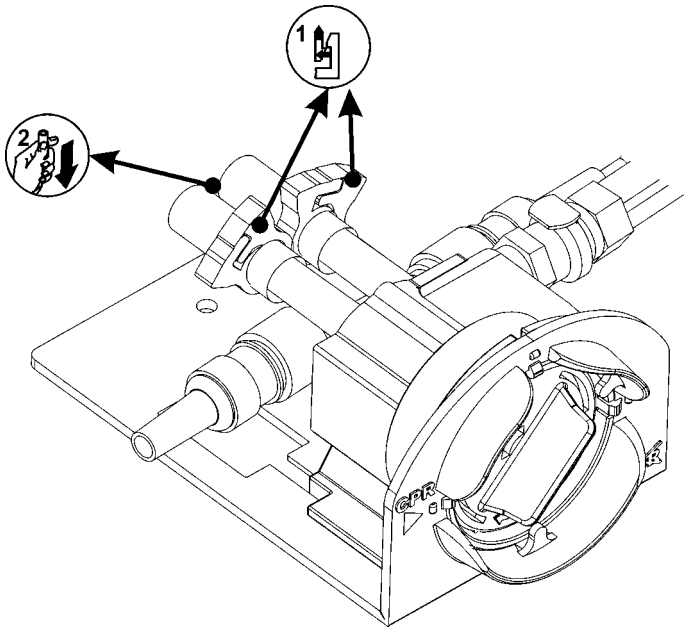
1.



2.



3.



4. Locate the sensor connector. Disconnect it.

5. Fold and remove the mattress.

NOTE:
Leave the plastic buttons in position on the cover.

Installation