OPERATING MANUAL

Romulus® 800 Anaesthetic Apparatus

BA 5122.10e

A 14

From Dräger:
Romulus® 800/800 V/800 M/800 MV

OPERATING INSTRUCTIONS

Important Notice

For correct and effective use of the device, and to avoid hazards, we would point out the following:

1 **Any use of the device** requires precise knowledge and observation of these operating instructions.

2 The device is intended only for the purposes specified in the Operating Manual or for purposes confirmed in writing by Drägerwerk AG.

3 The device should be inspected by experts at regular time intervals. An official report of the inspections should be drawn up.

4 Only original Dräger spare parts should be used for maintenance and repairs. Repairs and maintenance, and the replacement of spare parts should only be carried out by experts.

5 We recommend having inspections and repair work carried out by the Technical Customer Service of your Dräger Branch or Agent.

Regular inspection is best ensured by entering into an Inspection Service Contract with the Technical Customer Service of your Dräger Branch or Agent.

6 Responsibility for the reliable function of the device passes to the owner or operator in all cases where the device has been inexpertly maintained or repaired by persons not employed by the Dräger Organization or where it has been used in a manner which does not conform to the normal conditions of use.

7 For reasons of safety, pressure reducers should be overhauled at least every 6 years.

We would also point out that the national recommendations, regulations and laws governing the use of technical equipment should be observed.

DRÄGERWERK AG LÜBECK

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Applicable model designation: .....
(see plate on front of device)

Fabrication No.: .....
(next to model designation)

Explanation of model designations

Romulus Model	Gas blending by means of	Ventilator Ventilog®	Remarks
800	Flowmeter unit[1]	Attachment possible	
800 V	Flowmeter unit[1]	Integrated	
800 M	Gas blender[2]	Attachment possible	
800 MV	Gas blender[2]	Integrated	
800 »Air«[3]	Flowmeter unit[1]; operation with third gas, namely air; can be switched to mixture of O_2/N_2O or O_2/air	Attachment possible	For additional operating notes: see Section 11
800 V »Air«[3]		Integrated	

[1] Setting of gas flows in L/min
[2] Setting of desired O_2 concentration in vol. %
[3] The term »Air« denotes the Romulus 800/800 V models with ancillary compressed-air unit (see Section 11 on page 19)

1 Intended Use

1.1 Applications

The Romulus 800, Romulus 800 M and Romulus 800 »Air« models are inhalation anaesthesia machines with a continuous fresh-gas flow.

The Romulus 800 V, Romulus 800 MV and Romulus 800 V »Air« models are additionally fitted with a removable automatic anaesthesia lung ventilator (Ventilog).

All models are compact, mobile machines designed for inhalation anaesthesia; they can be used in operating theatres, induction rooms and wake-up rooms.

1.2 Notes on safety

Because of the danger of explosion, never grease or oil valves on oxygen cylinders and pressure reducers for oxygen or touch them with greasy fingers.

Oxygen cylinders must not be stored together with readily flammable materials. Filled steel cylinders must not be exposed to direct sunlight or stored in the immediate vicinity of a radiator.

Valve handwheels must only be turned by hand. Never use tools!

The cylinder valves are precision parts which can easily be damaged if undue force is applied. Valves which leak and/or do not move easily must be repaired in a workmanlike manner.

Knurled connections are only intended for manual operation.

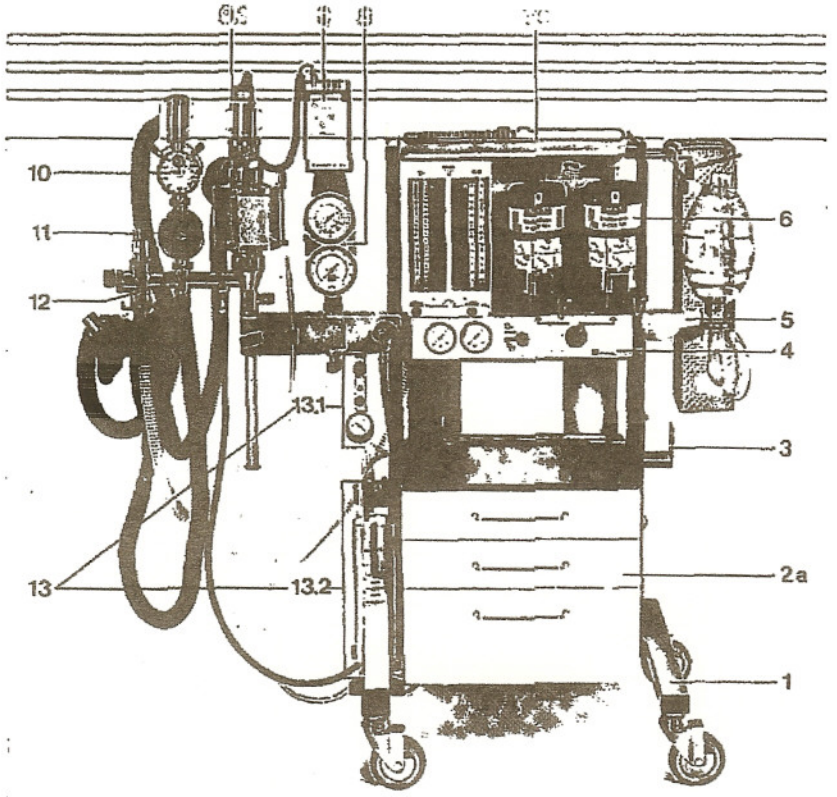

Fig. 1 Romulus 800

Key to Figs. 1 and 2

1 Trolley
2a Cabinet 8 H
2b Cabinet 4 H
3 Hose holder
4 Instrument housing
5 Retaining arm for Pulmomat 19 or 19.K1
6[1] Vapor 19.1
7a Depositing tray 1 B
7b Depositing tray 0.5 B
8 Sphygmomanometer/anaesthesia timer combination
9[1] Oxycom® 100 D O_2 meter and monitor
9.1 O_2 sensor for Oxycom 100 D
10[1] Minute Volumeter® 3000
11[1] Precom® (airway pressure gauge with alarm)
12[1] Circle system 7a/8 ISO
13[1] Secretion aspirator, comprising
13.1 – drive (in illustration: vacuum drive)
13.2 – cylinder battery

14[1] Ventilog® anaesthesia lung ventilator
14.1 Pneumatic switching valve for Ventilog
15[1] Barolog® A (airway pressure monitor)
15.1 Barolog measurement connection
16 Base plate 0.5 B

[1] Device or accessory with own operating manual

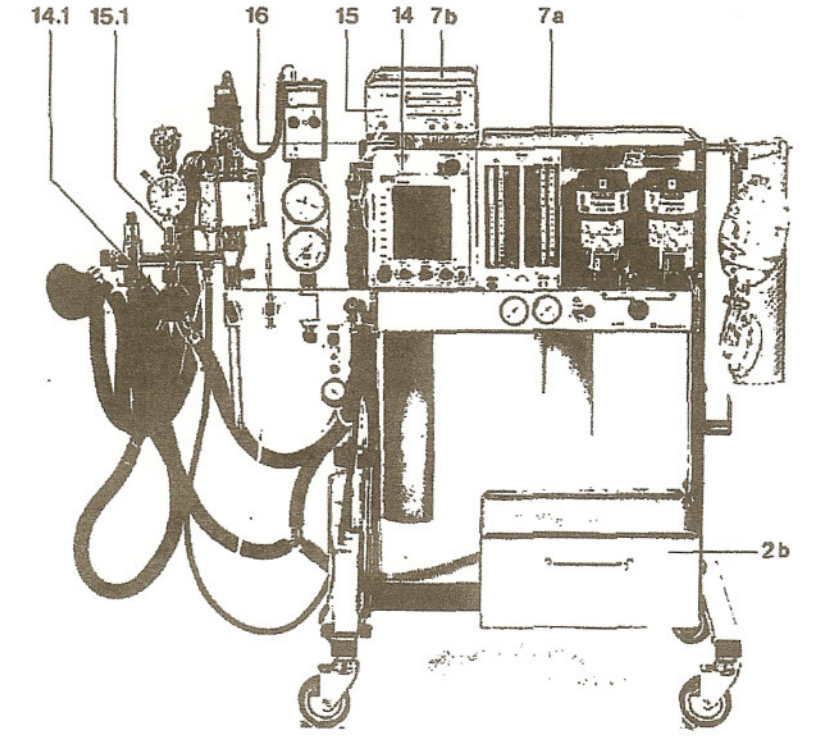

Fig. 2 Romulus 800 V with integrated Ventilog

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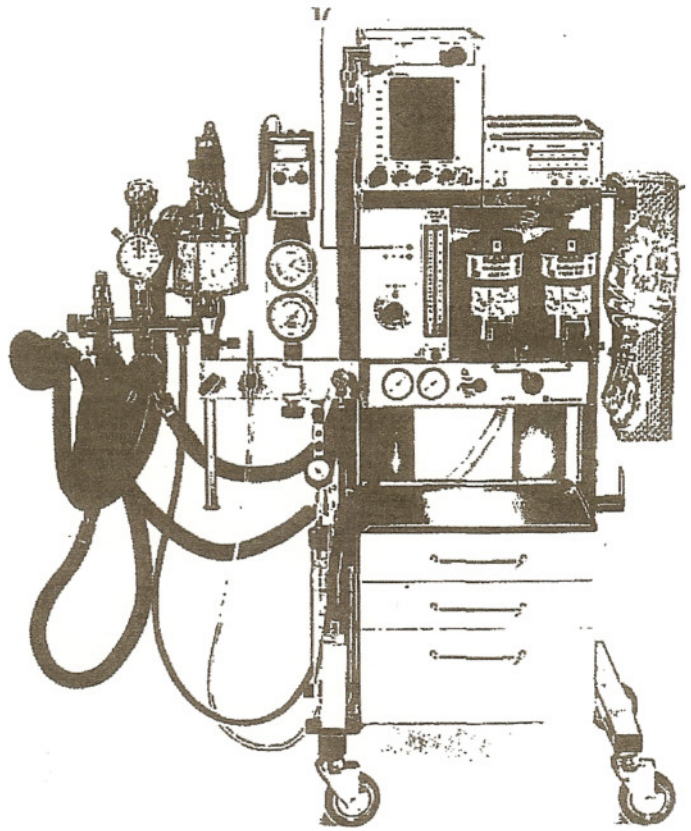

Fig. 3 Romulus 800 M with blender; Ventilog additionally latched on

Key to Figs. 3 and 4

17 Blender

18 Writing surface
19 Catheter basket
20 Bag for manual ventilation
21[1] Spirolog® 1 N (tidal volume monitor)
22[1] Microbe filter (in inspiration branch)

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[1] *Device or accessory with own operating manual*

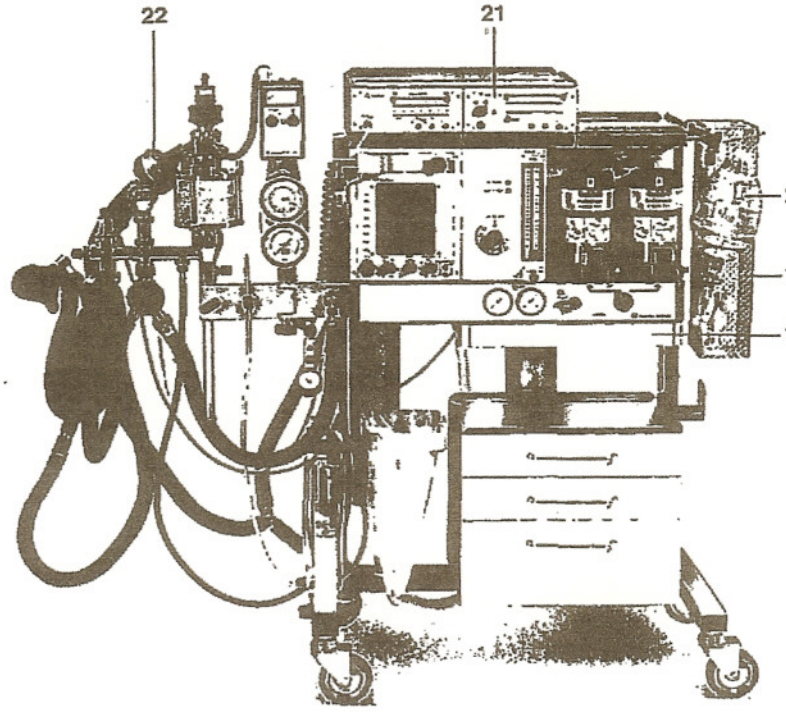
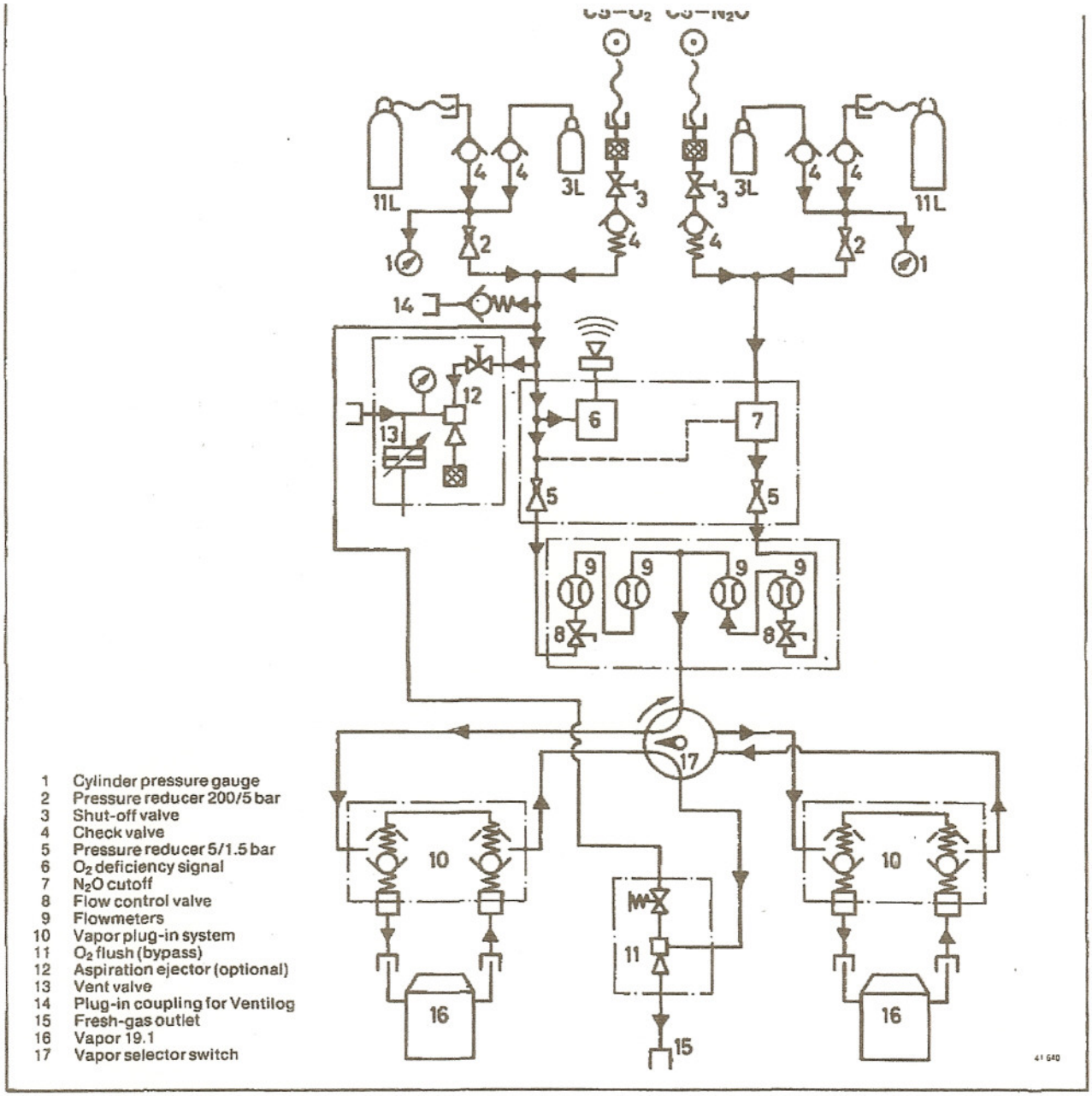


Fig. 4 Romulus 800 MV with blender and integrated Ventilog



1 Cylinder pressure gauge
2 Pressure reducer 200/5 bar
3 Shut-off valve
4 Check valve
5 Pressure reducer 5/1.5 bar
6 O_2 deficiency signal
7 N_2O cutoff
8 Flow control valve
9 Flowmeters
10 Vapor plug-in system
11 O_2 flush (bypass)
12 Aspiration ejector (optional)
13 Vent valve
14 Plug-in coupling for Ventilog
15 Fresh-gas outlet
16 Vapor 19.1
17 Vapor selector switch

41 640

Fig. 5 Functional schematic of Romulus 800/800 V

2
Design and Function

The numbers indicated in this section **refer only to the** functional schematics in Figs. 5 and 6.

All Romulus 800 models are operated **with oxygen and nitrous** oxide. Supply **can either be effected** from a central gas **supply unit (referred to** in the following **as CS) or from gas cylinders.** In the case **of CS operation the** shut-off valves **3 must be opened. When** using gas cylinders, **the cylinder pressure** is indicated **on the pressure** gauges 1 and reduced **in the pressure** reducers 2 to 5 bar. The check valves 4 prevent overflow from one gas cylinder to another or from the cylinders into the CS.

The oxygen pressure (see Fig. 5 for Romulus 800/800 V) is monitored by the O_2 deficiency signal 6 which gives an audible alarm if the O_2 pressure drops to below 2 bar. Should the pressure continue to fall, the N_2O supply is interrupted by the N_2O cutoff 7.

With the Romulus 800 M/800 MV models (Fig. 6) the N_2O cutoff is integrated into the blender 7a. The O_2 and N_2O pressure is monitored by the O_2/N_2O deficiency signal 6a; if the O_2 or N_2O pressure drops below 2 bar, an audible alarm is given. The indicator 18 shows which gas has failed.

The pressure reducers 5 (Romulus 800/800 V, Fig. 5) reduce the oxygen and nitrous-oxide pressure to 1.5 bar.

The flow control valves 8 make it possible to meter the two gas flows. The flow rates can be read off in each case from two series-connected flowmeters 9 of the flowmeter unit. The two gases are routed together and passed to the Vapor selector switch 17.

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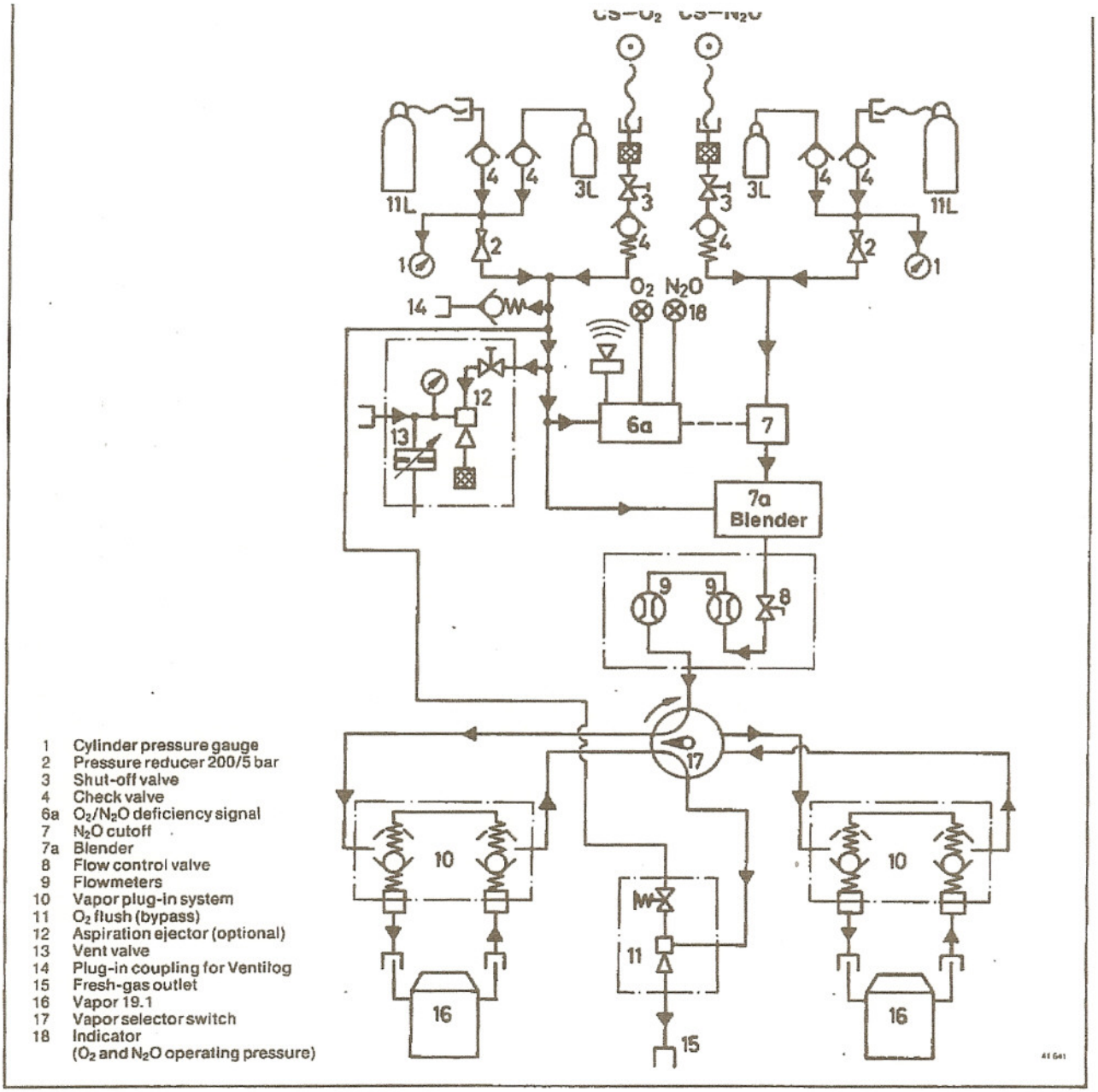

Fig. 6 Functional schematic of Romulus 800 M/800 MV

With the Romulus 800 M/800 MV (Fig. 6) the O_2 and N_2O are mixed in the blender 7a. The mixed gas is metered using the flow control valve 8 and the flow rate can be read off from two series-connected flowmeters 9 of the flowmeter unit. The mixed gas then flows to the Vapor selector switch 17.

The selector switch 17 makes it possible to switch either the right-hand or left-hand Vapor into the mixed-gas flow for metering in the desired anaesthetic. Both Vapors 16 are connected by way of plug-in systems 10 thus permitting rapid replacement. Gas can flow from the flowmeter unit to the fresh-gas outlet 15 even when no Vapor is connected.

The O_2 flush 11 enables an O_2 flow of roughly 55 L/min (depending on CS pressure) to be added to the mixed gas without affecting the pressure ratios (ejector system). The lever of the O_2 flush resets automatically.

The aspiration ejector 12 (if fitted) serves to generate a vacuum for operating the secretion aspirator. The vacuum (max. −0.9 bar) can be reduced by way of the vent valve 13.

The self-closing plug-in coupling 14 is used to drive a Ventilog anaesthesia lung ventilator with oxygen.

Alarm and Safety Devices

3.1 O_2 deficiency signal, N_2O cutoff

All Romulus 800 models are fitted with an O_2 deficiency signal and an N_2O cutoff. The 800 M/800 MV models have an additional N_2O deficiency signal.

The O_2 deficiency signal (with the 800 M/800 MV models also the N_2O deficiency signal) is designed such that an audible alarm, which cannot be reset, is given if a minimum supply pressure is dropped below.

The possible gas supply statuses are listed for all models (with the exception of Romulus 800 »Air«/800 V »Air« which are discussed in Section 11.2) in Table 1.

Explanatory notes on Table 1

A Normal operation

Oxygen and nitrous oxide are available at the prescribed pressure (see Technical Data). The O_2 deficiency signal and the nitrous-oxide cutoff are ready for operation.

Should the O_2 supply pressure drop below 2 bar, the audible O_2 deficiency alarm sounds for at least 7 seconds[1]. If the O_2 pressure drops below roughly 1.4 bar, the N_2O supply is reduced – until cutoff is effected – such that the pre-selected O_2 concentration is not dropped below (flow reduction). The N_2O supply is blocked completely at an O_2 pressure of ≤ 0.4 bar.

[1] The anaesthetic apparatus must have been connected for at least 20s to a supply pressure ≥ 2.7 bar.

O_2 and N_2O metering can be effected again when the O_2 pressure in the system has increased to at least 2.7 bar; at this level the N_2O cutoff is also ready for further operation. The O_2 deficiency signal is ready for operation again when the O_2 pressure in the system has reached at least 2.7 bar.

O_2 failure with 800 M/800 MV models

In contrast to the 800/800 V models, the supply of N_2O is cut off completely when the alarm sounds. The green indicator for the O_2 operating pressure goes out. O_2 and N_2O metering can be effected again when O_2 supply pressure has increased to at least 2.7 bar; at this level the N_2O cutoff is also ready for further operation.

In the event of N_2O failure, O_2 can still be metered and the O_2 deficiency signal is ready for operation. No audible alarm is given. N_2O metering can be effected again when the N_2O supply pressure has reached at least 2.7 bar.

N_2O failure with 800 M/800 MV models

In contrast to the 800/800 V models, an audible alarm is given in the event of N_2O failure as well. The green indicator for the N_2O operating pressure goes out.

Moreover, should the N_2O pressure drop below 2 bar, the blender switches to 100% O_2 (slight change in flow); this switch is only made after the alarm has sounded. N_2O metering can be effected again when the N_2O supply pressure has reached at least 2.7 bar.

D O_2 and N_2O failure

Should both gases fail, the devices essentially react as described under B.

When a malfunction occurs and/or the supply pressure fluctuates outside the prescribed values, operation of the de-

Case	Model	O_2 supply	N_2O supply	O_2 deficiency signal N_2O deficiency signal[1] [1] only 800 M/800 MV	N_2O cutoff	Device operable
A	All	1	1	Ready for operation	Ready for operation	Ready for operation
B	800/800 V	0	1	Audible alarm (O_2 ≤ 2 bar)	Reduction in N_2O supply (O_2 ≤ 1.4 bar), N_2O cutoff (O_2 ≤ 0.4 bar)	No, O_2 failure
	800 M/800 MV	0	1	Audible alarm Additional visual indication (O_2 ≤ 2 bar)	N_2O cutoff (O_2 ≤ 2 bar)	
C	800/800 V	1	0	No alarm	Ready for operation No effect	No, N_2O failure
	800 M/800 MV	1	0	Audible alarm Additional visual indication (N_2O ≤ 2 bar)	N_2O cutoff Automatic switch to 100% O_2	
D	800/800 V	0	0	Audible alarm	N_2O cutoff (O_2 ≤ 0.4 bar)	No, O_2 and N_2O failure
	800 M/800 MV	0	0	Audible alarm Additional visual indication for O_2 and N_2O	N_2O cutoff (O_2 ≤ 2 bar)	

Table 1 Behaviour of Romulus 800/800 V/800 M/800 MV in the event of gas failure
0 ≙ not adequate
1 ≙ adequate

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ble and only re-continued when a fully functional compressed-gas supply has been re-established (see Section 6.5).

3.2
Other safety features

The flow control valves are provided with a guard to prevent unintentional and shape of their rotary knobs are such that they are clearly assigned to the respective gases.

All Romulus 800 models are (optionally) provided with an O_2 flush. Turning the self-resetting lever causes an O_2 flow of roughly 55 L/min (depending on O_2 supply pressure) to be added to the fresh gas flow.

and can be used in areas where there is an explosion hazard. On electrically conductive floors the devices are protected against static charges.

They are provided with an earthing pin for potential equalization which, on non-conductive floors and in special applications, enables the apparatus to be incorporated into the room's potential equalization system (see Section 4.8).

4
Initial Preparation

4.1
Gas supply

The Romulus 800 models can be supplied with gas in the following ways:

- Connection of 3 litre cylinders (Figs. 7–10)
  Attach cylinders **24** and **25** to corresponding connectors **26** and **27** and tighten connections by means of spanner **23**.

- Connection of 11 litre cylinders (Figs. 8 and 9)
  Insert cylinders **29** and **30** into cylinder holders **28** and clamp in position. In accordance with Figs. 8 and 9 screw high-pressure spiral tubes **31** and **32** onto corresponding cylinder valves and connectors **33** and **34** at anaesthetic apparatus and tighten with spanner (different threads for O_2 and N_2O!).

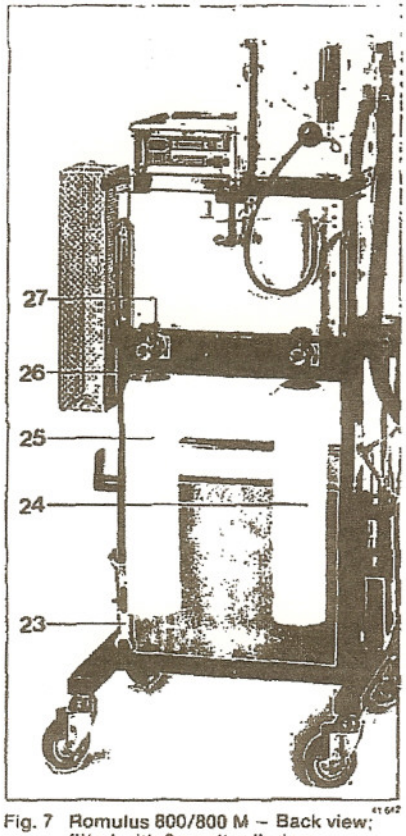

Fig. 7 Romulus 800/800 M – Back view; fitted with 2 small cylinders

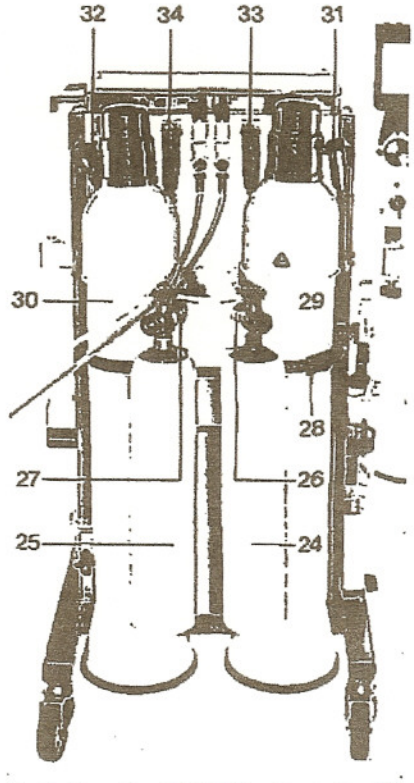

Fig. 8 Romulus 800/800 M – Back view; fitted with 2 small and 2 large cylinders

23 Spanner
24 O_2 cylinder, 3 litres
25 N_2O cylinder, 3 litres
26 O_2 connector (3 litre cylinder)
27 N_2O connector (3 litre cylinder)

28 Cylinder holder for 11 litres cylinders
29 O_2 cylinder, 11 litres
30 N_2O cylinder, 11 litres
31 O_2 high-pressure spiral tube
32 N_2O high-pressure spiral tube
33 O_2 connector (cylinder supply, 11 litre cylinder)
34 N_2O connector (cylinder supply, 11 litre cylinder)

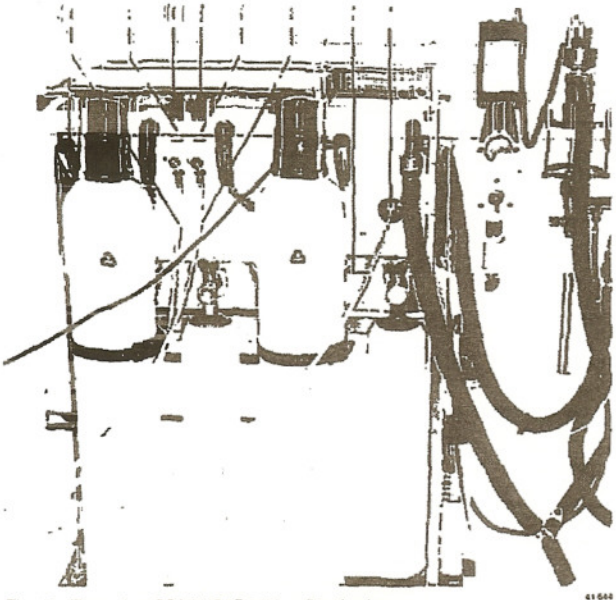

Fig. 9 Romulus 800 V/800 MV – Back view; fitted with 2 small and 2 large cylinders; Ventilog supplied with compressed air from central supply unit (CS)

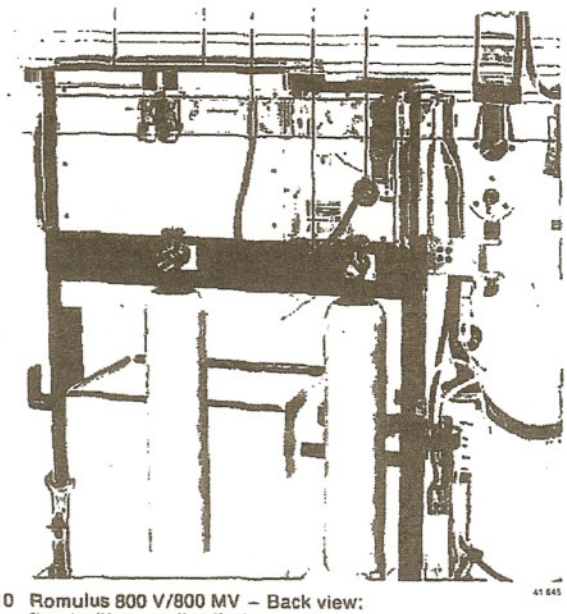

Fig. 10 Romulus 800 V/800 MV – Back view; fitted with 2 small cylinders; Ventilog supplied with O_2 from anaesthetic apparatus

35 O_2 connecting hose (from CS)
36 N_2O connecting hose (from CS)
37 O_2 connector
38 N_2O connector
39 O_2 shut-off valve
40 N_2O shut-off valve
41 O_2/air connection at Ventilog
42 O_2/air connecting hose (from CS) for Ventilog
43 O_2 connection hose (to Ventilog)
44 O_2 plug-in coupling (for O_2 supply of Ventilog from anaesthetic apparatus)

– *Connection to central supply unit* (CS) (Figs. 8 and 9).
First connect connecting hoses **35** and **36** to corresponding connectors **37** and **38** (Fig. 9); then press CS plugs into appropriate wall outlet valves. Ensure that shut-off valves **39** and **40** are opened for CS operation (open by turning in anti-clockwise direction). To avoid leakage losses, the valves **39** and **40** are to be kept closed when the cylinders are open and the CS connection is not being used.

Caution:
Even when operating the apparatus from a central supply unit the cylinders should remain in position as standby supply. In this way, it is only necessary to open the cylinder valves in order to switch rapidly to cylinder supply in the event of CS failure. Check valves prevent the backflow of gas out of the cylinders into the CS.

4.2
Ventilog

4.2.1
Gas supply

If used, the Ventilog can be driven with compressed air or oxygen. The use of oxygen is permitted if there is no compressed-air facility.

Operation with compressed air (Fig. 9)

The compressed air is to be taken from the central supply unit. The appropriate connecting hose **42** is to be screwed on to the connector **41** (»Air/O_2«) on the back of the Ventilog and the plug is to be connected to the central supply unit.

In the event of compressed-air failure, no alarm is given.

Operation with O_2 (Figs. 7 and 10)

Screw connection hose **43** on to back of Ventilog (»Air/O_2« connection) and insert other end of hose (with plug connection) into coupling **44** on anaesthetic apparatus.

In the event of O_2 failure the O_2 deficiency signal in the anaesthetic apparatus sounds.

4.2.2.
Pneumatic switching valve
(Fig. 11)

Attach pneumatic switching valve **14.1** to circle system 7a/8 ISO (Fig. 11 or 12). Connect control line **45** to connection **46** of Ventilog and attach to pneumatic switching valve (on back). Connect corrugated hoses **47** and **47a** in accordance with Fig. 11. The reservoir bag **48** can also be directly attached to the pneumatic switching valve. For further information consult »Ventilog« operating manual.

4.3
Circle system 7a/8 ISO
(Figs 11 and 12)

The circle system is attached to the mounting lug of the hinged arm **49** and locked in position; its height can be adjusted. Screw on mixed-gas hose **51** at fresh-gas outlet **50** of anaesthetic apparatus and mixed-gas inlet **52** of circle system.

Pay attention to instructions given in operating manuals for circle system and ancillary equipment used, such as »Minute Volumeter 3000«, »Precom«, »Barolog A«, »Spirolog 1 N« and »Oxycom 100 D«.

Note
The DGAI[1] Recommendations specify the use of an oxygen meter (e. g. Oxycom 100 D) in the inspiration section.

[1] DGAI = Deutsche Gesellschaft für Anästhesie und Intensivmedizin (German Association for Anaesthesiology and Intensive Care)

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Secretion aspirator
(Fig. 12)

The secretion aspirator is equipped for either vacuum or ejector operation.

The following applies when employing vacuum operation:

Connect appropriate connecting hose (with connector) to aspirator and insert connector into vacuum outlet valve of central supply unit.

The following procedure is to be adopted when using an ejector-driven aspirator:
Attach bacterial filter **58** (Fig. 12) to drive-gas outlet of ejector.

Position secretion jar set with jars **60 and 61** on mount provided on base of trolley. Attach connection hose **57** to thin nozzle of jar cap **59** and other end to socket at vacuum or ejector drive; attach aspiration hose **54** to thicker nozzle of jar cap and fit secretion sight glass **53** to end of hose. The secretion sight glass can be held in position on the hinged arm **49** by means of a clamp.

For flushing the catheter, the empty jar **61** is to be filled with rinsing liquid.

For further information consult operating manual »Secretion aspirator for anaesthetic apparatus«.

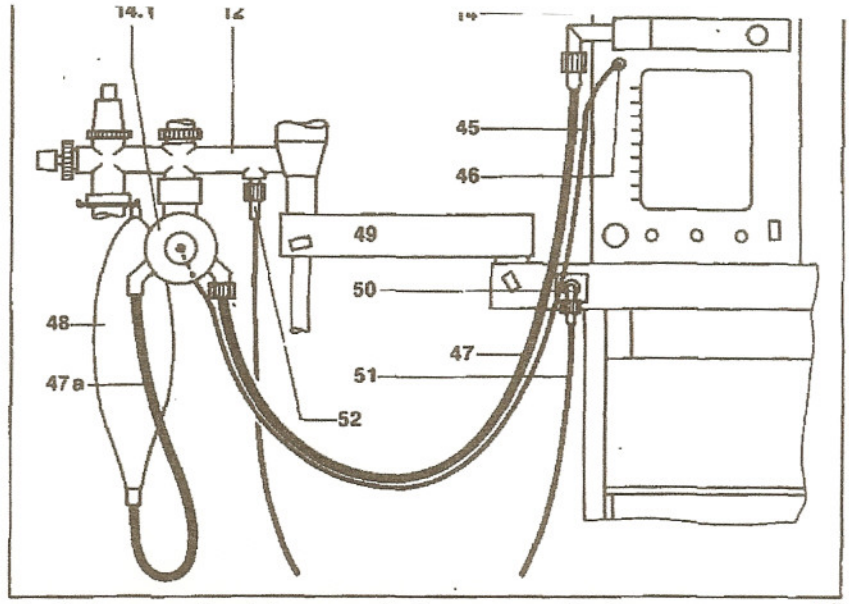

Fig. 11 Hose connections between anaesthetic apparatus and Ventilog as well as between circle system and pneumatic switching valve (schematic), see also Fig. 12.

Key to Figs. 11 and 12

12	Circle system 7a/8 ISO
14	Ventilog
14.1	Pneumatic switching valve
45	Control line
46	Connection for control line
47	Corrugated hose
47a	Corrugated hose
48	Reservoir bag
49	Hinged arm
50	Fresh-gas outlet at anaesthetic apparatus
51	Fresh-gas hose
52	Fresh-gas inlet at circle system
53	Secretion sight glass
54	Secretion aspiration hose
55	Shut-off valve
56	Vent valve
57	Vacuum connection hose
58	Bacterial filter
59	Jar cap with overflow safeguard and relief valve
60	Secretion jar
61	Rinsing jar

4.5
Microbe filter

The microbe filter **22** (Fig. 4) can be inserted between the inspiration valve and inspiration hose of the circle system using a connecting sleeve. It can also be fitted between the expiration valve and expiration hose.

Pay attention to the information given in the operating manual »Microbe filter«.

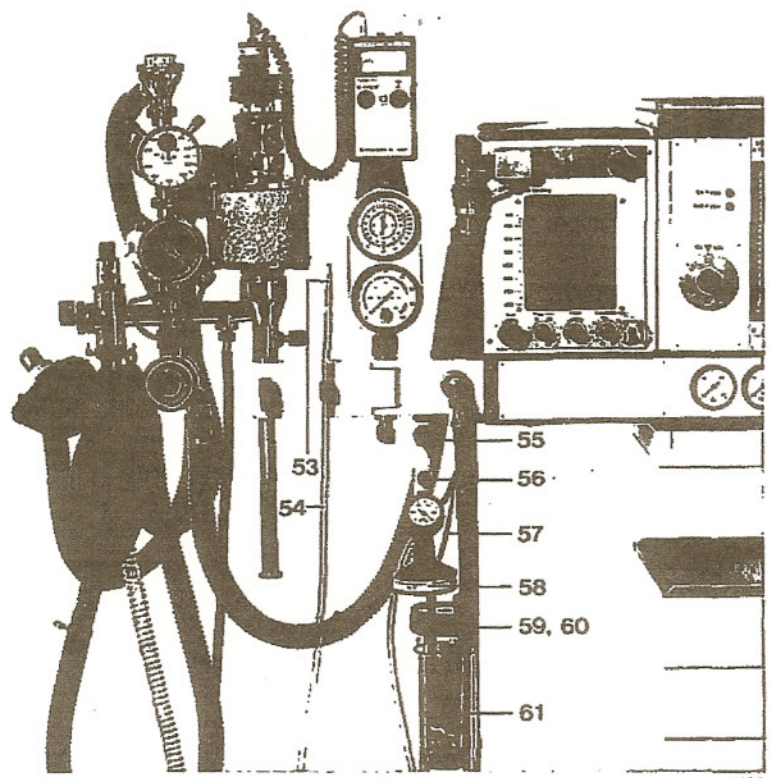

Fig. 12 Romulus 800 MV with circle system 7a/8 ISO and secretion aspirator

Vapor 19.1 (Fig. 13)

Prior to attaching the Vapor 19.1, a check must be made to ensure that the sealing rings **65** have been fitted and are in perfect condition. Mount Vapor on base **66** with plug-in adaptor **63**. Locking lever **62** must face forwards. Gas leakage at the plug connection is prevented by the sealing rings **65** being pressed together by the weight of the Vapor 19.1. After mounting the Vapor 19.1, the locking lever **62** must be moved to the left until it engages, in order to ensure secure attachment to the anaesthetic apparatus.

If no Vapor is attached, the valves in the socket pins **64** form a leak-proof seal and connect the flowmeter unit and fresh-gas outlet so that O_2/N_2O gas mixtures can be metered without inhalation anaesthetic as well.

Caution!
During transportation, as well as when mounting and removing the Vapor 19.1, care is to be taken to ensure that the maximum permissible angle of tilt of 45° is not exceeded.

The Vapors can be changed at any time (including during anaesthesia), since the gas flow is maintained in the metering system even when the Vapor is removed.

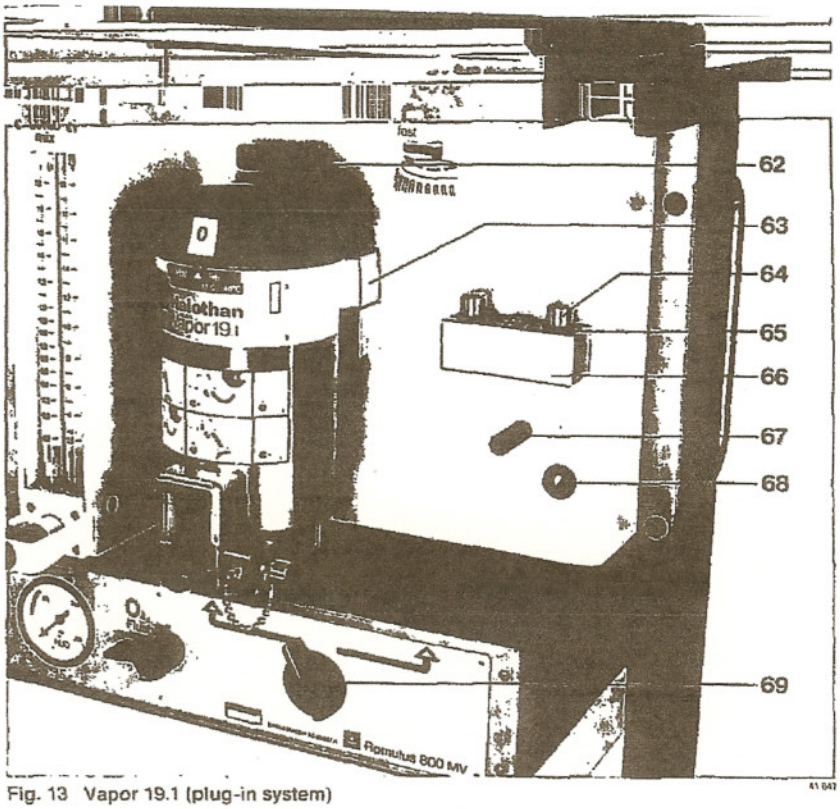

Fig. 13 Vapor 19.1 (plug-in system)

62 Locking lever
63 Plug-in adapter
64 Socket pin
65 Sealing ring
66 Base (plug-in system)
67 Support
68 Whistle for O_2 deficiency signal
69 Vapor selector switch

4.7 Anaesthetic gas removal
(Fig. 14)

The circle system and Ventilog are each equipped with an exhaust gas socket **72** or **73** to which either anaesthetic filter equipment (corrugated hose with anaesthetic filter) or an anaesthetic gas scavenging system (anaesthetic exhaust hoses **70a, b** with Y-piece **71**, Fig. 14) can be connected. If a Ventilog is not being used, the anaesthetic filter equipment or anaesthetic exhaust hose **70a** is to be connected only to the exhaust gas socket of the circle system.

Pay attention to the instructions given in the operating manual »Anaesthetic gas scavenging system«.

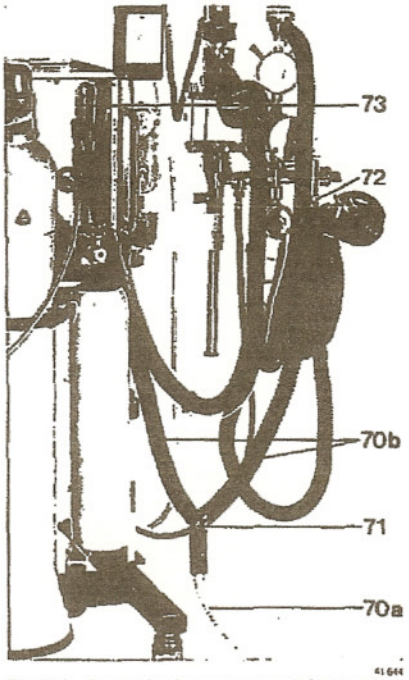

Fig. 14 Anaesthetic gas scavenging system on circle system and Ventilog

Key to Fig. 14
70a Anaesthetic gas scavenging hose
70b Anaesthetic gas scavenging hoses
71 Y-piece
72 Exhaust gas socket at circle system
73 Exhaust gas socket at Ventilog

4.8 Potential equalization

If potential equalization is required (e. g. on non-conductive floors or when monitors are latched on), it is to be provided by connecting up the cable 8301349 between the contact on the trolley of the anaesthetic apparatus and the appropriate room contact.

4.9 Bag for manual ventilation

In accordance with DGAI Recommendations[1] a bag for manual ventilation **20** (Fig. 4) is to be suspended from the anaesthetic apparatus.
Recommendation:
Dräger-Bag Resutator or
Dräger-Laerdal Resu Bag (suitable for sterilization in an autoclave).

[1] see footnote on page 10

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Testing Readiness for Operation

After cleaning, disinfection and sterilization the apparatus is always to be checked for completeness and proper operation.

A Check List for checking the apparatus prior to every start-up is given in Section 12 (information on how to use this Check List is given on page 22).

5.1 Gas supply

Check all connections for supply of O_2 and N_2O (from cylinders and from CS) on back of apparatus for tightness and freedom from leaks.

Ensure that all supply hoses are in perfect working order (visual inspection).

5.1.1 O_2 supply

(Fig. 15 for Romulus 800/800 V).
(Fig. 16 for Romulus 800 M/800 MV)

- Slowly open valve of large O_2 cylinder (11 litres). Check O_2 supply on pressure gauge **79**[1].
- Close cylinder valve and reduce pressure reading on gauge by opening flow control valve **77** or **86**.
- Slowly open valve of small O_2 cylinder (3 litres). Check O_2 supply on pressure gauge[1].

[1] The O_2 cylinders are full if the O_2 pressure gauge registers 200 bar. At this pressure 11 litre cylinders and 3 litre cylinders contain 2200 or 600 litres of gas respectively.

- With the N_2O supply shut off (cylinder and/or CS) open flow control valve **77** (for O_2) or **86** and check whether flow can be set over entire measuring range of appropriate flowmeters **75** or **85**; make sure that floats move freely. For this test the setting of the blender (handwheel **84**, Fig. 16) on the 800 M/800 MV model has no significance (arbitrary setting).
- After reducing pressure close O_2 cylinder and flow control valve again.
- Connect apparatus to central O_2 supply (Fig. 9). Open O_2 shut-off valve **39**. With 800 M/800 MV model check whether green O_2 indicator **82** lights (Fig. 16).
- Open flow control valve **77** or **86** and check whether gas flows through the appropriate flowmeters.
- Close flow control valve.
- Leave O_2 shut-off valve **39** at CS connection open.

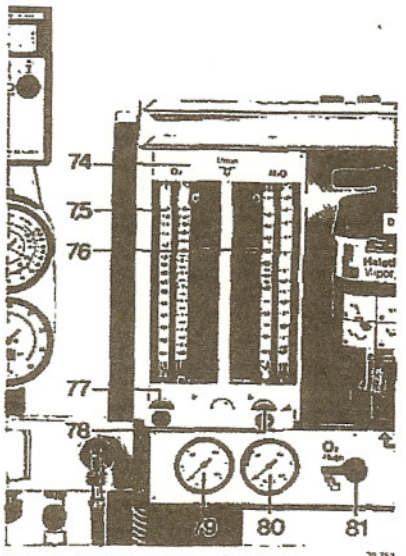

Fig. 15 Romulus 800 – Controls

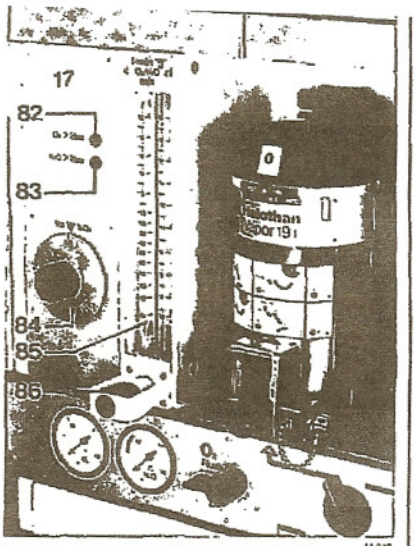

Fig. 16 Romulus 800 M (or 800 MV) – Controls

Key to Figs. 15 and 16

74	Flowmeter unit (Romulus 800/800 V)
75	O_2 flowmeters
76	N_2O flowmeters
77	O_2 flow control valve
78	N_2O flow control valve
79	Pressure gauge (cylinder pressure O_2)
80	Pressure gauge (cylinder pressure N_2O)
81	O_2 flush (Bypass)
17	Gas blender O_2/N_2O (Romulus 800 M/800 MV)
82	O_2 operating pressure indicator
83	N_2O operating pressure indicator
84	Handwheel on blender
85	*Flowmeters: mixed gas O_2/N_2O*
86	Flow control valve: mixed gas O_2/N_2O

5.1.2 N_2O supply

(Fig. 15 for Romulus 800/800 V,
Fig. 16 for Romulus 800 M/800 MV)

- Slowly open valve of large N_2O cylinder (11 litres). Check N_2O supply on pressure gauge **80**[2].
- Close cylinder valve and reduce pressure reading on the gauge by opening flow control valve **78** or **86**.
- Slowly open valve of small N_2O cylinder (3 litres). Check N_2O supply on pressure gauge[2].

[2] The N_2O pressure is roughly 50 bar as long as there is liquid nitrous oxide in the cylinder. When gas is extracted and the temperature drops as a result, the cylinder pressure may from time to time drop below 50 bar. The liquid content of the nitrous-oxide cylinders can only be determined by weighing them. A full 11 litre cylinder (8 kg of nitrous oxide) or 3 litre cylinder (2.25 kg of nitrous oxide) contains roughly 4000 or 1125 litres respectively.

- Open flow control valve **78** (for N_2O) or **86** and check whether flow can be set over entire measuring range of appropriate flowmeters **76** or **85**; make sure that floats move freely. With 800 M/800 MV model set blender to 30 vol. % O_2.
- After reducing pressure close N_2O cylinder and flow control valve again.
- Connect apparatus to central N_2O supply (Fig. 9). Open N_2O shut-off valve **40**. With Romulus 800 M/800 MV check whether green N_2O indicator **83** lights (Fig. 16).
- Open flow control valve **78** or **86** and check whether gas flows through the appropriate flowmeters.
- Close flow control valve.
- Leave N_2O shut-off valve **40** at CS connection open.

5.2 Gas deficiency signal, Blender function

5.2.1 Models 800/800 V only (Fig. 15): O_2 deficiency signal, N_2O cutoff

- Open O_2 and N_2O supply (cylinders or CS).
- Set O_2 flow and N_2O flow to 1 L/min and 2 L/min respectively.
- Shut-off O_2 supply (cylinder valve »closed« or pull CS plug).

  After a brief period the O_2 deficiency alarm must sound and continue to sound for at least 7 seconds. The N_2O flow must also drop to zero (N_2O cutoff).
- Close flow control valves. Re-establish gas supply.

Gas deficiency signal, blender function

- Open O_2 and N_2O supply (cylinders or CS).
- Set 30 vol. % O_2 on blender; set mixed-gas flow to 4 L/min.
- Shut off O_2 supply (cylinder valve »closed« or pull CS plug).

  After a brief period the O_2 indicator **82** must go out and the gas deficiency alarm must sound for at least 7 seconds. The flow must drop to zero (N_2O cutoff).
- Re-establish O_2 supply; shut off N_2O supply. After a brief period the N_2O indicator **83** must go out and the gas deficiency alarm must sound. The flow must however remain virtually the same (approx. 4 L/min), since the blender automatically switches to 100 vol. % O_2. The increase in the O_2 concentration is to be checked on the Oxycom 100 D oxygen meter.
- Check blender function:

  Re-establish O_2 and N_2O suppy. Set mixed gas flow to 4 L/min. The O_2 concentration is to be checked at the blender settings 30 and 80 vol. % (handwheel **84**). For testing purposes, unscrew sensor **9.1** (Fig. 1) of Oxycom 100 D and detach mixed-gas hose from connection **52** (Fig. 11). Route gas flow directly to sensor. The O_2 indication on the Oxycom 100 D must be 30 ± 5 vol. % or 80 ± 12 vol. % O_2.
- Screw sensor and mixed-gas hose back on again.

5.3
O_2 flush (Bypass)

When the O_2 flush lever **81** (Fig. 15) is actuated, a steady flow of gas out of the released, lever must return to initial position.

5.4
Circle system 7a/8 ISO (Fig. 11)

Check that mixed-gas hose **51** is properly connected; check that hose is in perfect condition (visual inspection). Perform functional check of circle system in accordance with appropriate operating manual.

5.5
Ventilog

- Check connection between Ventilog (connection **41**, Figs. 9 and 10) and compressed-gas supply (from CS or plug-in coupling **44** of anaesthetic apparatus).
- In accordance with Fig. 11, check all connections between Ventilog, pneumatic switching valve, circle system and reservoir bag.
- Perform functional check of Ventilog as per appropriate operating manual.

5.6
Secretion aspirator

- With vacuum-driven secretion aspirator: make connection to central supply unit.
- Perform functional check of secretion aspirator in accordance with operating manual »Secretion aspirator for anaesthetic apparatus«.

5.7
Microbe filter (Fig. 4)

Check condition and installation of filter **22** in accordance with recommendation given in operating manual »Microbe filter«.

- Check level and top up if necessary.
- Perform functional check of Vapor in accordance with appropriate manual.

5.9
Anaesthetic gas removal
(Fig. 14)

Check whether anaesthetic gas scavenging unit **70a, 70b** is connected to circle system (socket **72**) and – if applicable – to socket **73** of Ventilog. Insert connector (at hose **70a**) into coupling of central scavenging unit: this starts up the unit and the indicator at the scavenging coupling must be green.

If use is not being made of an anaesthetic gas scavenging unit, an anaesthetic filter with corrugated hose must be connected to the appropriate sockets on the circle system and – if applicable – the Ventilog. Check whether filters have been renewed. The filters must be firmly seated in the rubber collar.

5.10
Bag for manual ventilation

In accordance with DGAI[1)] Recommendations the anaesthetic apparatus must be provided with a bag for manual ventilation **20** (Fig. 4). Check function of the bag for manual ventilation by pumping manually: when the bag is squeezed, there must be an audible and perceptible stream of air out of the mask taper. When released, the bag must rapidly reassume its original shape. If the mask taper is sealed (e. g. with a finger), it must only be possible to squeeze the bag slightly by hand.

[1)] see footnote on page 10

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Operational Use

6.1
Possible ventilation modes

Prior to connection of the circle system to the patient, the desired gas flow and O_2/N_2O mixing ratio are to be set at the flow control valves or blender. The following modes are possible: **spontaneous breathing, manual ventilation** and – if use is made of a Ventilog – **automatic ventilation.**

Spontaneous breathing

Set lever of switching valve **89** (Fig. 17) at circle system 7a/8 ISO such that it points vertically downwards (»spontaneous breathing«). The patient can thus exhale freely via check valve **90**. The relief valve **88** has no function.

The selector switch **87** on the Ventilog must be in the »man/spont.« setting. Sufficient filling of the reservoir bag **48** is to be guaranteed by way of an adequate mixed-gas supply.

Manual ventilation

Set lever of switching valve **89** such that it points vertically upwards (»manual ventilation«). The air exhaled by the patient can escape via the relief valve **88** and the check valve. The airway pressure must be set at the relief valve **88**. The selector switch **87** on the Ventilog must be in the »man/spont.« setting. Ventilation is effected manually by way of the breathing bag **48** with care being taken to ensure that the bag is adequately filled.

Automatic ventilation

Set lever of switching valve **89** such that it is horizontal (»automatic ventilation«). The relief valve and check valve have no function. Inspiration and expiration are effected only via the Ventilog. The selector switch **87** of the Ventilog must be in the »Autom.« setting. The Ventilog is to be set in accordance with the appropriate operating manual.

For furhter information consult the operating manuals »Ventilog« and »Circle System 7a/8 ISO«.

6.2
Secretion aspirator (Fig. 17)

Attach aspiration catheter to secretion sight glass **53**. Open shut-off valve **55**, set vacuum at vent valve **56** and extract secretion. Following aspiration, suck rinsing liquid through system. Close shut-off valve. Secretion jar must be emptied at the latest when the 600 ml mark is reached. Overflow is prevented by means of an overflow safeguard.

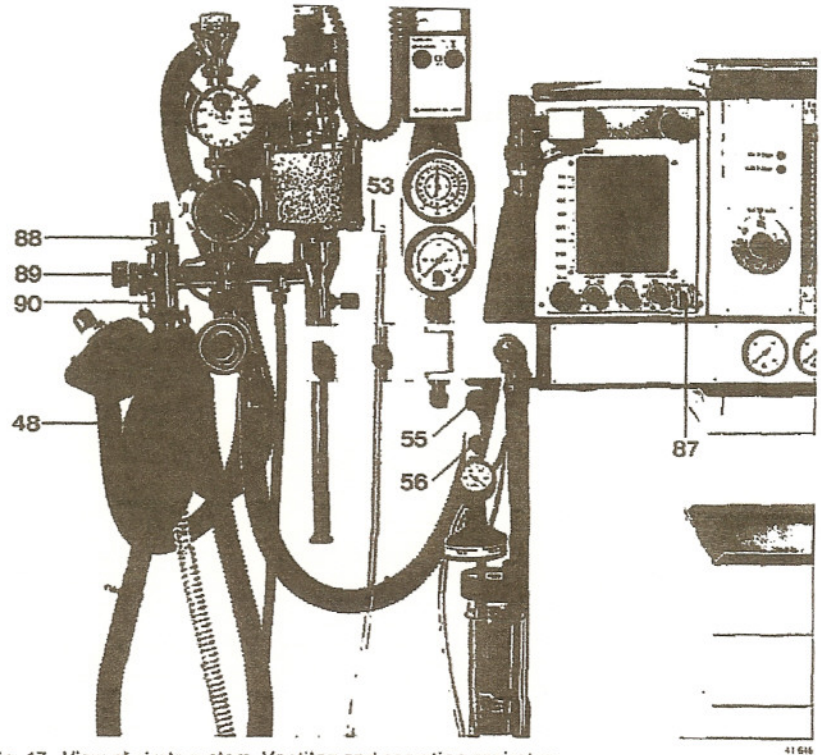

Fig. 17 View of circle system, Ventilog and secretion aspirator

87 Selector switch (Ventilog)
88 Relief valve
89 Switching valve (circle system)
90 Check valve

Pay attention to instructions given in operating manual »Secretion Aspirator for Anaesthetic Apparatus«.

6.3
Vapor 19.1

All Romulus 800 models can be fitted with two Vapor 19.1 vaporizers of which one can be selected in each case using the selector switch **69** (Fig. 13).

The Vapor 19.1 is switched on by pressing the locking button »zero« on the handwheel; the desired concentration is set by turning the handwheel.

To remove, turn locking lever **62** approximately 100° to the right. Lift off Vapor vertically and remove. Put replacement Vapor in position in reverse order.

For further information consult operating manual »Vapor 19.1«.

6.4
O_2 flush (Bypass)

Actuation of the O_2 flush **81** causes roughly 55 L/min of O_2 to flow into the circle system bypassing the flowmeters and Vapor.

Caution!
Observe pressure in breathing system! If the O_2 flush is actuated in an uncontrolled manner, impermissibly high airway pressures may result particularly in conjunction with automatic ventilation.

6.5
O_2 deficiency signal

When the O_2 deficiency alarm sounds, the O_2 supply is to be immediately re-established:

- With CS operation it is often sufficient to re-insert the CS plug. In the event of CS failure, the O_2 cylinder valve is to be opened and the O_2 shut-off valve **39** closed.
- In the event of O_2 deficiency during cylinder operation either the small O_2 standby cylinder is to be opened or a rapid cylinder change must be effected.

Note:
As an emergency gas supply, we recommend procuring the Dräger cylinder battery O_2/N_2O (for ordering data, see Prospectus 5303e).

N_2O deficiency

An N_2O deficiency does not lead to an audible alarm with the 800/800 V models, but it can be seen from the flowmeters. The situation is to be remedied in a manner similar to that described in Section 6.5. With the 800 M/800 MV models an alarm is given in the event of N_2O deficiency as well.

Bag for manual ventilation

The bag for manual ventilation 20 (Fig. 4) suspended from the anaesthetic apparatus in accordance with DGAI[1] Recommendations is intended for emergency ventilation.
Information on this topic is given in the operating manuals »Bag Resutator« or »Resu Bag«.

[1] See footnote on page 10.

7
Shut-Down Actions

Close O_2 and N_2O shut-off valves 39, 40 (Fig. 9). If the patient connection is detached, the following components must also be shut down:

- Switch off Vapor 19.1 (handwheel in »zero« setting);
- Close flow control valves 77 and 78 (or 86 with 800 M/800 MV models);
- Close shut-off valve 55 of secretion aspirator;
- Set switch on Ventilog to »man/spont.«.

In the event of lengthy periods of non-use (e. g. overnight), the cylinder valves must be closed and the plugs of the CS hoses detached from the wall outlet valves.

To prevent the gas deficiency alarm from sounding when shutdown is effected, the system is to be depressurized by opening the flow control valves until the flowmeter floats have dropped to their lowest position:

- With 800/800 V models, first open N_2O flow control valve, then O_2 flow control valve
- With 800 M/800 MV models first interrupt N_2O supply, open flow control valve and wait for N_2O deficiency alarm; only then is the O_2 supply to be interrupted. The O_2 pressure is also to be reduced by opening the flow control valve.
- Finally, the flow control valves are to be closed.

8
Care

8.1
Stripping down

- Detach all plug connections at CS outlet valves. The CS hoses can remain in position on the apparatus, but the CS plugs must not lie on the floor (in particular during disinfection in the Aseptor).
- Unscrew mixed-gas hose 51 from circle system.
- If anaesthetic apparatus is equipped with a Ventilog, then the following work is to be performed:
  Detach all hoses between Ventilog and circle system at Ventilog (see Fig. 11). Unscrew the Ventilog switching valve from circle system.
- Revove anaesthetic gas scavenging unit or anaesthetic filter equipment from exhaust gas sockets.
- Remove circle system.
- Remove ancillary equipment which is not to be disinfected in the Dräger Aseptor (pay attention to instructions given in pertinent manuals).
- Detach vacuum connection hose of aspirator from drive and remove secretion jar set.
- Remove secretion jar (with secretion aspiration hose) and rinsing jar from holder and empty.
- Remove patient system from Ventilog (see operating manual »Ventilog«).
- The Vapors remain in position on the apparatus.

8.2
Hygiene

The upkeep of ancillary equipment must be carried out in accordance with the specifications given in the respective operating manuals. This applies for example to the circle system, Vapor 19.1, Ventilog and secretion jar set.

As regards the anaesthetic apparatus itself, the following measures apply with respect to upkeep:

8.2.1
Cleaning

Dirt on the anaesthetic apparatus is to be removed using a damp cloth soaked in standard detergent (wetting agent). Care is also to be taken to ensure that drawers, pull-out writing surfaces and the like are not forgotten. When cleaning the flowmeter unit, pay attention to the enclosed compatibility list for Plexiglas.

After cleaning, the anaesthetic apparatus and component parts are to be allowed to dry. The cylinder jackets and caps are to be removed and cleaned if there is a suspicion of corrosion and in any case at least every six months. When doing so, the condition of the gas cylinders is to be checked (visual inspection).

8.2.2
Disinfection

Disinfection in Dräger Aseptor®

Disinfection of the Romulus 800 models is to be carried out in accordance with

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Aseptor«. Prior to disinfection, the Vapors must be in the zero setting (handwheel on »zero«). Disinfection measures for ancillary equipment, the Ventilog and the circle system are given in the respective operating manuals.

Wiping or spraying with liquid disinfectant

Wiping or spraying should only be employed if there is no possibility of using a Dräger Aseptor for disinfection purposes. Such methods only serve to reduce the number of bacteria on the surface of the device and can thus not be unreservedly recommended.

Spraying may also lead to controls sticking (switches, rotary knobs etc).

Please observe the enclosend compatibility list.

the flowmeter unit.

Disinfection in Dräger Purfactor®

Breathing hoses, reservoir bag, circle system, tube, mask, secretion jar, jar cap (not including ping-pong ball), aspiration hoses etc are placed on the Purfactor washing frame. All anaesthesia materials are cleaned, disinfected and dried in »Programme I«. Thermally instable materials, such as those made of PVC, are treated in »Programme II«.

8.2.3
Sterilization

Only the following items are suitable for sterilization in steam up to 120°C:

The parts of the circle system and Ventilog which carry breathing air, the secretion jar (not including ping-pong ball) and the aspiration hoses.

Maximum temperature for secretion sight glass: 134°C.

The permissible sterilization temperature for secretion jars and rinsing jars is printed on them.

Caution!
Sterilization in steam accelerates the natural aging of rubber parts. They must thus be checked for leaks at frequent intervals.

8.3 Assembly

The disassembled parts are assembled in reserve order of stripping down (see Section 8.1). A functional check as per Section 5 »Testing Readiness for Operation« is then to be performed.

9 Servicing

To ensure that the anaesthetic apparatus is always ready for use and fully functional, we recommend concluding a servicing agreement with the Technical Customer Service of Drägerwerk AG, thus guaranteeing regular checking and the necessary adjustments and spare part replacement. The apparatus should be serviced twice a year by the Technical Customer Service of Drägerwerk AG.
In this respect please note the information given under »Important Notice« page 2.
The limit switch in the blenders of the Romulus 800 M/800 MV must be replaced by the Technical Customer Service of Drägerwerk AG every 4 years.

10 Technical Data

The data marked with +) refer (additionally) to the Romulus 800 »Air«/800 V »Air« special versions as described in Section 11.

Ambient temperature
for operation of Romulus: 15...35°C

Gas supply

- From central supply unit (CS) with following requirements:

  Pressure O_2: 2.7 ... 5.5 bar
  N_2O: 2.7 ... 5.5 bar
  +) Air: 2.7 ... 5.5 bar

  Flow rates
  O_2 max. 20 L/min for O_2 metering
  max. 24 L/min for ejector
  approx. 55 L/min for O_2 flush at 5 bar
  approx. 35 L/min for O_2 flush at 2.7 bar
  approx. 30 L/min for Ventilog (80^{+10} L/min peak flow)
  N_2O: max 15 L/min for N_2O metering
  +) Air: max 15 L/min (without Ventilog)

  Screw connections on apparatus end
  for O_2: M 12 x 1 mm female thread
  for N_2O: M 14 x 1 mm female thread
  +) for »Air«: M 20 x 1.5 mm male thread

  O_2 and N_2O connections with shut-off valves.

- Additionally, cylinder supply option with following possibilities:
  a) One 11 litre cylinder each for O_2 and N_2O
  b) One 3 litre cylinder each for O_2 and N_2O
  c) One 11 litre cylinder each and one 3 litre cylinder each for O_2 and N_2O

  High-pressure reducer integrated into apparatus. Gas purity requirements in accordance with European Pharmacopoeia.

- Plug-in coupling (self-closing) for driving Ventilog with oxygen from anaesthetic apparatus; output pressure same as O_2 supply pressure.

Gas metering units
Models 800/800 V and
+) Models 800 »Air«/800 V »Air«

- Gas metering with flow control valves
  Colour code: blue[1] for O_2
  grey[1] for N_2O
  yellow[1] for »Air«
  [1] for Federal Republic of Germany

  Different knurling of adjustment knobs
  Adjustment range approx. 5 turns
- +) Selector switch »Air/N_2O« (manually operated)
- 2 O_2 flowmeters (connected in series)
  Measuring range: 0.1 – 2 L/min
  2.5 – 15 L/min
- 2 N_2O flowmeters (connected in series)
  Measuring range: 0.05 – 1 L/min
  1.25 – 10 L/min
- +) 1 Air flowmeter
  Measuring range: 0.8 – 15 L/min

1013 mbar)
± 10% of set value,
+ 15/−5% with smallest scale value of O_2 flowmeter,
−15/+5% with smallest scale value of N_2O flowmeter,
+ 15/− 5% with smallest scale value of »Air« flowmeter

Gas metering units
Models 800 M/800 MV

- Gas mixing with O_2/N_2O blender

Adjustment range	30—100 vol. % O_2
Mixing accuracy	± 10% of set value
Inherent consumption	1.5 L/min O_2 (discharged on back)

- Gas metering with 1 flow control valve; adjustment range approx. 5 turns
- 2 Mixed-gas flowmeters (connected in series)
  Measuring range: 0.5 — 2 L/min
  2.5 — 20 L/min
- Measurement accuracy (at 20°C and ± 10% of set value,
  +15/−5% with smallest measuring range value and a mixture of 30% O_2 and 70% N_2O

Anaesthetic metering

2 Vapor 19.1 vaporizers for halothane or enflurane with plug-in system and selector switch. The connections of the plug-in system are automatically bypassed and sealed off with respect to the atmosphere when the Vapor is removed.

- Vapor 19.1 for halothane:
  Adjustment range 0.2 — 4 vol. %
- Vapor 19.1 for enflurane:
  Adjustment range 0.2 — 5 vol. %

For technical data of Vapor 19.1 see appropriate operating manual.

Gas deficiency signal/N_2O cutoff
Models 800/800 V
+) Models 800 »Air«/800 V »Air«

If an O_2 supply pressure of 2.1 ± 0.1 bar is dropped below, an audible alarm, which cannot be disconnected, is given for at least 7 seconds. Should the O_2 pressure continue to drop to below roughly 1.4 bar, the N_2O supply is throttled and blocked completely at an O_2 pressure of approximately 0.4 bar.

+) In contrast to the 800/800 V models, the air supply to the »Air« flowmeter is automatically released with the 800 »Air«/800 V »Air« models should the O_2 pressure drop below 1 bar (in the system).

When the O_2 supply pressure starts to increase again, the alarm is ready for further operation as of 2.7 bar.

Models 800 M/800 MV

Should the O_2 or N_2O supply pressure drop below 2.1 ± 0.1 bar, an audible alarm is given in each case. Indicators show which gas has failed. In the event of an O_2 deficiency, the supply of N_2O is automatically cut off. Should the N_2O supply fail, the blender switches to 100 vol. % O_2 once the deficiency signal has sounded.

O_2 flush (bypass)

Approx. 55 L/min O_2 at 5 bar O_2 supply pressure
Approx. 35 L/min O_2 at 2.7 bar O_2 supply pressure
Self-resetting, no increase in pressure at Vapor.

Circle system

- For example modified circle system such as Dräger Circle System 7a or 8 ISO.
- For equipment and technical data see operating manual »Circle System 7a/8 ISO«.
- Connection for mixed-gas hose:
  Male thread M 16 x 1.5 mm
- Drive:
  By means of vacuum from central supply unit (connection via male thread ISO 228 G ¼ A) (previous designation R ¼")
  Or by means of O_2 ejector from anaesthetic apparatus.
- Vacuum setting:
  By means of vent valve, 0 to approx. −0.9 bar, vacuum indication on drive by means of pressure gauge, measuring range 0 to −1 bar.
- Effective capacity of secretion and rinsing jar: 700 mL
- Overflow safeguard, relief valve
- Rapid vent valve (only for vacuum drive)
- Bacterial filter (only for O_2 drive)
- For technical data see »Secretion aspirator« operating manual.

Ventilog anaesthesia lung ventilator

- Supply by means of O_2 plug-in coupling at anaesthetic apparatus or O_2 central supply 2—6 bar or compressed-air central supply 2—6 bar.
- Drive gas must be dry and free from oil.
- Drive gas consumption 30 L/min, peak flow 80^{+10} L/min O_2 or compressed air.
- For equipment and technical data see »Ventilog« operating manual.

Dimensions	**Model 800 800 M 800 »Air«**	**Model 800 V 800 MV 800 V »Air«**
– Width:	700 mm	900 mm
– Height:	1150 mm	1150 mm
– Depth:	600 mm	600 mm

Weight

Not including cylinders and circle system	approx. 75 kg	approx. 90 kg

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Special Versions

Romulus 800 »Air«/800 V »Air«

Section 11 contains additional information necessary for operation of the Romulus 800 models »Air«. Operation of these models does however presuppose knowledge of the preceding sections of this operating manual for the standard versions.

The »Air« models differ from the standard versions in that they have an additional gas supply (compressed air) from a CS and a flowmeter unit extended to include compressed air with a selector switch for »Air« and N_2O (Figs. 18a and 18b).

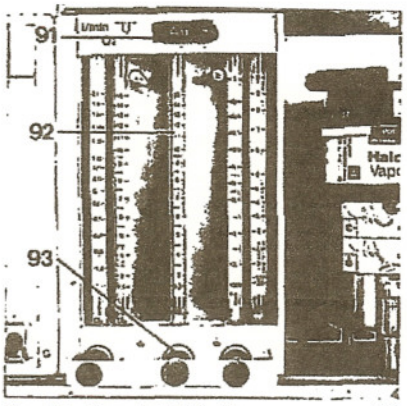


Fig. 18a Romulus 800 »Air« with ancillary compressed-air unit, selector switch in setting »O_2/Air«

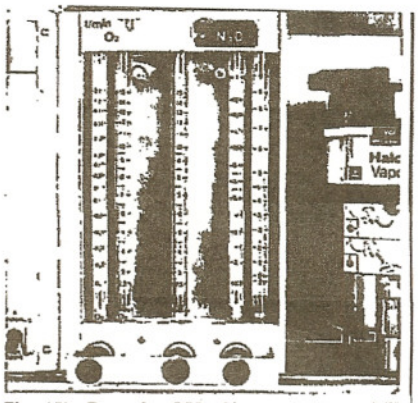


Fig. 18b Romulus 800 »Air« with ancillary compressed-air unit, selector switch in setting »O_2/N_2O«

91 Selector switch »Air«/N_2O
92 »Air« flowmeter
93 »Air« flow control valve

11.1 Design and function (Fig. 19)

The numbers in this section refer only to the functional schematic illustrated in Fig. 19.

The »Air« models are driven with oxygen, nitrous oxide and compressed air. Supply is effected from a CS or – however only for O_2 and N_2O – from gas cylinders.

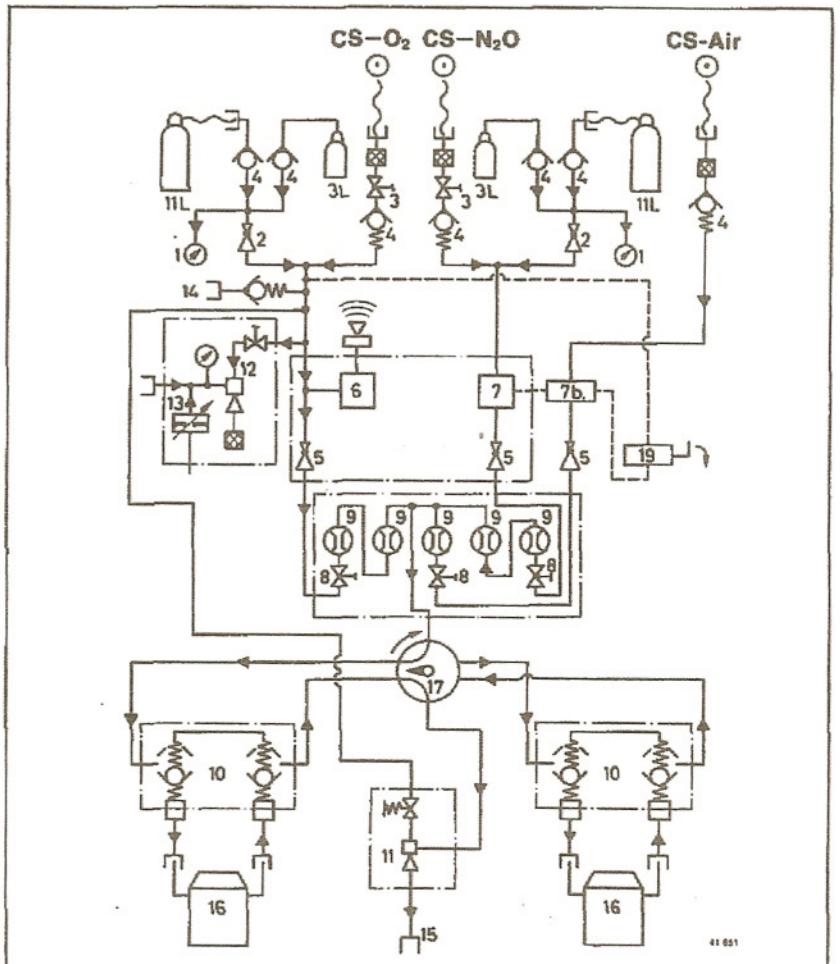
For CS operation the shut-off valves 3 must be opened. When effecting supply from gas cylinders, the cylinder pressure is indicated on the pressure gauges 1 and reduced to 5 bar at the pressure reducers 2. The check valves 4 prevent overflow between the cylinders and the CS.

As regards N_2O and compressed air, it is only possible to meter one gas or the other. For this purpose the selector switch 19 is to be moved to the »N_2O« or »Air« setting.

The oxygen pressure is monitored by the O_2 deficiency signal 6 which triggers an audible alarm when the O_2 pressure drops below 2 bar. Should the O_2 pressure continue to drop, the N_2O supply is interrupted by the N_2O cutoff 7 irrespective of the selector switch setting; the apparatus switches automatically (at compressed air valve 7b) to »Air«. If the selector switch 19 is in the »Air« setting, the supply of compressed air remains connected even in the event of oxygen deficiency.

The pressure reducers 5 reduce the pressure of the oxygen and nitrous oxide to 1.5 bar.

The flow control valves 8 make it possible to meter the two gas flows (O_2 and N_2O) and the flow rate can be read off in each case from two series-connected flowmeters 9 of the flowmeter unit. As an alternative to N_2O, air can be metered via an individual flowmeter. The gases are routed together and passed to the Vapor selector switch 17.



1 Cylinder pressure gauge
2 Pressure reducer 200/5 bar
3 Shut-off valve
4 Check valve
5 Pressure reducer 5/1.5 bar
6 O_2 deficiency signal
7 N_2O cutoff
7b Compressed-air valve
8 Flow control valve
9 Flowmeters
10 Vapor plug-in system
11 O_2 flush (Bypass)
12 Aspiration ejector (optional)
13 Vent valve
14 Plug-in coupling for Ventilog
15 Fresh-gas outlet
16 Vapor 19.1
17 Vapor selector switch
19 Selector switch »Air«/N_2O

Fig. 19 Functional schematic of Romulus 800/800 V with ancillary compressed-air unit

e 4

be switched into the fresh-gas flow for adding the desired anaesthetic. Both Vapors 16 are connected via plug-in systems 10 which permit rapid replacement. Gas can flow from the flowmeter unit to the fresh-gas outlet 15 even when no Vapor is connected.

The O_2 flush 11 (bypass) enables an O_2 flow of roughly 55 L/min (depending on CS pressure) to be added to the fresh-gas without affecting the pressure ratios (ejector system). The O_2 flush lever resets automatically.

If fitted, the aspiration ejector 12 is designed to generate a vacuum for operating the secretion aspirator. The vacuum generated (max. −0.9 bar) can be reduced via the vent valve 13.

The self-closing plug-in coupling 14 is intended for driving a Ventilog anaesthesia lung ventilator with oxygen.

11.2 Alarm and safety devices

The O_2 deficiency signal is designed as for the 800/800 V models: if an O_2 supply pressure of 2 bar is dropped below, an audible alarm is triggered which cannot be reset. Should the O_2 pressure drop below roughly 1 bar, the N_2O supply is blocked with the »Air« models and the supply of air released so that air can be metered in as emergency supply.

associated alarm functions are tabulated below (Table 2) and then described.

Switch setting »Air« (O_2 and air)

Case 1

In the switch setting »Air«, air can be metered in combination with O_2. The gas supply to the N_2O metering branch is automatically blocked. The O_2 deficiency signal is ready for operation. In the case of central supply units with a low pressure (e. g. 3 ± 0.3 bar), it is advisable, when connecting the apparatus to the CS, to keep the O_2 metering valve at the flowmeter unit closed for a brief period to enable the pressure reservoir of the O_2 deficiency signal to fill up thus ensuring that an alarm will be given for at least 7 seconds as prescribed.

Case 2

In the event of O_2 failure during operation, air can still be metered. Should the O_2 pressure drop below 2 bar, the O_2 deficiency signal sounds for at least 7 seconds.

The O_2 deficiency signal is only ready for operation again when there is an O_2 pressure of at least 2.7 bar in the system.

Case 3

In the event of air failure during operation, O_2 can still be metered. The O_2 deficiency signal remains ready for operation. No audible alarm is given. Air can only be metered again when there is an air pressure of at least 2.7 bar in the system.

Case 4

In the switch setting »N_2O«, N_2O can be metered in combination with O_2. The gas supply to the air metering branch is automatically blocked. Mixtures of N_2O and air are not possible. The O_2 deficiency signal and N_2O cutoff are ready for operation.

Case 5

Should the O_2 pressure drop below 2 bar, the O_2 deficiency signal sounds for at least 7 seconds. Should the O_2 pressure drop below roughly 1.4 bar, the N_2O supply is reduced — until it is shut off completely — in such a manner that the pre-selected O_2 concentration is not dropped below. At an O_2 pressure of ≤ 0.4 bar, the supply of N_2O is shut off completely.

The supply of air is released at an O_2 pressure below roughly 1 bar: air can be metered via the »Air« flow control valve. Irrespective of this, the selector switch remains in the »N_2O« setting.

The O_2 deficiency signal and the N_2O cutoff are only ready for operation again when there is an O_2 pressure of at least 2.7 bar in the system. At this pressure the supply of N_2O is also released again and the air supply is blocked.

Case 6

In the event of N_2O failure, O_2 can still be metered. The O_2 deficiency signal continues to be ready for operation. No audible alarm is given, N_2O metering can only be effected again when there is an N_2O pressure of at least 2.7 bar in the system again.

Case	Selector switch in setting	O_2 supply	Air supply	N_2O supply	O_2 deficiency signal	N_2O cutoff	Device operable
1	»Air«	1	1	Automatic. blocked	Ready for operation	Ready for operation No effect	Ready for operation
2		0	1	Automatic. blocked	Audible alarm (O_2 ≤ 2 bar)	Ready for operation No effect	No, O_2 failure
3		1	0	Automatic. blocked	Ready for operation	Ready for operation No effect	No Air failed No alarm
4	»N_2O«	1	No effect	1	Ready for operation	Ready for operation	Ready for operation
5		0	Automatic switch to air		Audible alarm (O_2 ≤ 2 bar)	Automatic blocking of N_2O (O_2 ≤ 0.4 bar)	No, O_2 failure
6		1	No effect	0	Ready for operation	Ready for operation No effect	No N_2O failure No alarm

Table 2 Behaviour of Romulus 800/800 V models with ancillary compressed-air unit in the event of gas failure
0 ≙ not adequate
1 ≙ adequate

Initial preparation

Gas supply

The 800 »Air«/800 V »Air« models have an additional CS connector **94** for air (Fig. 20). The »Air« models are to be connected as described in Section 4. The »Air« connecting hose **95** is to be additionally connected to the CS.

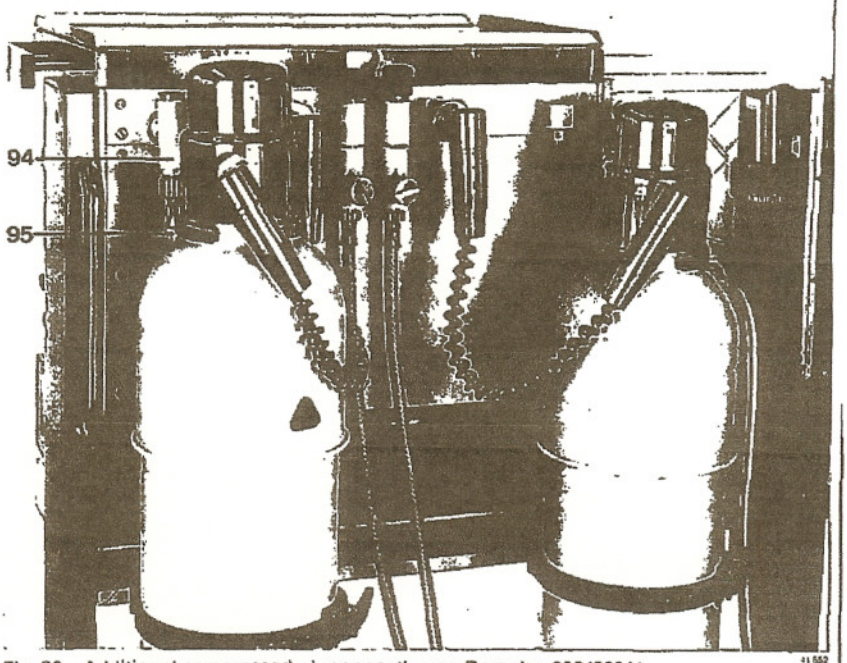


Fig. 20 Additional compressed-air connection on Romulus 800/800 V
94 »Air« connector
95 »Air« connecting hose (from CS)

11.4 Testing readiness for operation

Following cleaning, disinfection and sterilization the apparatus is always to be checked for completeness and proper functioning.

O_2 supply

As for Romulus 800/800 V (see Section 5.1).

N_2O supply

As for Romulus 800/800 V (see Section 5.1).

Compressed-air supply (Fig. 20)

- Check tightness of CS screw connection (at connector **94**) and ensure that the CS-plug is firmly attached. Move selector switch **91** to »Air« setting. Check whether the full flow range can be set with the aid of the »Air« flow control valve **93** at the air flowmeter **92**.
- Check that air flowmeter float moves freely.
- Open N_2O flow control valve: there must be no N_2O flow.
- Close N_2O and air flow control valve.

O_2 deficiency signal/N_2O cutoff/ switchover to air

- Set selector switch to »N_2O« setting. Set O_2 flow to 1 L/min and N_2O flow to 2 L/min.
- Open »Air« flow control valve: There must be no flow of gas (air). Close O_2 cylinder valve or pull O_2 CS-plug. After a brief period the O_2 deficiency signal must sound and continue to sound for at least 7 seconds. The N_2O flow must also drop to zero and the air flow must increase. Re-establish O_2 gas supply. Compressed air must be automatically blocked and N_2O flow rate must again be 2 L/min.
- Set selector switch to »Air« setting. Set O_2 flow to 1 L/min and air flow to 2 L/min. Close O_2 cylinder valve or pull O_2 CS-plug. After a brief period the O_2 deficiency signal must sound and continue to sound for at least 7 seconds. The air flow must not change and the N_2O flow must remain on zero. Re-establish gas supply. Close flow control valves.

The checking of all other functions is to be performed in accordance with the description given for the Romulus 800/800 V models (see Section 5.).

11.5 Operational use

Flowmeter unit with selector switch (Figs. 18a and 18b)

The compressed air is metered at the flow control valve **93**. The metered quantity is read off from the flowmeter **92**. *Air and O_2 can only be metered when* the selector switch **91** is in the »Air« setting. In the »N_2O« setting only N_2O and O_2 can be metered.

Reference values for the O_2 concentration *in O_2/air mixtures in the flow range* 2–24 l/min are given in Table 3 (page 22).

O_2 concentration in vol. %	2		4		6		8		10		12		14		16		18		20		22		24	
	Luft	O_2	Luft	O_2	Luft	O_2	Luft	O_2	Luft	O_2	Luft	O_2	Luft	O_2	Luft	O_2	Luft	O_2	Luft	O_2	Luft	O_2	Luft	O_2
21	2	0	4	0	6	0	8	0	10	0														
30	1,8	0,2	3,5	0,5	5,3	0,7	7,1	0,9	8,9	1,1														
40	1,5	0,5	3,0	1,0	4,6	1,4	6,1	1,9	7,6	2,4	9,1	2,9												
50	1,3	0,7	2,5	1,5	3,8	2,2	5,1	2,9	6,3	3,7	7,6	4,4	8,9	5,1	10	6,0								
60	1,0	1,0	2,0	2,0	3,0	3,0	4,0	4,0	5,0	5,0	6,1	5,9	7,1	6,9	8,1	7,9	9,1	8,9						
70	0,8	1,2	1,5	2,5	2,3	3,7	3,0	5,0	3,8	6,2	4,6	7,4	5,3	8,7	6,1	9,9	6,8	11,2	7,6	12,4	8,3	13,7	9,1	14,9
80	0,5	1,5	1,0	3,0	1,5	4,5	2,0	6,0	2,5	7,5	3,0	9,0	3,5	10,5	4,0	12	4,6	13,4	5,1	14,9				
90	0,3	1,7	0,5	3,5	0,8	5,2	1,0	7,0	1,3	8,7	1,5	10,5	1,8	11,2	2,0	14								
100	0	2	0	4	0	6	0	8	0	10	0	12	0	14										

Table 3 Gas composition: air/O_2 (average values)

Further notes

on Operational Use, Shut-Down Actions, Care, Servicing, Technical Data, Check List, Order List and Parts List are given in the corresponding **Sections 6–14.**

12 Check List

In the Federal Republic of Germany, testing of the anaesthetic apparatus in accordance with the Check List on page 23 is mandatory. Please observe the recommendations or regulations in force in your country.

For users in the Federal Republic of Germany, use of this Check List is described in the following.

»The Check List on page 23 for inhalation anaesthesia apparatus must, on the basis of the corresponding operating manuals (for the anaesthetic apparatus and ancillary equipment), be brought into line with the type and configuration of the respective apparatus by means of deletions and/or additions. The Check List then contains the tests which are always to be performed on the respective model prior to start-up. The model designation and serial number of the apparatus in question are also to be entered.

The above-mentioned entries are to be transferred to the Check List (plastic) included with the anaesthetic apparatus using a waterproof felt-tip pen. The plastic Check List is to be attached to the anaesthetic apparatus by means of the bead chain.

Entries in the ACTUAL column and in the space provided for the date and signature are intended as an indication of performance of the respective tests. These entries are to be made in pencil and rubbed out again when the next set of tests is performed.

The plastic Check List must not be wiped over with cleaning agents and disinfectants, alcohol or similar solvents, since the entries made with a waterproof felt-tip pen are not resistant to such substances. Disinfection in the Aseptor is however permitted«.

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Dräger

Model _____

Serial No. _____

- Knowledge of valid operating manuals is an absolute prerequisite
- Delete where not applicable; make additions where necessary

_____

Signature

Checking prior to start-up

What?	How?	Desired	Actual
Anaesthetic gas			tick off if okay
Cylinder supply	Open valves	Pressure $O_2 > 50$ bar	.....
		$N_2O > 30$ bar	.....
Central supply	Insert plug-in coupling	Indicator green	.....
	Open O_2/N_2O metering valves	Flow present	.....
Anaesthetic gas scavenging system	Insert plug-in coupling	Indicator green	.....
Anaesthetic filter	Condition of filter	Filter replaced	.....
O_2-flush (bypass)	Actuate switch	Flow present	.....
Vapor	Zero setting	Locked	.....
	Level	Adequate	.....
	Selector switch	Switch setting correct	.....
Plug-in system	Connection	Plug-in system locked	.....
Circle system	Hoses Reservoir bag Absorber Volumeter Volumeter heating Airway pressure gauge Measurement connections Valve discs (insp. and exp.) Mixed-gas hose	Completeness and tight fit	.....
Soda lime	Condition of lime	Lime renewed, no colour change	.....
O_2 meter	Functional check, calibration	Functional	.....
Monitors	Functional check, calibration	Functional	.....
Freedom from leaks for non-rebreathing and modified circle system	Seal relief valve and Y-piece, flow 0.4 L/min	Pressure ≥ 20 mbar for 10 seconds	.....
Relief valve	Relief valve 20 mbar, seal Y-piece, flow 10 L/min	Constant pressure 20 ± 5 mbar	.....
System Non-rebreathing/ modified circle system	Selector switch	Switch setting correct	.....
Ventilator	Connections to circle system	Tight	.....
	Switch on, check settings, seal Y-piece during inspiration	Airway pressure present	.....
Secretion aspirator	Switch on, seal aspiration hose	Vacuum present	.....
Bag for manual ventilation, for emergency ventilation	Check completeness	Complete	.....
	Check bag	Functioning properly	.....
Additions			

The articles such as masks, Y-pieces, corrugated hoses and connectors preceded by a (▷) symbol correspond in terms of connection dimensions to the ISO Draft Standard ISO/DB 5356. In addition there are a number of items which can be used both with ISO and with Dräger standard connecting elements.

Name and Description	Order Code
Basic versions	
A) Basic versions with flowmeter unit	
Romulus 800 basic version 1 For operation from two 11 litre gas cylinders and two 3 litre gas cylinders as standby or for operation from a central supply unit. With trolley, connections block with flowmeter unit, cylinder connections, O_2 and N_2O high-pressure spiral tubes, hinged arm, mixed gas hose, O_2 deficiency signal with N_2O cut-off	M 25804[1]
Romulus 800 basic version 5 For operation from a central supply unit and two 3 litre gas cylinders as standby. With trolley, connections block with flowmeter unit, cylinder connections, hinged arm, mixed gas hose, O_2 deficiency signal with N_2O cut-off	M 25808[1]
B) Basic versions with gas mixer	
Romulus 800 M basic version 1 For operation from two 11 litre gas cylinders and two 3 litre gas cylinders as standby or for operation from a central supply unit. With trolley, connections block with gas blender, cylinder connections, O_2 and N_2O high-pressure spiral tubes, hinged arm, mixed gas hose, O_2 deficiency signal with N_2O cut-off	M 25731[1]
Romulus 800 M basic version 5 For operation from a central supply unit and two 3 litre gas cylinders as standby. With trolley, connections block with gas blender, cylinder connections, hinged arm, mixed gas hose, O_2 deficiency signal with N_2O cut-off	M 25735[1]
C) Basic versions with flowmeter unit, envisaged for installation of a Ventilog	
Romulus 800 V basic version 3 For operation from two 11 litre gas cylinders and two 3 litre gas cylinders as standby or for operation from a central supply unit. With trolley, connections block with flowmeter unit, cylinder connections, O_2 and N_2O high-pressure spiral tubes, hinged arm, mixed gas hose, O_2 deficiency signal with N_2O cut-off	M 25806[1]
Romulus 800 V basic version 7 For operation from a central supply unit and two 3 litre gas cylinders as standby. With trolley, connections block with flowmeter unit, cylinder connections, hinged arm, mixed gas hose, O_2 deficiency signal with N_2O cut-off	M 25810[1]
D) Basic versions with gas blender, envisaged for installation of a Ventilog	
Romulus 800 MV basic version 3 For operation from two 11 litre gas cylinders and two 3 litre gas cylinders as standby or for operation from a central supply unit. With trolley, connections block with gas blender, cylinder connections, O_2 and N_2O high-pressure spiral tubes, hinged arm, mixed gas hose, O_2 deficiency signal with N_2O cut-off	M 25733[1]
Romulus 800 MV basic version 7 For operation from a central supply unit and two 3 litre gas cylinders as standby. With trolley, connections block with gas blender, cylinder connections, hinged arm, mixed gas hose, O_2 deficiency signal with N_2O cut-off	M 25737[1]
Anaesthesia cabinets required for all basic versions, option of:	
Cabinet 4 H Anaesthesia cabinet with one drawer and depositing tray	2 M 18093
Cabinet 8 H Anaesthesia cabinet with three drawers and depositing tray	2 M 18095
Cover plates required for all basic versions, option of:	
Cover plate, with rail Simple plate with depositing tray	M 25450
Base plate 1 B, with rail (Required for latching on Dräger Monitors).	M 25839
Accessories required for operation	
Circle system 7a With 2 carbon dioxide absorbers, inhalation and exhalation valve, relief valve, breathing bag, 3 corrugated hoses, soda lime filler funnel, 1 set of valve discs and sealing rings	M 23074 ▶M 25690
a) For operation from cylinders:	
O_2 cylinder, 11 litres 200 bar, contents 2200 litres of oxygen	B 2710[1]
N_2O cylinder, 11 litres Filled with 8 kg of nitrous oxide	B 2660[1]
O_2 cylinder, 3 litres 200 bar, contents 600 litres of oxygen	B 2533[1]
N_2O cylinder, 3 litres Filled with 2.25 kg of nitrous oxide	B 2540[1]
Cylinder jacket, 11 litres With valve cap and base ring, for 11 litre cylinder	M 3691
Cylinder jacket, 3 litres For 3 litre cylinder	M 8035
b) For operation from a central supply unit, option of:	
O_2 connecting hose, 3 m	M 22344
O_2 connecting hose, 5 m Connection – device end: Clamping screw M 12 × 1 Connection – wall end: Angled plug-in socket for O_2	M 22345
N_2O connecting hose, 3 m	M 22350
N_2O connecting hose, 5 m Connection – device end: Clamping screw M 14 × 1 Connection – wall end: Angled plug-in socket for N_2O	M 22351
Required for basic versions 3 and 7:	
Ventilog For controlled ventilation during anaesthesia	84 04 500
For operation from Romulus 800 M or 800 MV:	
Connecting hose, 0.6 m	M 25050
Alternatively (for operation from a central supply unit), option of:	
O_2-compressed-air connecting hose, 3 m	M 22494
O_2-compressed-air connecting hose, 5 m	M 22495
Connection accessories required:	
Connecting hose 2/1 m	84 04 758
Pneumatic switching valve	84 04 950 ▶84 05 276
Alternatively:	
Connection hose 2/1 m	84 04 758
Manual switching valve	84 05 305 ▶84 05 295
Accessories recommended for monitoring	
1. For continuous measurement and monitoring of O_2 in gas inhaled: **Oxycom 100 D oxygen meter and monitor** Measuring range 0–100% O_2 at normal pressure. With sensor housing, cable and sensor capsule.	68 03 255
Connection elements required for oxygen meter:	
a) If anaesthesia timer, sphygmomanometer or combination is being used: **O_2 meter holder 11**	M 21483
b) For screwing directly onto threaded connection of hinged arm: **O_2 meter holder 10**	M 21478

[1] **Order codes change** when the cylinder connection differs from the **standard German** connection. Will be inserted by Drägerwerk AG or its agency.

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Name and Description	Order Code
2. For continuous measurement and monitoring of airway pressure in circle system:	
a) **Barolog A**	83 02 930
With visual and audible alarm in the event of disconnection or obstruction	
Connection accessories required:	
Measurement connection	M 25636
Alternatively:	
b) **Respiratory pressure gauge with alarm "Precom"**	E 9711
Gives an audible alarm if a set pressure value is not attained within 15 seconds	
Alternatively:	
c) **Respiratory pressure gauge without alarm**	72 64 325
3. For continuous measurement and monitoring of minute volume, tidal volume and frequency:	
a) **Spirolog 1 N**	83 02 760
Connection accessories required:	
Spirolog sensor housing	M 26844
S-set: sensor, set of 5	84 03 735
Alternatively:	
b) For measurement of minute volume and tidal volume:	
Minute Volumeter 3000	2 M 18250
Special accessories	
Anaesthesia timer/sphygmomanometer Combined	M 14626
Anaesthesia timer	M 14692
Sphygmomanometer	M 14691
Blood pressure cuff, size 3 for adults	M 13790
Blood pressure cuff, size 2 for children	M 20139
Blood pressure cuff, size 1 for infants	M 20140
Gas-analysis measurement connections For continuous CO_2 and O_2 measurement during anaesthesia	M 18074
Set of microbe filters 644 St For insertion between inhalation valve and inhalation hose in circle system. 5 filters per pack. Can be sterilized 20 times	67 27 260
▶ **Set of microbe filters 644 St** Suitable for ISO circle system, comprising:	
Set of microbe filters 644 St	67 27 260
ISO-Set for microbe filters	M 26930
E-Vapor 19.1/5% pin safety With safety filling system	DB 01023
H-Vapor 19.1/4% pin safety With safety filling system	DB 01022
Special accessories for safety filling system	
Filling hose, Enflurane	M 26299
Filling hose, Halothane	M 26297
E-Vapor 19.1/5%	DB 01041
H-Vapor 19.1/4%	DB 01040
Possibilities for simultaneous removal of anaesthetic vapours from circle system and Ventilog	
1. Via an ejector system:	
a) **Accessory set – waste anaesthetic gas scavenging system 15** For basic versions 3 and 7 with built-in Ventilog	M 26094
b) **Accessory set – waste anaesthetic gas scavenging system 16** For basic versions 1 and 5 with latched-on Ventilog	M 26095
Further accessories:	
Plug	G 60225
Connecting hoses required, option of:	
Anaesthetic exhaust hose, 3 m	G 60305
Anaesthetic exhaust hose, 5 m	G 60306

Name and Description	Order Code
2. Via anaesthetic filter:	
Anaesthetic filter equipment 2 For filtering out harmful anaesthetic vapours. With 5 anaesthetic filters. 1 set of anaesthetic filter equipment in each case is required for the circle system and Ventilog	M 21262
Secretion aspirator, ejector	M 26136
Secretion aspirator, vacuum	M 26137
Required for operation of vacuum aspirator M 26137, option of:	
Vacuum connecting hose, 3 m	M 22353
Vacuum connecting hose, 5 m	M 22354
Connection – device end: Cap nut R ¾"	
Connection – wall end: Angled plug-in socket for vacuum	
Ventilog, fitted with latching elements, for latching onto base plate 1 B with basic versions 1 and 5 For operation from Romulus 800 or 800 M:	84 05 200
Connecting hose 1.2 m	M 25518
Alternatively (for operation from central supply unit), option of:	
O_2-compressed-air connecting hose, 3 m	M 22494
O_2-compressed-air connecting hose, 5 m	M 22495
Connecting accessories required:	
Connection hose 2/1.5 m	84 04 732
Pneumatic switching valve	84 04 950
	▶84 05 276
Alternatively:	
Connection hose 2/1.5 m	84 04 732
Manual switching valve	84 05 305
	▶84 05 295
Depositing tray 0.5 B for latching on to Ventilog or a Dräger Monitor (e. g. Barolog A or Spirolog 1 N)	2M 17680
Depositing tray 1 B for latching on to 2 adjacent Dräger Monitors	84 07 025
Dummy casing 2 H 0.5 B For height compensation, for latching on next to Dräger monitor	M 25625
Holder with rail For attachment to basic versions 3 and 7 on lefthand side next to anaesthesia cabinet. Designed to accomodate holder with refuse bag or the like	M 26390
Base plate 0.5 B for height compensation. To latch on to a built-in Ventilog in Romulus basic versions 3 and 7	M 26965
Writing surface	2 M 18260
Holder For accommodating a Pulmomat 19	M 25205
Bypass (accessory) for basic versions 1 and 5	M 25740
Bypass (accessory) for basic versions 3 and 7	M 25741
For expanding basic units with flowmeter unit Romulus 800/800 V to form basic units Romulus 800 »Air«/800 V »Air« *(air as third gas in addition to O_2 and N_2O):*	
Ancillary compressed-air unit	M 26597
Connecting hoses required, option of:	
Compressed-air connecting hose, 3 m	M 23193
Compressed-air connecting hose, 5 m	M 23235
Drawer inserts for anaesthesia cabinets:	
Insert 2 (2 compartments)	G 12101
Insert 4 (4 compartments)	G 12102
Insert 6 (6 compartments)	G 12103
See prospectus 5325e for Babylog N anaesthesia lung ventilator for infants	
Semi-open anaesthesia system 2.1 for spirometry, connection facilities for respiratory pressure gauge, Volumeter and waste anaesthetic gas scavenging system	M 23210 ▶M 26125
Infants' anaesthesia kit according to Kuhn	M 14832 ▶M 25634

Name and Description	Order Code
Waste anaesthetic gas exhaust connection, for Kuhn kit	M 23190 ▶M 25838
Set of Rendell-Baker masks, for Kuhn kit (qty. 4) 1 mask each, sizes 0–3	M 24526
Accessory set for children's circle system	M 26702
Bag Resutator	M 11900
Resu-bag	21 09 832
Hook	M 26349
Dust cover for basic versions 1 and 5	2 M 6832
Dust cover for basic versions 3 and 7	2 M 6835
Earth cable 3.2 m	83 01 349
For sealing of cylinder connections for 3 litre standby cylinders:	
O_2 screw plug	M 6620
N_2O lock nut	M 6621
Anaesthesia accessories (special prospectus 5301.0e)	
Replacement parts for sterilization	
Jar set, for secretion aspirator	M 26355
Patient set, for Ventilog including anaesthetic exhaust socket	84 05 040
Circle system 7a	M 23074 ▶M 25690
a) **Pneumatic switching valve, for Ventilog**	84 04 950 ▶84 05 276
Connection hose 2/1 m	84 04 758
Alternatively:	
Connection hose 1/1.5 m	84 04 732
b) **Manual switching valve, for Ventilog**	84 05 305 ▶84 05 295
Connection hose 2/1 m	84 04 758
Alternatively:	
Connection hose 2/1.5 m	84 04 732
Respiratory pressure gauge	E 9726
Further connecting accessories, eg. Y-pieces, masks, etc.: see prospectus 5301.0e »Anaesthetic Accessories«.	

No in Fig. 21	Name	Item No.
2	**Extension arm**	M 25 410
3	**Screw**	M 14 075
4	**Set of T-screws** (Qty. 2)	M 22 191
5	**Washer**	M 25 419
6	**T-screw**	M 19 816
7 8	**Mixed-gas hose** comprising Sealing ring (Qty. 2) Hose	M 17 734
7	**Set of sealing rings** (Qty. 10)	M 22 189
9	**T-screw**	M 24 953
10	**O-ring set** (Qty. 10)	U 15 314
11	**Corner piece**	M 23 396
12	**Spanner 32/22 mm**	M 12 401
13 14	**Connecting hose** comprising Sealing ring Hose	M 25 050
13	**Set of sealing rings** (Qty. 10)	M 23 454
15 16	**High-pressure spiral tube O_2** comprising High-pressure spiral tube O_2 Sealing ring (Qty. 2)	M 7 571
16	**Set of sealing rings** (Qty. 10)	D 20 065
16a	**Set of sealing rings** (Qty. 10) *for pin index cylinder connection* (not illustrated)	M 23 496
–	**Set of T-screws** (Qty. 2) for pin index cylinder connection (not illustrated)	M 23 615
18 19	**High-pressure spiral tube N_2O** comprising High-pressure spiral tube N_2O Sealing ring (Qty. 2)	M 7 572
19	**Set of sealing rings** (Qty. 10)	M 23 439
20	**Set of screws** (Qty. 10)	2M 17568
21	**Hose 2/1 m**	84 04 758

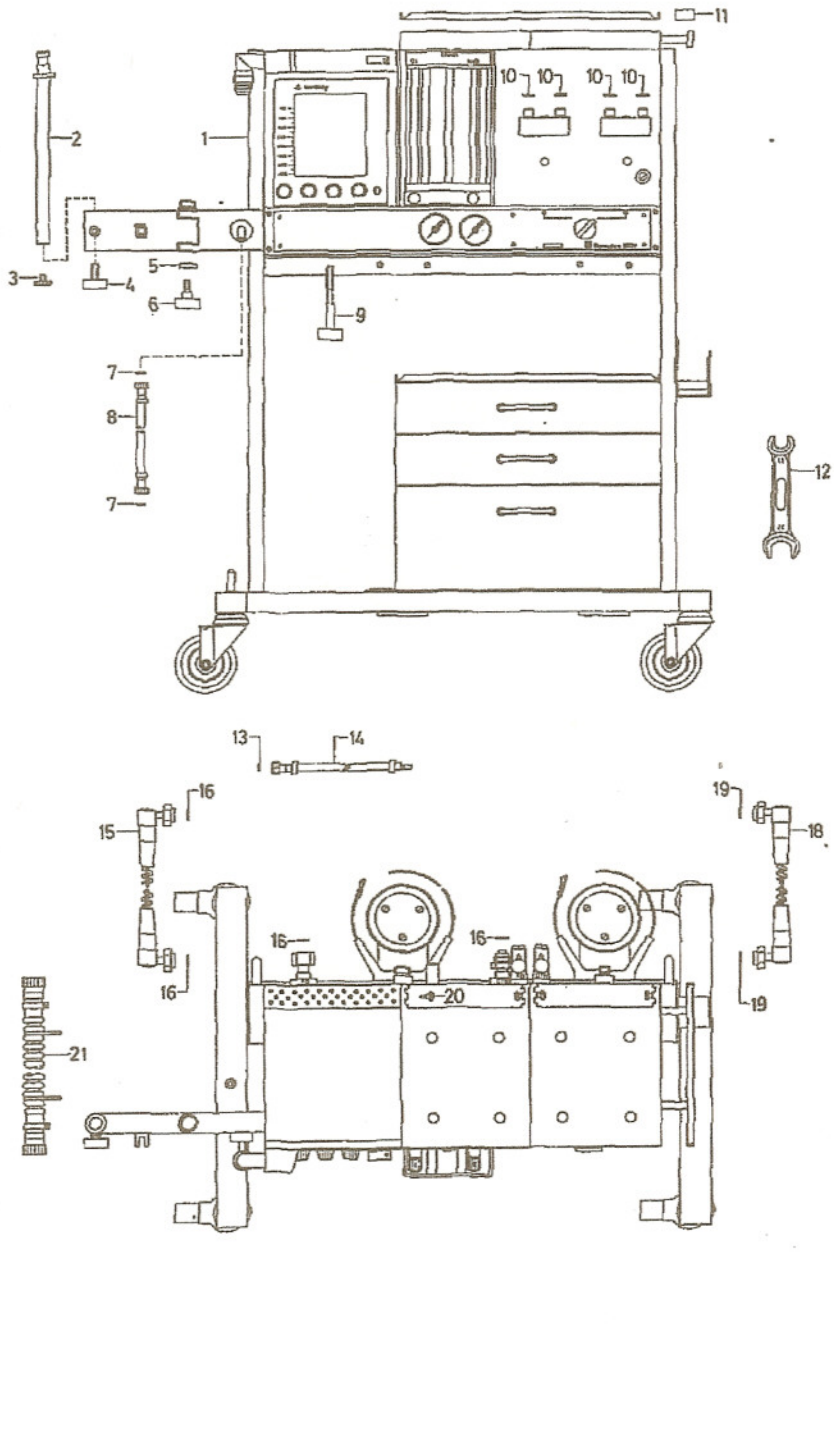

Fig. 21 Component parts for all Romulus models (see Parts List on page 26).
The item numbers are not identical with the item numbers in the other Figures

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