

Important Information

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HC500 Serial Number	Installation date

About this manual	Details
Part number	185041080
Revision date	August, 1999
Revision level	Rev D

Read this first

This manual

This manual has been written to provide information for two types of user of the Fisher & Paykel HC500 Respiratory Humidifier:

- the caregiver involved in day-to-day operation of the HC500
- the Clinician involved in setting up the HC500.

Please refer to the paragraphs below for more information.

CAREGIVER: What should I read?

As caregiver and operator of the HC500, you should read the following parts of this manual:

- “Read this first”
- Chapter 1: “Important Safeguards”
- Chapter 2: “Caregiver Information - Operating the HC500”.

These chapters give you the information you need to operate, clean and maintain the HC500 safely.

CLINICIAN: What should I read?

As the Clinician installing the HC500, you should read the complete manual.

Read this first, Continued

Important Alerts

The following alerts are used in this manual to draw your attention to important information.

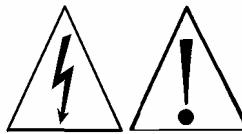
Alert type...	is used to...	Example
NOTE	provide additional information to point out procedures or conditions which may be misinterpreted or overlooked.	NOTE: Once assembled within the tube the heater wire should only be removed when absolutely necessary.
CAUTION	highlight situations where damage to equipment may result from not following the correct procedure exactly.	CAUTION: Never place the HC500 on a soft surface such as a bed or couch, where the openings may be blocked.
WARNING	highlight situations where personal injury may result from not following the correct procedure exactly.	WARNING <ul style="list-style-type: none"> • <i>DO NOT cover heated breathing circuits with sheets, towels or other materials as this may cause the tubing to overheat.</i>

Symbols

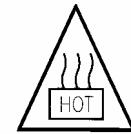
The following symbols appear on the humidifier:



IPX1



UL



CAUTION:
Hot surfaces
may exceed
85°

Type B ATTENTION: Drip Proof Alternating Current
Class1 Consult accompanying documents

CAUTION:
Electrical Shock Hazard Refer to qualified service personnel

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Important Safeguards

Read this first

You must read all these warnings before using the HC500.

Warnings

WARNING

- *Use the HC500 only for its intended use as described in this manual.*
- *Use the HC500 only on prescription from a licensed physician.*

Reduce risk of electrocution by taking these precautions:

- *Always unplug the HC500 immediately after use.*
- *Always connect the HC500 to a properly grounded power outlet (see “Grounding Instructions”).*
- *Do not use the HC500 whilst bathing.*
- *Do not store or place the HC500 where it can fall or be pulled into water.*
- *Do not place or drop the HC500 into water or other liquid.*
- *If the HC500 does fall into water, unplug the HC500 immediately.*

WARNING

- *The HC500 should always be placed lower than the patient so that any excess condensation in the patient delivery tube does not drain towards the patient.*
- *The HC500 must be securely mounted onto a ventilator or other solid object to ensure the humidifier stays horizontal.*
- *To prevent the possibility of accidental patient burns, ensure that the heated breathing circuit is not in contact with the patient’s skin.*
- *Use only Fisher & Paykel approved chambers, circuits and accessories. Performance and safety cannot be guaranteed if other types of accessories are used.*

Continued on next page

Important Safeguards, Continued

Warnings, continued

WARNING

Reduce the risk of burns, electric shock, fire or injury by taking these precautions:

- *Do not use the HC500 in the presence of flammable or explosive materials.*
- *Never operate the HC500 if*
 - *it has a damaged power cord or plug*
 - *it is not working properly*
 - *any part of the HC500 is dropped or damaged or dropped into water.*
- *Keep the power cord away from heated surfaces.*

Cautions

CAUTION:

- Never place the HC500 on a soft surface such as a bed or couch, where the openings may be blocked.
 - Never drop or insert any object into any opening or tube.
 - The function of this humidifier may be adversely affected by operation of high frequency apparatus, shortwave or microwave equipment in the close vicinity.
-

Grounding Instructions - All Countries

What is grounding?

In the event of an electrical short circuit, grounding reduces the risk of electric shock by providing an escape wire for the electric current.

Grounding the HC500

The HC500 must only be plugged into a power outlet that is properly installed and grounded.

Check with a qualified electrician or serviceman if you do not fully understand these grounding instructions or if you are in doubt as to whether the HC500 is properly grounded.

Using a 2-slot power outlet

In the event that you do not have the 3-slot power outlet required for the HC500 plug, you should use a temporary adaptor as described under "Grounding Instructions - USA and Canada Only".

Warning

WARNING

- *ELECTRICAL DANGER - Improper use of the grounding plug can result in a risk of electric shock.*
-

Extension power cords

If it is necessary to use an extension power cord, it must:

- be a 3-wire extension power cord
- have a 3-blade grounding plug
- have a 3-slot receptacle that fits the HC500 plug.

Replace or repair a damaged extension power cord.

Repairs

Do not attempt to repair or replace the power cord or plug without guidance from a qualified electrician or technician.

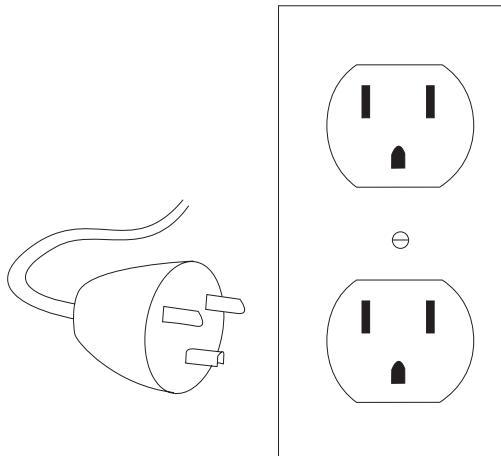
Grounding Instructions - USA and Canada Only

Voltage requirements

The HC500 is for use on a nominal 120V circuit. The HC500 has a hospital grade 3-blade grounding plug that looks like the one shown in the diagram below. The AC power connector can only be construed as hospital grade when used in conjunction with a hospital grade receptacle.

**Diagram:
120V grounded
power outlet**

The following diagram shows a typical grounded power outlet and plug.

**Using a 2-slot
power outlet**

In the event that you do not have the 3-slot power outlet required for the HC500 plug, you should use a temporary adaptor.

Details of the temporary adaptor are shown on the next page.

Continued on next page

Grounding Instructions - USA and Canada Only, Continued

Temporary adaptor

If a properly grounded power outlet is not available, a UL listed temporary adaptor may be used to connect the 3-blade plug of the HC500 to a 2-slot power outlet, where permitted by local electrical codes.

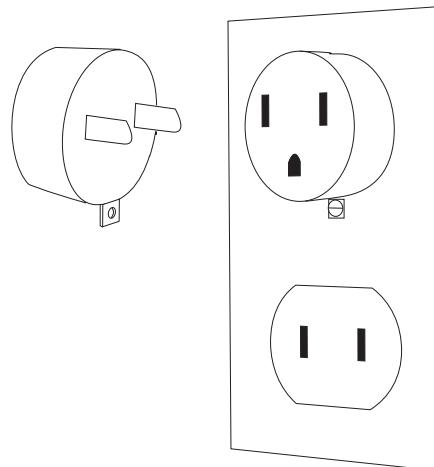
The temporary adaptor should be used only until a properly grounded power outlet can be installed by a qualified electrician.

The green colored rigid lug extending from the adaptor must be connected to a permanent ground such as a properly grounded power outlet box cover. Ensure that the power outlet box cover is grounded.

Whenever the adaptor is used it must be held in place by the screw to ensure that the grounding connection is complete.

**Diagram:
Temporary
adaptor**

The following diagram shows how the HC500 plug can be connected to a 2-slot power outlet by using a temporary adaptor.



YOUR HC500 RESPIRATORY HUMIDIFIER

Purpose of the HC500

**The HC500
Respiratory
Humidifier**

The Fisher & Paykel HC500 Respiratory Humidifier is designed for use with artificial ventilation systems. Portable volume ventilation systems, pressure support ventilation and Continuous Positive Airway Pressure (CPAP) systems may incorporate an HC500 to provide therapeutic levels of warm humidified air to patients with artificial airways or through mask ventilation.

**What is heated
humidification?**

When we breathe normally, the air is both warmed and humidified as it passes through our airways. About three-quarters of the heat and moisture is supplied in the upper airways (nose and pharynx) and one-quarter in the windpipe (trachea). This natural humidification system serves to protect the lungs from the external environment and from infection.

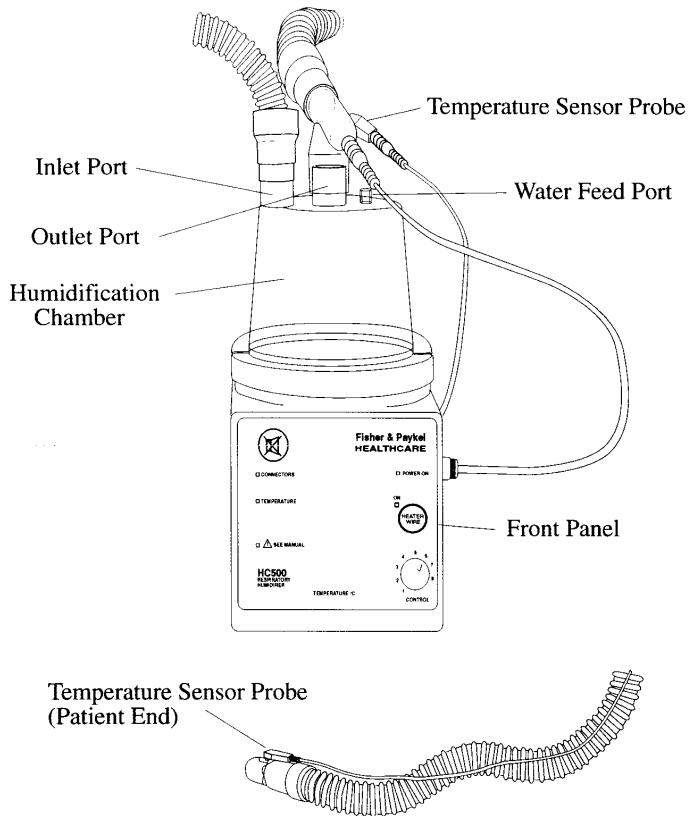
Our body's normal humidification system can be disrupted by the prolonged inhalation of dry air.

Fisher & Paykel have pioneered the use of heated humidifiers to compensate for the disruption of our natural humidification system.

Today, Fisher & Paykel Heated Respiratory Humidifiers are used in hospitals and home-care installations throughout the world for patients whose normal breathing has been disrupted by:

- artificial ventilation,
 - anaesthesia, or
 - high-flow oxygen therapy.
-

Important Parts of Your HC500



This diagram shows the key parts of your HC500 humidifier system, followed by a description on the following page.

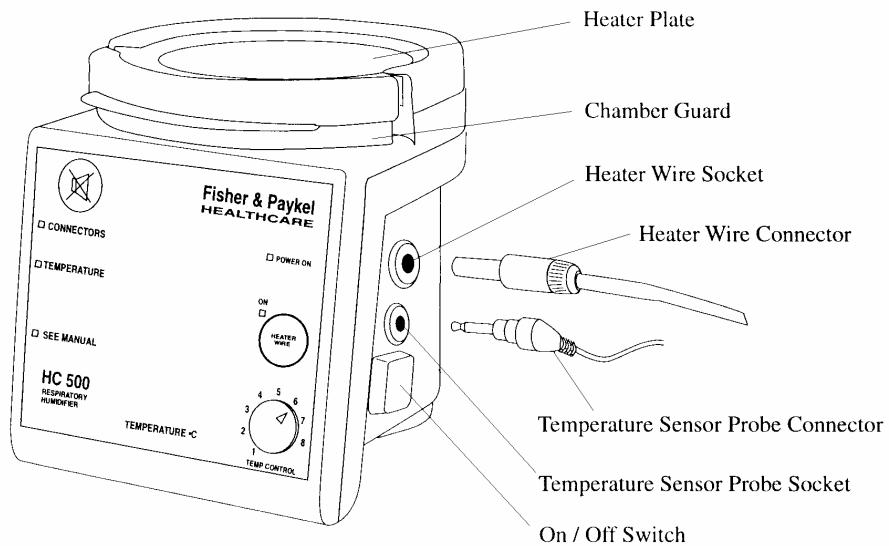
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Important Parts of Your HC500, Continued

Part name	Purpose
HC500	The Fisher & Paykel HC500 Respiratory Humidifier.
Power cord	Supplies power to the HC500 from an electrical power outlet.
Humidification chamber	Contains sterile water which is heated to provide the required level of humidification. The parts of the humidification chamber are described on pages 13-14.
Inlet Port	Air from the ventilator enters the humidification chamber through the inlet port. The ventilator tube connects the inlet port to the ventilator.
Outlet Port	Humidified air is supplied to the patient through the outlet port. The patient delivery tube connects the outlet port to the patient.
Water Feed Port	Fitted on certain humidification chambers - allows easy chamber refilling with use of a water bag and water feed set
Front panel	Houses the humidifier controls and alarm warning lights. The parts of the front panel are described on pages 11-12.
Temperature Sensor Probe	Fitted to the delivery circuit and connected to the HC500. The temperature sensor probe measures the temperature at the chamber and patient ends of the delivery tube.

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Important Parts of Your HC500, Continued



This diagram shows the major components of your HC500 humidifier, followed by a description on the following page.

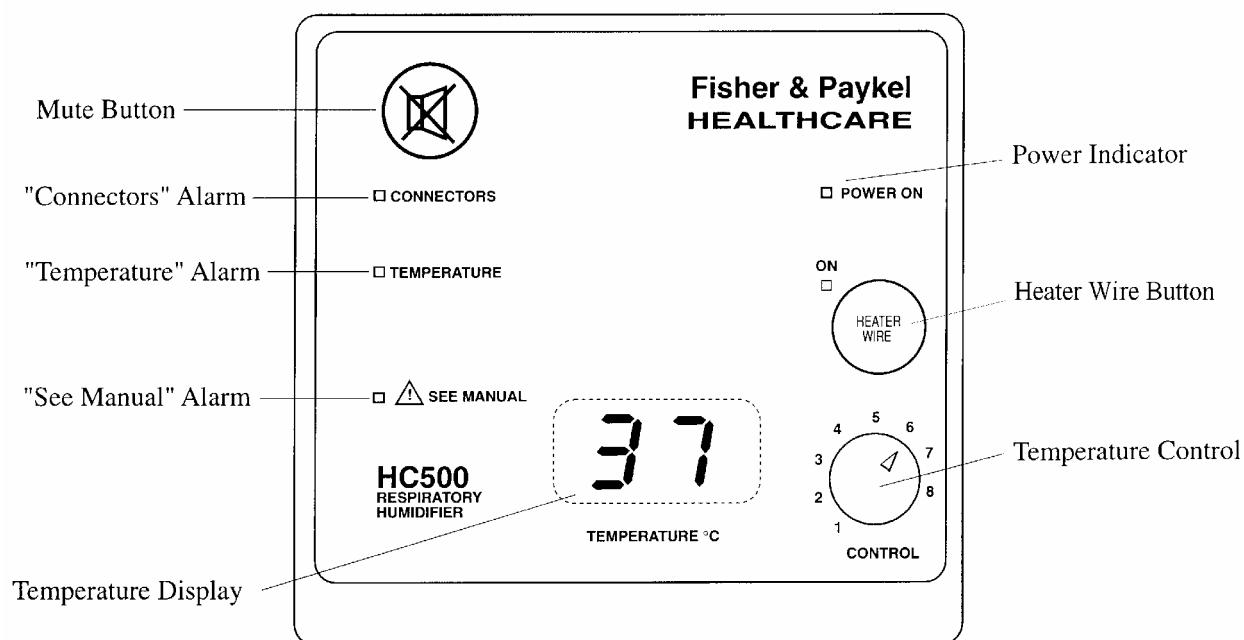
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Important Parts of Your HC500 Continued

Part name	Purpose
ON/OFF switch	Is used to turn the HC500 on and off.
Heater plate	Heats the water in the humidification chamber. WARNING <ul style="list-style-type: none"> • <i>Do not touch the heater plate as it may reach a temperature of 100 °Celsius (212 °Fahrenheit) during operation of the HC500.</i> <p><i>It will remain hot for some time after the HC500 has been switched off.</i></p>
Chamber guard	Retains the humidification chamber in position on the heater plate.
Temperature sensor probe socket	The temperature sensor probe connector plugs into this socket. The temperature sensor probe monitors the temperature of air being delivered to the patient.
Temperature sensor probe connector	The temperature sensor probe connector plugs into the temperature sensor probe socket.
Heater wire connector	The heater wire connector supplies power to the heater wire fitted inside the patient delivery tube.
Heater wire socket	The heater wire connector plugs into this socket. NOTE: Your HC500 may not be fitted with a heater wire. If a heater wire is not fitted, the heater wire connector and socket are not used.

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Important Parts of Your HC500 Continued



This diagram shows the major components of your HC500 front panel, followed by a description on the following page.

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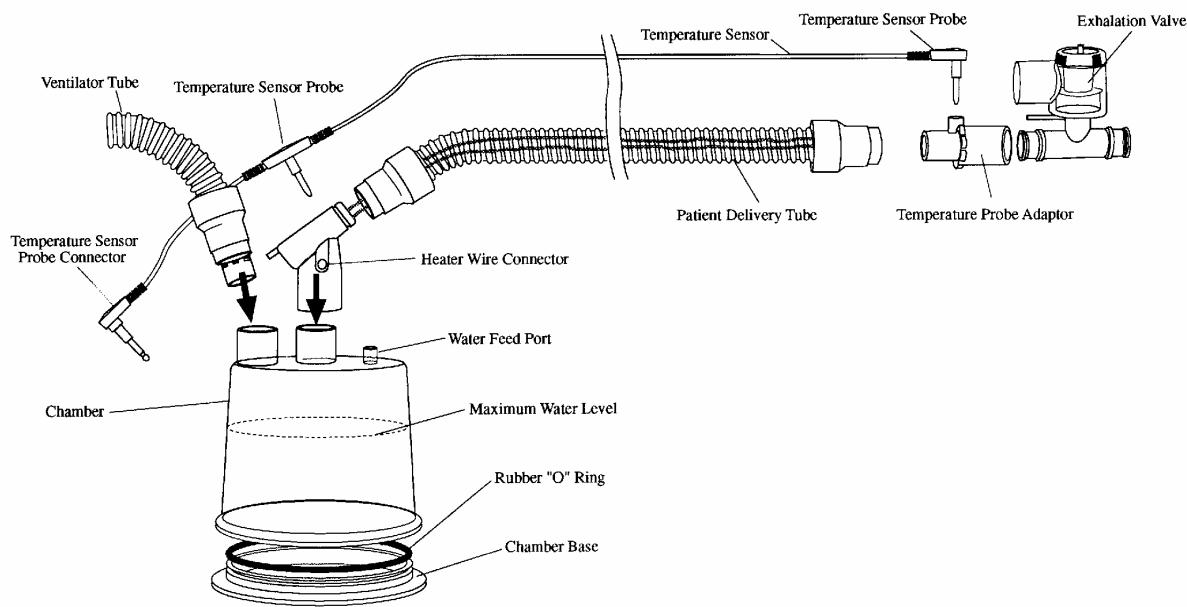
Important Parts of Your HC500, Continued

Part Name	Purpose
Power On indicator	Illuminates to indicate that the HC500 is turned on during normal operation.
Mute button	Silences the HC500 audible alarm (for approximately three minutes) when pressed. In normal operation, holding the Mute button for 1.5 seconds will display the temperature of the air at the end of the patient delivery tube.
Heater Wire Button	Switches the HC500 between heated and non-heated wire mode. NOTE: This control will be set by your Clinician. Do not attempt to change the mode of the HC500 unless you have been instructed by your Clinician to do so.
“Connectors” alarm	Flashes to indicate a possible fault with any of the electrical connectors on the HC500. An audible alarm also sounds. Refer to “Troubleshooting” for further details.
“Temperature” alarm	Flashes to indicate that a temperature high or low condition has been detected. An audible alarm also sounds. Refer to “Troubleshooting” for further details.
“See Manual” alarm	Illuminates to indicate a problem with the HC500 itself. An audible alarm also sounds. Refer to “Troubleshooting” for further details.
Temperature "CONTROL"	Sets the temperature of the humidified air supplied to the patient. NOTE: This control is set by the Clinician. You should not need to re-adjust this control during normal operation of the HC500.
Temperature Display	Displays temperature. NOTE: This display operates only when the mute button is pressed, or with a high temperature alarm. A half second delay occurs before the temperature is displayed.

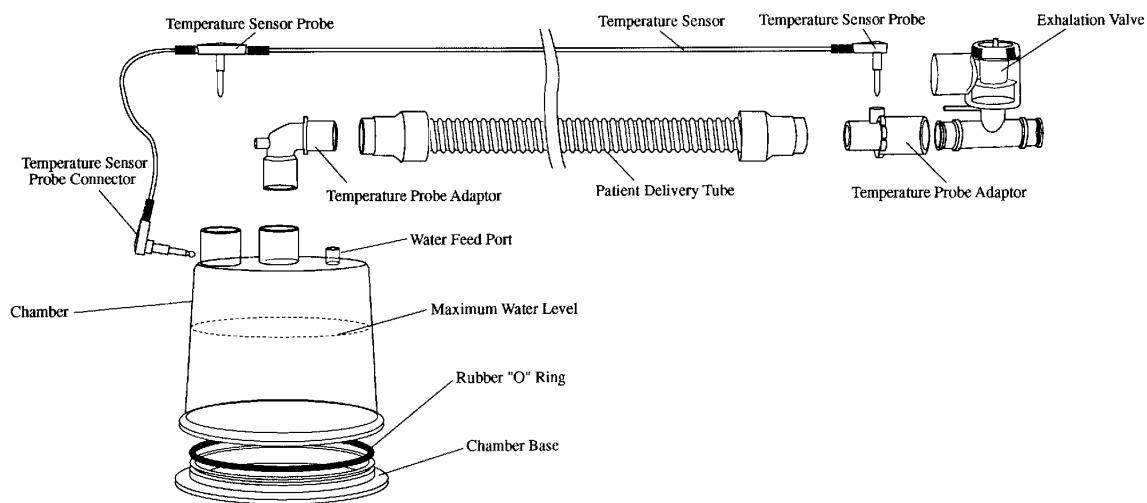
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Important Parts of Your HC500, Continued

Heated patient delivery circuit



Unheated patient delivery circuit



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Important Parts of Your HC500 Continued

The delivery circuit

The parts of the delivery circuit are described in the following table.
NOTE: Either a single use or re-useable humidification chamber may be used on the HC500. Please refer to “Cleaning the Humidification Chamber” for further details.

Part name	Purpose
Chamber	Provides a leak-proof water container when fitted on to the base.
Base	Conducts heat from the heater plate to the water in the chamber.
O-ring	Fitted to the base to prevent leaks when the chamber top is fitted (re-useable humidification chambers only).
Maximum water level	Indicates maximum water level for safe operation. WARNING <ul style="list-style-type: none"> • <i>Do not fill the chamber above the maximum water level as this may cause water to be drawn into the patient delivery tube.</i>
Feed port	A small port fitted to some humidification chambers for use when refilling. See “Refilling the Humidification Chamber” for details.
Patient delivery tube	Delivers humidified air from the HC500 to the patient. One of several different types of patient delivery tube may be fitted to your HC500. See “Cleaning the Delivery Tubes” for details.
Ventilator tube	Delivers air from the ventilator to the HC500. See “Cleaning the Delivery Tubes” for details.
Probe wire	Connects the HC500 to the two temperature sensor probes fitted into the patient delivery tube. These probes monitor the temperature of air being delivered to the patient. See “Cleaning the Delivery Tubes” for details.

Continued on next page

Operating Environment

- Environmental guidelines** Follow these guidelines to help ensure that the HC500 operates satisfactorily at all times.
- The HC500 is designed for use with a ventilator system. Do *not* replace any of the tubes, fittings or other components unless instructed to do so by a suitably qualified Clinician or technician.
 - Try to ensure that the room temperature is maintained between 18° and 25° Celsius (65° and 77° Fahrenheit) at all times. This will ensure consistent temperature and humidity of the air delivered to the patient.
 - Avoid rapid air temperature changes in the room as this may cause nuisance temperature alarms.
 - Make sure that the HC500 and delivery tubes are *not* exposed to drafts from fans, air conditioners or other sources. Drafts may cause excessive cooling of the humidified air and result in condensation forming in the delivery tubes.
 - Avoid exposing the patient delivery tube to radiant heat (such as a fan-heater).

Warning**WARNING**

- *DO NOT cover the patient delivery tube with blankets, towels or similar material as this may cause the patient delivery tube to overheat.*
-

OPERATING YOUR HC500

Humidifier Setup

Introduction

Once the HC500 has been installed by the Clinician you must become familiar with the overall setup of its main components as shown in the diagram below.

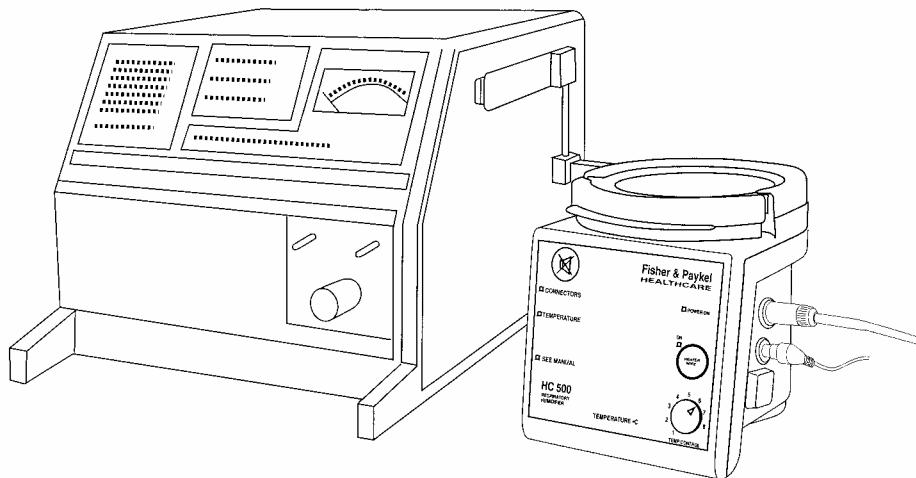
Warnings

WARNING

- *The HC500 should always be placed lower than the patient so that any excess condensation in the patient delivery tube does not drain towards the patient.*
- *The HC500 must be securely mounted onto the ventilator.*
- *To prevent the possibility of accidental patient burns, ensure that the heated breathing circuit is not in contact with the patient's skin.*
- *Use only Fisher & Paykel approved chambers, circuits and accessories. Performance and safety cannot be guaranteed if other types of accessories are used.*

Diagram: Typical setup

The following diagram shows the setup of a typical HC500 installation.



Switching On the HC500

The ON/OFF switch

The ON/OFF switch is located on the right side of the HC500 when looking at the front panel.

Warning

WARNING

- *Make sure that the humidification chamber contains water before you switch on the HC500. Take care not to overfill the chamber.*
 - *Switch the HC500 off immediately if the gas flow is interrupted or stopped.*
-

How to switch on the HC500

Follow these steps to switch on the HC500.

<u>Step</u>	<u>Action</u>
1	Make sure that the HC500 is connected to the power supply.
2	Press the upper edge of the ON/OFF switch. The power up sequence will begin. For both heated wire and non-heated wire mode, this consists of the following: <ul style="list-style-type: none">• the Power On indicator will now be illuminated• An audible alarm will sound briefly• The “See Manual” indicator will flash on and off• The “Connectors” and “Temperature” indicators and the temperature display will flash on and off. <i>The temperature display is not visible during normal operation.</i>

The unit will now operate normally after a warm up period of approximately 10 to 20 minutes.

Switching from Heated to Non-Heated Wire Mode

Should I switch between modes? Some users may need to switch between heated and non-heated wire mode operation at different times. If this is required, your Clinician will advise you.

Warning

WARNING

- *Do not attempt to switch between heated and non-heated wire modes unless you have been instructed by your Clinician to do so.*
-

Procedure

To operate in heater wire mode:

Ensure that the heated wire connector is plugged in to the heater wire socket. Press the “Heater Wire” button. A green indicator will illuminate to show that the unit is in heated wire mode.

Procedure

To operate in non-heated wire mode:

Ensure that the heater wire connector is unplugged from the heater wire socket. If the green indicator above the “Heater Wire” button is illuminated, press the “Heater Wire” button. The green indicator will no longer be illuminated, indicating that the heated wire mode is turned off.

Refilling the Humidification Chamber

When should the chamber be refilled?

The water level in the humidification chamber should be checked approximately every 4 hours and refilled when necessary.

Warnings**WARNING**

- *Make sure that the humidification chamber contains water before you switch on the HC500. Take care not to overfill the chamber.*
- *The heater plate will remain hot for some time after the HC500 has been switched off.*
- *A high air-flow rate and/or delivery temperature will increase the water consumption. You should check the water level more frequently, as advised by the Clinician.*
- *Do not fill the humidification chamber with hot water. (Exceeding 37°C)*
- *Do not overfill the humidification chamber. If overfilled above the maximum water level mark, water may enter the patient delivery tube.*

Water quality

We recommend that you use sterile distilled water to fill the humidification chamber.

Continued on next page

Refilling the Humidification Chamber, Continued

**Procedure 1:
Water feed
refill** Connect a suitable water feed set to the water feed port on the humidification chamber. Refill the humidification chamber to the maximum water level mark. Take care not to overfill the chamber.

No disconnections are required.

**Procedure 2:
Bypass refill** Follow these steps to refill the humidification chamber.

<u>Step</u>	<u>Action</u>
1	Switch the HC500 off.
2	Disconnect the heater wire connector at the patient delivery tube.
3	Disconnect the probe wire at the HC500.
4	Bypass the HC500 temporarily. This is done by: <ul style="list-style-type: none">• disconnecting the patient delivery tube and ventilator tube at the chamber, then• connecting the patient delivery tube directly to the ventilator tube. An adaptor may be required. Consult your clinician.
5	Refill the humidification chamber to the maximum water level mark. Take care not to overfill the chamber.
6	Reconnect the bypassed delivery tubes.
7	Reconnect the heater wire connector, and probe wire.
8	Switch the HC500 on.

CLEANING YOUR HC500 AND DELIVERY CIRCUIT

Changing the Delivery Circuit

Introduction Changing the delivery circuit consists of two tasks:

1. filling the spare humidification chamber
 2. replacing the working circuit with the spare circuit.
-

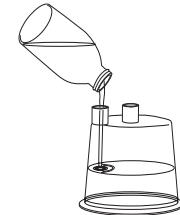
Before you begin

Before you begin this procedure, you will need:

- a bottle of sterile water for filling the humidification chamber
 - a small table or trolley for placing the circuit parts on during the circuit changeover
 - the complete spare circuit. Check that the circuit is clean and dry and is not damaged in any way.
-

TASK 1:

Place the spare humidification chamber on a clean, level surface. Fill the spare humidification chamber with water up to the maximum water level line.



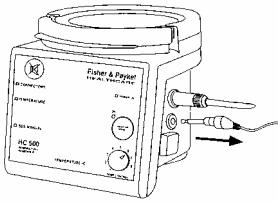
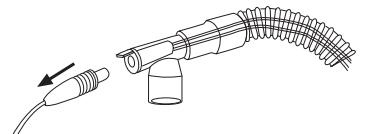
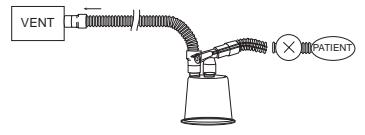
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Changing the Delivery Circuit, Continued

TASK 2: Follow these steps to replace the working circuit with the spare circuit.
Replacing the working circuit

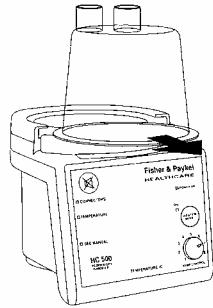
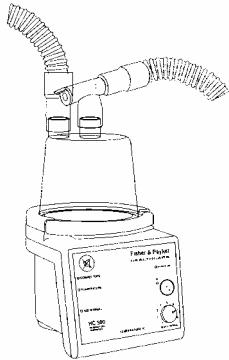
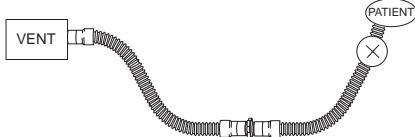
WARNING

- At all times follow the instructions of your clinician before changing the Delivery Circuit.
- Wash your hands before and after cleaning the delivery circuit

<u>Step</u>	<u>Action</u>	<u>Diagram</u>
1	Turn off the HC500.	
2	Disconnect the temperature sensor probe wire from the HC500.	
3	If you are using a heated wire circuit, disconnect the heater wire connector from the patient delivery tube.	
4	Bypass the HC500 temporarily. This is done by: <ul style="list-style-type: none">• disconnecting the patient delivery tube and the ventilator tube at the chamber, then• connecting the patient delivery tube to the ventilator tube. An adaptor may be required. Consult your clinician.	

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Changing the Delivery Circuit, Continued

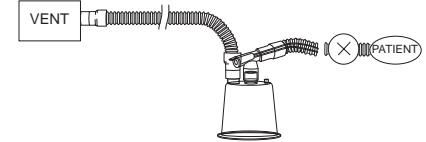
<u>Step</u>	<u>Action</u>	<u>Diagram</u>
5	Remove the humidification chamber from the HC500 by pressing down the chamber guard and sliding the chamber forward off the unit. Place the removed chamber on a level surface away from the humidifier.	
6	<p>Fit the spare humidification chamber onto the HC500 by holding down the chamber guard and sliding the chamber back onto the unit.</p> <p>Connect the spare delivery circuit and ventilator tube to the humidification chamber.</p> <p>NOTE: Ensure that both temperature sensor probes are correctly and securely fitted</p>	
7	Tell the patient you are going to interrupt their ventilation for one or two breaths. Remove the patient delivery tube and ventilator tube currently connecting the patient directly to the ventilator. Place these tubes with the removed humidification chamber.	

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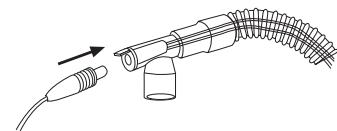
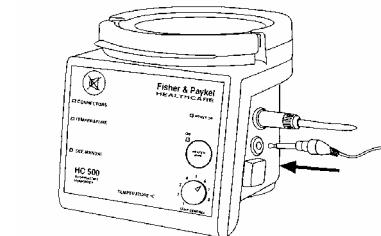
Changing the Delivery Circuit, Continued

<u>Step</u>	<u>Action</u>	<u>Diagram</u>
-------------	---------------	----------------

- 8 Connect the spare patient delivery tube from the chamber to the patient.
- 9 Connect the spare ventilator tube between the chamber and the ventilator.
- 10 Observe the patient's chest and the ventilator pressure manometer during the next inspiration; both should rise.
- 11 If the ventilator does not function correctly, hand ventilate the patient until the problem can be corrected.
- 12 Connect the temperature sensor probe wire to the HC500.



- 13 If you are using a heated wire circuit, plug the heater wire connector into the patient delivery tube and the HC500.
- 14 Switch on the HC500.



What to do next You may now clean the removed circuit, as described in the following pages.

Preparing the Cleaning Equipment

Materials and equipment required	You will need the following materials and equipment to clean the HC500 and accessories:
	<ul style="list-style-type: none">• Suitable medical grade disinfectant, eg Control III

WARNING

- *Keep all cleaning equipment out of reach of children.*

- Plastic 4 to 5 litre (1 gallon) container (with lid) for storing the disinfectant solution
- Measuring spoon or cup
- Liquid dishwashing detergent
- Small brush
- Two basins or buckets
- Disposable paper towels for drying the parts
- Clean plastic bag for storing the cleaned circuit ready for its next use

Use of disinfectant solution

Follow the instructions of your clinician, or the product instructions.

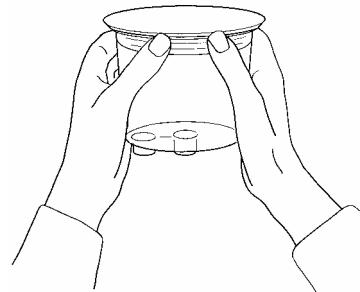
Cleaning the Humidification Chamber

Chamber types Your HC500 may be fitted with a reusable or a single use humidification chamber.

Reusable chambers should be cleaned approximately every 48 hours. Cleaning instructions are described in the following pages.

Single use chambers are intended for use with one patient only and should not be re-used. Please follow the instructions of your Clinician regarding the length of time that you can continue to use one of these chambers and for disposal instructions.

<u>Step</u>	<u>Action</u>
1	Empty any remaining water from the chamber.
2	Push the base off the chamber top



Continued on next page

Cleaning the Humidification Chamber, Continued

- 3 Remove the rubber O-ring from the base. Care should be taken not to damage the O-ring.
- 4 Scrub the chamber parts with a small brush in a basin using warm soapy water.

CAUTION: Do not use abrasive cloths or powders.

- 5 Rinse the chamber parts thoroughly under warm tap water and shake off excess water.
 - 6 Soak the chamber parts in the disinfectant solution following the instructions of your clinician.
 - 7 Rinse thoroughly in clean warm water and then dry.
 - 8 Refit the O-ring onto the base plate and press the base plate into the chamber top.
-

Cleaning the Delivery Tubes

Types of delivery tubes

The HC500 can be operated with two types of delivery tubes:

- reusable
- single use.

These tubes may be either heated or non-heated, depending on the way the HC500 is set up.

Your Clinician will tell you which type of tubes are fitted to your HC500.

NOTE: If your HC500 is fitted with single use delivery tubes, refer to the instruction sheet provided with the delivery tubes. Single use delivery tubes do not require cleaning and should not be disassembled. Consult your Clinician regarding disposal procedures.

When to clean the delivery tubes

The delivery tubes should be cleaned:

- whenever the humidification chamber is cleaned, or
- as recommended by your Clinician.

Continued on next page

Cleaning the Delivery Tubes, Continued

How to clean the temperature sensor probes

CAUTION: Try to ensure that the temperature sensor probe connector does not get wet during cleaning. If it does get wet, dry it thoroughly.

<u>Step</u>	<u>Action</u>
1	Remove the temperature sensor probes from the patient delivery tube.
2	Scrub the probes with a small brush in a basin using warm soapy water.
	CAUTION: Do not use abrasive cloths or powder to clean the probes as this could damage them.
3	Rinse the probes thoroughly under warm tap water and shake off excess water.
4	Soak the probes in the disinfectant solution following the instructions of your clinician. Make sure that the solution completely covers the probes.
5	Rinse thoroughly in clean warm water.
6	Shake excess water from the probes then dry them in a clean place.
7	Store the probes in a clean plastic bag while you clean the delivery tubes.

Continued on next page

Cleaning the Delivery Tubes, Continued

**How to clean
the patient
delivery tubes**

If you are using a heated patient delivery tube.

NOTE: The heater wire should be left inside the tubing during cleaning and should be removed only if absolutely necessary to clean the wire or the tubing.

<u>Step</u>	<u>Action</u>
1	Wash the tubes thoroughly in a basin using warm soapy water. CAUTION: Do not use abrasive cloths or powder to clean the tubes.
2	Rinse the tubes thoroughly under warm tap water and shake off excess water.
3	Soak the tubes in the disinfectant solution following the instructions of your clinician. Make sure that the solution fills and covers the tubes completely.
4	Rinse thoroughly in clean warm water.
5	Empty and shake excess water from the tubes then dry them in a clean place.
6	Refit the cleaned temperature sensor probes to the cleaned patient delivery tube. Ensure that the sensor probes are pressed firmly into their housings.

CAUTION:

For a heated patient delivery tube ensure that the heater wire inside the heated tube is between 25mm-100mm (1 inch-4 inches) from the temperature sensor probe at the patient end of the tube. If the wire is too close to or too far from the sensor probe, the HC500 may produce nuisance alarms.

Cleaning the HC500

Warnings

WARNING

- *Electrical shock hazard. Always switch off the HC500 and unplug the power cord from the power outlet before cleaning.*
- *Never rinse or place the HC500 in water or allow water to get into the interior of the unit.*
- *Ensure that the HC500 is dry before plugging into the power outlet.*

Step

Action

- 1 Switch off the HC500 and unplug it from the power outlet. Allow the heater plate to cool.
- 2 Wipe the exterior of the HC500 with a clean, damp (not wet) cloth. Take care not to disconnect any of the cables coming from the HC500.

Storage Guidelines

Storing the spare circuit

After cleaning, store the spare circuit until it is next needed for use.
The storage conditions should be:

- clean
- dry
- warm
- free from dust.

A large, clean plastic bag is ideal for storage purposes.

Storing the HC500

When not in use, you may wish to store the HC500.
The storage conditions should be the same as for the spare circuit.

Troubleshooting

Introduction

In certain circumstances an alarm indicator on the HC500 may be illuminated.

CAUTION: The HC500 contains no user-serviceable parts. Do not attempt to repair the unit yourself. If the fault persists after you have taken corrective action, contact your Clinician or your Fisher & Paykel Service Representative.

Alarm conditions

Use the following table to determine the cause of the alarm condition and possible remedies.

NOTE: The HC500 audible alarm will also sound.

Alarm Indicator	Possible causes	Action to take
“See Manual” (illuminated but no audible alarm)	Failure of electronic components within the HC500.	<ol style="list-style-type: none"> 1. Switch off the HC500. 2. Leave the HC500 in the circuit so that it can continue to provide some humidification. 3. Have the HC500 checked by a qualified technician as soon as possible.
“Connectors” (flashing)	<ul style="list-style-type: none"> • Missed connection during set-up. • Probe not fully plugged in. • Wire connector not plugged in fully. • Connector wire damage. • Incorrect circuit connected to HC500 • Heater wire function has been turned off while a heater wire is connected. • Heater wire function is turned on without a heater wire connected. • Fault with the heater wire. 	<ul style="list-style-type: none"> • Check that all temperature sensor probe and heater wire connectors are in their correct position. • Check that the connector wires are not damaged. If there is any damage contact your Clinician or your Fisher & Paykel representative to arrange replacement. • Contact your clinician or your Fisher & Paykel representative for advice on the correct circuit. • Either press “Heater Wire” button to resume heated wire mode operation, or unplug the heater wire connector from the heater wire socket to continue in non-heated mode. • Press “Heater Wire” button until the correct function is selected. • Replace the heater wire.

Continued on next page

Troubleshooting, Continued

Alarm Indicator	Possible causes	Action to take
“Temperature” (flashing)	No water in chamber.	Refill the humidification chamber.
	Sudden increase in air flow.	Push the Mute button and wait for the temperature to settle. If the alarm persists: 1. Switch off the HC500. 2. Leave the HC500 in the circuit so that it can continue to provide some humidification. 3. Have the HC500 checked by a qualified technician as soon as possible.
	Distance between heater wire and the temperature sensor probe is too small.	Ensure that the distance between the heater wire and the temperature sensor probe is at least 25 mm (1 inch).
	Distance between heater wire and the temperature sensor probe is too great.	Ensure the distance between the heater wire and the temperature sensor probe is less than 100mm (4 inches).
	Temperature probe is not inserted at the chamber outlet.	Fit the probe at the chamber outlet correctly.
	Poor contact between the base of the chamber and the heater plate.	Check the chamber base and heater plate are clean, smooth and flat. Replace if necessary.
	The air flow has been stopped or interrupted.	Switch the HC500 off until flow is resumed.
	Temperature probe is not inserted at the patient end of the patient delivery tube.	Fit the temperature sensor probe correctly.

Continued on next page

Troubleshooting, Continued

Display message	Possible causes	Action to take
The front panel display shows the temperature of air being delivered to the patient. Example: 42	The temperature of air at the patient end of the circuit has exceeded 41° (106° Fahrenheit). NOTE: The “Temperature” indicator will also be flashing.	1. Switch off the HC500. 2. Carry out the checks shown for the “Temperature” alarm on the previous page.

INSTALLATION INSTRUCTIONS

HC500 Parts Checklist

HC500 and accessories When you receive the HC500, check the contents of the package against the list below.

NOTE: If any items are missing or damaged, contact your Fisher & Paykel representative.

WARNING

- *Use only Fisher & Paykel approved chambers, circuits and accessories. Performance and safety cannot be guaranteed if other types of accessories are used.*

Item description	Part number reference	Number in pack
HC500 Humidifier	HC500	1
Heater wire connector	900MR558	1
Tamper proof control knob	693040483	1
Replacement fuses	See Technical Manual	4
HC500 Operating manual	185041080	1

NOTE: 900MR558 connector is not supplied in US or Canadian models.

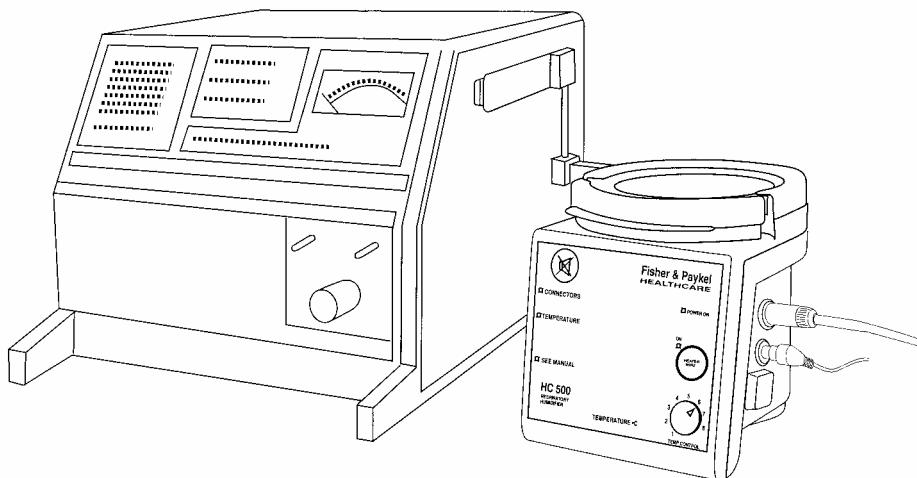
Fitting the HC500 to the Ventilator

Introduction

A suitable ventilator mounting bracket is required to fit the HC500 securely to the ventilator.

Fisher & Paykel provide a variety of mounting bracket options. Contact your Fisher & Paykel representative.

Most ventilator manufacturers supply humidifier mounting brackets. Please follow the bracket installation instructions to mount the HC500 to your ventilator.



Information about Heater Wire Connection

Heater wire operation modes The HC500 can operate in either non-heated wire or heated wire mode.

Non-heated wire mode

The non-heated wire mode:

- enables delivery of sufficient levels of humidity and temperature
- provides the security of patient airway monitoring and alarms.

When the HC500 has a non-heated patient delivery tube, it will operate only in non-heated wire mode.

NOTE: The heater wire connector should be disconnected from the HC500 when in the non-heated wire mode.

Heated wire mode

The heated wire mode provides, in addition to the non-heated wire features:

- stable temperature maintenance
- minimum condensation
- prolonged water endurance through more efficient operation.

When the HC500 has a heated patient delivery tube, it should be operated in heated wire mode.

Switching modes The procedure for switching the HC500 between the two modes is described in “Switching Heater Wire Modes”.

Assembly of Heated Wire Circuits

Before you begin

Before you begin this procedure, you will need:

- a clean patient delivery tube of suitable diameter and length for the intended application
- a 900MR558 heater wire connector
- a connector with a temperature sensor probe port
- an adaptor if the cuff on the patient delivery tube is not 22mm in diameter
- a heater wire assembly 25-100mm (1-4 inches) shorter than the patient delivery tube.
- a suitable Fisher & Paykel draw wire

WARNING

- *Do not assemble reusable heater wires into single use tubing.*

Re-assembly

It is recommended that the heater wire be kept within the patient delivery tube as much as possible during normal use and cleaning.

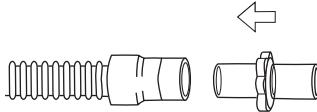
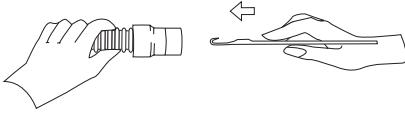
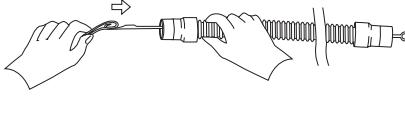
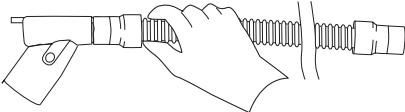
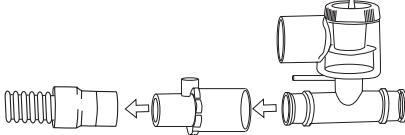
When it becomes necessary to remove the wire for checking, cleaning or replacement, follow the directions below for re-assembly

Follow these steps to assemble the heater wire into the patient delivery tube.

<u>Step</u>	<u>Action</u>
1	Clean all circuit parts following the instructions in the previous chapter.
2	Check that there are no splits or holes in the tubing. If there is any sign of damage, do not use.
3	Check that there is no damage to the heater wire insulation, particularly in the area of the loop and connector. If there is any sign of damage, do not use.

Continued on next page

Assembly of Heated Wire Circuits, Continued

<u>Step</u>	<u>Action</u>	<u>Diagram</u>
4	If the cuff of the tube is not 22mm in diameter, place the adaptor in one end of the tube.	
5	Examine the draw wire to ensure it is free from burrs and sharp edges. Replace if damaged.	
6	Thread the draw wire through the patient delivery tube, hook first (from the non-adaptor end if an adaptor is being used).	
7	Place the loop of the heater wire over the hook of the draw wire and gently pull the heater wire through the tubing until the wire housing and tube are just touching. CAUTION: Do not use the draw wire to pull the wire housing onto the tube. Ensure that the heater wire is straight, not bunched inside the tube.	
8	Push the draw wire forward and turn slightly to disengage the hook.	
9	Join the heater wire housing and the circuit tube carefully by hand.	
10	Place the connector onto the patient end of the tube.	

PREPARING THE HC500 FOR THE CAREGIVER

Switching Heater Wire Modes

Introduction The HC500 can be operated in heated wire mode or non heated wire mode. To minimise rainout and have accurate control of delivered humidity and temperature use the heated wire mode.

How to switch modes The HC500 may be set to either heated wire mode or non-heated wire mode, and the unit will remain in the previously set mode each time it is switched on. The HC500 is factory set to the heated wire mode.

To Operate in Heated Wire Mode:

- | <u>Step</u> | <u>Action</u> |
|-------------|---|
| 1 | Check that the heater wire connector is plugged into the heater wire socket. |
| 2 | Press the “Heater Wire” button firmly to turn the power to the heater wire on. The green indicator light above the “Heater Wire” button will illuminate to indicate that the unit is now in heated wire mode. |

To Operate in Non-Heated Wire Mode:

- 1 Remove the heater wire connector from the heater wire socket.
 - 2 Press the “Heater Wire” button firmly. The green indicator light above the Heater Wire button will turn off, indicating that the unit is now in non-heated wire mode.
-

Setting Control Parameters

Procedure:
**Heated wire
mode**

In the heated wire mode the control knob sets the temperature at the patient end of the patient delivery tube.

- | <u>Step</u> | <u>Action</u> |
|-------------|--|
| 1 | Turn on the HC500 and remove the tamper proof control knob if it is installed. |
| 2 | Adjust the control knob and notice that the display flashes a number on and off. The number is the temperature setting. Continue adjusting until the desired set temperature is displayed.

Use the chart below to assist in setting the set temperature |

CONTROL KNOB	AIR TEMPERATURE (°C)			
	Chamber Temp. Offset			
	-1	-2	-3	-4
1	32	33	34	35
2	33	33	34	35
3	34	34	34	35
4	35	35	35	35
5	36	36	36	36
6	37	37	37	37
7	38	38	38	38
8	39	39	39	39
	DEFAULT			

Recommended
temperature
range

- 3 The chamber temperature offset is the temperature gradient from the patient temperature sensor probe to the chamber temperature sensor probe. The factory setting is -3°C, therefore the chamber temperature will be 3°C less than the patient temperature. The offset affects relative humidity and condensation in the patient delivery tube.
- 4 Insert the tamper proof temperature control knob if necessary.

Continued on next page

Setting Control Parameters (Continued)

Procedure:
**Non Heated
wire mode** In the non heated wire mode the control knob sets the temperature of the heater plate. The heater wire connector should not be installed and a non heated wire delivery circuit used.

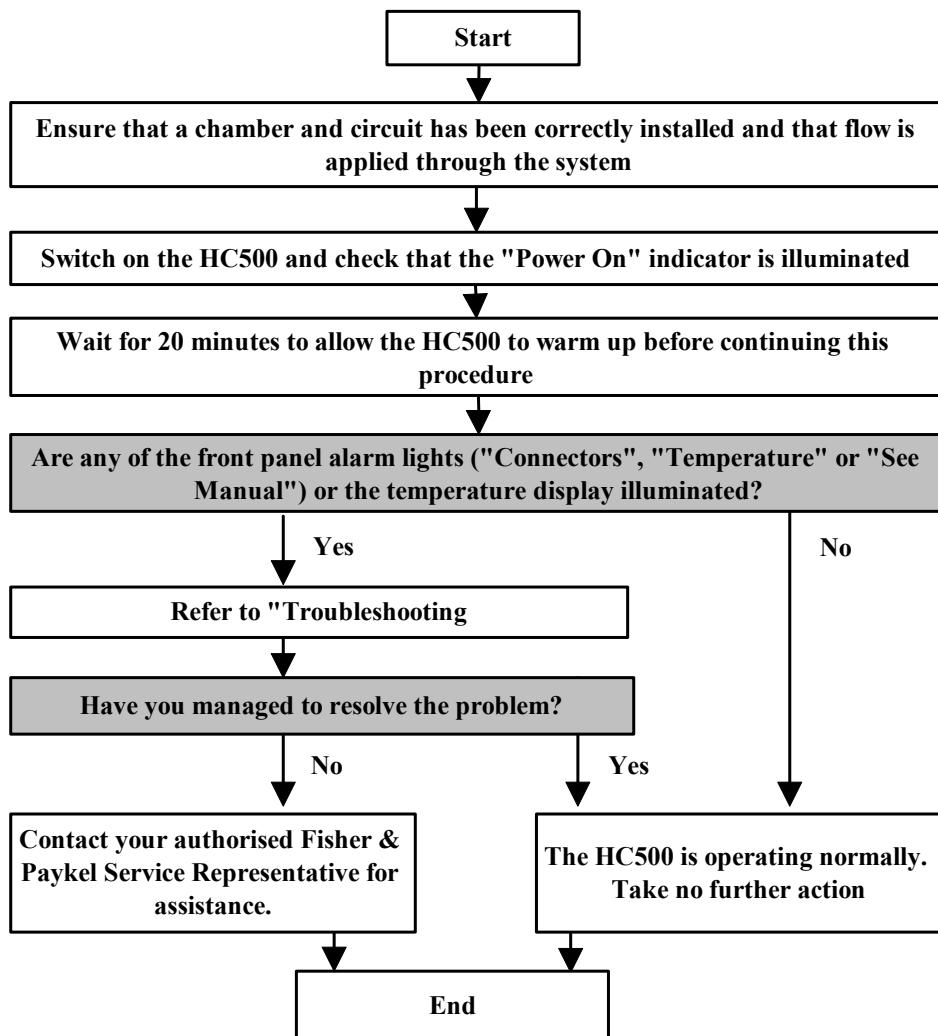
- | <u>Step</u> | <u>Action</u> |
|-------------|--|
| 1 | Turn on the HC500 and remove the tamper proof control knob if it is installed |
| 2 | Refer to Appendix B: Performance Data as a guide to setting the heater plate temperature. Performance will depend on delivery circuit length, air flow velocity and ambient temperature. |
| 3 | A water trap in the delivery circuit may be required to collect excess condensation |

Control knob setting	Heater Plate Control (°C)
1	45
2	50
3	55
4	60
5	65
6	70
7	75
8	80

- 4 Insert the tamper proof temperature control knob if necessary.
-

Test Instructions

Procedure Use this flow chart to test the operation of the HC500 once it has been installed.



Caregiver Training Instructions

Caregiver training checklist

It is extremely important that the caregiver who is to operate the HC500 understands their responsibilities regarding the use and maintenance of the unit.

To ensure that the caregiver/operator of the HC500 is familiar with the operation of the unit, you should go through each item in the following checklist with them.

Use the procedures and diagrams from the Caregiver part of this manual as you explain each topic to the operator.

Main topic	Explain and demonstrate	Comments	Check (✓)
Operating the HC500	Parts of the HC500 and its accessories.	Describe each part, naming it and relating it to the diagrams in this manual.	
	Switching the HC500 on/off	Caregiver to demonstrate	
	Switching Heater Wire Modes	Give careful instructions regarding use of two modes and changing modes. Caregiver to demonstrate	
	Bypassing the HC500.	Caregiver to demonstrate	
	Refilling the humidification chamber.	Caregiver to demonstrate	
Cleaning the HC500	Assembling and dis-assembling the HC500 and delivery circuit.	Caregiver to demonstrate	
	Cleaning the humidification chamber.	Caregiver to demonstrate	
	Cleaning the patient delivery tubes.	Caregiver to demonstrate	
	Cleaning the HC500.	Caregiver to demonstrate	
Troubleshooting	The meaning of the alarm indicators and what steps to take if the HC500 alarms.	Use the Troubleshooting table in the Caregiver part of the manual.	

MAINTAINING THE HC500

Fault Finding

Alarm indicators

In certain circumstances the HC500 may display an alarm indicator. The alarm indicator consists of an indicator light on the front panel accompanied by an audible warning tone.

For details of corrective action, refer to the “Troubleshooting” checklist in the Caregiver part of this manual.

In most cases, the problem causing an alarm indication can be resolved by the caregiver.

Alarm codes

In the event of a fault the HC500 may display an alarm code. The alarm code is displayed on the HC500 front panel.

The code consists of an alphabetic character such as “E” followed by up to two other characters.

Dealing with an alarm code

In the event that an alarm code is displayed, the HC500 will require service.

Please take a note of the code and advise the technician. A full list of alarm codes is included in the HC500 Technical Manual.

Recommended Maintenance Schedule

Six Monthly	<u>Step</u>	<u>Action</u>
	1	Check all external cables and connections as described below.
	2	Check temperature sensor probe for damage to sensor tips, abrasion of the cable or tarnishing of electrical contacts. Clean with alcohol on a swab or replace as necessary.
	3	Remove and check the reusable heater wire (if fitted) for kinks and abrasions. Replace if necessary.
	4	Check heater wire connector for damage to cable and both end plugs. Check for correct coupling of the plugs with their respective sockets on the heater base and heater wire assembly.
	5	Check humidifier power cable for damage and replace as necessary.
	6	Plug the temperature sensor probe and heater wire (if fitted) into the humidifier and switch on. Observe correct operation of the power up self test. Check for no immediate alarms and correct display of ambient temperature.
	7	Continue to run for at least 30 seconds by which time all the relevant internal tests will have been completed. Switch off.
	8	Perform the “dual probe temperature test” as outlined in Section 4.4 of the HC500 Technical Manual.
Annually	1	Perform the "Performance Check" as outlined in Section 4.0 of the HC500 Technical Manual.

Appendix A: Product Specification

General specifications

The general specifications of the HC500 are shown in the following table.

Dimensions	135 x 170 x 156mm (without chamber fitted).
Weight	2.8kg (without chamber fitted) 3.1kg (with a chamber fitted and filled with water)
Maximum operating pressure	20kPa
Maximum peak flow	70 L/min
Maximum continuous flow	30 L/min
Ambient operating temperature	18° to 25°C
Temperature display	Three digit red LED (14mm, 7-segment)
Display range	5° to 80°C
Display accuracy	± 0.5°C (between 25° to 45°C)
Power On indicator	Continuous green LED
Alarm indicators	<ul style="list-style-type: none"> • Single red flashing LEDs for temperature and electrical connectors • Audio transducer
Alarm parameters	<p><u>Airway temperature</u> Alarm at 41°C (or greater) Alarm at 30°C (or less) in heated wire mode only. <u>Chamber temperature (heated wire mode only)</u> 47°C over temperature alarm, or 41°C (or greater) for more than 20 minutes.</p>
Temperature control range	32° to 39°C Airway temperature (Heated wire mode) 45° to 80°C Heater Plate (Non-heated wire mode)
Heater Wire mode indicator	Continuous green LED
Maximum heater plate temperature	80°C Non-heated wire mode 100°C Heated wire mode

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Appendix A: Product Specification, Continued

Electrical specification

The electrical specification of the HC500 is shown in the following table.

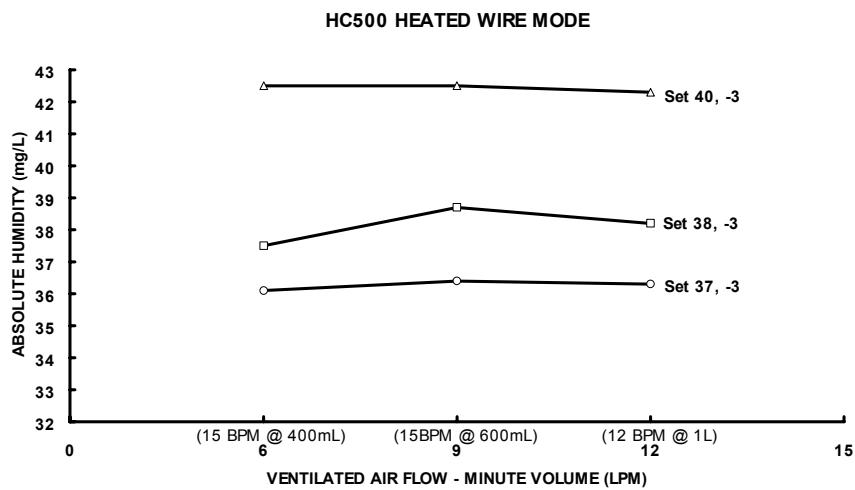
Feature	Specification	
Supply voltage	230V ±20V 115V	
Supply frequency	50 - 60 Hz	
Supply current	0.5A max at 230V 0.9A maxi at 115V 0.8A max at 230V 1.5A max at 115V	Non-heated wire mode Non-heated wire mode Heated wire mode Heated wire mode
Heater wire capacity	60W	
Water heater	85W	
Heater plate overheat protector	Operates at 118°C ±6°C	

Standards compliance

The HC500 is designed to comply with the following standards.

Feature	Standards
Designed to conform to the requirements of:	UL2601-1, CSA-C22.2 No.601.1 IEC601-1, AS3200.1
Classification	<ul style="list-style-type: none"> • Class 1 • Type B • Drip proof • Continuous operation • Not to be used in the presence of flammable anaesthetics.

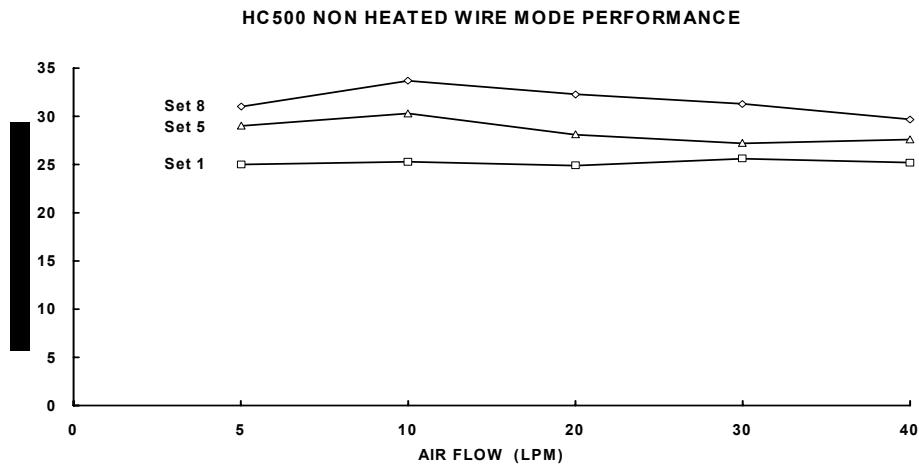
Appendix B: Performance Data



Heated Wire Performance Chart
1.5 Metre Heated Wire Hose, HC335 Chamber

Continued on the next page

Appendix B: Performance Data, Continued



Non Heated Wire Performance Chart
1.5 Metre Hose, HC335 Chamber
