

Models Covered:
8877,8878,8879,8805,8808
18" Forma Fury Washer



Instruction Manual #7018877

IMPORTANT!

READ THIS INSTRUCTION MANUAL.

**FAILURE TO READ, UNDERSTAND, AND FOLLOW MANUAL
INSTRUCTIONS MAY RESULT IN DAMAGE TO THE WASHER,
INJURY TO OPERATING PERSONNEL, AND POOR WASHER PERFORMANCE.**

CAUTION!

**ALL INTERNAL ADJUSTMENTS AND MAINTENANCE MUST BE
PERFORMED BY QUALIFIED SERVICE PERSONNEL.**

JUNE, 1983

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SECTION 1 - INTRODUCTION

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1.1 STANDARD FEATURES

PUMP SYSTEM: Separate pumps are employed for wash and rinse cycles, distilled water rinses, and power draining. The 1/3 HP drain pump is connected to a selector switch on the control panel to provide the operator the option of draining the final rinse water or of retaining the final rinse water for use in the next wash program. Two screens protect the pumps from debris.

SPRAY SYSTEM: Two rotary spray arm assemblies are driven by water pressure. A uniform wall of high-pressure spray is projected at rates as high as 240 pulses per minute.

HEATING: Immersion heaters with built-in safety thermostats are used in the electrically heated machines (Models 8877, 8878, and 8808). Steam heated machines (Models 8877 and 8805) use either a stainless steel steam coil or a direct steam injection system.

DETERGENT DISPENSER: The automatic detergent dispenser is capable of using either liquid or powder detergent without mechanical adjustment.

AUTOMATIC HEADER VALVE: Each washer is equipped with a header valve at the rear of the wash chamber. The valve supplies a high-pressure water spray for optional spindle and pipette header racks. Water flow is partially diverted from the spray arms to the spindles for effective internal cleaning of specialized glassware such as volumetrics and narrow-necked flasks.

SAFETY OVERFILL DRAIN: A safety overflow drain helps to prevent chamber flooding in the event of a unit malfunction.

SAFETY INTERLOCK DOOR: Machine operation is stopped if the door is opened in mid-cycle. The cycle resumes when the door is closed.

BUILT-IN DISTILLED WATER SYSTEM: A built-in distilled water pump and an independent distilled water reservoir allow for one to three distilled water rinses. The distilled water reservoir is removable.

1.2 AUXILIARY EQUIPMENT

OPEN BASKETS are 18" square, all-purpose baskets for use with most types of glassware, including large-mouth bottles, funnels, and graduates (pharmaceutical, conical, or beaker-shaped).

Catalog #114062

MULTI-PURPOSE BASKETS are designed for use with odd-sized glassware which might otherwise require several different baskets. The baskets' uprights are fitted with nylon.

Catalog #114061

ERLENMEYER FLASK BASKETS are for holding flasks in an inverted position to allow for high-pressure spray access and drainage. One hundred twenty-five 250 or 500 ml flask sizes are acceptable with the 114054 basket. One liter or 32 oz. prescription bottles will fit into the 114055 basket.

Catalog #114054

Catalog #114055

TEST TUBE BASKETS will fit into open baskets to accommodate a variety of test tube types. Four 9" x 9" baskets will fit into the 114062 open basket.

Catalog #114063

ADJUSTABLE TOPS FOR TEST TUBE BASKETS are available to allow secure loading and to prevent breakage. Mounting clips are included with the tops.

Catalog #114095

SPINDLE FLASK SUPPORTS are designed to hold spindle mounted flasks in an upright inverted position for complete washing of flask interiors. Flask supports will accommodate flasks sized from 125 cc to 400 cc.

Catalog #140950.

SPINDLE TUBE SUPPORTS hold spindle mounted culture test tubes in an upright inverted position. These supports are intended for use with flasks smaller than 125 cc and for culture test tubes.

Catalog #140960

GENERAL PURPOSE SPINDLE SUPPORTS will hold a variety of glassware in an upright position for complete washing.

Catalog #140965

TRANSFER CARTS are fabricated from stainless steel, and cart running tracks will mate with tracks on the Forma Fury Glassware Washers and companion dryers. The carts are 23-3/4" square. Cart height is 37.4"

Catalog #8802

FORMULA I DETERGENT is a washing compound for use in hard water. Formula I will promote thorough rinsing and will not damage washer components with prolonged use.

25 lb. Pail

Catalog #13002

85 lb. Drum

Catalog #13003

MICRO-CLEAN WATER FILTERS will extend the life of plumbing connections by reducing mineral deposits and scale. Water filters are recommended for all new installations.

Replacement Cartridges Catalog #195020
Catalog #195111

TEST TUBE BASKET DIVIDERS will allow several varieties of test tubes to be washed simultaneously by dividing test tube baskets into four compartments. If four baskets are used, sixteen different types of test tubes may be washed in a single load.

Catalog #114071

PETRI-DISH BASKETS are designed to hold dishes at an angle for even washing and easy loading and removal. One basket will hold eighteen 22 mm x 100 mm complete dishes (tops and bottoms).

Catalog #144060

SPINDLE HEADER RACKS may be used in either Fury Glassware washers or companion dryers. The racks provide a high-pressure spray through 8" spindles for cleaning of narrow-necked and odd-shaped glassware. Three rack sizes are available:

# OF SPINDLES	MAX. DIA. GLASSWARE	CATALOG #
9	5.75"	162016
20	3.75"	162018
42	2.75"	162017

PIPETTE HEADER RACKS will hold a variety of standard glass pipettes for efficient forced wash and rinse cleaning. Pipettes as long as 20" may be accommodated and held at a 40 degree angle. The cannisters are removable from their mounting racks. Two cannister sizes are available:

Rack: Catalog # 162013
4" Square Cannister: Catalog #162015
6" Square Cannister: Catalog #162021

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SECTION 2 - SPECIFICATIONS

2.1 DIMENSIONS

Exterior: 69.4" H x 27.3" W x 29.1" D
Plus 23.5" Door Clearance
176.2 cm H x 69.3 cm W x 73.9 cm D
Plus 59.7 cm Door Clearance
Interior: 18" H x 18" W x 18"D
46 cm H x 46 cm W x 46 cm D

2.2 CONSTRUCTION

Exterior: 20 Gauge Grainline Stainless Steel
Interior: 18 Gauge Stainless Steel 2-B
Insulation: 1" Thick Fiberglass

2.3 TEMPERATURE CONTROL SETTINGS (Factory Preset)

Glass/Plastic: 140 Degrees F (60 Degrees C)
Glass Only: 190 Degrees F (88 Degrees C)

2.4 ELECTRICAL REQUIREMENTS

NOTE: Full Load Amps (FLA) will vary, depending upon the line voltage and motor loading.

Model 8877: 208/230 VAC, 1 Phase, 3 Wire (Requires Neutral) (Steam), 15 FLA Nominal
Model 8878: 208/230 VAC, 1 Phase, 3 Wire (Requires Neutral) (Electric), 60 Hz, 54 FLA Nominal
Model 8879: 208/230 VAC, 3 Phase, 4 Wire (Requires Neutral) (Electric), 60 Hz, 34 FLA Nominal
Model 8805: 220/240 VAC, 1 Phase, 2 Wire (Steam), 50 Hz
Model 8808: 380 VAC, 3 Phase, 4 Wire (Requires Neutral) (Electric), 50 Hz

SECTION 2 - SPECIFICATIONS

2.5 UTILITY CONNECTIONS

Hot Water Inlet: 3/4" FPT W/Strainer Supplied
Distilled Water Inlet: 1/4" MPT
Steam Inlet: 3/4" FPT W/ Strainer Supplied
Chamber Drain: 1" FPT
Overfill Drain: 1/2" FPT
Drip Trough Drain: 1/4" Close Nipple

2.6 PUMPS

Power Drain Pump: 1/12 HP
Distilled Water Rinse Pump: 1/3 HP
Main Wash/Rinse Pump: 1-1/2 HP

2.7 SHIPPING WEIGHT

475 Lbs. (217 Kg)

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3.1 PROGRAM PROCESSOR: GENERAL INFORMATION

Any sequence of pre-wash, wash, rinse, and distilled water (DW) rinse cycles may be selected on the program processor control panel. It is generally advantageous to select the sequence which satisfies the particular cleaning requirements while minimizing overall operating time. (See Section *.*).

The Program Processor is equipped with a nickel-cadmium battery which allows the programmed cycle sequence information to be retained if the door is opened in mid-cycle or in the event of a power failure. Under these circumstances, the sequence is resumed as soon as power is restored. However, if the power switch is set to OFF while the washer is in operation, the battery is disconnected, and the sequence is re-started at the beginning when power is restored.

The battery is re-charged through the washer's electrical system and does not require regular replacement.

3.2 POWER SWITCH

The power switch controls the on/off electrical power to the washer. It must be set to ON before the program sequence can be selected.

3.3 CYCLE SELECT SWITCH

When the cycle select switch is set to GLASS ONLY, the wash solution will be heated to 190 degrees F (88 degrees C) before the timed wash cycle is initiated. Wash cycle time as set on the timer is additive with the time required for heating the wash solution when the Glass Only setting is used.

When the switch is set to GLASS/PLASTIC, the wash solution will be heated to 140 degrees F (60 degrees C). Wash temperature is reached during the wash cycle itself when the switch is in this position.

3.4 START SWITCH

The start switch initiates the programmed sequence. It should be pressed only after the desired program has been selected.

3.5 CYCLE PILOT LIGHTS

Four pilot lights are located on the top area of the control panel:

The POWER LIGHT is activated when the power switch is in the ON position, and the washer is receiving power.

The FILL LIGHT is activated when the hot water solenoid valve is open, and the main reservoir is being filled. The fill light will only be activated during pre-wash, wash, and regular rinse cycles and is not activated during distilled water rinse cycles.

The HEAT LIGHT cycles with the electric immersion heater on the electric washers and with the steam solenoid on steam-heated washers. The heat light indicates heating of the wash solution, and it will only be activated during the wash cycle.

The DRAIN LIGHT is activated when the 1/12 HP power drain pump is operating. It indicates that the main reservoir is being drained.

3.6 PRE-WASH SWITCH AND TIMER

The pre-wash cycle switch allows for wetting of the wash load with hot water to facilitate cleaning. Pre-wash time may be set between 0 and 5 minutes. A light on the pre-wash switch indicates when the washer is in a pre-wash cycle.

3.7 WASH SWITCH AND TIMER

Wash time may be set for any duration between 0 and 20 minutes. When the selector switch is set to the Glass Only position, wash time as set on the timer begins after the solution has been preheated to 190 degrees F (88 degrees C). When the selector switch is set to the Glass/Plastic position, the wash solution is heated during the timed wash cycle. A light on the wash switch indicates when the machine is in the wash cycle.

3.8 FIRST & SECOND RINSE SWITCHES AND TIMER

Rinse time may be set for any duration between 0 and 20 minutes. When two rinse cycles are used, each rinse lasts for the amount of time indicated on the variable timer.

3.9 FIRST, SECOND, & THIRD DISTILLED WATER RINSES AND TIMER

Either one, two, or three distilled water rinses may be programmed on the program processor. Each rinse cycle will last the length of time set on the distilled water rinse timer (between 0 and 10 seconds).

NOTE: When more than one 10 second distilled water rinse is used, the distilled water inlet fill rate must be sufficient to supply approximately 9 gallons of water in less time than is required for the reservoir to drain and the following distilled water rinse cycle to begin. If the flow rate is not sufficient, the reservoir will not fill to the proper level for the next distilled water rinse cycle. See Section 4.4 for proper inlet pressure flow rate for providing three 10 second distilled water rinses.

3.10 FINAL DRAIN SWITCH

The Final Drain switch provides for power draining of the last rinse cycle. If the final drain switch is set to the OFF position, the final rinse water will be retained for use in the next pre-wash cycle. If a pre-wash is not to be used in the following cycle, or if only distilled water rinses are used, the final drain switch must be set to ON.

3.11 FLOAT LEVEL CONTROL

Separate float levels control the water level in the main reservoir and in the distilled water tank. The main reservoir float control is located in the reservoir itself and may be reached when the bottom panel on the wash chamber is removed. The distilled water level control is located in the distilled water tank.

If the float control is not oriented correctly, the reservoir will not fill, since the control will always signal the program processor that no solution is needed.

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4.1 LOCATION

Locate the washer on a firm, level surface adjacent to adequate water and drain facilities, a building exhaust vent, and an adequate power source.

Approximately 18 inches of clearance space must be allowed on each side of the washer, and 12 to 18 inches of clearance must be available behind the washer to allow access to the utility connections.

Adjust the washer feet to 3-1/2" to allow for the necessary washer height for the transfer cart (37-3/4" from the floor to the top of the rack track).

If a transfer cart is to be used with the washer, there should be 6 or 7 feet of aisle space in front of the machine to allow for sufficient space for the cart to be maneuvered in.

The washer must be level before operation. If the washer is not level, any of the following problems may result:

- 1) The washer door tracks may not be aligned with the transfer cart tracks.
- 2) Air may become entrapped in the main pump and cause the pump mechanism to be damaged.
- 3) On electrically heated machines (Models 8878, 8879, and 8808), the wash solution must cover the heating element or a safety switch will disconnect power to the heater. The likelihood of the safety switch being tripped is increased if the washer is not level. See Section 6.2 for information about the heater safety.

4.2 REMOVING THE CONTROL PANEL HOUSING

The washer may not fit through some narrow doorways. To facilitate the installation, it may be necessary to remove the control panel housing. TO REMOVE THE HOUSING:

- 1) Remove the back panel from the housing by removing the screws holding it in place.
- 2) Remove the screws holding the housing to the main unit.
- 3) Remove the front panel (below the door) of the washer by removing the screws beneath the panel and lifting the panel off.

- 4) Unplug the wire harness.
- 5) Lift the housing up and off the brackets.
- 6) Reverse the above procedure to replace the housing.

4.3 CONNECTING THE HOT WATER SUPPLY

The hot water supply furnishes water for the pre-wash, wash, and regular rinse cycles.

The hot water inlet is the top connection located on the left side at the back of the machine. A 3/4" MPT connection is required.

A 40-mesh wire strainer (40 wires per inch) is supplied with the washer for use with the hot water inlet. THIS STRAINER MUST BE INSTALLED BETWEEN THE WATER LINE AND THE INLET WITH THE ARROW ON THE STRAINER POINTING IN THE DIRECTION OF THE WATER FLOW. Failure to install the strainer correctly may void the warranty on the hot water solenoid valve.

NOTE: Two strainers have been supplied with the Model 8877 washer, one for the hot water inlet and one for the steam inlet. The hot water strainer is T shaped, and the steam inlet strainer is Y shaped. Make sure that you have the correct strainer for the connection.

The hot water supply must be capable of providing a flow rate of 6 to 10 gallons per minute without allowing pressure drops greater than 10 PSIG in the supply line. The hot water pressure should be at least 40 PSIG and not more than 80 PSIG. Water temperature should not be less than 140 degrees F (60 degrees C).

NOTE: If plasticware is to be washed, the inlet water temperature should not exceed 150 degrees F (66 degrees C).

With a water pressure of 50 PSIG or more, each fill will require 90 seconds or less given a 6 to 10 GPM flow rate.

It is strongly recommended that the water line be flushed before connection is made. If the line is not flushed, particles in the line may accumulate in the strainer, and the effective flow rate of the line may be reduced. Flushing the hot water line is especially advisable if the washer is installed at a new construction site.

A manual shut-off valve should be installed in the hot water line for service purposes.

4.4 CONNECTING THE DISTILLED WATER SUPPLY

NOTE: Purity of the distilled water used in the washer must be within the 50K ohm to 1 Meg 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 will void the warranty.

The distilled water inlet is the second connection from the top on the left side at the back of the washer. A 1/4" FPT connection is required.

During a 10 second distilled water rinse, as much as 9 gallons of water will be used. The distilled water reservoir has a capacity of approximately 9.5 gallons. Thus, for example, the distilled water supply requirement of 4 loads per hour is 36 GPH (assuming one distilled water rinse per load).

In general, maximum distilled water usage requirements may be calculated by the following formula:

Required GPH = 9 x Number of Loads per Hour

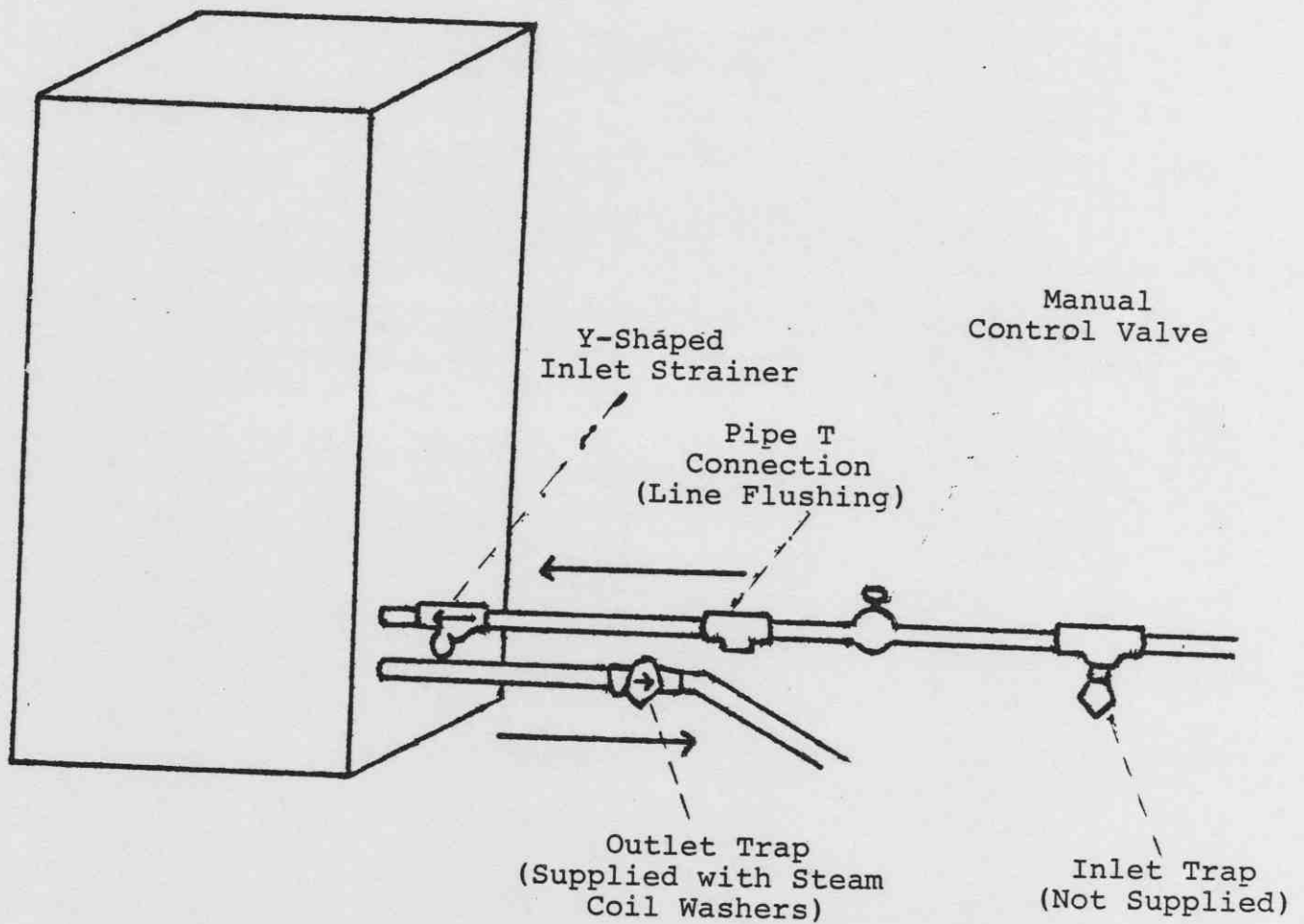
To provide an adequate cycle rate, the distilled water must be supplied at a pressure of at least 30 to 40 PSIG. The pressure should not exceed 80 PSIG. If these pressure levels are not attainable, an electric booster pump is recommended.

4.5 CONNECTING THE STEAM SUPPLY (Models 8877 and 8805 Only)

Two types of steam heating are possible with the Fury Washer: direct steam injection and steam coil. Of these, direct steam injection will provide the more rapid heating of the wash solution. Maximum cycle rates with the steam coil option may be achieved by the addition of a booster heater at the hot water inlet. Booster heaters are generally capable of increasing inlet temperature to approximately 180 degrees F (82 degrees C).

NOTE: Direct steam injection can only be used when a clean steam supply is available. Also, when direct steam injection is used, a steam outlet drain is unnecessary.

4.5 CONNECTING THE STEAM SUPPLY (Diagram)



In addition to the inlet condensate trap, it is recommended that a pipe T-connection be installed in the steam feed line to allow for periodic flushing of the line. (Note the position of the connection in the diagram.)

Connecting a manual control valve in the steam inlet line is also recommended for service purposes. (Note the position of the valve in the diagram.) The valve may be used in conjunction with the T-connection to flush the line.

WITH DIRECT STEAM INJECTION, steam should be supplied at a minimum rate of 7.5 lbs. per minute, and pressure must be maintained at a minimum level of 20 PSIG. Approximately 30 lbs. of steam are required for each load.

WITH STEAM COIL HEATING, steam should be supplied at a minimum rate of 3 lbs. per minute, and steam pressure should be maintained at a minimum level of 40 PSIG. Approximately 35 lbs. of steam are required for each load.

A 100-mesh (100 wires per inch) Y-shaped strainer has been supplied with the steam heated washers. This strainer MUST be installed between the steam source and the steam inlet with the arrow on the strainer pointing in the direction of the steam flow. FAILURE TO INSTALL THE STEAM STRAINER CORRECTLY MAY VOID THE WARRANTY ON THE STEAM SOLENOID VALVE.

To insure steam dryness in the inlet line, it is recommended that a steam condensate trap be installed in the feed line at a distance of 10 feet or less from the steam inlet. If this condensate trap is not installed, water may accumulate in the steam line which will cause the wash cycle heating time to be increased.

THE CONDENSATE TRAP IS NOT FURNISHED WITH THE MACHINE AND MUST BE SUPPLIED BY THE CUSTOMER. Do not confuse the inlet trap with the steam outlet trap which IS supplied with the washer.

The steam inlet is the second inlet from the bottom on the connection plate on the back of the washer. A 3/4" MPT connection is required when the steam strainer is connected to the steam inlet.

See the diagram on the following page for suggested piping for the steam system.

4.6 CONNECTING THE STEAM EXHAUST VENT

The steam exhaust vent should be connected directly to a building exhaust duct. A damper must be installed between the duct and the vent to restrict the rate of air flow through the wash chamber.

The vent bellows (and the extension to the building duct) must be positioned so there are no low spots where condensate can accumulate.

4.7 CONNECTING THE CHAMBER DRAIN

The chamber drain functions to drain the machine reservoir at the end of each cycle, unless the final drain switch is left off, in which case the final rinse water will be retained for use in the following pre-wash cycle.

The chamber drain must not be directly connected with any other drain line.

The chamber drain is located on the right side at the rear of the washer. It is the second drain from the top. A 1" MPT connection is required.

4.8 CONNECTING THE OVERFILL DRAIN

The lower drain on the right side at the rear of the unit is the overflow drain. This drain functions to maintain the main reservoir water level at the proper height in the event of abnormal conditions. A 1/2" MPT connection is required.

NOTE: The main drain into which overflow and chamber drains empty should be located as close to the machine as possible, and not farther away than 15 feet. The main drain must be open, free-flowing, and capable of handling a momentary flow rate of 25 GPM.

Drain lines from the washer must be positioned no more than 18" above the machine base.

4.9 CONNECTING THE DRIP TROUGH DRAIN

Although all installations will not require the connection of the drip trough drain, it is recommended that the drain be connected if the washer is to be run constantly and a trickle of water drips from under the door. A 1/4" close nipple (capped) is provided for the connection of the drip trough drain should the use of the drain become necessary. The drain line may be run separately, or it may be connected with a tee fitting to the overflow drain. **DO NOT CONNECT THE DRIP TROUGH DRAIN TO THE CHAMBER DRAIN!**

4.10 CONNECTING THE STEAM OUTLET DRAIN (Model 8877, Steam Coil Only)

The steam outlet is located on the left side at the rear of the washer. A 1/2" MPT connection is required.

A steam trap has been supplied with steam coil equipped washers. To maintain adequate back pressure in the steam coil while draining the steam condensate, the trap must be installed in the steam outlet (or return) line, with the arrow on the trap pointing in the direction of the flow.

Trap operation is governed solely by the difference in density of steam and water. The back pressure in the outlet line has no effect on the ability of the trap to open for condensate and close against steam.

The trap discharge line should run downhill to permit gravity drainage when no pressure exists in the coil.

4.11 RACK ADJUSTMENTS

If additional basket carrier racks or optional header racks have been purchased, they must be adjusted so that pressure exerted by the door on the rubber bumper at the front of each rack maintains pressure between the rack and header fittings. The header fitting at the right rear corner of the wash chamber allows full water pressure to be channeled to the spray arms when a basket carrier rack is used. It also allows jet spray water to be channeled through either spindles or pipette cannister when header racks are used.

A hex wrench (Forma Stock #68060) has been shipped with the washer so that the customer may make the necessary rack adjustments. Pressure is controlled by the position of the rubber bumper fitting located on the right front side of each rack.

Adjust the rubber bumper fitting by means of the set screws on the rack, so that when the rack is positioned tightly against the header fitting in the washer, the bumper extends approximately 1/16" behind the imaginary plane of the door gasket. The measurement may be made by placing a straight edge across the door gasket.

4.12 ELECTRICAL CONNECTIONS

All electrical connections must be made by a qualified electrician in accordance with local electrical codes.

For facilities wired with a high-leg delta system, the high-leg must be connected to the wire labeled L2 in the electrical connection box.

See Section 2.4 or the electrical data plate mounted on the unit for exact electrical specifications.

4.13 CHECKING MOTOR ROTATION (Model 8808 Only)

The direction of motor rotation for the main wash/rinse pump motor must be checked by a qualified electrician after the electrical connections have been made and before normal operation is initiated.

Use the following procedure to check the motor rotation:

- 1) Remove the front access panel and the right side panel from the machine without disturbing the program processor connections.
- 2) Locate the motor starter enclosure box mounted on the right side immediately behind the front access panel. A reset button is mounted on the front of the box.
- 3) Remove the front cover from the enclosure box by removing the screw at the bottom of the cover plate.
- 4) With the cover plate removed, observe the two push buttons located at the top area of the assembly. When pressed, the left (black) button completes the motor starter circuit and engages the main pump motor. The right button will break the circuit completed by the operation of pressing the left button.

To check the direction of motor rotation, momentarily press the left button, and note the direction of rotation (viewing from the right side of the washer). The correct direction of rotation is indicated by the arrow on the pump housing. Motor rotation must be counterclockwise when facing the pump housing.

- 5) If the direction of rotation is reversed, reverse L1 and L3 connections in the main electrical connection box at the rear of the machine.

4.14 TEMPERATURE SETTING ADJUSTMENT

When the washer is installed where elevation is between sea level and approximately 1000 feet, the temperature of the wash solution for the Glass Only cycle must not exceed 190 degrees F (88 degrees C). At elevations above 1000 feet, the Glass Only temperature control may require re-adjustment to prevent pump cavitation. The control should be set for a maximum temperature of 180 to 182 degrees F.

For temperature control re-adjustment instructions, see

Section 6.1 of this manual.

4.15 SELECTING A BASKET OR HEADER RACK

If the glassware items are other than narrow-necked, an open basket will generally be suitable. Beakers, wide-mouth bottles, test tubes, and wide-mouth flasks are best washed in an open basket. For petri-dishes, a petri-dish basket is specifically recommended. A multi-purpose basket is recommended for odd-sized, wide-mouthed objects.

Narrow-necked items are most efficiently washed with a spindle header rack. Supporting each piece with a spindle support is strongly recommended. General purpose spindle supports, spindle tube supports, and spindle flask supports are available.

Additional information about specialized baskets and header racks is provided in Section 1.2 of this manual.

4.16 LOADING THE DETERGENT DISPENSER

The automatic detergent dispenser, located in the upper right corner of the wash chamber, is designed to accept either liquid or powder detergents. Detergent placed in the removable cup of the dispenser is flushed from the cup for approximately 22 seconds after the reservoir is filled for the wash cycle.

To load the detergent dispenser, pull the bottom cup from the three flexible supports on the dispenser fitting, and fill the cup. Initially the cup should be filled about 1/3 full for test purposes. More or less detergent may be required for the most economical operation of the washer, depending on detergent brand type, type of soiling, and the size of the load.

Formula I (Forma Stock #13002, 13003) is a good alkaline detergent for effective cleaning of most biological soils. Use 2-1/4 ozs. per load.

Other detergents are acceptable as long as they are of the non-foaming variety.

4.17 LOADING THE GLASSWARE

When an open basket is used, glassware should be positioned at an even height in the center of the load. The outside corners of each load should be slightly higher than the center to provide stable support for the hold-down screens. The use of hold-down screens with open basket loads is mandatory to prevent breakage.

When a spindle header rack is used, support clips are strongly recommended. The clips will provide for an even load height, will minimize the possibility of breakage, and will decrease the time required for thorough cleaning.

In general, less time is required for an open basket wash than for a header rack wash.

4.18 PROGRAMMING AND CYCLE TIME OPTIMIZATION

The best method for optimizing cycle time is to experiment with a set of programs when load type and degree of soiling is generally consistent. Overall cycle sequence time should be recorded for each load.

A suggested procedure is as follows:

- 1) Set the desired cycle switches to the ON position, and set the cycle select switch for the Glass/Plastic position. Set wash time at 6 minutes, rinse time at 1 minute, and distilled water rinse time at 10 seconds. Wash one load, and examine the glassware for cleanliness.

If the glassware is clean, proceed to Step 2, and follow the procedure sequence until cleaning is obtained. If the cleaning is unsatisfactory after following Step 1, use step 1A, and then proceed through the sequence beginning with Step 2 until unsatisfactory results are again obtained.

- 1A) Set the cycle select switch to the Glass Only position, and set all other control switches as in Step 1. Check the glassware for cleanliness.
- 2) Set the pre-wash switch to the OFF position.
- 3) Reduce the wash time. (You may choose to repeat this step before proceeding with Step 4.)
- 4) Eliminate the second regular rinse cycle.

NOTE: If a distilled water rinse is not required, the DW rinse switch may, of course, be set to the OFF

position at the onset of the optimization test.

After the optimum cycle sequence time is determined, increase the wash time slightly to provide a safety margin for load variability, and record the control settings along with a description of the load type.

4.19 CHECKING THE SERVICE VALVES

All manual service valves installed in the inlet lines should be closed when the washer is not in use to avoid unnecessary wear on the solenoid valves.

SECTION 5 - ROUTINE MAINTENANCE

Table of Contents

- 5.1 Cleaning the Hot Water Strainer
- 5.2 Cleaning the Steam Strainer
- 5.3 Cleaning the Door Gasket
- 5.4 Cleaning the Screens
- 5.5 Cleaning the Wash Chamber

5.1 CLEANING THE HOT WATER STRAINER

The hot water strainer should be cleaned two weeks after the washer is installed and once every three months thereafter. The strainer should also be examined and cleaned whenever delayed fill times are noticed.

TO CLEAN THE STRAINER:

- 1) Shut off the hot water supply at the source.
- 2) Remove the plug from the bottom arm of the strainer, and remove any collected sediment from around the plug.
- 3) If the screen itself requires cleaning, scrub it with a fiber brush, and flush the mesh with water.

When replacing the screen, be sure that no dirt is trapped in the strainer fitting itself. Also replace the teflon tape around the threads of the fitting, and make sure that no teflon remains in the strainer.

5.2 CLEANING THE STEAM STRAINER (Models 8877 and 8805 Only)

The steam strainer should be cleaned two weeks after the washer is installed and once every three months thereafter. Check and clean the strainer whenever delayed heating is noticed.

TO CLEAN THE STRAINER:

- 1) Shut off the steam supply at the source, and allow about 10 minutes for the steam in the strainer to condensate.
- 2) Remove the plug on the side arm of the strainer, and remove any sediment from around the plug.
- 3) Check the screen itself by removing the machine bushing from the arm. The screen is connected to the bushing.
- 4) If cleaning is required, scrub the screen mesh with a fiber brush, and flush with water.

When replacing the screen, be sure that no deposits are present in the fitting. Replace the teflon tape around the threads of the fitting, and make sure that no teflon remains in the fitting.

5.3 CLEANING THE DOOR GASKET

The door gasket should be cleaned with a soft cloth and a non-abrasive cleaner whenever substantial amounts of deposit accumulate.

5.4 CLEANING THE SCREENS

There are two screens in the washer. The ROUGHING SCREEN is located directly below the spray arms, and the FINE SCREEN is located at the bottom of the main reservoir. The fine screen is visible when the roughing screen is removed.

It is strongly recommended that both screens be cleaned once every eight hours of continuous washer operation. If the glassware soil contains a high proportion of insolubles, it may be necessary to clean the screens more often.

Remove the screen, and clean by flushing with water and scrubbing with a fiber brush if necessary.

5.5 CLEANING THE WASH CHAMBER

To clean the wash chamber, use the following procedure:

- 1) Make sure that the main reservoir has been drained. If the reservoir has not been drained, set all cycle control switches to OFF, except the final drain switch, and press the start button. After the reservoir has drained, turn the power switch OFF.
- 2) Remove the rack from the chamber.
- 3) Remove the spray arms by rotating the base counter-clockwise, and remove the roughing screen and bottom chamber panel.
- 4) Leaving the fine strainer in place, clear all the debris from the main reservoir.

NOTE: Do not clean any part of the wash chamber with a ferrous type pad (e. g. steel wool), as iron will leave small deposits which may produce rust in the chamber.

- 5) Remove the ball float level control, and clean the area underneath the control in the float level housing. When removing the ball, mark the top side with a piece of tape so that the ball may be re-installed in the same orientation. If the ball is replaced in a reverse orientation, the reservoir will not fill. Although the writing may not be readily visible, the upper side of the ball should read "Normally Open" when the ball is in the correct position. ALWAYS MARK THE BALL BEFORE REMOVING IT.
- 6) If the washer is electrically heated (Models 8878, 8808, and 8879), clean the heating coil with a non-ferrous abrasive pad. Cleaning the coil is easier if the element is washed with vinegar and is allowed to soak while the rest of the machine is being cleaned.
- 7) Remove the end plugs from the spray arms, and clean the arm interiors with a fiber brush. The plugs are removed by extracting the nut from one end of the arm and then pulling the rod through the arm from the other end to free the plugs. Note that the nut can be removed from only one end of the arm. Also inspect the spray holes, and remove any trapped material with a piece of wire.
- 8) Remove the fine strainer screen, and clean the screen and the area underneath it.

For cleaning lime deposits and accumulated scale, a phosphoric acid based cleaner is recommended. LIME-A-WAY (manufactured by Economics Laboratory, Inc.) or a similar type of lime descaler is specifically recommended.

CAUTION! Do not have glassware in the washer during this procedure.

WARNING! DO NOT MIX THE CLEANER WITH REGULAR GLASS-WARE DETERGENT.

TO DESCALE THE WASHER:

- 1) Set the pre-wash switch to OFF.
- 2) Set the distilled water rinse switches to OFF.
- 3) Set the wash timer to 20 minutes.

- 4) Set rinse time at 5 minutes. Two rinse cycles are necessary to insure complete flushing of the solution.
- 5) Allow the washer to fill, and open the door.
- 6) Add two ounces of Lime-A-Way to the wash water.
- 7) Allow the washer to finish the wash and rinse cycles.

SECTION 6 - SERVICE

Table of Contents

- 6.1 Temperature Control Setting Adjustment
- 6.2 Resetting the Heater Safety
- 6.3 Replacing Pump Seals
- 6.4 Program Processor
- 6.5 Troubleshooting Guide

CAUTION! SERVICE PROCEDURES SHOULD BE PERFORMED BY QUALIFIED SERVICE PERSONNEL ONLY!

6.1 ADJUSTING THE TEMPERATURE CONTROL SETTING

Unless a remote temperature indicating instrument is available, the wash solution temperature must be measured with a thermometer placed at the bottom of the main reservoir, under the roughing screen.

To make an accurate initial measurement, set the Program Processor for the wash cycle, and set wash time at approximately 15 minutes. Secure the thermometer or remote probe in the main reservoir under the roughing screen, and close the door. When the heat light cycles, take a temperature reading. The temperature for both the Plastic setting (140 degrees F) and the Glass setting (190 degrees F) should be checked. If either control setting requires adjustment, use the following procedure:

- 1) Access the temperature adjustment potentiometers by swinging the control panel out. Locate the controls, behind the hole plugs, on top of the control panel. As viewed from the front of the control panel, the left adjustment is for the Glass cycle (preset at 190 degrees F), the right adjustment is for the Plastic cycle (preset at 140 degrees F).
- 2) Using a small slotted screwdriver, adjust the settings as required by rotating the potentiometer controls. Clockwise rotation decreases the temperature setting. One full revolution of either control changes the temperature setting approximately 15 degrees (8.3 degrees C).
- 3) Wait for about three minutes, then check the new temperature setting with the thermometer or remote indicator. Repeat Steps 2 and 3 as required.

IMPORTANT! When the washer is installed in an area where the elevation is between sea level and 1000 feet, wash solution temperature must not exceed 190 degrees F (88 degrees C), or the main wash/rinse pump may cavitate. In elevations above 1000 feet, the Glass setting may require adjustment to prevent pump cavitation.

6.2 RESETTING THE HEATER SAFETY SWITCHES

On electrically heated machines, each heater is equipped with an automatic safety switch which disconnects power to the heater if the element overheats.

Two conditions are likely to cause overheating and trip one or both of the safety switches:

- 1) The wash solution does not cover the heating element(s). This situation often occurs if the machine is not level, or when the float level control in the main reservoir is inoperative.
- 2) Deposits on the heating element(s) are preventing adequate heat exchange between the coil(s) and the wash solution.

Both heater safety resets are mounted on the underside of the wash chamber. The front panel and the right side panel of the washer must be removed to reach the resets.

The safety reset for the 10KW heater is housed in the octagonal electrical box mounted on the left front side of the chamber bottom. An access hole at the front of the box is provided for setting the safety mechanism.

The safety reset for the 5KW heater is housed in the octagonal electrical box mounted on the right front side of the chamber bottom. An access hole at the right side of the box is provided for setting the safety mechanism.

ALWAYS DISCONNECT THE WASHER FROM THE MAIN POWER SUPPLY BEFORE ATTEMPTING TO RESET EITHER OF THE SAFETY SWITCHES!

RESET THE SAFETIES WITH A PENCIL OR OTHER NON-CONDUCTION DEVICE.

NOTE: When heating time is excessive, the heater safety switches may be tripped as a result of water loss through the overflow drain. This situation will only occur if the hot water inlet temperature is

6.3 REPLACING THE PUMP SEALS

Seal replacement instructions for the main wash/rinse pump are included as a supplement at the rear of this manual. Pump leaks are usually the first indication of a defective or worn seal.

TO REPLACE DRAIN PUMP SEAL:

- 1) Disconnect the unit from the power source, and remove the pump from its mounting in the washer.
- 2) Remove the four screws connecting the plastic pump cover.
- 3) Remove the pump impeller by placing a screwdriver in the slot of the motor end of the pump shaft to restrain the shaft, and unscrew the impeller. The impeller is threaded onto the shaft.
- 4) The pump seal is mounted behind the impeller. Remove the seal, and replace it if necessary.

TO REPLACE THE DISTILLED WATER PUMP SEAL:

- 1) Disconnect the unit from the power source, and remove the pump from its mounting in the washer.
- 2) Remove the screws connecting the pump cover, and carefully remove the gasket behind the cover. If the gasket is worn or broken, it should be replaced.
- 3) Remove the pump impeller by restraining the shaft at the motor end of the pump and unscrewing the impeller. The carbon-ceramic seal on the back of the impeller should be inspected for wear and be replaced if necessary. It may be necessary to use a screwdriver or similar device to free the seal from behind the impeller.

All three pumps are permanently lubricated.

To locate the pumps, see Drawing #8877-62-0-D at the back of this manual.

6.4 PROGRAM PROCESSOR

If the Program Processor malfunctions:

- 1) Disconnect the unit from the power supply.
- 2) Remove the four screws securing the control panel.

- 3) Remove the front washer panel, and carefully unplug the connector on the back of the processor.
- 4) Return the Program Processor to Forma Scientific for replacement or repair.

6.5 TROUBLESHOOTING GUIDE

PROBLEM: Chamber fills constantly during a cycle.

- POSSIBLE CAUSES:
- a) Drain pump is clogged or inoperative.
 - b) Chamber drain line is blocked or line does not allow for adequate flow rate.
 - c) Program Processor malfunction.
 - d) Main fill (hot water) solenoid is inoperative.
-

PROBLEM: Chamber or DW tank fills slowly or not at all.

- POSSIBLE CAUSES:
- a) Float level control in main reservoir is upside-down or inoperative.
 - b) Hot water strainer is clogged.
 - c) Hot water fill or DW solenoid valves not working properly.
-

PROBLEM: Wash solution is not heating or is slow.

- POSSIBLE CAUSES: (Models 8878, 8879, 8808)
- a) Heater safety reset switch has been tripped.
 - b) Heaters not receiving adequate line voltage - check building circuit breaker.
 - c) One or both temperature controls on Program Processor defective.
 - d) Rate of air flow through steam vents is too great.
- (Models 8877, 8805)
- a) Steam strainer is clogged.
 - b) Steam solenoid valve defective.

- c) One or both temperature control adjustments in Program Processor defective.
 - d) Steam line service valve is closed.
 - e) Steam supply improperly connected to machine.
 - f) Rate of air flow through steam vents is too great.
-

PROBLEM: Incomplete or uneven cleaning.

- POSSIBLE CAUSES:
- a) Spray arm nozzles are clogged.
 - b) Rack improperly adjusted.
 - c) Debris trapped in main wash/rinse pump.
 - d) Roughing and/or fine screen clogged.
 - e) Detergent not suitable for soil type.
 - f) Cycle sequence inappropriate for degree of soiling.
 - g) Chamber drain is connected directly to overflow drain.
 - h) Debris trapped in main pump discharge check valve, located on output side of the main pump.
 - i) Glassware improperly loaded, so that items near the corners are not receiving enough spray.
-

PROBLEM: Excessive amount of glassware being broken.

- POSSIBLE CAUSES:
- a) Glassware improperly loaded.
 - b) Rack improperly adjusted, so spray is coming from header fitting.

- c) Chamber drain connected to overfill drain.
 - d) Too much water pressure from main wash pump.
-

PROBLEM: Detergent not dispensed properly.

- POSSIBLE CAUSES:
- a) Detergent dispenser solenoid valve is defective.
 - b) Hot water strainer is clogged.
 - c) Hot water pressure too low.
-

PROBLEM: Washer will not start the cycle sequence.

- POSSIBLE CAUSES:
- a) Safety interlock on door is broken or door is not completely closed.
 - b) Program Processor fuse is blown.
 - c) Program Processor is malfunctioning.
 - d) Power switch is off.
 - e) Washer not receiving power.
-

PROBLEM: Program cycles are skipped in the sequence.

- POSSIBLE CAUSES:
- a) Program Processor defective.
 - b) Excessive line voltage spikes are occurring.
-

PROBLEM: Programmed cycle sequence is restarted at the beginning after a short power failure or after the door is opened.

POSSIBLE CAUSE: a) Rechargeable battery in Program Processor is defective.

PROBLEM: Wash chamber will not drain.

POSSIBLE CAUSES: a) Debris trapped in drain pump.
b) Drain pump motor not functioning.
c) Washer not level.
d) Debris trapped in strainer(s).

PROBLEM: The door leaks.

POSSIBLE CAUSES: a) Door will not go completely down, or safety interlock is broken.
b) Rack is improperly adjusted.
c) Washer not level.
d) Door not correctly adjusted in respect to guide tracks.
e) One of the door-lift cables has slipped from pulley.

PROBLEM: Door will not open smoothly.

- POSSIBLE CAUSES:
- a) Counter-weight guide bars require lubrication.
 - b) Rack improperly adjusted.
 - c) Washer not level.
 - d) Door not properly adjusted in respect to guide tracks.
-

PROBLEM: Wash chamber overfills.

- POSSIBLE CAUSES:
- a) Float level control in main reservoir does not move freely on its axis, or switch is defective.
 - b) Wash chamber level relay not working.
 - c) Main fill (hot water) and/or DW solenoid valves not working properly.
-

PROBLEM: Leaks are detected in area below wash chamber.

- POSSIBLE CAUSES:
- a) One or more of pump seals need replacement.
 - b) One of hose clamps or hose connection fittings need to be tightened or replaced.
-

PROBLEM: Washer appears to be operating under pressure.

POSSIBLE CAUSE: a) Steam exhaust vents are restricted and air exchange is insufficient.

RECOMMENDED SPARE PARTS

Model 8877/8878

The following is a list of recommended spare parts to have on hand for when the need arises. The items included are parts that routinely may have to be replaced.

QUANTITY	STOCK #	DESCRIPTION
1	114069	Stainless Steel Cone, 24 Mesh
1	975030	3/4 FPT Brass Valve, 115V
1	970060	3/4 FPT BRZ Strainer, 40 Mesh
1	184005	#H-413 Repair Kit; Includes Gasket, Impeller, and Volute
1	184006	#10700 Repair Kit; Includes Gasket, Impeller, Seal Seat, Wear Face, and Seal
1	184001	#8355 Snap-In Shaft Seal and Liner Repair Kit
1	285461	Stainless Steel Level Switch, 1/4 MPT
1	960115	1-1/2 MPT Nylon CV W/HDSPG
1	620810	Immersion Heater, 10KW, 240V, 3 Phase W/Thermal Cut-Out
1	851610	Program Processor Control Panel, Solid State

8877/8878 PARTS LIST

ASSEMBLY

QUANTITY	STOCK #	DESCRIPTION
1	184501	1/3 HP Plastic DW Pump 115V, 60 Hz, 1 Phase
1	975040	1/4" FPT Stainless Steel Solenoid Valve, 115V, 50-60 Hz
1	255067	SPDT Micro Switch
1	970060	3/4" FPT Bronze T Strainer 40 Mesh
1	975030	3/4" FPT Brass Solenoid Valve 115V, 50-60 Hz
1	975010	1/4" FPT Brass Solenoid Valve 115V, 50-60 Hz
1	990508	1-1/2 HP Bronze Wash Pump 220V, 60 Hz
Opt	901625	1-1/2 HP Stainless Steel Pump 220V, 60 Hz
1	901500	1/2 HP Plastic Pump (Drain) 115V, 60 Hz
1	285461	Stainless Steel Water Level Switch 1/4" MPT
1	240067	Stainless Steel Cartridge Sensor 10K Ohm, 3/16" x 4"

COIL STEAM HEAT ASSEMBLY

1	980050	Steam Trap 1/2" NPT, 125 Lbs.
1	991327	1/2" FPT Steam Solenoid Valve

ELECTRIC HEAT ASSEMBLY (1 Phase)

1	250210	Contactator 3 Pole, 40A, 115V
1	620810	Immersion Heater w/Thermal Cutout 10KW, 240V, 3 Phase

ELECTRIC HEAT ASSEMBLY (3 Phase)

1	250210	Contactator 3 Pole, 40A, 115V
1	620810	Immersion Heater w/Thermal Cutout 10KW, 240V, 3 Phase
2	380196	3/8" MPT Brass Plug - Steam Line

STEAM EXPORT WIRING

1	250045	Relay SPST, 16A, 120V
1	275038	.5KVA Single Phase Powerformer
1	990506	1/12 HP PLastic Pump 230V, 1 Phase, 50 Hz
1	990504	1-1/2 HP Bronze Pump 220V, 1 Phase, 50 Hz
1	990505	1/2 HP Open Frame Plastic Pump 220V, 1 Phase, 50 Hz

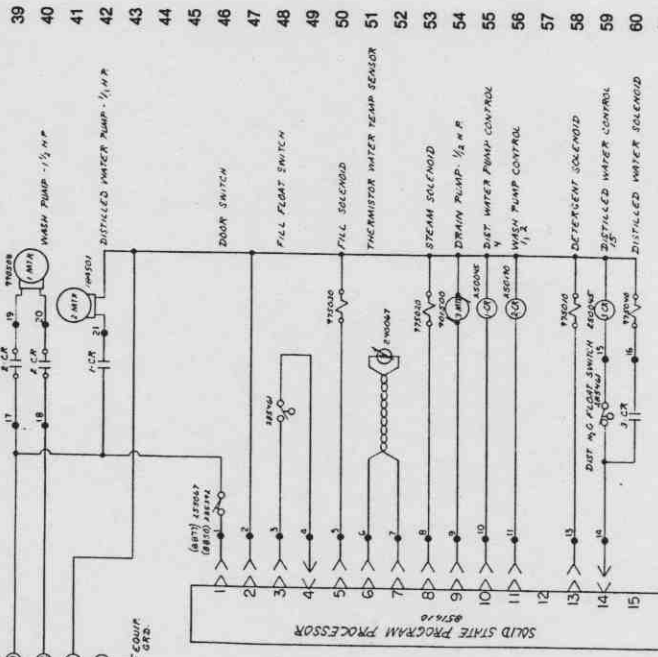
ELECTRICAL EXPORT ASSEMBLY

1	250045	Relay SPST 16A, 120V
1	275038	.5KVA Single Phase Powerformer
1	990506	1/12 HP Plastic Pump 230V, 1 Phase, 50 Hz
1	990504	1-1/2 HP Bronze Pump 220V, 1 Phase, 50 Hz
1	990505	1/2 HP Open Frame Plastic Pump 220V, 1 Phase, 50 Hz

Model 8877/8878

QUANTITY	STOCK #	DESCRIPTION
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1	970060	3/4 FPT BRZ Strainer, 40 Mesh
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1	620810	Immersion Heater, 10KW, 240V, 3 Phase W/Thermal Cut-Out
1	851610	Program Processor Control Panel, Solid State

POWER CONNECTION
208/230V 1Ø 3WIRE GND
11 FLA



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NOTES:
 1. Ⓢ DENOTES TERMINAL STRIP CONNECTIONS
 2. Ⓢ DENOTES INTERCONNECTING WIRES
 3. PARTS LIST REFERENCE NUMBERS

PANEL
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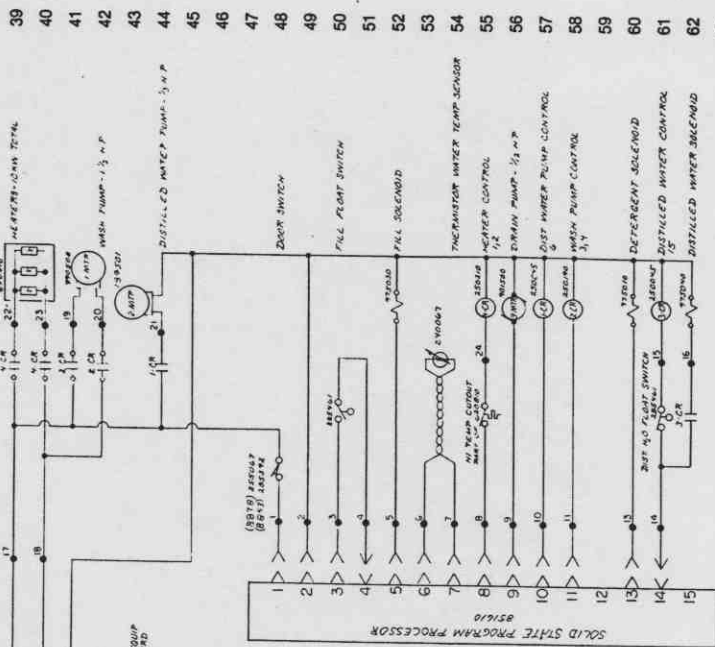
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 FOR ANY PARTS NOT LISTED FOR MANUFACTURING PURPOSES
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 INC. 805 041, MANUFACTURING DEPT. - 44737-018

2	11/88	REVISED PER ECR 7015	N/A	
1	10/88	REVISED PER ECR 7015	N/A	
1	08/88	REVISION OF DESIGN	N/A	
1	08/88	DATE: 08/88	DATE: 08/88	DATE: 08/88
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REVISED PER ECR 7015

POWER CONNECTION:
 400(238) 48 STAKE 60MA
 34 FCA



WIRE NO.	GAUGE	COLOR
1	16	BLUE
2	16	WHITE
3	16	ORANGE
4	16	ORANGE
5	16	RED
6	16	RED
7	16	ORANGE
8	16	RED
9	16	BLACK
10	16	BLACK
11	16	BLACK
12	16	BLACK
13	16	BLACK
14	16	BLACK
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NOTES:
 1. # DENOTES TERMINAL STRIP CONNECTIONS
 2. # DENOTES INTERCONNECTING WIRES
 3. PARTS LIST REFERENCE NUMBERS

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 CUSTOMER APPROVAL/REFERENCE

DATE OF APPROVAL: _____
 DATE OF REVISION: _____

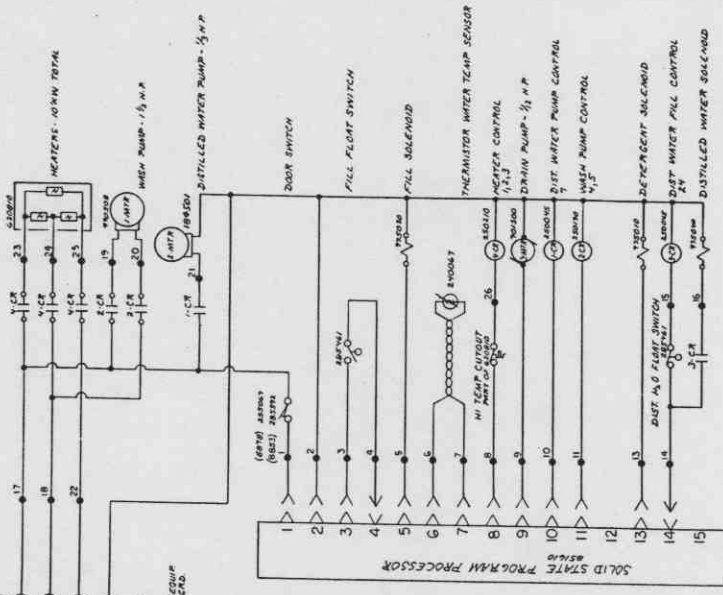
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DATE: 10/10/85
 BY: [Name]
 TITLE: ELECTRICAL SCHEMATIC

PROJECT NUMBER: B87B-60-0-D
 DRAWING NUMBER: B87B-60-0-D



**PUMP CONNECTION
SCHEDULE BY WIRE GAUGE**



WIRE GAUGE	COLOR
1	WHITE
2	BLUE
3	ORANGE
4	ORANGE
5	RED
6	N/A
7	N/A
8	ORANGE
9	RED
10	ORANGE
11	ORANGE
12	N/A
13	RED
14	BLACK

WIRE GAUGE	COLOR
15	BLUE
16	YELLOW
17	BLACK
18	BLACK
19	BLACK
20	BLACK
21	BLACK
22	BLACK
23	BLACK
24	BLACK
25	ORANGE

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NOTES:
 1. Ⓢ DENOTES TERMINAL STRIP CONNECTIONS
 2. Ⓢ DENOTES INTERCONNECTING WIRES
 3. PARTS LIST REFERENCE NUMBERS
 PANEL ASSEMBLY WIRING REFRIGERATION CUSTOMER APPROVAL/REFERENCE



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REVISED PER FOR E-2055				
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