



CT-1000HT

High Temperature Constant Temperature Bath

Instruction & Operation Manual





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INTRODUCTION

Overview

CT-1000HT function

The **CANNON**® CT-1000HT Constant Temperature Bath is designed to maintain precise temperatures at a wide range of settings for accurate viscosity measurements. Because of its temperature stability and ease of use, it is also suitable for any other application where temperatures must be maintained within close tolerances.

Temperature range/stability

The **CANNON**® CT-1000HT will maintain temperatures of 25°C to 100°C within 0.01°C, and temperatures of 101°C to 200°C within 0.03°C. The temperature stability of the CT-1000HT meets the accuracy requirements of ASTM D 445 for kinematic viscosity measurements.

A built-in cooling coil, when connected to tap water or a cooling system, permits operation below or slightly above ambient temperature. (Temperature stability at or below ambient may vary depending on the quality of the external cooling unit.)

Figure 1: The CT-1000



Manual

This manual is intended to provide information on the installation, characteristics and operation of the **CANNON**[®] CT-1000HT Constant Temperature Bath.

NOTE

The CT-1000 video does not contain information regarding temperature selection options above 150°C.

Temperature selection

Ten of the most commonly-used temperatures for kinematic viscosity measurement can be set by using a switch on the bath front panel. The bath will equilibrate within a fraction of one degree of the desired temperature. A fine-tuning control permits further temperature adjustments. By using the variable temperature adjustment procedure, nearly any temperature within the operating range of the instrument may be obtained.

Bath description

The bath chamber is a cylindrical clear vessel 300 mm (12 inches) in diameter and 300 mm (12 inches) high. A stainless steel baffle is located in the center of the bath and provides a convenient backdrop for viewing viscometers placed in the bath. The top cover contains seven round holes 51 mm (two inches) in diameter for insertion of viscometer holders. Two additional holes are provided for thermometers. Twin fluorescent lamps provide glare-free illumination of the bath.

A solid-state control circuit equipped with a stainless steel-encased thermistor provides proportional temperature control. A motor-driven stirrer ensures that a uniform temperature is maintained throughout the bath.

The bath housing is fabricated from heavy aluminum and coated with a corrosion-resistant epoxy. The top cover consists of three layers; a stainless steel top surface, an insulating layer, and a bottom stainless steel heat reflector.

Safety features

Overheat thermistor

A thermistor in the bath senses any over-temperature fault condition. If such a condition occurs, all power is removed from the bath until an operator resets the over-temperature limit circuit.

Thermistor detection/cutoff

If the control thermistor is disconnected, all power to the bath heaters is cut off.

Liquid-level control float

Operation of the bath is not possible unless it is filled with liquid to a safe operating level. A liquid-level control float prevents the control circuit from heating the bath until the safe operating level is attained. The bath heaters are automatically turned off if the bath liquid drops below the minimum safe level.

Operator safety

Please observe the following safety procedures and notices for proper operation of your CT-1000HT bath. Deviation from the installation, operation or maintenance procedures described in this manual may result in a hazardous situation and may void the manufacturer's warranty.



- Make sure that your unit is operated only by qualified personnel
- Make sure that you read and understand all operating instructions and safety precautions listed in this manual before installing or operating your unit. If you have questions regarding instrument operation or documentation, contact **CANNON**[®] Instrument Company.
- Transport the unit with care. Sudden jolts or drops may cause damage to components.
- Observe all warning labels.
- Never remove warning labels.
- Never operate damaged or leaking equipment.
- Never operate the equipment with damaged mains power cables.
- The instrument power cord should only be connected to a suitable AC mains power source (with protective earth ground) matching the specifications of the S/N label.
- Position power cords so that they are not likely to be walked on or pinched by items placed on or against them. Keep all connections as neat as possible.
- To disconnect the power cord, pull it out by the plug. Never pull the cord itself.
- Never operate the unit without appropriate levels of approved bath fluid in the bath.
- Do not add bath fluid to the bath unless the bath temperature is within 10°C of ambient.
- Do not splash liquids on the external surfaces of the bath, including the Pyrex[®] bath jar.
- Do not obstruct the cooling vent on the top of the bath.
- Always turn off the unit and disconnect the mains cable from the power source before performing approved service or maintenance procedures, or before moving the unit.
- Always empty the bath before moving the unit.
- Refer all service and repairs to qualified personnel.
- Do not attempt to service the unit beyond the service and/or repair procedures detailed in this manual. Contact **CANNON**[®] Instrument Company for all additional service/repair needs.



General Caution

In addition to the warnings listed above, additional cautions are posted throughout the manual. These warnings may be designated by an appropriate symbol inside an equilateral triangle. General cautions are indicated with an exclamation point (see diagram, left). Read and follow these important instructions. Failure to observe these instructions can result in permanent damage to the unit, significant property damage, and personal injury.



Hot Surface Caution



Protective Conductor



WARNING

Hot surface cautions (see diagram, left) may be attached on or near hot surfaces of the instrument. Avoid touching these surfaces during instrument operation above 50°C.

The Protective Conductor Terminal symbol is used to indicate required ground connections for your instrument electrical supply.

When supplying power to this instrument, connect the protective ground (earth) terminals of the instrument to the protective conductor of the (supplied) line (MAINS) power cord. The main plug for the power cord should only be inserted in a socket outlet (receptacle) provided with a protective ground (earth) contact. Do not use an extension cord (power cable) without a protective conductor (grounding).

~ **MAINS**

AC Power Input Symbol

The ~MAINS symbol indicates instructions or connections for the AC power supply. The AC Power input must match the electrical specifications listed on the label on the rear panel of the instrument. The supplied AC Mains power cord must be attached to the connector labelled ~MAINS. This connection serves as a means of disconnect and should be readily accessible.



Supply OFF Symbol

The (O) symbol indicates the OFF position for the electrical switches for your unit (AC Mains or accessories).

Specifications

CT-1000HT SPECIFICATIONS	
Dimensions	438 mm wide x 508 mm deep x 635 mm high (17.25 x 20 x 25 in)
Weight	49 kg (108 lbs) without bath fluid
Shipping Weight	59 kg (130 lbs) incl. bath jar
Temperature Range/Precision	25°C to 100°C ± 0.01°C 101°C to 200°C ± 0.03°C
Bath Capacity	17 L (4.5 gal)
Operating Conditions	15°C-30°C, 10%-90% RH non-condensing; Installation category II Pollution degree 2
Fuse Replacement	M 250V 15A; 1-¼" x ¼"
Electrical	[Match line voltage to requirements on instrument rear panel label]*
Compliance	EMC directive (89/336/EEC); Low voltage directive (73/23/EEC) HI-POT (1900 VDC, 60 sec.)
Catalog Number	9726-A27 --115V AC ± 10%; 50/60 Hz, 1500 watts 9726-A29 --230V AC ± 10%; 50/60 Hz, 1500 watts
<i>*Use only the approved power cord provided with the unit</i>	

UNPACKING AND ASSEMBLY

This chapter of the manual provides assistance in unpacking and assembling the CT-1000HT Constant Temperature Bath. For additional assistance, consult the instructional video.



CAUTION

CT-1000HT components are heavy. Obtain necessary assistance before moving heavier packed and unpacked items.

Unpacking the CT-1000HT

The **CANNON**® CT-1000HT Constant Temperature Bath is shipped in two boxes:

- Box 1 contains the glass jar, front glass panel pieces, jar gasket top, trimpot adjust screwdriver, Allen wrench, seven hole covers, rubber thermometer holder and instruction manual.
- Box 2 contains the bath housing, including the electronics drawer. Box 2 also contains a smaller box with the motor and stirrer, including the impellers (2) and mounting plate.

The bath unit housing is shipped completely assembled. However, the glass jar, the glass panels, and the motor and stirrer must be installed in it. To allow this, some disassembly of the bath unit housing is required. The tools required are a utility knife, Phillips screwdriver, and a 1/8" Allen wrench. The Allen wrench is included with the bath.



Figure 2: Primary bath components after unpacking

Assembly procedure

1. Unpack the bath unit housing.
2. Move the bath unit housing to its permanent location on the laboratory bench.
3. Remove all eight screws from the stainless steel top covers (see *Figure 3*).
4. Disconnect all probes, heaters, and float switch from the rear panel.
5. Remove the front top cover and rear top cover (see *Figure 4* and *5*). Use caution when removing the rear top cover because the temperature control probes and heating elements are attached to it.



Figure 3: Removing screws from top cover



Figure 4: Removing front cover



Figure 5: Removing rear cover

Glass jar installation

1. Remove the glass jar from its box.
2. Make sure the Viton® support ring is seated properly around the bottom jar opening in the bath unit (see *Figure 6*).



CAUTION

The glass jar is heavy. Use caution when lifting it.

3. Place the Viton® rubber gasket around the top rim of the jar (see *Figure 7*, next page). The ends of the gasket should meet with no gap when placed around the rim. If necessary, trim one end of the gasket to achieve a snug fit.



Figure 6: Checking support ring

4. Remove the large piece of foam packing from the inside of the cabinet. Also remove the small piece of foam from the float level, located on the upper left-hand corner of the inside of the cabinet.
5. Lower the glass jar into the cabinet so it seats evenly on the rubber support ring (see *Figure 8*).



Figure 7: Placing gasket

6. Unwrap the two glass panels. Place the thinner of the two pieces of glass in the slot closest to the jar (see *Figure 9*).
7. Place the wider piece of glass in the front slot furthest away from the jar. The middle slot is left empty for air circulation/cooling.



Figure 8: Installing bath jar

8. Replace the rear top cover. Align the four holes, then insert and tighten the screws.
9. Replace the front top cover. Line up the four holes, then insert and tighten the screws.
10. To ensure that the gasket forms a tight seal with the top covers of the bath, proceed as follows:
11. Pull out the drawer using the handles provided, disconnecting the two connection cables as you do so.



Figure 9: Placing inner glass plate



CAUTION

You will need to pull the AC line (power) cord through the rear panel opening as you remove the drawer—you should not try to remove the cord until you loosen the screw securing the power cord to its connection on the back of the drawer).

12. Press down or pull up on the plastic release bars on either side of the drawer track to release the drawer, then pull the drawer completely free of the unit and set it aside.
13. When the drawer is removed, locate the four 1/4-20 set screws visible at the top of the drawer opening underneath the bath.
14. Turn the set screws clockwise with the Allen wrench (included with

the bath) until the top of the jar forms a tight seal with the covers (see *Figure 10*). Make sure you tighten the set screws uniformly so the jar remains level.

15. Run the AC cord through the rear panel opening
16. Replace the drawer in the slide tracks and push the drawer back into its opening. Insert the two plugs into the rear of the drawer assembly.



Figure 10: Adjusting set screws

Motor-stirrer

Complete the assembly of the bath, including the motor-stirrer installation, per the instructions below:

1. Take the motor/stirrer from its box. Remove the two screws on the top heater housing and lift off the housing (see *Figure 11*).
2. After checking the impeller blades to make sure that the flat sections all lie in the same plane, insert the motor stirrer in the opening provided (see *Figure 12*).



Figure 11: Removing housing



Figure 12: Installing motor-stirrer



CAUTION

To keep from accidentally bending the motor shaft, do not hold the motor assembly by the shaft. Use care when inserting the motor shaft and impeller to prevent damage to delicate components.

NOTE

Two standoffs located on either side of the opening for the motor stirrer serve as locating pins for the motor support pad. The holes in the pad fit loosely over their heads. The motor line cord should point toward the rear of the bath (offset slightly to the right or left). The motor stirrer should now lie flat on the top of the bath.

3. Reattach the top heater housing, making sure that the heater, motor, and fan cords pass through the left-hand opening (as viewed from the rear) and that the control probe, over-temperature probe, and level

switch cords exit from the right opening (as viewed from the rear). The back lip on the rear top cover fits into the slot on the top heater housing. Line up the holes, insert screws, and tighten.

4. Connect all plugs and probes to the correspondingly labeled sockets at the rear of the CT-1000HT bath unit.
5. Adjust the four feet on the bottom of the bath housing to level the bath. This should be done *before* filling the bath with fluid.

Inserting viscometer tubes/thermometers

The top cover of the CT-1000HT contains seven apertures, 51 mm (2") in diameter, for the insertion of viscometer tube holders. Two additional holes are provided for insertion of thermometers.

Inserting viscometer tubes

If necessary, remove the viscometer tube hole cover(s) from the top of the bath and carefully place the viscometer tube(s), with the proper holder attached, into the bath through the aperture(s) in the top cover.

NOTE

After filling the bath with fluid, adjust the height of the viscometer tube(s) to ensure that the liquid under test and/or any timing marks on the tube are a minimum of 6 mm (¼") below the top level of the liquid.

Thermometer immersion

Proper thermometer immersion is critical for viscosity measurements. Even a calibrated thermometer will read incorrectly if it is improperly immersed in the bath. "Total immersion" kinematic viscosity thermometers should be used with the bulb and only the mercury column beneath the surface of the liquid, but with the emergent stem above the surface at ambient temperatures.

NOTE

Different thermometers have different immersion requirements. Refer to the information included with the thermometer in use for specific instructions.

Power/probe connections

Bath connections

To complete electronic connections between CT-1000HT bath components, attach the 9-pin thermistor connector from the bath to the THERMISTORS connection on the controller rear panel. Connect the bath power connector from the bath to the BATH POWER female connection on the controller rear panel.



MAINS power connections

~ **MAINS**

To provide power from your **MAINS** supply, verify line voltage compatibility by checking the label on the rear panel of the CT-1000HT. Then locate the approved power cord (provided) and plug it into the connector on the CT-1000HT rear panel.

Verify that the power switch for the CT-1000HT is in the **OFF** position. Then plug the other end of the power cord into the **MAINS** power source.

Attaching the vent hose

The CT-1000HT design includes a rear vent for channeling vapors from the bath to a user's venting system.

To complete CT-1000HT assembly, attach the length of vent hose included with the instrument to the rear of the CT-1000HT unit and secure the connection with a hose clamp.

Vent the other end of the hose to your exhaust system, using procedures and precautions appropriate for your facility and bath fluid.

Filling the bath

After CT-1000HT assembly is complete, you are ready to fill the bath (see *Figure 13*).

You should select a bath liquid appropriate to your operating temperature range (see *APPENDIX B*).



CAUTION

Make sure that the bath is placed in its intended final position with the vent hose in place before adding bath fluid. The CT-1000HT should not be moved with bath fluid in the bath jar. NEVER USE FLAMMABLE BATH LIQUIDS.



Figure 13: Filling the CT-1000HT bath

1. Make sure that the instrument power is **OFF** and select a bath liquid appropriate to your operating temperature range (see *APPENDIX B*).
2. Fill the jar with bath liquid at ambient temperature to a level sufficient to engage the float switch. This float permits bath operation when the minimum amount of fluid has been added to the bath jar.
3. Continue to add fluid until the bath liquid level has risen to approximately 40 mm (1.5") of the top of the jar.

4. Turn the instrument power **ON** and incrementally heat the bath to desired control temperature while monitoring the bath liquid level carefully. The bath level must be 15-20 mm (approximately ½" to ¾") from the top of the jar at the control temperature. If it becomes apparent that this liquid level will not be achieved, return the bath to within 10°C of ambient, turn the instrument power **OFF** and add or remove liquid as necessary.
5. Repeat step four until you have attained the proper bath liquid level at the desired control temperature.

**CAUTION**

Different bath fluids expand at different rates. Do not overfill the bath!

**WARNING**

Monitor the level of bath liquid closely when operating the CT-1000HT at higher temperatures (135-200°C). The bath liquid will expand as the temperature increases. The CT-1000HT bath jar is not designed to contain liquid under pressure. If the bath is overfilled, liquid may overflow.

Draining the Bath

If it becomes necessary to drain the liquid from the bath:

- Obtain a suitable container to hold all of the liquid drained from the bath (approximately 20-22 liters (4.5 - 5 gallons)).
- Check the bath temperature. The bath liquid should be at or near ambient temperature.
- Insert a tube into the bath chamber from the top opening and siphon the liquid from the bath into a container positioned lower than the bath.

**WARNING**

Always use a rubber bulb or similar device to apply suction to a tube containing bath liquids.

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BATH OPERATION

NOTE *The various functions controlling the bath are printed at the bottom of the front panel of the CT-1000. These functions, reading from left to right, are: 1) **Power**, 2) **Temperature**, 3) **Temperature Adjust**, 4) **Preheat**, and 5) **Limit Control**. In this manual the five functions are printed in boldface upper- and lowercase letters (to match their typeface on the panel). The switches and dials controlling each function are also printed in boldface type, but in capital letters (to match their typeface on the panel).*

Applying power

CAUTION *Do not power up the CT-1000HT without completing the installation requirements. Make sure that the mains voltage specified on the rear identification label matches your mains voltage.*

1. Turn the **Power BATH** switch on.

NOTE *The bath heaters will not be activated if there is no liquid in the bath.*

2. Set the **Limit Control TEMPERATURE ADJUST** turn the dial clockwise to its furthest setting to enable the bath to heat properly. Proper technique for resetting the dial after the bath reaches operating temperature is described in the following section of the manual.
3. Turn on the **Power LIGHT** switch to illuminate the interior of the bath.
4. Move the **Temperature Adjust SELECT** switch to the left.
5. After releasing its lock, move the **Temperature Adjust FIXED** dial to 50. Relock the dial.

NOTE *All the dials except **Temperature SELECT** are equipped with a dial lock to prevent accidental changing of dial settings. Push the lock upward to release the dial. When the dial has been set to the proper position, push the lock downward to relock the dial.*

Setting the bath temperature

There are two ways to set the bath temperature, depending on whether or not the desired temperature is on the **Temperature SELECT** dial.



Fixed temperature adjustments

To set the bath to a temperature on the **Temperature SELECT** switch:

1. Choose a temperature using the **Temperature SELECT** switch.

NOTE

*The **Preheat** switch activates an auxiliary heater for the CT-1000HT. You may turn it **ON** to heat up the bath more rapidly. You should turn the **Preheat** switch **OFF** when the desired temperature is reached if the operational temperature is under 120°C. For bath temperatures in excess of 120°C, the **Preheat** switch must remain **ON** to maintain temperature control. After the **Preheat** switch has been turned **ON**, the **Preheat HEAT** light will glow continuously until the bath temperature is approximately that selected with the **Temperature SELECT** switch. Then the light will begin to blink.*

The light above the **Temperature Adjust** control will glow steadily when the bath is heating. The light will start to blink when the bath temperature is approximately that selected with the **Temperature SELECT** switch.

2. To adjust the bath to the exact temperature, read from the kinematic viscosity thermometer (see *Appendix D*), then release the dial lock on the **Temperature Adjust FIXED** dial and turn the dial to incrementally adjust the temperature. To decrease the temperature, turn the dial counterclockwise; to increase the temperature, turn the dial clockwise. Relock the **Temperature Adjust FIXED** dial after each adjustment and allow several minutes for the bath to equilibrate.

NOTE

*If the desired temperature cannot be obtained by turning the **Temperature Adjust FIXED** dial, the small trimpots on the circuit board in the electronics drawer may require adjustment. Consult **CANNON**® service.*

Variable temperature adjustments

To set the bath to a temperature that is not on the **Temperature SELECT** switch you should use the following procedure:

1. Turn the **Temperature SELECT** switch to the temperature closest to that desired.
2. Move the **Temperature Adjust SELECT** switch to the right.

NOTE

*The **Preheat** switch activates an auxiliary heater for the CT-1000HT. You may turn it **ON** to heat up the bath more rapidly. You should turn the **Preheat** switch **OFF** when the desired temperature is reached if the operational temperature is under 120°C. For bath temperatures in excess of 120°C, the **Preheat** switch must remain **ON** to maintain temperature control. After the **Preheat** switch has been turned **ON**, the*

Preheat HEAT light will glow continuously until the bath temperature is approximately that selected with the **Temperature SELECT** switch. Then the light will begin to blink.

The light above the **Temperature Adjust** control will start to blink when the bath temperature has approximated the setting on the **Temperature SELECT** switch.

3. To adjust the bath to the exact temperature, read from the kinematic viscosity thermometer (see *Appendix D*), then release the dial lock on the **Temperature Adjust VARIABLE** dial and turn it. To incrementally decrease the temperature, turn the dial counterclockwise; to increase the temperature, turn the dial clockwise. Relock the **Temperature Adjust VARIABLE** dial after each adjustment and allow several minutes for the bath to equilibrate.

NOTE

*If a desired bath temperature is within two or three degrees of one on the **Temperature SELECT** dial, it is sometimes possible to attain the temperature by using the **Temperature Adjust FIXED** dial. Because this dial has a finer adjustment than the **Temperature Adjust VARIABLE** dial, the final temperature may be reached more quickly. If you wish to try this alternate method, follow the procedure for fixed temperature adjustments given on the previous page.*

Attaining lower temperatures

To attain temperatures below ambient temperature (20-25°C), a coolant must be pumped through the bath's cooling coil. The coil is accessed through the rear of the bath. Coolant temperature should be approximately 3°C below the desired bath temperature. Temperature stability below ambient temperature may be limited by the flow rate of the coolant.

Adjusting the High Temperature Limit Control

The Limit Control is designed to prevent the bath from overheating if a malfunction occurs. You should set the **Limit Control** *only* after the CT-1000HT bath has reached the desired temperature.

NOTE

During this procedure, the temperature of the bath may change slightly, but will quickly recover.

1. Using a screwdriver, slowly turn the **LC - TEMPERATURE ADJUST** control counterclockwise until the OVER TEMP message lights up on the **LC - PUSH TO RESET** button.
2. Turn the control clockwise approximately ¼ to ½ turn.

3. Push the **LC - PUSH TO RESET** button. If the bath doesn't recover, repeat step 2 and try again.

WARRANTY/RETURN INFORMATION

Products limited warranty

In addition to other manufacturers' warrantees, **CANNON**[®] Instrument Company ("the Company") warrants all products (other than reagents and chemicals) delivered to and retained by their original purchasers to be free from defect in material and workmanship for one year from the date of the Company's invoice to the purchaser. For a period of one year from the date of such invoice, the Company will correct, either by repair or replacement at the Company's sole election, any defect in material or workmanship (not including defects due to misuse, abuse, abnormal conditions or operation, accident or acts of God, or to service or modification of the product without prior authorization of the Company) without charge for parts and labor. The determination of whether any product has been subject to misuse or abuse will be made solely by the Company.

The Company shall not be liable for any special, incidental, or consequential damages, or any damage to plant, personnel, equipment or products, directly or indirectly resulting from the use or misuse of any product. Representations and warranties made by any person, including dealers and representatives of the Company, which are inconsistent, in conflict with, or in excess of the terms of this warranty shall not be binding upon the Company unless placed in writing and approved by an officer of the Company.

Reagent and chemical warranty

CANNON[®] Instrument Company ("the Company") warrants all reagents and chemicals sold by the Company and delivered to and retained by their original purchasers to conform to the weight, specifications and standards stated on the package. The Company will, at its sole option, either replace or refund the price (net of freight, handling charges and taxes), of any reagent or chemical sold by the Company which does not conform to such weight, specifications and standards upon the prompt return of the unused portion. Except for replacement or refund of the net price, the Company shall not be liable for any damages occurring as a consequence of the failure of any reagent or chemical sold by the Company to conform to the weight, specifications and standards stated on the package.

Returning a product to CANNON®

Procedure

Before returning a **CANNON®** product for repair or service, make every attempt to identify the problem. If, after careful checking, the problem remains unidentified or unsolved, telephone **CANNON®** Instrument Company (or the local service agent) to consult with a product specialist. If the specialist cannot recommend a simple solution or repair, **CANNON®** will authorize the return of the product through the issuance of a Receiving Authorization number (RA).

CANNON® Telephone Number	814-353-8000
CANNON® Fax Number	814-353-8007

Products returned to **CANNON®** must be carefully packed. Ship prepaid to the following address:

CANNON Instrument Company
 ATTN: Return Authorization # _____
 2139 High Tech Road
 State College, PA 16803 USA

Please include the following:

Required information

- The Receiving Authorization number (RA).
- The name and telephone number of the person at your company to contact regarding the product.
- Shipping and billing instructions for the return of the product to your location.
- A detailed explanation of the reason for the return.

If the product is not covered by warranty, the customer will be provided with an estimate of the repair costs and asked for approval before any repairs are made. The customer will be required to issue a purchase order for the cost of the repairs.

Hazardous materials

Stringent government regulations restrict the shipment of mercury. Please contact **CANNON®** before returning a product that could possibly contain mercury.

Shipping notification

Products returned without prior notification (by either telephone or fax), or without Cannon's authorization, will not be accepted.

The customer may be billed a testing fee if a product is returned to **CANNON®** and found to be working properly.



APPENDIX A — CT-1000 HT PROBLEM ANALYSIS

Problem	Probable Cause
Bath does not appear to have power.	<ul style="list-style-type: none"> • Power cable not connected to outlet or rear of electrical drawer. • Over-temperature control set too low. • Power out on mains.
Bath illumination not functioning.	<ul style="list-style-type: none"> • Separate switch for LIGHT must be on. • fluorescent lamps may be defective. • Lamps may be out of sockets. • Lamp ballast may be defective. • Power supply to ballast may not be working properly.
Bath liquid not agitated.	<ul style="list-style-type: none"> • Check connection of stirring motor on rear panel. • Check for working motor by connecting to outlet with the proper voltage (see motor label for correct voltage).
Bath does not heat.	<ul style="list-style-type: none"> • Check connections for sensors on rear panel. • Check temperature setting — it must be above existing bath temperature for heat to go on. • Bath fluid level may be too low. • Limit Control Temperature Adjust dial may be set too low (turn completely clockwise to 999, then press PUSH TO RESET button).
Bath control outside of specific limits.	<ul style="list-style-type: none"> • Bath fluid viscosity may be too high (if the fluid is too viscous at the desired temperature the stirring will be inadequate, resulting in poor control). • Check for normal function of stirring motor and motor impeller. • Remove control thermistor probe plug and check resistance with an ohmmeter (call CANNON[®] for proper resistance at bath temperature).
Bath top surface temperature too high.	<ul style="list-style-type: none"> • Check cooling fan on rear panel. • Check cooling fan in top assembly.
Air bubbles in bath fluid.	<ul style="list-style-type: none"> • Level of fluid may be too low. • Stirring impeller may be on shaft with the wrong orientation. • Bath fluid may be too viscous for operation at this temperature.

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APPENDIX B — CHOOSING A TEMPERATURE BATH LIQUID

The ideal bath liquid would possess low viscosity, high heat capacity, and low vapor pressure over a wide range of temperatures. In addition, the liquid should have a very high flash point and be relatively low in cost. If the fluid is to be used in a kinematic viscosity bath where it is necessary to view the instruments through the bath liquid, then it is important for the liquid to be clear and without color. Unfortunately, no single fluid meets all these requirements. When selecting a fluid, keep the following in mind.

THE IDEAL BATH LIQUID	
Viscosity	Viscosity should be very low so that moderate stirring can effectively eliminate temperature gradients in the bath.
Heat Capacity	Temperature changes in the bath are less rapid with a high heat capacity. With the exception of water, most choices for bath fluids will have about the same heat capacity.
Volatility	A liquid which is relatively volatile will require more frequent replenishment. Furthermore, rapid evaporation at the bath surface produces a cooling effect, making control more difficult.

Because no single fluid can be used at all possible bath temperatures, the choice of a suitable fluid must begin by establishing the temperature range over which the bath will be operated. The following table provides a list of operating temperature ranges and some liquids suitable for use in these ranges:

BATH FLUID OPTIONS (25 °C to +200 °C)	
Temperature Range (°C)	Suitable Bath Liquids
+5 °C to +60 °C	Water, Low Viscosity Oils, Silicones (Dow 200 fluid, 1 cSt)
+60 °C to +100 °C	White Oils with Oxidation Inhibitor, Silicones (Dow 200 fluid, 10 cSt)
+100 °C to +135 °C	Silicones (Dow 200 fluid, 20 cSt)
+135 °C to +200 °C	Silicones (Dow 200 fluid, 50 cSt)

Silicone fluids

Silicone fluids are available in a wide range of viscosities and can be used over a wide range of temperatures if the proper selection of viscosity is made for the temperature range of interest. Silicones are also relatively expensive liquids. However, a bath containing silicones requires extra care when used for capillary viscometry. If silicones are introduced into a viscometer capillary, its calibration factor will be altered by a significant amount.

Water

Water is almost the ideal fluid in the temperature range in which it can be used. Because in some cases there is a tendency for algae formation, some degree of water treatment may be necessary. Water can be used at temperatures close to the boiling point, but water replenishment to offset evaporation becomes a nuisance and the hot vapor can make working above the bath uncomfortable. Also, it may be difficult to establish optimum control at elevated temperatures because of the rapid cooling resulting from surface evaporation.

Refined white oils

Refined white oils (paraffin oils) of relatively low viscosity can be used at temperatures above the level at which water becomes unsatisfactory. Because these oils will turn faintly yellow and continue to darken with prolonged exposure to heat, we recommend adding an oxidation inhibitor to retard discoloration. The addition of an inhibitor will prolong the useful life of the oil, but it will eventually become as dark as untreated oil.

The search for more suitable bath oils is unending. Hydrogenated vegetable oils, coconut oil, synthetic oils, and certain chemical compounds have been used with some success at various temperatures.

APPENDIX C — CT-1000HT SPARE PARTS LIST

Following is a list of parts for the CT-1000HT which may be reordered from **CANNON**® Instrument Company.

<u>Part Number</u>	<u>Description</u>
P20.1	PYREX JAR 12 X 12
P20.22	THERMOMETER HOLDER (RUBBER)
P22.26	JAR TOP GASKET
P22.39	HOLE COVERS & THERM HOLDER SET
P22.40	JAR SUPPORT GASKET
P25.4045	SOLID STATE RELAY 25 A
P27.1260	SOCKET LAMP
P27.1300	FLOURESCENT LAMP
P27.1310	LAMINATED SAFETY GLASS
P27.1320	PLATE GLASS
P27.2220	PANEL MOUNT LED
P27.2230	TEMPERATURE RESET SWITCH
P27.2230.11	LAMP RESET SWITCH
P27.2280	BALLAST SOILD STATE
P27.3700	SCREWDRIVER TRIMPOT ADJ
P27.5110	FRONT BATH COVER W/ROUND HOLES
P27.5250	PTFE BAFFLE, WHITE
P27.5260	COOLING COIL (SS)
P27.5270	HEATER 700W 120V
P27.5271	HEATER 700W 240V
P27.5290	HEATER 400W 120V
P27.5291	HEATER 400W 240V
P27.9010	TEMPERATURE CONTROL PROBE
P27.9020	TEMPERATURE PROBE OVER
P27.5410.1	LEVEL SWITCH
P27.9011	CT1000 MOTOR STIRRER 120V
P27.9012	CT1000 MOTOR STIRRER 240V
P27.6121	SPONGE SUPPORT PAD
P50.82	10° TURN DIAL
P51.1432	LIGHTED SWITCH ROCKER 120V
P51.1433	LIGHTED SWITCH ROCKER 240V
P61.429	FUSE 15A

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