



VENTILATOR NEO

USER MANUAL



Western Surgical

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1.0 BRIEF DETAILS

1.1 MODEL NEO

This Ventilator has CMV (Variable I:E Ratio) and ASSIST mode. This is an ideal Ventilator, which meets all routine requirements of surgeon as well as Physician. NEO model can be used for anesthesia ambulence and postoperative care, application. It has monitoring circuit for the following alarm conditions.

- (a) DISCONNECTION
- (b) EXCESS FLOW OF INLET GAS
- (c) INSUFFICIENT FLOW OF INLET GAS
- (d) HIGH INSPIRATORY PRESSURE ALARMS
- (e) POWER FAILURE
- (f) UNIT MALFUNCTION
- (g) LOW TIDAL VOLUME
- (h) APNEA

NEO is recommended for ventilating Pediatric and Adult Patients.

This Ventilator is not recommended for Neonates and infants.

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2.0 SPECIFICATIONS :

MODEL NEO VENTILATOR

- 2.1 MODELS : CMV, ASSIST (Volume Controlled)
- 2.2 FLOW PATTERN : LINEAR
- 2.3 TIDAL VOLUME : 50 - 1100 cc adjustable in step of 10 cc.
- 2.4 CMV - VARIABLE MODE

I: E RATIO : 4:1 - 1:4

BPM : 6-60

TIDAL VOLUME : 50 - 1100 cc in step of 10 cc

2.5 ASSIST MODE

BPM : 1-60 adjustable in step of 1 BPM

TIDAL VOLUME : 50 - 1100 cc adjustable in step of 10 cc.

INSPIRATION TIME : 0.1 to 3.5 sec

TRIGGER SENSITIVITY : -1.0 cm to -15 cm. in step of 0.1 cm.

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NEO

2.6	POWER	: 184 V - 264 V, 50/60 H ₂ AC
2.7	PRESSURE GUAGE	: -20 to +100 cm. OF H ₂ O
2.8	PRESSURE RELEASE	: RANGE 10 - 80 cm. OF H ₂ O VALVE
2.9	HIGH INSPIRATORY PRESSURE ALARM	: 18 - 80 cm. OF H ₂ O
2.10	LCD DISPLAY	: TRIGGER : MODE : TIDAL VOLUME - (VOL) BREATHS PER MINUTE - (BPM) I:E RATIO - (I:E) INSPIRATION TIME - (Ti) TRIGGER SENSITIVITY - (Tg)
2.11	ALARMS	: UNIT MALFUNCTION (AUDIO, VISUAL) DISCONNECTION (AUDIO, VISUAL) EXCESSIVE INLET AGAS FLOW (AUDIO, VISUAL) INSUFFICIENT INLET GAS FLOW (AUDIO, VISUAL) LOW IN LET VOLUME (AUDIO, VISUAL) APENA (AUDIO, VISUAL) HIGH INSPIRATORY PRESSURE (AUDIO, VISUAL) POWER FAILURE (AUDIBLE)
2.12	POWER CONSUMPTION	: 50 VA
2.13	DIMENSIONS	: 485 X 290 X 250 (WX D X H)
2.14	WEIGHT	: 14 Kg. Approx.
2.15	OPERATING TEMPERATURE	: 0-38°C
2.16	INLET PORT	: LOW PRESSURE INLET FOR AIR, OXYGEN, ANAESTHETIC GAS. SIZE : 22 mm. INNER DIAMETER WITH SHUTOFF CAP.

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- 2.17 OUTLET PORT : FOR CONNECTION TO PATIENT CIRCUIT
SIZE : 22mm. OUTER DIAMETER.
- 2.18 FUSE : SLOW BLOW GLASS FUSE,
SPECIFICATIONS SIZE : 20 X 5 MM, 0.8A, 250 V

☒ Oxygen Gas is not required for driving the ventilator. Oxygen is required only for enrichment of FiO_2 for patient.

☒ Tidal Volume indicated above is set volume and is delivered at outlet port of Ventilator at atmospheric pressure.

☒ Actual delivered volume at working inspiratory pressure may be lower than the set volume.

User is advised to re-adjust the setting to meet the patients requirement.

☒ Maximum Inspiratory Pressure capacity of ventilator reduces as minute volume {BPM X Tidal Volume} Setting is increased.

*** The design and specifications are subject to change for upgradation without prior notice.**

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3.0 SAFETY INSTRUCTIONS

- 3.1 Your ventilator is a sensitive and valuable electronic instrument. handle it carefully keep away from jerks, undue vibrations and mechanical shocks, as they may result in malfunctioning of the unit.
- 3.2 During transportation, storage and while in operative conditions, protect it from direct sunlight, dust, heat, excessive humidity, rain, chemicals, anaesthesia drugs and edible liquids and solids.
- 3.3 Before connecting power, ensure following conditions :
- 3.3.1 Power supply is within $184 - 264 \text{ V} \pm 10\%$
- 3.3.2 Supply line has proper earthing.
- 3.3.3 Polarity of L, N, E, in the AC supply socket is as per standard convention.

CAUTION :

- ☒ Operating the ventilator with supply of improper polarity and without proper earthing may cause severe damage to sensitive electronic components or malfunction.
- ☒ Improper supply voltage can result in permanent damage to the equipment.
- ☒ Low voltage can result in malfunctioning or the equipment.
- ☒ Neutral-Earth voltage in excess of 5 volts can result in malfunctioning software
- ☒ corruption and damage to sensitive electronic components.

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- 3.4 To enhance safety and functional reliability use ferroresonant / servo type voltage corrector (at least 500va) to power the ventilator.
- 3.5 Do not allow unauthorized persons to service / repair / temper with the ventilator, such actions (efforts) may lead to expensive damages to the ventilator or malfunctioning of the unit.

CAUTION :

User is advised to have alternative means of providing ventilation to the patient during power failure or breakdown / improper functioning of ventilator.

- 3.6 Tidal volume set on display is the volume of gas delivered by ventilator while the inlet gas to the ventilator is at atmospheric pressure and the same is delivered by ventilator from outlet at atmospheric pressure. Actual delivered volume decreases with increase in delivery (inspiratory) pressure due to bellow inflation, resistance introduced by patient's respiratory systems and accessories connected in breathing circuit. User is requested to modify settings in order to meet patient's actual requirement.
- 3.7 Calculations and method for selecting Tidal Volume and BPM in this manual are only for guidance to the user. Precise settings may be derived using supporting supervisory equipment like pulse oxymeter capnograph etc.

WARNING

Use of ETHER can cause explosion OR fire and is not recommended with this Ventilator.

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3.8 HELP DURING POWER FAILURE

Max Ventilator is totally electrically operated hence it stops functioning when AC power supply fails. Here are few tips and guidelines for supporting a patients in such an eventually.

- 3.8.1 In place where power failure is frequent and of long duration. Use any computer grade UPS, for longer backup duration . Use of inverters (lighting application) is not recommended as they do not have voltage regulating facilities.
- 3.8.2. Keep AMBU Bag readily available as an alternate to ventilator.
- 3.8.3 As soon as power failure occurs, disconnect patient from ventilator and connect the patient to Resuscitate AMBU Bag. Switch off the ventilator. Let the patient be comfortable on manual ventilation. On resumption of AC power switch on the ventilator. Recheck ventilator settings. If ventilator settings are not as per patient requirements, readjust settings. Then connect, ventilator outlet to patient circuit.

CAUTION :

When ventilator is being fed from UPS / inverter, time monitoring of available backup is very much necessary. Poorly maintained batteries in UPS / Invertors, can get exhausted very fast. In critical cases always check the backup time available on the UPS. Avoid using UPS systems with unknown history.

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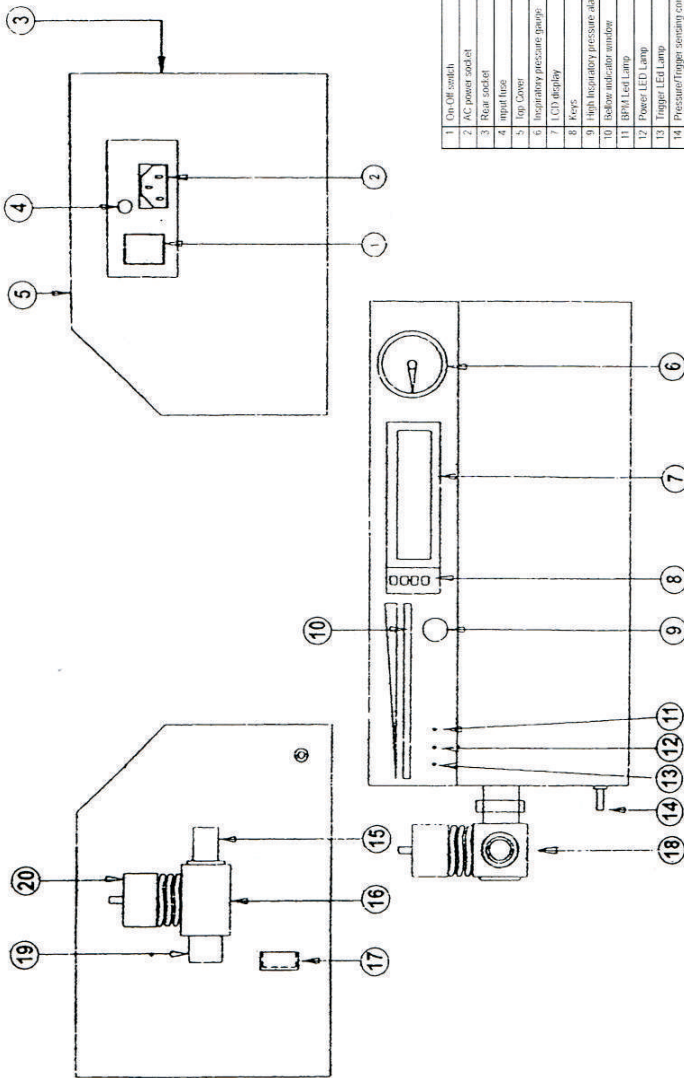


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1	On/Off switch
2	AC power socket
3	Rear socket
4	Input fuse
5	Top Cover
6	Inspiratory pressure gauge
7	LCD display
8	Keys
9	High inspiratory pressure alarm setting
10	Below indicator window
11	BFM Led Lamp
12	Power LED Lamp
13	Finger LED Lamp
14	Pressure/Toggle setting connection
15	Outlet port
16	O2 Valve
17	Cap to block port if required
18	Valve Block
19	Inlet Port
20	Pressure release adjustment

4 CONTROL & FUNCTIONS

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4.1 FUNCTIONS

1. **ON-OFF SWITCH** : To turn ON / OFF the ventilator from AC mains power. Always keep the switch in OFF position if the ventilator is not in use.
2. **INPUT FUSE** : To protect the ventilator from overload.
3. **AC POWER SOCKET** : To connect the three pin power cord.
4. **TRIGGER LED LAMP** : This monitors the patient's spontaneous effort in all modes. Trigger LED flashes when patient generates effort at least - 0.75cm H₂O.
5. **POWER LED LAMP** : indicates presence of AC mains power to the equipment.
6. **BPM LED LAMP** : This LED flashes at the end of each inspiratory cycle.
7. **BELLOW INDICATOR WINDOW** : The displacement of bellow represents proportional tidal volume delivered to the patient.
8. **HIGH INSPIRATORY PRESSURE ALARM SETTING** : With this knob HIP alarm can be set from 15 cm to H₂O of 80 cm H₂O. This can be done at any stage.
9. **LCD DISPLAY** : Displays the current settings of different parameters and alarm conditions.
10. **KEY BOARD** : To edit the parameters like Mode, BPM, I:E Ratio etc. It consist of the following keys :

ENTRY KEY : To enter the setting menu.

SET / RUN KEY : To set the selected parameters and to exit setting sequence.

UP KEY : To change value of selected parameter by one step upwards until it reaches the upper end value.

DOWN KEY : To change value of selected parameter by one step downwards until it reaches the lower end value.

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11. **INSPIRATORY PRESSURE GAUGE** : Indicates the airway pressure during various phases of respiratory cycle.
12. **SHUT OFF CAP-INLET PORT** : Please refer the closed anaesthesia circuit.
13. **INLET PORT** : Inlet port for atmospheric air / anaesthesia gases from Boyles Apparatus. Please refer the connection diagrams.
14. **PRESSURE / TRIGGER SENSING TUBE CONNECTION** : Port to connect the sensing tube to monitor airway pressure and various alarms.
15. **OUTLET PORT** : Port to connect the patient circuit. Please refer the connection diagram on page no.-20.
16. **PRESSURE RELEASE VALVE** : Automatically releases the pressure if it exceeds the set limit. The limit can be set by rotating the valve in either clockwise or anti clockwise direction.

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5.0 OPERATING PROCEDURE

Electrical Connections : Before connecting power to the ventilator make sure that the following requirements are fulfill

- 5.1 184-264 Volts, 50Hz, 1 Phase AC supply free from voltage fluctuation and voltage spikes / surges. If possible use a voltage corrector (servo controlled or ferroresonant type) of at least 500 va (0.5kva) to power the ventilator.
- 5.2 Ensure the correct polarity of L-N pins in AC supply socket.
- 5.3 Ensure that good earthing is available and voltage between neutral and earth line is less than 5 volts.
- 5.4 In case of using the ventilator from generator supply, ensure that the generator voltage not overshoot during starting. If so keep the ventilator in off condition while starting the generator . Generator frequently should be within 50 ± 3 Hz.
- 5.5 In case of ventilator being powered from inverter supply, make sure that voltage from inverter is not below 210 volts.

WARNING

Incorrect polarity of L-N, inadequate earthing and abnormal power supply can caused damage to sensitive electronic components of the ventilator or malfunction of the unit.

5.6 Switching on the ventilator :

Connect power cord to AC supply.

Turn on power switch to "ON" position.

To understand functions of various indicators, switches and controls, please refer 4.0 Control and functions on page No.9.

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NEO VENTILATOR :

NEO ventilators has two operational Modes.

CMV Mode with variable I:E and ASSIST following parameters can be set while operating the ventilator.

5.7 CMV MODE

In this model I:E ratios can be selected in range of 4:1-1:4

Parameters to be selected are Mode, BPM, I:E Ratio (I:E), Tidal Volume (VOL) and PEEP connection.

5.8 ASSIST MODE :

Parameters to be selected for this mode are Mode, BPM, Tidal Volume (VOL), Inspiration Time (Ti) Peep Connection and Trigger Sensitivity (Trg)

5.10 DATA SELECTION SEQUENCE

Desired or a new value of settings can be selected in the following manner :

Press ENT key to initiate the selection procedure.

Now, following message appears on the screen :

Press to select mode or to SET / RUN enter data.

Press key to choose mode, CMV VAR I:E, ASSIST

Press SET / RUN key to confirm the selected mode.

After the selection of mode the message : Set parameters appears on the screen.

On confirmation, all parameters pertaining to the selected mode are displayed on LCD screen. The parameters on display have their default (initial) values. These values can be altered as required in following manner.

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5.11 IF CMV VAR I: E MODE IS SELECTED :

Press key to set No. of Breaths (BPM).

Press SET / RUN key to confirm BPM setting.

Press key to select I:E Ratio.

Press SET / RUN key to confirm I:E Ratio selection.

Press key to set Tidal Volume (VOL)

Press SET / RUN key to confirm Tidal volume setting.

Press key to set PEEP Connected (Y/N)

Press SET / RUN key to confirm PEEP connection.

Ventilator starts functioning in CMV VAR I:E Ratio mode.

5.12 IF ASSIST MODE IS SELECTED :

Press to set No. of Breaths (BPM)

Press SET / RUN to confirm BPM settings.

Press to set Tidal volume (VOL)

Press SET / RUN to confirm volume settings.

Press to set Inspiration Time (Ti)

Press SET / RUN to confirm Ti settings

Press to set PEEP Connected (Y / N)

Press SET / RUN key to confirm PEEP connection.

Press to set Trigger Sensitivity (Trg) level.

Press SET / RUN key to confirm and ventilator starts functioning in assist mode.

To alter the selected values repeat the above procedure.

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5.13 STERILIZATION

The accessories supplied with the ventilator are STANDARD ACCESSORIES for single use only except for the patient valve and pressure monitoring / Trigger Sensing Tube.

COMPONENTS	FREQUENCY	METHOD
Ventilator Panel (LCD Display, Keyboard)	As Needed	Wipe with soft cloth wet it with water or 70% isopropyl Alcohol, only Splashing with direct liquid will damage parts.
Ventilator enclosure	As Needed	Wipe with any bactericidal agent, but not allow liquid to penetrate the inside of the ventilator
Pressure Release Valve	3-6 months	Wipe with soft cloth wet it with water or 70% isopropyl Alcohol only.
Patient Circuit : Patient Valve	Between patients or according to usual hospital protocol	<p>Disassemble the Non Rebreathing Valve. Inspect all components for wear or damage and replace as necessary. Wash thoroughly the components in warm water and mild detergent. Rinse all components thoroughly with water to eliminate all residues of the detergents used. Sterilize the components using one of the following methods : -ETO- Gas sterilisation-Autoclaving up to 134oC. After cleaning and sterilisation, thoroughly dry all components. inspect all parts for damage and replace as necessary.</p> <p>Reassemble the Non-rebreathing Valve to ensure correct performance before recommissioning.</p>

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COMPONENTS	FREQUENCY	METHOD
Patient Valve Adaptor and Pressure Monitoring and Trigger Sensing Tube	Between Patients or according to usual hospital protocol	Wash thoroughly the components in warm water and mild detergent. Afterwards rinse all components thoroughly with water to eliminate all residues of the detergents used. Sterilize the components using one the following methods : -ETO Gas Sterilization- Autoclaving upto 134°C after cleaning and sterilization, thoroughly dry all components.
Complete Ventilator	Between patients or according to usual hospital protocol	Cold Cycle with Ethylene oxide only at 125°F or 52°C

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6.0 ALARMS AND INDICATIONS

6.1 AUDIBLE ALARM :

THREE TYPES OF BEEP SOUNDS ARE AVAILABLE IN THREE PRIORITY ASSOCIATED WITH VARIOUS TYPES OF FAULTY CONDITIONS IN THE VENTILATOR.

Low Priority

Excessive Inlet Gas and insufficient inlet Gas is observed on display than two beep sounds come twice after the interval of 30 seconds (Approx)

Medium Priority

Low Tidal Volume and Malfunction are observed on display than three beep sounds come for two times in 2.6 seconds (Approx) after interval of 25 seconds (Approx).

High Priority

High inspiratory Pressure, Tube disconnection and Apena are observed on display than 5 beep sounds come for two times in 2 seconds after interval of 8-10 seconds (Approx.)

6.2 HIGH INSPIRATORY PRESSURE ALARM :

High inspiratory pressure alarm can be set by potentiometer at the level of slightly above the peak inspiratory pressure. This can be done without disturbing the ventilator's function at any time.

WARNING

Don't switch ON the ventilator while the patient is being connected to the ventilator

During power interruptions inbuilt battery will retain the current settings. As soon as power resumes, the ventilator starts functioning as per last setting.

ALWAYS CHECK THE WORKING DATA AFTER THE POWER IS RESUMED.

If FiO_2 adjustment is more than $\text{BPM} \times \text{Tidal Volume}$ the ventilator will show the alarm "EXCESS GAS FLOW", "UNIT MALFUNCTION " or " HIGH PRESSURE ALARM".

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LCD Display indications

CMV VAR I : E Ratio

Set BPM
Set Tidal Volume
Set I : E Ratio
Set Peep Connection

ASSIST

Mode
Set BPM
Set Tidal Volume
Set Inspiration Time
Set Trigger Sensitivity
Set Peep Connection

6.3 FAULT MESSAGES ON LCD DISPLAY

UNIT MALFUNCTION	:	In case of improper functioning of ventilator
DISCONNECTION	:	Largely when patient circuit is disconnected from Ventilator or when there is major leak in patient circuit
HIGH INSP. PRESURE	:	When inspiratory pressure goes beyond set pressure limit then this alarm appears on display.
EXCESS GAS	:	When inlet flow of gas is excessive OR higher than LPM, set on ventilator ($LPM = BPM \times \text{Tidal Volume}$). could be observed only when Inlet port of Ventilator is connected to Boyle's Apparatus/ Anesthesia Machine / Oxygen Equipment / External O_2 + Air blender.
INSUFFICIENT GAS	:	This alarm message is displayed when inlet flow of gas is insufficient or less than LPM set on ventilator. This may be due to incorrect direction of unidirectional valves connected on inlet parts OR insufficient flow from external equipment like Boyle's Apparatus, Anesthesia Machine, Oxygen Equipment, Air- O_2 , Blender, closed circuit apparatus etc.
LOW TIDAL VOLUME	:	If there is low voltage or there is some blockage in the inlet resulting in less expansion of bellow than the unit gives this alarm.
APENA	:	In ASSIST mode if there is no spontaneous effort from the patient or there is no triggering from the patient than the ventilator gives this alarm within 60 seconds.

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6.4 VISUAL INDICATIONS

- Power LED indicates presence of input supply.
- Trigger LED flashes when patient generates effort of at least -0.75cm. This indication remains active in CMV and ASSIST mode. Movement of Silicon bellow is shown by bellow position indicator represents proportional volume delivered to patient.
- BPM LED flashes at the end of every inspiratory cycle and can be monitored to count actual No of breaths delivered

7.0 BASIC BREATHING CIRCUIT

- 7.1 BASIC BREATHING CIRCUIT
- 7.2 CONNECTION OF VENTILATOR WITH ANESTHESIA MACHINE
- 7.3 CONNECTION OF VENTILATOR WITH BAIN'S CIRCUIT
- 7.4 CONNECTION OF VENTILATOR WITH CIRCLE ABSORBER
- 7.5 CONNECTION OF VENTILATOR WITH HUMIDIFIER

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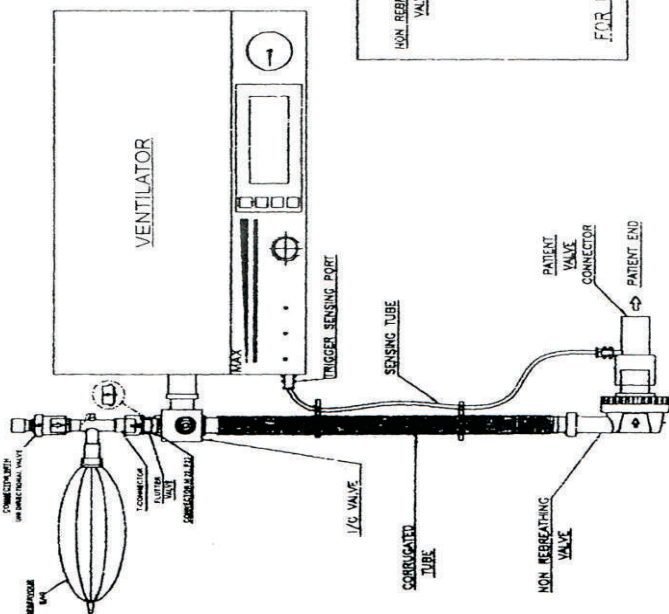


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7.1 BASIC BREATHING CIRCUIT

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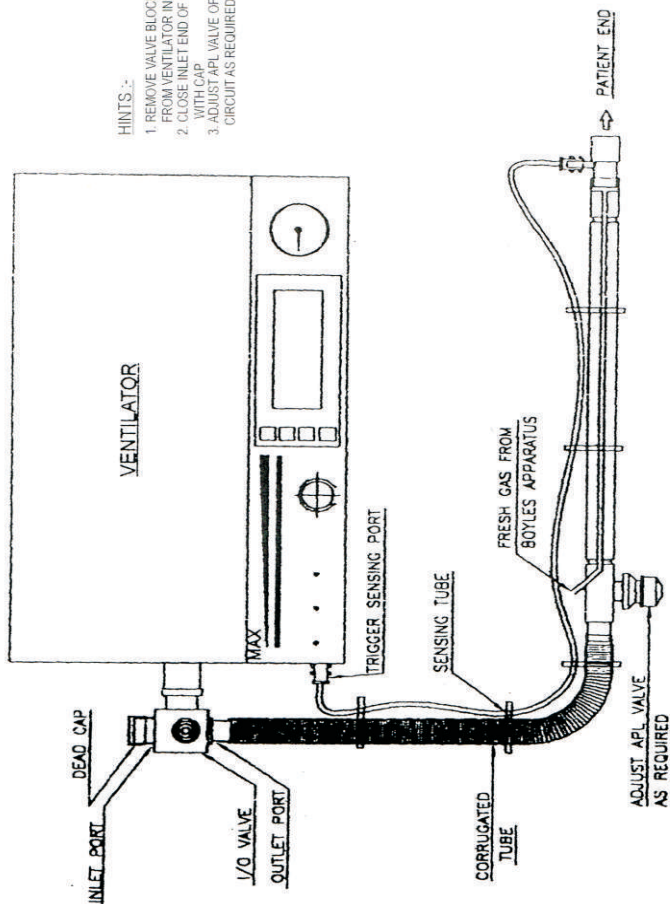
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HINTS :-

1. REMOVE VALVE BLOCK FROM VENTILATOR INLET PORT
2. CLOSE INLET END OF I/O VALVE WITH CAP
3. ADJUST APL VALVE OF BAIN'S CIRCUIT AS REQUIRED



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7.3 CONNECTION OF VENTILATOR WITH BAIN'S CIRCUITS

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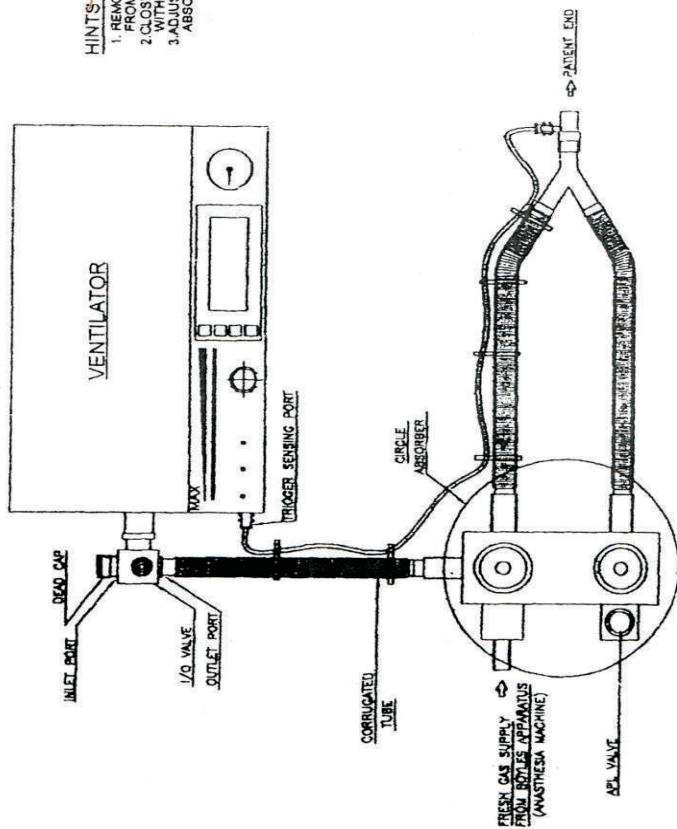


7.2 CONNECTION OF VENTILATOR WITH ANAESTHESIA MACHINE* (BOYLE'S APPARATUS)

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HINTS:-

1. REMOVE VALVE BLOCK FROM VENTILATOR INLET PORT
2. CLOSE INLET END OF I/O VALVE WITH CAP
3. ADJUST APL VALVE OF CIRCLE ABSORBER AS REQUIRED



7.4 CONNECTION OF VENTILATOR WITH CIRCLE ABSORBER(CAINSTER) CLOSED CIRCUIT)

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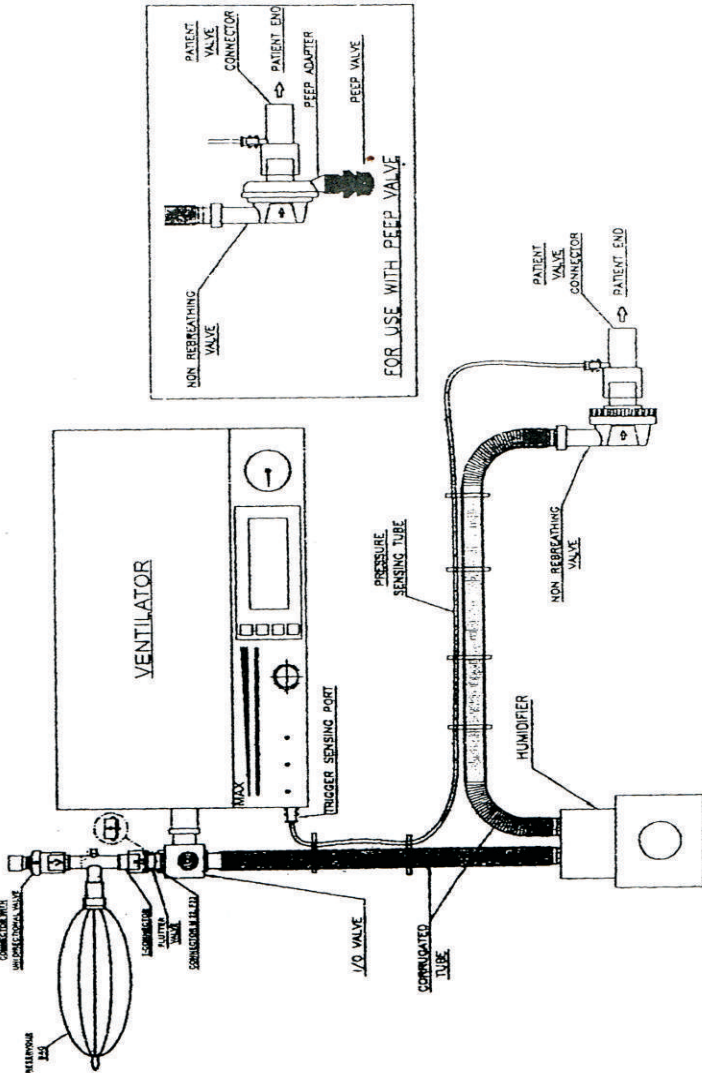
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7.5 CONNECTION OF VENTILATOR WITH HUMIDIFIER



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8.0 FUNCTIONAL CHARACTERISTICS OF VENTILATOR

The functioning of the ventilator under healthy and normal condition shows the following characteristics through suitable indicators and alarms.

8.1 VISUAL INDICATIONS

- | | | |
|---------------------------|---|---|
| Power LED Lamp | : | Glows when input supply. power on/off switch on and the supply is available. |
| BMP LED Lamp | : | Glows at the end of inspiration cycle
Number of flashes per minute are equal to BPM on dial / display |
| Trigger LED | : | Flashes when a patient develops self breath effort (at least -0.75 cm of H ₂ O)
This can occur in all modes. It helps to detect the spontaneous effort in CMV mode. |
| Bellow position indicator | : | It is to and fro motion indicates opening and closing of Silicon bellow. Displacement of indicator is proportional to the Tidal volume delivered to the patient. |

8.2 PRESSURE INDICATION ON DIAL GAUGE

Pressure gauge indication follows a cyclic pattern of breathing cycle

a) During inspiration cycle :

Pressure rises above zero as the inspiration a cycle progresses, after attaining the peak level, pressure drops to zero or low value as expiration cycle begins.

b) During expiration cycle :

- 1) When inlet is from atmospheric air, pressure indication remains at zero.
- 2) When ventilator inlet is connected to other anaesthetic machine oxygen may be +ve OR to zero depending on the flow rate & minute volume settings of ventilator and the gas supply equipment.
- 3) When ventilator is connected with the external PEEP VALVE, the pressure indication is positive depending on the set value on the PEEP valve.

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8.3 AUDIOALARM

Three types of beep sound are available in three priority associated with various types of faulty conditions in the ventilator. Trigger audio alarm signal of short duration beep does start as and when patient generates spontaneous breathing.

8.4 NOTE :

Physical deformations / disturbances in inlet / out let tube connections may cause shorttime audio-visual alarm. Frequent or persisent / repeated conditions of any of the above alarms call for detailed investigations of the operating conditions of ventilator, power supply, inlet / outlet gas circuit and patient conditions too. For inlet / outlet gas circuit and patient related conditions refer to "Remedies to application faults/problems."

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9.0 GUIDELINES FOR SETTING

Following are the general guidelines for selecting Tidal Volume & BPM in adult application.

- 1) Minute Volume Requirement : $\frac{(\text{Body Weight}) \text{ Kgs.} \times (80 \text{ to } 120)}{1000 \text{ ml. per minute}}$
- 2) Tidal requirement Volume : $(\text{Body Weight}) \text{ Kgs.} \times (12 \text{ to } 15) \text{ ml.}$
- 3) BPM : $\frac{\text{Minute Volume LPM} \times 1000}{\text{Tidal Volume cc}}$
- 4) Trigger Sensitivity

For normal ASSISTmode application, set -ve sensitivity setting only. Lower sensitivity value induces mechanical breath at Lower effort. Lower sensitivity may also induce hyperventilation of / in patient.

CAUTION

All the calculations indicated above are for guidelines only. User is requested to observe the efforts of initial settings and do readjustments to fulfill the deficiencies.

Units used for above quantities are :

Tidal Volume	: cc (ml)	Minute Volume	: Litre per minute
Body Weight	: kg.	BPM	: Nos.

Oxygen Enrichment : Following table enables the user to obtain desired FiO_2 level by selecting flow rate oxygen

CAUTION

Ventilator does not require pressure for enrichment of FiO_2 . Enrichment of FiO_2 can be done by giving flow from line gas or cylinder through pressure controlled regulator, flow controlled valve and bottle humidifier. While adjusting the flow pressure should not exceed 100c.m otherwise it will damage pressure gauge, transducer and monitoring circuit.

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FiO₂ Table

FiO ₂ MV LPM	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
3	0.0506	0.1139	0.1772	0.2405	0.3038	0.3671	0.4303	0.4936	0.5569	0.6202	0.6835	0.7468	0.81	0.8734	0.9367	1.00
4	0.15	0.34	0.53	0.72	0.91	1.10	1.30	1.48	1.67	1.86	2.05	2.24	2.43	2.62	2.81	3.00
5	0.20	0.46	0.71	0.96	1.22	1.46	1.72	1.97	2.22	2.48	2.73	2.98	3.24	3.50	3.75	4.00
6	0.25	0.57	0.88	1.20	1.52	1.83	2.15	2.47	2.78	3.10	3.41	3.73	4.05	4.38	4.68	5.00
7	0.30	0.68	1.06	1.44	1.82	2.20	2.58	2.96	3.34	3.72	4.10	4.48	4.86	5.24	5.62	6.00
8	0.35	0.80	1.24	1.68	2.12	2.57	3.01	3.45	3.90	4.34	4.78	5.23	5.67	6.11	6.56	7.00
9	0.40	0.91	1.41	1.92	2.43	2.93	3.44	3.95	4.45	4.96	5.47	5.97	6.48	6.99	7.50	8.00
10	0.45	1.00	1.59	2.16	2.73	3.30	3.87	4.44	5.01	5.58	6.015	6.72	7.29	7.86	8.43	9.00
11	0.50	1.04	1.77	2.40	3.08	3.67	4.30	4.93	5.57	6.20	6.83	7.47	8.10	8.73	9.37	10.00
12	0.55	1.25	1.95	2.64	3.34	4.03	4.73	5.43	6.12	6.82	7.52	8.21	8.91	9.61	10.30	11.00
13	0.60	1.37	2.12	2.88	3.64	4.41	5.16	5.92	6.68	7.44	8.20	8.92	9.72	10.48	11.24	12.00
14	0.65	1.48	2.30	3.12	3.95	4.77	5.60	6.42	7.24	8.06	8.88	9.71	10.53	11.35	12.18	13.00
15	0.70	1.59	2.48	3.36	4.25	5.14	6.02	6.91	7.80	8.68	9.57	10.45	11.34	12.23	13.11	14.00
16	0.75	1.71	2.66	3.60	4.56	5.51	6.45	7.40	8.35	9.30	10.25	11.20	12.15	13.10	14.05	15.00
17	0.80	1.82	2.83	3.84	4.86	5.87	6.88	7.90	8.91	9.92	10.90	11.95	12.96	13.97	14.98	16.00
18	0.86	1.93	3.01	4.08	5.15	6.24	7.31	8.39	9.46	10.54	11.62	12.70	13.77	14.85	15.92	17.00
19	0.91	2.05	3.19	4.33	5.46	6.61	7.74	8.88	10.02	11.16	12.30	13.44	14.58	15.72	16.86	18.00
20	0.96	2.16	3.36	4.57	5.77	6.97	8.18	9.38	10.58	11.78	12.99	14.19	15.39	16.60	17.80	19.00
21	1.01	2.28	3.54	4.81	6.07	7.34	8.61	9.87	11.41	12.40	13.67	14.93	16.20	17.47	18.73	20.00
22	1.06	2.39	3.72	5.05	6.38	7.71	9.03	10.36	11.69	13.02	14.35	15.68	17.01	18.34	19.67	21.00
23	1.11	2.51	3.90	5.29	6.68	8.07	9.46	10.85	12.25	13.64	15.04	16.43	17.82	19.21	20.61	22.00
24	1.16	2.62	4.07	5.53	6.98	8.44	9.90	11.35	12.81	14.26	15.72	17.18	18.63	20.08	21.54	23.00
25	1.22	2.73	4.25	5.77	7.29	8.81	10.32	11.84	13.36	14.88	16.40	17.92	19.44	20.96	22.43	24.00
25	1.27	2.85	4.43	6.01	7.60	9.17	10.75	12.34	13.92	15.50	17.08	18.67	20.25	21.84	23.42	25.00

Note : Horizontal Top rows shows FiO₂% required to be obtained.

Vertical Left row indicates minute volume Ventilation to Patient.

Figures in table shows Oxygen Flow rate to be set.

Units :

FiO₂ in %Flow Rate = FiO₂ : LPM

MV : Minute Volume in LPM

FiO₂ = MV (FiO₂-21)

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11.0 FUNCTIONAL FAULTS & REMEDIES FOR APPLICATION PROBLEMS

Sr. No.	Type of Fault	Cause	Remedy
1.	Power LED OFF (After switching ON)	Check AC supply circuit, socket, switches etc. Check AC fuse (2) on Ventilator. Check AC supply cord	If fuse is blown, replace it with 0.5 Amp slow blow fuse of 20 x 5 mm. size or equivalent fuse. Replace the cord if found defective.
2.	While during working : All indications go OFF and audio alarm is turned ON	Check AC supply	Supply failure OR Loose connection in supply line can generate the alarms.
3.	After switching ON : Bellow indicator does not move Audio Alarm ON	Check AC supply	If AC supply too high, use voltage corrector regulate the supply voltage. Reset M/C.
4.	Ventilator performs normal in free air but stops or functions erratically when connected to the patient Audio Alarm ON Display message shows "UNIT MALFUNCTION"	Check tube connection on Inlet / outlet port Check direction of unidirectional valve, flutter valve Check settings of BPM and volume, and inspiratory pressure generated. Check supply voltage Check for loose connection in power supply line	Rectify patient's circuit. Refer illustrated circuit connection in chart - 6. Rectify valve direction. Select slightly lower BPM/ Volume. Low voltage below 210 volts, causes reduction in minute volume capability and pressure delivering capability. Use CVt / Servo type Voltage corrector to rectify supply voltage. Rectify loose connection

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Sr. No.	Type of Fault	Cause	Remedy
5.	"EXCESS GAS FLOW" Alarm	Check whether Peep valve is connected and the PEEP selection is selected to NO	Change the PEEP selection to YES.
6.	"LOW TIDAL VOLUME" Alarm	Check the supply Voltage Check the inlet port	Rectify the voltage check the direction of flutter valve
7.	Tidal volume insufficient and very low, Audio alarm ON, Dial pressure swinging too high in +ve direction	Check supply voltage Monitor bellow movement indicator (3) Check patient circuit connections. inlet port connection, unidirectional valve direction.	Take corrective measure as per (4) If incorrect rectify connections.
8.	Audio alarm OFF pressure gauge indicator swinging too high in +ve direction	Check patient's condition.	Patient's air-way resistance abnormal Set volume is too high
9.	Audio alarm OFF and pressure gauge not changing significantly in either +ve / -ve direction and low tidal volume delivered to the patient.	Check for leakage of gases / air from bellow, Pressure Release Valve, tube connections, patient's end valve.	Eliminate Leakage. Readjust pressure release valve.
10.	(A) Audio alarm OFF and pressure gauge shows -ve indication, very little swing in +ve direction (B) Audio alarm ON, display shows "INSUFFICIENT GAS" message and pressure gauge shows -ve indication and remains -ve during entire cycle.	Check inlet gas flow and connetions at inlet Check inlet Gas flow.	Inlet blocked or incorrect polarity of unidirectional valves. Inlet gas flow rate too low, mismatch of quantity delivered in the ventilator and inlet flow rate. Adjust inlet gas flow rate.

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Sr. No.	Type of Fault	Cause	Remedy
11.	(A) Audio alarm OFF and dial gauge shows continuous +ve pressure (B) Audio alarm ON and dial gauge shows continuous +ve pressure. Display shows "EXCESS-GAS" message.	Check inlet gas flow rate	Inlet flow too high and ventilator minute volume does not match. Adjust inlet gas flow rate Inlet gas flow rate too high. Large mismatch between inlet gas flow rate and ventilator minute volume setting. Adjust inlet gas flow rate.
12.	Display indicates "DISCONNECTION" message and audio alarm ON, pressure gauge not showing any swing in +ve / -ve direction.	Check for major leakage in breathing circuit. Check Inlet valve direction Check air-way monitoring tube connection. Check outlet connection	Rectify the connections
13.	Excessive assisted breaths and hyperventilation if the patient.	Check patient's effort level before beginning of inspiration cycle.	Sensitivity may be lowered from -1 - -9cm. to appropriate level
14.	Pressure gauge shows abnormal high +ve swing during inspiration.	Check inspiration time. Check Tidal Volume	Flow rate too high increase inspiration time to reduce flow rate. Tidal Volume too large for the patient. Patient's parameter is not matching with the ventilator setting.
15.	Pressure gauge shows rise in pressure. Tidal Volume delivered is low.	Check for leakage in airway circuit. Check direction of unidirectional valve. Check inspiration time and tidal volume.	Eliminate leakage. Rectify direction of valve. Inspiration time too long resulting in poor flow rate. Long inspiration time reduces expiration time causing stacking of breaths. "REDUCE THE INSPIRATION TIME APPROPRIATELY"

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12.0 ASSESSORIES

Following standard accessories are supplied along with the ventilator MX-40P

<u>DESCRIPTION</u>	<u>QTY.</u>
22 mm Flexible tube, cuffed at 400 mm. 1.6 met. Length	1 Nos.
T- Connector 22M-22M / 15F-22m with 7.6 mm port	1 Nos.
Connector 22M-2F	1 Nos.
One way flutter valve	2 Nos.
2.0 liter Reservoir bag with 22F neck	1 Nos.
Non Return Valve	1 Nos.
Non Rebreathing (Fish-Mouth Valve)	1 Nos.
Pressure Monitoring Tube	1 Nos.
Patient Valve Connector	1 Nos.

MAX VENTILATOR CAN BE CONNECTED TO EXTERNAL EQUIUPMENT SOURCES LIKE :

1. PEEP VALVE
2. HUMIDIFIER
3. OXYGEN CONCENTRATOR
4. BATTERY POWERED INVERTER FOR USE DURING POWER FAILURE AS WELL AS IN MOBILE APPLICATIONS LIKE AMBULANCE, AIRCRAFT Etc.

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AMBULANCE APPLICATION

Max Ventilators (MX-10 AL NEO & MX-40P) can be connected with ambulance and following precautions are to be taken for connecting ventilator.

1. Use sine wave type Inverter with out put of 210V AC 0.5KVA or 500 VA.
2. If Ambulance does not have any 210 AC (Inverter) supply, user can use Max Battery Backup (UPS) unit with external battery connector. External battery connector can be connected with ambulance battery. If Ambulance is in running condition then ventilator keeps on running and incase of breakdown of ambulance then it can give back up of around 3-4 hours depending on the ampere of battery.
3. Ambulance with AC (Inverter) supply facility do not require any backup unit.

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MAINTENANCE RECORD

[illegible]

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INSTALLATION REPORT OF NEO

Model : _____ Installation Date : _____

Sr. No. _____ Warranty Validity from Date : _____ To _____

Customer Name : _____

Landline No : STD Code : _____ Tel No. : _____

Installed in : OT/ICU/AMBULANCE

Voltage condition at Installation Place :

	Recommended	Current reading
Supply Voltage	230V, 50HZ, 1 Phase	
Neutral - Earth Voltage	Should not exceed 5V	

Accessories			
22 mm Patient tubing, 1.6 Mtrs.	01 NO	Non Rebreathing patient valve	01 NO
Reservoir bag-2 Ltr	01 NO	Pressure monitoring Tube	01 NO
T Connector	01 NO	Pressure monitoring Adaptor	01 NO
Straight Connector	01 NO	22mm Tube Clamp	7 Nos.
One way Valve	01 NO	Operating Manual	01 NO
Flutter Valve	02 Nos.	Spare Fuse 0.5A	02 Nos.
Oxygen steam connector	01 NO	Power Cord	01 NO

Optional accessories

Peep Valve with Adaptor	
UPS with built in CVT	
CVT	
Trolley	

Training for Preventive Maintenance :

Sr. No.	CUSTOMER TRAINING	NAME OF PERSON TO WHOM TRAINING IS GIVEN	SIGNATURE
1	Understanding of Ventilator & it's operation		
2	Explanation of patient circuit connection		
3	Setting of equipment		
4	Interpretation of Alarms		

Installation of ventilator is completed to my satisfaction and is working satisfactorily.

Name of incharge Doctor / person : _____

Customer Remark : _____

Remark by installation Engineer : _____

Customer Signature : _____ Name of Engineer : _____
Signature : _____

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INSTALLATION REPORT OF NEO

Model : _____

Installation Date : _____

Sr. No. _____

Warranty Validity from Date : _____ To _____

Customer Name : _____

Landline No : STD Code : _____ Tel No. : _____

Installed in : OT/ICU/AMBULANCE

Voltage condition at Installation Place :

	Recommended	Current reading
Supply Voltage	230V, 50HZ, 1 Phase	
Neutral - Earth Voltage	Should not exceed 5V	

Accessories			
22 mm Patient tubing, 1.6 Mtrs.	01 NO	Non Rebreathing patient valve	01 NO
Reservoir bag-2 Ltr	01 NO	Pressure monitoring Tube	01 NO
T Connector	01 NO	Pressure monitoring Adaptor	01 NO
Straight Connector	01 NO	22mm Tube Clamp	7 Nos.
One way Valve	01 NO	Operating Manual	01 NO
Flutter Valve	02 Nos.	Spare Fuse 0.5A	02 Nos.
Oxygen steam connector	01 NO	Power Cord	01 NO

Optional accessories

Peep Valve with Adaptor	
UPS with built in CVT	
CVT	
Trolley	

Training for Preventive Maintenance :

Sr. No.	CUSTOMER TRAINING	NAME OF PERSON TO WHOM TRAINING IS GIVEN	SIGNATURE
1	Understanding of Ventilator & it's operation		
2	Explanation of patient circuit connection		
3	Setting of equipment		
4	Interpretation of Alarms		

Installation of ventilator is completed to my satisfaction and is working satisfactorily.

Name of incharge Doctor / person : _____

Customer Remark : _____

Remark by installation Engineer : _____

Customer Signature : _____ Name of Engineer : _____

Signature : _____

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Date of Installation	Installed By
Model No.	Serial No.
Warranty Period	
Name of Doctor & Address :	

Customer Sign. With Stamps

**Marketed By: Western Surgical
 Sign. With Stamps**

No Claim Warranty :

- 1) Any Defect Throughtout Power Supply**
- 2) Any Physical Damage**

3) Under Warranty Standby Unit Not Provide

4) Under Warranty When Company Send Parts or Machine we Imidiat send to Buyer.

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