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English

ATMOS S 351 ATMOS S 351 Natal



Serviceanleitung

FO.04



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The ATMOS S 351 is a surgical suction unit which is used in medical ranges to remove bodily fluids (secretions) and rinsing fluids by means of a vacuum generated in the suction system. The variants of the ATMOS S 351 are used in obstetrics, during eye operations and for intermittent drainage.

1.1 Valid operating instructions

The ATMOS S 351 is manufactured in 3 variants:

- ATMOS S 351
- ATMOS S 351 Natal

The ATMOS S 351 Natal provides for a comfortable realisation of vacuum extractions.

ATMOS	Current issue
S 351, S 351 Natal	
Software control	2.0 (or higher)
Software, CAN	–
Hardware control	1.1
Operating instructions:	
ATMOS S 351	444.0405.A
ATMOS S 351 Natal	444.0401.A

The operating instructions relating to the ATMOS S 351 form part of these service instructions. The persons authorized for service work must be familiar with the contents, the kind of installation, the start-up as well as the operation described therein.

1.2 Information on manufacturer

Further information, accessories and spare parts are available from:

ATMOS

MedizinTechnik GmbH & Co. KG
Ludwig-Kegel-Straße 16
79853 Lenzkirch
Deutschland
Tel. + 49 (0) 76 53 / 6 89-0
Fax: + 49 (0) 76 53 / 6 89-190
+ 49 (0) 76 53 / 6 89-493 (Service Center)
atmos@atmosmed.de
www.atmosmed.de


1.3 Exclusion of liability


ATMOS assumes responsibility for the unit, as far as safety, dependability and functionality are concerned, only if

- assembly, readjustment, modifications, extensions or repairs are carried out by ATMOS or by persons authorized by ATMOS,
- only original ATMOS parts are used and,
- the unit is used in compliance with the operating instructions.

1.4 For your safety

Please also pay attention to chapter 2.0 "For your safety" in the operating instructions.

 Information which is of particular interest to the user is printed in a box throughout this manual.

 Before opening the ATMOS S 351 for service work, switch off the unit and remove the power cab-

Maintenance and/ or opening and repair of the ATMOS S 351 may be carried out only by an expert authorised by the manufacturer. When doing this, technical and hygienic protective measures are to be taken.

When assembling the housing, particular care is to be given to the electric cabling and the silicone hose. These must not be bent sharply or get caught. If necessary, the lines should be retracted somewhat into the rear housing shell.

In case of improper maintenance or repair of the appliance and the use of non-original parts the product liability of the manufacturer will become forfeited. When opening the appliance during the period of guarantee the guarantee given by the manufacturer will be forfeited.

When the appliance is decommissioned at the end of its service life and is to be disposed of, the components are to be given separately into the various recycling processes. The same regulations are to be observed concerning the disposal of replacement parts.

See chapter 4.0 "Installation and commissioning" in the operating instructions.

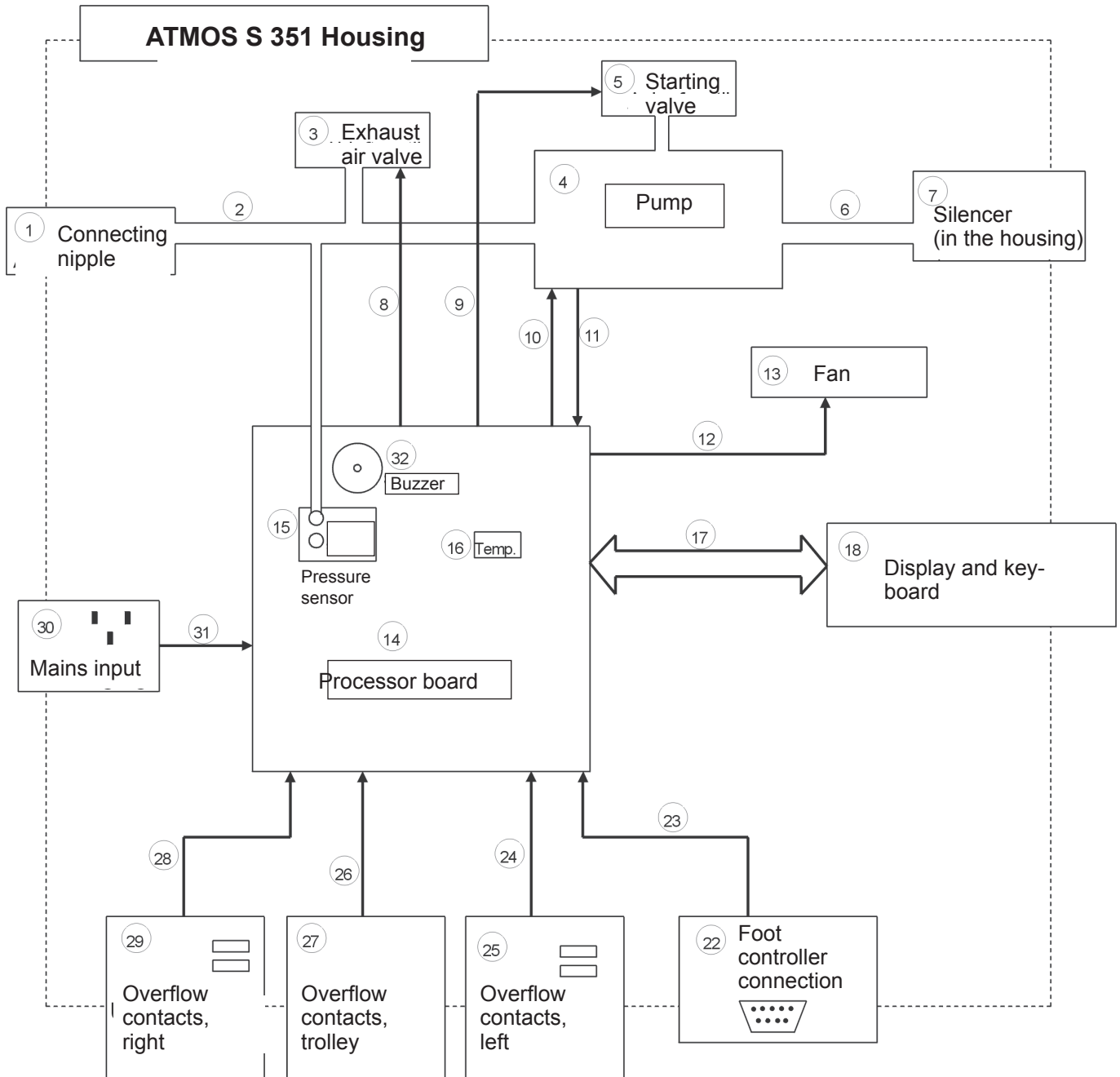



Fig. 1. Block Diagram

3.1 Functional description

The main part of the suction unit is the diaphragm-type pump (4). The motor of the pump is controlled by the processor board (14). A pressure transducer (15) delivers the actual vacuum to the processor board (14). The pump (4) is driven until the desired final vacuum is shown in the safety glass and in the collection jar.

With the help of the vacuum generated, liquid passes through the suction hose into the collection jar. A level monitor (overflow contacts (25, 27, 29) checks the resistance between double socket nipple and an electrode fitted in the collection jar lid. If the resistance changes (by the increasing liquid level in the collection jar) the pump (4) is shut down and an acoustic signal is given by the buzzer (32). Only when the double socket nipple is removed and put into another collection jar is the suction unit again ready for service.

The vacuum can be selected by 3 push buttons. A further way of controlling the vacuum is with the foot controller. This is connected to the sub-D-connection bush (22). If vacuum is to be reduced, the exhaust air valve (3), which is controlled by the processor board (14), opens. A temperature monitor (16) monitors the internal temperature of the suction device. This controls the installed fan (13) when required. If the temperature rises above a certain limit (65°C) then a warning is given. If the 2nd limit is exceeded (85°C) the unit is shut down and a corresponding fault indication is given. The variant ATMOS S 351 and ATMOS S 351 Natal have additional functions, which allow vacuum creation and reduction over a predetermined time.

 When using accessories, which are not provided especially for the ATMOS S 351 or its variant, functional limitations may occur (overflow recognition, short circuit).

3.2 Description of the sub-assemblies

The ATMOS S 351 and its variant are made up of the following components:

- housing
- collection jar system with hose connections and bacterial filter
- internal components (pump, processor board,...)
- electronics

3.2.1 Housing

The housing of the ATMOS S 351 or its variant is made of plastics (ABS UL). The main switch, the operating and indicating strip, the connection bushes, the jar fixings (overflow contacts right (29) and left (25)) and the fastening nuts for the trolley (overflow contacts on the trolley (27)) are fitted on the housing.

3.2.2 Collection jar system with hose connections and bacterial filter

The collection jars which can be supplied in various sizes and materials (see technical specifications) are put into the mountings provided. The collection jar lids then contact the rails. As a result an electrical overflow protection is provided by the overflow contacts (25, 27, 29). The processor board (14) assesses the signals appropriately. The electronics differentiate between "no existing overflow" (= resistance close to ∞), "overflow present" and a "short circuit" ($< 100 \Omega$). In addition on the signal input of the trolley (27) the trolley is recognised. This is done by a resistance installed in the trolley ($1 \text{ M}\Omega \pm 20\%$). Please note that if using an older trolley the resistance may not yet be installed (see Page 38: Trolley for ATMOS S 351 or modify its variant).

A hydrophobic bacterial filter must be fitted in the airway in front of the connection nipple (1) which prevents the secretion being sucked into the pump and thus avoids a bacteria contamination of the space inside the housing. There are two ways of doing this:

1. Use of the bacterial filter that is included in the scope of supply. This filter is fitted in the pipework between the connection nipple (1) and the overflow container.
2. Use the bacterial filter that can be obtained as an accessory in the overflow container. This bacterial filter has a longer life and can be autoclaved.

Further details on this are given in the Operating Instructions.



3.2.3 Internal components

(2) Pipework on the vacuum side

The pipework on the vacuum side connects the connection nipple (1), the exhaust air valve (3), the pressure transducer (15) on the processor board (14) to the pump (4, vacuum connection). The pipework is manufactured complete with silicone hoses.

(3) Exhaust air valve

The exhaust air valve (3) serves to reduce the vacuum, if the system (collection jar, etc.) is shutdown. The valve is controlled by the processor board (14) with 12V dc. The function can be tested in Service Mode 2.

(4) Pump

The pump (4) is supplied with mains voltage through the processor board (14). The processor controls the pump (4) until the preset vacuum is reached. When the vacuum is reached the power supply is switched off. The function can be tested in Service Mode 2.

(5) Start valve

The pump (4) does not start automatically under vacuum. Therefore, when necessary the vacuum in the pumping head of the pump (4) is reduced by the start valve. Since the valve is located in the intermediate piping of the pump, no reduction of vacuum occurs on the vacuum side. The control of the valve (5) is done by the processor board (14). The processor uses the running signal of the pump which is reported by the control wire (11) to the processor board to recognise a start.

(6) Pipework on the pressure side

The piping on the pressure side connects the pump (4) with the silencer (7). The piping is made of silicone hoses.

(7) Silencer

The silencer is integrated into the housing. The exhaust air hose (6) is clamped in the silencer housing and secured with 5 screws and a cover plate. Noise absorbing padding is fitted in the silencer housing to absorb the noise. The air passes out of the back of the housing to the outside.

(13) Fan

The fan serves to cool the pump (4) and generally to cool the inner space. The fan is supplied with 12V dc by the processor board (14). The fan switches on at a temperature of 45°C and off at a temperature of 40°C on the temperature transducer (16).

(14) Processor board

The processor board serves to control and monitor the ATMOS S 351. It forms the central unit. On the processor board there is the processor, the power supply for the electronics, the pressure transducer (15) and the temperature transducer (16).

(18) Display and keyboard

The display and the keyboard are directly connected to the processor board (14) with the ribbon cable (17). On the ribbon cable (17) there are 2 ferrite cores for fault clearance. The display is a graphic LC display with 128 x 64 pixels. The lighting is done by means of LEDs.

(22) Foot controller connection

In the standard component ATMOS S 351 the connection is done directly through cable (23) to the processor board (14). The foot controller connection consists of a 9 pole Sub-D-Bush.

(25,27,29) Overflow contacts (left, trolley, right)

The overflow contacts are connected through the connection wires (24, 26, 28) to the processor board (14). The overflow recognition is done by a resistance measurement.

(30) Mains input

The mains input consists of a cold device connection box with integrated fuses and an EMC-filter. In addition a potential equalisation bush is connected here.

3.2.4 Electronics

The description is done by means of function blocks.

- **Block 1 Potential separation and production of 12V dc:**

The supply voltage is connected at the entry to the block. There is a switch to switch over between 115 and 230V ac. The transformer has an insulation designed for a voltage of 4kV and supplies an output voltage of 18V ac. The secondary winding is protected by a fuse (0.6 AT). A bridge rectifier is fitted to rectify the ac voltage.

- **Block 2 Control of the motor:**

The motor is connected through a semi-conductor relay. This semi-conductor relay has an insulation designed for 4kV. The control of the relay is achieved directly from an output of the controller. If the input signal of the motor is low, the motor is turned on.

- **Block 3 Control of the 5V dc:**

The 5V dc is controlled by an LM 2574 switch regulator. The regulation is done by back coupling, which by means of a voltage divider is taken back to the feedback of the switch regulator. The switch regulator is short circuit proof. The voltage is smoothed by capacitors.

- **Block 4 Control of the 12V dc:**

The 12V dc is controlled by an LM 2574 switch regulator. The regulation is done by back coupling, which by means of a voltage divider is taken back to the feedback of the switch regulator. The switch regulator is short circuit proof. The voltage is smoothed by capacitors.

- **Block 5 Production of the negative 12V supply:**

The negative voltage is produced by a charging pump (IC 7660). It is fed by the positive 12V.

- **Block 6 Reference voltage:**

The 2.5V reference voltage is produced by a low power band gap diode. The diode has a temperature coefficient of 50 ppm. All AD converter values are based on this reference voltage.

- **Block 7 Low pressure measurement:**

A silicon transducer is fitted to measure the low pressure. The measuring bridge of the transducer is fed with a constant voltage. This constant voltage is produced by means of an amplifier and the reference voltage.

$$U_{\text{sensor}} = 10.025 \text{ V}$$

In addition the measuring bridge is evaluated by means of a difference amplifier. The difference amplifier amplifies the signal, so that 1 bar under pressure corresponds to 2.5V.

- **Block 8 Motor rotation monitoring:**

A reflex light barrier is used to check whether the motor is started in the switched on condition. The reflex light barrier consists of an LED and an open collector exit. The light diode is fed through a pre-resistance of 5V. The voltage differences on the open-collector-exit are assessed by the comparator circuit of the OP2 and so prepared that a rectangular signal is made available to the controller.

- **Block 9 Control of valves and fans:**

The two valves (start and exhaust air) as well as the fans are connected with a FET. The loads lie on one side on +12V and are, if necessary, pulled with an FET to GND. The FETs are controlled directly by the controller. Two other FETs ensure that the intake and outlet air valves cannot be connected while the reset signal produced from the reset module is on. BYV27 diodes are used to prevent radio interference.

- **Block 10 Brightness control of the LC - display:**

The brightness of the LC display can be controlled with the controller. The current through the LEDs to light the display is controlled through a constant current source. This constant current source is produced by means of a shunt (R_{33}) and an operation amplifier. The target value for the current source is given by the PWM signal of the controller.

- **Block 11 Indicator:**


The connection to the indicator board is done by a 26 pole ribbon cable. The control of this LC display and the two LEDs as well as the inputting of the push buttons is done by means of this ribbon cable. The control of the LCD graphic display is done by means of the data bus and some generated control signals. The LEDs lie on one side at +5V and are on the other side pulled through a resistance with the controller to GND. The push buttons are held with a Pull Up to +5V. If a push button is pressed, the level falls to GND and is registered by the controller.

- **Block 12 Overflow contacts:**

There are 3 overflow sources:

- overflow right
- overflow left
- overflow trolley

The overflow contacts are supplied from the reference voltage through a resistance. The other side of the contact is read with an AD converter of the controller. If the resistance between the contacts is reduced, then the voltage at the AD converter increases and can be detected by the controller as safety glass.

 The resistance values must not be reduced!



- **Block 13 Temperature monitoring:**

A PTC temperature transducer is used to monitor the temperature in the ATMOS S 351 or its variant. This temperature transducer is read by the internal AD converter of the controller. Thus the fan can be switched on when necessary or a high temperature reported. The following voltage values are produced at the input of the AD converter.

Temperature	Voltage
20°C	1.225 V
40°C	1.322 V
60°C	1.412 V
80°C	1.496 V

Table 3: Temperature values

- **Block 14 CAN connection:**

Is not used.

- **Block 15 Buzzer:**

The buzzer for acoustic output of warning signals is switched with an FET from the controller.

- **Block 16 Foot controller:**

The foot controller is read with the help of the AD converter. In order to guarantee a voltage at the input of the AD converter of 0-1.9V a pre-resistance of 15 kOhms is used. The resistance R_{35} is used to recognise whether a foot controller is attached.

- **Block 17 EEPROM:**

Various settings are stored in the EEPROM 93LC66B. The communication with the EEPROM is done by means of a serial SPI-bus.

- **Block 18 Controller:**

An 80C552 made by Philips is used as the controller. The controller possesses the following features:

- 80C51 core
- 256 x 8 internal RAM, externally upgradable to 64k
- 3 independent timers
- 8x 10 bit AD - converter input
- 2x 8 bit PWM signals
- 5x 8 bit I/O - Ports plus an 8 bit inlet port (ADC)
- a UART
- watchdog on chip
- 24 MHz type

- **Block 19 Oscillator:**

The oscillator is produced by a quartz crystal and 2 capacitors. The cycle frequency is 24 MHz.

- **Block 20 Address latch:**

An IC 74HC573 is used to latch the lower 8 address wires (A0-A7). First the addresses are given over the combined data/address bus and intermediately stored by the 74HC573 before the data is read in or read out over the data bus.

- **Block 21 Eprom:**

An Eprom 27C512 is fitted as program memory. The eprom has a storage capacity of 512 kbits and is organised in 64k x 8 bit.

- **Block 22 RAM:**

An RAM HY6264A is fitted as volatile memory. The RAM has a storage capacity of 64 kbit and is organised in 8k x 8 bit.

- **Block 23 Address decoding:**

A 74HC00 is used for the address decoding for the control of the LC display. This decoding circuit has several functions:

- The RD signal is inverted.
- The enable signal is generated by the connection of the RD, WR and A15 signals.

- **Block 24 AD-transducer setting:**

This circuit part serves to adjust and filter the AD converter signal. An RC member filters the signals. A Z-diode protects from over voltage.

- **Block 25 Reset unit:**

The reset-unit TC1232CPA has 3 functions:

1. Voltage monitoring: If an input voltage of 4.5V is exceeded, the TC1232 sends a reset signal to the controller.
2. Watchdog function: A port is continually toggled by the controller. If this toggling is set for a time of more than 150 ms, the unit reports a reset to the computer.
3. Manual reset: If the J1 is short circuited the unit sends a reset.

3.3 Allocation of wires to the plug

Foot controller

Pin	Designation	Type of signal
1		
2		
3		
4		
5	GND	Low voltage
6		
7		
8	Schleifer potentiometer	Low voltage
9	Supply potentiometer	Low voltage
Housing	Screening	Earth

Allocation of wires to the pins of the foot controller

3.4 Test and measuring points

The following measuring points are available on the control board:

Designation	Signal	Type of signal (valve)	Remarks
MOTOR	Speed of the pump	5 v, rectangular	
SENSOR	Vacuum (amplified)	0 - 2.5 V	2.5 V at 1 bar
REF	Reference voltage	2.5 V	
RST	Reset	0 / 5 VDC	
-5V	Negative supply	- 5 VDC	
+5V	5 V supply	+ 5 VDC	
+12V	12 V supply	+ 12 VDC	
GND	Mass/earth	0 VDC	

Control board measuring point

3.5 Service Mode

The ATMOS S 351 or its variant differentiate between 2 Service Levels:

- Service Level 1: Serves to set the suction device. This level is described in the Operating Instructions.
- Service Level 2: Serves to support the service.

3.5.1 Service Level 1

With the ATMOS S 351 you reach Service Level 1 if you hold the "Standby" key down when switching on.

Functions of Service Level 1:

- Adjust Unity: The units of the indicator can be changed over here: mbar / kPa / mmHg.
- LCD Brightness: The LCD background lighting can be adjusted here (0 to 25)
- Adjust Intermit: Adjustment of the Intermit-mode can be done here. Read the description of this in the Operating Instructions.

3.5.2 Service Level 2

Overview of the functions of Service Level 2:

- Show Errors: Any errors that have occurred, including the error history, can be seen here.
- Clear Errors: Serves to delete the error memory.
- Test Airtight: The system tightness can be tested here.
- Test Hardware: The main functions of the suction device can be directly tested.

With the ATMOS S 351 you reach Service Level 2 when you hold the "standby" and the intermittent key depressed when switching on:

Select with the arrow keys the corresponding functions and confirm them by pressing on the "Max" key. In order to leave the service level press the "Standby" key and the "Extraction cup" key on ATMOS S 351 Natal

☞ With the ATMOS S 351 Natal you get into the Service Level 1, if you hold depressed the extraction cup key or the eye key during starting; The additional functions of Service Level 1 of ATMOS S 351, ATMOS S 351 Natal is described in detail in the Operating Instructions.

☞ With the ATMOS S 351 Natal you get into the Service Level 2, if you hold depressed the suction bell key or the eye key together with the "End" key during starting.

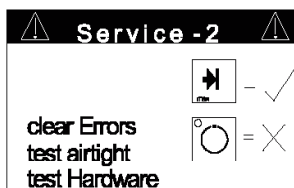


Fig. 2. Start picture Service Level 2

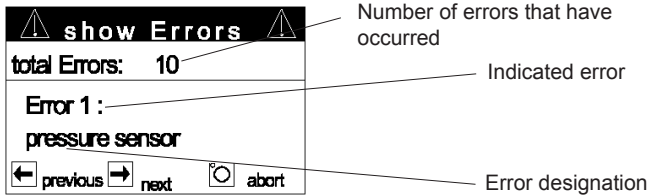


Fig. 3. Error memory

a) Show Errors

The error history can be used to make the search for errors easier:

A maximum of 10 errors can be stored. If more than 10 errors occur then the first 9 and the last error that occurs are stored. The last error is always at the start (Error 1).

The following errors are recognised and displayed by the ATMOS S 351 or its variant:

Error	Description of error	Reaction of the ATMOS S 351 or its variants	Possible sources of the error
Key error	A key is jammed or is depressed for more than 7 seconds	The device goes into emergency operation, error message is entered in the error memory.	<ul style="list-style-type: none"> - Key jammed - Parts on the keyboard
Motor sensor	When the motor is switched on the rotation sensor gives no feedback after 4 seconds	The device goes into emergency operation, error message is entered in the error memory.	<ul style="list-style-type: none"> - Motor does not turn - Motor sensor defective or not correctly positioned - Motor control defective
Pressure sensor	The pressure measured is outside the range.	The device goes into emergency operation, error message is entered in the error memory.	<ul style="list-style-type: none"> - Hose on the wrong sensor nipple - Pressure sensor defective - Pressure sensor not connected
Temperature	If the temperature exceeds 85°C or falls below -5°C an error message is given, which is only erased when the temperature falls below 80°C or rises above 0°C.	An acoustic signal sounds every 10 seconds. The high temperature symbol appears on the display. The pump is switched off. The error message is entered in the error memory.	<ul style="list-style-type: none"> - Temperature in the suction device is too high - Ventilation slot blocked - Surrounding temperature too high - Fan does not work - Temperature transducer defective
Overflow short circuit	If the contacts of the overflow are short circuited (<100Ω) an error message is given	Every 10 sec error message in the display as well as buzzer for 1 second. The error message is entered in the error memory	<ul style="list-style-type: none"> - Contacts shorted

Error codes

b) Clear Errors

When the errors have been resolved the error memory needs to be cleared again. Choose the "clear errors" function for this.

c) Test air tightness of system

This can test to what extent the total system is tight.

Connect all hoses/containers on the ATMOS S 351 or its variant to be tested. Close the suction hose and start the test with the "max" key. It takes place as shown on the adjacent display.

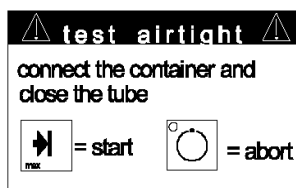


Fig. 4. Tightness test - Start diagram

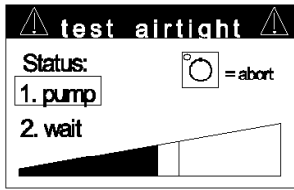
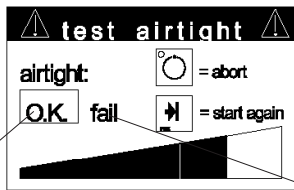


Fig. 5. Tightness test - Test

The ATMOS S 351 or its variant begin to create vacuum (Phase 1, as shown). Then there is a waiting time (Phase 2, "wait").



System is tight

System is leaking

Fig. 6. Tightness test - Result

The test result is shown with a box. Then start a new test run with the "Max" key or end the function with the "Stand-by" key, "Extraction cup" key with ATMOS S 351 Natal.

The example shows a tight system.

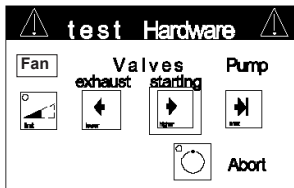


Fig. 7. Test hardware

d) Test Hardware

This function serves for the targeted testing of individual components. Chose the function to control the valves, fan or pump directly:

- Fan on/off with the "intermittent" key for the ATMOS S 351, with the "extraction cup" key for the ATMOS S 351 Nata;
- Exhaust valve on/off with the "arrow left" key (valves – exhaust)
- Starting valve on/off with the "arrow right" key (valves – starting)
- Pump on/off with the "max" key (pump)

Clean the ATMOS S 351 or its variant before you carry out repairs. Take suitable precautions (to prevent contamination).

4.1 Removal and fitting of the housing

Removal:

- a) Remove the mains cable at the back of the device.
- b) Remove the two cover plates on the back of the handle.
- c) Remove the 2 connecting screws on the handle (Torx).
- d) Remove the 2 connecting screws on the lower side of the housing forward shell.
- e) Pull the housing shells from one another.

Assembly:

After carrying out the repair assemble the ATMOS S 351 as follows:

- a) Push the two housing halves together.
- b) Push the cable loom (between both housing shells) as far as possible into the back half of the housing.
- c) Now slide the two halves of the housing completely together. Take care that you do not pinch/clamp either the hose or the cable.
- d) Screw in all fastening screws again.
- e) Insert the cap again.

4.2 Removal of the pump module

- a) Remove the two fixing screws on the pump console.
- b) Remove the 6 fixing screws on the silencer (sheet above the set).
- c) Pull the pump module out forwards.
- d) Remove if required the corresponding cable/hoses.

4.3 Membrane and valve change

Remove the pipework from the pump.


Remove the four socket headed screws (1a or 1b) of the pump head (2a or 2b) (Figure 8, Page 14).


Clean the diaphragm disk (3); check whether the diaphragm (4) has fractures, if necessary renew it. For this, remove the socket headed screw 5. Remember when assembling that the membrane is assembled in the lower dead point (Figure 10, Page 15).


Remove the three countersunk head screws (6a or 7a) on the valve head, the valve plates (6c or 7b) and O-rings (6b or 7c). Clean valve heads and complete pump head with spirit, fit new valve plates and O-rings and assemble the aggregate in the reverse direction (Figure 11 and Figure 12, Page 15).

In addition the noise absorbing material must be changed.

In no case may the connecting rod be disconnected from the motor shaft, since this can result in out of balance running or very bad behaviour on starting.

 The right and left pump heads are different and must not be interchanged.

 Take care when assembling that the hoses are correctly connected.

 For new pumps: When fitting a new pump you must remove the stopper on the motor transducer connection (8). Then press the motor transducer into the hole. Take care that the light fields lie one above the other (not side by side). In addition, the transducer must not be on the flywheel.

4.4 View of pump

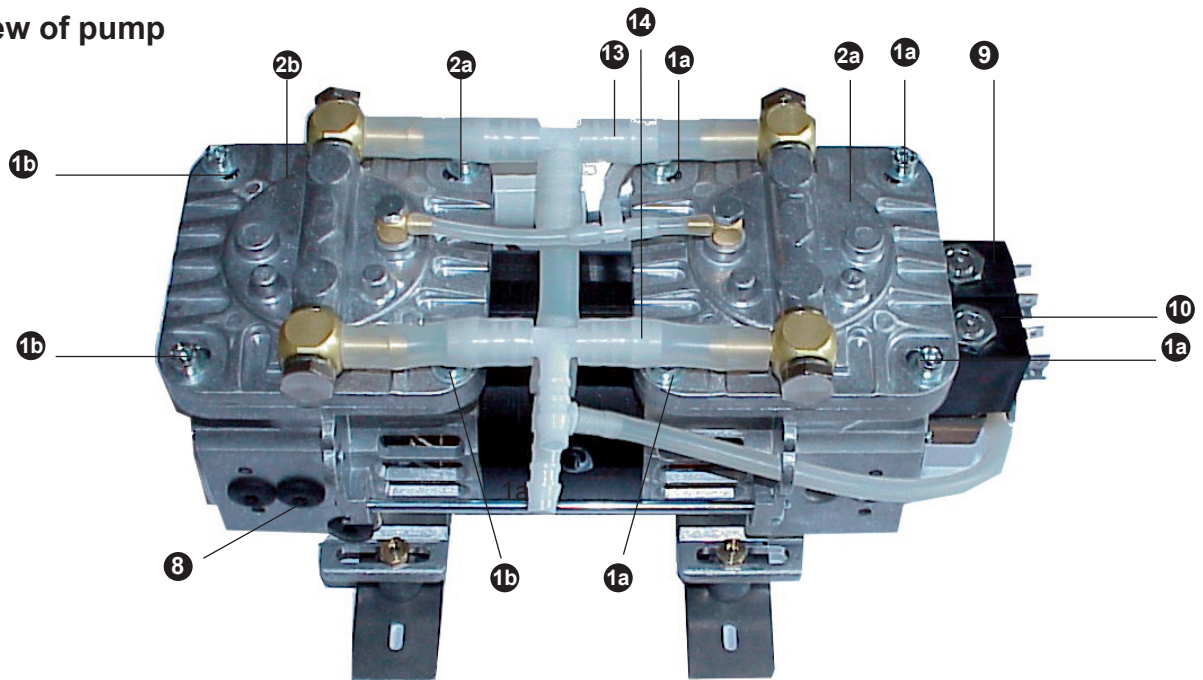


Fig. 8. View of the complete pump from the front

- 1a Fixing screws pump head right
- 1b Fixing screws pump head left
- 2a Pump head right 069.0065.0
- 2b Pump head left 069.0064.0
- 8 Connection for motor transducer
- 9 Starting valve
- 10 Exhaust air valve
- 13 Vacuum side
- 14 Pressure side

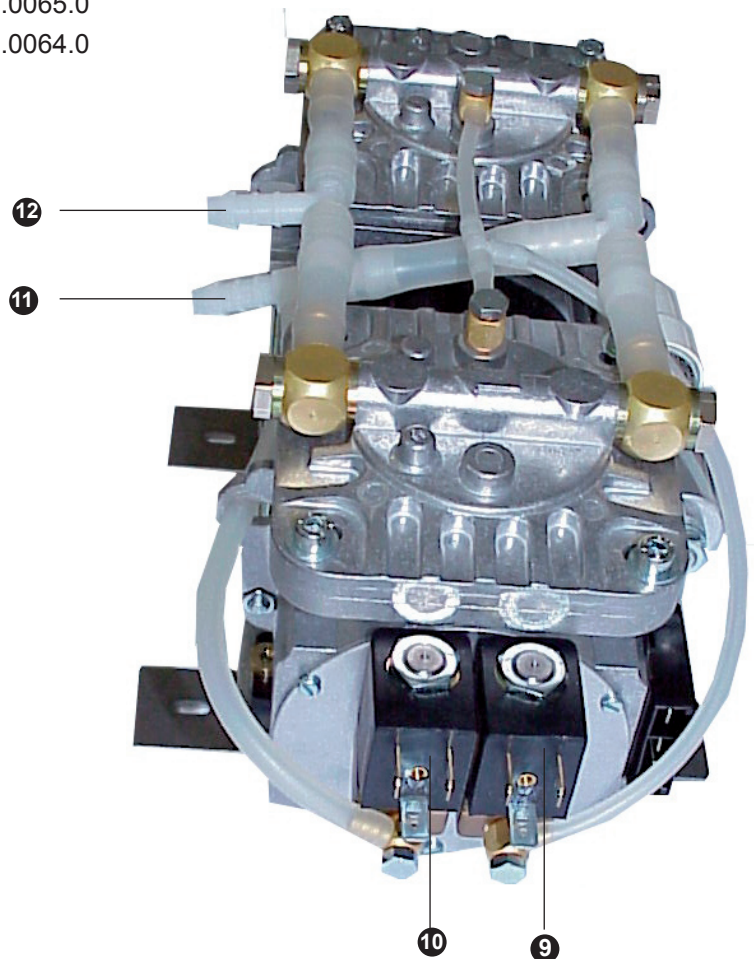


Fig. 9. View of pump from the valve side

- 9 Start valve
- 10 Exhaust air valve
- 11 Vacuum connection
- 12 Pressure connection (to the damper)

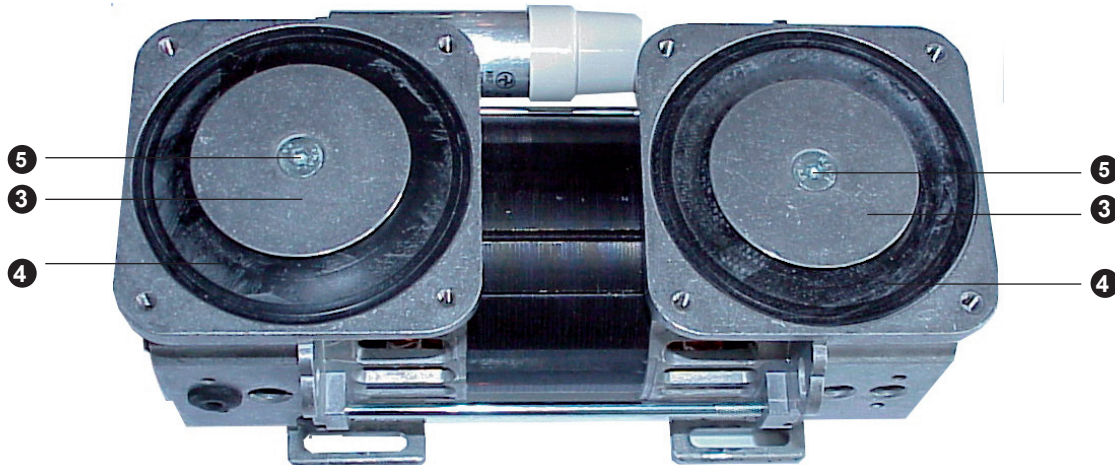


Fig. 10. Pump without pump head

- 3 Diaphragm disk069.0036.0
- 4 Membrane069.0025.0
- 5 Fixing screw for diaphragm disk

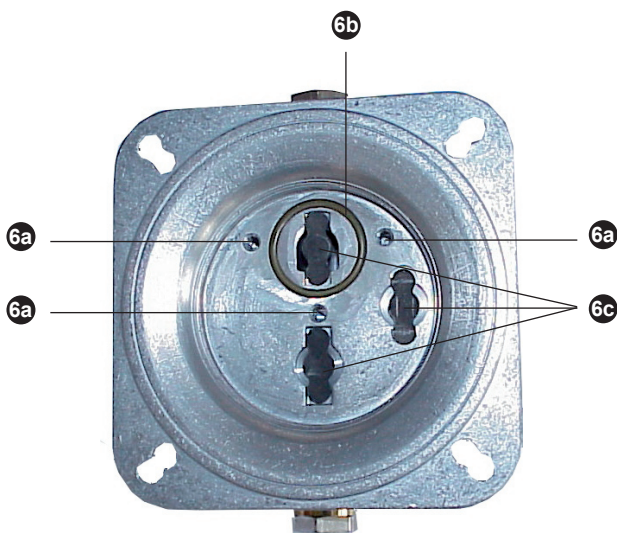


Fig. 11. Pump head left (internal view)

- 6a Fixing screws for valve plate
- 6b O-ring69.0024.0
- 6c Valve plates69.0020.0

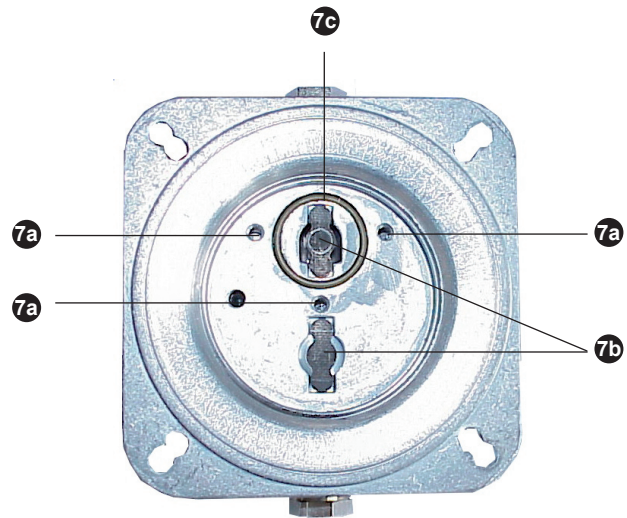


Fig. 12. Pump head right (internal view)

- 7a Fixing screws for valve plate
- 7b Valve plates69.0020.0
- 7c O-ring69.0064.0

5.1 General errors of the ATMOS S 351 and its variant

Please look also under the corresponding Chapter of the Operating Instructions.

Error	Possible causes	Remedy
The indication "Emergency operation" appears in the display	See Chapter 3.5.2 (Service Level 2)	Look in error memory, see Chapter 3.5.2 (Service Level 2)
The indication "Overheating" appears in the display	Fan defect	Check operation of the fan (Service Level 2: test hardware)
	Ventilation slots blocked	Check the ventilation holes and remove any foreign bodies
		Only put the ATMOS S 351 on a solid surface (no foam base plates)
	Supply voltage too high	Measure the supply voltage. The voltage must not exceed +10% (at 230V~ : 253 V~)
	Ambient temperature under -5°C	Allow the device to stand for at least 1h in an air conditioned room (the error message is erased if the device exceeds 0°C)
	Ambient temperature over 40°C	Let the device stand for at least 1h in an air conditioned room (the error message is erased when the device falls below 60°C)
Oversuction of the ATMOS S 351	Use without or with wrong bacterial filter and jar	The device must be completely cleaned and disinfected. For this the pump has to be removed and valve plates changed. All parts which come into contact with the secretion (hoses, pump head, membrane), must be disinfected or changed. In addition the silencer material should be changed. Use only the original accessories.
Message "Filter blocked" with new bacterial filter	Airway on the connection pipe closed	There is no error in this case. Always operate the ATMOS S 351 with a secretioncontainer.
	Crushed hose	Check the hoses (externally and internally). The hoses must not be buckled or squeezed.
Suction power too low	Hoses blocked	Check the hoses for places that are kinked
	Secretion is sucked into the pump	See over-suction
	Filter is blocked	Change the bacterial filter
	Membrane torn	Change the membranes
	Valve stuck	Clean the valve plates



☞ When opening used equipment and repairing hose and pump components it must be assumed that these parts are contaminated. Protect yourself from direct contact (use disposable gloves) and follow the hygiene safety regulations.

☞ After assembly, the operation of the suction device should be checked. Please use the following test procedure.

☞ See also the respective standards of the country involved for carrying out the service work (as, for example, in Germany the VDE 0751).

☞ The checks should be documented.

ATMOS S 351:		ATMOS S 351	
	Type: Surgery		Version: 2.0 (or higher)
ATMOS S 351 Natal:		ATMOS S 351	
	Type: Natal		Version: 2.0 (or higher)

6.1 Test procedure

6.1.1 Visual inspection

- The electrical connections shall be made as specified in the wiring diagram.
- The electrical wires shall be so laid that damage due to chafing is not possible. Take care that there are no adjacent sharp edges. The wires must not be close to cooling units.
- The electrical wires shall be so secured (e.g. by cable binders) that if a wire breaks off no adjacent metallic parts can be touched.
- All mechanical parts, including printed circuit boards shall be checked after assembly to see they are properly secured and have not suffered any damage that can be seen.
- The main switch is correctly installed (switch down: device in service/switch up: device out of service).
- Sticker/printing must be legible and be in the correct position:
 - Type plate with safety data beside the mains input bush.
 - Voltage equalisation sign beside the earthing point.
 - "Take note of Operating Instructions" beside the foot controller bush of the ATMOS S 351.
 - Front foil (operating foil) must sit correctly. There must be no fouling between the graphic display and the front foil.
 - Hose connection diagram on the back of the housing or opposite the intake connections.
 - "Exhaust" plate besides the exhaust opening on the back of the housing.
- The supply voltage specified must agree with the setting on the plate, the set and the type plate.
- The screw covering caps on the two upper housing fixing screws are appropriate.
- The software version number which appears when switching on the graphic display, agrees with the address on the EPROM on the control plate. The software version number shall be recorded.
- The bacterial filter shall be checked for passability and correct position as well as the correct direction of flow (see Operating Instructions).

6.1.1a Suction device-setting-locking

- While switching on press the "intermittent", "<", ">" and "Max" keys at the same time. The message "Suction unit locked" appears in the display. The suction device then changes to the respective switching on menu (Surgery, Natal).



6.1.2 Electrical testing

Protective earth conductor:

Measurement: See User's Handbook of the respective safety tester (protective earth conductor measurement, protective earth conductor testing).

Carry out the corresponding operating instructions with the safety tester on the unit.

NOTE:

The resistance of the mains cable should not be included in the measurements. The resistance should, however, be measured and subtracted from the measurements on the device.

Measuring points:

- Earthing point besides the mains connection bush
- Foot controller
- Pump
- Fixing screws of the pump

Duration of the measurement: 5 - 10 seconds/measuring point

Permissible measured value: $\leq 0.1 \Omega$

Earth current test

Measurement: See User's Handbook of the respective safety tester (earth current test).

Adapt a mains cable for the device and safety tester and take the device into service. The earth current is measured in the *protective earth conductor* of the mains supply line. The earth current before and after pole changing should be recorded in the test report.

Permissible measured values: N.C. $< 500 \mu\text{A}$

The following 1st error is tested:

- Mains supply interrupted: press SFC mains key, read value and record in test report.

Permissible measured values: S.F.C. $< 1000 \mu\text{A}$

Housing current test

Measurement: See User's Handbook of the respective safety tester (housing current test).

Adapt a mains cable for the device and take it into service. The housing current test is carried out on metallic parts which are not connected to the protective earth conductor. The housing current before and after pole changing shall be recorded in the test report.

Measuring points:

- Overflow contacts on the side
- Overflow contacts on the housing floor
- Housing fastening screws on the housing floor
- Foot controller bush
- Fixing screws of the mains connection bush

Permissible measured values: N.C. $< 100 \mu\text{A}$

After the 1st error the following shall be tested:

- Mains interrupted: Press SFC mains key, read value and record in test report.

Permissible measured values: S.F.C. $< 500 \mu\text{A}$

- Protective earth conductor interrupted: Press SFC SL key, read value and record in test report.

Permissible measured values: S.F.C. $< 500 \mu\text{A}$



Patient leakage current test

Measurement: See User's Handbook of the respective safety tester (patient leakage current test).

Adapt a mains cable for the device and the safety tester and take the device into service.

The patient leakage current is measured on all patient connections/signal inputs and signal outlets that are connected together (users parts).

Record patient leakage current before and after pole changing in the test report.

Measuring points: Overflow contacts on the sides
Overflow contacts on the housing floor

Permissible measured value: N.C. < 10 μ A

The following errors are checked:

- Mains interrupted: press mains SFC key, read value and record in test report.

Permissible measured value: S.F.C. < 50 μ A

- Protective earth conductor: Press SFC SL key, read value and record in test report.

Permissible measured value: S.F.C. < 50 μ A

Insulation testing (high voltage)

The insulation test must not be carried out. It was already carried out before the device was delivered and should not be repeated.



6.1.3 Functional test of ATMOS S 351

The functional testing of the unit shall be done with the supply voltage ($\pm 10\%$) on the type plate and with the given mains frequency.

The following functions must be checked:

The accessories of the ATMOS S 351 must be attached to the unit for the following functional test.

Intermit function (increase vacuum, hold vacuum, reduce vacuum, pause)

The following intermittent settings shall be chosen in Service Menu 1 (Press the Standby key during starting):

- Final vacuum (Vac Limit) = -500 mbar
- Increase/decrease time (incr. decr. time) = 10s
- Holding time (Vac hold) = 15s
- Pause = 10s

(The parameters to be set are in the Adjust Intermit Menu)

- Connect the end of the suction hose to the vacuumgauge
- Switch off/on: A beep should be heard
- The display must be easily readable, there should be no dirt particles visible and no pixels should be missing.

Change into Intermit-mode by pressing the Intermittent key:

Phase 1: Unit creates vacuum within about 10 seconds (upper left counter in the display counts from 10s downwards) (-500 mbar). Observe increase of vacuum. Note end value of vacuum.

Phase 2: The vacuum is held for about 15 seconds (see counter).

Phase 3: Unit decreases the end vacuum set within about 10s (see counter) (-500 mbar) to 0 mbar. Observe vacuum reduction.

Phase 4: System is completely ventilated. The unit pauses for about 10 seconds.
After Phase 4 the unit begins again at Phase 1.

Leave the Intermit-Modus by pressing the intermittent key.

Function of overflow/short circuit

Start the Intermit-mode by pressing the intermittent key.

Connection of the test unit to the test sample (to overflow contacts left or right): The terminal marked with (+) should be connected to the upper contact unit, the terminal marked with (-) to the lower contact unit.

- Setting "Overflow high": The overflow message must appear. Any vacuum present is destroyed.
- Setting "Overflow low": The overflow message must appear. Any vacuum present is destroyed.
- Setting "Short circuit": Produces a continuous short circuit. The short circuit message must appear at regular intervals. Any vacuum present is not affected by this.

Leave the Intermit-Mode by pressing the intermittent-key.



Function of foot controller

- Switch on unit with foot controller connected: The foot controller is recognised. Start the Intermit-mode by pressing the intermittent key.
- Move the foot controller: The function of the unit is not affected by the foot controller.

Leave the Intermit-mode by pressing the intermittent key.

Function of arrow keys

Start the Intermit-mode by pressing the intermittent key

- With the Max-key the target value for the end vacuum is set to -maxbar.
- With the '<' - key the end vacuum target value can be reduced.
- With the '>' - key the end vacuum target value can be increased.

Leave the Intermit-mode by pressing the intermittent key.

Filter blocked function

Start the Intermit-mode by pressing the intermittent key.

- During vacuum increase (Phase 1) suddenly put a kink in the suction connection piece and after the "Filter blocked" message appears release the kink again: The "Filter blocked" message disappears after a while. Vacuum creation was not interrupted.

Suction function (standard setting):

The end of the suction hose is connected to the vacuumgauge.

- Switch off/on: A beep should be heard.
- Check vacuum indicator is at -500 mbar. The indicator must lie between -480 and -520 mbar. The test shall be carried out with "standing vacuum", that is to say the pump must not run (closed system, set regulation to -500 mbar). Note the vacuum measured.
- Check the starting of the set at -500 mbar and -800 mbar, the set must start within 3 seconds.
- Check exhaust air valve. It must be possible to create vacuum with a closed system.
⇒ Test environment. 1.5l secretion glass. With a closed system switch from higher target value to lower target value.
The vacuum must be decreased (without opening the hose).
- Test overflow, use test device:
A voltage measuring instrument is used to check the polarity of the contact elements. For this the bush of the test instrument marked with (+) is connected with the voltage input (V), the bush of the test instrument marked with (-) is connected with the reference input (0, Com) of the voltage measuring instrument.

Overflow contacts left/right:

- Connection of the test instrument to the unit being tested: The terminal marked with (+) shall be connected to the upper contact element, the terminal marked with (-) to the lower contact element.
- Setting "Terminal voltage": The voltage displayed by the voltage measuring instrument is between +2V and +3V.
- Setting "Trolley low": No overflow message can be given.
- Setting "Overflow high": The overflow message must appear.
- Setting "Overflow low": The overflow message must appear.
- Setting "Short circuit": The corresponding short circuit message (left/right) must appear.



Overflow contacts on trolley:

- Connect the test device to the item to be tested:
The two terminals of the test device shall be connected to the contacts for connecting the trolley. The terminal marked with (-) is connected to the contact element, which is located in the vicinity of the round fan opening.
- Setting "Terminal voltage": The voltage shown by the voltage measuring device shall be between +2V and +3V.
- Without activation: No trolley symbol must appear in the display
- Setting "Trolley high": The trolley symbol must appear in the display
- Setting "Trolley low": No overflow message must result, the trolley symbol must appear in the display
- Setting "Overflow high": The overflow message must appear
- Setting "Overflow low": The overflow message must appear
- Setting "Short circuit": The corresponding short circuit message (left/right) must appear

Auto-Standby function:

- Activate auto-standby.
- Use the test environment from the vacuum regulation test.
- After a maximum of 30 seconds with free flow the set must go into standby.
- Wait 10 seconds.
- After closing the end of the hose the unit must start within 5 seconds again.

Foot controller:

- Set the target value to the maximum and connect the foot controller. The foot controller-bargraph must be adjustable from 0 to maximum.

Memory function:

- Operate the set in Intermit-mode. Switch off unit and switch it on again after about 5 seconds. When it is switched on again the ATMOS S 351 changes automatically into Phase 1 of the Intermit-mode.
- Operate the unit in suction mode: Set any chosen vacuum value. Switch off the unit and switch it on again after about 5 seconds. When it is switched on again the ATMOS S 351 changes automatically into suction mode and retains the vacuum value set before it was shut down.

Service Level 2:

- By simultaneously pressing the keys "Standby" and "Intermittent" when switching on the unit goes into the Service 2 menu.
- Select the Function Test Hardware.
- Check the operation of the fan: Operate the fan control. The fan must start and blow into the housing.
- Check start/exhaust valves: Operate the valve controls. The switching of each valve must be audible.
- Check the running of the set (pump).
- Select the function test airtight.
- Carry out the tightness test according to the instructions in the display. 'OK' appears as a result.



Performance test

The performance test of the unit shall be carried out with the supply voltage given in the operating contract and the given mains frequency. The unit is operated in the suction mode for this.

The following performance must be checked:

- Vacuum: > 88%
- Flow: at least 32 l/min on the unit connection pipes (without bacterial filter).

Set delivery condition

The delivery condition must be set as follows:

In Service Mode 1:

- Adjust unity: Delivery in Germany: kPa
Delivery abroad: kPa
- LCD brightness: 20
- Vacuum limit 50 kPa
- Increase/decrease time 10 seconds
- Vacuum hold time 60 seconds
- Pause 60 seconds

In Service Mode 2:

- Clear Errors: Yes (erase error memory)

Operation on the unit before switching it off:

- Vacuum: Maximum
- Type of operation: Suction Mode with Auto-Standby



6.1.4 Functional test of ATMOS S 351 Natal: Vacuum extraction

The functional test of the unit shall be done with the supply voltage ($\pm 10\%$) given on the description plate and with the given mains frequency:

- for 230 V ac 207 V ac should be set
- for 100 V ac 90 V ac should be set
- for 115 V ac 103 V ac should be set
- for 127 V ac 114 V ac should be set

The following functions must be checked:

The Natal accessories shall be connected to the unit for the functional test. The extraction cup is replaced by a piece of hose of the same length. The unit is set to VE fully automatic (see Service 1 Menu).

Function increase/decrease vacuum

The end of the suction hose is open.

- Switch off/switch on: A beep must be heard.
- The display must be clearly visible. There must be no dirt particles visible and no pixel must be missing.
- The pump runs continuously the green LED flashes, the heading 'VE Auto' can be seen in the display. Connect the end of the suction hose to the vacuumgauge.
- An audible signal sounds when the indicated vacuum value is 200 mbar (start beep).
- Observe automatic vacuum increase. Counter (upper left) counts from 120 downwards.
- Accelerate vacuum increase by pressing the '>' key. While the '>' key is kept depressed a continuous peep sound can be heard. When the counter figure is about 10s release '>' key and observe the end phase of the automatic vacuum increase.
- After the end of the vacuum increase two signal peeps can be heard one after another. Note the value of the final vacuum achieved. The target value (upper right in the display) is -800 mbar.
- Simulate a mains failure by switching off the unit. No vacuum decrease occurs. After about 5 seconds switch on the device again. The vacuum is maintained.
- Start the ventilation procedure by pressing the END key and check the vacuum decrease time (typically 20 seconds). The counter (upper left) counts from 20 downwards.
- After the vacuum decrease time the system is completely ventilated.

Function of Semi-Automatic Mode:

- Switch off unit. While starting change into Service 1 Menu by pressing the "extraction cup" key. In the VE Automatic menu select 'VE Semi-Automatic' and confirm with the Max key.
- Switch unit off/on. The heading 'VE semi' can be seen in the display. The unit creates about -200 mbar vacuum and gives an acoustic sign simultaneously with the flashing of the LED.
- Automatic creation of vacuum is started with the pressing of the extraction cup key (beginning from about 200 mbar).
- Ventilate by pressing the END key.
- Set VE Fully Automatic in Service 1 Menu and confirm with the Max key.
- Switch unit off/on. The heading 'VE Auto' must be visible in the display.
- Ventilate by pressing the END key.



Supplementary fan recognition

- Connect end of the suction hose to the supplementary air valve. Press extraction cup key, in order to start automatic vacuum creation. By pressing the '>' key accelerate the creation of vacuum up until about 500 mbar is reached.
- Carefully open the supplementary air valve until the warning signal sounds and the LED flashes quickly.
- Close the supplementary air valve. Vacuum decrease is equalised and the warning signal stops. Accelerate vacuum creation by pressing the '>' key until the counter (upper left) shows zero.
- Wait for the end vacuum to be reached and the signal "End vacuum reached" sounds.
- Carefully open the supplementary air valve until the vacuum has fallen to just under 600 mbar. Now the warning signal sounds.
- Close supplementary air valve. Vacuum decrease is equalised. On reaching the end vacuum the warning signal stops.
- Ventilate by pressing the END key.

Function of arrow keys

- Close the end of the suction hose so that it is airtight.
- Switch on the unit, wait for vacuum to be created.

During the creation of vacuum

- The creation of vacuum can be delayed with the '<' key.
- The creation of vacuum can be accelerated with the '>' key.
- Pressing the Max key will be ignored by the unit.
- Wait for the end vacuum to be reached.

After reaching the end vacuum

- The end vacuum target value can be reduced with '<' key.
- The end vacuum target value can be increased with the '>' key.
- Pressing the Max key will be ignored by the unit.
- Ventilate by pressing the END-key.

During the ventilation

- The decrease of vacuum can be accelerated with the '<' key.
- The decrease of vacuum can be delayed with the '>' key.
- Pressing the Max key will be ignored by the unit.

Filter blocked function

- While vacuum is being created kink the suction hose on the suction connecting piece suddenly and after the "Filter blocked" message appears release the kink. The "Filter blocked" message disappears after a while. Vacuum creation is not interrupted.

Function for the non- achievement of the end vacuum because of altitude

- Connect the adjacent air valve restricted to about -740 mbar to the suction hose.
- Press extraction cup key, in order to restart the automatic vacuum creation.
- Accelerate the creation of vacuum by pressing the '>' key, until about -600 mbar is reached.
- Release '>' key.
- The adjacent air flap prevents the end vacuum being reached (-800 mbar). A vacuum of > -700 mbar is achieved.
- The pump runs continuously. No warning signal sounds.
- After about 30 seconds press the END key.



Overflow/short circuit function

- Close the end of the suction hose so that it is airtight.
- Press extraction cup key, in order to start the automatic creation of vacuum.
- Connect the test equipment to the unit to be tested (on the overflow contact left or right). The terminal marked with (+) should be connected to the upper contact element, the terminal marked with (-) should be connected to the lower contact element.

- Setting "Overflow high": The overflow message must appear at regular intervals. The creation of vacuum is not, however, affected.
- Setting "Overflow low": The overflow message must appear at regular intervals. The creation of vacuum is not, however, affected.
- Setting "Short circuit": Produce continuous short circuit. The short circuit message must appear at regular intervals. The creation of vacuum is not however affected.

- Ventilate by pressing the END key.

Foot controller function

- Close the end of the suction hose so that it is airtight.
- Switch on unit with foot controller connected (foot controller in **heel** stop).
- While creating vacuum move foot controller in the direction of the toe stop. When covering the currently set vacuum value the foot controller should take over the checking of the set vacuum. The suction device changes into the suction mode.
- Reduce vacuum to 0 and switch off the unit.
- Switch on unit with foot controller connected (foot controller in **toe** stop).
- During vacuum creation move foot controller in the heel stop direction: When covering the currently set vacuum value the foot controller should take over the checking of the set vacuum. The suction device changes into the suction mode.
- Reduce the vacuum to 0 and switch off the unit. Unplug the foot controller.



6.1.5 Functional test of ATMOS S 351 Natal: Suction

The following functions must be checked:

For the following functional test the accessories of the ATMOS S 351 shall be attached to the unit.

The end of the suction hose must be attached to the vacuum meter.

Switching on procedure

- Switch unit off/on.
- An audible beep should be heard.
- By pressing the END key, change into the suction mode.

Vacuum control

- Check the vacuum indicator at -500 mbar. The indicator must lie between -480 and -520 mbar. The check should be carried out with "standing vacuum", that is to say the pump must not run (closed system, set control on -500 mbar).
- Note the vacuum measured.

Starting procedure

- Check the starting of the set at -500 mbar and -800 mbar: The set must start within 3 seconds.

Check exhaust air valve

- It must be possible to create vacuum with a closed system.
⇒ Test environment: 1.5l secretion glass. With a closed system switch over from a higher target value to a lower target value. The vacuum must be reduced (without opening the hose).

Test overflow, use test equipment

- A voltage measuring instrument is used to check the polarity of the contact elements. For this the bush of the test equipment that is marked with (+) is connected to the voltage input (V), the bush of the test equipment marked with (-) is connected to the reference-entry (0, Com) of the voltage measuring instrument.

Overflow contacts left/right:

- Connection of the test equipment to the unit to be tested: The terminal marked with (+) should be connected to the upper contact element and the terminal marked with (-) to the lower contact element.
- Setting "Terminal voltage": The voltage shown by the voltage measuring instrument lies between +2V and +3V.
- Setting "Trolley low": No overflow message shall be given.
- Setting "Overflow high": The overflow message must appear.
- Setting "Overflow low": The overflow message must appear.
- Setting "Short circuit": The corresponding short circuit message (left/right) must appear.



Trolley overflows contact:

- Connect the test equipment to the unit to be tested:
The two terminals of the test equipment should be connected to the contacts of the trolley connection. The terminal marked with (-) is connected to the contact element which is in the vicinity of the round fan opening.
- Setting "Terminal voltage":
The voltage value indicated by the voltage measuring instrument is between +2V and +3V.
- Without activating:
No trolley symbol appears in the display.
- Setting "Trolley high":
The trolley symbol must appear in the display.
- Setting "Trolley low":
No overflow message must appear, the trolley symbol must appear in the display.
- Setting "Overflow high":
The overflow message must appear.
- Setting "Overflow low":
The overflow message must appear.
- Setting "Short circuit":
The corresponding short circuit message (left/right) must appear.

Foot controller

- Set the target value to maximum, connect the foot controller. The foot controller-bargraph must be adjustable from 0 to max.

Change into the VE mode

Change into the VE mode by pressing the extraction cup key.

Tests in Service Level 2

The Service 2 Menu can be reached by simultaneously pressing the 'extraction cup' and END keys when switching on.

Functional test of hardware

- Choose the hardware functional test
- Check that the fan works: Operate the fan control, the fan must start, The direction of flow is into the housing.
- Check the start/exhaust air valves. Operate the valve control. The switching of the respective valve must be audible.
- Check the starting of the pump set.

Airtight functional test

- Select the airtight functional test.
- Carry out the tightness test according to the instructions in the display. 'OK' should appear.

Performance test

The performance test of the unit shall be carried out with the supply voltage given in the service contract and the mains frequency specified. For this operate the unit in suction mode.

The following performance must be checked:

- Vacuum > 88%.
- Flow at least 32 l/min at the unit connection pipe (without bacterial filter).



Set to the delivery condition

The delivery condition must be set as follows:

In the Service Mode 1:

The Service 1 Menu can be reached by pressing the "extraction cup" key when starting.

- Adjust units: Delivery in Germany: kPa
Delivery outside Germany: kPa
- LCD brightness: 20
- VE tone
 - VE start beep ON
 - VE stop beep ON
- VE Time
 - Increase time: 120 seconds
 - Decrease time: 20 seconds
- VE Vac: 80 kPa
- VE Automatic: VE Fully Automatic

In Service Mode 2:

- Clear errors: Yes (erase error memory)

Operation of the unit before switching off:

- Type of operation: VE-Mode



Subunit (if no fig.)	Spare Part	Article-No.
COLLECTION JAR	RECEPTALBEUTEL 1500ML W. OVERFLOW VALVE FILTER, 50 PCS.	310.0222.1
COLLECTION JAR	RECEPTAL BAG 1500ML W/O OVERFLOW VALVE FILTER, 50 PCS.	310.0222.2
COLLECTION JAR	MEDI-VAC EXTERNAL JAR 1 L	312.0473.0
COLLECTION JAR	MEDI-VAC INTERNAL JAR 1 L	312.0474.0
COLLECTION JAR	RECEPTAL BAG 2000ML W/O OVERFLOW VALVE FILTER, 50 PCS.	443.0257.0
COLLECTION JAR	RECEPTALBEUTEL 2000ML W. OVERFLOW VALVE FILTER, 50 PCS.	443.0257.2
COLLECTION JAR	BACTERIAL FILTER	443.0738.0
COLLECTION JAR	RECEPTAL JAR SET I	444.0022.0
COLLECTION JAR	RECEPTAL JAR SET II	444.0023.0
COLLECTION JAR	RECEPTAL JAR SET III	444.0024.0
COLLECTION JAR	GLASS COLLECTION JAR 1.5 L	444.0032.0
COLLECTION JAR	GLASS COLLECTION JAR 3.0 L	444.0033.0
COLLECTION JAR	GLASS COLLECTION JAR 5.0 L	444.0034.0
COLLECTION JAR	POLYSULPHONE JAR 1.5 L	444.0036.0
COLLECTION JAR	POLYSULPHONE JAR 3.0 L	444.0037.0
COLLECTION JAR	POLYSULPHONE JAR 5.0 L	444.0038.0
COLLECTION JAR	RECEPTAL BAG 3000ML W/O OVERFLOW VALVE FILTER, 50 PCS.	444.0153.0
COLLECTION JAR	RECEPTALBEUTEL 3000ML W. OVERFLOW VALVE FILTER, 50 PCS.	444.0154.0
COLLECTION JAR	BAXTER HOLDER	444.0451.0
DOUBLE SOCKET NIPPLE	DOUBLE SOCKET NIPPLE COMPLETE	444.0012.0
DOUBLE SOCKET NIPPLE	NIPPLE REDUCER	444.0013.1
ELECTRICS	ROCKER SWITCH TYPE S351 SPARE PARTS SET	444.0444.0
ELECTRICS	FAN MICRONEL F62LM012GK-0-S	008.0622.0
ELECTRICS	CONTROL BOARD COMPLETE	444.0403.0
ELECTRICS	CONTROL BOARD COMPLETE, 127 V	444.0403.3
ELECTRICS	DISPLAY PCB	444.0413.0
ELECTRICS	CABLE PART, MOTOR SENSOR	444.0416.0
HOSES	SUCTION HOSE 1.30 M.	000.0013.0
HOSES	SUCTION HOSE 2.0M	000.0243.0
HOSES	SAUGSCHLAUCH 2.0 M.	000.0361.0
HOUSING (INSIDE)	HOSE PART RD 6 X 3- 420	443.0046.0
HOUSING (INSIDE)	HOSE HARNESS, VACUUM	444.0117.0
HOUSING (OUTSIDE)	ELASTIC BUFFER 5J-5017, SELF-ADHESIVE	000.0018.0
HOUSING (OUTSIDE)	SAFETY CLAMP	000.0714.0
HOUSING (OUTSIDE)	NUT FOR SAFETY CLAMP	000.0715.0
HOUSING (OUTSIDE)	PLUG FOR NON-HEATING APPLIANCES	008.0452.0
HOUSING (OUTSIDE)	HOUSING NIPPLE	444.0421.0


7.0 Spare Parts (contin.)



Subunit (if no fig.)	Spare Part	Article-No.
LID SYSTEM	PRESSURE SPRING 3.6X0.40S1,7X9.6	000.0522.0
LID SYSTEM	LID SYSTEM FOR COLLECTION JAR	444.0015.0
LID SYSTEM	COLLECTION JAR, BODY	444.0050.0
LID SYSTEM	COLLECTION JAR INSERT COMPLETE	444.0052.1
LID SYSTEM	SPLASH PROTECTION, COLLECTION JAR INSERT	444.0064.0
PUMP	OSCILLATING ELEMENT RD.15X15	000.0343.1
PUMP	DIAPHRAGM-TYPE PUMP V 35L/88% 3,0µF	000.0717.0
PUMP	MAGNETIC VALVE TYPE 9.211.004.	008.0628.0
PUMP	VALVE PLATES MOD. 7010	069.0003.0
PUMP	VALVE PLATE MOD. 8050/8010	069.0020.0
PUMP	O-RING 18.77 x 1.78	069.0024.0
PUMP	MEMBRANE FOR MOD.8010	069.0025.0
PUMP	PUMP HEAD LEFT COMPLETE	069.0064.0
PUMP	PUMP HEAD RIGHT COMPLETE	069.0065.0
SAFETY JAR	BOTTLE, 3521 FORM	000.0504.0
SAFETY JAR	SAFETY JAR COMPLETE	444.0080.0
SAFETY JAR	BACTERIAL FILTER	444.0082.0
SAFETY JAR	SAFETY JAR	444.0646.0
TROLLEY	CASTOR RD 75 TYPE D 375	000.0517.0
TROLLEY	CASTOR RD 75 TYPE D 375	000.0518.0
TROLLEY	CAPTIVE PLATE, SKIFFY	053.0066.0
TROLLEY	STAR-SHAPED HANDLE	061.0064.0

8.0 Technical Specifications



Air flow rate	36 ± 2 l/min.
Max. vacuum	-90 kPa**
Vacuum readout	digital numeric, resolution 10 mbar / 10 mmHg / 1 kPa and quasi analog via bar graph; accuracy ± 2%
Auxiliary air control	electronically controlled magnetic valve
Fine- suction	up to -0.3 bar (can be set between -0.2 bis -0.5 bar by service engineer)
Collection jars	1.5 l / 3 l / 5 l glass or polysulfone or 1.5 l / 2 l / 3 l Receptal® collection jar, bracket for Medi-Vac available
Suction hoses	6mm dia., 1.30 m long; 10 mm dia., 2 m long
Voltage	230 V ~ 50 Hz Special voltage: 115 V ~ 50/60 Hz
Current consumption (max.)	0.6 A
Power consumption	max. 135 W
Mains cable	5 m
Operating period	continuous operation
Fuse	T 1.0
Interface	foot switch
Protective earth conductor resistance	< 0.1 Ω
Earth leakage current	< 500 µA NC
Casing leakage current	< 100 µA
Patient leakage current	< 10 µA
Heat emission	135 J/s
Noise level	43.9 dB (A) @ 1m (as per ISO 7779)
Ambient conditions	
Transport/storage	-10 to +60°C; 30 to 95 % humidity, non-condensing at a pressure of 700...1060 hPa
Operation	+10 to +40°C; 30 to 95 % humidity, non-condensing at a pressure of 700...1060 hPa
Dimensions HxWxD	300 x 330 x 200 mm, without trolley; 840 x 490 x 520, with trolley
Weight	10.2 kg, without collection jar, without trolley
Protection class (EN 60601-1)	I
Degree of protection	Type B 
Protection category	IPX 0
Classification as per Appendix IX of EC Directive 93/42/EEC	IIb
CE Mark	CE 0124
Standards applied	EN 60601-1:1990 + A1: 1993 + A2: 1995; EN ISO 10079-1: 11/1996 EN 60601-1-2: 1993 (EMV / EMC); EN 30993: 1994; EN 60601-1-4:07/1997
UMDNS Code	10-217
REF (basic unit without accessories)	444.0405.0
ATMOS S 351	444.0401.0
ATMOS S 351 Natal	

Canadian Classification

Device Group	General & Plastic Surgery
PNC7	9QBU
Risk Class	2
Description	ASPIRATOR, SURGICAL

All values are quoted with a tolerance of ± 5 %, unless separately specified.

Issue of Technical Specifications: 15.10.2002

9.1. Trolley

The following conversion instructions enable the trolley of the Atmoforte 350 and Record 500 to be used on the ATMOS S 351:

Validity:

From series 20414701 / 2000-05 no longer necessary (17.05.2000 modification 5085/00). After the conversion the trolley can be used for Atmoforte 350, Record 500, ATMOS S 351 and Atmoforte 350 A.

Modification:

Insertion of a 1 M Ω resistance (011.0042.0) on the overflow contact rail.

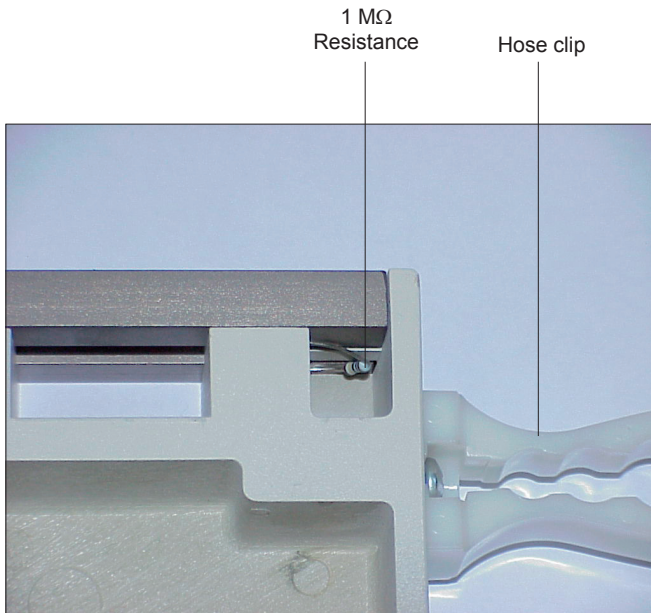


Fig. 12. Trolley - view from below

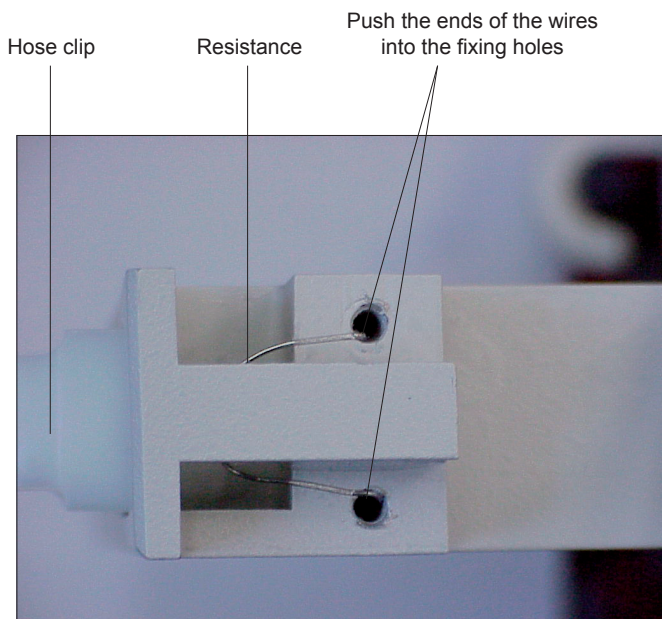


Fig. 13. Trolley - view without contact rails (from the side)

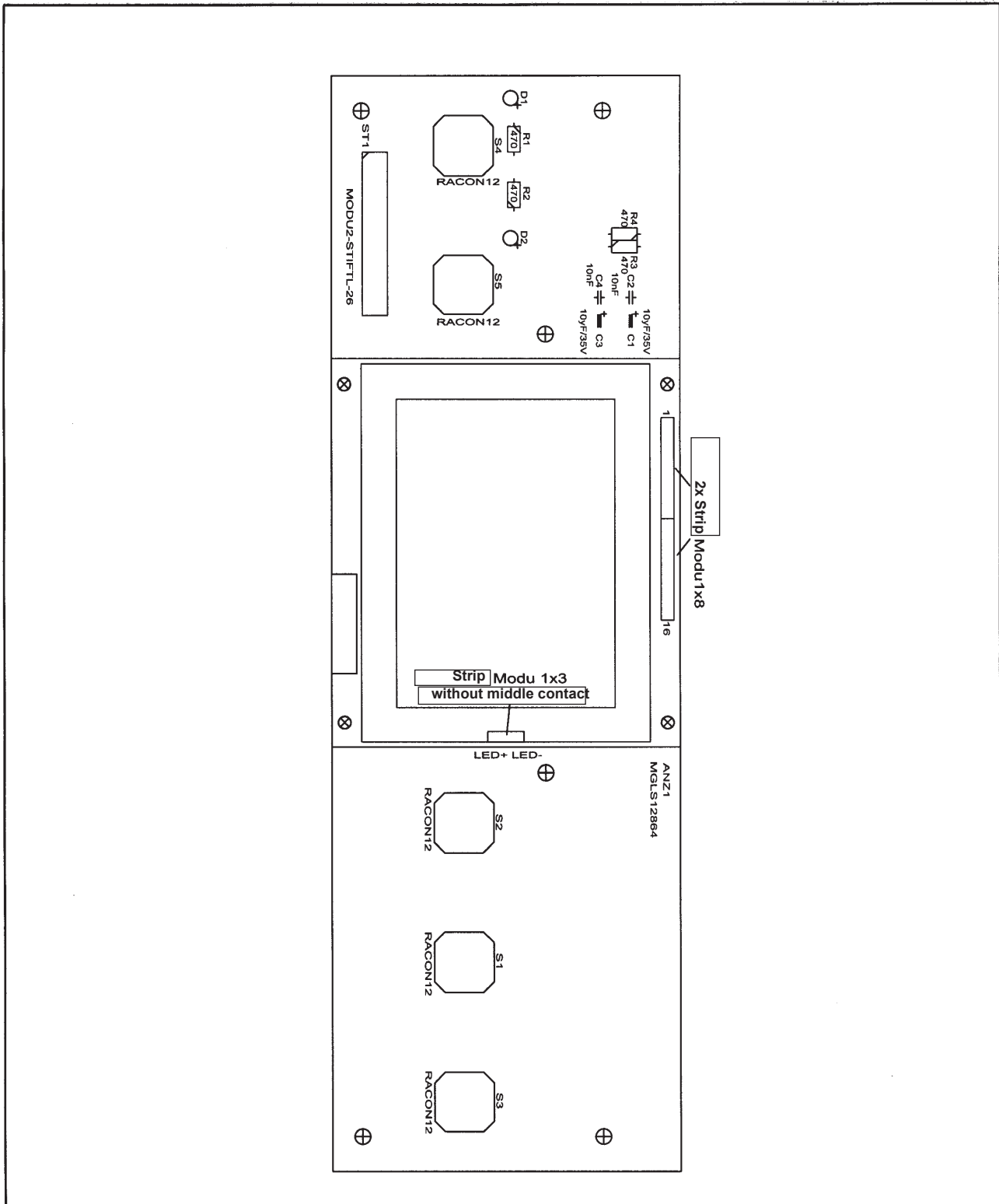


Fig. 15. Display board ATMOS S 351, ATMOS S Natal
Issue: 1 August, 2000

