



NARKOMED 2 ANESTHESIA SYSTEM

OCTOBER, 1979

NORTH AMERICAN DRAGER
148B Quarry Rd., Telford, PA 18969

NARKOMED 2 ANESTHESIA SYSTEM

1. Classification

The NARKOMED 2 Anesthesia System is a continuous flow anesthesia machine incorporating the features described in the specifications and equipment section of this manual.

2. Serial Number Identification

All inquiries referring to the NARKOMED 2 should include the serial number of the machine; the serial number is located on the rear side of the left leg of the machine.

3. Warranty

NARKOMED 2 Anesthesia Systems are unconditionally guaranteed to be free from original defects in parts, materials, and workmanship for a period of twelve (12) months from date of delivery. This warranty applies to repair, replacement, or credit with North American Drager holding the option. All rubber parts and accessories are guaranteed to be free from defects at time of delivery.

4. Markings and Color Identification

NARKOMED 2 Anesthesia Systems produced for sale in the United States are supplied with the following color coding.

Air		Yellow
Carbon Dioxide	CO ₂	Gray
Helium	He	Brown
Nitrogen	N ₂	Black
Nitrous Oxide	N ₂ O	Blue
Oxygen	O ₂	Green

Systems produced for export are either provided with the color code recommended by ISO or in compliance with the national color code if requested by the purchaser.

5. Installation

Installation of the NARKOMED 2 shall be by or under the direction of an authorized service representative of North American Drager.

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ROUTINE TEST PROCEDURES

THE NORTH AMERICAN DRÄGER ANESTHESIA MACHINES WITH ANESTHESIA BREATHING SYSTEMS AS WELL AS ALARM AND MONITORING DEVICES REPRESENT AN INTEGRAL SYSTEM AND SHALL BE TESTED AS SUCH. THE FOLLOWING ROUTINE TEST PROCEDURES ARE RECOMMENDED BY NORTH AMERICAN DRÄGER PRIOR TO DAILY USAGE.

1. HIGH PRESSURE TEST

TEST TO BE PERFORMED WITH EACH GAS INDEPENDENTLY, NOT APPLICABLE TO OXYGEN ON THE NARKOMED 2 OR AM III ANESTHESIA MACHINES.

1. 1. CLOSE FLOW CONTROL VALVE BY CLOCKWISE MOTION.
1. 2. OPEN CYLINDER VALVE UNTIL INDICATED PRESSURE AT CYLINDER PRESSURE GAUGE STABILIZES.
1. 3. CLOSE CYLINDER VALVE.

THE DECREASE OF PRESSURE INDICATED AT THE PRESSURE GAUGE DURING THE FOLLOWING TWO (2) MINUTES SHALL NOT BE MORE THAN 50 PSI.

2. ANESTHESIA BREATHING SYSTEM AND FRESH GAS DELIVERY SYSTEM TEST

THE BELOW TEST SPECIFICATIONS APPLY TO AN ANESTHESIA BREATHING SYSTEM WITHOUT ACCESSORIES, E.G. RESPIRATORY METER, FILTERS, NARKOTEST-M, CONCENTRATION MEASUREMENT DEVICE, AND OTHER ADAPTERS. TEST LIMITS DESCRIBED BELOW WILL BE EXCEEDED WHEN ACCESSORY ITEMS ARE INCLUDED IN THE TEST. THE SUPPLIER OF THE ACCESSORY SHOULD BE CONTACTED FOR LEAK SPECIFICATIONS.

2. 1. CLOSE ALL FLOW CONTROL VALVES.
2. 2. TURN MAIN SWITCH TO OFF (APPLICABLE ONLY TO NARKOMED 2 AND AM III).
2. 3. TURN VAPORIZER(S) TO ZERO (0) CONCENTRATION.
2. 4. SHORT CIRCUIT INSPIRATORY AND EXPIRATORY VALVES WITH 22MM HOSE.
2. 5. SET MANUAL AUTOMATIC SELECTOR VALVE TO BAG (ONLY APPLICABLE TO NAD/AV ABSORBERS).
2. 6. CLOSE APL VALVE (POP-OFF VALVE); KNOB MUST BE TURNED FULLY CLOCKWISE TO STOP POSITION.

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2. 7. ATTACH TEST TERMINAL TO BAG MOUNT.
2. 8. CONNECT SPHYGMOMANOMETER SQUEEZE BULB TO HOSE BARB ON TEST TERMINAL.
2. 9. HAND PUMP SQUEEZE BULB UNTIL PRESSURE AT BREATHING SYSTEM PRESSURE GAUGE INDICATES PRESSURE HIGHER THAN 50 CM H₂O.
2. 10. OBSERVE PRESSURE DROP AT GAUGE.

THIRTY (30) SECONDS, OR LONGER, SHALL BE REQUIRED FOR A PRESSURE DECREASE FROM 50 TO 30 CM H₂O.

3. OXYGEN CONCENTRATION TEST

3. 1. THIS TEST SPECIFICATION APPLIES TO BREATHING SYSTEMS WITH THE OXYGEN SENSOR MOUNTED INTO THE INSPIRATORY VALVE; THE HOSE TERMINAL AT THE INSPIRATION VALVE MUST BE OPEN TO ATMOSPHERE.
3. 1. 1. CLOSE APL VALVE.
3. 1. 2. ADJUST O₂ FLOW TO 8 LPM.

OXYGEN METER SHALL INDICATE AN O₂ CONCENTRATION OF APPROXIMATELY 100%.

3. 2. THIS TEST SPECIFICATION APPLIES TO BREATHING SYSTEMS WITH THE OXYGEN SENSOR MOUNTED AT A LOCATION OTHER THAN IN THE INSPIRATORY VALVE.
3. 2. 1. DISCONNECT INSPIRATORY HOSE.
3. 2. 2. PLACE O₂ SENSOR IN FRONT OF INSPIRATORY VALVE TERMINAL.
3. 2. 3. CLOSE APL VALVE.
3. 2. 4. ADJUST O₂ FLOW TO 8 LPM.

OXYGEN METER SHALL INDICATE AN O₂ CONCENTRATION OF APPROXIMATELY 100%.

4. APL VALVE (POP-OFF VALVE) FLOW TEST

THE BELOW TEST SPECIFICATIONS APPLY ONLY TO ABSORBER SYSTEMS INCORPORATING A MANUAL AUTOMATIC SELECTOR VALVE.

4. 1. SET VALVE TO BAG POSITION.
4. 2. SHORT CIRCUIT INSPIRATORY AND EXPIRATORY VALVES WITH 22 MM HOSE.

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4. 3. OPEN APL VALVE; KNOB MUST BE TURNED FULLY COUNTER-CLOCKWISE TO STOP POSITION.
4. 4. OPEN O₂ FLOW CONTROL VALVE AND SET FLOW TO 8 LPM.
4. 5. OBSERVE BREATHING SYSTEM PRESSURE GAUGE.

BREATHING SYSTEM PRESSURE GAUGE SHALL NOT EXCEED 2 CM H₂O.

5. FLOW DIRECTION TEST

5. 1. THIS TEST SPECIFICATION APPLIES TO SYSTEMS INCORPORATING A VENTILATOR AND A BREATHING SYSTEM WITH A MANUAL AUTOMATIC SELECTOR VALVE.
5. 1. 1. SET MANUAL AUTOMATIC SELECTOR VALVE TO BAG POSITION.
5. 1. 2. CONNECT VENTILATOR HOSE AT Y-PIECE.
5. 1. 3. OPEN APL VALVE.
5. 1. 4. OPEN O₂ FLOW CONTROL VALVE AND ADJUST FLOW TO 3 LPM.
5. 1. 5. TURN ON VENTILATOR.
5. 1. 6. SET BPM TO 16.
5. 1. 7. SET TIDAL VOLUME TO 700 ML.
5. 1. 8. ADJUST VENTILATOR INSPIRATORY FLOW SO THAT TIDAL VOLUME IS FULLY DELIVERED WITHIN INSPIRATORY PHASE TIME.

THE PRESSURE ON THE BREATHING SYSTEM PRESSURE GAUGE SHALL NEITHER EXCEED +2 CM H₂O DURING THE EXPIRATORY PHASE NOR GO BELOW -2 CM H₂O DURING THE INSPIRATORY PHASE.

5. 2. THIS TEST SPECIFICATION APPLIES TO SYSTEMS INCORPORATING A VENTILATOR BUT A BREATHING SYSTEM WITH NO MANUAL AUTOMATIC SELECTOR VALVE.
5. 2. 1. CONNECT BAG TO BAG TERMINAL.
5. 2. 2. CONNECT VENTILATOR HOSE TO Y-PIECE.
5. 2. 3. PROCEED WITH 5. 1. 3 TO END OF TEST (ABOVE).
5. 3. THIS TEST SPECIFICATION APPLIES TO SYSTEMS NOT INCORPORATING A VENTILATOR.
5. 3. 1. CONNECT RESUSCITATOR BAG OR BELLOWS TO Y-PIECE.
5. 3. 2. OPEN APL VALVE.
5. 3. 3. OPEN O₂ FLOW CONTROL VALVE AND ADJUST FLOW TO 3 LPM.



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5. 3. 4. OCCLUDE AIR INTAKE VALVE (IF EXISTING) OF THE BAG OR BELLOWS.
5. 3. 5. HAND SQUEEZE RESUSCITATOR BAG OR BELLOWS IN THE FREQUENCY OF NORMAL BREATHING, GENERATING A TIDAL VOLUME OF APPROXIMATELY 700 CC.

TEST RESULTS AS DESCRIBED UNDER 5.1 SHALL BE OBTAINED.

6. VENTILATION PRESSURE MONITOR (D.P.M.) TEST

THE BELOW TEST SPECIFICATIONS APPLY TO VENTILATION PRESSURE MONITORS INCORPORATED INTO THE NARKOMED 2 OR THE AM III; THE OXYGEN CYLINDER MUST BE CLOSED AND THE OXYGEN PIPELINE SUPPLY DISCONNECTED. THE OXYGEN LOW PRESSURE ALARM WILL BE ACTUATED AND LAMPS WILL FUNCTION DURING THE TEST AFTER THE MAIN SWITCH HAS BEEN TURNED ON.

6. 1. SHORT CIRCUIT INSPIRATORY AND EXPIRATORY VALVES WITH 22 MM HOSE.
6. 2. SET MANUAL AUTOMATIC SELECTOR VALVE TO BAG, WHERE APPLICABLE.
6. 3. CLOSE APL VALVE.
6. 4. ATTACH TEST TERMINAL TO BAG MOUNT.
6. 5. CONNECT SPHYGMOMANOMETER SQUEEZE BULB TO HOSE BARB ON TEST TERMINAL.
6. 6. TURN OFF AUDIBLE ALARM, APPLICABLE ONLY TO NARKOMED 2 AND AM III.
6. 7. TURN ON MAIN SWITCH OF ANESTHESIA MACHINE, APPLICABLE ONLY TO NARKOMED 2 AND AM III.
6. 8. TURN ON VENTILATOR SWITCH, APPLICABLE ONLY TO DRAGER AV ANESTHESIA VENTILATOR IN NARKOMED 2 AND AM III.
6. 9. TURN ON MONITOR SWITCH, APPLICABLE ONLY TO MONITORS WHICH ARE NOT INTEGRAL PARTS OF AN ANESTHESIA MACHINE, E.G. ATTACHED TO NARKOMED OR NARKOMED COMPACT.

FOLLOWING STEP 6.8, OR 6.9, THE VENTILATION PRESSURE MONITOR ALARM SHALL BE ACTUATED; AUDIBLE AND VISUAL ALARMS CANNOT BE SILENCED.

- 6.10. ADJUST PRESSURE SELECTOR SWITCH TO 5 CM H₂O.
- 6.11. HAND PUMP SQUEEZE BULB UNTIL BREATHING PRESSURE GAUGE INDICATES 8 CM H₂O; ALARM SHALL BE SILENCED.

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- 6.12. OPEN RELIEF VALVE AT SQUEEZE BULB TO ALLOW SYSTEM PRESSURE TO DECREASE TO ZERO (0).

THE ALARM WILL BE REACTUATED 15 SECONDS (+/- 3.5 SEC.) AFTER THE SYSTEM PRESSURE HAS DECREASED BELOW THE PRESSURE SET AT THE SELECTOR SWITCH.

- 6.13. ADJUST PRESSURE SELECTOR SWITCH TO 12.5 CM H₂O.
6.14. REPEAT STEPS 6.11 AND 6.12.
6.15. ADJUST PRESSURE SELECTOR SWITCH TO 25 CM H₂O.
6.16. REPEAT STEPS 6.11 AND 6.12.

7. CONTINUING PRESSURE MONITOR ALARM TEST, IF APPLICABLE

7. 1. TEST SET-UP IS AS DESCRIBED UNDER (6) VENTILATION PRESSURE MONITOR TEST.
7. 2. HAND PUMP SQUEEZE BULB UNTIL BREATHING PRESSURE GAUGE INDICATES 15 CM H₂O.

MAINTAINING THIS PRESSURE, THE ALARM SHALL BE ACTUATED AFTER A PERIOD OF 10 SECONDS (+/- 3 SEC.).

8. HIGH PRESSURE MONITOR ALARM TEST

8. 1. TEST SET-UP IS AS DESCRIBED UNDER (6) VENTILATION PRESSURE MONITOR TEST.
8. 2. HAND PUMP SQUEEZE BULB UNTIL BREATHING PRESSURE GAUGE INDICATES 65 TO 70 CM H₂O; THE HIGH PRESSURE ALARM SHALL BE ACTUATED.

DURING THIS TEST THE CONTINUING PRESSURE MONITOR ALARM MAY BE ACTUATED IF A PRESSURE HIGHER THAN 12.5 CM H₂O IS MAINTAINED IN THE SYSTEM FOR A PERIOD LONGER THAN 10 SECONDS.

9. SUB-ATMOSPHERIC PRESSURE MONITOR ALARM TEST

9. 1. TEST SET-UP IS AS DESCRIBED UNDER (6) VENTILATION PRESSURE MONITOR TEST; HOWEVER, THE SQUEEZE BULB IS CONNECTED DIRECTLY TO THE TEST TERMINAL, ELIMINATING SPIRAL HOSE AND BLEED VALVE AT BULB.



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9. 2. OPEN APL VALVE.
9. 3. HAND SQUEEZE BULB, ENGAGE IN SQUEEZED CONDITION.
9. 4. OCCLUDE INTAKE PORT OF BULB WITH THUMB.
9. 5. RELEASE BULB QUICKLY.

THE PRESSURE IN THE SYSTEM SHALL DROP BELOW 10 CM H₂O FOR AN INSTANT AND ACTUATE THE SUB-ATMOSPHERIC ALARM; IF THIS RESULT IS IMPOSSIBLE TO OBTAIN, OTHER MEANS SHALL BE APPLIED, E.G. USING A LARGE SYRINGE.

10. OXYGEN RATIO MONITOR ALARM TEST

- 10.1. TURN MAIN SWITCH TO ON (APPLICABLE ONLY TO NARKOMED 2 AND AM III).
- 10.2. TURN ON MONITOR SWITCH, APPLICABLE ONLY TO MONITORS WHICH ARE NOT INTEGRAL PARTS OF AN ANESTHESIA MACHINE, E.G. ATTACHED TO NARKOMED OR NARKOMED COMPACT.
- 10.3. SET N₂O FLOW TO 3.5 LPM.
- 10.4. ADJUST O₂ FLOW TO 500 CC/MIN FLOW.
- 10.5. INCREASE O₂ FLOW.

THE OXYGEN RATIO MONITOR ALARM SHALL BE SILENCED WITH AN OXYGEN FLOW OF 950 CC/MIN TO 1.2 LPM.

11. FLOWMETER TEST

ADJUST FLOW FOR EACH GAS OVER THE FULL RANGE OF ITS ASSOCIATED FLOW-METER(S). WITH AN ANESTHESIA MACHINE SUPPLY PRESSURE WITHIN THE NOMINAL RANGE, IT SHALL BE POSSIBLE TO ADJUST THE FLOW OVER THE FULL RANGE OF THE FLOWMETER(S). THE FLOAT WITHIN THE FLOWMETER(S) SHALL FREELY ROTATE AT ALL POSITIONS.

12. VENTILATOR TEST

- 12.1. TURN MAIN SWITCH TO ON (APPLICABLE ONLY TO NARKOMED 2 AND AM III).
- 12.2. TURN VENTILATOR SWITCH TO ON.
- 12.3. ADJUST O₂ FLOW TO 3 LPM.

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- 12.4. ADJUST FREQUENCY TO 10 BPM.
- 12.5. ADJUST TIDAL VOLUME TO APPROXIMATELY ONE (1) LITER.
- 12.6. ADJUST FLOW TO MAXIMUM OF LOW ZONE.
- 12.7. SWITCH MANUAL-AUTOMATIC SELECTOR VALVE TO AUTO.
- 12.8. CLOSE 15 MM OUTLET AT Y-PIECE WITH THUMB.

SYSTEM PRESSURE GAUGE SHALL INDICATE A PRESSURE IN EXCESS OF 40 CM H₂O WHEN BELLOWS STOPS ITS UPWARD MOTION (NOTE: THE BELLOWS WILL NOT FULLY DEFLATE). DURING THE EXPIRATORY PHASE, DOWNWARD MOVEMENT OF THE BELLOWS, THE PRESSURE IN THE SYSTEM INDICATED AT THE PRESSURE GAUGE SHALL DECREASE TO APPROXIMATELY 2 CM H₂O PRESSURE WHEN THE BOTTOM OF THE BELLOWS REACHES ITS RESTING POSITION. THE PRESSURE IN THE SYSTEM MAY DROP BELOW ZERO (0) MOMENTARILY BEFORE REACHING ITS FINAL CONDITION.

13. NAD OXYGEN MONITOR

A "DAILY CHECK LIST" IS CONTAINED ON A CARD LOCATED IN THE BATTERY COMPARTMENT OF THE UNIT.

14. SPHYGMOMANOMETER LEAK TEST

- 14.1. INSERT MALE LUER FITTING OF A SPHYGMOMANOMETER SQUEEZE BULB-HOSE ASSEMBLY INTO THE FEMALE LUER FITTING ADJACENT TO THE BLOOD PRESSURE LABEL ON THE MACHINE.
- 14.2. HAND PUMP SQUEEZE BULB UNTIL PRESSURE OF 200 MM Hg IS INDICATED ON THE SPHYGMOMANOMETER GAUGE ON THE MACHINE. PINCH HOSE CLOSED ADJACENT TO THE LUER FITTING TO ASSURE THAT THE HOSE-BULB ASSEMBLY IS NOT THE SOURCE OF ANY LEAK INDICATED.

THE DECREASE OF PRESSURE INDICATED AT THE SPHYGMOMANOMETER GAUGE DURING THE FOLLOWING 30 SECONDS SHALL NOT EXCEED 10 MM Hg.



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15. OXYGEN FLUSH

ACTUATE THE OXYGEN FLUSH BY PRESSING THE "O₂ FLUSH" BUTTON ON THE LEFT FRONT EDGE OF THE TABLE TOP. THE OXYGEN FLUSH DELIVERS AN UNMETERED FLOW OF APPROXIMATELY 50 LPM OF OXYGEN DIRECT TO THE COMMON OUTLET. RELEASING THE "O₂ FLUSH" BUTTON MUST IMMEDIATELY SHUT OFF THIS FLOW.

16. OXYGEN SUPPLY PRESSURE FAILURE PROTECTION DEVICE

- 16.1. SET OXYGEN FLOW TO 1.0 LPM.
- 16.2. SET NITROUS OXIDE FLOW TO 1.0 LPM.
- 16.3. SHUT OFF OXYGEN CYLINDER VALVE IF E-CYLINDER IS SOURCE OF PRESSURE, OR PIPELINE VALVE IF PIPELINE IS SOURCE OF OXYGEN PRESSURE.
- 16.4. NITROUS OXIDE FLOW MUST CEASE WHEN THE FLOW OF OXYGEN HAS STOPPED.
- 16.5. REPEAT TEST (STEPS 1 TO 4) FOR ADDITIONAL GAS CIRCUIT(S) (OPTIONAL) ON THE MACHINE.
- 16.6. FOLLOWING STEP 4, WHEN AN OXYGEN SUPPLY PRESSURE ALARM IS INCORPORATED INTO THE SYSTEM, SHUTTING OFF THE OXYGEN MAY ACTUATE THE ALARM.

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6. Service and Repair

All North American Drager anesthesia equipment shall be serviced and/or repaired only by persons authorized by North American Drager. Service to anesthesia machines at regular intervals is recommended; details regarding preventive maintenance service contracts are available upon request.

7. Dimension Specifications

Maximum height	68"	173 cm
Maximum width	40"	102 cm
(with absorber fully extended)		
Maximum depth	25"	63.5 cm
Table-top height	34"	86 cm
Table-top area	310 square inches	2,000 cm ²
Shelf Area	200 square inches	1,290 cm ²
Drawer dimensions:		
Large Drawer	14" X 20-1/2" X 7	35.5 X 52 X 17.8 cm
Small Drawers	14" X 17" X 3-1/4"	35.5 X 43 X 8.3 cm
Nominal Weight	325 lbs	147 kg

8. Electrical Conductivity

The NARKOMED 2 is equipped with conductive casters. All anesthesia machines are tested for electrical conductivity between one caster as a measuring point and the table-top, shelf-top, and inspiration valve, alternately, as the other measuring point. The maximum allowable resistance between any two points is 250,000 ohm. This conductivity test should be performed monthly to assure continued conductivity of the machine.

Call or write for technical assistance with design or application problems or for the name of the authorized distributor in your area.

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STANDARD AND OPTIONAL EQUIPMENT

9. Gas Cylinder Yokes (Standard)

The NARKOMED 2 is equipped with one (1) oxygen and one (1) nitrous oxide yoke to facilitate attachment of gas cylinders with flush type valves. Additional yokes are optional. The Pin-Index System is used to prevent connection of a cylinder of incorrect type. All yokes contain check valves to prevent transfer of gas from one cylinder to another, and to prevent leakage of gas to the atmosphere when the yoke is not holding a cylinder. The check valve will also prevent accidental backward leakages of gases that are assumed to be moving toward the patient, a condition that can occur when the flow control valve is open and there is no cylinder in the yoke. When there is no cylinder in a yoke, we suggest that our yoke plug (Part #1100535) be inserted in the yoke for added security. Only one (1) washer shall be used for sealing purposes in a cylinder yoke. The safety of the Pin-Index System can be compromised if more than one washer is used. When changing cylinders special attention should be given to check the existence of both index pins.

10. AIR Circuit (Optional)

When AIR is supplied to the AIR gas circuit via a pipeline inlet connection, the inlet is keyed by a diameter index system (DISS). The inlet incorporates a check valve which permits gas to enter when suitable hose connection is made but prevents reverse flow of gas from the machine. The pipeline inlet connection is located at the left side of the anesthesia machine. The AIR gas circuit incorporates an oxygen supply pressure protection device (see paragraph #15 on OFPD). When AIR is supplied by utilizing high pressure gas cylinders, suitable connection of the gas cylinder is made through a cylinder yoke. The Pin-Index System is used to prevent connection of a cylinder of incorrect type. The flowmeter for the AIR gas circuit is a single tube; the meter will be mounted between the N₂O and O₂ flowmeters.

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11. Pressure Regulators (Standard)

All gas circuits utilizing yokes are equipped with pressure regulators. These regulators are adjusted to a delivery pressure of 40 psi. By this adjustment, the delivery pressure of the regulator is purposely pre-set below the commonly used hospital pipeline pressure of 50 psi. This arrangement ensures that gas will be supplied from the pipeline and not the cylinder if both sources of supply are open. All pressure regulators are equipped with a safety relief device of appropriate discharging capacity.

12. Pressure Gauges (Standard)

Each yoke or group of interconnected yokes is provided with a cylinder pressure gauge which indicates the gas pressure in the cylinder when the valve is open. Each gauge is calibrated in pounds per square inch (psi) and is identified with the symbol for the specific gas it accommodates. The pressure gauges are located directly below the flow control valve and flowmeter with which they are associated. The gauge pressure indicated is directly proportional to cylinder contents in the case of non-liquified gases (O₂, AIR). For liquified gases (N₂O), the gauge indicates the vapor pressure of the vaporized liquid in the cylinder. This pressure remains approximately constant until all of the liquid in the cylinder has vaporized; the pressure then drops proportionally with further removal of gas from the cylinder. When two (2) cylinders of the same gas are open, the gauge will indicate the pressure in the cylinder having the higher pressure.

	Cylinder Fill Pressure Values (at 21°C/70°F)		F	Full Scale Gauge Pressure Values	
	<u>kPa</u>	<u>lbf/in²</u>		<u>kPa</u>	<u>lbf/in²</u>
Air	15,000	2,200		20,700	3,000
Nitrous Oxide	5,100	745		13,800	2,000
Oxygen	15,000	2,200		20,700	3,000

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The pressure of O₂ and N₂O (AIR optional) supplied from hospital pipelines at reduced pressure is indicated at an additional set of gauges located in the lower portion of the flowmeter housing.

Pipeline Pressure Gauge Values

	Nominal		Full Scale	
	<u>kPa</u>	<u>lbf/in²</u>	<u>kPa</u>	<u>lbf/in²</u>
Air	345	50	690	100
Nitrous Oxide	345	50	690	100
Oxygen	345	50	690	100

13. Pipeline Inlet Connections (Standard)

The oxygen and nitrous oxide gas systems include low pressure pipeline inlets located at the left side of the flowmeter housing (air optional). These inlets include check valves which permit gas to enter when suitable hose connections are made, but prevent reverse flow of gas from the machine cylinder system to the pipeline or to atmosphere if no hose is connected. The inlets are of the type known as Diameter Index Safety System (DISS), male. The purpose of the DISS system is to prevent misconnection of gases to the machine.

14. Pipeline Inlet Connections (Optional)

Machines with air circuit, in addition to the standard oxygen and nitrous oxide circuits, may also be supplied with a pipeline connection. Special air pipeline inlet connections will be of the DISS type, and will be equipped with a check valve similar to that described for standard inlet connections.

15. OFPD - Oxygen Supply Pressure Failure Protection Device (Standard)

To minimize hazards to the patient in the case of oxygen supply pressure failure, all gas dispensing systems of the NARKOMED 2, with the exception of oxygen,

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are provided with an oxygen pressure failure protection device. This device consists of pneumatically operated valves which are located in the supply lines to the flow control valves of each gas other than oxygen. These valves are controlled by the pressure of the gas in the oxygen supply line delivering gas to the oxygen control valve. A failure, or reduction, of pressure in the oxygen supply line will proportionally reduce and eventually shut off the supply of all other gases. As an indication of the actuated system, the floats in the flowmeters will drop to zero.

16. Oxygen Flush (Standard)

The NARKOMED 2 Anesthesia System is equipped with a manually operated oxygen flush valve of self-closing construction located at the left front of the frame. The valve, if actuated, delivers an unmeasured oxygen flow of approximately 50 lpm directly to the common outlet of the machine. The oxygen flow of the flush by-passes the out-of-circuit vaporizers of the system. The connection of the fresh gas line and the oxygen flush line is designed to prevent the build-up of excessive pressure within certain limits of downstream resistance when the flush is actuated. The oxygen flush may be operated without the main switch being in the "on" position.

17. Flowmeters (Standard)

The NARKOMED 2 is equipped with both fine and coarse flow tubes for the oxygen and nitrous oxide circuits. In each case the fine tube is calibrated from 100 cc to 1,000 cc and the coarse tube is calibrated from 1.0 lpm to 10.0 lpm. All flowtubes have the scale etched and printed directly onto the glass tubing. The accuracy of the flowtubes is certified to be within $\pm 3\%$ of full scale reading under test conditions. All flow tubes are calibrated at 20°C and 760 mm Hg barometric pressure. The center of the ball is the indication of flow. The sapphire balls within the flowmeter tubes are one-half sphere chromeplated to indicate free movement of the ball through rotation. Lack of rotation may indicate malfunctioning of the tube and misindication of flow; an authorized North American Drager service representative should be consulted. Anesthesia machines manufactured for use in the United States and its territories have the oxygen flowmeter to the far right of all flowmeters on the machine. The nitrous oxide flowmeter is located to the far left of the bank of flowmeters. Machines manufactured for export outside of the United States have the flowmeters positioned as mandated by the rules and regulations of the importing nation.

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18. Flow Control Valves (Standard)

Each gas line which dispenses metered gas to the patient breathing system incorporates one precision flow control valve. The flow control valve is located immediately below the flowmeter for the specific gas it controls, or below the low range tube where two flow tubes are used in tandem. The gas flow in all cases is increased by counter-clockwise motion of the valve knob, and decreased by clockwise motion of the knob. The flow control valves are capable of adjusting the range of flow within the limits of the associated flowmeter or flowmeters where the delivery and supply pressures are within normal limits. Excessive force should be avoided when shutting off the valve in order to prevent damage to the valve seat. The oxygen control valve utilizes a touch-coded knob; the knob is deeply serrated, all other control knobs have minimal serrations. (Refer to paragraph #4 on color coding). In order to reduce possible damage to the delicate valve seats, the valve arrangement incorporates a zero flow stop; readjustment of this stop can be accomplished by authorized North American Drager personnel. Inadvertent readjustment of the flow control valve is reduced by pulling the flow control knob protection bar (optional) toward the operator.

19. Fresh Gas Common Outlet (Standard)

The fresh gas outlet is located in clear view of the operator and consists of a 15 mm female connector equipped with a safety-locking device which prevents an inadvertent disconnect of the fresh gas hose; an adapter for conversion to 22 mm is an available option.

20. Main Switch (Standard)

The main switch is located at the left side of the flowmeter housing at the same level as the flow control valves. The main switch has two positions, "off" (9 o'clock position) and "on" (12 o'clock position). With the "on" position, the main switch actuates all gas supplied to respective control valves and supplies battery power to all alarm systems with the exception of the ventilation pressure monitor which is actuated by the ventilator switch. In order to prevent inadvertent disengagement of the main switch it is necessary to push and turn the control knob when changing positions. The electrical system is protected by a 500 ma fuse located in the battery lead adjacent to the battery terminal.

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21. Battery Test Assembly (Standard)

The battery test assembly is located in the central alarm panel at the lower left of the flowmeter housing and consists of a red test button and a green L.E.D. Pressing the test button will result in illuminating of the L.E.D. if the potential for sufficient battery power for several hours of use exists.

22. Oxygen Supply Pressure Alarm (Standard)

The oxygen supply pressure alarm, marked O₂ SUPPLY PRESSURE, is located in the central alarm panel at the left side of the flowmeter housing and displays alternating red warning lights. The audible alarm may be silenced if desired. It is actuated if the oxygen supply pressure in the system decreases to below 30 psi.

23. Oxygen Flow Ratio Alarm Monitor (Standard)

The oxygen flow ratio alarm, marked O₂ FLOW RATIO, is located in the central alarm panel at the left side of the flowmeter housing and displays alternating red warning lights. The audible alarm may be silenced if desired. It is actuated if the ratio of Nitrous Oxide flow to Oxygen flow decreases below a factory preset level. The oxygen flow ratio monitor is factory adjusted to give a warning when the oxygen flow decreases to below 30%, +/- 5%, of the combined oxygen and nitrous oxide flow at an oxygen flow greater than one liter per minute. At oxygen flows less than 1 lpm the alarm point is adjusted at a higher oxygen concentration to assure adequate supply of oxygen to the rebreathing system when rebreathing systems are used.

24. Minimum Ventilation Pressure Alarm (Standard)

The minimum ventilation pressure alarm, marked MIN. VENT PRESSURE, is located in the central alarm panel at the left side of the flowmeter housing and consists of a minimum ventilation pressure selector switch and two alternating red warning lights. The audible alarm can not be turned off. The selector switch has three alternate positions: 5, 12.5, and 25 cm H₂O. The alarm

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consists of a breathing system pressure monitor which will actuate the audio and visual signal when the maximum pressure amplitude in the system is less than the monitored pressure set at the selector switch or if the frequency of artificial ventilation is less than four times per minute. A decrease of maximum pressure below the monitor setting and the actuation of the warning signal may be the result of a disconnect of the patient, an excessive leak in the system, or failure of the ventilator in the expiratory phase. To operate, set pressure selector switch to next lower pressure setting below maximum pressure indicated at system pressure gauge.

Example: For system peak pressure higher than 30 cm H₂O,
set monitoring pressure selector to 25 cm H₂O.
For system peak pressure between 15 and 30 cm H₂O,
set monitoring pressure selector to 12.5 cm H₂O.
For system peak pressure between 7 and 15 cm H₂O,
set monitoring pressure selector to 5 cm H₂O.

25. Continuing System Pressure Alarm (Standard)

The continuing system pressure alarm, marked CONT'G PRESSURE, is located in the central alarm panel at the left side of the flowmeter housing at the same level as the flow control valves and consists of two alternating red warning lights. The audible alarm can not be silenced. The alarm is actuated in the event that a positive pressure of more than 12.5 cm H₂O is monitored for longer than ten seconds in the system. Such continuing pressure in the system may be caused by inadvertent closing or misadjustment of the APL valve, a blockage of the APL valve, blockage of the ventilator relief valve, blockage of gas passages leading to or from these valves, blockage or other failure of the gas scavenging system or a failure of the automatic ventilator during the inspiratory phase thus keeping the bellows contracted and the ventilator relief valve closed.

26. Sub-Atmospheric Alarm (Standard)

The sub-atmospheric alarm, marked SUB. ATM. PRESSURE, is located in the central alarm panel at the left side of the flowmeter housing and displays one, red, continually-lighted, L.E.D. The audible alarm can be silenced. The alarm is actuated if the pressure in the system decreases below 8 cm H₂O sub-atmospheric

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pressure and is actuated for the period of time the sub-atmospheric pressure exists. A condition like this may be caused by the malfunctioning of a suction scavenging system or by a blocked anesthesia breathing system where the patient creates the sub-atmospheric pressure by inhaling from a dead-ended system, or by lack of fresh gas supplied into the breathing system.

27. High Pressure Alarm (Standard)

The high pressure alarm, marked HIGH PRESSURE, is located in the central alarm panel at the left side of the flowmeter housing and displays one, red, continually-lighted, L.E.D. The audible alarm can be silenced. It is actuated if the system pressure exceeds 60 cm H₂O; the alarm is actuated for the period of time the pressure is in excess of the threshold pressure. A condition like this may be caused by drastically increased airway resistance or an otherwise blocked inspiratory path.

28. Terminal Panel (Standard)

The terminal panel, located at the lower left side of the flowmeter housing, contains the blood pressure gauge terminal and pressure alarm line as well as the valve pilot line for the DRAGER AV. All terminals on the panel are keyed to prevent inadvertent interchange of connections.

29. Battery (Standard)

The battery which furnishes power for all electrical functions, except the oxygen monitor, is located at the left rear of the unit. The battery is a 6.0 volt, Eveready type 731, Mallory M918, or equivalent.

30. Vaporizer Selector Valve (Optional)

The vaporizer selector valve is located at the right top of the unit above the vaporizers. It has two alternate positions, full-right and full-left. The stick shift must be directed to the side above the vaporizer which is intended to be utilized; internal inlet and outlet connections are established for the chosen vaporizer while the unused vaporizer is disengaged from the system by movement

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of the lever. A pneumatic rotowink indicator above each vaporizer will inform the operator as to which vaporizer is actuated. An additional advisory of the inactive vaporizer is the off-pendulum blocking access to the dial of that vaporizer.

31. Vaporizer Interlock System (Optional)

The vaporizer interlock system consists of a mechanical interlock incorporated into the vaporizer mounting bracket which limits the concentration adjustment to one vaporizer only. The interlock system requires at least one vaporizer to be locked in the zero position. To change the administration of anesthetic from one vaporizer to the other requires both vaporizers to be turned to the zero concentration position.

32. Vaporizers (Optional)

Vaporizers for the administration of liquid anesthetics are located at the right side of the flowmeter housing. For detailed information refer to the vaporizer manufacturer's instruction manual.

33. DRAGER AV (Optional)

The DRAGER AV is a volume preset, time-cycled ventilator which features fluidic circuitry, independent controls and ease of operation and cleaning. The unit acts as a controller of respiratory rate. The inspiratory/expiratory phase time ratio is preset at 1:2. The frequency range of the DRAGER AV incorporated into the NARKOMED 2 is 10 to 30 breaths per minute (standard, other frequencies optional). For detailed instructions refer to the DRAGER AV Instruction Manual.

34. NAD Oxygen Monitor (Optional)

The oxygen monitor is mounted on the left side of the flowmeter head directly above the common outlet connection and includes the following features.

- a. battery check indicator
- b. visual and audio low oxygen alarm
- c. safety stop, which prevents accidental movement of the alarm set-point below the 18% oxygen level. The range of the instrument is 0 to 100% oxygen with incremental markings of 2%

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- d. polarographic sensor, located in the dome of the inspiratory or expiratory valve of the breathing circuit
- e. actuated by a switch separate from the main switch on the control panel. It also has its own power supply consisting of three (3) 4.05 volt⁺ Mallory mercury batteries (type TR133R) located behind the access door at the bottom of the monitor
- f. alarm feature, located on the monitor panel
- g. operating instructions, contained on a card located in the battery compartment of the unit

Connection of the monitor to the breathing system is accomplished by means of a sensor cord assembly. The sensing head of the cord is inserted in a valve dome adapter (Part #4102170) attached to the inspiratory or expiratory valve of the breathing circuit. The monitor end of the cord assembly is connected to an indexed male plug on the top rear of the monitor.

35. NAD Sphygmomanometer (Optional)

The sphygmomanometer is located on the left side of the flowmeter head beneath the ventilator bellows assembly. Connection to the gauge is by means of a female Luer fitting mounted on the left side of the flowmeter head approximately three inches above the table-top. The connector block is labeled BLOOD PRESSURE. The gauge features a "floating zero" position. The reset forces of the pointer are minimal at zero pressure, thus the pointer may rest at any point within the horizontal arc when no pressure is applied. A "zero" position of the pointer deviating from the exact 6 o'clock position, but within the horizontal arc, is no indication of any inaccuracy of the gauge. If the pointer is outside of the horizontal arc, tap the gauge lightly with a forefinger. Tapping may cause the pointer to move. If the pointer remains outside of the arc, check the gauge with a master gauge. Your service representative will help you with this test.

36. Drawers (Optional)

The NARKOMED 2 is equipped with one, two, three, or four drawers. They are of heavy gauge steel construction with ball bearings for easy movement. The drawer assembly is designed to allow full extension of the drawers.

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Operator Alert to Special Features of the NARKOMED 2

1. The main switch must be turned on to operate unit.
2. The ventilator relief valve is located at the anesthesia breathing system, controlled via a pilot line, and not incorporated into the ventilator itself. The DRAGER AV shall not be used with any anesthesia breathing system other than a unit supplied by North American Drager to accommodate the AV.
3. The alarm systems of the unit are six (6) volt battery operated.
4. During automatic ventilation, the APL valve (pop-off valve) is excluded from the breathing system by the manual automatic selector valve. A closing of the APL valve during automatic artificial ventilation is not necessary.

Warnings and Restrictions

The NARKOMED 2 is designed for use with non-flammable anesthetic agents. Flammable anesthetic agents shall not be used with this equipment.

Oil and grease may combine explosively with oxygen or nitrous oxide. For this reason oil and grease shall never be allowed to come in contact with cylinders, cylinder valves, gauges, fittings, etc. which conduct oxygen or nitrous oxide on the machine. For further information regarding medical gases, consult CGA pamphlets P-2, G-4, and G-4.3; and NFPA Standards 53M, 56B, and 56F.

Delivery hoses used between wall outlets and machines have been the cause of accidents when, during assembly, an oxygen fitting was placed on one end of the hose and a nitrous oxide fitting on the other end. Hoses must be carefully checked each time a machine is connected to a wall or ceiling outlet to ensure that both ends of the hose are intended for the same gas.

If the machine has vaporizers with safety interlocked adjustment knobs, any replacement vaporizer must have an identical interlock.

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The safety potential of oxygen supply pressure failure protection devices is widely overstated. The following causes are known to actuate the system.

1. depletion of pressure in the oxygen cylinder
2. closed oxygen cylinder valve
3. depletion of pressure in the oxygen pipeline
4. improper connection of oxygen supply hose
5. blockage of the oxygen dispensing system upstream of the pneumatically operated valve of the protection device
6. excessive leakage in the oxygen dispensing system upstream of the pneumatically operated valve of the protection device

The vaporizer selector valve shall always be set to either full-right or full-left position; never stop movement of the control arm between these positions.

Check proper connection of endotracheal tube connector frequently.

Check tightness of vaporizer filler caps.

Check pressure gauges for adequate supply of gases.

Check status of absorbent in absorber.

Check oxygen analyzer, see details for instructions.

Turn on oxygen analyzer before use of unit.

Check function of flowmeters over full range.

Assure that oxygen delivery system supplies oxygen by using oxygen analyzer at common outlet.

Check function of patient system relief valve (APL valve) and unidirectional valves.

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Check proper connection of fresh gas delivery hose; machine side and patient system.

For scavenging purposes the ventilator relief valve is located at the manual automatic selector valve and operates via a pilot line. Check proper connection of pilot line.

Never use the NARKOMED 2 Anesthesia System with an absorber system other than supplied by North American Drager for the NARKOMED 2.

For spontaneous breathing the APL valve must be turned fully counter-clockwise (lowest resistance).

For manually assisted or manually controlled ventilation, adjust the APL valve to desired resistance by clockwise rotation.

Observe breathing pressure gauge frequently.

The stick shift of the manual automatic selector valve must point toward the operator for spontaneous breathing or manually assisted ventilation - away from the operator for automatic ventilation.

