

WarmTouch™

Convective Warming Unit



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1 Introduction

1.1 Overview

This manual, for use by qualified personnel only, contains instructions for servicing, testing, and maintaining the Covidien WarmTouch™ Convective Warming Unit. The manual includes all information necessary for troubleshooting problems with the warming unit and replacing affected components, including parts lists, replacement procedures, and system diagrams.

<i>Safety Information</i>	<i>Page 1-2</i>
<i>ESD (Electrostatic Discharge) Precautions</i>	<i>Page 1-7</i>
<i>Tools Required for Service</i>	<i>Page 1-7</i>
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1.2 Safety Information

This section lists safety information associated with the warming unit. Where appropriate in the manual, individual Warnings and Cautions are repeated as reminders. Please familiarize yourself with this safety information before servicing the warming unit.

For reference, additional Warnings and Cautions that apply to operating the warming system in the clinical environment are provided in [Warnings \(Patient Treatment\)](#) on page 1-4 and [Cautions \(Patient Treatment\)](#) on page 1-6.

1.2.1 Safety Symbol Definitions

Table 1-1. Safety Symbol Definitions

Symbol	Definition
	WARNING Warnings alert users to potential serious outcomes (death, injury, or adverse events) to the patient, user, or environment.
	Caution Cautions alert users to exercise appropriate care for safe and effective use of the product.
	Note Notes provide additional guidelines or information.

1.2.2 Warnings (Service)



WARNING:

Possible electric shock hazard. Grounding reliability can be achieved only when the warming unit is connected to a suitable mains outlet with protective earth grounding.



WARNING:

The use of accessories or cables with the warming system other than those indicated in this manual may result in non-compliance with the specifications listed in [Electromagnetic Compatibility \(EMC\)](#) on page 13-4.

**WARNING:**

No modification of this equipment is allowed. Modification can result in death, injury, or property damage.

**WARNING:**

Before attempting to open or disassemble the warming unit, disconnect the power cord from the AC power source.

**WARNING:**

Do not operate the warming unit with the filter enclosure removed.

1.2.3 Cautions (Service)

**Caution:**

Do not spray, pour, or spill any liquid on the warming unit, its accessories, connectors, switches, or openings in the case.

**Caution:**

The HEPA filter must be replaced every 2,000 hours of operation or 365 days, whichever comes first.

**Caution:**

Operation of the warming system may affect or be affected by other devices in the vicinity due to electromagnetic interference (EMI). If interference occurs, try increasing the distance between devices, repositioning the cabling, or plugging the devices into separate outlet circuit branches. Reference [Electromagnetic Compatibility \(EMC\)](#) on page 13-4 for additional guidance.

**Caution:**

The institution should follow local governing ordinances and recycling instructions regarding disposal or recycling of filter and device components or end of life of the product.

**Caution:**

Observe ESD (electrostatic discharge) precautions when servicing the warming unit.

1.2.4 Warnings (Patient Treatment)

The following additional Warnings apply to operating the warming system in a clinical environment for patient treatment:



WARNING:

Possible explosion hazard. Do not use the device in the presence of flammable anesthetics or in an oxygen-rich environment.



WARNING:

No free-hosing. Keep hose nozzle connected to a WarmTouch™ blanket at all times or thermal injury may occur.



WARNING:

Possible burn or infection hazard. Do not allow warming blanket to come in contact with open wounds. All patients' wounds should be covered while using the warming system.



WARNING:

Possible patient burns. Use caution and consider discontinuing use on patients during vascular surgery when an artery to an extremity is clamped. Do not apply the warming system to ischemic limbs.



WARNING:

Thermal injury may occur if the warming unit hose comes into contact with the patient.




WARNING:


Possible fire hazard. Prevent the blanket material from coming into contact with a laser or an electrosurgical active electrode.





WARNING:


Continuously monitor the patient's temperature during treatment with the warming system. Use good clinical judgment in selecting and adjusting temperature settings based on the patient's warming needs and response to treatment.

 **WARNING:**
Using the warming system on patients with transdermal medication patches may increase the rate of drug delivery, potentially causing harm to the patient.

 **WARNING:**
Thermally conductive materials, such as water, gel, and similar substances, can decrease the patient's body temperature when the warming unit is switched off.

 **WARNING:**
Do not use the warming system during magnetic resonance imaging (MRI) scanning.


 **WARNING:**
Do not operate the warming system in a stacked configuration with other equipment.

 **WARNING:**
Do not operate the warming system adjacent to other equipment. If such a configuration cannot be avoided, first test the warming system in the intended configuration to verify normal operation.

 **WARNING:**
Use WarmTouch™ blankets only as directed. Carefully follow the *Instructions for Use* provided with the blankets regarding proper handling and positioning.

 **WARNING:**
WarmTouch™ blankets are for single patient use only.

 **WARNING:**
Clean the warming unit after each use, as described in this manual.

 **WARNING:**
If a fault or sudden change in performance occurs in the warming system, discontinue use. Notify your sales/service center. The unit must be serviced by qualified personnel using procedures provided in the *Service Manual*.



WARNING:

Possible electrical shock hazard. To reduce the risk of electrical shock, do not remove the back case. Servicing is only to be done by qualified personnel.

1.2.5 Cautions (Patient Treatment)

The following additional Cautions apply to operating the warming system in a clinical environment for patient treatment:



Caution:

Federal (U.S.A.) law restricts the use of the warming system to sale by or on the order of a physician.



Caution:

Only use WarmTouch™ blankets with the WarmTouch warming unit. Do not attempt to use other types of blankets with the warming unit. Similarly, do not attempt to use WarmTouch blankets with other types of warming units.



Caution:

The USB port on the warming unit is for service use by qualified personnel only. During patient treatment, a USB cable must not be connected to the warming unit.

1.3 ESD (Electrostatic Discharge) Precautions



Caution:

Observe ESD (electrostatic discharge) precautions when servicing the warming unit.

To avoid damaging ESD-sensitive components while service the warming unit, follow all appropriate ESD guidelines. These guidelines include:

- Using an ESD wrist strap, properly connected to a reliable ground.
- Using an anti-static mat.
- Handling ESD-sensitive components properly. (Do not touch connection points, connector pins, leads, or terminals.)
- Keeping non-conducting materials (plastic containers, foam cups, synthetic clothing, cellophane tape, etc.) away from the work area.

1.4 Tools Required for Service

- Electrical leakage tester
- Ground bond tester
- Ohmmeter or digital multi-meter with resistance function
- Temperature probe (see [page 7-2](#) for requirements)
- Torque driver with:
 - #1 Phillips bit
 - #2 Phillips bit
 - 11/32" hex socket
 - 10mm hex socket

(See [Table 1-2](#) on page 1-8 for torque requirements.)

- 10 mm open-end or box wrench
- 70% isopropyl alcohol solution and soft cloth for cleaning
- Small flat-blade screwdriver
- Pliers

- Medium flat-blade screwdriver with long handle
- Knife, box cutter, or similar tool with a thin, stiff blade
- Wire cutters
- Small knife or scissors
- Cable ties
- Strap or cable tie to wrap around handle of unit and hose duct adapter
- Non-metallic stylus or similar tool
- Ruler
- Small rubber mallet or similar tool
- Handheld blow-dryer

Table 1-2. Torque Requirements

Item	Bit	Torque (Metric)	Torque (English)
USB port cover screw	Phillips #2	1.1 to 1.5 N-m	9.7 to 13.3 lb-in
USB cable connector screws	Phillips #1	0.18 to 0.27 N-m	1.6 to 2.4 lb-in
Filter enclosure screws	Phillips #2	1.2 to 1.6 N-m	10.6 to 14.2 lb-in
Front/rear enclosure screws	Phillips #2	1.1 to 1.5 N-m	9.7 to 13.3 lb-in
UI PCBA screws	11/32" socket	0.4 to 0.6 N-m	3.5 to 5.3 lb-in
Power PCBA screws	Phillips #2	1.1 to 1.5 N-m	9.7 to 13.3 lb-in
Speaker screws	Phillips #2	1.1 to 1.5 N-m	9.7 to 13.3 lb-in
Power supply screws	Phillips #1	0.4 to 0.6 N-m	3.5 to 5.3 lb-in
Equipotential stud screws	10mm socket	3.2 to 3.8 N-m	28.3 to 33.6 lb-in
AC power inlet screws	Phillips #1	0.4 to 0.6 N-m	3.5 to 5.3 lb-in
Fan assembly screws	Phillips #2	1.1 to 1.5 N-m	9.7 to 13.3 lb-in

1.5 Serial Number, Software Version, and Error Codes

Prior to servicing the warming unit, note the unit's serial number, software version, and any error codes.

The serial number is located on the back of the warming unit (*Figure 1-1*).

Figure 1-1. Serial Number Label on Back of Warming Unit



TEM_10120_A

The software version number and error codes can be obtained from the warming unit's System Information screen as described below.

To access the System Information screen:



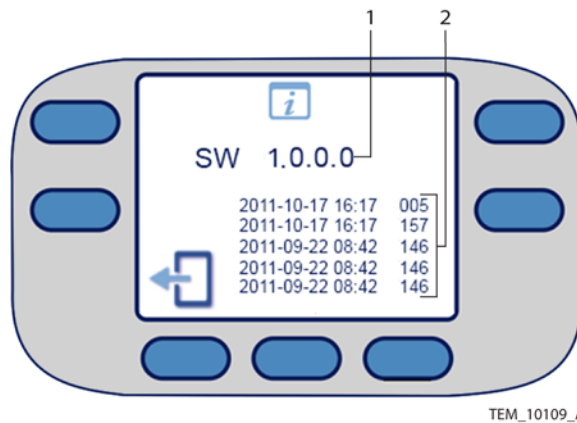
-  1. Plug the warming unit's power cord into the outlet, and press the **On/Standby** key.
-  2. Press the **Menu** key. The Menu screen appears (*Figure 1-2*).

Figure 1-2. Menu Screen



3. Press the **System Information** key. The System Information screen shows the software version and the most recent error messages, if any (Figure 1-3).

Figure 1-3. System Information Screen



- 1 Software Version 2 Error Messages (Up to Six)

**Note:**

Time stamps associated with error messages do not necessarily reflect local time. The warming unit is set to UTC (Coordinated Universal Time) at manufacture.



4. To return to the Main screen, press the **Exit** key twice.



5. Press the **On/Standby** key to power off the unit.

1.6 Component Disposal - WEEE Directive



The warming unit contains components that must be disposed of in accordance with WEEE Directive. Do not dispose of the warming unit as a whole or the following individual components as unsorted municipal waste:

- Power cord – [page 8-5](#)
- Display (LCD) – [page 10-8](#)
- User Interface (UI) PCBA – [page 10-12](#)
- Clock battery – [page 10-29](#)
- Power PCBA – [page 10-31](#)
- Power supply – [page 10-43](#)

1.7 Labeling Symbols

Table 1-3 defines the symbols that appear on the warming unit or its shipping label.

Table 1-3. Symbols on the Warming Unit and Shipping Label












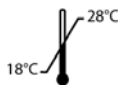












Symbol	Description	Appears On...	
		Warming Unit	Shipping Label
	By prescription only	X	X
	No Free Hosing: Hose nozzle must be connected to a WarmTouch™ blanket or thermal injury may occur.	X	
	Do not use during magnetic resonance imaging (MRI).	X	X
	Degree of protection from electric shock: Protection Class I, Type BF applied part	X	
	Recommendation to consult accompanying documents	X	X
	Requirement to consult accompanying documents	X	X
	Nature of power supply: Alternating Current (AC)	X	
	Potential equalization conductor terminal Used to access the warming unit's electrical ground for electrical safety testing	X	
	Universal Serial Bus (USB) port (For service use by qualified personnel only)	X	
	Keep dry	X	X
	Temperature limitations (shipping/storage): -40°C to +70°C		X

Table 1-3. Symbols on the Warming Unit and Shipping Label (Continued)

Symbol	Description	Appears On...	
		Warming Unit	Shipping Label
	Temperature limitations (operating): +18°C to +28°C	X	
	Relative humidity limitations (shipping/storage): 10% to 95% (non-condensing)		X
	Relative humidity limitations (operating): 15% to 85% (non-condensing)	X	
	Atmospheric pressure limitations (shipping/storage): 12 kPa to 106 kPa		X
	Atmospheric pressure limitations (operating): 70 kPa to 106 kPa	X	
	CE – Conformité Européene authorization mark 0123 – TÜV SÜD Product Service GmbH (notified body) Signifies compliance with Medical Device Directive 93/42/EEC	X	X
	CSA – Canadian Standards Association certification mark	X	
	European Community (EC) authorized representative	X	X
	Serial number	X	X
	Catalog number	X	X
	Manufacturer	X	X
	Date of manufacture	X	X
	Proper waste disposal for electrical and electronic equipment (WEEE)	X	

1.8 Obtaining Technical Assistance

For technical assistance or to order parts and additional manuals, contact Covidien Technical Services or a local Covidien representative.

When contacting Covidien for troubleshooting or service issues, please provide the information described in [Serial Number](#), [Software Version](#), and [Error Codes](#) on page 1-9.

Covidien Technical Services		
Covidien Argentina Agüero 351 Capital Federal - 1171 ABC Argentina Tel: (5411) 4863-5300 Fax: (5411) 4863-4142	Covidien Asia Singapore Regional Service Centre 15 Pioneer Hub, #06-04 Singapore 627753 Tel (65) 6578 5288 Fax (65) 6515 5260	Covidien Australia 52A Huntingwood Drive Huntingwood, NSW 2148 Australia Tel: (+61) 1800 - 350702 Fax: (+61) 2967 - 18118
Covidien Austria GmbH Campus21 Europaring F09402 Brunn am Gebrige A-2345 Österreich Tel: (+43) 2236 - 3788 39 Fax: (+43) 2236 - 3788 3940	Covidien Belgie S.A.-N.V. Generaal De Wittelaan 9/5 Mechelen 2800 België Tel +32 152 981 37 Fax +32 152 167 83	Covidien Brazil Av. Das Nações Unidas 12995 Andar 23 - Brooklin São Paulo, SP Brasil 04578-000 Tel: (5511) 2187-6200 Fax: (5511) 2187-6380
Covidien Canada 19600 Clark Graham Baie d'Urfe, QC, H9X 3R8 Canada Tel: 1-514-695-1220, Ext.4004 Fax: 1-514-695-4965	Covidien Chile Camino lo Boza (Ex 8395) Pudahuel Santiago Chile Tel: (562) 739 - 3000 Fax: (562) 783 - 3149	Covidien China 2F, Tyco Plaza 99 Tian Zhou Rd Shang Hai 200233 P.R. China Tel: (+86) 4008 1886 86 Fax: (+86) 2154 4511 18
Covidien Colombia Edificio Prados de la Morea Carretera Central Del Norte (Cra 7a) Kilometro 18, Chia-Cundinamarca Bogota, Colombia Tel: (571) 619-5469 Fax: (571) 619-5425	Covidien Costa Rica Global Park, Parkway 50 La Aurora de Heredia Costa Rica Tel: (506) 2239 - 5386 Fax: (506) 2239 - 5319	Covidien ECE Prosecká 851/64 190 00 Praha 9 Česká republika Tel: +420 239 000 711 Fax: +420 239 000 437

Covidien Technical Services (Continued)		
<p>Covidien Danmark A/S Langebrogade 6E, 4. sal 1411 København K Danmark Tel +45 702 753 50 Fax:+45 702 756 50</p>	<p>Covidien Deutschland GmbH Technisches Service Center Raffineriestr. 18 93333 Neustadt / Donau Germany Tel + 49 944 595 93 80 Fax + 49 944 595 93 65</p>	<p>Covidien ECE Galvaniho 7/a 821 04 Bratislava Slovakia Tel.: +421 248 214 573 Fax: +421 248 214 501</p>
<p>Covidien Finland Oy Läkkisepäntie 23 00620 Helsinki Finland Te. +35 896 226 84 10 Fax +35 896 226 84 11</p>	<p>Covidien France SA Parc d'affaires Technopolis Bat. Sigma, 3 Avenue du Canada LP 851 Les Ulis 91975 Courtaboeuf Cedex France Tel +33 169 821 416 Fax +33 169 821 532</p>	<p>Covidien Hong Kong Unit 12 - 16, 18/F BEA Tower Millennium City 5 4187 Kwun Tong Road Kwum Tong, Kowloon, Hong Kong Tel + 852 3157 7299 Fax + 852 2838 0749</p>
<p>Covidien India 10th Floor Building No 9B DLF Cyber City Phase III Gurgaon Haryana - 122002 India Tel + 91 1244 709800 Fax + 91 1244 206850</p>	<p>Covidien Hungary 1095 Budapest Mariassy u. 7 Magyarország Hungary Tel + 36 1880 7975 Fax + 36 1777 4932</p>	<p>Covidien Ireland Block G, Ground Floor, Cherrywood Technology Park, Loughlinstown County Dublin, Ireland Tel +353 1 4381613 Fax 353 1 439 3039</p>
<p>Covidien Israel 5 Shacham St. North Industrial Park Caesarea 38900 Israel Tel +97 246 277 388 Fax+97 266 277 688</p>	<p>Covidien Italia S.p.A. Via Rivoltana 2/D 20090 Segrate Italy Tel +39 027 030 81 31 Fax +39 027 031 72 84</p>	<p>Covidien Japan Inc. Technical Support Center 83-1, Takashimadaira 1- Chome Itabashi-ku, Tokyo 175-0082 Japan Tel: +81 (0) 3 6859 0120 Fax: +81 (0) 3 6859 0142</p>
<p>Covidien Korea 5F, Hibrand Living Gwan, #215, Yangjae-Dong, Seocho-Gu Seoul, Korea Tel: +822 570 5459 Fax: +822 570 5499</p>	<p>Covidien Mexico Insurgentes Sur # 863, Piso 16 Col. Nápoles Del. Benito Juarez Mexico, D.F. 03810 Mexico Tel: (5255) 5804-1524 Fax: (5255) 5536-1326</p>	<p>Covidien Nederland BV Hogeweg 105 5301 LL Zaltbommel Nederland Tel +31 41 857 66 00</p>

Covidien Technical Services (Continued)		
<p>Covidien Norge AS Postboks 343 1372 Asker. Norway Tel +47 668 522 22 Fax +47 668 522 23</p>	<p>Covidien Panama Parque Industrial Costa del Esta Calle Primera, Edificio # 109 Panama City, Panama Tel: (507) 264-7337 Fax: (507) 236-7408</p>	<p>Covidien Polska Al. Jerozolimskie 162 Warszawa. 02-342 Polska Tel +48 223 122 130 Fax +48 223 122 020</p>
<p>Covidien Portugal Lda. Estrada do Outeiro de Polima, Lote 10-1º Abóboda 2785-521 S.Domingos de Rana Portugal Tel +35 121 448 10 36 /30 Fax +35 121 445 1082</p>	<p>Covidien Puerto Rico Palmas Industrial Park Road 869 Km 2.0 Bdlg. #1 Cataño, PR 00962 Tel. 787-993-7250 Ext. 7222 & 7221 Fax 787-993-7234</p>	<p>Covidien Russia 53 bld. 5 Dubininskaya Street Moscow RUSSIA. 119054 Tel +70 495 933 64 69 Fax +70 495 933 64 68</p>
<p>Covidien Saglik A.S. Maslak Mahallesi Bilim Sokak No: 5, Sun Plaza Kat: 2-3 Sisli, Istanbul 34398 Turkey Tel +90 212 366 20 00 Fax +90 212 276 35 25</p>	<p>Covidien South Africa Corporate Park North 379 Roan Crescent Randjespark Midrand, South Africa Tel +27 115 429 500 Fax +27 115 429 624</p>	<p>Covidien Spain S.L. Business Park World Trade Center Almeda Park Edificio 7 - 3ª planta Plaça de la Pau s/n Cornellà de Llobregat</p>
<p>Covidien Sverige AB Box 54 171 74 Solna Sweden Tel +46 858 56 05 00 Fax + 46 858 56 05 29</p>	<p>Covidien Switzerland Roosstrasse 53 8832 Wollerau Schweiz Tel +41 44786 5050 Fax +41 44786 5010</p>	<p>Covidien Thailand 99 Soi Rubia, Sukhumvit 42 Road 13 - 14 Fl., Berli Jucker Building Prakanong, Klongtoey Bangkok 10110, Thailand Tel +662 2073 - 100 Fax +662 657 - 6325</p>
<p>Covidien UK Unit 2, Talisman Business Park London Road, Bicester OX26 6HR, United Kingdom Tel +44(0)1869 328092 Fax +44(0)1869 327585</p>	<p>Covidien US 15 Hampshire Street Mansfield, MA 02048 USA Tel 1.800.635.5267 Tel 1.925.463.4635 (toll)</p>	

1.9 Related Documents

- *Operator's Manual - Covidien WarmTouch™ Convective Warming System* — This document provides instructions for operating the WarmTouch warming system in a clinical environment.
- *Instructions for Use - Covidien WarmTouch™ Warming Blanket* — This document, provided with WarmTouch warming blankets, contains important information regarding intended use, handling, connection, and positioning of the blanket.

1.10 Warranty Information

To obtain warranty information, contact Covidien Technical Services or a local Covidien representative. Reference [Obtaining Technical Assistance](#) on page 1-14.

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2 Product Overview

2.1 Overview

This chapter provides an introduction to the Covidien WarmTouch™ Convective Warming System, including information about its features and controls.

2.2 Product Description

The warming system provides a means for treating or preventing hypothermia in adult and pediatric patients in clinical settings. The warming system consists of an electronic blower (warming unit) that delivers heated air through a flexible hose to a lightweight blanket placed on the patient. The blanket distributes the heated air through numerous small perforations that allow the air to reach the targeted areas of the patient's body.

2.2.1 Features

- **Multiple Temperature Settings** — A range of temperature settings allows the clinician to customize and adjust treatment based on the patient's needs.
- **Boost Mode** — For rapid warming, air is generated at 47°C for 45 minutes, after which the temperature automatically drops to the 45°C (High) temperature setting.
- **HEPA Filter** — A High Efficiency Particulate Air (HEPA) filter removes at least 99.97% of particles 0.3 micrometers or larger from the air delivered to the warming blanket. The warming unit monitors the amount of time the filter is in use and indicates when the filter needs to be replaced.
- **Automatic Over- and Under-Temperature Protection** — At any of the heated air settings, if the temperature of the generated air is out of range for a specific amount of time, the heater and fan automatically shut off and an alarm is issued.
- **Optional Cart with Wheel Locks** — An optional transport cart, equipped with wheel locks, is available for the warming unit. The wheel locks reduce cart movement while the system is in use.

2.2.2 Indications for Use

The WarmTouch Convective Warming System (warming unit and blanket) is intended for prevention and treatment of hypothermia, and for the management of appropriate normothermia.

2.2.3 Contraindications

None known.

2.2.4 Covidien WarmTouch™ Warming Blankets

The Covidien WarmTouch™ Convective Warming Unit is designed for use with WarmTouch™ blankets only. WarmTouch blankets are designed to attach securely to the warming unit's hose nozzle. The nozzle features guides and a clip to ensure correct orientation.

Do not attempt to use other types of blankets with the warming unit; the performance of the warming system has not been evaluated with other blankets and cannot be predicted.

The warming unit is compatible with all WarmTouch blankets.

2.3 Product Views

2.3.1 Front View

Figure 2-1. Front View



TEM_10110_A

- | | | | |
|---|----------------------|---|------------------------|
| 1 | Operator's Panel | 4 | Hose |
| 2 | Handle | 5 | Nozzle Strap with Clip |
| 3 | No Free-Hosing Label | 6 | Nozzle |

2.3.2 Back View

Figure 2-2. Back View



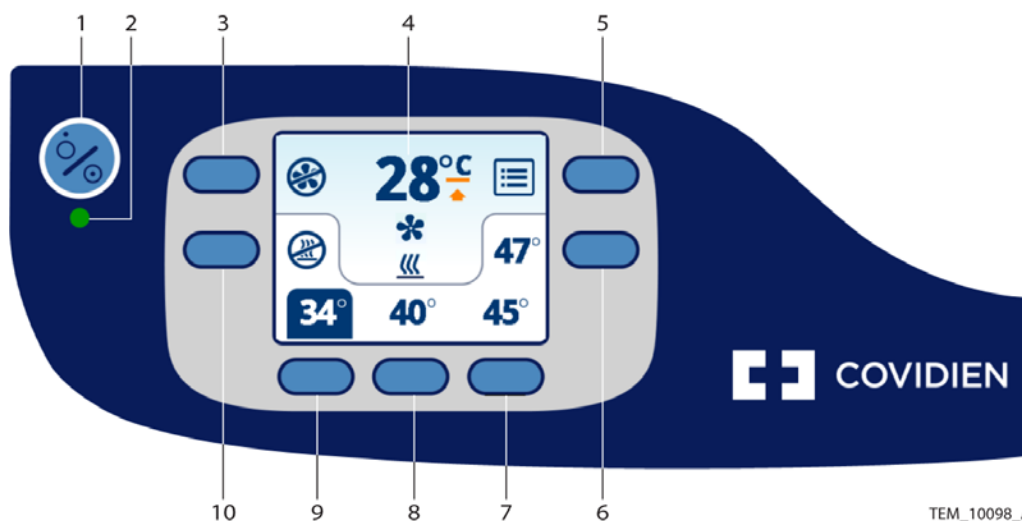
TEM_10111_A







- | | | | |
|---|------------------------|---|-----------------------|
| 1 | No Free-Hosing Label | 5 | Mounting Channel (x2) |
| 2 | Serial Number Label | 6 | Pole Clamp (x3) |
| 3 | Symbols Label | 7 | Bed Hook |
| 4 | USB Port (Under Cover) | 8 | Power Cord |

2.4 Operator's Panel

The operator's panel includes an **On/Standby** key, a multi-functional keypad, and a display that provides temperature and status information. The display indicates the function of each adjacent key. Key functions change based on operating context, as described in subsequent chapters.



Figure 2-3. Operator's Panel



- 1  **On/Standby Key** – Press to place the warming unit in Ready mode or to return to Standby mode. Reference [Beginning Operation](#) on page 4-4 and [Returning to Standby Mode](#) on page 4-8.
- 2  **Status LED** – Indicates the warming unit's operational status. Reference [Overview of Warming Unit Operating Modes](#) on page 4-3.
- 3  **Fan Off Key** – During operation, press to turn off the fan. The heater, if running, shuts off automatically. Reference [Returning to Ready Mode](#) on page 4-7.
- 4 **Temperature/Information Area** – Displays the current air temperature being generated (rounded to the closest 1°C). The following symbols can also appear in this area:
 -  Dashes instead of a temperature reading indicate that the warming unit is in Ready mode (both heater and fan are off).
 -  Animated symbol indicates that the fan is on.
 -  Animated symbol indicates that the heater is on.



Animated arrow indicates that the temperature is adjusting upward or downward to a new setting. The symbol disappears when the temperature is within 1.5°C of the new setting.

- 5  **Menu Key** – Press to access screens for viewing filter status and system information. Reference [Monitoring the Filter Status](#) on page 5-10 and [Serial Number, Software Version, and Error Codes](#) on page 1-9.
Note: Symbol is shown for reference only. This menu is accessible only when the heater and fan are off (Ready mode).
- 6 **47°** **47°C (Boost Mode) Key** – Press to generate air at 47°C (116.6°F) for 45 minutes. Reference [Using Boost Mode](#) on page 4-6.
- 7 **45°** **45°C (High) Key** – Press to generate air at 45°C (113°F). Reference [Controlling the Temperature](#) on page 4-5.
- 8 **40°** **40°C (Medium) Key** – Press to generate air at 40°C (104°F). Reference [Controlling the Temperature](#) on page 4-5.
- 9 **34°** **34°C (Low) Key** – Press to generate air at 34°C (93.2°F). Reference [Controlling the Temperature](#) on page 4-5.
- 10  **Heat Off Key** – Press to deliver air at room temperature (unheated). Reference [Controlling the Temperature](#) on page 4-5.



Note:

When you press any of the temperature setting keys, the **Heat Off** key, or the **Fan Off** key, the setting is highlighted on the display to indicate the current selection. For example, in the previous figure, 34° is the current selection.



Note:

A soft click tone indicates a successful key press.

3 Installation

3.1 Overview

This chapter contains information for installing the Covidien WarmTouch™ Convective Warming Unit.

3.2 Safety Reminders



WARNING:

The use of accessories or cables with the warming system other than those indicated in this manual may result in non-compliance with the specifications listed in *Electromagnetic Compatibility (EMC)* on page 13-4.



WARNING:

No modification of this equipment is allowed. Modification can result in death, injury, or property damage.

3.3 Attaching the Power Cord

The warming unit is shipped with a power cord appropriate to the country of use.

To attach the power cord:

1. Position the warming unit on its front so the bottom of the unit is accessible (*Figure 3-2*).

Figure 3-1. Positioning the Unit for Power Cord Installation



- 1 Power Cord Routing Bracket 2 Power Cord Socket

2. Insert the power cord into the socket on the warming unit, making sure that it is fully seated.

Note: Do not route the power cord through the metal hook on the filter enclosure.

3. Press the power cord into the routing bracket until it is completely seated (*Figure 3-2*). If necessary, use a screwdriver to carefully spread the sides of the bracket while inserting the cord.

Figure 3-2. Power Cord Connection



TEM_10263_A

4. Set the warming unit upright. Wrap the power cord around the back of the unit, and secure it with the attached strap (*Figure 3-3*).

Figure 3-3. Power Cord Wrapped and Secured



TEM_10113_A

3.4 Installing the Warming Unit

The warming unit can be used as a standalone device, or it can be mounted on an IV pole, bed, or optional transport cart. The following sections provide mounting instructions.

3.4.1 IV Pole Installation

The warming unit can be mounted on an IV pole with a maximum diameter of 3.2 cm (1.25 inches) and a minimum diameter of 1.9 cm (0.75 inches).

To avoid tipping, the warming unit must be mounted on the pole with the handle no higher than 76 cm (30 inches) above the floor.

Requirements:

- Measuring tape

To install the warming unit on an IV pole:

1. On the IV pole, mark the maximum mounting height. The warming unit's handle must be no higher than 76 cm (30 inches) above the floor.
2. Ensure that the power cord is secured at the back of the warming unit. Reference [Figure 3-4](#) on page 3-6.
3. Locate the mounting channel with two clamps at the back of the warming unit. Do not use the mounting channel with one clamp. Reference [Figure 3-4](#) on page 3-6.
4. Loosen the knobs on the two clamps and rotate the clamp feet away from the mounting channel.

Figure 3-4. Back View



TEM_10114_A

- | | | | |
|---|------------------|---|-----------------|
| 1 | Mounting Channel | 3 | Clamp Knob (x2) |
| 2 | Clamp Foot (x2) | | |

5. Bracing the IV pole, position the warming unit against the pole so that the pole is fully seated in the mounting channel. Verify that the handle is not above the maximum height. Reference [Figure 3-5](#) on page 3-7.
6. Rotate the two clamp feet across the IV pole, and tighten the clamp knobs to secure the warming unit. Do not overtighten.

Figure 3-5. Warming Unit Mounted on IV Pole



TEM_10115_A

3.4.2 Bed Installation

The warming unit can be attached to a bed that has a mounting surface up to 3.6 cm (1.4 inches) wide. Typically, the unit is attached to the bed's head board or foot board.

To attach the warming unit to a bed:

1. Locate the bed hook on the back of the warming unit. Reference [Figure 2-2](#) on page 2-4. The hook slides in and out to accommodate different mounting surface widths.
2. Hang the bed hook over the mounting surface to attach the warming unit to the bed.

Figure 3-6. Bed Installation



TEM_10116_A

3.4.3 Cart Installation

An optional transport cart is available for the warming unit. Contact Covidien Technical Services or a local Covidien representative to purchase the transport cart. Reference [Obtaining Technical Assistance](#) on page 1-14.

To install the warming unit on the cart:

1. Ensure that the power cord is secured at the back of the warming unit. Reference [Figure 3-7](#).
2. Loosen the knobs on the three clamps at the back of the warming unit, and rotate the clamp feet away from the mounting channels.

Figure 3-7. Back View

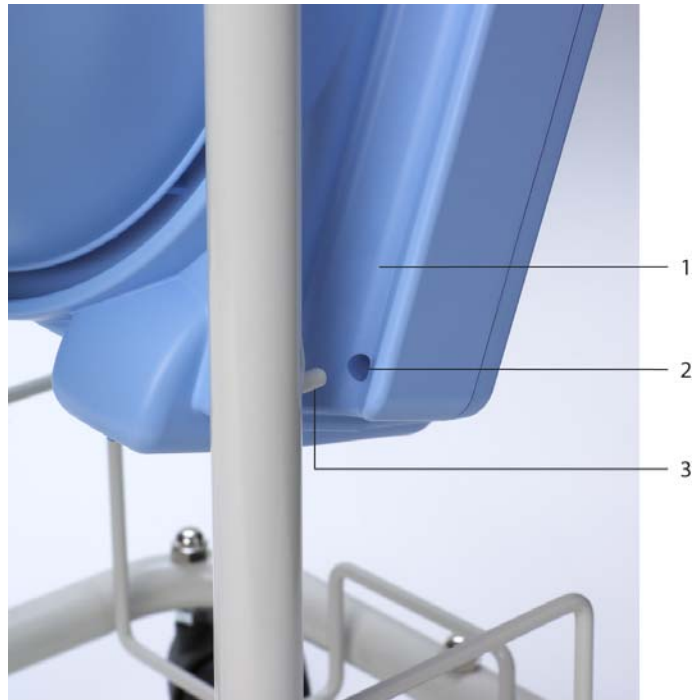


TEM_10117_A

- | | | | |
|---|-----------------------|---|-----------------|
| 1 | Mounting Channel (x2) | 3 | Clamp Foot (x3) |
| 2 | Clamp Knob (x3) | | |

3. Locate the mounting pegs on the cart's vertical poles, and locate the holes at the bottom of the warming unit's mounting channels.

Figure 3-8. Cart Mounting Peg and Warming Unit Mounting Hole



TEM_10118_A

- | | | | |
|---|-----------------------|---|-------------------|
| 1 | Mounting Channel (x2) | 3 | Mounting Peg (x2) |
| 2 | Mounting Hole (x2) | | |

4. Holding the warming unit by the handle and bracing the cart, position the warming unit against the cart so that the mounting holes engage the mounting pegs. The cart poles must be fully seated in the mounting channels.
5. Rotate each of the three clamp feet across the cart poles, and tighten the clamp knobs to secure the warming unit. Do not overtighten.

Figure 3-9. Warming Unit Mounted on Cart



TEM_10119_A

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4 Operation

4.1 Overview

This chapter provides basic operating instructions for the Covidien Warm-Touch™ Convective Warming Unit. Full instructions for operating the unit in a clinical setting are provided in the *Covidien WarmTouch™ Convective Warming System Operator's Manual*. Clinicians intending to use the warming system for treatment of patients must consult the *Operator's Manual*.

<i>Applying Power</i>	<i>Page 4-2</i>
<i>Overview of Warming Unit Operating Modes</i>	<i>Page 4-3</i>
<i>Beginning Operation</i>	<i>Page 4-4</i>
<i>Controlling the Temperature</i>	<i>Page 4-5</i>
<i>Powering Off the Warming Unit</i>	<i>Page 4-8</i>

4.2 Safety Reminder



WARNING:

The use of accessories or cables with the warming system other than those indicated in this manual may result in non-compliance with the specifications listed in *Electromagnetic Compatibility (EMC)* on page 13-4.

4.3 Applying Power



WARNING:

Possible electric shock hazard. Grounding reliability can be achieved only when the warming unit is connected to a suitable mains outlet with protective earth grounding.

To apply power to the warming unit:

1. Locate a hospital-grade or suitable mains outlet with protective earth grounding.

Ensure that the power outlet is easily accessible; disconnection from the outlet is the only way to completely remove power from the warming unit.

2. Plug the warming unit's power cord into the outlet. The status LED illuminates amber to indicate that the warming unit is in Standby mode. The fan and heater are off, and the display is blank.

4.4 Overview of Warming Unit Operating Modes

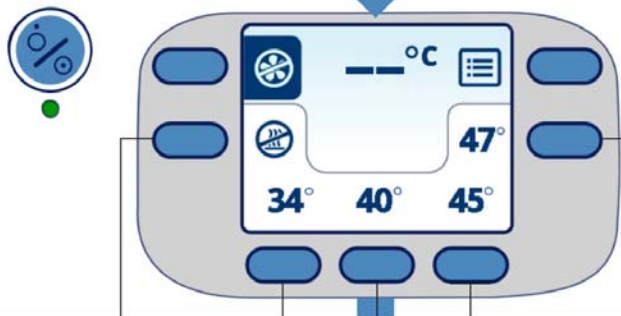
Standby Mode

- **Status LED:** AMBER
- **Heater:** OFF
- **Fan:** OFF
- **Display:** OFF



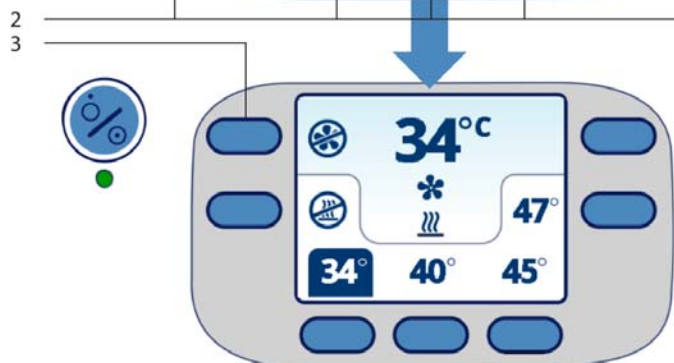
Ready Mode

- **Status LED:** GREEN
- **Heater:** OFF
- **Fan:** OFF
- **Display:** ON



Treatment Mode

- **Status LED:** GREEN
- **Heater:** ON or OFF
- **Fan:** ON
- **Display:** ON



See [Operator's Panel](#) on page 2-5 for descriptions of the display symbols.

TEM_10099_A

- 1 **On/Standby Key** — Press to place the unit in Ready mode and prepare for operation, or press to return to Standby mode when treatment is complete. See [Beginning Operation](#) on page 4-4 and [Returning to Standby Mode](#) on page 4-8.
- 2 **Temperature Keys** — Press to place the unit in Treatment mode, delivering air to the blanket. See [Controlling the Temperature](#) on page 4-5.
- 3 **Fan Off Key** — Press to return to Ready mode, pausing air delivery. See [Returning to Ready Mode](#) on page 4-7.

4.5 Beginning Operation

To begin operation:



1. Press the **On/Standby** key. The unit enters Ready mode:
 - The status LED turns green, and the display turns on.
 - A short tone indicates a successful power-on self-test (POST). If POST is unsuccessful, an alarm screen appears. See [Alarms](#) on page 6-12.
 - The Main screen appears ([Figure 4-1](#)). Note that if the filter needs to be replaced, the Replace Filter screen appears instead of the Main screen ([Figure 4-2](#)).

Figure 4-1. Main Screen at Power-On

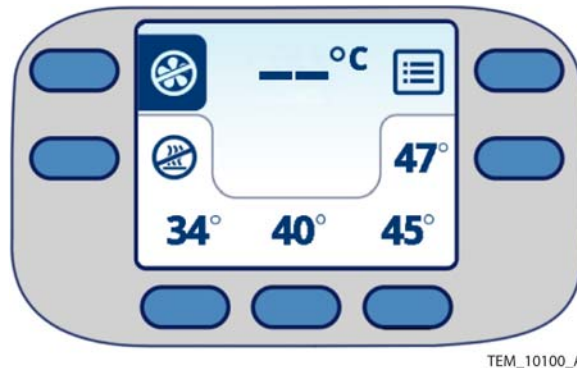


Figure 4-2. Replace Filter Screen at Power-On



2. If you see the Replace Filter screen, follow the procedure [Filter Replacement](#) on page 5-4. It is possible to continue operation; however, failure to replace the filter

as recommended can adversely affect device performance. If you choose to continue operation, press the **OK** key. The Main screen appears ([Figure 4-1](#)). Until the filter is replaced, the Replace Filter screen reappears at each subsequent power-on.

4.6 Controlling the Temperature



Note:

During patient treatment, a WarmTouch™ warming blanket must be attached to the warming unit at all times.

Select a setting by pressing one of the temperature keys. Change the setting as desired.

Note that the temperature settings and readings on the display correspond to internal measurements of the air entering the hose. The air temperature entering the blanket is lower and can vary depending on environmental conditions. Use [Table 4-1](#) as a guideline for selecting temperature settings.

Table 4-1. Temperature Settings



Setting	Avg. Temperature Entering Hose	Avg. Temperature Entering Blanket	Typical Use
 (Heat Off)	Room temperature	Room temperature	To aid in cooling the patient, if necessary.
34° (Low)	34°C (93°F)	32°C (90°F)	To help prevent or treat hypothermia, or to maintain appropriate normothermia.
40° (Medium)	40°C (104°F)	38°C (100°F)	
45° (High)	45°C (113°F)	42°C (108°F)	
47° (Boost)	47°C (117°F) for 45 minutes	44°C (111°F)	To rapidly warm patients.

Figure 4-3. Warming System Set to 40°C (Medium)



 Note that when you change the temperature setting, an amber arrow appears next to the current temperature while it adjusts. When the temperature is within approximately 1.5°C of the new setting, the arrow disappears.

4.6.1 Using Boost Mode

Boost mode allows rapid warming of patients. Air is generated at 47°C (116.6°F) for 45 minutes. After 45 minutes, the setting automatically changes to 45°C (High).

47° To use Boost mode, press the **47°C (Boost Mode)** key. A countdown timer shows the time remaining before the temperature switches to the 45°C (High) setting. Boost mode sessions can be repeated as necessary.

Figure 4-4. Warming System Set to Boost Mode



4.6.2 Using the Heat Off Setting


-  The heat off setting provides a means to cool a patient. To use the heat off setting, press the **Heat Off** key. Air is delivered to the warming blanket at room temperature (heater off).

Figure 4-5. Warming System Set to Heat Off



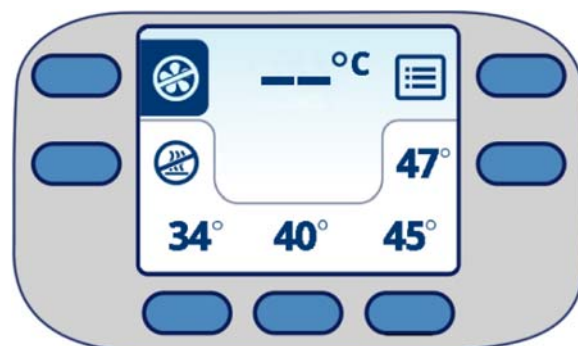
TEM_10108_A

4.6.3 Returning to Ready Mode

During operation, you can switch back to Ready mode (fan and heat off) any time you do not need to apply air to the warming blanket. The display stays on, and the unit remains ready to operate.

-  To return to Ready mode, press the **Fan Off** key. Note that in Ready mode, the temperature reading shows dashes.

Figure 4-6. Warming System Set to Ready Mode



TEM_10100_A

4.6.4 Returning to Standby Mode

Use Standby mode when you are finished using the warming system but do not wish to unplug it.



To return to Standby mode during operation, press the **On/Standby** key. The heater and fan shut off, the display goes blank, and the status LED turns amber.

4.6.5 If Power is Interrupted...

If power is interrupted during operation, the warming unit responds as follows, based on the duration of the power loss:

- **Power restored within approximately 15 seconds** — The warming unit powers up, performs a power-on self-test (POST), and resumes operation in the same mode as before the power loss.
- **Power restored after approximately 15 seconds** — The warming unit powers up in Standby mode.



If the warming unit powers back up in Standby mode, press the **On/Standby** key to enter Ready mode, then select a temperature setting to resume operation.

4.7 Powering Off the Warming Unit

To power off the warming unit:



1. Press the **On/Standby** key. The fan and heater (if running at the time) turn off. The display goes blank, and the status LED turns amber.
2. To completely remove power from the warming unit, unplug the unit's power cord from the outlet.

5 Maintenance

5.1 Overview

This chapter describes the cleaning and maintenance requirements for the Covidien WarmTouch™ Convective Warming Unit.

<i>Cleaning the Warming Unit</i>	<i>Page 5-2</i>
<i>Safety Checks</i>	<i>Page 5-3</i>
<i>Filter Replacement</i>	<i>Page 5-4</i>
<i>Monitoring the Filter Status</i>	<i>Page 5-10</i>

5.2 Safety Reminders



WARNING:

Before attempting to open or disassemble the warming unit, disconnect the power cord from the AC power source.



Caution:

Observe ESD (electrostatic discharge) precautions when servicing the warming unit.

5.3 Cleaning the Warming Unit



WARNING:

Clean the warming unit after each use, as described in this manual.



WARNING:

Disconnect the warming unit's power cord from the AC power source before performing this procedure.



Caution:

Do not spray, pour, or spill any liquid on the warming unit, its accessories, connectors, switches, or openings in the case.

For surface cleaning and disinfection of the warming unit, follow your institution's procedures or the recommended actions below:

- **Surface cleaning** — Use a soft cloth dampened with either a commercial, non-abrasive cleaner or a solution of 70% alcohol in water, lightly wiping the surfaces of the warming unit.
- **Disinfection** — Use a soft cloth saturated with a solution of 10% chlorine bleach in tap water, lightly wiping the surfaces of the warming unit.

5.4 Safety Checks

5.4.1 Physical Inspection

Covidien recommends that the customer perform a visual check of the following items before each use of the warming unit:

- **Equipment** — Inspect the warming unit and power cord for mechanical damage or deterioration.
- **Labels** — Inspect the safety labels for legibility.

After performing any service on the warming unit, be sure to check these items before returning the unit to operation.

Covidien also recommends checking the time remaining time before the filter must be replaced before returning the unit to operation. See [Monitoring the Filter Status](#) on page 5-10 for instructions.

5.4.2 Temperature and Alarm Verification

Once a year, the following tests must be performed:

- **Temperature Accuracy Test** — Use this test to verify heater output temperatures. See [page 7-8](#) for instructions.
- **Thermostat Test** — Use this test to verify the alarm system. See [page 7-11](#) for instructions.

These tests are also required after certain service procedures. Refer to the instructions in each component replacement section for testing requirements.

5.4.3 Electrical Safety Tests

The following electrical safety tests must be performed after certain service procedures:

- **Ground Bond Test** — See [page 7-14](#) for values.
- **Earth Leakage Current Test (Line Leakage)** — See [page 7-14](#) for values.
- **Enclosure Leakage Current Test (Line Leakage)** — See [page 7-14](#) for values.

Refer to the instructions in each component replacement section for testing requirements.

5.5 Filter Replacement

**WARNING:**

Do not operate the warming unit with the filter enclosure removed.

**WARNING:**

Disconnect the warming unit's power cord from the AC power source before performing this procedure.

**Caution:**

The HEPA filter must be replaced every 2,000 hours of operation or 365 days, whichever comes first.

**Caution:**

The institution should follow local governing ordinances and recycling instructions regarding disposal or recycling of filter and device components or end of life of the product.

The warming unit contains a HEPA filter that must be replaced at regular intervals. When the filter needs to be replaced, the screen shown in [Figure 5-1](#) appears at each power-on. **Failure to replace the filter as recommended can adversely affect device performance.**

Figure 5-1. Replace Filter Screen



TEM_10101_A

Requirements:

- WT HEPA Filter Kit ([page A-7](#))
- Torque driver with #2 Phillips bit
- 70% isopropyl alcohol solution and soft cloth (if replacing gasket in filter enclosure)

To replace the filter:

1. If the power cord is secured around the back of the unit, unwind it completely.
2. Position the warming unit on its front so the bottom of the unit is accessible ([Figure 5-2](#)).

Figure 5-2. Filter Enclosure and Power Cord Connection

- | | | | |
|---|------------------------------|---|----------------------------|
| 1 | Filter Enclosure | 3 | Power Cord Routing Bracket |
| 2 | Filter Enclosure Screws (x3) | 4 | Power Cord Connector |

3. Remove the three screws from the filter enclosure. Lift the enclosure away from the unit, disengaging the power cord from its socket. Set the enclosure and attached power cord aside.



Caution:
The institution should follow local governing ordinances and recycling instructions regarding disposal or recycling of filter and device components or end of life of the product.

4. Remove the filter (*Figure 5-3*). Dispose of the filter as required by local governing ordinances.

Figure 5-3. HEPA Filter



TEM_10242_A

5. Place the new filter on the unit.

6. Before placing the filter enclosure back on the unit, check the circular gasket inside the enclosure (*Figure 5-4*). If the gasket is worn or damaged, replace it as follows:
 - a. Peel the gasket off the enclosure.
 - b. Use a soft cloth dampened with a solution of 70% isopropyl alcohol to remove any adhesive remnants from the surface. Make sure that the surface is completely dry before proceeding.
 - c. Remove the backing from the new gasket to expose the adhesive.
 - d. Center the gasket around the raised area in the enclosure, and press around the entire gasket to adhere.

Figure 5-4. Gasket inside Filter Enclosure



7. Place the filter enclosure back on the unit, aligning the power cord with its socket. Make sure that the enclosure is fully seated on the unit.
8. Press the power cord connector into the socket so that it is fully connected (*Figure 5-2* on page 5-5).
9. Reinstall the three screws in the filter enclosure. Tighten the screws to 1.2 to 1.6 N-m (10.6 to 14.2 lb-in).

10. Set the unit upright, and plug the power cord into the power outlet.
11. Reset the filter counters as follows:



- a. Press the **On/Standby** key. The Replace Filter screen appears ([Figure 5-5](#)).

Figure 5-5. Replace Filter Screen



TEM_10101_A



- b. Press the **Replace Filter** key. The Filter Information screen appears ([Figure 5-6](#)).

Figure 5-6. Filter Information Screen - Filter Expired



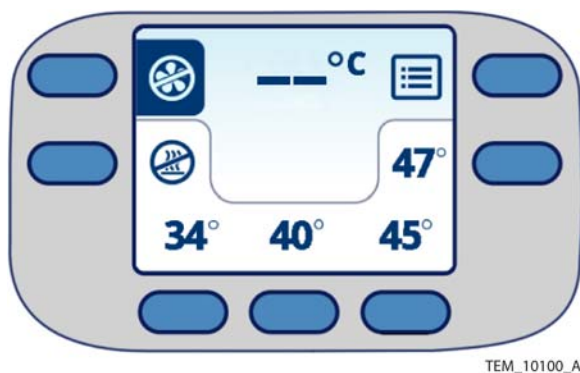
TEM_10272_A



- c. Press the **Filter Reset** key.
- d. Press the key code as described in [Service Screen Access](#) on page 7-2. The filter counters are reset to 365 days and 2000 hours.



- e. Press the **On/Standby** key to return to Standby mode. Press the **On/Standby** key again and verify that the Main screen appears ([Figure 5-7](#)) rather than the Replace Filter screen.

Figure 5-7. Main Screen at Power-On

12. Power off the warming unit by pressing the **On/Standby** key. Disconnect the power cord from the outlet.
13. Wrap the power cord around the back of the unit, and secure it with the attached strap (*Figure 5-8*).

Figure 5-8. Power Cord Wrapped and Secured

5.6 Monitoring the Filter Status

The warming unit monitors filter usage and provides counters that indicate the number of operating hours and days until the filter needs to be replaced. You can anticipate filter replacement by checking the counters on the Filter Information screen.



Note:

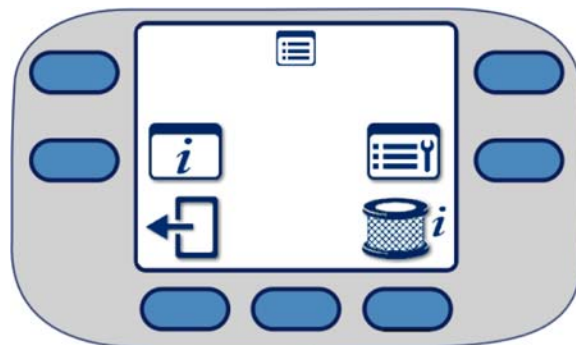
The Filter Information screen is only accessible when the warming unit is in Ready mode. It is not accessible while the warming unit is operating.

To view the Filter Information screen:

1. If the warming unit is not already powered on, follow the steps in [Applying Power](#) on page 4-2.
2. Press the **On/Standby** key to enter Ready mode.
3. Press the **Menu** key on the Main screen. The Menu screen appears ([Figure 5-9](#)).



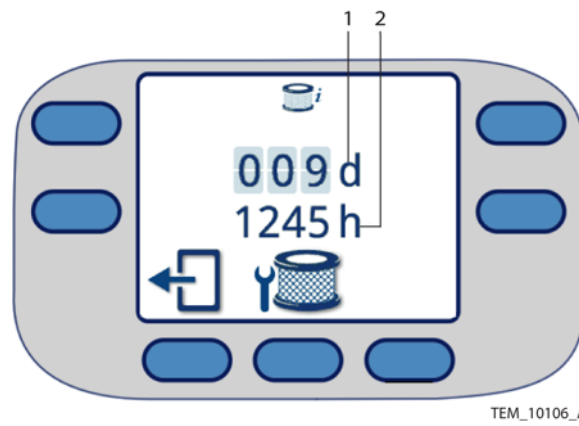
Figure 5-9. Menu Screen



TEM_10105_A



4. Press the **Filter Information** key. The Filter Information screen indicates the days and operating hours remaining before the filter needs to be replaced ([Figure 5-10](#)).

Figure 5-10. Filter Information Screen

- 1 Filter Days Remaining 2 Filter Hours Remaining

5. To return to the Main screen, press the **Exit** key twice.

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6 Troubleshooting

6.1 Overview

This chapter provides information for troubleshooting problems that may occur with the Covidien WarmTouch™ Convective Warming Unit.

<i>Principles of Operation</i>	<i>Page 6-2</i>
<i>Basic Troubleshooting</i>	<i>Page 6-9</i>
<i>Alarms</i>	<i>Page 6-12</i>

6.2 Safety Reminders



WARNING:

No modification of this equipment is allowed. Modification can result in death, injury, or property damage.



Caution:

Operation of the warming system may affect or be affected by other devices in the vicinity due to electromagnetic interference (EMI). If interference occurs, try increasing the distance between devices, repositioning the cabling, or plugging the devices into separate outlet circuit branches. Reference [Electromagnetic Compatibility \(EMC\)](#) on page 13-4 for additional guidance.

6.3 Principles of Operation

6.3.1 Overview

The Covidien WarmTouch™ Convective Warming System provides clinicians with a means to supply warmed or room temperature air to the skin surface of patients to achieve and maintain normothermia. The system consists of the Covidien WarmTouch™ Convective Warming Unit and specially designed blankets to distribute the air.

The warming unit is powered from wall outlet AC power through an internal power supply that maintains a consistent output across a range of input voltages and frequencies. Users interact with the unit via a set of hardware keys arranged around a software-controlled Graphical User Interface (GUI).

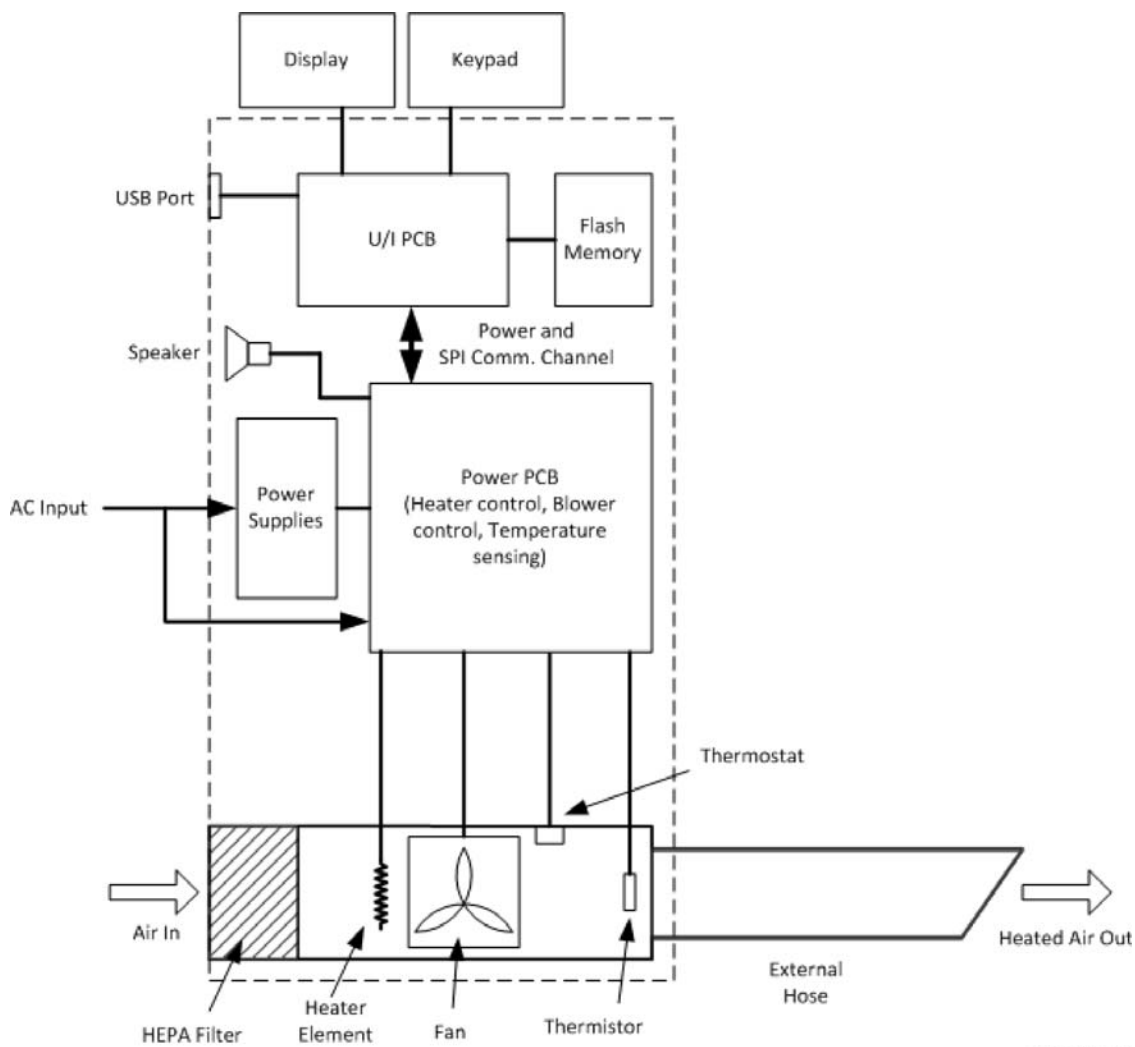
The warming unit produces air output by drawing room air through a High Efficiency Particulate Air (HEPA) filter, across a heating element, and into an electrically-operated fan. The fan outputs the air across a control thermistor at the base of the hose. The temperature of the air is monitored by a hardware circuit under software control that provides power to the heating element to regulate the temperature for the heated air settings. The heated air is delivered to the output hose where the nozzle connects distally to the blanket, resulting in air delivery to the patient.

The delivered air temperature is constantly monitored by the warming unit's microprocessors. If the temperature does not stay within specification, the unit shuts down the heating element and the fan. A safety thermostat provides additional protection by shutting down the heating element and fan if the heated air temperature exceeds its operating limit.

6.3.2 Block Diagram

Figure 6-1 shows the relationship between the major components in the warming unit. Descriptions of the components and their interactions follow. A detailed diagram of the cable connections between the components is provided on page 6-8.

Figure 6-1. Warming Unit Block Diagram



6.3.3 Component Descriptions

Display

The unit uses a 2.5", QVGA (320 x 240) TFT liquid crystal display (LCD) to relay status and provide interactive information to the user. The display is located inside the unit's front enclosure behind the UI PCBA (see [Figure 10-7](#) on page 10-8). The display is controlled by the UI microprocessor on the UI PCBA and connects to the PCBA via a cable that is fixed to the display.

Keypad

The keypad on the front of the unit consists of an On/Standby key and seven multifunction control keys. The On/Standby key switches the unit between Standby mode and Ready mode (see [Overview of Warming Unit Operating Modes](#) on page 4-3). The control keys perform a variety of functions depending on operating context.

The keypad is built into the die-cut panel that attaches to the unit's front enclosure. The panel includes an LED that indicates warming unit status:

- Green for operating modes
- Amber for standby mode
- Off when disconnected from power

The keypad connects to the UI PCBA via a fixed cable that is routed into the unit through a slot below the panel (see [Figure 10-4](#) on page 10-6).

USB Port

To facilitate software updates, error log downloads, and other service tasks performed at Covidien Service Centers, the warming unit can communicate with a computer via its USB interface. The USB port is located under a protective cover at the back of the unit (see [Figure 10-18](#) on page 10-23). An internal USB cable connects the port to the UI PCBA (see [Figure 10-17](#) on page 10-22).

Speaker

The unit's speaker is located inside the front enclosure (see [Figure 10-27](#) on page 10-37). The speaker generates alert tones (such as when POST passes), alarm tones, and key clicks. It is connected to and driven by the power PCBA. There is no external speaker opening.

UI PCBA

The UI PCBA is located inside the front enclosure below the operator's panel (see [Figure 10-10](#) on page 10-12). It contains the UI microprocessor which is responsible for all user interface functions. The UI microprocessor displays information and menus on the LCD and receives user input from the keypad. It sends commands based on the input to the A/D microprocessor on the power PCBA which controls the unit's power, fan, and heating functions.

The UI PCBA also contains a real-time clock (RTC) that allows filter use to be tracked and log/code entries to be time-stamped. The replaceable battery for the RTC is located on the UI PCBA.

The USB connector on the UI PCBA supports software updates, error log downloads, and other service functions performed at Covidien Service Centers.

Power PCBA

The power PCBA is located inside the front enclosure (see [Figure 10-24](#) on page 10-31). It contains the A/D microprocessor and control circuitry for the fan, heater, and thermostat.

The power PCBA has power input connections from the AC power inlet and power supply, and output connections to the heater, fan, thermostat, and speaker. The power PCBA converts the 48VDC output from the power supply to various voltages required to power components throughout the system. The power circuits are protected by redundant fuses located on the PCBA.

The A/D microprocessor maintains a communication channel with the UI microprocessor and controls power to the UI PCBA and display. It also receives input from the thermistor and relays that input to the UI microprocessor which displays the temperature readings on the LCD.

Power Supply

The power supply is located inside the front enclosure ([Figure 10-31](#) on page 10-43). It is an internally-fused AC/DC converter delivering 48VDC, 65W output from an input range of 90-264VAC. It has an input connection from the AC power inlet, an output connection to the power PCBA, and a ground connection to the equipotential stud. The 48V output from the power supply is converted to 12V, 5V, 3.3V, and 2.5V on the power PCBA to drive various system components.

HEPA Filter

The HEPA filter is located inside the filter enclosure at the back of the unit (see [Figure 5-3](#) on page 5-6). The fan draws air into the filter through the opening at the base of the filter enclosure prior to delivering the air across the heating element.

The filter must be replaced every 2,000 hours of operation or 365 days, whichever comes first. Software counters track the number of power-on hours and calendar days since the previous filter change. These counters rely on the real-time clock (RTC) located on the UI PCBA.

When the filter needs to be replaced based on either of the counters, the user is notified at power-on. The counters can be reset using a key code at the keypad when the filter is replaced.

Heater

The heater is located below the fan assembly inside the rear enclosure (see [Figure 11-40](#) on page 11-43). The heater consists of a wire-wound element that generates heat when current (90-264VAC) is passed through it. The heater connects to the power PCBA and is controlled by the A/D microprocessor based on user input and thermistor feedback.

Fan

The fan is located inside the rear enclosure (see [Figure 11-30](#) on page 11-33). It is powered by 48VDC from the power PCBA. Fan speed is monitored by the A/D microprocessor and is voltage-controlled via circuitry on the PCBA. If the speed is too low or too high, the software shuts down the fan and heater and generates an alarm.

Thermostat

The thermostat is located in the hose duct adapter near the base of the hose (see [Figure 11-9](#) on page 11-10). It is connected to the power PCBA. The thermostat provides thermal cut-out protection by opening at 49°C to 55°C (120°F to 131°F), resulting in heater and fan shutdown.

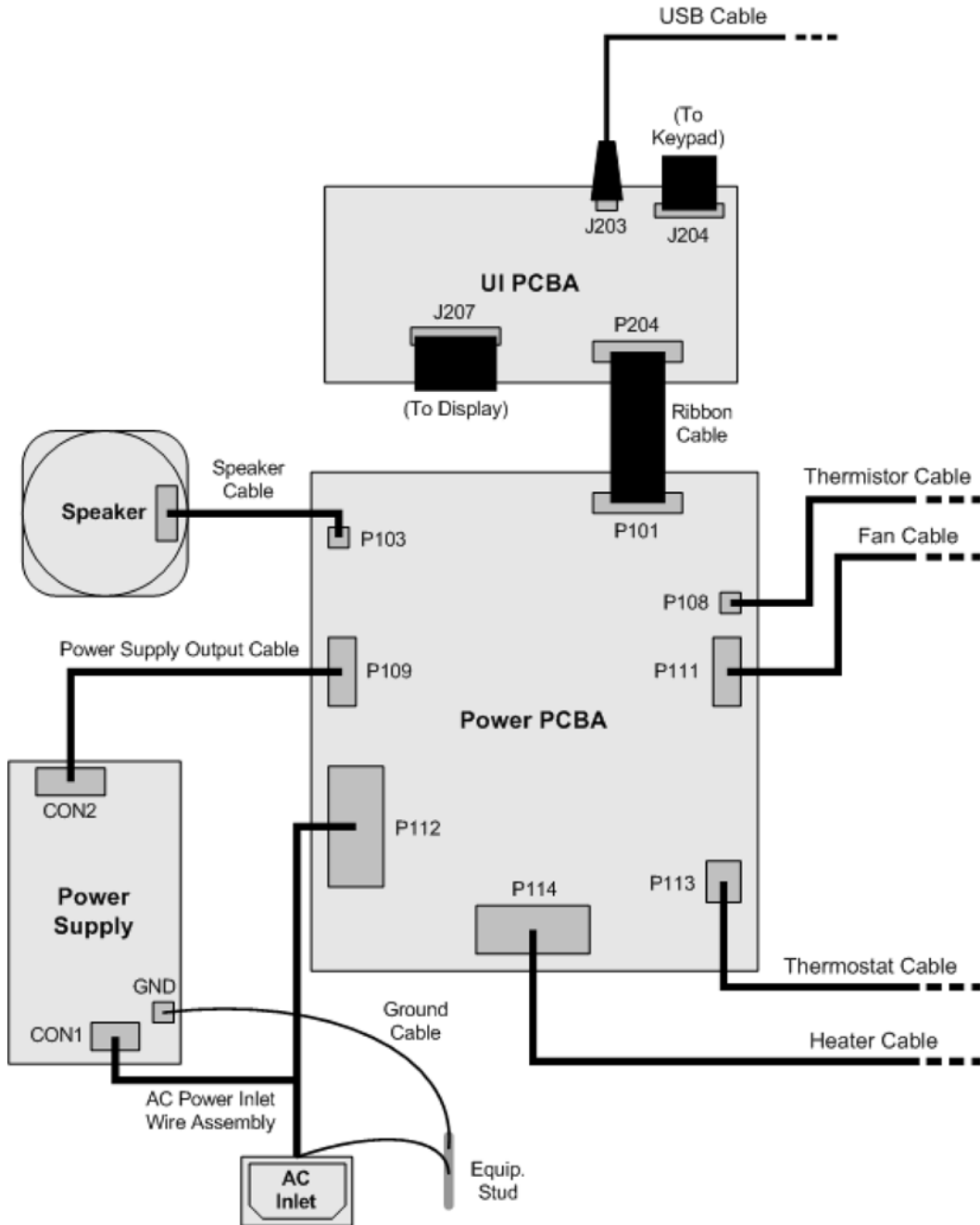
Thermistor

The thermistor is located in the hose duct adapter just below the screen at the base of the hose (see [Figure 11-2](#) on page 11-4 and [Figure 11-6](#) on page 11-7). It is connected to the power PCBA.

During operation, the temperature measured by the thermistor is monitored by the A/D processor and relayed to the UI microprocessor for display on the LCD. If the temperature does not remain within specification, the software shuts down the heater and fan and generates an alarm.

6.3.4 Component Cable Connections

Figure 6-2. Cable Connections Between Major Components



TEM_10282_A

6.4 Basic Troubleshooting

Table 6-1. Warming Unit Problems and Resolutions



Problem	Resolution
<p>Low-priority alarm</p>  <p>Medium-priority alarm</p>  <p>(flashing)</p>	<p>See Alarms on page 6-12.</p>
<p>Failure to power on (LED not turning on)</p>	<ul style="list-style-type: none"> • Check the power cord's connection to the warming unit. The connector must be fully seated (page 3-2). • Try a different power cord (page 8-5). • Check the cable connections between the AC power inlet and the power supply, power PCBA, and equipotential stud (page 10-51). • Check the fuses on the power PCBA (page 10-35). • Check the ribbon cable connection between the power PCBA and the UI PCBA (page 10-19). • Check the keypad cable connection to the UI PCBA (page 10-3). • Try replacing components in the following order: <ol style="list-style-type: none"> 1. Ribbon cable (page 10-19). 2. Power supply output cable (page 10-46). 3. AC power inlet (page 10-51). 4. Power supply (page 10-43). 5. Power PCBA (page 10-31). 6. UI PCBA (page 10-12). 7. Keypad (page 10-3).
<p>Power-on self-test (POST) failure</p>	<p>Check the error codes on the System Information screen (page 1-9), and perform recommended corrective actions (page B-1).</p>

Table 6-1. Warming Unit Problems and Resolutions (Continued)

Problem	Resolution
Display not working	<ul style="list-style-type: none"> • Make sure that the On/Standby key has been pressed and the status LED is green. (If the status LED is amber, the display is blank.) • Check the display cable connection to the UI PCBA (page 10-8). • Try replacing components in the following order: <ol style="list-style-type: none"> 1. Display (page 10-8). 2. UI PCBA (page 10-12).
Display test failure (bad pixels or incorrect colors)	<ul style="list-style-type: none"> • Check the display cable connection to the UI PCBA (page 10-8). • Try replacing components in the following order: <ol style="list-style-type: none"> 1. Display (page 10-8). 2. UI PCBA (page 10-12).
Key(s) not working on keypad or Keypad test failure	<ul style="list-style-type: none"> • Check the keypad cable connection to the UI PCBA (page 10-3). • Try replacing components in the following order: <ol style="list-style-type: none"> 1. UI PCBA (page 10-12). 2. Keypad (page 10-3).
Speaker not working	<ul style="list-style-type: none"> • Check the speaker cable connection to the power PCBA and to the two terminals on the speaker. Make sure the wires are on the correct terminals (red to positive; black to negative) (page 10-40). • Try replacing components in the following order: <ol style="list-style-type: none"> 1. Speaker cable (page 10-40). 2. Speaker (page 10-37). 3. Power PCBA (page 10-31).
Fan not operating	<ul style="list-style-type: none"> • Check the error codes on the System Information screen (page 1-9), and perform recommended corrective actions (page B-1). • Check the fan cable connection to the power PCBA (page 10-31). • Try replacing components in the following order: <ol style="list-style-type: none"> 1. Fan (page 11-33). 2. Power PCBA (page 10-31).
Flow test failure (fan speed out of range)	<ul style="list-style-type: none"> • Check the fan cable connection to the power PCBA (page 10-31). • Try replacing components in the following order: <ol style="list-style-type: none"> 1. Power PCBA (page 10-31). 2. Fan (page 11-33).

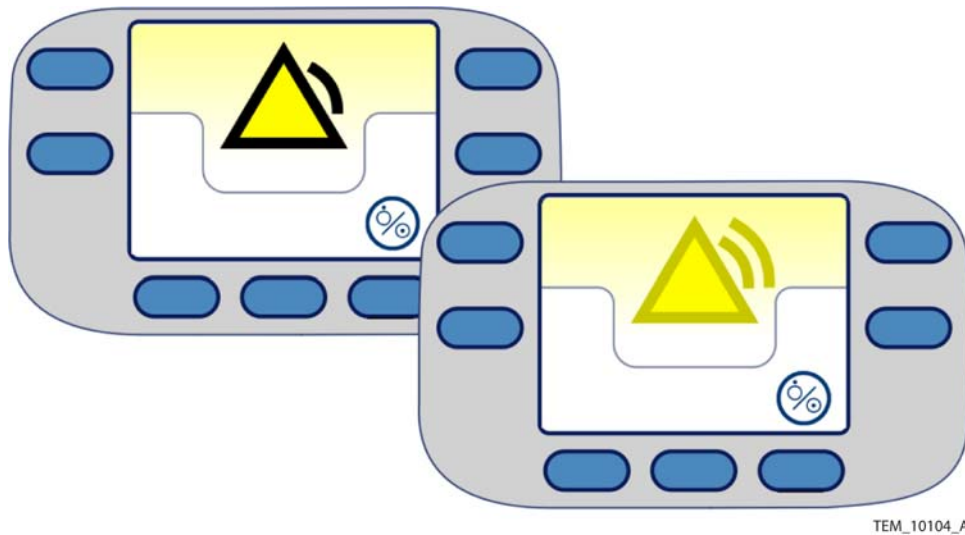
Table 6-1. Warming Unit Problems and Resolutions (Continued)

Problem	Resolution
Heater not operating	<ul style="list-style-type: none"> • Check the error codes on the System Information screen (page 1-9), and perform recommended corrective actions (page B-1). • Check the heater cable connection to the power PCBA (page 10-31). • Try replacing components in the following order: <ol style="list-style-type: none"> 1. Heater (page 11-43). 2. Power PCBA (page 10-31).
Thermostat test failure (thermostat fails to open)	<ul style="list-style-type: none"> • Check the error codes on the System Information screen (page 1-9), and perform recommended corrective actions (page B-1). • Check the thermostat cable connection to the power PCBA and to the thermostat terminals (page 11-14). • Try replacing components in the following order: <ol style="list-style-type: none"> 1. Thermostat (page 11-9). 2. Power PCBA (page 10-31). 3. Thermostat cable (page 11-14).
Temperature accuracy test failure (output air temperature not within specification)	<ul style="list-style-type: none"> • Check the error codes on the System Information screen (page 1-9), and perform recommended corrective actions (page B-1). • Check the thermistor cable connection to the power PCBA (page 11-3). • Make sure that the thermistor wire and rivet are correctly attached to the hose duct adapter (page 11-4). • Check the heater cable connection to the power PCBA (page 10-31). • Try replacing components in the following order: <ol style="list-style-type: none"> 1. Thermistor sensor assembly (page 11-3). 2. Power PCBA (page 10-31).
Electromagnetic interference between the warming unit and other devices	<ul style="list-style-type: none"> • Check the error codes on the System Information screen (page 1-9), and perform recommended corrective actions (page B-1). • Advise the customer to try increasing the distance between devices, repositioning the cabling, or plugging the devices into separate outlet circuit branches. See Electromagnetic Compatibility (EMC) on page 13-4 for additional guidance.

6.5 Alarms



If an alarm condition or error occurs during operation, the warming unit sounds alarm tones and displays an alarm screen. There are two types of alarms: low-priority and medium-priority.

Figure 6-3. Low-Priority Alarm (Left) and Medium-Priority Alarm (Right)



TEM_10104_A

Table 6-2. Alarm Indicators

Symbol	Tones	Type of Alarm
	Two successive tones repeating	Low-priority alarm: A condition that requires operator awareness.
 (flashing)	Three successive tones repeating at decreasing intervals	Medium-priority alarm: A condition that requires prompt operator response.



Note:

If multiple alarms occur at the same time, the unit reports the highest priority alarm.

To troubleshoot an alarm:

1. If the alarm is currently indicated on the unit's display, try clearing the alarm as follows:



- a. Power off the warming unit by pressing the key indicated on the alarm screen.
- b. Press the **On/Standby** key to power the warming unit back on.

Note: While a low-priority alarm may be cleared this way, a medium-priority alarm typically will not be cleared.

2. If possible, check the error codes on the System Information screen (see [Serial Number, Software Version, and Error Codes](#) on page 1-9). Perform the repair(s) listed for the error code(s) (see [Error Codes and Suggested Resolutions](#) on page B-2).

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7 Performance Verification

7.1 Overview

This chapter provides instructions for testing the Covidien WarmTouch™ Convective Warming Unit after repair. Testing is required after most service procedures. Refer to the instructions in each component replacement section for minimum testing requirements.

<i>Required Test Equipment</i>	<i>Page 7-2</i>
<i>Service Screen Access</i>	<i>Page 7-2</i>
<i>Performance Tests</i>	<i>Page 7-3</i>
<i>Electrical Safety Tests</i>	<i>Page 7-14</i>

7.2 Safety Reminders



WARNING:

Possible electric shock hazard. Grounding reliability can be achieved only when the warming unit is connected to a suitable mains outlet with protective earth grounding.



Caution:

Observe ESD (electrostatic discharge) precautions when servicing the warming unit.

7.3 Required Test Equipment

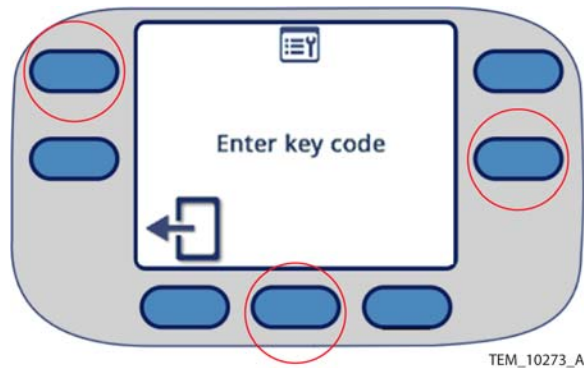
- Temperature probe (either handheld meter or USB-based):
 - Accuracy of probe must be $\pm 0.25^{\circ}\text{C}$ or better over the range 10°C to 60°C .
 - Probe cable must be long enough to reach from computer to hose duct adapter screen inside compressed hose.
- Electrical leakage tester
- Ground bond tester

7.4 Service Screen Access

The warming unit provides screens for performing functions restricted to service personnel. These screens are protected by a key code.

When you see the message “Enter Key Code” press the keys indicated in [Figure 7-1](#) simultaneously to access these screens.

Figure 7-1. Key Code Screen



7.5 Performance Tests

<i>Power-On Test</i>	<i>Page 7-3</i>
<i>Keypad Test</i>	<i>Page 7-5</i>
<i>Display Test</i>	<i>Page 7-7</i>
<i>Temperature Accuracy Test</i>	<i>Page 7-8</i>
<i>Flow Test</i>	<i>Page 7-10</i>
<i>Thermostat Test</i>	<i>Page 7-11</i>



Note:

A test data sheet that can be used to record test results is provided on [page C-2](#).

7.5.1 Power-On Test

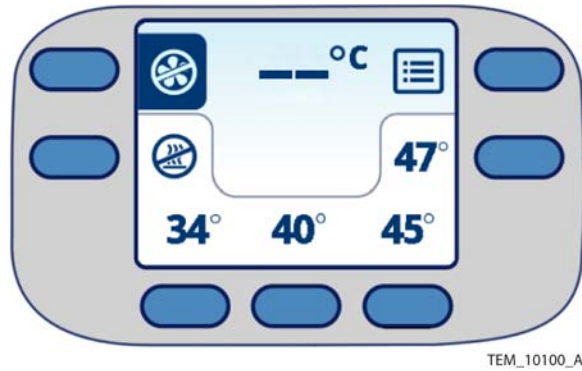
Use the power-on test to confirm basic functionality of the unit.

To perform the power-on test:



1. Plug the warming unit's power cord into the outlet, and press the **On/Standby** key.
2. Verify that the unit passes its power-on self-test (POST) and enters Ready mode:
 - The status LED turns green, and the display turns on.
 - A short tone sounds, indicating a successful POST. If POST is unsuccessful, an alarm screen appears (see [Alarms](#) on page 6-12).
 - The Main screen appears ([Figure 7-2](#)). Note that if the filter needs to be replaced, the Replace Filter screen appears instead of the Main screen ([Figure 7-3](#)). If you see the Replace Filter screen, press the **OK** key to proceed to the Main screen. (The filter must be replaced before placing the unit back in operation. Refer to [Filter Replacement](#) on page 5-4.)

Figure 7-2. Main Screen at Power-On



TEM_10100_A

Figure 7-3. Replace Filter Screen at Power-On



TEM_10101_A

3. Press one of the temperature keys. Verify that the temperature reading on the screen rises and stabilizes.
4. When finished with all testing:
 - a. Press the **On/Standby** key to power off the unit.
 - b. Unplug the unit from the outlet.



Power-On Test Failure





If the test fails, see [Basic Troubleshooting](#) on page 6-9.




7.5.2 Keypad Test

Use the keypad test to confirm that each key is functioning and that the unit responds as expected.

To perform the keypad test:

1. Perform steps 1 and 2 of the power-on test ([page 7-3](#)).
2. Press and verify each key:

Key	Expected Behavior of Unit
34°	Temperature reading on Main screen rises and stabilizes. Reading corresponds to key pressed.
40°	
45°	
47°	
 (Heat Off)	Unit delivers air at room temperature: - Heater: OFF - Fan: ON - Status LED: GREEN
 (Fan Off)	Unit returns to Ready mode: - Heater: OFF - Fan: OFF - Status LED: GREEN
 (Menu)	Menu screen appears:  TEM_10105_A

Key	Expected Behavior of Unit
 (Exit)	Main screen appears:  <small>TEM_10100_A</small>
 (On/Standby)	Unit powers off: - Display: OFF - Status LED: AMBER

- When finished with all testing, unplug the unit from the outlet.

Keypad Test Failure

If the test fails, see [Basic Troubleshooting](#) on page 6-9.

7.5.3 Display Test

Use the display test to confirm that there are no bad pixels.

To perform the display test:



1. Plug the warming unit's power cord into the outlet, and press the **On/Standby** key.
2. Verify that the initial display screen is lighted white and has no vertical or horizontal black or colored rows.
3. When finished with all testing:



- a. Press the **On/Standby** key to power off the unit.
- b. Unplug the unit from the outlet.

Display Test Failure

If the test fails, see [Basic Troubleshooting](#) on page 6-9.

7.5.4 Temperature Accuracy Test

Use the temperature accuracy test to verify that the unit's output air temperature is within specification.

Requirements:

- Temperature probe (see [page 7-2](#)).

To perform the temperature accuracy test:

1. Perform steps 1 and 2 of the power-on test ([page 7-3](#)).
2. Fully compress the warming unit's hose and position it vertically, nozzle facing up ([Figure 7-4](#)).

Figure 7-4. Position of Hose for Temperature Accuracy Test



TEM_10281_A

3. Lower the temperature probe into the hose until it contacts the metal screen at the base of the hose duct adapter. The probe should be approximately centered on the screen.

4. Test the 34°C setting:

34°

- a. Press the **34°C** key. Allow the temperature to stabilize for at least 3 minutes.
 - b. Confirm that the temperature measured by the probe is within 1°C of the temperature setting.
5. Test the 47°C setting:

47°

- a. Press the **47°C** key. Allow the temperature to stabilize for at least 3 minutes.
 - b. Confirm that the temperature measured by the probe is within 1°C of the temperature setting.
6. Remove the temperature probe from the unit.
 7. When finished with all testing:



- a. Press the **On/Standby** key to power off the unit.
- b. Unplug the unit from the outlet.

Temperature Accuracy Test Failure

If the test fails, see [Basic Troubleshooting](#) on page 6-9.

7.5.5 Flow Test

Use the flow test to confirm fan functionality.

To perform the flow test:

1. Position the hose on the nozzle hook with the hose compressed as much as possible (*Figure 7-5*).

Figure 7-5. Position of Hose for Flow Test



TEM_10280_A

2. Perform steps 1 and 2 of the power-on test (*page 7-3*).
- 34°**
3. Press the **34°C** key. The fan should ramp up to operating speed and air should flow from the nozzle. Confirm that no alarms occur.
 4. When finished with all testing:
 - a. Press the **On/Standby** key to power off the unit.
 - b. Unplug the unit from the outlet.



Flow Test Failure

If the test fails, see *Basic Troubleshooting* on page 6-9.

7.5.6 Thermostat Test

Use the thermostat test to verify that the thermostat opens when an over-temperature condition occurs and that an audible and visual alarm is generated.

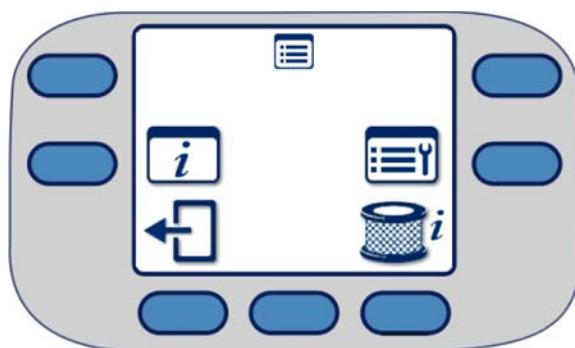
To perform the thermostat test:

1. Perform steps 1 and 2 of the power-on test ([page 7-3](#)).



2. Press the **Menu** key on the Main screen. The Menu screen appears ([Figure 7-6](#)).

Figure 7-6. Menu Screen

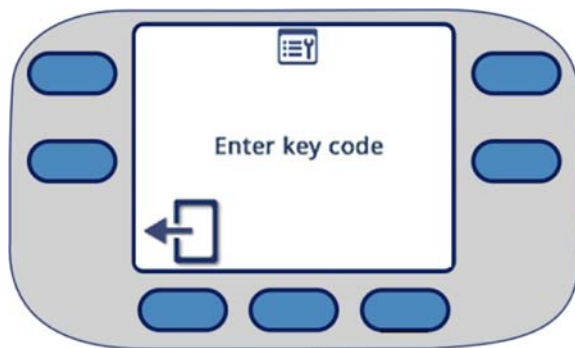


TEM_10105_A



3. Press the **System Test** key. The Key Code screen appears ([Figure 7-7](#)).

Figure 7-7. Key Code Screen



TEM_10274_A

4. Press the key code as described in [Service Screen Access](#) on page 7-2. The Select Test screen appears ([Figure 7-8](#)).

Figure 7-8. Select Test Screen



5. Press the **Test Thermostat** key to begin the thermostat test. The Thermostat Test screen appears ([Figure 7-9](#)).

Figure 7-9. Thermostat Test Screen



6. Verify that within 1-2 minutes, the heater and fan shut down and an alarm is generated. (It is not necessary to time the process, however, if the thermostat fails to open, see [Thermostat Test Failure](#) on page 7-13.)
7. Press the **On/Standby** key to power off the unit. Allow the unit to cool 5 -10 minutes, then power it back on.
8. Press the **Menu** key. The Menu screen appears.



9. Press the **System Information** key. The System Information screen shows the most recent error messages. Look for error code 006, indicating that the thermal cut-out switch opened.

10. When finished with all testing:



- a. Press the **On/Standby** key to power off the unit.
- b. Unplug the unit from the outlet.

Thermostat Test Failure

If the thermostat fails to open within 20 minutes after the thermostat test begins, the heater and fan automatically shut down. The following message appears on the display:

Thermostat Test Failed. Consult Service Manual

If the test fails, see [Basic Troubleshooting](#) on page 6-9.

7.6 Electrical Safety Tests

This section provides values for electrical safety tests required by the warming unit. Technicians must be familiar with the standards applicable to their respective institution and country. Test equipment and its application must comply with the applicable standards.

7.6.1 Ground Bond Test

Without power cord: $\leq 100 \text{ m } \Omega$

With power cord: $\leq 200 \text{ m } \Omega$

7.6.2 Earth Leakage Current Test (Line Leakage)

Table 7-1. Earth Leakage Current Test

AC Polarity	Line Cord	Neutral Cord	Leakage Current
Normal	Closed	Closed	300 μA
Reversed	Closed	Closed	300 μA
Normal	Open	Closed	1000 μA
Normal	Closed	Open	1000 μA

7.6.3 Enclosure Leakage Current Test (Line Leakage)

Table 7-2. Enclosure Leakage Current Test

AC Line Cord	Neutral Line Cord	Power Line Ground Cable	AAMI / ANSI Standard ES1
Normal	Closed	Closed	100 μA
Normal	Closed	Open	500 μA
Normal	Open	Closed	500 μA
Reversed	Closed	Closed	100 μA
Reversed	Open	Closed	500 μA
Reversed	Closed	Open	500 μA

8 External Component Replacement

8.1 Overview

This chapter provides instructions for replacing external components of the Covidien WarmTouch™ Convective Warming Unit.

<i>Pole Clamp Replacement</i>	<i>Page 8-2</i>
<i>USB Port Cover Replacement</i>	<i>Page 8-4</i>
<i>Power Cord Replacement</i>	<i>Page 8-5</i>
<i>Nozzle Replacement</i>	<i>Page 8-8</i>
<i>Nozzle Strap with Clip Replacement</i>	<i>Page 8-10</i>
<i>No Free-Hosing Label Replacement</i>	<i>Page 8-11</i>

8.2 Safety Reminders



WARNING:

No modification of this equipment is allowed. Modification can result in death, injury, or property damage.



WARNING:

Before attempting to open or disassemble the warming unit, disconnect the power cord from the AC power source.



Caution:

Observe ESD (electrostatic discharge) precautions when servicing the warming unit.

8.3 Pole Clamp Replacement

This procedure describes replacing pole clamps only, not the mounting bolts for the clamps. If you are replacing the mounting bolts, refer to [Pole Clamp and Mounting Bolt Replacement](#) on page 11-18.

Figure 8-1. Pole Clamps



TEM_10162_A

Requirements:

- WT-CWU Pole Clamp Kit ([page A-2](#))

Note: Each kit contains three clamps, knobs, and mounting bolts.



WARNING:

Disconnect the warming unit's power cord from the AC power source before performing this procedure.

To replace a pole clamp:

1. At the back of the unit, completely loosen the knob on the clamp to be replaced, and remove it from the mounting bolt (*Figure 8-2*).

Figure 8-2. Pole Clamp Foot and Knob

TEM_10163_A

1 Clamp Foot (x3)

2 Clamp Knob (x3)

2. Slide the clamp foot off the bolt.
3. Slide the new clamp foot onto the bolt, making sure that the rubber pad is toward the unit.
4. Place the new knob on the bolt and tighten it until the clamp foot is secure. Do not overtighten.

8.4 USB Port Cover Replacement

Figure 8-3. USB Port Cover



TEM_10164_A

Requirements:

- WT-CWU USB Port Cover Kit ([page A-2](#))
- Torque driver with #2 Phillips bit



WARNING:

Disconnect the warming unit's power cord from the AC power source before performing this procedure.

To replace the USB port cover:

1. Remove the screw securing the cover over the USB port. Remove the cover.
2. Place the new cover in position and install the screw. Tighten the screw to 1.1 to 1.5 N-m (9.7 to 13.3 lb-in).

8.5 Power Cord Replacement

**WARNING:**

The use of accessories or cables with the warming system other than those indicated in this manual may result in non-compliance with the specifications listed in *Electromagnetic Compatibility (EMC)* on page 13-4.



The power cord requires proper disposal in accordance with WEEE Directive. Do not dispose of this item as unsorted municipal waste.

There are several power cord options available for the warming unit. Ensure that the replacement power cord is appropriate to the country of use.

Figure 8-4. Power Cord Connection



1 Power Cord Routing Bracket

2 Power Cord Connector

Requirements:

- WarmTouch power cord ([page A-2](#))



WARNING:

Disconnect the warming unit's power cord from the AC power source before performing this procedure.

To replace the power cord:

1. If the power cord is secured around the back of the unit, unwind it completely.
2. Position the warming unit on its front so the bottom of the unit is accessible ([Figure 8-4](#) on page 8-5).
3. Disengage the power cord from its routing bracket and remove it from the socket.



Caution:

The institution should follow local governing ordinances and recycling instructions regarding disposal or recycling of filter and device components or end of life of the product.

4. Dispose of the power cord as required by WEEE Directive.
5. Insert the new power cord into the socket, making sure that it is fully seated.
Note: Do not route the power cord through the metal hook on the filter enclosure.
6. Press the power cord into the routing bracket until it is completely seated. If necessary, use a screwdriver to carefully spread the sides of the bracket while inserting the cord.
7. Perform the [Power-On Test](#) on page 7-3.
8. Wrap the power cord around the back of the unit, and secure it with the attached strap ([Figure 8-5](#)).

Figure 8-5. Power Cord Wrapped and Secured



TEM_10113_A

8.6 Nozzle Replacement

Figure 8-6. Nozzle



TEM_10166_A

Requirements:

- WT-CWU Nozzle Kit ([page A-2](#))
- Medium flat-blade screwdriver with long handle



WARNING:

Disconnect the warming unit's power cord from the AC power source before performing this procedure.

8.7 Nozzle Strap with Clip Replacement

Figure 8-8. Nozzle Strap with Clip



TEM_10168_A

Requirements:

- WT Nozzle Strap/Clip Kit ([page A-2](#))



WARNING:

Disconnect the warming unit's power cord from the AC power source before performing this procedure.

To replace the nozzle strap with clip:

1. Lift the nozzle off the hook on the side of the warming unit.
2. If the current nozzle strap is still present, slide it down the hose and over the nozzle, stretching the strap as necessary to remove it.
3. Slide the replacement nozzle strap over the nozzle and onto the hose, positioning it as desired.

8.8 No Free-Hosing Label Replacement

The front enclosure and nozzle must display the no free-hosing label ([Figure 8-9](#)). If either of these labels is damaged or becomes unreadable, it must be replaced.

Figure 8-9. No Free-Hosing Labels on Front Enclosure (L) and Nozzle (R)



TEM_10169_A

Requirements:

- WT No Free-Hosing Label Kit ([page A-2](#))
- 70% isopropyl alcohol solution and soft cloth

Note: Each kit contains six labels.



WARNING:

Disconnect the warming unit's power cord from the AC power source before performing this procedure.

To replace a no free-hosing label:

1. Peel off the old label.
2. Use a soft cloth dampened with a solution of 70% isopropyl alcohol to remove any adhesive remnants from the surface.
3. After the surface is completely dry, remove the backing from the new label.
4. Position the label as shown in [Figure 8-9](#) on page 8-11.
5. Press from one edge to the opposite edge to adhere, taking care to eliminate air from under the label.

9 Accessing the Inside of the Warming Unit

9.1 Overview

This chapter provides instructions for accessing components inside the Covid-ien WarmTouch™ Convective Warming Unit.



Note:

Testing is required after service procedures that involve accessing the inside of the warming unit. Refer to the instructions in each component replacement section for minimum testing requirements.

9.2 Safety Reminders



WARNING:

No modification of this equipment is allowed. Modification can result in death, injury, or property damage.



WARNING:

Before attempting to open or disassemble the warming unit, disconnect the power cord from the AC power source.

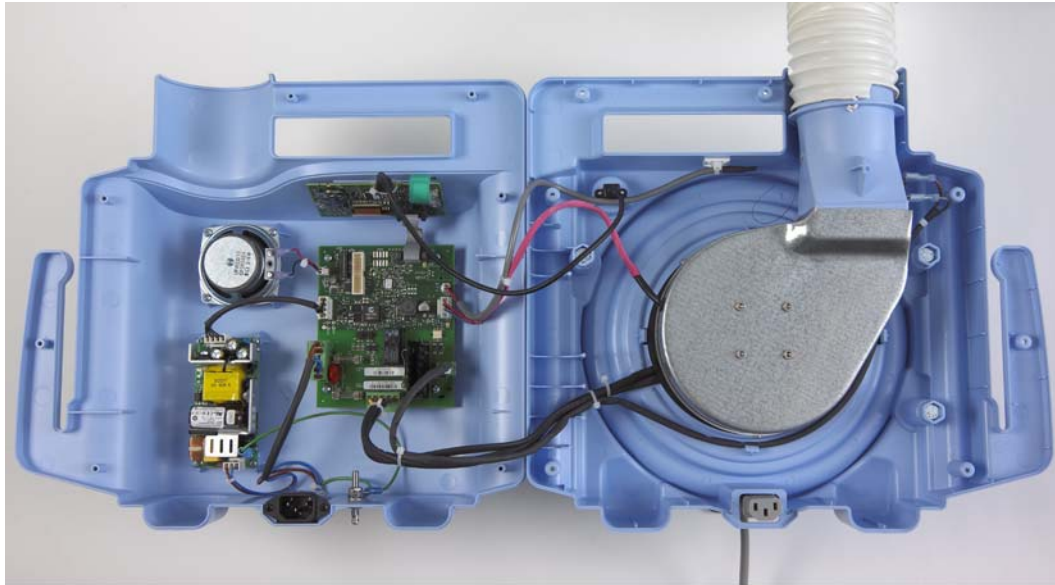


Caution:

Observe ESD (electrostatic discharge) precautions when servicing the warming unit.

9.3 Separating the Front and Rear Enclosures

Figure 9-1. Separated Enclosures



Requirements:

- Torque driver with #2 Phillips bit



WARNING:

Disconnect the warming unit's power cord from the AC power source before performing this procedure.

To separate the front and rear enclosures:

1. If the power cord is secured around the back of the unit, unwind it completely.
2. Position the warming unit on its front so the bottom of the unit is accessible ([Figure 9-2](#)).

Figure 9-2. Power Cord Connection

- 1 Power Cord Routing Bracket 2 Power Cord Connector

3. *Optional Step:* Disengage the power cord from its routing bracket and remove it from the socket.
4. Remove the seven screws securing the rear enclosure to the front enclosure ([Figure 9-3](#)). Note that one of the screws is located in the nozzle hook that secures the hose when not in use.

Figure 9-3. Enclosure Screws



5. Supporting both enclosures, reposition the unit on its back.



Caution:
The front and rear enclosures are connected by cables. When separating the enclosures, do not apply stress to the cables.

6. Carefully lift the front enclosure at the nozzle hook and rotate it away from the rear enclosure. Note that if you did not remove the power cord previously, you will need to disengage it from its socket while rotating the front enclosure. The power cord can remain with the rear enclosure.
7. Set the front enclosure next to the rear enclosure, taking care not to apply stress to the connecting cables ([Figure 9-1](#) on page 9-2).

9.4 Rejoining the Front and Rear Enclosures

Requirements:

- Torque driver with #2 Phillips bit



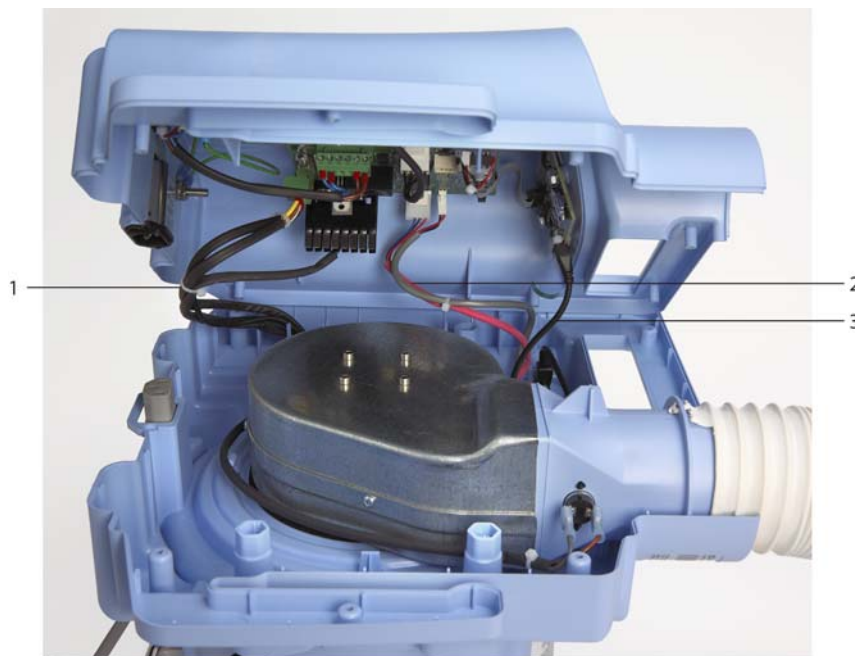
Caution:

When rejoining the front and rear enclosures, ensure that no cables are caught between them.

To rejoin the front and rear enclosures:

1. Carefully rotate the front enclosure onto the rear enclosure, tucking the cables into the rear enclosure as follows (*Figure 9-4*):
 - Heater and thermostat cables in lower-left corner.
 - USB, thermistor, and fan cables in upper-left corner.

Figure 9-4. Rejoining the Enclosures



- | | | | |
|---|------------------------------|---|-----------|
| 1 | Heater and Thermostat Cables | 3 | USB Cable |
| 2 | Thermistor and Fan Cables | | |

Note: If the power cord is attached to the rear enclosure, check its alignment with the socket while positioning the front enclosure. Make sure that the power cord is fully seated in the socket when the enclosures are together.

2. Align all edges of the enclosures, making sure they are fully seated and that no cables are caught between them.
3. Supporting both enclosures, reposition the unit on its front.
4. Reinstall the seven screws securing the rear enclosure to the front enclosure ([Figure 9-3](#) on page 9-4). Tighten the screws to 1.1 to 1.5 N-m (9.7 to 13.3 lb-in).
5. If the power cord is not yet attached, attach it as follows ([Figure 9-5](#)):
 - a. Insert the power cord into its socket, making sure that it is fully seated.

Note: Do not route the power cord through the metal hook on the enclosure.
 - b. Press the power cord into the routing bracket until it is completely seated. If necessary, use a screwdriver to carefully spread the sides of the bracket while inserting the cord.

Figure 9-5. Power Cord Connection



1 Power Cord Routing Bracket

2 Power Cord Connector

6. Set the warming unit upright.
7. Perform all required tests for the component being replaced. (Each component replacement procedure lists testing requirements.)
8. Wrap the power cord around the back of the unit, and secure it with the provided strap (*Figure 9-6*).

Figure 9-6. Power Cord Wrapped and Secured



TEM_10113_A

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10 Internal Component Replacement (Inside Front Enclosure)

10.1 Overview

This chapter provides instructions for replacing components that require accessing the inside of the Covidien WarmTouch™ Convective Warming Unit's front enclosure.

<i>Keypad Replacement</i>	<i>Page 10-3</i>
<i>Display (LCD) Replacement</i>	<i>Page 10-8</i>
<i>User Interface (UI) PCBA Replacement</i>	<i>Page 10-12</i>
<i>Ribbon Cable Replacement</i>	<i>Page 10-19</i>
<i>USB Cable Replacement</i>	<i>Page 10-22</i>
<i>Clock Battery Replacement</i>	<i>Page 10-29</i>
<i>Power PCBA Replacement</i>	<i>Page 10-31</i>
<i>Fuse Replacement</i>	<i>Page 10-35</i>
<i>Speaker Replacement</i>	<i>Page 10-37</i>
<i>Speaker Cable Replacement</i>	<i>Page 10-40</i>
<i>Power Supply Replacement</i>	<i>Page 10-43</i>
<i>Power Supply Output Cable Replacement</i>	<i>Page 10-46</i>
<i>Ground Cable Replacement</i>	<i>Page 10-48</i>
<i>AC Power Inlet Replacement</i>	<i>Page 10-51</i>
<i>Equipotential Stud Replacement</i>	<i>Page 10-55</i>



Note:

Testing is required after each of these procedures. Refer to the instructions in each section for minimum testing requirements.

10.2 Safety Reminders



WARNING:

No modification of this equipment is allowed. Modification can result in death, injury, or property damage.



WARNING:

Before attempting to open or disassemble the warming unit, disconnect the power cord from the AC power source.



Caution:

Observe ESD (electrostatic discharge) precautions when servicing the warming unit.

10.3 Keypad Replacement

Figure 10-1. Keypad



TEM_10205_A

Requirements:

- WT-CWU Keypad Kit ([page A-3](#))
- Torque driver with #2 Phillips bit
- Knife, box cutter, or similar tool with a thin, stiff blade
- 70% isopropyl alcohol solution and soft cloth
- Strap or cable tie to wrap around handle of unit



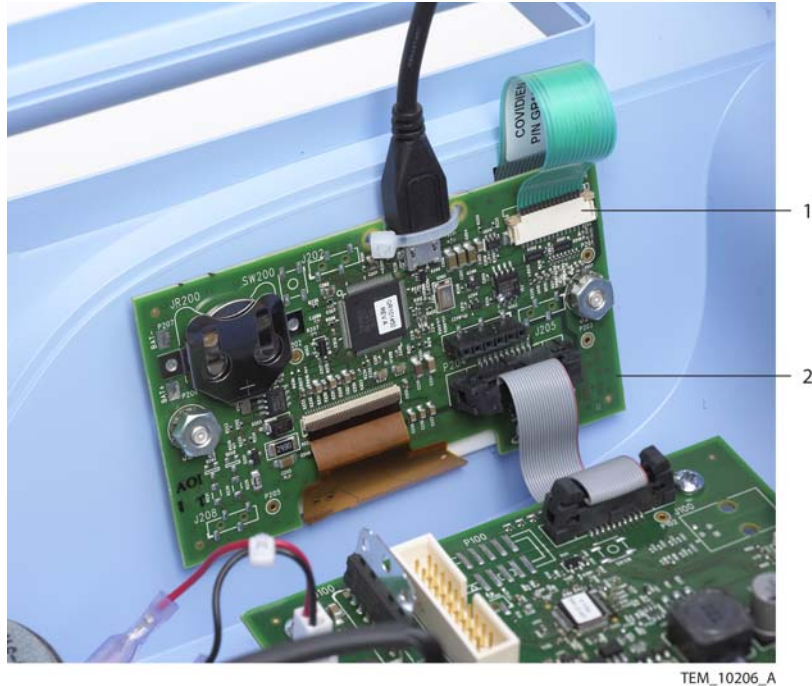
WARNING:

Disconnect the warming unit's power cord from the AC power source before performing this procedure.

To replace the keypad:

1. Follow the procedure [Separating the Front and Rear Enclosures](#) on page 9-2.
2. On the UI PCBA, slide the locking bar up from the J204 connector, and disconnect the keypad cable ([Figure 10-2](#)).

Figure 10-2. Keypad Cable Connection on UI PCBA



- | | | | |
|---|-----------------------------------|---|---------|
| 1 | Keypad Cable
(J204 Connection) | 2 | UI PCBA |
|---|-----------------------------------|---|---------|

3. Carefully rotate the front enclosure onto the rear enclosure, ensuring that no cables are caught between the enclosures. Make sure all edges are fully seated.
4. Place a strap or cable tie around the handle to hold the enclosures together, then set the unit upright.
5. Using a knife, box cutter, or similar tool, pry up a corner of the old keypad ([Figure 10-3](#)). Peel the keypad completely off, pulling the keypad cable with it.

Figure 10-3. Removing the Keypad

TEM_10264_A

6. Use a soft cloth dampened with a solution of 70% isopropyl alcohol to remove any adhesive remnants from the surface. Make sure that the surface is completely dry before proceeding.
7. Remove the clear window film and protective paper from the back of the new keypad. Make sure that all of the paper is removed from under the keypad cable.
8. Check the window for dust, fingerprints, and debris. If necessary, clean the window. Note that there is a clear plastic spacer on the back of the window. Do not remove this spacer.
9. Attach the keypad to the recessed area on the enclosure as follows:
 - a. Aligning the keypad with the recess, feed the keypad cable through the access slot (*Figure 10-4*).

Figure 10-4. Feeding the Keypad Cable Through the Access Slot



TEM_10207_A

- b. Align the keypad with the top edge of the recess, and press the top edge of the keypad against the recess (*Figure 10-5*).
- c. Rub the keypad downward towards the bottom edge across its full width to engage the adhesive, taking care to eliminate any air from the seal.

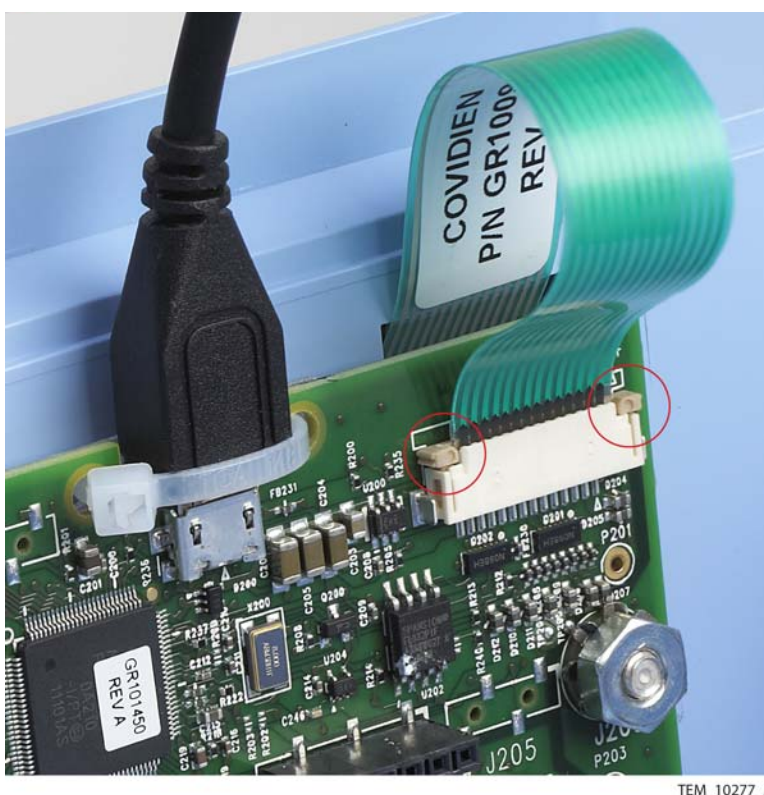
Figure 10-5. Aligning the Keypad



TEM_10208_A

10. Place the unit on its back. Remove the strap or cable tie from the handle, and re-open the unit.
11. On the UI PCBA, slide the locking bar up from the J204 connector, and slide the keypad cable completely into the connector in front of the locking bar. Press down on both sides of the locking bar to secure the cable. The locking bar must be completely seated on both sides (*Figure 10-6*).

Figure 10-6. Keypad Cable Secured by Locking Bar

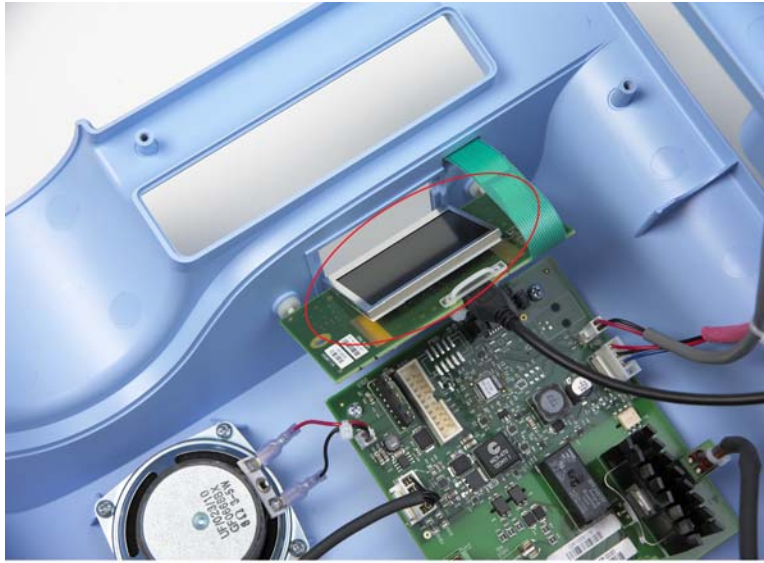


10.4 Display (LCD) Replacement



The display requires proper disposal in accordance with WEEE Directive. Do not dispose of this item as unsorted municipal waste.

Figure 10-7. Display behind UI PCBA



Requirements:

- WT-CWU Display Kit ([page A-3](#))
- Torque driver with #2 Phillips bit and 11/32" hex socket

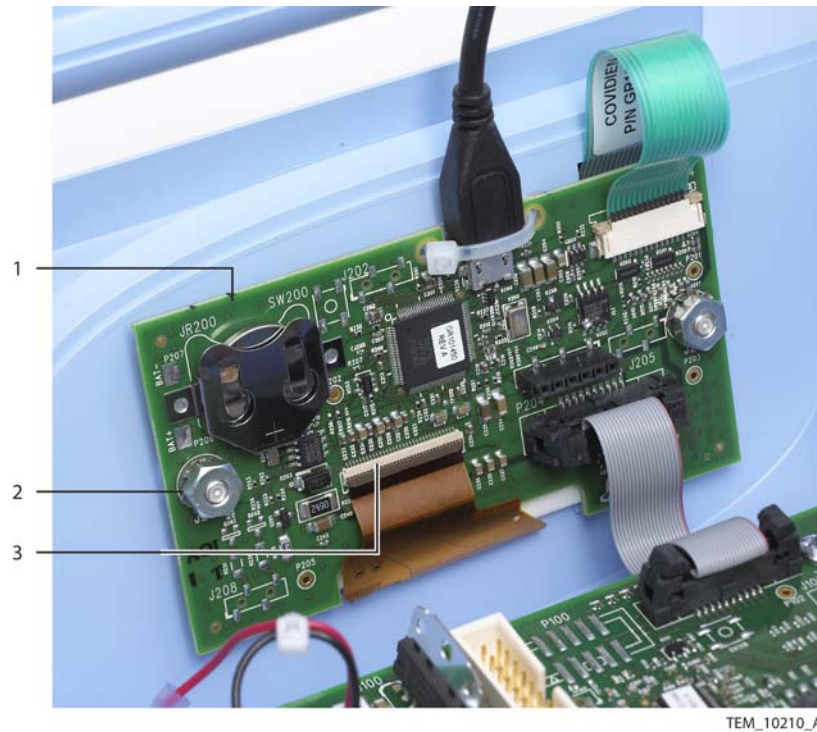


WARNING:

Disconnect the warming unit's power cord from the AC power source before performing this procedure.

To replace the display:

1. Follow the procedure *Separating the Front and Rear Enclosures* on page 9-2.
2. On the UI PCBA, lift the locking tab at the J207 connector, and disconnect the display cable. Leave the remaining cables attached to the PCBA (*Figure 10-8*).

Figure 10-8. Display Cable Connection on UI PCBA

- | | | | |
|---|---|---|------------------------------------|
| 1 | UI PCBA | 3 | Display Cable
(J207 Connection) |
| 2 | Nut, Lock Washer,
Shoulder Washer (x2) | | |

3. Remove the UI PCBA from its mounting screws as follows:
 - a. Remove the nut from each mounting screw.
 - b. Remove the lock washer from each mounting screw.
 - c. Slide the UI PCBA off the mounting screws, taking care not to apply stress to the cables still attached. Leave the shoulder washers in the mounting holes on the PCBA.

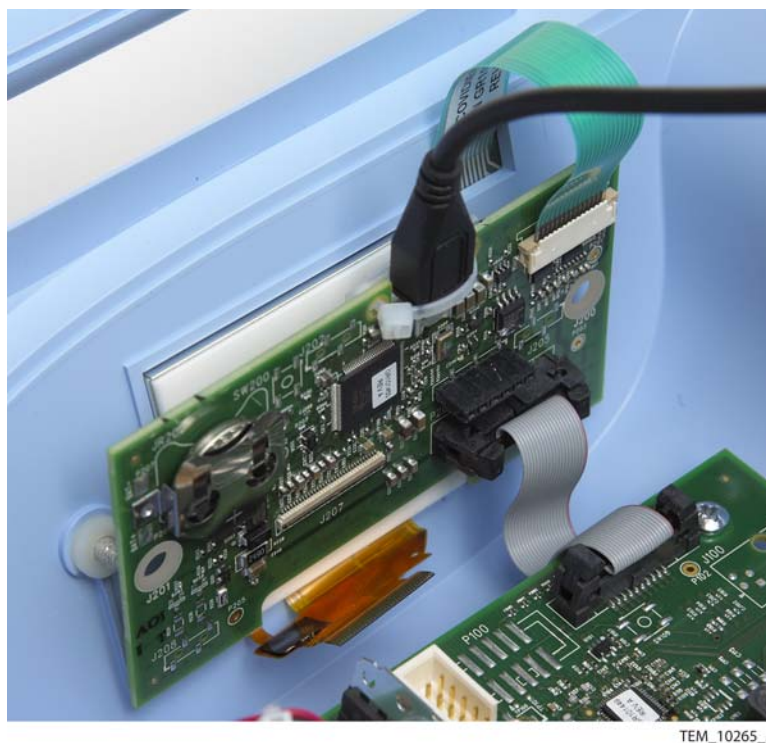
- d. Leave the nylon spacer on each mounting screw.



Caution:
The institution should follow local governing ordinances and recycling instructions regarding disposal or recycling of filter and device components or end of life of the product.

- 4. Lift the display out of its window. Dispose of the display as required by WEEE Directive.
- 5. Peel the protective film from the new display.
- 6. Place the display into the window with the display cable toward the bottom and the foam gasket facing the inside of the unit (*Figure 10-9*).

Figure 10-9. Positioning the Display



- 7. Reattach the UI PCBA to the mounting screws as follows (*Figure 10-8* on page 10-9):
 - a. Make sure that the display is still seated in the display window.
 - b. Make sure that the nylon spacers are still on the mounting screws.

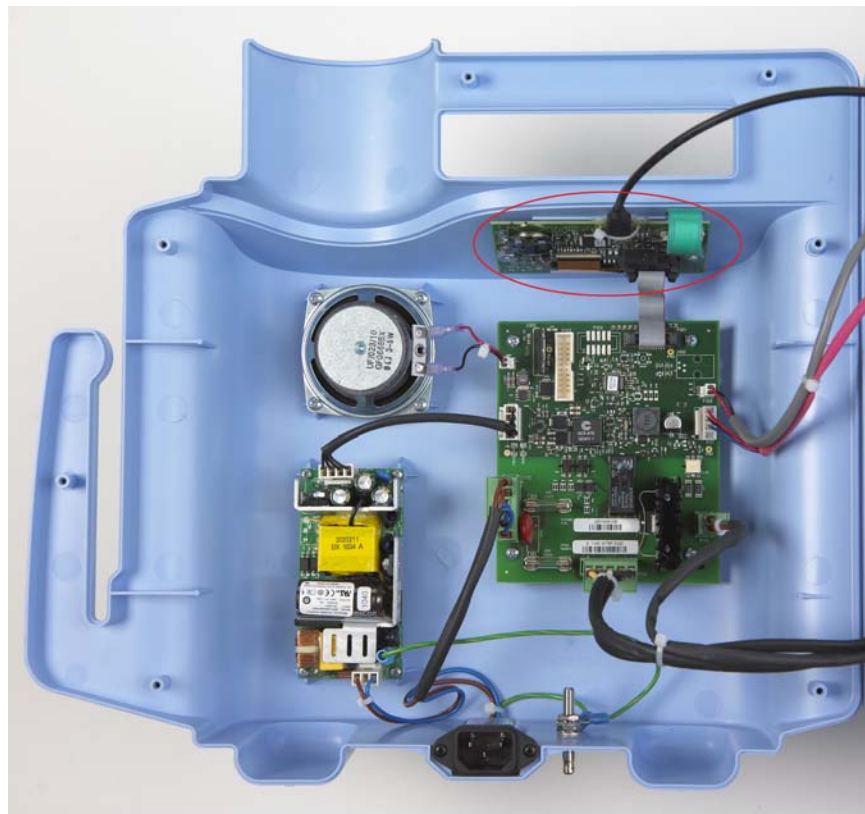
- c. Position the PCBA on the mounting screws with the USB cable at the top. Make sure that the display cable isn't caught behind the PCBA.
 - d. Make sure that the shoulder washers are in place in the PCBA mounting holes, with the bottom of the shoulder against the top surface of the PCBA.
 - e. Place a lock washer on each mounting screw.
 - f. Place a nut on each mounting screw. Tighten the nuts to 0.4 to 0.6 N-m (3.5 to 5.3 lb-in).
8. Lift the locking tab at the J207 connector, and insert the display cable until it stops against the end of the connector (*Figure 10-8* on page 10-9). Press the locking tab down to secure the cable. Pull lightly on the cable to make sure it is fully attached.
 9. Follow the procedure *Rejoining the Front and Rear Enclosures* on page 9-5.
 10. Perform the following tests:
 - a. *Keypad Test* on page 7-5.
 - b. *Display Test* on page 7-7.
 - c. *Electrical Safety Tests* on page 7-14.

10.5 User Interface (UI) PCBA Replacement



The UI PCBA and the battery on the PCBA require proper disposal in accordance with WEEE Directive. Do not dispose of these items as unsorted municipal waste.

Figure 10-10. UI PCBA



TEM_10211_A

Requirements:

- WT-CWU UI PCBA Kit ([page A-3](#))
- Torque driver with #2 Phillips bit and 11/32" hex socket
- Wire cutters
- 1 cable tie

**WARNING:**

Disconnect the warming unit's power cord from the AC power source before performing this procedure.

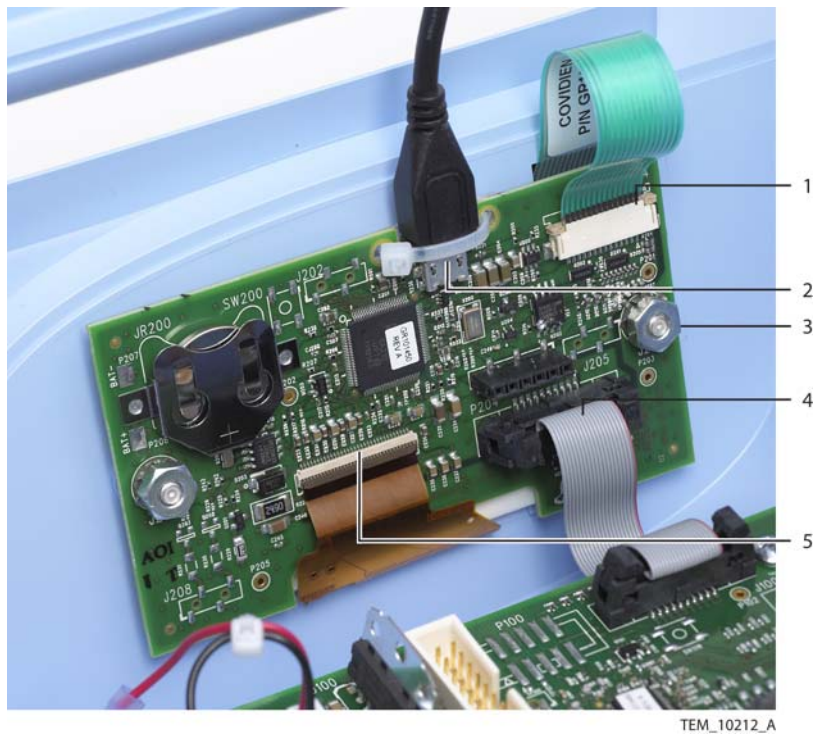
To replace the UI PCBA:

1. Follow the procedure [Separating the Front and Rear Enclosures](#) on page 9-2.
2. Disconnect the cables from the UI PCBA as follows ([Figure 10-11](#)):
 - a. Slide the locking bar up from the J204 connector, and disconnect the keypad cable.
 - b. Open the locking ears at the P204 connector, and disconnect the ribbon cable.
 - c. Lift up the locking tab at the J207 connector, and disconnect the display cable.

**Note:**

Do not remove the USB cable yet (item 2 in [Figure 10-11](#)).

Figure 10-11. UI PCBA Connections

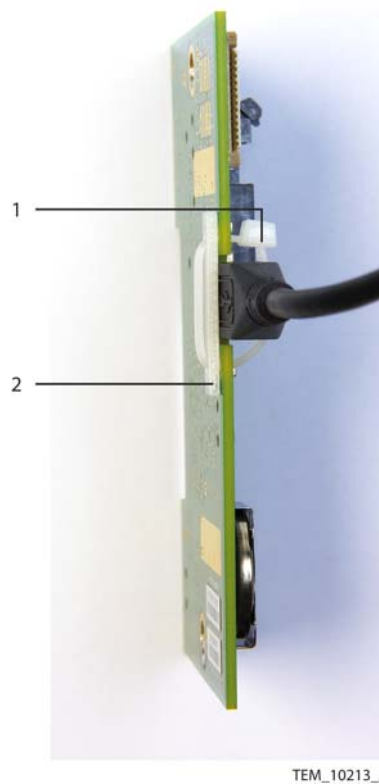


- | | | | |
|---|--|---|------------------------------------|
| 1 | Keypad Cable
(J204 Connection) | 4 | Ribbon Cable
(P204 Connection) |
| 2 | USB Cable
(J203 Connection) | 5 | Display Cable
(J207 Connection) |
| 3 | Nut, Lock Washer, Shoulder Washer (x2) | | |

3. Remove the UI PCBA from its mounting screws as follows:
 - a. Remove the nut from each mounting screw.
 - b. Remove the lock washer from each mounting screw.
 - c. Slide the UI PCBA and shoulder washers off the mounting screws (USB cable still attached).
 - d. Leave the nylon spacer on each mounting screw.

4. Detach the USB cable from the J203 connector as follows (*Figure 10-12*):
 - a. Carefully cut the cable tie securing the USB cable.
 - b. Remove the cable tie and USB backing plate.
 - c. Disconnect the USB cable.

Figure 10-12. USB Connection on UI PCBA



- 1 Cable Tie
- 2 Backing Plate

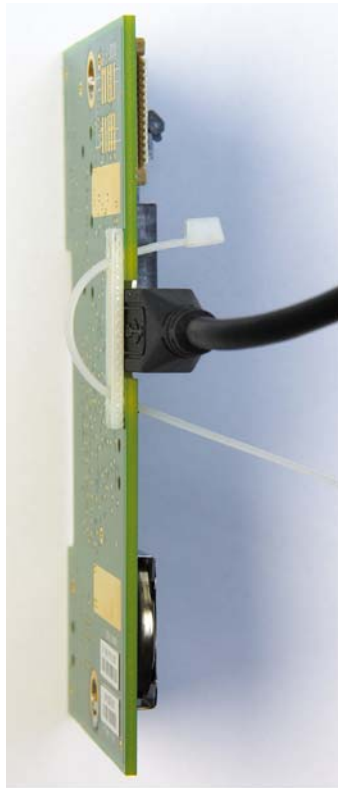


Caution:
The institution should follow local governing ordinances and recycling instructions regarding disposal or recycling of filter and device components or end of life of the product.

5. Dispose of the UI PCBA and the battery on the PCBA as required by WEEE Directive.

6. Attach the USB cable to the new UI PCBA as follows (*Figure 10-13*):
 - a. Place the backing plate against the non-component side of the PCBA, covering the notch at the top of the board. Align the holes in the backing plate with the holes on each side of the notch.
 - b. From the front of the PCBA, insert the cable tie into either hole and through the backing plate.
 - c. From the back of the PCBA, insert the cable tie through the opposite hole in the backing plate to the front of the PCBA.
 - d. Connect the USB cable to the J203 connector.

Figure 10-13. Attaching Backing Plate and Cable Tie to UI PCBA

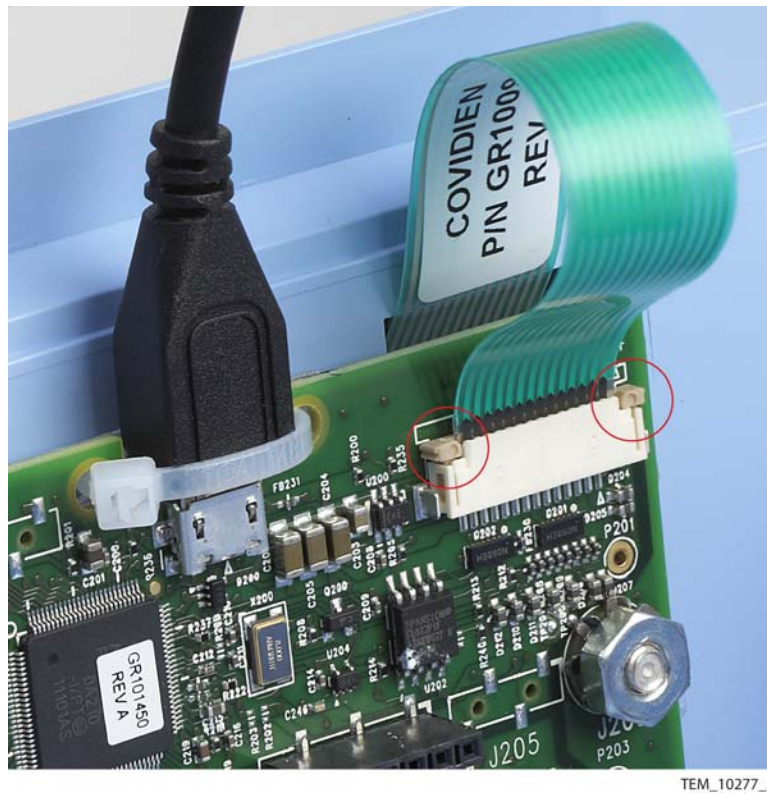


TEM_10214_A

- e. Adjust the cable tie so that the lock is snug against the PCBA.
- f. Secure the USB cable by pulling the cable tie through the lock until the tie is snug against the connector.
- g. Trim off the end of the cable tie.

7. Attach the UI PCBA to the mounting screws as follows:
 - a. Make sure that the display is still seated in the display window.
 - b. Make sure that the nylon spacers are still on the mounting screws.
 - c. Position the PCBA on the mounting screws with the USB cable at the top. Make sure that the display cable and keypad cable aren't caught behind the PCBA.
 - d. Place a shoulder washer on each mounting screw positioned so that the bottom of the shoulder will rest against the top surface of the PCBA.
 - e. Place a lock washer on each mounting screw.
 - f. Place a nut on each mounting screw. Tighten the nuts to 0.4 to 0.6 N-m (3.5 to 5.3 lb-in).
8. Connect the remaining cables to the UI PCBA as follows ([Figure 10-11](#) on page 10-14):
 - a. Lift the locking tab at the J207 connector, and insert the display cable until it stops against the end of the connector. Press the locking tab down to secure the cable. Pull lightly on the cable to make sure it is fully attached.
 - b. Open the locking ears at the P204 connector, and connect the ribbon cable from the Power PCBA. Make sure the locking ears close completely on the connector.
 - c. Slide the locking bar up from the J204 connector, and slide the keypad cable completely into the connector in front of the locking bar. Press down on both sides of the locking bar to secure the cable. The locking bar must be completely seated on both sides ([Figure 10-14](#) on page 10-18).

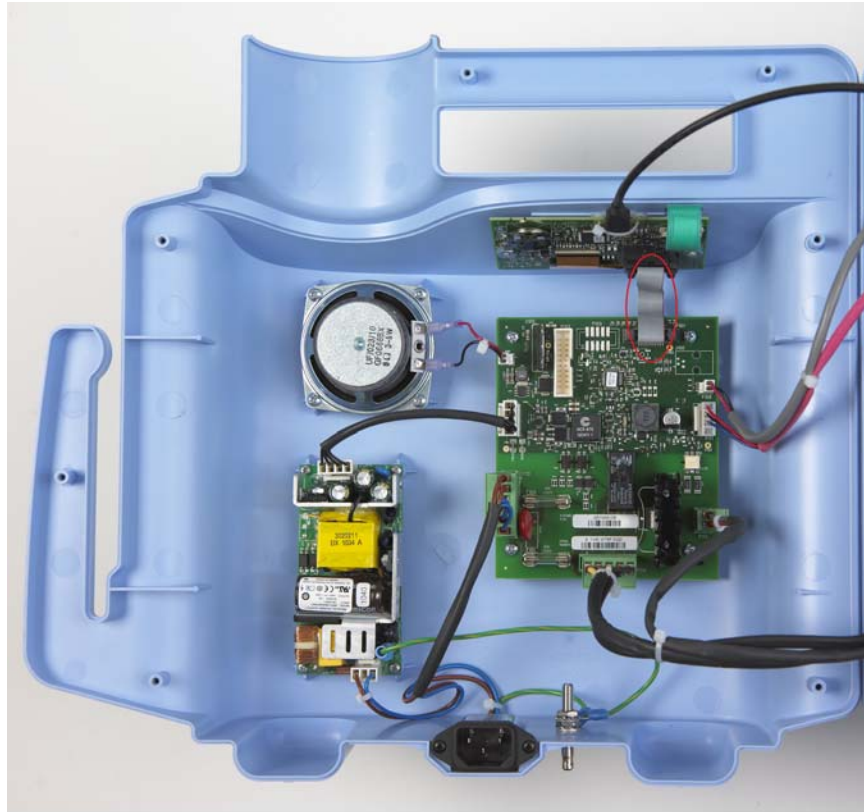
Figure 10-14. Keypad Cable Secured by Locking Bar



9. Follow the procedure [Rejoining the Front and Rear Enclosures](#) on page 9-5.
10. Perform the following tests:
 - a. [Keypad Test](#) on page 7-5.
 - b. [Display Test](#) on page 7-7.
 - c. [Electrical Safety Tests](#) on page 7-14.

10.6 Ribbon Cable Replacement

Figure 10-15. Ribbon Cable



TEM_10215_A

Requirements:

- WT-CWU Ribbon Cable Kit ([page A-3](#))
- Torque driver with #2 Phillips bit



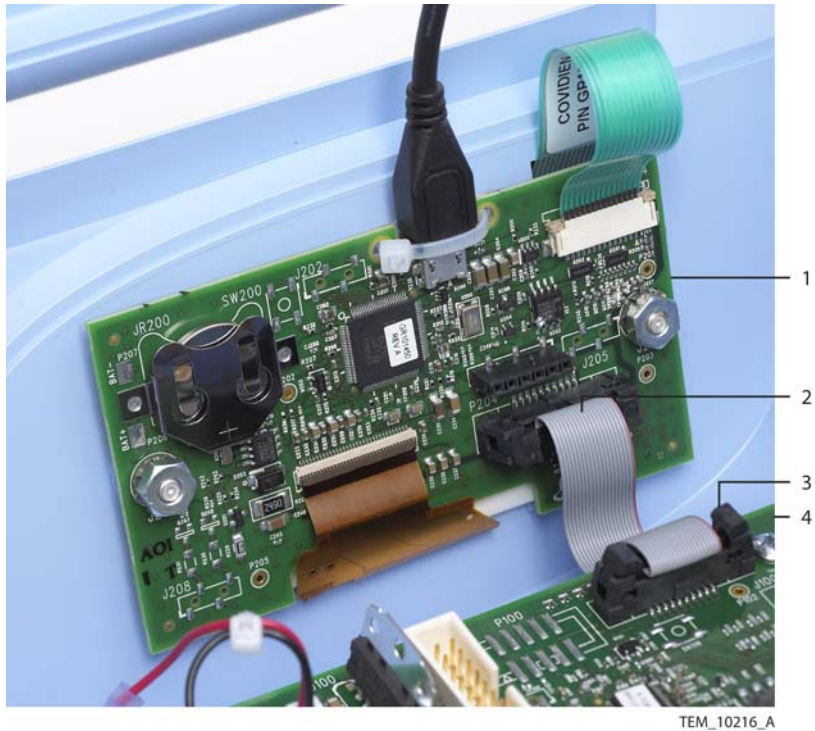
WARNING:

Disconnect the warming unit's power cord from the AC power source before performing this procedure.

To replace the ribbon cable:

1. Follow the procedure [Separating the Front and Rear Enclosures](#) on page 9-2.
2. On the UI PCBA, open the locking ears at the P204 connector, and disconnect the ribbon cable ([Figure 10-16](#)).

Figure 10-16. Ribbon Cable Connections



- | | | | |
|---|-----------------------------------|---|-----------------------------------|
| 1 | UI PCBA | 3 | Ribbon Cable
(P101 Connection) |
| 2 | Ribbon Cable
(P204 Connection) | 4 | Power PCBA |

3. On the Power PCBA, open the locking ears at the P101 connector, and disconnect the ribbon cable.
4. Connect the new ribbon cable to the P101 connector on the Power PCBA. Make sure the locking ears close completely on the connector.
5. Connect the ribbon cable to the P204 connector on the UI PCBA. Make sure the locking ears close completely on the connector.

6. Follow the procedure [Rejoining the Front and Rear Enclosures](#) on page 9-5.
7. Perform the following tests:
 - a. [Power-On Test](#) on page 7-3.
 - b. [Electrical Safety Tests](#) on page 7-14.

10.7 USB Cable Replacement

Figure 10-17. USB Cable



TEM_10217_A

Requirements:

- WT-CWU USB Micro AB Cable Kit ([page A-3](#))
- Torque driver with #1 and #2 Phillips bits and 11/32" hex socket
- Wire cutters
- 1 cable tie



WARNING:

Disconnect the warming unit's power cord from the AC power source before performing this procedure.

To replace the USB cable:

1. At the back of the unit, loosen the screw securing the cover over the USB port, and rotate the cover aside (*Figure 10-18*). Do not remove the cover.

Figure 10-18. USB Port

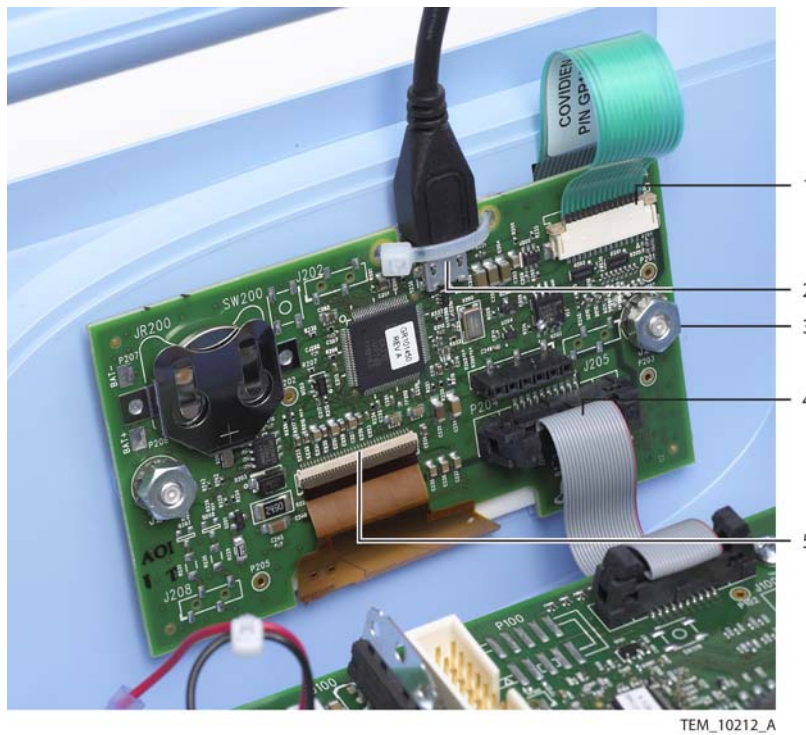
- 1 USB Connector Screw (x2) 2 USB Port Cover

2. Remove the two screws securing the USB cable connector to the enclosure. Save the screws.
3. Follow the procedure *Separating the Front and Rear Enclosures* on page 9-2.
4. Disconnect the cables from the UI PCBA as follows (*Figure 10-19*):
 - a. Slide the locking bar up from the J204 connector, and disconnect the keypad cable.
 - b. Open the locking ears at the P204 connector, and disconnect the ribbon cable.
 - c. Lift up the locking tab at the J207 connector, and disconnect the display cable.

**Note:**

Do not remove the USB cable from the UI PCBA yet (item 2 in *Figure 10-19*).

Figure 10-19. UI PCBA Connections

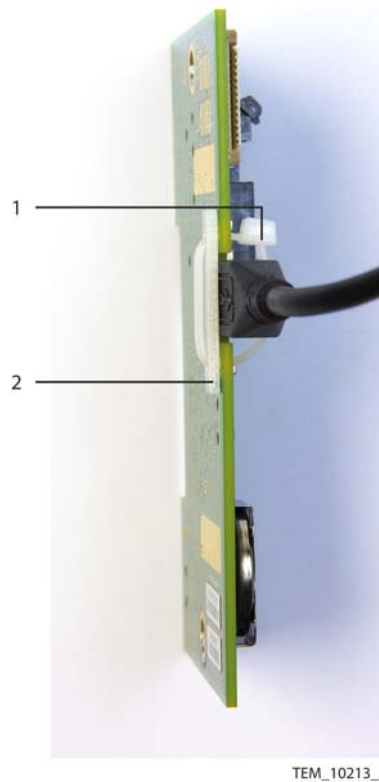


- | | | | |
|---|--|---|------------------------------------|
| 1 | Keypad Cable
(J204 Connection) | 4 | Ribbon Cable
(P204 Connection) |
| 2 | USB Cable
(J203 Connection) | 5 | Display Cable
(J207 Connection) |
| 3 | Nut, Lock Washer, Shoulder Washer (x2) | | |

5. Remove the UI PCBA from its mounting screws as follows:
 - a. Remove the nut from each mounting screw.
 - b. Remove the lock washer from each mounting screw.
 - c. Slide the UI PCBA and shoulder washers off the mounting screws (USB cable still attached). Leave the shoulder washers in the mounting holes on the PCBA.
 - d. Leave the nylon spacer on each mounting screw.

6. Detach the USB cable from the J203 connector as follows ([Figure 10-20](#)):
 - a. Cut the cable tie securing the USB cable.
 - b. Remove the cable tie and set the USB backing plate aside.
 - c. Disconnect the USB cable.

Figure 10-20. USB Connection on UI PCBA

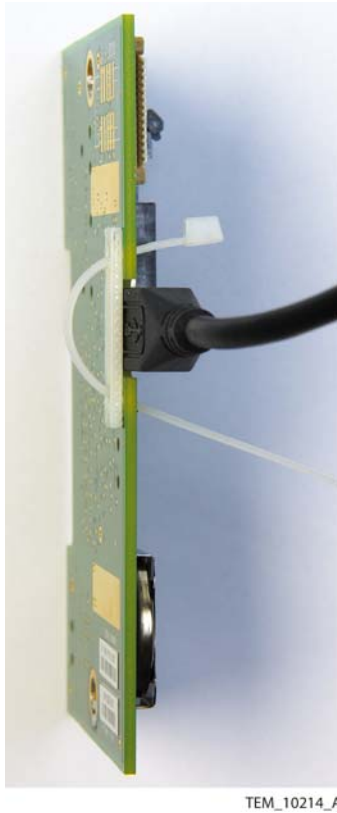


- 1 Cable Tie
- 2 Backing Plate

7. Attach the new USB cable to the UI PCBA as follows ([Figure 10-21](#)):
 - a. Place the backing plate against the non-component side of the PCBA, covering the notch at the top of the board. Align the holes in the backing plate with the holes on each side of the notch.
 - b. From the front of the PCBA, insert the cable tie into either hole and through the backing plate.

- c. From the back of the PCBA, insert the cable tie through the opposite hole in the backing plate to the front of the PCBA.
- d. Connect the USB cable to the J203 connector.

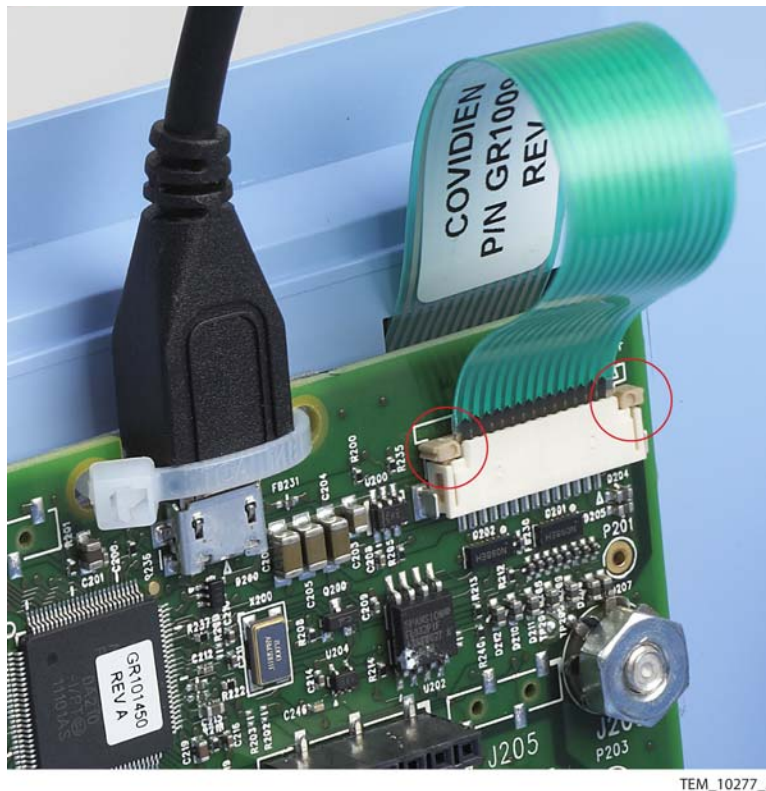
Figure 10-21. Attaching Backing Plate and Cable Tie to UI PCBA



- e. Adjust the cable tie so that the lock is snug against the PCBA.
- f. Secure the USB cable by pulling the cable tie through the lock until the tie is snug against the connector.
- g. Trim off the end of the cable tie.

8. Attach the UI PCBA to the mounting screws as follows:
 - a. Make sure that the display is still seated in the display window.
 - b. Make sure that the nylon spacers are still on the mounting screws.
 - c. Position the PCBA on the mounting screws with the USB cable at the top. Make sure that the display cable and keypad cable aren't caught behind the PCBA.
 - d. Make sure that the shoulder washers are in place in the PCBA mounting holes, with the bottom of the shoulder against the top surface of the PCBA.
 - e. Place a lock washer on each mounting screw.
 - f. Place a nut on each mounting screw. Tighten the nuts to 0.4 to 0.6 N-m (3.5 to 5.3 lb-in).
9. Connect the remaining cables to the new UI PCBA as follows ([Figure 10-19](#) on page 10-24):
 - a. Lift the locking tab at the J207 connector, and insert the display cable until it stops against the end of the connector. Press the locking tab down to secure the cable. Pull lightly on the cable to make sure it is fully attached.
 - b. Open the locking ears at the P204 connector, and connect the ribbon cable from the Power PCBA. Make sure the locking ears close completely on the connector.
 - c. Slide the locking bar up from the J204 connector, and slide the keypad cable completely into the connector in front of the locking bar. Press down on both sides of the locking bar to secure the cable. The locking bar must be completely seated on both sides ([Figure 10-22](#) on page 10-28).

Figure 10-22. Keypad Cable Secured by Locking Bar



TEM_10277_A

10. Position the connector on the other end of the USB cable in the port inside the rear enclosure, with the connector paddle toward the bottom of the enclosure ([Figure 10-17](#) on page 10-22).
11. Supporting the USB connector, rotate the rear enclosure so that you can access the outside. Secure the connector by installing the two screws from the outside of the enclosure. Tighten the screws to 0.18 to 0.27 N-m (1.6 to 2.4 lb-in).
12. Follow the procedure [Rejoining the Front and Rear Enclosures](#) on page 9-5.
13. At the back of the unit, rotate the cover for the USB port back into position, and tighten the screw to 1.1 to 1.5 N-m (9.7 to 13.3 lb-in).
14. Perform the following tests:
 - a. [Keypad Test](#) on page 7-5.
 - b. [Electrical Safety Tests](#) on page 7-14.

10.8 Clock Battery Replacement


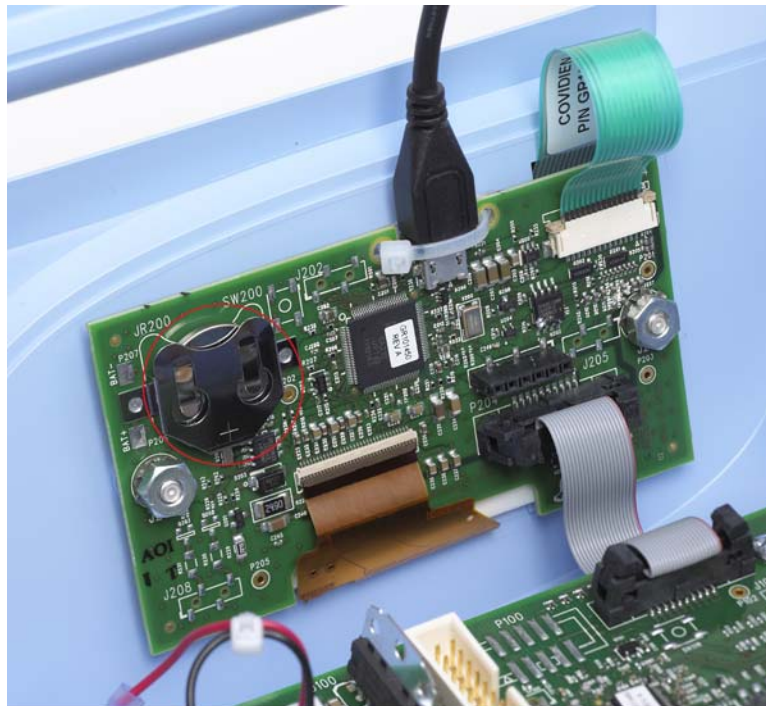
 The battery requires proper disposal in accordance with WEEE Directive. Do not dispose of this item as unsorted municipal waste.

Figure 10-23. Clock Battery on UI PCBA



TEM_10222_A

Requirements:

- 3V CR 2032, lithium-ion coin-cell battery
- Torque driver with #2 Phillips bit
- Non-metallic stylus or similar tool



WARNING:

Disconnect the warming unit's power cord from the AC power source before performing this procedure.

To replace the battery:

1. Follow the procedure [Separating the Front and Rear Enclosures](#) on page 9-2.
2. Using a non-metallic stylus or similar tool, carefully push the battery up from the bottom of its holder on the UI PCBA until you can grasp the battery and remove it.



Caution:

The institution should follow local governing ordinances and recycling instructions regarding disposal or recycling of filter and device components or end of life of the product.

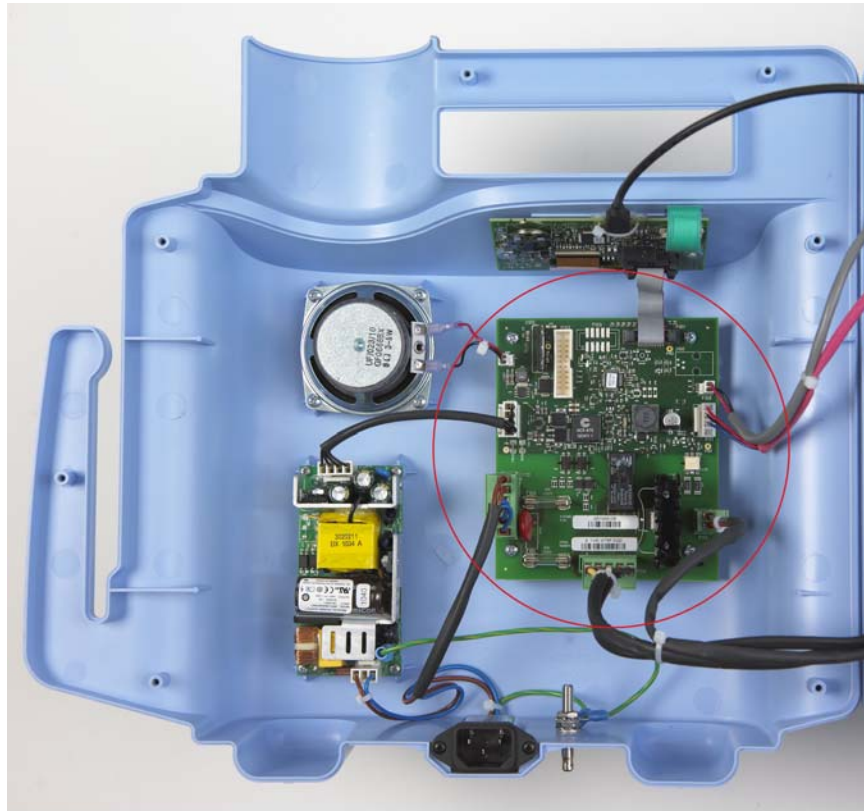
3. Dispose of the battery as required by WEEE Directive.
4. Insert the new battery into the holder with the positive side facing outward (away from the UI PCBA). Make sure the battery is completely seated in the holder.
5. Follow the procedure [Rejoining the Front and Rear Enclosures](#) on page 9-5.
6. Perform the following tests:
 - a. [Power-On Test](#) on page 7-3.
 - b. [Electrical Safety Tests](#) on page 7-14.

10.9 Power PCBA Replacement



The Power PCBA requires proper disposal in accordance with WEEE Directive. Do not dispose of this item as unsorted municipal waste.

Figure 10-24. Power PCBA



TEM_10223_A

Requirements:

- WT-CWU Power PCBA Kit ([page A-3](#))
- Torque driver with #2 Phillips bit



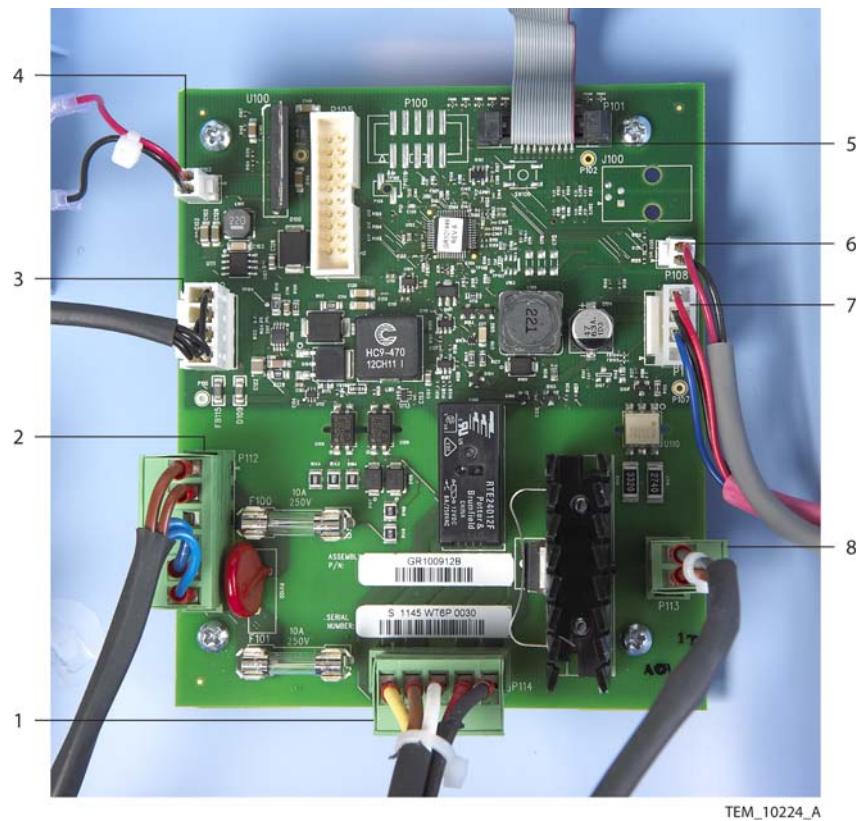
WARNING:

Disconnect the warming unit's power cord from the AC power source before performing this procedure.

To replace the Power PCBA:

1. Follow the procedure [Separating the Front and Rear Enclosures](#) on page 9-2.
2. Disconnect the cables from the Power PCBA as follows ([Figure 10-25](#)):
 - a. Disconnect the AC power inlet wire assembly from the 6-pin P112 connector.
 - b. Disconnect the power supply output cable from the 4-pin P109 connector.
 - c. Disconnect the speaker cable from the 2-pin P103 connector.
 - d. Open the locking ears at the P101 connector, and disconnect the ribbon cable.
 - e. Disconnect the thermistor cable from the 2-pin P108 connector.
 - f. Disconnect the fan cable from the 4-pin P111 connector.
 - g. Disconnect the thermostat cable from the 2-pin P113 connector.
 - h. Disconnect the heater cable from the 5-pin P114 connector.

Figure 10-25. Power PCBA Connections



- | | | | |
|---|---|---|---------------------------------------|
| 1 | Heater Cable
(P114 Connection) | 5 | Ribbon Cable
(P101 Connection) |
| 2 | AC Power Inlet Wire Assembly
(P112 Connection) | 6 | Thermistor Cable
(P108 Connection) |
| 3 | Power Supply Output Cable
(P109 Connection) | 7 | Fan Cable
(P111 Connection) |
| 4 | Speaker Cable
(P103 Connection) | 8 | Thermostat Cable
(P113 Connection) |

3. Remove the four screws securing the Power PCBA to the enclosure.

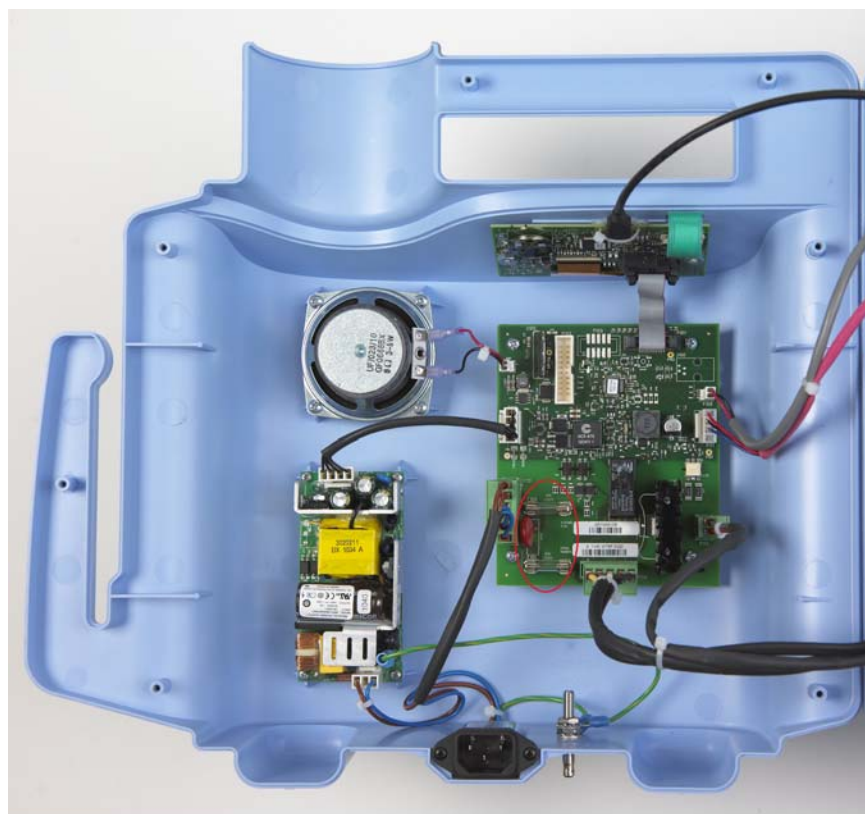


Caution:
The institution should follow local governing ordinances and recycling instructions regarding disposal or recycling of filter and device components or end of life of the product.

4. Dispose of the Power PCBA as required by WEEE Directive.
5. Position the new Power PCBA on the four mounting bosses, with the P101 connector toward the UI PCBA ([Figure 10-25](#) on page 10-33).
6. Attach the Power PCBA to the mounting bosses with the four screws. Tighten the screws to 1.1 to 1.5 N-m (9.7 to 13.3 lb-in).
7. Connect the cables to the new Power PCBA as follows ([Figure 10-25](#) on page 10-33):
 - a. Connect the heater cable to the 5-pin P114 connector. Make sure that the connector is oriented as shown in [Figure 10-25](#), and that it is fully seated.
 - b. Connect the thermostat cable to the 2-pin P113 connector. Make sure that the connector is oriented as shown in [Figure 10-25](#), and that it is fully seated.
 - c. Connect the fan cable to the 4-pin P111 connector. Make sure the connector latch engages.
 - d. Connect the thermistor cable to the 2-pin P108 connector. Make sure the connector latch engages.
 - e. Connect the ribbon cable from the UI PCBA to the P101 connector. Make sure the locking ears close completely on the connector.
 - f. Connect the speaker cable to the 2-pin P103 connector. Make sure the connector latch engages.
 - g. Connect the power supply output cable to the 4-pin P109 connector. Make sure the connector latch engages.
 - h. Connect the AC power inlet wire assembly to the 6-pin P112 connector. Make sure that the connector is oriented as shown in [Figure 10-25](#), and that it is fully seated.
8. Follow the procedure [Rejoining the Front and Rear Enclosures](#) on page 9-5.
9. Perform the following tests:
 - a. [Power-On Test](#) on page 7-3.
 - b. [Temperature Accuracy Test](#) on page 7-8.
 - c. [Flow Test](#) on page 7-10.
 - d. [Thermostat Test](#) on page 7-11.
 - e. [Electrical Safety Tests](#) on page 7-14.

10.10 Fuse Replacement

Figure 10-26. Fuses on Power PCBA



TEM_10225_A

Requirements:

- WT-CWU Fuse Kit ([page A-3](#)) or Littlefuse 0218010; 250 V, 10 A fuse (or equivalent)
- Torque driver with #2 Phillips bit

Note: Each kit contains five fuses.



WARNING:

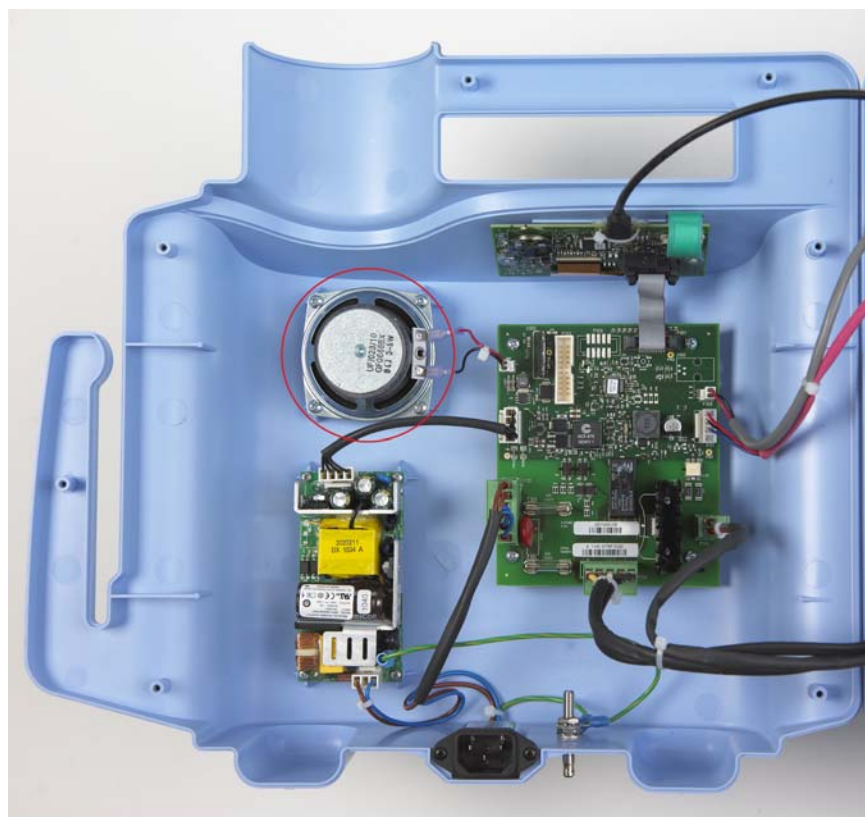
Disconnect the warming unit's power cord from the AC power source before performing this procedure.

To replace the fuse(s):

1. Follow the procedure [Separating the Front and Rear Enclosures](#) on page 9-2.
2. Locate and remove the blown fuse(s) on the Power PCBA.
3. Insert the new fuse(s).
4. Follow the procedure [Rejoining the Front and Rear Enclosures](#) on page 9-5.
5. Perform the following tests:
 - a. [Power-On Test](#) on page 7-3.
 - b. [Electrical Safety Tests](#) on page 7-14.

10.11 Speaker Replacement

Figure 10-27. Speaker



TEM_10226_A

Requirements:

- WT-CWU Speaker Kit ([page A-3](#))
- Torque driver with #2 Phillips bit



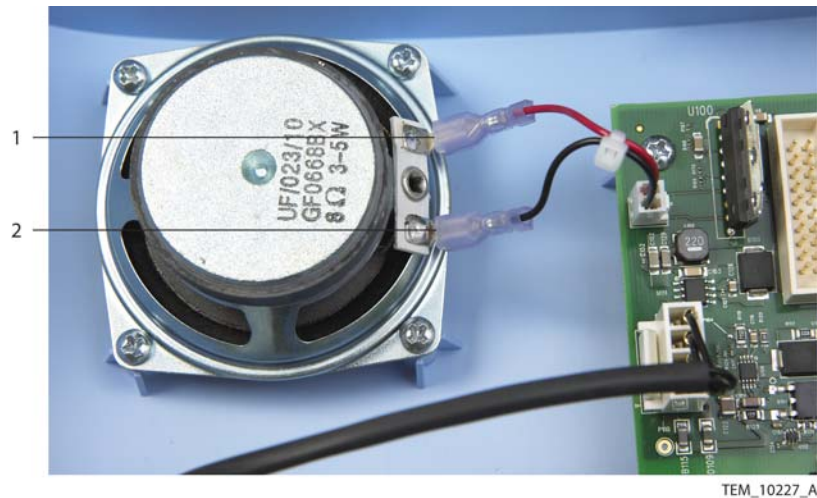
WARNING:

Disconnect the warming unit's power cord from the AC power source before performing this procedure.

To replace the speaker:

1. Follow the procedure [Separating the Front and Rear Enclosures](#) on page 9-2.
2. Disconnect the two speaker wires from the speaker.
3. Remove the four screws securing the speaker to the enclosure, and remove the speaker.
4. Position the new speaker on the four mounting bosses, with the connector terminals towards the Power PCBA ([Figure 10-28](#)).
5. Attach the speaker to the mounting bosses with the four screws. Tighten the screws to 1.1 to 1.5 N-m (9.7 to 13.3 lb-in).
6. Connect the speaker cable to the speaker ([Figure 10-28](#)):
 - Red wire to the positive (+) terminal
 - Black wire to the negative (-) terminal

Figure 10-28. Speaker Cable Connections



1 Positive (+) Terminal
(Red Wire)

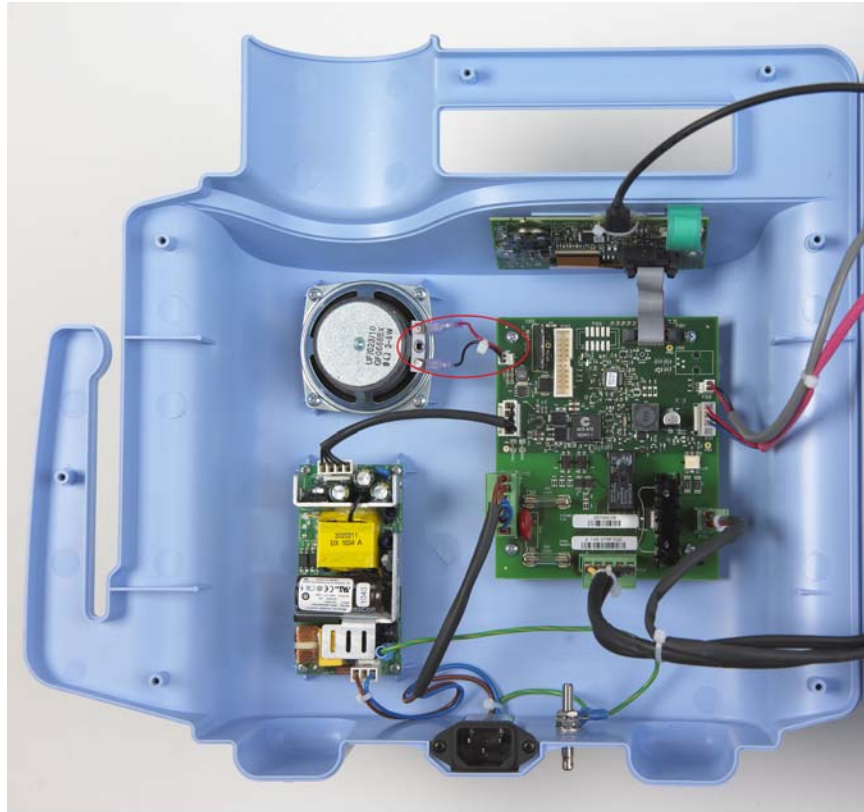
2 Negative (-) Terminal
(Black Wire)

7. Follow the procedure [Rejoining the Front and Rear Enclosures](#) on page 9-5.

8. Perform the following tests:
 - a. *Power-On Test* on page 7-3. Listen for the POST tone to verify speaker operation.
 - b. *Electrical Safety Tests* on page 7-14.

10.12 Speaker Cable Replacement

Figure 10-29. Speaker Cable



TEM_10228_A

Requirements:

- WT-CWU Speaker Cable Kit ([page A-4](#))
- Torque driver with #2 Phillips bit

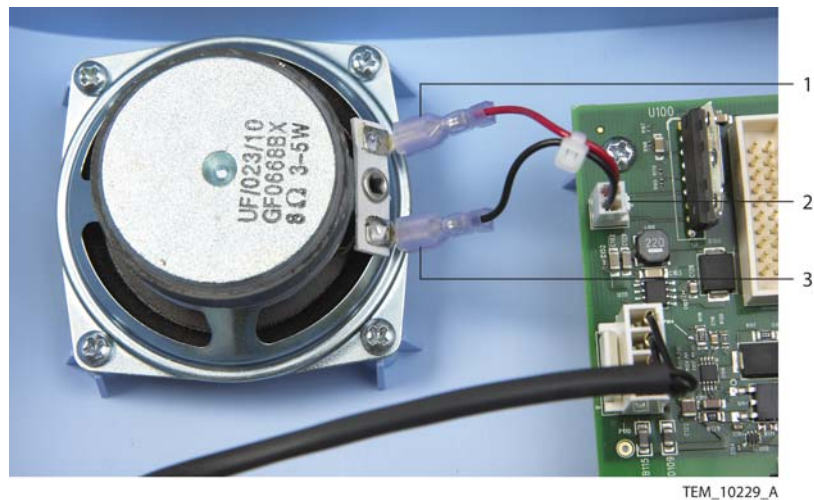


WARNING:

Disconnect the warming unit's power cord from the AC power source before performing this procedure.

To replace the speaker cable:

1. Follow the procedure [Separating the Front and Rear Enclosures](#) on page 9-2.
2. Disconnect the two speaker cable connections from the speaker terminal ([Figure 10-30](#)).
3. On the Power PCBA, disconnect the speaker cable from the 2-pin P103 connector.

Figure 10-30. Speaker Cable Connections

1 Positive (+) Terminal
(Red Wire)

3 Negative (-) Terminal
(Black Wire)

2 P103 Connection
(Power PCBA)

4. Connect the new speaker cable to the P103 connector on the Power PCBA. Make sure the connector latch engages.
5. Connect the speaker cable to the speaker:
 - Red wire to the positive (+) terminal
 - Black wire to the negative (-) terminal
6. Follow the procedure [Rejoining the Front and Rear Enclosures](#) on page 9-5.

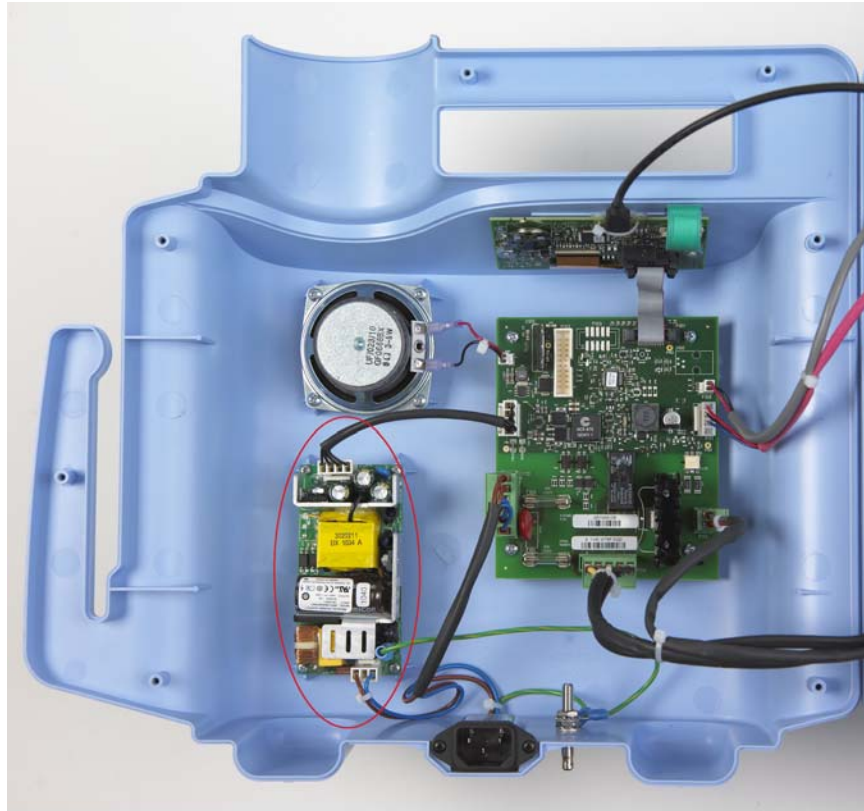
7. Perform the following tests:
 - a. *Power-On Test* on page 7-3. Listen for the POST tone to verify the speaker cable connection.
 - b. *Electrical Safety Tests* on page 7-14.

10.13 Power Supply Replacement



The power supply requires proper disposal in accordance with WEEE Directive. Do not dispose of this item as unsorted municipal waste.

Figure 10-31. Power Supply



TEM_10230_A

Requirements:

- WT-CWU Pwr Supply Kit ([page A-4](#))
- Torque driver with #1 and #2 Phillips bits
- Wire cutters and cable tie (some warming unit configurations)



WARNING:

Disconnect the warming unit's power cord from the AC power source before performing this procedure.

To replace the power supply:

1. Follow the procedure [Separating the Front and Rear Enclosures](#) on page 9-2.
2. Disconnect the cables from the power supply as follows ([Figure 10-32](#)):
 - a. Disconnect the ground cable from the GND terminal.
 - b. Disconnect the AC power inlet wire assembly from the 3-pin CON1 connector.
 - c. Disconnect the power supply output cable from the 4-pin CON2 connector.

Figure 10-32. Power Supply Connections



- | | | | |
|---|--|---|---|
| 1 | Power Supply Output Cable
(CON2 Connection) | 3 | AC Power Inlet Wire Assembly
(CON1 Connection) |
| 2 | Ground Cable
(GND Terminal Connection) | | |

Note: A cable tie may secure the AC power inlet wire assembly to the power supply mounting boss next to the CON1 connector. If so, cut and remove this cable tie.

3. Remove the four screws securing the power supply to the enclosure.



Caution:
The institution should follow local governing ordinances and recycling instructions regarding disposal or recycling of filter and device components or end of life of the product.

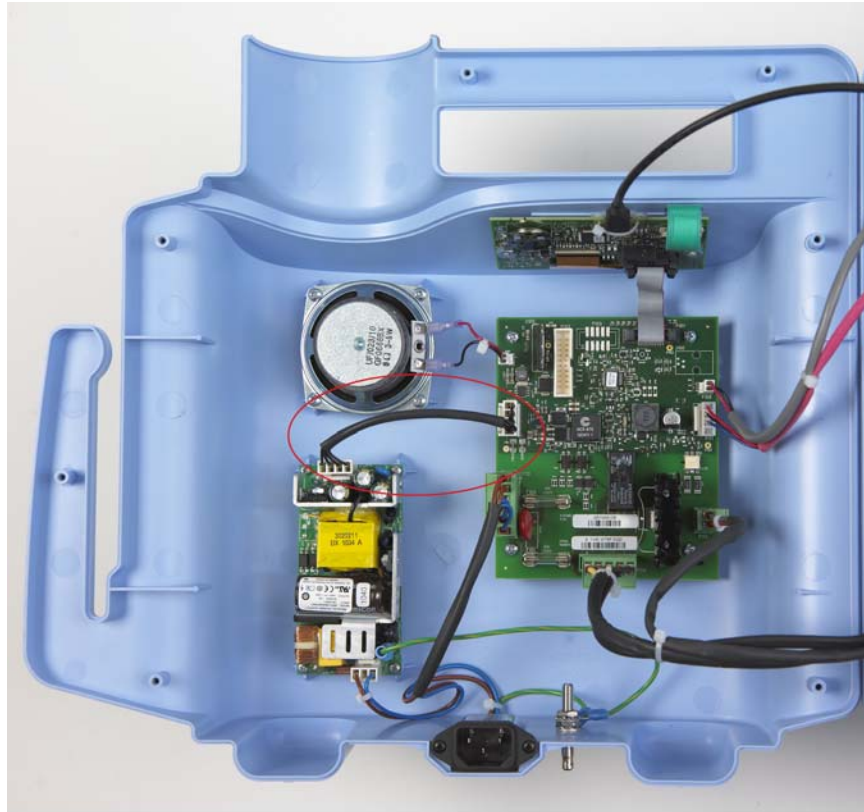
4. Dispose of the power supply as required by WEEE Directive.
5. Position the new power supply on the four mounting bosses, with the GND terminal at the lower right near the AC power inlet ([Figure 10-32](#) on page 10-44).
6. Attach the power supply to the mounting bosses with the four screws. Tighten the screws to 0.4 to 0.6 N-m (3.5 to 5.3 lb-in).
7. Connect the cables to the new power supply as follows ([Figure 10-32](#) on page 10-44):
 - a. Connect the ground cable from the equipotential stud to the GND terminal. Make sure the connector is fully seated on the terminal, and that the heat shrink on the adjacent capacitor does not get caught under the connector.
 - b. Connect the AC power inlet wire assembly to the 3-pin CON1 connector. Make sure the connector latch engages.
 - c. Connect the power supply output cable to the 4-pin CON2 connector. Make sure the connector latch engages.

Note: If a cable tie previously secured the AC power inlet wire assembly to the power supply mounting boss (see [page 10-44](#)), install a new cable tie at the same position. The cable tie should cause the wires connected to CON1 to form an arch approximately 4 cm (1.5 in) above the connector. Trim off the end of the cable tie.

8. Follow the procedure [Rejoining the Front and Rear Enclosures](#) on page 9-5.
9. Perform the following tests:
 - a. [Power-On Test](#) on page 7-3.
 - b. [Electrical Safety Tests](#) on page 7-14.

10.14 Power Supply Output Cable Replacement

Figure 10-33. Power Supply Output Cable



TEM_10232_A

Requirements:

- WT-CWU P/S Output Cable Kit ([page A-4](#))
- Torque driver with #2 Phillips bit

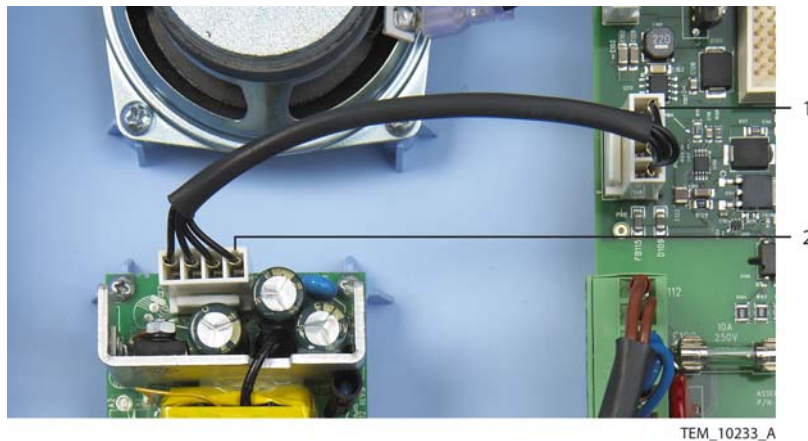


WARNING:

Disconnect the warming unit's power cord from the AC power source before performing this procedure.

To replace the power supply output cable:

1. Follow the procedure [Separating the Front and Rear Enclosures](#) on page 9-2.
2. Disconnect the power supply output cable from the 4-pin P109 connector on the Power PCBA and from the 4-pin CON2 connector on the power supply ([Figure 10-34](#)).

Figure 10-34. Power Supply Output Cable Connections

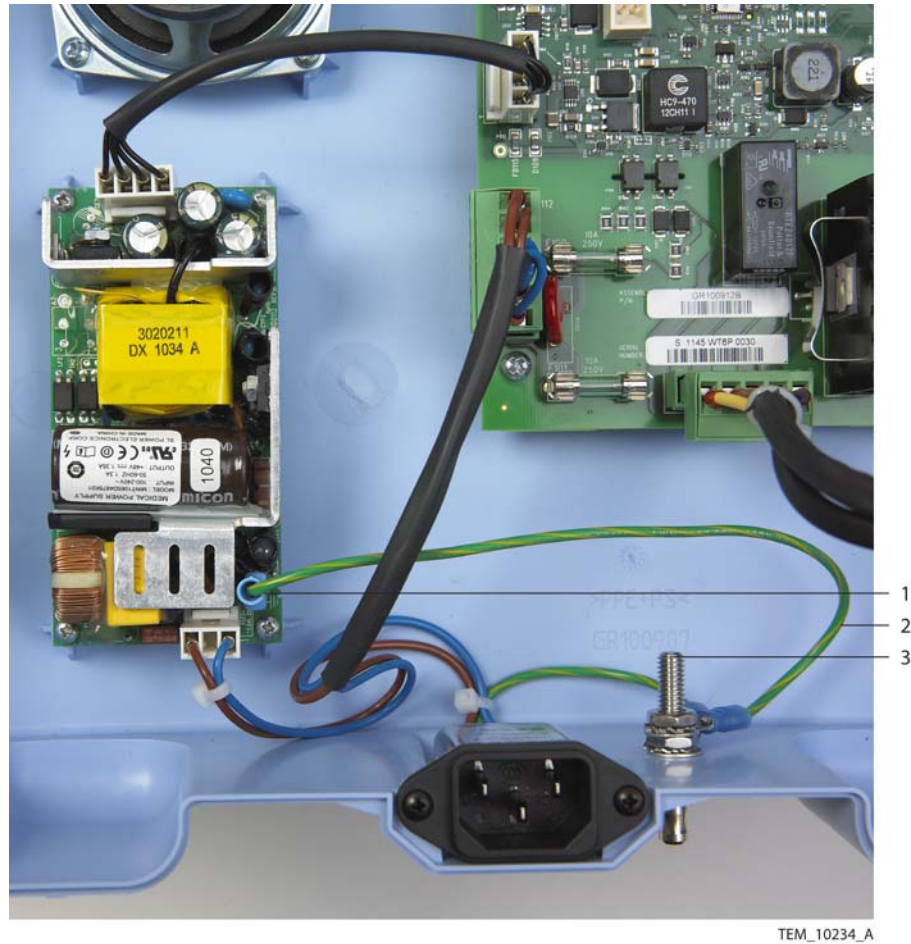
1 P109 Connection
(Power PCBA)

2 CON2 Connection
(Power Supply)

3. Connect the new power supply output cable to the 4-pin P109 connector on the Power PCBA. Make sure the connector latch engages.
4. Connect the power supply output cable to the 4-pin CON2 connector on the power supply. Make sure the connector latch engages.
5. Follow the procedure [Rejoining the Front and Rear Enclosures](#) on page 9-5.
6. Perform the following tests:
 - a. [Power-On Test](#) on page 7-3.
 - b. [Electrical Safety Tests](#) on page 7-14.

10.15 Ground Cable Replacement

Figure 10-35. Ground Cable



- | | | | |
|---|--------------------------------|---|--------------------|
| 1 | GND Terminal
(Power Supply) | 3 | Equipotential Stud |
| 2 | Ground Cable | | |

Requirements:

- WT-CWU Ground Cable Kit ([page A-4](#))
- Torque driver with #2 Phillips bit and 10mm hex socket

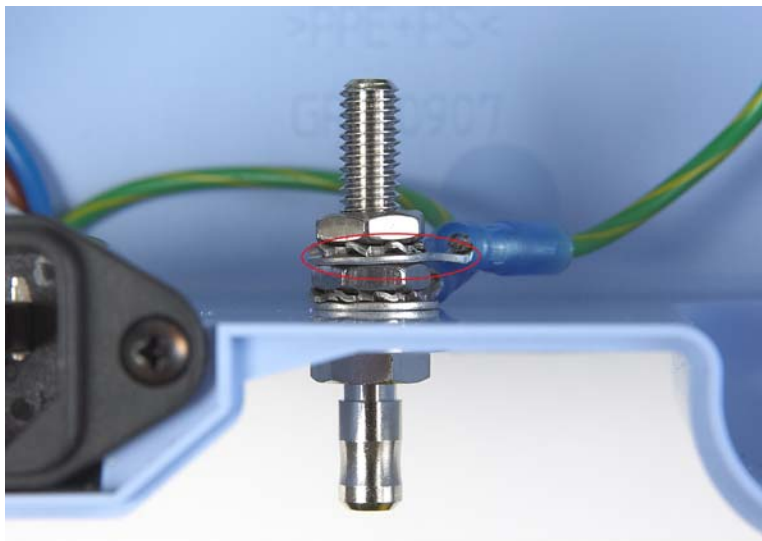
**WARNING:**

Disconnect the warming unit's power cord from the AC power source before performing this procedure.

To replace the ground cable:

1. Follow the procedure *Separating the Front and Rear Enclosures* on page 9-2.
2. Disconnect the ground cable from the GND terminal on the power supply (*Figure 10-35* on page 10-48).
3. Disconnect the ground cable from the equipotential stud as follows (*Figure 10-36*):
 - a. Remove the top nut from the threaded end of the stud.
 - b. Remove the lock washer.
 - c. Lift the ground cable terminal off the stud.

Figure 10-36. Ground Cable Terminal on Equipotential Stud

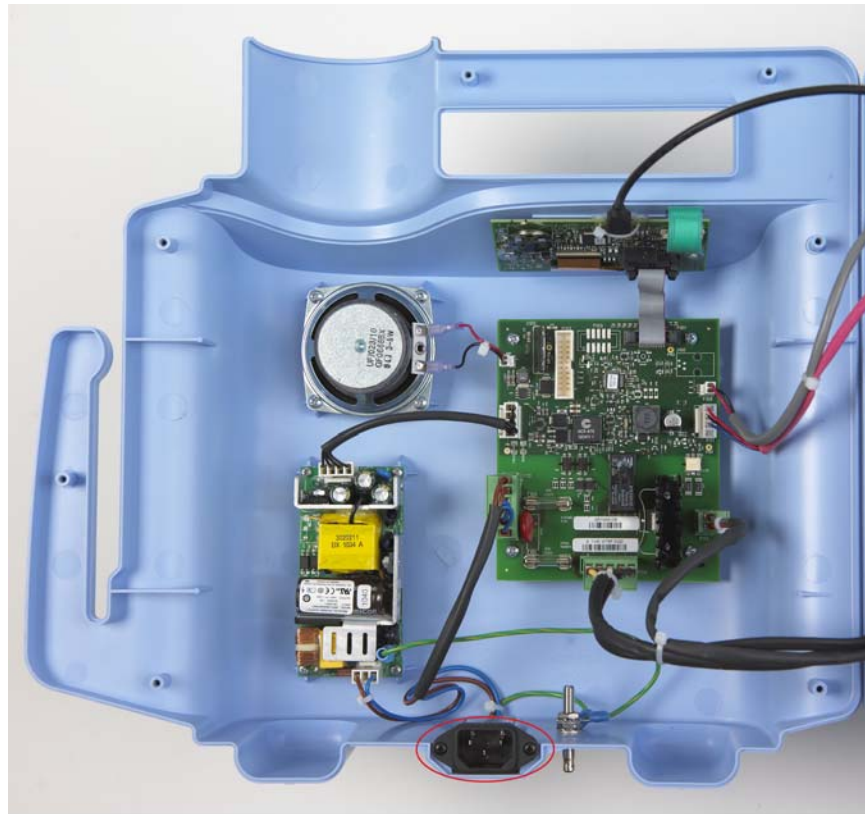


TEM_10235_A

4. Attach the new ground cable to the equipotential stud as follows:
 - a. Place the ground cable terminal on the stud.
 - b. Place the lock washer on top of the terminal.
 - c. Place the nut on top of the lock washer. Tighten the nut to 3.2 to 3.8 N-m (28.3 to 33.6 lb-in).
5. Connect the ground cable to the GND terminal on the power supply ([Figure 10-35](#) on page 10-48). Make sure the connector is fully seated on the terminal, and that the heat shrink on the adjacent capacitor does not get caught under the connector.
6. Follow the procedure [Rejoining the Front and Rear Enclosures](#) on page 9-5.
7. Perform the following tests:
 - a. [Power-On Test](#) on page 7-3.
 - b. [Electrical Safety Tests](#) on page 7-14.

10.16 AC Power Inlet Replacement

Figure 10-37. AC Power Inlet



TEM_10236_A

Requirements:

- WT-CWU AC Inlet Kit ([page A-4](#))
- Torque driver with #1 and #2 Phillips bits and 10mm hex socket
- 10 mm open-end or box wrench
- Wire cutters and cable tie (some warming unit configurations)



WARNING:

Disconnect the warming unit's power cord from the AC power source before performing this procedure.

To replace the AC power inlet assembly:

1. Follow the procedure [Separating the Front and Rear Enclosures](#) on page 9-2.
2. Disconnect the AC power inlet wire assembly from the 6-pin P112 connector on the Power PCBA and from the 3-pin CON1 connector on the power supply ([Figure 10-38](#)).

Figure 10-38. AC Power Inlet Connections



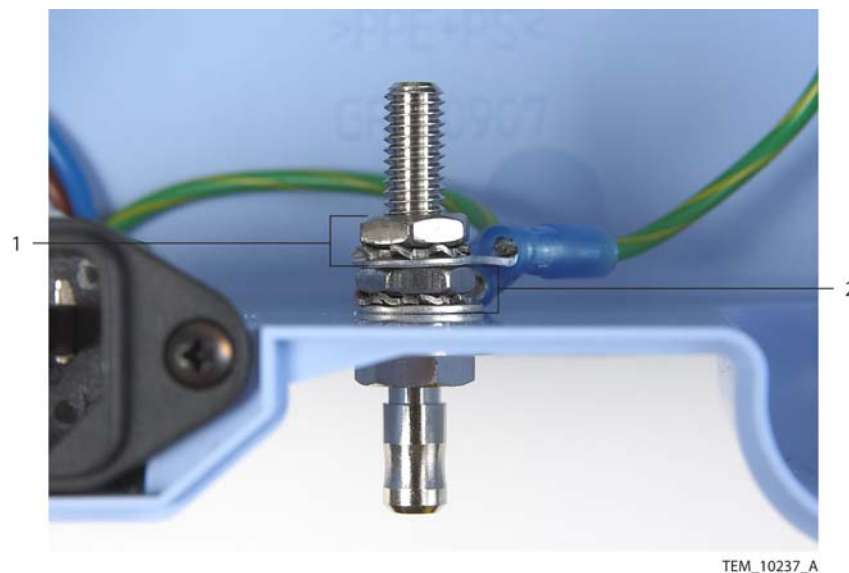
1 P112 Connection (Power PCBA)

2 CON1 Connection (Power Supply)

Note: A cable tie may secure the wire assembly to the power supply mounting boss next to the CON1 connector. If so, cut and remove this cable tie.

3. Disconnect the AC power inlet ground cable from the equipotential stud as follows (*Figure 10-39*):
 - a. Remove the top nut from the threaded end of the stud.
 - b. Remove the lock washer and lift the power supply ground cable terminal off the stud.
 - c. Remove the next nut from the stud.
 - d. Remove the next lock washer and lift the AC power inlet ground cable terminal off the stud.
 - e. Leave the equipotential stud on the enclosure.

Figure 10-39. Equipotential Stud Connections



1 Power Supply Ground Cable
(Nut, Lock Washer, Terminal)

2 AC Power Inlet Ground Cable
(Nut, Lock Washer, Terminal)

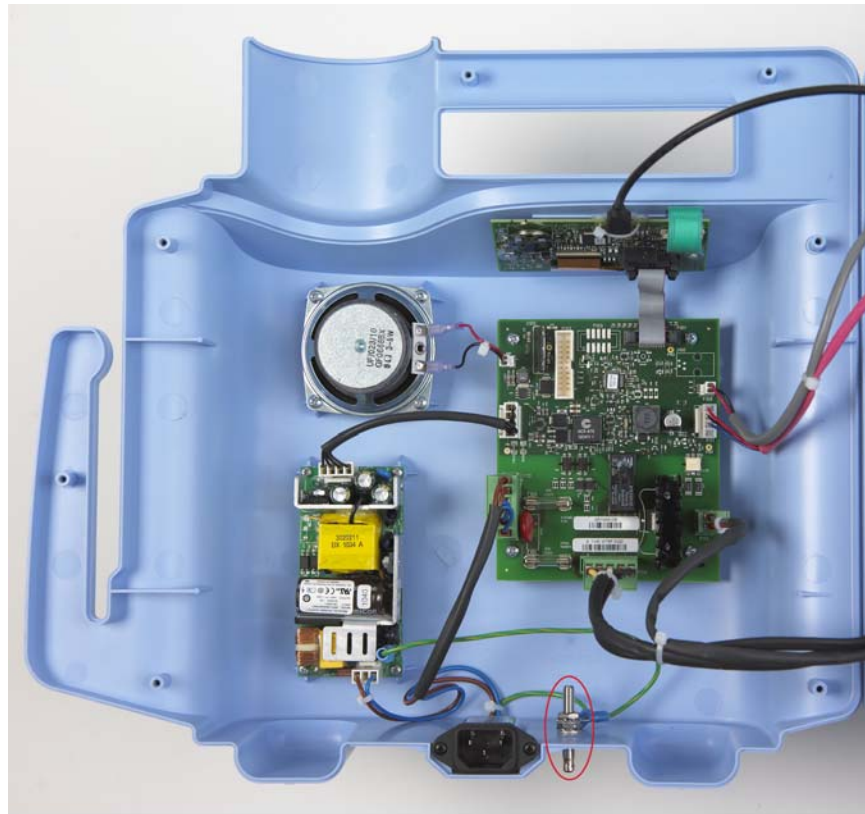
4. Remove the two screws securing the AC power inlet assembly to the enclosure, and remove the assembly.
5. Position the new AC power inlet assembly as shown in *Figure 10-38* on page 10-52. Make sure that the ground-pin side of the assembly is toward the bottom of the enclosure.
6. Attach the AC power inlet to the enclosure with the two screws. Tighten the screws to 0.4 to 0.6 N-m (3.5 to 5.3 lb-in).

7. Connect the AC power inlet wire assembly as follows ([Figure 10-38](#) on page 10-52):
 - a. Connect the 6-pin connector to P112 on the Power PCBA. Make sure that the connector is oriented as shown in [Figure 10-38](#), and that it is fully seated.
 - b. Connect the 3-pin connector to CON1 on the power supply. Make sure that the connector latch engages.

Note: If a cable tie previously secured the AC power inlet wire assembly to the power supply mounting boss (see [page 10-52](#)), install a new cable tie at the same position. The cable tie should cause the wires connected to CON1 to form an arch approximately 4 cm (1.5 in) above the connector. Trim off the end of the cable tie.
8. Reinstall the cables on the equipotential stud as follows ([Figure 10-39](#) on page 10-53):
 - a. Place the AC power inlet ground cable terminal on the stud.
 - b. Place a lock washer on top of the terminal.
 - c. Place a nut on top of the lock washer. Tighten the nut to 3.2 to 3.8 N-m (28.3 to 33.6 lb-in).
 - d. Place the power supply ground cable terminal on top of the nut.
 - e. Place a lock washer on top of the terminal.
 - f. Place a nut on top of the lock washer. Tighten the nut to 3.2 to 3.8 N-m (28.3 to 33.6 lb-in).
9. Follow the procedure [Rejoining the Front and Rear Enclosures](#) on page 9-5.
10. Perform the following tests:
 - a. [Power-On Test](#) on page 7-3.
 - b. [Electrical Safety Tests](#) on page 7-14.

10.17 Equipotential Stud Replacement

Figure 10-40. Equipotential Stud



TEM_10239_A

Requirements:

- WT-CWU Equipotential Stud Kit ([page A-4](#))
- Torque driver with #2 Phillips bit and 10mm hex socket
- 10 mm open-end or box wrench
- Ohmmeter or digital multi-meter with resistance function



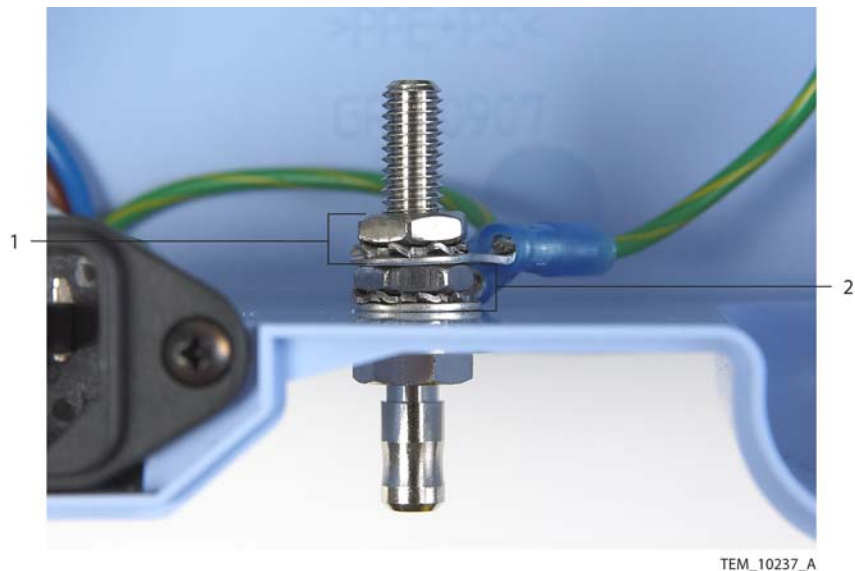
WARNING:

Disconnect the warming unit's power cord from the AC power source before performing this procedure.

To replace the equipotential stud:

1. Follow the procedure [Separating the Front and Rear Enclosures](#) on page 9-2.
2. Remove the equipotential stud as follows ([Figure 10-41](#)):
 - a. Remove the top nut from the threaded end of the stud.
 - b. Remove the lock washer and lift the power supply ground cable terminal off the stud.
 - c. Remove the next nut from the stud.
 - d. Remove the next lock washer and lift the AC power inlet ground cable terminal off the stud.
 - e. Pull the stud and ground washer out of the enclosure from the bottom.

Figure 10-41. Equipotential Stud Connections



1 Power Supply Ground Cable
(Nut, Lock Washer, Terminal)

2 AC Power Inlet Ground Cable
(Nut, Lock Washer, Terminal)

3. Place the ground washer on the new equipotential stud with the color-coded side toward the fixed nut.

4. From the bottom of the enclosure, insert the threaded end of the stud into the hole ([Figure 10-42](#)).

Figure 10-42. Equipotential Stud and Washer



5. Connect the cables to the equipotential stud as follows ([Figure 10-41](#) on page 10-56):
 - a. Place the AC power inlet ground cable terminal on the threaded end of the stud.
 - b. Place a lock washer on top of the terminal.
 - c. Place a nut on top of the lock washer. Tighten the nut to 3.2 to 3.8 N-m (28.3 to 33.6 lb-in).
 - d. Place the power supply ground cable terminal on top of the nut.
 - e. Place a lock washer on top of the terminal.
 - f. Place a nut on top of the lock washer. Tighten the nut to 3.2 to 3.8 N-m (28.3 to 33.6 lb-in).
6. Follow the procedure [Rejoining the Front and Rear Enclosures](#) on page 9-5.
7. Perform the following tests:
 - a. Run an ohmmeter or digital multi-meter with resistance function between the ground pin on the AC power inlet and the equipotential stud. The value must be <1 Ohm.
 - b. [Power-On Test](#) on page 7-3.
 - c. [Electrical Safety Tests](#) on page 7-14.

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11 Internal Component Replacement (Inside Rear Enclosure)

11.1 Overview

This chapter provides instructions for replacing components that require accessing the inside of the Covidien WarmTouch™ Convective Warming Unit's rear enclosure.

<i>Thermistor Sensor Assembly Replacement</i>	<i>Page 11-3</i>
<i>Thermostat Replacement</i>	<i>Page 11-9</i>
<i>Thermostat Cable Replacement</i>	<i>Page 11-14</i>
<i>Pole Clamp and Mounting Bolt Replacement</i>	<i>Page 11-18</i>
<i>Hose Replacement</i>	<i>Page 11-21</i>
<i>Hose Duct Adapter Replacement</i>	<i>Page 11-25</i>
<i>Fan Assembly Replacement</i>	<i>Page 11-33</i>
<i>Heater Assembly Replacement</i>	<i>Page 11-43</i>



Note:

Testing is required after each of these procedures. Refer to the instructions in each section for minimum testing requirements.

11.2 Safety Reminders



WARNING:

No modification of this equipment is allowed. Modification can result in death, injury, or property damage.



WARNING:

Before attempting to open or disassemble the warming unit, disconnect the power cord from the AC power source.

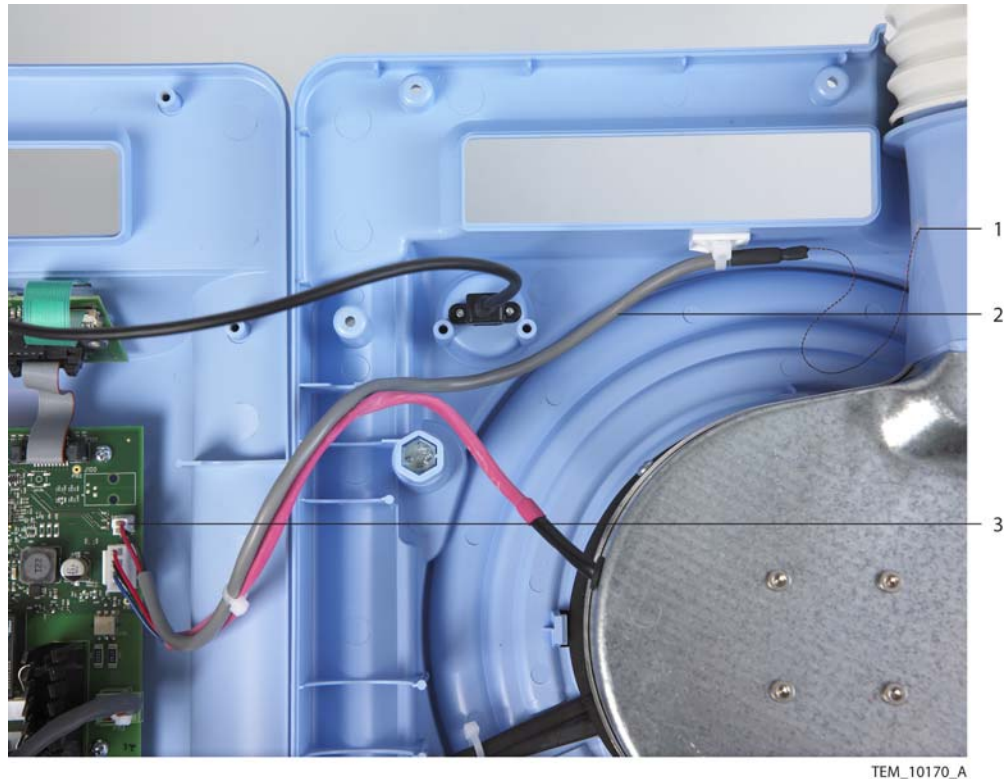


Caution:

Observe ESD (electrostatic discharge) precautions when servicing the warming unit.

11.3 Thermistor Sensor Assembly Replacement

Figure 11-1. Thermistor Sensor Assembly



1 Thermistor Wire and Rivet

3 Thermistor Cable Connection
(Power PCBA)

2 Thermistor Cable

Requirements:

- WT-CWU Thermistor Sens Assy Kit ([page A-5](#))
- Torque driver with #2 Phillips bit
- Wire cutters
- Ruler
- 2 cable ties



WARNING:

Disconnect the warming unit's power cord from the AC power source before performing this procedure.



Caution:

The thermistor is very delicate and easily damaged. Use extreme care when working with the thermistor sensor assembly.

To replace the thermistor sensor assembly:

1. Follow the procedure *Separating the Front and Rear Enclosures* on page 9-2.
2. Locate the rivet connecting the thermistor wire to the hose duct adapter (*Figure 11-2*).

Figure 11-2. Thermistor Wire and Rivet

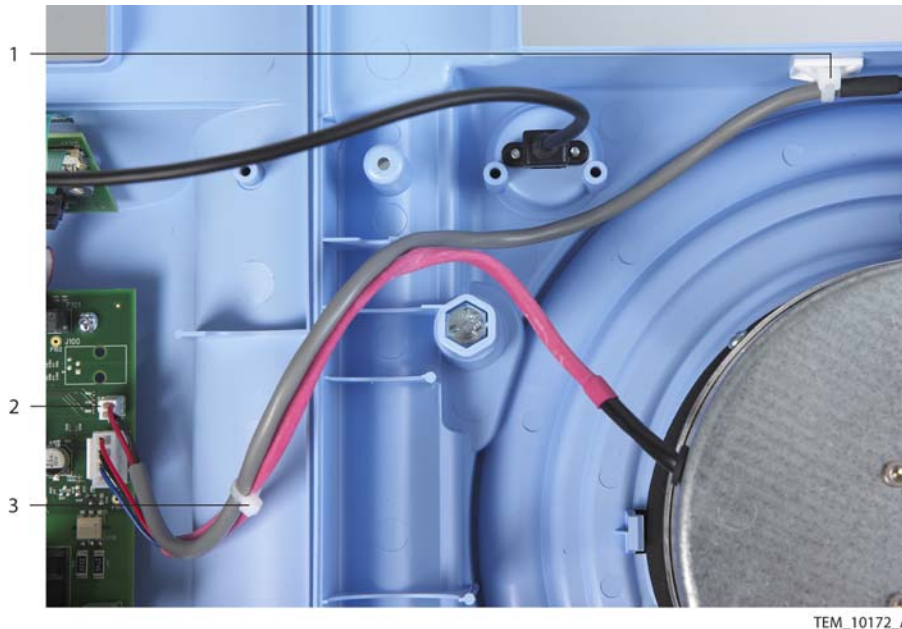


TEM_10171_A

3. Place a small flat instrument under the rivet head and remove the rivet and wire from the hose duct adapter.
4. Cut and remove the cable tie securing the thermistor cable to the tie mount (*Figure 11-3*).

5. Carefully cut and remove the cable tie securing the thermistor cable to the fan cable.
6. Disconnect the thermistor cable from the 2-pin P108 connector on the Power PCBA. Remove the thermistor sensor assembly from the unit.

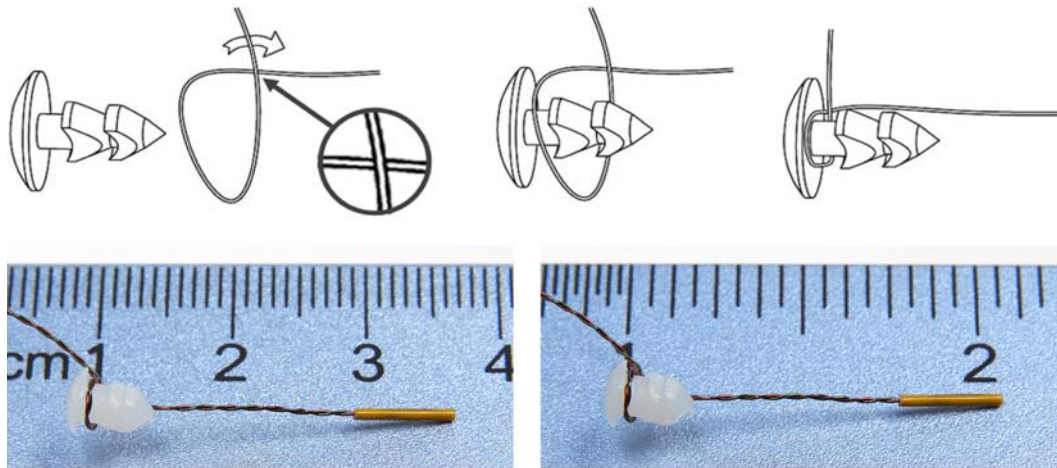
Figure 11-3. Thermistor Cable Connections



- | | | | |
|---|---|---|--|
| 1 | Cable Tie and Tie Mount
(Thermistor Cable) | 3 | Cable Tie
(Thermistor Cable to Fan Cable) |
| 2 | P108 Connector
(Power PCBA) | | |

7. Attach the new thermistor sensor assembly to the new rivet as follows ([Figure 11-4](#)):
 - a. On the exposed twisted-pair wire of the assembly, measure a distance just under 3 cm (approximately 1 and 1/8 inches) from the tip of the thermistor.
 - b. Wrap the wire once around the rivet as shown in [Figure 11-4](#). The distance from the base of the rivet head to the tip of the thermistor should measure between 2.54 cm and 2.86 cm (between 1 inch and 1 and 1/8 inches).

Figure 11-4. Attaching Rivet to Thermistor Wire



TEM_10173_A



Caution:

Be careful when moving the hose duct adapter. The connected thermistor wire can break if too much stress is applied to it.

- a. Position the thermistor in the hose duct adapter as follows ([Figure 11-5](#)):
 - a. Make sure that the portion of wire between the rivet and the tip of the thermistor is straight.
 - b. Insert the wire and rivet into the hole on the side of the duct adapter until the rivet snaps into place.

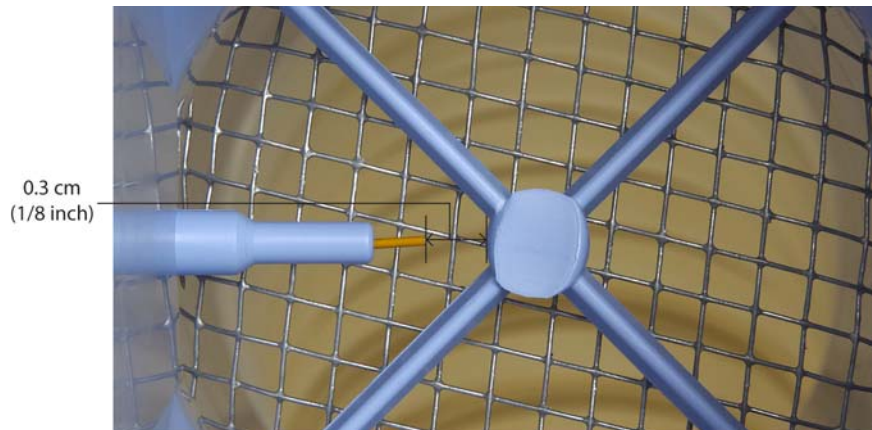
Figure 11-5. Inserting Thermistor Wire and Rivet



TEM_10174_A

- c. Lift the hose duct adapter away from the fan duct just enough to see inside the adapter.
- d. Make sure that the tip of the thermistor is no more than 0.3 cm (1/8 inch) from the center hub of the duct adapter (*Figure 11-6*).

Figure 11-6. Thermistor Position Inside Hose Duct Adapter



TEM_10175_A

9. Place the duct adapter back into the fan duct by inserting the top edge of the adapter first, then rotating the adapter downward until it drops into place (*Figure 11-7*).

Figure 11-7. Inserting the Hose Duct Adapter

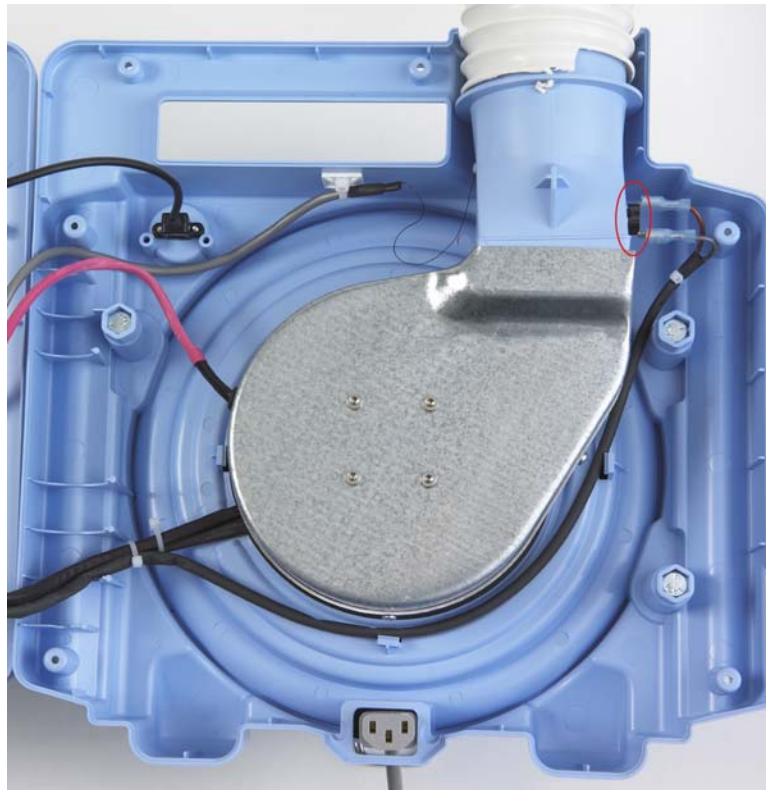


TEM_10176_A

10. Position the thermistor cable against the tie mount on the enclosure as shown in [Figure 11-2](#) on page 11-4. Secure the cable with a cable tie and trim the end of the cable tie.
11. Connect the thermistor cable to the 2-pin connector at P108 on the Power PCBA ([Figure 11-3](#) on page 11-5). Make sure that the connector latch engages.
12. Place a cable tie around the thermistor cable and fan cable approximately 10 cm (4 inches) from the Power PCBA connectors ([Figure 11-3](#) on page 11-5). Trim the end of the cable tie.
13. Follow the procedure [Rejoining the Front and Rear Enclosures](#) on page 9-5.
14. Perform the following tests:
 - a. [Power-On Test](#) on page 7-3.
 - b. [Temperature Accuracy Test](#) on page 7-8.
 - c. [Electrical Safety Tests](#) on page 7-14.

11.4 Thermostat Replacement

Figure 11-8. Thermostat



TEM_10177_A

Requirements:

- WT-CWU Thermostat Kit ([page A-5](#))
- Torque driver with #2 Phillips bit
- Small flat-blade screwdriver



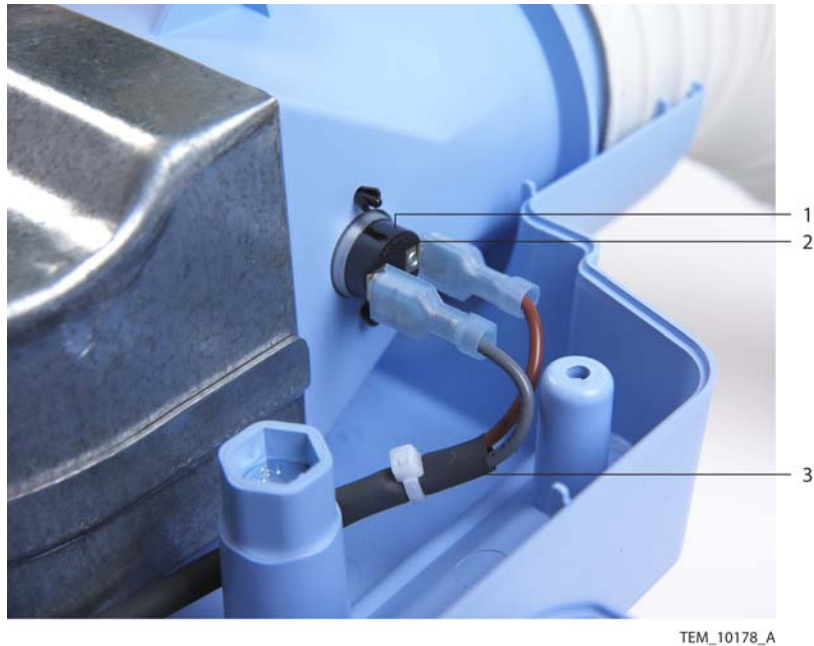
WARNING:

Disconnect the warming unit's power cord from the AC power source before performing this procedure.

To replace the thermostat:

1. Follow the procedure [Separating the Front and Rear Enclosures](#) on page 9-2.
2. Detach the thermostat cable from the two terminals on the thermostat ([Figure 11-9](#)).

Figure 11-9. Thermostat Cable Connection to Thermostat



- | | | | |
|---|---------------|---|------------------|
| 1 | Thermostat | 3 | Thermostat Cable |
| 2 | Terminal (x2) | | |



Caution:

Be careful when moving the hose duct adapter. The connected thermistor wire can break if too much stress is applied to it.

3. Lift the hose duct adapter upward so you can access the inside of the duct adapter.
4. Remove the thermostat from the hose duct adapter as follows ([Figure 11-10](#)):
 - a. Locate the two rivets securing the thermostat to the hose duct adapter.
 - b. From the outside of the duct adapter, use a small flat-blade screwdriver to push the locking pin in each rivet inward until the rivet releases.

- c. Remove the rivets and thermostat.

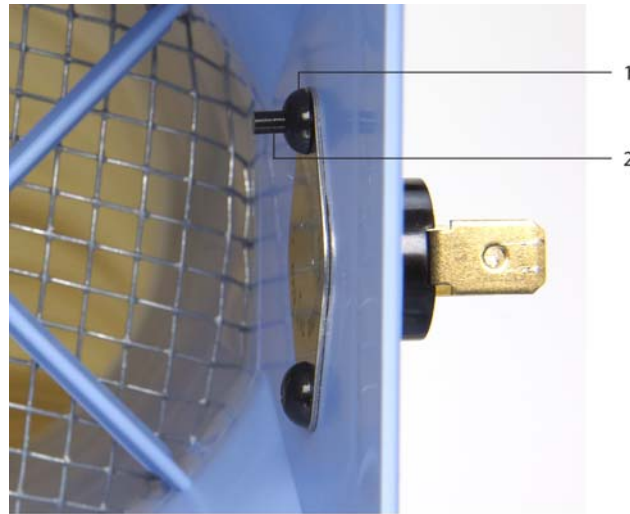
Figure 11-10. Thermostat Rivets (Outside of Hose Duct Adapter)



- 1 Thermostat Rivet (x2)
- 2 Rivet Pin (x2)

5. Attach the new thermostat to the hose duct adapter as follows (*Figure 11-11*):
 - a. From the inside of the hose duct adapter, insert the terminal side of the thermostat through the hole in the duct adapter.
 - b. Line up the thermostat mounting holes with the holes in the duct adapter.
 - c. From the inside of the duct adapter, insert a plastic rivet in each of the mounting holes.
 - d. Lock each rivet in place by pressing on the center locking pin until it is flush with the surface of the rivet head.

Figure 11-11. Thermostat Rivets (Inside of Hose Duct Adapter)



TEM_10180_A

- 1 Thermostat Rivet (x2) 2 Rivet Pin (x2)

6. Place the hose duct adapter back into the fan duct by inserting the top edge of the adapter first, then rotating the adapter downward until it drops into place ([Figure 11-12](#)).

Figure 11-12. Inserting the Hose Duct Adapter

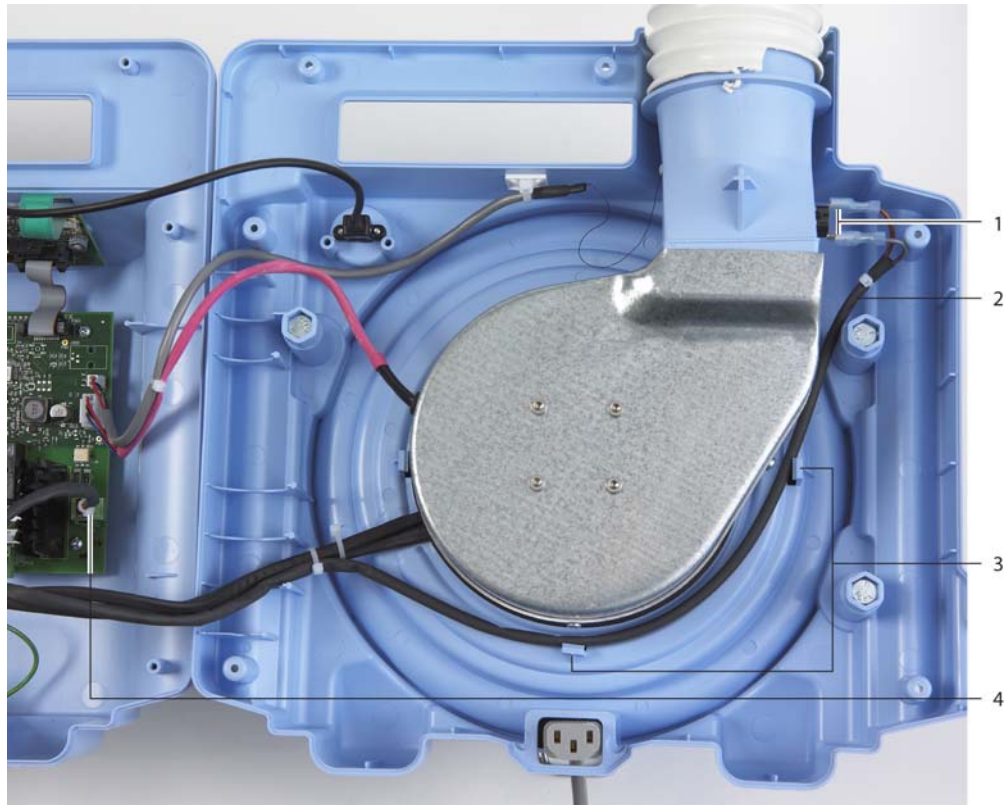


TEM_10181_A

7. Connect the two thermostat wires to the new thermostat as shown in [Figure 11-9](#) on page 11-10. Note that the wires can be connected to either terminal, but for consistency across units they should be connected as shown.
8. Make sure that thermostat cable is routed as shown in [Figure 11-8](#) on page 11-9. It must be positioned to the inside of the adjacent screw boss and pole clamp mounting bolt and inside the tabs around the fan assembly.
9. Follow the procedure [Rejoining the Front and Rear Enclosures](#) on page 9-5.
10. Perform the following tests:
 - a. [Power-On Test](#) on page 7-3.
 - b. [Thermostat Test](#) on page 7-11.
 - c. [Electrical Safety Tests](#) on page 7-14.

11.5 Thermostat Cable Replacement

Figure 11-13. Thermostat Cable



TEM_10182_A

- | | | | |
|---|---|---|--|
| 1 | Thermostat Cable Connection (to Thermostat) | 3 | Thermostat Cable Routing Tabs |
| 2 | Thermostat Cable | 4 | Thermostat Cable Connection (Power PCBA) |

Requirements:

- WT-CWU Thermostat Cable Kit ([page A-5](#))
- Torque driver with #2 Phillips bit
- Wire cutters
- 2 cable ties

**WARNING:**

Disconnect the warming unit's power cord from the AC power source before performing this procedure.

To replace the thermostat cable:

1. Follow the procedure [Separating the Front and Rear Enclosures](#) on page 9-2.
2. Disconnect the thermostat cable from the 2-pin P113 connector on the Power PCBA ([Figure 11-14](#)).

Figure 11-14. Thermostat Cable Connection to Power PCBA



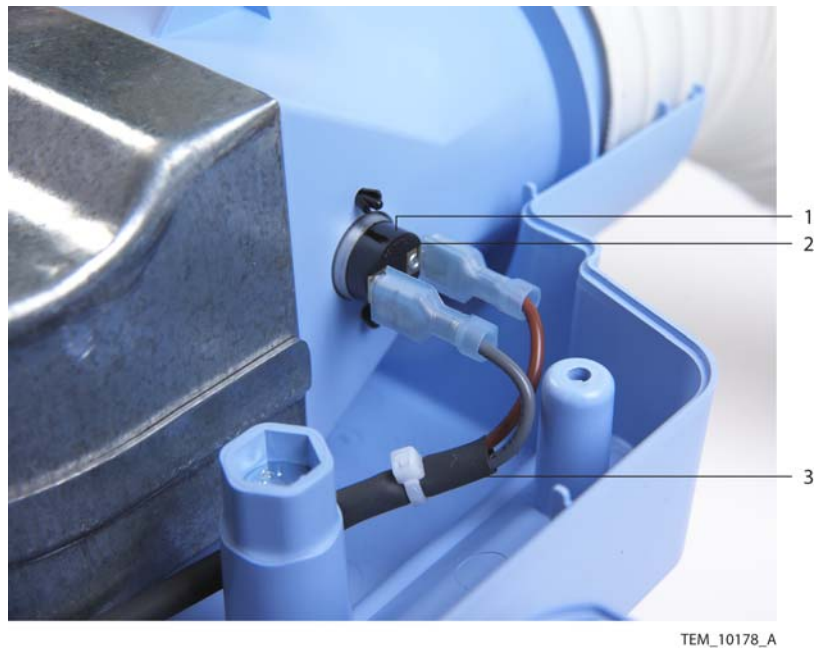
TEM_10183_A

- | | | | |
|---|---------------------------------|---|--|
| 1 | P113 Connection
(Power PCBA) | 3 | Heater Cable |
| 2 | Thermostat Cable | 4 | Cable Ties (Thermostat Cable
to Heater Cable) |

3. Carefully cut and remove the two cable ties securing the thermostat cable to the heater cable.

4. Disconnect the thermostat cable from the two terminals on the thermostat ([Figure 11-15](#)).

Figure 11-15. Thermostat Cable Connection to Thermostat



- | | | | |
|---|---------------|---|------------------|
| 1 | Thermostat | 3 | Thermostat Cable |
| 2 | Terminal (x2) | | |

5. Connect the new thermostat cable to the two terminals. Note that the wires can be connected to either terminal, but for consistency across units they should be connected as shown in [Figure 11-15](#).
6. Connect the other end of the thermostat cable to the 2-pin P113 connector on the Power PCBA. Make sure that the connector is oriented as shown in [Figure 11-14](#) on page 11-15, and that it is fully seated.
7. Make sure that thermostat cable is routed as shown in [Figure 11-13](#) on page 11-14. It must be positioned to the inside of the adjacent screw boss and pole clamp mounting bolt and inside the tabs around the fan assembly.

8. Using two cable ties, secure the thermostat cable to the heater cable as follows ([Figure 11-14](#) on page 11-15):
 - a. Place one cable tie around the cables approximately 5 cm (2 inches) from where the heater cable exits below the fan assembly.
 - b. Place the other cable tie around the cables approximately 10 cm (4 inches) from the heater cable connector (P114) on the Power PCBA.
 - c. Trim the ends of the cable ties.
9. Follow the procedure [Rejoining the Front and Rear Enclosures](#) on page 9-5.
10. Perform the following tests:
 - a. [Power-On Test](#) on page 7-3.
 - b. [Thermostat Test](#) on page 7-11.
 - c. [Electrical Safety Tests](#) on page 7-14.

11.6 Pole Clamp and Mounting Bolt Replacement

This procedure describes replacing the pole clamps and the mounting bolts for the clamps. If you are replacing the pole clamps only, refer to [Pole Clamp Replacement](#) on page 8-2.

Figure 11-16. Pole Clamps



TEM_10162_A

Requirements:

- WT-CWU Pole Clamp Kit ([page A-5](#))
- Torque driver with #2 Phillips bit
- Small rubber mallet or similar tool

Note: Each kit contains three clamps, knobs, and mounting bolts.



WARNING:

Disconnect the warming unit's power cord from the AC power source before performing this procedure.

To replace a pole clamp and mounting bolt:

1. At the back of the unit, completely loosen the knob on the clamp to be replaced. Remove the knob and clamp foot from the mounting bolt (*Figure 11-17*).

Figure 11-17. Pole Clamp Foot and Knob

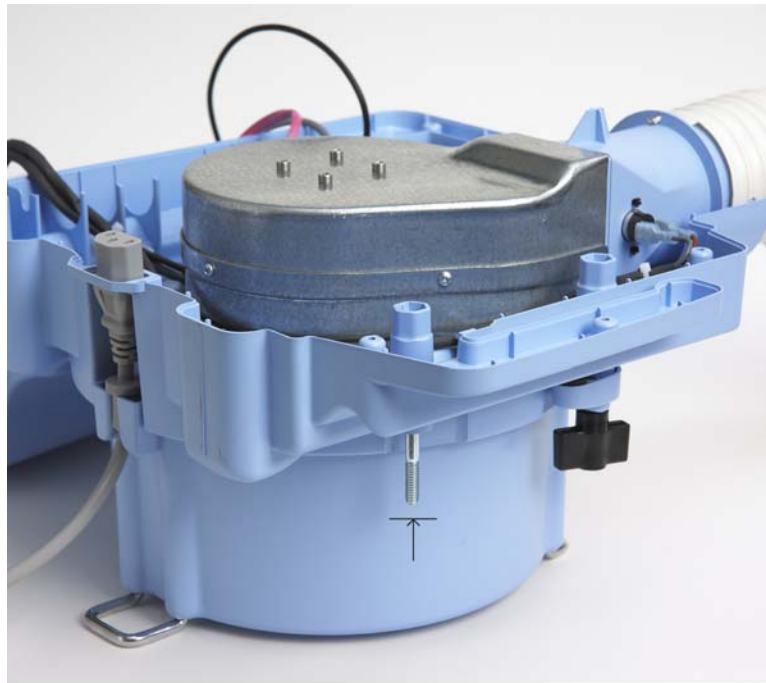
TEM_10163_A

1 Clamp Foot (x3)

2 Clamp Knob (x3)

2. Follow the procedure *Separating the Front and Rear Enclosures* on page 9-2.
3. Remove the pole clamp mounting bolt as follows (*Figure 11-18*):
 - a. Position the rear enclosure so that you can access the end of the mounting bolt.
 - b. Use a small rubber mallet or similar tool to drive the mounting bolt toward the inside of the enclosure until you can grasp it and remove it.

Figure 11-18. Pole Clamp Mounting Bolt

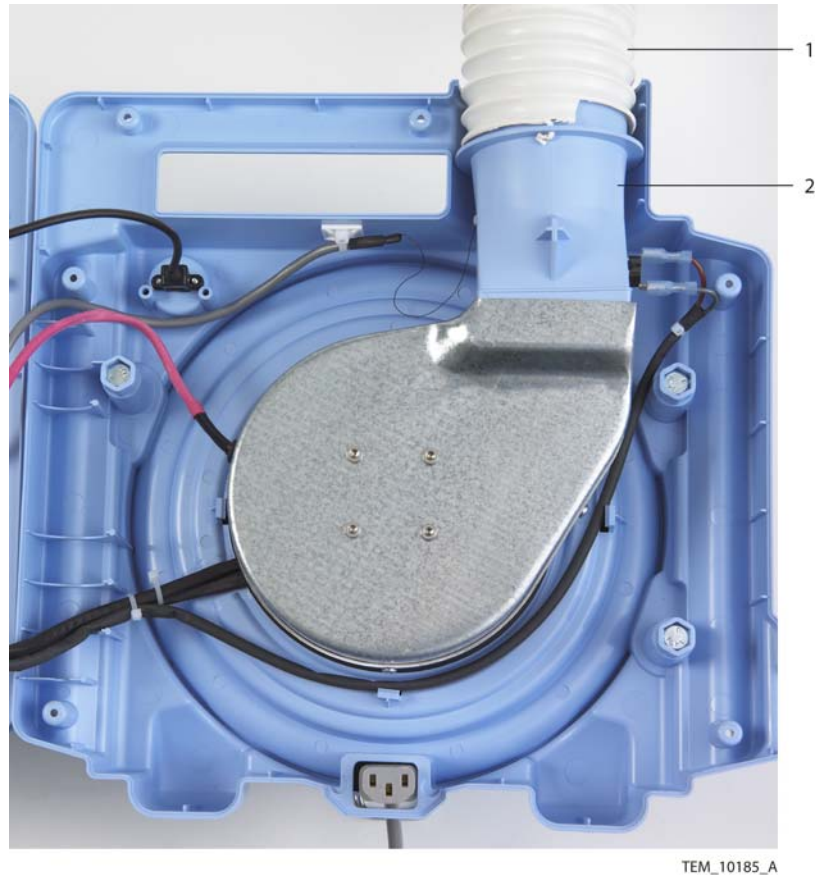


TEM_10184_A

4. Install the new mounting bolt by placing the bolt into its mounting hole and pressing downward until fully seated.
5. Follow the procedure [Rejoining the Front and Rear Enclosures](#) on page 9-5.
6. Slide the new clamp foot onto the bolt, making sure that the rubber pad is toward the unit.
7. Place the new knob on the bolt and tighten it until the clamp foot is secure. Do not overtighten.
8. Perform the following tests:
 - a. [Power-On Test](#) on page 7-3.
 - b. [Electrical Safety Tests](#) on page 7-14.

11.7 Hose Replacement

Figure 11-19. Hose



- 1 Hose 2 Hose Duct Adapter

Requirements:

- WT-CWU Hose Kit ([page A-5](#))
- Torque driver with #2 Phillips bit
- Medium flat-blade screwdriver with long handle
- Pliers
- Small knife or scissors



WARNING:

Disconnect the warming unit's power cord from the AC power source before performing this procedure.

To replace the hose:

1. Remove the nozzle strap from the hose and set it aside. (Reference [Nozzle Strap with Clip Replacement](#) on page 8-10.)
2. Follow the procedure [Separating the Front and Rear Enclosures](#) on page 9-2.
3. Locate the reinforcing wire that attaches the hose to the duct adapter. Unbend the wire and slide it through the hole in the duct adapter flange ([Figure 11-20](#)).

Figure 11-20. Wire Attaching Hose to Hose Duct Adapter



TEM_10186_A



Caution:

Be careful when moving the hose duct adapter. The connected thermistor wire can break if too much stress is applied to it.

4. Pull the hose duct adapter away from the duct. Rotate the hose clockwise to disengage it from the duct adapter.

5. Follow the procedure [Nozzle Replacement](#) on page 8-8 to remove the nozzle from the end of the old hose and install it on the new hose. **Note:** Replacement of the No Free-Hosing label on the nozzle does not apply in this case.
6. On the new hose, find the end of the reinforcing wire in the hose and trim around the wire so that approximately 1.6 cm (5/8 inch) is free of the hose material.
7. Position the new hose on the duct adapter. Rotate the hose counter-clockwise until the hose material reaches the flange and the exposed reinforcing wire is at the hole in the flange.
8. At a point approximately 1.3 cm (1/2 inch) from its free end, bend the wire 90 degrees and insert it into the flange hole.
9. Bend the wire back toward the flange so that the hose is secured ([Figure 11-20](#) on page 11-22).
10. Place the duct adapter back into the fan duct by inserting the top edge of the adapter first, then rotating the adapter downward until it drops into place ([Figure 11-21](#)).

Figure 11-21. Inserting Hose Duct Adapter



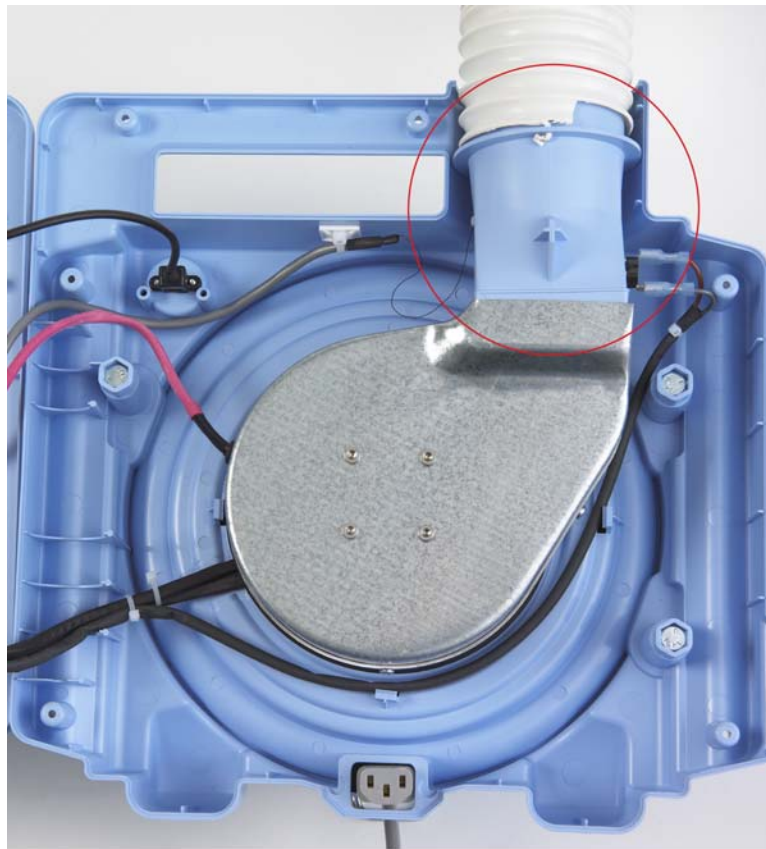
TEM_10176_A

11. Follow the procedure [Rejoining the Front and Rear Enclosures](#) on page 9-5.
12. Slide the nozzle strap over the nozzle and onto the hose, positioning it as desired.

13. Perform the following tests:
 - a. *Power-On Test* on page 7-3.
 - b. *Electrical Safety Tests* on page 7-14.

11.8 Hose Duct Adapter Replacement

Figure 11-22. Hose Duct Adapter



TEM_10187_A

Requirements:

- WT-CWU Hose Duct Adapter Kit ([page A-5](#))
- Torque driver with #2 Phillips bit
- Small flat-blade screwdriver
- Pliers



WARNING:

Disconnect the warming unit's power cord from the AC power source before performing this procedure.

To replace the hose duct adapter:

1. Follow the procedure [Separating the Front and Rear Enclosures](#) on page 9-2.
2. Locate the rivet connecting the thermistor wire to the hose duct adapter ([Figure 11-23](#)).

Figure 11-23. Thermistor Wire and Rivet



TEM_10171_A

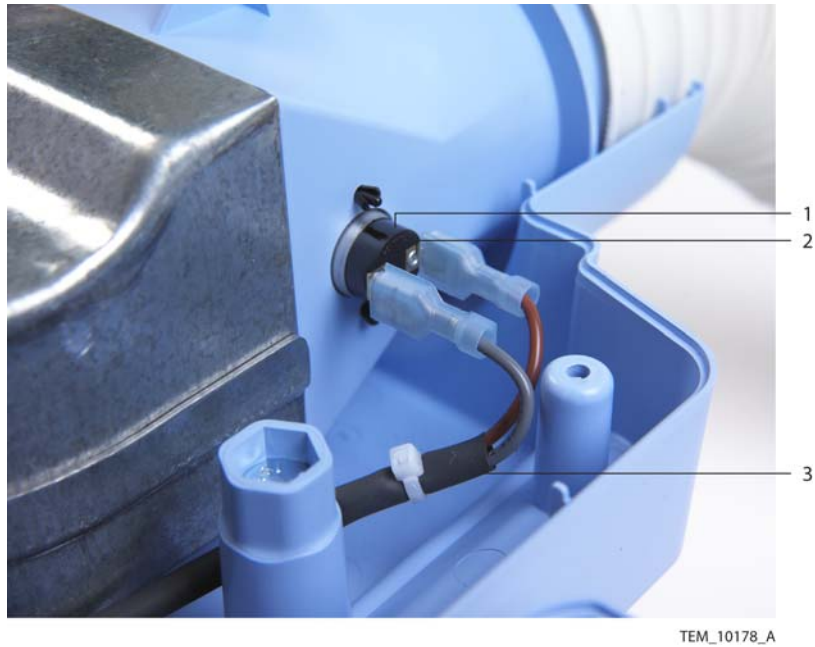


Caution:
The thermistor is very delicate and easily damaged. Use extreme care when working with the thermistor sensor assembly.

3. Carefully place a small flat instrument under the rivet head and gently pull the rivet and wire out of the duct adapter. Take care to keep the wire wrapped around the rivet. (If the wire slips off the rivet, refer to [Thermistor Sensor Assembly Replacement](#) on page 11-3 for information about re-wrapping the wire.)

4. Detach the thermostat cable from the two terminals on the thermostat (*Figure 11-24*).

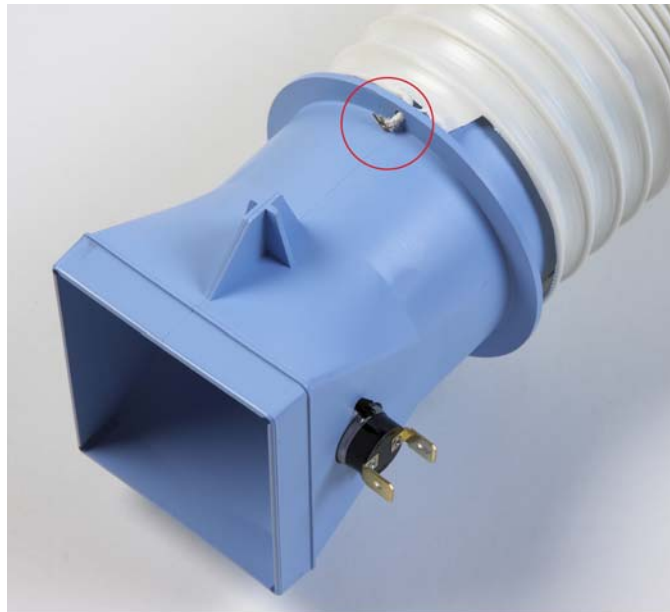
Figure 11-24. Thermostat Cable Connection to Thermostat



- | | | | |
|---|---------------|---|------------------|
| 1 | Thermostat | 3 | Thermostat Cable |
| 2 | Terminal (x2) | | |

5. Lift the hose and duct adapter out of the unit.
6. Locate the reinforcing wire that attaches the hose to the duct adapter. Unbend the wire and slide it through the hole in the duct adapter flange (*Figure 11-25*).

Figure 11-25. Wire Attaching Hose to Hose Duct Adapter



TEM_10188_A

7. Rotate the hose clockwise to disengage it from the duct adapter.
8. Remove the thermostat from the hose duct adapter as follows (*Figure 11-26*):
 - a. Locate the two rivets securing the thermostat to the duct adapter.
 - b. From the outside of the duct adapter, use a small flat-blade screwdriver to push the locking pin in each rivet inward until the rivet releases.
 - c. Remove the thermostat and rivets.

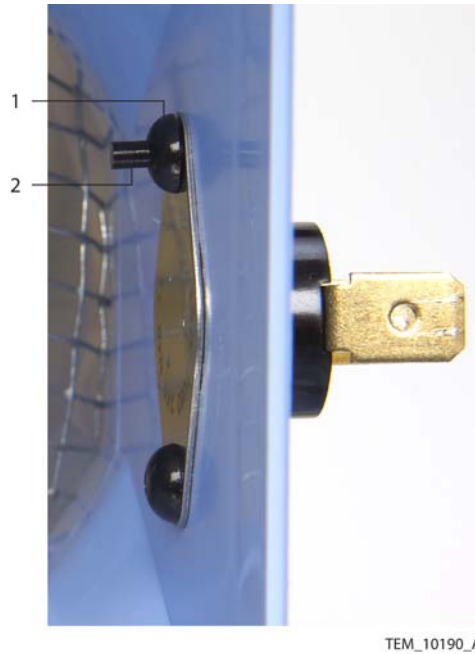
Figure 11-26. Thermostat Rivets (Outside of Hose Duct Adapter)



- 1 Thermostat Rivet (x2)
- 2 Rivet Pin (x2)

9. Attach the thermostat to the new hose duct adapter as follows (*Figure 11-27*):
 - a. From the inside of the hose duct adapter, insert the terminal side of the thermostat through the hole in the duct adapter.
 - b. Line up the thermostat mounting holes with the holes in the duct adapter.
 - c. From the inside of the duct adapter, insert a plastic rivet in each of the mounting holes.
 - d. Lock each rivet in place by pressing on the center locking pin until it is flush with the surface of the rivet head.

Figure 11-27. Thermostat Rivets (Inside of Hose Duct Adapter)



- 1 Thermostat Rivet (x2)
- 2 Rivet Pin (x2)

10. Attach the hose to the hose duct adapter as follows:
 - a. Position the hose on the duct adapter. Rotate the hose counter-clockwise until the hose material reaches the flange and the exposed reinforcing wire is at the hole in the flange.
 - b. Insert the wire into the flange hole.
 - c. Bend the wire back toward the flange so that the hose is secured ([Figure 11-25](#) on page 11-28).
11. Place the duct adapter into the fan duct by inserting the top edge of the adapter first, then rotating the adapter downward until it drops into place ([Figure 11-28](#)).

Figure 11-28. Inserting the Hose Duct Adapter



TEM_10181_A



Caution:
The thermistor is very delicate and easily damaged. Use extreme care when working with the thermistor sensor assembly.

12. Position the thermistor in the hose duct adapter as follows (*Figure 11-29*):
 - a. Make sure that the portion of wire between the rivet and the tip of the thermistor is straight.
 - b. Insert the wire and rivet into the hole on the side of the duct adapter until the rivet snaps into place.

Figure 11-29. Inserting Thermistor Wire and Rivet

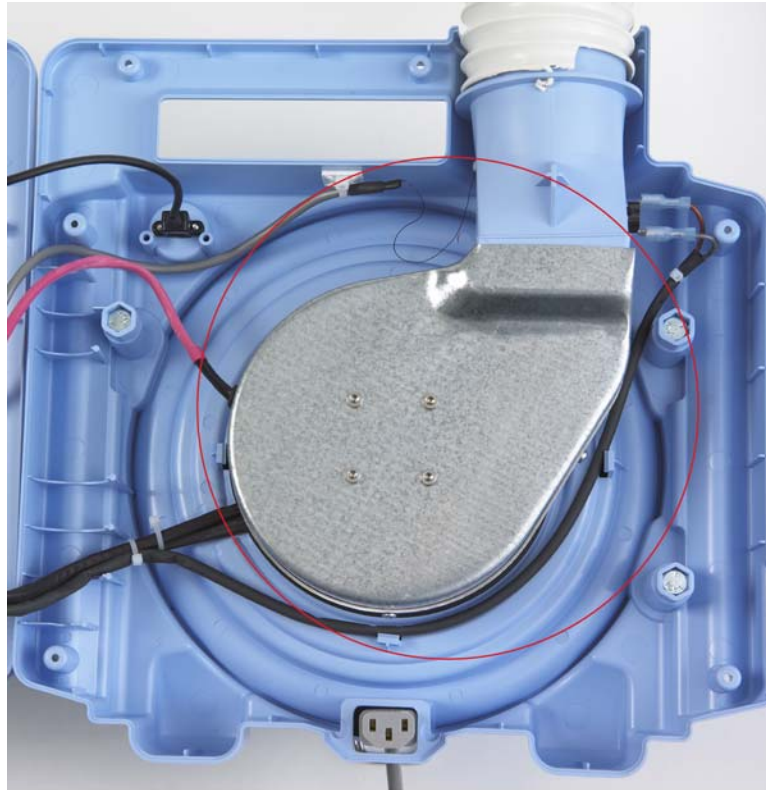


TEM_10174_A

13. Connect the two thermostat wires to the thermostat as shown in [Figure 11-24](#) on page 11-27. Note that the wires can be connected to either terminal, but for consistency across units they should be connected as shown.
14. Make sure that thermostat cable is routed as shown in [Figure 11-22](#) on page 11-25. It must be positioned to the inside of the adjacent screw boss and pole clamp mounting bolt and inside the tabs around the fan assembly.
15. Follow the procedure [Rejoining the Front and Rear Enclosures](#) on page 9-5.
16. Perform the following tests:
 - a. [Power-On Test](#) on page 7-3.
 - b. [Temperature Accuracy Test](#) on page 7-8.
 - c. [Thermostat Test](#) on page 7-11.
 - d. [Electrical Safety Tests](#) on page 7-14.

11.9 Fan Assembly Replacement

Figure 11-30. Fan Assembly



TEM_10191_A

Requirements:

- WT-CWU Fan Assembly Kit ([page A-5](#))
- Torque driver with #1 and #2 Phillips bits
- Wire cutters
- 1 cable tie
- Strap or additional cable tie to wrap around the hose duct adapter



WARNING:

Disconnect the warming unit's power cord from the AC power source before performing this procedure.

To replace the fan assembly:

1. At the back of the unit, loosen the screw securing the cover over the USB port, and rotate the cover aside (*Figure 11-31*). Do not remove the cover.

Figure 11-31. USB Port



- 1 USB Connector Screw (x2) 2 USB Port Cover

2. Remove the two screws securing the USB cable connector to the enclosure. Save the screws.
3. Remove the filter enclosure and filter as follows (*Figure 11-32*):
 - a. If the power cord is secured around the back of the unit, unwind it completely.
 - b. Position the warming unit on its front so the bottom of the unit is accessible.
 - c. Remove the three screws from the filter enclosure. Lift the enclosure away from the unit, disengaging the power cord from its socket.

- d. Set the filter enclosure (with power cord attached), filter, and screws aside.

Figure 11-32. Filter Enclosure and Screws



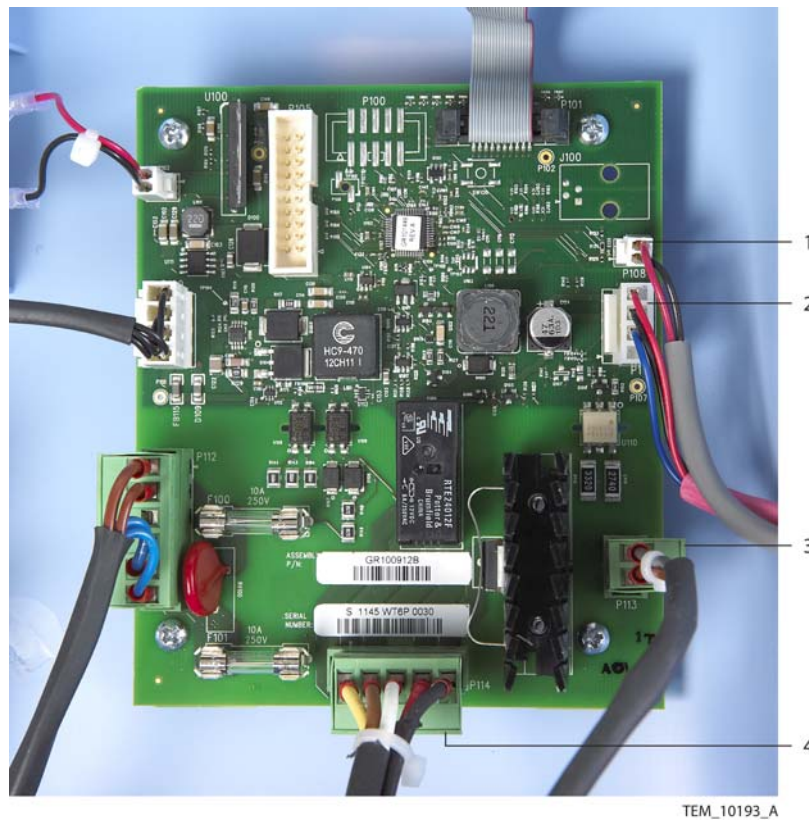
TEM_10192_A

- | | | | |
|---|------------------------------|---|----------------------------|
| 1 | Filter Enclosure | 3 | Power Cord Routing Bracket |
| 2 | Filter Enclosure Screws (x3) | | |

4. Follow the procedure [Separating the Front and Rear Enclosures](#) on page 9-2.

5. Disconnect the following cables from the Power PCBA (*Figure 11-33*):
 - a. Disconnect the thermistor cable from the 2-pin P108 connector.
 - b. Disconnect the fan cable from the 4-pin P111 connector.
 - c. Disconnect the thermostat cable from the 2-pin P113 connector.
 - d. Disconnect the heater cable from the 5-pin P114 connector.

Figure 11-33. Power PCBA Connections



- | | | | |
|---|---------------------------------------|---|---------------------------------------|
| 1 | Thermistor Cable
(P108 Connection) | 3 | Thermostat Cable
(P113 Connection) |
| 2 | Fan Cable
(P111 Connection) | 4 | Heater Cable
(P114 Connection) |

6. Turn the now separated rear enclosure over so you can access the back of the unit.

7. Remove the four screws securing the fan assembly to the rear enclosure (*Figure 11-34*).

Figure 11-34. Fan Assembly Screws



TEM_10195_A

8. Supporting the fan assembly, turn the enclosure over.

- Carefully cut and remove the cable tie securing the fan cable to the thermistor cable (*Figure 11-35*).

Figure 11-35. Cable Tie Securing Fan Cable to Thermistor Cable



TEM_10194_A

- | | | | |
|---|------------------|---|-----------|
| 1 | Fan Cable | 3 | Cable Tie |
| 2 | Thermistor Cable | | |



Caution:
Be careful when moving the hose duct adapter. The connected thermistor wire can break if too much stress is applied to it.

- Disengage the hose duct adapter from the fan assembly, and lift the fan assembly out of the unit.

11. Position the new fan assembly in the unit as shown in [Figure 11-36](#).

Figure 11-36. Position of Fan Assembly



TEM_10196_A

12. Insert the top edge of the hose duct adapter into the duct and rotate the adapter downward until it drops into place (*Figure 11-37*).

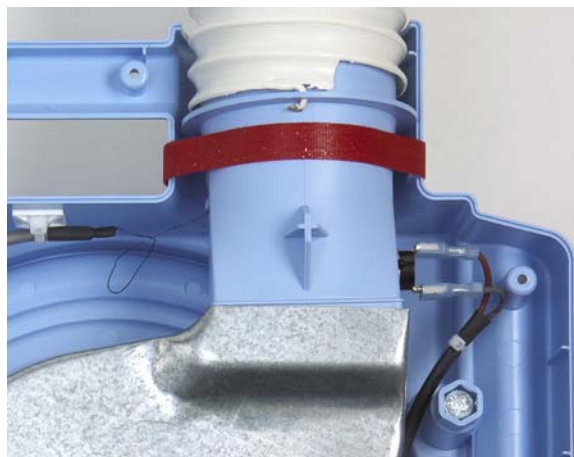
Figure 11-37. Inserting the Hose Duct Adapter



TEM_10176_A

13. Using a strap or cable tie, secure the hose duct adapter to the enclosure as shown in *Figure 11-38*.

Figure 11-38. Securing the Hose Duct Adapter



TEM_10197_A

14. Secure the fan assembly to the rear enclosure as follows:
 - a. Supporting the fan assembly with your hand, turn the enclosure over.
 - b. Align the fan screw holes in the enclosure with the fan assembly (*Figure 11-34* on page 11-37).
 - c. Install the four screws and tighten them to 1.1 to 1.5 N-m (9.7 to 13.3 lb-in).
15. Reinstall the filter and filter enclosure as follows:
 - a. Place the filter back onto the unit.
 - b. Place the filter enclosure on the unit, aligning the power cord with the socket opening and making sure that the enclosure is fully seated on the unit.
 - c. Reinstall the three screws in the filter enclosure (*Figure 11-32* on page 11-35). Tighten the screws to 1.2 to 1.6 N-m (10.6 to 14.2 lb-in).
16. Turn the enclosure over.
17. Reattach the USB cable to the enclosure as follows:
 - a. Set the front enclosure next to the rear enclosure for reconnection.
 - b. Position the USB cable connector in the port inside the rear enclosure, with the connector paddle toward the bottom of the enclosure (*Figure 11-39*).

Figure 11-39. USB Connector in Rear Enclosure



TEM_10198_A

- c. Supporting the USB connector, rotate the rear enclosure so that you can access the outside. Secure the connector by installing the two screws from the outside of the enclosure. Tighten the screws to 0.18 to 0.27 N-m (1.6 to 2.4 lb-in).
18. Remove the strap or cable tie from the hose duct adapter.
19. Reconnect the cables to the Power PCBA as follows ([Figure 11-33](#) on page 11-36):
 - a. Connect the heater cable to the 5-pin P114 connector. Make sure that the connector is oriented as shown in [Figure 11-33](#), and that it is fully seated.
 - b. Connect the thermostat cable to the 2-pin P113 connector. Make sure that the connector is oriented as shown in [Figure 11-33](#), and that it is fully seated.
 - c. Connect the fan cable to the 4-pin P111 connector. Make sure the connector latch engages.
 - d. Connect the thermistor cable to the 2-pin P108 connector. Make sure the connector latch engages.
20. Make sure that thermostat cable is routed as shown in [Figure 11-30](#) on page 11-33. It must be positioned to the inside of the adjacent screw boss and pole clamp mounting bolt and inside the tabs around the fan assembly.
21. Place a cable tie around the fan cable and thermistor cable approximately 10 cm (4 inches) from the Power PCBA connectors ([Figure 11-35](#) on page 11-38). Trim the end of the cable tie.
22. Follow the procedure [Rejoining the Front and Rear Enclosures](#) on page 9-5.
23. At the back of the unit, rotate the cover for the USB port back into position, and tighten the screw to 1.1 to 1.5 N-m (9.7 to 13.3 lb-in).
24. Perform the following tests:
 - a. [Power-On Test](#) on page 7-3.
 - b. [Temperature Accuracy Test](#) on page 7-8.
 - c. [Flow Test](#) on page 7-10.
 - d. [Thermostat Test](#) on page 7-11.
 - e. [Electrical Safety Tests](#) on page 7-14.

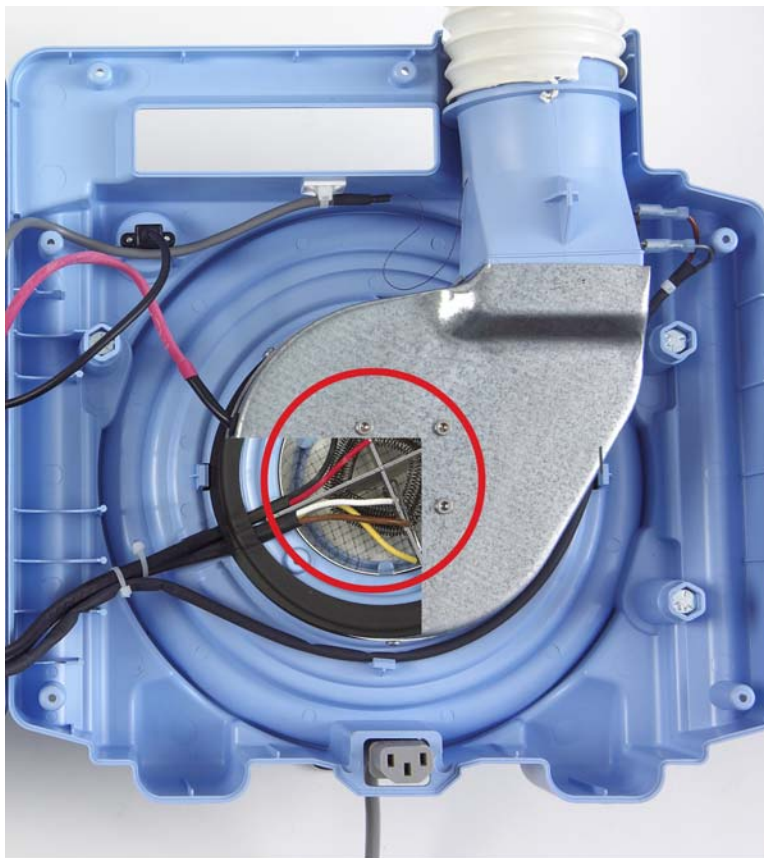
11.10 Heater Assembly Replacement



Caution:

Do not touch the heater coil. Body oil can damage the coil and affect heater operation.

Figure 11-40. Heater Assembly (below Fan Assembly)



TEM_10199_A

Requirements:

- WT-CWU Heater Assembly Kit ([page A-5](#))
- Torque driver with #1 and #2 Phillips bits
- Wire cutters
- 2 cable ties
- Strap or additional cable tie to wrap around the hose duct adapter
- 70% isopropyl alcohol solution and soft cloth



WARNING:

Disconnect the warming unit's power cord from the AC power source before performing this procedure.

To replace the heater assembly:

1. At the back of the unit, loosen the screw securing the cover over the USB port, and rotate the cover aside ([Figure 11-41](#)). Do not remove the cover.

Figure 11-41. USB Port



TEM_10218_A

1 USB Connector Screw (x2)

2 USB Port Cover

2. Remove the two screws securing the USB cable connector to the enclosure. Save the screws.
3. Remove the filter enclosure and filter as follows (*Figure 11-42*):
 - a. If the power cord is secured around the back of the unit, unwind it completely.
 - b. Position the warming unit on its front so the bottom of the unit is accessible.
 - c. Remove the three screws from the filter enclosure. Lift the enclosure away from the unit, disengaging the power cord from its socket.
 - d. Set the filter enclosure (with power cord attached), filter, and screws aside.

Figure 11-42. Filter Enclosure and Screws



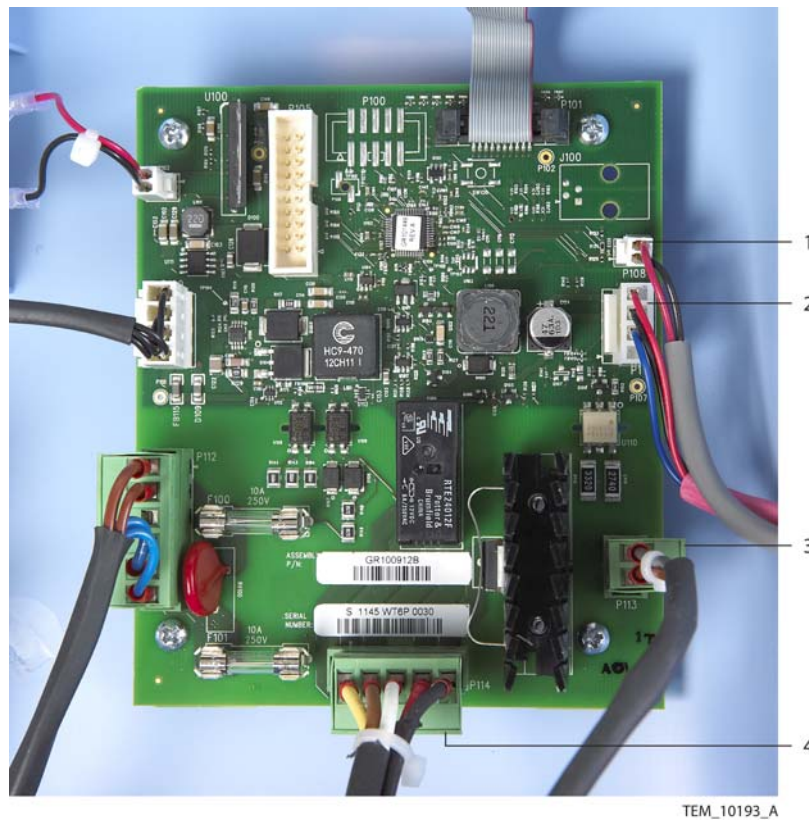
TEM_10192_A

- | | | | |
|---|------------------------------|---|----------------------------|
| 1 | Filter Enclosure | 3 | Power Cord Routing Bracket |
| 2 | Filter Enclosure Screws (x3) | | |

4. Follow the procedure *Separating the Front and Rear Enclosures* on page 9-2.

5. Disconnect the following cables from the Power PCBA (*Figure 11-43*):
 - a. Disconnect the thermistor cable from the 2-pin P108 connector.
 - b. Disconnect the fan cable from the 4-pin P111 connector.
 - c. Disconnect the thermostat cable from the 2-pin P113 connector.
 - d. Disconnect the heater cable from the 5-pin P114 connector.

Figure 11-43. Power PCBA Connections



- | | |
|---|---|
| 1 Thermistor Cable
(P108 Connection) | 3 Thermostat Cable
(P113 Connection) |
| 2 Fan Cable
(P111 Connection) | 4 Heater Cable
(P114 Connection) |

6. Turn the now separated rear enclosure over so you can access the back of the unit.

7. Remove the four screws securing the fan assembly to the rear enclosure (*Figure 11-44*).

Figure 11-44. Fan Assembly Screws



TEM_10195_A

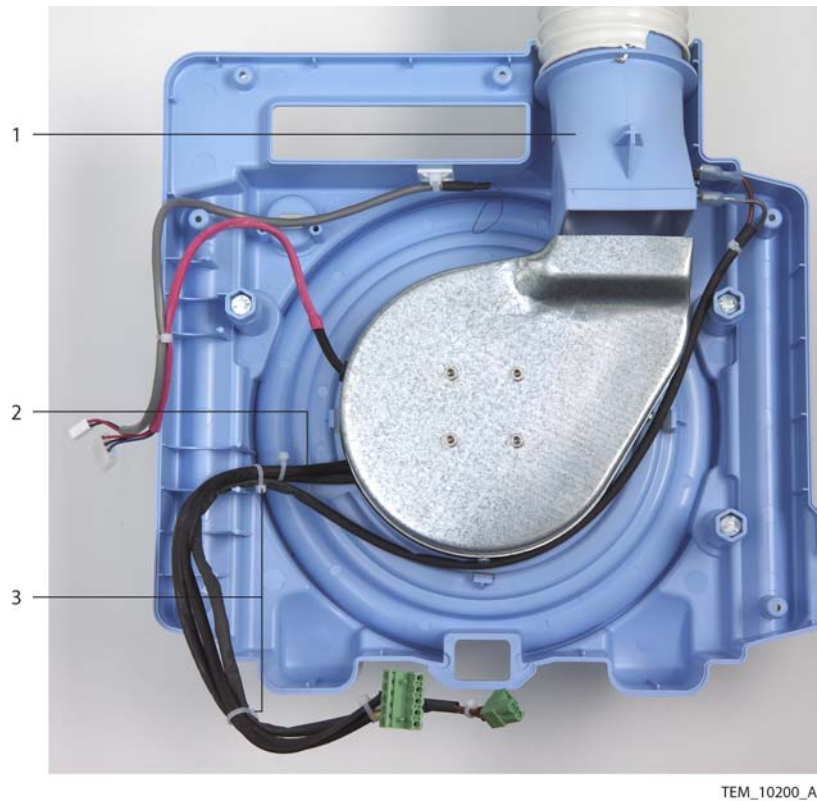
8. Supporting the fan assembly, turn the rear enclosure over.



Caution:
Be careful when moving the hose duct adapter. The connected thermistor wire can break if too much stress is applied to it.

9. Disengage the hose duct adapter from the fan assembly (*Figure 11-45*).

Figure 11-45. Fan Assembly and Hose Duct Adapter



- | | | | |
|---|-------------------|---|--|
| 1 | Hose Duct Adapter | 3 | Cable Ties
(Thermostat Cable to Heater Cable) |
| 2 | Heater Cable | | |

10. Carefully cut and remove the cable ties securing the heater cable to the thermostat cable (*Figure 11-45*).

12. Peel the circular gasket off the enclosure (*Figure 11-47*).

Figure 11-47. Heater Assembly and Gasket



- | | | | |
|---|-------------|---|-----------------|
| 1 | Heater Cone | 3 | Heater Assembly |
| 2 | Gasket | | |

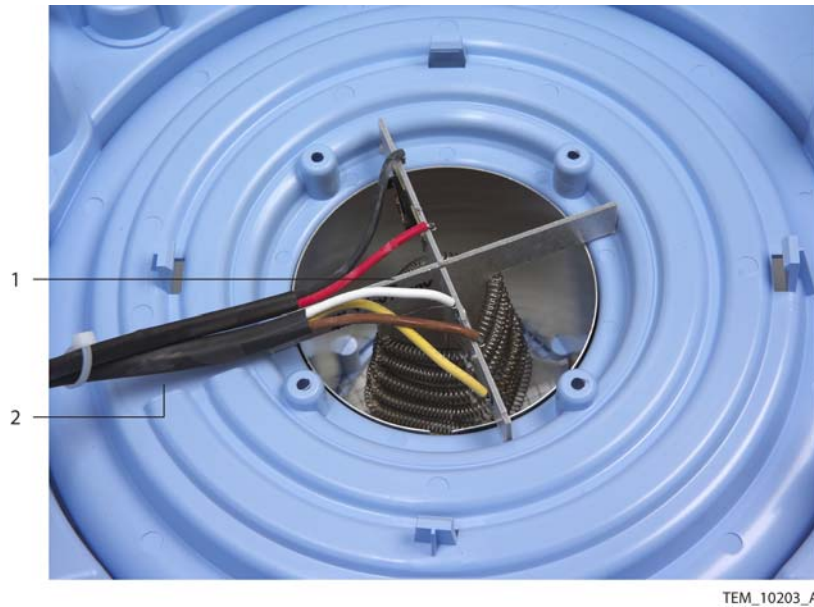
13. Remove the heater assembly from the metal heater cone.
14. Use a soft cloth dampened with a solution of 70% isopropyl alcohol to remove any adhesive remnants from the surface. Make sure that the surface is completely dry before proceeding.



Caution:
Do not touch the heater coil. Body oil can damage the coil and affect heater operation.

15. Position the new heater assembly in the heater cone, with the wires routed through the notch in the enclosure. Make sure that the two wrapped sets of wires lie on opposite sides of the heater's metal support rib (*Figure 11-48*).

Figure 11-48. Routing of Heater Wires



TEM_10203_A

- 1 Heater Support Rib 2 Notch for Heater Wires

16. Attach the new circular gasket as follows (*Figure 11-47* on page 11-50):
 - a. Remove the backing from the gasket to expose the adhesive.
 - b. Center the gasket around the heater assembly, just outside the four screw bosses in the enclosure.
 - c. Making sure that the heater wires are lying flat in the notch, press the gasket down on both sides of the wires.
 - d. Continue pressing around the rest of the gasket to adhere it to the enclosure.
17. Position the fan assembly back in the unit as shown in *Figure 11-45* on page 11-48.

18. Insert the top edge of the hose duct adapter into the duct and rotate the adapter downward until it drops into place (*Figure 11-49*).

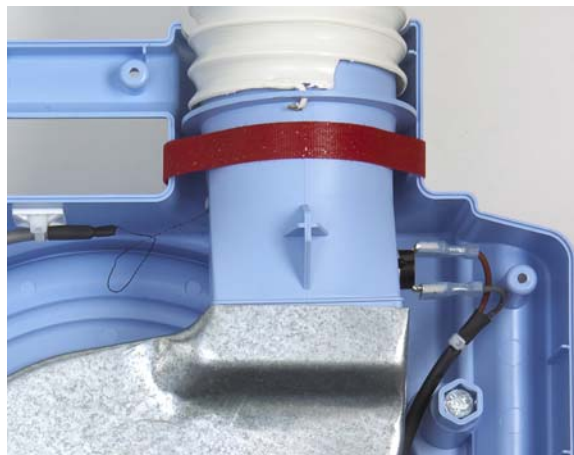
Figure 11-49. Inserting the Hose Duct Adapter



TEM_10176_A

19. Using a strap or cable tie, secure the hose duct adapter to the enclosure as shown in *Figure 11-50*.

Figure 11-50. Securing the Hose Duct Adapter



TEM_10197_A

20. Secure the fan assembly to the rear enclosure as follows:
 - a. Supporting the fan assembly with your hand, turn the rear enclosure over.
 - b. Align the fan screw holes in the enclosure with the fan assembly (*Figure 11-44* on page 11-47).
 - c. Install the four screws and tighten them to 1.1 to 1.5 N-m (9.7 to 13.3 lb-in).
21. Reinstall the filter and filter enclosure as follows:
 - a. Place the filter back onto the unit.
 - b. Place the filter enclosure on the unit, aligning the power cord with the socket opening and making sure that the enclosure is fully seated on the unit.
 - c. Reinstall the three screws in the filter enclosure (*Figure 11-42* on page 11-45). Tighten the screws to 1.2 to 1.6 N-m (10.6 to 14.2 lb-in).
22. Turn the enclosure over.
23. Reattach the USB cable to the enclosure as follows:
 - a. Set the front enclosure next to the rear enclosure for reconnection.
 - b. Position the USB cable connector in the port inside the rear enclosure, with the connector paddle toward the bottom of the enclosure (*Figure 11-51*).

Figure 11-51. USB Connector in Rear Enclosure



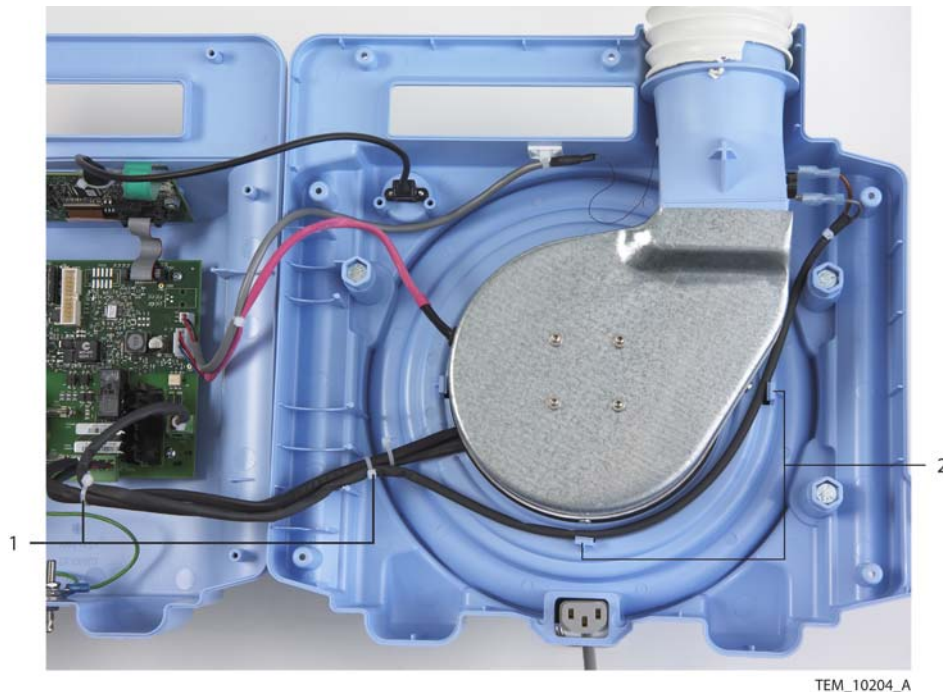
TEM_10198_A

- c. Supporting the USB connector, rotate the rear enclosure so that you can access the outside. Secure the connector by installing the two screws from the

outside of the enclosure. Tighten the screws to 0.18 to 0.27 N-m (1.6 to 2.4 lb-in).

24. Remove the strap or cable tie from the hose duct adapter.
25. Reconnect the cables to the Power PCBA as follows (*Figure 11-43* on page 11-46):
 - a. Connect the heater cable to the 5-pin P114 connector. Make sure that the connector is oriented as shown in *Figure 11-43*, and that it is fully seated.
 - b. Connect the thermostat cable to the 2-pin P113 connector. Make sure that the connector is oriented as shown in *Figure 11-43*, and that it is fully seated.
 - c. Connect the fan cable to the 4-pin P111 connector. Make sure the connector latch engages.
 - d. Connect the thermistor cable to the 2-pin P108 connector. Make sure the connector latch engages.
26. Make sure that thermostat cable is routed as shown in *Figure 11-52*. It must be positioned to the inside of the adjacent screw boss and pole clamp mounting bolt and inside the tabs around the fan assembly.

Figure 11-52. Routing of Cables around Fan Assembly



1 Cable Ties
(Heater Cable to Thermostat Cable)

2 Thermostat Cable
Routing Tabs

27. Using two cable ties, secure the thermostat cable to the heater cable as follows (*Figure 11-52*):
 - a. Place one cable tie around the cables approximately 5 cm (2 inches) from where the heater cable exits below the fan assembly.
 - b. Place the other cable tie around the cables approximately 10 cm (4 inches) from the heater cable connector (P114) on the Power PCBA.
 - c. Trim the ends of the cable ties.
28. Follow the procedure *Rejoining the Front and Rear Enclosures* on page 9-5.
29. At the back of the unit, rotate the cover for the USB port back into position, and tighten the screw to 1.1 to 1.5 N-m (9.7 to 13.3 lb-in).
30. Perform the following tests:
 - a. *Power-On Test* on page 7-3.
 - b. *Temperature Accuracy Test* on page 7-8.
 - c. *Flow Test* on page 7-10.
 - d. *Thermostat Test* on page 7-11.
 - e. *Electrical Safety Tests* on page 7-14.

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12 Enclosure Replacement

12.1 Overview

This chapter provides instructions for replacing the Covidien WarmTouch™ Convective Warming Unit's enclosures.

<i>Front Enclosure Replacement</i>	<i>Page 12-2</i>
<i>Filter Enclosure Replacement</i>	<i>Page 12-12</i>
<i>Rear Enclosure Replacement</i>	<i>Page 12-15</i>



Note:

Testing is required after each of these procedures. Refer to the instructions in each section for minimum testing requirements.

12.2 Safety Reminders



WARNING:

No modification of this equipment is allowed. Modification can result in death, injury, or property damage.



WARNING:

Before attempting to open or disassemble the warming unit, disconnect the power cord from the AC power source.

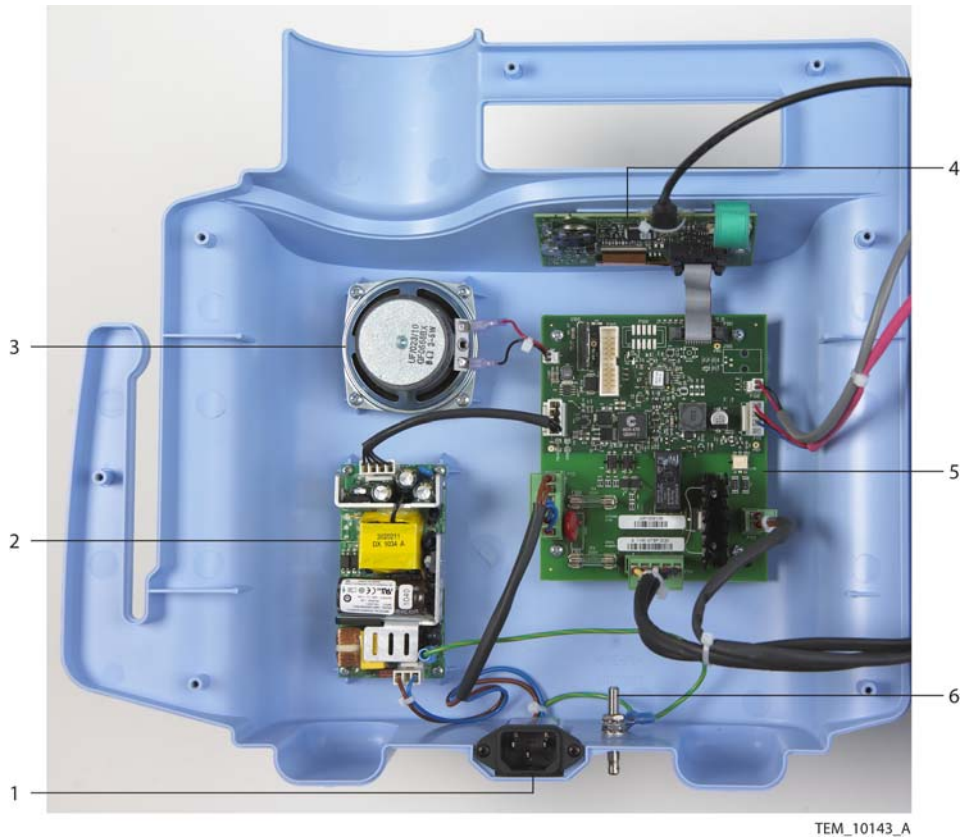


Caution:

Observe ESD (electrostatic discharge) precautions when servicing the warming unit.

12.3 Front Enclosure Replacement

Figure 12-1. Front Enclosure – Components to be Removed/Reinstalled



- | | | | |
|---|----------------|---|---------------------|
| 1 | AC Power Inlet | 4 | UI PCBA and Display |
| 2 | Power Supply | 5 | Power PCBA |
| 3 | Speaker | 6 | Equipotential Stud |

Requirements:

- WT-CWU Front Enclosure Kit ([page A-6](#))
- Torque driver with #1 and #2 Phillips bits and 11/32" and 10mm hex sockets
- 10 mm open-end or box wrench
- Wire cutters and cable tie (some warming unit configurations)

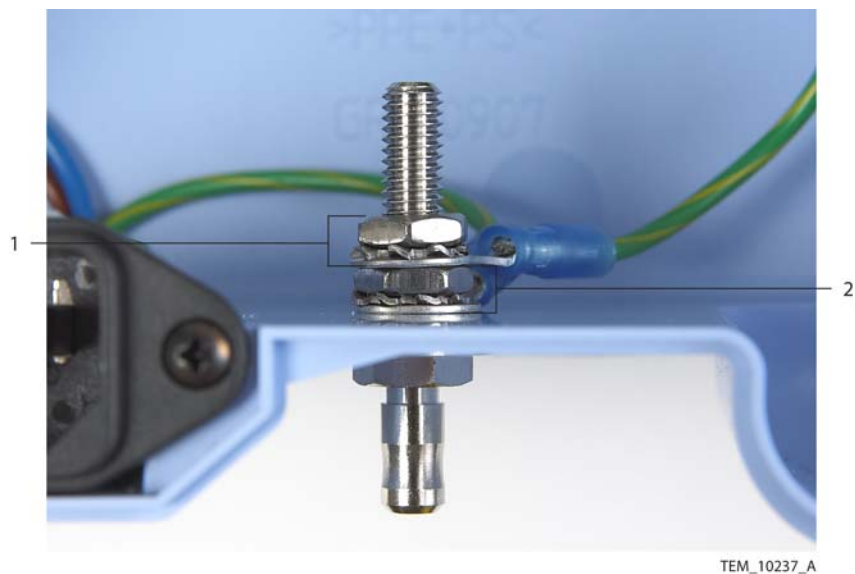
**WARNING:**

Disconnect the warming unit's power cord from the AC power source before performing this procedure.

To replace the front enclosure:

1. Follow the procedure [Separating the Front and Rear Enclosures](#) on page 9-2.
2. Remove the equipotential stud from the enclosure as follows ([Figure 12-2](#)):
 - a. Remove the top nut and lock washer from the threaded end of the stud.
 - b. Lift the power supply ground cable terminal off the stud.
 - c. Remove the next nut and lock washer from the stud.
 - d. Lift the AC power inlet ground cable terminal off the stud.
 - e. Pull the stud and ground washer out of the enclosure from the bottom.
 - f. Save all components for installation in the new enclosure.

Figure 12-2. Equipotential Stud Connections



1 Power Supply Ground Cable
(Nut, Lock Washer, Terminal)

2 AC Power Inlet Ground Cable
(Nut, Lock Washer, Terminal)

TEM_10237_A

3. Remove the AC power inlet from the enclosure as follows (*Figure 12-3*):
 - a. Disconnect the cable from the 6-pin P112 connector on the Power PCBA.
 - b. Disconnect the cable from the 3-pin CON1 connector on the power supply.
Note: A cable tie may secure the AC power inlet wire assembly to the power supply mounting boss next to the CON1 connector. If so, cut and remove this cable tie.
 - c. Remove the two screws securing the AC power inlet assembly to the enclosure.
 - d. Remove the assembly and save all components for installation in the new enclosure.

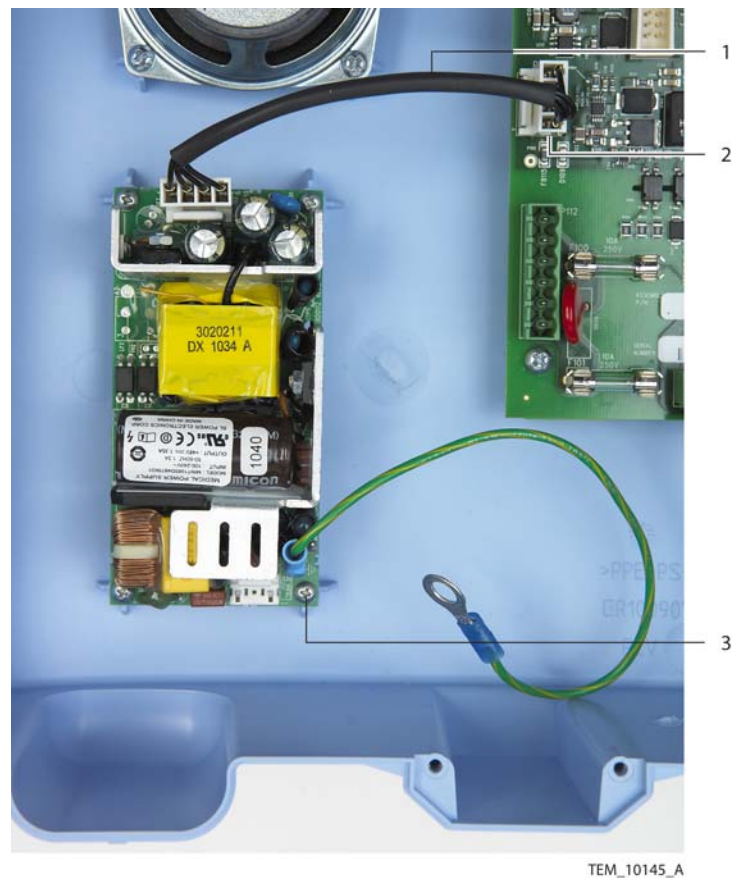
Figure 12-3. AC Power Inlet Connections



- | | | | |
|---|---|---|---------------------------|
| 1 | AC Power Inlet Wire Assembly
(P112 Connection on Power PCBA) | 3 | AC Power Inlet Screw (x2) |
| 2 | AC Power Inlet Wire Assembly
(CON1 Connection on Power Supply) | | |

4. Remove the power supply from the enclosure as follows (*Figure 12-4*):
 - a. Disconnect the power supply output cable from the 4-pin P109 connector on the Power PCBA. (Leave this cable connected to the power supply.)
 - b. Remove the four screws securing the power supply to the enclosure.
 - c. Remove the power supply and save all components for installation in the new enclosure.

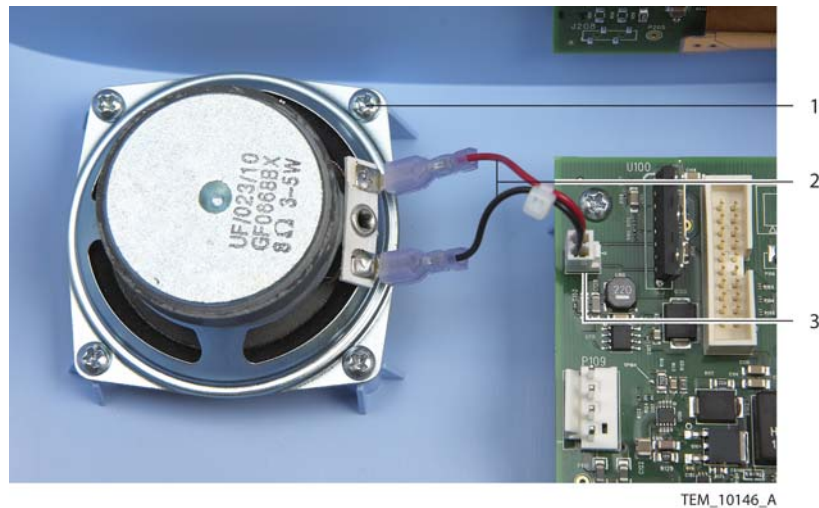
Figure 12-4. Power Supply Connections



- | | | | |
|---|---------------------------------|---|-------------------------|
| 1 | Power Supply Output Cable | 3 | Power Supply Screw (x4) |
| 2 | P109 Connection
(Power PCBA) | | |

5. Remove the speaker from the enclosure as follows (*Figure 12-5*):
 - a. Disconnect the speaker cable from the 2-pin P103 connector on the Power PCBA. (Leave this cable connected to the speaker.)
 - b. Remove the four screws securing the speaker to the enclosure.
 - c. Remove the speaker and save all components for installation in the new enclosure.

Figure 12-5. Speaker Connections

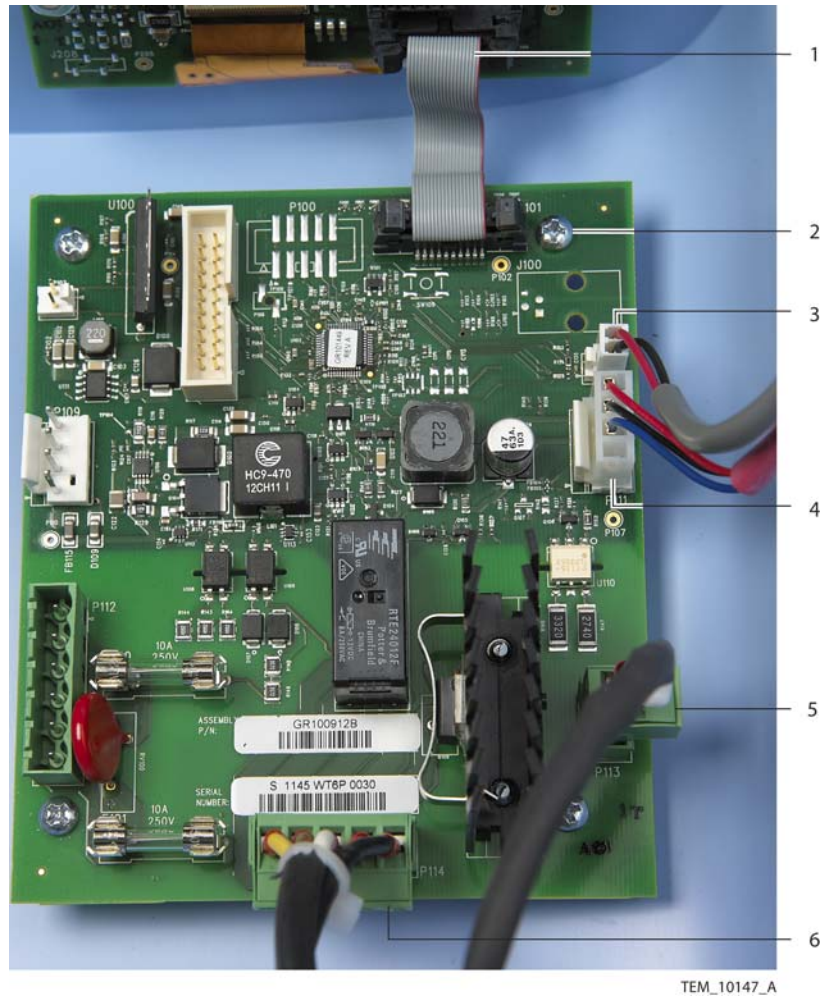


- | | | | |
|---|--------------------|---|---------------------------------|
| 1 | Speaker Screw (x4) | 3 | P103 Connection
(Power PCBA) |
| 2 | Speaker Cable | | |

6. Remove the Power PCBA from the enclosure as follows (*Figure 12-6*):
 - a. On the UI PCBA, open the locking ears at the P204 connector, and disconnect the ribbon cable. Leave this cable attached to the Power PCBA.
 - b. Disconnect the thermistor cable from the 2-pin P108 connector on the Power PCBA.
 - c. Disconnect the fan cable from the 4-pin P111 connector.
 - d. Disconnect the thermostat cable from the 2-pin P113 connector.
 - e. Disconnect the heater cable from the 5-pin P114 connector.
 - f. Remove the four screws securing the Power PCBA to the enclosure.

- g. Remove the Power PCBA and save all components for installation in the new enclosure.

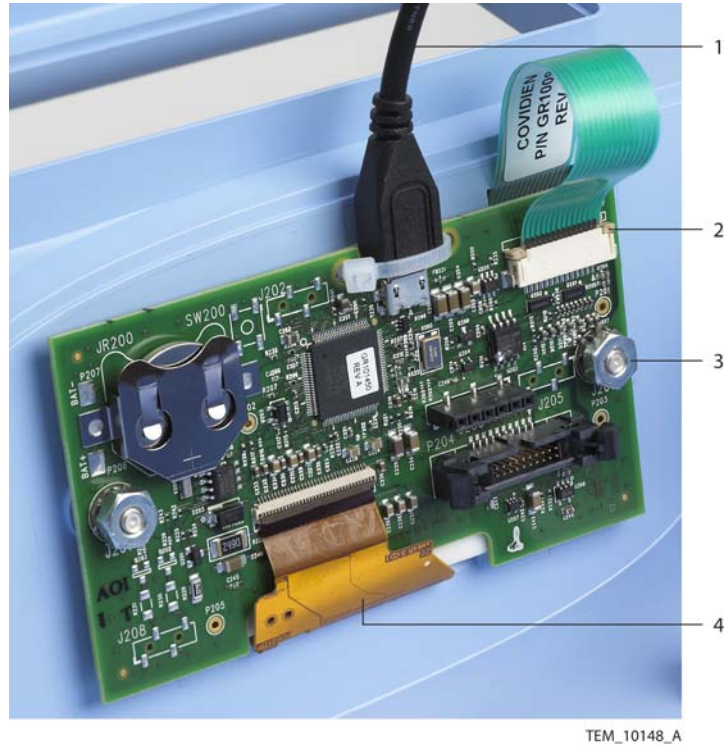
Figure 12-6. Power PCBA Connections



- | | |
|---|---|
| 1 Ribbon Cable
(P204 Connection) | 4 Fan Cable
(P111 Connection) |
| 2 Power PCBA Screw (x4) | 5 Thermostat Cable
(P113 Connection) |
| 3 Thermistor Cable
(P108 Connection) | 6 Heater Cable
(P114 Connection) |

7. Remove the UI PCBA and display from the enclosure as follows (*Figure 12-7*):
 - a. Slide the locking bar up from the J204 connector, and disconnect the keypad cable. Leave the remaining cables attached.
 - b. Remove the nut and lock washer from each mounting screw.
 - c. Slide the UI PCBA and shoulder washers off the mounting screws, supporting the attached display. Leave the shoulder washers in the mounting holes on the PCBA. Place the UI PCBA and display with the rear enclosure, taking care to protect the display from damage.
 - d. Remove the nylon spacer from each mounting screw.
 - e. Save all components for installation in the new enclosure.

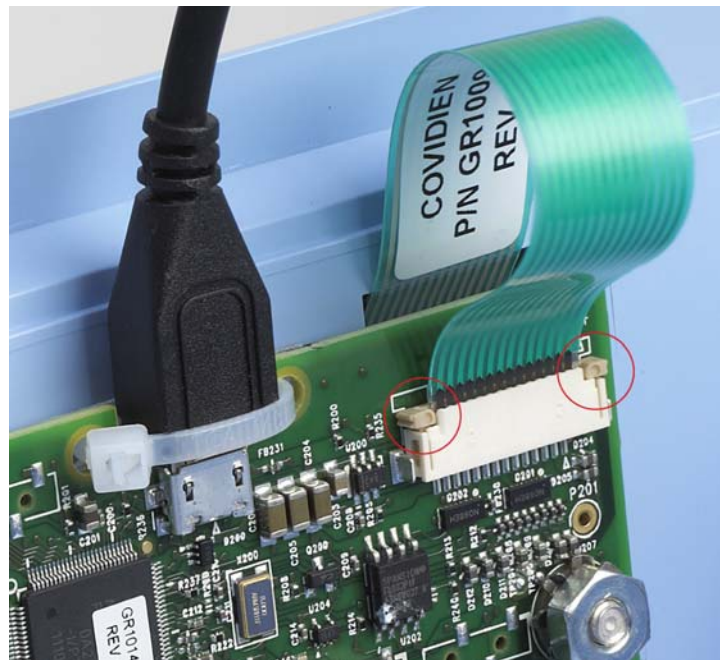
Figure 12-7. UI PCBA Connections



- | | | | |
|---|-----------------------------------|---|---|
| 1 | USB Cable
(Leave Connected) | 3 | Nut, Lock Washer,
Shoulder Washer (x2) |
| 2 | Keypad Cable
(J204 Connection) | 4 | Display Cable
(Leave Connected) |

8. Discard the old front enclosure (with keypad and labels attached).
9. Install the UI PCBA and display in the new front enclosure as follows ([Figure 12-7](#) on page 12-8):
 - a. Place a nylon spacer on each mounting screw.
 - b. Check the display window and display for dust, fingerprints, and debris. If necessary, clean the window and display.
 - c. Holding the display behind the UI PCBA, place the PCBA on the mounting screws with the USB cable at the top. Position the display so that it is fully seated in its window. Make sure that the keypad cable is not caught behind the UI PCBA.
 - d. Make sure that the shoulder washers are in place in the PCBA mounting holes, with the bottom of the shoulder against the top surface of the PCBA.
 - e. Place a lock washer on each mounting screw.
 - f. Place a nut on each mounting screw. Tighten the nuts to 0.4 to 0.6 N-m (3.5 to 5.3 lb-in).
 - g. Slide the locking bar up from the J204 connector, and slide the keypad cable completely into the connector in front of the locking bar. Press down on both sides of the locking bar to secure the cable. The locking bar must be completely seated on both sides ([Figure 12-8](#)).

Figure 12-8. Keypad Cable Secured by Locking Bar



10. Install the Power PCBA in the new enclosure as follows ([Figure 12-6](#) on page 12-7):
 - a. Position the Power PCBA on the four mounting bosses, with the attached ribbon cable toward the UI PCBA.
 - b. Attach the Power PCBA to the mounting bosses with four screws. Tighten the screws to 1.1 to 1.5 N-m (9.7 to 13.3 lb-in).
 - c. Connect the heater cable to the 5-pin P114 connector. Make sure that the connector is oriented as shown in [Figure 12-6](#), and that it is fully seated.
 - d. Connect the thermostat cable to the 2-pin P113 connector. Make sure that the connector is oriented as shown in [Figure 12-6](#), and that it is fully seated.
 - e. Connect the fan cable to the 4-pin P111 connector. Make sure the connector latch engages.
 - f. Connect the thermistor cable to the 2-pin P108 connector. Make sure the connector latch engages.
 - g. Connect the ribbon cable to the P204 connector on the UI PCBA. Make sure the locking ears close completely on the connector.
11. Install the speaker in the new enclosure as follows ([Figure 12-5](#) on page 12-6):
 - a. Position the speaker on the four mounting bosses, with the speaker cable toward the Power PCBA.
 - b. Attach the speaker to the mounting bosses with four screws. Tighten the screws to 1.1 to 1.5 N-m (9.7 to 13.3 lb-in).
 - c. Connect the speaker cable to the 2-pin P103 connector on the Power PCBA. Make sure the connector latch engages.
12. Install the power supply in the new enclosure as follows ([Figure 12-4](#) on page 12-5):
 - a. Position the power supply on the four mounting bosses, with the power supply output cable toward the speaker.
 - b. Attach the power supply to the mounting bosses with four screws. Tighten the screws to 0.4 to 0.6 N-m (3.5 to 5.3 lb-in).
 - c. Connect the power supply output cable to the 4-pin P109 connector on the Power PCBA. Make sure the connector latch engages.

13. Install the AC power inlet in the new enclosure as follows ([Figure 12-3](#) on page 12-4):
 - a. Position the AC power inlet assembly as shown in [Figure 12-3](#).
 - b. Attach the AC power inlet to the enclosure with the two screws. Tighten the screws to 0.4 to 0.6 N-m (3.5 to 5.3 lb-in).
 - c. Connect the 6-pin connector of the AC power inlet wire assembly to P112 on the Power PCBA. Make sure that the connector is oriented as shown in [Figure 12-3](#), and that it is fully seated.
 - d. Connect the 3-pin connector of the wire assembly to CON1 on the power supply. Make sure that the connector latch engages.

Note: If a cable tie previously secured the AC power inlet wire assembly to the power supply mounting boss (see [page 12-4](#)), install a new cable tie at the same position. The cable tie should cause the wires connected to CON1 to form an arch approximately 4 cm (1.5 in) above the connector. Trim off the end of the cable tie.
14. Install the equipotential stud in the new enclosure as follows ([Figure 12-2](#) on page 12-3):
 - a. From the bottom of the enclosure, insert the threaded end of the stud, with the ground washer attached, into the hole.
 - b. Place the AC power inlet ground cable terminal on the threaded end of the stud. See [Figure 12-2](#) for the order of items on the stud.
 - c. Place a lock washer on top of the terminal.
 - d. Place a nut on top of the lock washer. Tighten the nut to 3.2 to 3.8 N-m (28.3 to 33.6 lb-in).
 - e. Place the power supply ground cable terminal on top of the nut.
 - f. Place a lock washer on top of the terminal.
 - g. Place a nut on top of the lock washer. Tighten the nut to 3.2 to 3.8 N-m (28.3 to 33.6 lb-in).
15. Follow the procedure [Rejoining the Front and Rear Enclosures](#) on page 9-5.
16. Perform the following tests:
 - a. [Keypad Test](#) on page 7-5.
 - b. [Display Test](#) on page 7-7.
 - c. [Temperature Accuracy Test](#) on page 7-8.
 - d. [Flow Test](#) on page 7-10.
 - e. [Thermostat Test](#) on page 7-11.
 - f. [Electrical Safety Tests](#) on page 7-14.

12.4 Filter Enclosure Replacement

Figure 12-9. Filter Enclosure



TEM_10241_A

- | | | | |
|---|------------------------------|---|----------------------------|
| 1 | Filter Enclosure | 3 | Power Cord Routing Bracket |
| 2 | Filter Enclosure Screws (x3) | 4 | Power Cord Connector |

Requirements:

- WT-CWU Filter Enclosure Kit ([page A-6](#))
- Torque driver with #2 Phillips bit



WARNING:

Disconnect the warming unit's power cord from the AC power source before performing this procedure.



WARNING:

Do not operate the warming unit with the filter enclosure removed.

To replace the filter enclosure:

1. If the power cord is secured around the back of the unit, unwind it completely.
2. Position the warming unit on its front so the bottom of the unit is accessible (*Figure 12-9* on page 12-12).
3. Disengage the power cord from its routing bracket and remove it from the socket. Set the power cord aside.
4. Remove the three screws from the filter enclosure, and remove the enclosure.

Note: Do not remove the filter unless it needs to be replaced. (See *Filter Replacement* on page 5-4 for instructions.)

5. Place the new filter enclosure on the unit, aligning the power cord routing bracket with the socket. Make sure that the enclosure is fully seated on the unit.
6. Install the three screws in the filter enclosure. Tighten the screws to 1.2 to 1.6 N-m (10.6 to 14.2 lb-in).
7. Insert the power cord into the socket, making sure that it is fully seated.

Note: Do not route the power cord through the metal hook on the filter enclosure.

8. Press the power cord into the routing bracket until it is completely seated. If necessary, use a screwdriver to carefully spread the sides of the bracket while inserting the cord.
9. Perform the *Power-On Test* on page 7-3.
10. Wrap the power cord around the back of the unit, and secure it with the attached strap (*Figure 12-10*).

Figure 12-10. Power Cord Wrapped and Secured



TEM_10113_A

12.5 Rear Enclosure Replacement

**Note:**

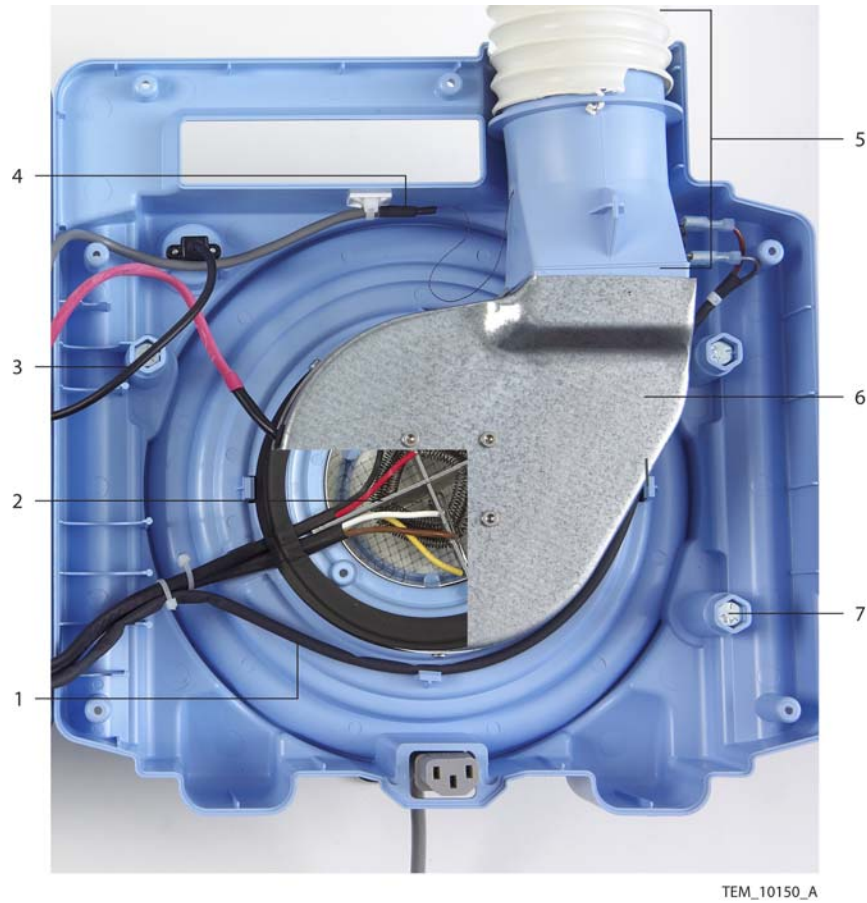
This procedure requires removing the serial number label from the rear enclosure and attaching it to the new enclosure. Be careful not to damage this label.

Figure 12-11. Rear Enclosure (Outside) – Components to be Removed/Reinstalled



- | | | | |
|---|--|---|--|
| 1 | Serial Number Label | 4 | Filter Enclosure and Filter
(below Enclosure) |
| 2 | USB Port Cover | 5 | Power Cord |
| 3 | Pole Clamps and Mounting Bolts
(below Pole Clamps) (x3) | | |

Figure 12-12. Rear Enclosure (Inside) – Components to be Removed/Reinstalled



- | | | | |
|---|--------------------------------------|---|---|
| 1 | Thermostat Cable | 5 | Hose Duct Adapter, Hose, and Thermostat |
| 2 | Heater Assembly (below Fan Assembly) | 6 | Fan Assembly |
| 3 | USB Cable | 7 | Pole Clamp Mounting Bolt (x3) |
| 4 | Thermistor Cable | | |

Requirements:

- WT-CWU Rear Enclosure Kit ([page A-6](#))
- Torque driver with #1 and #2 Phillips bits
- Wire cutters
- Small rubber mallet or similar tool
- Handheld blow-dryer
- 4 cable ties
- Strap or additional cable tie to wrap around the hose duct adapter

**WARNING:**

Disconnect the warming unit's power cord from the AC power source before performing this procedure.

To replace the rear enclosure:

1. At the back of the unit, remove the USB port cover and detach the USB connector as follows:
 - a. Remove the screw securing the cover over the USB port ([Figure 12-11](#) on page 12-15). Remove the cover.
 - b. Remove the two screws securing the USB cable connector to the enclosure ([Figure 12-13](#)).
 - c. Set the cover and screws aside for installation in the new enclosure.

Figure 12-13. USB Connector and Screws



TEM_10151_A

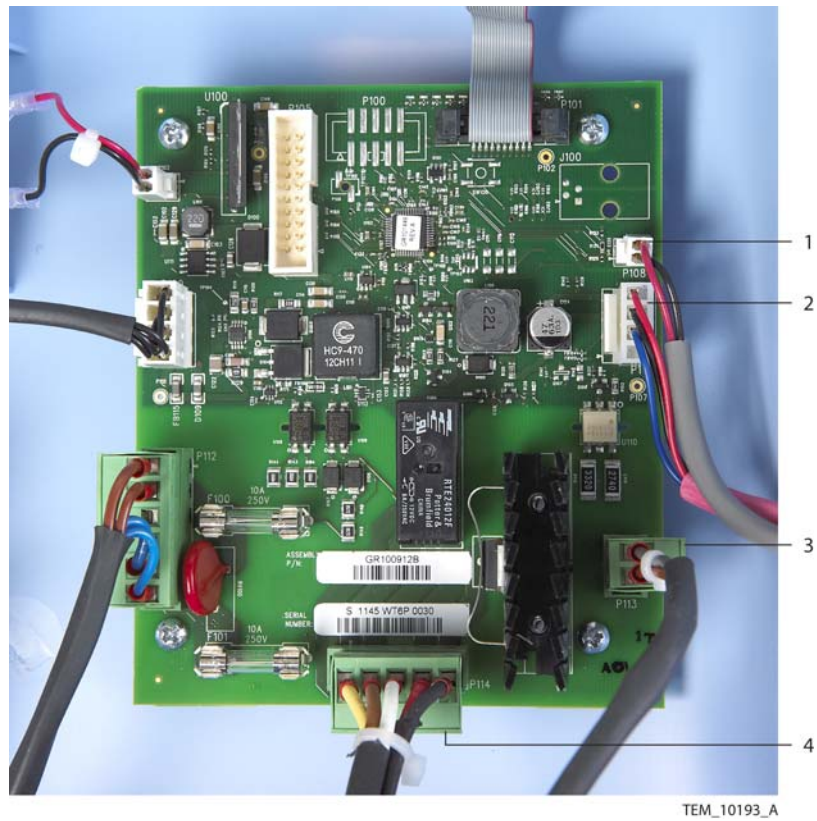
2. Remove the filter enclosure and filter as follows ([Figure 12-14](#)):
 - a. If the power cord is secured around the back of the unit, unwind it completely.
 - b. Position the warming unit on its front so the bottom of the unit is accessible.
 - c. Remove the three screws from the filter enclosure. Lift the enclosure away from the unit, disengaging the power cord from its socket.
 - d. Set the filter enclosure (with power cord attached), filter, and screws aside for installation in the new enclosure.

Figure 12-14. Filter Enclosure and Power Cord Connection

- | | | | |
|---|------------------------------|---|----------------------------|
| 1 | Filter Enclosure | 3 | Power Cord Routing Bracket |
| 2 | Filter Enclosure Screws (x3) | | |

3. Follow the procedure [Separating the Front and Rear Enclosures](#) on page 9-2.
4. Disconnect the following cables from the Power PCBA ([Figure 12-15](#)):
 - a. Disconnect the thermistor cable from the 2-pin P108 connector.
 - b. Disconnect the fan cable from the 4-pin P111 connector.
 - c. Disconnect the thermostat cable from the 2-pin P113 connector.
 - d. Disconnect the heater cable from the 5-pin P114 connector.

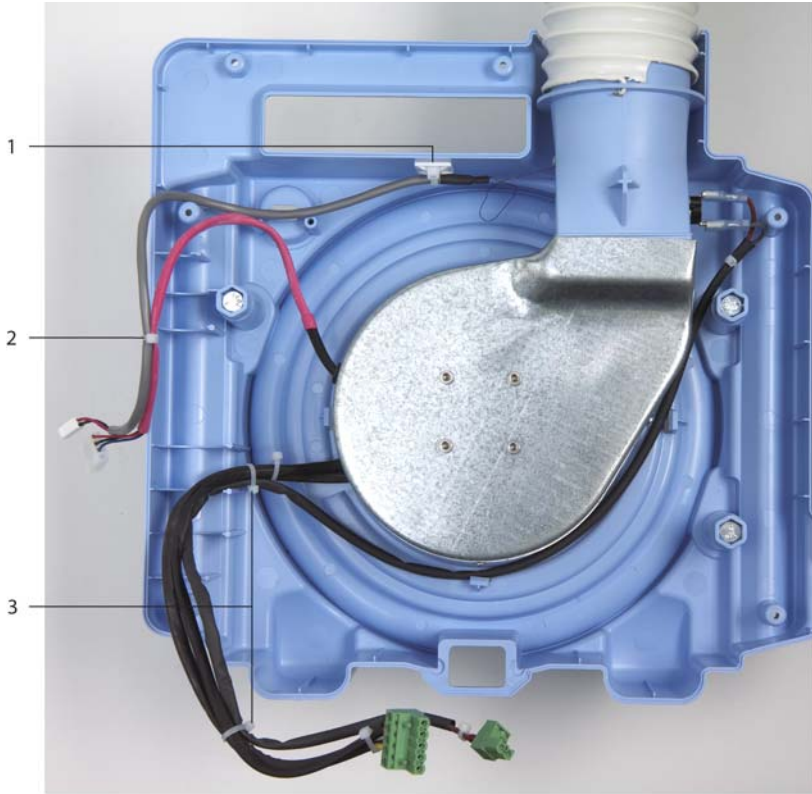
Figure 12-15. Power PCBA Connections



- | | |
|--|---|
| <p>1 Thermistor Cable
(P108 Connection)</p> <p>2 Fan Cable
(P111 Connection)</p> | <p>3 Thermostat Cable
(P113 Connection)</p> <p>4 Heater Cable
(P114 Connection)</p> |
|--|---|

5. Carefully cut and remove the following cable ties (*Figure 12-16*):
 - a. Remove the cable tie securing the fan cable to the thermistor cable.
 - b. Remove the cable tie securing the thermistor cable to the tie mount on the enclosure.
 - c. Remove the two cable ties securing the heater cable to the thermostat cable.

Figure 12-16. Cable Ties to be Removed from Rear Enclosure



TEM_10152_A

- 1 Cable Tie and Tie Mount (Thermistor Cable)
- 2 Cable Tie (Fan Cable to Thermistor Cable)
- 3 Cable Ties (Heater Cable to Thermostat Cable)

6. Turn the rear enclosure over.

7. Remove the four screws securing the fan assembly to the rear enclosure (*Figure 12-17*). Set the screws aside for installation in the new enclosure.

Figure 12-17. Fan Assembly Screws



TEM_10256_A

8. Supporting the fan assembly, turn the rear enclosure over.



Caution:
Be careful when moving the hose duct adapter. The connected thermistor wire can break if too much stress is applied to it.

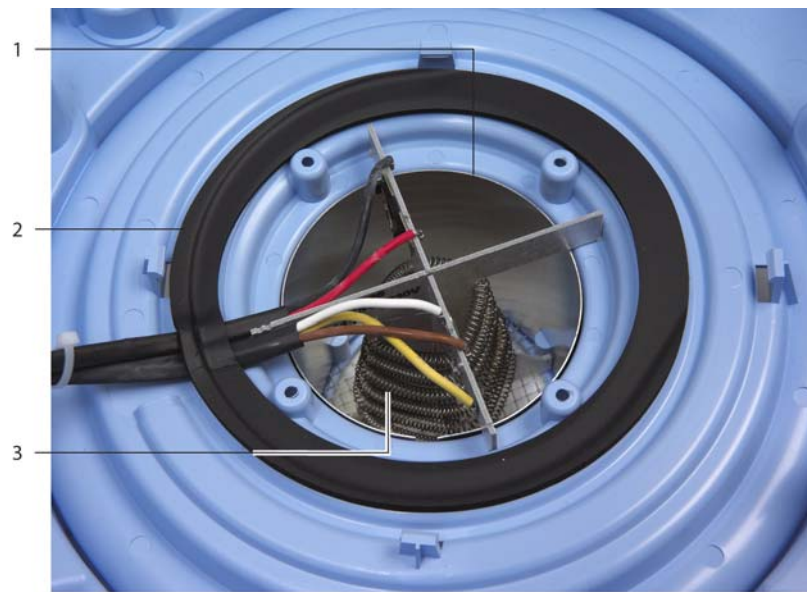
9. Disengage the hose duct adapter from the fan assembly.
10. Lift the hose and hose duct adapter out of the unit, taking care not to dislodge the thermistor and thermostat connections. Set the hose, duct adapter, and connected cables aside for installation in the new enclosure.
11. Lift the fan assembly out of the unit and set it aside for installation in the new enclosure.



Caution:
Do not touch the heater coil. Body oil can damage the coil and affect heater operation.

12. Remove the heater assembly as follows (*Figure 12-18*):
 - a. Peel the circular gasket off the enclosure. Discard the gasket.
 - b. Lift the heater assembly out of the metal heater cone.
 - c. Set the heater assembly aside for installation in the new rear enclosure.

Figure 12-18. Heater Assembly and Gasket



TEM_10202_A

- | | | | |
|---|-------------|---|-----------------|
| 1 | Heater Cone | 3 | Heater Assembly |
| 2 | Gasket | | |

13. Remove the three pole clamps and their mounting bolts as follows (*Figure 12-19*):
 - a. Turn the enclosure over.
 - b. Completely loosen each clamp knob. Remove the knobs and clamp feet from the mounting bolts.
 - c. Use a rubber mallet or similar tool to drive the mounting bolts toward the inside of the enclosure until you can grasp the bolts and remove them.

- d. Set the clamp knobs, feet, and bolts aside for installation in the new enclosure.

Figure 12-19. Pole Clamps and Mounting Bolts



- | | | | |
|---|-----------------|---|--------------------|
| 1 | Clamp Knob (x3) | 3 | Mounting Bolt (x3) |
| 2 | Clamp Foot (x3) | | |

14. Remove and save the serial number label for attachment to the new rear enclosure as follows ([Figure 12-20](#)):
 - a. Using a handheld blow-dryer, warm the label slightly to avoid damage during removal.
 - b. Carefully peel away the label.
 - c. Place the label on a non-stick surface in a location where it will not get damaged.

Figure 12-20. Serial Number Label

TEM_10156_A

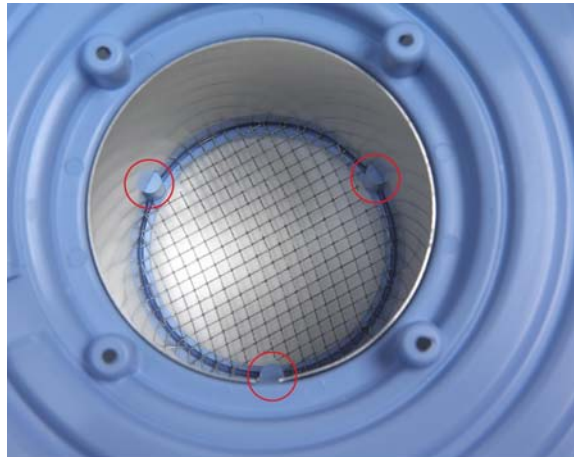
15. Discard the old rear enclosure.
16. Position the new rear enclosure with the inside facing up.
17. Attach the cable tie mount for the thermistor cable as follows (*Figure 12-21*):
 - a. Remove the backing from the mount to expose the adhesive.
 - b. Position the mount approximately 0.8 cm (1/3 inch) below the handle opening and no more that 3.8 cm (1 and 1/2 inches) from the right edge of the opening.
 - c. Press to adhere the mount to the enclosure.

Figure 12-21. Cable Tie Mount for Thermistor Cable

TEM_10157_A

18. Install the three pole clamp mounting bolts in the rear enclosure by placing each bolt into its mounting hole and pressing downward until fully seated. (See [Figure 12-12](#) on page 12-16 for location.)
19. Install the pole clamps on the mounting bolts as follows ([Figure 12-19](#) on page 12-24):
 - a. Turn the enclosure over.
 - b. Slide a clamp foot onto each bolt, making sure that the rubber pad is toward the unit.
 - c. Place a knob on each bolt and tighten it until the clamp foot is secure. Do not overtighten.
20. Turn the enclosure over and remove the tape and packing material from the heater cone. Make sure that the heater cone and screen are positioned as shown in [Figure 12-22](#):
 - The notches at the bottom of the cone should fit over the three mounting screw bosses. The top edge of the cone should be even with the enclosure inside surface.
 - The screen should lie flat at the bottom of the cone, with the cutouts in the screen aligned with the mounting screw bosses.

Figure 12-22. Position of Heater Cone and Screen



TEM_10257_A



Caution:
Do not touch the heater coil. Body oil can damage the coil and affect heater operation.

21. Position the heater assembly in the heater cone, with the wires routed through the notch in the enclosure. Make sure that the two wrapped sets of wires lie on opposite sides of the heater's metal support rib (*Figure 12-23*).

Figure 12-23. Routing of Heater Wires



TEM_10203_A

- 1 Heater Support Rib 2 Notch for Heater Wires

22. Attach the new circular gasket as follows (*Figure 12-18* on page 12-23):
 - a. Remove the backing from the gasket to expose the adhesive.
 - b. Center the gasket around the heater assembly, just outside the four screw bosses in the enclosure.
 - c. Making sure that the heater wires are lying flat in the notch, press the gasket down on both sides of the wires.
 - d. Continue pressing around the rest of the gasket to adhere it to the enclosure.



Caution:
Be careful when moving the hose duct adapter. The connected thermistor wire can break if too much stress is applied to it.

23. Position the hose duct adapter and hose at the hose opening in the enclosure, making sure that the thermostat is facing toward the side of the enclosure with the hose hook (*Figure 12-24*).

Figure 12-24. Position of Hose Duct Adapter



TEM_10258_A

24. Position the fan assembly in the enclosure as shown in *Figure 12-12* on page 12-16.
25. Insert the top edge of the hose duct adapter into the duct and rotate the adapter downward until it drops into place (*Figure 12-25*).

Figure 12-25. Inserting the Hose Duct Adapter



TEM_10176_A

26. Using a strap or cable tie, secure the hose duct adapter to the enclosure as shown in [Figure 12-26](#).

Figure 12-26. Securing the Hose Duct Adapter



TEM_10160_A

27. Secure the fan assembly to the rear enclosure as follows:
 - a. Supporting the fan assembly with your hand, turn the enclosure over.
 - b. Align the fan screw holes in the enclosure with the fan assembly ([Figure 12-17](#) on page 12-22).
 - c. Install the four fan screws and tighten them to 1.1 to 1.5 N-m (9.7 to 13.3 lb-in).
28. Install the filter and filter enclosure as follows:
 - a. Place the filter onto the unit.
 - b. Place the filter enclosure on the unit, aligning the power cord with the socket opening and making sure that the enclosure is fully seated on the unit.
 - c. Reinstall the three screws in the filter enclosure ([Figure 12-14](#) on page 12-19). Tighten the screws to 1.2 to 1.6 N-m (10.6 to 14.2 lb-in).
29. Turn the enclosure over.
30. Attach the USB cable to the enclosure as follows:
 - a. Set the front enclosure next to the rear enclosure for reconnection.
 - b. Position the USB cable connector in the port inside the rear enclosure, with the connector paddle toward the bottom of the enclosure ([Figure 12-27](#)).

Figure 12-27. USB Connector in Rear Enclosure



TEM_10198_A

- c. Supporting the USB connector, rotate the rear enclosure so that you can access the outside. Secure the connector by installing the two screws from the outside of the enclosure. Tighten the screws to 0.18 to 0.27 N-m (1.6 to 2.4 lb-in).
31. Remove the strap or cable tie from the hose duct adapter.
32. Reconnect the cables to the Power PCBA as follows (*Figure 12-15* on page 12-20):
 - a. Connect the heater cable to the 5-pin P114 connector. Make sure that the connector is oriented as shown in *Figure 12-15*, and that it is fully seated.
 - b. Connect the thermostat cable to the 2-pin P113 connector. Make sure that the connector is oriented as shown in *Figure 12-15*, and that it is fully seated.
 - c. Connect the fan cable to the 4-pin P111 connector. Make sure the connector latch engages.
 - d. Connect the thermistor cable to the 2-pin P108 connector. Make sure the connector latch engages.
33. Position the thermistor cable against the tie mount on the enclosure as shown in *Figure 12-28*. Secure the cable with a cable tie and trim the end of the cable tie.

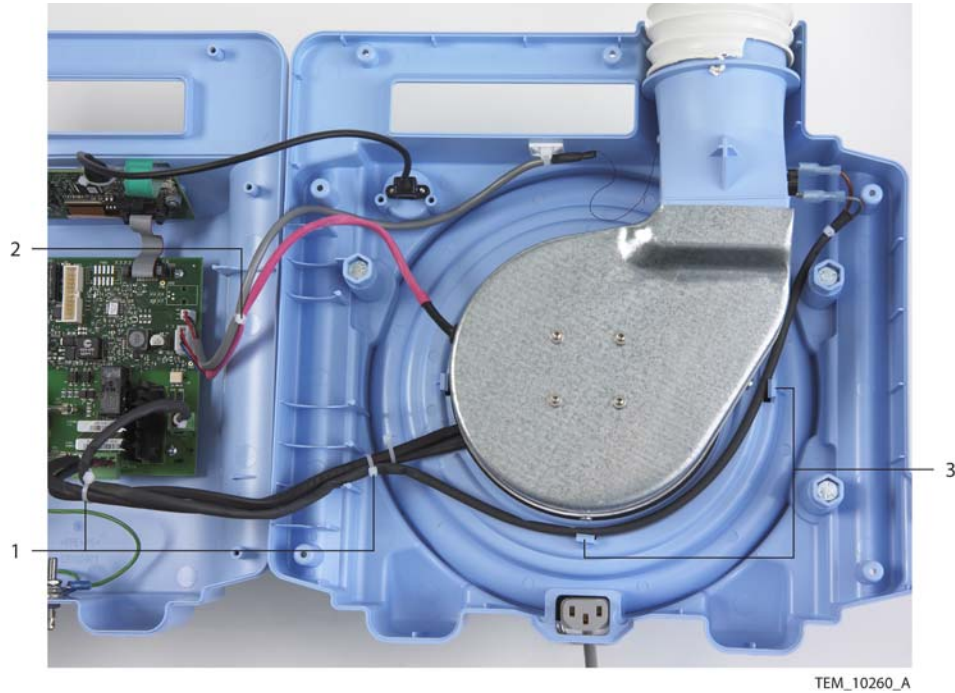
Figure 12-28. Thermistor Cable Secured



TEM_10259_A

34. Place a cable tie around the fan cable and thermistor cable approximately 10 cm (4 inches) from the Power PCBA connectors (*Figure 12-29*). Trim the end of the cable tie.

Figure 12-29. Cable Ties and Routing of Cables



- | | | | |
|---|--|---|----------------------------------|
| 1 | Cable Ties
(Thermostat Cable to Heater Cable) | 3 | Thermostat Cable
Routing Tabs |
| 2 | Cable Tie
(Fan Cable to Thermistor Cable) | | |

35. Make sure that thermostat cable is routed as shown in *Figure 12-29*. It must be positioned to the inside of the adjacent screw boss and pole clamp mounting bolt and inside the tabs around the fan assembly.
36. Using two cable ties, secure the thermostat cable to the heater cable as follows (*Figure 12-29*):
 - a. Place one cable tie around the cables approximately 5 cm (2 inches) from where the heater cable exits below the fan assembly.
 - b. Place the other cable tie around the cables approximately 10 cm (4 inches) from the heater cable connector (P114) on the Power PCBA.
 - c. Trim the ends of the cable ties.

37. Follow the procedure [Rejoining the Front and Rear Enclosures](#) on page 9-5.
38. Attach the saved serial number label to the rear enclosure as follows:
 - a. Position the label as shown in [Figure 12-30](#).
 - b. Press from one edge to the opposite edge to adhere, taking care to eliminate air from under the label.

Figure 12-30. Serial Number Label



39. Place the cover for the USB port in position on the back of the unit and install the screw. Tighten the screw to 1.1 to 1.5 N-m (9.7 to 13.3 lb-in).
40. Perform the following tests:
 - a. [Power-On Test](#) on page 7-3.
 - b. [Temperature Accuracy Test](#) on page 7-8.
 - c. [Flow Test](#) on page 7-10.
 - d. [Thermostat Test](#) on page 7-11.
 - e. [Electrical Safety Tests](#) on page 7-14.

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13 Product Specifications

13.1 Overview

This chapter provides physical and operational specifications for the Covidien WarmTouch™ Convective Warming Unit.

13.2 Physical Characteristics

13.2.1 Warming Unit

Weight with Power Cord	5.2 kg (11.5 pounds)
Dimensions - hose fully collapsed, nozzle in storage position on unit	60 cm x 43 cm x 30 cm (24 inches x 17 inches x 12 inches)
Power Cord Length	4.3 m (14 feet)

13.2.2 Transport Cart (Optional)

Weight	3.1 kg (6.8 pounds)
Height	67.1 cm (26.4 inches)
Width	32.3 cm (12.7 inches)
Depth	38.6 cm (15.2 inches)

13.3 Electrical Requirements

Power Requirements	100 to 240 V AC Max. current at 100 V = 8 A Max. current at 240 V = 5 A
Input Frequency	50/60 Hz \pm 1 Hz
Fuse (x2)	Littlefuse (mfr.) 0218010; 250 V, 10 A

13.4 Environmental Specifications

13.4.1 Operating

Temperature	18°C to 28°C (64.4°F to 82.4°F)
Relative Humidity	15% to 85% (non-condensing)

13.4.2 Shipping and Storage

Temperature	-40°C to 70°C (-40°F to 158°F)
Relative Humidity	10% to 95% (non-condensing)
Atmospheric Pressure	12 kPa to 106 kPa (90 mmHg to 795 mmHg)



Note:

Before operating the warming unit after it has been shipped or stored, allow the unit to acclimate to the operating environment for at least 60 minutes.

13.5 Performance Specifications

Maximum Contact Surface Temperature	44.1°C (111.4°F)
Average Time for Contact Surface Temperature to Rise from 23°C ±2°C to 37°C	6 minutes
Average Time for Temperature of Air Exiting the Hose to Rise from 23°C ±2°C to 37°C	< 1 minute
Accuracy of Displayed Temperature	±1.0°C (air entering hose)
Automatic Temperature Stepdown (Boost to High Temperature)	After 45 minutes of continuous use, blower will step down from the Boost to High setting.
Thermal Protection Threshold	Thermostat (internal): 49°C to 55°C (120°F to 131°F)
Average Alarm Level	56 dB @ 1 meter

13.6 Product Compliance

Equipment Classification	IEC 60601-1:2005, EN 60601-1:2006 ANSI/AAMI ES60601-1:2005 CAN/CSA C22.2 No 60601-1:08 IEC 80601-2-35:2009 EN 80601-2-35:2010
Protection Type	Class I
Degree of Protection	Type BF - Applied part
Mode of Operation	Continuous
Electromagnetic Compatibility	IEC/EN 60601-1-2:2007, Class A Emissions, Non Life-Support Equipment. IEC/EN 80601-2-35; Hazard Free to 10 V/m.
Protection Against Ingress of Fluids	Ordinary

13.7 Electromagnetic Compatibility (EMC)

13.7.1 Manufacturer's Declaration

The warming system is suitable for prescription use only in the specified electromagnetic environments. Use the warming system in accordance with the electromagnetic environments described in the following sections.

13.7.2 Electromagnetic Emissions

Table 13-1. Electromagnetic Emissions Guidelines

Guidance and Manufacturer's Declaration—Electromagnetic Emissions (IEC/EN 60601-1-2:2007, Table 1)		
The warming system is intended for use in the electromagnetic environment specified below. The customer or the user of the warming system should assure that it is used in such an environment.		
Emissions Test	Compliance	Electromagnetic Environment Guidance
RF emission CISPR 11	Group 1, Class A	This is a class A product per IEC CISPR 11 and is not intended to be used in a residential environment. If used in a domestic environment, this equipment may not offer adequate protection to radio-frequency communication services. The user may be required to take mitigation measures, such as relocating or re-orienting the equipment.
Harmonic emissions IEC/EN 61000-3-2	Class A	The warming system is suitable for use in all establishments other than domestic and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Voltage fluctuation/ flicker emissions IEC/EN 61000-3-3	Complies	



Caution:


The warming system is not intended for use in residential environments and may not provide adequate protection to radio communication services in such environments.

13.7.3 Electromagnetic Immunity

Table 13-2. Electromagnetic Immunity Guidelines

Guidance and Manufacturer's Declaration—Electromagnetic Immunity (IEC/EN 60601-1-2:2007, Table 2)			
The warming system is intended for use in the electromagnetic environment specified below. The customer or the user of the warming system should assure that it is used in such an environment.			
Immunity Test	IEC/EN 60601-1-2 Test Level	Compliance Level	Electromagnetic Environment Guidance
Electrostatic discharge (ESD) IEC/EN 61000-4-2	±6 kV contact ±8 kV air	±6 kV contact ±8 kV air	Floors should be wood, concrete, or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%.
Electric fast transient/burst IEC/EN 61000-4-4	± 2 kV for power supply lines ± 1 kV for input/output lines	± 2 kV for power supply lines ± 1 kV for input/output lines	Mains power quality should be that of a typical commercial and/or hospital environment.
Surge IEC/EN 61000-4-5	± 1 kV line(s) to line(s) ± 2 kV line(s) to earth	± 1 kV line(s) to line(s) ± 2 kV line(s) to earth	Mains power quality should be that of a typical commercial and/or hospital environment.
Voltage dips, short interruptions and voltage variations on power supply IEC/EN 61000-4-11	<5% UT (>95% dip in UT) for 0.5 cycle	<5% UT (>95% dip in UT) for 0.5 cycle	Mains power quality should be that of a typical commercial and/or hospital environment. If the user of the warming system requires continued operation during power mains interruption, it is recommended that the warming system be powered from an uninterruptible power supply or battery.
	40% UT (60% dip in UT) for 5 cycles	40% UT (60% dip in UT) for 5 cycles	
	70% UT (30% dip in UT) for 25 cycles	70% UT (30% dip in UT) for 25 cycles	
	<5% UT (>95% dip in UT) for 5 seconds	<5% UT (>95% dip in UT) for 5 seconds	
Power frequency (50/60 Hz) magnetic field IEC/EN 61000-4-8	3 A/m	3 A/m	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.
Note: UT is the AC main's voltage prior to application of the test level.			

Table 13-3. Recommended Separation Distance Calculations

Guidance and Manufacturer's Declaration—Electromagnetic Immunity (IEC/EN 60601-1-2:2007, Table 4)			
The warming system is intended for use in the electromagnetic environment specified below. The customer or the user of the warming system should assure that it is used in such an environment.			
Immunity Test	IEC/EN 60601-1-2 Test Level	Compliance Level	Electromagnetic Environment Guidance
Conducted RF IEC/EN 61000-4-6 Radiated RF IEC/EN 61000-4-3	3 Vrms 150 kHz 80 MHz 3 V/m 80 MHz 800 MHz 3 V/m 800 MHz 2.5 GHz	3 Vrms 150 kHz 80 MHz 3 V/m 80 MHz 800 MHz 3 V/m 800 MHz 2.5 GHz	Portable and mobile RF communications equipment should be used no closer to any part of the warming unit, including cables, than the recommended separation distance calculated from the equation appropriate for the frequency of the transmitter.
			Recommended Separation Distances $d = 1.2\sqrt{P}$ 150 kHz to 80 MHz $d = 1.2\sqrt{P}$ 80 MHz to 800 MHz $d = 2.3\sqrt{P}$ 800 MHz to 2.5 GHz
			where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation distance in metres (m). Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey, ^a should be less than the compliance level in each frequency range. ^b Interference may occur in the vicinity of equipment marked with the following symbol:
			

Note 1: At 80 MHz and 800 MHz, the higher frequency range applies.
 Note 2: These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

^a Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the warming system is used exceeds the applicable RF compliance level above, the warming system should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as re-orienting or relocating the warming system.

^b Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 V/m.

Table 13-4. Recommended Separation Distances

Recommended Separation Distances Between Portable and Mobile RF Communications Equipment and the Warming System (IEC/EN 60601-1-2:2007, Table 6)			
The warming system is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the warming system can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the warming system as recommended below, according to the maximum output power of the communications equipment.			
Rated Maximum Output Power (<i>P</i>) of Transmitter in Watts	Separation Distance in Meters		
	150 kHz to 80 MHz $d = 1.2\sqrt{P}$	80 MHz to 800 MHz $d = 1.2\sqrt{P}$	800 MHz to 2.5 GHz $d = 2.3\sqrt{P}$
0.01	0.12	0.12	0.23
0.10	0.38	0.38	0.73
1.00	1.20	1.20	2.30
10.00	3.80	3.80	7.30
100.00	12.00	12.00	23.00
For transmitters rated at a maximum output power not listed above, estimate the separation distance (<i>d</i>) using the equation in the corresponding column, where <i>P</i> is the maximum output [power rating of the transmitter in watts (W)] according to the transmitter manufacturer.			
Note 1: At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies. Note 2: These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.			

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14 Packing for Shipment

14.1 Overview

This chapter provides instructions for packing and shipping the Covidien WarmTouch™ Convective Warming Unit.

14.2 Returning the Warming Unit to Covidien

If you are returning the warming unit to Covidien, first contact Covidien Technical Services or your local Covidien representative for shipping instructions and a Returned Goods Authorization (RGA) number. Be sure to mark the shipping carton and any shipping documents with the RGA number.

If possible, ship the warming unit in its original shipping carton. If the original carton is not available, use a suitable carton with appropriate packing material to protect the warming unit during shipping.

Reference [Obtaining Technical Assistance](#) on page 1-14 for contact information for Covidien Technical Services.

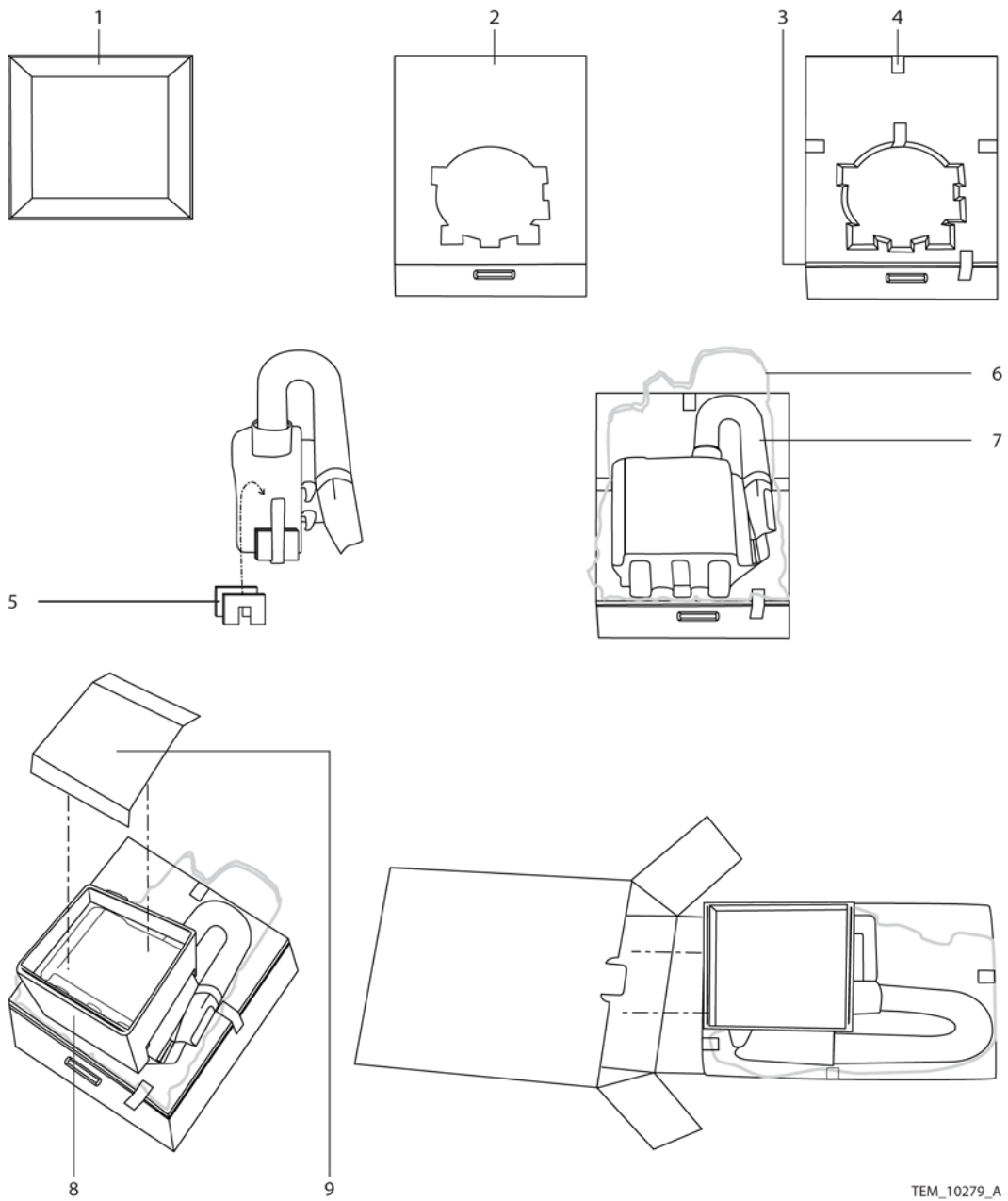
14.3 Packing in the Original Carton

If packing the warming unit in its original shipping carton, use the following procedure and reference [Figure 14-1](#) on page 14-3.

To pack the warming unit in its original carton:

1. Place the lower insert on the work surface.
2. Place the die-cut tray over the lower insert with the flat side up. Make sure that the lower insert is centered under the die-cut opening of the tray.
3. Place the die-cut pad on top of the tray, aligning the cutouts.
4. Place tape on all four sides and in the center of the curved part of the cutout.
5. Place the two corrugated nozzle support pieces into the notch at the bottom of the nozzle hook. Place the nozzle on the hook.
6. Place the warming unit into a poly bag.
7. Place the unit, front side up, into the tray.
8. Place the upper insert over the front of the unit.
9. Place the scope pad into the upper insert. Align the folded flaps of the scope pad with the edges of the upper insert. Place any items to be shipped with the warming unit (such as the power cord and shipping documents) into the scope pad.
10. Place the shipping carton on the work surface with the opening toward the tray.
11. Slide the tray into the carton.
12. Set the carton upright and close the carton lid. Seal the carton with packing tape.
13. Label the carton with the shipping address, return address, and RGA number.

Figure 14-1. Packing in the Original Carton



TEM_10279_A

- | | | |
|----------------|-----------------------|----------------|
| 1 Lower Insert | 4 Tape | 7 Warming Unit |
| 2 Die-Cut Tray | 5 Nozzle Support (x2) | 8 Upper Insert |
| 3 Die-Cut Pad | 6 Poly Bag | 9 Scope Pad |

14.4 Packing in a Different Carton

If the original carton is not available, use the following procedure to pack the warming unit.

To pack the warming unit in a different carton:

1. Locate a corrugated cardboard shipping carton with a bursting strength of at least 200 pounds per square inch (psi).
2. Fill the bottom of the carton with at least 2 inches of packing material.
3. Place the warming unit on the layer of packing material and fill the box completely with packing material.
4. Seal the carton with packing tape.
5. Label the carton with the shipping address, return address, and RGA number.

A Parts and Accessories

A.1 Overview

This appendix describes the parts and accessories available for the Covidien WarmTouch™ Convective Warming Unit. Most spare parts are available as kits containing all components necessary for replacement.

To order parts and accessories, contact Covidien Technical Services or your local Covidien representative. Reference [Obtaining Technical Assistance](#) on page 1-14.

<i>External Components</i>	<i>Page A-2</i>
<i>Internal Components (Inside Front Enclosure)</i>	<i>Page A-3</i>
<i>Internal Components (Inside Rear Enclosure)</i>	<i>Page A-5</i>
<i>Enclosures</i>	<i>Page A-6</i>
<i>Miscellaneous Components</i>	<i>Page A-7</i>
<i>Parts Locator</i>	<i>Page A-8</i>

A.2 External Components

Table A-1. Parts List – External Components

Kit or Part	Part Number	Figure	Procedure
WT-CWU Pole Clamp Kit 3 - Pole Clamp Assy, with Bumper 3 - Knob, IV Pole Clamp 3 - Hex Bolt 1/4-20 x 3.25, ST Zinc	10088298	<i>Figure A-2</i>	<i>Page 8-2</i> (Clamps and Knobs only)
WT-CWU USB Port Cover Kit 1 - Screw #6 x 7/16", Plastite, PH HD, SS 1 - Cover, Test Port 1 - USB Label (attached to cover)	10088306	<i>Figure A-2</i>	<i>Page 8-4</i>
Power Cord, Australia/New Zealand, 14 ft	GR102844	<i>Figure A-3</i>	<i>Page 8-5</i>
Power Cord, Brazil, 14 ft	GR102843	<i>Figure A-3</i>	<i>Page 8-5</i>
Power Cord, European Union, 14 ft	GR102842	<i>Figure A-3</i>	<i>Page 8-5</i>
Power Cord, North American, 14 ft	GR102810	<i>Figure A-3</i>	<i>Page 8-5</i>
Power Cord, UK, 14 ft	GR102841	<i>Figure A-3</i>	<i>Page 8-5</i>
WT-CWU Nozzle Kit 1 - Assembly, Nozzle 1 - No Free Hosing Label (attached to nozzle)	10088307	<i>Figure A-1</i>	<i>Page 8-8</i>
WT Nozzle Strap/Clip Kit 1 - Strap, Nozzle, with Clip	10092813	<i>Figure A-1</i>	<i>Page 8-10</i>
WT No Free-Hosing Label Kit 6 - No Free Hosing Label	10088308	<i>Figure A-1</i> <i>Figure A-2</i>	<i>Page 8-11</i>

A.3 Internal Components (Inside Front Enclosure)

Table A-2. Parts List – Internal Components (Inside Front Enclosure)

Kit or Part	Part Number	Figure	Procedure
WT-CWU Keypad Kit 1 - Keypad, WarmTouch	10088294	Figure A-1 Figure A-5	Page 10-3
WT-CWU Display Kit 1 - TFT Display, 2.5", QVGA, 320x240, 350 NITS, 80/80/80/80 View Ang 1 - Foam, Non-conductive, 1 Side PSA (attached to back of display) 2 - Washer, Shoulder, Nylon 2 - Nut, 8-32, Machine Screw, Hex 2 - Washer, Lock, #8, Ext. Tooth 2 - Washer, #8, Flat, Nylon	10088292	Figure A-5	Page 10-8
WT-CWU UI PCBA Kit 1 - PCB Assembly, UI, WarmTouch 1 - Backing Plate, USB Connector 2 - Washer, Shoulder, Nylon 2 - Nut, 8-32, Machine Screw, Hex 2 - Washer, Lock, #8, Ext. Tooth 2 - Washer, #8, Flat, Nylon	10088293	Figure A-5	Page 10-12
WT-CWU Ribbon Cable Kit 1 - Cable Assembly, Ribbon, 20 Pos, .050" Pitch	GR103059	Figure A-5	Page 10-19
WT-CWU USB Micro AB Cable Kit 1 - Cable Assembly, USB Micro AB 2 - Machine Screw #4-40 x 3/8" PH PAN HD LG	GR103063	Figure A-5 Figure A-6	Page 10-22
WT-CWU Power PCBA Kit 1 - PCB Assembly, Power, WarmTouch 4 - Screw #6 x 7/16", Plastite, PH HD, SS	10088295	Figure A-6	Page 10-31
WT-CWU Fuse Kit 5 - Fuse, Glass, 10A, 250V, 5 x 20mm	10092815	Figure A-5	Page 10-35
WT-CWU Speaker Kit 1 - Speaker, 8 Ohm, 2.5" Sq x 1.16" H, 10 dB Max 4 - Screw #6 x 7/16", Plastite, PH HD, SS	10088296	Figure A-5	Page 10-37

Table A-2. Parts List – Internal Components (Inside Front Enclosure) (Continued)

Kit or Part	Part Number	Figure	Procedure
WT-CWU Speaker Cable Kit 1 - Wire Assembly, Speaker	GR103061	<i>Figure A-5</i>	<i>Page 10-40</i>
WT-CWU Pwr Supply Kit 1 - AC/DC Converter, 90-264VAC, 65W, 48VDC Output 4 - Screw #4 x .38 Lg, Plastite, PH PAN HD	10088291	<i>Figure A-5</i>	<i>Page 10-43</i>
WT-CWU P/S Output Cable Kit 1 - Wire Assembly, Output AC/DC Converter	GR103060	<i>Figure A-5</i>	<i>Page 10-46</i>
WT-CWU Ground Cable Kit 1 - Wire Assembly, Ground	GR103064	<i>Figure A-5</i>	<i>Page 10-48</i>
WT-CWU AC Inlet Kit 1 - Wire assembly, AC inlet 2 - Screw #4 x.5 LG, Plastite,PH PAN HD	10088288	<i>Figure A-5</i>	<i>Page 10-51</i>
WT-CWU Equipotential Stud Kit 1 - Washer, Color Code 2 - Washer, Lock External, M6 2 - Hex Nut, M6 Thin, Stainless Steel 1 - Pin, Equipotential	10088290	<i>Figure A-3</i> <i>Figure A-5</i>	<i>Page 10-55</i>

A.4 Internal Components (Inside Rear Enclosure)

Table A-3. Parts List – Internal Components (Inside Rear Enclosure)

Kit or Part	Part Number	Figure	Procedure
WT-CWU Thermistor Sens Assy Kit 1 - Spec, Cable, Thermistor Duct Assy, WarmTouch 1 - Pop Rivet, Plastic, 0.126-0.138 1 - Cable Tie, Adhesive	10088304	<i>Figure A-6</i>	<i>Page 11-3</i>
WT-CWU Thermostat Kit 1 - Thermostat, Open 52 +/- 3C, Close 43 +/- 5C 2 - Rivet, Plastic	10088301	<i>Figure A-6</i>	<i>Page 11-9</i>
WT-CWU Thermostat Cable Kit 1 - Wire Assembly, Thermostat	GR103062	<i>Figure A-6</i>	<i>Page 11-14</i>
WT-CWU Pole Clamp Kit 3 - Pole Clamp Assy, with Bumper 3 - Knob, IV Pole Clamp 3 - Hex Bolt 1/4-20 x 3.25, ST Zinc	10088298	<i>Figure A-6</i>	<i>Page 11-18</i> (Clamps, Knobs, and Mounting Bolts)
WT-CWU Hose Kit 1 - Clip, Nozzle/Hose (attached to hose) 1 - Hose, White, 5'	10088303	<i>Figure A-1</i> <i>Figure A-6</i>	<i>Page 11-21</i>
WT-CWU Hose Duct Adapter Kit 1 - Pop Rivet, Plastic, 0.126-0.138 1 - Screen, Adapter Duct, Circular (attached to hose duct adapter) 2 - Rivet, Plastic 1 - Hose Duct, WarmTouch, Modified	10088302	<i>Figure A-6</i>	<i>Page 11-25</i>
WT-CWU Fan Assembly Kit 1 - Fan Assembly, WarmTouch 4 - Screw, #6 x .38" Long, Sht Metal T-A, ST Zinc	10088300	<i>Figure A-6</i>	<i>Page 11-33</i>
WT-CWU Heater Assembly Kit 1 - Gasket, with Adhesive, WarmTouch 1 - Wire Assy, Heater with Connector 4 - Screw, #6 x .38" Long, Sht Metal T-A, ST Zinc	10088299	<i>Figure A-6</i>	<i>Page 11-43</i>

A.5 Enclosures

Table A-4. Parts List – Enclosures

Kit or Part	Part Number	Figure	Procedure
WT-CWU Front Enclosure Kit 1 - Front Enclosure 1 - Keypad, WarmTouch (attached to enclosure) 1 - No Free Hosing Label (attached to enclosure) 1 - Equipotential Ground Label (attached to enclosure) 7 - Screw #6 x 7/16", Plastite, PH HD,SS	10088280	<i>Figure A-1</i>	<i>Page 12-2</i>
WT-CWU Filter Enclosure Kit 1 - Enclosure Air Filter, WarmTouch 1 - Gasket, with Adhesive, WarmTouch (attached to enclosure) 3 - Screw, #8 x .50, Plastite, PH HD 4 - Screw 8-32 x .38, Truss HD, ST Zinc 1 - Foot, Filter Cover (Short) (attached to enclosure) 1 - Bed Hook (attached to enclosure) 1 - Symbols Label (attached to enclosure)	10088305	<i>Figure A-3</i>	<i>Page 12-12</i>
WT-CWU Rear Enclosure Kit 1 - Enclosure, Rear, WarmTouch 1 - Gasket, with Adhesive, WarmTouch 2 - Machine Screw #4-40 x 3/8" PH PAN HD LG 1 - Cable Tie, Adhesive 1 - Insert, Heater Cone 1 - Screen, Heater 4 - Screw, #6 x .38" Long, Sht Metal T-A, ST Zinc 8 - Screw #6 x 7/16", Plastite, PH HD,SS	10088297	<i>Figure A-6</i>	<i>Page 12-15</i>

A.6 Miscellaneous Components

Table A-5. Parts List – Miscellaneous Components

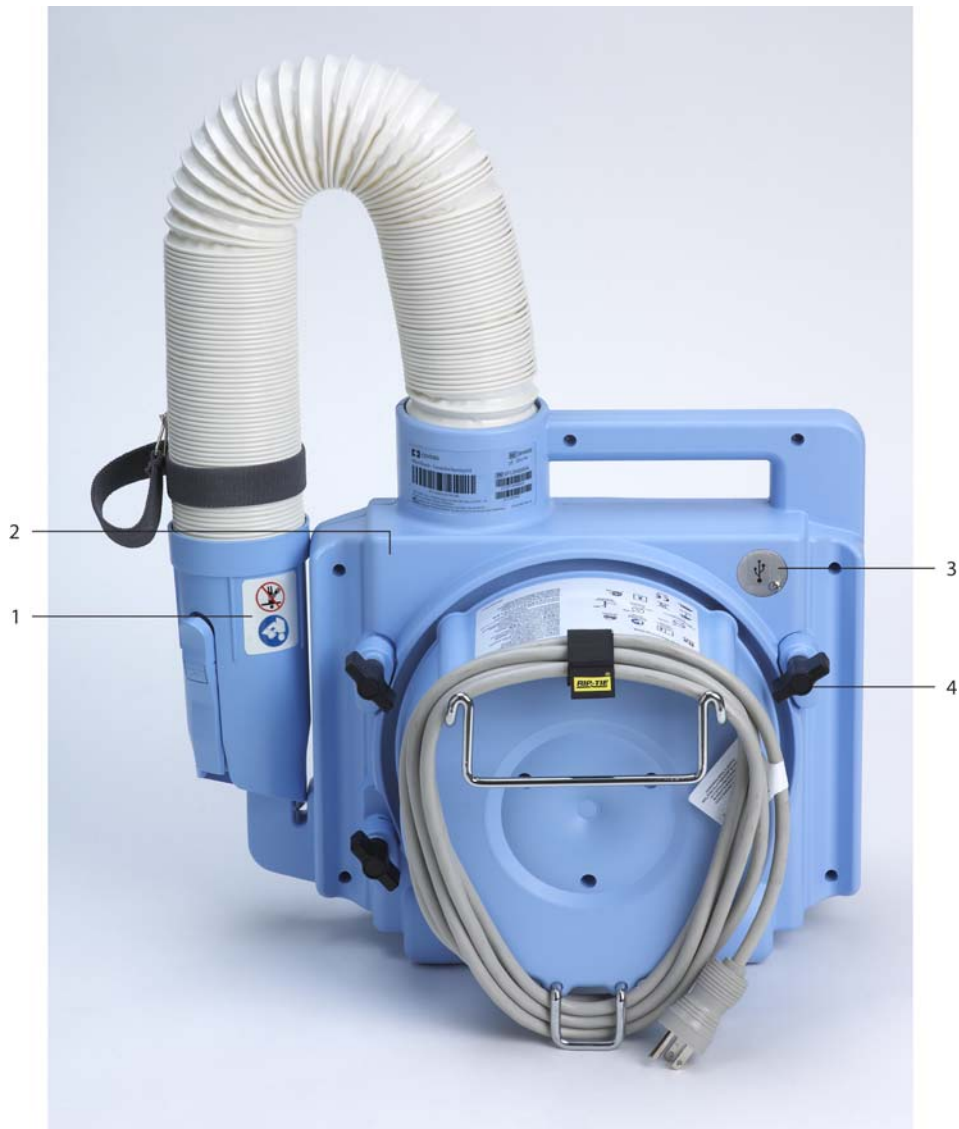
Kit or Part	Part Number	Figure	Procedure
WT-CWU Hardware Kit 25 - Screw #6 x 7/16",Plastite, PH HD,SS 10 - Screw, #8 x .50, Plastite, PH HD 10 - Screw 8-32 x .38,Truss HD,ST Zinc 10 - Screw #4 x .38 Lg, Plastite, PH PAN HD 10 - Machine Screw #4-40 x 3/8" PH PAN HD LG 5 - Pop Rivet, Plastic, 0.126-0.138 5 - Backing Plate, USB Connector 10 - Rivet, Plastic 10 - Washer, Shoulder, Nylon 10 - Nut, 8-32, Machine Screw, Hex 10 - Washer, Lock, #8, Ext. Tooth 10 - Screw #4 x .5 Lg, Plastite, PH PAN HD 10 - Washer, #8,Flat, Nylon 10 - Screw, #6 x .38" Long, Sht Metal T-A,ST Zinc	10088289	N/A	N/A
WT HEPA Filter Kit 1 - Filter, HEPA 1 - Gasket with Adhesive, WarmTouch 3 - Screw, #8 x .50, Plastite, PH HD	10092812	<i>Figure A-4</i>	<i>Page 5-4</i>
Transport Cart	5022900	N/A	<i>Page 3-9</i>
Operator's Manual - Covidien WarmTouch™ Convective Warming System	10077305	N/A	N/A

A.7 Parts Locator

Figure A-1. External Components (Front)



- | | | | |
|---|---------------------------|---|------------------------|
| 1 | Front Enclosure | 4 | Hose |
| 2 | Keypad (Operator's Panel) | 5 | Nozzle Strap with Clip |
| 3 | No Free-Hosing Label | 6 | Nozzle |

Figure A-2. External Components (Back)

TEM_10245_A

1 No Free-Hosing Label

2 Rear Enclosure

3 USB Port Cover

4 Pole Clamp (x3)

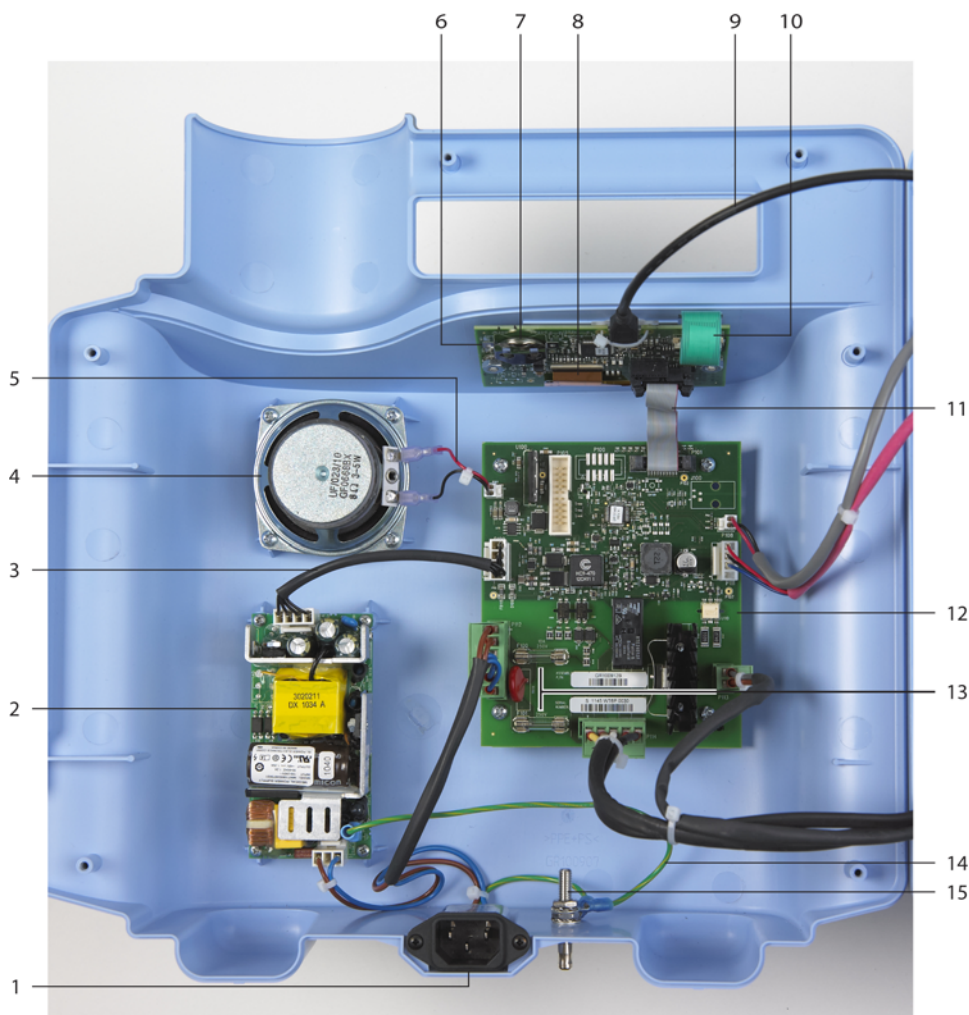
Figure A-3. External Components (Bottom)



- 1 Filter Enclosure
- 2 Power Cord
- 3 Equipotential Stud

Figure A-4. HEPA Filter (Filter Enclosure Removed)

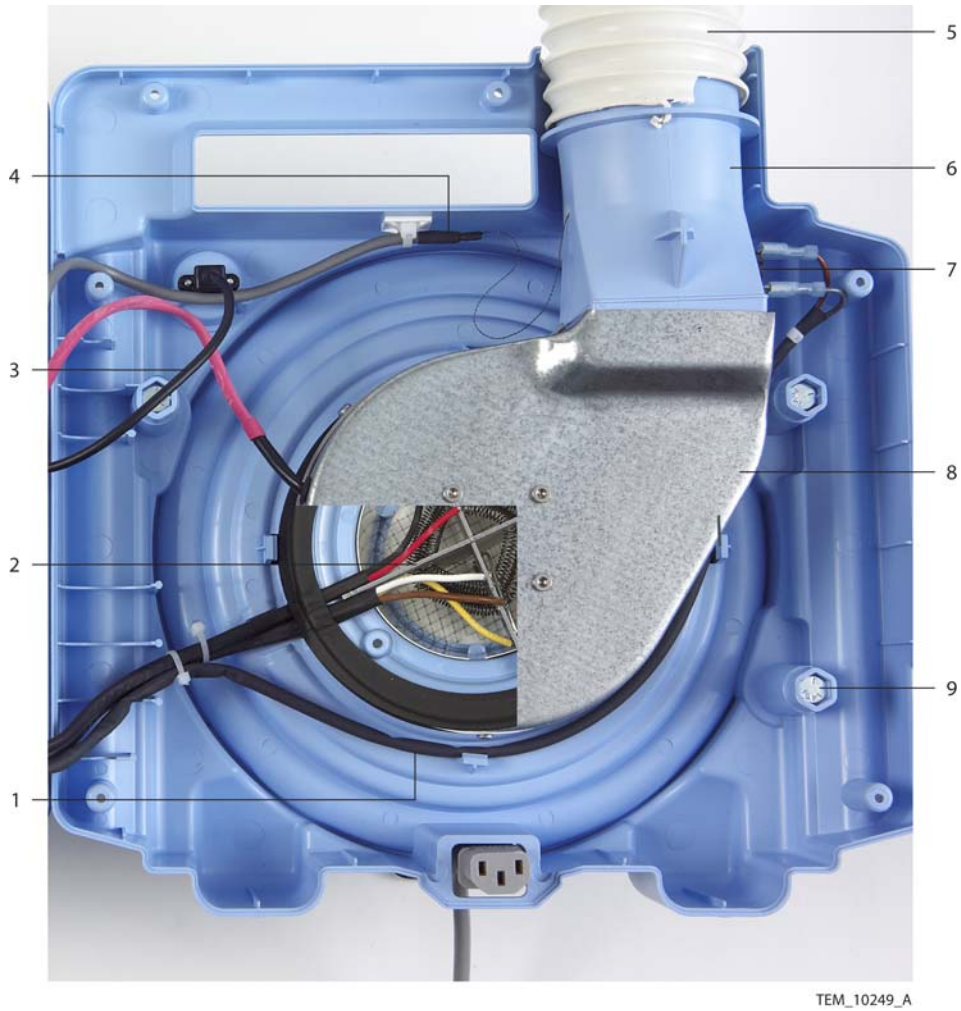


Figure A-5. Internal Components (Inside Front Enclosure)

TEM_10248_A

- | | | | |
|---|---|----|--|
| 1 | AC Power Inlet | 9 | USB Cable |
| 2 | Power Supply | 10 | Keypad Cable
(to Keypad on Front Enclosure) |
| 3 | Power Supply Output Cable | 11 | Ribbon Cable |
| 4 | Speaker | 12 | Power PCBA |
| 5 | Speaker Cable | 13 | Fuses |
| 6 | User Interface (UI) PCBA | 14 | Ground Cable |
| 7 | Clock Battery | 15 | Equipotential Stud |
| 8 | Display Cable
(to Display under UI PCBA) | | |

Figure A-6. Internal Components (Inside Rear Enclosure)



- | | | | |
|---|---|---|-------------------------------|
| 1 | Thermostat Cable | 6 | Hose Duct Adapter |
| 2 | Heater Assembly
(below Fan Assembly) | 7 | Thermostat |
| 3 | USB Cable | 8 | Fan Assembly |
| 4 | Thermistor Sensor Assembly | 9 | Pole Clamp Mounting Bolt (x3) |
| 5 | Hose | | |

B Error Codes

B.1 Overview

This appendix defines the error codes that may be generated during operation of the Covidien WarmTouch™ Convective Warming Unit. You can view the most recent error codes on the System Information screen. See [Serial Number, Software Version, and Error Codes](#) on page 1-9.

Suggested resolutions are provided for each error. If an error situation cannot be resolved, or if you see an error code that is not listed, contact Covidien Technical Services. See [Obtaining Technical Assistance](#) on page 1-14.

B.2 Error Codes and Suggested Resolutions

Error Categories:

- **A/D** — Errors associated with or reported by the A/D microprocessor.
- **POST** — Errors occurring during power-on self-test.
- **UI** — Errors associated with or reported by the UI microprocessor.



Note:

For most errors, the initial corrective action is to power-cycle the warming unit. If the error persists, continue with the recommendations listed for the error.

003	
Category:	A/D
Alarm Priority:	Low
Description:	Checksum error on code in flash. A/D flash is defective.
Resolution:	Try reloading software to the unit. See page 7-7 . If this does not resolve the issue, replace the power PCBA. See page 10-31 .

004	
Category:	A/D
Alarm Priority:	Low
Description:	One of the following conditions occurred: <ul style="list-style-type: none"> • Temperature was more than $\pm 1^{\circ}\text{C}$ from the setpoint for at least 30 consecutive seconds after the setpoint was reached. • Temperature did not reach the specified setpoint within 10 minutes.
Resolution:	Check for: <ul style="list-style-type: none"> • Blockages in the air intake, hose, and filter. <p>This error may also appear due to issues at the customer site:</p> <ul style="list-style-type: none"> • Low mains voltage • Ambient temperature outside of specification.

005	
Category:	A/D
Alarm Priority:	Low
Description:	Temperature > 48°C for at least 30 consecutive seconds.
Resolution:	Replace the power PCBA. See page 10-31 .

006	
Category:	A/D
Alarm Priority:	Medium
Description:	Thermal cut-out switch has opened.
Resolution:	<p>Check for:</p> <ul style="list-style-type: none"> • Thermistor dislodged from hose duct adapter - See page 11-3. <p>If the thermistor is in position, replace the power PCBA. See page 10-31.</p> <p>Note: This error is also generated during the thermostat test as part of performance verification.</p>

011	
Category:	A/D
Alarm Priority:	Medium
Description:	Thermistor temperature too low to measure.
Resolution:	Replace the thermistor. See page 11-3 .

012	
Category:	A/D
Alarm Priority:	Medium
Description:	Thermistor temperature too high to measure.
Resolution:	Replace the thermistor. See page 11-3 .

013	
Category:	A/D
Alarm Priority:	Low
Description:	Fan motor drew too much current.
Resolution:	Check for: <ul style="list-style-type: none">• Blockage in fan - See page 11-33. If there is no blockage, replace the fan. See page 11-33 . If this does not resolve the issue, replace the power PCBA. See page 10-31 .

014	
Category:	A/D
Alarm Priority:	Low
Description:	Fan speed < 3000 rpm.
Resolution:	Check for: <ul style="list-style-type: none">• Blockage in fan - See page 11-33. If there is no blockage, replace the fan. See page 11-33 . If this does not resolve the issue, replace the power PCBA. See page 10-31 .

015	
Category:	A/D
Alarm Priority:	Low
Description:	Fan speed > 5000 rpm.
Resolution:	Replace the power PCBA. See page 10-31 .

016	
Category:	A/D
Alarm Priority:	Low
Description:	Fan speed too low for current fan voltage.
Resolution:	Check for: <ul style="list-style-type: none">• Blockage in fan - See page 11-33. If there is no blockage, replace the fan. See page 11-33 .

017	
Category:	A/D
Alarm Priority:	Low
Description:	Fan speed too high for current fan voltage.
Resolution:	Replace the fan. See page 11-33 .

028	
Category:	A/D
Alarm Priority:	Low
Description:	Flash erase error during software upgrade.
Resolution:	Replace the power PCBA. See page 10-31 .

029	
Category:	A/D
Alarm Priority:	Low
Description:	Flash write error during software upgrade.
Resolution:	Replace the power PCBA. See page 10-31 .

030	
Category:	A/D
Alarm Priority:	Low
Description:	Flash verify error during software upgrade.
Resolution:	Replace the power PCBA. See page 10-31 .

031	
Category:	A/D
Alarm Priority:	Low
Description:	Invalid flash state (software error) during software upgrade.
Resolution:	Replace the power PCBA. See page 10-31 .

032	
Category:	A/D
Alarm Priority:	Low
Description:	Checksum error on downloaded software during software upgrade.
Resolution:	Try reloading the software. See page 7-7 . If this does not resolve the issue, either the A/D or UI microprocessor could be at fault. First, try replacing the power PCBA. See page 10-31 . If the problem persists, try replacing the UI PCBA. See page 10-12 .

033	
Category:	A/D
Alarm Priority:	Low
Description:	Timeout on A/D SW update data message during software upgrade.
Resolution:	Check for: <ul style="list-style-type: none">• Disconnected USB cable. Try reloading the software. See page 7-7 .

038	
Category:	A/D
Alarm Priority:	Low
Description:	Too many consecutive CRC errors in SPI commands.
Resolution:	<p>Replace the ribbon cable. See page 10-19.</p> <p>If this does not resolve the issue, try replacing the power PCBA. See page 10-31.</p> <p>If the problem persists, try replacing the UI PCBA. See page 10-12.</p> <p>This error may also appear due to electromagnetic interference from other devices at the customer site. Advise the customer to try increasing the distance between devices, repositioning the cabling, or plugging the devices into separate outlet circuit branches. See Electromagnetic Compatibility (EMC) on page 13-4 for additional guidance.</p>

045	
Category:	A/D
Alarm Priority:	Medium
Description:	Thermistor open circuit.
Resolution:	Replace the thermistor. See page 11-3 .

046	
Category:	A/D
Alarm Priority:	Medium
Description:	Thermistor shorted.
Resolution:	Replace the thermistor. See page 11-3 .

048	
Category:	A/D
Alarm Priority:	Low
Description:	Fan voltage > 48.1 V (or > 10 V when turned off).
Resolution:	Replace the power PCBA. See page 10-31 .

049	
Category:	A/D
Alarm Priority:	Low
Description:	Fan voltage < 10 V.
Resolution:	Replace the power PCBA. See page 10-31 .

051	
Category:	A/D
Alarm Priority:	Low
Description:	Thermistor values not changing.
Resolution:	Replace the power PCBA. See page 10-31 .

053	
Category:	A/D
Alarm Priority:	Low
Description:	No edges detected on AC_STATUS signal.
Resolution:	N/A - Indicates that the power cord was disconnected while the unit was still powered on.

131	
Category:	POST
Alarm Priority:	Low
Description:	RAM check error during POST.
Resolution:	Replace the UI PCBA. See page 10-12 .

132	
Category:	POST
Alarm Priority:	Low
Description:	Clock frequency error during POST.
Resolution:	Replace the UI PCBA. See page 10-12 .

133	
Category:	POST
Alarm Priority:	Low
Description:	Keypad error during POST. Typically, this occurs when the user presses a key while POST is running.
Resolution:	If this error occurs without a key being pressed during POST, replace the keypad. See page 10-3 .

138	
Category:	POST
Alarm Priority:	Low
Description:	Flash write/read test failed during POST.
Resolution:	Replace the UI PCBA. See page 10-12 .

140	
Category:	POST
Alarm Priority:	Low
Description:	RTC NVRAM write/read test failed during POST.
Resolution:	Replace the UI PCBA. See page 10-12 .

144	
Category:	POST
Alarm Priority:	Low
Description:	UI calculated checkword does not match the stored checkword.
Resolution:	Replace the UI PCBA. See page 10-12 .

145	
Category:	POST
Alarm Priority:	Low
Description:	GPX calculated checkword does not match the stored checkword.
Resolution:	Replace the UI PCBA. See page 10-12 .

152	
Category:	UI
Alarm Priority:	Low
Description:	External watchdog timed out.
Resolution:	Replace the UI PCBA. See page 10-12 .

157	
Category:	UI
Alarm Priority:	Medium
Description:	Thermostat open.
Resolution:	Check for: <ul style="list-style-type: none">• Thermistor dislodged from hose duct adapter - See page 11-3. If the thermistor is in position, replace the power PCBA. See page 10-31 .

158	
Category:	UI
Alarm Priority:	Low
Description:	<p>One of the following conditions occurred:</p> <ul style="list-style-type: none"> • Temperature was more than $\pm 1^{\circ}\text{C}$ from the setpoint for at least 30 consecutive seconds after the setpoint was reached. • Temperature did not reach the specified setpoint within 10 minutes.
Resolution:	<p>Check for:</p> <ul style="list-style-type: none"> • Blockages in the air intake, hose, and filter. <p>This error may also appear due to issues at the customer site:</p> <ul style="list-style-type: none"> • Low mains voltage • Ambient temperature outside of specification.

159	
Category:	UI
Alarm Priority:	Low
Description:	Temperature $> 48^{\circ}\text{C}$ for at least 30 consecutive seconds.
Resolution:	Replace the power PCBA. See page 10-31 .

163	
Category:	UI
Alarm Priority:	Low
Description:	Bad CRC on packet received from AD microprocessor.
Resolution:	<p>Replace the ribbon cable. See page 10-19.</p> <p>If this does not resolve the issue, try replacing the power PCBA. See page 10-31.</p> <p>If the problem persists, try replacing the UI PCBA. See page 10-12.</p> <p>This error may also appear due to electromagnetic interference from other devices at the customer site. Advise the customer to try increasing the distance between devices, repositioning the cabling, or plugging the devices into separate outlet circuit branches. See Electromagnetic Compatibility (EMC) on page 13-4 for additional guidance.</p>

165	
Category:	UI
Alarm Priority:	Low
Description:	No communication from AD microprocessor.
Resolution:	Replace the power PCBA. See page 10-31 .

175	
Category:	UI
Alarm Priority:	Low
Description:	Software upgrade cannot proceed due to checkword check error. Software file may be corrupted.
Resolution:	Obtain new software file(s) and retry the upgrade.

176	
Category:	UI
Alarm Priority:	Low
Description:	Software upgrade cannot proceed due to header check error. Software file may be corrupted or invalid.
Resolution:	Obtain new software file(s) and retry the upgrade.

177	
Category:	UI
Alarm Priority:	Low
Description:	The UI microprocessor received a message from the A/D microprocessor indicating that the heater and fan were shut down. Cause is typically provided in subsequent error messages.
Resolution:	N/A - Refer to subsequent error messages.

178	
Category:	UI
Alarm Priority:	Low
Description:	The UI microprocessor received a message from the A/D microprocessor indicating that the fan was shut down. Cause is typically provided in subsequent error messages.
Resolution:	N/A - Refer to subsequent error messages.

179	
Category:	UI
Alarm Priority:	Low
Description:	The UI microprocessor received a message from the A/D microprocessor indicating that the heater was shut down. Cause is typically provided in subsequent error messages.
Resolution:	N/A - Refer to subsequent error messages.

181	
Category:	UI
Alarm Priority:	Low
Description:	Corrupt data in the RTC section of the RTC chip.
Resolution:	Replace the clock battery. See page 10-29 . If this does not resolve the issue, replace the UI PCBA. See page 10-12 .

182	
Category:	UI
Alarm Priority:	Low
Description:	Unable to communicate with the RTC chip.
Resolution:	Replace the UI PCBA. See page 10-12 .

184	
Category:	UI
Alarm Priority:	Low
Description:	RTC NVRAM contained an illegal setpoint temperature.
Resolution:	Replace the clock battery. See page 10-29 . If this does not resolve the issue, replace the UI PCBA. See page 10-12 .

186	
Category:	UI
Alarm Priority:	Low
Description:	Error communicating with AD microprocessor across SPI bus.
Resolution:	Replace the ribbon cable. See page 10-19 .

202	
Category:	UI
Alarm Priority:	Low
Description:	UI microprocessor is receiving too many interrupts from the AD microprocessor.
Resolution:	This error may appear due to electromagnetic interference from other devices at the customer site. Advise the customer to try increasing the distance between devices, repositioning the cabling, or plugging the devices into separate outlet circuit branches. See Electromagnetic Compatibility (EMC) on page 13-4 for additional guidance.

204	
Category:	UI
Alarm Priority:	Low
Description:	Spurious interrupt from AD microprocessor.
Resolution:	This error may appear due to electromagnetic interference from other devices at the customer site. Advise the customer to try increasing the distance between devices, repositioning the cabling, or plugging the devices into separate outlet circuit branches. See Electromagnetic Compatibility (EMC) on page 13-4 for additional guidance.

205	
Category:	UI
Alarm Priority:	Low
Description:	Bad checksum or other failure during file download for software upgrade.
Resolution:	Try reloading software to the unit. See page 7-7 . If this does not resolve the issue, replace the UI PCBA. See page 10-12 .

207	
Category:	UI
Alarm Priority:	Low
Description:	The length of the UI code image downloaded to external flash is too small.
Resolution:	Try reloading software to the unit. See page 7-7 . If this does not resolve the issue, replace the UI PCBA. See page 10-12 .

211	
Category:	UI
Alarm Priority:	Low
Description:	The UI and AD microprocessors disagree as to the temperature setpoint.
Resolution:	This error may appear due to electromagnetic interference from other devices at the customer site. Advise the customer to try increasing the distance between devices, repositioning the cabling, or plugging the devices into separate outlet circuit branches. See Electromagnetic Compatibility (EMC) on page 13-4 for additional guidance.

213	
Category:	UI
Alarm Priority:	Low
Description:	Read error from RTC.
Resolution:	This error may appear due to electromagnetic interference from other devices at the customer site. Advise the customer to try increasing the distance between devices, repositioning the cabling, or plugging the devices into separate outlet circuit branches. See Electromagnetic Compatibility (EMC) on page 13-4 for additional guidance.

214	
Category:	UI
Alarm Priority:	Low
Description:	Write error to RTC.
Resolution:	This error may appear due to electromagnetic interference from other devices at the customer site. Advise the customer to try increasing the distance between devices, repositioning the cabling, or plugging the devices into separate outlet circuit branches. See Electromagnetic Compatibility (EMC) on page 13-4 for additional guidance.

215	
Category:	UI
Alarm Priority:	Low
Description:	Unspecified RTC error.
Resolution:	This error may appear due to electromagnetic interference from other devices at the customer site. Advise the customer to try increasing the distance between devices, repositioning the cabling, or plugging the devices into separate outlet circuit branches. See Electromagnetic Compatibility (EMC) on page 13-4 for additional guidance.

C Service Test Data Sheet

c.1 Overview

Use the form on the following page to record basic maintenance details and test results for Covidien WarmTouch™ Convective Warming Units under service.

Refer to the instructions in each component replacement section for minimum testing requirements. Refer to [Chapter 7, Performance Verification](#) for specific instructions for performing tests.

Service Test Data - Covidien WarmTouch™ Convective Warming Unit

Job Number: _____		Date: _____		Serial Number: _____	
Customer Name: _____					
HEPA Filter			Software		
Initial Counter Reading		Days: _____		Initial S/W Version: _____	
		Hours: _____		S/W Upgraded? <input type="checkbox"/> Yes <input type="checkbox"/> No	
Filter Replaced?		<input type="checkbox"/> Yes <input type="checkbox"/> No		Upgraded to: _____	
Filter Counters Reset?		<input type="checkbox"/> Yes <input type="checkbox"/> No			

Testing

Test	Results	Remarks
Power-On Test	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A	
Keypad Test	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A	
Display Test	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A	
Temperature Accuracy Test		
34°C Setting Reading: _____ °C	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A	
47°C Setting Reading: _____ °C	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A	
Flow Test	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A	
Thermostat Test	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A	
Electrical Safety Tests		
Ground Integrity	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A	
Earth Leakage Current	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A	
Enclosure Leakage Current	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A	
Comments:		
Tests Performed by:		

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