



Forma Scientific, Inc.

P.O. Box 649
Marietta, Ohio 45750
USA

Model 3980/3986
29 Cubic Foot
Reach-In Incubator
Manual 7003980

Important! Read this instruction manual prior to applying power to the unit. Failure to comply with stated installation requirements may cause poor equipment performance, component failure, or void warranty.

Complete model number and serial number are required when consulting the factory for any reason.

Caution! All internal adjustments and maintenance must be performed by qualified service personnel.

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SECTION 1 - RECEIVING

1.1 PRELIMINARY INSPECTION

This item was thoroughly inspected and carefully packed prior to shipment and all necessary precautions were taken to ensure safe arrival of the merchandise at its destination. Immediately upon receipt, before the unit is moved from the receiving area, carefully examine the shipment for loss or damage. Unpack the shipment and inspect both interior and exterior for any in-transit damage.

1.2 VISIBLE LOSS OR DAMAGE

If any loss or damage is discovered, note any discrepancies on the delivery receipt. Failure to adequately describe such evidence of loss or damage may result in the carrier refusing to honor a damage claim. Immediately call the delivering carrier and request that their representative perform an inspection. Do not discard any of the packing material and under no circumstances move the shipment from the receiving area.

1.3 CONCEALED LOSS OR DAMAGE

If damage is discovered upon unpacking the shipment, stop further unpacking, retain all packaging material and immediately notify the delivering carrier, requesting that an inspection be performed as soon as possible. Again, under no circumstances move the shipment from the receiving area.

1.4 RESPONSIBILITY FOR SHIPPING DAMAGE

For products shipped F.O.B. Marietta, Ohio, the responsibility of Forma Scientific, Inc. ends when the merchandise is loaded onto the carrier's vehicle.

On F.O.B. Destination shipments, Forma Scientific's and the carrier's responsibility ends when your Receiving Department personnel sign a free and clear delivery receipt.

Whenever possible, Forma Scientific, Inc. will assist in settling claims for loss or in-transit damage.

SECTION 2 - AUXILIARY EQUIPMENT

2.1 SHELVES

Additional shelves are available from stock. They are stainless steel, non-perforated, and have a raised edge. The shelves slide easily into channel brackets and can be quickly removed for easy cleaning.

Catalog No. 505071

2.2 RECORDER

Recorders maintain a permanent, accurate record of chamber humidity and/or temperature. All recorders feature new long-life, disposable felt-tip inking pens.

TEMPERATURE RECORDER: Single Pen, 6" Chart, 7-Day Chart Drive, Factory Mounted.
Catalog No. 245131

TEMPERATURE RECORDER: Single Pen, 12" Chart, 7-Day Chart Drive, Factory Mounted.
Catalog No. 245196

TEMPERATURE AND HUMIDITY RECORDER: Dual Pen, 12" Chart, 7-Day Chart Drive, Factory Mounted.
Catalog No. 245197

2.3 CH/P PORTAMATIC CO2 CONTROL SYSTEM

Model 3057 Portable Digital Automatic system for all reach-in incubators.
Catalog No. 3057

2.4 SOLID FACED DOOR

Polished stainless steel for light-tight applications.
Catalog No. 921005

2.5 DIGITAL THERMOMETER

This panel mounted thermometer provides direct digital temperature display in 0.1°C increments.
Catalog No. 260154

2.6 DUPLEX OUTLET

Weather-proof, mounted inside the incubator chamber.
115V - Catalog No. 505099
220V - Catalog No. 505094

2.7 THRU-WALL ACCESS PORT

1-3/4" diameter port with plug, centered on the right side of the chamber interior.
Catalog No. 505101

2.8 FYRITE CO₂ ANALYZER KIT

The Fyrite CO₂ analyzer kit instantly verifies the chamber CO₂ percentage in a 0 to 20% range. It comes complete with a specially designed aspirator, sampling tube, and steel carrying case.
Catalog No. 220012

2.9 TWO-STAGE PRESSURE REGULATOR

A convenient two-stage general-purpose regulator for controlling cylinder gas pressure. The first stage automatically reduces tank pressure to a pre-set intermediate level. The second stage reduces pressure to the recommended (10 PSIG) incubator input level. It permits stable CO₂ flow and low demand throughout the cylinder supply.
Catalog No. 965010

2.10 TISSUE CULTURE SHELVES

The 11" x 16" stainless steel shelves for culture dishes are designed for stacking to increase the incubator storage area. Minimum order of 6 shelves.
Catalog No. 500171

SECTION 3 - SPECIFICATIONS

3.1 CONSTRUCTION

Exterior: Reinforced Steel
Interior: Polished Stainless Steel
Shelves: (6) Non-Perforated, Stainless Steel
Finish: Polyurethane Enamel

3.2 DIMENSIONS

Exterior: 88-1/2"H x 38"W x 31"D
225cmH x 97cmW x 87cmD
Interior: 60"H x 31"W x 27"D
153cmH x 79cmW x 69cmD

3.3 CAPACITY AND WEIGHT

Capacity: 29 Cubic Feet
823 Liters
Shelf Capacity: 19 Shelves with 103.3 Sq. Ft. available space
Shipping Weight: 850 lbs. (Nominal)
386 kg. (Nominal)

3.4 TEMPERATURE

Range: 0 to +60°C.
Control Uniformity: +/- 0.2°C.

3.5 HUMIDITY and CO₂

Humidity Range: Above Ambient to 96%
CO₂ Range: 0 to 20%

3.6 HEATING AND REFRIGERATION

Heaters: (2) Wirewound
Refrigeration: 1/4 HP Air-Cooled Compressor

SECTION 3 – SPECIFICATIONS (continued)

3.7 ELECTRICAL REQUIREMENTS

Model 3980: 220V, 3 Wire, 17 FLA, 60 Hz

Model 3986: 220/240V, 2 Wire, 23 FLA, 50 Hz

3.8 UTILITY CONNECTIONS

3/8" NPT Drain Connection

1/8" NPT Water Connection

1/4" Compression Fitting for CO₂

SECTION 4 - INSTALLATION

4.1 LOCATION

Locate the unit on a firm, level surface in an area of minimum ambient temperature fluctuation.

A minimum of 12 inches clearance at the top of the incubator is required. A minimum of 3 inches clearance must exist between the back of the incubator and any walls or obstructions to ensure adequate airflow around the refrigeration system.

4.2 WATER AND DRAIN CONNECTIONS

To ensure continuous satisfactory operation of the incubator, it is recommended that only distilled water be used in the reservoir. In localities where the water has a high mineral content, the use of distilled water is especially important.

CAUTION! Purity of the distilled water used in the incubator humidifier reservoir must be within the 50K to 1M Ohm range to protect, and prolong the life of the stainless steel unit. Use of tap water, or distilled water outside the specified range, will decrease the operating life of the unit and may void the warranty.

The water inlet is the 1/8" NPT connection located at the top left side of the back of the incubator. Water inlet pressure at the unit should be from 15 to 80 PSI. To facilitate service, it is recommended that a manually operated shut-off valve be installed between the main water supply and the incubator.

A 3/8" NPT drain connection is required on the Model 3980. A drain trap is necessary on the drain line to maintain precise CO₂ control within the chamber.

NOTE: If the incubator is to be operated without humidity, but with CO₂, the inner drain line must be plugged to prevent erratic CO₂ control within the chamber.

SECTION 4 – INSTALLATION (continued)

4.3 PREPARATION OF THE HUMIDIFICATION SYSTEM

CAUTION! When the incubator is initially put into operation, the humidifier boiler is dry.

Before operating the incubator:

- 1) Turn the overtemp thermostat fully clockwise.
- 2) Set the humidity range switch to LOW.
- 3) Turn the humidity control knob to the lowest possible setting.
- 4) Turn the main power switch ON.
- 5) Turn the humidity switch ON.
- 6) Open the control panel. Water should be flowing to the water level tank mounted on the side of the humidifier boiler. When a constant trickle of water begins to flow through the clear plastic tubing, the humidifier boiler is operational.

4.4 CO₂ CONNECTION

To provide for the most economical use of CO₂, a main supply of liquid CO₂ is recommended. The liquid CO₂ should be supplied from tanks without siphon tubes to ensure that only CO₂ gas enters the incubator injection system. It is also recommended that a two-stage pressure regulator, with indicating gauges, be installed at the supply cylinder outlet. The high-pressure gauge should have an indicating range of 0 to 2000 PSIG to monitor tank pressure. The low-pressure gauge should have an indicating range of 0 to 30 PSIG to monitor actual input pressure to the incubator injection system. Connecting two tanks will help to insure continuous availability of CO₂. A suitable two-stage pressure regulator is available from Forma Scientific, Inc.

The CO₂ pressure must be between 5 and 10 PSIG. Pressure higher than 10 PSI will damage the CO₂ control system. The user should determine the most economical pressure level (between 5 and 10 PSIG) appropriate for the desired CO₂ percentage in the chamber.

SECTION 4 – INSTALLATION (continued)

To connect the CO₂ supply:

- 1) Slip the copper tubing provided with the unit, or a copper CO₂ supply tubing, as far as it will go into the nut of the CO₂ connection.
- 2) Turn the nut until it is finger tight.
- 3) For reference, scribe the nut at the 6:00 position.
- 4) While holding the fitting body steady with a wrench, tighten the nut 1-1/4 turns until the mark is at the 9:00 position.
- 5) Securely attach the CO₂ line to the open end of the copper tubing.
- 6) Check the tubing connection for leaks.

SECTION 5 - CONTROL & INDICATING DEVICES

5.1 MAIN POWER SWITCH AND INDICATING LIGHT

The main power switch controls the ON/OFF power to the incubator systems. The indicating light is energized when the main power switch is ON, and the unit is receiving power.

5.2 REFRIGERATION SWITCH & INDICATING LIGHT

The refrigeration switch controls the power to the refrigeration unit compressor. The switch should be in the ON position when the setpoint temperature is 4°C above ambient or below. It should also be ON when the incubator is to be operated at high levels of humidity.

The refrigeration indicating light is energized when the refrigeration switch is on, and the compressor is receiving power.

5.3 DEFROST SWITCH & INDICATOR LIGHT

The defrost switch controls power to the defrost system. The defrost timer is factory-set to provide two 15-minute defrost cycles during a twenty-four hour period. The defrost switch should be placed in the ON position when the temperature setpoint is 10°C or below.

CAUTION! Failure to turn the defrost switch "ON" when required will cause icing of the refrigeration coil, which in turn will impair performance.

The defrost timer is energized by the main power switch, but timed defrosting can occur only when the defrost switch is in the ON position.

The defrost indicator light is activated when the defrost switch is in the ON position and the incubator is in a defrost cycle. The indicator light will go out when the defrost cycle is completed.

5.4 DIGITAL TEMPERATURE CONTROLLER

The solid state digital thumbwheel switch controls power to the incubator heater circuit. On a demand for heat, the temperature controller energizes the heaters to bring the temperature up to setpoint.

On the controller face, there are three manually adjustable rotary discs for direct dialing of the chamber setpoint temperature. Temperature settings are made by rotating the individual discs until the digits correspond with the desired temperature setpoint.

The disc on the extreme right is used for setting temperature in tenths of a degree Centigrade. Settings for 0 to 0.9°C are selected on this disc. The two discs to the left are adjustable from 0 to 60°C.

The temperature controller indicating light cycles with the incubator heaters demand for heat.

5.5 OVERTEMPERATURE SAFETY THERMOSTAT AND ALARM

The overtemperature safety thermostat is designed to be set for a temperature slightly above the operating setpoint temperature of the incubator. In the event of an overtemp condition in the chamber the safety thermostat performs two functions:

- 1) It activates both the audible alarm and the overtemp indicating light.
- 2) It interrupts power to the heaters and maintains the temperature at the safety thermostat setpoint.

The overtemp control is not directly calibrated. The numbers (0 to 10) on the dial are for reference only in setting the safety thermostat.

The source of any overtemp condition must be determined and corrected before the incubator can be returned to the normal control system.

5.6 HUMIDITY CONTROLLER

The humidity controller is used to set the desired level of humidity in the incubator chamber.

5.7 HUMIDITY RANGE SELECTOR

The humidity range selector is used to select the proper humidity range:

Low Range: 10% to 50% RH

High Range: 40% to 100% RH

The range is set by pushing the switch to the LEFT for high range RH or to the RIGHT for low range RH. The range selector must be set before the percent RH is selected.

5.8 HUMIDITY SWITCH & INDICATING LIGHT

The humidity switch controls the ON/OFF power to the humidity boiler circuit. The boiler heaters will operate only if there is sufficient water in the boiler.

The humidity indicating light is activated when the humidity switch is in the ON position.

CAUTION! Be sure there is a sufficient supply of water in the boiler before activating the humidification system!

5.9 RELATIVE HUMIDITY INDICATOR

The relative humidity indicator provides a direct read-out of chamber humidity in both ranges.

5.10 DEHUMIDITY SWITCH & INDICATING LIGHT

When the dehumidity switch is set to ON, the refrigeration compressor is locked in the cool position providing a "drying action" from the refrigeration coil. This "drying action" of the refrigeration cooling coil is limited and does not have the capability of taking the cabinet RH level below ambient conditions. In order to obtain the most effective results from this drying action, the humidity switch should be in the OFF position.

5.11 CO₂ FLOWMETER

The CO₂ flowmeter controls the flow of CO₂ into the incubator chamber.

A float ball indicates the CO₂ flow rate against the 0 to 100 arbitrary scale. A reading of 40 on the scale provides approximately 5% CO₂ tension in the incubator.

CO₂ content should be checked with a Fyrite™ or similar device to insure the desired percentage.

5.12 PURGE LEVEL DIAL

The purge level dial is used to set the duration of the CO₂ purges. For example, when the dial is set at 5%, the incubator will be purged with CO₂ for approximately 108 seconds. This is enough to replace 5% of the air in the incubator with CO₂.

The dial is marked for 5%, 10%, and 15%. Settings between these markings should be considered arbitrary and will produce less than precise CO₂ percentages.

5.13 PURGE BUTTON

When pressed, the purge button permits a flow of CO₂ to the chamber to replace the CO₂ lost to the air when the incubator door has been opened. The duration of the purge is dependent on the purge level dial setting.

5.14 PURGE INDICATING LIGHT

The purge indicating light is energized when CO₂ is being purged into the incubator chamber. The purge light will be energized for approximately 108 seconds when the purge dial is set at 5% purge.

5.15 CO₂ SAMPLE PORT

The sample port is used for checking CO₂ percentage by independent means, such as a Fyrite or similar CO₂ measuring device. The sample port should be tightly capped when not in use to prevent CO₂ loss to the atmosphere.

5.16 AIR PRESSURE GAUGE

The air pressure gauge indicates the air pump pressure in a range from 0 to 5 PSI.

5.17 BLOWER SWITCH

A two speed blower switch has been added to the unit to facilitate air flow in the incubator chamber to reduce the possibility of culture desiccation.

The switch is located behind the control panel, either on the right side of the control panel housing or on the right side of the component mount on the back of the hinged panel.

The switch has been factory-set to the high (up) position, but it may be turned to the low (down) position if there is a problem with the cultures drying up.

**WARNING: HIGH VOLTAGE IS PRESENT BEHIND THE CONTROL PANEL.
DISCONNECT THE UNIT FROM THE POWER SOURCE BEFORE OPENING THE PANEL
TO RESET THE SWITCH.**

SECTION 6 - OPERATION

6.1 POWER CONNECTION

Connect the unit to an adequate power source:

Model 3980: 220 Volts, 3 Wire, 17 FLA, 60 Hz.

Model 3986: 220/240 Volts, 2 Wire, 16-23 FLA, 50 Hz.

6.2 INITIAL SETTINGS

Main Power Switch.....	OFF
Temperature Controller.....	Desired Setpoint
Overtemp Thermostat	10 (Fully Clockwise)
Refrigeration Switch.....	OFF
Defrost Switch	OFF
Humidity Switch.....	OFF
Humidity Range Selector.....	Low Range
Humidity Controller.....	Fully Clockwise
Dehumidity Switch	OFF (Fully Clockwise)
CO ₂ Flowmeter	OFF (Fully Clockwise)
CO ₂ Purge Control	OFF (Fully Clockwise)

Turn the main power switch ON. The main power indicating light and the heat light should be energized. Turn the refrigeration switch ON. The refrigeration indicating light should be energized.

NOTE: Compressor may not switch ON if chamber temperature is less than 4° above or below ambient temperature.

6.3 HUMIDITY SYSTEM OPERATION

CAUTION! Do not operate the humidity system without water in the boiler. To do so will cause overheating of the boiler heaters, and the overtemp safety thermostat will shut down the system.

Following stabilization of the incubator temperature:

- 1) Set the humidity range selector to the desired range.
- 2) Set the humidity controller to the desired percent humidity.
- 3) Set the humidity switch to the ON position.

SECTION 6 – OPERATION (continued)

6.4 SETTING THE OVERTEMP SAFETY THERMOSTAT

Once the chamber temperature has stabilized, the overtemp thermostat should be set as follows:

- 1) Turn the overtemp control knob slowly counterclockwise until the audible alarm sounds and the overtemp indicating light is energized.
- 2) Turn the control knob clockwise approximately two increments on the arbitrary scale. The alarm should be silenced, and the overtemp indicating light should go out.

The overtemp thermostat is now set a few degrees above the control temperature setpoint. If chamber temperature should rise above operation setpoint, the alarm system will be activated and the temperature will be maintained at the overtemp setpoint.

Whenever the chamber temperature setpoint is changed, the overtemp thermostat must be reset to accommodate the change.

6.5 OVERVIEW OF HUMIDIFICATION AND CO₂

Of all the ways to measure incubator CO₂ levels, Forma's thermal conductivity method represents the best combination of economy, accuracy and reliability possible today.

Thermal conductivity of the incubator atmosphere is affected not only by the quantity of CO₂ present, but by the quantity of water vapor present in the incubator atmosphere as well. This effect is linearly related to the absolute humidity of the atmosphere (See graph on following page).

In monitoring the effects of CO₂, absolute humidity must be held constant so any change in thermal conductivity is caused only by a change in the CO₂ concentration. Under the worst circumstances, a change in absolute humidity could cause such a significant change in thermal conductivity that the controller could shift the CO₂ content by as much as 4%.

Maintaining the water level inside the incubator is a relatively simple procedure. We cannot emphasize strongly enough the importance of keeping the humidity in the incubator constant. Any water pan, used in lieu of flooding the incubator floor, must be stainless steel and at least 187 square inches of surface area. Our tests indicate that smaller pans, bowls or non-metallic pans do not provide adequate humidification, which can lead to incubator humidity variations with ambient humidity shifts, resulting in CO₂ changes in the incubator.

When operating a dry incubator, as opposed to a humidified one, ambient humidity fluctuations will affect CO₂ calibrations. Since the fluctuations possible in extreme ambient changes have less effect on the total absolute humidity, the CO₂ calibration can be affected by as much as 1.5%.

When a change in humidity or temperature is needed, the CO₂ control can be easily zeroed for the new condition.

One additional note: Temperature changes have little affect on CO₂ calibration, but do cause large changes in the absolute humidity which is reflected in changes in CO₂ calibration.

6.6 CO₂ SYSTEM OPERATION

- 1) Check the CO₂ percentage chart, and set the flow- meter to the desired level. The float ball indicates the level of the setting.
- 2) Set the CO₂ purge control to the desired percentage.
- 3) Turn on the CO₂ at the source.
- 4) Press and release the CO₂ purge button. The purge light should indicate that CO₂ is entering the chamber and the CO₂ percentage is rising to the desired level.

NOTE: The CO₂ purge button should be pressed to regain CO₂ percentage after each incubator door opening.

SECTION 7 - GENERAL MAINTENANCE

7.1 CLEANING

The chamber interior should be cleaned with alcohol and/or soap and water. The interior panels should be sterilized with a general use laboratory disinfectant. Information about disinfectants recommended by Forma Scientific, Inc. is included as a supplement to this manual.

The cabinet exterior may be cleaned with soap and water or a non-abrasive commercial spray cleaner.

The Thermopane glass door may be cleaned with commercial glass cleaner or with a solution of ammonia and water.

7.2 CLEANING STAINLESS STEEL

The continued cleanliness of the stainless steel utilized in Forma products has a direct effect on the appearance and operation of the unit.

WARNING! Do not use chlorinated solvents on stainless steel, as they can cause rust.

NOTE: The use of volatiles or aromatic solvents is not recommended for cleaning cabinet interiors, as residues could cause contamination of the chamber environment.

7.3 GENERAL INSTRUCTIONS

Use the mildest cleaning agents that will do the job effectively. To ensure maximum effectiveness and to avoid marring the surface, always rub in the direction of the finish polish lines. Be sure to rinse the surface thoroughly after every cleaning operation. To avoid watermarks, wipe the surface dry.

Use the following pages as a guide for specific cleaning problems.

CLEANING CHART INFORMATION

THE USE OF PROPRIETARY NAMES IS INTENDED ONLY TO INDICATE A TYPE OF CLEANER AND DOES NOT CONSTITUTE AN ENDORSEMENT, NOR IS OMISSION OF ANY PROPRIETARY CLEANSER TO IMPLY ITS INADEQUACY. IT SHOULD BE EMPHASIZED THAT ALL PRODUCTS SHOULD BE USED IN STRICT ACCORDANCE WITH INSTRUCTIONS ON THE PACKAGE.

IN ALL APPLICATIONS A STAINLESS STEEL WOOL, SPONGE, FIBROUS BRUSH OR PADS ARE RECOMMENDED.

AVOID USE OF ORDINARY STEEL WOOL OR STEEL BRUSHES FOR SCOURING STAINLESS STEEL.

CAUTION!

DO NOT USE STRONG ALKALINE OR CAUSTIC AGENTS. STAINLESS STEEL IS CORROSION RESISTANT, NOT CORROSION PROOF.

DO NOT USE SOLUTIONS OF SODIUM HYPOCHLORITE (PUREX, CLOROX ETC.), AS THEY MAY CAUSE PITTING AND RUST.

NOTE:

CLEAR WATER RINSING FOLLOWED BY WIPE-DOWN WITH SOFT CLOTH IS RECOMMENDED AFTER ALL CLEANING PROCEDURES EXCEPT WAXING.

STAINLESS STEEL CLEANING CHART

	CLEANING AGENT	APPLICATION	EFFECT ON FINISH
ROUTINE CLEANING	Soap, ammonia, or detergent & water.	Sponge with cloth then rinse with clear water and wipe dry.	Satisfactory for use on all finishes.
SMEARS AND FINGERPRINTS	Arcal 20, Lac-O-NU Lumin Wash, O-Cedar Cream Polish, Stainless Steel Shine.	Rub with cloth as directed on the package.	Satisfactory for use on all finishes. Provides barrier film to minimize prints.
STUBBORN SPOTS AND STAINS	Allchem concentrated Cleaner.	Apply with damp sponge or cloth.	Satisfactory for use on all finishes.
BAKED ON SPLATTER, AND OTHER LIGHT DISCOLORATIONS	<p>Samae, Twinkle, or Cameo Copper Cleaner.</p> <p>Grade FFF Italian pumice, whiting, or talc.</p> <p>Liquid NuSteel, Paste NuSteel or DuBois Temp.</p> <p>Copper's Stainless Steel Cleaner, Revere Stainless Steel Cleaner.</p>	<p>Rub with damp cloth.</p> <p>Rub with damp cloth.</p> <p>Rub with damp cloth. Use small amount of cleaner.</p> <p>Apply with damp sponge or cloth.</p>	<p>Satisfactory for use on all finishes if rubbing is light.</p> <p>Rub in direction of polish lines on finish. Use light pressure.</p> <p>Rub in direction of polish lines on finish. May scratch mill or polished finishes.</p> <p>Use in direction of polish lines on finish. May scratch mill or polished finishes.</p>

STAINLESS STEEL CLEANING CHART (continued)

	CLEANING AGENT	APPLICATION	EFFECT ON FINISH
TENACIOUS DEPOSITS, RUSTY DISCOLORATIONS INDUSTRIAL ATMOSPHERIC STAINS	Oakite #33, Dilac, Texe 12, Texe N.Y., Flash-Klenz, Caddy Cleaner, Turco Scale 4368, Permag 57.	Swab and soak with clean cloth. Let stand 15 minutes or more according to to directions on package. Rinse and dry.	Satisfactory for use on all finishes.
HARD WATER SPOTS AND SCALE	Vinegar 5% Oxalic Acid, 5% Sulfamic Acid, 5% to 10% Phosphoric Acid, Dilac, Oakite #33, Texe 12, Texe N.Y.	Swab or wipe with cloth. Rinse with water and dry. Swab or soak cloth. Let stand 10-15 minutes. Always follow with neutralizer rinse and dry.	Same as above. Same as above.
GREASE AND OIL	Organic solvents such as Acetone, Kerosene, Gasoline, and Alcohol.	Rub with cloth. Organic solvents may be flammable and/or toxic. OBSERVE ALL PRE- CAUTIONS AGAINST FIRE. BE SURE AREA IS WELL VENTILATED.	Same as above.

STAINLESS STEEL CLEANING CHART (continued)

	CLEANING AGENT	APPLICATION	EFFECT ON FINISH
HEAVY TINT OR DISCOLORATION	Penny-Brite or Copper-Brite.	Rub with dry cloth.	Use in direction of polish lines on finish. May scratch mill or polished finishes.
	Paste NuSteel, DuBois or Tarnite.	Rub with dry cloth or stainless steel wool.	Same as above.
	Revere Stainless Steel Cleaner.	Apply with damp sponge or cloth.	Same as above.
	Allen Polish, Steel Brite, Bab-O, Zud, or Wyandotte.	Rub with damp cloth.	Same as above.
BURNT-ON FOODS AND GREASE, FATTY ACIDS MILKSTONE	Easy-Off, DeGrease-It, 4% to 6% hot solution of such agents as trisodium phosphate, sodium tripolyphosphate, or a 5% to 15% caustic soda solution.	Apply generous coating. Allow to stand for 10-15 minutes. Rinse. Repeated applications may be necessary.	Excellent removal. Satisfactory for use on all finishes.

SECTION 8 – SERVICING (For Qualified Personnel Only)

CAUTION! All servicing must be performed by qualified maintenance and electrical personnel only. Always disconnect incubator from power source before beginning service procedures.

8.1 CHECKING AND RECALIBRATING THE DIGITAL TEMPERATURE CONTROLLER

A periodic check of temperature calibration is recommended to insure the accuracy of the controller.

To check the accuracy of the digital temperature controller, place an accurate calibrating thermometer inside the incubator chamber. Allow time for the temperature and thermometer to stabilize. If the temperature of the calibrating thermometer and the digital controller differ, recalibration is necessary. To recalibrate the controller:

- 1) Open the control panel.
- 2) Locate the temperature control circuit board. It is mounted directly behind the thumbwheel switch.
- 3) Locate the adjustment screw marked "Set Pot Span".
- 4) To raise the chamber temperature, turn the screw clockwise in small increments. To lower the temperature, turn the screw counterclockwise. Allow the temperature to stabilize between adjustments.

EXAMPLE: If the chamber temperature is measured at 37.8° C by a precision thermometer or indicating pyrometer, and the thumbwheel switch reads 34°C, turn the calibration screw to the left. This will lower the chamber temperature and will, with further adjustment, bring the temperature into alignment with the thumbwheel switch. Turning the screw to the right will raise the chamber temperature.

- 5) Allow the chamber temperature to stabilize, and re- check. Repeat Step 4 if necessary.

SECTION 8 – SERVICING (continued)

8.2 RECALIBRATING THE DIAL THERMOMETER

NOTE: Recalibration is necessary only if the dial thermometer is not giving an accurate reading.

- 1) Place an accurate thermometer in the center of the incubator chamber. Allow sufficient time for the temperature reading to stabilize.
- 2) Being careful not to scratch the surface, remove the plastic ring from the dial thermometer by snapping it off of the dial with a thin blade knife.
- 3) Determine difference between the thermometer reading and the dial indicator.
- 4) Hold the dial steady, and use a small screwdriver to turn the center calibration screw. Turn screw clockwise if dial is to be moved to left, and counterclockwise if dial is to be moved to right.
- 5) When thermometer has been recalibrated, replace plastic ring and cover.

8.3 RECALIBRATING THE HUMIDITY CONTROLLER

Recalibration of humidity controller is necessary only if the humidity in the chamber, as measured by a calibrating hygrometer, differs significantly from the reading on the humidity meter.

To recalibrate the humidity controller:

- 1) Open the control panel.
- 2) Set the temperature controller to 25°C.
- 3) Set the humidity range switch to LOW.
- 4) Locate the relative humidity indicator (rear of control panel), and disconnect wires from S-1 and S-2 on the indicator.
- 5) Connect a 685K Ohm resistor across S-1 and S-2. The humidity meter should read 20%; if not, adjust the bias adjustment on the control until the humidity meter reads 20%.
- 6) Remove the 685K Ohm resistor, and connect a 20.5K Ohm resistor in its place. The humidity meter should now read 50%; if not, adjust the span adjustment on the control until the humidity meter reads 50%.

- 7) Repeat Steps 4 and 5.
- 8) Place the humidity switch in the HIGH position.
- 9) Connect a 5.3K Ohm resistor across S-1 and S-2. The humidity meter should read between 68 to 70%; if not, repeat Steps 4 and 5.
- 10) Remove the 5.3K Ohm resistor, and connect a 1.3K Ohm resistor in its place. The humidity meter should now read between 98 to 100%; if not, repeat Steps 4 and 5.
- 11) If all meter readings are correct, the humidity system is now calibrated. Return the S-1 and S-2 wires to their original locations.
- 12) To adjust the humidity percent potentiometer so that it agrees with the humidity meter, follow the steps outlined below:
 - a) Set the humidity range switch to "HIGH".
 - b) Turn the humidity dial clockwise until the humidity meter reads 60%.
 - c) Carefully loosen the setscrews on the humidity percent potentiometer. Be careful not to move the setpoint.
 - d) Turn the loosened knob until it reads the same as the humidity meter.
 - e) Re-tighten the setscrews.
- 13) If you do not have access to precision resistors, a decade box with resistors and leads may be purchased from Forma Scientific, Inc.

8.4 REPLACING THE OVERTEMP PROBE AND THERMOSTAT

To replace the overtemp probe and thermostat:

- 1) Disconnect the unit from the power source.
- 2) Remove the incubator ceiling by extracting the four screws holding it in place.
- 3) Remove the top three screws from the top of the right duct cover.
- 4) Lean the duct sheet out, and remove the Permagum seal from around the probe access hole.
- 5) Remove the 15" copper capillary overtemp probe by extracting the two plastic clips that hold the probe in place.

- 6) Open the control panel.
- 7) Pull the overtemp probe up through the access hole and into the control panel.
- 8) Follow the wires from the probe to the thermostat mounted on the control panel. Clip the plastic ties holding the overtemp cable to the other wiring.
- 9) Locate the overtemp knob on the front of the control panel, and pull it off.
- 10) Remove the two screws that hold the overtemp assembly to the control panel.
- 11) Disconnect the two wires from the back of the thermostat assembly.
- 12) Pull the entire assembly out of the panel, and remove the unit.
- 13) Replace thermostat and probe with Forma part #270010.
- 14) Reseal the probe access hole with Permagum, and re-tie the overtemp cable to the other wires after replacing the probe.

8.5 REPLACING THE HUMIDITY SENSOR

To replace the humidity sensor:

- 1) Disconnect the unit from the power source.
- 2) Locate the probe mounting plate in the center of the right side of the incubator interior.
- 3) Open the mounting plate by removing the screws holding it in place.
- 4) Locate the humidity sensor mounted on the inside of the panel in a black housing. Note the angle of the probe.
- 5) Grasp the probe, and unplug it from the probe cable.
- 6) Replace the humidity sensor with Forma part #245055.
- 7) Mount the probe by reversing the above procedure. Be sure to mount the probe at the same angle as it was originally mounted.

8.6 REPLACING THE RELATIVE HUMIDITY INDICATOR

To replace the humidity indicator:

- 1) Disconnect the unit from the power source.
- 2) Open the control panel access door.
- 3) Remove the two wires on the back of the indicator.

NOTE: The red wire is connected to the plus (+) terminal, and the black wire is connected to the negative (-) terminal.

- 4) Remove the four bolts holding the unit in place.
- 5) Pull the indicator out of the control panel.
- 6) Replace the humidity indicator with Forma part #260083.

8.7 REPLACING THE (OPTIONAL) RECORDER AND PROBE(S)

To replace the recorder:

- 1) Disconnect the unit from the power source.
- 2) Open the incubator door, and remove the probe mounting plate attached to the center of the right interior wall.
- 3) Single pen recorders have only one long, stainless steel probe, attached to the lower end of the back of the mounting plate. Remove the probe by carefully sliding it out of the housing.

Dual pen recorders have the stainless steel probe plus a wet-bulb probe, attached to the back of the mounting plate. Remove the screws holding the mounting plate in place, and slide the wet bulb probe out of its housing.

- 4) Remove the ceiling of the incubator by removing the screws securing it in place.
- 5) Remove the top three screws on both edges of the right duct sheet.
- 6) Lean duct sheet out and remove Permagum seal from around the probe access hole.
- 7) Open control panel door, and remove Permagum from around the access hole.

- 8) Pull the probe(s) carefully up through the hole.
- 9) Trace probe cable(s) to back of recorder. Carefully clip plastic ties holding cable(s) to other wiring.
- 10) Remove three screws holding recorder in place, and carefully pull recorder from control panel.
- 11) Replace recorder with Forma part. See Section 2 (Auxiliary Equipment) for correct part number and description. When replacing recorder and probe(s), re-tie probe cable to other wires.

CAUTION! Use care when installing the recorder to avoid kinking the probe capillary tube. Kinking cap tube will render probe unusable.

8.8 REMOVING THE TOP SECTION

The following instructions are intended to provide a sequential plan for removing the top assembly from the 3900 Series Reach-In Incubator. It is sometimes necessary to remove the top when moving the incubator through low doorways.

OVERVIEW

The work area should be well lighted with adequate work space. A minimum of 12" above the overall height of the incubator is necessary to provide adequate room for removing the top section.

DISCONNECT THE POWER SUPPLY before proceeding. Also disconnect the inlet water supply, the drain line, and the CO₂ supply.

In order to remove the top assembly, the ten 5/16" x 4" hex bolts that secure the assembly to the main body of the cabinet will need to be removed. In addition, probes serving the various controls and/or instruments will need to be disconnected from the probe mounting bracket. Prior to lifting the top section from the incubator, a suitable support arrangement for the top must be provided. Carpenter's horses or other means should be provided so that the underside of the top (and capillaries) are suspended to prevent damage.

PROCEDURE

- 1) Remove all test materials from the chamber.
- 2) All temperature and/or humidity sensing probes are mounted on a probe mounting bracket located inside the incubator chamber. The bracket is secured to the duct sheet on the right side of the chamber. Remove the nuts, then remove the probes from the bracket. Note the location and positioning of the probes.
- 3) The sensing bulb capillaries are routed behind the duct sheet up to the access port at the top of the unit behind the control panel. Place all probes into the space between the duct sheet and the outside wall of the chamber so that when the top is raised, all probes will move freely up and out. Take care not to bend or kink the capillaries.
- 4) The humidifier boiler drain line (3/8" clear tygon tubing) is routed down through the access port and secured to the condensate drain tube on the center left side of the incubator (as viewed from the rear). To free this drain line, pull it away from the float tank, located behind the control panel, and route it down through the access port.
- 5) Open the control panel by swinging it out from left to right. It can be opened to a 90° position.
- 6) Loosen the top gasket around each of the air exhaust vents by turning the screw.
- 7) Remove the 8 screws from the top cover of the unit.
- 8) Remove the 4 screws from each of the vent caps located on the top cover of the incubator. The top cover can now be removed.
- 9) Remove the nine 5/16" x 4" hex head bolts, lockwashers, and two flatwashers that secure the top assembly to the cabinet. Note the washer arrangement on the bolts.
- 10) Remove the black trim gasket located at the juncture of the top assembly and the main incubator section. The ends of this gasket have been joined together at the rear of the incubator.
- 11) Carefully and slowly lift the entire top assembly up and off the lower chamber section. The top assembly and bottom chamber section separate where the black gasket was located. As the top assembly is lifted off, the capillaries and sensing bulbs will need to be carefully guided and threaded out of the chamber area.

The top assembly can be reinstalled by reversing the above procedure. Use care, however, particularly when:

- Placing and aligning the sealer gasket on the 1/2" flange on top of the incubator as the top is lowered in place.
- Routing the temperature and humidity sensors and capillaries to prevent bending or kinking.
- Mounting the temperature and humidity sensor bulbs on the mounting brackets.
- Tightening the top mounting bolts. Make sure the bolts are tightened alternately to insure a balanced pressure on the sealer gasket.

SECTION 9 - PARTS LIST

QTY	STOCK #	DESCRIPTION
1	940235	Thermometer, 2" Dial
2	901900	Pump, Air, Silent Giant
1	505087	Boiler, 3900 Series
1	475510	Door, 3900 Reach-In 36 x 65
1	434010	Gauge, Air, 5#
8	290113	Light, Pilot, 5/16 Red, 115V
1	285660	Knob, 2-1/4
1	285607	Switch, Toggle 3 PDT
2	285606	Switch, Toggle Switch SPST
1	285476	Switch, Digital Thumbwheel, 0 To 69.9°C
2	285422	Triac, 15A, 400 PIV
1	285081	Extension, Circuit Board, Kwik Purge
1	285020	Alarm, Sonalert, 110 VAC,
1	400073	Overtemp Thermostat Lo-Temp, Adjust
2	260122	Knob, Blue, 2-1/4" w/Skirt
1	260116	Triac, Temp Control, Digital
1	310028	Potentiometer, 5K Ohm, 2 Watt
1	260083	Indicator, Direct Read
1	260082	Controller, RH Relay
1	260081	Module, RH Indicator
2	260039	Switch, Toggle, DPST
1	255068	Switch, SPDT Toggle
1	255066	Switch, SPST Black
1	250190	Contact, 2 Pole, 25A 1
1	250079	Relay, Delay, 3-300 Second, 220V
1	250012	Relay, DPDT, 10A, 120V
1	245215	Probe, Temp Controller, Digital
1	116001	Hinge, Door, Bottom Rh-Rhs
1	116000	Hinge, Door, Top Rh-Rhs
1	54021	Gasket, Boiler 1/4 X 2 X 2 Silicon
1	131300	Wheel, Blower, Aluminum 6.28 x 3.5
2	630090	Heater, 600W, 115V

REVISION HISTORY

D. Goode - 10/18/88

Section 1, Put in new Receiving section

Section 2.3, Fixed typo "each-in" incubators

Section 4.2, Added distilled water specifications write-up

Section 6.4 and 6.5 switched around. Added 6.5 (pulled from 7003193) entitled "Overview of Humidification and CO₂"

Changed Index and Title Page accordingly & paged the report
Per R. Trotter/A. Porter