

MONNAL D2

Maintenance Manual

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GENERAL SAFETY INSTRUCTIONS

Use of oxygen

Keep to the safety rules for the use of oxygen:

Do not smoke,

Do not use in the vicinity of a source of sparks or incandescent objects,

Do not lubricate operating equipment



Use and servicing of the machine

Compliant with NF C 74010 (§ 1.3):

"The manufacturer, assembler, installer or the importer are not considered responsible for the safety, reliability and the characteristics of a machine unless:

- Assembly, extensions, settings, modifications or repairs have been carried out by persons authorised by them, and
- The electrical wiring of the relevant premises complies with IEC regulations,
- The machine is used in accordance with the instructions for use."

If the replacement parts used for the periodic servicing do not comply with the manufacturer's specifications, the latter is absolved from all responsibility in the event of an accident.

- Do not open the machine while it is switched on.
- Do not use ether type solvents.
- Do not use pipes or tubes which are anti-static or conductors of electricity.
- Do not use in a specifically magnetic environment (MRI, etc.).
- The **MONNAL D2** pulmonary ventilator must not be used with inflammable anaesthetic materials or explosive products.

GENERAL SAFETY INSTRUCTIONS

Electromagnetic compatibility

The **MONNAL D2** ventilator is a medical device compliant with the protection requirements of directive 93/42/CEE.

Its operation may be affected by the use in its vicinity of machines such as diathermy machines, high frequency electrosurgery machines, defibrillators, short-wave therapy machines or mobile telephones, and more generally by electromagnetic interference exceeding the levels specified by standard EN 60 601-1-2 (1993 edition).

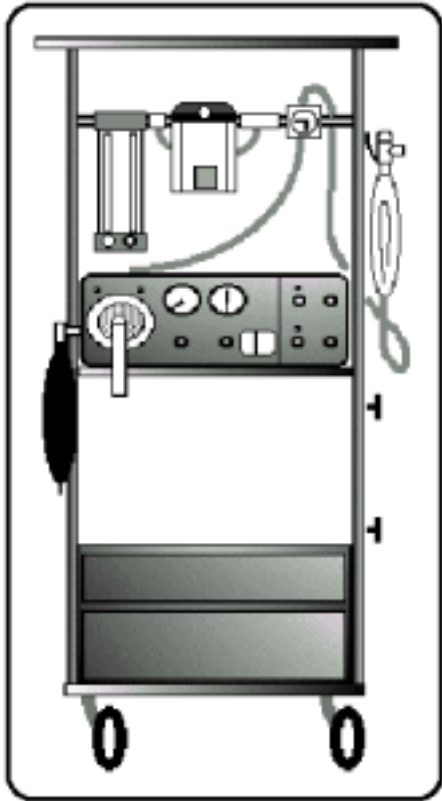
The *MONNAL D2* ventilator must be associated with the necessary complementary monitoring (O₂, flow measurement, etc.) in compliance with the regulations in force.

It is recommended that a manual ventilation system (Taema type *IM5*) and an emergency medical oxygen tank equipped with a low pressure pressure reducing valve be kept nearby.

The *MONNAL D2* must be used in association with a patient airways monitoring system (Taema *Pmax UNIT* type).

1 - GENERAL

1.1 Introduction



The **MONNAL D2** ventilator is a machine specially designed to meet the needs of anaesthetist-reanimators who wish to use a flexible and multi-purpose ventilator:

- in the recovery room and in post-operative situations
- in anaesthesia (open-circuit)

The **MONNAL D2** ventilator can ventilate a patient with a gas or mixture of gases (in the presence of a halogenated agent or not).

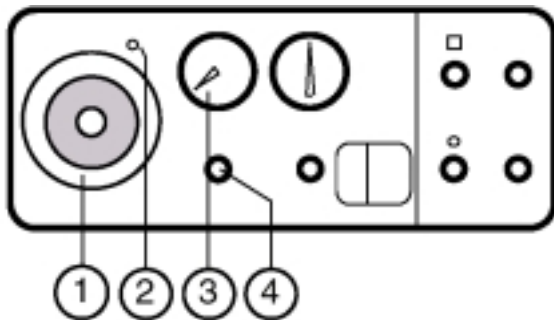
To constitute an **anaesthesia system**, it can be supplied with O₂ and N₂O from a source of O₂ gas under pressure (or from an oxygen concentrator) and from a source of N₂O gas under pressure (and with air from the ventilator).

The **MONNAL D2** ventilator is generally associated with:

- a halogenated agent evaporator,
- a safety O₂/N₂O mixer,
- a manual induction circuit,
- an anaesthesia table.

1 - GENERAL

1.2 Descriptions and settings



FRONT PANEL

1- Bacteriological filter cover

2- Collector nozzle

Controls expiratory valve operation

3- Flowmeter for ambient air provided by compressor

4- Air flow adjustment

5- Insufflation pressure manometer

6- Safety pressure adjustment (Pmax).

To adjust, it is necessary to:

-Block the patient circuit patient at the Y piece

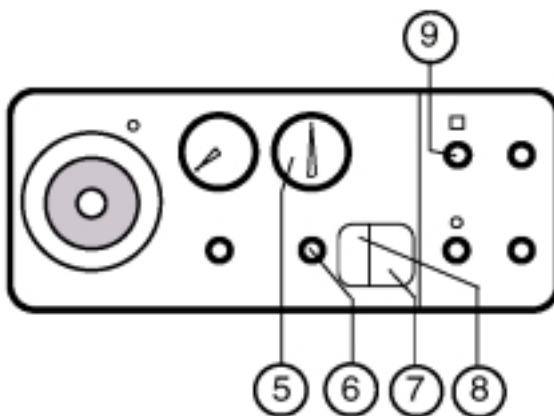
-Read off P max as it appears on the manometer during insufflation

-adjust the setting by turning towards +/-

Note: The user may keep the P max value constant by removing the removable button

7- Green illuminated On/Off button

8- Yellow illuminated compressor start button (on the rear panel on old models).



When the switch is in the on position, the **MONNAL D2** ventilator delivers compressed ambient air. Otherwise only the mixture from the anaesthesia rack is used.

9- Pmin alarm setting

Setting by potentiometer.

10- Red LED and disabling button of Pmax. audible alarm

When the audible and visible alarm is triggered, pressing on the button disables the audible alarm for 2 minutes but the red flashing LED continues to operate.

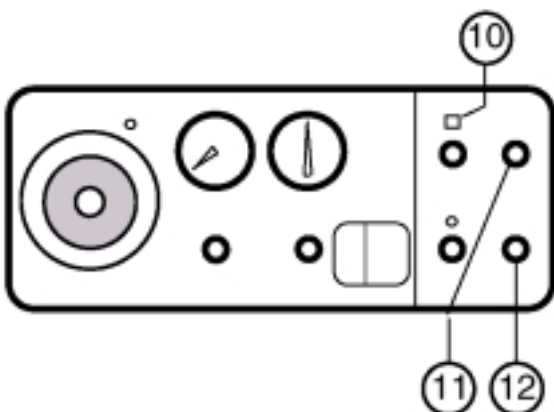
11- I/E ratio setting

From 1/3 to 1/1.

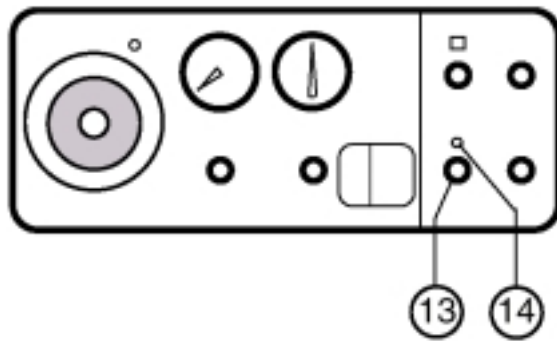
12- Frequency setting

Minimum controlled cycle frequency setting. from 8 to 40 bpm.

13- Trigger sensitivity adjustment (SD/TS)



1 - GENERAL

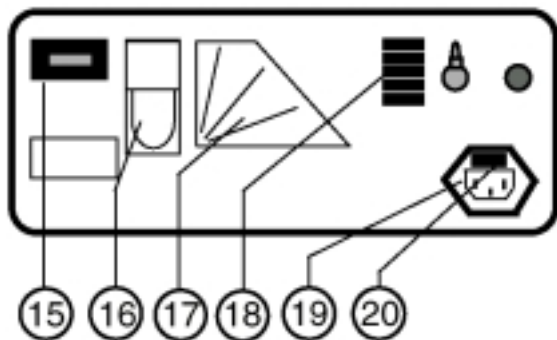


Trigger sensitivity allows Controlled Assisted Ventilation (CAV). The detection of a call sets off a controlled cycle. If no call is detected a controlled cycle is supplied by the machine to guarantee the minimum set frequency

The standard SD/TS settings for CAV are from - 1 to - 5 mbar. To move into Controlled Ventilation mode (VC), set trigger sensitivity at - 20 mbar.

14- Inspiratory effort trigger

REAR PANEL



15- Hour counter

16- Water trap

17- Abacus: air and oxygen mixtures

18- Aeration

19- Mains socket

20- Fuse

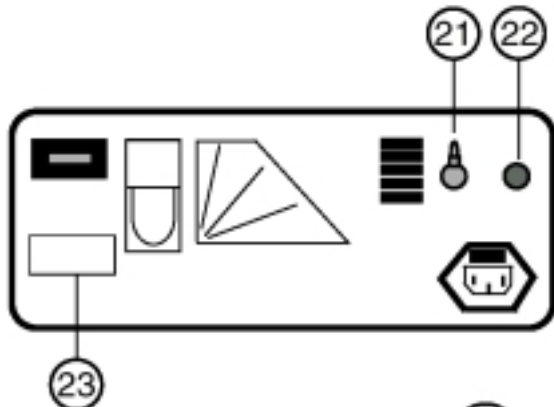
2 supply protection fuses.

21- Compressed ambient air outlet nozzle

Outlet used for autonomous anaesthesia system connection

22- Fresh gas inlet nozzle

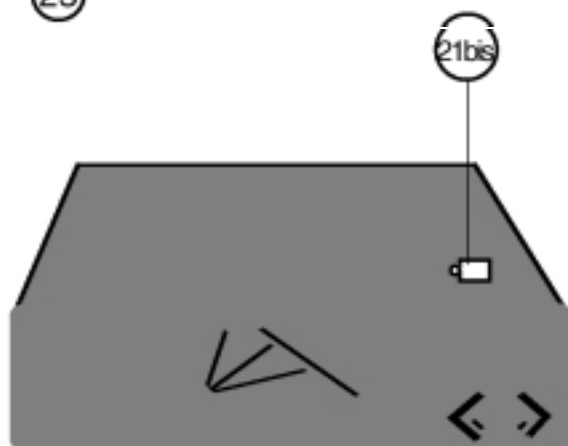
23- Manufacturer's label



UPPER COVER CONTROL

21a - Compressed ambient air outlet control

Compressor to outlet air duct control (21) used for autonomous anaesthesia connection.



The AIR DIRECT position corresponds to standard operation; the AIR INDIRECT position corresponds to the autonomous system configuration.

1 - GENERAL

1.3 Specifications

PHYSICAL

- Dimensions: L x D x H = 470 x 308 x 150 mm.
- Mass: 14 kg.

ELECTRICAL

- Electrical supply: 220 V~ 50 Hz
 - Own electrical consumption: 160 VA
 - Class I machine
 - Type B machine
- Protection at maximum current:
 - General supply protection: 2 F 1A fuses (rear panel),
 - Electronic card protection: 1 100 mA internal fuse.
- Power failure protection:
 - Audible alarm (duration of discharge: 10 minutes).

ENVIRONMENT

- Minimum and maximum storage temperatures: From -40°C to +70°C.
- Minimum and maximum operating temperatures: From +10°C to +40°C.
- Atmospheric pressure (use): From 700 to 1060 mbar.
- Relative humidity (storage and use): From 30 to 75%.
- Protection index: IP20 (protected against solid bodies greater than 12 mm and non-protected against penetration by liquids).

1 - GENERAL

PERFORMANCE

- Breathing rate: From 8 to 40 bpm
- I/E ratio: From 1/1 to 1/3.
- Mean flow (insufflated per minute): From 0 to 20 l/min.
- Pmin pressure sensitivity: From 0 to 60 hPa.
- Trigger sensitivity (CAV): From 0 to -20 hPa.
- Instantaneous pressure display: From -20 to 100 hPa.

MATERIALS IN CONTACT WITH THE PATIENT AND GASES BREATHED

Silicone (autoclavable patient circuit),
Latex (accumulation bag),
PVC,
Aluminium.

STANDARDS/DIRECTIVES

NF C 74350: Artificial respiration treatment machines
NF S 90-118: Medical use ventilators
NF EN 601-1: Electromedical machine safety
NF EN 60-601-1-2: Electromagnetic compatibility of electromedical machines.
European directive 93/42/CEE concerning medical devices.

1 - GENERAL

1.4 Symbols



Stop (power off)



Start (power on)



Pmin audible alarm disable

I/E

Ratio of inspiration phase to expiratory phase

f

Breathing rate (frequency)

SD / Trigger

Trigger sensitivity



Protection earth



Equipotential



Attention: Refer to accompanying documents



Type B machine

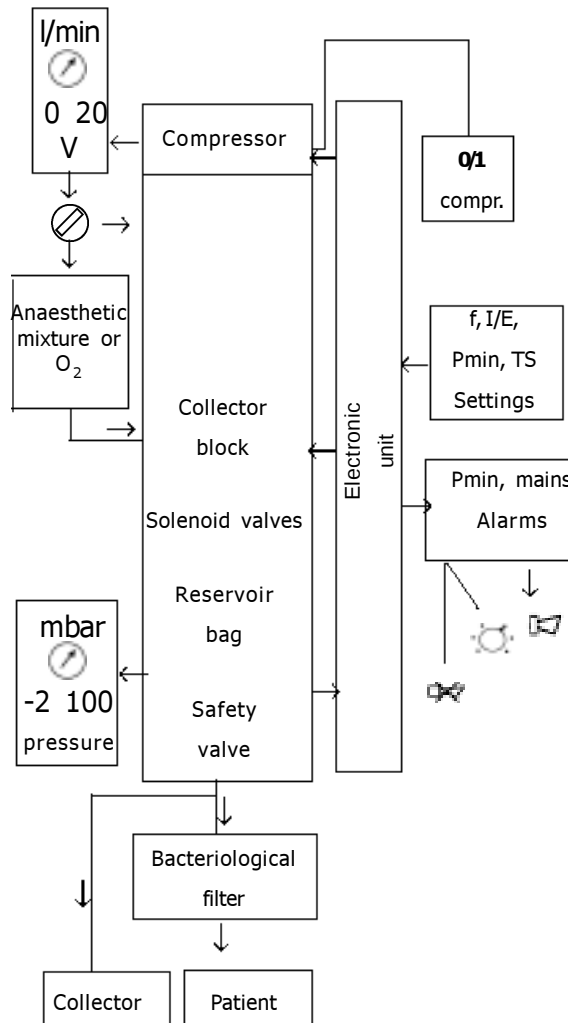


Compliance with directive 93/42/CEE (established by notified organisation n° 0459).

(**MONNAL D2** units are systematically marked  starting from serial number **1770**)

2 - OPERATION

2.1 Operating principle



Operating diagram

The collector/solenoid block is supplied with air, and/or with a gas mixture (or with pure oxygen), by means of a compressor.

Air ventilation (V) is displayed on a flowmeter and controlled by a tap.

The collector block including diaphragms associated with solenoid valves, controlled by the electronic unit, distributes the continuous flow

- on one hand, towards the reservoir bag during the expiratory phase,
- on the other hand, with the addition of gas stored by the bag, towards the patient through a bacteriological filter during the inspiratory phase.

The insufflation pressure is displayed on a manometer and can be limited by adjusting a safety valve.

By means of the electronic unit the rate, the I/E ratio, the trigger sensitivity SD/TS (in CAV mode) and Pmin sensitivity can be set. It also enables visual indication of the trigger sensitivity SD/TS, audible and visual indication of Pmin, and audible indication of a mains power cut.

2 - OPERATION

DESCRIPTION OF VENTILATION PHASES

Inspiratory phase

The patient receives the continuous flow from the compressor or from the fresh gas inlet nozzle to which are added, by the Venturi effect, the gases which have accumulated in the reservoir bag during the inspiratory phase.

The reservoir bag deflates.

If resistance is felt, the pressure in the patient circuit reaches the Venturi discharge pressure, in which case the bag's non-return valve shuts, and this allows the compressor to increase the insufflation pressure if necessary. This pressure is, however, limited to the value of the patient safety valve setting.

Expiratory phase

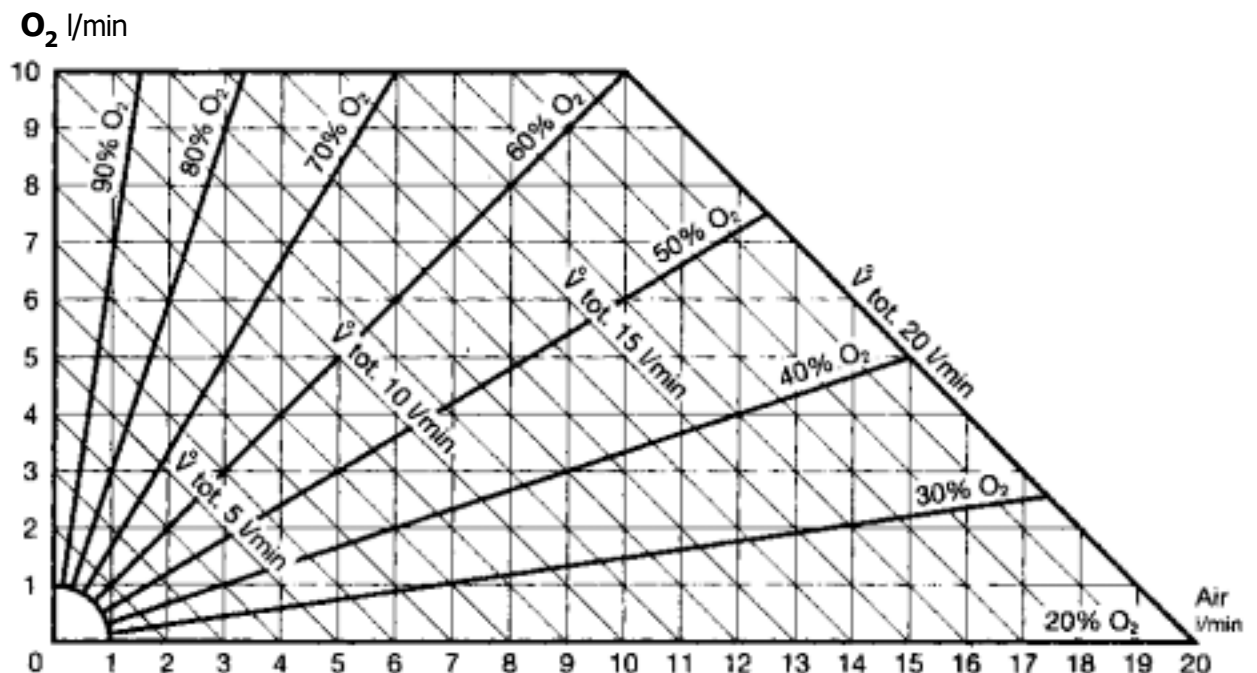
The patient circuit is isolated from the machine, and the patient breathes out freely towards the outside, through the expiratory valve.

Meanwhile the circuit towards the reservoir bag opens and the bag inflates.

The pressure in the bag is in any case limited to the opening pressure of the overpressure valve.

AIR AND OXYGEN MIXTURE

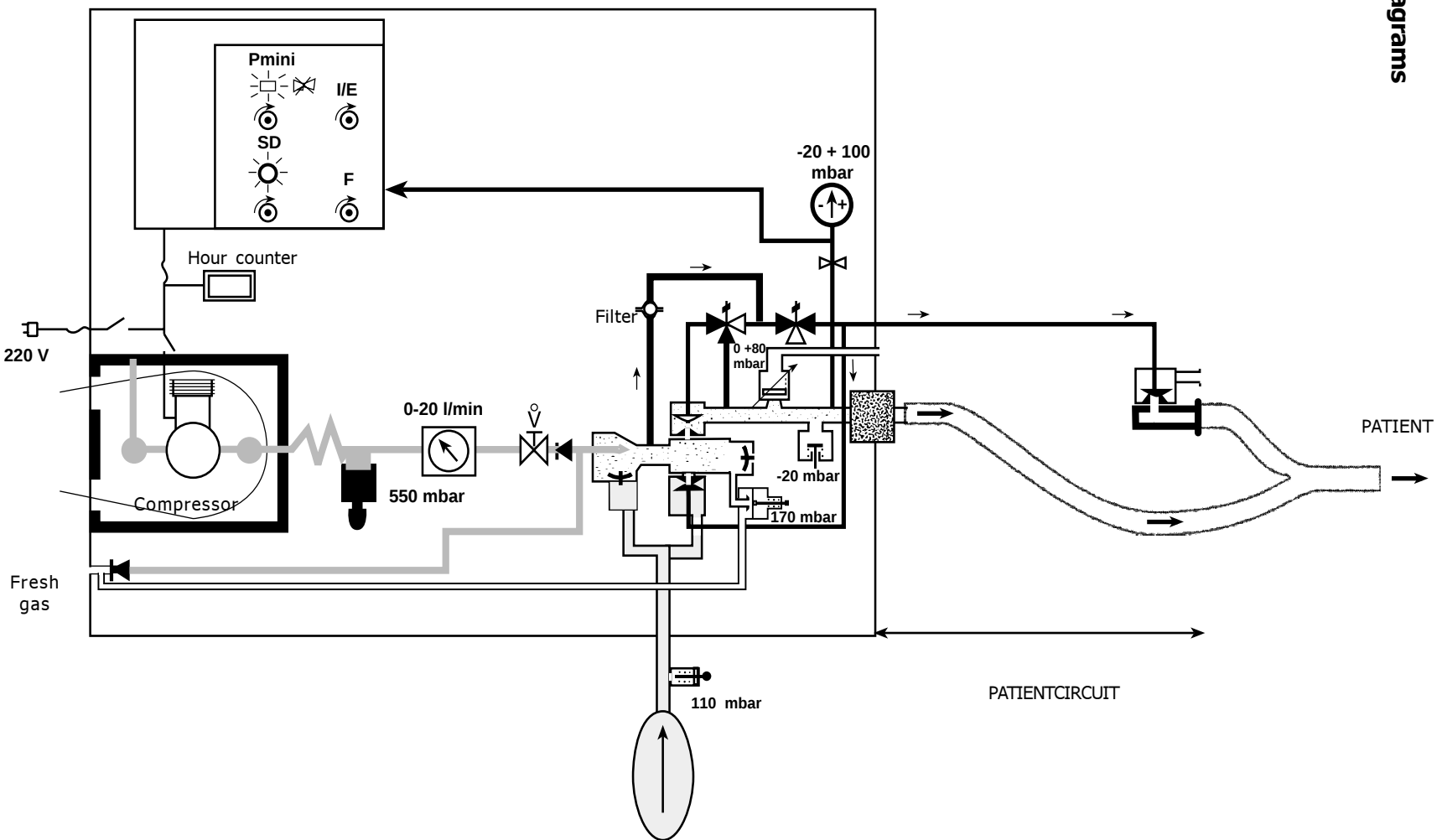
If an additional supply of 100% oxygen is insufflated to the patient when the compressor is operating, this oxygen flow is added to the air flow set on the manometer on the front panel.



2- OPERATION

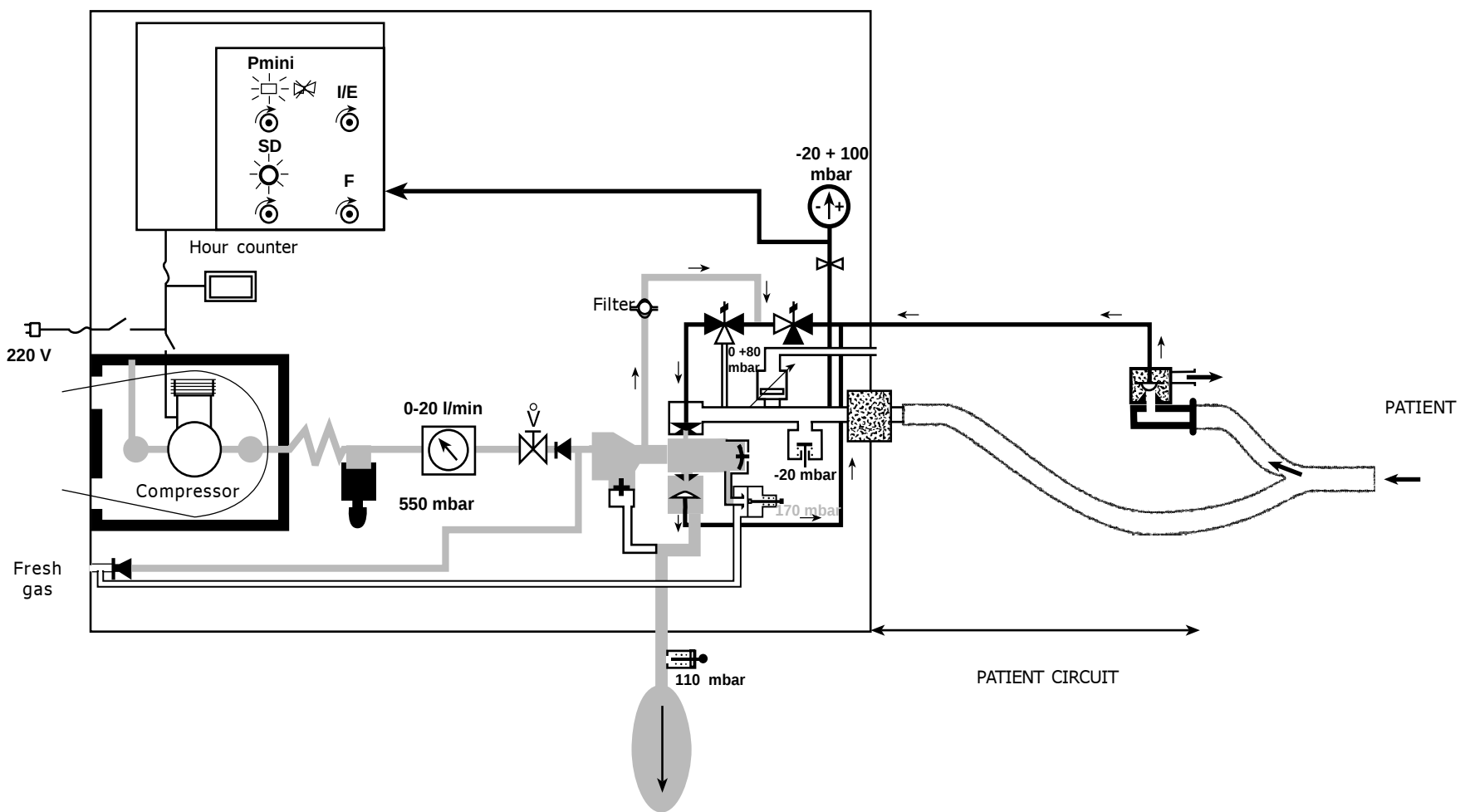
2.2 Operating diagrams

2.2.1 Inspiratory phase



2 - OPERATION

2.2.2 Expiratory phase



2 - OPERATION

2.3 Troubleshooting

2.3.1 Ventilation problems

OBSERVATIONS	SYMPTOMS	REMEDIES
No ventilation The compressor does not operate, the clock is not working and there is no "mains power fault" alarm.	- On/Off button not pressed in. - Defective electronic unit.	- Press the on/off button. - Replace the unit.
The compressor does not operate, the clock is not working, but the "mains power fault" alarm trips.	- No electrical supply. - Defective machine supply fuse(s).	- Check that the machine is properly plugged in. - Replace the F1A fuse(s).
The compressor does not operate, but the clock is working.	- Compressor on/off switch not engaged - Compressor overheating (internal thermal circuit breaker tripped).	- Switch on the compressor (switch on rear panel on old models). - Check the air vents - Recondition or replace the compressor.
The compressor operates, but the reservoir bag does not inflate and the Pmin alarm trips.	- Ventilation button is in off position (flowmeter shows 0) and the fresh gas supply is zero.	- Open the ventilation tap and/or supply the MONNAL D2 with fresh gas.
The compressor operates, the reservoir bag inflates and deflates, but the Pmin alarm trips.	- Automatic triggering at wrong time. - Expiratory valve malfunction. - Defective patient circuit.	- Press the SD (TS) button (trigger sensitivity). - Check the expiratory diaphragm and its tube. - Check the patient circuit very carefully.
The compressor operates but the clock is not working and the "mains power fault" alarm trips.	- Defective fuse. - Defective electronic unit.	- Replace the F100 mA fuse - Replace the unit.

2 - OPERATION

OBSERVATIONS	SYMPTOMS	REMEDIES
Insufficient ventilation	- Leak on patient circuit. - Bacteriological filter assembly not airtight. - Expiratory valve collector wrongly connected.	- Check patient circuit assembly. - Disassemble and re-assemble the assembly. - Check the collector and its membrane.
Failure of Controlled Assisted Ventilation The "TRIGGER" LED is permanently lit up. The "TRIGGER" LED does not light up.	- Automatic triggering. - Trigger sensitivity set around - 20 mbar. - Electronic defect.	- Set the trigger sensitivity correctly (SD/ TS). - Set the trigger sensitivity correctly . - Check the power supply to the LED and/or Replace the electronic unit.
Failure of Controlled Ventilation The "TRIGGER" LED lights up.	- Ventilatory parameters wrongly set.	- Set the ventilatory parameters correctly.
Failure of Pmin disconnection alarm The Pmin alarm is permanently triggered. The Pmin does not trigger.	- Wrong setting. - Leak on the pressure sensor circuit. - Electronic defect.	- Set the Pmin sensitivity correctly. - Check that there are no internal leaks. - Replace the Pmin card.
No humidification (models with humidifier socket)	- Humidifier not connected. - Humidifier socket fuse blown.	- Plug in the humidifier card. - Replace the fuse.

2 - OPERATION

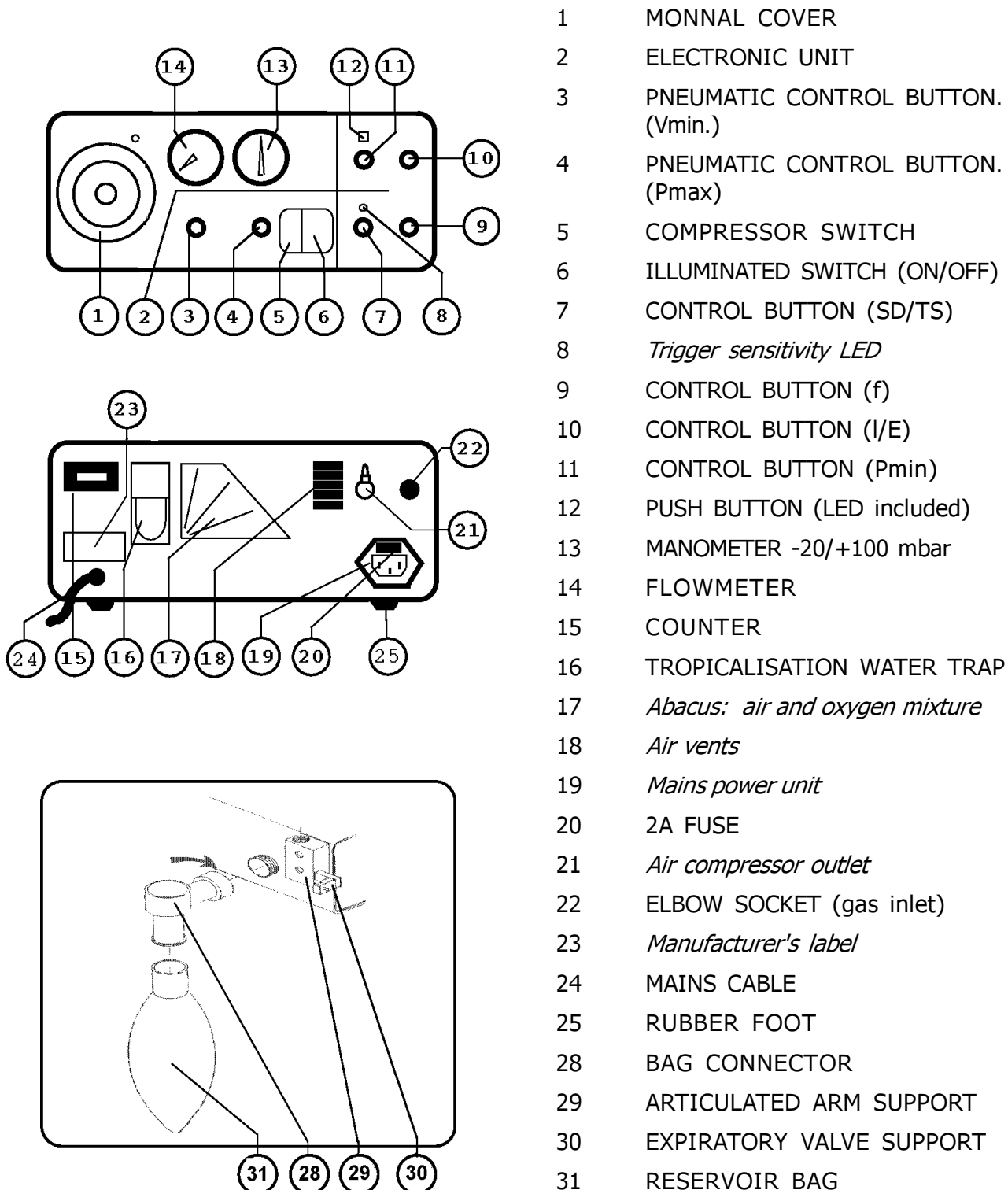
2.2.2 Problems originating in solenoid valve unit

SYMPTOMS	CAUSES	REMEDIES
The reservoir balloon stays inflated.	Inspiratory solenoid valve blocked in the open position.	Replace inspiratory solenoid valve.
The reservoir balloon stays deflated.	Inspiratory solenoid valve blocked in the shut position.	Replace inspiratory solenoid valve.
The reservoir balloon works, but the test balloon hardly inflates.	Expiratory solenoid valve blocked in the shut position.	Replace expiratory solenoid valve.
A leak occurs at the expiratory valve during inspiration.	Expiratory solenoid valve blocked in the open position.	Replace expiratory solenoid valve.

3 - DESCRIPTION

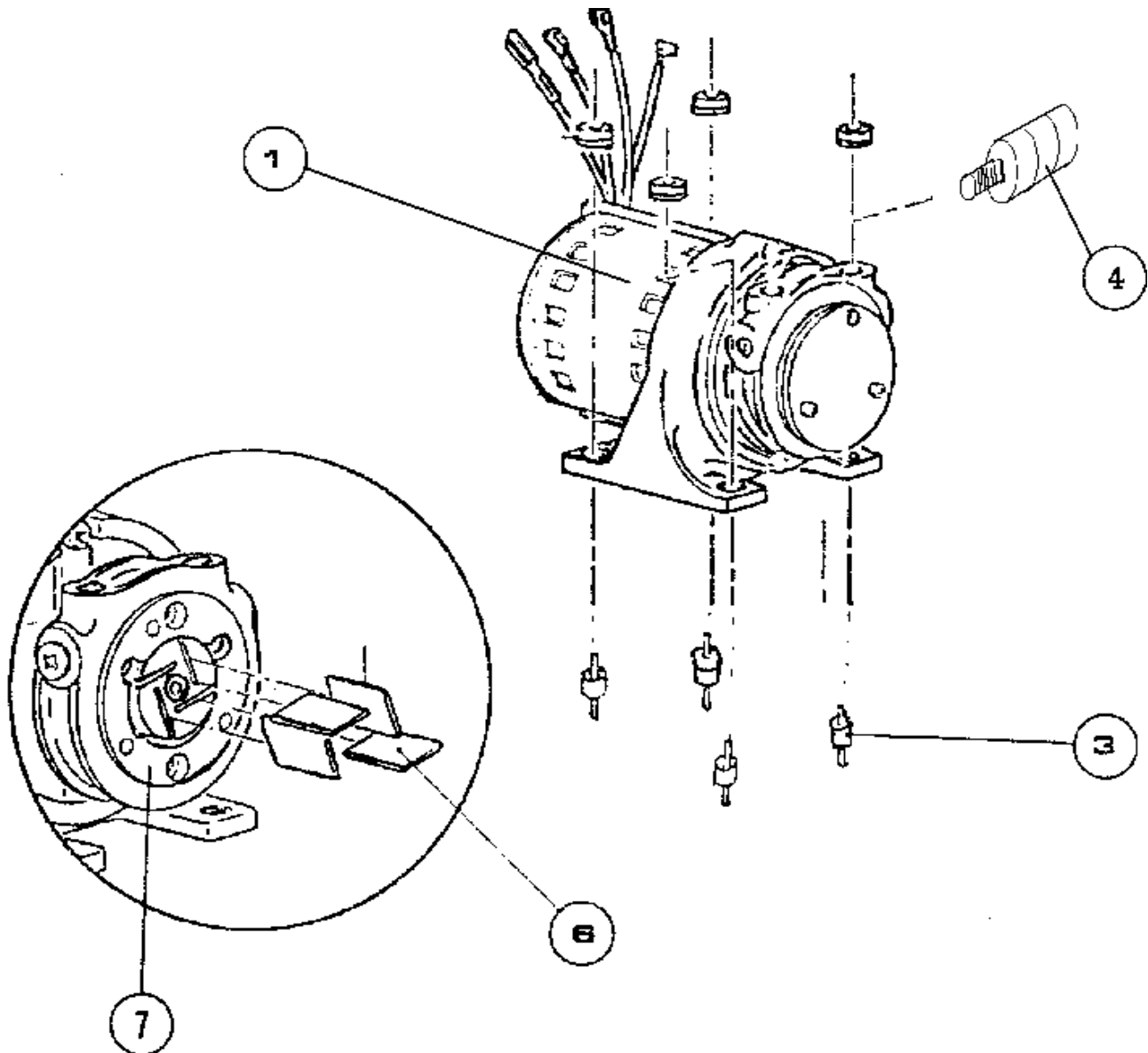
N.B. The descriptions in lower case and *italics* are not listed as spare parts
(c.f. § 6 - LIST OF PARTS)

3.1 Overall views



3 - DESCRIPTION

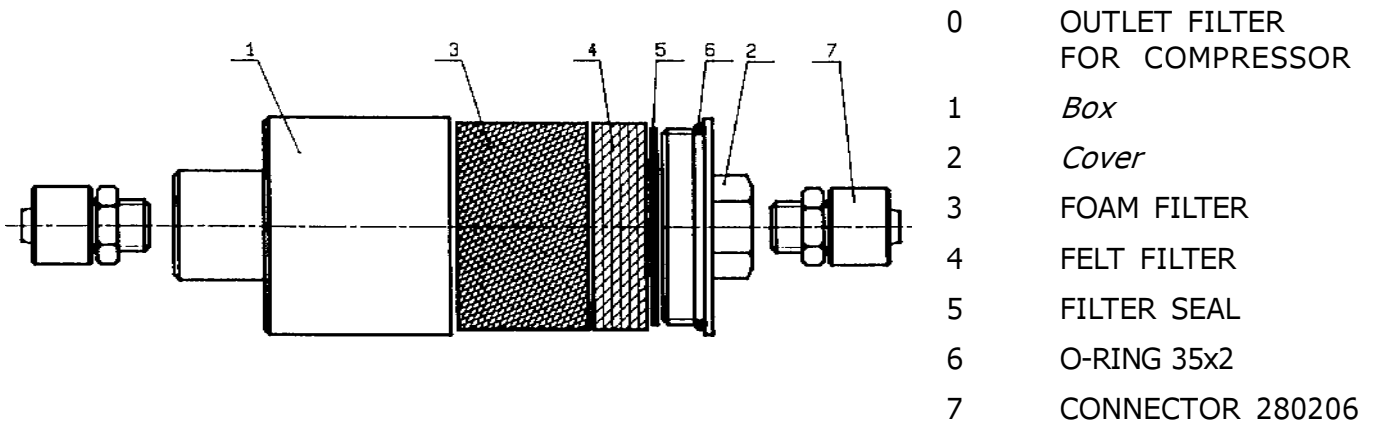
3.2 Compressor assembly



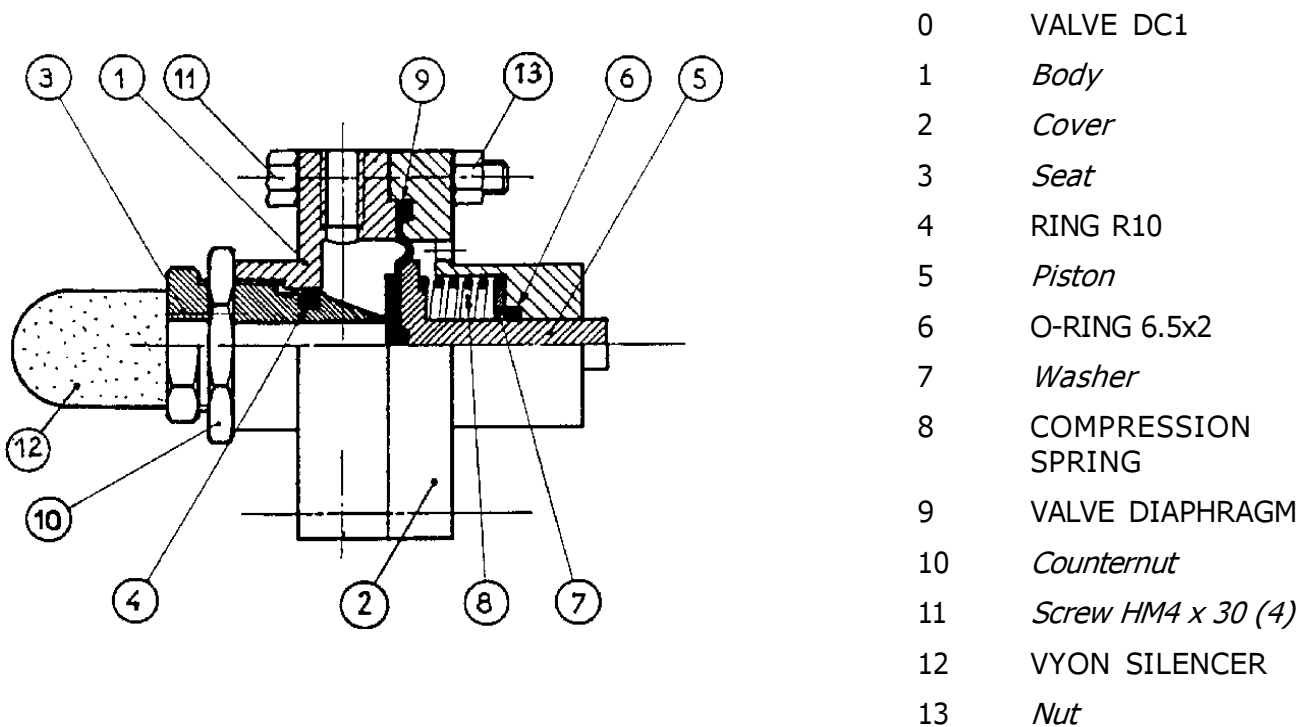
- 1 NM COMPRESSOR
- 3 SILENCER/SILENT UNIT
- 4 GREY NM COMPRESSOR INLET FILTER
- 6 COMPRESSOR PLATE
- 7 UNIT FLANGE

3 - DESCRIPTION

3.3 Compressor outlet filter box assembly



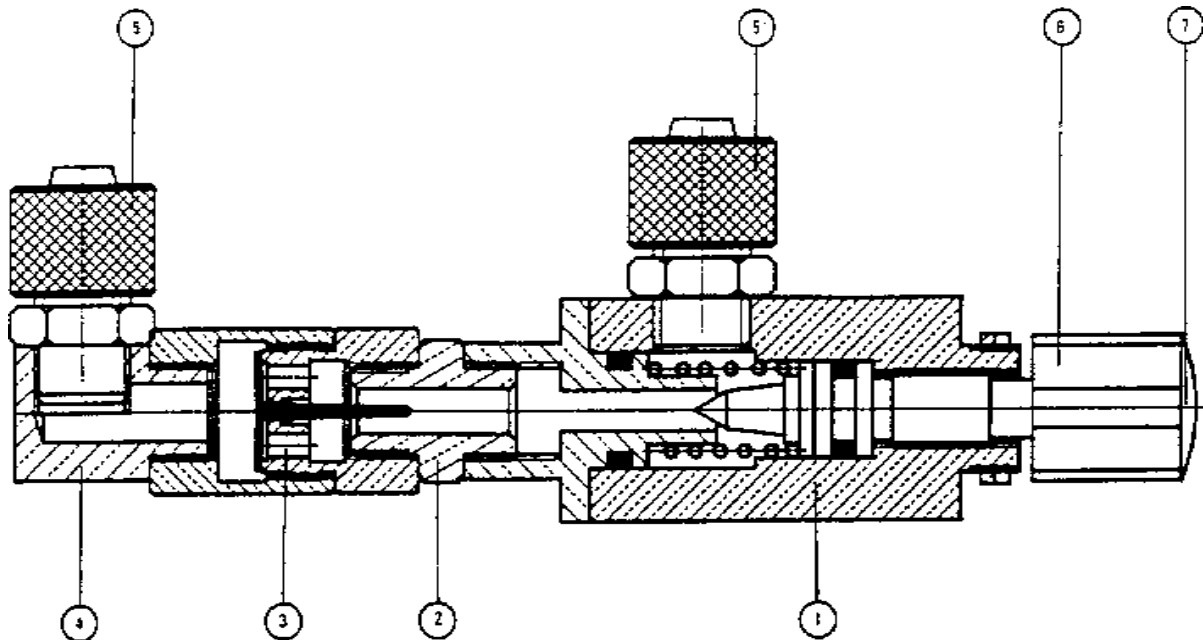
3.4 Compressor valve assembly (DC1)



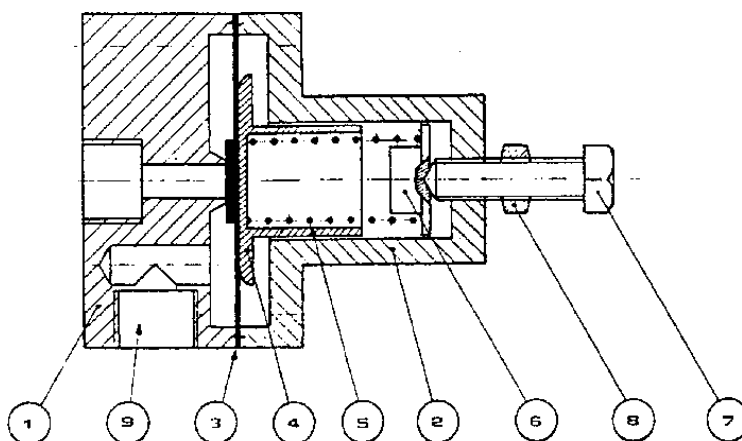
3 - DESCRIPTION

3.5 Ventilation tap assembly

- | | | | |
|---|---------------------------|---|--------------------------|
| 1 | VENTILATION TAP | 5 | CONNECTOR 280206 |
| 2 | <i>Connector</i> | 6 | PNEUMATIC CONTROL BUTTON |
| 3 | COMPLETE NON-RETURN VALVE | 7 | CAP W1-401 FOR END. |
| 4 | <i>Elbow socket</i> | | |



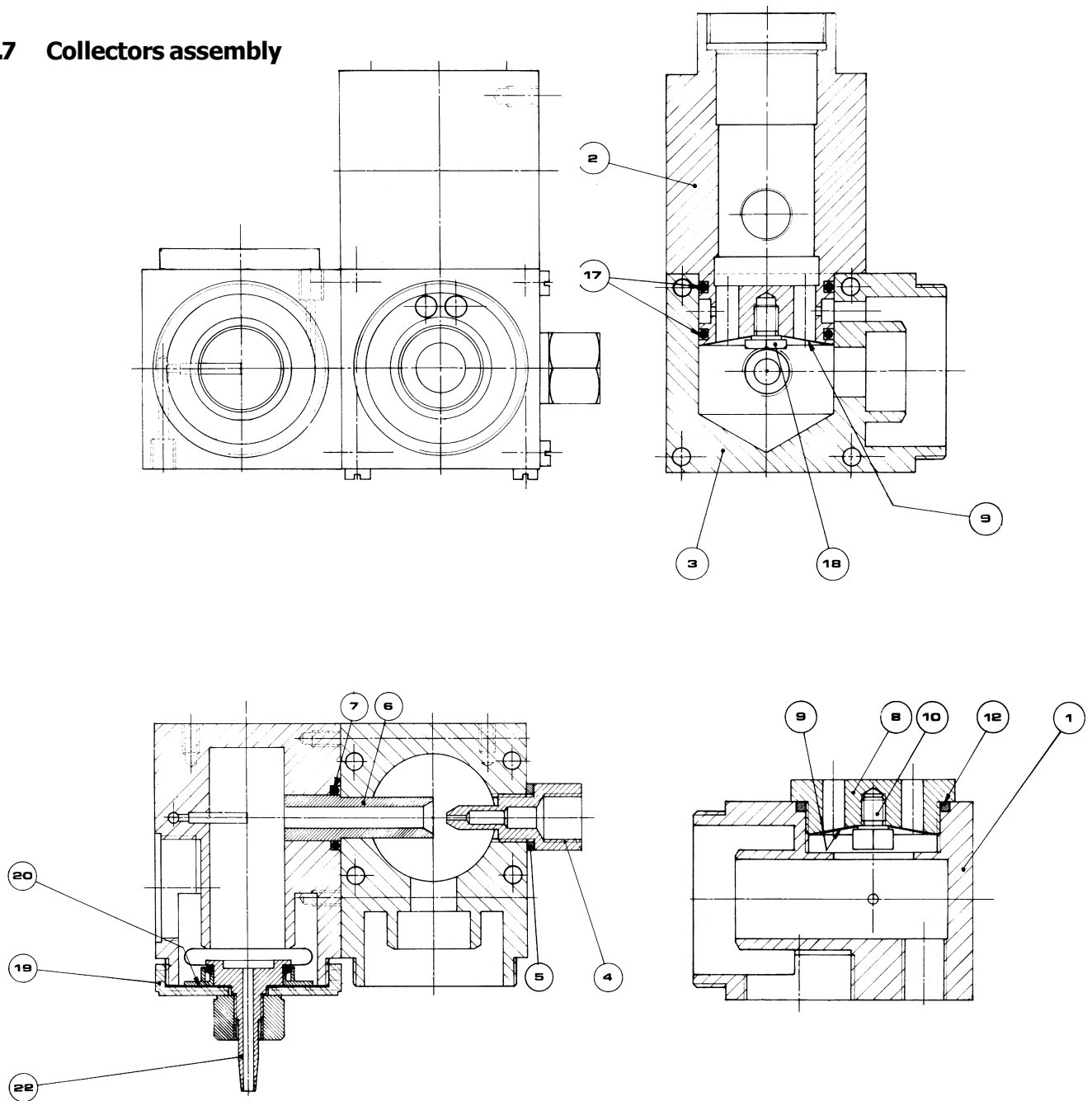
3.6 Distributor assembly



- | | |
|---|---------------------------|
| 0 | DISTRIBUTOR |
| 1 | <i>Body</i> |
| 2 | <i>Cover</i> |
| 3 | DISTRIBUTOR DIAPHRAGM |
| 4 | <i>Diaphragm piston</i> |
| 5 | <i>Spring</i> |
| 6 | <i>Compression piston</i> |
| 7 | <i>Adjustment screw</i> |
| 8 | <i>Counter-nut</i> |

3 - DESCRIPTION

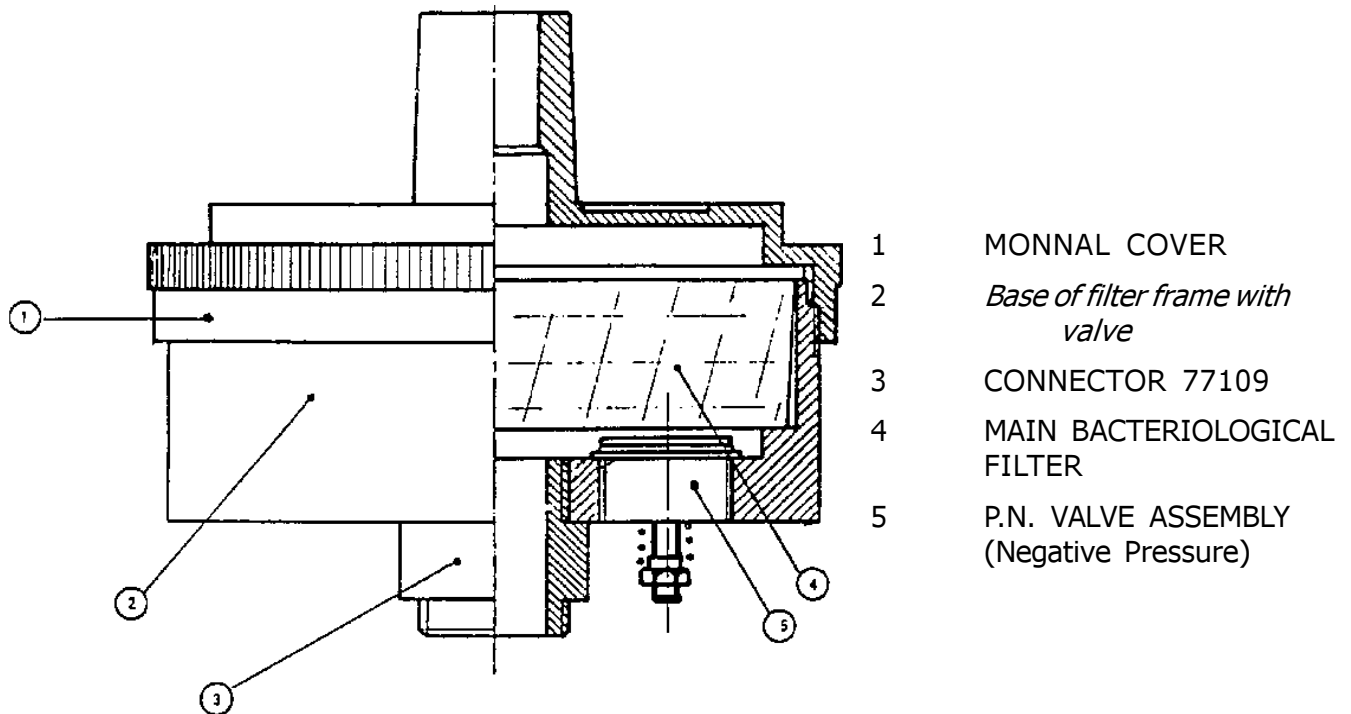
3.7 Collectors assembly



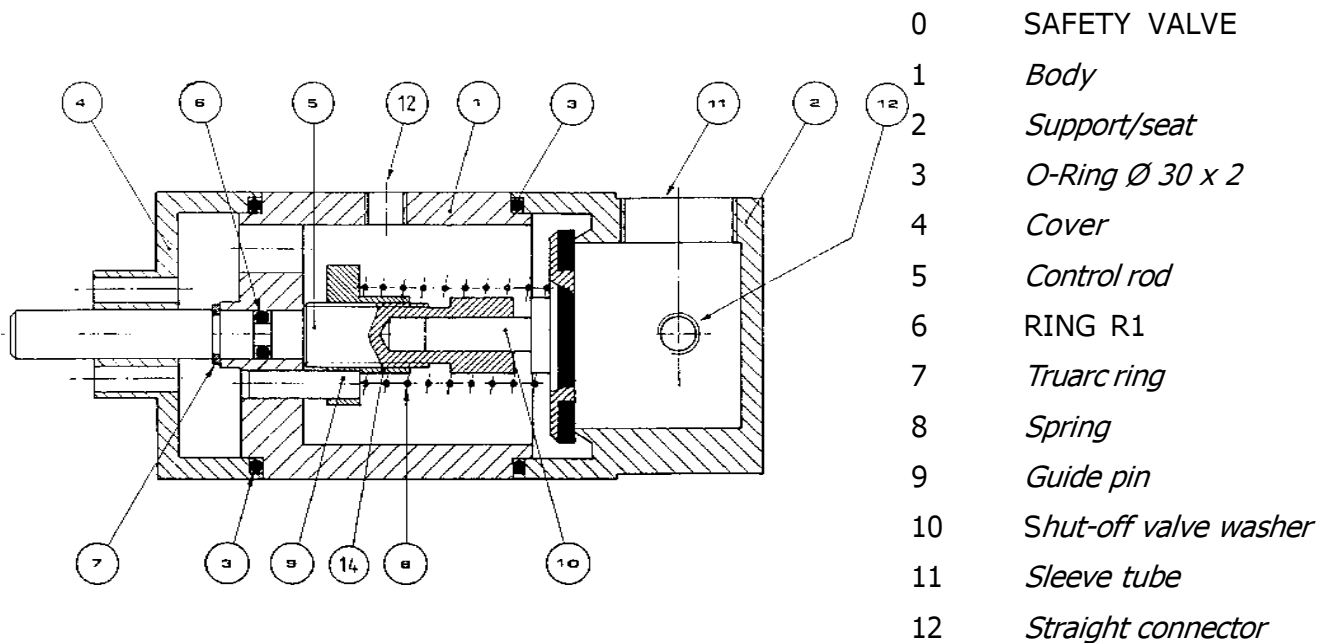
1	<i>Inspiration collector</i>	9	SILICONE VALVE 24X6,1X0,35
2	<i>Bag collector</i>	10	Ambient air valve port screw
3	<i>Injector collector</i>	12	<i>Valve port seal</i>
4	INJECTOR WITHOUT NYLON SEAL	17	O-RING 24x2
5	NYLON SEAL 14X10X1.5	18	<i>Non-return valve port screw</i>
6	<i>Injector collar</i>	19	COLLECTOR COVER
7	<i>Collector seal</i>	20	WASHER 50 SHORE D33
		22	DIAPHRAGM WITH NUT

3 - DESCRIPTION

3.8 Filter frame assembly with valve

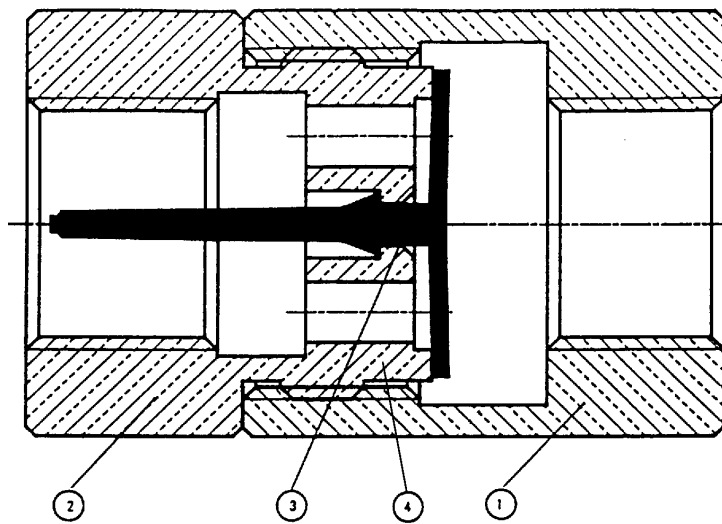


3.9 Safety valve assembly



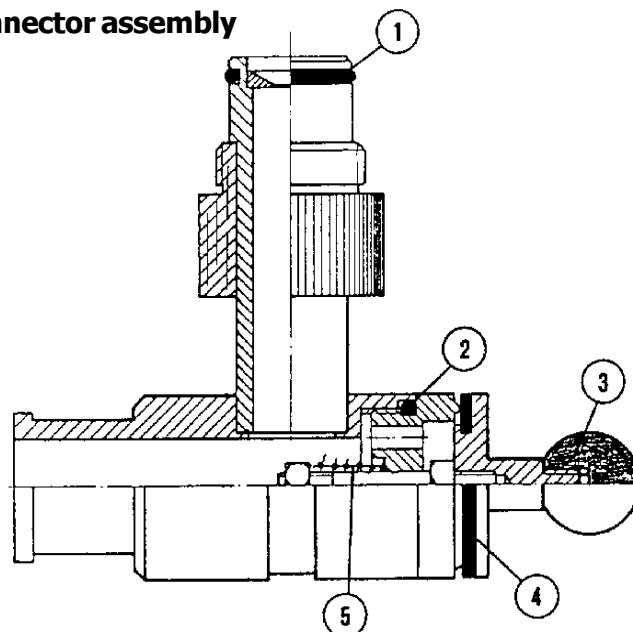
3 - DESCRIPTION

3.10 Non-return valve assembly



- 0 COMPLETE NON-RETURN VALVE
- 1 *Grooved female connector*
- 2 *Grooved male connector*
- 3 NEW MODEL NON-RETURN VALVE
- 4 *Valve support*

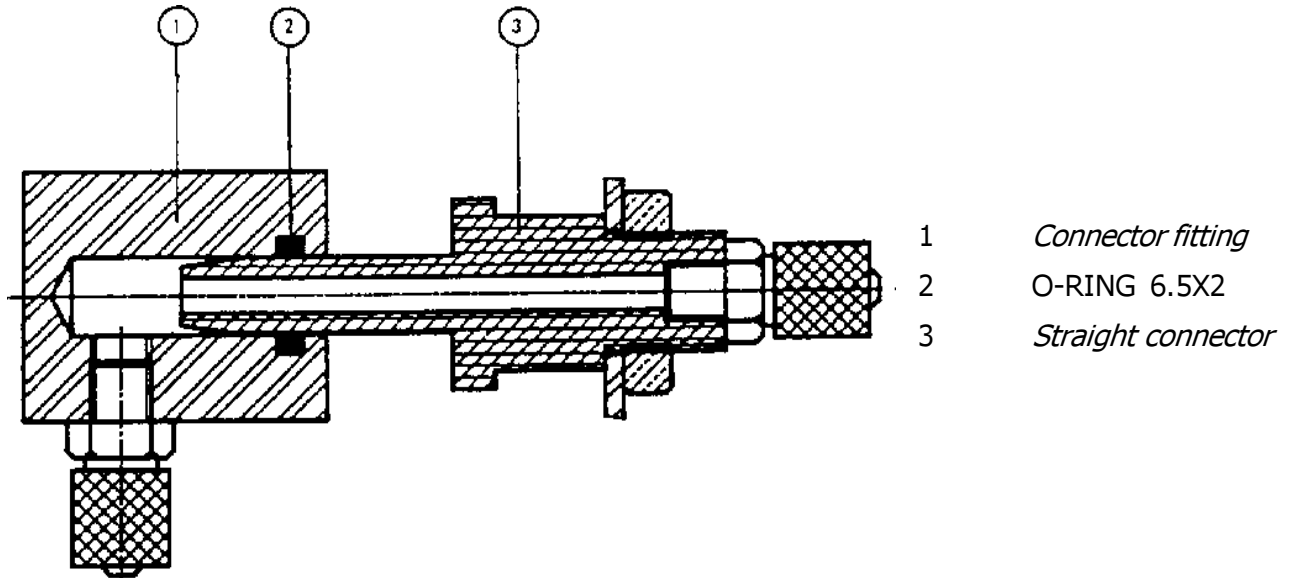
3.11 Reservoir bag connector assembly



- 0 CONNECTOR FOR MONNAL BAG
- 1 O-RING 16X2
- 2 O-RING 24X2
- 3 *Bakelite ball*
- 4 *Seal*
- 5 *Spring*

3 - DESCRIPTION

3.12 Pneumatic connector for pressure sensor assembly



4 - MAINTENANCE

4.1 Maintenance recommendations

4.1.1 Routine maintenance

Cleaning / Disinfection

Wash the patient circuit assembly by immersing it in a cleaning solution such as Surfanios®.

Rinse it in hot water and dry. It can be disinfected/decontaminated with a solution of the Hexanios® G+R type.

Clean or replace the patient circuit for each new patient and whenever necessary (damaged or soiled circuit, etc.).

The respirator can be washed in soapy water with using a cloth (well wrung) impregnated with soapy water and dried with a dry cloth, or alternatively with wipes impregnated with an alcohol based aqueous solution.

Routine sterilisation

The bacteriological filter (27) at the machine outlet means that the patient circuit has to be sterilised.

Change the bacteriological filter every 600 hours.

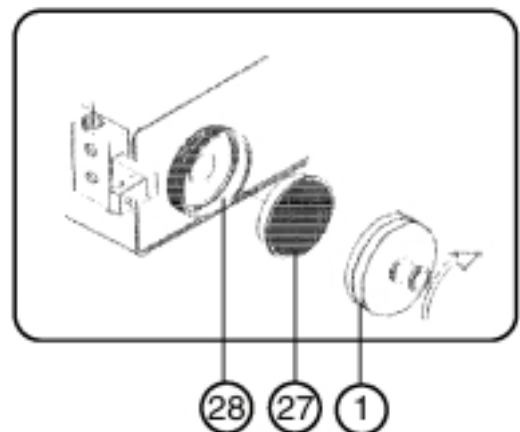
Sterilisation by autoclave: The **Taema** autoclavable patient circuit is compatible with the following AFNOR cycles:

- . 134°C, 18 minutes (cf prions)
- . 121°C, 30 minutes.

Recommended frequency of autoclave sterilisation: Between each patient or after each cleaning/disinfection cycle.

The patient circuit is also sterilisable by all normal procedures (gaseous formaldehyde, etc.).

Warning: Do not use abrasive powders, pure alcohol, acetone or other powerful solvents.



4 - MAINTENANCE

4.1.2 Maintenance by a technician

Every 600 hours (if not done by the user):

- Replace bacteriological filter,
- Check the patient circuit,
- Test machine's functions,
- Fill in a **MONNAL D2 RETURN TO SERVICE SHEET; 1st LEVEL (§ 7 - APPENDICES)**.

Every 1500 hours or at least once a year:

- Replace bacteriological filter,
- Replace compressor inlet filter,
- Replace the diaphragms of the collector unit and expiratory valve,
- Test the ventilator according to **§ 4.2 Test procedures**.
- Fill in a **MONNAL D2 RETURN TO SERVICE SHEET; 2nd LEVEL (§ 7 - APPENDICES)**.

Every 5000 hours:

- Replace bacteriological filter,
- Replace compressor inlet and outlet filters,
- Replace the diaphragms of the collector unit and expiratory valve,
- Replace valve silencer DC1,
- Replace the reservoir bag,
- Replace the solenoid valve filter,
- Test the ventilator according to **§ 4.2 Test procedures**.
- Fill in a **MONNAL D2 RETURN TO SERVICE SHEET; 2nd LEVEL (§ 7 - APPENDICES)**.

4 - MAINTENANCE

4.2 Testing and adjustment procedures

4.2.1 Compressor flow

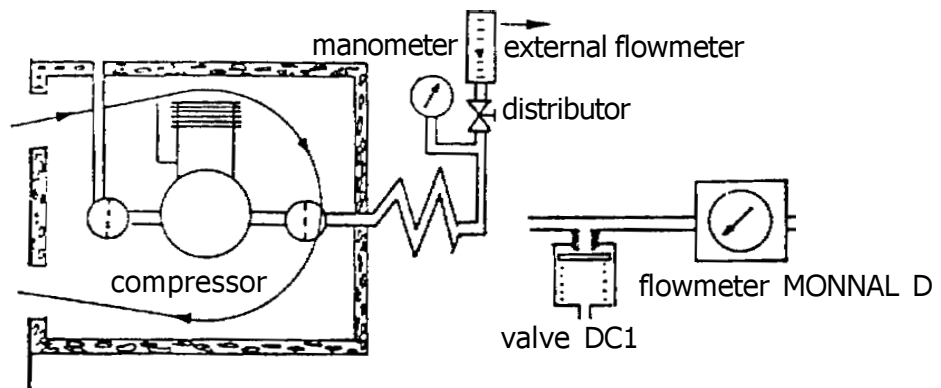
Connect a manometer and a distributor to the cooling coil outlet, apply a counter-pressure P , and check the flows:

at $P = 0$

Flow ~ 30 l/min (for information),

at $P = 550$ mbar

Flow > 20 l/min



If necessary: 1- Check that there are no leaks at the compressor outlet,

2- Proceed to reconditioning or standard exchange of the compressor.

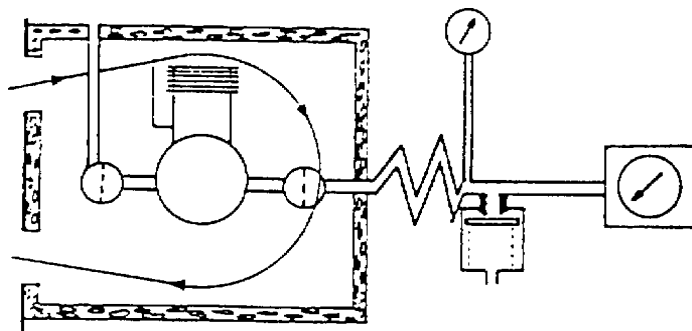
4.2.2 Compressor valve (DC1)

Set the flow on the **MONNAL D2** flow meter and measure the pressure upstream from the valve:

for 0 l/min check $P < 600$ mbar

for 15 l/min check $P = 550$ mbar ± 50 mbar

for 20 l/min check $P > 500$ mbar



if necessary: check the compressor inlet and outlet filters,

adjust the valve so as to obtain a pressure of 550 mbar at 15 l/min:

1- untighten the counter-nut (10),

2- tighten or untighten the seat by 10 ths of turns (3)

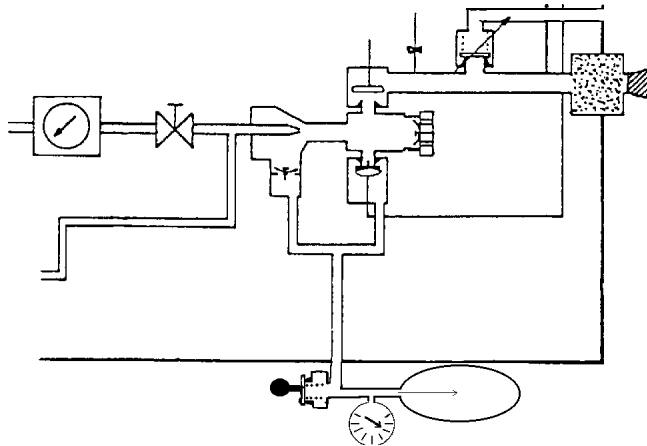
3- re-tighten the counter-nut (10).

N.B. to locate parts, see. § 3.4 Valve compressor assembly

4 - MAINTENANCE

4.2.3 Reservoir bag valve

Plug the patient outlet. Set ventilation at 20 l/min, breathing rate at 8 bpm, the I/E ratio at 1/3. Let the **MONNAL D2** ventilate a few cycles, then check that the bag pressure at the end of the expiratory phase is somewhere **between 105 and 115 mbar**. During expiration, the manometer pointer will fall back slightly.



If necessary: set the bag valve 110 +/- 5 mbar
(c.f. § 3.11 Connector reservoir bag assembly).

4.2.4 Safety valve

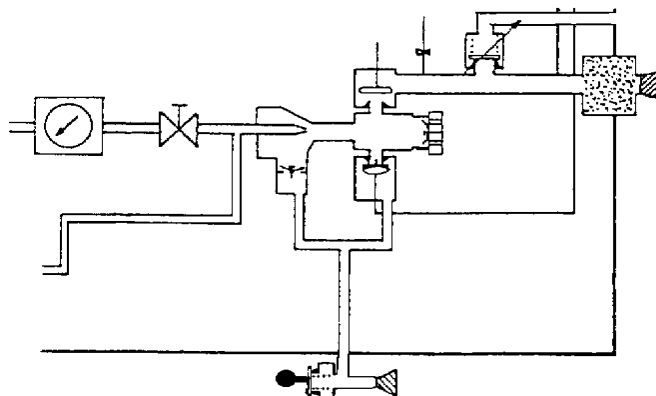
Shut the nebulizer tap and set the flow at 10 l/min and the breathing rate at 8 bpm.

Plug the patient outlet.

Set the safety valve at stop (clockwise).

- Check that:
- 1- $P_{max} > 80$ mbar,
 - 2- During expiration, the pointer will fall back without ever reaching 0 mbar,

Then check the possible setting of the valve across the whole range of 20 - 80 mbar.

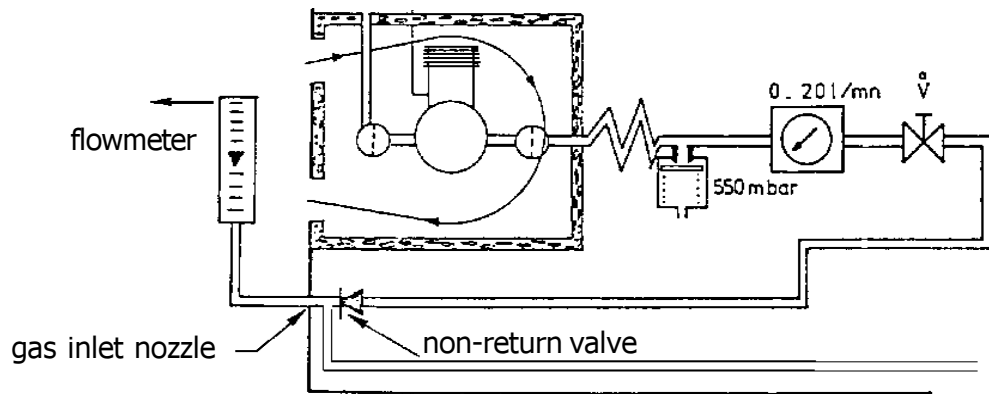


If necessary: Check that there are no internal leaks,
check for the satisfactory mechanical operation of the safety valve

4 - MAINTENANCE

4.2.5 Tightness of the O₂ non-return valve

With a flowmeter, check on the gas inlet nozzle that the leak is less than or equal to 0.1 l/min (make the measurement for a flow set on the **MONNAL D2** of 0 to 5 l/min).



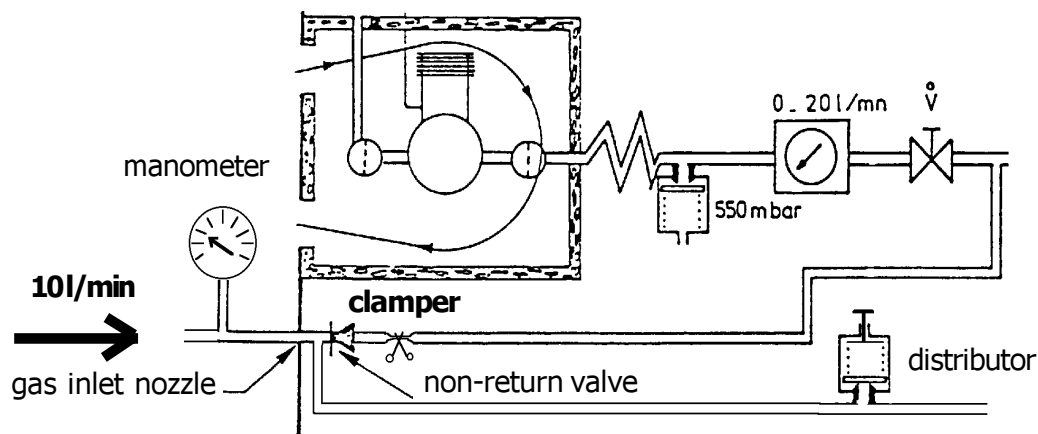
If necessary: Change the non-return valve.

4.2.6 Distributor

Stop the **MONNAL D2** and supply the machine with gas at 10 l/min

Clamp the pipe linking the non-return valve and the inspiratory unit.

The pressure upstream from the **MONNAL D2** must be equal to **170 mbar +/- 5 mbar**



If necessary: Adjust the distributor, having previously untightened its counter-nut (see § 3.6 Distributor assembly).

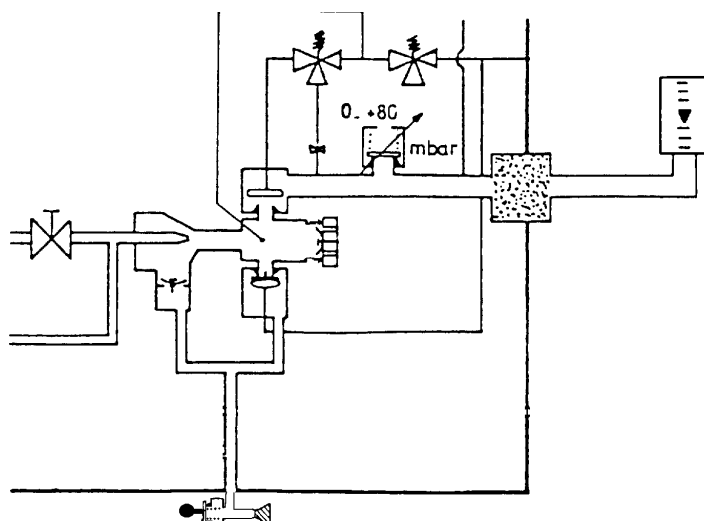
4 - MAINTENANCE

4.2.7 Patient flow

Remove the fuse from the electronic unit.

Connect the flow meter directly to the machine outlet (with the bacteriological filter in place).

Flow displayed (l/min)	Flow measured (l/min)
0	0
5	3.5 to 6
10	9 to 11
15	14 to 16
20	19 to 21



If necessary: 1- change the setting of valve DC1

2- replace the **MONNAL D2** flowmeter

4 - MAINTENANCE

4.2.8 Breathing rate

Check the **8, 20 and 40 bpm** rates, with the aid of a **RT200** Timeter (or equivalent) or an **FC10** flow meter connected directly to the machine outlet.

If necessary: Adjust the recommended rate on the front panel to **40**.

Adjust the rate read off by turning **Pa 1**.

Adjust the recommended rate on the front panel to **8**.

Adjust the rate read off by turning **Pa 3**.

Check the rates again.

Note: In the absence of measuring equipment, it is possible to use a mechanical chronometer but measurement is less easy and less accurate.

4.2.9 I/E ratio

Check the I/E ratios: **1/3, 1/2 and 1/1** (Inspiratory time / Expiratory time) with the aid of an **RT200** Timeter (or equivalent) connected directly to the machine outlet.

If necessary: Adjust the recommendation on the front panel to **I/E = 1/1**.

Adjust the ratio read by turning **Pa 2**.

Adjust the recommendation on the front panel to **I/E = 1/3**.

Adjust the ratio read by turning **Pa 4**.

Check the I/E ratios again.

Note: In the absence of measuring equipment, it is possible to use a mechanical chronometer but measurement is less easy and less accurate.

4.2.10 Trigger sensitivity (SD/TS)

Connect a patient circuit equipped with a test bag.

Set the SD/TS on the front panel at **0 mbar**.

Check that there is no self-triggering (the trigger LED does not light up).

Using the bag, create a slight pressure drop during the expiratory phase.

Check that the SD/TS LED lights up and an inspiratory phase is triggered.

Set SD/TS at **-10 mbar**.

Using the bag, create a pressure drop during the expiratory phase and check this trigger sensitivity on the manometer on the front panel.

4 - MAINTENANCE

If necessary: Reset the trigger:

Set the potentiometer on the front panel at **0 mbar**.

Adjust **P1** so that it is at the limit of self-triggering.

Set the potentiometer on the front panel at **-20 mbar**.

Disconnect the pressure sampling line at the T connector.

Connect a syringe and effect a pressure drop.

With **P4** set trigger sensitivity at -20 mbar.

N.B. : To locate the potentiometers see the Pmin card layout diagram (**§ 5 DIAGRAMS**)

4.2.11 Pmin disconnection alarm

Effect a ventilation on the test bag to obtain a peak pressure slightly less than 20 mbar.

Set the Pmin alarm threshold on the front panel at **20 mbar**.

Check the tripping of the audible and visual alarm.

Disable the audible alarm and check the **disabling time limit: 1 min 45 ± 15 s**.

Set the Pmin alarm threshold at a value less than peak pressure.

Check that the audible and visual alarm stop.

Set the Pmin alarm threshold at 60 mbar and simultaneously start a chronometer.

Check the **disabling time limit** of the audible and visual alarm: **10 s ± 1 s**.

(Warning: For effective triggering of the audible alarm, the last disabling of this alarm must have occurred more than 2 min earlier)

If need be: Reset the threshold and the time limit:

Disconnect the patient pressure sampling line at the T connector, then connect a syringe on this line.

1- Setting of min. pressure

Connect a voltmeter (DC) between test points TP2 (+) and TP1 (-); the voltage is nil (0V). Set the Pmin button on the front panel at 40 mbar.

Bring the pressure to **40 mbar** and adjust to **P2** to obtain a voltage of (4,7 V).

2- Setting the alarm trigger time limit (and disabling time limit)

Adjust the potentiometer by **P5** so as to obtain a triggering time limit of the Pmin alarm equal to **10 s ± 1 s**.

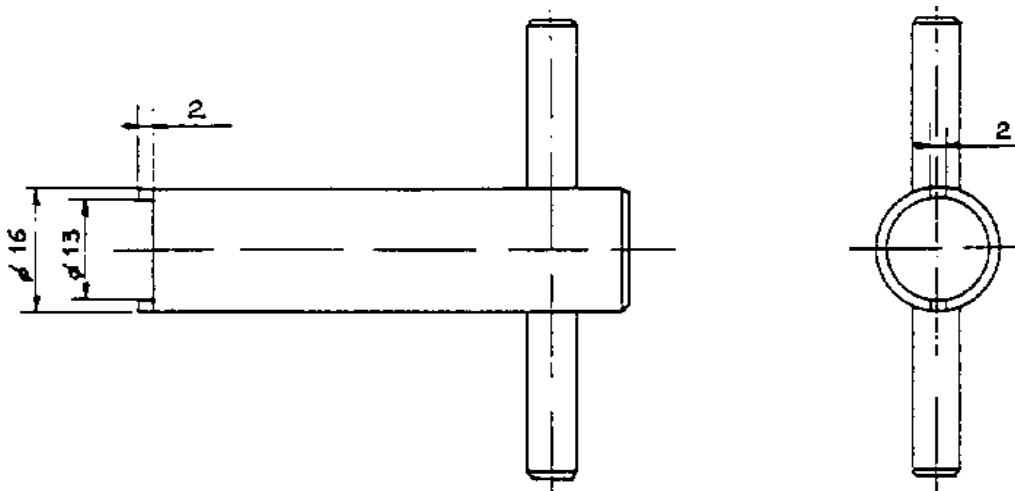
Note: To locate the potentiometers see the Pmin card layout diagram (**§ 5 DIAGRAMS**).

4 - MAINTENANCE

4.3 Tools and special equipment

4.3.1 Tools

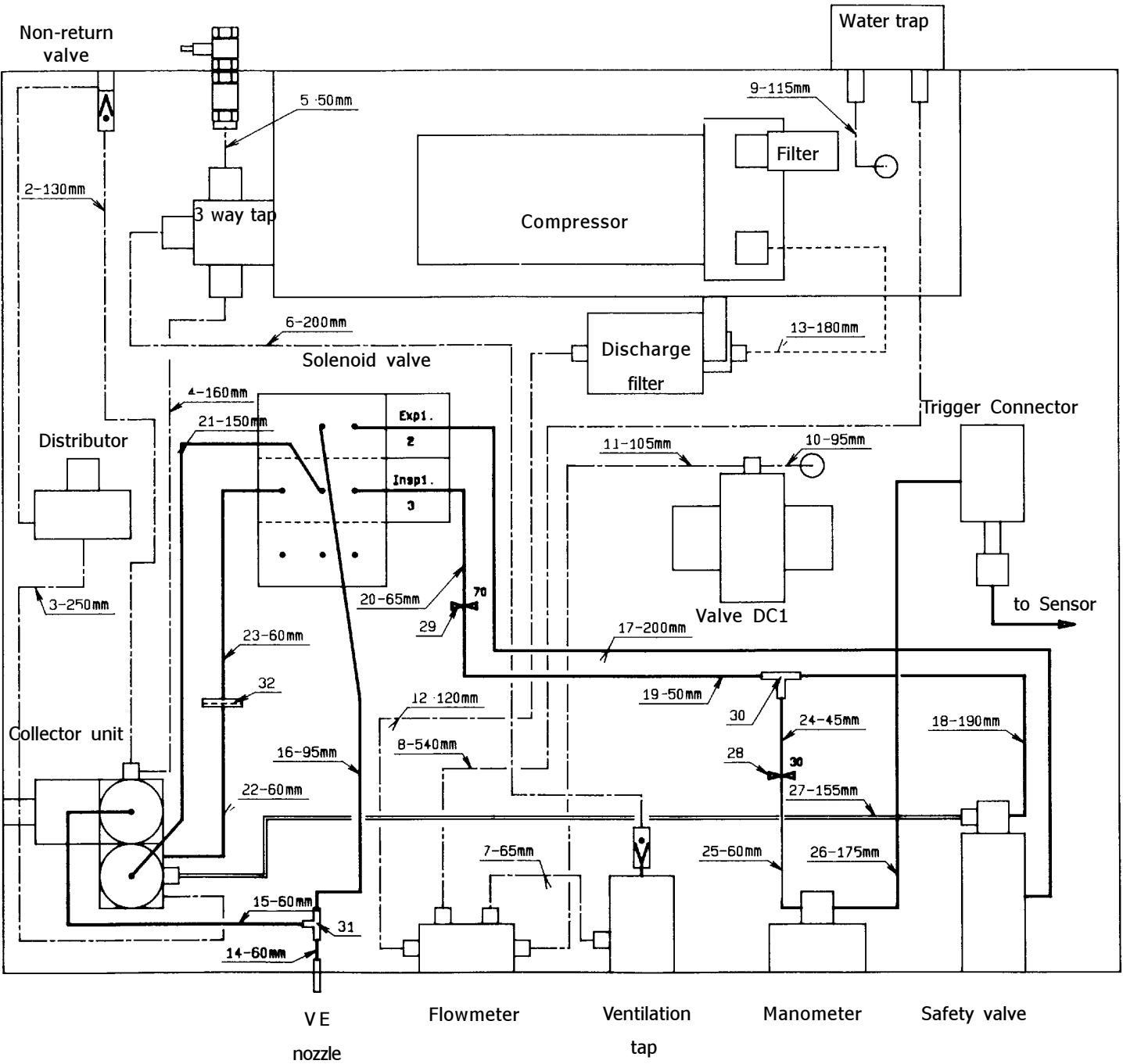
- Flat spanners: Size 7,8,10,12,14,21,and 26
- Test bag and circuit with nebulizer
- Syringe
- Special key for disassembling taps (See diagram below): YA003800



4.3.2 Measurement

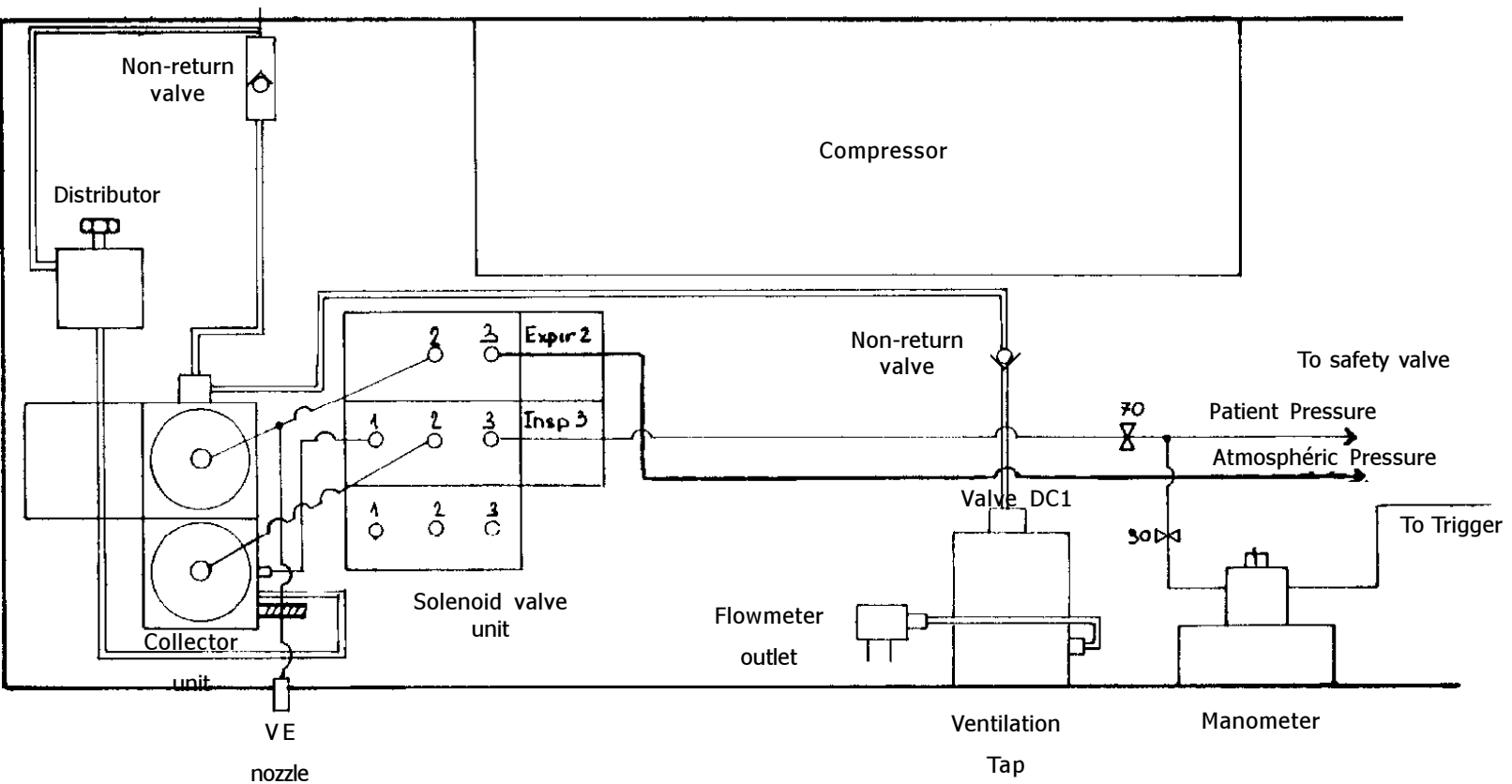
- Timeter RT200 (or equivalent)
or electronic flow meter FC 10
or failing that, a mechanical chronometer
- Mechanical chronometer
- Manometer 1.6 bar (class1)
- Manometer -20 to 100 mbar (class 1.6)
- Rotameter 3 to 30 l/min (air) (accuracy 1% full scale)

5.1 Pneumatic circuit diagrams



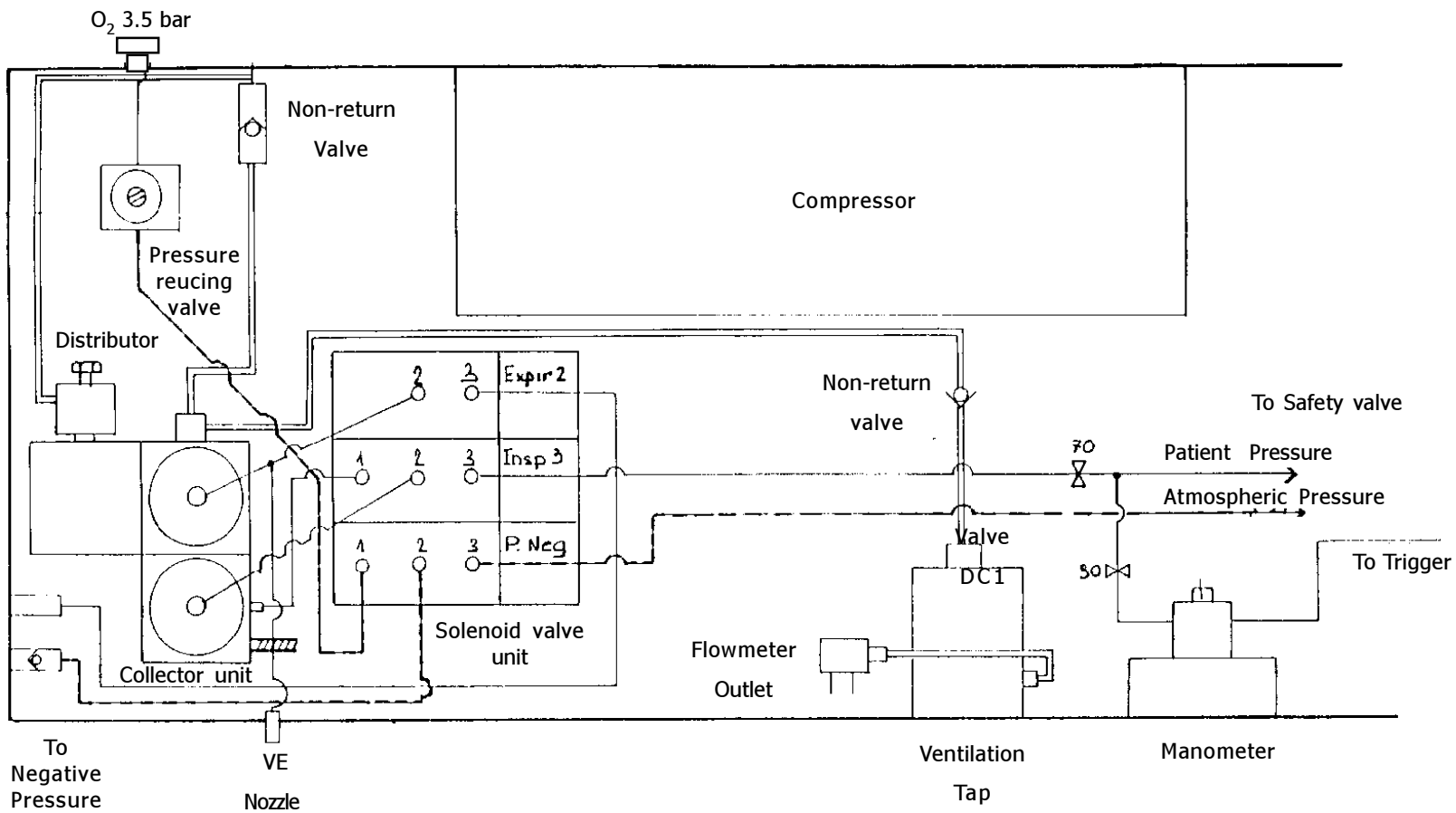
5 - DIAGRAMS

5.1.2 Pneumatic circuit for $551 \leq n^\circ < 1300$



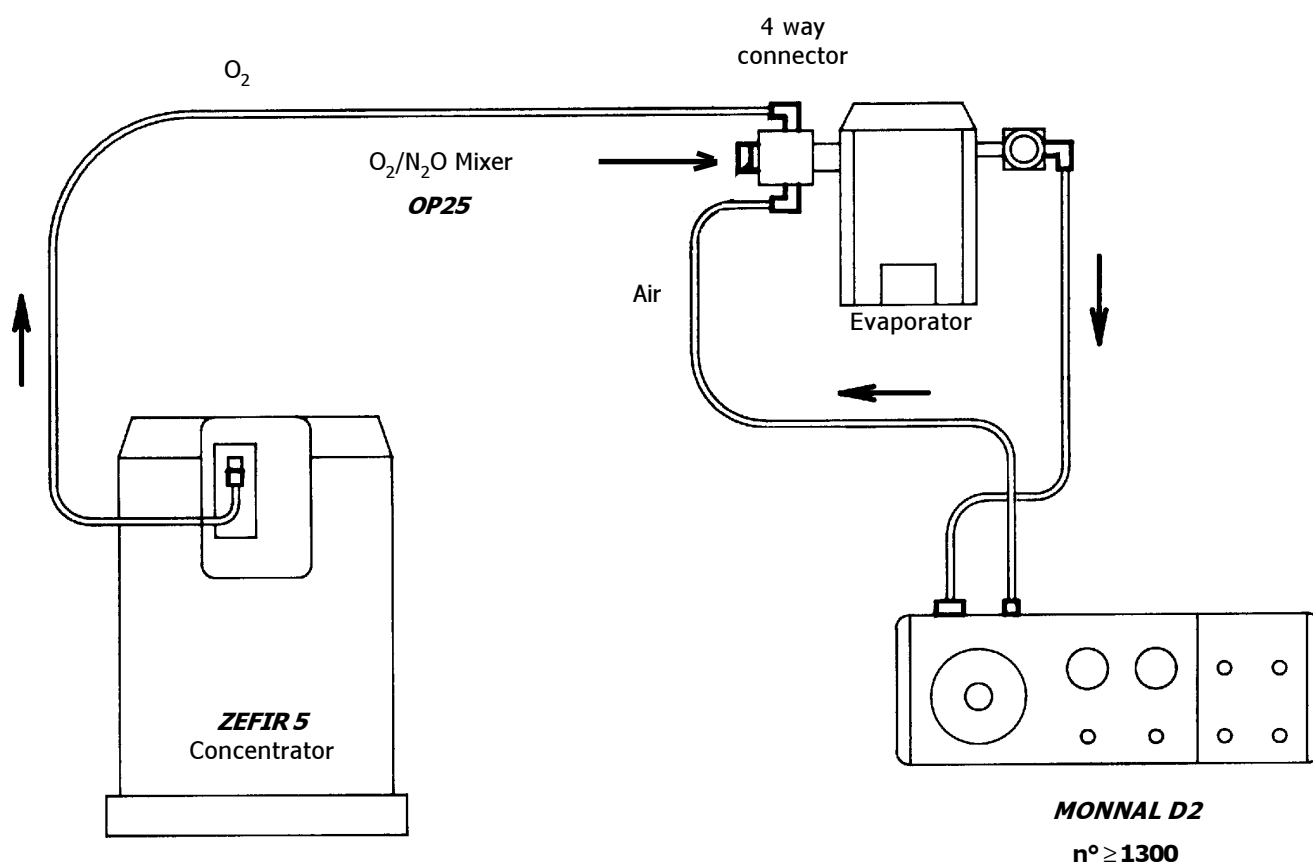
5 - DIAGRAMS

5.1.3 Pneumatic circuit for n° < 551



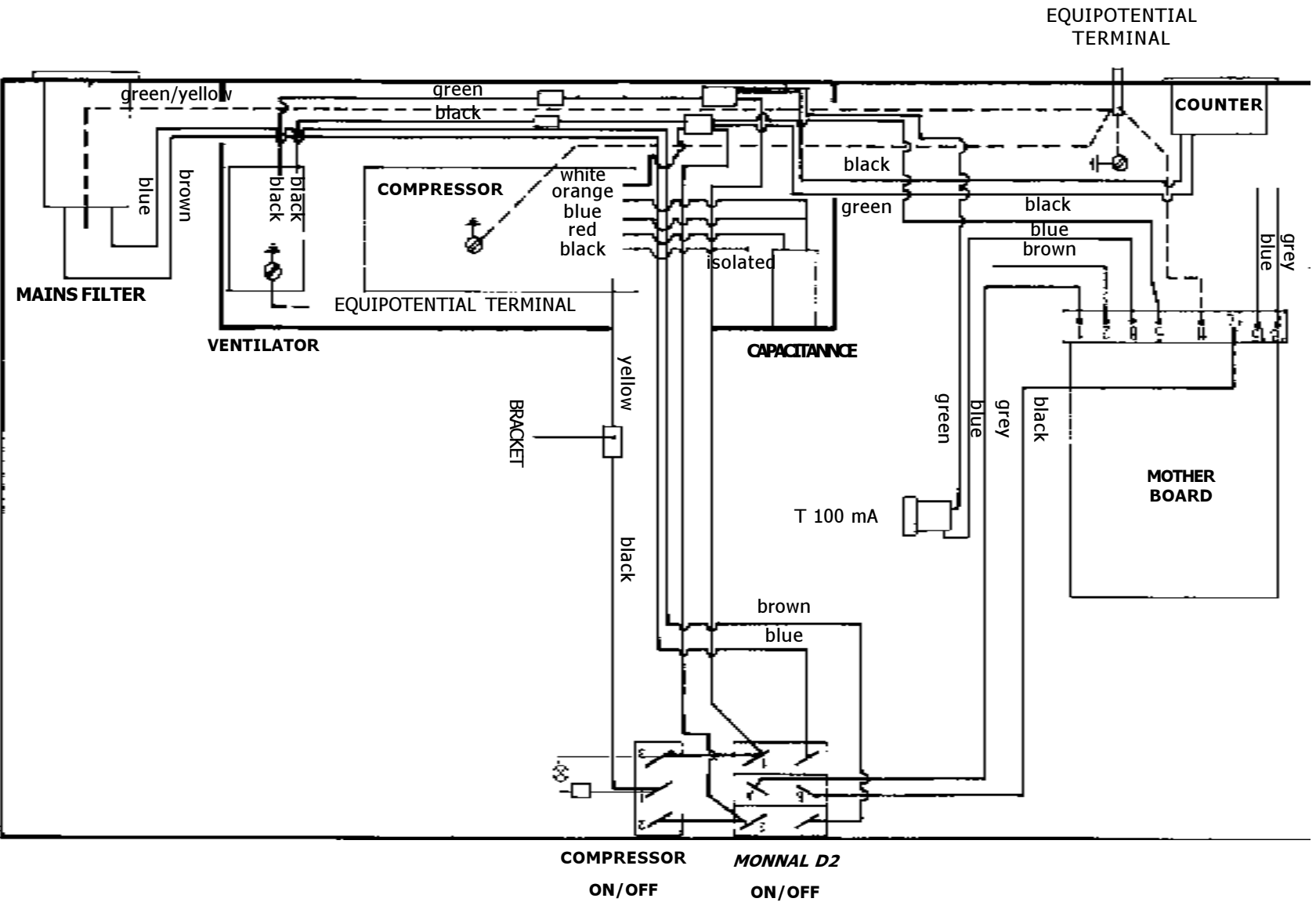
5 - DIAGRAMS

5.2 Pneumatic circuit for autonomous anaesthesia system



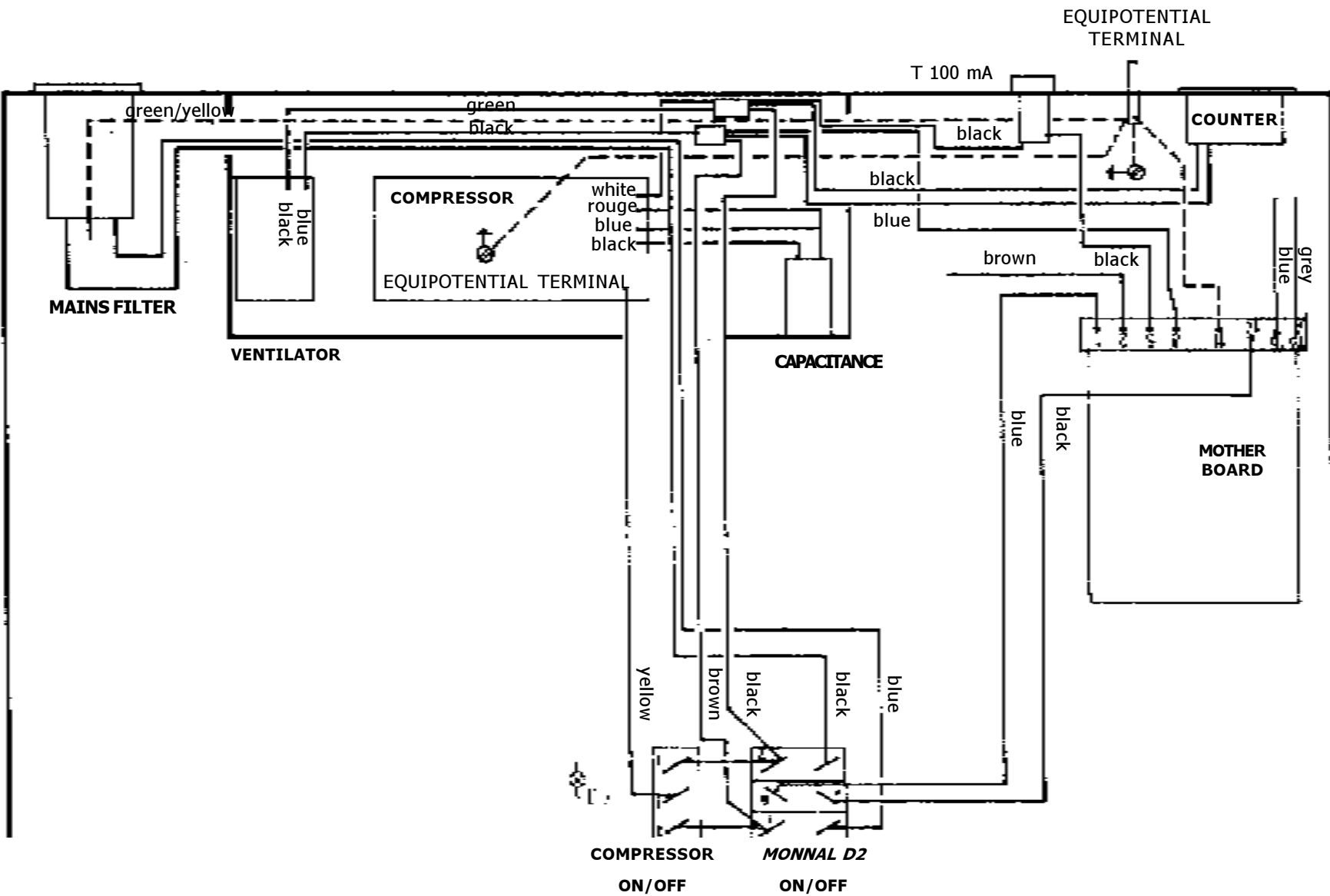
5 - DIAGRAMS

5.3 Electrical circuit diagrams



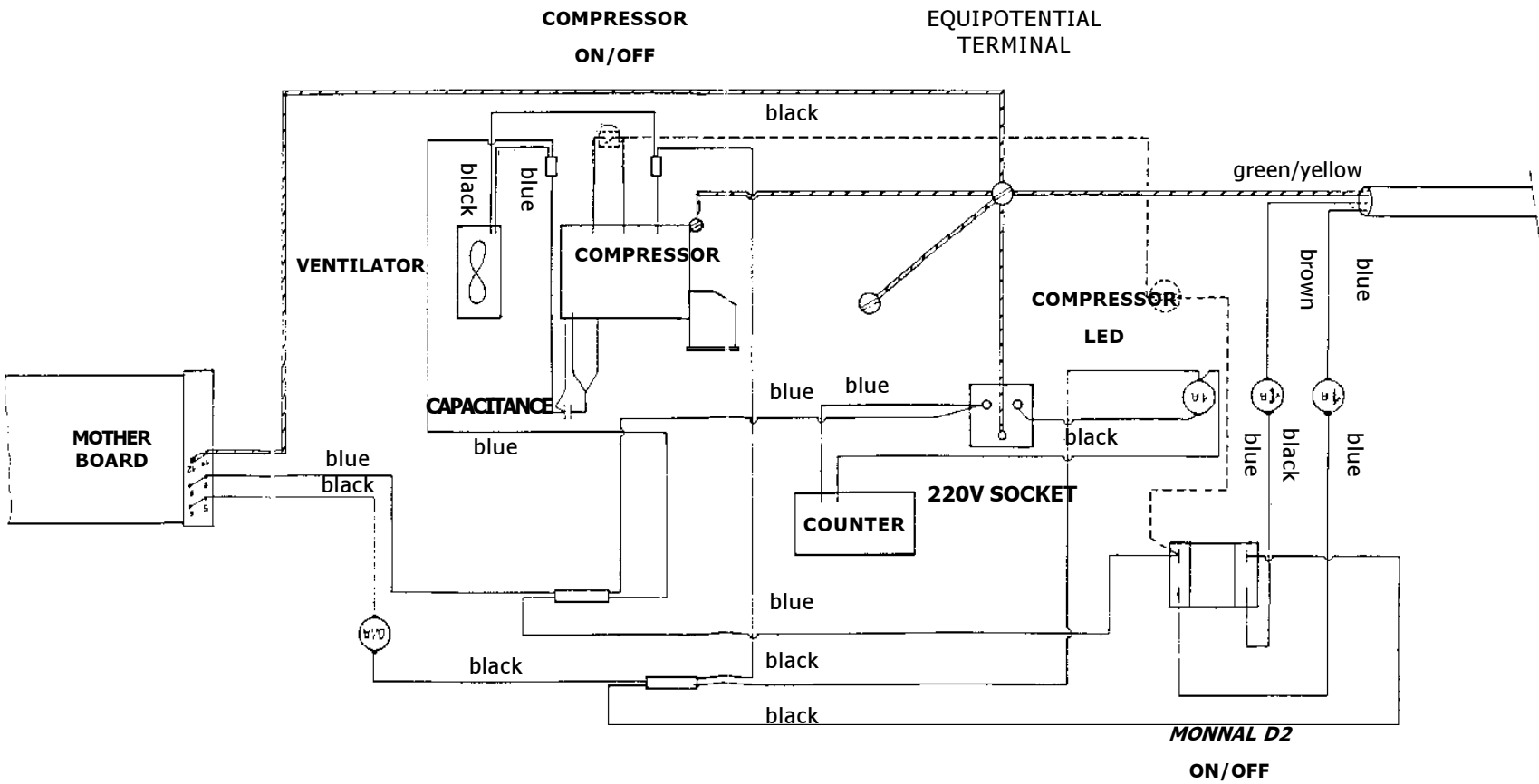
5.3.1 Electrical circuit n° ≥ 1300

5 - DIAGRAMS



5.3.2 Electrical circuit $650 \leq n^\circ < 1300$

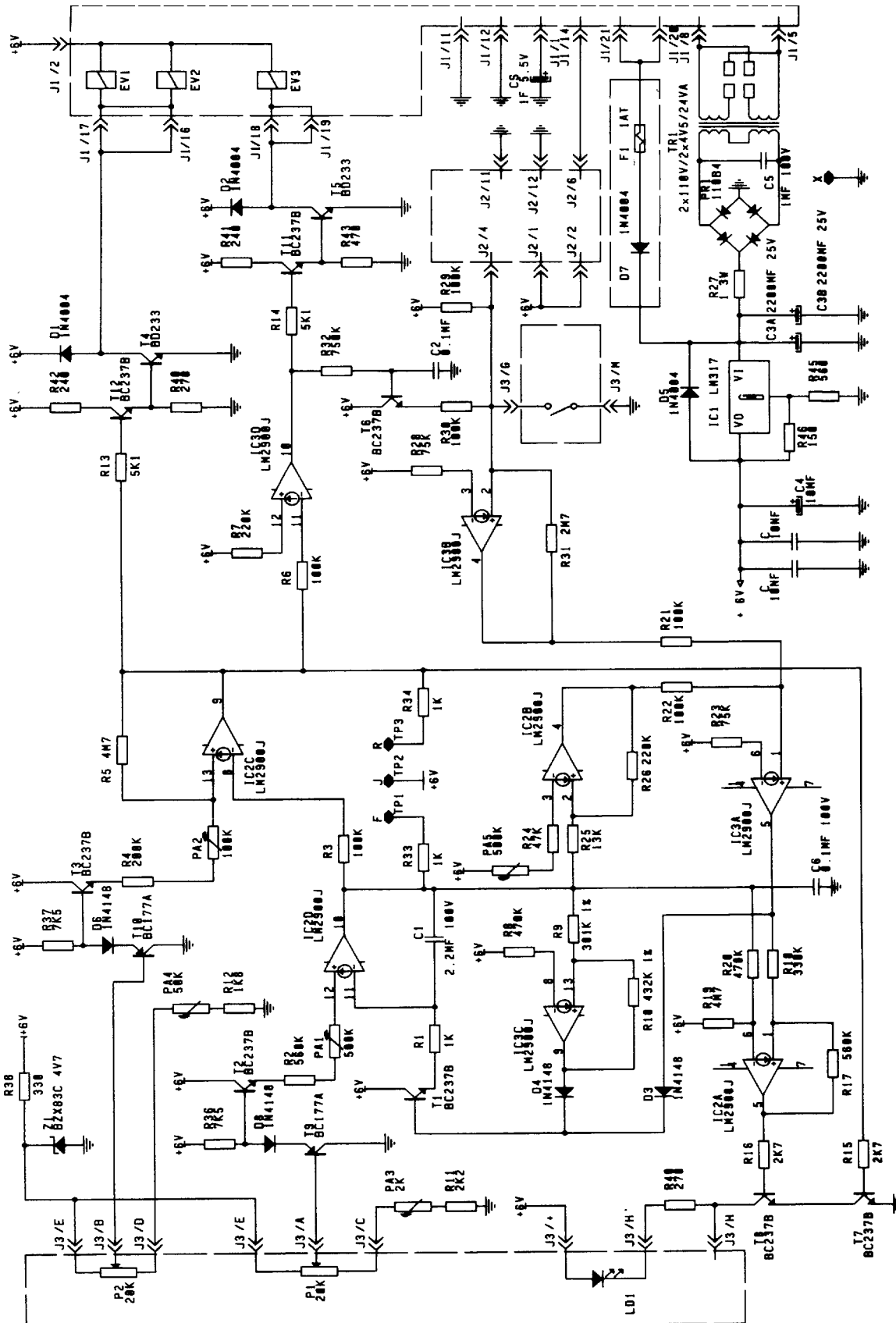
5 - DIAGRAMS



5.3.3 Electrical circuit n° < 650

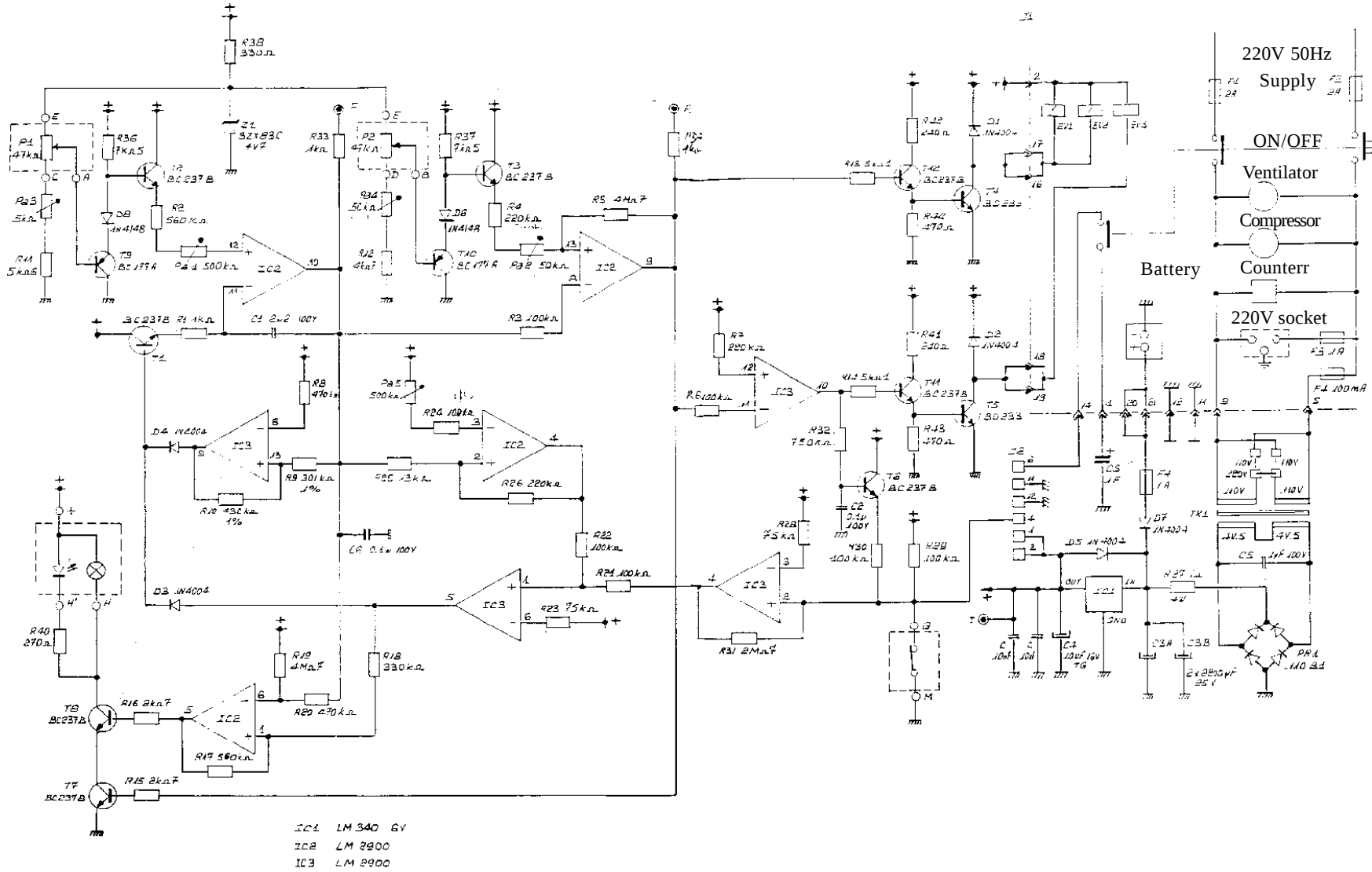
5 - DIAGRAMS

5.4 Skeleton diagrams of motherboards



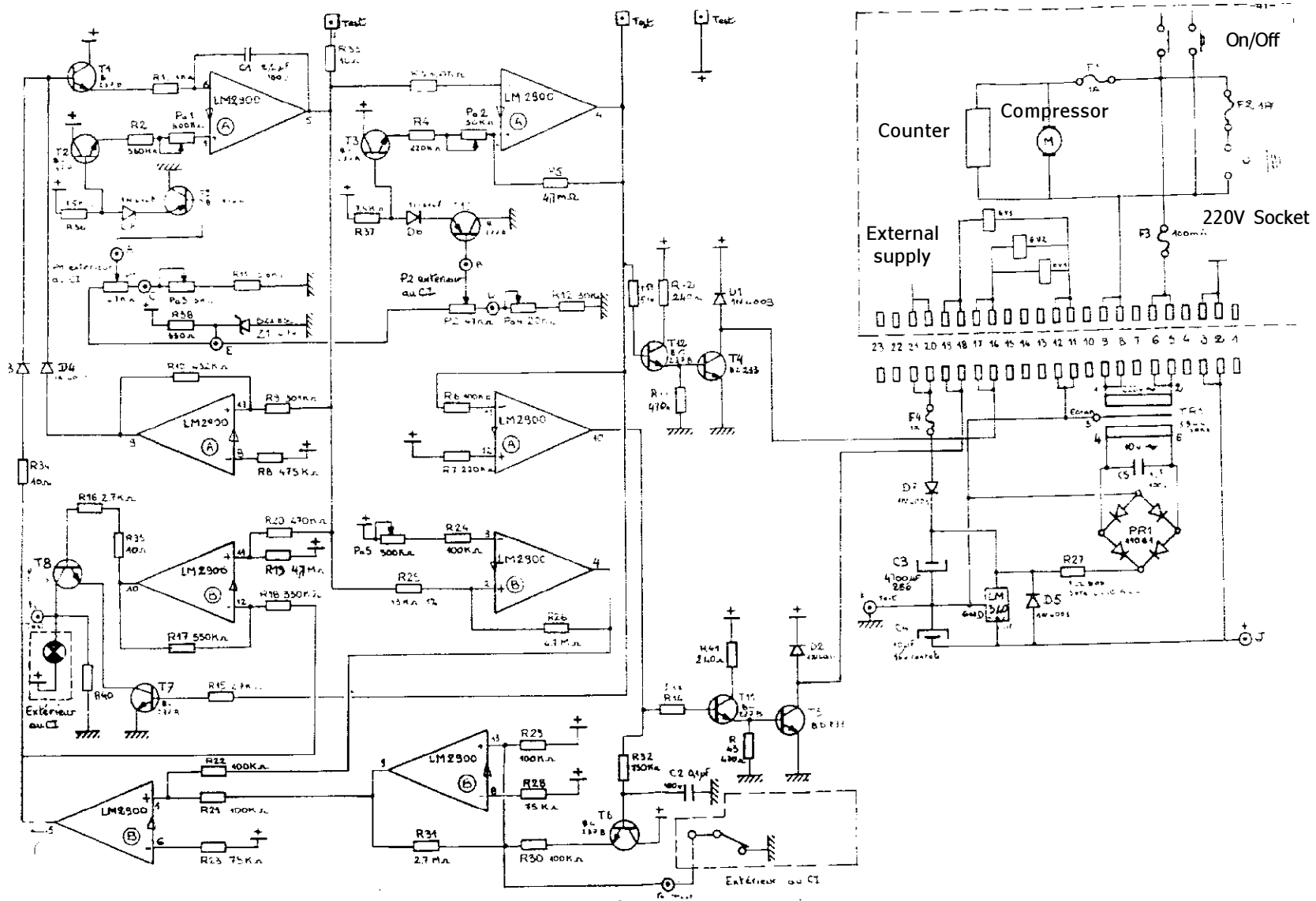
5.4.1 Motherboard n° ≥ 1300

5 - DIAGRAMS



5.4.2 Motherboard 650 ≤ n° < 1300

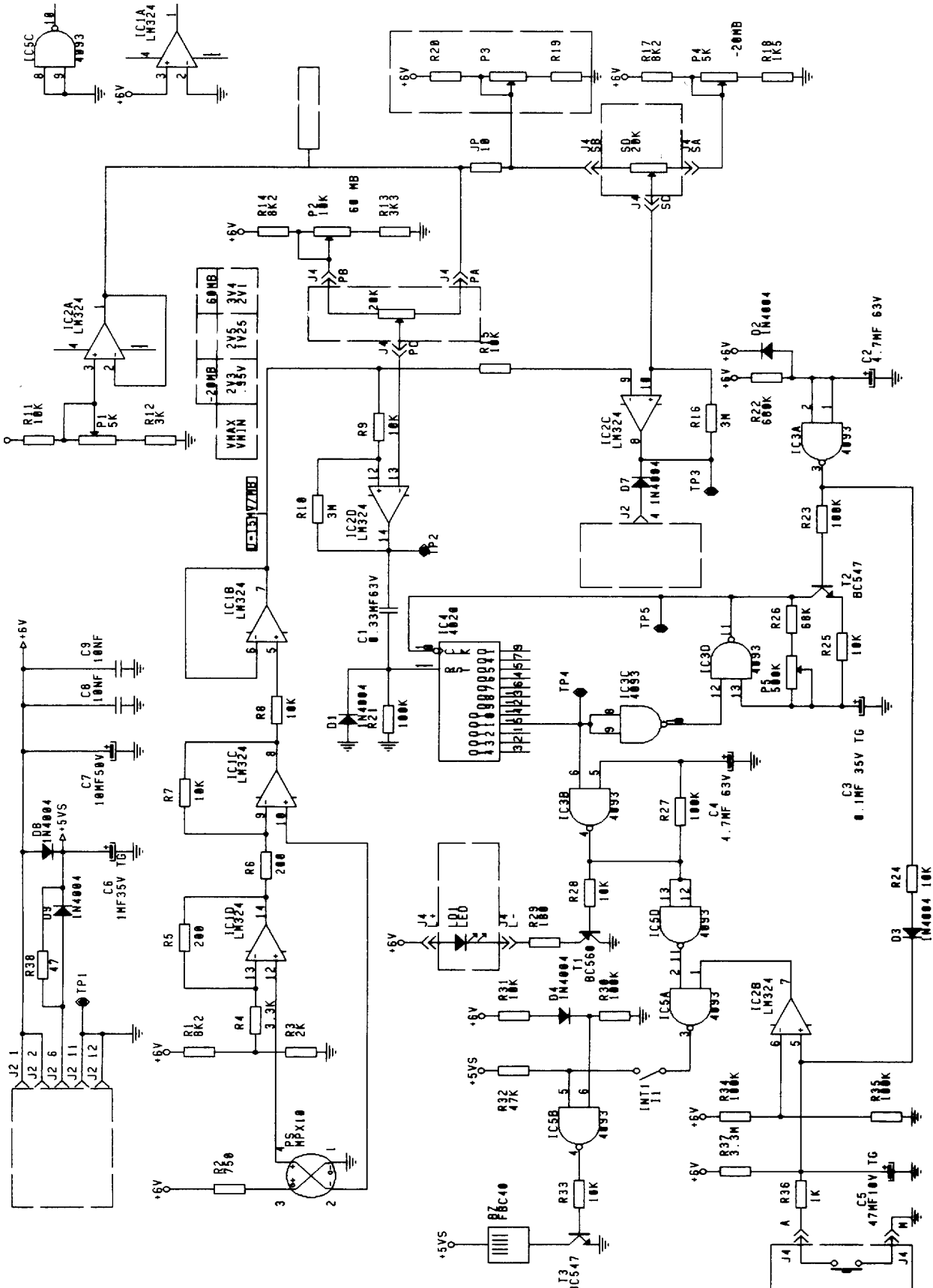
5 - DIAGRAMS



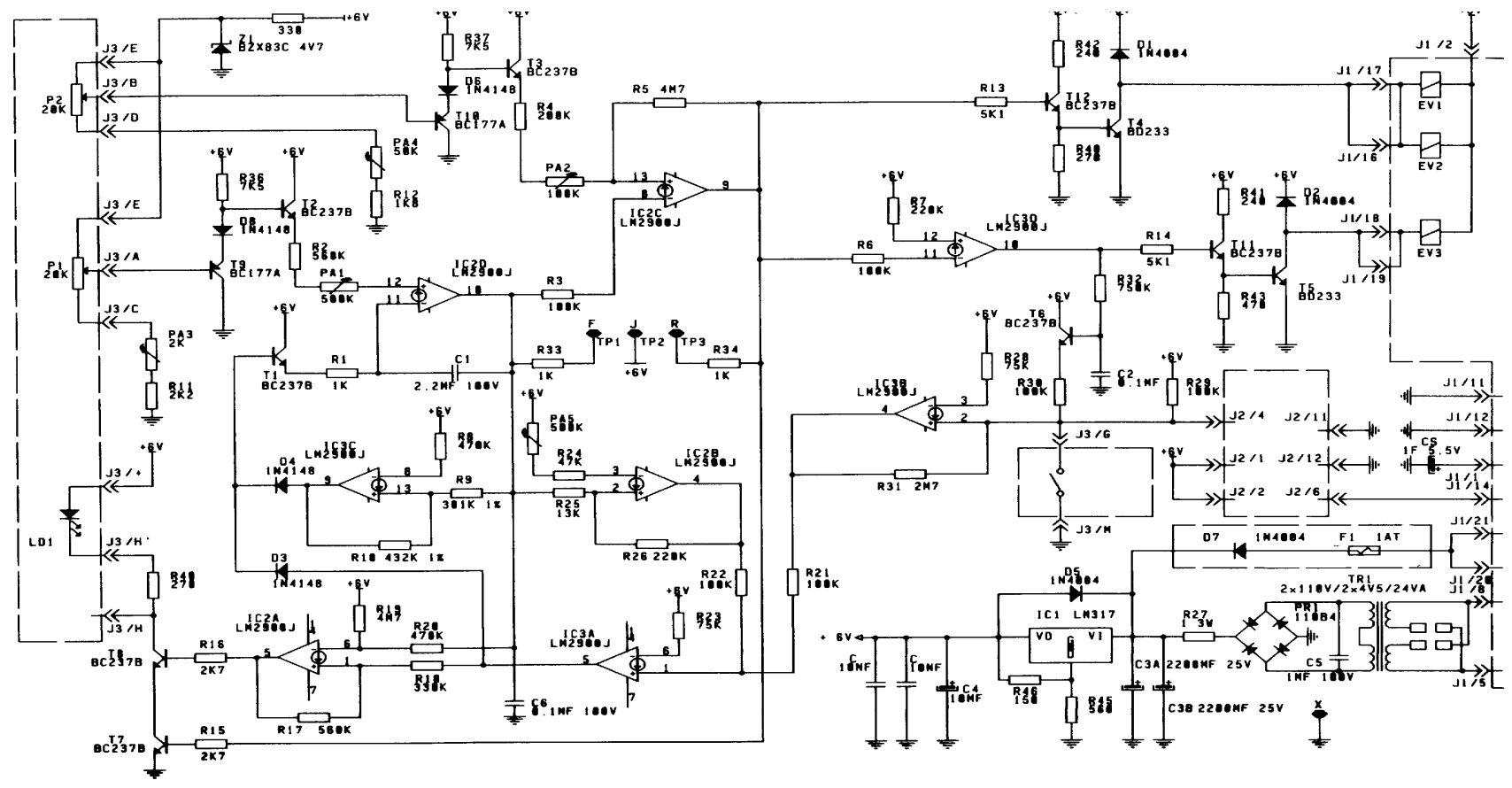
5.4.3 Motherboard n° < 650

5 - DIAGRAMS

5.5 Skeleton diagram of Pmin card for $n^{\circ} \geq 1300$

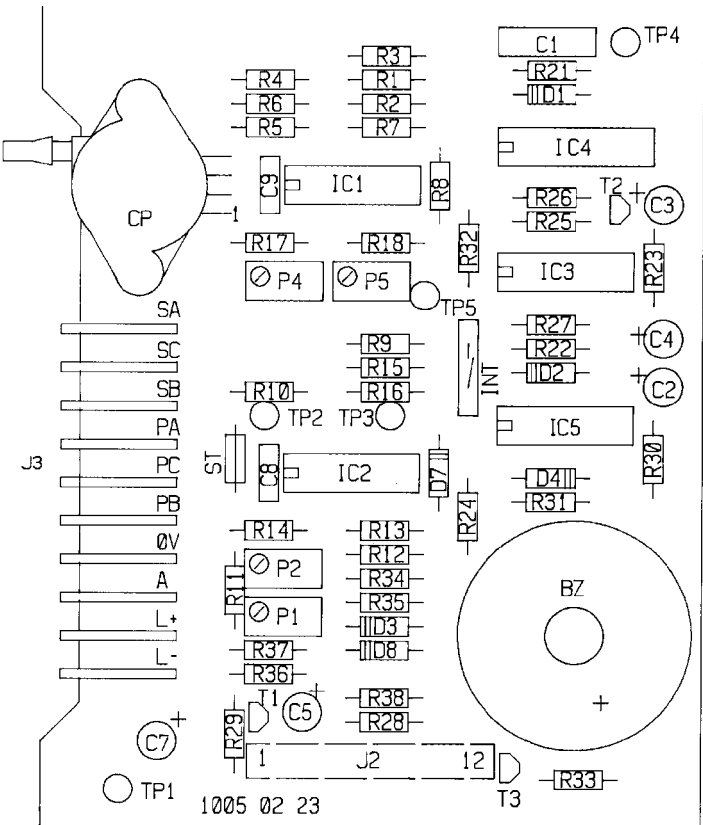


5 - DIAGRAMS



5.6 Layout diagram of components on motherboard for n° ≥ 1300

5 - DIAGRAMS



5.7 Layout diagram of components of Pmin card for n° ≥ 1300

6 - PARTS LIST

PARA.	ITEM	DESCRIPTION	CODE
		Descriptions located in § 3 - DESCRIPTION	
3.1	1	MONNAL COVER D AND R1	KY019400
3.1	2	ELECTRONIC UNIT WITH ALARMS	KY094300
3.1	2	ELECTRONIC UNIT MONNAL D/D2	KY354700
3.1	3-4	PNEUMATIC CONTROL BUTTON	KY281000
3.1	5	ON/OFF SWITCH FOR COMPRESSOR	KY094700
3.1	6	SWITCH LUMINUS 220V	KY092600
3.1	7,9,10,11	ELECTRONIC UNIT CONTROL BUTTON	KY281100
3.1	7,9,10,11	COVER W1 311	KY092900
3.1	12	HOOD AND LED PUSH BUTTON	KY093200
3.1	13	MD/MD2 BLUE PRESSURE GAUGE	KY002100
3.1	14	MD/MD2 AIR BLUE FLOWMETER	KY002200
3.1	15	HOUR METER	KY004800
3.1	16	TROPICALISATION WATER TRAP MONNAL D/D2	KY021600
3.1	20	2A FUSE(BOX OF 10)	KY006400
3.1	22	ANGLE CONNECTOR OUTLET WITH	KY088900
3.1	24	SUPPLY CABLE 3.50 M	KY003500
3.1	24	FEED-THROUGH SLEEVE FOR MONNAL	YR000700
3.1	25	RUBBER STPE OF TOOL-CHEST FOR	KY053000
3.1	28	CONNECTOR OF INTEGRATOR BALLON	KY021200
3.1	29	HOLDER OF ARTICULATED ARM FOR	KY082900
3.1	29	OLD STRAIGHT ARM SUPPORT FOR M D/D2	KY007700
3.1	30	SUPPORT FOR EXPIRATORY VALVE	KY099200
3.1	31	INTEGRATOR BALLON FOR MONNAL D	KY000600
3.2	1	COMPRESSOR NM	KY298300
3.2	3	DAMPER LXA 77 M/F TYPE C	KY091500
3.2	3	SILENT UNIT	KY002700

6 - PARTS LIST

PARA.	ITEM	DESCRIPTION	CODE
3.2	4	FILTER OF SQIZZER INLET FOR	KY298700
3.2	4	COMPLETE INLET FILTER, OLD MODEL	KY093900
3.2	6	COMPRESSOR PLATE	KZ503600
3.2	7	SINGLE FLANGE	KZ503700
3.3	0	OUTLET FILTER FOR COMPRESSOR	KY008500
3.3	3	BEIGE FOAM FILTER	KY019200
3.3	4	FELT FILTER WITH AIR INLET	KY019100
3.3	5	FILTER GASKET	KY001700
3.3	6	O-RING 35X2	YJ011600
3.3	7	CONNECTOR 280206 FOR MONNAL	KY072100
3.4	0	SAFETY VALVE DC1 FOR MONNAL D	KY010100
3.4	4	RING R10	YJ001000
3.4	6	O-RING 6.5X2	YJ010500
3.4	8	SPRING OF COMPRESSOR	KY072400
3.4	9	MEMBRANE OF INFERIOR SEAT TO	KY052400
3.4	12	VYON SILENCER FOR MONNAL D	KY002300
3.5	1	TAP OF VENTILATION FOR	KY008100
3.5	3	NON-RETURN VALVE FOR MONNAL NM	KY090500
3.5	5	CONNECTOR 280206 FOR MONNAL	KY071200
3.5	6	PNEUMATIC CONTROL BUTTON T 1-447	KY003600
3.5	7	CAP W1-401 FOR BUTTON T 1-447	KY003700
3.6	0	DISTRIBUTOR	KY147500
3.6	3	MEMBRANE OF DIVERSOR FOR	KY081700
3.7	4	INJECTOR WITHOUT NYLON SEAL	KY104500
3.7	5	NYLON GASKET10X14X1,5	YJ030300
3.7	9	SILICONE VALVE24X6,1x0,35	KY009200
3.7	17	O-RING 24X2	YJ011500
3.7	19	COVER OF COLLECTOR OF MONNAL	KY051200

6 - PARTS LIST

PARA.	ITEM	DESCRIPTION	CODE
3.7	20	WASHER 50 SHORE D33	KY005200
3.7	22	DIAPHRAGM WITH BOLT SET OF 2	KY098000
3.8	1	MONNAL COVER	KY019400
3.8	3	CONNECTOR77109	KY010500
3.8	4	MAIN BACTERIOLOGICAL FILTER	KY000300
3.8	5	ASSEMBLY OF SAFETY VALVE P.N.	KY039700
3.9	0	SAFETY VALVE	KY037600
3.9	6	RING R1	YJ000100
3.10	0	NON-RETURN VALVE FOR MONNAL NM	KY090500
3.10	3	NON-RETURN VALVE	KY097000
3.10	3	NON-RETURN VALVE OLD MODEL	KY004000
3.11	0	CONNECTOR OF INTEGRAL BALLON	KY021200
3.11	1	O-RING 16X2	YJ010200
3.11	2	O-RING 24x2	YJ011500
3.12	2	O-RING 6.5X2	YJ010500

6 - PARTS LIST

PARA.	ITEM	DESCRIPTION	CODE
		Other descriptions not located (tri alphanumeric)	
		CABLE CLIP 100X25	YR000500
		RING R16	YJ001600
		RING R5	YJ000500
		RING R7	YJ000700
		COMPLETE ELECTROVALVE 3 BLOCKS	KY004400
		SENSOR OF PRESSURE FOR MONNAL	KY093100
		CIRCLIPS EXT. FOR SHAFT D-6 TYPE 7100	KY005300
		CIRCLIPS EXT. FOR SHAFT D-8 TYPE 7122	KY005400
		DISASSEMBLY SPANNER FOR MONNAL D TAP	YA003800
		FILTER BOX HOLDER	KY237700
		CONDENSER 6.3V 1F	YR023700
		CONNECTOR TRIPLE 50 1280	KY125400
		BODY LS 9 FOR LED, MONNAL D/D2	KY005700
		HOUSING NUT	YV085200
		NUT OF DIAPHRAGM	KY075600
		SOLENOID VALVE 5-5V 1-5W	KY007300
		SOLENOID VALVE FILTER FOR MONNAL	KY015500
		FUSE 1A FFS (5X20)	KY001800
		FUSE 100 MA TFS (5X20) X10	KY001900
		NYLON SEAL	YJ033700
		O-RING	YJ014500
		SKIRT W7 321	KY134000
		MIDGET LAMP 6V 40 mA 528 E TRIGGER AM	KY002600
		POTENTIOMETER	KY097700
		UNION CONNECTOR DIAMETER 0.3	KY069200

6 - PARTS LIST

PARA.	ITEM	DESCRIPTION	CODE
		VALVE WASHER, NEOPRENE	KY004200
		VALVE WASHER, FLAT 7780	KY003900
		HEAD OF FUSE HOLDER	YR016800
		MOVABLE BUTTON ROD	KY007800
		TRANSFORMER FOR MONNAL D	KY006100
		SILICONE TUBE 5X8 FOR PRESSURE PORT	YB002400
		FLEXIBLE CLEAR TUBE 3X5	YB002500
		BLUE RILSAN TUBE, BY METRE	YB003400
		SILICONE TUBE 3X5	YB002800
		SILICONE TUBE 3X6 EXPIRATORY VALVE CONTROL	YB002300
		VENTILATOR FOR MONNAL D ET D2	KY038100
		<i>N.B.: For unlisted parts contact:</i> Taema - Direction des Services Clients Parc de Haute Technologie 6, rue Georges Besse - CE80 F-92182 ANTONY CEDEX FRANCE Tel.: +33(0)1 40 96 66 88 Fax.: +33(0)1 40 96 66 21	

7 - APPENDICES

RETURN TO SERVICE SHEET MONNAL D2 1st level

Maintenance: commissioning 0

600 hours 0

Serial N°

No. H

WORK DOCUMENT N°

STAGE	DETAIL (according to maintenance manual)	VALUE OR ⊕
COMPRESSOR OPERATION CHECK		
1	Compressor start-up	0
	Compressor stop	0
TEST BAG TEST		
2	Coherence of parameters:	
	Breathing rate	0
	I/E ratio	0
	Ventilatory flow (if spirometer available)	0
PATIENT SAFETY VALVE TEST		
3	Valve setting value	
	Valve operation	0
TRIGGER SENSITIVITY TEST		
4	SD = 0 mbar, Test bag disconnected: No self-triggering	0
	SD = -10 mbar, Pressure drop on connected test bag > -10 mbar:	
	Triggering of an inspiratory phase	0
ALARMS TEST		
5	Disconnection alarm (Pmin)	0
	Triggering time limit	0
	Alarm disabling	0
	Mains power cut alarm	0

Returned to service on:

by:

Technician's stamp/signature:

7 - APPENDICES

RETURN TO SERVICE SHEET MONNAL D2 2nd level

Maintenance: 1500 hours (or annual) 0
5000 hours 0

Serial N°

No H

WORK DOCUMENT N°

ETAPE	DETAIL (according to maintenance manual)	VALUE OR ⊕
COMPRESSOR TEST (l/min)		
1	Accuracy : +/- 1 l/min Counter-pressure = 0 mbar Counter-pressure = 550 mbar	
VALVE DC1 TEST (mbar)		
2	Accuracy: +/- 50 mbar 0 l/min P < 600 mbar 15 l/min P = 550 mbar 20 l/min P > 500 mbar	0 0 0
VALVES TEST		
3	Accuracy: +/- 2 mbar Bag valve 105 < P < 115 Safety valve P > 80 then adjustable internal seal	0 0 0
NON-RETURN VALVE TIGHTNESS TEST		
4	Leak towards gas inlet < 0.1 l/min	0
DISTRIBUTOR TEST		
5	Accuracy : +/- 5 mbar Pressure for 10 l/min: 170 mbar	0
FLOW TESTS (l/min) q		
6	0 l/min q = 0 5 l/min 3.5 < q < 6 10 l/min 9 < q < 11 15 l/min 14 < q < 16 20 l/min 18 < q < 20	
ELECTRONICS TESTS		
7	Breathing rate 8 c/min 20 c/min 40 c/min I/E ratio 1/1 1/2 1/3 Trigger sensitivity (SD/TS) -10 mbar	0 0 0 0 0 0 0
ALARMS TEST		
8	Disconnection alarm (Pmin) 20 mbar Trigger time limit 10 s +/- 1 s Alarm disable 1 min 45 s +/- 15 s Mains power cut alarm	0 0 0 0

Returned to service on:

by:

Technician's stamp or signature: