

NS-500

Installation and Operating Manual



INTRODUCTION

The NS-500 is a one or two-chemical product dispensing system with probe control of detergent for use with high temperature conveyor or door type warewashing machines.

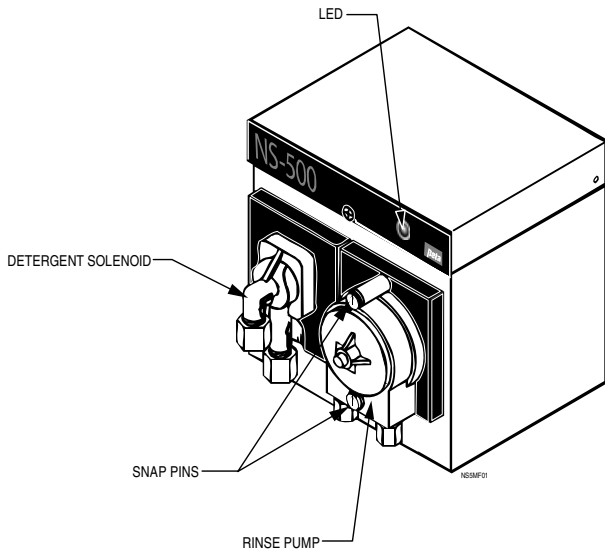


Figure 1. NS-500 Typical Two-Product System

Figure 1 shows a two-product system, with a solenoid for dry detergent dispensing and a pump for liquid rinse.

FEATURES DESCRIPTION

The following table lists the features and configurations available.

**Single or double transformers for line voltage. Pressure switch operation available on single transformer models.*

General

Priming - The rinse pump is primed with a prime button located on the PCB.

Probe Detergent Operations

Wash Tank Concentration - Setpoint is adjusted with a PCB mounted potentiometer. Range is 660-1280 micro-siemens.

Low Detergent Alarm - The alarm will sound if concentration setpoint is not reached within:

- 24 seconds on a door machine, or
- 36 seconds on a conveyor machine the alarm will sound. See Note.
- Detergent pump will run in probeless speed mode when the probe output is shorted.

Overfeed Stop - When a low detergent alarm is present, the detergent feed will stop if setpoint is not reached in 180 seconds.

Reduced Feed Rate - When the tank concentration is within 25% of setpoint detergent feed will:

- cycle 2 seconds on /2 seconds off on a door machine, and
- 4 seconds on /4 seconds off on a conveyor machine to minimize overshoot. See Note.

Rinse Operation - Rinse pump speed can be set during the rinse cycle in a range of .3 to 15 ml/min for a period of 15 seconds for door machines and continuously for conveyor machines. See Note.



If both transformers are powered at the same time conveyor machine operation is selected automatically.

Terms

The following terms are used in this manual.

LED - A light emitting diode. The LED on the NS-500 unit indicates power (see Figure 1).

PCB - Printed circuit board that contains the electronics for the NS-500.

Squeeze Tube - Tubing designed for use in peristaltic pumps.

SPECIFICATIONS

PHYSICAL DIMENSIONS, CONSTRUCTION & MOUNTING

Two Product Enclosure

Size

5.5 H x 5.5 W x 5.63 D (inches)

14 H x 14 W x 14.3 D (centimeters)

Weight: 5.3 lb. (2.4 kg) with 2 transformers and 2 pumps

Cabinet Material: Type 304 stainless steel

Mounting: Wall mounted with 2 keyhole slots and a single hole in the backplate.

Operating Conditions

Ambient Operating Temperature: 36 to 120 °F (2 to 49 °C)

Electrical Power Configurations:

100 to 120 VAC, 50/60 Hz, 0.2 Amperes maximum.

200 to 240 VAC, 50/60 Hz, 0.1 Amperes maximum.

Applications over 240 Volts AC require optional transformer(s). 24 VAC, 1 Ampere maximum with external transformer.

Components

Fuse: Type IEC 127, 1 Ampere, 5 x 20 mm (or)
Type AGC, 250 Volts, fast blow, 1 Ampere

Pumps: Peristaltic, dual roller, self-priming and self-checking. 24 Volts DC.

Tube Materials

Detergent B-Flex, Silicone, Viton, Norprene, Nordel, C-Flex

Rinse B-Flex, Silicone, Norprene, Nordel, C-Flex

Speed & Displacement (Run with Water)

Detergent Pump - (3/16 ID Tube)

100 rpm 5 oz per min/148 ml per min

Detergent Pump (1/4 ID Tube)

100 rpm 8 oz per min/240 ml per min

Rinse Pump - (1/16 ID Tube)

Adjustable 2 to 80 rpm - 0.01 to 0.5 oz per minute/0.3 to 15.0 ml per minute

Hydraulic Performance

Detergent Pump

Maximum vacuum 8 inches (200 mm) of Mercury [Hg]

Maximum pressure 20 psi (1.4 bar)

Rinse Pump

Maximum vacuum 8 inches (200 mm) of Mercury [Hg]

Maximum pressure 30 psi (2.1 bar)

Solenoid: 10 watts, 24 Volts DC

Conductivity Probe Input Measurement Range - 660 to 12,800 microsiemens when using 0.4 constant (K factor) probes at 65 °C.

Low Detergent Alarm - Audible alarm. The indicator LED on the front panel flashes approximately 2 times per second when the alarm sounds.

INSTALLATION & SET-UP PROCEDURES

PHYSICAL INSTALLATION



Refer installation and service to qualified personnel only.

Installation must comply with all applicable plumbing and electrical codes.

MOUNTING THE UNIT

Mount the unit so there is room to access switches, buttons, wires and tubing, and to swing the top door open for both installation and maintenance. The unit is normally mounted against a stable wall with the pumps side-by-side and their tube openings at the bottom. Avoid steam and other sources of moisture such as spray or splash. Do not subject the unit to temperatures outside the range 36 °F to 120 °F (2 °C to 49 °C)

Two keyhole slots plus a third mounting hole are on the interior back panel. A mounting bracket kit is available for dishmachine top mounting applications (see Recommended Spare Parts & Accessories).

The PCB door is held closed by a captive hold down screw that fits through a slot in the door. The pump door is held closed by the PCB door.

INSTALLING THE CONDUCTIVITY PROBE

Use the washer manufacturer's predrilled access hole or punch a 7/8 inch (2.2 centimeter) hole through the wash tank in a location that will provide accurate sampling of the detergent solution. Typically, you would mount the probe about 4 inches (10 centimeters) above the bottom of the tank, away from any heater elements, corners or mechanical components (such as water level floats). Smooth the edges (so gaskets will seal well) and mount the probe.

INSTALLING THE DETERGENT BULKHEAD FITTING

Punch a hole in the wash tank in a suitable location above the water level line. For best results, mount the fitting directly above the point where the probe is located. The bulkhead fitting for a typical installation is included in the installation kit supplied with the NS-500, or with the powder/solid detergent hopper.

CONNECTING THE PRESSURE SWITCH

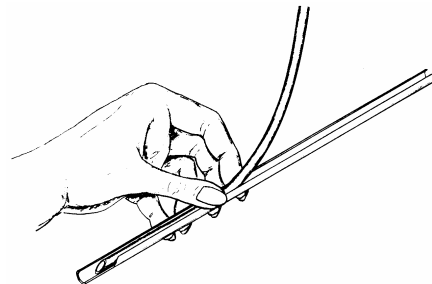
When using the NS-500 with a single transformer, a pressure switch can be used to sense demand for rinse. The pressure switch should be connected to the machine rinse line downstream of the rinse solenoid, either directly or through the rinse injector fitting. Use a 1/4 inch line for this purpose.

CONNECTING CHEMICAL SUPPLY LINES

Delivery Lines		
Pump Type	Inlet (in Inches)	Outlet (in Inches)
Detergent	1/4	1/4
Rinse	1/4 or 1/8	1/4 or 1/8

Detergent & Rinse Input Lines

Connect the 1/2 or 1/4 inch line to the nut on the left (inlet side) of the pump squeeze tubes. Tighten the nuts on the fittings. Make sure the connection is airtight. Run the lines to the chemical drums and secure the end of each supply line into its respective container. Use a snap-in standpipe for liquid detergent lines. The snap-in standpipe is a rigid three-quarter round U-shaped tube section 18 inches long. Cut the line at a 45° angle. Press the feed end of the line into the open part of the U. Leave the bottom of the standpipe slightly lower than the inlet of the line.



Detergent Pump Output Lines

Connect the 1/4 inch line to the nut on the right (outlet side) of the detergent pump squeeze tubes. Tighten the nut on the

fitting. Run the feed line to a bulkhead or injector fitting. Use as short a line as possible and keep the lines away from steam pipes, open flues or other areas where machine operators may accidentally damage them. Try to avoid uphill runs in all output lines. Secure the line into the fitting.

Rinse Pump Output Line

Connect the 3/8 or 1/4 inch line to the nut on the right side (outlet side) of the rinse pump squeeze tube. Tighten the nut on the fitting. Run the feed line to the plastic injector/check valve fitting. Follow the instructions included in the installation kit.



The rinse pump is capable of pumping against 40 psi but it is not advisable to operate at this level for prolonged periods. The rinse pump tubing life will be severely shortened. Most dishwasher manufacturers specify no more than 25 psi in the washer rinse line and the water pressure should always be below this specification to ensure optimum performance and results.

PLUMBING CONNECTIONS TO WATER SOLENOID

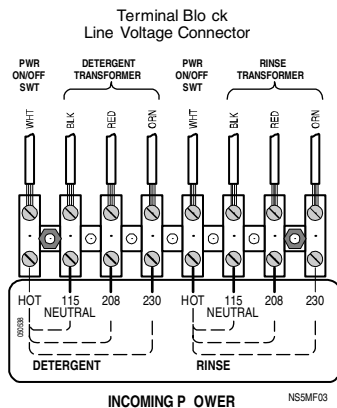
Solenoids are used to supply water to a powder or solid detergent hopper. The compression fittings on the solenoid inlet and outlet accept either 1/4 inch plastic line or 1/4 inch copper tube. Follow the flow arrows on the solenoid when making connections. Consult the instructions supplied with the detergent hopper. Regulate water pressure to the hopper in the range from 20 to 30 psi (1.4 to 2.1 bar).

ELECTRICAL CONNECTIONS

PRIMARY POWER



Dangerous voltages may be present in the enclosure even when the power switch is set to off. Refer installation and service to qualified personnel only. Installation must comply with all applicable electrical codes.



Locate electrical circuits on the dishmachine that provide power as described in Specifications. Power must be supplied to the NS-500 when the dishmachine is in operation (wash and/or rinse cycle) and must be turned off when the dishmachine is off. Connect the 2 legs of each power source to their appropriate terminals inside the enclosure, as detailed on the power-wiring label. See the Appendix for dishmachine and mode specific details.

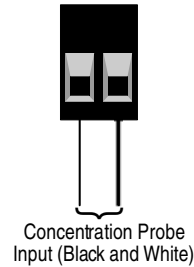


The terminal block is designed for one or two power sources. When only using one power source, connections are made to the left terminals labeled "detergent".

PROBE CONNECTIONS

If you do not wish to use a probe, short the probe input connection. See note below.

Probe Connector



The PCB has a 2-wire connector for the probe installation.

1. Bring the probe wires into the NS-500 through the bottom access hole.
2. Insert the wires from the probe into the connector and tighten the screws.



If the probe input connection is shorted, the detergent pump will run in probeless speed mode such that the detergent setpoint dial will control the speed.

SET-UP PROCEDURES

GENERAL

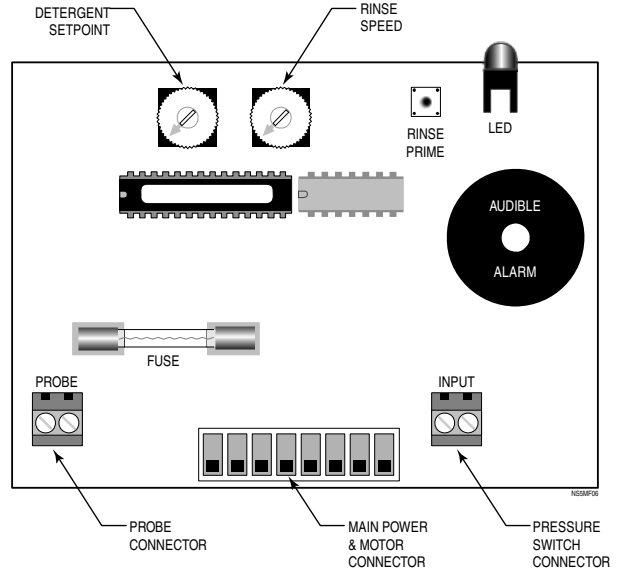
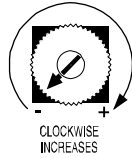


Figure 2. PCB Controls and Connections External Operator Controls

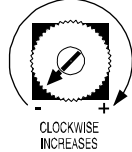
SET-UP ADJUSTMENTS

Detergent Concentration Adjustment

The detergent concentration set-point range is 660 – 12,800 microsiemens. This is the speed setting if the probe wires are shorted.



Rinse Flow Rate Adjustment



Rinse pump speed is adjustable from 2-80 RPM (0.3 to 15 ml/min) the pump will run at the selected speed for a maximum of 15 seconds in a door machine and continuously in a conveyer machine.



Machine type is determined automatically based on power input timing, this will determine:

- Low detergent alarm delay
- Reduced detergent feed rate
- Rinse run time

See INTRODUCTION Section for operating ranges.

OPERATOR CONTROLS

Power ON / OFF Switch

The double-pole, single-throw switch mounted on the bottom of the unit controls 1 or 2 transformer configurations.

Rinse Prime Button

The rinse pump runs as long as this button is pressed when there is power to either detergent or rinse inputs.

Alarm & LED

The internal audible alarm and the LED on the front panel together provide the following operating status information:

Input power to detergent

or rinse terminals.....LED is on continuously

Detergent or rinse feeding.....LED is flashing slowly

Detergent low.....LED is flashing rapidly and alarm is pulsing

Overfeed Stop.....LED and alarm are on continuously

MAINTENANCE

PERIODIC MAINTENANCE

Pump & Squeeze Tube Replacement Schedule

Since every installation is different (chemicals, tube runs, operating frequency, and so on), an exact tube replacement schedule cannot be specified. With use, the tube slowly evolves from round to oval and the amount of chemical pumped decreases. By regularly checking the amount of chemical pumped, you can determine general tube life. It is recommended that you closely monitor the time it takes the original tube to reach the end of its flex life, and then establish a replacement schedule. Replacing tubes at regularly scheduled intervals ensures more accurate product use and reduces service calls. In general, short feed lines of a large diameter will improve pump tube life.

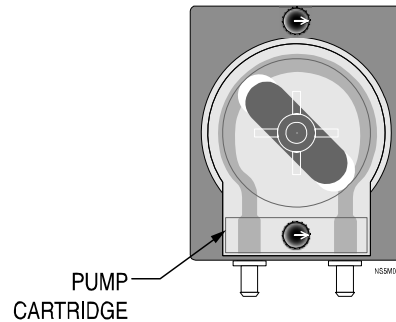


It is very important not to let the tubes become worn to the point where they tear and allow chemicals to saturate the pump housing.

How to Replace Pump Cartridges

Note that each product has different delivery line configurations and squeeze tubes.

To Remove



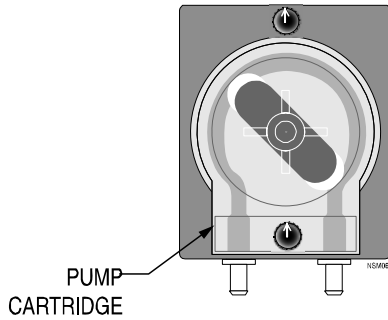
1. Turn off power to the unit.
2. Remove the cartridge from the motor housing by twisting the snap pins at top and bottom 90° to the left or right.



Wear adequate protective clothing such as gloves and glasses.

3. Remove the supply and feed lines from the old pump squeeze tubing and connect them to the new pump squeeze tubing.

To Install



1. Align and engage the pump drive spline with the motor gear by rotating the roller assembly.
2. Turn the snap pins so that the arrow is pointed up, then push in until you hear a distinct click.

How to Change the Pump Squeeze Tubing

Remove the cartridge as described above.

Remove the small screw at the bottom of the rear cover and lift the cover from the cartridge.

Pull the adapter fittings rearward until they clear the cartridge.

Pull the roller assembly rearward to release the pump squeeze tubing.

Cut the tie wraps holding the pump squeeze tubing to the adapter fitting and pull the tubing from the fittings.

Replace the pump squeeze tubing making certain to use the proper size tube.

Push the adapters on to the ends of the tubing and secure with tie wraps. Make certain that the "buckles" of the tie wraps are both facing the same direction. This will keep the tube from twisting in the cartridge.

When using B-Flex tubing, coat the inside of the cartridge with a liberal amount of Silicone 111 lubricant.

Press the 2 adapter fittings into the cartridge so that the tie wrap "buckles" face toward the center of the pump. See Figure 4 below. Remember, the tube must not be twisted during the assembly.

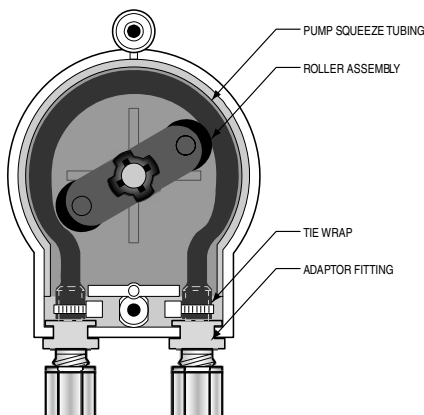


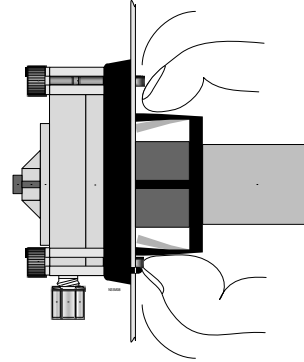
Figure 4. Pump Cartridge

Push the roller assembly onto the cartridge shaft using a twisting motion to engage the rollers properly with the pump squeeze tubing.

Return the rear cover and secure with the small screw at the bottom. The flat side of the cover should face inward.

How To Replace Pump Motor & Solenoid Subassemblies

To Remove



1. Ensure power is off to the washer.
2. Remove the pump cartridge from the motor assembly, leaving the chemical lines attached.
3. Remove the electrical connections at the back of the motor.
4. Compress the two flex ears on the back of the motor until the motor slides out through the hole in the cabinet.

To Replace

1. Locate the alignment tip of the motor housing so it is in the down position.
2. Slide the pump motor/solenoid housing into the enclosure hole. The holding ears will expand to hold the pump motor/solenoid in place. Verify that both ears popped out and are locked in place.
3. Reinstall the electrical connections at the back of the motor.
4. Install the pump cartridge.
5. Prime the pump to verify proper pump rotation (clockwise). If the direction is wrong, switch the motor wires.

Cleaning The Probe

You must clean the conductivity probe tips (electrodes) on a regular basis to ensure control accuracy. The water conditions (for example, water hardness) and the type of soil load are the primary factors in determining a cleaning schedule.

Adding a Pressure Switch

The Pressure Switch can be used only with a single transformer. The Pressure Switch is located in the lower left side of the bottom plate and is connected to the Pressure Switch Connector on the PCB (see Figure 2).

TROUBLESHOOTING

Refer to the assembly drawings and the complete unit wiring diagram in the Appendix, and the PCB illustration in Internal Controls Description. To order replacement spares, see Recommended Spare Parts and Accessories. Please order using the item number.

No Power

- Is the On/Off switch on?



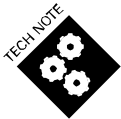
The following procedure is to be performed only by qualified personnel.

For units connected directly to line voltage:

- Is proper line power voltage connected to the power input terminals in the unit? Check both transformers. Is a PCB fuse blown?
- With the power wiring harness unplugged from the PCB, is 24 VAC measured across the transformer secondary wires when power is supplied from the washer? If not, replace the transformer. If yes, replace the PCB.

Properly Rated Fuse Blows Repeatedly

1. Is there a mechanical problem with a motor or solenoid (for example, jammed tubing or frozen gears in the gearbox)?
2. Do motor and/or solenoid resistance measurements fall in the approximate range from 4 to 100 ohms? If yes, go on to the next step. If no, replace suspect part(s) since a shorted motor or solenoid will cause the fuse to blow.



Measure resistance only when the power is turned off. A short will typically measure less than 0.2 ohms; an open will typically measure more than 2000 ohms.

3. Are proper voltages measured across the appropriate output terminals (detergent drive and rinse drive) when power is applied? If not, replace the PCB. Maximum voltage is 33 to 34 VDC (without load). Rinse voltages may be lower depending on the speed setting.

Detergent Feeds Too Often/Too Much Detergent Used

1. Is the concentration setting correct? Are the probe electrodes clean?
2. Is a dishwasher problem the cause? This could include: fill valve on, too much rinse tank overflow into the wash tank, leaking or open drain valve, or wash motor not running to agitate the solution.
3. While the detergent is feeding, short the two probe wires together (down at the probe). Does the detergent feed stop? If so, proceed to the next two troubleshooting categories. If not, go on to the next step.
4. Are the probe wires loose or disconnected? If not, short across the two probe wire terminals on the circuit board (instead of at the probe). This should stop the detergent feed.
5. Replace the PCB if either of the above steps do not stop the detergent feeding.

Detergent Does Not Feed at All

1. Are the two probe wires shorted together? If so, the unit will never feed until this is corrected.
2. Disconnect one of the wires at the probe to cause an open circuit. The indicator should flash slowly, indicating feeding, and the pump or solenoid should function. If so, see Checking the Detergent System Functions. If not, go on to the next step.

3. Disconnect one of the probe wires from the PCB. If the detergent does not feed (or there is no voltage output from detergent drive), replace PCB.
4. Before replacing the PCB, measure the voltage from the transformer secondary wires to ground. Approximately 14 VAC should be present. A transformer short to ground could cause the pump motor to run erratically.
5. Replace the PCB if either of these tests does not start the detergent feeding.

Checking the Detergent System Functions

1. Turn off power.
2. Turn the Detergent Setpoint Adjustment dial to minimum (counterclockwise).
3. Connect a forty-seven (47) ohm 1/4 or 1/2 watt resistor across the two circuit board probe terminals, or at the end of the probe wires.
4. Turn the power on to the unit. Observe that the detergent pump or solenoid is not feeding.
5. Slowly increase the Detergent Concentration Adjustment dial until the detergent pump runs or solenoid clicks.
6. Verify that the reduced feed function causes the detergent pump to start and stop (approximately 4 seconds on, 4 seconds off) with a conveyor, and (2 seconds on, 2 seconds off) with a door machine.
7. Note the low detergent alarm does not sound. Rotate the Detergent Concentration/Recharge Adjustment dial fully clockwise. The detergent pump should run continuously.
8. Wait for about 24 seconds on a door machine and 36 seconds on a conveyor machine (after continuous feed starts) until the low detergent alarm sounds.
9. Wait for 3 minutes until the unit goes into overfeed stop and the overfeed alarm sounds.
10. Slowly rotate the Detergent Concentration Adjustment dial counterclockwise until the detergent alarm stops.
11. Test completed. If the test does not perform as described, replace the PCB.

Rinse Pump will Prime but not Feed

1. If the pump will not slow down when the speed is adjusted replace the PCB.
 1. Rinse Pump will Feed but not Prime
 1. Replace the PCB.
 2. Rinse Pump will Neither Prime nor Feed
 1. Washer must be in wash/rinse cycle to prime pump.
 2. Check for a loose wire connection to the pump.
 3. When you push the Rinse Prime button, 33 to 34 VDC should be measured across the motor terminals.

4. If voltage in the proper range is present and the pump will still not run, remove the pump cartridge and observe the drive spline while you push the Rinse Prime button. If the drive spline does not turn, replace the motor assembly.
5. Replace the PCB if it does not fix rinse pump.

Rinse Pump Feeds Continuously

Check the operation of the Rinse Prime button. If the pump continues to run beyond 15 seconds on a door machine operation, replace the PCB.

Pump Will Not Pull the Chemical Out of the Drum

1. Too much vacuum created. The supply line in the chemical drum may be up against either the side or bottom, the supply lines may be too long for a viscous product, or there may be a crimp in the intake supply line, thus exceeding the pump's vacuum specifications.
2. There may be an air leak somewhere in the input supply line. Most often this is caused by inadequate sealing of the supply line into the line nuts.
3. Squeeze tube is worn and the rollers can no longer squeeze the tube properly. Correct by changing the pump cartridge with the correct size squeeze tube and line nuts for the chemical being pumped.

ACCESSORIES & SPARE PARTS

The items listed in this section provide you with quick reference numbers for some of the major parts and accessories. A complete exploded assembly drawing is located in the back of the manual. Refer to the Preface for contact telephone numbers.

Description	Item N°
Printed Circuit Board	099407
Solenoid Valve Assembly	091934
Fuse, AGC 250 Volt 1 Amp	1206535
Dummy Cover	051606
Power Switch	037598

Detergent Pump Spares

Norprene Pump cartridge, Norprene, detergent	039556
Tubing, 0.188 ID, Norprene, detergent, with fittings	039553
Insert, detergent, inlet, 1/4 in	036969
Tube nut, compression, 1/4 in	043823

Rinse Pump Spares

Nordel Pump cartridge, Nordel, rinse	095872
Insert, rinse, inlet and outlet, 1/8 in	036982
Tube nut, compression, 1/8 in	017458

Miscellaneous Pump Spares

Pump Motor Gearbox	051351
Transformer Kit	091962
Probe Kit	018079
Mounting Bracket Kit	018224



Pump tubes are also available in B-Flex, Silicone, C-Flex, and Viton.

TECHNICAL ASSISTANCE

If you require additional technical information, contact our Technical Support Department. Refer to the Preface for telephone numbers.

Returning Equipment For Repair

If you need to send an item back to be repaired, you must call or write to obtain a Returned Product Report (RPR number) before sending it back. Our Repair Department will provide you with a return number. Please write the RPR number on the outside of the box before sending it back. It is also very helpful to our repair department if you include a note inside the box explaining the nature of the problem. Failure to obtain an authorization number before sending an item in for repair or replacement may delay the return of your equipment.

APPENDIX

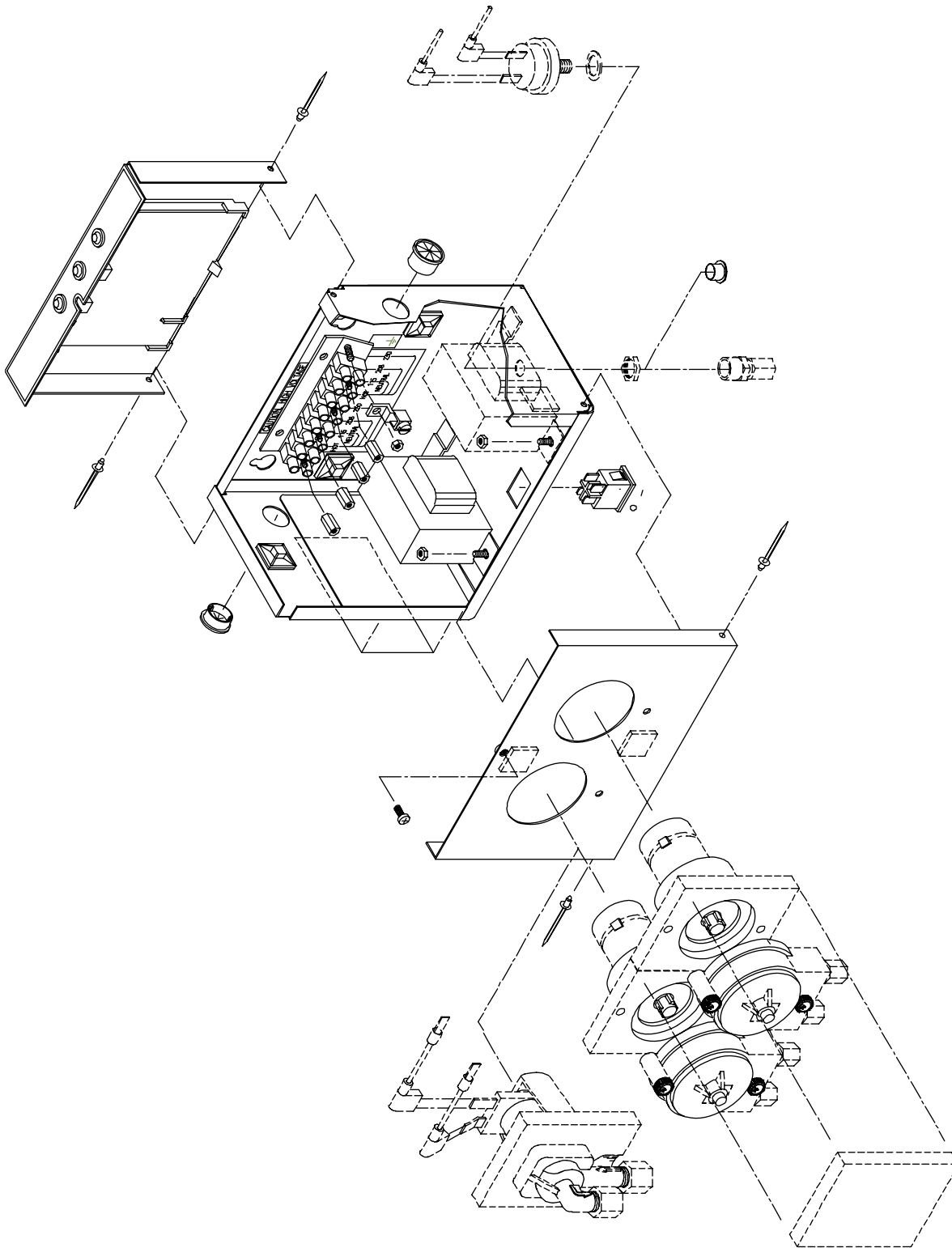
NS-500 INTERNAL TRANSFORMER POWER CONNECTIONS

		Transformer Connection/ Machine Power Source
Machine Type	Product	Probe Material
Door or Conveyor	Detergent	Detergent Transformer/ Washer Power
	Rinse	Rinse Transformer/ Rinse Power

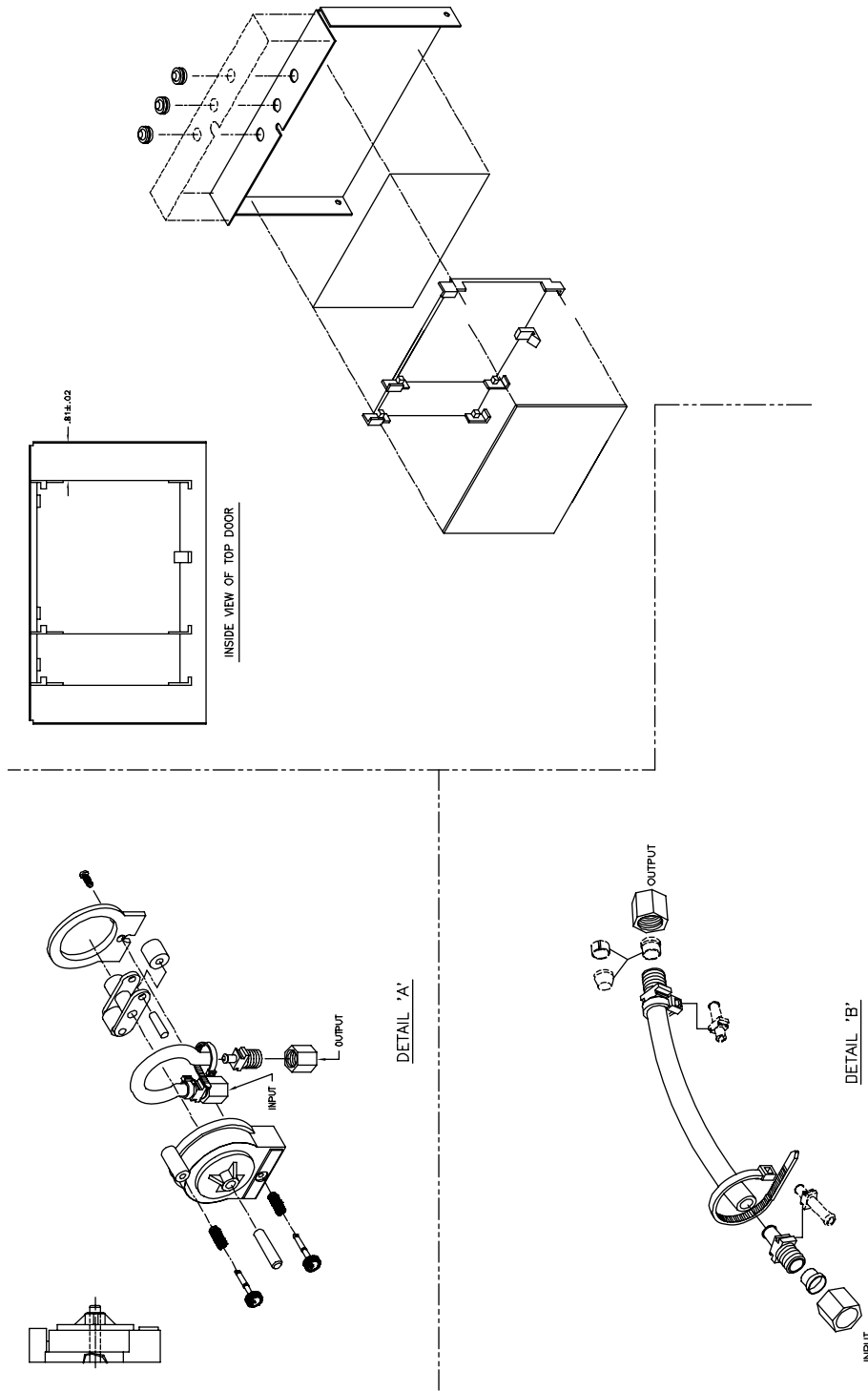
NS-500 WITH 1 INTERNAL TRANSFORMER AND A PRESSURE SWITCH

(Not applicable to machines with split wash and rinse power sources)

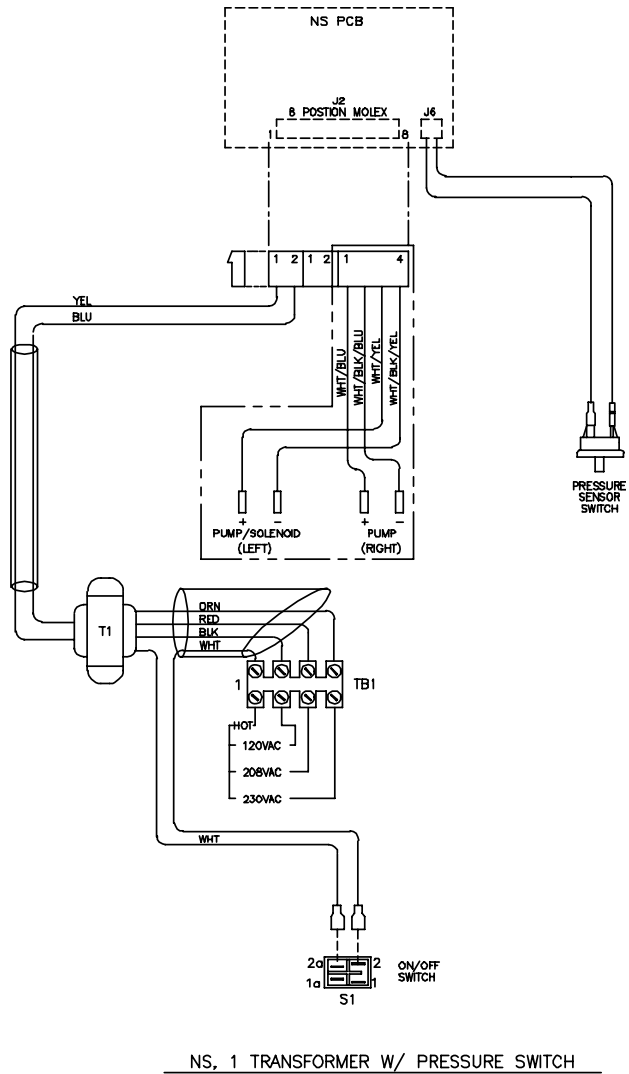
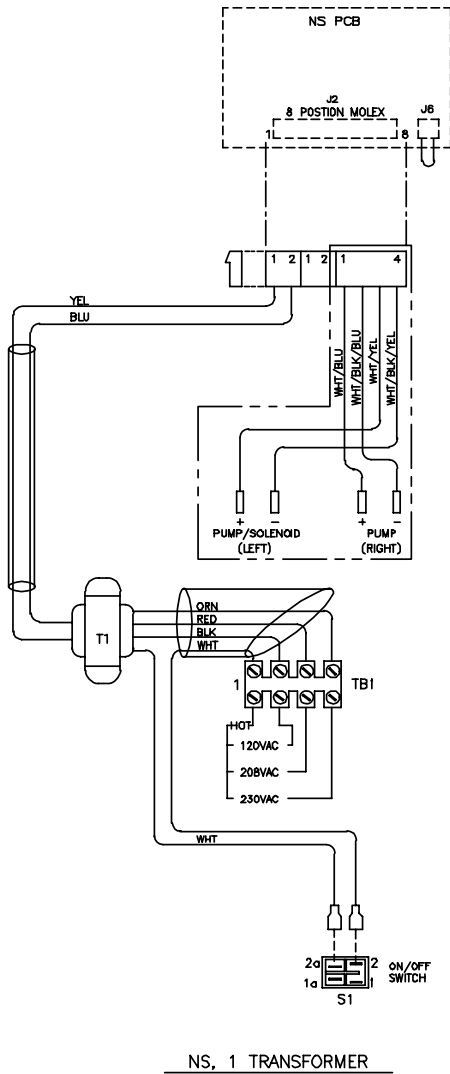
		Transformer Connection/ Machine Power Source
Machine Type	Product	Probe Material
Door or Conveyor	Detergent	Detergent Transformer/
	Rinse	Continuous Power during entire wash and rinse cycles



NS-500 Final Assembly
DRW # 12862-00 REV A
SHT 1 of 7

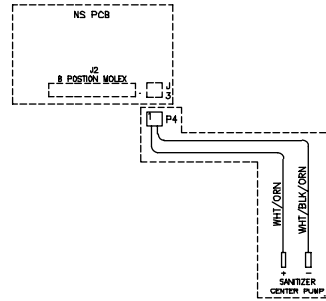
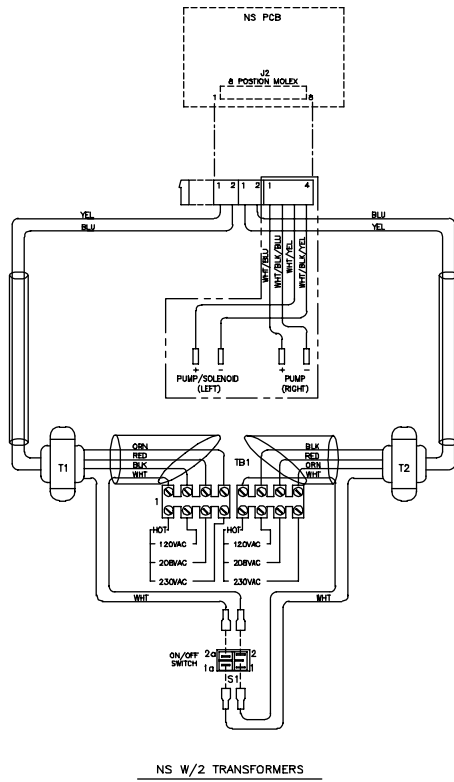


NS-500 Pump, Tubing & PCB Assembly
 DRW # 12862-00 REV A
 SHT 2 of 7

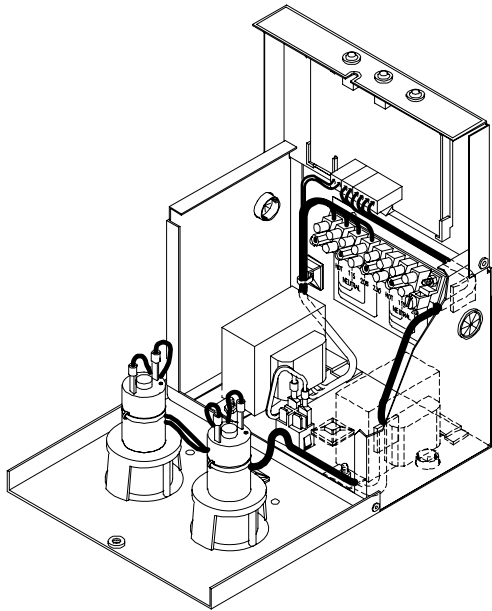


WIRING DIAGRAM

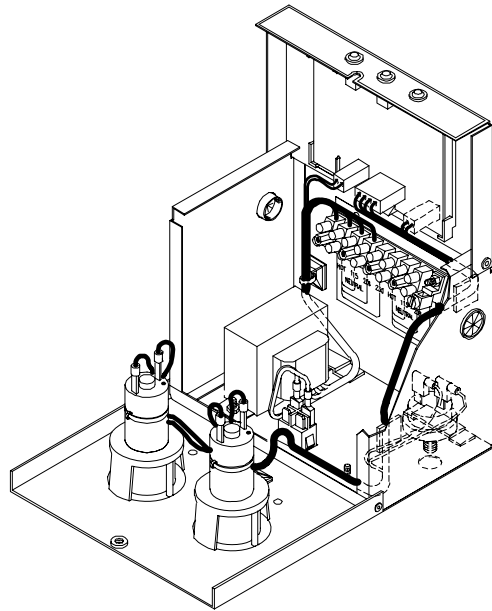
NS-500 Wiring, 1 Transformer
 DRW # 12862-00 REV A
 SHT 3 of 7



NS-500 Wiring, 2 Transformers
DRW # 12862-00 REV A
SHT 5 of 7



110/208/230 VAC, 2 XFMR VERSION



115/208/230 VAC, 1 XFMR VERSION

NS-500 Wire Routing
 DRW # 12862-00 REV A
 SHT 6 of 7



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