# Function check

## Contents
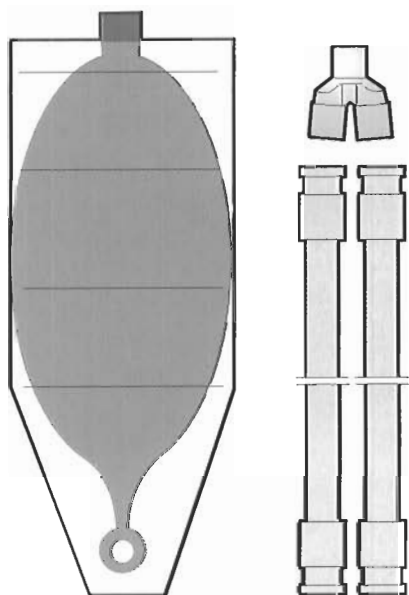
A complete function check must be done after cleaning and after calibration (before the ventilator is connected to a patient).
If any malfunctions are detected during the function check, the ventilator must not be connected to patient before remedy of malfunction. The malfunction must be remedied by local technical staff trained by Siemens or a service technician from Siemens.
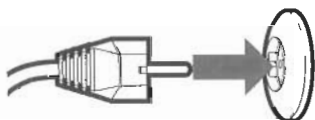
For those who do not have access to tubings and other accessories for adults a Neonatal kit, P/N 64 06 487 E380E, is available. The kit includes an alternative Operating Manual with Pre-use check, Calibration and Function check adapted for neonatal use.
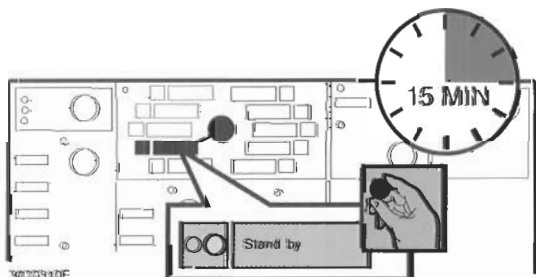
## Equipment

- 2 patient tubes.

- Y-piece.

- Test lung. Only a Siemens test lung shall be used.

- Gas supply: Air and $O_2$.

## Preparations

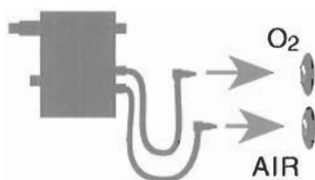- Connect the ventilator to mains.

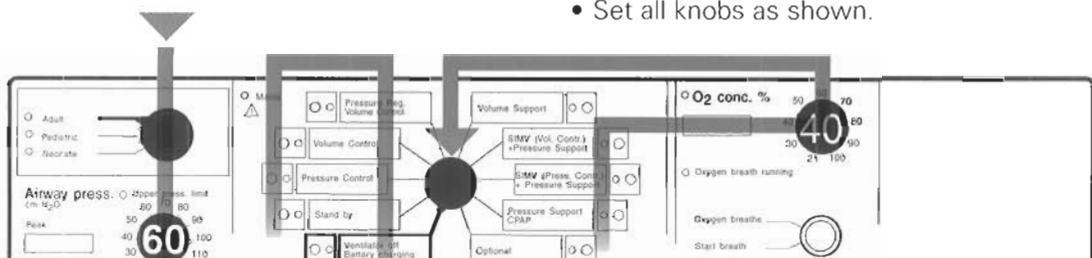- Set the mode selector to "Stand by". Allow a warm-up period of at least 15 minutes.

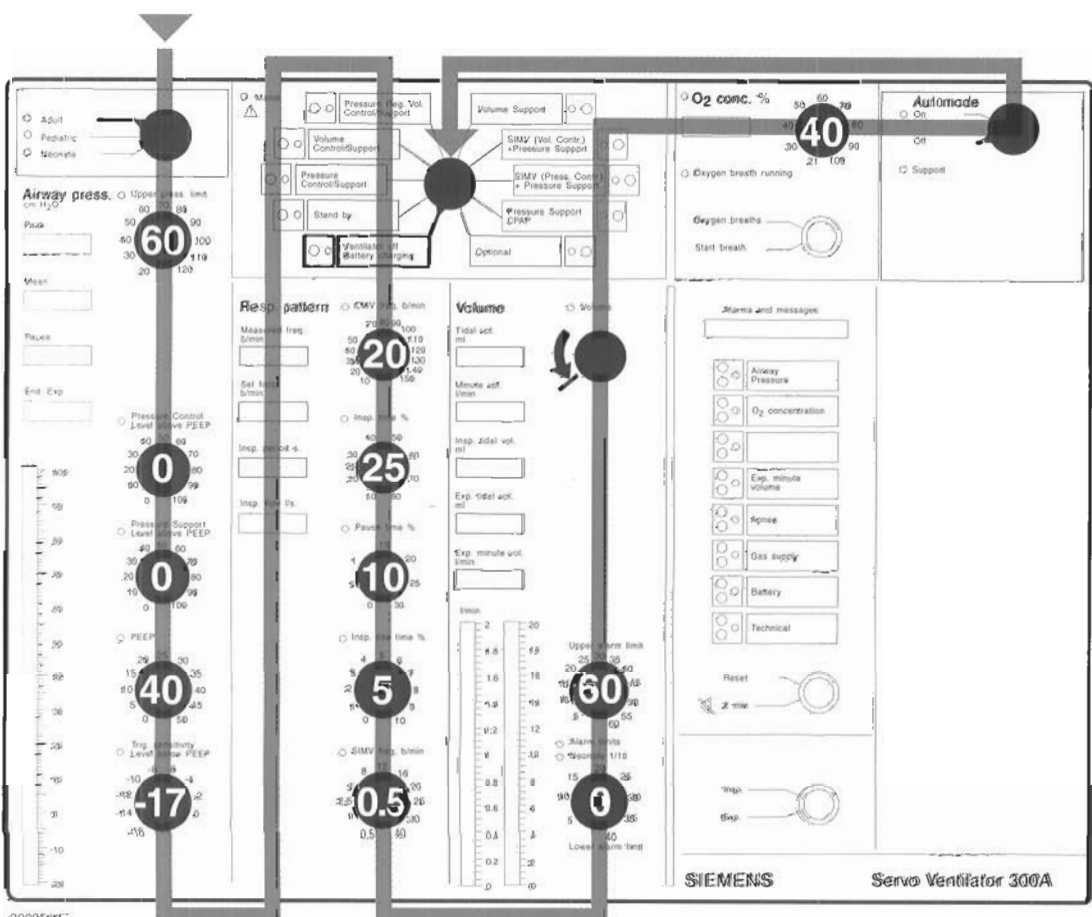15 MIN

Stand by

# Function check



- Connect gases.

O₂

AIR

- Open the lid on the patient unit.
- Set all knobs as shown.
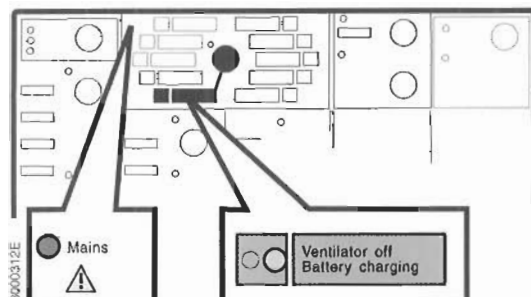


SIEMENS          Servo Ventilator 300
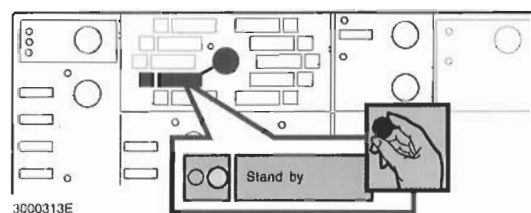


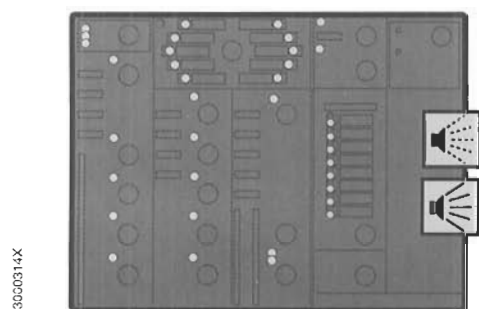SIEMENS          Servo Ventilator 300A

300-F22E

## 1. Start up



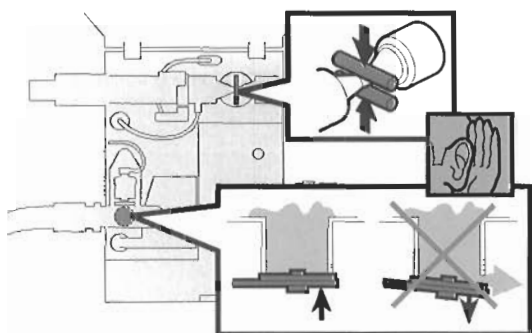* Make sure the yellow light at "Ventilator off Battery charging" and the green light "Mains" are lit.



* Set the mode selector to "Stand by" and make sure:



– the **back-up alarm** (intermittent signals) is heard.

– all yellow lights are lit for a few seconds.

– all yellow and red lights in the "Alarms and messages" section stay lit for an additional moment.

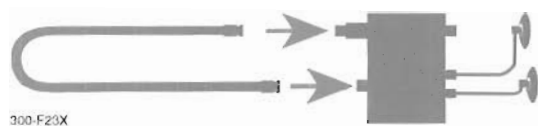– the caution signal is heard.

4

# Function check

Alarms and messages

**STAND BY**

– the expiratory valve closes.

– the safety valve closes with a distinct click.

– the "Alarms and messages" display shows STAND BY.

These checks can be done separately by repeated switching between "Ventilator off Battery charging" and "Stand by".
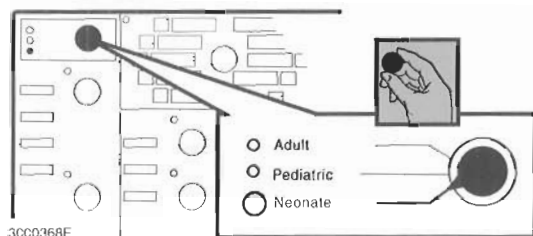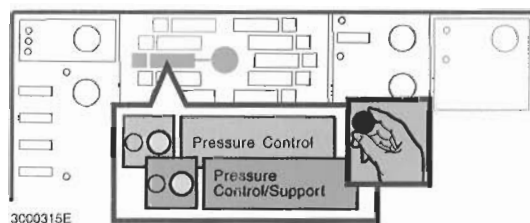
## 2. Leakage test

**Test for leakage and pressure transducer integrity**

300-F23X
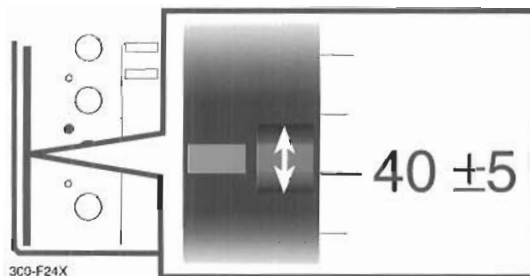
- Connect a patient tube between the inspiratory outlet and the expiratory inlet.



3CC0368E

O  Adult
O  Pediatric
O  Neonate

- Set the patient range selector to "Neonate".



3CC0315E

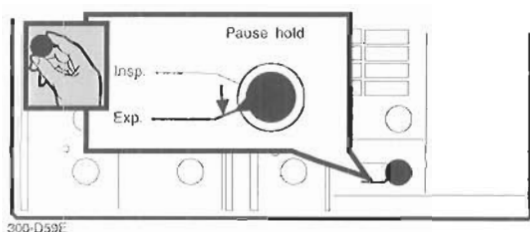Pressure Control

Pressure
Control/Support

- Set to "Pressure Control" mode.



3C0-F24X

$40 \pm 5$

- Make sure:

– the diodes showing the actual pressure on the "Airway press." bargraph show the same value $\pm 5$ cm $H_2O$. If not, see chapter Calibration. **Note**: The diodes can be hidden behind the diodes showing the set PEEP level.

# Function check



300-D59E

- Keep "Pause hold" at "Exp." and make sure:



300-D60E

-- the "End exp." display reading does not drop more than 10 cm $H_2O$ during the exp. pause hold time (30 seconds).
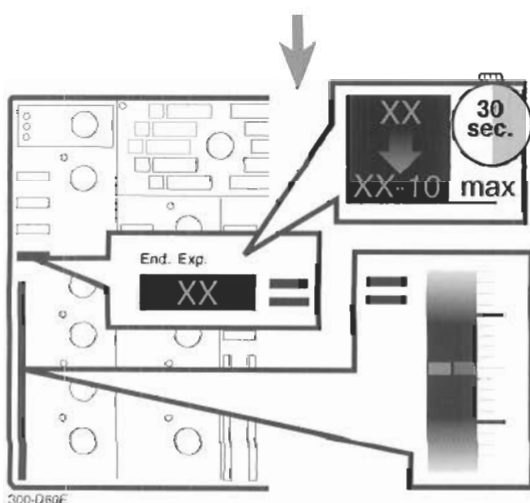
- the diodes showing the actual pressure on the "Airway press." bargraph show the same value ±5 cm $H_2O$. If not, see chapter calibration. **Note:** The diodes can be hidden behind the diodes showing the set PEEP level.

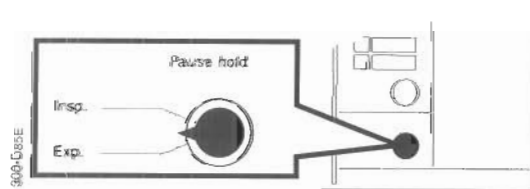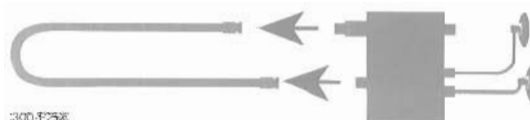In case of leakage, check all connections in the ventilator.
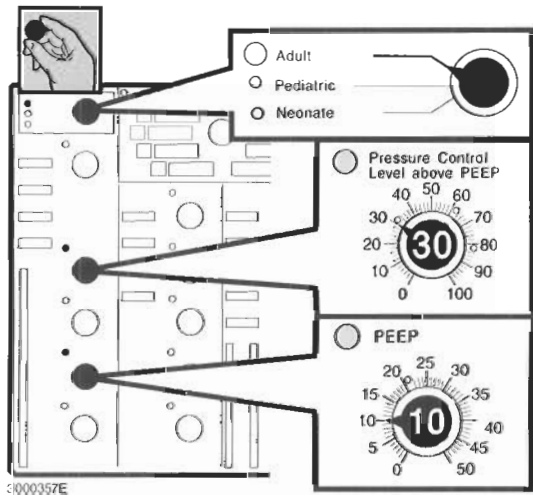


300-D85E

- Release "Pause hold".



300-F25X

- Remove the patient tube.
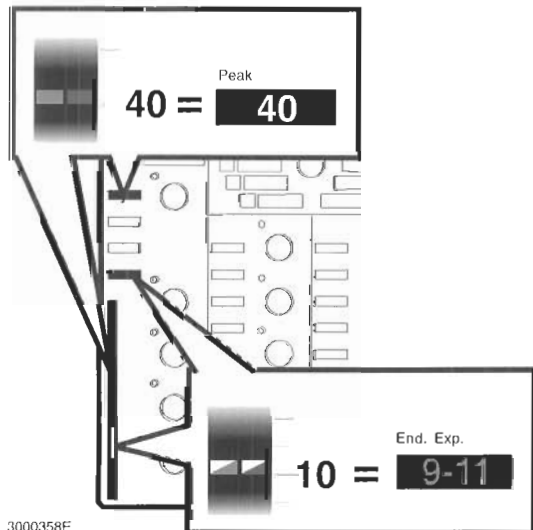
7

# Function check

## 3. Pressure levels

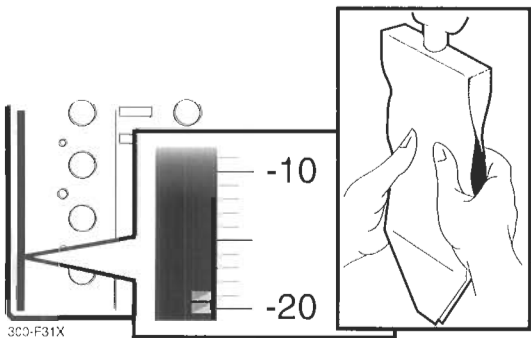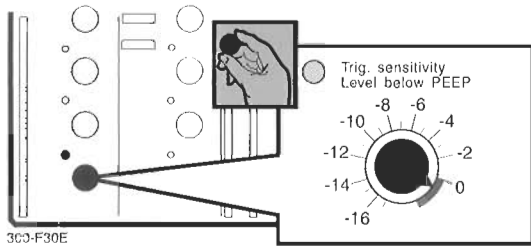• Connect patient tubes, Y-piece and test lung.



300-F26X

• Set the patient range selector to "Adult".

• Set "Pressure Control Level above PEEP" to 30 cm $H_2O$.

• Set "PEEP" to 10 cm $H_2O$.



Adult
Pediatric
Neonate

Pressure Control
Level above PEEP
40  50  60
30        70
20  (30)  80
10        90
   0    100

PEEP
   20  25  30
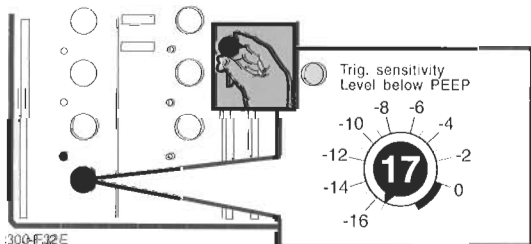15         35
10  (10)   40
 5         45
   0    50

3000357E

• Make sure the pressure indication on the "Airway press." bargraph equals the display "Peak" reading at the end of inspiration. The value must be in the range 38 – 42 cm $H_2O$.



Peak
40 = 40

• Make sure the pressure indication on the "Airway press." bargraph equals the display "End exp." reading at the end of expiration. The value must be in the range 9 – 11 cm $H_2O$.
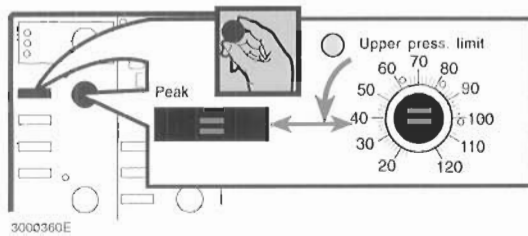
End. Exp.
10 = 9-11

3000358E

8

# Function check

## 4. Trigger function

- Set "Trig. sensitivity Level below PEEP" in the green range.

Trig. sensitivity
Level below PEEP

3C0-F30E

- Toward the end of expiration, quickly compress and release the test lung and make sure:
  - two yellow diodes at the lower right end of the "Airway press." bargraph flash once.
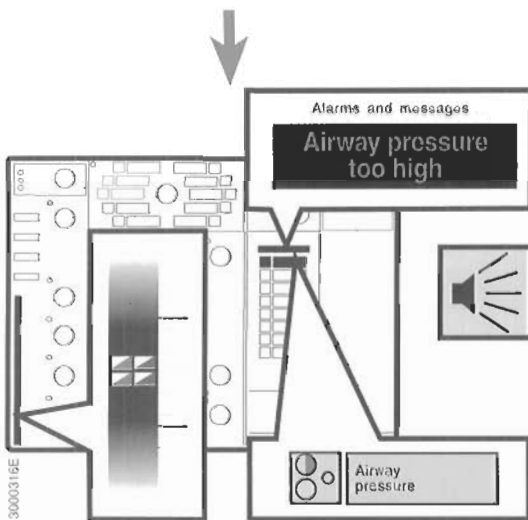  - a breath is initiated.

-10

-20

3C0-F31X

- Set "Trig. sensitivity Level below PEEP" to -17 cm $H_2O$.

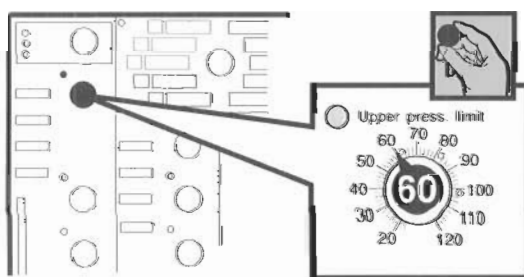Trig. sensitivity
Level below PEEP

:300-F32E

## 5. Upper pressure limit alarm



3000360E

- Turn "Upper press. limit" **slowly** counter-clockwise and make sure upper pressure limit alarm is activated when "Upper press. limit" and the display "Peak" show the same value ±2 cm $H_2O$.
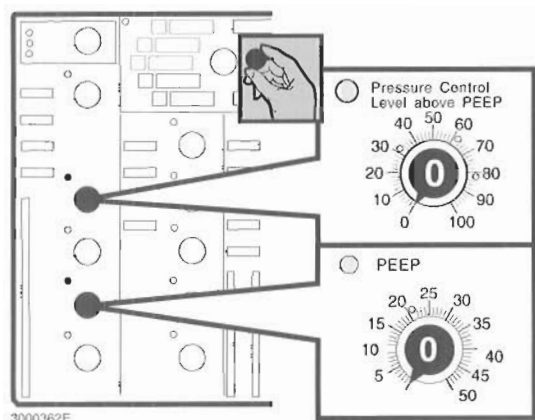


**Alarms and messages**

**Airway pressure too high**

Airway pressure

3000316E

- At the alarm activation, make sure:

  – the audible alarm is heard.

  – the inspiration stops and expiration starts.

  – the red light at "Airway pressure" in the alarm section lights up each time the alarm is activated.

  – the yellow light at "Airway pressure" is lit at the end of each alarm activation (when the red light at "Airway pressure" goes out).

  – the "Alarms and messages" display shows **Airway pressure too high**.

  – the upper pressure limit indication on the bargraph flashes.

  – the safety valve does not open. (If it opens, a distinct sound is heard and the PEEP-level drops to zero.)
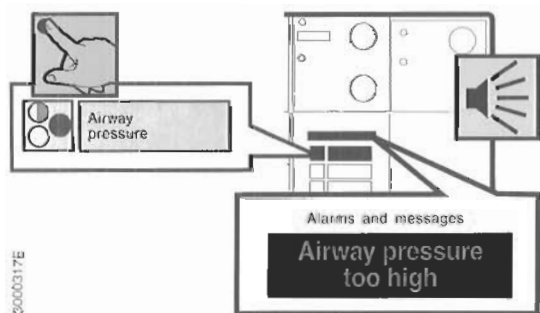


3000351E
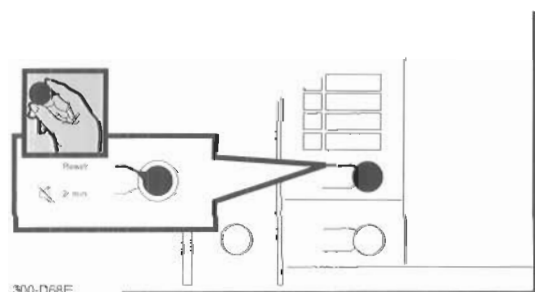
- Set "Upper press. limit" to 60 cm $H_2O$.

# Function check



- Set "Pressure Control Level above PEEP" to 0 cm $H_2O$.
- Set "PEEP" to 0 cm $H_2O$.



- Touch the touchpad at "Airway pressure" in the alarm section and make sure the display shows **Airway pressure too high**.
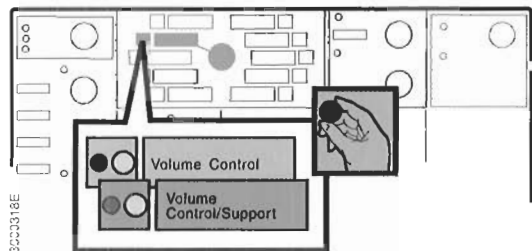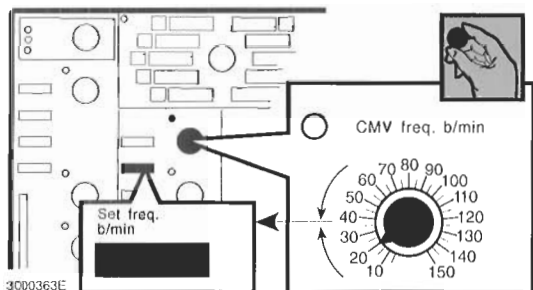


- Reset the alarm.

## 6. Tidal and minute volumes

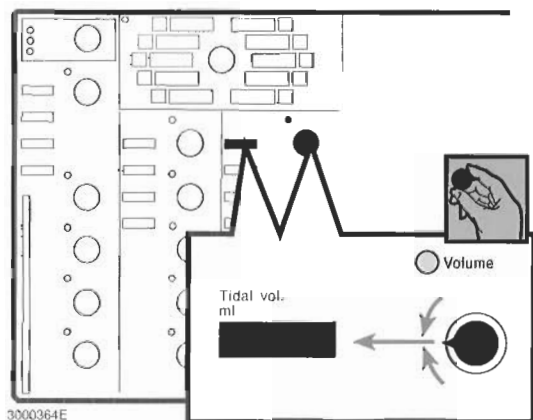**Test of tidal and minute volumes and flow transducer integrity.**
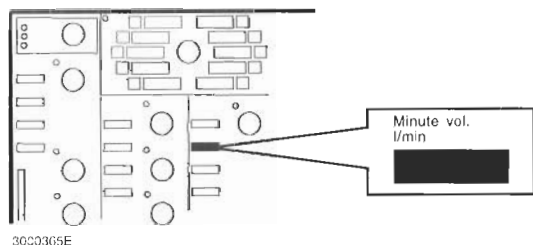
• Set to "Volume Control" mode.

• Adjust "CMV freq. b/min" so that the green display "Set freq. b/min" shows 20 b/min.

• Adjust "Volume" so that the green display "Tidal vol. ml" shows 375 ml.
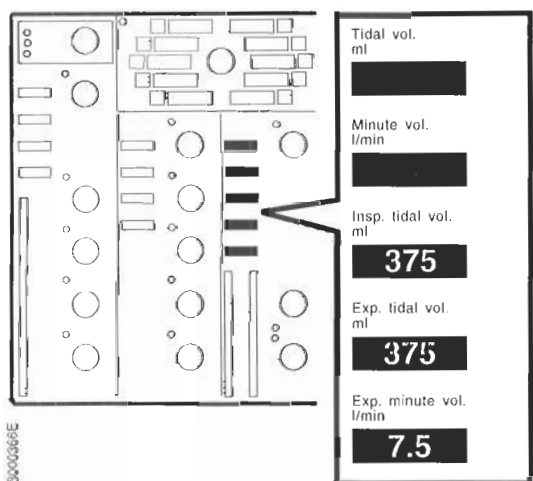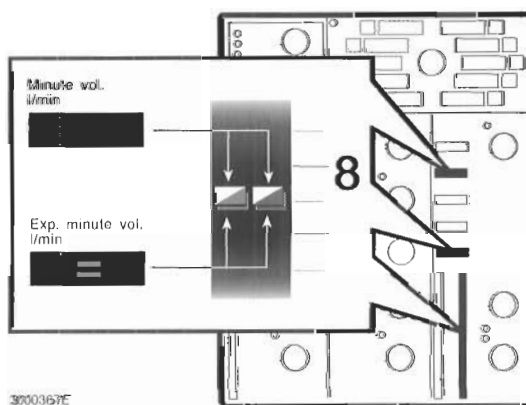
12

# Function check



Minute vol.
l/min

3000365E

- Make sure the green display
  "Minute vol. l/min" shows 7.5 ±0.2 l/min.



Tidal vol.
ml

Minute vol.
l/min

Insp. tidal vol.
ml

**375**

Exp. tidal vol.
ml

**375**

Exp. minute vol.
l/min

**7.5**

3000366E

- Wait a few breaths, then make sure:

  – the readings on the red display
    "Insp. tidal vol. ml" and the green
    display "Tidal vol. ml" correspond.
    Accuracy: ±10 ml.

  – the readings on the red display
    "Exp. tidal vol. ml" and the green
    display "Tidal vol. ml" correspond.
    Accuracy: ±10 ml.

  – the readings on the red display
    "Exp. minute vol. l/min" and the green
    display "Minute vol. l/min" correspond.
    Accuracy: ±0.5 l/min.



Minute vol.
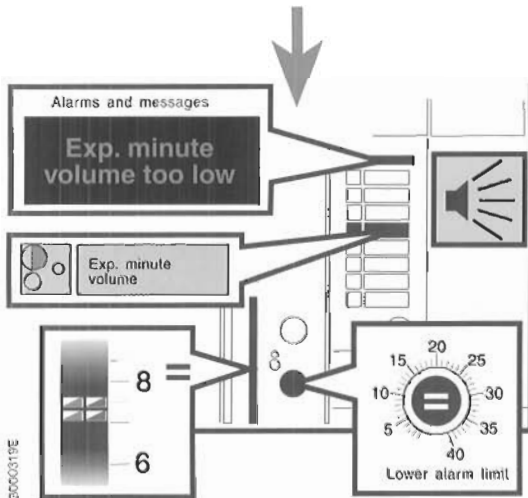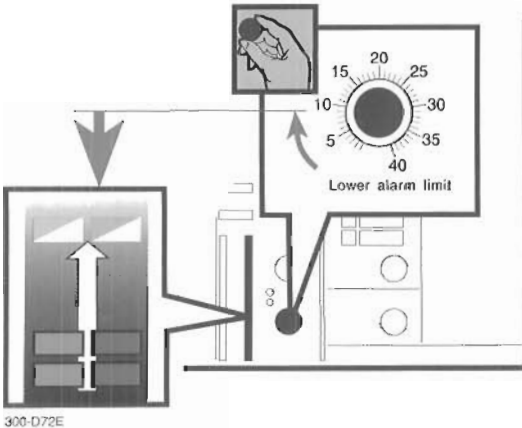l/min

Exp. minute vol.
l/min

8

3000367E

- Also make sure the minute volume
  bargraph shows:

  – preset minute volume at the same value
    as the green display "Minute vol.
    l/min." Accuracy:±0.5 l/min

  – measured minute volume at the same
    value as the red display "Exp. minute
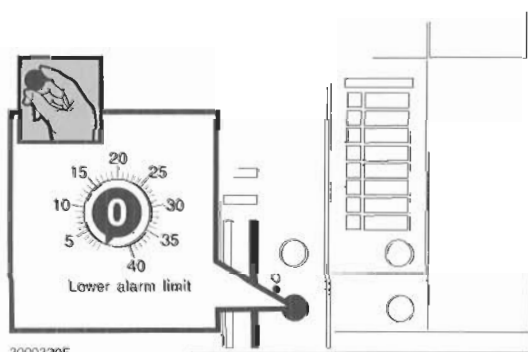    vol. l/min". Accuracy: ±0.5 l/min.

## 7. Minute volume alarms

### Lower alarm limit

- Turn "Lower alarm limit" slowly clockwise and make sure:

  – the expired minute volume alarm is activated when the lower alarm limit indication passes the measured minute volume indication on the bargraph.
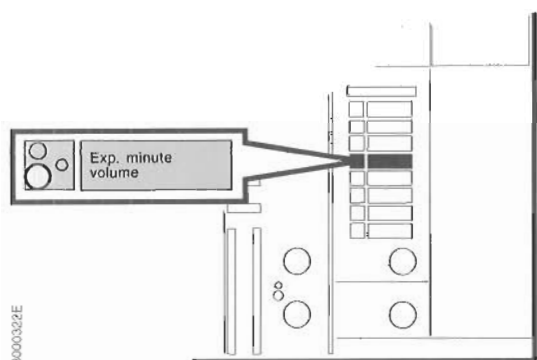
300-D72E

- At the alarm activation, make sure:

  – the audible alarm is heard.

  – the "Alarms and messages" display shows **Exp. minute volume too low**.

  – the red light at "Exp. minute volume" flashes.

  – the lower alarm indication on the bargraph flashes.

  – the lower alarm limit indication on the bargraph corresponds to the "Lower alarm limit" setting. Accuracy: ±0.5 l/min.
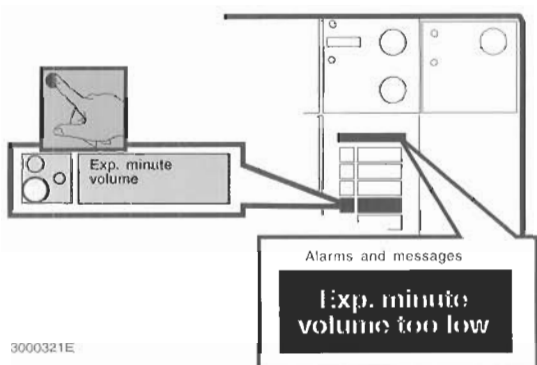
- Turn "Lower alarm limit" to 0 l/min.

3000320E

14

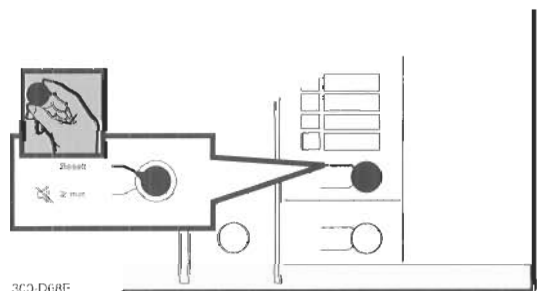# Function check

- Make sure the yellow light at "Exp. minute volume" is lit.

Exp. minute volume

3000322E

- Touch the "Exp. minute volume" touchpad and make sure the display "Alarms and messages" shows **Exp. minute volume too low**.

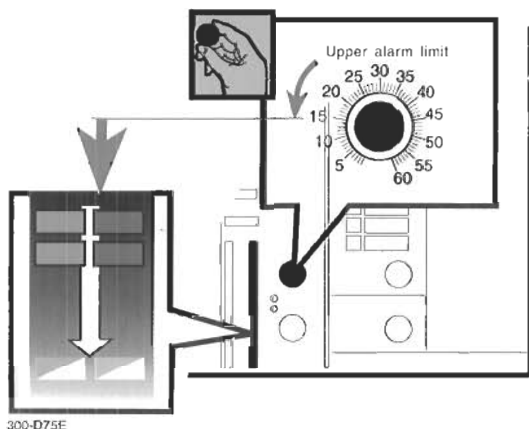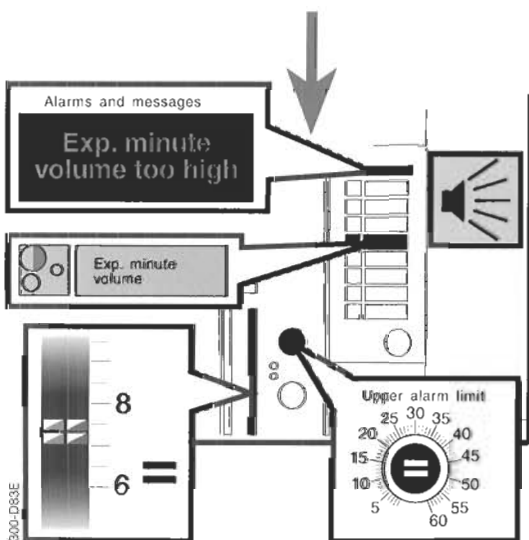Exp. minute volume

Alarms and messages

**Exp. minute volume too low**

3000321E

- Reset the alarm.

Reset

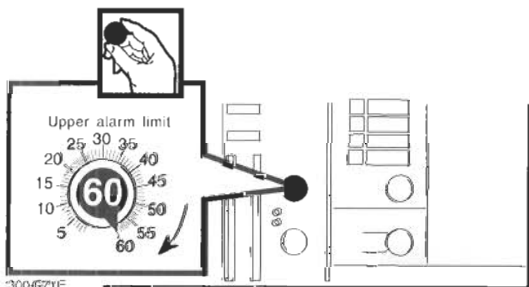2 min

3C0-D68E

**Upper alarm limit**



300-D75E

- Turn "Upper alarm limit" slowly counter-clockwise and make sure:
  - the expired minute volume alarm is activated when the upper alarm limit indication passes the measured minute volume indication on the bargraph.
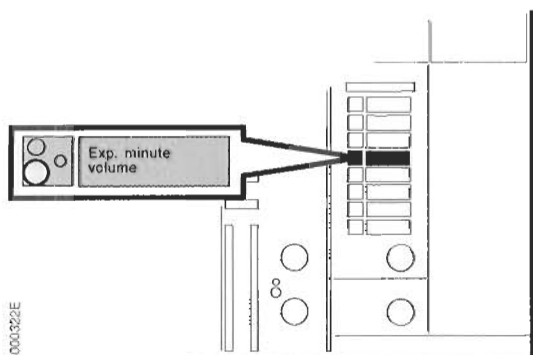


300-D83E

- At the alarm activation, make sure:
  - the audible alarm is heard.
  - the "Alarms and messages" display shows **Exp. minute volume too high**.
  - the red light at "Exp. minute volume" flashes.
  - the upper alarm limit indication on the bargraph flashes.
  - the upper alarm limit indication on the bargraph corresponds to the "Upper alarm limit" setting. Accuracy: ±0.5 l/min.
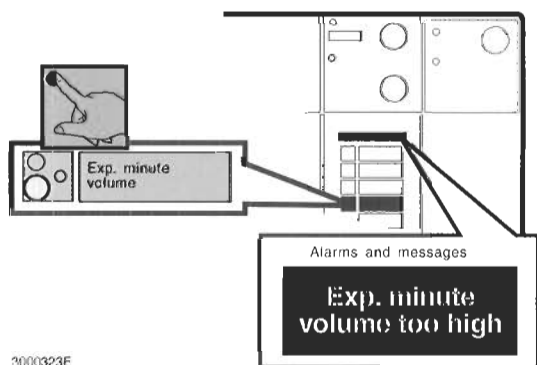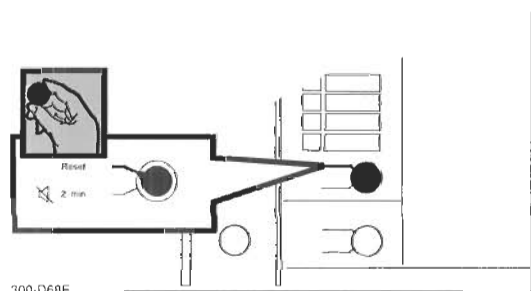
- Turn "Upper alarm limit" to 60 l/min.



300-G71E

# Function check



• Make sure the yellow light at "Exp. minute volume" is lit.

Exp. minute volume

3000322E



Exp. minute volume

Alarms and messages

**Exp. minute volume too high**

3000323E

• Touch the "Exp. minute volume" touchpad and make sure the display "Alarms and messages" shows **Exp minute volume too high**.



Reset

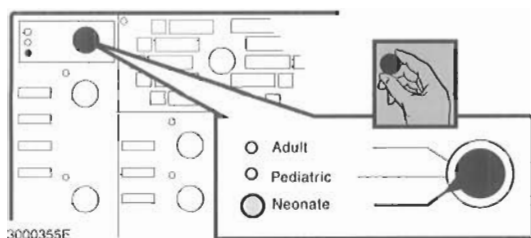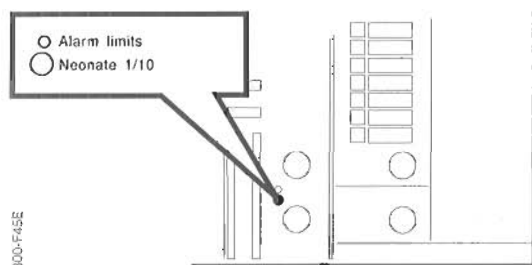2 min
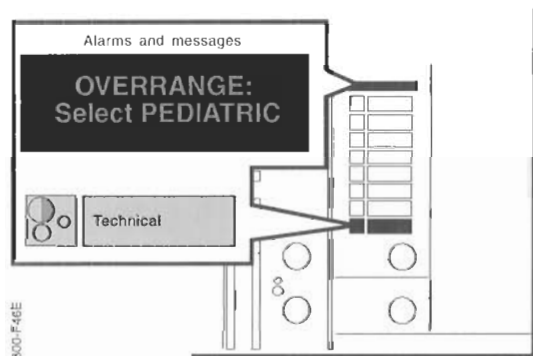
300-D60E

• Reset the alarm.

## 8. Check of "Neonate" range
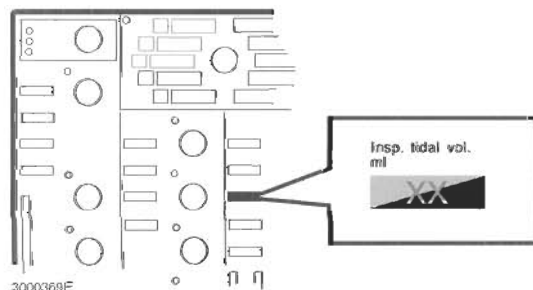
- Set the patient range selector to "Neonate."

3000355E

- Make sure:
  - the yellow light "Neonate 1/10" is lit.

300-F45E

Alarm limits
Neonate 1/10

- the red light at "Technical" flashes.
- the display "Alarms and messages" shows **Overrange: Select pediatric**.

Alarms and messages
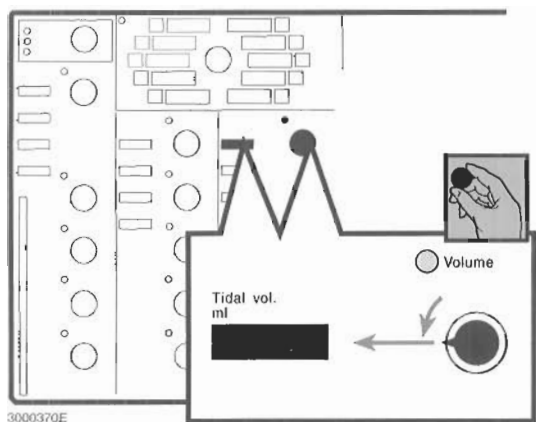
OVERRANGE:
Select PEDIATRIC

Technical

300-F46E

- the red "Insp. tidal vol. ml" display flashes.
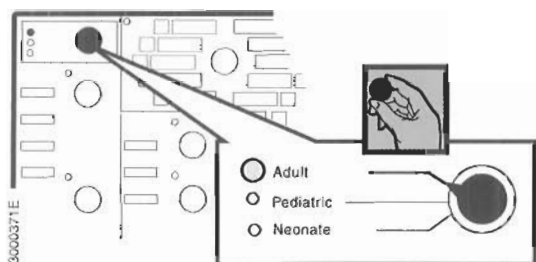
Insp. tidal vol. ml

XX

3000369E

- Check the "Upper alarm limit" and "Lower alarm limit" for expired minute volume as described in section 7.

# Function check



3000370E
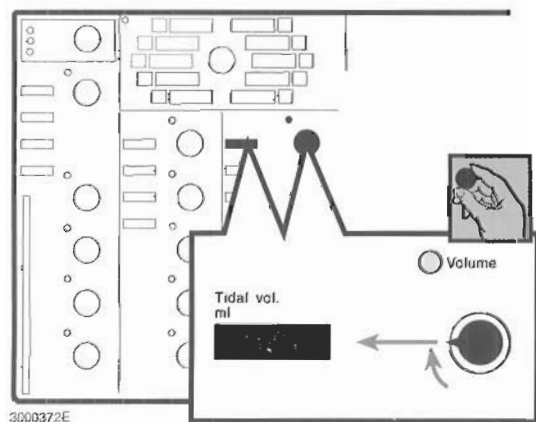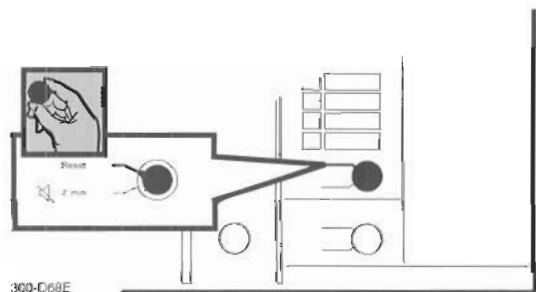
- Turn "Volume" counter-clockwise until the display "Insp. tidal vol. ml" stops flashing. The green display "Tidal vol. ml" reading shall be below 40 ml.
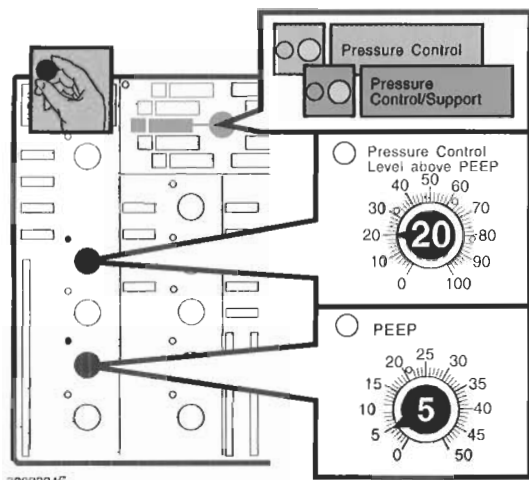


3000371E

- Set the patient range selector to "Adult."



3000372E

- Set "Volume" so that the display "Tidal vol. ml" shows 375 ml.
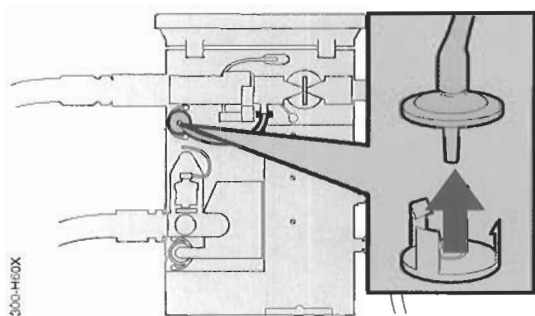
- Reset all alarms.



300-068E

3000324E

## 9. "Check tubings" alarm

• Set to "Pressure Control" mode.

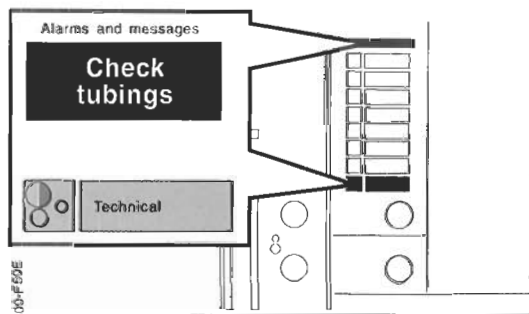• Set "Pressure Control Level above PEEP" to 20 cm $H_2O$.

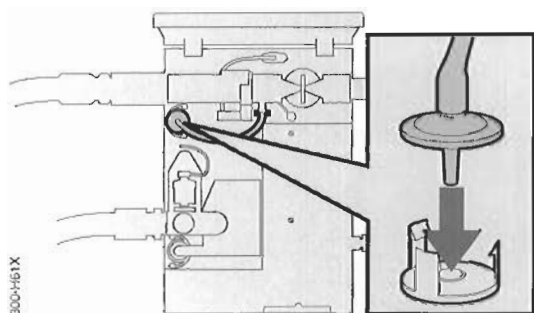• Set "PEEP" to 5 cm $H_2O$.



• Loosen the bacteria filter.



• Make sure:

  − the red light at "Technical" flashes

  − the display "Alarms and messages" shows **Check tubings**.

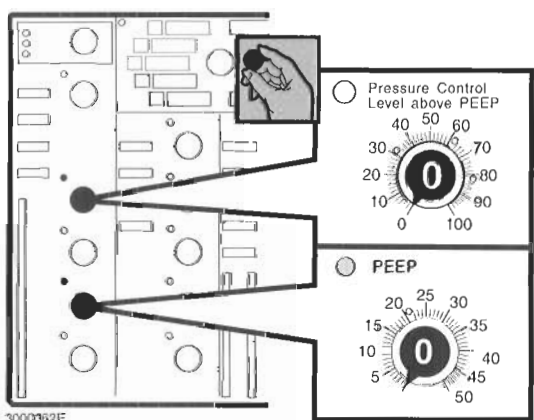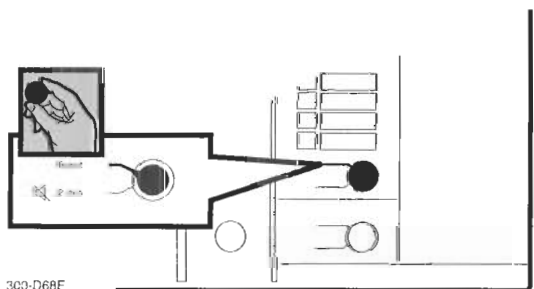  − the safety valve opens for approx 5 seconds.
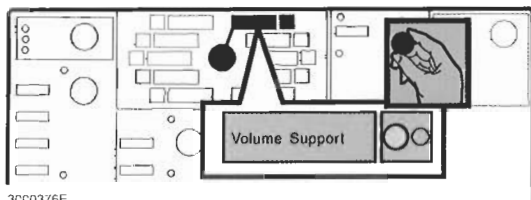
# Function check



• Reconnect the bacteria filter.



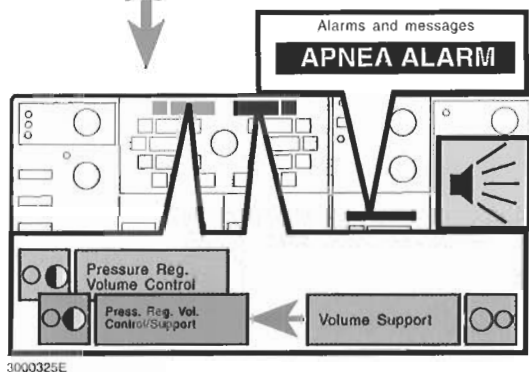• Set "Press. Control Level above PEEP" to 0 cm $H_2O$.

• Set "PEEP" to 0 cm $H_2O$.

Pressure Control
Level above PEEP

PEEP



• Reset the alarm.

## 10. Apnea alarm



3CC0376E

• Set to "Volume Support" mode.

**20 sec**

Alarms and messages

**APNEA ALARM**



3000325E
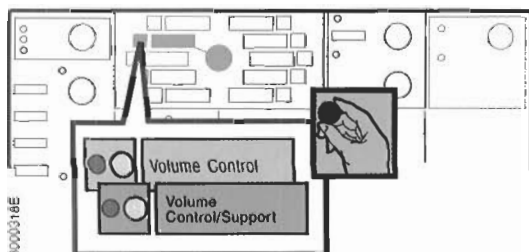
• Wait for 20 seconds and make sure apnea alarm is activated.

• At the alarm activation, make sure:

  – the audible alarm is heard.

  – the "Alarms and messages" display shows **Apnea alarm**.

  – the ventilator changes from "Volume Support" to "Pressure Reg. Volume Control" mode (indicated by flashing yellow light at "Pressure Reg. Volume Control").
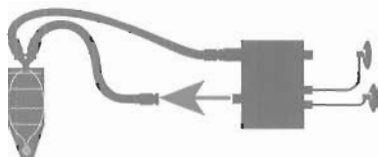
• Reset the alarm and make sure:

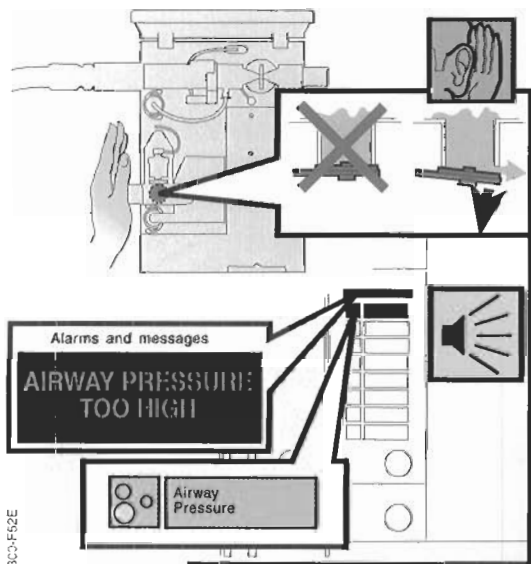  – the ventilator switches back from "Pressure Reg. Volume Control" to "Volume Support."



3000326E

• Set to "Volume Control" mode.



3000318E

## 11. Safety valve

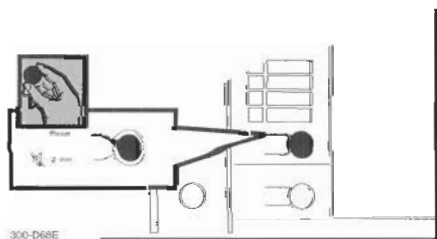• Disconnect the patient tube from the inspiratory outlet.

• Cover the opening of the inspiratory outlet and make sure:

  – the audible alarm is heard.

  – the safety valve opens with a distinct click.

  – the display "Alarms and messages" shows **Airway pressure too high**.

  – the yellow light at "Airway pressure" is lit.

> Do not activate the safety valve repeatedly since this may cause an overload of the electromagnet that controls the valve.

Alarms and messages

AIRWAY PRESSURE TOO HIGH

Airway Pressure
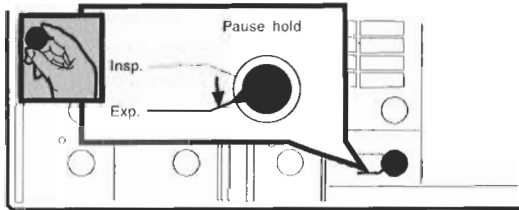
• Connect the patient tube to the inspiratory outlet.
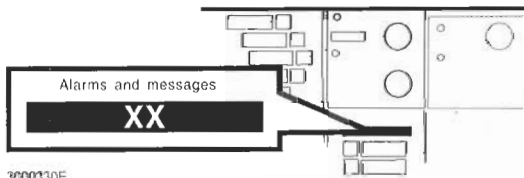
• Reset the alarm.

## 12. O₂ alarm
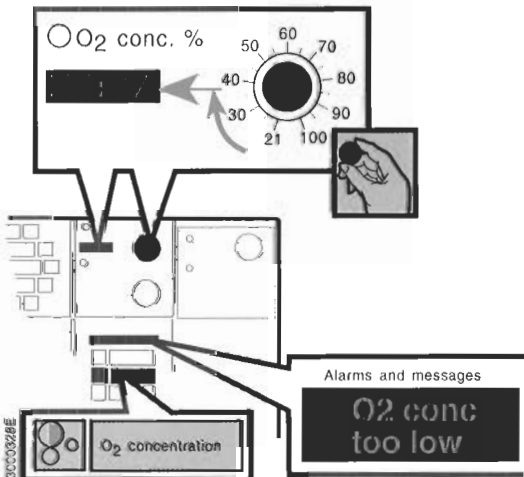
**Lower alarm limit**

• Hold "Pause hold" at "Exp" and:

300-D59E

– note the O₂ concentration value on the display "Alarms and messages". The reading shall be 40 ± 3% O₂.

Alarms and messages

**XX**

3C00330E

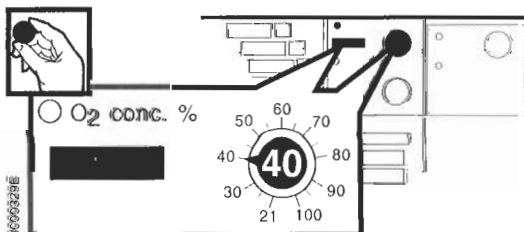• Turn "O₂ conc. %" clockwise and make sure the "O₂ concentration" alarm is activated when the green display "O₂ conc. %" reading is 6 ±1% **higher** than the noted value.

• At the alarm activation, make sure:

– the red light at "O₂ concentration" flashes.

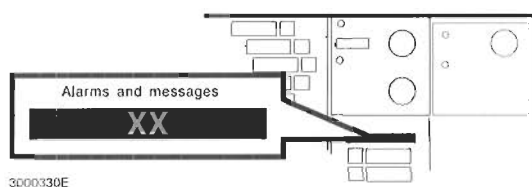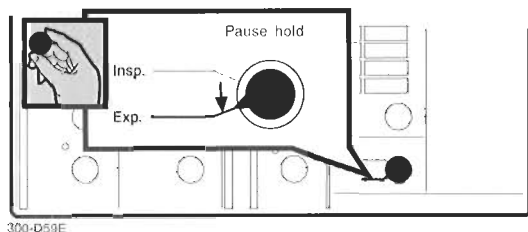– the display "Alarms and messages" shows **O₂ conc too low**.

Alarms and messages

O2 conc too low

O₂ concentration

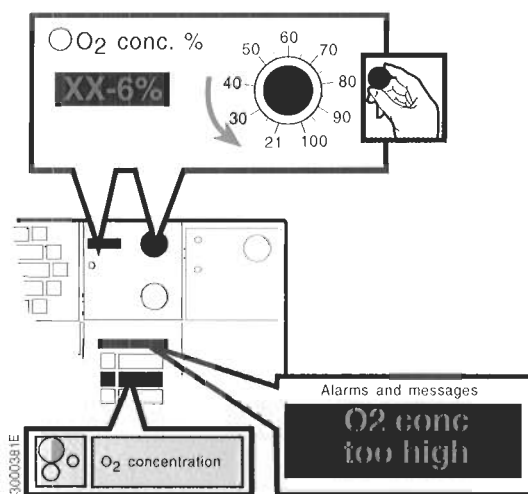• Set "O₂ conc.%" to 40%.

# Function check



300-D59E

## Upper alarm limit
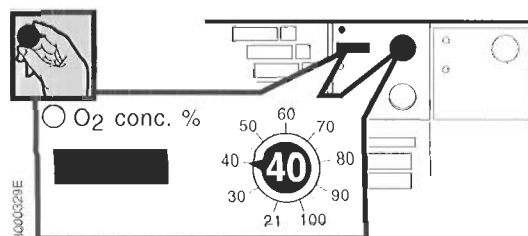
- Hold "Pause hold" at "Exp." and:



3000330E

- note the $O_2$ concentration value on the display "Alarms and messages". The reading shall be 40 ± 3% $O_2$.



3000381E

- Turn "$O_2$ conc. %" counter-clockwise and make sure the $O_2$ concentration alarm is activated when the green display "$O_2$ conc. %" reading is 6 ±1% **lower** than the noted value.
- At the alarm activation, make sure:
  - the red light at "$O_2$ concentration" flashes.
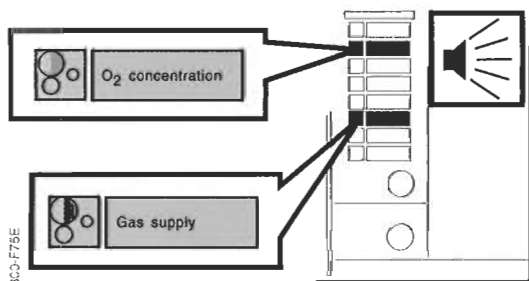  - the display "Alarms and messages" shows **$O_2$ conc too high**.
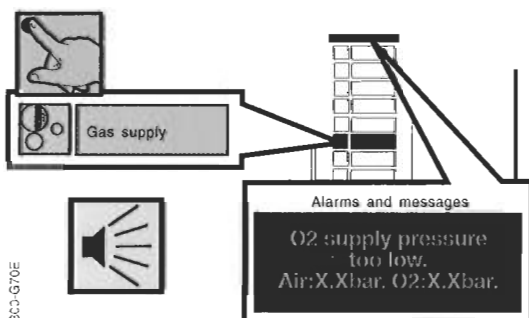


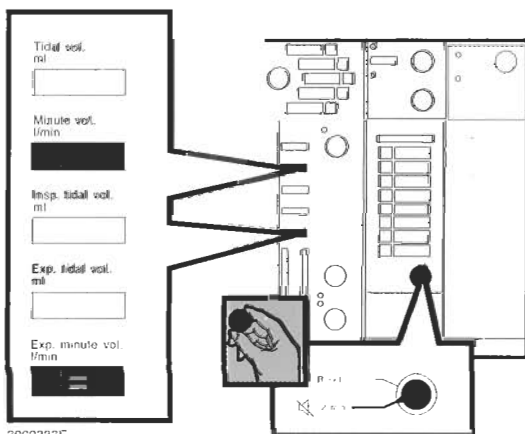3000329E

- Set "$O_2$ conc. %" to 40%.

## 13. Gas supply system

O2

300-D88X

• Disconnect the $O_2$ supply and make sure Gas supply and $O_2$ concentration alarms are activated.

$O_2$ concentration

Gas supply

3C3-F75E

• At the alarm activation, make sure:

– the audible alarm is heard.

– the red light at "Gas supply" flashes.

– the red light at "$O_2$concentration" flashes.

Gas supply

Alarms and messages

O2 supply pressure
too low.
Air:X.Xbar. O2:X.Xbar.

3C3-G70E
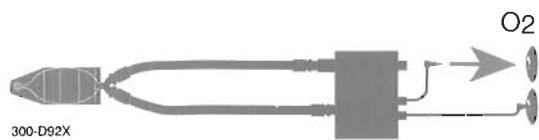
• Touch the touchpad at "Gas supply" and make sure:

– the "Alarms and messages" display shows **O2 supply pressure too low. Air: X.X bar. O2: X.X bar.**

Tidal vol.
ml

Minute vol.
l/min

Insp. tidal vol.
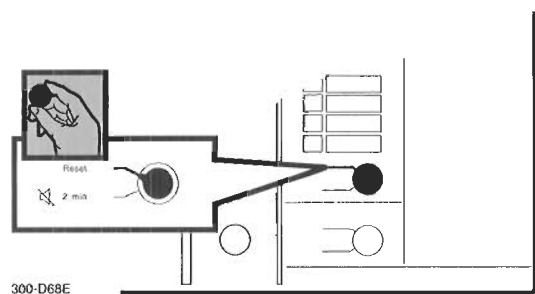ml

Exp. tidal vol.
ml

Exp. minute vol.
l/min

3C00333E

• Mute the alarm and make sure:

– the red display "Exp. minute vol. l/min" still shows the same value as the green display "Minute vol. l/min." Accuracy: ±0.5 l/min.
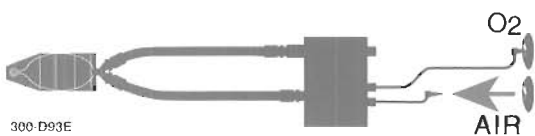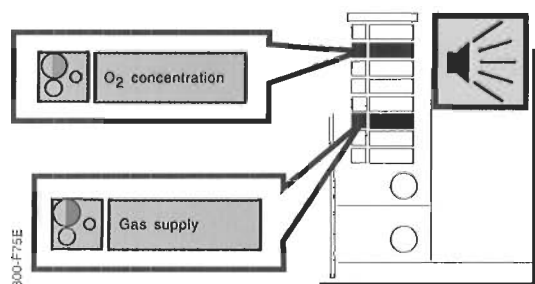
# Function check

O2    • Connect O$_2$ supply.

300-D92X

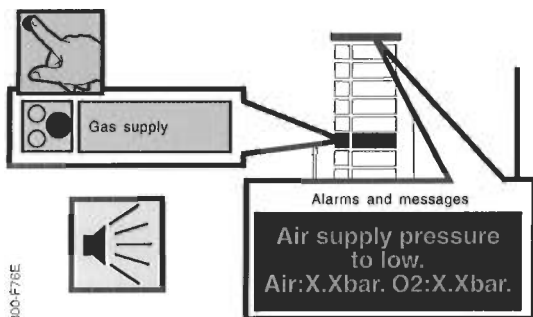• Wait a few breaths and then reset the alarms.

300-D68E

O2    • Disconnect the air supply and make sure Gas supply and O$_2$ concentration alarms are activated.
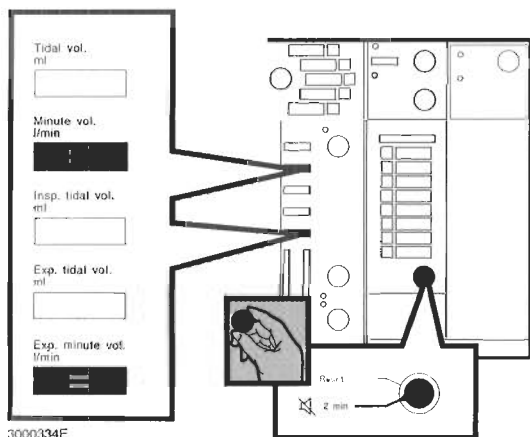
300-D93E

AIR

• At the alarm activations, make sure:
  – the audible alarm is heard.
  – the red light at "O$_2$ concentration" flashes.
  – the red light at "Gas supply" flashes.

O$_2$ concentration

Gas supply

300-F75E

# Function check



Gas supply

Alarms and messages

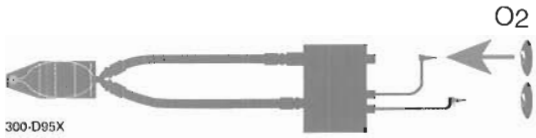**Air supply pressure to low.
Air:X.Xbar. O2:X.Xbar.**

300-F76E

- Touch the touchpad at "Gas supply" and make sure:

  –the "Alarms and messages" display shows **Air supply pressure too low. Air: X.X bar. O2: X.X bar**.



Tidal vol.
ml

Minute vol.
l/min

Insp. tidal vol.
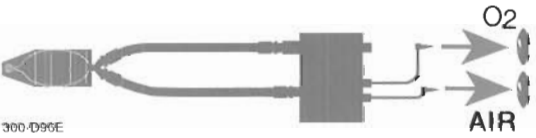ml

Exp. tidal vol.
ml

Exp. minute vol.
l/min

3000334E

- Mute the alarm and make sure:

  – the red display "Exp. minute vol. l/min" still shows the same value as the green display "Minute vol. l/min" Accuracy: ±0.5 l/min.
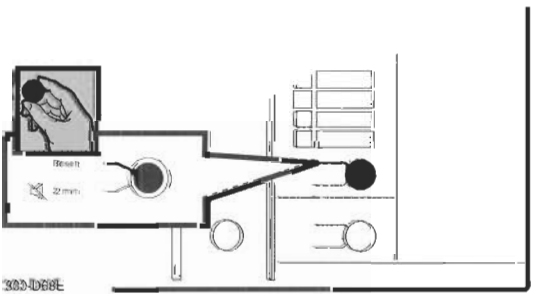
# Function check

300-D95X

O2

• Disconnect $O_2$ supply so that no gas is connected to the ventilator.
Make sure:

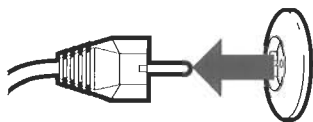— the safety valve opens with a distinct click.

— the expiratory valve opens.

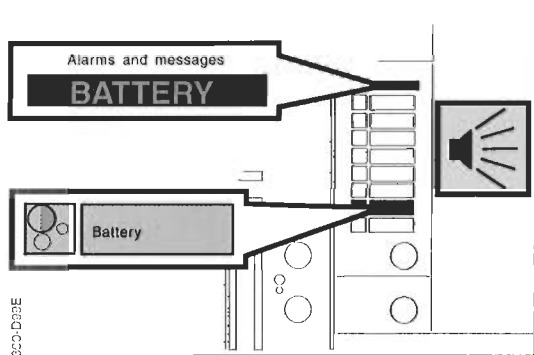300-D96E

O2

AIR

• Connect the air and $O_2$ supplies.

• Reset the alarms.

300-D98E

## 14. Battery operation

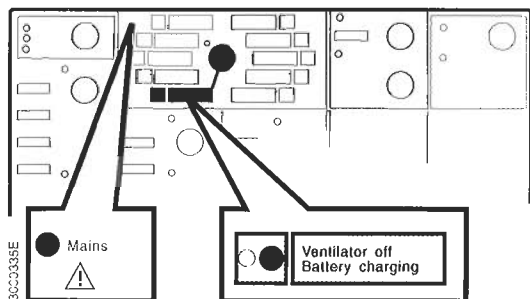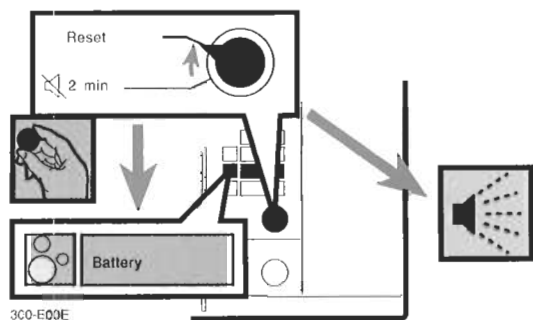• Disconnect the ventilator from mains and make sure Battery alarm is activated.

• At the alarm activation, make sure:
  – the audible alarm is heard.
  – the red light at "Battery" flashes.
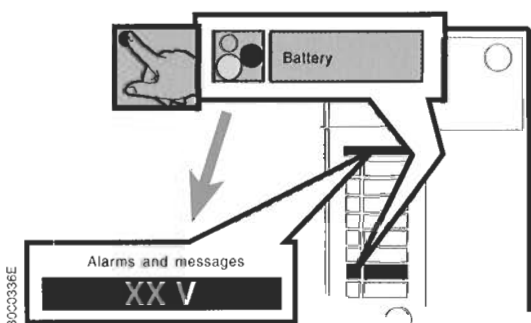  – the display "Alarms and messages" flashes **BATTERY**.

  – the yellow light at "Ventilator off Battery charging" and the green light "Mains" are not lit.
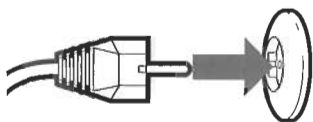
# Function check



Reset
✕ 2 min
Battery
3C0-E00E

• Reset the alarm and make sure:
  – the caution signal starts.
  – the yellow light at "Battery" is lit.



Battery
Alarms and messages
XX V
30C0336E
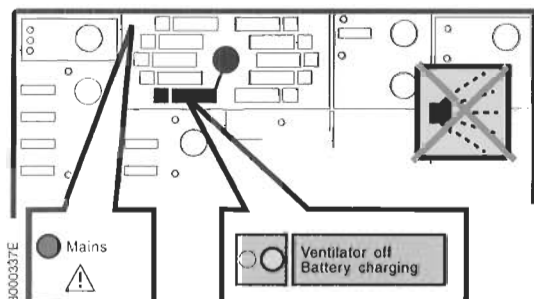
• To check the internal battery, touch the touchpad at "Battery" and read the displayed text. (Normal value approx. 24 V.)
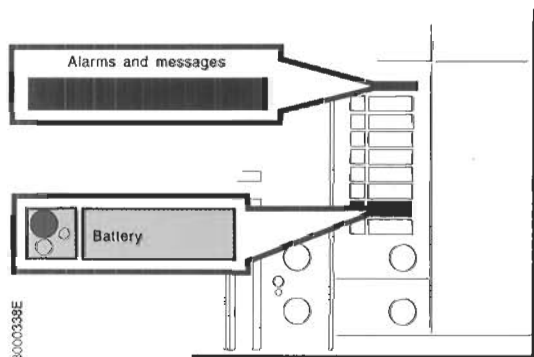
• Connect the ventilator to mains again.



• Make sure :
  – the yellow light at "Ventilator off Battery charging" and the green light "Mains" are lit.
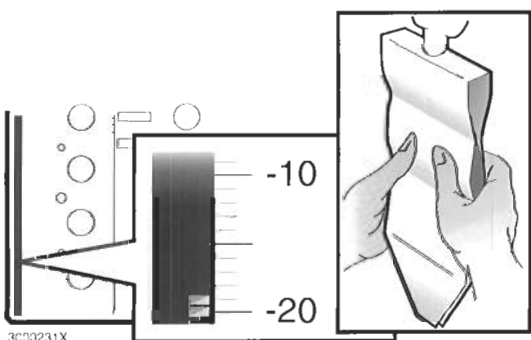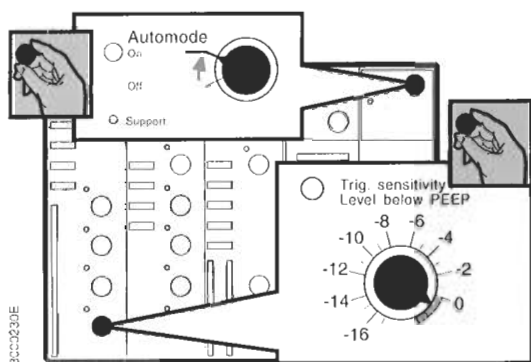  – the caution signal stops.



  – the display "Alarms and messages" no longer flashes **BATTERY**.
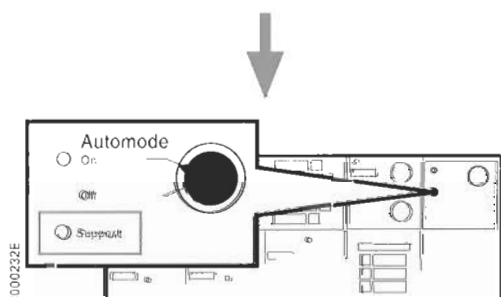  – the yellow light at "Battery" is no longer lit.

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## 15. Automode
## (SV 300A only)

- Set "Automode" to "On".

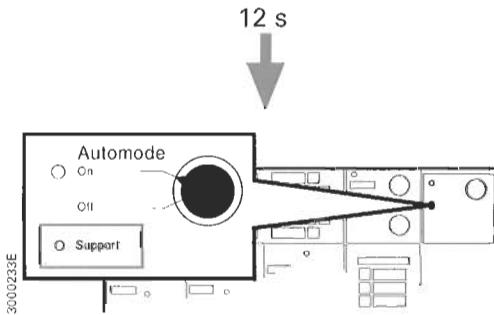- Set "Trig sensitivity Level below PEEP" in the green range.

- Compress and release the test lung twice to trigger a breath. Two diodes on the bargraph for airway pressure show that a breath is triggered.
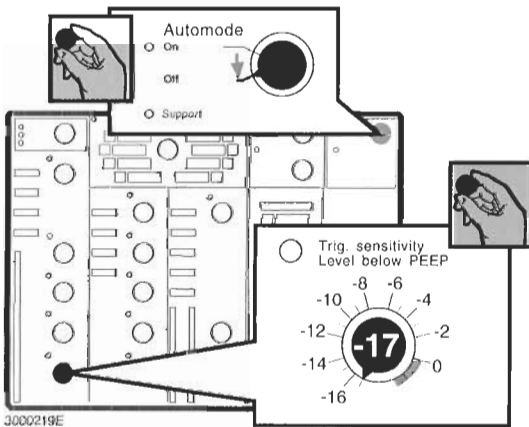
- Make sure the ventilator switches to support mode. This is shown by the yellow light "Support".
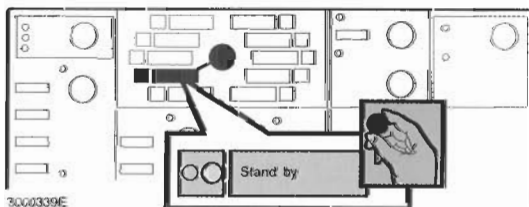
# Function check

**12 s**



- Do not trigger any more breaths and make sure the ventilator switches back to "Volume Control" after about 12 seconds. (The yellow light "Support" is no longer lit.)



- Set "Trig sensitivity Level below PEEP" to -17 cm $H_2O$.
- Set "Automode" to "Off"



- The Function check is now complete, set the mode selector to "Stand by", or, if the ventilator is to be connected to a patient, make the appropriate settings for that patient.

## 16. Log sheet

- Note on a log sheet that a function check has been performed.