MAXI

Washer Extractor

INSTRUCTION MANUAL

Model
MWHI 85

TABLE OF CONTENTS

KEY SYMBOLS

Anyone operation or servicing this machine must follow the safety rules in this manual. Particular attention must be paid to the **DANGER**, **WARNING**, and **CAUTION** blocks which appear throughout the manual

The lightening flash and arrowhead within the triangle is a warning sign alerting you of the presence of dangerous.

The exclamation point within the triangle is a warning sign alerting you of important instructions concerning the machine.

This warning symbol alerts you to the presence of possible dangerous drive mechanisms within the machine. Guards should always be in place when the machine is in operation.

This warning symbol indicated the presence of possibly dangerous chemicals. Proper precautions should be taken when handling corrosive or caustic material.

This warning symbol indicated the presence of hot surfaces that could cause serious burns. Stainless steel and steam lines can become extremely got and should not and should not be touched.

This warning symbol indicates the presence of possible dangerous pinch-points. Moving mechanical parts can crush an/or sever body parts.

Before servicing any equipment, make certain it is disconnected from the electrical power source. Never allow operation of the machine when any safety device is malfunctioning. Never bypass safety devices.

SECTION 1

IMPORTANT INFORMATION

MWHI Series Washer – Extractors

The model MWHI 85 is the largest freestanding washer-extractor in a series of machines from Accurate Technologies Co., Ltd. It is an open pocket washer-extractor with a large door opening for easy and quick loading and unloading. It has been developed for the institutional and industrial market, and is suitable for commercial laundries, hotel, food processing plants, factories and other places where laundry might be processed.

The design allows for top performance at lowest possible operation cost and investment. The flexible electronic control center 2000X microprocessor ensures that maximum productivity is obtained.

The MWHI Series 85 utilizes high quality material, such as 304 (18/8) stainless steel in vital parts in contact with the wash solution. It has a stainless steel cabinet for long life with easy removable panels.

The key advantages of this model are the simplicity of the microprocessor and the electronic AC drive system, which utilizes only one motor. The system allows for washing and extraction at any speed and mechanical action to suit any textile fiber used today and tomorrow. A built in suspension system isolate objectionable vibrations and the high speed final extraction saves time and energy in the finishing operation.

The main bearing is located outside the wash solution and will not be damaged, should the shell seals leak. The machine is provided with two v-seals, which are very reliable and will last for many years. The calculated life expectancy of the bearing is in excess of twenty years under normal operating conditions.

The three compartments, side mounted supply dispenser for powder and liquid detergents are standard and the machine is designed to accept the connection of 3 additional external chemical lines and pumps. More chemical connections are available as an option.

The MWHI Series can be provided with tilt devices that can tilt the machine one of both ways. This option provides for easy loading and unloading and saves hard labor.

The MWHI Series is also prepared to accept the connection of water reuse systems. These systems can be installed separate of on to of the machine. They are available in either single of dual tanks for maximum savings of water up to 40%. The tanks can be equipped with or without steam of electrical heat depending on installation and operation. The water reuse system is programmable by the machines electronic control center 2000X.

IMPORTANT INFORMATION

General Design

The design of the MWHI Series is robust and sturdy for long life in tough laundry environment. Every component, electrical and mechanical, is selected to meet the highest quality standards in the world.

Design details are described in the following:

Enclosure

The front, top and side panels as well as the upper rear panels are made of 304(18/8) stainless steel. Rear covers are made of galvanized mild steel.

The side panels are provided with noise-absorbent padding. All removable covers and panels are provided with quick release locks for easy service.

The front of the machine has finger guards between the stationary and moving parts in according to international safety standards.

Shell

The shell wrap in made of 16 ga (1.5 mm.) 304(18/8) stainless steel.

The rear of the shell is a 3/8" inch (9.5 mm.) thick mild steel plate lined with a 16 ga (1.5 mm) . 304(18/8) stainless steel.

The front shell is made of 16 ga(1.5 mm) stainless steel covered.

The front shell is hold the shell by ring and belt.

Shell Door and Gasket

The shell door is located at a convenient height for loading and unloading. The large door opening is 20 inch (508 mm.).

The door is made of 304(18/8) stainless steel 14 ga (2mm.) and is supported by a heavy hinge design.

The door is provided with a large 5/16" inch (8mm.) thick heat tempered door glass for viewing the wash action in the machines.

The door gasket is made of silicon and inflated by air for a seal-tight fit.

Basket

The cylinder wrap is made of116 ga (1.5mm.) 304(18/8) stainless steel having a 3 inch (75 mm) wide by 0.375 inch (9.5 mm) thick band around the center for safety and rigidity.

The front of the basket is made of 14 ga (1.9 mm) 304(18/8) stainless steel

The rear of the basket is made of 5/8" inch (15.875 mm) mild steel lined with a 16 ga (1.5mm.) stainless steel on inside and 16 ga(1.5 mm) on the outside.

The open area of the perforation is more than 20%, which gives a good exchange of water between the shell and the inside of the cylinder. This perforation size and configuration is selected to provide safety for any garments at high extraction speed, as well as to provide for maximum extract efficiency.

The top of the lifters is perforated. This allows the lifters to cascade water over the laundry, thereby reducing the water consumption.

Bearings

The MWHI Series is provided with two SKF steel pillow blocks, that contains double roll spherical roller bearings.

The front bearing is located outside the wash solution to avoid any damage, should the shell seal leak. See Figure.

Each pillow block has its internal lip seal to eliminate oil or grease leakage.

The pillow block bearings are provided with grease nipples and can be manually greased from the rear of the machine. A grease gun is supplied with the machine.

Frame

The frame is made of structural I-Beam 10"x5" (250x125) for rigid design.

The frame is painted with an environmental safe and corrosion resistant paint.

An option with a hot galvanized frame is available for harsh environment.

The frame is designed to facilitate installation as it is constructed for truck lifting.

The machine also has lifting ears and holes in the top of the shell. This will facilitate when a crane is used for installation.

Drive System

The machine uses one single 7.5Hp (5.5 kW) motor controlled by a variable frequency drive. The drive system has only one set of belts and requires no adjustment as it is provided with an automatic belt tensional.

The variable frequency drive adjusts to the operation conditions and saves energy by using no more power than absolutely necessary.

The drive has programmable speed acceleration and deceleration times, etc. to optimize performance of the machine.
The drive has diagnostic features, such as more than 16 alarm codes displayed in plain English.

The drive regulates supply voltage conditions and optimizes all motor operations, The frequency controller adjusts the current and eliminates inrush when the machine enters into extraction. See Figure.

The voltage current and alarm codes can be checked by a parameter unit installed on the drive (not supplied as standard). This unit can also be used to re-program the drive for any operation condition and speed desired.

As seen from figure, the energy used with and AC-drive system is much less than what is used in normal two of four motor systems.

IMPORTANT INFORMATION

The frequency control drive has a built in dynamic braking system (Quick-Stop). Which provides for fast deceleration and stopping of the machine after extraction. The energy generated during braking is returned to the electrical power supply.

The frequency controller is installed in a control box located in the rear of the machine. The control box is cooled by two fans that are provided with a dust filters.

Motor

The motor is rated at 7.5Hp (5.5 kW). It is totally enclosed and cooled by an separate external fan.

The motor winding is Class B and is protected for over and under voltage as well as for overload by the electronic frequency controller.

Electrical System

The electrical system consists of a microprocessor for control of the wash cycle, an AC-drive, motor, water inlet valves, steam valve and drain valves. Circuit breakers are provided for the control system. All the controls are electronic and the machine uses no relays except for the main switch off contractor.

The microprocessor is located on the front of the machine within easy reach for the operator.

An emergency stop switch is located within easy reach on the front of the machine.

All other components are located in a control box in the rear of the machine. All components exposed to the environment in the machine are connected with water tight cables using DIN connectors or conduits.

The cables and wires are shielded where necessary to eliminate electrical interference. They are also routed to avoid mechanical interference and wear and tear from moving parts.

As an option, a special radio interference filter can be provided for installations that demand EMI reduction to comply with National Codes i.e. Europe.

SECTION 2

SPECIFICATIONS/COMPONENT IDENTIFICATION

Delivery inspection

Upon delivery, visually inspect crate, protective cover, and unit for any visible shipping damage. If the crate, protective cover, or unit are damaged or signs of possible damage are evident, have the carrier note the condition on the shopping document before the shopping receipt is signed, or advise the carrier of the conditions as soon as it is discovered.

Remove the crate and protective cover as soon after delivery as possible. If any damages discovered upon removal of the crate and/or protective cover, advise the carrier and file a written claim immediately.

Customer Service

If literature or replacement parts are required contact the source from whom the machine was purchased or contact:

A record of each machine is on file with the manufacturer. The serial number decal is located at the rear of the machine. Always provide the machine's serial number and model number when ordering part or when seeking technical assistance.

NOTE: Keep the manuals, installation instruction and the wiring diagrams which accompany the machine in a safe place for ready reference. They have been included with the machine at no charge. Additional copies are available at a nominal charge.

A. TECHNICAL SPECIFICATION

CAPACITY:	US Units	Metric / Unit	MWHI 85	
CYLINDER:	Lbs	Kg.	85	38.5
Diameter	Inch	mm.	36	195
Length	Inch	mm.	24	610
Volume	cuft	Liters	14.17	4.1
Door Opening	Inch	mm.	20	508
SPEEDS: (Programmable)				
Wash	rpm	G	40	0.8
Distribution	rpm	G	70	2.5
Extract 1	rpm	G	325	54
Extract 2	rpm	G	408	85
Extract 3	rpm	G	630	202.3
MOTOR SIZE:	Hp	kW	7.5	5.5
UTILITY CONNECTIONS:				
Water	Inch	DN	1	25.4
Drain	Inch	mm.	3	76.2
Steam	Inch	DN	¾"	19.1
DIMENSIONS:				
A- Width	Inch	mm.	43.7	1110
B- Depth	Inch	mm.	54.52	1358
C- Height	Inch	mm.	62.59	1590
WEIGHT:				
Net weight	Lbs	Kg.	1700	771.1

B. TECHNICAL DIMENSION

1590

905

1385

1590
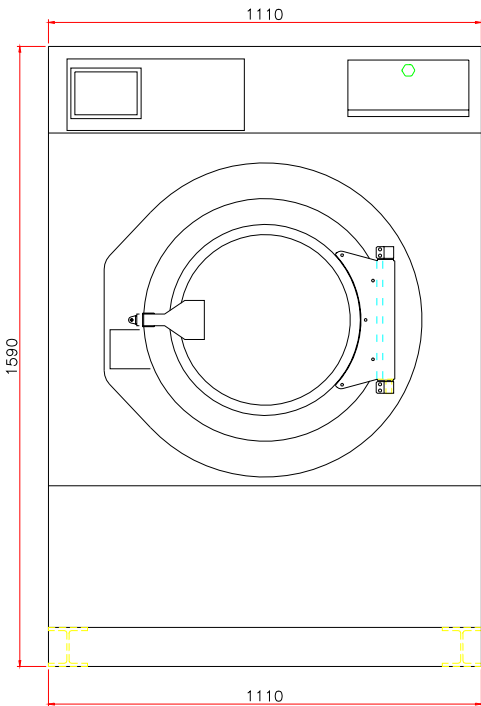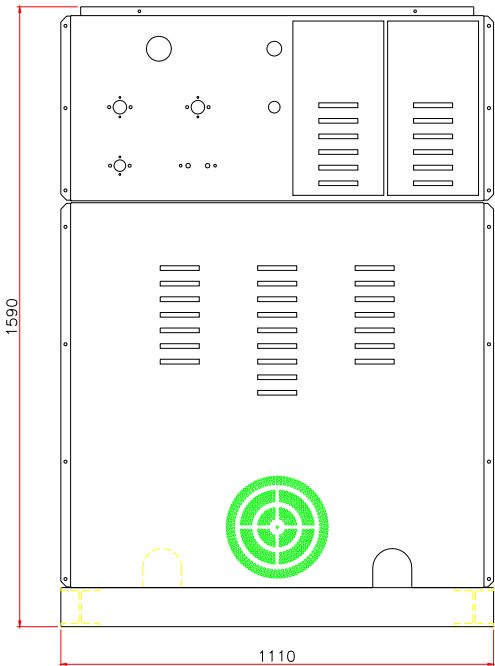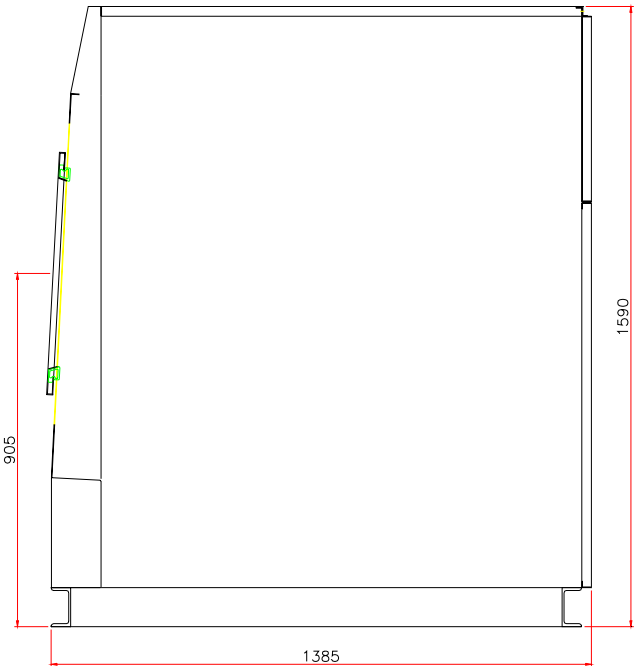
1110

1110

1590

1110

Basket   =   915 mm.
Basket Depth   =   610 mm.
Machine Width   = 1110 mm.
Machine Depth   = 1385 mm.
Machine Height   = 1590 mm.
Motor   =   7.5 HP.
Wash Speed   = 40 rpm
Balance Speed   = 70 rpm
Extract Speed 1   = 325 rpm
Extract Speed 2   = 408 rpm
Extract Speed 3   = 480 rpm

SECTION 3

INSTALLATION PROCEDURES

A. DIMENSION CLEARANCES

When installing the washer-extractor, it is important to allow adequate clearance on all sides of the machine. When multiple machines are installed, it is important to allow for the specified minimum clearances between machines. The following table shows recommended minimum clearances for the various freestanding models.

NOTE: The dimensions are approximate and subject to normal manufacturing tolerances. If exact dimensions are required for construction purposes, request certified drawings from the factory. We reserve the right to make changes at any time without notice.

Table.3-1 Dimension Clearances

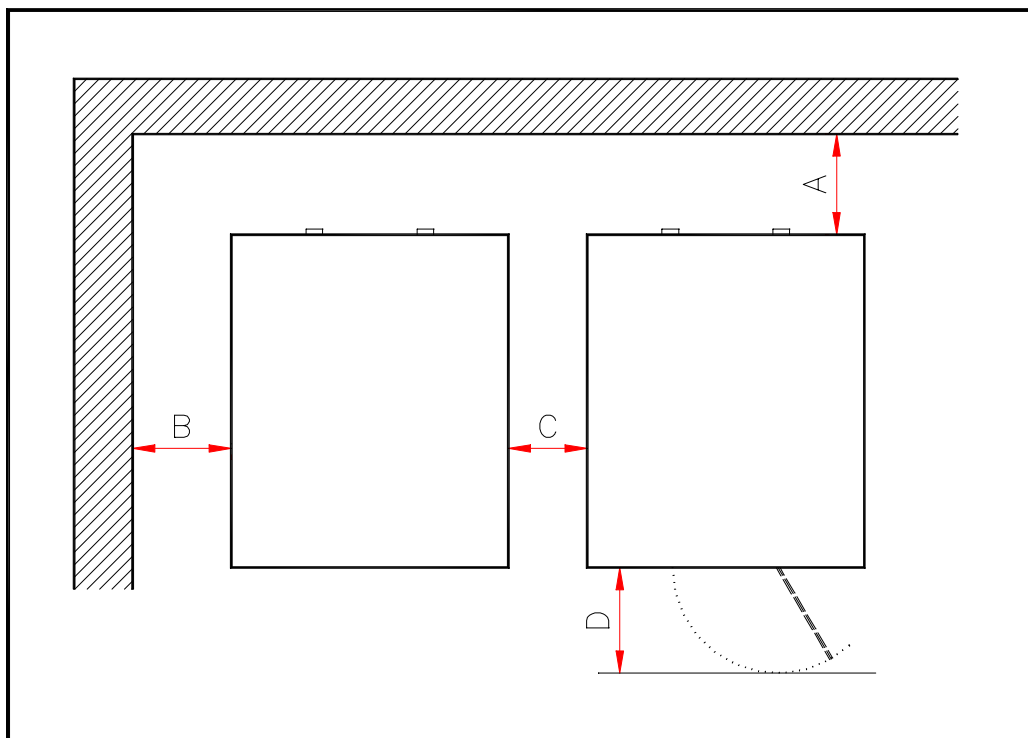| MODEL	Unit		85lb.	
	Metric	US		
(**A**) Minimum rear clearance	mm.	in	760	30
(**B**) Minimum clearance between machine and wall	mm.	in	455	18
(**C**) Minimum clearance between machine	mm.	in	35	1-3/8"
(**D**) Minimum rear clearance	mm.	in	650	25-9/16

Figure.3-1 Dimensions for construction

B. MACHINE FOUNDATION

Thoroughness of details must be stressed with all foundation work to insure a stable unit installation, eliminating possibilities of excessive vibrations during extraction.

The machine must be anchored to a smooth level surface so that the entire base of the machine is supported and rest on the mounting surface.

NOTE: Do not support the machine on only four points.

NOTE: Freestanding washer-extractors do not require anchoring bolts unless specified by state or local codes. However it is always recommended that the machines be anchored.

Special care must be taken when machines are installed on an upper floor. Make sure that the floors are designed to carry the static and dynamic loads of the machines.

Further vibrations should be taken into consideration so that the machine does not create vibrations in the building. Static and dynamic loads on the floor or foundation are shown in the table below. This table can be used as reference when designing floors and foundations. See figure for mounting bolt layout measurement and pattern.

Ensure that the machine is installed on a level floor of sufficient strength and that the recommended clearances for inspection and maintenance are provided. Never allow the inspection and maintenance space to be blocked.

Table.3-2 Machine Foundation

Machine Foundation

MODEL	Unit		85lb.	
	Metric	US		
Static floor load	KN	Lbs	10.6	2383
Static pressure	KN/m^2	Lbs-ft^2	9.12	191
Dynamic floor load	KN	Lbs	15.1	3400
Maximum dynamic load	KN	Lbs	16.6	3740
Dynamic pressure	KN/m^2	Lbs-ft^2	13	272

C. MOUNTING BOLT INSTALLATION
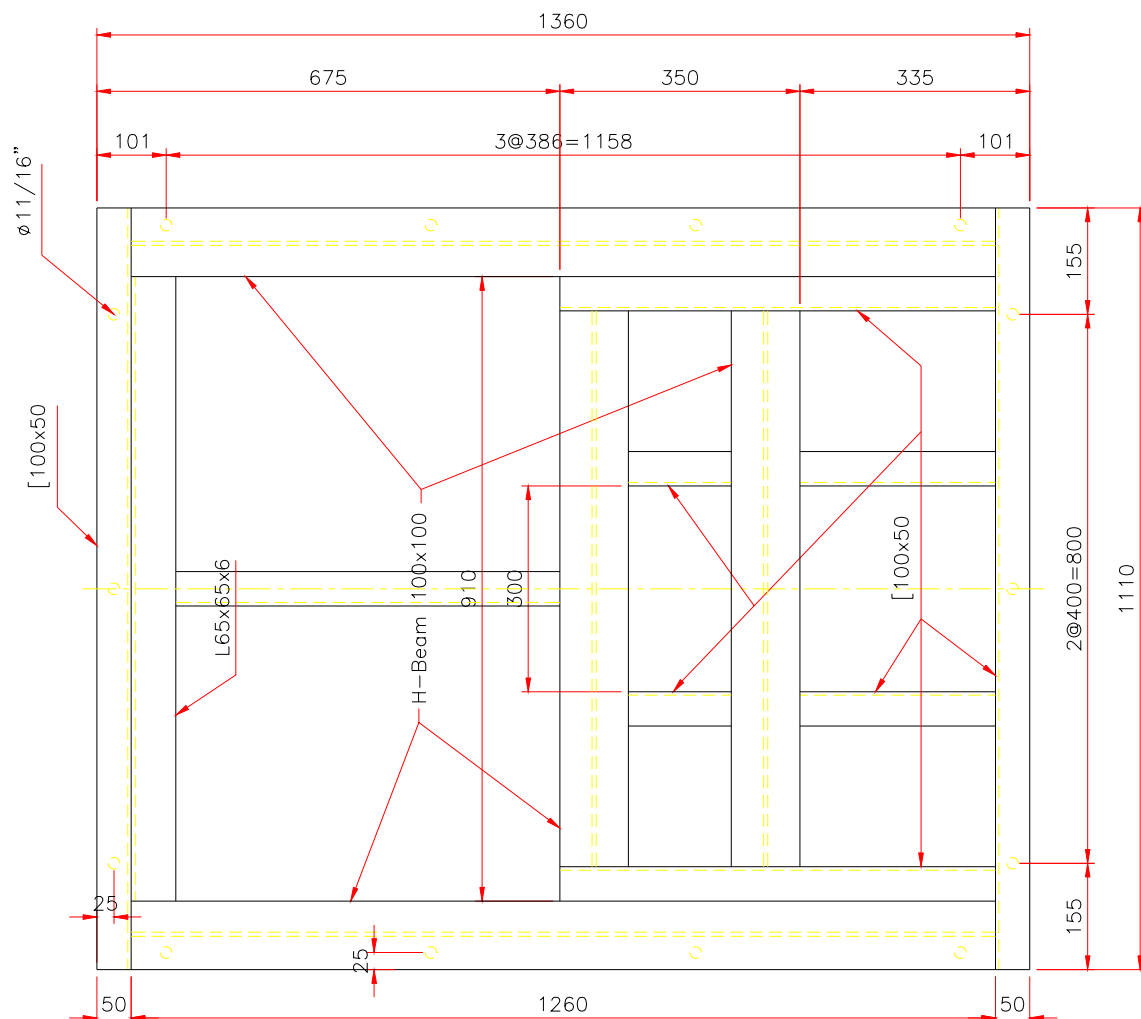
Figure.3-1 Mounting Bolt Installation

A bolt kit consisting of eight bolts is available as an option. MWHI 85 machines use 5/8-16 x 8" bolts. The bolts should be imbedded in a 3500 psi minimum reinforced concrete floor that is a minimum of 10 Inches thick. Use the mounting bolt layouts in **Figure 3-1**.

The threaded end of the bolts should extend 2 inches above the surface of the floor.

INSTALLATION PROCEDURES

See **Figure 3-2** for a typical installation of individual mounting bolts.
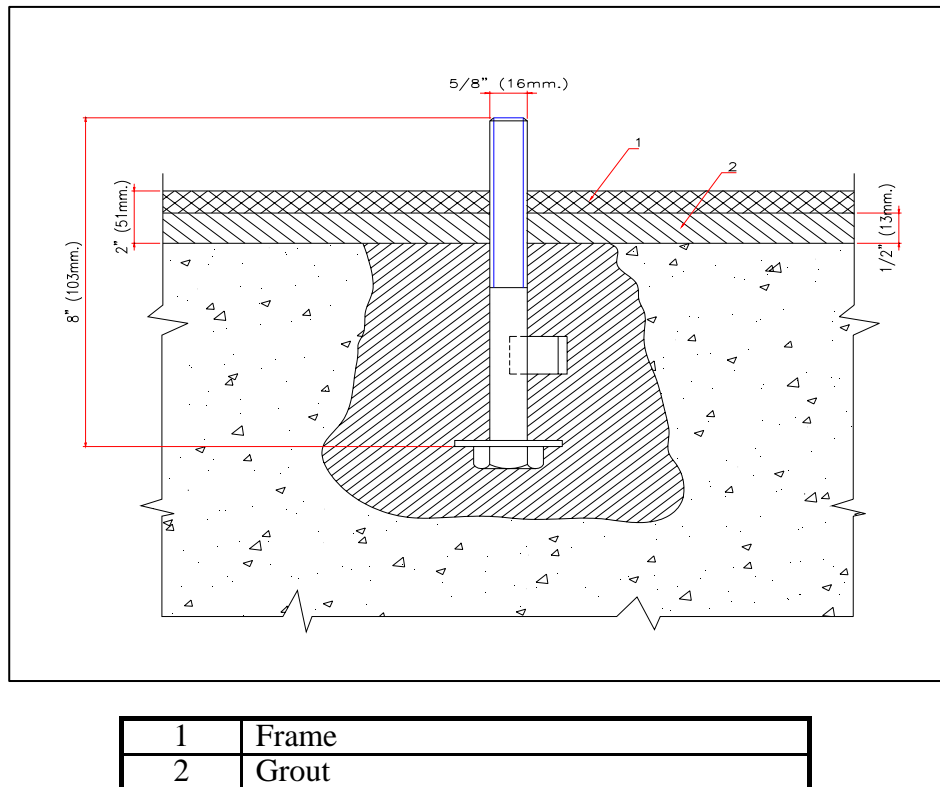
1	Frame
2	Grout

Figure.3-2 Typical Individual Mounting Bolt Installation

A bolt-locator fixture or rebar frame is available as an option. This rigid welded assembly made of reinforcing rod and mounting bolts is designed to be embedded in concrete. See **Figure 3-3**.

1	Reinforcing Rod
2	Mounting Bolt Threads
3	½" Grouting
4	Machine Base
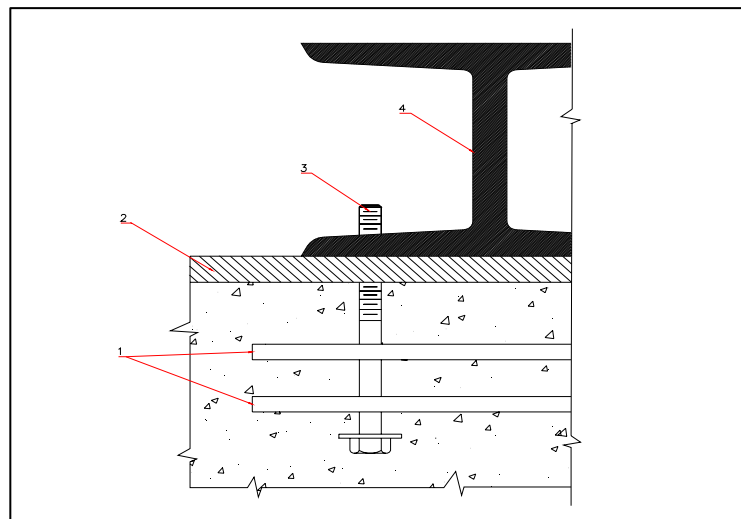
Figure.3-3 Typical Rebar Frame Mounting Bolt Installation

After the concrete has cured, proceed as follows:

1. Place the machine adjacent to the foundation. Do not attempt to move the machine by pushing on the sides. Always insert a pry bar or other device under the bottom frame of the machine to move it.
2. Remove the wood skid by unscrewing the carriage bolts holding the skid to the bottom frame of the machine.
3. Place the machine carefully over the anchor bolts. Never attempt to lift the machine by the door handle or by pushing on the cover panels.
4. Raise and level the machine 1/2 inch off the floor on three points, using spacers such as nut fasteners.
5. Fill the space between the machine base and the floor with machinery grout; grout completely under all frame members. (Remove front panel and expanded metal back panel to gain access to all frame members.) Force grout under machine base until all voids are filled. See Figure A.
6. Remove the spacers carefully, allowing the machine to settle into the wet grout.
7. Before grout sets completely, make a drain opening in the rear of the machine grouting with a stiff piece of wire; this opening should be approximately 1/2 inch (13 mm) wide to allow any surface water build-up under the base of the machine to drain away. Do not omit this step.
8. Attach the mounting bolt washers and locknuts to the anchor bolts after the grout has hardened. Tighten the lock nuts by even increments-one after the other-until all are tightened evenly and the machine is fastened securely to the floor.

NOTE: Check and retighten the locknuts after five to ten days of operation and every month thereafter.

NOTE: The wet-clean water recirculation system does not require permanent attachment to the floor.

D. DRAIN CONNECTION

A drain system of adequate capacity is essential t? the machine performance. Ideally the water should empty through a 4 Inch vented pipe directly into a sump or floor drain. See **Figure 3-4**

A flexible connection must be made to a vented drain system to prevent an airlock or siphon effect. On the tilt option models a flexible drain hose must be provided of adequate length to compensate for tilting action of the machine. If proper drain size is not available or practical, a surge tank is required. A surge tank in conjunction with a sump pump should be used when gravity drainage is not possible, such as in below- ground-level installations.

Before any deviation from specified installation procedures is attempted, the customer or installer should contact the manufacturer. Increasing the drain hose length, installing elbows, or causing bends will decrease drain flow rate and increase drain time, impairing machine performance, if the drain arrangement is inadequate, the machine will not extract and will not discharge water properly.
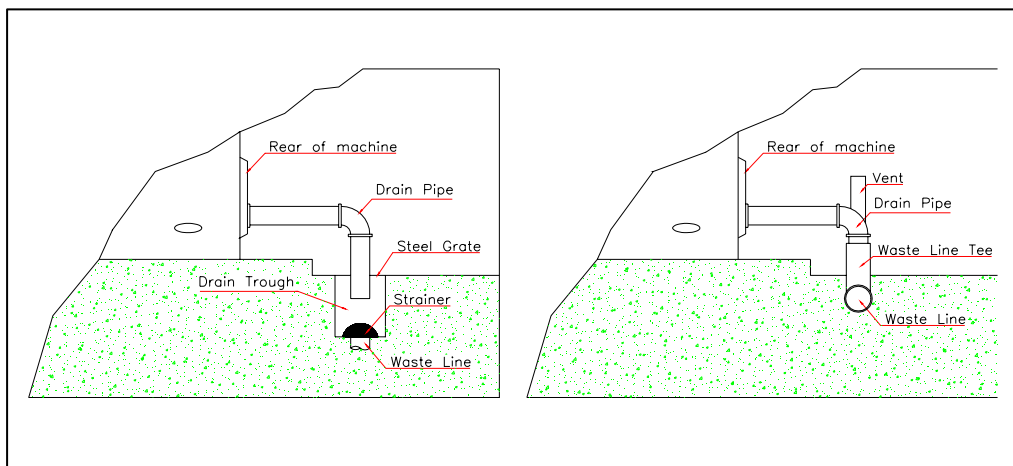
Figure.3-4 Drain Installation

Table.3-3 Drain Information

MODEL	Unit		85lb.	
Drain connection size	mm.	In	76.2	3
Drain flow capacity	Gal-min	l-min	145	549
Recommended drain pit size	Ft^3	l	12.8	362

E. ELECTRICAL INSTALLATION

The AC drive requires a clean power supply free from voltage spikes and surges. A voltage monitor should be sued to check incoming power. The customer's local power company may provide such a monitor.

The AC drive provides for an internal circuit breaker. A separate circuit breaker governs the control circuit.

If input voltage measures above 230V for a 200V drive, or above 440V for a 400V drive, either ask the power company if their representative can lower the voltage or install a step – down transformer kit available from the manufacturer. Voltages above 250V and 490V require additional measures. Contact the distributor or the manufacturer for assistance.

This machine must be installed, adjusted, and serviced by a qualified electrical maintenance personnel familiar with the construction and operation of this type of machinery. They must also be familiar with the potential hazards involved. If this warning is not observed, personal injury or equipment damage resulting in voiding the warranty may result.

When controlling the AC drive with a parameter unit, the machine's computer and its safety features are bypassed. This would allow the basket to rotate at high speeds with the door open. When using a parameter unit to control the AC drive, a large sign should be placed on the front of the machine warning people of the imminent danger.

Never touch terminals or components of theca drive unless power is disconnected and the "CHARGE" indicator LED is off. The AC drive retains potential deadly voltage for some time after the power is disconnected. There are no users – serviceable parts inside the AC drive. Tampering with the drive will void the warranty.

Dangerous voltages are present in the electrical control boxes and at the motor terminals. Only qualified personnel familiar with electrical test procedures test equipment, and safety precautions should attempt adjustments and troubleshooting. Disconnect power from form the machine before removing the control box cover, and before attempting any service procedures.

Table.3-4 Breaker And Wire Installation Data

MODEL	VOLTAGE	ELECTRIC HEAT	FULL LOAD CURRENT AMP	BREAKER SIZE AMP	WIRE SIZE
MWHI 85S	208-240V 50/60Hz 3ph 3wire	No.	26	40	8 AWG / 10 sq.mm.
	380-415V 50/60Hz 3ph 3wire	No.	14	25	12 AWG / 4 sq.mm.
	440-480V 50/60Hz 3ph 3wire	No.	14	25	12 AWG / 4 sq.mm.
MWHI 85E	208-240V 50/60Hz 3ph 3wire	Yes.	101	150	2 AWG / 35sq.mm.
	380-415V 50/60Hz 3ph 3wire	Yes.	55	80	4 AWG / 25 sq.mm.
	440-480V 50/60Hz 3ph 3wire	Yes.	50	75	6 AWG / 16 sq.mm.

NOTE: Do not use phase adder on freestanding washer-extractor

NOTE: Wire sizes shown are for copper, THHN, 90 conductors per NEC article 310

The machine should be connected to an individual branch circuit not shard with lighting or other equipment.

The connection should be shielded in liquid tight or approved flexible conduit with proper conductor of correct size installed in accordance with National Electric Code or other applicable codes. The connection must be made by a qualified electrician using the wiring diagram provided with the machine. See the Electrical Connection data Chart for correct wire sizes.

Use wire sized indicated in the chart for runs up to 50 feet (15m). Use next larger size for runs of 50 to 100 feet (15-30m). Use 2 sizes larger for runs greater than 100 feet (30m).

For personal safety and for proper operation, the machine must be grounded in accordance with state and local codes and in the USA in accordance with the national Electric Code, article 250-96.

The ground connection must be to a proven earth ground, not to conduit or water pipes. Do not connect the ground to the neutral (N) leg at the terminal strip.

If a DELTA supply system is used, the high leg may be connected to L1, L2 and L3. As the machines are equipped with control transformer.

F. WATER CONNECTION

Individual hot and cold plumbing lines with individual shut-off valves must be available to the machine. Hot water should be minimum of 160F (70C). if lower temperature water is used the machine should be equipped for steam heating to heat the wash solution to desired temperature. Best performance will be realized if water is provided at a pressure of 30-85 psi (2-7 Bar). Although the machine will function properly at lower pressures, increased fill time will occur.

Flush the water system for at least two minutes.

Use flexible hoses and install separated screen filters in the lines to keep rest and other foreign particles out of the solenoid valves. Hang the hoses in a large loop. Do not allow the hoses to kink. The water connections to the machine should be supplied by a hot and cold water line of least the sizes shown in the table below. Installation of additional machines will require proportional larger water lines, see table.

To avoid eventual water hammer in the water line, suitable devices to reduce the water hammer should be installed.

Table.3-5 Drain Size Data

NUMBER OF MACHINES	SUPPLY LINE PIPE SIZES	
	Metric DN	US in.
1	25	1
2	25	1
3	40	1-1/2
4	40	1-1/2
5	50	2
6	50	2

G. STEAM CONNECTION

Never touch internal or external steam pipes, connections, or components. These surfaces can be extremely hot and will cause severe burns. The steam must be turned off and the pipe, connections, and components allowed to cool before the pope can be touched

For machines equipped with optional steam heat, install piping in accordance with approved commercial steam practices. Steam requirements are shown in the table below. Failure to install the supplied steam filter may void the warranty.

Table.3-6 Steam Size Data

MODEL	MWHI 85
Steam inlet connection size, in./mm.	¾" / 19.1
Number of steam inlets	1
Steam required to raise LOW	6.84 / 3.11
Bath temperature 10°F, lb/kg HIGH	9.67 / 4.40

H. EXTERNAL CHEMICAL SUPPLIES

Wear Eye and hand protection when handling chemicals. Always avoid direct contact with raw chemicals. Read the manufacturer's directions for accidental contact before handling chemicals. Ensure that an eye-rinse facility and an emergency shower are within easy reach. Check at regular intervals for chemical leaks.

The following procedures must be observed when connecting any chemical injector to the washer – extractor. See the figure for a typical supply injection system setup. Undiluted chemicals dripping can damage the machine. Therefore, all chemicals supply dispenser pumps should be mounted below the washer's injection point.

All dispensers tubing should also run below the injection point. Loops do not prevent drips if these instructions are not followed. Failure to follow these instructions could damage the machine and void the warrant.
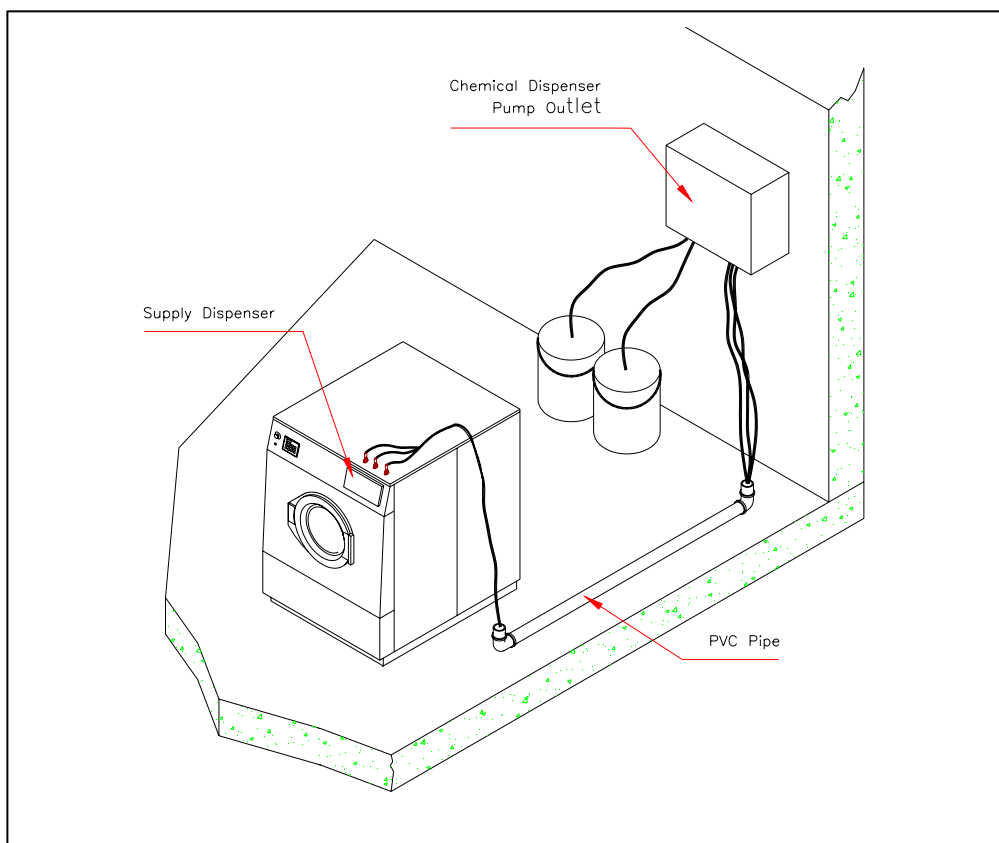
Figure.3-5 Typical Injection System Hook-Up

The supply compartment on the MWHI 85 model is located on the Right side of the machine. Supply cups can be accessed by open the dispenser lid. The supply cups can be removed and filled as desired. Supply compartments are numbered 1, 2 and 3 from the rear of the machine to the front.

Connecting External Supplies to the machine.

External supply connections for the MWHI 85 washer-extractor are located on top of the supply dispenser. Hose connections should be made via the strain relief. See **Figure 3-6**.

1. Remove plugs from base. See Picture 3-7. Plugs are assembled inside the tubing ring.
2. Install strain relief, included in the seal nut.
3. Insert tubes through base. Do not remove cups. Tubs should extend into the plastic cup, with the exception of the softener tube, which should be routed to the outside of the cup.
4. Tighten the seal nut to prevent tubing from escaping the assembly.
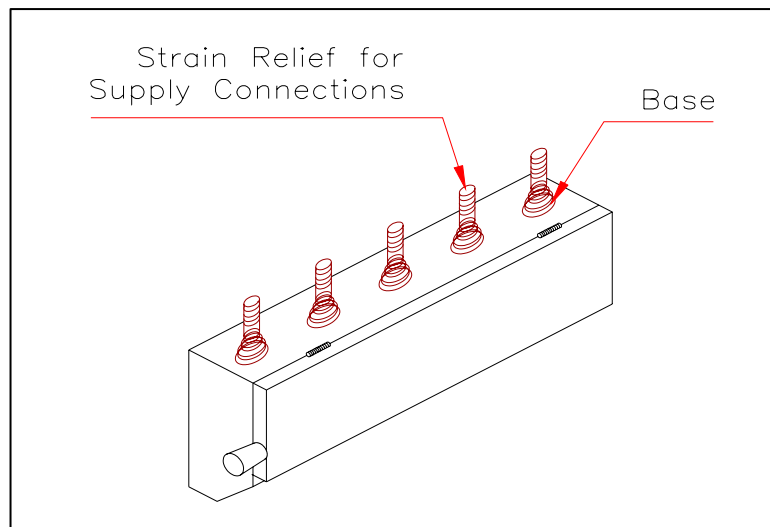
Figure.3-6 Strain Relief And Hook-Up To Supply Dispenser

I. ELECTRICAL CONNECTIONS

Connection terminals are located in the rear control box for output signals to the chemicals injection supply pump.

Terminals **SUPPLY 1** through **SUPPLY 8** provides contact closings for external chemical supply pumps. The contact rating is maximum 3 amps at 24-220V 50/60Hz.

Do not attempt to increase fuse rating as this cause damage to the washer-extractor circuitry.

Any injection system pump, which requires 24-220V AC, must be powered by a separate external power source.

Attempting to obtain power from the machine terminals may damage the machine circuit and/or the chemical injection system. Consult the chemical injection supply system instructions for operational details.

J. CONTROL FUNCTION TEST

The machine should be cleaned after the installation is complete. A function test should ten be executed on the unloaded machine as follows:

1.   Check the proper supply for such characteristics as correct voltage, phase, and cycles to be certain they are correct for the machine.

2.   Open manual shut-off water valves to the machine.

3.   Press Emergency Stop button.

4.   Apply power to the machine.

5.   Release the Emergency button.

6.   Check the door interlock before starting the machine.
   a.   Attempt to start the machine with the door open. The machine should not start with the door open.
   b.   Close the door without locking it and attempt to start the machine. The washer should not start with the door unlocked.
   c.   Close and lock the door and start a cycle. Attempt to open the door while the cycle is in progress. The door should not open.

   If the door lock and interlock are not functioning properly, call a service technician.

7.   For standard processing, select cycle **01** by pressing key **0** and key **1** on the keypad. Then press enter and the **Start** key. Run a complete cycle, checking operation of water inlet valves, drain, and extract functions. Cycle **01** is test cycles that go through most of the machines functions.

8.   Cylinder rotation must be counter-clockwise in the extract step. If rotation is not correct, disconnect the power to the machine. A qualified technician must reverse any two leads between the AC drive and the motor.

SECTION 4

OPERATING INSTRUCTIONS

WC 03 Controller

The WC 03 controller is a powerful and programmable solid state controller. Up to 30 programs, each with up to 15 cycles can be freely programmable. In addition, the WC 03 can be programmed in 6 languages -English, Italian, German, Spanish and French. The water level can be programmed, and is accurate to 1 cm (0.4 in). Spin speeds are fully programmable in RPM. In the event of power failure, the operator is prompted to continue the cycle, or abort it.

Keypad
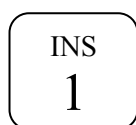
INS 1	Number key, Insert Key. Enables a new cycle to be inserted in an existing program during programming. During operation, press and hold for cylinder RPM.
DEC 2	Number key, Decrement Key. Lowers the current value during programming mode.
INC 3	Number key, Increment Key. Raises the current value during programming mode. If pressed simultaneously with the TEMP or LEVEL key, allows temporary modification.
TEMP 4	Number key, Temperature Key. Allows temporary modification of the target temperature if used with the INC and DEC keys. Displays current temperature in wash cylinder.
LEVEL 5	Number key, Level Key. Allows temporary modification of the target water level if used with the INC and DEC keys. Displays current water level in wash cylinder.
TIME 6	Number key, Time Key. Displays the watch dog timer value for the current step.
7	Number keys.
8	Number keys.
9	Number keys.
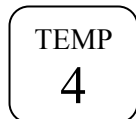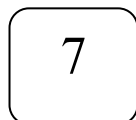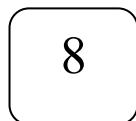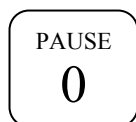
PAUSE **0**	Number key, Pause Key. If pressed during operation, pauses the wash program indefinitely. Not active during distribution or spin.
UNLOCK DOOR	On SI series equipment, this button unlocks the door and allows it to open. Not used on other equipment.
ADVAN	Advances to the next program step. During final spin, the remainder of the spin is aborted. If pressed before starting a program, it allows the operator to begin the program at any segment. During programming, skips to the next segment.
ENTER	Confirms settings in creation and editing of wash programs. During operation, shows the current segment or program number.
DEL RESET	Deletes any selection or setting.
STOP	Terminates the current activity (operation or programming). While the machine is powered but not executing a program, can be pressed with RESET to see the current firmware version.
START	Starts execution of the currently selected wash program. Restarts a paused program. When pressed with RESET, function codes can be entered to program and setup the machine. See the quick reference list on the next page.
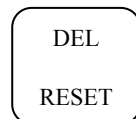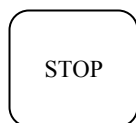
To access this mode, press START and RESET together, then at the prompt, key in the desired number.

Programming	
12	Programming cycles
27	Creation of Programs
45	Programming motors
System Setup	
118	Disable Machine
181	Resets controller -erases all memory
201	Language option (1 -Italian, 2 -English, 3 -German, 4 -Spanish, 5 -French)
205	16 or 24 outputs (Image uses the 24 output version)
207	Maximum RPM
209	Temperature Hysterisi (min 1 deg, max 10 deg) Default is 3 deg.
210	Display temperature in degrees C
211	Display temperature in degrees F
212	Maximum water level that can be set (10 -100 cm)
213	Minimum water level for heating (2 -30 cm)
214	Display number of hours of operation
215	Display total number of washes
216	Display number of washes since the last maintenance
217	Reset maintenance request
218	Display and set number of washes until maintenance request
219	Spin slow down time (40 -200 sec)
220	Erases Programs and cycles
221	Copy from control to memory card
222	Copy from memory card to control (only programs and cycles)
223	Copy from memory card to control (programs, cycles, and parameters)
225	Disables Advance Key
230	Maximum water level allowed during spin (2 -60 cm)

Highlighted items are safety related and SHOULD NOT BE CHANGED!

DO NOT ALTER THESE VALUES WITHOUT CONSULTING

ACCURATE TECHNOLOGIES OR A QUALIFIED TECHNICIAN!

Programming

Programming the WC03 takes place on three levels:

1. Programming motors (45)

Allows 15 different operating modes to be created. For each mode, the clockwise rotation time, the counterclockwise rotation time and the pause time can be programmed.

2. Programming the cycles (12)

For each sequence of steps, creates a sequence of events in which various functions can be activated or deactivated (drain, cold fill, spin, etc.). Going from one step to another may require reaching a water level or temperature, or a time value. There are five different programmable cycle types: Prewash, Wash, Rinse, Spin and Unroll (Shakeout). Each cycle can be assigned a number between 1 and 99.

3. Creation of Wash Programs (27)

Consists of putting the various cycles as programmed above together to form a complete wash program. Up to 30 programs can be stored, each with 15 cycles (segments).
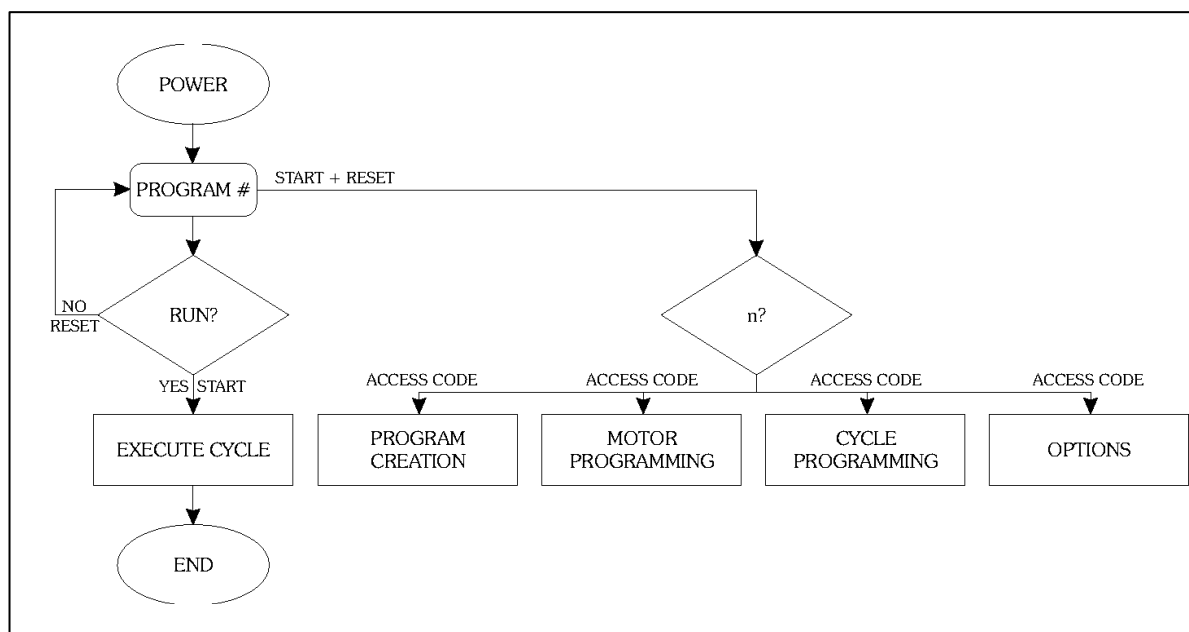
Motor Programming

To access the motor programming mode, press START and RESET together. The display shows:

```
NO. ?
```

Enter 45 at this prompt, followed by the ENTER key. For two seconds, the display will show:

```
* EDIT MOTORS *
```

You are then asked to enter the motor routine number to be programmed (1-15).

```
MOTOR NO.
```

You may now enter the number and press the ENTER key. There are now two cases:
1. The motor routine does not exist.
2. The motor routine does exist

New motor routine
In this case, you are prompted to enter a clockwise rotation time with this message:

> **T. FORWARD = S**

Enter the desired time in seconds, followed by the ENTER key. The display will change

> **T. PAUSE = S**

Enter the desired time in seconds, followed by the ENTER key. The display will change

> **T. BACKWARDS = S**

Enter the counterclockwise time in seconds, followed by the ENTER key. The display will show:

> **STORE?**

Pressing ENTER will store the motor timing routine and the display will change to request a new access code:

> **NO. ?**

Enter 45 at the prompt to program additional motor timing sequences as required. Pressing RESET instead of ENTER will exit programming.

Editing an Existing Routine
If the motor routine number you entered id already present, the display will show:

> **ALREADY EXISTS!**

Pressing the ENTER key again displays the forward rotation time:

> **T. FORWARD = XXs**

Pressing the INC and DEC keys allow you to step through the values for Forward, Pause, and Backwards. Pressing ENTER will allow you to modify the value on the display

After having viewed or modified the backwards value, pressing the INC or ENTER key displays:

> **STORE?**

Pressing **ENTER** confirms the changes mode (if any) and exits programming

Pressing **RESET** exits the current programming mode and leaves the existing values as they were.

Notes on Motor Programming

There are a number of different moles available for motor programming:

1. Forwards – Pause k - Backwards

T. FORWARD = XXs

T. PAUSE = XXs

T. BACKWARDS = XXs

2. Forwards - Pause

T. FORWARD = XXs

T. PAUSE = XXs

3. Forwards

T. FORWARD = XXs

T. PAUSE = SO

4. Pause - Backwards

T. FORWARD = SO

T. PAUSE = XXs

T. BACKWARDS = XXs

5. Backwards

T. FORWARD = SO

T. PAUSE = SO

T. BACKWARDS = XXs

The minimum pause time that can be programmed between forward and backwards is 2 seconds.

Cylinder speed is programmed during cycle programming. In this mode, step can be programmed with different values if desired.

Motor Programming Flow Chart

POWER

PROGRAM #

START +
RESET

n?

RESET

45
ENTER

EDIT MOTORS

MOTOR N

NO   EXIST?   YES

T. FORWARD = S   ALREADY EXISTS!

OF SEC
ENTER   ENTER

T. PAUSE = S   T. FORWARD = S0

OF SEC   INC
ENTER   DEC

T. BACKWARDS = S   T. PAUSE = XXs

OF SEC   DEC
ENTER   INC

                                  T. BACKWARDS = XXs

STORE?   no
                RESET

yes
ENTER
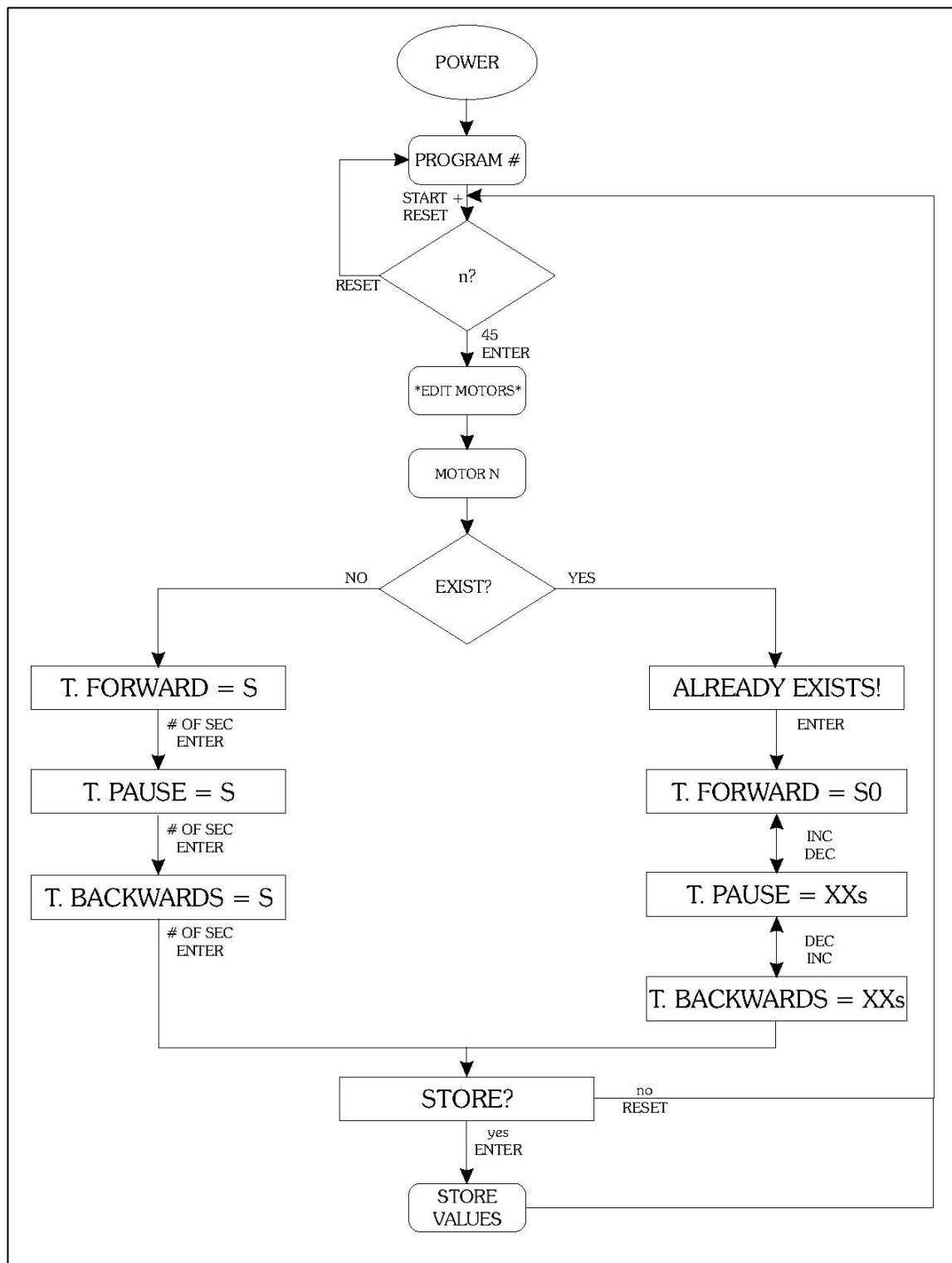
STORE
VALUES

Cycle Programming

Cycle libraries can be created for later use in the wash programming step. When the machine is stopped, press the START and RESET buttons together. The display is:

> **No.?**

Using the keypad, type 12 and press ENTER. For two seconds, the display shows:

> *** EDIT CYCLES ***

The message for choosing the programming cycle is then displayed:

> **PREWASH = ?**

Pressing INC or DEC will show the other cycle types in succession:

> **WASH = ?**

> **SPIN = ?**

> **RINSE = ?**

> **UNROLL = ?**

When the cycle type you wish to edit is displayed, press ENTER to begin creating or editing of the cycle. As an example, we will go through programming a prewash cycle.

> **PREWASH = ?**

Using the numerical keypad, enter the cycle you wish to create or modify. After you have entered the number and pressed ENTER, there are two possible cases:

◄   The cycle chosen does not exist and has to be programmed. (This Page)

◄   The cycle chosen does exist. If this is the case, you can view and modify the cycle as needed. (see page 14).

New Cycle Creation

   If the cycle you chose does not exits, you will be taken directly into the programming mode. For two seconds, the display will show:

> **START STEP 1**

The display then changes to:

> **COOLING? NO**

You can now define for step 1 whether the cool down feature is activated. If you wish to activate cool down, press ENTER, and the display changes to:

<div style="border:1px solid black">**COOLING? YES**</div>

To implement the cool down phase, five additional parameters must be entered. These are discussed in the next section. If you do not wish to activate the cool down phase, pres INC. the display will show:

<div style="border:1px solid black">**BALLOAD? NO**</div>

You can now define for step 1 whether the load balancing is enabled. Load balancing is essentially a modulated fill. A target temperature can be programmed and the machine will use a combination of the hot water fill valve and the cold water fill valve to maintain a given temperature. If you wish to activate temperature controlled fill, press ENTER. The display will change to:

<div style="border:1px solid black">**BALLAD? NO**</div>

To implement temperature controlled fill, four additional parameters must be entered. These are discussed in the next section. If controlled fill, press INC. The display will

<div style="border:1px solid black">**DRAIN? NO**</div>

To activate the Drain and end Step 1, press ENTER, pressing INC or DEC will scroll through the other functions to end the step. The step can end with a Drain, a Water Level, a Water Temperature, or an elapsed Time. Selecting on of the functions by pressing ENTER changes the display and prompts you to enter a value for the particular function.
EXAMPLE:

<div style="border:1px solid black">**LEVEL NO**</div>

ENTER

<div style="border:1px solid black">**LEVEL = cm**</div>
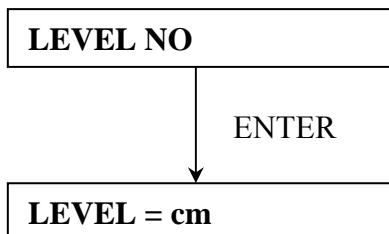
Type the required value in using the numerical keypad and press ENTER.

In the event that you choose a level or a temperature to end the step, you will be prompted with:

<div style="border:1px solid black">**WDT = NO**</div>

This is the **W**atch **D**og **T**imer. Press ENTER to set the value.

<div style="border:1px solid black">**WDT = m**</div>

Set the time in minutes, press ENTER

<div style="border:1px solid black">**WDT = s**</div>

Set the time in seconds, press ENTER. This timer provides a time in which the temperature or water level you have programmed can be reached. If the level or temperature cannot be reached in the given amount of time, the wash program will continue. Be sure do enter a time that is reasonably longer than the presumed time for filling or heating.

The display now shows:

> **STORE?**

Pressing STOP will cancel the programming and abort any parameters you have entered. To save, press ENTER. Now the start of a new step will be indicated. For two seconds the display show:

> **STAET STEP 2**

The display then changes to:

> **COOLING? NO**

At this point, you may continue assign steps to the cycle using the same programming sequence as used for step 1. If programming is complete, press STOP. the

> **PREWASH =?**

You may now program another Prewash cycle, or select one of the other cycle types and continue programming. To exit from cycle programming, press RESET.

Cool down Phase

The cool down phase allows you to specify a temperature to reach before draining the machine. There are five parameters to be programmed: Minimum Level, Maximum Level, Temperature, WDT, and Motor. The cool down phase operates as follows:

 ➢ The water is drained to the minimum level as mentioned above.

 ➢ Cold water is then added up to the maximum level as mentioned above, and the temperature is monitored.

 ➢ Draining and filling continue until either the temperature is reached, or the WTD (watch dog timer) has expired.

The motor profile chosen is active throughout this step.

Load Balancing / Temperature Controlled Fill

The Load Balancing option is essentially a temperature controlled, or modulated, fill. Cold and Hot water are added to the machine while the temperature and level are monitored. Four parameters must be entered: Level, Temperature, WDT, and Motor. The option functions as follows: Cold or Hot water is added to the machine depending upon the temperature set (Hot if the water temperature is lower than programmed or cold if it is higher) until the programmed water level is reached. Then the next step of the cycle can begin. During this phase, the WDT (watch dog timer) is active, which will flag a fault if the fill time is longer than the programmed WDT. The chosen motor routine is active for this entire process.

Heating

Throughout the programming of the steps, when heating is inserted, this tells the control to regulate the temperature. In a step that ends with a required temperature, the heating value must be greater than or equal to the step ending temperature. For example, if 50 degrees was set for heating, but 70 degrees was required to end the step, the machine could never reach 70 degrees, causing a fault from the Watch Dog Timer. In cases where the step is ended by time or level, the temperature can be selected from 30 to 93 degrees C.

Motor

For the motor function, after pressing ENTER, you are asked to enter a motor function (programmed earlier, see pages 8-10). When you have confirmed the selection with ENTER, the display shows:

RPM =

Enter the desired value and press ENTER to confirm. In Prewash, Wash, Rinse, and Unroll, the maximum speed is 100 RPM. Use Programming Code 207 to set maximum Spin RPM.

Programming Sequence

For Prewash, Wash, Rinse and Unroll, the programming sequence is as follows:

- » Cooling
- » Load Balanced (Temp Controlled Fill)
- » Drain
- » Cold Water
- » Hot Water
- » Heating
- » Detergent 1
- » Detergent 2
- » Detergent 3
- » Detergent 4
- » Hard Water
- » Relay 16 (Detergent 7)
- » Relay 11 (Aux Fill)
- » Relay 12 (Injection Flush)
- » Relay 13 (Drive Balancing)
- » Motor
- » Relay 17 (Detergent6)
- » Relay 18 (Not used)
- » Relay 19 (Detergent 8)
- » Relay 20 (Aux Drain)

» Relay 21 (Not Used)
» Relay 22 (Not Used)
» Relay 23 (Not Used)
» Relay 24 (Not Used)

Editing an existing cycle
If the cycle you chose already exists, the display will show:

ALREADY EXISTS!

At this point, four choices are possible:
1. Choose another cycle by pressing STOP
2. Access the existing cycle by pressing ENTER. In this case, INC or DEC will display the various segments, and the configuration can be modified by using the ENTER and RESET keys as described in the previous section.
3. Insert one or more steps. To do so, scroll through the steps by using the ADVAN key. The display will show START STEP X for two seconds, followed by ALREADY EXISTS! To insert a step, press INS and to:

START STEP 1

Followed by:

COOLING? NO

You may now proceed to program the new step using the techniques described earlier. After confirming storage of the new steps, press STOP.

Remove one or more of the steps from the existing ones. Proceed by pressing ADVAN as describe above in (3). When the message

ALREADY EXISTS!

Appears after the step you wish to remove, press the DEL key. The following message appears:

DELETE?

To confirm deletion of the step, press the ENTER key or press RESET to cancel the operation. After confirmation, press the STOP key to exit.

Each cycle can comprise a maximum of 100steps.
A total of 400 steps can be programmed.

Wash Program Creation
When the machine is stopped, press the START and RESET buttons together. The display is:

No.?

Using the keypad, type 27 and press ENTER. For two seconds, the display shows:

EDIT PROG. No

At this prompt, type the program number you wish to create or edit, followed by the ENTER key. Again, two situations are possible:

➢ The Program does not exist and must be created.

➢ The Program already exists and can be viewed and modified.

Creating a new Wash Program
The display reads

> **NOT FOUND!**

For two seconds, then:

> **C1>?**

At this prompt, press ENTER. The display changes to:

> **C1>PREWASH =?**

Using the INC or DEC key, you can select the type of cycle to insert: Prewash, Wash, Spin, Rinse, and Unroll. For example, if you wish to insert a wash cycle you have named 3, press INC until the display changes to:

> **C1>WASH =?**

Confirm the selection by pressing ENTER. The display changes to:

> **C1>WASH = No.**

Type 3 on the keypad, the press ENTER. Wash 3 is now stored as the first segment of the program. The display will prompt you to enter a second cycle:

> **C2>?**

At this prompt, press ENTER. The choice of cycle will be displayed as previously. Programs can be compiled with up to 15 cycles chosen from those in available in the cycle's library. The same cycle can be used repeatedly in a wash program. After you are through programming, and have confirmed the last cycle, press STOP to terminate programming. The display then shows:

> **STORE?**

Press ENTER to store the program. Press RESET to cancel and return to the beginning if while programming, you enter a wash cycle that does not exist, the following message will appear.

> **NOT FOUND!**

Since the wash cycle doesn't exist, you will have to create it before adding it to a wash program.

Editing an Existing Program

In the event the wash program already exists, the display will change to:

> **ALREADY EXISTS!**

For two seconds, followed by the display of the program contents. For example:

> **C1>RINSE = 1**

By using the INC or DEC keys, the various cycles comprising the wash program can be viewed. The program can be modified, and cycles can be added or deleted.

Deleting a Cycle

Using the INC and DEC keys, find the cycle you wish to delete. While the cycle is displayed, press the delete key, and then press the STOP key when the display changes to:

> **STORE?**

Confirm by pressing the ENTER key. The cycle in question will be deleted, and the cycles following will be decremented by one.

> **STORE?**

Inserting a Cycle

To insert a cycle, use the INC and DEC keys to find the cycle that will follow the cycle you are about to insert. The new cycle will be inserted just before the cycle displayed. Now press the INS key, the request to enter a new cycle will be displayed:

> **C->?**

Press ENTER to confirm that you wish to insert a new cycle:

> **Cn> PREWASH=?**

Use the INC and DEC keys to reach the required cycle and press ENTER to confirm. You will then be asked to enter the cycle number:

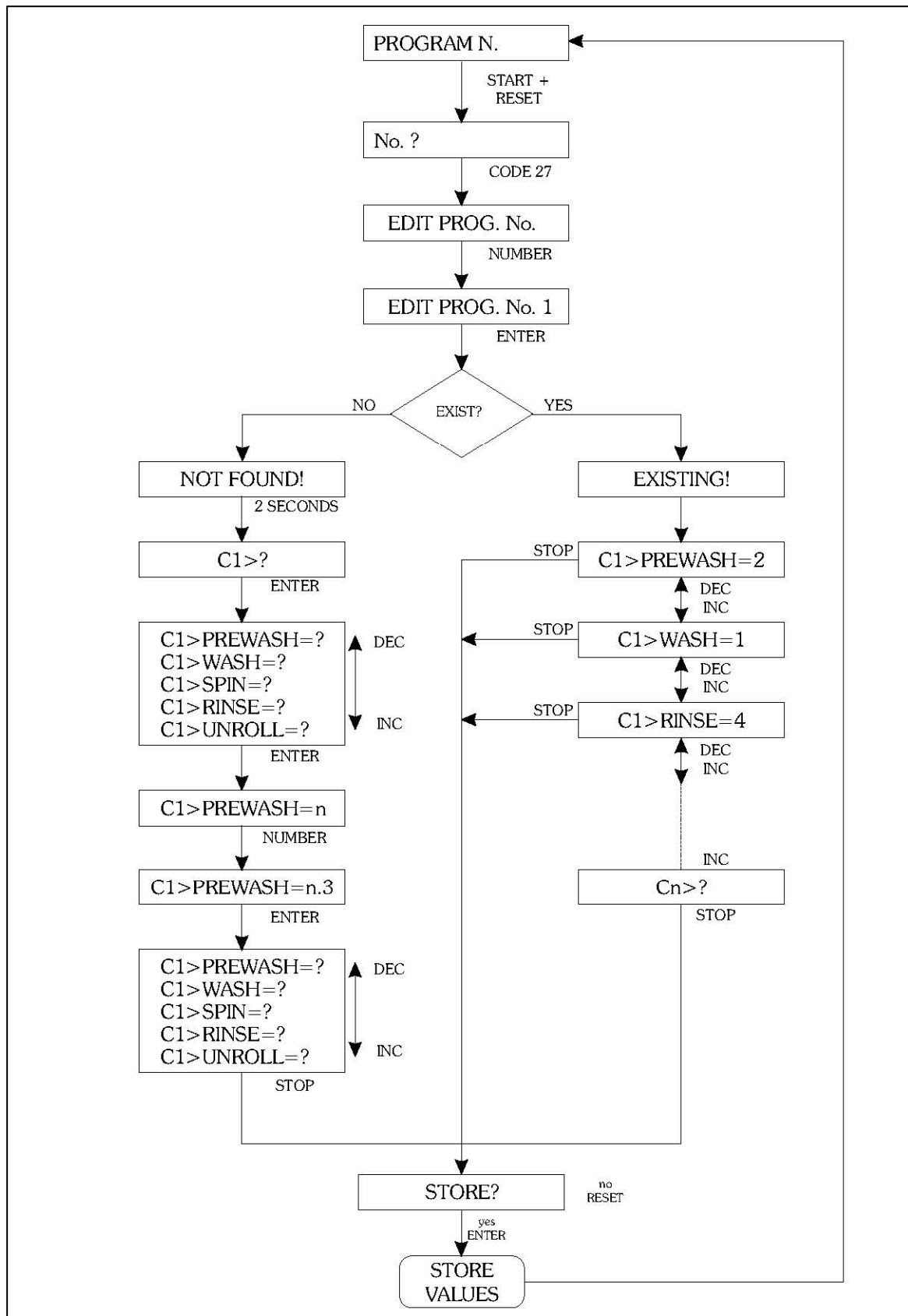> **Cn> PREWASH=No.?**

After entering the cycle number and pressing the ENTER key, you can leave programming by pressing STOP. The display changes to:

> **STORE?**

Press the ENTER key to store the altered program. All the following cycles will be incremented by one. If you don't want to change the program, press the RESET key rather than the ENTER key. This will cancel all modifications made.

Wash Program Creation Continued

```
                          ┌─────────────────┐ ◄──────────────────────────┐
                          │   PROGRAM N.    │                            │
                          └─────────────────┘                            │
                               │ START +                                 │
                               │  RESET                                  │
                               ▼                                         │
                          ┌─────────────────┐                            │
                          │     No. ?       │                            │
                          └─────────────────┘                            │
                               │ CODE 27                                 │
                               ▼                                         │
                          ┌─────────────────┐                            │
                          │  EDIT PROG. No. │                            │
                          └─────────────────┘                            │
                               │  NUMBER                                 │
                               ▼                                         │
                          ┌─────────────────┐                            │
                          │ EDIT PROG. No. 1│                            │
                          └─────────────────┘                            │
                               │  ENTER                                  │
                               ▼                                         │
              NO          ╱───────────╲         YES                      │
        ┌─────────────────    EXIST?    ─────────────────┐               │
        │                ╲───────────╱                   │               │
        ▼                                                ▼               │
  ┌──────────────┐                             ┌──────────────┐          │
  │  NOT FOUND!  │                             │  EXISTING!   │          │
  └──────────────┘                             └──────────────┘          │
        │ 2 SECONDS                                   │                   │
        ▼                              STOP           ▼                   │
  ┌──────────────┐                 ┌──────── ┌──────────────────┐        │
  │    C1>?      │                 │         │ C1>PREWASH=2     │        │
  └──────────────┘                 │         └──────────────────┘        │
        │ ENTER                    │              │  DEC                  │
        ▼                          │              │  INC                  │
  ┌──────────────┐ ▲ DEC           │     STOP     ▼                       │
  │ C1>PREWASH=? │ │        ┌──────┼──────── ┌──────────────────┐        │
  │ C1>WASH=?    │ │        │      │         │ C1>WASH=1        │        │
  │ C1>SPIN=?    │ │        │      │         └──────────────────┘        │
  │ C1>RINSE=?   │ │        │      │              │  DEC                  │
  │ C1>UNROLL=?  │ ▼ INC    │      │              │  INC                  │
  └──────────────┘          │      │     STOP     ▼                       │
        │ ENTER             │  ┌───┼──────── ┌──────────────────┐        │
        ▼                   │  │   │         │ C1>RINSE=4       │        │
  ┌──────────────┐          │  │   │         └──────────────────┘        │
  │ C1>PREWASH=n │          │  │   │              │  DEC                  │
  └──────────────┘          │  │   │              │  INC                  │
        │ NUMBER            │  │   │              ┊                       │
        ▼                   │  │   │              ┊  INC                  │
  ┌──────────────┐          │  │   │         ┌──────────────────┐        │
  │C1>PREWASH=n.3│          │  │   │         │    Cn>?          │        │
  └──────────────┘          │  │   │         └──────────────────┘        │
        │ ENTER             │  │   │              │  STOP                 │
        ▼                   │  │   │              │                       │
  ┌──────────────┐ ▲ DEC    │  │   │              │                       │
  │ C1>PREWASH=? │ │        │  │   │              │                       │
  │ C1>WASH=?    │ │        │  │   │              │                       │
  │ C1>SPIN=?    │ │        │  │   │              │                       │
  │ C1>RINSE=?   │ │        │  │   │              │                       │
  │ C1>UNROLL=?  │ ▼ INC    │  │   │              │                       │
  └──────────────┘          │  │   │              │                       │
        │ STOP              │  │   │              │                       │
        └──────────────┐    │  │   │    ┌─────────┘                       │
                       ▼    ▼  ▼   ▼    ▼                                 │
                    ┌─────────────────┐   no                             │
                    │     STORE?      │  RESET                           │
                    └─────────────────┘                                  │
                         │ yes                                           │
                         │ ENTER                                         │
                         ▼                                               │
                    ╭─────────────────╮                                  │
                    │     STORE       │──────────────────────────────────┘
                    │     VALUES      │
                    ╰─────────────────╯
```

After power is applied to the machine, and the internal diagnostics are complete, the machine is ready for a program to be chosen. The display will show:

> **PROGRAMN._**

Using the keypad, type the number of the program you wish to run followed by the ENTER key. The display will change to show the fist cycle of the selected program:

> **PRWH 1 EXECUT.?**

Press START to execute the program, or RESET to return to program selection. While the program is executing, the display shows the current segment of the program, and the ending condition of the segment. See the following examples:

Level
If the end requirement of the segment (cycle) is a particular water level, the display will show:

> **RINSE1 LVL=cm12**

Cm12 is the actual water level in the machine (12 centimeters). Pressing the LEVEL key shows, for 3 seconds, the required value to advance. If INC or DEC is pressed, you can temporarily modify the value for the current step. Pressing TEMP allows you to see the current temperature of the water. Pressing the TIME key shows the watch dog timer (WDT) value for the current step.

Temperature
If the end requirement of the segment is a particular temperature, the display will show:

> **WASH3 TEMP = 35C**

Where 35C is the actual temperature of the wash solution. By pressing TEMP the display will change, for 3 seconds, show the required step temperature for advance. Pressing INC or DEC allows modification of the value for the step. Pressing LEVEL allows you to see the current water level. Pressing the TIME key shows the watch dog timer (WDT) value for the current step.

Time
If the e In this case, the display shows:

> **RINSET1 T =2m 30s**

The remaining time left in the step. INC and DEC allow you to add or subtract minutes for the current cycle. TEMP allows you to view the current water temperature, and LEVEL shows the current water level.

NOTE: During heating, fill and drain phases, the WDT (watch dog timer) is activated. If the phase does not complete before the timer expires, an alarm will be displayed indicating that the particular phase did not complete within the maximum time allowed.

Single Step Execution
A single step or cycle of a wash program can be executed. At the main prompt, enter zero for the program number. For two seconds, the display changes to:

> | **SINGLE CYCLE** |

Then, using the INC and DEC keys, you may choose the cycle you wish to run (PREWASH, WASH, RINSE, SPIN, UNROLL). When you have selected you cycle, confirm by pressing ENTER. The display changes to:

> | **RUN?** |

Pressing the START key will start the machine.

Partial Program
A program can be partially run. After selecting the program you wish to execute, the display will show:

> | **RUN?** |

Instead of pressing ENTER to execute the program, press the ADVAN key. The cycles within the program will be displayed incrementally. Choose the point at which you would like to begin, and press the START key. The machine will begin operation from this point.

Displaying the Current Program and Step
While the machine is in operation, pressing then ENTER key will cause the display to show the current program number and step.

> | **PRG 1 STP 3** |

Soak
You can insert a pause at any point of the wash program with the exception of distribution and spin. To do so, simply press the PAUSE key. The display will begin showing a time, counting up as long as the machine remains paused. Pressing the START key will restart the program at the point it was paused. As long as the machine is paused, all other WDT (watch dog timers) are paused as well.

Advance
While any program is running, you can end the current step and advance to the next one by pressing the ADVAN key. If the key is pressed during a spin, the spin will be aborted, and the standard spin slow down time will be activated.

Halting a Program
At any time during the execution of the wash program, the running program can be terminated by pressing the STOP key.

Water Level Refresh
While a program is running, if the water level drops to a level which is 3cm below the target level, cold water will automatically be added to replenish the level.

Unbalance

If, during a spin segment, the load is excessively out of balance, the spin will stop, and a redistribution of the goods will take place. If three consecutive out of balances occur, the machine will end the program. After the first unbalance, the balance indicator will light on the control panel.

Power Failure

If the power fails during execution of a program, and is of less than one second, it is ignored. If the failure is longer than one second, the machine stops. Upon restoration of mains power, the display shows RESTART CYCLE? And the power failure indicator illuminates on the front panel. If you wish to restart the program at the point in which power failed, press the START key. At this point, the program restarts at the point of power failure and the power failure indicator turns off. If you wish to cancel the program, simply press the RESET key. This function is not active while a single cycle is running.

End of Program

When a program has completed, the message PLEASE WAIT is displayed and the buzzer sounds for 40 seconds. Then, if the water level is lower than 3cm and the temperature is lower than 40C, the message END OF ACTIVITIES is displayed and the door may be opened. The buzzer can be silenced by pressing the RESET key. If the temperature or water level are out of bounds, the display shows the offending value and the door cannot be opened.

Malfunction Alarms

The state of the water temperature and water levels are constantly monitored to prevent functioning problems with these devices. Watch Dog Timers (WDT) are used to prevent cycle failure when temperatures, fills, drains, and levels don't meet programmed values. In the event of a program fault, the buzzer sounds and the display changes to show the fault:

> **LEVEL FAULT**

Indicates a problem with the level sensing system. This could be a loose or cracked water level tube, the level sensor, or the level sensing circuit. As long as the system detects a problem with the level sensing system, the machine will be inoperable. The buzzer can be disabled with the RESET key.

> **TEMP FAULT**

Indicates a problem with the temperature sensing circuitry, temperature probe, or wiring. The machine continues to function, although auxiliary heating (if equipped) is not possible. The Temperature fault indicator on the control panel will be illuminated.

> **WDT TEMP EXPIRED**

Indicates the programmed temperature was not reached within the allotted time. The most common cause is a malfunctioning auxiliary heating system. A short WDT time and very cold water can also cause this problem. Pressing the START key will cancel the alarm.

> **WDT LEVEL EXPIRED**

Indicates the programmed level was not reached within the allotted time. The most common causes:

During Fill
➤ Faulty water inlet
➤ Low or no water pressure
➤ Faulty drain valve
➤ Problem with water level tube Pressing START will continue the program, while RESET will cancel the program.

During Fill
➤ Drain valve blocked
➤ Drain hose blocked
➤ Faulty Drain valve

Press RESET to end the program.

OVERLOADED!

Indicates a fault in the drive system. On inverter driven equipment, indicates a drive fault, on non inverter driven equipment, indicates a motor overload condition. Press RESET to clear the fault. If this fault recurs during the next wash program, contact a qualified service technician.

DOOR OPEN!

Indicates the door is not closed properly. This fault disables the machine until cleared, and aborts a program if active. Press RESET to clear the fault.

DRAIN

Indicates a water level of greater than 2cm a the onset of spin. The machine will resume the spin when the level falls below the threshold. Press RESET to abort the cycle.

Access Functions
All machine functions are accessed by pressing START and RESET simultaneously. At the changed prompt, enter the required function.

12   Cycle (segment) Programming
27   Wash Programming
45   Motor rotation programming (agitation profiles).
181   Clears all programs. Will delete anything programmed in memory.
201   Language: 1 -Italian, 2 -English, 3 German, 4 -Spanish, 5 -French.
205   16 or 24 relay output.
207   Maximum RPM.
209   Temperature hysterisis (1 -10 degrees C). 3 degrees C is default.
210   Temperature displayed in degrees C
211   Temperature displayed in degrees F
212   Maximum water level (10 -100cm)
213   Minimum water level for heating (230cm)
214   Display number of hours in operation
215   Display total number of programs run

216   Display number of wash programs run since last maintenance request.
217   Reset maintenance request.
218   Display and set the number of washes between maintenance requests.
219   Coast down safety timer. DO NOT MODIFY!
220   Deletes all programs and cycles from memory.
221   Copy from control to the memory card
222   Copy from memory card to the control (programs and cycles only)
223   Copy from memory card to the control (programs, cycles and parameters)
225   Disables the ADVANCE key
230   Maximum water level allowed during spin DO NOT MODIFY!

Maintenance Request
It is possible to set a number of wash programs to execute, following which the machine will call for maintenance:

> ### MAINT. REQ.

The message appears at the start of a program, and is repeated at the beginning of each wash program until reset by a qualified service technician.

Disable the Machine
Function 118
Upon entering this function, the machine will not operate. The power must be cycled (turned off, then back on) for the function to activate. Upon power up, the display will show:

> ### !

To re-enable the machine, type 118 at prompt. START + RESET is not needed.

Change Language
Function 201
The control can display in 5 different languages. To change the language, use function 201. Upon entering the function, the display changes to:

> ### Lingua No.

Type the number which corresponds to your language, followed by ENTER:
1. Italian
2. English
3. German
4. Spanish
5. French

16 or 24 Relays
Function 205
Each time function 205 is entered, the controller toggles between 16 and 24 relay setup. After entering 205, the display shows the current mode.

Maximum Spin Speed
 Function 201
This function allows you to display or modify the maximum spin speed. Upon entering the function, the display will show the current value. To exit without changing, press RESET. If you wish to change the value, press ENTER, type the new value, and press ENTER again. If the value is within the acceptable range, the display will show YES. Otherwise, the display will show NO.

Temperature Hysterics
 Function 209
This function sets the allowed temperature variation parameter. The default value is 3 degrees. If you wish to change the value, press ENTER, key in the new value (1 -10 degrees C), then press ENTER again to confirm. To exit without changing, press RESET.

Temperature Display
 Function 210 Function 211
During program execution, the temperature may be displayed in degrees Fahrenheit or degrees Centigrade. For degrees F, enter function 211. For degrees C, enter function 210. Please note that this is for display only. Programming is always done in degrees C. See the handy conversion chart in the back of this manual.

Maximum Water Level
 Function 212
This function allows display and modification of the maximum programmable water level. To change the value, press ENTER, type in the new value, and press ENTER again to confirm. To exit without modification, press RESET. The allowable values are 11 to 100 cm.
Minimum Level for Heat Function 213
This function sets the minimum allowable water level for heat to activate. Upon entering the function, the value will be displayed. To modify, press ENTER. Type the new value, and press ENTER again to confirm.

Hours of Work
 Function 214
Entering function 214 displays the total number of hours the machine has operated. The display shows the value for about 3 seconds. Only complete cycles are counted for this timer -partially complete cycles are not counted as part of the total work time.

Total Number of Washes
 Function 215
This function shows the total number of wash programs executed since the machine was installed.

Number of Washes since last Maintenance
Function 216
This function shows the total number of wash programs executed since the last required maintenance was performed (set with function 218).

Reset Maintenance Alarm
Function 217
This function resets the maintenance alarm, but does not clear the number of washes counter (function 215).

Maintenance Required
Function 218
This function sets the number of washes before the maintenance alarm is activated. The default value is 450. This means that after 450 wash programs have been completed, the maintenance alarm will be displayed. To change the value, use the INC or DEC keys. The value changes by 10 each time a key is pressed. You may hold down the key to change the number quickly. Once the desired value is reached, press the ENTER key to confirm.

Spin Safety Coast down Time
Function 219
Upon entering function 219, you display the spin safety coast down time. If you wish to change this (not recommended), press ENTER, followed by the new value, then ENTER to confirm. To exit without changing the value, press RESET

Memory Erasure
Function 181 Functions 220
Partial or total clearing of the control memory is possible. Function 220 clears all programs and cycles, but machine parameters are not erased. Function 181 erases all programs and cycles, and also erases all machine parameters, thus reinitializing the control. After keying in the function, the display reads: "DELETE EEPROM?" Press ENTER to confirm. Press RESET to abort the procedure.

Memory Card
Function 222
Function 223
The control allows transfer of programs from and to a credit card sized memory card. This allows great flexibility in programming. The card must be inserted into the control with the contacts facing up. Card insertion and removal must be done with the machine powered down.

Function 221
To transfer programs, cycles and parameters onto the memory card, use function 221.
  1. Power down the machine
  2. Insert the memory card
  3. START + RESET
  4. 221
  5. ENTER The display now shows "COPY TO M. CARD?"
  6. Press ENTER The display now shows "COPY TO CARD" followed by "COPY OK."

Function 222
Function 222 works exactly like function 221, except it transfers programs and cycles from the memory card to the control.
  1. Power down the machine
  2. Insert the memory card
  3. START + RESET
  4. 221

5. ENTER The display now shows "COPY FROM M. CARD?"
6. Press ENTER The display now shows "COPY FROM CARD" followed by "COPY OK."

Function 223

Function 223 works exactly like function 222, except it transfers programs, cycles *and machine parameters* from the memory card to the control.

1. Power down the machine
2. Insert the memory card
3. START + RESET
4. 221
5. ENTER The display now shows "COPY FROM M.CARD?"
6. Press ENTER The display now shows "COPY FROM CARD" followed by "COPY OK."

Disabling the Advance Key
Function 225

This function disables the ADVAN key. This function toggles between enabled (YES) and disabled (NO). Default value is enabled (YES).

Maximum Level in Spin
Function 230

This function sets the maximum water level during execution of a spin. If you do not wish to modify the value, press RESET. If you want to modify the value, press ENTER, followed by the new value, then ENTER again to confirm. Allowed values are from 2 to 60 cm.

Software Version
STOP + RESET

Pressing the STOP and RESET keys simultaneously displays the installed firmware version.

Cylinder Speed INS

Pressing the INS key during execution of a wash program displays the commanded wash cylinder speed in RPM.

Metric Conversions
Fahrenheit to Centigrade

F	C		F	C		F	C
86	30		129.2	54		172.4	78
87.8	31		131	55		174.2	79
89.6	32		132.8	56		176	80
91.4	33		134.6	57		177.8	81
93.2	34		136.4	58		179.6	82
95	35		138.2	59		181.4	83
96.8	36		140	60		183.2	84
98.6	37		141.8	61		185	85
100.4	38		143.6	62		186.8	86
102.2	39		145.4	63		188.6	87
104	40		147.2	64		190.4	88
105.8	41		149	65		192.2	89
107.6	42		150.8	66		194	90
109.4	43		152.6	67		195.8	91
111.2	44		154.4	68		197.6	92
113	45		156.2	69		199.4	93
114.8	46		158	70		201.2	94
116.6	47		159.8	71		203	95
118.4	48		161.6	72		204.8	96
120.2	49		163.4	73		206.6	97
122	50		165.2	74		208.4	98
123.8	51		167	75		210.2	99
125.6	52		168.8	76		212	100
127.4	53		170.6	77			

Centimeters to Inches

cm	in		cm	in		cm	in		cm	in		cm	in
1	0.39		21	8.27		41	16.14		61	24.02		81	31.89
2	0.79		22	8.66		42	16.54		62	24.41		82	32.28
3	1.18		23	9.06		43	16.93		63	24.8		83	32.68
4	1.57		24	9.45		44	17.32		64	25.2		84	33.07
5	1.97		25	9.84		45	17.72		65	25.59		85	33.46
6	2.36		26	10.24		46	18.11		66	25.98		86	33.86
7	2.76		27	10.63		47	18.5		67	26.38		87	34.25
8	3.15		28	11.02		48	18.9		68	26.77		88	34.65
9	3.54		29	11.42		49	19.29		69	27.17		89	35.04
10	3.94		30	11.81		50	19.69		70	27.56		90	35.43
11	4.33		31	12.2		51	20.08		71	27.95		91	35.83
12	4.72		32	12.6		52	20.47		72	28.35		92	36.22
13	5.12		33	12.99		53	20.87		73	28.74		93	36.61
14	5.51		34	13.39		54	21.26		74	29.13		94	37.01
15	5.91		35	13.78		55	21.65		75	29.53		95	37.4
16	6.3		36	14.17		56	22.05		76	29.92		96	37.8
17	6.69		37	14.57		57	22.44		77	30.31		97	38.19
18	7.09		38	14.96		58	22.83		78	30.71		98	38.58
19	7.48		39	15.35		59	23.23		79	31.1		99	38.98
20	7.87		40	15.75		60	23.62		80	31.5		100	39.37

Blank Programming Chart

Prewash:		Wash:		Rinse:		Spin:		Unroll:	

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Function																						
Cooling																						
Temp Cont Fill																						
Drain																						
Cold Water																						
Hot Water																						
Heating																						
Detergent 1																						
Detergent 2																						
Detergent 3																						
Detergent 4																						
Detergent 5																						
Relay 16																						
Aux Fill																						
Injection Flush																						
Balancing																						
Motor Profile																						
Speed RPM																						
Detergent 6																						
Detergent 7																						
Detergent 8																						
Aux Drain																						
Relay 21																						
Relay 22																						
Relay 23																						
Relay 24																						
End Step																						
Level cm																						
Temp C																						

Cooling		Temperature Controlled Fill		Heating	
Level min	cm=	Level	cm=	Temperature	C=
Level max	cm=	Temperature	C=		
Temperature	C=	WDT m:s	:		
WDT m:s	:				

Notes:

Water Level Guide

Machine	Cylinder Dia	Offset	Low-15%		Med – 25%		High – 35%	
MWSP-40	0.680 m	6 cm	16 cm	6.4 in	23 cm	9.1 in	30 cm	11.7 in
MWSP-60	0.790 m	6 cm	18 cm	7.0 in	26 cm	10.1 in	34 cm	13.2 in
MWSP-100	0.940 m	6 cm	20 cm	7.9 in	30 cm	11.6 in	39 cm	15.3 in
MWSI-110	0.940 m	10 cm	24 cm	9.5 in	34 cm	13.2 in	43 cm	16.9 in
MWSI-135	1.092 m	10 cm	26 cm	10.4 in	37 cm	14.7 in	48 cm	19.0 in
MWSI-200	1.169 m	10 cm	28 cm	10.8 in	39 cm	15.4 in	51 cm	20.0 in
MWSI-275	1.321 m	10 cm	30 cm	11.7 in	43 cm	16.9 in	56 cm	22.1 in
MWSI-300	1.321 m	10 cm	30 cm	11.7 in	43 cm	16.9 in	56 cm	22.1 in
MWSI-450	1.629 m	10 cm	34 cm	13.6 in	51 cm	20.0 in	67 cm	26.4 in
MWHI-85	0.914 m	10 cm	24 cm	9.3 in	33 cm	12.9 in	42 cm	16.5 in
MWHI-125	1.060 m	10 cm	26 cm	10.2 in	37 cm	14.4 in	47 cm	18.5 in
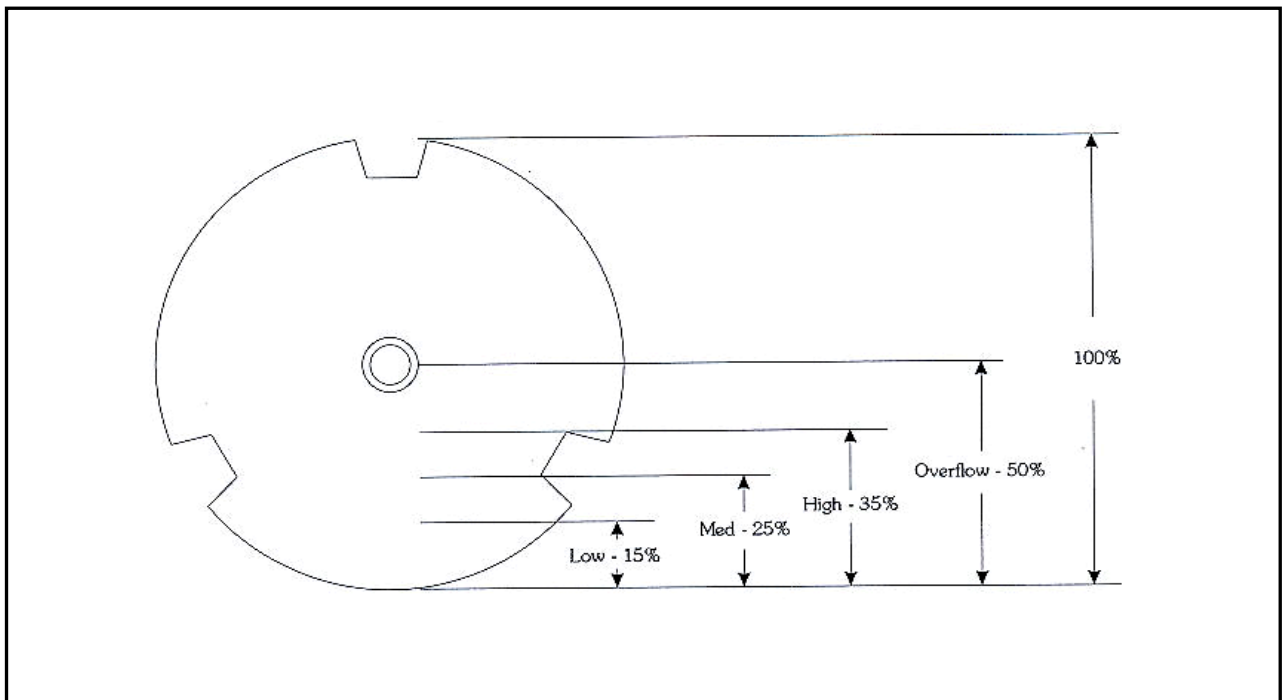
WC 03 PROGRAM SPEEDS IN RPM FROM G-FORCE POINTS

Machine	Cylinder Dia	0.4 G	0.8 G	1.0 G	1.5 G	3.0 G	50 G	150 G	320 G	350 G
MWHE-30	0.612 m	34.2	48.4	54.1	66.2	93.7	382.4	662.4	967.5	1011.8
MWSP/MWHP/MWHE-40	0.680 m	32.4	45.9	51.3	62.8	88.9	362.8	628.4	917.5	959.9
MWSP/MWHP/MWHE-60	0.790 m	30.1	42.6	47.6	58.3	82.4	336.6	583.0	851.5	890.6
MWHE-80	0.924 m	27.8	39.4	44.0	53.9	76.2	311.2	539.1	797.4	823.4
MWSP/MWHP-100	0.940 m	27.6	39.0	43.6	53.4	75.6	308.6	534.5	780.6	816.4
MWSI-110	0.940 m	27.6	39.0	43.6	53.4	75.6	308.6	534.5	780.6	816.4
MWSI-135	1.092 m	25.6	36.2	40.5	49.6	70.1	286.3	495.9	724.3	757.5
MWSI-200	1.169 m	24.7	35.0	39.1	47.9	67.8	276.7	479.3	700.0	732.1
MWSI-275	1.321 m	23.3	32.9	36.8	45.1	63.8	260.3	450.9	658.5	688.7
MWSI-300	1.321 m	23.3	32.9	36.8	45.1	63.8	260.3	450.9	658.5	688.7
MWSI-450	1.629 m	21.0	29.6	33.1	40.6	57.4	234.4	406.0	593.0	620.2
MWHI-85	0.914 m	28.0	39.6	44.2	54.2	76.7	312.9	542.0	791.6	827.9
MWHI-125	1.060 m	26.0	36.8	41.1	50.3	71.2	290.6	503.3	735.1	768.8

EXTRAC RPM TO G-FORCE

Machine	Cylinder Dia	0.4 G	0.8 G	1.0 G	1.5 G	3.0 G	50 G	150 G	320 G	350 G
MWHE-30	0.612 m	382.4	468.4	540.8	604.7	662.4	715.5	764.9	811.2	855.1
MWSP/MWHP/MWHE-40	0.680 m	362.8	444.3	513.1	573.6	628.4	687.7	725.6	769.6	811.2
MWSP/MWHP/MWHE-60	0.790 m	336.6	412.2	476	532.2	583	629.7	673.2	714	752.7
MWHE-80	0.924 m	311.2	381.2	440.2	492.1	539.1	582.3	622.5	660.2	695.9
MWSP/MWHP-100	0.940 m	308.6	377.9	436.4	487.9	534.5	577.3	617.1	654.6	690.0
MWSI-110	0.940 m	308.6	377.9	436.4	487.9	534.5	577.3	617.1	654.6	690.0
MWSI-135	1.092 m	286.3	350.6	404.9	452.7	495.9	535.6	572.6	607.3	640.2
MWSI-200	1.169 m	276.7	338.9	391.3	437.5	479.3	517.7	553.4	587.0	618.7
MWSI-275	1.321 m	260.3	318.8	368.1	411.6	450.9	487	520.6	552.2	528.0
MWSI-300	1.321 m	260.3	318.8	368.1	411.6	459.9	487	520.6	552.2	582.0
MWSI-450	1.629 m	234.40	287.1	331.5	370.6	406	438.5	468.8	497.2	524.1
MWHI-85	0.914 m	312.9	383.3	442.5	494.8	542.0	585.4	625.8	663.8	699.7
MWHI-125	1.060 m	290.6	355.9	410.9	459.4	503.3	534.6	581.2	616.4	469.7

Machine	Cylinder Dia	275 G	300 G	325 G	350 G
MWHE-30	0.612 m	896.9	936.7	975.0	1011.8
MWSP/MWHl	0.680 m	850.8	888.7	925.0	959.9
MWSP/MWHl	0.790 m	789.4	824.5	858.2	890.6
MWHE-80	0.924 m	729.9	762.4	793.5	823.4
MWSP/MWHl	0.940 m	723.7	755.8	786.7	816.4
MWSI-110	0.940 m	723.7	755.8	786.7	816.4
MWSI-135	1.092 m	671.4	701.3	729.9	757.5
MWSI-200	1.169 m	648.9	677.8	705.5	732.1
MWSI-275	1.321 m	610.5	637.6	663.6	688.7
MWSI-300	1.321 m	610.5	637.6	663.6	688.7
MWSI-450	1.629 m	549.7	574.2	597.6	620.2
MWHI-85	0.914 m	733.9	766.5	797.8	827.9
MWHI-125	1.060 m	681.5	711.8	740.8	768.8

SECTION 5

MAINTENANCE

A. MACHINE MAINTENANCE

Routine Maintenance

Routine maintenance maximizes operating efficiency and minimizes downtime. The maintenance procedures described below will prolong the life of the machine and help prevent accidents.

Daily, weekly, monthly, and quarterly checklists are provided at the end of this section. Laminate the checklists to preserve them for repeated copying. Operators and technicians are encouraged to add checks specific to their machine's particular application. When possible, space is provided on the checklists for this purpose.

The following maintenance procedures must be performed regularly at the required intervals.

Install all panels that are removed to perform service and maintenance procedures. Do not operate the machine with missing guards or with broken or missing parts. Do not bypass any safety devices!

Daily

1. Inspect water inlet valve hose connections on the back of the machine for leaks.

2. Inspect steam hose connections for leaks, where applicable.

3. Verify that insulation is intact on all external wires and that all connections are secured. If bare wire is evident, call a service technician.

4. Check door interlock before starting operation:
   a. Attempt to start the washer with the door open. The washer should not start with the door open.
   b. Close the door without locking it and attempt to start the machine. The machine should not start with the door open.
   c. Close and lock the door and start a cycle. Attempt to open the door while the cycle is in progress. The door should not open. If manual latch is moved out of position the machine should stop.

If the door lock and interlock are not functioning properly, call a service technician.

End of the day

1.   Clean the AC drive box filters.

      a.   Snap off the external plastic cover which contains the filter. Remove the foam filter from the cover.
      b.   Wash the filter in a mild soap solution or vacuum it clean.

2.   Clean the door gasket of residual detergent and foreign matters.

3.   Clean the automatic supply dispenser and the lid inside and out with mild detergent. Rinse with clean water.

4.   Clean the washer's top, front and side panels with mild detergent. Rinse with clean water.

5.   Leave loading door open at the end of each day to allow moisture to evaporate.

NOTE: Leave loading door open at end of each complete cycle to allow moisture to evaporate. Unload the machine promptly after each completed cycle to prevent moisture build up.

Weekly

1. Check the machine for leaks.
      a.   Start an unloaded cycle to fill the machine.
      b.   Verify that door and door gaskets do not leak.
      c.   Verify that the drain valve is operating. If water does not leak or during the pre wash segment, drain valve is closed and functioning properly.

Monthly

NOTE: Disconnect power to the machine at its source before performing the monthly maintenance procedures.

1.   Each month or after every 200 hours of operation, lubricate bearing and seals. See instructions on the machine.
      a.   Use premium grade lithium based #2 grease, Never mix two types of grease, such as petroleum and silicone.
      b.   Pump the grease gun slowly, permitting only the following number of strokes:
         1.   Bearing grease fitting, 2 strokes.
         2.   Seal grease fitting, 1 stroke.

     Do not pump the grease gun if grease comes out of the bearing housing. This can result in over lubrication, causing damage to bearings and seals.

2.   If the machine is provided with automatic lubricators, check that they are injecting grease. Normally they last for approximately one year. Mark new lubricators with installation date.

3.   Clean the AC drive fins:
      a.   Remove the AC drive box cover.
      b.   Blow the fins clean using compressed air at a pressure of 60-90 psi (4-6 Bar) or by using canned compressed air. Use care to avoid damaging cooling fan or other components.

NOTE: No amount of visible foreign matter should be allowed to accumulate on fins or the finger guard.

4.   Use the following procedures to determine if v-belts require replacement or adjustment. Call a qualified service technician in either case.
   a.   Check V- belts for uneven wear and frayed edges.
   b.   After disconnecting power to the machine and removing all panels necessary for access to the drive belts, use the following method to verify that the V-belts are properly tensioned. See figure? Belt deflection should be measured as close to the center of the span length as possible. A set force should be applied in the center of the length, as specified in the table below. Belt tension is adjusted by turning the set screw on the idler pulley, Turning the set screw clockwise tighten the belt, and vice versa. Clean external water and steam filters.

Belt Tension Chart

Machine Model	Deflection		Force Applied	
	inch	mm.	Lbs	Kg.
MWHI 85	0.62	16	5.62	2.55

   c.   Verify that V-belts are properly aligned by checking pulley alignment. Place a straightedge across both pulley faces. The straight edge should make contact with the pulleys in four places. See Figure.

5.   Remove Back panel and check overflow hose and drain hose for leaks.

6.   Unlock the hinged lid and check the supply dispenser hoses and hose connections.

7.   Clean inlet hose filter screen:
   a.   Turn water off and allow valve to cool, if necessary
   b.   Unscrew inlet hose and remove filter screen.
   c.   Clean with compressed air and reinstall. Replace if worn or damage.

8.   Tighten motor mounting bolt lock nuts and bearing bolt lock nuts, if necessary.

9.   Use compressed air to clean lint from, motor.

10.   Clean interior of machine, both basket and shell, by wiping with a water-soaked sponge or cloth.

11.   Use compressed air to ensure that all electrical components are free of moisture and dust.

Belt tension figure   **Pulley Alignment**
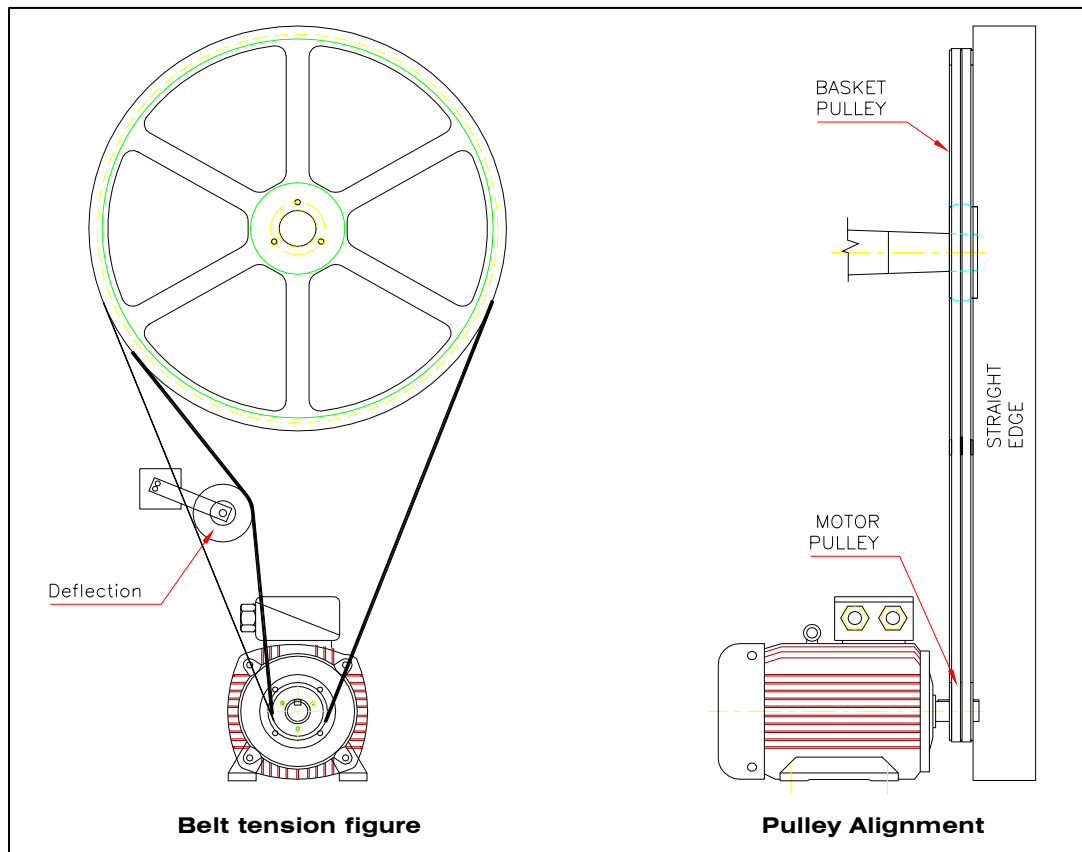
Quarterly

NOTE: Disconnect power to the machine before performing the quarterly maintenance procedures.

1. Tighten door hinges and fasteners, if necessary.

2. Tighten anchor bolts, if necessary.

3. Check all painted surfaces for bare metal (matching paint is available from the manufacturer.)
    a. If bare metal is showing, paint with primer or solvent-based paint.
    b. If rust appears, remove it with sandpaper or chemical means. Then paint with primer or solvent-based paint.

4. Clean steam filter, where applicable. See picture of steam filter.
    a. Turn off steam supply and allow time for the valve to cool.
    b. Unscrew nut on filter.
    c. Remove filter element and clean.
    d. Replace element and nut, if necessary.

5.   Inspect suspension components for wear or corrosion. Observe the operation of the machine to ensure proper tension and operation of the suspension system.

6. On machines with tilting device, inspect the mechanism for proper operation and paint corroded areas.

    1. Turn off steam supply and allow time for the valve to cool if necessary.

    2. Unscrew nut.

3.   Remove element and clean.

4.   Replace element and nut.

NUT

ELEMENT

Steam valve filter
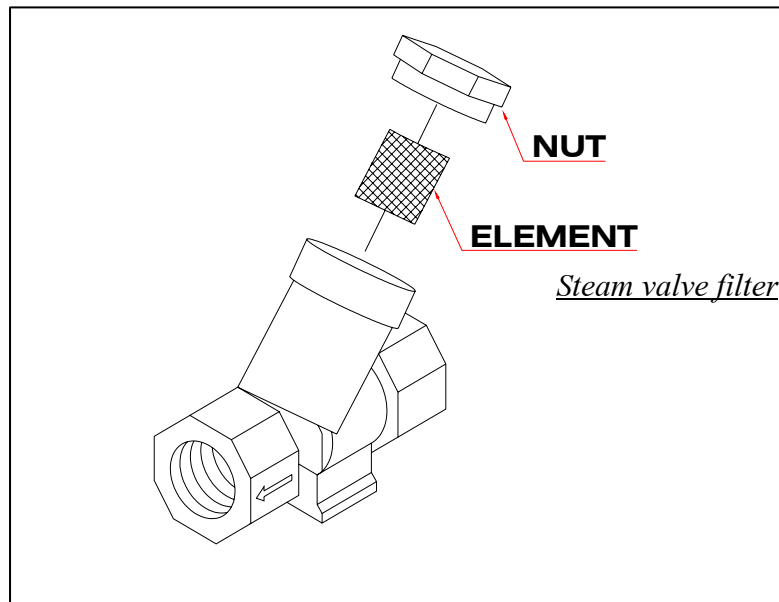
Care of stainless steel

Maintain the natural beauty of stainless steel and prolong its service lift by following these steps.

1. Ordinary deposits if dirt and grease can be remove with detergent and water. The metal should be thoroughly rinsed and dried after washing. Periodic cleaning will help to maintain the bright surface appearance and prevent corrosion.

2. Contact with dissimilar metal should be avoided whenever possible. This will help prevent galvanic corrosion when salty or acidic solutions are present.

3. Salty or acidic solutions should not be allowed to evaporate and dry on stainless steel. They may cause corrosion. Ensure that the stainless steel is wiped clean of acidic solution residues.

4. Deposits that adhere to the stainless steel should be removed, especially from crevices and corners. When using abrasive cleaners, always rub in the direction of the polish lines or grain of the stainless steel to avoid scratch marks. Never use ordinary steel wool or steel brushes on the stainless steel. Use stainless steel wool or soft non-metal bristle brushes.

5. If the stainless appears to be rusting the source of the rust may actually be an iron or steel part not made of stainless steel, such as a nail or screw. One remedy is to paint all carbon steel parts with a heavy protective coating. Stainless steel fasteners should be used when possible.

6. Discoloration or heat tint from overheating may be removed by scouring with powder or by employing special chemical solutions.

7. Sanitizes or sterilizing solution should not be left in stainless steel equipment for prolonged periods of time. They often contain chlorine, which may cause corrosion.   The stainless steel should be cleaned and rinsed thoroughly of any solution containing chlorine.

8. When an external chemical supply system is used, make certain that no siphoning of chemicals occurs when the washer-extractor is not in use. Highly concentrated chemicals can cause severe damage to stainless steel and other components within the machine. Damage of this kind is not covered by the manufacturer warranty. Locate the pump below the washer's injection point to prevent siphoning of chemicals into the machine.

B. AC DRIVE MAINTENANCE

Perform daily and periodic inspection to avoid trouble and keep reliable operation for a long time. Take care of the following during work.

WARNING

The electric charge in the DC bus capacitor may be being charged even after the power is turned off. Therefore, it may take a long time until the DC link circuit voltage reaches a safety potential. Do not open the control circuit terminal block cover within 5 minutes after the power ha been turned off. Then remove the control circuit and main circuit terminal block covers. Check that the DE link circuit voltage between main circuit terminals P(+) and N(-) does not exceed the safety voltage (+25 VDC) with a multi meter and start the maintenance and inspection.

Electric shock may occur.
- Maintenance, inspection, and parts replacement should be mace only by authorized persons.
- Take off the watch, rings and other metallic matter before starting work.
- Use insulates tools.
- Never remodel

Electric shock or injuries could occur.

Daily Inspection

Visually inspect errors in the state of operation from the outside without removing the covers while the inverter operates or while it is turned on.
- Check if the expected performance (satisfying the standard specification) is obtained.
- Check if the surrounding environment satisfies "Operating Environment."
- Check that the LED monitor displays normally.
- Check for abnormal noise, odor, or excessive vibration.
- Check for traces of overheat, discoloration and other defects.

Judgement of service life using maintenance information

Menu#5 "Maintenance information" in Programming mode can be used to display data for the judgement of replacement of "DC bus capacitor," "electrolytic capacitor on the printed circuit board"and"cooling fan" as a guide.

If the replacement data is out of the judgement level for early warning, an early warning signal is output to an external device through terminal (Y1) (function code E20). (When any replacement data is out of the judgement level, terminal (Y1) outputs ON signal.)

Part Replacement Judgement with Menu#5 "Maintenance Information"

Parts to be replaced	Judgement level
DC bus capacitor	85% or lower of the capacitance than that of the factory setting
Electrolytic capacitor on the printed circuit board.	61,000 hours or longer as accumulated run time
Cooling fan (Applicable motor rating: 1.5 to 3.7 kW).	61,000 hours or longer as accumulated run time (Assumed life of cooling fan at ambient inverter temperature of 40ºC).

1. DC bus capacitor

Measure the capacitance of the DC bus capacitor as follows:

The capacitance is displayed in the reduction ratio (%) of the initial value written in the inverter memory before shipment.

Capacitance measurement procedure

1. Remove the RS485 communications card (option) from the inverter if it is mounted. Disconnect the DC bus link circuit to other inverters from terminals P (+) and N (-) of the main circuit if any. A DC reactor (option) an braking resistor (option) may not be disconnected.
   Keep the ambient temperature at $25 \pm 10°C$.
2. Turn off the digital inputs (FWD, REV, and X1 to X3) at the control terminals.
   - If an external potentiometer is connected, to terminal (13), remove it.
   - Set the data of function codes E20 and E27 as the transistor output (Y1) or relay output (30A, B, C) does not come on while the inverter power is turned off. E.g. recommended settings are to assign normal logic signal (RUN) and (ALM) to terminals (Y1) and (30A, B, C,) respectively.
3. Turn the inverter power on.
4. Check that the cooling fan rotates and the inverter is on halt.
5. Turn the main power supply off. Start measuring the capacitance of the DC bus capacitor.
6. After the LED monitor is unlit completely, turn the main power supply on again.
7. Select Menu#5 "Maintenance Information" in Programming mode, and check the reduction ratio (%) of the capacitance of the DC bus capacitor.

2. Electrolytic capacitor on the printed circuit board

The inverter keeps an accumulative total of the number of hours that power has been applied to the control circuit and displays it on the LED monitor. Use this to determine when the capacitor should be replaced. The display is in units of 1000 hours.

3. Cooling fan

The inverter accumulates hours for which the cooling fan has run. The display is in units of 1000 hours.

The accumulated time should be used just a guide since the actual service life will be significantly affected by the temperature and operation environment.

SECTION 6

DECOMMISSIONING

In the event that the machine must be decommissioned, follow the following steps:

1. Remove the chemical injection supply system, if applicable.
    a. Have a qualified electrician disconnect power to the chemical infection supply system and the re-circulation pump at their source.
    b. Using the manufacturer's instructions, carefully remove the chemical injection supply system from the machine. Make certain that no chemicals come in contact with or clothing.

2. Clean interior of machine, both basket and shell.
    a. Flush supply dispenser with water.
    b. Run a short rinse cycle to clean chemical residues from the interior of the machine.

3. Disconnect electrical power.
    a. Shut of main power supply at the breaker box or main control panel.
    b. Do not attempt to disconnect power supply wires from power supply. Have a qualified electrician disconnect power to machine at is source.

4. Disconnect hoses.
    a. Disconnect drain hose from sump. Gutter or drain. Turn off water supply.
    b. Disconnect individual hot and cold water inlet hoses from the machine.
    c. Disconnect the compressed air supply to the machine.
    d. Allow time for residual water in the machine to drain. Then disconnect drain hoses from the machine.
    e. Disconnect necessary plumbing on the re-circulation system, if applicable.

5. Disconnect steam hoses, if applicable
    a. Turn off steam supply and allow time for the valve to cool.
    b. Disconnect steam hose from machine.

6. Remove the machine from its foundation pad.
    a. Keep all panels in place to provide stability when moving the machine.
    b. Verify that door is closed and secure.
    c. Loosen and remove anchor bolts holding the machine base to the floor.
    d. Break the grout seal at each corner of the machine, using a crowbar.
    e. Place the machine on skid and bolt the frame to the skid. This will facilitate the removal of the machine, on to a truck.

7. Recycle.
    The manufacturer uses the highest quality material in their products so that those materials may be recycled at the end of the product's service life.

SECTION 7

TROUBLE SHOOTING

Before Proceeding with Troubleshooting

WARNING

      If any of the protective functions have been activated, first remove the cause. Then, after checking that the all run commands are set to off, reset the alarm. Note that if the alarm is reset while any run commands are set to on, the inverter any supply the power to the motor which may cause the motor to rotate.

Injury may occur.

      - Even though the inverter has interrupted power to the motor, if the voltage is applied to the main circuit power input terminals L1/R, L2/S and L2/T (L1/L and L2/N for single-phase voltage input), voltage may be output to inverter output terminals U, V, and W.

      - Some electric charge may remain in the DC bus capacitor even after the power is turned off. Therefore, it may take some time until the DC link circuit voltage reaches a safe level. Before touching the circuit, wait for at least five minutes after the power has been turned off and check that the DC voltage between main circuit terminals P (+) and N(-) is less than +25 VDC using a multi meter.

Electric shock may occur.

Follow the procedure below to solve problems.
1. First, check that the inverter is correctly wired, referring "Wiring for Main Circuit Terminals and Grounding Terminals"
2. Check whether an alarm code is displayed on the LED monitor.
If no alarm code appears on the LED monitor

      If any problems persist after the above recovery procedure, contact the shop where you bought the inverter or your local Fuji branch office.

Quick reference table of alarm codes

Alarm code	Name	Refer to	Alarm code	Name	Refer to
OC1			OH4	PTC thermister for motor protection	P.7-12
OC2	Over current protection	P.7-8	dbH	Overheat protection for braking resistor	P.7-13
OC3			OL1	Electronic thermal overload relay	P.7-14
OU1			OLU	Overload protection	P.7-14
OU2	Over voltage protection	P.7-9	Er1	Memory error	P.7-15
OU3			Er2	Remote keypad communications error	P.7-15
LU	Under voltage protection	P.7-10	Er3	CPU error	P.7-16
L in	Input phase loss protection	P.7-11	Er6	Operation protection	P.7-16
OPL	Output phase loss protection	P.7-11	Er8	RS485 communications error	P.7-16
OH1	Overheat protection for heat sink	P.7-11	ErF	Data save error during under voltage	P.7-17
OH2	External alarm input	P.7-12			

If no alarm code appears on the LED monitor
Motor is running abnormally

1. The motor does not rotate.

Possible Causes	What to Check and Suggested Measures
1. No power supplied to the inverter.	Check the input voltage, output voltage and inter phase voltage unbalance. → Turn on a molded case circuit breaker, an earth leakage circuit breaker (with the exception of those exclusively designed for protection from ground faults) or a magnetic contactor. → Check for voltage drop, phase loss, poor connections, or poor contacts, and fix them if necessary.
2. No forward/reverse operation command was inputted, or both the commands were inputted simultaneously (external signal operation).	Check the input status of the forward/reverse command with menu#4 "I/O checking" using the keypad. → Input a run command. → Set either the forward or reverse operation command to off if both commands are being inputted. → Correct the assignment of commands (FWD) and (REV) to function codes E98 and E99. → Connect the external circuit wires to control circuit terminals (FWD) and (REV) correctly.
3. No indication of rotation direction (keypad operation).	Check the input status of the forward/reverse rotation direction command with Menu#4 "I/O Checking" using the keypad. → Input the rotation direction (F02=0), or select the keypad operation with which the rotation direction is fixed (F02=2 or 3)
4. The inverter could not accept any run commands from the keypad since it was not in Running mode.	Check which operation mode the inverter is in, using the keypad. → Shift the operation mode to Running mode.
5. A run command with higher priority than the one attempted was active, and the run command was stopped.	While referring to the block diagram of the drive command generator check the higher priority run command with Menu#2 "Data checking: and Menu#4 "I/O checking" using the keypad. Refer to the FRENIC-Mini User's Manual (MEH446), → Correct any incorrect function code data settings (e.g. cancel the higher priority run command).
6. The set frequency was set to the same or lower than the value of the starting or stop frequency.	Check that a frequency command has been entered, with Menu#4 "I/O checking" using the keypad. → Set her value of the set frequency to the same of higher than that of the starting or stop frequency (F23 of F25). → Reconsider the starting and stop frequencies (F23 and F25), and if necessary, change them to lower values. → Inspect the frequency command devices, signal converters, switches or relay contacts. Replace any ones that are faulty. → Connect the external circuit wires correctly to terminals (13), (12), (11) and (C1).

Possible Causes	What to Check and Suggested Measures
7. A frequency command with higher priority than the one attempted was active.	Check the higher priority run command with Menu#2 "Data checking" and Menu#4 "I/O checking" using the keypad, referring to the block diagram of the drive command generator. Refer the FRENIC-Mini User's Manual (MEH446), → Correct any incorrect function code data settings (e.g. cancel the higher priority run command).
8. The peak and bottom frequencies for the frequency limiters were set incorrectly.	Check the data of function codes F15 and F16. → Change the peak and bottom frequencies (F15 and F16) the correct ones.
9. The coast-to-stop command was effective.	Check the data of function codes E01, E02, E03, E98 and E99 with Menu#2 "Data Checking" and the input signal status with Menu#4 "I/O checking" using the keypad. → Release the coast-to-stop command setting.
10. Broken wire, incorrect connection or poor contact with the motor.	Check if the output current and connection are correct. → Repair the wires to the motor, or replace them.
11. Overload	Check that the output current is not too large. → Lighten the load (e.g. operate the mechanical brake correctly).
12. Torque generated by the motor was insufficient.	Check that the motor starts running if the value of torque boost (F09) is increased. → Increase the value of torque boost (F09) and try to run the motor
	Check the data of function codes F04, F05, H50, and H51. → Change the V/f pattern to match the motor's characteristics.

2. The motor rotates, but the speed does not increase.

Possible Causes	What to Check and Suggested Measures
1. The maximum frequency was set to too low a value.	Check the data of function code F03. → Correct the data of the maximum frequency (F03).
2. The peak frequency of the frequency limiter was set to too low a value.	Check the data of function code F15. → Correct the data of the peak frequency of the frequency limiter (F15).
3. The set frequency was set to too low a value.	Check the signals for the set frequency from the control circuit terminals with Menu#4 "I/O checking" using the keypad. → Increase the set frequency. → If an external potentiometer for fre3quency command, signal converter, switches, or relay contacts are malfunctioning, replace them. → Connect the external circuit wires to terminals (13), (12), (11), and (C1) correctly.
4. A frequency command with higher priority than the one attempted (e.g. multistep frequency, communications or jogging operation, etc.) was active and the set frequency was set to too low a value.	Check the higher priority run command with Menu#2 "Data checking" and Menu#4 "I/O checking" using the keypad, referring to the block diagram of the drive command generator. Refer to the FRENIC-Mini User's Manual (MEH446) → Correct any incorrect function code data settings (e.g. cancel the higher priority run command, etc).

Possible Causes	What to Check and Suggested Measures
5. The acceleration/deceleration time was too long.	Check the data of function code F07, F08, E10, E11 and H54. → Change the acceleration/deceleration time to match the load.
6. Overload	Measure the output current. → Lighten the load (e.g. operate the mechanical brake correctly).
7. The current limiting operation did not increase the output frequency.	Check whether current limiting is active or not with Menu#3 "Drive monitoring" and check the current limiting level (F44) using the keypad. → Change the level of the current limiting (F44) to an appropriate value.
	Decrease the value of torque boost (F09), then turn the power off and back on again and check if the speed increases. → A
	Check the data of function codes F18, C50, C32, C34, C37 and C39 → Change the bias and gain to correct values.
8. Bias and grain set incorrectly.	Check the data of function codes F18, C50, C32, C34, C37 and C39 → Change the bias and gain to correct values.

3. The motor runs in the opposite direction to the command.

Possible Causes	What to Check and Suggested Measures
1. Wiring had been connected to the motor incorrectly	Check the wiring to the motor. → Connect terminals U, V, and W of the inverter to the respective U, V, and W terminals of the motor.
2. Incorrect connection and settings for run commands and rotation direction command (FWD) and (REV)	Check the data of function codes E98 and E99 and the connection to terminals (FWD) and (REV). → Correct the data of the function codes and the connection.
3. The setting for the rotation direction via keypad operation is incorrect.	Check the data of function code F02. → Change the data of function code F02 to 2 (forward rotation) or 3 (reverse rotation).

4. If the speed variation and current vibration (such as hunting) occur at the regular speed.

Possible Causes	What to Check and Suggested Measures
1. The frequency command fluctuated.	Check the signals for the frequency command with Menu#4 "I/O checking" using the keypad. → Increase the filter constants (C33 and C38) for the frequency command.
2. The external frequency command device was used.	Check that there is no noise in the control signal wires from external sources. → Isolate the control signal wires from the main circuit wires as far as possible. → Use shielded or twisted wires for the control signal.
3. The slip compensation gain was too large.	Check that the motor vibration is absorbed if the slip compensation (P09) is cancelled. → Correct or cancel the slip compensation (P09) data.

Possible Causes	What to Check and Suggested Measures
4. The vibration system having low stiffness in a load caused hunting or the current is irregular due to special motor constants.	Cancel the automatic control system (automatic torque boost, slip compensation, energy saving operation, overload prevention control, current limiting) and check that the motor vibration is suppressed (F37, P09, H70, and F43). → Cancel the functions causing the vibration. → Readjust the data of the oscillation suppression gain (H80) currently set.
	Check that the motor vibration is Suppressed if you decrease the carrier frequency (F26) or set the sound tune to level 0 (F27=0). → Decrease the carrier frequency (F26) or set the sound tune level 0 (F27=0).

5. If grating sound can be hard

Possible Causes	What to Check and Suggested Measures
1. The carrier frequency was set too low.	Check the data of function codes F26 and F27. → Increase the carrier frequency (F26). → Select the optimal value to the selection function (F27).

6. If grating sound can be hard

Possible Causes	What to Check and Suggested Measures
1. The inverter ran the motor by S-curve or curvilinear pattern.	Check the data of function code H07. → Select the linear pattern.
2. The current limiting prevented the output frequency from increasing.	Check that current limiting is enabled with Menu#3 "Drive monitoring" and check the current limiting level (F44) using the keypad. → Change the current limiting level (F44) to a correct value. → Increase the acceleration and deceleration time (F07, F08, E10, and E11).
3. The automatic deceleration was active.	Check the data of function code H69. → Consider the use of a braking resistor. → Increase the deceleration time (F08 and E11).
4. Overload	Measure the output current. → Lighten the load.
5. Torque generated by the motor was insufficient.	Check that the motor starts running if the value of the torque boost (F09) is increased. → Increase the value of the torque boost (F09).
6. An external frequency command device is being used.	Check that the there is no noise in the external signal wires. → Isolate the control signal wires from the main circuit wires as far as possible. → Use shielded wire or twisted wire for the control signal wires.

7. Even if the power recovers after an instantaneous power failure, the motor does not restart.

Possible Causes	What to Check and Suggested Measures
1. The setting of function code F14 did not make the motor restart even if the power recovered after an instantaneous power failure.	Check if an under voltage trip occurs. → Change the data of function code F14 to 4 or 5.
2. The run command stayed off even after the power recovered.	Check the input signal with Menu#4 "I/O checking" using the keypad. → Check the power recovery sequence with an external circuit. If necessary, consider the use of a relay that can keep the run command on.

Problems with inverter settings

1. If the data of function codes cannot be changed

Possible Causes	What to Check and Suggested Measures
1. An attempt was made to change function code data that cannot be changed when the inverter is running.	Check if the inverter is running with Menu#3 "Drive monitoring" using the keypad and then confirm whether the data of the function codes can be changed when the motor is running by referring to the function code tables. → Stop the motor then change the data of the function cades.
2. The data of the function codes is protected.	Check the data of function code F00 → Disable data protection of function codes.
3. The WE-KP command ("Enable editing of function codes data from keypad") is not input though it has been assigned to a digital input terminal.	Check the data of function code E01, E02, E03, E98 and E99 and the input signals with Menu#4 "I/O checking" using the keypad. → Cancel data protection of the function codes or turn on the "Enable editing of function codes data from keypad" command.
4. DC link circuit voltage was below the under voltage detection level.	Check the DC link circuit voltage with Menu #5 "Maintenance information" and measure the input voltage using the keypad. → Supply power to match the inverter's input rating and change the data of the function codes.

2. The desired menu is not displayed.

Possible Causes	What to Check and Suggested Measures
1. The limiting menus function was not selected appropriately.	Check the data of function code E52. → Change the data of function code E52 to display the desired menu.

3. Nothing appears on the LED monitor.

Possible Causes	What to Check and Suggested Measures
1. No power supplied to the inverter.	Check the input voltage, output voltage and inter phase voltage unbalance. → Connect a molded case circuit breaker, an earth leakage circuit breaker (with the exception of those exclusively designed for protection from ground faults) or a magnetic contactor. → Check for voltage drop, phase loss, poor connections, or poor contacts, and fix them if necessary.
2. The power for the control circuit did not reach a high enough level.	Check if the jumper bar has been removed between terminals P1 and (+) or if there is poor contact between the jumper bar and the terminals. → Connect the jumper bar to terminals P1 and P (+) or tighten the screws. Or connect a DC reactor. → Replace the inverter if it is malfunctioning.

If an alarm code appears pm the LED monitor
1. "OCn" Overcurrent protection

Problem The inverter output current momentarily exceeded the over current level.
    OC1   Overcurrent occurred during acceleration.
    OC2   Overcurrent occurred during deceleration.
    OC3   Overcurrent occurred when running at a constant speed.

Possible Causes	What to Check and Suggested Measures
1. The inverter output terminals were short circuited.	Remove the wires connected to the inverter output terminals (U, V, and W) and measure the inter phase resistance. Check if the resistance is too low. → Remove the part that short-circuited (including replacement of the wires, relay terminals and motor).
2. Ground faults occurred at the inverter output terminals.	Remove the wires connected to the inverter output terminals (U, V, and W) and perform a Mugger test. → Remove the part that short-circuited (including replacement of the wires, relay terminals and motor).
3. Loads were too heavy.	Measure the motor current with a measuring device, and to trace the current trend. Therefore, use this information to judge if the trend is over the calculated load value for your system design. → If the load is too heavy, decrease it or raise the inverter capacity.
	Trace the current trend and check if there are any sudden changes in the current. → If there are any sudden changes, make the load variation smaller or raise the inverter capacity. → Enable current limiting (H12)
4. The value set for torque boost (F09) was too large. F37 = 0, 1, 3, or 4)	Check that the output current decreases and that the motor does not come to stall if you set a lower value than the current one for F09. → Lower the value for torque boost (F09) if the motor is not going to stall.

Possible Causes	What to Check and Suggested Measures
5. The acceleration/deceleration time was too short.	Check that the motor generates enough torque required during acceleration/deceleration. That torque is calculated from the moment of inertia for the load and the acceleration/deceleration time. → Increase the acceleration/deceleration time (F07, F08, E10, E11, and H54). → Enable current limiting (F43). → Raise the inverter capacity.
6. Malfunction caused by noise.	Check if noise control measures are appropriate (e.g. correct grounding and routing of control and main circuit wires). → Implement noise control measures. → Enable the auto-reset function (H04).

2. "OUn" Overvoltage protection

Problem The DC link circuit voltage was over the detection level of overvoltage.
    OU1   Overvoltage occurs during the acceleration.
    OU2   Overvoltage occurs during the deceleration.
    OU3   Overvoltage occurs during running at constant speed.

Possible Causes	What to Check and Suggested Measures
1. The power supply voltage was over the range of the inverter's specifications.	Measure the input voltage. → Decrease the voltage to within that of the specifications.
2. The acceleration time was too short.	Check if the overvoltage alarm occurs after sudden acceleration. → Increase the acceleration time (F07, E10, and H54). → Select the S-curve pattern (H07). → Consider the use of a braking resistor.
3. The deceleration time was too short for the moment of inertia for load.	Recalculate the deceleration torque from the moment of inertia for load and the deceleration time. → Increase the deceleration time (F08, E11, and H54). → Enable automatic deceleration (H69=1) so that when the DC link circuit voltage exceeds the overvoltage suppression level, the inverter changes the deceleration time to three times longer than the set value. → Set the rated voltage (at base frequency) (F05) to 0 to improve braking ability. → Consider the use of a braking resistor.
4. Loads were suddenly removed.	Check if the alarm occurs when loads are suddenly removed. → Check if the inverter operation suddenly changes from driving operation to braking operation. → Consider the use of a braking resistor.
5. Braking load was too heavy.	Compare the braking torque of the load with that of the inverter. → Set the rated voltage (at base frequency) (F05) to 0 to improve braking ability. → Consider the use of a braking resistor.

Possible Causes	What to Check and Suggested Measures
6. Malfunction caused by noise.	Check if the DC link circuit voltage was below the protective level when the alarm occurred. → Improve noise control. → Enable the auto-reset function (H04).

3. "LU" Undervoltage protection

Problem DC link circuit voltage was below the undervoltage detection level.

Possible Causes	What to Check and Suggested Measures
1. An instantaneous power failure occurred.	Reset the alarm. → If you want to restart running the motor without making the alarm occur, set 4 or 5 to F14 depending on load.
2. The power inverter was switched back on too soon (with F14=1)	Check that you switch the inverter on after the power for the control circuit had reached an appropriate level. This can be checked using the display on the LED monitor. → Wait for a longer time than the last time before switching the inverter on.
3. The power supply voltage did not reach the range of the inverter's specifications.	Measure the input voltage. → Increase the voltage to within that of the specifications.
4. Peripheral equipment for the power circuit malfunctioned, or the connection was incorrect.	Measure the input voltage to find where the peripheral equipment malfunctioned or which connection is incorrect. → Replace any faulty peripheral equipment, or correct any incorrect connections.
5. Other loads were connected to the same power system and required a large current to start running to the extent that it caused a temporary voltage drop.	Measure the input voltage and check the voltage variation. → Reconsider the power system configuration.
6. Inrush current caused the power voltage drop because power transformer capacity was insufficient.	Check if the alarm occurs when you switch on a molded case circuit breaker, an earth leakage circuit breaker (with the exception of those exclusively designed for protection from ground faults) or a magnetic contactor. → Reconsider the capacity of the power transformer.

4. "Lin" Input phase loss protection

Problem Input phase loss occurred, or interphase voltage unbalance rate was large.

Possible Causes	What to Check and Suggested Measures
1. Main circuit power input wires broken.	Measure the input voltage. → Repair or replace the wires.
2. The terminal screws for the main circuit power input were not tight enough.	Check if the terminal screws have become loose. → Tighten the terminal screws to the recommended torque.
3. Interphase unbalance rate of three-phase voltage was too large.	Measure the input voltage. → Connect an AC reactor (ACR) or a DC reactor (DCR) to lower the rate. → Raise the inverter capacity.
4. Overload cyclically occurred.	Measure ripple wave of DC link circuit voltage. → If the ripple is large, raise the inverter capacity.
5. Single-phase voltage was inputted to the inverter instead of three-phase voltage input.	Check the inverter type. → Change the inverter to one for single-phase voltage input.

5. "OPL" Output phase loss protection

Problem Output phase loss occurred.

Possible Causes	What to Check and Suggested Measures
1. Inverter output wires are broken	Measure the output current. → Replace the output wires.
2. Wire for motor winding are broken	Measure the output current. → Replace the motor.
3. The terminal screws for inverter output were not tight enough.	Check if any terminal screws have become loose. → Tighten the terminal screws to the recommended torque.
4. A single-phase motor has been connected	Single-phase motor cannot be used. Note that the FRENIC-Mini only drives three-phase induction motors.

6. "OH1" Overheat protection for heat sink

Problem Temperature around heat sink rose.

Possible Causes	What to Check and Suggested Measures
1. Temperature around the inverter exceeded that of inverter specifications.	Measure the temperature around the inverter. → Lower the temperature around the inverter (e.g. ventilate the enclosure well). → Lighten the load.
2. Accumulated running time of the cooling fan exceeded the standard period for replacement, or the cooling fan malfunctioned	Check the accumulated running time (E52=2). Refer to "Reading Maintenance Information". → Replace the cooling fan.
	Visually check that the cooling fan rotates normally. → Replace the cooling fan.

Possible Causes	What to Check and Suggested Measures
3. Air vent is blocked.	Check if there is sufficient clearance around the inverter. → Increase the clearance.
	Check if the heat sink is clogged. → Clean the heat sink.
4. Load was too heavy.	Measure the output current. → Lighten the load (e.g. lighten the load before the overload protection occurs using the overload early warning (E34). → Decease the carrier frequency (F26). → Enable the overload protection control (H70).

7. "OH2" External alarm input

Problem External alarm was inputted (THR).

Possible Causes	What to Check and Suggested Measures
1. An alarm function of the external equipment was activated.	Inspect external equipment operation. → Remove the cause of the alarm that occurred.
2. Connection ha been performed incorrectly.	Check if the wire for the external alarm signal is correctly connected to the terminal to which the "Alarm from external equipment" has been assigned. → Connect the wire for the alarm signal correctly.
3. Incorrect settings.	Check if the "Alarm from external equipment" has been assigned to an unassigned terminal. → Correct the assignment.

8. "OH4" PTC thermistor for motor protection

Problem Temperature of the motor rose abnormally.

Possible Causes	What to Check and Suggested Measures
1. Temperature around the motor exceeded that of motor specifications.	Measure the temperature around the motor. → Decrease the temperature. → Lighten the load.
2. Cooling system for the motor malfunctioned.	Check if the cooling system is operating normally. → Repair or replace the cooling system.
3. Load was too heavy.	Measure the output current. → Lighten the load (e.g. lighten the load before overload occurs using the overload early warning (E34) function). → Decrease the temperature around the motor. → Increase the carrier frequency (F26).
4. The set activation level (H27) of the PTC thermistor for motor overheat protection was inadequate.	Check the thermistor specifications and recalculate the detection voltage. → Reconsider the data of function code H27.

Possible Causes	What to Check and Suggested Measures
5. A PTC thermistor and pull-up resistor were connected incorrectly or their resistance was inadequate.	Check the connections and resistance. → Correct the connections and resistance.
6. The value set for the torque boost (F09) was too high.	Check the data of function code F09 and readjust the data so that the motor does not stall even if you set the data to a lower value. → Change the data of the function code.
7. The V/f pattern did not match the motor.	Check if the base frequency (F04) and rated voltage (at base frequency) (F05) match the values on the nameplate on the motor. → Match the function code data to the values on the nameplate of the motor.

9. "dbH" Overheat protection for barking resistor

Problem Thermal protection for braking resistor activated.

Possible Causes	What to Check and Suggested Measures
1. Braking load was too heavy.	Recalculate the relation between the braking load and braking capacity. → Lighten the braking load. → Reconsider the braking resistor in order to improve braking ability. Resetting the data of function codes F50 and F51 is also required.
2. The deceleration time was too short.	Recalculate the required deceleration torque and time from the moment of inertia for the load and the deceleration time. → Increase the deceleration time (F08, E11, and H54). → Reconsider the braking resistor in order to improve the braking ability. Resetting the data of function codes F50 and F51 is also required.
3. Incorrect values have been set for the data of function codes F50 and F51.	Check the braking resistor specifications. → Reconsider and change the data of function codes F50 and F51.

NOTE: The inverter does not detect the overheating alarm of a braking resistor by monitoring its surface temperature, but by monitoring its load magnitude. Therefore, even if the surface temperature itself does not rise, the alarm may be detected if the resistor is used more frequently than the set data of function codes F50 and F51. If you use the resistor to the limit of its capacity, you must adjust the data of function codes F50 and F51 while checking the surface temperature of the resistor.

10. "OL1" Electronic thermal overload relay

Problem Electronic thermal function for motor overload detection activated.

Possible Causes	What to Check and Suggested Measures
1. Load was too heavy.	Measure the output current. → Lighten the load (e.g. lighten the load before overload occurs using the overload early warning (E34).
2. The acceleration/deceleration time was too short.	Check that the motor generates enough torque for acceleration/deceleration, This torque is calculated from the moment of inertia for the load and the acceleration/deceleration time. → Increase the acceleration/deceleration time (F07, F08, E10, E11 and H54).
3. The characteristics of electronic thermal did not match those of the motor overload.	Check the motor characteristics. → Reconsider the data of function codes P99, F10 and F12. → Use an external thermal relay.
4. Activation level for the electronic thermal relay was inadequate.	Check the continuous allowable current of the motor. → Reconsider and change the data of function code F11.

11. "OLU" Overload protection

Problem Temperature inside inverter rose abnormally.

Possible Causes	What to Check and Suggested Measures
1. Temperature around the inverter exceeded that of inverter specifications.	Measure the temperature around the inverter. → Lower the temperature (e.g. ventilate the enclosure well). → Lighten the load.
2. The service life of the cooling fan has expired or the cooling fan malfunctioned.	Check the accumulated running time of cooling fan (E52=2). Refer to "Reading Maintenance Information". → Replace the cooling fan.
	Visually check that the cooling fan rotates normally. → Replace the cooling fan.
3. Air vent is blocked.	Check if there is sufficient clearance around the inverter. → Increase the clearance.
	Check if the heat sink is clogged. → Clean the heat sink.
4. Load was too heavy.	Measure the output current. → Lighten the load (e.g. lighten the load before overload occurs using the overload early warning (E34). → Decrease the carrier frequency (F26). → Enable overload protection control (H70).
5. The acceleration/deceleration time was too short.	Recalculate the required acceleration/deceleration torque and time from the moment of inertia for the load and the deceleration time. → Increase the acceleration/deceleration time (F07, F08, E10, E11 and H54).
6. The wires to the motor are too long and caused a large amount of current to leak from them.	Measure the leak current. → Connect an output circuit filter (OFL).

12. "Er1" Memory error

Problem Error occurred in writing the data to the memory in the inverter.

Possible Causes	What to Check and Suggested Measures
1. The power supply was turned off when the inverter was writing data (especially initializing data), and the remaining control circuit voltage was not high enough to enable writing of data.	Check if pressing the PRG/RESET key resets the alarm after the function code data are initialized by setting the data of H03 to 1. → Return the initialized function code data to their previous settings, then restart the operation.
2. A high intensity noise was given to the inverter while data (especially initializing data) was being written.	Check if appropriate noise control measures have been implemented (e.g. correct grounding and routing of control and main circuit wires). Alternatively, perform the same check as described in (1) above. → Improve noise control. Alternatively, return the initialized function code data to their previous settings, then restart the operation.
3. The CPU did not operate normally.	Initialize the function code data by setting H03 to 1, and then reset the alarm by pressing the PRG/RESET key and check that the alarm goes on. → This problem was caused by a printed circuit board (PCB) (including the CPU) malfunction, so it is necessary to replace the PCB.

13. "Er2" Remote keypad communications error

Problem A communications error occurred between the remote keypad and the inverter.

Possible Causes	What to Check and Suggested Measures
1. Break in the communications cable or poor contact.	Check continuity of the cable, contacts and connections. → Replace the cable.
2. A high intensity noise was given to the inverter.	Check if appropriate noise control measures have been implemented (e.g. correct grounding and routing of control and main circuit wires). → Improve noise control.
3. The remote keypad malfunctioned.	Check that alarm Er2 does not occur if you connect another remote keypad to the inverter. → Replace the remote keypad.
4. The RS485 communications card malfunctioned.	Check that alarm Er2 does not occur even if you connect another remote keypad to the inverter. → Replace the card.

14. "Er3" CPU error.

Problem A CPU error (e.g. erratic CPU operation) occurred.

Possible Causes	What to Check and Suggested Measures
1. A high intensity noise was given to the inverter.	Check if appropriate noise control measures have been implemented (e.g. correct grounding and routing of control and main circuit wires). → Improve noise control.
2. The printed control circuit board in the inverter malfunctioned.	→ Replace the board.

15. "Er6" Operation protection

Problem An error occurred due to incorrect operation of the motor.

Possible Causes	What to Check and Suggested Measures
1. The STOP key was pressed when H96 = 1 or 3.	→ Change the setting for H96 so that the STOP key priority function is invalid to ensure that the inverter does not operate unexpectedly.
2. The start check function was activated when H96 = 2 or 3.	Check that Er6 occurs when: - The power is switched on - An alarm is released (by pressing the PRG/RESET key or turning reset alarm (RST) on). - The link command (LE) has switched the inverter operations. → Reconsider the running sequence to avoid input of the run command when Er6 has occurred. → Change the setting for H96 so that the STOP key priority function is invalid to ensure the inverter does not operate unexpectedly. (To reset the alarm, turn the run command off.)

16. "Er8" RS485 communications error

Problem A communications error occurred during RS485 communications.

Possible Causes	What to Check and Suggested Measures
1. Host controllers (e.g. PLCs and personal computers) did not operate due to incorrect settings and/or defective software/hardware.	Check the controllers. → Remove the cause of the controller error.
2. Relay converters (e.g. RS232C/RS485 converter) did not operate due to incorrect connections and settings, and defective hardware.	Check the converter (e.g. check for poor contact). → Change the various converter settings, reconnect the wires, or replace hardware (such as recommended devices) as appropriate.
3. Broken communications cable or poor contact.	Check continuity of the cable, contacts and connections. → Replace the cable.

Possible Causes	What to Check and Suggested Measures
4. Even though no response error detection time (y08) has been set, communications did not occur cyclically.	Check the host controllers. → Change the settings of host controller software, or make the no response error detection time invalid (y08=0).
5. A high intensity noise was given to the inverter.	Check if appropriate noise control measures have been implemented (e.g. correct grounding and routing of control and main circuit wires). → Improve noise control. → Improve measures against noise from host controllers. → Replace the relay converter with a recommended insulated converter.
6. Conditions for communications differ between the inverter and host controllers.	Compare the settings of the y codes (y01to y10) with those of the host controllers. → Correct any settings which differ.
7. The RS485 communications card malfunctioned.	→ Replace the card.

17. "ErF" Data save error during under voltage

Problem The inverter was unable to save data such as the frequency commands, timer, and PID process commands set through the keypad when the power was switched off.

Possible Causes	What to Check and Suggested Measures
1. The control circuit voltage dropped suddenly while the data was being saved when the power was turned off, because the electric charge in the DC bus capacitor was rapidly discharged.	Check how long it takes for the DC link circuit voltage to drop to the preset voltage when the power is turned off. → Remove whatever is causing the rapid discharge of the electric charge. After pressing the PRG/RESET key and releasing the alarm, reset the data (such as the frequency commands, timer, and PID process commands) set with the keypad to the correct settings and then restart the motor.
2. A high intensity noise was given to the inverter while data was being written when the power was turned off.	Check if appropriate noise control measures have been implemented (e.g. correct grounding and routing of control and main circuit wires). → Improve noise control. Press the PRG/RESET key to release the alarm, then reset the data (e.g. frequency commands, timer, and PID process commands) set through the keypad to the correct settings. Restart the motor.
3. The CPU did not operate normally.	Check if ErF occurs each time the power is switched off. → This problem was caused by a printed circuit board (PCB) (including the CPU) malfunction, so it is necessary to replace the PCB.

SECTION 8

PARTS LIST

ORDERING SPARE PARTS

In case spare parts are needed, please include the following information with your order:

1. Model and serial number of the equipment (located on the name plate).
2. Part number, part name, and quantity required. Use this manual to facilitate ordering.
3. When ordering electrical motors, please include complete name plate data, motor manufacturer, and wiring diagram number.

Our service and spare parts department consists of specially trained personnel to assist you with your needs. Please do not hesitate to call if we can be of any assistance to you.

Item	Part No.	Qty.	Description
1	A1-S085-001	1	Lid, Supply dispenser
2	A1-S085-002	1	Panel, Front top
3	A1-S085-003	1	Panel, Front middle
4	A1-S085-004	1	Panel, Front lower
5	A1-S085-005	1	Base machine
6	A1-S085-006	1	Right panel assembly
7	A1-S085-007	1	Left panel assembly
8	A1-S085-025	1	Top panel assembly
9	A0-A086-003	1	Plastic knob screw
10	A0-E007-001	1	CPU, Control EL6
11	A0-E032-018	1	Emergency Stop
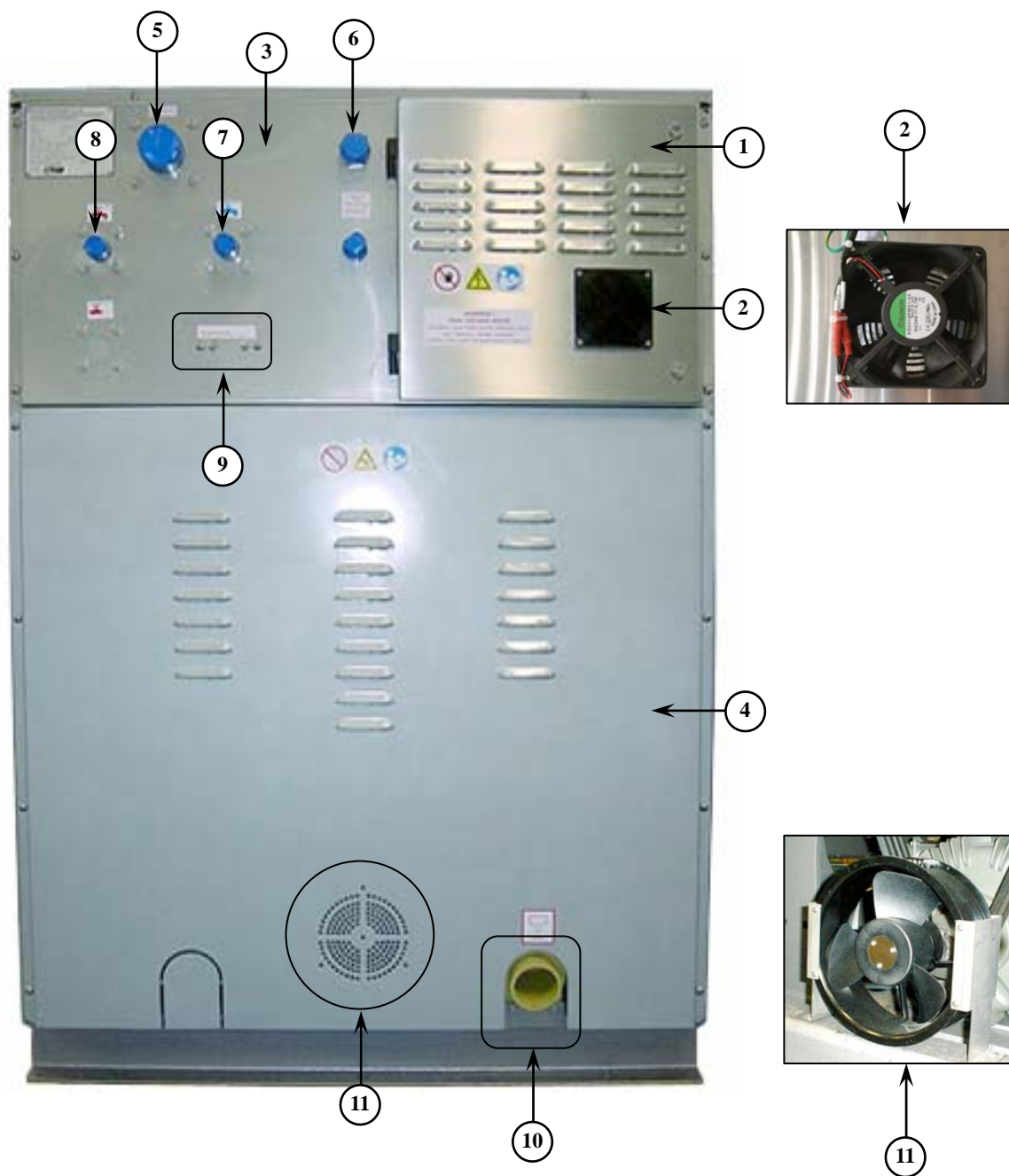
Item	Part No.	Qty.	Description
1	A1-S085-026	1	Door, Control panel
2	A0-E012-006	1	Fan, Cooling
	A0-E012-009	1	Filter, Cooling
3	A1-S085-036	1	Panel, Rear top
4	A1-S085-010	1	Panel, Rear lower
5	A1-S085-031	1	Air vent
6	A0-A028-004	1	Connection PG29
7	A1-S085-032	1	Cold water inlet
8	A1-S085-033	1	Hot water inlet
9	A0-A024-001	1	Grease fitting
10	A0-E041-002	1	Drain valve with overflow
11	A0-E012-005	1	Fan
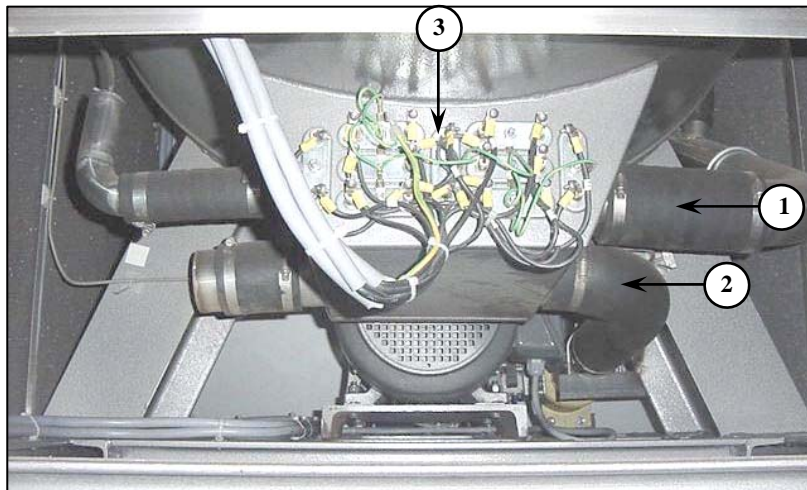
Item	Part No.	Qty.	Description
1	A0-A018-020	1	Tube, Hot & Cold water inlet
2	A0-A018-021	1	Drain hose
3	A0-E005-001	9	Heating element 4000 W
	A0-E005-002	9	Heating element 3000 W
4	A0-E027-007	1	Temperature probe
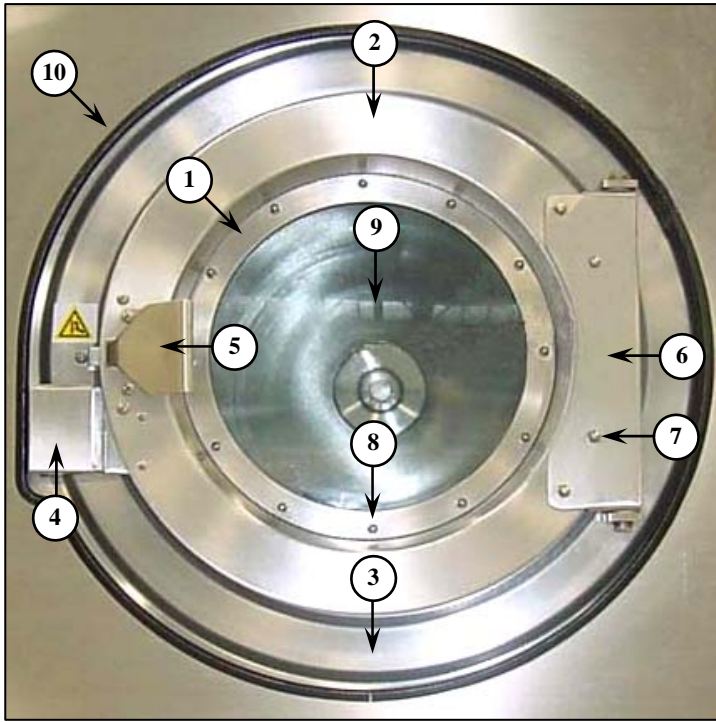
Item	Part No.	Qty.	Description
1	A1-S101-010	1	Glass retainer ring
1	A0-A001-042	1	Gasket, Door glass
2	A1-S101-011	1	Door tub
3	A1-S101-012	1	Front panel tub
4	A1-ST00-002	1	Door lock assembly complete set
5	A1-ST00-001	1	Door Handle and Brackets complete set
6	A1-S101-015	1	Door hinge, Tub
6	A1-S101-041	1	Door hinge bracket
7	A0-A081-066	4	Cap nut
7	A0-A057-003	4	Bolt Studs Stainless
8	A0-A081-005	12	Cap Hex. nut
8	A0-A057-002	12	Bolt Studs Stainless
9	A0-A003-004	1	Door glass
10	A0-A001-004	1	Rim protection Gasket
11	A1-SSP2-005	1	Door hinge washer
12	A0-A033-002	1	Door hinge bushing
13	A0-A033-003	1	Bolt, Shoulder, Door Hinge
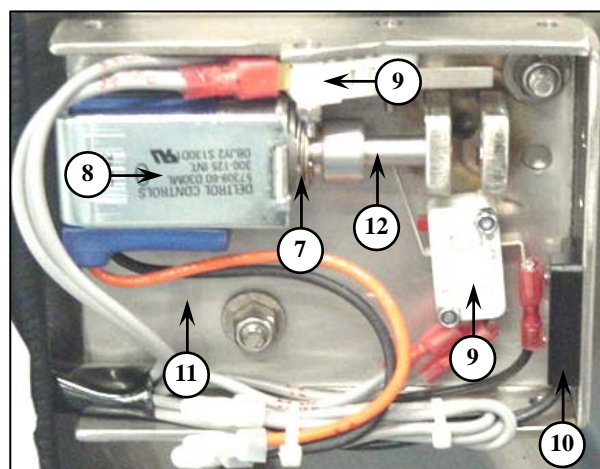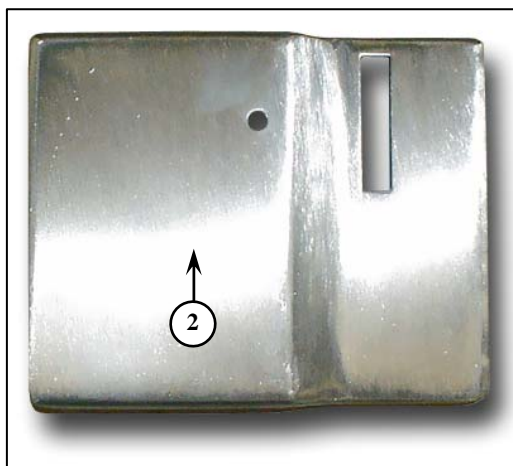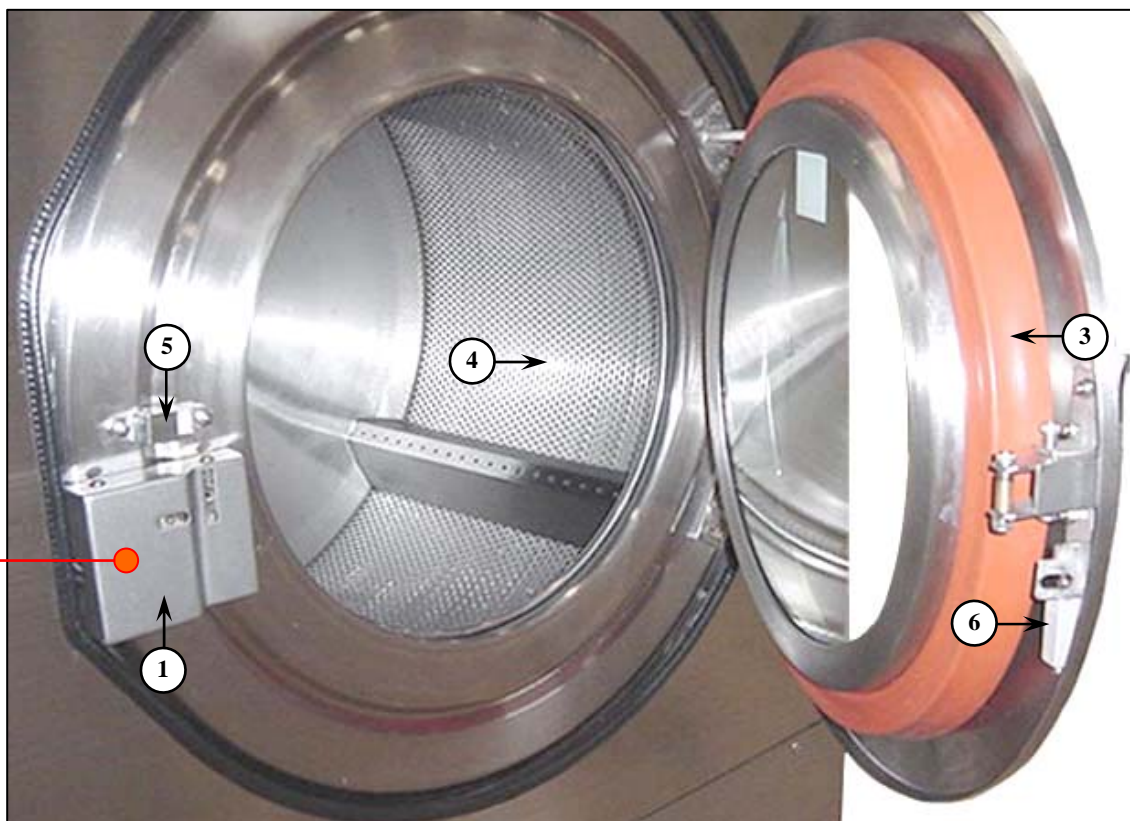
Item	Part No.	Qty.	Description
1	A1-ST00-002	1	Door lock assembly complete set
2	A1-ST00-002-02	1	Door lock cover
3	A0-A001-014	1	Door Gasket
4	A1-S101-018	1	Basket stainless steel
5	A0-A013-009	1	Door lock block
6	A0-A036-001	1	Magnet actuator for magnetic reed Switch (White)
7	A0-A008-120	1	Spring, Solenoid lock
8	A0-E015-024	1	Solenoid door lock (for DC)
9	A0-E014-004	2	Micro switch
10	A0-E014-007	2	Switch, Magnet reed
11	A1-ST00-002-01	1	Base box with Guides
12	A0-A033-014	1	Locking Pin, Head. (for DC)
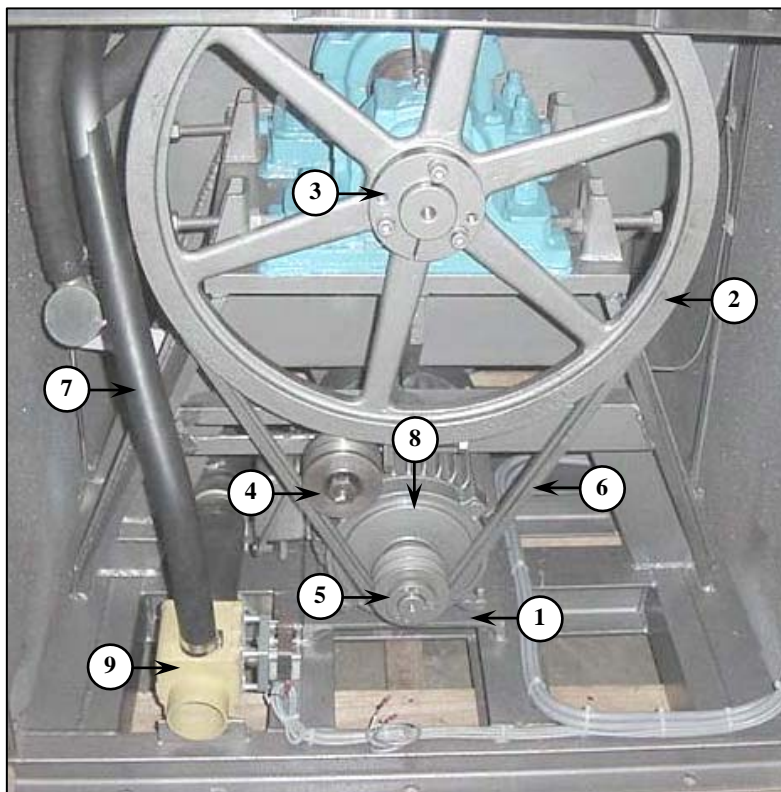
Item	Part No.	Qty.	Description
1	A1-S085-024	1	Shell support
2	A0-M008-015	1	Basket pulley
3	A0-M009-019	1	Basket pulley bushing
4	A0-M008-058	1	Pulley, adjusting belt
	A0-A004-055	1	Ball Bearing
5	A0-M008-016	1	Motor pulley
	A0-M009-020	1	Motor pulley bushing
6	A0-A002-095	2	V-Belt
7	A0-A018-001	1	Overflow hose
8	A0-E008-212	1	Motor "TECO"
	A0-E008-220	1	Motor "TECO"
	A0-E008-303	1	Motor "BEIJING"
9	A0-E041-002	1	Drain valve with overflow
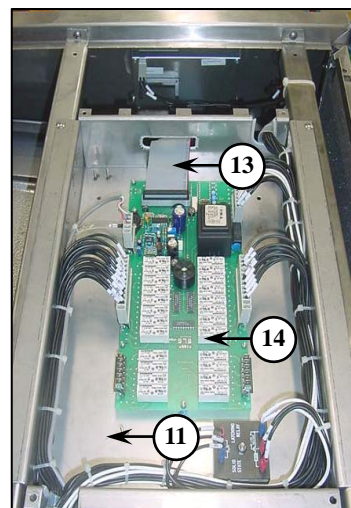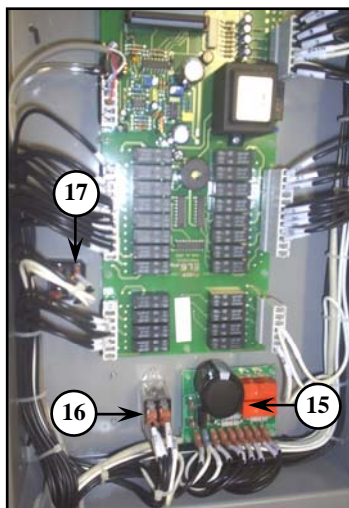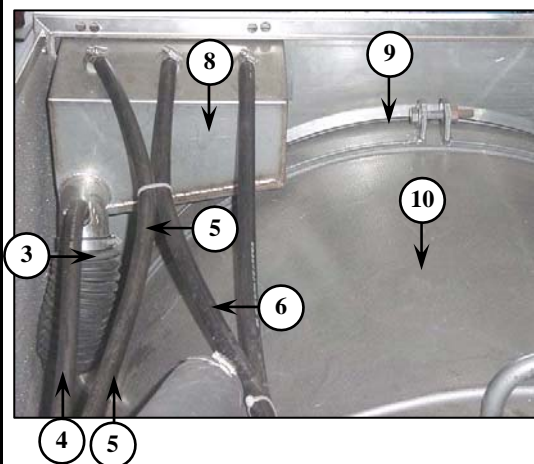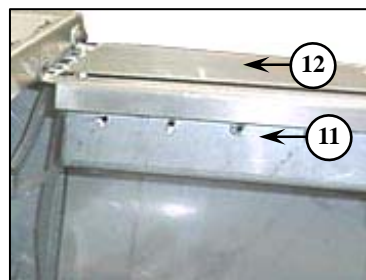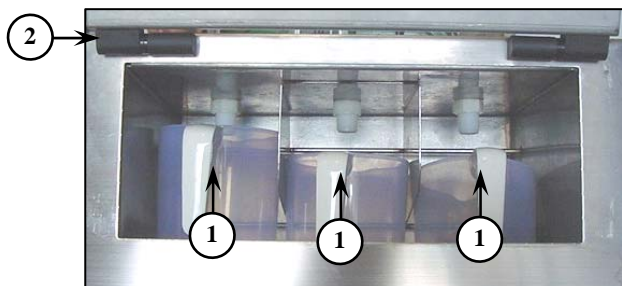
Item	Part No.	Qty.	Description
1	A0-A030-001	3	Plastic cups
2	A0-A029-001	2	Hinge, Nylon, Liftoff
3	A0-A018-009	1	Overflow hose
4	A0-A018-016	1	Heater Hose
5	A0-A018-016	1	Heater Hose
6	A0-A018-014	1	Cold water supply tube
7	A0-A018-014	1	Cold water supply tube
8	A1-S085-021	1	Detergent dispenser
9	A1-S085-022	1	Shell ring
10	A1-S085-023	1	Assembly, Shell
11	A1-S085-027	1	Control enclosure
12	A1-S085-028	1	Control panel cover
13	A0-E007-002	1	Ribbon cable
14	A0-E007-003	1	Microprocessor unit, control output board
15	A0-E015-026	1	Board PCB, Door lock
16	A0-E009-017	1	Relay
17	A0-E050-002	1	Bridge
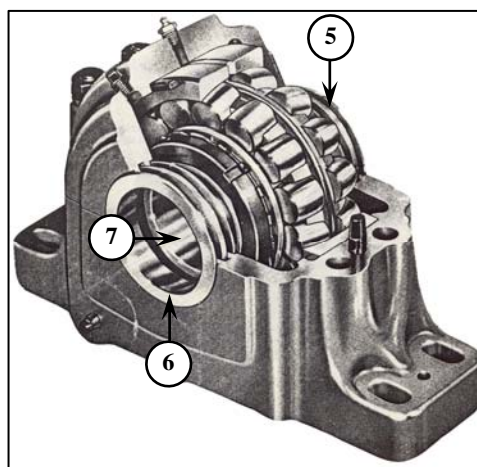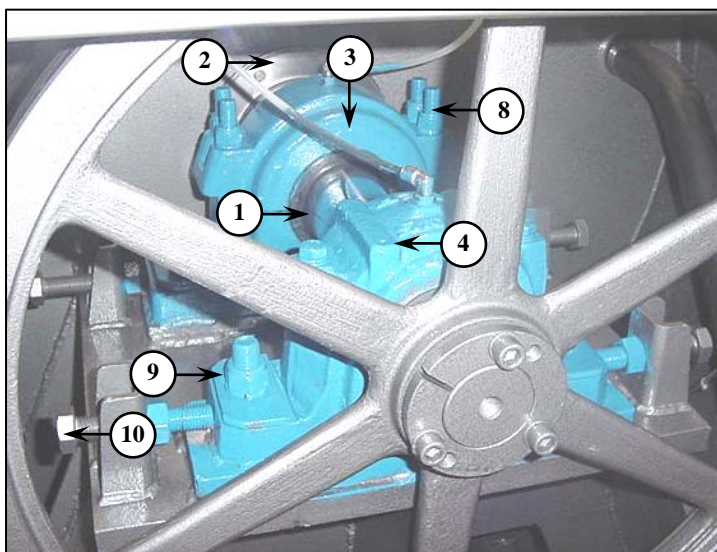
Item	Part No.	Qty.	Description
1	A1-S085-029	1	Shaft
2	A1-S085-030	1	Shaft ring
3	A0-A007-002	1	Housing (Front)
4	A0-A007-001	1	Housing (Rear)
5	A0-A004-002	1	Bearing (Front)
5	A0-A004-125	1	Bearing (Rear)
6	A0-A005-006	1	Seal (Front)
6	A0-A005-014	1	Seal (Rear)
7	A0-A006-005	1	Adapters (Front)
7	A0-A006-020	1	Adapters(Rear)
8	A0-A079-012	4	Hexagon bolt
9	A0-A079-012	4	Hexagon bolt
10	A0-A079-019	4	Hexagon bolt
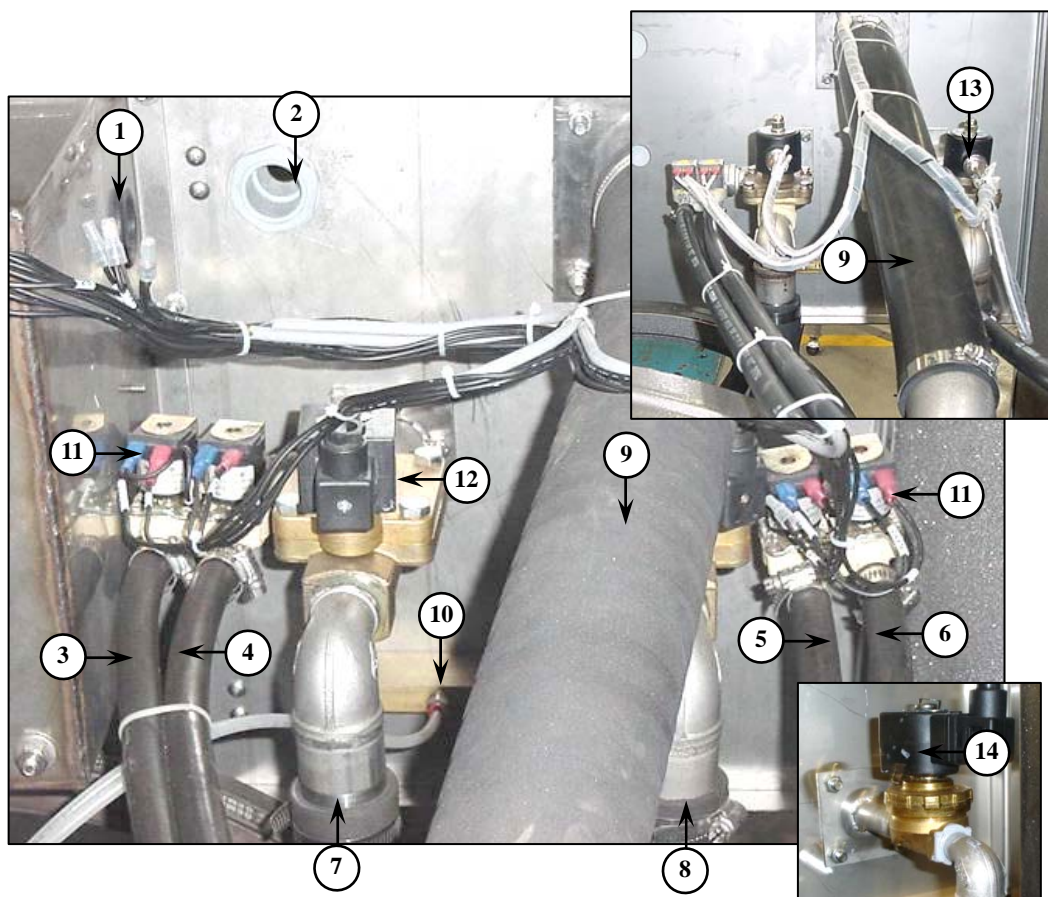
Item	Part No.	Qty.	Description
1	A0-A039-005	1	Rim protection rubber
2	A0-A028-004	1	Connection PG29
3	A0-A018-014	1	Cold supply dispenser
4	A0-A018-014	1	Cold supply dispenser
5	A0-A018-016	1	Tube, Soap water
6	A0-A018-016	1	Hot supply dispenser tube
7	A0-A018-020	1	Tube, Hot water inlet
8	A0-A018-024	1	Tube, Cold water inlet
9	A0-A018-074	1	Dispenser hose
10	A0-A024-004	1	Grease fitting unit (Brass)
11	A0-E040-001	1	Supply valve 2-way
	A0-E040-027	1	Supply valve 1-way
12	A0-E040-009	1	Cold water solenoid valve
13	A0-E040-008	1	Solenoid water valve
14	A0-E047-005	1	Solenoid steam valve

Item	Part No.	Qty.	Description
1	A0-E006-032	1	Transformer
2	A0-E021-047	4	Terminal
3	A0-E010-029	2	Breaker fuse 6 A
	A0-E010-034	2	Circuit Contactor 3A
	A0-E010-035	1	Circuit Contactor 2A
4	A0-E001-147	1	Inverter "Fuji"
5	A0-E021-043	1	Terminal
6	A0-TSE01-1271	1	Plugs fuse (Special)
	A0-E051-008	1	Fuse 2A (Special)
	A0-TSE01-1279	1	Fuse (Leg rand 1 A)

Dec.5, 2006

K.H.T. Central Supply Co., Ltd.
27/3-4 Yenakat Lane 2,
Yannawa, Bangkok 10120, Thailand
Tel: (662) 249-0987
Fax: (662) 249-0986

Dear Mr. Wittaya Mahachavaroj,

Subject : Phase Loss Protection of Fuji Electric AC Low voltage Inverters

We supply the following series of inverters for your machines at present.

1) FRNXXXC1S-2J/ 4J/ 7J
2) FRNXXXE1S-2BM/ 4BM
3) FRNXXXE1S-2A/ 4A
4) FRNXXXG11S-2BK/ 4BK
5) FRNXXXG11S-2BM/ 4BM

All of the above mentioned models have "Phase Loss Protection" at both input and output of the inverters. This function for input protects the inverter from being damaged by adding extreme stress caused by a power phase loss or imbalance between phases.
The one for output detects breaks in inverter output wiring at the start of operation and during running, and shut off the inverter output.

We hope you could understand above answers.
Should you have any questions on that, please feel free to contact us.

Yours faithfully,

A.Shirayama
Sales Manager/ Drive Systems Division
Fuji Electric FA Singapore Pte. Ltd
/ Regional HQ of Fuji Electric FA Components and Systems Co., Ltd. , Japan