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<td>New release for dual internal battery update</td>
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OPERATOR’S RESPONSIBILITY FOR PATIENT SAFETY

The Operation manual (p/n OPRHT50-NA) contains information intended to ensure safe and effective ventilator use. The label on the inside of the front panel cover door is meant to complement not replace the Operation manual.

The design of the HT50 ventilator, the Operating and Service manuals, and the labeling on the ventilator take into consideration that the purchase and use of the equipment is restricted to trained professionals, and that certain inherent characteristics of the ventilator are known to the operator. Instructions, warnings and caution statements are therefore limited to the specifics of the Newport HT50.

**Caution**  Federal law restricts this device to sale by or on the order of a physician.

This manual excludes references to various hazards which are obvious to medical professionals and operators of this equipment, to the consequences of product misuse, and to potentially adverse effects in patients with abnormal conditions.

When the HT50 is used in home care and sub acute environments it is important that the primary caregiver has received training and has demonstrated competency in all equipment functions. A specific written care plan must be established by the attending physician.

Transport of patients with the HT50 requires that medical staff have a good working knowledge of the ventilator’s use and problem resolution. Proper emergency back-up equipment must be immediately available during transport.

HT50 operators must recognize their responsibility for implementing safety monitoring mechanisms which supply appropriate information on equipment performance and patient condition. Patient safety may be achieved through a wide variety of means such as electronic surveillance of equipment performance and patient condition. However, equipment surveillance should not replace direct observation of clinical signs. The HT50 operator is solely responsible for selecting the appropriate level and method of patient monitoring.

Product modification or misuse can be dangerous. Newport Medical Instruments, Inc. (NEWPORT) disclaims all liability for the consequences of product alterations or modifications, as well as for the consequences which might result from the combination of this ventilator with other products, whether supplied by Newport or by other manufacturers, unless such a combination has been specifically endorsed by Newport.
OPERATOR’S RESPONSIBILITY

LIMITATION OF LIABILITY

The liability of Newport Medical Instruments, Inc. (NEWPORT) is subject to and limited to the exclusive terms and conditions as set forth herein. Said liability is limited whether arising out of, or related to, the manufacture and sale of goods, their installation, demonstration, sales representation, use, performance, or otherwise. Any liability based upon product warranty, whether breach of warranty or otherwise, is limited regardless of any fault attributable to NEWPORT and the nature of the action (including breach of warranty, negligence, and strict liability).

The expressed warranties are in lieu of all other warranties, expressed or implied, including, without limitation, warranties of merchantability, fitness for any purpose, or noninfringement.

NEWPORT shall not be liable for any special incidental or consequential damages incurred by the buyer to a third party. The buyer shall not be entitled to make liability recoveries from NEWPORT due to such situations.

WARRANTY

The Newport HT50 Ventilator is guaranteed to be free of defects for a period of two (2) years from date of delivery. The following are exceptions to this warranty:

1. Defects caused by misuse, mishandling, tampering, or by modifications not authorized by Newport Medical Instruments, Inc. (NEWPORT) or its representatives.

2. Rubber and plastic components and materials are guaranteed to be free of defects at time of delivery.

3. The internal batteries are warranted for six months.

Any product which proves to be defective in workmanship or material will be replaced, credited, or repaired. Newport retains the discretion to select the most suitable of these options. Newport is not responsible for deterioration, wear, or abuse. In all cases, Newport will not be liable beyond the original selling price.

Application of this warranty is subject to the following conditions:

1. NEWPORT or its authorized representatives must be promptly notified upon detection of the defective material or equipment.

2. Defective material or equipment must be returned to NEWPORT or its authorized representative.
3. Examination by NEWPORT or its authorized representatives must confirm that the defect is covered by the terms of this warranty.

To ensure complete protection under this warranty, the Warranty Registration Card must be returned to Newport within ten (10) days of equipment receipt.

The above is the sole warranty provided by NEWPORT. No other warranty, expressed or implied, is intended. Representatives of Newport are not authorized to modify the terms of this warranty.

DEFINITIONS

**WARNING** Possibility of personal injury, to patient or others, if disregarded.

**Caution** Possibility of equipment damage if disregarded.

**NOTE:** Additional information intended to avoid inconveniences during operation. Notes also indicate important procedures to be followed.

**Inspection:** Examination of actual condition.

**Service:** Measures required to maintain a specified condition.

**Repair:** Measures required to restore a specified condition.

**Maintenance:** Required inspection, service, and repair of the device.

**Preventive Maintenance:** Maintenance performed at regular intervals to keep the device in good working condition.

**Typing Conventions**

Within the text of this manual, controls, alarms, and indicators are designated by the labeling name as they appear on the ventilator, e.g.: P.support (pressure support), P.trig (pressure trigger), and SPONT (spontaneous mode).

Please review all **WARNINGS** and **Cautions** outlined in this manual prior to servicing the HT50 for the first time.
OPERATOR’S RESPONSIBILITY

WARNINGS AND CAUTIONS

At all times, strictly follow this Manual. The safe use of the HT50 Ventilator requires a full understanding of its operation and adherence to the manual’s instructions. The equipment is only to be used for the purpose specified under “Intended Use” (see Section 2). Observe all of the WARNINGS and Cautions posted in this manual and on labels found on the HT50 Ventilator and associated accessories.

General Warnings

External power connection: To maintain grounding integrity when using A.C. power, only connect to hospital grade receptacles. Always disconnect the external power supply prior to servicing. Always use the power cord supplied with the HT50. Make certain the power cord ferrite is always attached to the A.C. power cord to ensure that the HT50 meets EMC requirements.

There is a risk of explosion if used in the presence of flammable anesthetics.

All settings and adjustments in the different ventilation modes must be made in accordance with a physician’s prescribed therapy.

NEWPORT cannot warrant or endorse the safe performance of third party humidifiers for use with the HT50.

When the HT50 is operating on battery power, the optional built-in humidifier does not function. A heat moisture exchanger, or other humidification device, should be used until the unit is connected to A.C. power at which time the built-in humidifier can be used.

Do not use electrically conductive patient circuits.

Always use a clean patient circuit.

Always use an inline filter (p/n HT6004701 or equivalent) at the Airway Pressure Connector to protect the internal transducers from moisture or other contaminants.

Always use appropriate monitors to ensure sufficient oxygenation and ventilation (such as pulse oximeter and/or capnograph) when the HT50 Ventilator is in use on a patient.

The ventilator is ready for operation only when:

a) It is completely assembled, and;
b) The Quick Check Procedure, including the Exhalation Valve Calibration (see Appendix A, Operating Manual) or OVP (Service Manual) has been successfully completed.

Constant attention by qualified medical personnel is recommended whenever a patient is ventilated with the HT50.
When the HT50 is used in homecare environments, proper education and training of the appointed caregiver must be provided prior to the patient leaving the health care facility.

If a fault is detected in the ventilator and its life support functions are in doubt, immediately discontinue use; use an alternative method of ventilation until the fault has been corrected. Contact NEWPORT Technical Service Department immediately.

Failure to identify and correct alarm violations may result in patient injury.

Continuous oxygen monitoring is required for patient safety. The HT50 does not have a built-in alarm system to notify user of a failure or disconnection of the oxygen source.

Ensure that the oxygen source is not empty before and during the use of the optional Air/Oxygen Entrainment Mixer or Oxygen Blending Bag Kit.

The primary internal battery should be replaced every 12 months or sooner if the use time no longer meets the needs of the user. This will depend on a number of factors including settings and usage patterns. The secondary internal battery should be replaced every 24 months.

Please recognize that any life support equipment should have appropriate alternate power sources and means of ventilation readily available in case of a mechanical or system problem. If you need alternative power sources, contact Newport Medical Instruments Inc.

When the HT50 is used for transport applications, ensure that the internal battery system is fully charged prior to use.

When the Battery Empty audible alarm sounds continuously, only a limited time of internal battery power remains and an alternate power source should be found immediately.

Frequent deep discharge of the internal battery system will decrease the amount of time the HT50 will operate on battery power from a full charge state.

If you use the internal battery system as your primary power source, replace the primary battery as needed to ensure that the battery operation time is sufficient.
Charge the internal battery system for a minimum of 8 hours before powering the ventilator from the internal batteries. This will provide approximately 80% of the battery charge. If the battery system is completely depleted, it will take approximately 10 hours to fully recharge.

Always ensure that the green *Ext. Power* LED lights after connecting the HT50 to an external AC or DC power source (it can take up to two minutes to light). If the LED does not light, check all power connections and resolve any problems.

Always plug the HT50 into an external power supply source when not in use to insure best battery performance. The flow resistance of the air inlet filter, located on the right side of the ventilator, is likely to increase with repeated use. Ensure that the filter is changed regularly.

The HT50 Ventilator is guaranteed to perform to specification when the Newport HT50 breathing circuit with exhalation valve is used. See Appendix B for circuit configurations and parts list.

Only *NEWPORT* approved exhalation valves can be used with the HT50.

Perform an exhalation valve calibration each time a clean circuit/exhalation valve is installed.

The functioning of this machine may be adversely affected by the operation of equipment, such as high frequency surgical (diathermy) equipment, defibrillators or short-wave therapy equipment in the vicinity.

This equipment has been tested and found to comply with the EMC limits for the Medical Device Directive 93/42/EEC (EN55011 Class A and EN 60601-1-2). These limits are designed to provide reasonable protection against harmful interference in a typical medical installation. The equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with these instructions, may cause harmful interference to other devices in the vicinity. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference with other devices, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving device
- Increase the separation between the equipment
• Connect the equipment into an outlet on a circuit different from that to which the device(s) is connected

• Consult the manufacturer or field service technician for help.

Cautions

Only use medical grade oxygen with the Air/Oxygen Entrainment Mixer or Oxygen Blending Bag Kit.

Do not place liquid containers in the immediate vicinity or on top of the HT50. Liquids that get into the ventilator can cause equipment malfunction and damage.

After servicing an HT50, it must completely pass an Operational Verification Procedure (see Service Manual) before being returned to patient use.

An authorized Newport Medical Instruments factory-trained technician must do all service or repairs performed on the HT50.

Do not open the ventilator or perform service on an open unit while connected to external power.

Use standard anti-static techniques while working inside the ventilator or handling any electronic parts.

Clean all external parts of the ventilator prior to servicing.

Water in the oxygen supply can cause equipment malfunction and damage.

Always replace a blown fuse with one of proper rating for corresponding voltage range.

NOTE: Review HT50 Operating Manual and Theory of Operation (Section 4 of this manual) before servicing the ventilator.

NOTE: Use the tools and equipment specified in this manual to perform specific procedures.

Batteries contain materials that can harm the environment. Do not discard them in an incinerator or force them open. Batteries cannot be disposed of with normal waste.

Factory Maintenance or Repair

Scheduled maintenance or repair services are available from the Newport Technical Service Department. To send your ventilator in for service, see HT50 Service Manual for repackaging and shipping instructions.
Current pricing for scheduled maintenance and labor rates can be found in Newport Medical Instruments Annual Price List. To obtain a copy, please contact your local Newport Sales Representative or contact our Customer Service Department using information below.

Contact Information

**Address:** Newport Medical Instruments, Inc.
1620 Sunflower Ave
Costa Mesa, California, USA 92626

**Phone numbers:**
- Toll-free within the United States: 800.451.3111
- Worldwide: 1.714.427.5811

**Fax numbers:**
- Main fax: 1.714.427.0489
- Technical Service fax: 1.714.427.0572

**Website:**
- www.NewportNMI.com /
- www.ventilators.com

**Email:**
- Info@NewportNMI.com

**Department extensions:**
- Customer Service: 282
- Technical Service: 500 (24-hour pager activated after Technical Service department hours)
- Clinical Support: 123 (24-hour pager)

**Corporate Office hours:**
- Monday through Friday, 8:00 am to 5:00 pm (USA Pacific Time)

**Technical Service hours:**
- Monday through Friday, 7:00 am to 4:00 pm (USA Pacific Time)

HT50s distributed internationally have CE authorization (HT50-H, HT50-H1) and are represented by: Obelis, s.a., 34 Ave de Tervuren, bte 44, B-1040 Brussels, Belgium. Tel: +32.2.732.59.54 Fax:+32.2.732.60.03 email:mail@obelis.net
2. SPECIFICATIONS

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INTENDED USE

This device is intended to provide continuous or intermittent mechanical ventilator support for the care of individuals who require mechanical ventilation. The ventilator is a restricted medical device intended for use by qualified, trained personnel under the direction of a physician. Specifically, the HT50 is applicable for adult and pediatric (i.e. infant, child and adolescent) patients, greater than or equal to 10 kg or 22 lbs., who require the following general types of ventilatory support, as prescribed by an attending physician: positive pressure ventilation with assist/control, SIMV and SPONT modes of ventilation. The HT50 is suitable for use in hospital, sub-acute, emergency room, home care environments as well as for transport and emergency response applications.

Front panel controls allow trained operators to select between a number of operational modes, pressure support and volume or pressure control. A comprehensive alarm system is built-in to alert the user to violations of set safety limits. When new and fully charged, the internal battery system provides up to 10 hours of power. With its patented, self-contained gas supply source, the HT50 requires no external air compressor.
## SYMBOLS/LABELING TABLE

<table>
<thead>
<tr>
<th>Controls/Alarms/Monitors</th>
<th>Range/Selection</th>
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| 1. MODE (Pressure or Volume Control) | A/CMV  
SIMV  
SPONT |
| 2. Volume Control (Tidal Volume) | 100 to 2,200 mL, ATPS, ± 10% |
| 3. Pressure Control (Target Pressure) | PEEP + 5 to 60 cmH2O / mbar |
| 4. V (Flow) | 6 to 100 L/min |
| 5. t₁ (Inspiratory Time) | 0.1 to 3.0 sec |
| 6. f (Frequency) | 1 to 99 b/min |
| 7. P trig (Sensitivity) | −9.9 to 0 cmH2O / mbar, pressure triggering  
(Patient Effort Indicator LED blinks once each time the airway pressure reaches the P trig setting.) |
| 8. PEEP/CPAP | 0 to 30 cmH2O / mbar |
| 9. P support (Pressure Support) | 0 to 60 cmH2O / mbar above baseline pressure,  
limited to PEEP + P support ≤ 60 cmH2O / mbar |
| 10. I:E Ratio | 1:99 to 3:1 |
| 11. Maximum Limited Airway Pressure (Safety Valve) | 100 cmH2O (98 mbar) |
| 12. Manual Inflation | 3 sec maximum  
(While button is pushed, the ventilator closes the exhalation valve and delivers a operator controlled breath to the patient.) |
| 13. Humidifier (Optional) | 19°C to 39°C |
| 14. Airway Pressure Meter | −10 to 100 cmH2O / −10 to 98 mbar |
| 15. Alarm Silence/Reset Button & Indicator | Pressing button silences an audible alarm violation for 60 seconds and resets a latched alarm indicator. LED lights to indicate that Silence is active |
| 16. ALARMS Indicators | Indicators for violated alarms blink red. When the alarm is no longer violated, the indicator latches (stays lit). Cancel a latched indicator by pressing the Silence/Reset button. |
| 17. Int. Battery Button & Indicator | Pressing button displays the internal battery charge level in the airway pressure meter (Paw) window when operating on the internal battery system for accurate reading. LED lights to indicate internal battery system operation and alarms. |
Controls/Alarms/Monitors | Range/Selection
---|---
18. FIO2 (with optional accessories) | 0.21 to 1.00
19. On / Standby Button | Press once to put in Setting condition. (On-Setting/LED off) Press again to begin ventilating (On-Ventilating/LED on). When the HT50 is ventilating, press two times to put ventilator into Standby/Off condition (LED off).
20. Push To Unlock Buttons & Indicator | Pressing button unlocks front panel buttons if locked by automatic panel lock feature. Auto lock is enabled/disabled in User Set Up. LED lights to indicate panel is locked.
21. Alarms
   ▲Paw (High Pressure) | 4 to 99 cmH2O / 4 to 99 mbar, must be 1< Low Paw
   ▼Paw (Low Pressure) | 3 to 98 cmH2O / 3 to 98 mbar, limited by ≥ PEEP + 3 and High Paw -1
   Low Baseline Pressure | Paw ≤ PEEP - 3 cmH2O/mbar for 3 sec during exhalation
   High Baseline Pressure | Paw ≥ PEEP + 8 cmH2O/mbar at onset of a breath or 3 sec after the start of exhalation
   Occlusion | Paw ≥ PEEP + 15 cmH2O/mbar at onset of a breath or 3 sec after start of expiration
   Apnea | 30 sec ± 3 sec
   PCV Not Reached | Paw P < 50% of PCV setting
   ▲Vji Ins. Min. Volume | 1.1 to 50.0 L/min
   ▼Vji Ins. Min. Volume | 0.1 to 49.0 L/min
   Check Prox Line | Prox Paw does not match machine Paw during inspiration
   Humidifier (5 messages) | Humidifier malfunction/disconnection
   Power Switchover | External power to internal battery switchover alert
   Battery Low | Minimum of 30 minutes battery time remains until shutdown
   Battery Empty | Minimum of 15 minutes battery time remains until shutdown

NOTE: The time between the Battery Low Alarm violation and the Battery Empty Alarm violation will vary depending on the ventilator load. At high volumes and pressures, the Battery Empty Alarm will occur much sooner after the Battery Low Alarm, than it will at lower volumes and pressures. In all cases, the stated minimum times for each alarm will be met, even if the two alarms occur almost simultaneously.

Device Alert (5 messages) | Ventilator malfunction: FAULT BAT SYS, OCCLUSION, 10V SHUTDOWN, SYSTEM ERROR or MOTOR FAULT
Shut Down Alert | On to Standby/Off Shut Down Alert
22. Message Display Window
Up to 16 characters, LED alpha numeric display
Displayed monitored parameters:

- \( V_T \) (Actual delivered tidal volume)
- \( V_i \) (Inspiratory minute volume)
- \( f \) (Total breath frequency)
- Paw P (Peak airway pressure)
- Paw M (Mean airway pressure)
- Paw B (Baseline airway pressure)
- H (Hours of operation)
- S (Software version)
- L (or Q) (Buzzer volume (Loud or Quiet) for audible alarm)

Other displayed parameters
(In USER SET UP):

- Power Save (On / Off)
- Airway Pressure Units (cmH\(_2\)O / mbar)
- Set Up (User / Default)
- Auto Panel Lock (Enabled / Disabled)
- Tech. Setup (Technical set up, refer to Service Manual)

23. Front Panel Indicators

**Modes**
- A/CMV Green LED indicates that A/CMV mode is active.
- SIMV Green LED indicates that SIMV mode is active.
- SPONT Green LED indicates that SPONT mode is active.

**Controls**
- Volume Control Green LED indicates Volume Control ventilation.
- Pressure Control Green LED indicates Pressure Control ventilation.

**Alarms**
- \( \Delta \)Paw (High Pressure) Red LED indicates high peak airway pressure, high baseline pressure, or occlusion alarm violation.
- \( \nabla \)Paw (Low Pressure) / Apnea Red LED indicates low peak airway pressure, low baseline pressure, apnea, or PCV (50% of PCV setting not achieved) alarm violation.
- Device Alert Red LED indicates ventilator malfunction alert.
- \( \Delta V_i \) (High Insp. Min. Volume) Red LED indicates high inspiratory minute volume alarm limit is violated.
- \( \nabla V_i \) (Low Insp. Min. Volume) (Back-Up Vent) Red LED indicates low inspiratory minute volume alarm limit is violated.

**Misc. Indicators**
- Silence / Reset Yellow LED indicates that the audible alarm is silenced for 60 seconds.
- Auto Lock On Green LED indicates that the panel is currently locked.
- On / Standby Green LED indicates that the HT50 is ventilating.
- P trig Green LED blinks on to indicate patient breathing effort.
- \( V \) (Flow) Green LED indicates that Flow is displayed in the \( V/I:E \) Ratio numeric window display.
- I:E Green LED indicates that the I:E Ratio is displayed in the \( V/I:E \) Ratio numeric window display. Blinking LED indicates a breath with an inverse I:E Ratio.
Ext. Power / Charging Int. Battery
Green LED indicates external power is on and the internal battery is being charged. Red LED indicates power switchover to internal battery.

Int. Battery (Push to Test)
Yellow LED indicates internal battery is in use. LED blinks yellow to indicate Battery Low alarm condition or blinks red to indicate Battery Empty alarm condition.

Humidifier On
Green LED indicates humidifier is active. LED blinks yellow to indicate humidifier alarm condition.

Hardware Requirements

24. Electrical
Applied parts type BF

25. External A.C. /D.C. (Battery Input)
100-240 VAC, max. 2 A
50 / 60 / 400 Hz
12-30 VDC, max. 12 A

26. Dual Internal Battery
Primary battery: lead acid, 12 VDC, 5 AH
Secondary back up battery: nickel metal hydride, 12 VDC, 2.1 AH
When new and fully charged, the Dual Pac internal battery supplies power for up to 10 hours of operation at these settings: A/CMV mode, \( f = 15 \), Volume Control=500 mL, \( t_I = 1.0 \) sec, PEEP=Ø, max. airway pressure 30 cmH\(_2\)O/mbar, Power Save mode ON.

NOTE: The Dual Pac internal battery charges whenever the HT50 is connected to an external power source. Battery charge level is best maintained by keeping the HT50 continuously connected to external power.

NOTE: The primary internal battery capacity diminishes with age. As the battery ages the Battery Low alarm will occur sooner. If this begins to infringe on the needed battery time, prior to scheduled replacement, the primary internal battery should be replaced.

27. RS-232C Interface /Remote Alarm Output
8 pin SEMCONN connector. Operates at 19,200 baud. Allows put for interfacing with central alarms systems.

28. Pneumatics
Gas delivery system requires no external air compressor.

Miscellaneous Description

29. Operating Temperature
\(-18^\circ C \) to \( 50^\circ C \)

NOTE: For proper operation at low range temperatures (-18°C), the HT50 must be started in a normal room temperature environment and allowed to run for 30 minutes prior to transfer to colder environment.

NOTE: At temperatures over 40°C the charging circuit is disabled and the internal battery does not charge.

30. Operating Humidity
15 to 95% non-condensing

31. Operating Altitude
Sea level to 15,000 ft (0 to 4,572 m)
There is no altitude limitation when HT50 is operated in a pressurized environment.
32. Operating Pressure 600 to 1,100 mbar

33. Regulatory and Agency Standards/Requirements

Complies with the following international standards & requirements:
Testing and evaluation of the NEWPORT HT50 Ventilator has been conducted in compliance with the following voluntary standards:
- **IEC/IEC 60529**: 2001 Degrees of Protection Provided by Enclosures (IP Code)
- **MIL-STD-810E**: Environmental Test Methods and Engineering Guidelines
- **IEC 601-2-12**: 1988 Particular Requirements for the Safety of Lung Ventilators for Medical Use
- **IEC 68-2-6**: Test Fc Environmental Tests: Vibration (sinusoidal)
- **IEC 68-2-29**: Test Eb Environmental Tests: Bump
- **IEC 68-2-32**: Test Ed Environmental Tests: Free Fall
- **IEC 68-2-36**: Test Fdb Environmental Tests: Random Vibration
- **ISO 8185**: 1997 Humidifiers for Medical Use: General Requirements for Humidification Systems
- **ASTM F 1100-90**: 1990 Standard Specifications for Ventilators Intended for Critical Care Use
- **DO-160D**: Environmental Conditions and Test Procedures for Airborne Equipment

34. Storage Temperature −40°C to 65°C

35. Storage Humidity 0 to 95% non-condensing

36. Height (includes handle) 10 inches (26 cm)

37. Width 11 inches (27 cm)

38. Depth 8 inches (20 cm)

39. Weight 16.7 lbs. (7.6 kg) without humidifier
18.0 lbs. (8.2 kg) with humidifier

40. Patient Range Adult - Pediatric (i.e. infant, child & adolescent) with body weight ≥10 kg
41. Factory Default Parameters

**Patient Settings:**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODE</td>
<td>A/CMV</td>
</tr>
<tr>
<td>Volume Control</td>
<td>500 mL</td>
</tr>
<tr>
<td>$t_i$</td>
<td>1.0 sec</td>
</tr>
<tr>
<td>$f$</td>
<td>15 b/min</td>
</tr>
<tr>
<td>Ptrig</td>
<td>−1.0 cmH$_2$O</td>
</tr>
<tr>
<td>Paw Alarms</td>
<td>5 cmH$_2$O $\nabla$Paw</td>
</tr>
<tr>
<td>$V_i$ Alarms</td>
<td>3 L/min $\nabla$V$_i$</td>
</tr>
<tr>
<td></td>
<td>20 L/min $\Delta$V$_i$</td>
</tr>
</tbody>
</table>

**User Set Up:**

- Power Save: On
- Pressure Units: cmH$_2$O
- Auto Panel Lock: Disabled
- Set Up: User

42. Patient Circuit

Reusable 22 mm I.D. adult/pediatric circuit with 3/16 inch (4.8 mm) I.D. proximal pressure sensing line, 1/8 inch (3.2 mm) I.D. exhalation valve control drive line, and exhalation valve.

43. Exhalation Valve

NEWPORT’s HT50 exhalation valve (P/N HT600039) is manufactured and designed specifically for the NEWPORT HT50 Ventilator. NEWPORT MEDICAL does not approve of the use of any type or brand of exhalation valve that has not been tested and approved by NEWPORT MEDICAL for use with the HT50.

**HT50-H, HT50-HB Humidifier Specifications**

(operates on A.C. power only)

- **Set Target Temperature Range:** 19°C to 39°C
- **Operating Water Volume:** 300 mL
- **Usable Volume of Water Bottle:** 265 mL
- **Compliance at Minimum Water Level (Refill Line):** 0.5 mL/cmH$_2$O / mbar @ 23°C
- **Compliance at Maximum Water Level (Full Line):** 0.33 mL/cmH$_2$O / mbar @ 23°C
- **Intended Use:** Adult and pediatric patients whose supraglottic airway is or is not bypassed.
SPECIFICATIONS

Warm-Up Time: 30 minutes

Gas Leakage: 2 mL/min at airway pressure of 80 cmH₂O / mbar

Humidifier Output: 33.8 mg/L at a continuous flow of 10 L/min @ 39°C

Maximum Operating
Airway Pressure: 100 cmH₂O / 98 mbar

Maximum Temperature at the Patient Wye That Triggers an Alarm: 41°C

(optional) Air / Oxygen Entrainment Mixer Specifications

Pneumatic Requirements:
- Oxygen: 35 to 90 psig (2.4 to 6.2 Bar) full operating range
  40 to 70 psig (2.7 to 4.8 Bar) accuracy ± 0.08
- Air: Atmospheric pressure

F₁O₂ Control: adjusted continuously from 0.21 to 1.00

WARNING Continuous oxygen monitoring is required for patient safety. The HT50 does not have a built-in alarm system to notify user of a failure or disconnect of the oxygen source.

(optional) Oxygen Blending Bag Kit Specifications

Pneumatic Requirements:
- Oxygen: 0-10 L/min (calibrated)
- Air: Atmospheric pressure

F₁O₂ Control: F₁O₂, indirectly adjusted from 0.21 up to 1.00 via oxygen flow (L/min)

WARNING Continuous oxygen monitoring is required for patient safety. The HT50 does not have a built-in alarm system to notify user of a failure or disconnect of the oxygen source.
3. DESCRIPTION OF CONTROLS, INDICATORS, ALARMS & CONNECTORS

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Front Panel Controls and Indicators .......................... 3-5
Front Panel Alarms ..................................................... 3-14
Front Panel Message Display Window ......................... 3-23
Left Side Connectors .................................................. 3-24
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Optional Accessories ............................................... 3-26
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FRONT PANEL OVERVIEW

The following is an overview of the HT50 front panel button functions. For an indepth description, please review FRONT PANEL CONTROLS AND INDICATORS.

Turning the HT50 On and Off

The On/Standby button toggles between the following conditions:

Standby → Setting → On → → Standby

Press On/Standby button once to go from Standby to Setting. Press again to turn On. Press twice to go from On to Standby.

Standby: HT50 dormant.
Setting: Enables setting of control parameters and exhalation valve calibration.
On: Enables ventilation

NOTE: There is approximately a two second delay in going from Standby to Setting condition. During this time, the HT50 performs a self test and will light all displays on the front panel.

Changing the MODE Control

The MODE control buttons (A/CMV / SIMV / SPONT) function differently in Setting and On conditions.

Setting Condition
Press the A/CMV, SIMV or SPONT button. The LED on the selected Mode will light green to confirm the selection.

On Condition
Press the A/CMV, SIMV or SPONT button. The LED on the selected Mode will blink green and the Message Display Window will read “PRESS AGAIN.” Press the button again within 5 seconds to confirm the mode change, or the previously selected mode will continue.

Changing between Pressure Control and Volume Control

The Pressure Control and Volume Control buttons function differently when in A/CMV or SIMV in On condition compared to when in SPONT mode in On condition or Settings condition.

On Condition: A/CMV or SIMV
Select—Adjust (▲Up / ▼Down)—Accept
Select the Pressure Control or Volume Control button. Both the LED indicator and the target value will blink.
Adjust the blinking target value for the selected control with the ▲Up / ▼Down buttons.
To Accept the new control and target value you must press the desired control button (Volume or Pressure) a second time.
On Condition: SPONT
or
Setting Condition: A/CMV, SIMV, or SPONT

Select—Adjust (▲Up / ▼Down)—Accept

Select the Pressure Control or Volume Control button. Both the LED indicator and target value will blink.

Adjust the blinking target value for the selected control with the ▲Up / ▼Down buttons.

Accept the new control and target value by either pressing the selected button again; or by pressing another button to select a new parameter for adjustment, or by waiting 5 seconds without making a change.

Note: The transition to a new pressure or volume target may require several breaths.

Changing a Parameter (or Multiple Parameters)

Select—Adjust (▲Up / ▼Down)—Accept

Select the parameter by pressing the labeled button (i.e. f, P trig, etc). The parameter’s numeric display will blink.

Adjust the numeric value with the ▲Up / ▼Down buttons.

Accept the value by either pressing the selected button again; or by pressing another button to select a new parameter for adjustment, or by waiting 5 seconds without making a change.

Enabling/Disabling Auto Panel Lock

Auto Panel Lock can be enabled or disabled via User Set Up (see pg 3-27). When the Auto Panel Lock is enabled, the Panel will lock 30 seconds after the last button is pushed and the LED lights green. All touch buttons (except Silence/Reset and Internal Battery Test) are locked, preventing accidental parameter changes.

NOTE: Auto Panel Lock is factory preset to “Disabled” (off).

To temporarily unlock parameters when Auto Panel Lock is active, push the Push To unlock button for at least one second. The Panel will relock 30 seconds after the last button is pushed.
Figure 3-1
HT50 Ventilator Front Panel
(model HT50-H1, HT50-H1B)
Figure 3-2
Newport HT50-H, HT50-HB (with built-in humidifier)
FRONT PANEL CONTROLS & INDICATORS

Front panel controls that have corresponding LED indicators are included with the description of the control.

The HT50 front panel is shown in Figure 3-1 on pg 3-3.

On / Standby

This button toggles between the following conditions:

- **Standby** (if attached to external power, the battery is being charged) → **Setting** (allows setting of control parameters) → **On** (enables ventilation) → → **Standby**

**Standby**: The HT50 is dormant and ventilation is not enabled. If attached to external power, the Ext. Power/Charging Int. Battery LED is lit green, indicating that the internal battery is being charged. The On/Standby indicator is not lit.

**Setting**: Pressing the On/Standby button once changes the ventilator from Standby to Setting condition.

**NOTE**: There is approximately a two second delay in going from Standby to Setting condition. During this time, the HT50 performs a self test and will light all displays on the front panel.

During Setting condition, all adjustable LEDs are lit. This allows the operator to preset and adjust controls prior to ventilation. The On/Standby indicator is not lit. The Message Display Window shows “Press ON to Vent,” suggesting that the On/Standby button needs to be pressed if you want the HT50 to start ventilation.

**On**: Pressing the On/Standby button once more changes the ventilator from Setting to On. In the On condition, the HT50 is ventilating and the On/Standby indicator is lit green.

Pressing the On/Standby button twice while in On condition turns the ventilator from On to Standby.

MODE Control

The MODE control buttons enable the user to switch between the following operational modes:

- A/CMV
- SIMV
- SPONT

In A/CMV and SIMV, mandatory breaths can be pressure controlled or volume controlled. A green LED indicates which operational mode is active.
If the HT50 is in Setting condition, changes are made by pressing the requested MODE button once. If in ON condition, changes are made by pressing the requested MODE button twice. After the first press, the Message Display Window reads “PRESS AGAIN” and the requested MODE’s indicator starts to blink. If the requested MODE button is not pressed within 5 seconds, the change is cancelled.

A/CMV
(Assist / Control Mandatory Ventilation)

In A/CMV, the user may choose to pressure or volume control mandatory breaths. In either case, all breaths delivered to the patient, whether time (ventilator initiated) or patient-triggered, are the same.

The $f$ (frequency) setting determines the minimum number of time-triggered mandatory breaths delivered each minute. The $P_{trig}$ setting determines the airway pressure threshold that patient effort must reach to trigger additional mandatory breaths. If patient effort doesn’t cause airway pressure to drop enough to meet the $P_{trig}$ threshold, or if the patient doesn’t breathe, the HT50 will deliver the set $f$ (frequency) of mandatory breaths.

**NOTE:** If the $P_{trig}$ setting is not adjusted to a level that allows the patient’s inspiratory effort to be detected, A/CMV mode performs as CMV (control) mode.

SIMV
(Synchronized Intermittent Mandatory Ventilation)

In SIMV, the user may choose to pressure or volume control mandatory breaths. In either case, all mandatory breaths delivered to the patient, whether time (ventilator initiated) or patient-triggered, are the same. In addition, the user may choose to pressure support the spontaneous breaths in between mandatory breaths.

Unlike A/CMV, the $f$ (frequency) setting in this mode determines the total rather than the minimum number of time (ventilator) or patient triggered mandatory breaths delivered each minute.

The $f$ (frequency) setting also establishes a timing window which determines whether a patient trigger results in a mandatory breath or a spontaneous breath.

The $P_{trig}$ setting determines the airway pressure threshold that patient effort must reach to trigger mandatory breaths and also to trigger spontaneous breaths in between mandatory breaths.

If patient effort doesn’t cause airway pressure to drop enough to meet the $P_{trig}$ threshold or if the patient doesn’t breathe, the HT50 will deliver the set $f$ (frequency) of mandatory breaths each minute.
SPONT (Spontaneous Ventilation)

In this mode, all breaths are patient triggered by spontaneous efforts. P support (Pressure Support Ventilation) may be used to support spontaneous efforts. When PEEP/CPAP is set above 0, the ventilator mode is CPAP (without P support) or Bilevel Positive Airway Pressure (with P support).

▲ Up and ▼ Down Control

The ▲Up/▼Down control buttons have multiple uses on the HT50.

1. Parameter Adjustment: Use the ▲Up/▼Down buttons to adjust ventilation control parameter values (including Pressure Control and Volume Control values), alarms, and humidifier setting (if available). Select the desired parameter by pressing its touch button once. The corresponding value (numerical display) will blink. Press the ▲Up control to increase or the ▼Down to decrease the affected parameter value. The value continuously changes when the ▲Up/▼Down controls are pressed and held. The value adjustment is accepted if (1) the user presses the selected parameter button again, or (2) the user selects a different parameter, or (3) five seconds elapses. Pressing a parameter button without pressing either the ▲Up or ▼Down control button within 5 seconds causes the parameter to retain its current value.

NOTE: If in the On condition and switching between Volume Control and Pressure Control, the value adjustment for the new breath type selected (Volume or Pressure) will be accepted as noted above, but the breath type (VC or PC) will only change if the user presses the new breath type control button again.

2. Monitored Information: The ▲Up/▼Down controls are used to access and display monitoring messages in the Message Display Window. Monitored information includes volume, frequency, pressure values and operation information. See pg 3-23 for more information on the Message Display Window.

When the HT50 is ventilating, and there are no alarm messages displayed on the Message Display Window, press the ▲Up control button to access the monitoring information. Pressing the ▲Up button again allows you to scroll through the messages.

3. Changing Default Settings: The ▲Up/▼Down controls are also used in User Set Up to change a set up value. See User Set Up on pg 3-27 for more details.
**DESCRIPTION OF CONTROLS, INDICATORS, ALARMS & CONNECTIONS**

\( f \)  
(frequency)  

**Range:** 1 to 99 b/min  

The \( f \) (frequency) setting determines the minimum number of time triggered mandatory breaths in the A/CMV mode and the total number of mandatory breaths in the SIMV mode. The frequency or rate value is displayed in the window adjacent to the selector button.

The user is alerted to frequency settings which result in an inverse I:E Ratio by an audible beep and an “Inverse I:E” message in the Message Display Window. Attempts to continue increasing the value after this alert are permitted up to an I:E Ratio of 3:1.

**NOTE:** In SPONT mode, the \( f \) setting is not utilized but the value can be preset.

\( t_I \)  
(inspiratory time)  

**Range:** 0.1 to 3.0 sec  

The \( t_I \) setting determines the inspiratory time for mandatory breaths (volume or pressure control). The selected time value is displayed in the window adjacent to the selector button. The user is alerted to \( t_I \) settings which result in an inverse I:E Ratio by an audible beep and an “Inverse I:E” message in the Message Display Window. Attempts to continue increasing the value after this alert are permitted up to an I:E Ratio of 3:1. If the inspiratory time setting causes the flow rate to reach the maximum or minimum level of the flow specification, adjustment of \( t_I \) ceases, a beep sounds, and a setting limitation message appears in the Message Display Window.

**NOTE:** In SPONT mode, the \( t_I \) setting is not utilized but the value can be preset.

**NOTE:** See pg. 3-24 for a list of setting limitation messages.

**Volume Control**  
(tidal volume)  

**Range:** 100 to 2,200 mL, ATPS  

**NOTE:** When Volume Control is first initiated, or when a large change is made to the volume setting, it may take 5 or 6 breaths to reach the volume setting.

Pressing this control button, followed by pressing the ▲Up/▼Down controls, allows the adjustment of the tidal volume setting. When the green Volume Control LED illuminates, the adjacent window displays the set tidal volume. See Theory of Operation, pg 4-5 for more details.
If the Volume Control setting causes the flow rate to reach the maximum or minimum level of the flow specification, adjustment of Volume Control ceases, a beep sounds, and a setting limitation message appears in the Message Display Window.

**NOTE:** See pg. 3-24 for a list of setting limitation messages.

**NOTE:** In SPONT mode, the Volume Control is not utilized but the value can be preset.

### Switching from Pressure Control to Volume Control:

Press the Volume Control button. The set tidal volume is displayed in the adjacent window if the HT50 is ventilating. A “PRESS AGAIN” message appears in the Message Display Window.

Adjust the tidal volume level by pressing the ▲Up/▼Down controls while the LED and numerical display are blinking. If the HT50 is ventilating you will need to Press the Volume Control button again within 5 seconds following adjustment.

---

#### Pressure Control (target pressure)

**Range:** 5 to 60 cmH₂O / mbar

**NOTE:** When Pressure Control is first initiated or the setting is changed, the first few breaths may cycle off early until slope/rise is optimized. If early cycling off continues, re evaluate the breathing circuit configuration and lengthen the tubing as necessary.

Pressing this control button, followed by pressing the ▲Up/▼Down controls, allows the adjustment of the target airway pressure setting. Target pressure is referenced to ambient (atmospheric pressure). When the green Pressure Control LED illuminates, the adjacent window displays the set airway pressure. See Theory of Operation pg 4-4 for more details.

**NOTE:** In SPONT mode, the Pressure Control is not utilized but the value can be preset.

### Switching from Volume Control to Pressure Control:

Press the Pressure Control button. The set target airway pressure value is displayed in the adjacent window if the HT50 is ventilating. A “PRESS AGAIN” message appears in the Message Display Window.

Adjust the set target airway pressure by pressing the ▲Up/▼Down controls while the LED and numerical display are blinking. If the HT50 is ventilating you will need to press the Pressure Control button again within 5 seconds following adjustment.

**NOTE:** The minimum target airway pressure is 5 cmH₂O / mbar above set baseline pressure.
DESCRIPTION OF CONTROLS, INDICATORS, ALARMS & CONNECTIONS

P\textsubscript{trig} (sensitivity)

\begin{align*}
\text{Range:} & \quad 0.0 \text{ to } -9.9 \text{ cmH}_2\text{O/mbar} \\
& \text{The P\textsubscript{trig} setting determines trigger sensitivity in terms of how far airway pressure must drop below the set baseline pressure for a patient's spontaneous efforts to be detected. The P\textsubscript{trig} LED indicator illuminates each time the airway pressure reaches the set P\textsubscript{trig} level, and turns off once the airway pressure has returned to baseline pressure. The blinking P\textsubscript{trig} LED is referred to as the Patient Effort Indicator. The P\textsubscript{trig} value is displayed in the adjacent window. Set P\textsubscript{trig} as close to 0.0 cmH}_2\text{O as possible without autotriggering to maximize triggering synchrony.}
\end{align*}

PEEP/CPAP

\begin{align*}
\text{Range:} & \quad 0 \text{ to } 30 \text{ cmH}_2\text{O/mbar} \\
& \text{The PEEP/CPAP setting establishes airway pressure in the patient circuit during the exhalation phase. It is also referred to as base or baseline pressure. The set PEEP/CPAP value is displayed in the adjacent window.}
\end{align*}

\begin{itemize}
\item[]\textbf{NOTE:} In Pressure Control ventilation, PEEP/CPAP cannot be set higher than 5 cmH\textsubscript{2}O/mbar below the set Pressure Control setting.
\item[]\textbf{NOTE:} The value of PEEP/CPAP plus P\textsubscript{support} cannot exceed 60 cmH\textsubscript{2}O/mbar.
\end{itemize}

P\textsubscript{support} (pressure support)

\begin{align*}
\text{Range:} & \quad 0 \text{ to } 60 \text{ cmH}_2\text{O/mbar} \\
& \text{The P support (pressure support) setting determines the target rise/change in pressure during inspiration for patient triggered spontaneous breaths in SIMV and SPONT modes. The target pressure is the set P support plus the PEEP level. Any time the active P support control is pressed, P support flow delivery slows to a lower level then it gradually increases to the appropriate level as pressure rise is re-assessed.}
\end{align*}

\begin{itemize}
\item[]\textbf{NOTE:} The value of PEEP/CPAP plus P\textsubscript{support} cannot exceed 60 cmH\textsubscript{2}O/mbar.
\end{itemize}
Manual Inflation

**Range:** 0 to 3.0 sec

Pressing this button delivers an operator initiated Manual Inflation. Pressing the Manual Inflation button will not initiate an inflation if the patient is currently in the inspiratory phase of a breath or if airway pressure is > 5 cmH₂O (mbar) above the set PEEP/CPAP level. Manual Inflation delivers the set flow rate (in Volume Control) or the set target pressure (in Pressure Control), but inspiratory time is controlled by the user.

During Manual Inflation, the breath is terminated if (1) the Manual Inflation button is released, or (2) the ▲Paw (High Pressure) alarm is violated or (3) three seconds have elapsed.

**NOTE:** Manual Inflation is only available in A/CMV and SIMV modes.

**NOTE:** Manual Inflation may be prematurely cycled off in the first several breaths in Pressure Control when the initial flow has not yet been optimized.

Humidifier On Button

*(HT50-H, HT50-HB only)*

**Range:** 19°C to 39°C

This touch button activates the built-in humidifier. Pressing this button displays the set target temperature in the adjacent window. While the display is blinking, use the ▲Up/▼Down controls to adjust the target temperature. When temperature adjustment is complete and (1) five seconds have elapsed without touching the control, (2) the Humidifier On button is pressed again, or (3) another parameter is selected for adjustment, the display stops blinking and the measured temperature is displayed. While the humidifier is On, the target temperature can be readjusted at any time by pressing the Humidifier On button and using the ▲Up/▼Down controls.

**NOTE:** Preheating the humidifier for 30 minutes prior to beginning ventilation will improve the heating performance of the humidifier.

During ventilation (On condition) the displayed temperature is the measured temperature at the patient connector. In the Setting condition, the displayed temperature is the measured temperature at the humidifier bottle outlet.

To turn the humidifier Off, press and hold the Humidifier On button for three seconds. See pg 5-11 for more details.

**NOTE:** The measured proximal temperature may be different from the set target temperature due to the environmental temperature, minute volume, patient temperature, etc.
DESCRIPTION OF CONTROLS, INDICATORS, ALARMS & CONNECTIONS

NOTE: The humidifier is operational only when the HT50 is powered by external A.C. power.

NOTE: If the humidifier and/or the temperature probe is removed or malfunctions or if the humidifier bottle is removed prior to turning the humidifier off, the Humidifier On LED changes from green to blinking yellow, an audible alarm sounds and the heater shuts down automatically. To restart the humidifier, correct the alarm condition and press the Humidifier On button.

\[ \text{V} \]
(mandatory flow)

Range: 6 to 100 L/min

V shares a numeric display window with I:E Ratio. V LED is illuminated green when flow is displayed.

Displays the calculated flow delivered from the ventilator during volume controlled mandatory breaths. V display is not available during Pressure Controlled breaths or SPONT mode.

NOTE: Flow can be adjusted indirectly by changing the tidal volume (Volume Control) or \( t_i \) settings.

\[ \text{I:E Ratio} \]
(inspiratory time to expiratory time)

Range: 1:99 to 3:1

I:E Ratio shares a numeric display window with V. I:E LED is illuminated green when I:E Ratio is displayed.

I:E Ratio is determined by the \( f \) and \( t_i \) settings. If expiratory time is longer than inspiratory time, the display format is 1:X.X. If expiratory time is shorter than \( t_i \), the display format is X.X:1. When the I:E Ratio is inverse, the I:E Ratio indicator illuminates once every breath. I:E Ratio does not function during SPONT mode.

Internal Battery Test Button and Indicator

When the HT50 is powered by the dual internal battery, the LED on this button illuminates. A yellow LED indicates the internal battery system is in use. A blinking yellow LED indicates low power. When the battery system is completely discharged, the LED blinks red.

Pressing this button allows the Int. Battery Charge Level to be read in the lower half of the Paw meter window. The battery charge level should only be tested when the HT50 is operating on the dual internal battery. Testing while plugged into any external power source will give inaccurate readings.

Test the HT50 dual internal battery periodically to verify that the charge level is in the blue area. The numbers on the Paw meter do not reflect the percent of charge.
Internal Battery Charge Level Meter

The Int. Battery Charge Level meter is located beneath the Paw meter. If the needle is in the red when the test button is pressed the battery charge is low. You should use an external power source. The blue area indicates medium to full battery charge. Each battery use time is different based on your conditions. The numbers on the Paw meter do not reflect the percent of charge.

NOTE: The battery charge level is best maintained by keeping the HT50 continuously plugged into an external power source.

Push to Unlock Button and Auto Lock Indicator

Auto Panel Lock can be enabled or disabled via User Set Up (see pg 3-29). When Auto Lock is set to “Enabled” in User Set Up and the ventilator is in On condition and 30 seconds have elapsed without pressing any buttons, the Auto Lock function is automatically activated and the (Auto Lock On) LED illuminates green. When Auto Lock is active, all touch buttons (except Silence/Reset and Int. Battery Test) are locked, preventing accidental changes.

Press and hold the Push to Unlock button for at least one second to unlock the panel and enable the activation of all touch buttons for adjustment. An audible beep sounds and the LED is extinguished. When 30 seconds have elapsed without pressing any buttons, the Auto Lock is automatically activated again.

NOTE: Auto Panel Lock is factory preset to “Disabled” (off).

Silence / Reset

The Silence/Reset button has three functions:

1. Silencing alarms: Press the Silence/Reset button to silence all alarms for 60 seconds. When the Silence/Reset indicator is illuminated, all alarms are silenced except Device Alert alarm. Press the Silence/Reset button again to cancel the silence period.

2. Clearing alarm messages: Press the Silence/Reset button to clear all alarm messages in the Message Display Window and to release latched LED indicators when the cause for the alarm is no longer present.

3. Toggle Buzzer Volume (alarm loudness) between Loud and Quiet: Press and hold the Silence/Reset button when there are no alarm messages displayed to toggle the alarm audible volume between loud and quiet. The alarm will sound at the new setting.
NOTE: The Battery Empty Alarm and the Device Alert Alarm cannot be silenced permanently. These alarms indicate that an alternate source of ventilation must be utilized. See pgs 3-20 and 3-21 for more details.

Paw Meter
(airway pressure meter)

Range: \(-10\) to \(100\) cmH\(_2\)O / \(98\) mbar

The Paw meter displays airway pressure. It also indicates the internal battery charge level when the Int. Battery button is pressed.

FRONT PANEL ALARMS

The front panel alarm LED indicators blink when an alarm limit setting is violated. Once the violation is no longer in effect, the indicators latch (remain steadily lit) until they are reset by pressing the Silence/Reset button.

High ▲ Paw and Low ▼ Paw Alarm Control and Display
(airway pressure)

Range:

- Paw: \(-10\) to \(100\) cmH\(_2\)O / \(98\) mbar
- High ▲Paw Alarm: \(4\) to \(99\) cmH\(_2\)O / \(97\) mbar
- Low ▼Paw Alarm: \(3\) to \(98\) cmH\(_2\)O / \(96\) mbar

The ▲Paw button allows the selection of the high (peak) airway pressure alarm setting.

The ▼ Paw button allows the selection of the low peak airway pressure alarm setting.

To adjust either alarm, press the desired button once. The value in the adjacent display window will blink. Use the ▲Up/▼Down controls to adjust the displayed alarm setting value. The new setting can be retained by (1) pressing the selected button again to accept the alarm setting, (2) selecting another parameter for adjustment, or (3) allowing five seconds to elapse without adjustment.

NOTE: In SPONT mode the ▼ Paw alarm is inactive but the value can be preset.

NOTE: The ▼ Paw alarm setting cannot be a value below PEEP/CPAP + \(3\). The ▲Paw alarm setting must be a value at least \(1\) above the ▼ Paw alarm setting.
Footnotes: The Low ▼Paw Alarm does not function in SPONT mode. The ▼Paw alarm limit does not apply to spontaneous breaths in SIMV mode.

High ▲ V̇i and Low ▼ V̇i Alarm Control and Display
(inspiratory minute volume)

Range: V̇i 0 to 99.0 L/min
High ▲ V̇i Alarm 1.1 to 50.0 L/min
Low ▼ V̇i Alarm 0.1 to 49.0 L/min

This window displays the inspiratory minute volume (in liters) and is automatically updated every 10 seconds. The V̇i window always displays the delivered minute volume, except when the user is in the process of setting either the High or Low V̇i alarm limit.

To adjust the High or Low V̇i alarm limit, press the ▲ or ▼ V̇i button. The value in the adjacent display window will blink. Use the ▲Up/▼Down controls to adjust the displayed alarm limit value. The new limit can be retained by (1) pressing the selected button again to accept the alarm setting, (2) selecting another parameter for adjustment, or (3) allowing five seconds to elapse without adjustment.

NOTE: The high inspiratory minute volume alarm limit is limited to 1 > the low alarm limit setting. The low alarm limit is limited to 1 < the high alarm limit setting.
DESCRIPTION OF CONTROLS, INDICATORS, ALARMS & CONNECTIONS

\( \Delta \dot{V}_i \) (High Insp. Minute Volume) Alarm
(user adjustable)

- **Audible Alarm:** Intermittent beep
- **Visual Alarm:** \( \Delta \dot{V}_i \) indicator blinks red
- **Message Window:** HIGH \( \dot{V}_i \)

The High Insp. Minute Volume Alarm is activated when the delivered inspiratory minute volume exceeds the High \( \Delta \dot{V}_i \) alarm setting. The alarm is cancelled after delivered inspiratory minute volume falls below the \( \Delta \dot{V}_i \) alarm setting.

**WARNING** The Insp. Minute Volume Alarms are based on the delivered volume from the ventilator. The actual minute volume in the patient lungs may be significantly different in cases such as circuit leak, disconnection, and pneumothorax. To verify the exhaled minute volume, use a separate exhaled volume monitor.

\( \nabla \dot{V}_i \) (Low Insp. Minute Volume) Alarm
Back-up Ventilation
(user adjustable)

- **Audible Alarm:** Intermittent beep
- **Visual Alarm:** \( \nabla \dot{V}_i \) indicator blinks red
- **Message Window:** LOW \( \dot{V}_i \)
  - LOW \( \dot{V}_i \) (BUV) (if back-up ventilation is active)

The Low Insp. Minute Volume Alarm is activated when delivered inspiratory minute volume falls below the Low \( \nabla \dot{V}_i \) alarm limit setting.

**WARNING** The Insp. Minute Volume Alarms are based on the delivered volume from the ventilator. The actual minute volume in the patient lungs may be significantly different in cases such as circuit leak, disconnection, and pneumothorax. To verify the exhaled minute volume, use a separate exhaled volume monitor.

**Back-up Ventilation**

Back-up Ventilation is an alarmed function that activates when the delivered inspiratory minute volume (\( \dot{V}_i \)) falls below the Low \( \nabla \dot{V}_i \) setting. During Back-up Ventilation, the Low \( \nabla \dot{V}_i \) (Back-up Vent) alarm indicator blinks, an audible alarm sounds, and “LOW \( \dot{V}_i \) (BUV)” is displayed in the Message Display Window. The ventilation settings employed by Back-up Ventilation are then displayed on the front panel. Back-up Ventilation ceases when \( \dot{V}_i = \nabla \dot{V}_i + 10\% \), at which time ventilation and front panel displays return to user-set values.

Back-up Ventilation is functional in all modes. See page 4-5 for a complete description of Back-up Ventilation.
High Baseline Pressure Alarm
(automatic)

Audible Alarm:   Intermittent beep  
Visual Alarm:   ▲Paw indicator blinks red  
Message Window:  HIGH Pbase

The High Baseline Pressure (High Pbase) alarm is activated when airway pressure is above the Low ▼Paw alarm limit setting at the beginning of a time activated mandatory breath. The alarm resets when Paw drops to within 5 cmH₂O / mbar of the set PEEP/CPAP level.

Occlusion Alarm, Circuit
(automatic)

Audible Alarm:   Intermittent beep  
Visual Alarm:   ▲Paw indicator blinks red at the high priority rate  
Message Window:  OCCLUSION

An Occlusion alarm is activated when airway pressure is above the set PEEP + 15 cmH₂O/mbar at 3 seconds after the beginning of expiration, or at the end of expiration, whichever comes first. When a breathing circuit occlusion occurs, the ventilator will be unable to release the pressure, therefore additional breaths will not be delivered until the condition is corrected. The alarm resets when airway pressure falls to within 15 cmH₂O/mbar of baseline, at which point breath delivery is resumed.

Occlusion Alarm, Device
(automatic)

Audible Alarm:   Intermittent beep  
Visual Alarm:   ▲Paw indicator blinks red at the high priority rate and Device Alert indicator blinks  
Message Window:  OCCLUSION

An Occlusion alarm is activated when airway pressure is above the set PEEP + 15 cmH₂O/mbar at 3 seconds after the beginning of expiration, or at the end of expiration, whichever comes first. When the Occlusion alarm is caused by a malfunction inside the ventilator, the HT50 will attempt to relieve circuit pressure through its redundant safety system. If successful, ventilation will continue, but in an alarmed state. It is possible that the condition causing the alarm will self-correct, in which case the alarm is reset. Otherwise, the ventilator will continue to alarm until the necessary service is performed. If the HT50 is unsuccessful in relieving circuit pressure, additional breaths will not be delivered unless airway pressure falls to within 15 cmH₂O/mbar of baseline.
DESCRIPTION OF CONTROLS, INDICATORS, ALARMS & CONNECTIONS

WARNING Any time a Device Alert violation occurs along with the message “OCCLUSION,” an alternate method of ventilation should be provided for the patient as soon as possible so that the cause of the violation can be adequately and safely investigated.

Low Baseline Pressure Alarm (automatic)

| Audible Alarm: | Intermittent beep |
| Visual Alarm:  | ▼Paw/Apnea indicator blinks red |
| Message Window: | LOW Pbase |

The Low Baseline Pressure (Low Pbase) Alarm is activated by an unstable baseline (leak in the breathing circuit) or by a baseline decrease since the last PEEP/CPAP control change. A Low Pbase violation occurs in all modes when airway pressure remains ≥ 3 cmH₂O/mbar below baseline for 3 seconds. The same LED that blinks during Low ▼Paw violations blinks when this alarm is activated. The alarm resets when airway pressure is < 3 cmH₂O/mbar below baseline.

Check Prox Line Alarm (automatic)

| Audible Alarm: | Intermittent beep |
| Visual Alarm:  | ▼Paw/Apnea indicator blinks red |
| Message Window: | CHECK PROX LINE |

The Check Prox Line Alarm is activated when, during inspiration, the pressure measurement of the proximal pressure sensing line is significantly different from the internal back up pressure sensing line located inside the ventilator. This may be caused by a disconnected, kinked, water-filled proximal sensing line, or a blocked proximal line filter. Ventilation is continued during the alarm condition, using the pressure measurement of the internal sensing line.

Apnea Alarm (automatic)

| Audible Alarm: | Intermittent beep |
| Visual Alarm:  | ▼Paw/Apnea indicator blinks red |
| Message Window: | APNEA |

The Apnea Alarm is activated when no mandatory breaths or detected spontaneous efforts occur for 30 seconds. The alarm is reset by a time or patient trigger.

NOTE: The Apnea Alarm does not activate Back-up Ventilation.
PCV Not Reached Alarm  
(automatic)  

Audible Alarm:  Intermittent beep  
Visual Alarm:  ▼Paw/Apnea indicator blinks red  
Message Window:  PCV NOT REACHED  

The PCV Not Reached Alarm is activated in pressure control ventilation when the maximum inspiratory pressure (Paw P) is less than 50% of the target pressure for 2 consecutive mandatory breaths. The alarm is reset when maximum inspiratory pressure (Paw P) is ≥ 50% of the target pressure.

Humidifier Alarm  
(automatic) HT50-H only  

Audible Alarm:  Intermittent 3-pulse caution beep  
Visual Alarm:  Humidifier indicator blinks yellow  

The Humidifier Alarm is activated when any of the following conditions occur in the HT50 built-in humidifier. When an alarm condition is detected the humidifier heater shuts down.

There are five humidifier alarms:

**Message Display Window** | **Cause of Alarm**
--- | ---
Check Humidifier | Bottle removed or not clamped properly when trying to activate the humidifier. Temp Probe not connected or missing when trying to activate the humidifier.
Humidifier Fail | Bottle removed while humidifier is On. Failure of the primary humidifier control.
Check Temp Probe | Temp Probe damaged or missing while humidifier is On.
High Prox Temp | Proximal temperature exceeds set target temperature by 4°C when set at ≥ 34°C or 6°C when set at < 34°C.
High Temp Core | Excessive temperature in the humidifier heating element.

**NOTE:** The Humidifier Alarm is automatically set when using the HT50 humidifier. Humidifier Alarms (and the built-in humidifier) do not function when the HT50 is powered on internal battery.
Battery Low Alarm
(automatic)

Audible Alarm: Intermittent 3-pulse caution beeps
Visual Alarm: Int. Battery indicator blinks yellow
Message Window: Battery Low

Indicates that a minimum of 30 minutes of operating power remains in the dual internal battery. Pressing the Silence/Reset button will cancel the audible three-pluse caution beeps but the visual alarm will continue to blink and the alarm will beep once every three minutes as long as the alarm condition continues. The alarm is reset when A.C. or external D.C. power is connected to the HT50.

NOTE: The battery condition and ventilator settings will affect remaining time, but it will be at least 30 minutes.

Battery Empty Alarm
(automatic)

Audible Alarm: Intermittent beep
Visual Alarm: Int. Battery indicator blinks red
Message Window: BATTERY EMPTY

Indicates that a minimum of 15 minutes of operating power remains in the dual internal battery. An alternate power source must be located immediately. This alarm can only be temporarily silenced as long as the alarm condition continues. The alarm is reset when A.C. or external D.C. power is connected to the HT50.

NOTE: The battery condition and ventilator settings will affect remaining time, but it will be at least 15 minutes.

NOTE: Frequent deep discharge of the dual internal battery will decrease the amount of time the HT50 will operate on battery power from a full charge state. Replace the battery when battery operation time is insufficient for application.

WARNING Immediately secure an external power source when the Battery Empty alarm is violated. Charge the battery for a minimum of 5 hours (~80% recharged) before powering the ventilator again from the internal battery. If the battery is completely depleted, it takes approximately 7 to 8 hours to fully recharge.

NOTE: If the HT50 is to be powered from the dual internal battery for an extended period, ensure that the dual internal battery is fully charged prior to use.
Fault, Battery System Alarm, Device Alert
(automatic)

Audible Alarm: Intermittent beep
Visual Alarm: Device Alert indicator blinks red
Message Window: FAULT BAT SYS

The status of the internal battery system and the charging system is continuously monitored and any deficiency will result in a Battery Fault Alarm. The HT50 will continue to operate properly from an external power source but it can not be powered by the internal battery system.

NOTE: If the “Fault Bat Sys” device alert alarm occurs, keep the HT50 plugged into an external power source. Contact Newport Medical Technical Service Dept.

Power Switchover Alarm
(automatic)

Audible Alarm: Intermittent 3-pulse caution beeps
Visual Alarm: Ext. Power indicator illuminates red
Int. Battery indicator blinks yellow
Message Window: No ext power

The Power Switchover Alarm is activated by switching from external power to the dual internal battery due to disconnection from the power cord or a power interruption. Pressing the Silence/Reset button will (1) cancel the audible alarm, (2) cancel the “No ext power” message, (3) cancel the Ext. Power LED and (4) cause the Int. Battery LED to change to non-blinking yellow indicator.

If external power is connected within 60 seconds following internal battery operation, the HT50 will immediately switch back to external power. If internal battery operation has lasted longer than 60 seconds, there will be a delay of up to an additional 60 seconds before the HT50 will switch back to external power. If “No ext power” message is still displayed following the re-connection to external power, press Silence/Reset button to cancel the message.

Device Alert Alarm
(automatic)

Audible Alarm: Intermittent beep
Visual Alarm: Device Alert indicator blinks red
Message Window: OCCLUSION or 10V SHUTDOWN or FAULT BAT SYS or SYSTEM ERROR or MOTOR FAULT
The Device Alert Alarm is activated when the microprocessor detects a functional problem with the ventilator. With the exception of OCCLUSION & FAULT BAT SYS, all other Device Alert alarms are non-recoverable and will result in the HT50 discontinuing ventilation. When this occurs, the ventilator must be powered down by pressing the On/Standby button. DO NOT use the ventilator until the cause of the alert has been determined and corrected.

**NOTE:** See Pg. 3-17, Occlusion Alarm, Device, and Pg. 3-21, Fault Battery System Alarm, for a detailed description of these recoverable Device Alert Alarms.

There are three possible messages that will be displayed when a non-recoverable Device Alert Alarm occurs; (1) MOTOR FAULT, (2) 10V SHUTDOWN and (3) SYSTEM ERROR. For MOTOR FAULT and 10V SHUTDOWN the full text message will be displayed for 5 seconds, followed by an abbreviated form of the message, eg. MTR Fail, or 10V Fail. A timing message will also appear, documenting how long the condition has been present. The format for the time is “H:MM:SS.” The SYSTEM ERROR message will always be displayed with full text.

**NOTE:** If the cause of the SYSTEM ERROR does not allow the HT50 to display the alarm message and the Device Alert indicator to light, the ventilator will shut down and the Shut Down Alert Alarm will activate. Upon the next power up of the unit, the SYSTEM ERROR message will be displayed. If the cause of the alarm has been corrected, the message can be cancelled by pressing the Silence/Reset button.

**WARNING** If a non-recoverable Device Alert alarm occurs, immediately disconnect the patient from the ventilator and provide an alternate method of ventilation.

**NOTE:** A non-recoverable Device Alert Alarm cannot be silenced without first turning the ventilator Off (Standby).

**Shut Down Alert Alarm**
(automatic)

**Audible Alarm:** Intermittent beeps
**Visual Alarm:** –
**Message Window:** –

The Shut Down Alert Alarm occurs when the ventilator is powered Off. An intermittent audible alert indicates the ventilator is no longer operating. The intermittent beeps will continue for at least 10 minutes or until it is silenced by pressing the Silence/Reset button.
FRONT PANEL MESSAGE DISPLAY WINDOW

All messages and alarms are displayed in a 16 character, alpha numeric window located above the MODE controls.

Monitoring Messages:

When the Message Display Window is blank (no message displayed) press the ▲ Up control button to scroll through the monitoring messages available. Monitored information includes volume, frequency, pressure values and operation information. Tidal volume, peak pressure, and baseline pressure are updated breath by breath. Frequency and mean pressure are also updated breath by breath, using a 6 sec. rolling average for frequency and a 60 sec. rolling average for mean pressure. Minute volume is updated every 10 seconds using a 60 sec. rolling average.

NOTE: Monitoring Messages cannot be accessed during alarm violations.

There are 3 selections available:

• VT / Ṿi / f
• Paw / P / M / B
• H/S/L (or Q)

Press the ▲ Up button to scroll through the lines. Three seconds after selecting a line, the relevant operating parameters are displayed.

Following are the parameters for each line:

Line 1: “VT xxx Ṿi xx f xx”
  
  VT – Tidal volume (in mL)
  Ṿi – Insp. Minute Volume (in L/min) rounded to nearest whole number
  f – Total number of patient or time activated breaths detected for the last 60 seconds (in b/min)

Line 2: “Paw Pxx Mxx Bxx”
  
  P – Peak airway pressure of last breath
  M – Mean airway pressure
  B – Baseline airway pressure at the end of expiration

Line 3: “H xxxx Sxxxxx L (or Q)”
  
  H – Hour meter reading
  S – Software Version
  L/Q – Audible Level of Alarm (Loud or Quiet)

After 4 seconds this line will go blank. Access this information any time by pressing the ▲ Up button.
Alarm and Caution Messages:

All alarms have corresponding messages in the Message Display Window. See pg 2-3 for list of alarms. If more than one alarm is violated, they are displayed in order of medical priority. Alarm messages override the display of monitored parameters.

Setting Limitation Messages:

The following “Setting Limitation” messages are displayed to notify the user that adjustments have caused parameters to reach software defined limitations.

- Reached Max \( V \): maximum \( V \) (flow) setting has been reached
- Reached Min \( V \): minimum \( V \) (flow) setting has been reached
- Inverse I:E: inverse I:E ratio has been reached
- Reached Max I:E: inverse I:E ratio has reached 3:1
- \( V \) Unavailable: \( V \) display is not available in Pressure Control
- Peep + PS Too High: set PEEP + Psupport is higher than 60
- PC – Peep Too Low: Pressure Control value minus PEEP is less than 5 cmH\(_2\)O/mbar
- ↑ – PEEP Too Low: High Pressure alarm limit minus PEEP is less than 5 cmH\(_2\)O/mbar

The following messages are provided as “prompts” or reminders.

- Panel Locked: notifies user that the front panel buttons are now locked
- PRESS AGAIN: notifies user that a second press on the same button is required in order to confirm change requested

LEFT SIDE CONNECTORS

**WARNING** The round heater for the optional humidifier is located near the left side connectors. This heater becomes extremely hot when the humidifier is on. DO NOT TOUCH!

**Airway Pressure Connector**

Measures airway pressure. Connect the proximal pressure sensing line of the patient breathing circuit to this fitting.

**WARNING** Always use an inline filter (p/n HT6004701 or equivalent) at the Airway Pressure Connector to protect the internal pressure transducers from moisture or other contaminants.

**Gas Output Connector**

Supplies gas flow to the patient. Connect the patient breathing circuit to this outlet.
Exhalation Valve Connector

**▲ EXH. VALVE**

Controls the exhalation valve. Connect the exhalation valve control drive line to this outlet.

Temperature Probe Connector

(HT50-H model)

**TEMP. PROBE**

Electrical connector for dual-channel temperature probes which are used to measure the temperature in the humidifier water bottle and the patient breathing circuit.

RS-232C Connector

**COMM. PORT**

An 8 pin SEMCONN connector operating at 19,200 baud which allows the ventilator system to interface with central alarm systems and remote alarms.

**NOTE:** Contact your NEWPORT representative for more information regarding compatibility with specific remote monitoring systems.

Emergency Air Intake

**WARNING** DO NOT OBSTRUCT!

Allows the patient to pull ambient air into the breathing circuit in the event of a complete system failure. Air intake opening pressure is approximately \(-3\) cmH\(_2\)O \((-3\) mbar).

**WARNING** Do not obstruct the Emergency Air Intake! Any impediment could result in patient suffocation.

**WARNING** HOME CAREGIVERS: Should a complete failure of the ventilator occur, the Emergency Air Intake allows the patient to breathe from room air through the intake valve. Blockage of the valve could result in suffocation. Check periodically to ensure that the valve functions correctly.

RIGHT SIDE CONNECTORS

Fresh Gas Intake And Filter Cover

Environmental air enters through this 30 mm ID Fresh Gas Intake. The air inlet particle filter is placed behind the Filter Cover to protect the patient as well as the ventilator’s piston system from dirt and particles. The Fresh Gas Intake is the attachment socket for the optional HT50 Air/Oxygen Entrainment Mixer or an Oxygen Blending Bag.

**WARNING** Do not block the Fresh Gas Intake.
External Power Connector

100-240 VAC, max. 2A
12-30 VDC, max. 12A
50/60/400 Hz

The HT50 uses a single inlet for both A.C. and D.C. power sources. The inlet power connector automatically recognizes A.C. voltage ranges from 100 to 240 and D.C. ranges from 12 to 30. A Newport approved external battery can be attached to this connector.

**WARNING** To ensure proper grounding and prevent possible shock hazards, this device should only be connected to "Hospital Grade" power receptacles.

**WARNING** HOME CAREGIVERS: External power in the home environment must support min. 100 to max. 240 VAC and must have a grounded receptacle.

Equipotential Connector

Used for electric potential equalization.

Power Cord Ferrite

Use of the Power Cord Ferrite ensures that the HT50 meets EMC requirements. Anytime the HT50 is operating on A.C. power, the ferrite should be attached to the power cord. Operating from D.C. power does not require the use of the ferrite.

**NOTE:** Always use the A.C. power cord supplied with the HT50.

OPTIONAL ACCESSORIES

Air/Oxygen Entrainment Mixer

The Air/Oxygen Entrainment Mixer (p/n HT460700) is used to blend atmospheric air with medical grade oxygen at a precise ratio. A control knob allows for incremental adjustment from 0.21 to 1.00 FIO₂. The high pressure oxygen hose has a standard female DISS 1240 connection. The Mixer attaches into the Fresh Gas Intake of the HT50 on the Filter Cover, located on the right side of the ventilator.

Pneumatic Requirements
Oxygen 35-90 psig (2.4 to 6.2 Bar)
Oxygen Blending Bag Kit

The Oxygen Blending Bag Kit (p/n HT600044) is used to blend atmospheric air with a low flow (0 to 10 L/min) medical grade oxygen source. The Oxygen Blending Bag Kit attaches into the Fresh Gas Intake on the Filter Cover, located on the right side of the ventilator. This system allows the user to ventilate patients with oxygen enriched gas from 0.21 up to 1.00 $F_1O_2$.

Pneumatic Requirements
Oxygen 0-10 L/min

Auto Lighter Cable

The Auto Lighter Cable (p/n HT460085) allows the HT50 to be powered through the D.C. lighter plug in an automobile. The internal battery charges whenever the HT50 is connected to an external power source, equal to or greater than 12 VDC, including the D.C. lighter plug.

USER SET UP

The User Set Up allows the operator to select a variety of functional parameters. User Set Up parameters must be established before the HT50 is used for ventilation.

**NOTE:** HOME CAREGIVERS: The User Set Up parameters should be defined in conjunction with your physician or Homecare Dealer. Once established, these parameters are kept in memory and will be in affect each time the ventilator is powered on until the operator enters User Set Up and makes changes.

**NOTE:** To enter User Set Up the HT50 must be in the Standby condition.

To access User Set Up, when connected to A.C. power, press and hold the Silence/Reset button down. When operating on internal battery, you must press the On/Standby button while pressing and holding the Silence/Reset button. When the Message Display Window briefly displays the message “USER SETUP”, release the button. The Message Display Window will next display the first parameter. See Table 3-1.

The user may scroll through the rest of the set up parameters by pressing the Int. Battery button. Use the ▲Up/▼Down control buttons to change the parameter setting. To exit User Set Up, press the Silence/Reset button once. The HT50 is now ready for use.
# Description of Controls, Indicators, Alarms & Connections

## Table 3-1: User Set Up Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Display</th>
<th>▲ Up/ ▼ Down</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headline</td>
<td>USER SETUP</td>
<td>None</td>
</tr>
<tr>
<td>Power Save</td>
<td>Power Save ON*</td>
<td>Toggles On/Off</td>
</tr>
<tr>
<td>Pressure Units</td>
<td>Pressure cmH₂O*</td>
<td>Toggles cmH₂O/mbar</td>
</tr>
<tr>
<td>Set up</td>
<td>Set up USER*</td>
<td>Toggles User/Default</td>
</tr>
<tr>
<td>Auto Panel Lock</td>
<td>Lock DISABLED*</td>
<td>Toggles Enabled/Disabled</td>
</tr>
<tr>
<td>Technical Set Up</td>
<td>Tech. Setup</td>
<td>Refer to Service Manual Section 5</td>
</tr>
</tbody>
</table>

* Factory default setting. May be different if another setting was selected during the previous User Set Up.

## User Set Up Parameter

### Power Save

Use the ▲Up/▼Down controls to toggle the Power Save function On or Off. To conserve battery power consumption during internal battery operation, the Power Save function automatically blanks the HT50’s numeric displays if the ventilator has operated for 2 minutes with no buttons pressed or alarms violated. MODE, On/Standby, Int. Battery indicators and message display window remain active at all times.

If an alarm condition occurs, or any button is pressed, the Power Save function is suspended for 2 minutes. The Power Save feature can extend battery operating time by as much as 30%.

### Pressure Units

Selects between cmH₂O and mbar as the unit used on the pressure meter and the various front panel controls. The HT50 is factory set to cmH₂O. Use the ▲Up/▼Down controls to toggle to the mbar setting.

**NOTE:** For consistency, particularly in medical record keeping, it is recommended that each institution standardize to either “cmH₂O” or “mbar” operation.

**NOTE:** HOME CAREGIVERS: The unit of measure, along with other parameter settings, should be established by the patient’s physician or Homecare Dealer.
Set Up

The Set Up parameter allows the operator to set the ventilator’s start up settings. There are two selections, DEFAULT or USER. Use the ▲Up/▼Down button to toggle between selections.

When USER is selected, all of the ventilation parameters in effect at shutdown will be saved. The saved parameters will appear next time the ventilator is powered on.

When DEFAULT is selected, factory set default parameters will appear next time the ventilator is powered on. Default parameters are listed on pg 2-7.

NOTE: HOME CAREGIVERS: This parameter should always be set to USER for home use to ensure that when the HT50 is powered off and on the physician directed ventilation settings remain in place.

Auto Panel Lock

This setting allows the user to enable (turn on) or disable (turn off) the Auto Panel Lock feature. For a complete description of Auto Panel Lock see pg 3-13. The Auto Panel Lock feature is factory set at Disabled or off. Use the sUp/tDown buttons to toggle between Enabled and Disabled.

NOTE: HOME CAREGIVERS: Newport recommends that the Auto Panel Lock feature be enabled in homecare environments as an added safety feature to prevent accidental changes to panel controls.

Exiting User Set Up

Exit by pressing the Silence/Reset button at any time.
4. THEORY OF OPERATION

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    Mandatory Ventilation). .................... 4-2
SIMV Mode (Synchronized Intermittent
    Mandatory Ventilation). .................. 4-3
SPONT Mode (Spontaneous Ventilation) .... 4-3
P support (Pressure Support) ................. 4-4
Pressure Control (Pressure Control Ventilation) . 4-4
Volume Control (Volume Control Ventilation) . 4-5
Back-Up Ventilation ......................... 4-5
GENERAL SYSTEM OVERVIEW

The Newport HT50 Ventilator is a compact, lightweight, power-conservative, ventilator that is designed to provide ventilation for adult and pediatric (infants, children & adolescents) patients with body weight ≥10 kg.

The HT50 Ventilator’s unique, patented dual-micro-piston gas compressing technology allows the HT50 to operate without an external compressed gas source, making it convenient to use in a variety of environments such as hospitals, emergency response, subacute facilities, homes and transport operations. The dual micro pistons’ ability to deliver a variable flow enables the HT50 to provide a full range of operating modes and breath types, including Assist Control, SIMV and SPONT modes with Volume Control and Pressure Control mandatory breaths, Pressure Support of spontaneous breathing and servo-controlled leak-compensated PEEP. Leak compensation helps to improve triggering and avoid auto-triggering when a leak is present. The HT50 may be used with an endotracheal tube, tracheal tube, mask or mouthpiece.

The HT50 provides monitoring of inspiratory tidal volume (every breath), inspiratory minute volume, total respiratory rate, peak pressure, mean pressure and baseline (PEEP) pressure. Real-time patient circuit pressure is displayed at all times on the airway pressure gauge on the face panel.

The user sets variable alarm settings for High Pressure, Low Pressure, High Inspiratory Minute Volume and Low Inspiratory Minute Volume, with Back Up Ventilation provided in all modes in response to a Low Minute Volume Alarm. There are also built in alarms for High Baseline, Low Baseline, (Circuit) Occlusion, Apnea, PCV Not Reached, Check Prox Line, Power Switchover (from external to internal), Low Battery and Empty Battery and Device Alerts. The HT50-H model also provides humidifier related alarms.

Gas delivery to the patient may be enriched with oxygen (0.21-1.00) using either the Air Oxygen Entrainment (50 psi) Mixer (HT460700) or the Low Flow Oxygen Blending Bag Kit (HT600044).

There is an Auto-Lock feature that may be enabled or disabled. The alarm loudness may be set to two different levels.

The HT50 may be operated from a variety of AC (100-240 VAC @ 50 / 60 / 400 Hz) or DC (12-30 VDC) external power sources or from the Dual Pac Internal Battery System. The Autolighter Cable (HT460085) accessory enables connection to an automobile-type DC outlet.
Any time external power is connected to the ventilator, the Dual Pac Internal Battery system is charging. And when external power is lost, the (new and fully charged) Dual Pac Internal Battery system takes over and powers the HT50 for up to 10 hours, at standard ventilator settings. A Battery Low Alarm alerts the user when a minimum of 30 minutes operating time remains.

The HT50 is available with a built-in humidifier or without.

The HT50 is very easy to set up and use with clear indications of all ventilation and alarm settings and alarm violations.

**NOTE:** When the HT50 is used in a home care environment it is important that the primary caregiver has received training and has demonstrated competency in all equipment functions. A specific written care plan must be established by the attending physician.

**NOTE:** Transport of patients with the HT50 requires that medical staff have a good working knowledge of the ventilator’s use and problem resolution. Proper emergency back-up equipment must be immediately available during transport.

**A/CMV MODE**
(Assist/Control Mandatory Ventilation)

In A/CMV mode, time activated (mandatory) breaths are delivered in accordance with the $f$ setting. Patients can trigger mandatory breaths in addition to, or in place of, time activated (mandatory) breaths if the effort they generate causes airway pressure to meet the $P_{\text{trig}}$ setting. Every such patient effort results in a mandatory breath. The breath can be volume or pressure controlled. PEEP/CPAP may be added. Tidal volume is determined by the target pressure, $t_i$, and patient respiratory mechanics in Pressure Control and by the tidal volume setting in Volume Control.

As with all HT50 operating modes, Back-up Ventilation is activated if the Low $\nabla V_t$ alarm limit is violated.
**SIMV MODE**

(Synchronized Intermittent Mandatory Ventilation)

In SIMV mode, patients receive a fixed number of volume or pressure controlled mandatory breaths (time or patient activated) and may breathe spontaneously between mandatory breaths, with or without pressure support (Psupport). See Figure 4-1 for schematic illustration. PEEP/CPAP may be added.

The first patient triggered breath in any mandatory breath interval will be a patient triggered mandatory breath. The patient has the rest of the interval to breathe spontaneously. If the patient does not trigger the ventilator, and one complete mandatory breath interval has elapsed, a time triggered mandatory breath is delivered.

A mandatory breath lockout interval is activated whenever the patient triggers a mandatory breath. This limits the number of mandatory breaths (time triggered or patient triggered) the patient receives in 60 seconds to the $f$ (b/min) setting.

As with all HT50 operating modes, Back-up Ventilation is activated if the Low $\nabla V_J$ alarm limit is violated.

**SPONT MODE**

(Spontaneous Ventilation)

In SPONT mode, mandatory breaths are not delivered but the user can adjust both PEEP/CPAP and pressure support (Psupport) levels. The patient has control over each breath.
When PEEP/CPAP is set above 0, the ventilator mode is CPAP (without P support) or Bi-level Positive Airway Pressure (with P support). Ensure that P trig is set so the HT50 detects all spontaneous patient efforts.

Entries for tidal volume, pressure control, $f$, $t_I$ and Low Paw alarm limit are all inactive in SPONT mode. However, users can preset these parameters for future A/CMV or SIMV operation.

As with all HT50 operating modes, Back-up Ventilation is activated if the Low $\nabla V_I$ alarm limit is violated.

PSUPPORT
(Pressure Support)

P support only functions during patient triggered spontaneous breaths in SIMV and SPONT modes. During each spontaneous breath, the ventilator supports the patient by elevating the airway pressure to the P support + PEEP level. Breaths are terminated when (1) flow to the patient drops to 25% of that breath’s peak flow rate, or (2) the target airway pressure is exceeded by 3 cmH$_2$O (mbar), or (3) after 3 seconds of inspiration.

PRESSURE CONTROL
(Pressure Control Ventilation)

The HT50 targets and maintains patient airway pressure at the set pressure control level throughout inspiration. Breath termination occurs when (1) the set $t_I$ elapses, or (2) Paw exceeds the Pressure Control setting by 8 cmH$_2$O (mbar).

**NOTE:** The target airway pressure for pressure controlled mandatory breaths in A/CMV and SIMV is the display setting above ambient pressure, not above PEEP.

Both time and patient triggered mandatory breaths can be delivered in A/CMV and SIMV Pressure Control operation. During SIMV Pressure Control operation, patients can breathe spontaneously between mandatory breaths with or without pressure support.

**NOTE:** When disconnecting the patient circuit during PCV/PSV ventilation, i.e. for suctioning, the flow may increase in order to compensate for the low pressure. After reconnecting the patient circuit, the flow will automatically readjust to meet the patient’s demand.
VOLUME CONTROL
(Volume Control Ventilation)

During Volume Control ventilation, tidal volume can be set for mandatory breaths. If a volume setting is changed while the ventilator is operating, the change takes place in increments over a series of breaths.

When tidal volume is adjusted, inspiratory time remains constant and $V_m$ (mandatory flow) changes.

If an attempted tidal volume setting results in a flow rate in excess of 100 L/min or less than 6 L/min, adjustment ceases and the user is alerted by an audible beep and the message “Reached Max $V_m$” or “Reached Min $V_m$” will appear in the Message Display Window.

**NOTE:** Make sure that the mandatory flow ($V_m$) setting is adequate to meet patient flow demands. The flow setting is displayed by pressing the front panel button labeled $V_m$. Mandatory flow is changed by adjusting $\bar{t}_i$.

BACK-UP VENTILATION

Back-up Ventilation is an alarmed function that activates when the delivered inspiratory minute volume ($\dot{V}_i$) falls below the Low $\min \dot{V}_i$ alarm limit setting. During Back-up Ventilation, the Low $\min \dot{V}_i$ (Back-up Vent) alarm indicator blinks, an audible alarm sounds, and “Low $\dot{V}_i$ (BUV)” is displayed in the Message Display Window. The ventilation settings employed by Back-up Ventilation are displayed on the front panel.

Back-up Ventilation is functional in all modes.

**NOTE:** Back-up Ventilation is not active for 60 seconds after the user adjusts any ventilator controls, changes modes or turns the ventilator On from the Setting condition.

**NOTE:** During Back-up Ventilation, the Silence/Reset button can be pressed to silence the audible alarm. This will not cancel Back-up Ventilation.

**NOTE:** Back-up Ventilation in the HT50 is based on the delivered inspiratory minute volume. The inspiratory minute volume may be different from the expiratory minute volume in some conditions, such as in the case of a patient breathing circuit or patient airway leak.
Back-up Ventilation in A/CMV and SIMV Modes:
(Back-up Ventilation parameters are indicated on the front panel displays.)

In A/CMV or SIMV modes, mandatory breath frequency increases by 1.5 times the frequency ($f$) setting, up to a maximum of 99 b/min. The minimum breath frequency delivered is 15 b/min.

The frequency ($f$) will only increase up to a rate that produces a 1:1 I:E ratio even if the calculated Back-up Ventilation rate is higher.

Back-up Ventilation in SPONT Mode:
(Back-up Ventilation parameters are indicated on the front panel displays.)

In SPONT mode, the MODE changes from SPONT to SIMV, Pressure Controlled ventilation, mandatory breath frequency ($f$) = 15 b/min., peak inspiratory pressure = 15 cmH$_2$O/mbar above set PEEP and inspiratory time ($t_I$) = 1.0 sec.

Cancellation of Back-up Ventilation

User Cancelled

If during Back-up Ventilation, the user adjusts any ventilation parameter, Back-up Ventilation is suspended for one minute and all user selected ventilation parameters are employed. Another 60 seconds must pass after parameter adjustments before a $\downarrow V_I$ alarm violation will result in Back-up Ventilation.

Patient Cancelled

If delivered inspiratory minute volume exceeds the Low $\downarrow V_I$ alarm setting by 10%, Back-up Ventilation is cancelled, the audible alarm stops, the Low $\downarrow V_I$ (Back-up Vent) alarm indicator latches and the HT50 resumes ventilation at the user-selected parameters.

Press the Silence/Reset button to cancel the latched alarm indicator and alarm message in the Message Display Window.
5. CALIBRATION AND OPERATIONAL VERIFICATION PROCEDURE (OVP)

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INTRODUCTION

This procedure is intended to assist a Newport authorized service technician to establish a routine verification program to verify proper operation of the HT50 Ventilator (p/n HT50-H1, HT50-H1-B, HT50-H). An OVP must be performed each time the ventilator is serviced or a minimum of once a year.

**WARNING**  Do not use the ventilator if it does not pass the Operational Verification Procedure.

TEST EQUIPMENT REQUIRED

- 20 cc syringe with Luer lock
- HT50 adult reusable breathing circuit with exhalation valve
- 500 cc Test Lung (LNG500A with restrictor or LNG800P) that will function at 90 cmH₂O/mbar or equivalent
- Parabolic resistor Rp50 (p/n RP50)
- Cap (CAP100P)
- Calibrated manometer or pressure gauge (range: 0 to 100 cmH₂O/mbar)
- T-connector (p/n TOL200A)
- Humidifier bottle and probe (for HT50-H with humidifier)
- Vacuum gauge (0-120 mmHg minimum)
- Stop watch or equivalent

**Caution**  The accuracy of any test equipment should be annually certified by a testing laboratory before use. Take calibration data into account.

**NOTE:**  Make a copy of the Test Record at the end of this section and check off each test as it is performed. Enter the software version number and hours on the test record.

**NOTE:**  Audible alarms will activate periodically while performing some tests. You may silence the alarm by pushing the Silence/Reset button.

**NOTE:**  After every setup parameter change, wait a few breaths to allow the ventilator to stabilize before recording values.
PRE-TEST INSPECTION

Refer to Figure 9-1.

1. General Inspection
   - Inspect the patient breathing circuit, exhalation valve, and 500 cc test lung for any deterioration which may cause leaks in the system. Replace any defective parts prior to performing the OVP.
   - Inspect the A.C. power cord for any deterioration. Replace the power cord as necessary.
   - Inspect the proximal filter. If filter housing indicates the presence of dirt or moisture, replacement of the filter is necessary.

   **WARNING** DO NOT reverse filters. This practice will allow contaminates to enter the breathing circuit or ventilator. Dirty or contaminated filters must always be replaced with new filters.

2. Air Inlet Filter
   - Remove the Air Inlet Filter Cover (8).
   - Inspect the inlet filter (11). If the filter material indicates the presence of dirt or is discolored, replacement of the filter is necessary.
   - Before reinstalling the Inlet Filter Cover, make certain that the filter is lying flat within the counterbore of the cover.
   - Reinstall the Cover, making certain that the filter material remains securely in place. Verify that the O-ring (9) is in its proper place.

3. Connecting Breathing Circuit, Exhalation Valve, and Test Lung
   - Connect one end of the patient tubing to the main flow outlet labeled “GAS OUTPUT” (bypassing any humidifier) and the other end to the exhalation valve. Connect one end of the exhalation drive line tubing to the connector labeled “EXH. VALVE” and the other end to the white connector on the exhalation valve. Connect one end of the proximal pressure tubing to the connector labeled “AIRWAY PRESSURE” (via the proximal inline filter) and the other end to the blue connector on the exhalation valve.
   - Connect the 500 cc test lung to the exhalation valve.

   **NOTE:** The proximal filter must remain inline for all calibrations and tests.
FRONT PANEL TEST/ALARM CHECK

1. Connect the ventilator to A.C. power.

2. Press the On/Standby button once. The ventilator performs a self-test and then switches to the Settings condition. During the self-test, verify operation of the audible alarm and all LED indicators, numeric and alphanumeric displays. Verify that:
   - All single color and dual color indicator LEDs are functional and are at the same intensity.
   - All 7-segment LEDs are functional.

3. Press all buttons and verify that all buttons are functional and can be operated with the same force.

   NOTE: Before continuing to the next step, verify that the ventilator has been in Settings or On mode for at least 5 minutes.

4. Disconnect the ventilator from A.C. power.

5. Place the ventilator in the Standby condition by pressing the On/Standby button twice.

6. Let the shutdown alarm continue for at least two minutes before silencing it with the alarm Silence/Reset button.

7. If the alarm does not continue strongly for at least two minutes, contact Newport technical support.

8. Connect the ventilator to A.C. power.

SYSTEM LEAK TEST

1. Set the HT50 to Standard Test Settings.

2. Check the 3 thumbscrews of the inlet filter cover in order to ensure no leakage around the cover.

3. Connect the vacuum (negative pressure) gauge to the gas inlet.

4. Start ventilation. The required pressure reading must be 120 mmHg or greater. A failed test is characterized by either (1) failing to achieve 120 mmHg negative pressure, or (2) a rapid drop in the vacuum during exhalation.

   NOTE: During exhalation phase, a decrease in negative pressure on the negative pressure gauge is normal.
NOTE: If system leak test fails and the leak exists in the pneumatic system between the manifold and patient circuit, calibration shall be performed again after the leak is fixed.

PRESSURE TRANSDUCERS CALIBRATION

1. Connect the T-connector between the patient fitting on the exhalation valve and a test lung. Connect the small bore tubing from the T-connector to the calibrated pressure gauge.

2. While in the Standby condition, enter USER SETUP by pressing and holding the Silence/Reset button until the Message Display Window shows “USER SETUP,” then release the button.

3. Use the Int. Battery button to scroll to the “Tech. Setup” message. Use the ▲Up control button to select this parameter. When the Message Display Window displays “Enter Code…,” press the f button then the A/CMV button within 5 seconds.

4. The Message Display Window will display “Pressure Cal.”

5. Press the ▲Up control button and the Message Display Window will display “Apply Zero Pressure.” Make sure that the calibrated pressure gauge shows zero pressure. If pressure > 0, remove breathing circuit to relieve pressure.

6. Press the Int. Battery button. The system will start the motor and will inflate the test lung. The Message Display Window will show “Pressure = 60.0” (60 is the default value). Adjust the displayed value in the Message Display Window on the ventilator using the ▲Up/▼Down control buttons so that it shows the same value as the calibrated pressure gauge. The value should be between 40 and 90.

7. Press the Int. Battery button again. After a couple of seconds you will see two pressure values displayed: P1 = X and P2 = X (X is the pressure value). After a few seconds the Message Display Window will show the message “Pressure Cal.” You are now ready to repeat the calibration.

8. Repeat steps 5 through 7, this time making note of the P1 and P2 values. These two numerical values should be within 1.5 of each other. If the difference is within an acceptable range, you are ready for the next calibration. If they are not, repeat calibration until the values are within this range.

9. Remove the T-connector and 500 cc test lung.
PRESSURE METER CALIBRATION

1. Use the Int. Battery button to scroll to “Meter Cal.”

2. Press the ▲Up control button to select “Meter Cal.” The Message Display Window will display “Adjust to 0.”

3. Use the ▲Up/▼Down control buttons to adjust the Paw needle to 0.

4. Press the Int. Battery button and the Message Display Window will display “Adjust to 60.”

5. Use the ▲Up/▼Down control buttons to adjust the Paw needle to 60.

6. Press the Int. Battery button and the Message Display Window will display “Verification” and will then cycle the Paw meter needle to 0, 30, 60 and 90. The needle should be within 4 at each setting. If it is not, complete step 7 then repeat steps 1-6.

7. Press the Int. Battery button to exit “Verification.” The routine will exit after reaching 90, and the display will return to “Meter Cal.”

VOLUME FACTOR CALIBRATION

1. Use the Int. Battery button to scroll to “Set Vol Factor.”

2. Press the ▲Up control button. The Message Display Window will display “Connect Rp50.”

3. Connect an Rp50 parabolic resistor to the patient end of the exhalation valve and leave the other side of the resistor open to air. MAKE SURE IT IS NOT BLOCKED IN ANY WAY.

4. Press the Int. Battery button and the system will start the motor. After the motor stops the Message Display Window will display “Vol Factor=XXX.” Valid numbers are between 80-120. Record the value on the test sheet.

5. Press the Int. Battery button. Press the ▲Up control button.

6. Repeat step 4. If the Volume Factor is not within ± 5 of the previous value and within the range of 80-120, repeat steps 2-6 until two consecutive calibration procedures produce Vol Factor ± 5 of each other and both are between 80 and 120.

7. Press the Int. Battery button to exit the Volume Factor Calibration.
PRESSURE RELIEF VALVE CALIBRATION

1. Use the Int. Battery button to scroll to “Adjust Rel Valve.”

2. Block the Mainflow outlet using CAP100P, and press the ▲ Up control button. This will start the motor and pressure in the system will begin to rise.

3. Verify there is no air leaking from the exhalation valve. All air leakage must be from the pressure relief valve.

   If no leakage is noted, proceed to step 4. If leakage is noted, you will need to pressurize the exhalation valve from an external source. While the motor continues to run, perform the following:

   • Disconnect the exhalation valve tubing from the EXH.VALVE connector on the ventilator.
   • Connect this same tubing to the Luer connector on the 20 cc syringe.
   • Pressurize the exhalation valve diaphragm by pushing on the syringe plunger until the leakage from the exhalation valve ceases.

4. The Message Display will indicate the circuit pressure. Verify that the displayed pressure is 110 ±10.

5. If the pressure is outside this limit, use a Phillips screwdriver to adjust the pressure by turning the pressure relief screw located on the underside of the Mainflow Outlet Assembly.

6. After verifying that the Message Display Window is showing 110 ±10, unblock the outlet of the Rp50, and press the Int. Battery button.

   **NOTE:** If the 20 cc syringe was used, remove it now and reconnect the exhalation valve tubing to the exhalation valve connector.

7. To exit Tech. Setup and USER SETUP, press the Silence/Reset button twice.

   **NOTE:** If the pressure relief valve is adjusted, perform Pressure Transducers Calibration and Volume Factor Calibration again.

EXHALATION VALVE CALIBRATION

**WARNING** Each time an exhalation valve is replaced it must be calibrated.
1. Connect the HT50 patient breathing circuit to the ventilator. Connect an adult test lung with restrictor or use test lung (LNG800P) or occlude the patient side of the exhalation valve.

2. Press the On/Standby button once to enter Settings condition.

3. Press the Manual Inflation button once, then again within three seconds.

4. The HT50 will start the exhalation valve calibration and the ventilator will automatically test the exhalation valve. If it passes the test, the messages "Cal Completed", then "Press ON to Vent" will be displayed.

5. If the test fails, the message "Cal Failed" will be displayed.
   - Press the Silence/Reset button.
   - Check the integrity of the circuit, connections and test lung, then press the Manual Inflation button twice to initiate calibration again.

**OPERATIONAL SET-UP**

1. Connect the 500 cc test lung to the patient connection on the exhalation valve.

2. If testing model HT50-H (w/ humidifier), the humidifier should no longer be bypassed. The patient circuit should be connected to the output of the humidifier chamber and the humidifier tubing should be connected between the input to the humidifier chamber and the connector on the ventilator labeled "GAS OUTPUT."

3. With the ventilator in the Standby condition, press the On/Standby button once to enter Setting condition. Adjust controls to the following Standard Test Settings:

<table>
<thead>
<tr>
<th>MODE</th>
<th>A/CMV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume Control</td>
<td>500 mL</td>
</tr>
<tr>
<td>t_i</td>
<td>1.0 sec</td>
</tr>
<tr>
<td>f</td>
<td>15 b/min</td>
</tr>
<tr>
<td>P trig</td>
<td>1 cmH2O/mbar</td>
</tr>
<tr>
<td>Paw alarm</td>
<td>3 cmH2O/mbar △Paw /</td>
</tr>
<tr>
<td></td>
<td>99 cmH2O/mbar ▲Paw</td>
</tr>
<tr>
<td>V_i alarm</td>
<td>1 L/min min ▼ / 50 L/min max ▲</td>
</tr>
<tr>
<td>PEEP/CPAP</td>
<td>0 cmH2O/mbar</td>
</tr>
<tr>
<td>P support</td>
<td>0 cmH2O/mbar</td>
</tr>
<tr>
<td>Humidifier</td>
<td>Off</td>
</tr>
</tbody>
</table>
CALIBRATION / OPERATIONAL VERIFICATION PROCEDURE

PRESSURE VERIFICATION

1. Connect the T-connector between the test lung and the exhalation valve. Connect the tubing from the T-connector to a calibrated pressure gauge.

2. Press the ▲Up control button to select “Paw P M B” in the Message Display Window. Press the On/Standby button to begin ventilation.

NOTE: Whenever an alarm message is in the Message Display Window, the user cannot select pressure or volume measurements for display.

3. Set \( t_i \) to 2.0 seconds. Verify that the peak pressure displayed on both the calibrated pressure gauge and the Message Display Window (i.e. “P”) are within 10% of each other.

4. Leave calibrated pressure gauge connected.

P trig

1. Set \( t_i \) to 1.0 second and set \( f \) to 1 b/min. Trigger breaths by squeezing the test lung hard enough to create a negative pressure equal to or greater than 1 cmH\(_2\)O/mbar. Verify the P trig indicator blinks and the ventilator delivers a mandatory breath with each successful squeeze of the test lung.

2. Set \( f \) to 15 b/min and Ptrig to 0.2 cmH\(_2\)O/mbar. Verify that there is no auto-triggering.

PEEP / CPAP

1. Connect the Rp50 parabolic resistor between the T-connector and the test lung.

2. Set Volume Control to 250 mL, PEEP to 5, and Ptrig to 1.0. After a few breaths, verify that the baseline pressure measurements for the Paw meter and the Message Display Window are both 5 \( \pm 1 \) cmH\(_2\)O/mbar. If necessary, increase Ptrig level until there is no auto triggering. Verify the Ptrig level does not exceed 1.5 cmH\(_2\)O/mbar.

3. Set PEEP to 15. After a few breaths, verify that the baseline pressure measurements for the Paw meter and the Message Display Window are both 15 \( \pm 2 \) cmH\(_2\)O/mbar. If necessary, increase Ptrig level until there is no auto triggering. Verify the Ptrig level does not exceed 2 cmH\(_2\)O/mbar.
PRESSURE CONTROL

1. Set ventilator to Standard Test Settings.

2. Press the Pressure Control button, then adjust the Pressure Control setting to 15 cmH₂O/mbar. Set t₁ to 3.0 seconds.

3. Verify both the Message Display Window and the calibrated pressure gauge indicate 15 ±2 cmH₂O/mbar.

4. Set Pressure Control to 30 cmH₂O/mbar. Verify the Message Display Window and the calibrated pressure gauge indicate 30 ±3 cmH₂O/mbar.

5. Remove T-connector, leaving the Rp50 inline.

EXHALATION VALVE SEALING

1. Set the HT50 to Standard Test Settings. Set the f to 5.

2. Change the Volume Control setting so that the Paw meter reaches 70 ±5 cmH₂O/mbar during inspiration.

3. Verify there is no gas leakage from the exhalation valve during inspiration.

MANUAL INFLATION


2. Verify that a manual inflation occurs each time the Manual Inflation button is pressed. Verify inflation is terminated when the button is released. Set f to 15.

HIGH ▲Paw ALARM

1. Set High ▲Paw alarm to 20 cmH₂O/mbar. Verify that (1) an audible and visual High ▲Paw alarm occurs, (2) inspiration is terminated, and (3) maximum pressure displayed on the Paw meter is 20 ±4 cmH₂O/mbar.

2. Set the High ▲Paw back to 99 cmH₂O/mbar and press the Silence/Reset button to clear the visual alarm.
LOW ▼Paw ALARM

1. Disconnect the test lung from the breathing circuit and verify that after 2 breaths, both an audible and visual Low ▼Paw Alarm occurs.

2. Attach the test lung to the breathing circuit and verify that the audible alarm ceases. Press the Silence/Reset button to clear the visual alarm.

CHECK PROX LINE ALARM

1. Disconnect the Proximal Airway Pressure Line at the ventilator connection and verify that both an audible and visual Check Prox Line Alarm occurs.

2. Reconnect the Proximal Airway Pressure Line to the ventilator. Verify that the audible alarm ceases. Press the Silence/Reset to clear the visual alarm.

BATTERY TEST

NOTE: Before proceeding with this test, ensure that the HT50 has been connected to an external power source for the purpose of charging the Int. Battery.

1. Press and hold the Int. Battery button. Verify the charge level on the Paw meter is in the blue area, and there is no “Charge Fault” message in the Message Display Window.

2. Disconnect the A.C. power cord, verify the “Ext. Power” visual and audible alarm occurs, the charging indicator illuminates red, the Int. Battery indicator turns on, and “No Ext. Power” message is displayed in the Message Display Window.

3. Silence the alarm. Press and hold the Int. Battery button. Verify the charge level on the Paw meter is in the blue area after 5 minutes.

4. Reconnect the AC. power cord, verify the Int. Battery LED turns off and the Ext. Power LED indicator changes to green.

5. Repeat steps 2-4, allowing 90 seconds to elapse prior to reconnecting to AC power. Verify the HT50 switches back to A.C. power between 30 and 90 seconds later.
HUMIDIFIER

1. Connect the temperature probe to the ventilator. Attach an empty humidifier bottle to the ventilator (no water or heat sink).

2. Use the HT50 On/Standby button to enter the Settings condition. Press the Humidifier On button and adjust the set target temperature to 39 ºC. Press the Humidifier On button to accept.

3. Verify the continuously displayed temperature is stable and is approximately room temperature for at least 5 seconds.

4. Use the HT50 On/Standby button to enter the ON condition. Verify the continuously displayed temperature is stable and is approximately room temperature for at least 5 seconds.

5. Disconnect the humidifier bottle. Verify that the audible and visual "Humidifier Fail" alarm occurs.

6. Reconnect the humidifier bottle. Clear the alarm message by pressing the Silence/Reset button. Press the Humidifier On button.

7. Disconnect the temperature probe from the Temp Probe inlet jack beneath the Mainflow Outlet Manifold. Verify that the audible and visual "Temp Probe" alarm occurs.

8. Reconnect the temperature probe. Clear the alarm message by pressing the Silence/Reset button.

9. Remove the humidifier bottle and replace the heat sink. Reinstall the bottle on the HT50.
## TEST RECORD FOR HT50

<table>
<thead>
<tr>
<th>Hospital/Organization</th>
<th>Model No. HT50-H1-B</th>
<th>Serial No.</th>
<th>Software Version</th>
<th>Hour Meter</th>
<th>Tested By</th>
<th>Date</th>
<th>Released By</th>
<th>Date</th>
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<tr>
<th>TESTS</th>
<th>PASS</th>
<th>REMARKS</th>
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<tr>
<td>Pre-Test Inspection</td>
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</tr>
<tr>
<td>Front Panel Test</td>
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<tr>
<td>System Leak Test</td>
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</tr>
<tr>
<td>Pressure Calibration</td>
<td>P1=</td>
<td>P2=</td>
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<td>Pressure Meter Calibration</td>
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<tr>
<td>Volume Calibration</td>
<td>Volume factor =</td>
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<td>Pressure Relief Calibration</td>
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<td>Exhalation Valve Calibration</td>
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<td>Pressures Verification</td>
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<td>Manual Inflation</td>
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<td>High Paw Alarm</td>
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<td>Low Paw Alarm</td>
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<td>Check Prox Line Alarm</td>
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<td>Battery Test</td>
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<td>Humidifier</td>
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### OVP TESTS

- Pre-Test Inspection
- Front Panel Test
- System Leak Test
- Pressure Calibration P1= P2=
- Pressure Meter Calibration
- Volume Calibration Volume factor =
- Pressure Relief Calibration
- Exhalation Valve Calibration
- Pressures Verification
- P trig
- PEEP / CPAP
- Pressure Control
- Exhalation Valve Sealing
- Manual Inflation
- High Paw Alarm
- Low Paw Alarm
- Check Prox Line Alarm
- Battery Test
- Humidifier

### TEST EQUIPMENT IDENTIFICATION ID NO.

- Calibration Analyzer
- Oxygen Analyzer
- Electrical Safety Analyzer
- Digital Multimeter

### ELECTRICAL SAFETY TEST COMMENTS

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<tr>
<th>TEST</th>
<th>TOLERANCE</th>
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<tbody>
<tr>
<td>Ground Resistance</td>
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<tr>
<td>Maximum Leakage</td>
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</tbody>
</table>

The HT50 is operational when all tests have been performed successfully.
6. MAINTENANCE PROCEDURES

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Parts Required .............................................. 6-2
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Annual Maintenance Procedure ...................... 6-3
10,000 Hour Maintenance Procedure .............. 6-4
INTRODUCTION

The HT50 ventilator requires routine maintenance for best performance and technical maintenance every 10,000 hours. It is recommended that the primary internal battery be replaced every 12 months. If the primary internal battery is used to LOW BATTERY alarm level on a routine basis, the battery life will be shortened. It is recommended that the secondary internal battery be replaced every 24 months. If the dual internal battery no longer meets the time requirements of the user, it should be replaced.

NOTE: When 10,000 hours has elapsed, the HT50's Message Display Window will indicate “Service Needed” after the next power up.

WARNING After every technical maintenance, the Calibration and Operational Verification Procedure (Section 5) must be performed successfully before returning the HT50 to patient use.

WARNING Lethal voltages are present inside the ventilator. To prevent electrical shock, use extreme caution when working on the ventilator with the front or bottom cover panel opened.

When preparing to return service replacement parts clearly identify them as such, and return them to NEWPORT with the following information:

- Date
- Ventilator serial number
- Contact name
- Organization name
- Organization address
- Reason for replacement
- Copy of completed OVP test record (Section 5)

Follow the shipping instructions detailed in Section 10 of this manual.

Contact NEWPORT Tech. Service for more information. Tel. 714.427.5811, ext. 500 or fax 714.427.0572.

TOOLS REQUIRED

Computer with PCS download program
Download cable P/N V23-00001-29
#10 Torx screwdriver
Philips head screwdriver
7/64" Allen wrench
Torque screwdriver (for #10 torx & 7/64" allen)

NOTE: All allen head and #10 torx screws are tightened to 12 inch/lbs.
MAINTENANCE PROCEDURES

PARTS REQUIRED

1 ea. V11-21000-60 Pump Assembly
1 ea. G19-00001-29 Internal Battery, Lead Acid
1 ea. HT460300 Air Intake Filters, 5 pk
1 ea HT6004701 Proximal Inline Filters, 5 pk
1 ea V09-13130-60 Internal Battery, NIMH

NOTE: The items listed above are not offered as a kit, since they are replaced at different intervals.

ROUTINE MAINTENANCE PROCEDURE

Inspection of the Ventilator

NOTE: While performing the maintenance, visually inspect all parts of the ventilator for wear or damage. Replace parts as necessary.

1. Power Cord
   • Inspect the power cord to ensure that there are no exposed wires. If damage is noted, replace power cord.
   • Inspect the ends of the power cord to ensure that the plugs do not show excessive wear.

2. Front Panel Overlay
   • Inspect the front panel overlay to ensure that there are no raised edges or cuts in the overlay that would allow moisture underneath the panel.

3. Humidifier Assembly (HT50-H model only)
   • Inspect the humidifier chamber for any stress fractures or cracks. Replace as necessary.
   • Inspect the heater plate for corrosion and clean as necessary.

WARNING Before disassembly of parts on the inside of the HT50 takes place, the HT50 power supply needs to be discharged.

Cleaning the HT50 Ventilator

Wipe the surfaces of the ventilator with a damp cloth containing a mild medical detergent.

Caution Do not use agents containing acetone, toluene, halogenated hydrocarbons, or strong alkalines on the face panel or ventilator housing.

NOTE: Alcohol may be used to sanitize the face panel and ventilator housing. Care should be taken not to allow liquids to penetrate the ventilator.
Changing the Air Inlet and Proximal Inline Filters

WARNING Do not reverse the filters. Always replace them if dirty or contaminated.

1. Remove the Air Inlet Filter Cover (#8) by loosening the three (3) thumbscrews.

2. Remove and discard the old filter. Install the new filter (p/n HT460300), making certain that the filter media is laying flat within the counterbore of the cover.

3. Reinstall the Air Inlet Filter Cover, making certain that the filter media remains in place and the three thumbscrews are tightened securely.

4. Remove and discard the old Proximal Inline Filter and tubing. Replace with new filter/tubing assembly (p/n HT6004701).

ANNUAL MAINTENANCE PROCEDURE

NOTE: Perform all Routine Maintenance procedures with the addition of the following to replace the internal battery.

Discharge the HT50 Power Supply

1. Discharge the HT50 power supply per Discharge the HT50 Power Supply in Section 8.

Removal of Lower Case Assembly

1. Remove the lower case assembly per Disassembly (lower case) in Section 8.

2. Remove the lower case cover, carefully avoiding tension on the battery wire harness. Disconnect the 3 connectors at the dual pack battery circuit board connecting the dual pack battery circuit board to the main board. See figure 8-1.

3. To reinstall the lower case assembly reverse above steps.
Replacement of Internal Primary Battery

1. Replace the Internal Primary Battery per Removal of Internal Primary Battery in Section 8.

Operational Verification Procedure

Upon completion of the internal battery replacement, perform all calibrations and Operation Verification Procedures as detailed in Section 5.

Replacement of the Internal Secondary Battery

NOTE: To ensure the NiMH battery can supply adequate power to the HT50 after the LOW BATTERY alarm Newport recommends the NiMH battery to be replaced every 2 years or if the NiMH battery no longer meets the time requirements of the user, it should be replaced.

1. Replace the Internal Secondary Battery as per Removal of Internal Secondary Battery in Section 8.

Operational Verification Procedure

Upon completion of the internal battery replacement, perform all calibrations and Operation Verification Procedures as detailed in Section 5.

10,000 HOUR MAINTENANCE PROCEDURE

Replacement of Pump Assembly

NOTE: The Pump Assembly is scheduled to be replaced every 10,000 hrs. The pump should also be replaced if it exhibits any unusual noise or if it appears to be malfunctioning in any way.

1. Replace the Pump Assembly as per Pump Assembly Replacement in Section 8.

Setting “Next Service Due Meter”

After replacing the pump assembly due to the 10,000 hour maintenance or for any reason, it is necessary to properly set the next service due meter. Set “Next Service Due Meter” per setting “Next Service Due Meter” in Section 8.
Burn-in Test

**WARNING** The ventilator is a critical life support device. Upon replacement of any critical assembly, it is important to complete a 24 hour burn-in to assure proper operation.

1. To complete the burn-in test, set the ventilator to the Standard Test Settings detailed in Section 5.
2. Let the ventilator operate for 24 hours.

**Operational Verification Procedure**

Upon completion of the Burn-in test, perform all calibrations and Operation Verification Procedures as detailed in Section 5.
7. TROUBLESHOOTING GUIDE

Introduction .................................................. 7-1
Mechanical and Pneumatic Troubleshooting .... 7-2
Electronic Troubleshooting ......................... 7-5
INTRODUCTION

This troubleshooting guide is intended to assist a NEWPORT authorized service technician to troubleshoot and repair the HT50 ventilator.

The troubleshooting instructions are separated into two sections:
• Mechanical and Pneumatic
• Electronic.

NOTE: Refer to the Troubleshooting section of the Operating manual for more clinically oriented ventilator problems.

WARNING Hazardous voltages are present inside the ventilator. Disconnect electrical power and oxygen sources before attempting any disassembly. Failure to do so could result in injury to service personnel or equipment.

Further questions or problems should be addressed to the Technical Service Department at Newport Medical Instruments.

800.451.3111 (USA only) or 1.714.427.5811 ext. 500
FAX 1.714.427.0572
email: TechSupport@NewportNMI.com

Or write to:

Technical Service Department
NEWPORT MEDICAL INSTRUMENTS, INC.
1620 Sunflower Avenue
Costa Mesa, California 92626 USA
## TROUBLESHOOTING

### MECHANICAL & PNEUMATIC TROUBLESHOOTING

<table>
<thead>
<tr>
<th>PROBLEM</th>
<th>POTENTIAL CAUSE</th>
<th>SUGGESTED CORRECTIVE ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ventilator fails System Leak Test.</td>
<td>Pump is pulling in air from around the air inlet filter cover.</td>
<td>Make certain that the filter media is positioned within the counterbore of the cover and that the thumbscrews are tightened securely.</td>
</tr>
<tr>
<td></td>
<td>Muffler Assembly is disconnected or leaking or is cracked.</td>
<td>Verify Muffler Assembly is securely connected to both the pump inlet and the air intake. With the air intake filter cover removed, verify that the end of the muffler is flush with the ventilator housing. Visually inspect muffler assembly for cracks. Replace if cracked.</td>
</tr>
<tr>
<td></td>
<td>Silicone cuff around ends of muffler may be old.</td>
<td>Replace as needed.</td>
</tr>
<tr>
<td>Ventilator fails Pressure Transducer and/or Pressure Relief Valve calibration.</td>
<td>Leak in the patient circuit Assembly</td>
<td>Make certain that the humidifier chamber is bypassed for these tests. The breathing circuit tubing should be directly connected to the GAS OUTPUT connector. Also, verify that the exhalation valve is not leaky at the highest pressure level. If so, replace exhalation valve. <strong>Note:</strong> When performing the Pressure Relief Valve calibration, if an alternate Newport approved exhalation valve is used it may begin to leak at lower maximal pressures than the permanent blue exhalation valve. This is a limitation of the exhalation valve and the HT50 driving pressure. The ventilator is performing appropriately.</td>
</tr>
<tr>
<td></td>
<td>Torn or improperly sealed manifold diaphragm.</td>
<td>Remove manifold pump and inspect diaphragm. Replace if damaged.</td>
</tr>
<tr>
<td>Low proximal pressure (Paw), but normal flows.</td>
<td>Faulty patient breathing circuit.</td>
<td>Check breathing circuit for leaks and/or proper connections.</td>
</tr>
<tr>
<td></td>
<td>Humidifier chamber leaking.</td>
<td>Bypass chamber and retest. If problem is solved, loosen, reposition, and tighten chamber cover. Retest.</td>
</tr>
<tr>
<td></td>
<td>Pressure transducer out of calibration.</td>
<td>Calibrate entire HT50 (see Section 5)</td>
</tr>
<tr>
<td></td>
<td>Faulty exhalation valve.</td>
<td>Recalibrate exhalation valve (Section 5). If problem persists, replace valve.</td>
</tr>
<tr>
<td></td>
<td>Pressure relief valve or emergency intake valve leaking.</td>
<td>Check both valves for proper sealing. Perform the Pressure Relief Valve calibration (Section 5).</td>
</tr>
<tr>
<td>PROBLEM</td>
<td>POTENTIAL CAUSE</td>
<td>SUGGESTED CORRECTIVE ACTION</td>
</tr>
<tr>
<td>---------</td>
<td>----------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>Low proximal pressure (Paw) and low flows at Gas Output connector.</td>
<td>Pressure relief valve or emergency intake valve leaking.</td>
<td>Check both valves for proper sealing. Perform the Pressure Relief Valve calibration (Section 5).</td>
</tr>
<tr>
<td></td>
<td>Air inlet filter clogged.</td>
<td>Replace air inlet filter.</td>
</tr>
<tr>
<td></td>
<td>Internal leak in the pump (i.e. ruptured diaphragm, leaking one way valve).</td>
<td>Check diaphragm, replace if damaged. Tighten 4 screws connecting the pump to the left side. If problem persists, replace the Pump Assembly.</td>
</tr>
<tr>
<td>“Motor Fault” Device Alert alarm, or no Device Alert alarm, but proximal pressure is rising slower than expected.</td>
<td>Blocked air inlet.</td>
<td>Replace air inlet filter.</td>
</tr>
<tr>
<td></td>
<td>High FIO2 selected on Air/O2 mixer, and oxygen supply is depleted.</td>
<td>Verify sufficient oxygen supply. Replace as needed. If problem continues, remove Air/O2 mixer. If problem is resolved, replace Air/O2 mixer. If problem persists, replace Pump Assembly.</td>
</tr>
<tr>
<td>Unstable baseline.</td>
<td>Breathing circuit leak.</td>
<td>Check breathing circuit for leaks and/or proper connections. Make certain “star” tubing is not a direct connection to any HT50 connectors.</td>
</tr>
<tr>
<td></td>
<td>Exhalation valve is not calibrated.</td>
<td>Calibrate the exhalation valve (Section 5). If the valve fails calibration, replace. If valve passes but problem persists, try a new valve.</td>
</tr>
<tr>
<td></td>
<td>Internal solenoid is not functioning properly.</td>
<td>Verify that both ends of the tubings connected to the solenoid are secure. Verify that the tubing from the Gas Output connector and the internal pressure transducers are secure. Calibrate the exhalation valve. Retest for baseline stability. If the problem persists, replace the Pump Assembly. (Note: Solenoid is part of the pump.)</td>
</tr>
<tr>
<td></td>
<td>Main board not calibrated correctly.</td>
<td>Calibrate entire HT50 (see Section 5)</td>
</tr>
</tbody>
</table>
### TROUBLESHOOTING

<table>
<thead>
<tr>
<th>PROBLEM</th>
<th>POTENTIAL CAUSE</th>
<th>SUGGESTED CORRECTIVE ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline shows PEEP w/ PEEP set to zero.</td>
<td>Water inside exhalation valve diaphragm.</td>
<td>Disconnect the exhalation drive line tubing, then turn exhalation valve upside down to allow any water that is trapped to exit. If problem still persists, replace exhalation valve.</td>
</tr>
<tr>
<td></td>
<td>Kinked or obstructed exhalation or proximal pressure tubing.</td>
<td>Check and correct as needed. Replace inline proximal filter.</td>
</tr>
<tr>
<td></td>
<td>Paw meter needs calibration.</td>
<td>Calibrate. (See Section 5.)</td>
</tr>
</tbody>
</table>
| | Contaminated solenoid. | Replace Pump Assembly.  
(Note: Solenoid is part of the pump) |
| Proximal pressure returns to baseline very slowly. | Kinked or obstructed proximal pressure line. | Check and correct as needed. Replace inline proximal filter. |
| | HME causing resistance to exhalation. | Remove/change HME. |
| Pump is emitting “squeaking” noise. | Contamination on the piston rods. | Using alcohol and a non-residue type material (i.e. gauze), gently clean piston rods. If problem is not corrected, replace Pump Assembly. |
| Pump is emitting “ticking” noise. | Loose bearing. | Replace Pump Assembly. |
| Pump loudness seems to be much greater than normal. | Large leak in breathing circuit. | Resolve leak. |
| | Internal muffler is disconnected. | Open lower case and make sure that the muffler is connected securely at both ends with the appropriate silicone cuff. Perform System Leak Test in Section 5. |
| | Problem with Pump Assembly | Replace Pump Assembly. |
| Vibration noise (i.e. bezel, humidifier, retaining arm, etc.) | Improper Assembly | Secure all external screws to 12” lbs.  
Tighten all thumbscrews or knobs securely. |
| Front panel cover is loose, rattling, or not shutting properly. | Physical damage to the front panel cover. | Remove and replace front panel cover.  
Verify that the springs are present on both ends of the cover. |
| Unit triggers with PEEP set > 0 | Leak in circuit. | Check circuit for leaks. |
| | Exhalation valve not calibrated. | Calibrate exhalation valve. |
## ELECTRONIC TROUBLESHOOTING

<table>
<thead>
<tr>
<th>PROBLEM</th>
<th>POTENTIAL CAUSE</th>
<th>SUGGESTED CORRECTIVE ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ventilator does not operate on internal battery.</td>
<td>Battery fully discharged.</td>
<td>Connect HT50 to A.C. power, allowing battery to charge for several hours, then check charge level. If the battery does not seem to be charging, disconnect the battery wiring harness from the charger. Check the voltage across the battery wiring harness connector. If voltage is &gt; 0 volts but &lt; 8 volts, replace battery.</td>
</tr>
<tr>
<td></td>
<td>Battery fuse defective.</td>
<td>Check the voltage across the battery wiring harness connector. If voltage is 0 volts, replace fuse.</td>
</tr>
<tr>
<td></td>
<td>Defective Main PCB.</td>
<td>Replace Main PCB.</td>
</tr>
<tr>
<td>Ventilator is unable to switch from DC power back to AC power.</td>
<td>Defective Power Supply PCB.</td>
<td>If ventilator functions normally on internal battery, replace Power Supply PCB.</td>
</tr>
<tr>
<td></td>
<td>Defective Main PCB.</td>
<td>Replace Main PCB.</td>
</tr>
<tr>
<td>10 V SHUTDOWN Device Alert Alarm</td>
<td>Defective Main PCB.</td>
<td>Replace Main PCB.</td>
</tr>
<tr>
<td>OCCL. SHUTDOWN Device Alert Alarm</td>
<td>Prox line kinked or prox filter occluded.</td>
<td>Replace prox line filter and check prox line for obstruction.</td>
</tr>
<tr>
<td></td>
<td>Defective Solenoid.</td>
<td>Replace Pump Assembly.</td>
</tr>
<tr>
<td></td>
<td>Defective Main PCB.</td>
<td>Replace Main PCB.</td>
</tr>
<tr>
<td>SYSTEM ERROR Device Alert Alarm</td>
<td>EPROM not seated firmly.</td>
<td>Make certain EPROM is firmly in the socket.</td>
</tr>
<tr>
<td></td>
<td>Battery completely empty or disconnected during ventilation.</td>
<td>Check battery connectors and fuse. Charge battery.</td>
</tr>
<tr>
<td></td>
<td>Defective Main PCB.</td>
<td>Replace Main PCB.</td>
</tr>
<tr>
<td>MOTOR FAULT Device Alert Alarm</td>
<td>Pump is unable to get sufficient air intake.</td>
<td>Check air intake filter. Replace as needed. If using Air/O₂ mixer, verify sufficient tank supply pressure.</td>
</tr>
<tr>
<td></td>
<td>Defective Pump Assembly</td>
<td>Replace Pump Assembly.</td>
</tr>
<tr>
<td></td>
<td>Defective Main PCB.</td>
<td>Replace Main PCB.</td>
</tr>
<tr>
<td>PROBLEM</td>
<td>POTENTIAL CAUSE</td>
<td>SUGGESTED CORRECTIVE ACTION</td>
</tr>
<tr>
<td>---------</td>
<td>----------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>Meter does not calibrate.</td>
<td>Meter is holding static charge.</td>
<td>Using a cloth with alcohol, gently wipe the surface area of the front panel that covers the meter. Recalibrate.</td>
</tr>
<tr>
<td>Humidifier Fail alarm (HT50-H)</td>
<td>Loss of A.C. power.</td>
<td>Restart humidifier when A.C. power is available.</td>
</tr>
<tr>
<td></td>
<td>Improper installation of the chamber or temperature probe.</td>
<td>See Operating manual for installation instructions.</td>
</tr>
<tr>
<td></td>
<td>Defective temperature probe.</td>
<td>Replace temp. probe.</td>
</tr>
<tr>
<td></td>
<td>Humidifier heater Assembly is defective.</td>
<td>With humidifier chamber firmly secured, disconnect the square four pin connector on the Main PCB. Using an ohmmeter, measure the resistance between the pins of the two blue wires. Resistance should be &lt; 3000 ohms, but &gt; 0. Next, measure the resistance between the pins of the two black wires. Resistance should be approx. 4 ohms. If either of these measurements are incorrect, replace the heater Assembly</td>
</tr>
<tr>
<td></td>
<td>Defective connection to Main PCB.</td>
<td>Using an ohmmeter, verify continuity from probe connector to Main PCB.</td>
</tr>
<tr>
<td></td>
<td>Defective Main PCB.</td>
<td>Replace Main PCB.</td>
</tr>
<tr>
<td>LED(s) and or control panel button(s) do not function.</td>
<td>Ribbon cable not securely fastened.</td>
<td>Verify that both ends of the ribbon cable are securely fastened.</td>
</tr>
<tr>
<td></td>
<td>Defective Panel PCB.</td>
<td>Replace Panel PCB.</td>
</tr>
<tr>
<td>Unit auto triggers</td>
<td>Relief valve set too high or pressure transducers out of calibration.</td>
<td>Perform a complete HT50 calibration (see Section 5)</td>
</tr>
</tbody>
</table>
8. ELECTRONIC & PNEUMATIC COMPONENT REMOVAL & REPLACEMENT PROCEDURES

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Disassembly (Lower Case)......................... 8-2
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Pump Assembly Replacement.................... 8-5
Outlet Assembly Replacement.................... 8-7
Humidifier Heater Assembly Replacement.... 8-8
Front Panel Board Replacement............... 8-9
Front Panel Bezel Replacement................... 8-9
Main Board Assembly Replacement.......... 8-10
Power Supply Board Replacement........... 8-10
INTRODUCTION

The following assemblies are replaceable during service, if they are worn, damaged or suspected to be performing improperly.

- Internal battery assembly
- Pump assembly
- Outlet assembly
- Humidifier assembly
- Front panel PCB assembly
- Main board assembly
- Power supply assembly

Parts that are removed from the ventilator for warranty exchange are to be placed in their replacement box with the following information:

- Date
- Ventilator serial number
- Contact name
- Organization name
- Organization address
- Reason for the replacement: performance observations or user complaint that initiated the replacement
- Copy of the completed OVP test record
- Total operating hours

Follow the shipping instructions detailed in Section 10.

Replacement parts and assemblies which are returned to the manufacturer in the proper manner will be credited according to the warranty core charge list. Contact Newport Service Department for more information. 1.714.427.5811, ext. 500
Fax: 714.427.0572

**Warning**  Hazardous voltages are present inside the ventilator. Disconnect electrical power and oxygen sources before attempting any disassembly. Failure to do so could result in injury to service personnel or equipment.

TOOLS REQUIRED

#10 torx screwdriver
Phillips head screwdriver
7/64" Allen wrench
Torque screwdriver (for #10 torx & 7/16" Allen)

**NOTE:** All allen head and size #10 torx screws are tightened to 12 in-lb torque.
WARNING Before disassembly of parts on the inside of the HT50 takes place, the HT50 power supply needs to be discharged.

DISCHARGE THE HT50 POWER SUPPLY

NOTE: Refer to pg. 3-26, External Power Connector, for proper connection of an external DC power source.

1. Connect a DC power source to the external power connector on the HT50. Leave the external DC power source connected to the HT50 for at least 10 seconds.

2. After 10 seconds has elapsed, remove the external power source. Only after the HT50 power supply has been discharged is it safe to remove components from the inside of the HT50.

DISASSEMBLY (Lower Case)

1. Remove the 6 ea. #10 torx screws securing the lower case (1) of the HT50 to the ventilator housing.

2. Remove the lower case cover, carefully avoiding tension on the battery wire harness. Disconnect the 3 connectors at the dual pack battery circuit board connecting the dual pack battery circuit board to the main board. See figure 8-1.

3. To reinstall the lower case assembly reverse above steps.

Three connectors to be disconnected

Figure 8-1
INTERNAL BATTERY ASSEMBLY REPLACEMENT

Removal of the Primary Internal Battery

1. Remove lower case assembly. See Above Steps

2. Disconnect the 2 cables on the dual pack battery circuit board connecting the NiMH battery to the circuit board.

3. Disconnect the 2 cables on the dual pack battery circuit board connecting the lead acid battery and the transistor to the circuit board. See Figure 8-2

4. Remove the 10 ea #10 torx screws (6) securing the battery case (2) to the lower case cover. Loosen the strain relief securing the battery wiring harness to the battery case. Remove the battery case.

5. Remove the battery wiring harness from the old battery and install it onto the new battery. Make certain the red wire terminal connector with the in-line fuse is attached to the positive (+) terminal and the black wire terminal connector is attached to the negative (-) terminal on the battery.

6. Write the installation date and hours of the HT50 on the side of the new battery.

7. Lay the battery on the side with the negative terminal closest to the lower case, tighten the strain relief securing the battery wiring harness to the battery case, secure the battery cover over the battery using the 10 torx screws removed in step 4.

8. Connect the 3 connectors at the dual pac battery circuit board (Figure 8-1). Gently insert the lowering assembly into the HT50. Pay attention to not pinch the harness.

9. Tighten the 6 torx screws to secure the lower case assembly.

Figure 8-2
Removal of the Secondary Internal Battery

1. Remove lower case assembly. See above steps

2. Disconnect the 2 cables on the dual pack battery circuit board connecting the NiMH battery to the circuit board. See figure 8-3

3. Remove the 2 ea. Phillips screws securing the NiMH battery pack to the NiMN battery bracket. See figure 8-4

4. Install the new NiMH battery by reversing the above steps.

**NOTE:** The NiMH battery comes with a thermal pad already installed. Be sure to install the NiMH battery so the thermal pad is not facing the NiMH bracket.
PUMP ASSEMBLY REPLACEMENT

Refer to Figure 9-1 (Internal View).

1. Follow steps 1-3 in the DISASSEMBLY (Lower Case) section.

2. Disconnect the solenoid two-pin wiring harnesses from the Main harness by pressing the release tab on each connector.

3. Slide the Muffler Assembly (#13) from the pump inlet by pushing and twisting it back and forth until it disengages from the silicone cuff on the pump. After disconnecting the Muffler Assembly from the pump inlet, rotate it toward the rear panel of the ventilator housing so that it creates minimal interference with the removal of the pump.

4. Remove the four (4) #10 torx screws (#28) securing the pump to the ventilator housing. These screws are located externally near the Main Flow Outlet Manifold of the ventilator.

5. Remove the 6 pin power supply wiring harness connector from the Main PCB JP8 by pressing the release tab on the connector.

6. Remove the two (2) silicone tubes (#38 & 49) from the Solenoid.

7. Gently slide the Pump Assembly out of the ventilator housing.
NOTE: Before installing the new Pump Assembly, make certain the diaphragm in the new pump is clean and is properly seated in the pump housing counterbore.

8. Before installing the new Pump Assembly, refer to Figure 9-5. Make certain to attach each tube to the identical connector on the new solenoid.

9. Install replacement Pump Assembly by reversing steps 2 through 7.

NOTE: When sliding the Muffler Assembly (#13) back into place, open the air intake filter cover (8) and make certain that the end of the muffler is flush with the ventilator housing. This will minimize the possibility of a leak around either Muffler connection.

10. Remove Front Panel Assembly per Front Panel Board Replacement in this section.

11. Verify the silicone tube (#12) covers the Muffler Assembly (#13) and the air intake connector on the side pane (#5).

12. Reinstall the Front Panel Assembly.

13. Reassemble the ventilator per instructions on pg. 8-2.

Setting “Next Service Due Meter”

After replacing the pump assembly due to the 10,000 hour maintenance or for any reason, it is necessary to properly set the next service due meter. Follow these steps:

1. Record the current hours meter reading.

2. Connect the HT50 to the computer with the PCS download program via the communication cable P/N V23-00001-29.

3. Connect the HT50 to an AC power source.

4. Start the PCS download program.

5. Select the project (current version is 1.071, however, yours may be different)

6. The tables in the PCS download program will fill up with information from the HT50 Ventilator.
7. Locate the label “NextService”.

8. Press the download button in the upper right corner of the PCS download program.

9. A window will show the progress of the download. While the software is being downloaded, select and highlight the “NextService” label. Change the number according to the hour meter reading and press the enter key.

**NOTE:** The “NextService” number comes from the factory set to 10. This indicates the “Service Needed” message will appear when the HT50 hour meter reading equals 10,000 hours. If the motor pump was replaced at 10,000 hours, the “NextService” number should be changed to 20. If the motor pump was replaced at 7,500 hours, the “NextService” number should be changed to 17.5.

10. Do not remove the communication cable or close the PCS download program until these 3 END of download criteria have been met.

1. The program has completed the download.

2. The green LED for external power is illuminated.

3. The bottom of the PCS download program displays the message “Done Downloading Data”

### OUTLET ASSEMBLY REPLACEMENT

Refer to drawing Figure 9-1, Internal View and Figure 9-5 Main Board Tubing Connections.

**NOTE:** The outlet assemblies are different between the HT50-H and HT50-H1 models.

The Outlet Assembly should be replaced if:

- Damage to either of the 3 connectors is visible.
- Emergency Intake Valve is leaking (rear of outlet block).
- Pressure Relief Valve is leaking at low pressure (bottom of outlet block).

1. Follow steps 1 through 7 of the PUMP ASSEMBLY REPLACEMENT section.

2. Remove the four (4) silicone tubes attached to the Outlet Assembly, marking them to avoid improper reattachment.

3. Remove the two (2) #10 torx screws (#31) which secure the Outlet Assembly to the ventilator housing.
4. Install the new Outlet Assembly, making certain the o-ring seal and the humidifier's heater wires (HT50-H only) are within the counterbore of the Outlet Assembly so that neither are pinched by the Outlet Assembly when securing it to the ventilator housing.

5. Reverse steps 1 through 3 to reassemble.

**HUMIDIFIER HEATER ASSEMBLY REPLACEMENT (HT50-H ONLY)**

Refer to drawing Figure 9-1, Internal View.

The Humidifier Heater Assembly should be replaced if:

- the humidifier chamber is securely fastened but the safety thermostat activates, turning the heater off.
- the assembly is cracked or physically damaged.
- the heater plate does not rise and activate the safety switch beneath it when the humidifier chamber is removed.

1. Follow steps 1 through 3 in the previous Outlet Assembly Replacement section.

2. Remove the two (2) #10 torx screws (#27) that secure the Humidifier Heater Assembly to the ventilator housing.

3. Disconnect the humidifier heater’s wiring assembly connector from the Main PCB by pressing the release tab on the connector. Pull the connector out through the hole in the ventilator housing to remove the old Assembly.

4. Place the connector of the new Humidifier Heater Assembly through the hole in the ventilator housing.

5. Place the Outlet Assembly (#30) over the heater assembly’s wiring harness, making certain that it is not pinched and that the o-ring seal of the Outlet Assembly is properly in place.

6. Secure the Outlet Assembly to the ventilator housing with 2 ea. #10 torx screws (#31).

7. Secure the Humidifier Heater Assembly to the ventilator housing with two (2) #10 torx screws (#27).

8. Reattach the wiring harness connector to the Main PCB.

9. Reverse step 1 to reassemble.
FRONT PANEL BOARD REPLACEMENT

Refer to drawing Figure 9-2, Final Assembly Front View.

The Front Panel PCB should be replaced if:

- any of the front panel buttons, displays, or alarms are malfunctioning.
- the analog meter is malfunctioning.

1. Remove the six (6) 7/64" allen screws (#49) from the Front Panel bezel. Gently separate the bezel from the main ventilator housing.

2. Disconnect two (2) connectors (JP1 & JP2) from the Front Panel PCB.

3. Place the Front Panel Assembly face down on a flat surface. Remove the ten (10) Phillips head screws securing the Front Panel PCB to the front panel plate.

**NOTE:** Some older HT50 units have nine (9) Phillips screws securing the Front Panel PCB to the front panel plate.

4. Remove Front Panel PCB and place it inside an anti-static bag.

5. Remove the protective plastic cover from the analog meter. Install the new Front Panel PCB, by reversing steps 1 through 3.

FRONT PANEL BEZEL REPLACEMENT

Refer to drawing Figure 9-2, Final Assembly Front View.

The Front Panel Bezel should be replaced if:

- the bezel is cracked or dented

1. Follow steps 1 through 4 in the FRONT PANEL BOARD REPLACEMENT section.

2. Remove the six (6) #10 torx screws securing the front panel plate to the bezel. Gently separate the plate from the bezel.

3. To install the new Front Panel Bezel, reverse steps 1 and 2.
MAIN BOARD ASSEMBLY REPLACEMENT

Refer to drawing Figure 9-1, Internal View, Figure 9-3, Final Assembly Front View, Figure 9-4, Main Board with Mounting Hardware and Figure 9-5 Main Board Tubing Connection.

NOTE: Any electronic malfunction that is not resolved with the replacement of the Front Panel PCB is usually resolved by replacing the Main PCB Assembly

1. Follow steps 1 through 3 of the DISASSEMBLY (Lower Case) section.

2. Remove the six (6) 7/64” allen screws (#49) from the Front Panel bezel. Gently separate the bezel from the main ventilator housing.

3. Disconnect two (2) connectors (JP1 & JP2) from the Front Panel PCB.

4. Disconnect all electrical connectors from the Main PCB.

5. Remove the four (4) Philips head screws (#58) securing the RS232 connector (P1) and the two transistors (Q1 & Q9) to left hand side of the ventilator housing.

6. Remove the three (3) #10 torx screws (#52 & 61) securing the Main PCB's mounting hardware to the ventilator housing.

7. Disconnect the two (2) silicone tubes (#39 & 40) from the transducers mounted to the Main PCB, marking them to avoid incorrect reattachment.

8. Remove defective Main PCB. Transfer the mounting hardware as necessary to the new PCB.

9. Reverse steps 1 through 7 to install the new Main PCB and reassemble.

NOTE: The small white insulator should be inserted into the transistor hole. Gently tighten the screws making sure not to pinch the insulator.

NOTE: Make certain that the insulator and the insulating bushing are properly placed.
POWER SUPPLY BOARD REPLACEMENT

WARNING Before disassembly of parts on the inside of the HT50 takes place, the HT50 power supply needs to be discharged. See instructions on pg. 8-2.

WARNING Ensure that the HT50 is unplugged from the AC power source.

Refer to drawing Figure 9-1, Internal View.

The Power Supply Board should be replaced if the ventilator is inoperable with either external A.C. or D.C. power.

1. Follow steps 1 through 3 of DISASSEMBLY (Lower Case) section.

2. Remove the Filter Cover Assembly (8).

3. Remove the six (6) #10 torx screws (#5) securing the Power Supply PCB to the ventilator housing.

NOTE: These screws are located externally on the right hand side of the ventilator. The two longer screws are used to secure the black electrical socket inlet.

4. Disconnect the wiring harness from the Power Supply PCB by pressing the release tab on the connector.

5. Remove and replace the old PCB with the new assembly.

6. Reverse steps 1 through 4 to reassemble.
9. DIAGRAMS AND PARTS LIST

Figure 9-1, Internal View
Figure 9-2, Final Assembly, Front View HT50-H
Figure 9-3, Final Assembly, Front View HT50-T, HT50-H1
Figure 9-4, Main Board with Mounting Hardware
Figure 9-5, Main Board Tubing Connection, Left Side
Figure 9-6, Right Side Case
Figure 9-7, Front Panel, Side View
Figure 9-8, Pneumatic Schematic
Parts Reference List
<table>
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**Figure 9-1**

Internal View
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**Figure 9-2**
Final Assembly
Front View HT50-H
Figure 9-3
Final Assembly
Front View HT50-H1
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Figure 9-5
Main Board Tubing Connection, Left Side
TO ASSURE PROPER GROUND RELIABILITY AND PREVENT POSSIBLE SHOCK HAZARD, THIS DEVICE SHOULD ONLY BE CONNECTED TO A WALL RECEPTACLE MARKED "HOSPITAL GRADE".

100-240V~ max. 2A    12-36V - max. 1.2A

DO NOT REVERSE FILTER WHEN DIRTY.
ATTACHMENT SOCKET FOR OXYGEN BLENDER FILTER IS TO BE CHECKED WEEKLY AND LOOSEN SCREWS TO REMOVE COVER. REPLACED WHEN DIRTY.

AC CONNECTION

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<td>V11-35100-03</td>
<td>3</td>
<td>FILTER THUMB</td>
</tr>
<tr>
<td>9</td>
<td>V11-36000-26</td>
<td>1</td>
<td>O-RING 50 DUROMETER SILICONE</td>
</tr>
<tr>
<td>8</td>
<td>V11-35001-63</td>
<td>1</td>
<td>FILTER COVER</td>
</tr>
<tr>
<td>7</td>
<td>G27-00002-27</td>
<td>1</td>
<td>FIXED DIA. CABLE CLAMP 1/4&quot;</td>
</tr>
<tr>
<td>6</td>
<td>G23-00013-23</td>
<td>1</td>
<td>PHIL. HEAD SCREW 8-32 X 1/4&quot;</td>
</tr>
<tr>
<td>5</td>
<td>V11-37000-69</td>
<td>1</td>
<td>ALARM ASSY.</td>
</tr>
<tr>
<td>4</td>
<td>V11-38400-03</td>
<td>1</td>
<td>EQUIPOTENTIAL CONNECTOR (CUT)</td>
</tr>
<tr>
<td>3</td>
<td>G13-00002-23</td>
<td>1</td>
<td>EQUIPOTENTIAL COLOR CODE WASHER FT-POAG-S</td>
</tr>
<tr>
<td>2</td>
<td>V11-38100-03</td>
<td>1</td>
<td>CASE SIDE PLATE RIGHT</td>
</tr>
<tr>
<td>1</td>
<td>V11-31001-85</td>
<td>1</td>
<td>POWER SUPPLY ASSY.</td>
</tr>
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</table>

No. PART NUMBER QTY DESCRIPTION AND REFERENCE DESIGNATION
Figure 9-6
Right Side Case
<table>
<thead>
<tr>
<th>Item No.</th>
<th>Description of Part</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Battery Case Cover</td>
<td>V11-14000-07</td>
</tr>
<tr>
<td>3</td>
<td>Battery Cable w/ Fuse</td>
<td>V11-11200-69</td>
</tr>
<tr>
<td>4, 6, 18, 28, 31, 35, 46, 52, 53, 61, 63, 67</td>
<td>Torx Screw, 6-32 x 1/4&quot;</td>
<td>G23-00001-23</td>
</tr>
<tr>
<td>7</td>
<td>Battery (Primary or Secondary)</td>
<td>G19-00001-29</td>
</tr>
<tr>
<td>8</td>
<td>Air Inlet Filter Cover Assembly</td>
<td>V11-35001-63</td>
</tr>
<tr>
<td>9</td>
<td>Air Inlet Filter Cover O-ring</td>
<td>V11-36000-26</td>
</tr>
<tr>
<td>11</td>
<td>Air Inlet Filter (5 pk)</td>
<td>HT460300</td>
</tr>
<tr>
<td>12</td>
<td>Silicone Tube, Muffler</td>
<td>V11-32000-06</td>
</tr>
<tr>
<td>13</td>
<td>Muffler Assembly</td>
<td>V11-33000-67</td>
</tr>
<tr>
<td>19</td>
<td>Knob, Humidifier Bracket</td>
<td>V12-22000-03</td>
</tr>
<tr>
<td>20</td>
<td>Cap Screw, 1/4&quot; x 1-1/4&quot;</td>
<td>G23-00021-23</td>
</tr>
<tr>
<td>21</td>
<td>Humidifier Bracket</td>
<td>V12-21000-03</td>
</tr>
<tr>
<td>22</td>
<td>Humid. Bottle, Upper</td>
<td>HT460910</td>
</tr>
<tr>
<td>23</td>
<td>Absorbent Paper (10 pk)</td>
<td>HT460960</td>
</tr>
<tr>
<td>24</td>
<td>Humid. Bottle, Lower</td>
<td>HT460920</td>
</tr>
<tr>
<td>25</td>
<td>Humid. Heat Sink</td>
<td>HT460930</td>
</tr>
<tr>
<td>26</td>
<td>Humid. Heater Assembly</td>
<td>V12-10000-60</td>
</tr>
<tr>
<td>27</td>
<td>Torx Screw, K35 x 10</td>
<td>G23-00006-23</td>
</tr>
<tr>
<td>29</td>
<td>Pump Diaphragm</td>
<td>V11-21700-06</td>
</tr>
<tr>
<td>30</td>
<td>Outlet Assembly., HT50-H</td>
<td>V10-24000-63</td>
</tr>
<tr>
<td>30</td>
<td>Outlet Assembly, HT50-H1</td>
<td>V11-24000-63</td>
</tr>
<tr>
<td>32</td>
<td>Pump (manifold) Assembly</td>
<td>V11-21000-60</td>
</tr>
<tr>
<td>34</td>
<td>Rubber Foot</td>
<td>G01-00001-67</td>
</tr>
<tr>
<td>38</td>
<td>Silicone Tubing Kit, Solenoid</td>
<td>V11-26000-60</td>
</tr>
<tr>
<td>39, 40</td>
<td>Silicone Tubes, Transducer</td>
<td>V11-28000-06</td>
</tr>
<tr>
<td>42</td>
<td>Plug, Alarm Comm. Port</td>
<td>V11-29000-06</td>
</tr>
<tr>
<td>43</td>
<td>Temp. Probe Conn. Kit</td>
<td>V11-25000-60</td>
</tr>
<tr>
<td>45</td>
<td>Plug, Temp. Probe (H1)</td>
<td>V11-27100-06</td>
</tr>
<tr>
<td>47</td>
<td>Power Supply Assembly</td>
<td>V11-31001-65</td>
</tr>
<tr>
<td>49</td>
<td>Cap Screw, 6/32&quot; x 1/4&quot;</td>
<td>G23-00031-23</td>
</tr>
<tr>
<td>50</td>
<td>Main PCB Assembly</td>
<td>V09-60000-65</td>
</tr>
<tr>
<td>58, 65</td>
<td>Pan Head Screw, 4-40 x 1/4&quot;</td>
<td>G23-00014-23</td>
</tr>
<tr>
<td>60</td>
<td>Flat Cable Assembly, Panel to Main PCB</td>
<td>V11-78000-69</td>
</tr>
<tr>
<td>66</td>
<td>Panel PCB Assembly</td>
<td>V11-71000-65</td>
</tr>
<tr>
<td>68</td>
<td>Front Panel Assembly, Eng. (no bezel)</td>
<td>V11-72000-63</td>
</tr>
<tr>
<td>71</td>
<td>Cover Assembly, Control Panel</td>
<td>V11-75002-67</td>
</tr>
<tr>
<td>72</td>
<td>Bezel Assembly</td>
<td>V11-77000-03</td>
</tr>
<tr>
<td>74</td>
<td>Alarm Assembly</td>
<td>V11-37000-69</td>
</tr>
<tr>
<td>76</td>
<td>Phillips Screw, 8-32 x 1/4&quot;</td>
<td>G23-00013-23</td>
</tr>
</tbody>
</table>
10. REPACKAGING AND SHIPPING INSTRUCTIONS

Introduction ........................................ 10-1
RGA (Return Goods Authorization) .......... 10-1
Packaging: Complete Unit ................. 10-1
Packaging: Parts or Accessories .......... 10-2
INTRODUCTION

This section will help ensure that returns are properly packaged, the risk of shipping damage is reduced and that the return is delivered to the correct department within Newport Medical Instruments. Please follow the instructions below. This will help you avoid any inconveniences or delays when returning merchandise.

RGA (RETURN GOODS AUTHORIZATION)

1. All returns to Newport Medical Instruments must have an RGA number assigned. Returning goods without an RGA number could delay service, replacement or credit issues.

2. To obtain an RGA number please call Newport Medical Instruments during business hours (800.451.3111 or 714.427.5811) or email TechSupport@NewportNMI.com. Dial extension 500 for any parts or products being returned to the Technical Service Department for maintenance, warranty or non-warranty repairs. Dial extension 282 (Customer Service Department) or email Customers@NewportNMI.com for all other returns or FAX your request to 714.427.0489, attention Customer Service.

PACKAGING: COMPLETE UNIT

1. When returning an HT50 Ventilator, the original box and packaging must be used. If you do not have the original box and packaging, please contact the Technical Service Department at extension 500 to have one shipped to you.

2. Remove all accessories from the ventilator.

3. Do not ship any accessories unless they are requested by a Technician.

4. Once the ventilator is sealed in the box, write the RGA number on the shipping label.

5. When addressing the shipping label, use the following address: Newport Medical Instruments, 1620 Sunflower Avenue, Costa Mesa, California, USA 92626.
PACKAGING: PARTS OR ACCESSORIES

1. When returning any parts or accessories, please package them in a large enough box that the parts or accessories can be wrapped in a sufficient amount of packaging materials.

2. Once the parts or accessories are sealed in the box, write the RGA number on the shipping label.

3. When addressing the shipping label, use the following address: Newport Medical Instruments, 1620 Sunflower Avenue, Costa Mesa, California, USA 92626.

NOTE: When calling Newport Medical Instruments regarding a return, please have your assigned RGA number available to avoid any delays in answering your inquiry.
APPENDIX A: 
HT50 PARTS AND ACCESSORIES

HT50 Ventilator Parts and Accessories . . . . . . . A-1
Service Parts List . . . . . . . . . . . . . . . . . . . . . . . . . A-3
# HT50 Ventilator Parts and Accessories

For more details contact your NEWPORT MEDICAL representative or NEWPORT MEDICAL Customer Service.

<table>
<thead>
<tr>
<th>No.</th>
<th>Part number</th>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HUMIDIFIER ACCESSORIES</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>HT460910</td>
<td>Humidifier Bottle – upper</td>
<td>1</td>
</tr>
<tr>
<td>2.</td>
<td>HT460920</td>
<td>Humidifier Bottle – lower</td>
<td>1</td>
</tr>
<tr>
<td>3.</td>
<td>HT460930</td>
<td>Humidifier – heat sink</td>
<td>1</td>
</tr>
<tr>
<td>4.</td>
<td>HT460940</td>
<td>Humidifier – airway temperature probe</td>
<td>1</td>
</tr>
<tr>
<td>5.</td>
<td>HT460950</td>
<td>Humidifier – hose connection (12 in)</td>
<td>1</td>
</tr>
<tr>
<td><strong>AIR/OXYGEN MIXER</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>HT460700</td>
<td>Air/oxygen mixer – DISS 1240</td>
<td>1</td>
</tr>
<tr>
<td>8.</td>
<td>HT600044</td>
<td>Oxygen blending bag kit (1L)</td>
<td>1</td>
</tr>
<tr>
<td><strong>PATIENT BREATHING CIRCUITS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>51006000</td>
<td>Patient breathing circuit – disposable ped/adult 6’/1.8m, non-heated, J-circuit with exh. valve</td>
<td>10/case</td>
</tr>
<tr>
<td>10.</td>
<td>51006700</td>
<td>Abbreviated patient circuit – disposable ped/adult J-circuit without inspiratory limb, for use with disp. heated wire inspiratory limbs</td>
<td>20/case</td>
</tr>
<tr>
<td>11.</td>
<td>RT114</td>
<td>Heated inspiratory limb - disposable 5’/1.5m, 2 temp. probe ports and 2’/0.6m humidifier tubing</td>
<td>10/case</td>
</tr>
<tr>
<td>12.</td>
<td>003762</td>
<td>Patient breathing circuit – disposable ped/adult 6’/1.8m, non-heated, single limb with exh. valve</td>
<td>15/case</td>
</tr>
<tr>
<td>13.</td>
<td>10862-701</td>
<td>Patient breathing circuit – disposable pediatric 8’/2.4m, non heated, single limb with exh. valve</td>
<td>20/case</td>
</tr>
<tr>
<td>14.</td>
<td>10855-855</td>
<td>Patient breathing circuit – disposable ped/adult 8’/2.4m, non-heated, J-circuit with exh. valve</td>
<td>20/case</td>
</tr>
<tr>
<td>15.</td>
<td>10856-H08</td>
<td>Patient breathing circuit – disposable ped/adult 8’/2.4m, heated-wire, J-circuit with exh. valve</td>
<td>20/case</td>
</tr>
<tr>
<td>16.</td>
<td>HT600047</td>
<td>Patient breathing circuit – reusable with prox line, water trap, exh. valve</td>
<td>1</td>
</tr>
<tr>
<td>17.</td>
<td>HT600048</td>
<td>Patient breathing circuit – reusable with prox line, water trap</td>
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</tr>
<tr>
<td>18.</td>
<td>HT600045</td>
<td>Patient breathing circuit – reusable with prox line, exh. valve</td>
<td>1</td>
</tr>
<tr>
<td>19.</td>
<td>HT600049</td>
<td>Patient breathing circuit – reusable with prox line</td>
<td>1</td>
</tr>
<tr>
<td><strong>MOUNTING ACCESSORIES</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21.</td>
<td>HT460231</td>
<td>Compact stand assembly with support arm and breathing circuit hanger</td>
<td>1</td>
</tr>
<tr>
<td>22.</td>
<td>HT460200</td>
<td>Rail / bed bracket</td>
<td>1</td>
</tr>
</tbody>
</table>

Contact NEWPORT MEDICAL or your local NEWPORT MEDICAL representative for pricing and availability on all accessories and parts listed.
## HT50 PARTS AND ACCESSORIES

<table>
<thead>
<tr>
<th>No.</th>
<th>Part number</th>
<th>Description</th>
<th>Quantity</th>
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<tbody>
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<td></td>
<td><strong>MOUNTING ACCESSORIES</strong></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>HTBKT01</td>
<td>Bracket, humidifier pole mount (for stand)</td>
<td>1</td>
</tr>
<tr>
<td>24</td>
<td>HTECH01</td>
<td>Bracket, e-cylinder holder (for stand)</td>
<td>1</td>
</tr>
<tr>
<td>25</td>
<td>HTECH02</td>
<td>Bracket, dual e-cylinder holder (for stand)</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>MISCELLANEOUS ACCESSORIES</strong></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>HT460300</td>
<td>Air inlet particle filter (disposable)</td>
<td>5/ea</td>
</tr>
<tr>
<td>27</td>
<td>LNG500A</td>
<td>Adult test lung (500 mL) with R20 restrictor</td>
<td>1</td>
</tr>
<tr>
<td>28</td>
<td>PWR290P</td>
<td>Electrical power cord / A.C.</td>
<td>1</td>
</tr>
<tr>
<td>29</td>
<td>HT460400</td>
<td>Power cord ferrite</td>
<td>1</td>
</tr>
<tr>
<td>30</td>
<td>HT460085</td>
<td>Automobile 12 V accessory power cord</td>
<td>1</td>
</tr>
<tr>
<td>31</td>
<td>OPRHT50NA</td>
<td>Operating manual for HT50</td>
<td>1</td>
</tr>
<tr>
<td>32</td>
<td>SERHT50NA</td>
<td>Service manual for HT50</td>
<td>1</td>
</tr>
<tr>
<td>33</td>
<td>HT6004701</td>
<td>Prox inline filters (disposable)</td>
<td>5/ea</td>
</tr>
<tr>
<td>34</td>
<td>BAT3300A</td>
<td>External Battery Pack Assy</td>
<td>1</td>
</tr>
<tr>
<td>35</td>
<td>CHG3313P</td>
<td>Battery Charger for BAT3300A</td>
<td>1</td>
</tr>
</tbody>
</table>

Contact Newport Medical or your local Newport Medical representative for pricing and availability on all accessories and parts listed.
## Service Parts List

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description of Part</th>
</tr>
</thead>
<tbody>
<tr>
<td>V11-14000-67</td>
<td>Battery Case Cover Assembly</td>
</tr>
<tr>
<td>V11-11200-69</td>
<td>Battery Cable w/ Fuse</td>
</tr>
<tr>
<td>G23-00001-23</td>
<td>Torx Screw, 6-32 x 1/4&quot;</td>
</tr>
<tr>
<td>G19-00001-29</td>
<td>Battery, Primary Lead Acid</td>
</tr>
<tr>
<td>V09-13130-60</td>
<td>Battery, Secondary NiMH</td>
</tr>
<tr>
<td>V11-35001-63</td>
<td>Air Inlet Filter Cover Assembly</td>
</tr>
<tr>
<td>V11-36000-26</td>
<td>Air Inlet Filter Cover O-ring</td>
</tr>
<tr>
<td>HT460300</td>
<td>Air Inlet Filter (5 pk)</td>
</tr>
<tr>
<td>V11-32000-06</td>
<td>Silicone Tube, Muffler</td>
</tr>
<tr>
<td>V11-33000-67</td>
<td>Muffler Assembly</td>
</tr>
<tr>
<td>V12-22000-03</td>
<td>Knob, Humidifier Bracket</td>
</tr>
<tr>
<td>G23-00021-23</td>
<td>Cap Screw, 1/4&quot; x 1-1/4&quot;</td>
</tr>
<tr>
<td>V12-21000-03</td>
<td>Humidifier Bracket</td>
</tr>
<tr>
<td>HT460910</td>
<td>Humid. Bottle, Upper</td>
</tr>
<tr>
<td>HT460960</td>
<td>Absorbent Paper (10 pk)</td>
</tr>
<tr>
<td>HT460920</td>
<td>Humid. Bottle, Lower</td>
</tr>
<tr>
<td>HT460930</td>
<td>Humid. Heat Sink</td>
</tr>
<tr>
<td>V12-10000-60</td>
<td>Humid. Heater Assembly</td>
</tr>
<tr>
<td>G23-00006-23</td>
<td>Torx Screw, K35 x 10</td>
</tr>
<tr>
<td>V11-21700-06</td>
<td>Pump Diaphragm</td>
</tr>
<tr>
<td>V10-24000-63</td>
<td>Outlet Assembly, HT50-H</td>
</tr>
<tr>
<td>V11-24000-63</td>
<td>Outlet Assembly, HT50-T, HT50-H1</td>
</tr>
<tr>
<td>V11-21000-60</td>
<td>Pump (manifold) Assembly</td>
</tr>
<tr>
<td>G01-00001-67</td>
<td>Rubber Foot</td>
</tr>
<tr>
<td>V11-26000-60</td>
<td>Silicone Tubing Kit, Solenoid</td>
</tr>
<tr>
<td>V11-28000-06</td>
<td>Silicone Tubes, Transducer</td>
</tr>
<tr>
<td>V11-29000-06</td>
<td>Plug, Alarm Comm. Port</td>
</tr>
<tr>
<td>V11-25000-60</td>
<td>Temp. Probe Conn. Kit</td>
</tr>
<tr>
<td>V11-27100-06</td>
<td>Plug, Temp. Probe (HT50-T, -H1)</td>
</tr>
<tr>
<td>V11-31001-65</td>
<td>Power Supply Assembly</td>
</tr>
<tr>
<td>G23-00031-23</td>
<td>Cap Screw, 6/32&quot; x 1/4&quot;</td>
</tr>
<tr>
<td>V09-60000-65</td>
<td>Main PCB Assembly</td>
</tr>
<tr>
<td>G23-00014-23</td>
<td>Pan Head Screw, 4-40 x 1/4&quot;</td>
</tr>
<tr>
<td>V11-78000-69</td>
<td>Flat Cable Assembly, Panel to Main PCB</td>
</tr>
<tr>
<td>V11-71000-65</td>
<td>Panel PCB Assembly</td>
</tr>
<tr>
<td>V11-72000-63</td>
<td>Front Panel Assembly, Eng. (no bezel)</td>
</tr>
<tr>
<td>V11-75000-67</td>
<td>Cover Assembly, Control Panel</td>
</tr>
<tr>
<td>V11-77000-03</td>
<td>Bezel</td>
</tr>
<tr>
<td>V11-37000-69</td>
<td>Alarm Assembly</td>
</tr>
<tr>
<td>G23-00013-23</td>
<td>Phillips Screw, 8-32 x 1/4&quot;</td>
</tr>
<tr>
<td>V11-24700-67</td>
<td>Emergency Intake Valve Assembly</td>
</tr>
<tr>
<td>R26-00204-26</td>
<td>Silicone Tube Assembly, Sol. to Outlet</td>
</tr>
<tr>
<td>V09-13120-65</td>
<td>Dual Battery Circuit Board</td>
</tr>
<tr>
<td>V09-13000-29</td>
<td>Main Board and Dual Battery Circuit Board Cable</td>
</tr>
</tbody>
</table>
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