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TITAN V-300

Owner's Manual

This Manual Applies to:

Part #	Series
108001	0001

SECTIONS:

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Section 2:	Operation and Maintenance
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PLEASE READ!

For your safety and convenience we have summarized here the precautions you should always take when you are servicing or examining your V-300. Please review them carefully. They are repeated in appropriate places throughout the procedural instructions in this manual. If you still have doubts about safe operating procedures after reading the manual, please call your dealer or your Polar Bear Titan Customer Service Representative.

- To avoid hurting yourself or damaging the V-300, use mechanical aid when lifting it.
- Always turn **off** the power switch and unplug the V-300 before servicing or changing fuses.
If the unit shuts down during operation it may start up again without warning!
- The components inside the V-300 will be hot if the unit has been recently operated. The normal operating temperature is 225°F. Let the system cool before you service it.
- Make sure that the compressor belt guard is installed when you are operating the V-300.
- Wear eye protection when opening the unit if it is still hot.

Take these precautions to protect your V-300 from damage:

- Running the V-300 on hard water causes scaling, which results in a decrease in your system's performance. A service call to de-scale the V-300 is not covered under your warranty. Maintenance of the pretreatment equipment is the responsibility of the owner. Polar Bear Water Distillers Mfg. Co. Ltd. only warrants the pretreatment equipment to the extent of the pretreatment equipment manufacturer's warranty.
- While the water softener or deionizer is being regenerated the V-300 must be turned off so that hard water does not enter the system.
- The *Aquaseal* compressor bearing case requires a portion of feedwater for cooling purposes. Be sure you don't turn off the feedwater supply while the V-300 is running.
- Be sure the feedwater is turned on before you start up the system.
- Be sure that there is no restriction of wastewater flow from the V-300 to the drain.
- Closely follow the inspection and maintenance procedures at the prescribed intervals outlined in the "Maintenance" section of this manual. Record the results in the maintenance log provided.

If the covers are removed, the V-300 will not operate to full capacity due to heat loss.

NOTE

The information in this manual is based upon technical data and tests which Polar Bear believes to be reliable. This information is intended for use by persons having technical skill, at their own discretion and risk. *Polar Bear* is not responsible for any damage or injury resulting from failure to follow the directions for installation and use, or any other misuse of its products. Also, because conditions of use are outside its control, *Polar Bear* assumes no liability for results obtained or damages incurred through the application of the equipment or the information in this manual.

This information is not intended as a license to operate under or a recommendation to infringe any patent of Polar Bear Water Distiller Mfg. Co. Ltd. or others, covering any material or use.

When using other products with your Titan V-300 system, follow the manufacturer's recommendations.

In order to activate your V-300 warranty, the system inspection and initial start-up of the unit must be conducted by a factory-trained service representative and Polar Bear Water Distiller Mfg. Co. Ltd. must receive the signed and completed warranty registration form. The service representative who starts up your system will train operators and will also complete the warranty registration form. Your warranty starts when *Polar Bear* receives the registration form. Refer to the Warranty (Section 12) for details and time limits.

50 HERTZ SUPPLEMENT

The V-300 achieves optimum performance when the Impeller rotates at approximately 10,000 revolutions per minute (rpm). The Impeller is belt driven by a single-phase motor. The frequency at which a motor operates is correlated to the speed at which it operates. A motor that usually runs at 3600 rpm at 60 Hertz (Hz) will run at about 3000 rpm at 50 Hz. Two problems exist though. First, a 60 Hz, single-phase motor will not operate properly in a 50 Hz application. Second, the Evaporator/Condenser pressure differential created by the Impeller at this speed would not be great enough for the V-300 to operate efficiently; 1 psi is normally required. Because the Impeller is belt driven, the Impeller speed can be increased in a 50 Hz application by using a different pulley; the same belt is used in both applications.

A 60 Hz, single-phase motor will not operate properly in a 50 Hz application.

The single phase motor used on the V-300 has a centrifugal switch mounted inside it which plays an important role in motor longevity. The motor is designed so that at a specific rpm, the centrifugal switch will cause the motor to switch from start mode to run mode. This is what makes the motor used in a 60 Hz application different from the motor used in a 50 Hz application. On a 60 Hz application, the centrifugal switch causes the motor to switch from start mode to run mode at 2950 rpm's. On a 50 Hz application, the centrifugal switch causes the motor to switch from start mode to run at 2450 rpm's. Do not confuse start and run mode of the motor with warm-up and run mode of the V-300 unit itself.

Throughout this manual, reference is made to 60 Hz applications. Please substitute 50 Hz accordingly.

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INSTALLATION AND STARTUP

Overview of the V-300

The V-300 is a water distiller designed to produce 12.5 gallons per hour from feedwater which contains less than 1 part per million (ppm) of total hardness.

The system takes in “feed water” and puts out “pure water” and “waste water”. Before entering the V-300, the feedwater must be filtered and softened. The V-300 boils the water, producing steam. The steam is condensed into pure water. Impurities are left behind in the boiler and flow out with the wastewater to the drain. Figure 1 summarizes the system process.

Note that in this manual, all volumes are specified in U.S. Gallons. If a volume is specified in gallons, the volume refers to **U.S. gallons**.

Water entering the V-300 must be properly pretreated to keep it from “scaling” the boiler. Pretreatment systems typically consist of a filter, followed by a dual tank water softener, followed by a hardness monitor and second filter. Filters and softeners are available from your dealer or your Polar Bear representative. **Your warranty does not cover service required to repair damage to the V-300 caused by hard water.**

This manual provides instructions for installing, operating, maintaining and troubleshooting the V-300 system. **You are responsible for preparing the site and installing the system as described below.**

Getting Ready for Installation

Before you begin installation, make sure your site is properly equipped and that you have all needed equipment and supplies. You may need the services of a plumber and/or an electrician.

Installation Site Requirements

- An indoor site protected from direct sunlight, rain and freezing temperatures
- A feedwater source (40 psig minimum) with a shut-off valve.
- A storage tank(s) for pure water.
- A drain for wastewater.
- Power: dedicated 220 VAC (minimum 208, maximum 240 VAC), 60 hertz, single phase, split-by-neutral line with standard 20 amp circuit breaker and NEMA L1420R plug receptacle. Also required is a 120 VAC 60 Hz circuit for the hardness monitor, and a 120 VAC 60 Hz dedicated circuit for the booster pump, if required. All specifications are subject to local codes.

Unpacking the V-300

Inspect the exterior of the crate and the exterior of the V-300 after removing it from the crate. If you can see any damage, notify Polar Bear Water Distiller Mfg. Co. Ltd. and file a claim with the shipper. Be careful not to discard loose parts with the packing materials from the crate. **Do not discard the crate. It must be returned to Polar Bear.**

The V-300 weighs more than 450 pounds. **To avoid injuring yourself or damaging the unit, use mechanical aid in lifting the V-300. Note: Always remove the side covers before lifting the V-300.** Always lift the unit by the frame, not the covers.

Required Equipment and Supplies

The following list includes the items included with your V-300:

Line	Qty	Item	Description
1	1	108432	V-300 ASSEMBLY STAGE #2
2	1 EA	108304	SAFETY SOFTENER W/MONITOR 110V
3	1	108482	PARTS BOX,V-300 TITAN
4	1 EA	108481	PUMP,JET,110V,ASSY
5	1 EA	80269	SOFTENER,WATER,DUAL,PRESET 25G
6	2 EA	108488	TANK,POLY,200GAL W/FITTINGS

The parts box, #108482, includes the following:

Line	Qty	Item	Description
1	2	108480	FILTER,PRE/POST,V-300,20"W/GAG
2	1	108483	SAMPLING VALVE ASSY
3	1 EA	60150	SWITCH,HG,PRESSURE,2-15PSI,NO
4	1	108485	VENT ASSY,DIST.H.T.,V-300
5	1	108487	MANIFOLD,200GAL TANK ASSY
6	1	108486	CARBON FILTER ASSY
7	75 FT	45007	TUBING,LDPE NAT,1/2"x3/8"ID
8	50 FT	45018	TUBE,JAYLON,BRAID,1/2IDx3/4"OD
9	20 FT	45008	TUBING,LDPE NAT,5/8x1/2"ID
10	10 FT	45006	TUBING, LDPE NAT,1/4x.170"ID
11	240	60122	CABLEIN,22AWG,5C,GREY
12	5	60050	TAB,250,18-22AWG,NORMAL
13	5 EA	60010	RECEPTACLE,250,18-22AWG,NORMAL
14	4 EA	60060	RING,#10,18-22AWG
15	3 EA	30177	ELBOW,90,1/2STEM X 1/2,JG,POLY
16	15 EA	80014	GEAR CLAMP, 5/8", S.S.
17	2 EA	80284	CLAMP,SNAP,3/4"OD HOSE,POLY
18	20 EA	80013	CLAMP,CABLE,NYLON,WALL MT 1/2"
19	10 EA	80183	CLAMP,CABLE,WALL MT.,5/8"
20	41 EA	10125	SCREW,WD,PLD,FLT/SKT 10X 1 3/4
21	4 EA	30108	COUPLER,POLY,3/8ID TUBE-BE
22	2 EA	30111	TEE,POLY,3/8ID TUBE POLY
23	2 EA	30127	ELBOW,90,1/2OD TUBE BE
24	4 EA	30035	COUPLER, 1/2"BARB - 1/2"MPT
25	2 EA	31023	ELBOW,90,1/2FPTX1"SWEAT,CPVC
26	2	108491	COUPLER,BRAZED,SOFTENERX1/2FPT
27	1 EA	30100	ELBOW,NYLON,90,1/2TUBE-3/8MPT
28	1 EA	102085	STRAIN RELIEF, METAL CLAMP
29	16 EA	10109	SCREW,SHTMTL,SS,#10-12x1/2"
30	4	100736	BRKT, FILTER MT
31	1 EA	60152	FUSE,0.8AMP,SLOWBLOW
32	1 EA	60151	FUSE,2AMP,SLOWBLOW
33	1 EA	100161	FUSE,1 AMP,SLOWBLOW
34	1	108484	PRESSURE MONITOR ASSY
35	1 EA	80292	TEST KIT,HARDNESS TOTAL
36	1 EA	108259	TOOL,BELT TENSIONING
37	1 EA	80276	CUP,OZ GRADUATED,POLY,32OZ,4CP
38	1 EA	80275	WRENCH,CROWFOOT,9/16
39	1 EA	80274	WRENCH,ALLEN,5/32,L STYLE
40	1	108470	PLUG,V-300,EXT.CONTROL ASSY
41	1 EA	108179	BELT,COMPRESSOR,1X37
42	1	99072	MANUAL,V-300 TITAN,VC DIST

Optional Equipment and Supplies

See the V-300 System Accessories List on Page 5-1 for more information and part numbers of most of the following components.

1. A jet pump to increase feed water pressure, should it be below 40 psig. Note that this option is shipped with most installations, but should only be used if needed.
2. A conductivity (TDS) meter.

Other Equipment You May Need

Depending on where you locate your system, you may require the following:

1. A backflow preventer at the feedwater source if required by local code. Note that a backflow preventer is included with the jet pump supplied by Polar Bear.

Calculation of Required Water Softener Capacity

Water softeners use an “ion exchange” process to soften water. When water passes through the softener resins (a sort of plastic “sand”) the calcium and magnesium ions which cause hardness are replaced by sodium ions. Before all the sodium ions are used up and the resins become “exhausted”, the softener must be regenerated. Using the softener up to or past the point of exhaustion will allow hardness leakage, which results in scale formation.

Softener regeneration involves flushing the resins with a saturated solution of sodium which is supplied from common salt (sodium chloride). The Kinetico water softener provided with the V-300 performs the regeneration process automatically at preset intervals, depending on the disc in the softener. Regeneration frequency increases with increasing disc number.

To determine the disc required for the softener, the compensated¹ hardness of the feedwater in grains per gallon must be known. This must be determined before the softener is shipped, and can be determined by sending a water sample to Polar Bear. It typically ranges from 3 to 40 grains, depending on feed water quality. Because the hardness level of your water supply may vary from season to season, be sure to use the highest tested hardness level for specifying your softener.

The following chart indicates maximum feed water compensated hardness (in grains per gallon) for each disc. If feed water hardness is close to the disc capacity, a larger disc should be used.

Disc Number	1	2	3	4	5	6	7	8
Maximum Feed Hardness (grains per gallon)	7	15	21	27	31	36	40	44

¹ Compensated hardness accounts for the presence of ferrous iron in the water. To determine compensated hardness, multiply the iron content of the water (in ppm) by 3 and add this value to the measured hardness. For example, if the iron content of the water is 1 ppm, and the hardness is 6 ppm, the compensated hardness would be 9 ppm.

Installing the Pretreatment System

Figure 2 below illustrates a generic, and simplified, dual tank softener and hardness monitor pretreatment system. The numbers in each Figure refer to steps in the instructions which follow. Use only the figure and instructions which apply to your pretreatment system.

Installation Steps for System with Dual Tank Water Softener and Hardness Monitor

1. Connect the jet pump (if required) to the feed water line. If a jet pump is not required, install a backflow preventer, if needed. Do not plug in the jet pump until there is water flowing through it.
2. Connect from the jet pump (or feed line, if a jet pump is not required) to the prefilter.
3. Install the primary (Kinetico) softener as per the instructions in the softener manual. Connect the inlet to the prefilter and the outlet to the sampling valve assembly. Slowly open the feed valve. Purge the air from the prefilter. Run a few hundred gallons of raw water through the softener.
4. Install the hardness monitor with brine tank (item #5) according to the instructions in the

Hardness Monitor Manual in Section __. Connect the inlet to the sampling valve and the outlet to the post filter.

5. Connect from the post filter to the pressure monitor assembly. Place the pressure monitor assembly as close to the V-300 as possible. It will need to be adjusted depending on the feed water pressure. Tightening the regulator increases pressure to the V-300, while backing it off lowers pressure.
6. Follow the startup procedure for the hardness monitor, as described in the hardness monitor manual (included later in this manual). Run several gallons slowly through the hardness monitor and post filter. Purge the air from the post filter.

Installing the V-300

After preparing your site and installing your pretreatment system, you are ready to install the V-300 as described below.

1. Connect the pretreatment system to the “RAW WATER IN” bulkhead on the V-300. The 1/2” tube simply pushes into the bulkhead.
2. Run a line from the “WASTE WATER OUT” bulkhead on the V-300 to the drain.
3. Connect the “PURE WATER OUT” bulkhead on the V-300 to the carbon filter inlet.
4. Connect the carbon filter outlet to an inlet on top of each storage tank.
5. Connect a line from the other fitting on the top of each storage tank to the vent filter.
6. Run a line from the vent filter to a drain.
7. Connect the mercury switch to the tank which has a 1/2” FPT bulkhead on the bottom.
8. Connect the manifold assembly between the two tanks and the water dispenser system.
9. Wire the external controls, as shown in Figure _____. Note that the external control switches are connected in series, so that breaking any of the three will shut down the V-300. Connect the external controls to the external control plug on the V-300. Note that the external controls can be bypassed by connecting the two wires on the external control plug. On the pressure switch, connect to L1 & M1.

Testing and Starting the System

After the site has been prepared and the system installed as described in the preceding sections, testing and initial start-up may commence. A Polar Bear service representative will train operators to perform the necessary operation and maintenance produces on the V-300.

Warning: If the unit shuts itself down during operation it may start up again without warning. If the machine is hot, always allow the machine time to cool before shutting it off. Always turn off both power switches and unplug the unit before servicing. If you suspect a malfunction, note which troubleshooting lights (white) are on in the control panel before turning off the V-300 (see page ____). Also, allow the unit to cool before touching any interior components. If the V-300 won't restart, wait until it cools sufficiently to automatically reset itself.

Initial Startup Steps

1. Double check all hoses and pipes throughout the pretreatment system. Be sure there are no kinks in the hoses, and that there are no loose clamps or fittings.
2. Open the valve at your feedwater source. DO NOT turn on the V-300 yet. Plug in the jet pump.
3. For the first start-up and approximately every three months thereafter, measure the hardness of the raw feedwater. Raw feedwater is water that has not yet passed through the pretreatment system. Follow the HIGH RANGE testing instructions included in the hardness test kit to measure grains of hardness. Double check that the softener is rated for the tested hardness (see section Calculation of Required Water Softener Capacity).
4. Draw some pretreated water into the container provided for LOW RANGE testing using the sampling valve. Follow the instructions included in the hardness kit to measure parts per million (ppm) of hardness. 1 Grain = 17 parts per million (ppm) CAUTION! Running the V-300 on hard water causes scaling. Your warranty does not cover service required to repair damage caused by hard water.
5. If you find less than 1 ppm total hardness proceed with step 6. If you find hardness in excess of 1 PPM, run several gallons of feedwater through the softener and retest. If the water is still hard, check for hardness at both sampling valves to determine which softener is not softening. If it is not soft after the Kinetico softener, perform a manual regeneration on the softener by advancing the screw on the disc. Wait a few minutes, and then retest. If the softener is still not producing soft water, contact your Polar Bear service representative. Do not continue until testing shows less than 1 ppm total hardness.
6. Check the input voltage on the receptacle for the V-300 to ensure that it is between 208 and 240VAC. Plug in the V-300. Caution: To avoid damage to the V-300, double-check to ensure that the feedwater valve is open.

7. Turn on the “Standby” switch. The amber “Standby” light and the top three white indicator lights should illuminate.
8. Turn on the “run” switch. The green “run” light should illuminate, and you should hear the V-300 motor start.
9. After about 1 minute, the red “heater” light should illuminate, and after about 2 minutes the lower white indicator light should illuminate. The red indicator light indicates that the heaters are on, while the white indicator light indicates that water has entered the E/C (evaporator/condensor) core.
10. Check the Aquaseal cooling water flow rate. Disconnect the cooling water sight tube from the lower bulkhead and run the cooling water into the graduated cylinder provided (marked in U.S. fluid ounces). The number of U.S. fluid ounces in 28 seconds equals the number of gallons per hour. The rate should be between 8 and 15 gallons per hour. If cooling water flow is less than 8 gallons per hour, turn the unit off immediately. Ensure that the feedwater pressure is greater than 40 psig and that there are no kinks or obstructions in any hoses.
11. The E/C core in the V-300 will take a few minutes to fill. Once it is full, warm up of the V-300 will occur. Warm-up involves the V-300 heating the water in the E/C core to steam, and pressurizing that steam. Warm-up is complete when the V-300 is able to condense the steam, resulting in a steady flow of pure water. Warm-up takes about 2 to 3 hours from a cold start. The best method of determining if your unit is still in warm-up is to feel the pure water inspection tube. If it is hot to the touch, it contains steam and the system has not started producing distilled water.
12. While the system is running, check the pressure gauge on the pressure monitor assembly. Pretreated water pressure should be 40 psig. If the pressure is too low, adjust the regulator valve by screwing the handle down.
13. For the initial installation start-up, once the V-300 is producing water, run the first several pumpouts of distilled water to drain. This will remove any debris which may have collected inside the V-300 during shipping.
14. Once the V-300 produces a steady flow of pure water, recheck the hardness of the pretreated water. If the treated water does not have less than 1 ppm total hardness, test again. If the treated water still does not have less than 1 ppm total hardness, shut off the run switch on the V-300 immediately. Remove the covers on the V-300 and manually regenerate both softeners (not at the same time). If the trouble persists, contact your Polar Bear service representative.
15. When pure water has been produced for at least 1 hour, check the flow rate of distilled water from the pure water inspection tube. Distilled water output should be between 12 and 16 gph. If your flow is not within this range, allow the unit to stabilize for another hour and test again.
16. When pure water has been produced for at least 1 hour, check the flow rate of waste water from the waste water inspection tube. Waste water output should be between 8 and 16 gph. If your flow is not within this range, allow the unit to stabilize for another hour and test again.

17. When pure water has been produced for at least one hour, check its conductivity. If the conductivity is greater than 3 ppm, call Polar Bear Customer Service for advice and/or service. 1 micromho is roughly equivalent to 0.5 ppm total dissolved solids.
18. Ensure that the heater light is cycling on and off. Once startup is complete, the heater should only be on about 30% of the time. If the heater stays on, contact your Polar Bear service representative. Note that the heater relays will chatter, producing a clicking sound. This chattering indicates normal operation.
19. Remove the clamps holding the front cover of the V-300 in place and check for leaks.

Maintenance Cautions:

1. To keep the V-300 operating properly, check the water hardness from the sampling valve each time you turn on the system and once a day on automatic systems. Also, for the first week, check and record the cooling water rate daily. Check the salt level in your water softener(s) frequently.
2. Consult the “Maintenance” schedule, pages ____ to ____, for more information on when to perform these and other necessary maintenance procedures. Use the Maintenance Log included with this manual to record measurements (see page ____ for an example of a page from the log filled in with hypothetical data).

Operation

General Information

Warning: Be sure that the compressor belt guard is installed when you are operating the machine.

Caution: To protect the V-300 from damage:

- Never allow hard water to enter the unit.
- When operating the V-300, never shut off the feedwater supply
- When shutting off the unit for maintenance, turn off only the run switch until the unit cools. Not until cooling water has stopped flowing through the cooling water inspection tube can the standby power switch can be turned off and the V-300 unplugged.

Figure __ shows a diagram of the side of the V-300, with the cover removed, to provide an overall orientation to parts location. See the Parts Identification photographs in Section __ for additional parts labeling.

Operation of the V-300

When operating properly, the V-300 is a fully automatic system. Aside from the maintenance requirements described in the *Maintenance* section, there are no steps required to operate the unit once it has been installed.

Maintenance

Maintenance Schedule

Proper maintenance is essential for efficient operation and to prevent scale accumulation on the evaporator surfaces. The recommendations that follow are general guidelines for maintenance of the system under normal use. Use the Maintenance Log as a schedule for applying each procedure and for recording the results. See page ____ for an example of the first page of the maintenance log with hypothetical data representing the first 300 hours of operation. The machine running time is indicated by the hour meter located on the control panel (see Figure ____). Note that maintenance times do not include any hours of factory testing; therefore the times in the log will not match the hour meter reading.

Refer to the Procedures section for instructions on conducting the service procedures described below. Some of the procedures (e.g., Belt Service, Wastewater Strainer Service and Water level Determination) are relatively simple to perform. Other procedures require more technical expertise. If you do not feel confident in performing a procedure, contact a *Polar Bear* customer service representative.

Daily Maintenance (Every 24 hours Running Time)

1. Check the hardness of the pretreated water. Never allow the feedwater hardness to exceed 1 ppm.
2. Check the salt level in the primary softener. The softener should be at least 1/2 full of salt. Note that salt domes can form in the brine tank, preventing salt from contacting the water. Stirring the salt periodically helps to prevent the formation of salt domes.
3. Check and record the pure water and wastewater flow rates. These are a primary indicator of system performance. If the wastewater flow rate has been steadily decreasing, clean the wastewater strainer screen (see Wastewater Strainer Service, page ____).
4. Observe the pressure differential across each of the filters. If the differential is greater than 20 psi, change the filter.

Maintenance After 10 Days (Every 250 hours Running Time)

1. Ensure the Aquaseal cooling water flow rate is 8-12 gallons per hour.
2. Check the compressor belt tension and adjust if necessary. See the Belt Service procedure, page ____.
3. Remove the covers and carefully inspect all interior connections for leaks. Tighten any leaking hose connections. After a few more hours, recheck any previously leaking connections.
4. Manually drain the E/C core into a bucket or pail. If the water is badly discolored, clean the waste water strainer. See Wastewater Strainer Service, page ____.

Maintenance After 20 Days (Every 500 hours Running Time)

1. Visually inspect the float valve plunger and gasket. Lift the end of the float rod with a flat screwdriver, as shown in Figure _____. Ensure that the plunger rises with the float rod. If it does not, refer to page _____, Float Valve Service.

Maintenance After 6 Months (Every 2500 Hours Running Time)

1. Replace the compressor belt. See the Belt Service procedure, page ____.
2. Clean the Aquaseal cooling water filter.
3. Measure the (untreated) raw feedwater hardness. Referring to the chart on page _____, ensure that the disc on your softener is rated for that hardness of water. If it is not, contact your Polar Bear Service Representative immediately.

Mercury Switch Adjustment Procedure

The mercury switch is preset by your installation technician to shut off with the water about 4” below the top of the tanks, and to restart when about 3 feet of water is removed from the tank.

Note that fine adjustment will be required. The adjustment procedures are outlined below.

Upper Level Shutdown (Main) Adjustment

The large screw on the top of the mercury switch (main) controls upper level adjustment. Tightening the screw (turning clockwise) raises the upper and lower levels, while backing it off (counter-clockwise) lowers the upper and lower levels.

If the holding tanks are overflowing and the V-300 is still running:

Turn the large screw counter-clockwise (back it off) until the distiller shuts off, and then back it off another ¼ turn. The distiller will remain off until the water level drops to the low-level restart position (about 3’ of water removed).

If the upper level switch is set too low (the distiller shuts off when the tanks are not full enough), tighten the screw another ¼ turn. Note that this will not cause the distiller to restart; restart will occur when the water level drops to the low-level restart.

Low-Level Restart (Differential) Adjustment

The small screw on top of the mercury switch controls restart of your distiller. If your tank level has dropped far enough so that the distiller should restart, and the mercury float is down (mercury away from the green plug), back the screw off (turn counter-clockwise) until the distiller restarts. If the float is up (mercury close to the green plug) and the distiller has not yet restarted, something else is preventing it from starting.

If the tank level has not dropped far enough and the distiller has restarted, turn the low-level

adjustment switch clockwise $\frac{1}{2}$ turn. Note that this will not cause the distiller to shut off; it will not turn off until the upper shutdown level is reached. Some important notes to remember:

1. Keep track of amount of adjustment (ie $\frac{1}{2}$ turn ccw) so that adjustments can be returned to preset if necessary.
2. The adjustments are very sensitive. A $\frac{1}{4}$ turn makes a large change.

The distiller is externally controlled by this mercury switch, the feed water pressure switch and the hardness monitor. The three switches are connected in series, and all must be closed for the distiller to run. Ensure that the distiller was started/stopped by the mercury switch (and not the hardness monitor or feed water pressure switch) before adjusting the mercury switch.

Troubleshooting

The troubleshooting section begins with a brief description of the components in the control panel, as well as their function. It also contains a brief description of some other components in your distiller. Actual troubleshooting procedures begin with the troubleshooting table.

The Control Panel

The control panel, located on the front of the machine, controls the operation of the V-300. A brief description of the components on the control panel is as follows.

Troubleshooting Lights

The troubleshooting lights are the white lights on the top right side of the electrical panel. They are numbered 1 through 4, from top to bottom. These lights indicate if the *Aquaseal* temperature switch, high level water switch, heater temperature switch and low level water switch, respectively, are closed. Under normal operating conditions, these lights will be on at all times. Note that during startup, the low level light (#4) will be off for a few minutes while the E/C core fills with water.

Standby Light

The amber light at the bottom of the panel is the *standby* light. It is illuminated if power is available to the unit, and should be illuminated at all times.

Run Light

The green light at the bottom of the panel is the *run* light. It is illuminated if there is power to the contactor (which starts the motor, feed valve and heaters and allows the V-300 to produce water), and should be illuminated if the holding tanks require water.

Heater Light

The red light at the bottom of the electrical panel is the *heater* light. It is illuminated if there is power to the heaters. It should be on when the machine is heating up (running but not yet producing water), and should be on about 30% of the time when the unit is making water.

Pumpout Lights

The pumpout tank lights are the 2 red lights in the middle of the electrical panel. The light on the right is the waste pumpout tank light, while the light on the left is the distilled pumpout tank light. These lights illuminate when the pumps are running.

Pumpout Switches

The pumpout switches are the momentary rocker switches above the pumpout lights. These switches manually activate the pumps when they are depressed.

Hour Meter

The hour meter, located in the middle of the control panel, indicates the amount of time the machine has been running. Note that the hour meter reading will not be zero when your machine is installed, due to factory testing.

Standby Power Switch

The standby power switch is the large switch located on the left side of the control panel. It controls power to the entire distiller, and should be on at all times. Note that this switch contains a built in 20 Amp breaker which will trip in the event of a power surge or short circuit.

Run Switch

The run switch is the small rocker switch beside the standby switch. It can be used to manually turn your distiller off. Under normal operating conditions, this switch should be on.

Fuses

There are 3 fuses on the top of your electrical panel. From left to right, the fuses are 0.8 Amp, 2 Amp, and 1 Amp. The left fuse protects the transformer, fan, standby light, run light, and hour meter. The middle fuse protects the solenoid valves and heater controls. The right fuse protects the contactor, external controls and control relay.

Reset Operator

The reset operator is the button in the upper middle of the control panel. It is used to reset the contactor if the thermal cutout relay overheats.

Additional Switches

Transformer Reset

Inside the control panel is a transformer with a manual reset. If the transformer overheats, the reset breaks the circuit to the transformer. When the transformer cools, it can be reset. Under normal operating conditions, the transformer should never need to be reset.

Aquaseal Temperature Switch

This switch is located on the *Aquaseal*. It shuts down the V-300 if the *Aquaseal* overheats, and resets automatically.

High Level Water Switch

The high level water switch is located in the float chamber. It shuts down the V-300 if the water level in the float chamber gets too high, and resets automatically.

Heater Temperature Switch

The heater temperature switch is located on the heaters at the bottom of the E/C core. It opens the circuit to the heaters if they get too hot. It resets automatically.

Low Level Water Switch

The low level water switch is located in the float chamber. It shuts the heaters off if the water level in the E/C core is too low. It resets automatically.

Motor Temperature Switch

The motor temperature switch is located on the motor. It shuts down the V-300 if the motor overheats. If this switch breaks, it will need to be manually reset.

Backing Plate Temperature Switch

The backing plate temperature switch is located on the octagonal plate on the E/C core. It closes when it heats up to provide power to the cooling water solenoid. It operates automatically.

Pressure Switch

The pressure switch controls power to the heaters. It opens when pressure inside the E/C core reaches a certain level, removing power to the heaters. It operates automatically.

External Controls

The external controls consist of three switches in series. Any one of these switches opening will shut down the distiller. The external control switches are connected to the distiller through the external control plug. The external controls are the pressure switch, the mercury switch, and the hardness monitor switch.

Pressure Switch

The pressure switch is connected to the feed line where the feed water enters the distiller. This switch opens if pressure at the switch drops below 40 psi. This switch resets automatically.

Mercury Switch

The mercury switch is mounted on the wall, near to the polyethylene holding tanks. This switch opens when the tanks are full, and closes when the water level has dropped sufficiently. The switch is open when mercury float is down, and is closed when it is up, as shown in Figure ____.

Hardness Monitor Switch

The hardness monitor switch shuts the distiller off if hard water is detected. For complete information about the hardness monitor, refer to section ____.

Warning

Warning: If the V-300 shuts down automatically, it may start up again without warning. Look at the troubleshooting lights and note which ones are on and then turn off the run switch. Do not unplug the unit until water has stopped flowing through the cooling inspection tube. Once the unit is cool, unplug the unit before touching any interior components. If the unit will not restart, you may have to wait until it cools and automatically restarts itself.

If you unplug the V-300 while it is hot, you will stop your cooling water flow and your *Aquaseal* thermal protection will trip. This can result in *Aquaseal* failure. **Never unplug the unit until it is cool.** If the unit is unplugged when it is hot, the V-300 will not restart until the *Aquaseal* has cooled or until the V-300 is plugged in and cooling water is flowing.

For more detailed technical information, consult the following pages:

- Page ____ for the General Layout Wiring Diagram
- Page ____ for the Layout Flow Diagram of the V-300.

V-300 Troubleshooting Table

Lights							Problem	Chart
Standby	Run	Heater	1	2	3	4		
ON	ON	OFF/ON	ON	ON	ON	ON	No problem indicated	
ON	OFF	OFF	ON	ON	ON	ON	Break in run circuit	1
ON	ON	OFF	ON	ON	ON	OFF	Low water in E/C core	3
ON	ON	OFF	ON	ON	OFF	OFF	Heaters are overheating	3
ON	OFF	OFF	ON	OFF	ON	ON	High water in E/C core	1
ON	OFF	OFF	ON	OFF	OFF	OFF	Motor overheating	1
ON	OFF	OFF	OFF	OFF	OFF	OFF	Aquaseal or transformer overheating	1
OFF	OFF	OFF	OFF	OFF	OFF	OFF	No power to transformer	2

Note: The heater light should be off for the first minute when the motor starts to run. It should then turn on until the V-300 is producing water, at which point it should cycle off and on (on about 30% of the time)

Note: The pumpout tank lights should only be illuminated when the tanks are pumping water. If the lights are illuminated and no water is being pumped, refer to Chart ____.

Chart 1 : Motor Not On When Standby Light is On

Line	Item to Check	If Yes	If No
1	Is run switch ON ?	Proceed to the next line	Turn it ON
2	Is external control plug plugged into the V-300?	Proceed to the next line	Plug it in
3	Does motor start when external control plug is jumped?	Proceed to the next line	Leave external control plug jumped and proceed to line 7. After the motor is running, reconnect to the external controls.
4	Is safety softener dial set on soften?	Proceed to next line	Advance safety softener dial to soften. Check raw water hardness & softener rating. Check hardness after Kinetico softener.
5	Is feed pressure above 40 psi? (Feed pressure switch closed)	Proceed to next line.	Adjust regulator valve to increase pressure. Install jet pump if needed.
6	Is the mercury float up?	Check for loose or damaged external control wires. Contact Polar Bear service	Wait for tank level to drop. Readjust mercury switch, if necessary (see section ____)
7	Are all 4 troubleshooting lights ON ?	Proceed to line 12	Proceed to next line
8	Are all 4 troubleshooting lights OFF ?	Proceed to next line	Proceed to line 10
9	Does machine restart after it cools?	Aquaseal has overheated. Contact Polar Bear service.	Reset transformer inside control panel. If it is reset, contact Polar Bear service.
10	Are troubleshooting lights 2, 3 and 4 OFF , with light 1 ON ?	Reset the temperature switch on the motor. If the problem persists, contact Polar Bear service.	Proceed to the next line
11	Is troubleshooting light 2 OFF , with lights 1, 3 & 4 ON ?	High level water switch has tripped. Check water level in E/C core. Inspect float chamber and plunger	Proceed to next line
12	Depress reset button. Does motor start?	If motor stops again, check water level in E/C core. It may be too full	Proceed to next line
13	Is motor plugged into receptacle on control panel?	Proceed to next line	Unplug distiller and plug in motor
14	Are fuses 2 and/or 3 blown?	Replace the defective fuses	Proceed to the next line
15	Are the three plugs in the back of the control panel plugged in?	Plug them in. Note that it is not possible to interchange the plugs	See note below

If the above chart does not indicate the problem, each item in the run circuit must be tested. To test, contact an authorized Polar Bear service representative. **CAUTION: Testing will involve high voltages and dangerous currents. This should only be performed by technically competent personnel.** If no break is found in the above circuit, and the contactor is closing, check the voltage at the motor receptacle. If the motor is receiving 220V but is not starting, replace the motor.

Chart 2: Standby Power Not on When Standby Switch is On

Line	Item to Check	If Yes	If No
	Is V-300 plugged in?	Proceed to next line	Plug it in
	Is Standby Power Switch On?	Proceed to next line	Turn it to ON position. If the switch immediately springs down to OFF , the breaker in the switch is tripping. Contact Polar Bear service.
	Is electrical panel cooling fan on?	Standby light is burnt out; replace	Proceed to next line
	Is fuse 1 blown?	Replace fuse 1	Proceed to next line
	Does the wall receptacle have 220V?	Proceed to next line	Reset the breaker for the receptacle or contact a local electrician to provide power to the receptacle
	Is there 220V between the red and black on T1?	Troubleshoot circuit: see wiring diagram	Unplug V-300 and check for continuity along power cord

Chart 3: No Pure Water After 3 Hours with Motor On

Line	Item to Check	If Yes	If No
1	Is heater light on?	Proceed to line 9	Proceed to next line
2	Are troubleshooting lights 3 & 4 OFF ?	Heater temperature switch has overheated, a wire has burnt, or heater cable is not plugged in	Proceed to next line
3	Is troubleshooting light 4 OFF ?	Water level is low in E/C core. Proceed to next line	Proceed to line 9
4	Is cooling water flowing?	Proceed to next line	Inspect fuse 2. Ensure feed water is available. Ensure solenoid valve cable is installed in back of electrical panel. Check voltage to solenoid valves.
5	Is float plunger up? (refer to figure __)	Proceed to next line	Pry up the rod (refer to Figure __) If the float plunger “sticks”, see float chamber service procedures
6	Is feed water flowing through the solenoid valve? ²	Turn off run switch. Reconnect hose and proceed to next line	.Inspect wires leading to feed solenoid valve. If the solenoid is receiving 24V, replace the solenoid valve.
7	Is feed water flowing through the float chamber? ³	Turn off run switch. Reconnect hose and proceed to next line	Turn V-300 off and inspect float chamber. See service procedures
8	Is feed water flowing through the heat exchanger? ⁴	Turn off run switch. Reconnect hose and contact Polar Bear service.	Heat exchanger is plugged. See service procedures
9	Is E/C core hot (well above room temperature)?	If heater light is not on, it is burnt out; replace. Note that this will not solve the problem. Proceed to next line	Inspect wires around heater and heater switch. Ensure the heater plug is plugged into the electrical panel. Check voltage at heater. Contact Polar Bear service
10	Is excessive condensation inside the V-300?	Find the source of the condensation ⁵ . Restart the V-300	Proceed to next line
11	Is belt tensioned properly?	Retension belt and retest	Plug off pure water inspection tube until water flows through waste inspection tube. Reinsert pure water tube.

Chart 4: Waste Water Flow Diminishes or Stops

² To test, turn the run switch off and remove the braided hose leading into the float valve (bottom hose). Run this hose into a bucket and turn on the run switch.

³ To test, turn off the run switch. Remove the braided hose coming out of the float valve (top hose). Have a small container ready to catch water coming out of the nipple on the float valve. Turn on the run switch.

⁴ To test, turn off the run switch. Remove the hose coming out of the heat exchanger, leading into the primary degasser. Run this hose into a bucket and turn on the run switch.

⁵ The condensation is a result of a steam or water leak. It may result from a loose clamp, unsealed gasket, loose fitting, or failed component.

Note: Before beginning any of these steps, drain the E/C core. If the water is badly discolored, turn the V-300 on for about 2 minutes, then shut it off and drain the E/C core again. Repeat this procedure until the water runs clear, and then begin following this chart.

Line	Item to Check	If Yes	If No
1	Is the pressure drop across the pre- and post filters less than 20 psi?	Procede to next line	Replace the plugged filter(s)
2	Is feedwater pressure at 40 psi?	Procede to next line	Find the obstruction, adjust the regulator, or install jet pump if required
3	Is the belt tensioned properly?	Procede to next line	Retension the belt
4	Is there excessive condensation in the V-300?	Find the source of the leak	Procede to next line
5	Is the waste water strainer clean?	Procede to next line	Clean it
6	Is the heater light on over 50% of the time?	Call for service	Adjust pressure switch

Chart 5: Feed Water Flow Stops

Note: If feed water flow stops while the V-300 is still hot, **remove the covers immediately!**

Line	Item to Check	If Yes	If No
1	Is the feed valve open?	Procede to next line	Open the valve
2	Is water present before the ball valve?	Check for kinks in the feed line. Call for service	Call a plumber or find any closed valves before the feed valve
3	Is the pressure drop across the pre- and post filters less than 20 psi?	Procede to next line	Replace the plugged filter(s)
4	Is feedwater pressure at 40 psi?	Procede to next line	Find the obstruction, adjust the regulator, or install jet pump if required
5	Is fuse 2 blown?	Replace the fuse	Procede to next line
6	Are solenoid wires plugged in to solenoid cable?	Procede to next line	Plug them in
7	Is solenoid cable plugged in to control panel?	Call for service	Plug it in

Chart 6: Poor Quality Water is Produced

Note: Distilled water should be checked at the pure water sight tube to ensure that no contamination is present from the tubing. If water quality is good at the sight tube but poor afterwards, clean the distilled pumpout tank, the carbon filter, and any tubing in between.

Line	Item to Check	If Yes	If No
1	Has the V-300 been producing water for at least 1 hour?	Procede to next line	Wait for 1 hour and retest
2	Is the belt tight?	Procede to next line	Retension the belt
3	Has waste water flow been diminishing? If you are unsure, assume that it has and record your flow rates in the future!	Refer to chart 4	Procede to next line.
4	Turn off the run switch and drain the E/C core. Is the drain water discolored?	Follow the procedure outlined in the preamble to chart 4	Procede to next line
5	Is a side-to-side leak present in the E/C core? Check according to the procedure in section ____	Fix the side-to-side leak	Thoroughly clean the unit. Check for side-to-side leaks in the secondary heat exchanger.

Chart 7: Excessive Condensation is Present

Line	Item to Check	If Yes	If No
1	Is the unit producing water?	Find the leak	Procede to next line
2	Unplug the distilled sight tube so that steam escapes the unit. Remove all moisture. Does any more return?	Search for the steam leak using a mirror. It may come from loose clamps, unsealed gaskets, or defective components.	Condensation is present from steam exiting the distilled pumpout tank before startup

Chart 8: Heater Light On All the Time

Line	Item to Check	If Yes	If No
1	Is the unit hot?	Procede to next line	Check heater plug and heater wires for cuts or burns.
2	Is the unit producing water?	Procede to next line	No problem. Heater should be on continuously during startup
3	Has waste water rate been decreasing?	Refer to chart 4	Procede to next line
4	Is condensation present in the unit?	Refer to chart 7	Procede to next line
5	Is waste water flow greater than 9 gallons per hour?	Turn down the pressure switch. Note the number of turns of adjustment.	Clean the waste strainer, and flush the E/C core several times.
6	Did turning the pressure switch down turn off the heaters?	No problem	Heater relay(s) is defective; replace.

Chart 9: Excessive Noise or Vibration

Line	Item to Check	If Yes	If No
1	Are all bolts tight?	Procede to next line	Tighten any loose bolts
2	Are any welds on the frame broken?	Contact Polar Bear service	Procede to next line
3	Is the belt tensioned properly?	Procede to next line	Tension it properly
4	Remove the belt. Is the motor tightened to the channel?	Procede to next line	Tighten it
5	Does the aquaseal spin freely?	Procede to next line	Contact Polar Bear service
6	Turn on the run switch with the belt still off. Is the motor noisy?	Check the fan at the back of the motor. If it is damaged, replace the fan, otherwise replace the motor	Procede to next line
7	Are the pumps on the pumout tanks running quietly? (test with momentary switched)	Procede to next line	Replace noisy pumps
8	Is the electrical panel cooling fan running freely and quietly?	Procede to next line	Remove the electrical panel cover and remove any impeding wires. If no wires are in the way, replace the fan.
9	Does the motor seem to be dragging?	Check water level in E/C core.	Call for vibrations not related to the V-300.

Service Procedures

Belt Service

Warning: If the unit shuts down during operation it may start up again without warning. Always turn off run switch before servicing.

Ensure that the run switch is off and the V-300 is cool (water has stopped flowing through the cooling water sight tube). Unplug the V-300 and remove the side panel. Figure __ shows the location of the belt and pulleys.

The steps for checking belt tension are as follows:

1. Remove the belt guard by loosening (but not removing) the four hex socket screws. Inspect the belt for wear.
2. If the belt is frayed, cracked, worn, or over 2 years old, replace it. Install the new belt by feeding it onto the compressor and motor pulleys while turning them. The belt is self-aligning.
3. Check the belt tension. Place the tension gauge on the top part of the belt as shown in Figure __. The gauge gap should be 1/8 to 1/4 inch above the belt surface at the compressor pulley when the V-300 is hot. Since the belt tension increases when the V-300 is hot, the cold gauge gap should be set at 1/16 to 1/8 inch above the belt surface at the compressor pulley.
4. If the gap is correct, proceed to step 5. If the gap is incorrect, adjust the belt tension as follows:
 - Loosen the four motor mounting bolts, which are located behind the motor pulley, using the 9/16 inch crowfoot wrench included with your V-300.
 - Loosen the locking nut on the adjustment bolt.
 - Install the tension gauge. Tighten or loosen the adjustment screw until the gap is 1/8 to 1/4 inch above the belt. This may require moving the motor toward the compressor if the belt tension is too tight.
 - Tighten the four motor mounting bolts.
 - Rotate the pulleys by hand and recheck the belt tension.
5. Replace the belt guard. Replace the cover, plug in the V-300 and turn the run switch on.

Wastewater Strainer Service

Warning: If the unit shuts down during operation it may start up again without warning. Always turn off the run switch and allow the unit to cool before servicing.

If the wastewater rate has been steadily decreasing, clean the wastewater strainer screen. Be sure the run switch is off and the V-300 is cool (water has stopped flowing through the cooling water sight tube). Unplug the V-300 and remove the side panel. Figure __ shows the location of the strainer. You must drain the V-300 before cleaning the strainer.

Draining the V-300

1. The drain hose is the hose lying loose along the front of the middle plate. Place the free end in a container that holds at least three gallons and is suitable for hot water.
2. Open the drain valve by turning the handle one-quarter turn.
3. Close the valve once the flow completely stops.

Cleaning the Strainer

1. Drain the V-300 as described above.
2. Remove the black snap clamp and hose at the adaptor (Figure __, item #1).
3. Unscrew the 1/4" MPT x 1/2" hose barb from the 1/2" MPT x 1/4" FPT reducer bushing. Do not allow the reducer bushing to turn.
4. Carefully clean the screen with a stiff brush and flush with running water. If the screen appears to be damaged, replace it.
5. Wrap teflon tape on the threads (Figure 10, item #2) and screw the coupler back into the reducer bushing.
6. Reconnect the hose at the adaptor (Figure 10, item #1) and tighten the clamp. If the clamp appears to be sprung, replace it. Double check to ensure that the drain valve is closed.
7. Replace the front cover and start the V-300. After it is producing water, remove the front cover and check for leaks.

Warning: Wear eye protection and do not touch any interior components if the unit is hot or running. Replace the cover if no leaks are detected.

Water Level Determination

At times you might need to know what the water level is. For example, if you call for telephone assistance the service representative may ask for this information.

Important: This procedure can only be performed when the V-300 is completely cool.

1. Remove the front cover.
2. Locate a small bucket or container and have it ready.
3. Lift the free end of the drain hose so that the hose is pointing up. The drain hose is the hose lying loose along the front of the middle plate. The top of the hose should be at least as high as the motor support channel.
4. Open the drain valve. Water will flow into the drain tube, to the same height as the water in the E/C core. The water level should be 9 to 10 inches above the middle plate. Record the water level and close the drain valve.
5. Empty the water left in the drain hose into the small container.

Float Valve Service

Refer to the Float Valve Assembly diagram on page ____.

Removal

1. Turn off the run switch on the V-300, remove the covers and allow the unit to cool. The unit is cool when no water is flowing through the cooling water inspection tube.
2. Unplug the V-300 and shut off the feedwater supply. Open the sampling valve at the pressure monitor to bleed the pressure out of the system. Keep it open until the pressure gauges read zero and no water is flowing.
3. Drain the E/C core as described previously.
4. Remove the 1/2" hose from the feedwater bulkhead.
5. Remove the two high-pressure braided silicon hoses from the float valve body.
6. Loosen the brass nut between the valve body and the float chamber.
7. Carefully remove the valve body by sliding it straight off the chamber. Ensure that the actuator arm is not removed with the float body.

Pulling out the actuator arm from the float chamber will require removal of the float chamber and resetting of the actuator arm in the float tank before you can restart the unit.

Plunger Seal and Gasket Replacement

1. Remove the set screw from the valve body and separate the seat assembly from the valve body. (Refer to float valve figure)
2. Remove the plunger from the valve body.
3. Remove the float valve seal from the valve body.
4. Lightly lubricate the new seal and press into the valve body.
5. Inspect the plunger and plunger gasket for wear. Replace if necessary. Reinstall the plunger into the valve body.
6. Inspect the o-ring on the seat assembly. Reinstall the seat assembly and lock it in with the set screw.

Actuator Arm Replacement and Float Inspection

If the actuator arm is accidentally removed during float valve inspection, or if a more thorough inspection of the float system is required, the following procedure may be used. For standard maintenance and inspection, actuator arm and float chamber inspection is not required.

1. Remove the float valve according to the procedure indicated above.
2. Disconnect the high-level and low-level float switch wires.
3. Open the upper and lower black hose clamps nearest to the float chamber on the hoses that connect the float chamber to the motherboard.

4. Pull the float chamber straight out. A slight rocking motion may be required to remove the chamber.
5. Lay the chamber on its side with the actuator arm facing up.
6. Remove the lower 5" gear clamp on the float chamber and remove the float chamber cap.
7. Pull out the actuator arm. It should slide straight out of the chamber.
8. Inspect the o-ring and actuator arm for wear. Replace if necessary.
9. Turn the chamber upside down. The float will drop out.
10. Pick up the float. If it feels heavy, if there is water inside, or if there is a noticeable leak or defect, the float must be replaced.

Float Valve Reassembly

1. Lay the float chamber on its side with the actuator arm hole facing up.
2. Slide the float into the chamber. The L-shaped extension on the float must be pointing down, away from the actuator arm hole, as shown in Figure _____. The hole in the L-extension should be lined up with the actuator arm hole.
3. While sliding the float into the chamber, insert the actuator arm into the float L-extension hole. Ensure that the o-ring on the actuator arm will seal.
4. Inspect the blue silicon gasket around the outside of the float cap. Reattach the top cap onto the float chamber.
5. Re-install the complete float assembly onto the motherboard. A slight rocking motion may be required to install the chamber.
6. Reinstall the float valve assembly onto the float chamber.
7. Reattach all wires, hoses and clamps. Ensure that the black snap clamps are not sprung.
8. Reinstall the 1/2" feedwater hose into the feedwater bulkhead. Check the hardness of the feedwater, and open the feedwater valve.
9. Start the V-300. After a 20-60 second time delay, the feedwater should start to flow. Allow the V-300 to run for 5 minutes, and then shut off the machine. Open the covers and check for leaks.
10. Check the water level in the E/C core. It should be 8 to 10 inches above the middle plate.

Prefilter and Post Filter Replacement

These filters only need to be replaced when they are a year old or when the pressure differential across them is greater than 15 psi.

1. Shut off the V-300 and allow it to cool. It is cool when water is no longer flowing through the cooling water sight tube.
2. Shut off the feedwater. Remove the pressure in the lines by draining the water out of either of the sampling valves. The pressure is removed when the gauges read zero.
3. Unscrew the blue filter housing from the black filter top cap. NOTE THAT THE FILTER WILL BE FULL OF WATER. Drain the water out of the filter.
4. Remove the filter from the filter body. Insert the new filter into the blue housing and tighten the housing onto the top cap.
5. Turn on the feedwater supply and check the filter housing for leaks.
6. Purge the air from the filter by depressing the red button at the top of the black filter cap until water begins to flow through the button.

Once the air has been purged from the filter, check the feedwater hardness at the pressure monitor. If the water is soft, the V-300 may be restarted.

Plumbing Manifold Removal

1. Shut off the V-300 and allow it to cool. It is cool when water has stopped flowing through the cooling water sight tube.
2. Shut off the feedwater supply. Remove the pressure in the lines by draining the water out of the sampling valve at the pressure monitor.
3. Unplug the V-300 and remove the side covers.
4. Remove the 1/2" feedwater hose from the feedwater bulkhead.
5. Unplug the wires leading to the two solenoid valves.
6. Remove the 1/2" braided silicon hose from the float valve at the feed solenoid valve.
7. Remove the compression nut and 1/8" capillary tube at the cooling water strainer.
8. Remove the stainless steel 1/2" stem x 1/2" hose barb fitting from the inside of the feedwater bulkhead. Note that a flat screwdriver may be required to depress the collet on the bulkhead.
9. Cut any tie straps attaching the solenoid valve assembly to the bracket, and lift the assembly out of the bracket and out of the unit.

Reverse the above steps for reinstallation of the plumbing manifold. Note that the black and white wires go to the cooling valve, while the orange and brown wires go to the feed valve.

Acid Flush

Warning: Safety Glasses and Rubber Gloves Must Be Worn!

This procedure removes scale from the V-300. Figure ___ shows how to set up the procedure.

Materials Required

- PK-1 pump (available from Polar Bear)
- 5-gallon acid-resistant reservoir
- 10 feet of acid resistant hose (LDPE & Silicon are acceptable)
- 3 pinch clamps (or 4 plugs and 1 foot of tubing)
- citric acid (at least 2 kg)

Setting Up

1. Turn off the run switch and allow the V-300 to cool. The V-300 is cool when water is no longer flowing through the cooling water inspection tube.
2. Close the valve at the source of your feedwater supply and jump the external control plug (see page ___).
3. Using the drain valve at the drain tower (Figure ___, item #_), drain the E/C core.
4. Using hot water, mix up a saturated solution of citric acid in the reservoir. The solution is saturated when no more acid crystals will dissolve. Caution: citric acid is corrosive on skin!
5. Connect a hose from the acid reservoir to the pump inlet (Figure ___, item #a).
6. Disconnect at the heat exchanger the hot feedwater hose connecting the top of the heat exchanger to the feed degasser inlet (Figure ___, item #b).
7. Connect a hose from the outlet of the pump to the feed degasser inlet hose (Figure ___, item #c).
8. Clamp shut or plug off the hot wastewater hose which connects the strainer outlet to the middle hose adapter on the heat exchanger (Figure ___, item #d).
9. Clamp shut the gas vent line off the top of the feed degasser (Figure ___, item #j).
Alternatively, disconnect the line from the feed degasser and plug it off, and use the 1 foot length of tubing and a plug to plug off the other fitting.
10. Connect the waste strainer drain hose (Figure ___, item #e) to another length of hose long enough to reach the acid reservoir (item #g). Place the end of the hose in the acid reservoir (item #g). Ensure that the drain valve is closed.
11. Remove the hose that connects the E/C pressure tap to the pressure switch (Figure ___, item #h).
12. Connect a hose from the E/C pressure tap to the acid reservoir (Figure ___, item #i). Be sure

the hose is above the surface of the solution in the reservoir. The hose will be the overflow and the level indicator.

13. Remove the belt guard and walk the belt off the pulleys.
14. Disconnect one of the wires leading to the feed solenoid valve.

Filling the E/C Core

Warning: Safety Glasses and Rubber Gloves must be worn!

1. Turn on the pump. Fill the E/C with acid solution until the solution begins to run out of the overflow line, then turn off the pump. Caution: Do not overfill. Clamp shut or plug off the inlet hose (Figure __, item #c) so the solution won't run back to the pump.
2. Open the feed water valve and confirm that the feed water is soft, and then turn on the run switch. The motor will start and the heaters will turn on, heating up the acid solution. The motor will sound very smooth because it is not turning the impeller.
3. Allow the acid solution to sit in the E/C for one hour with both the motor and the heat on. If the scale is heavy, turn off the run switch after 1 hour and allow the solution to sit overnight.
4. Turn off the run switch, open the strainer drain valve (Figure __, item #f) and drain the acid solution from the E/C into the reservoir.
5. Repeat steps 1-4 for a minimum of 3 to 4 hours. Remember to unclamp or unplug the hose from the pump to the feed degasser before turning on the pump. Scale from the evaporator neutralizes the solution. As needed, add acid until no more dissolves. You may need to add acid before each repetition. If the flush solution becomes very dirty, it may be necessary to discard the water and mix a new solution. If a pH meter is available, the solution should be pH 1-2.

Flushing the Heat Exchanger

Flushing the heat exchanger may improve performance in cases of extreme scaling.

Using warm water when mixing the acid solution will improve the cleaning process.

1. The same pump and reservoir used for flushing the E/C may be used for flushing the heat exchanger. Again, ensure the solution is saturated and use warm water.
2. Do not turn on the run switch. Attach the pump outlet to the wastewater out hose (Figure __, item #a).
3. Attach a hose from the reservoir to the wastewater inlet nipple on the top of the heat exchanger (Figure __, item #b). Run the acid solution through the pump for 2 hours or more.
4. Here, as for flushing the E/C, scale from the evaporator neutralizes the solution. If needed, add crystals until no more dissolve. If the flush solution becomes very dirty, it may be necessary to discard the water and mix a new solution. The pH solution should be pH 1.0-2.0.
5. Note that the above procedure cleans the waste side of the heat exchanger. To clean the feed side repeat the process, exchanging the waste for the feed inlet and outlet.

Reassembly

1. Turn off the run switch.
2. Remove all pinch clamps or plugs and reconnect all hoses.
3. Reinstall the belt and the belt guard.
4. Reconnect the wire removed at the feed solenoid valve.
5. Turn on the feedwater supply.
6. Restart the unit. Flush the system by running the pure water into a drain until it's pure. If you have no way to measure the purity of the pure water, let the purewater flow into a drain for at least two hours after the unit has started producing water.
7. During the two hour period after startup pay close attention to the flow rate of the wastewater. If the wastewater rate diminishes, the strainer will need to be cleaned.

Compressor Service

Tools Required

- 5/32" Allen wrench
- 3/8" ratchet and 6" extension
- 7/16", 1/2", 9/16" and 3/8" drive sockets
- 7/16" and 3/4" open-end wrench
- Phillips head screwdriver
- Slotted screwdriver
- Electric or air impact driver with 3/4" socket

Compressor Removal

Note: Refer to Figure ____.

1. Shut off the V-300 and let it cool. It is cool when water no longer flows through the cooling water inspection tube.
2. Remove the side covers.
3. Remove the rear panel by removing the nuts on the carriage bolts. Do not pull the carriage bolts out of the panel; remove the panel with the bolts still attached but the nuts removed.
4. Remove the belt guard and the belt.
5. Remove the motor pulley by removing the 4 set screws attaching the pulley to the motor shaft. Note that there are two more set screws below the two visible set screws. Lubrication and a gear puller may be required. Also remove the key stock on the motor shaft.
6. Remove the compressor pulley by using the impact driver on the jam nut. The slot in the inside of the pulley should be up so as not to drop the half-moon key inside the pulley. Be sure to remove the half-moon key when the pulley is removed.
7. Remove the hoses leading into and out of the motor cooling coil.
8. Remove the four bolts holding the motor to the motor mount channel and remove the motor.
9. Remove the two 1/4" x 5-1/2" bolts attaching the motor mount to the octagonal plate. Remove the 4" x 1" round support tubes when the bolts are removed.
10. Remove the four Allen screws holding the motor mount to the bearing cases, and set the motor mount to one side.
11. Remove the degasser bracket where it attaches to the bulkhead.
Disconnect the following:
 - Aquaseal cooling line
 - Feed line (hot) from the motor cooling coil at the feed degasser

- Pressure switch hose
 - Hot product degasser hose (top of degasser)
 - Bearing and bottom motor cooling line at the & connection, below the bearing case
 - Top motor cooling line at bearing case
12. Unplug the orange and violet wire that is attached to the thermal disc on the compressor backing plate (see Figure 14, page 4-16) and the two yellow wires on the bearing case. Remove the two Allen bolts from the pressure switch. Leaving its wires attached, move the switch off to the side, out of your way.
 13. Remove the four bolts and the nut from the compressor assembly. As you remove the side bolts, catch the spacers in your hand.
 14. Carefully remove the compressor assembly. Be careful not to damage any hoses.

Impeller Removal

1. Place the compressor assembly in a vise. Clamp the vise to the compressor backplate, using a cloth to prevent damage to the assembly.
2. For compressors with a star washer: Bend the tab away from the titanium nut. Remove the nut and discard the star washer. Note: The nut is best removed using an impact driver.
3. Remove the impeller with extreme care. Do not bend or distort the impeller during removal.
4. Install the new impeller on the shaft. The impeller should fit snugly. Note: Do not bend or distort the impeller while installing it on the shaft.
5. Put one drop of Lock Tight 620 on the shaft. Tighten the nut to 45ft lbs.
6. Inspect the scroll band gasket for cracking and splitting.

Installation

1. Install the compressor assembly. First mount it onto the top stud. Then align the bottom holes on the compressor backing plate with the hex standoffs (see Figure 14).
2. Twist a nut onto the top stud. Then install the two bottom bolts into the hex standoffs.
3. Insert two side bolts through the compressor, then through the two remaining side spacers. As you look from the left side of the compressor, be sure the scroll band gasket clears the hex standoffs and the side spacers.
4. Tighten the four bolts and one nut evenly until the spacers are bottomed out. Spin the bearing case shaft by hand to make sure it's not binding. If it is binding, check the scroll band alignment.
5. Reinstall the pressure switch.
6. Plug the orange and violet wires into the thermal disc and the two yellow wires to the bearing case thermal disc.
7. Reinstall the degasser bracket to the bulkhead.

8. Reconnect the hoses that you disconnected in Step 11 of the Compressor Removal Section, page 4-15. Clamp all connections.
9. Reinstall the motor mount.
10. Bolt the motor to the motor mount. The Aquaseal bearing case must have a plastic insulating ring installed between the motor mount and the bearing case itself.
11. Reinstall the motor and compressor pulleys.
12. Install the belt and check the tension with a belt tensioning gauge. Adjust tension as necessary.
13. Reinstall the belt guard.
14. Double check all hoses and clamps.
15. Start the V-300.
16. Check the Aquaseal cooling water flow rate. It should be 8-12 gallons per hour.
17. Check all hose connections for leaks.

Aquaseal Bearing Case

NOTE: MANUAL NOT UPDATED PAST THIS POINT

Removal

1. Shut off the V-300 and let it cool.
2. Shut off the feedwater.
3. Remove the six screws holding the left side insulating panel to the frame.
4. Remove the compressor assembly as described in the Compressor section, page 4-14.
5. Place the compressor assembly in a vise by the compressor back plate and remove the impeller nut (see Figure 14, page 4-16).
6. Remove the impeller. Note the location of the spacers. There are two different kinds of spacers. You'll have to install them onto the new assembly in the same relative positions they're in now. **Do not bend or distort the impeller during removal.**
7. Remove the three screws from the clamp ring.
8. Pull the bearing case from the compressor backing plate (Figure 14, page 4-16) by its stainless steel cooling jacket (not the black bearing case section).

Be sure the stainless jacket and black bearing case don't separate during or after removal.

Service

1. Check the condition of the O-ring in the backing plate. Look for cracks, cuts, etc. If it is damaged it must be replaced.
2. Lubricate the O-ring with silicone lubricant. Insert the new bearing case into the backing plate. Be careful not to cut the O-ring and be sure the insulating ring on the seal end (versus the pulley ring) is in place.
3. Install the clamp ring and screw in the three screws hand tight.
4. Take the motor mount and set it on the bearing case so that the four mounting holes line up. Now check the alignment with the holes on the motor mount pillars on the backing plate. The bearing case may have to be rotated to line up all six of these holes at the same time.
5. Once the holes are lined up, the three screws on the clamp ring can be screwed in tight.
6. Remove the motor mount and set it aside for later use.
7. Install the spacers (the cone-shaped spacer is the outer one) and the impeller. Tighten the nut to 45 ft. lbs. Be sure the silicone spacer is in place before installing the metal spacer.

Installation

1. Before reinstalling the compressor assembly, check the scroll band gasket for splits or cracks.
2. Install the compressor assembly. First mount it onto the top stud. Then align the bottom holes on the compressor backing plate with the hex standoffs.
3. Twist a nut onto the top stud. As you look from the left side of the compressor, be sure the scroll band gasket clears the hex standoffs and side spacers. The impeller will rub if the gasket is not properly lined up. Then install the two bottom bolts into the hex standoffs and tighten.
4. Insert the two side bolts through the compressor and then through the two remaining spacers.
5. Tighten the four bolts and the nut until the spacers are bottomed out. While tightening, check the gasket to be sure it doesn't get clamped between the spacers and the backing plate. Then spin the bearing case shaft by hand to make sure it's not binding. If it is binding, check the scroll band alignment.
6. Reinstall the pressure switch.
7. Reinstall the degasser bracket to the bulkhead.
8. Reconnect the feed hoses. The motor cooling coil hose goes to the feed degasser.
9. Connect the cooling water line and the drain hoses to the bearing case and motor.
10. Install the motor mount. **The Aquaseal bearing case must have a plastic insulating ring installed between the motor mount and the bearing case itself.**
11. Bolt the motor to the motor mount.
12. Reinstall the motor pulley and the compressor pulley.
13. Install the belt and check the tension. It may need adjustment.
14. Reinstall the belt guard.
15. Check all the hoses and connections.
16. Turn on the feedwater.
17. Start the V-300.
18. Check the cooling water flow. It should be 8-12 gph. Check for leaks.

E/C Core

The evaporator/condensor (E/C) core is the central part of the V-300. It is responsible for boiling (evaporating) and condensing the water to be distilled.

The E/C core is attached to a stainless steel bulkhead, sometimes referred to as a “motherboard”, since most of the inner workings of the V-300 are mounted on it. The construction of a V-300 starts with the mounting of the E/C core bulkhead onto the frame. The core itself is a stack of E/C plates that are compressed down with a backing plate and sealed with two gaskets and a core band.

The following instructions allow you to disassemble the E/C core while it is still in the frame. It is not necessary to remove the bulkhead during disassembly of the E/C core.

Before disassembling the core, please notify Polar Bear Water Distillers Mfg. Co. Ltd.’s customer service department of the core’s log number, stamped on the bulkhead just above the top of the core band. This will keep records about core performance up to date.

Materials Required

- knife
- long screw driver
- drain hose
- 7/16-inch socket or open wrench
- 9/16-inch wrench
- two large C-clamps or two 8” long 1/4-20 all-threads
- replacement plates

E/C Plate Removal

1. Turn off the main power switch and unplug the V-300. Remove the covers and allow the machine to cool.
2. Take off the left side panel insulation (the core side) by removing the six screws holding it in place.
3. Drain the water from the unit.
4. Loosen the bolts on the degasser bracket where the bracket attaches to the front of the E/C core.
5. Cut the tie wrap or remove the insulation that holds the motor harness in place and unplug it from the control box.
6. From the rear, remove the two top 9/16-inch nuts holding the E/C into the top of the frame. Push the core forward so the mounting studs pull through the rubber grommets and the core is resting at an angle in the frame. Place a block of wood between the

frame and the top of the E/C to hold it in place.

7. Using a 7/16" wrench, evenly loosen and remove the twelve 1/4-20 nuts holding the back plate down. Remove the four center nuts first.
8. Lift off the black backing plate and the clad plate. Leave the studs in place.
9. Lift the plates straight out from the core one at a time, very carefully. The gaskets can stick from torquing and the plate edges are very sharp. Lift evenly around the edges until the outside gaskets are separated, then lift off. Don't bend the metal on the inside of the alignment holes as they pass over the threads on the studs. Bent metal will keep the gaskets from sealing when you reassemble the core. Once removed, stack the plates on a flat surface in the order that you removed them.
10. Examine the plates that have been or are suspected of leaks. If the problem was side-to-side leak, examine each plate's gaskets around the flow holes. Run your fingernail over a gasket to check for air bubbles or a cut. Also look for loose bonds and deteriorated gaskets. Replace any plates that have faulty gaskets. **Note: Keep the plates in order during reassembly, starting with a gasketed plate, then a blank, gasket, blank, gasket, blank, etc., ending with a gasketed plate. Rearrange any plates that are out of sequence.**

E/C Core Assembly

1. Reverse the E/C plate removal procedure to reassemble the core.
2. Place the E/C core band on the master bulkhead so the bottom interior baffle contacts the bulkhead below the 3-inch diameter compressor intake hole.
3. Slip the core plates onto the four center studs one at a time, starting with a gasketed plate. The order should start with a gasketed plate, then a blank plate, gasket, blank, etc., ending with a gasketed plate. Constantly check the order of the plates.
4. Align the plates carefully. Sight through the 1/2 inch diameter fill-holes. You should be able to see through to the master bulkhead.
5. Adjust the band so the spacing from studs to core band is even on all sides and so the dam on the bottom of the core band is pushed up into the bottom groove of the plate stack.
6. Remove two of the studs on opposite sides of the E/C and install two lengths (8 inches long) of 1/4-20 althread.
7. Slip the clad plate and the backing plate over the four center studs and the two all-threads. Use the six nuts to draw the E/C back plate evenly down until all nuts can be threaded onto the remaining studs.
8. Remove the all-thread and install the original studs.
9. Check the gasket all the way around for proper core band alignment. Then tighten the nuts until the back plate bottoms out on the spacers.
10. Push on the top of the core so that the bolts which extend from it are inserted into the

upper mounting grommets. Retighten the two 9/16" nuts.

11. Install the side panel insulation.
12. Re-attach the degasser bracket.
13. Plug in the motor to the control box.
14. Check all hoses and connections.
15. Start the V-300.

E/C Core Pressure Test

For the V-300 to function, pressure must be maintained. To maintain pressure, all flow paths must be sealed from each other and in order. Pressure tests show if there are leaks which indicate that pressure cannot be maintained.

The evaporator/condenser core (also called the E/C core or simply the core) has two chambers within it: the evaporator and the condenser. These two must seal against each other and the atmosphere. The following procedure tests that seal.

Core plates will leak if they are not in the right order (e.g., two gasketed or blank plates together). It is very important to keep plates in the right order when disassembling or reassembling the core.

Materials Required

- rubber hoses
- clamps to attach hoses to adapters
- clamps to clamp hoses shut
- compressor pump with psi gauge and shut-off valve before the gauge
- soapy water (to locate leaks)

Sealing

1. Remove the compressor as described in the Compressor Removal section, page 4-14.
2. Seal the compressor hole and the eight condenser holes (Figure 15, page 4-25) by whatever means you can find. If available, you can use a plumbing plug and eight sanding plug mandrills. Alternatively, clamp over the holes a metal plate covered with rubber gasket material. Viton must be glued on to the material in areas that will cover the nine holes. However done, these holes must be sealed before you can test core pressure.
3. Clamp hoses in place to seal the four adapters on the bulkhead (Figure 15, page 4-25). The feed and pure water adapters, where the compressor is to be attached during the test, should not be sealed.

The Test

1. Once sealing is complete, attach the compressor pump with psi gauge and shut-off valve to the feed adapter, as shown in Figure 15. Clamp it in place if necessary.
2. Turn on the compressor, open the valve, bring the psi up to 6 psi (more than double the pressure the core requires), then shut off the valve.
3. Check the psi gauge for a drop in pressure. Wait at least 60 seconds and listen. You may be able to hear a leak. If the psi drops to 0 immediately, or drops in show increments, there is a leak. See the following section, “If There Is A Leak”.
4. If the psi remains steady, test the pure water. Move the test equipment to the pure water adapter, seal the exposed feed adapter (clamp a sealed hose over it) and bring the pressure up to 6 psi.
5. If the psi drops to 0 immediately, or drops in slow increments, see the following section, “If There Is A Leak”.

If There Is A Leak

- **Total failure on the psi test** (pressure drops to zero immediately and you can also hear such a leak):
With the compressor pump attached to the feed adapter, a total failure on the psi test may occur if the core band is not sealed to the bulkhead. To check this, spray soapy water around the band. Bubbles may appear around some studs. Tighten the studs near where bubbles appear - tighten just enough, lightly please! Then test again.
If the core band is not sealing well, plates may be in the wrong order. Disassemble the core (see the E/C Plate Removal section, page 4-21). Reorder any plates that are out of order, e.g. two gasketed plates together. Keeping the plates in order, reassemble the core, then retest the E/C core with pressure.
- **Slow leakage** (psi drops in small increments):
Finding the leak is similar to looking for a leak in a tire. Bring the psi up to specification, then spray soapy water all around the core band.
Bubbles around center hole studs indicate a cut or air bubbles in the gaskets around a plate's center hole, or perhaps a bent center hole in a blank plate.
Follow the procedure to disassemble the core. Remove plates one at a time and check for leaking plates, using your fingernail to feel for cuts or bubbles in gaskets. Replace the leaking plates, reassemble the core (being sure to keep the plates in the correct order) and retest.
- **Other** (while compressor is attached to the feed inlet adapter):
Put some soapy water on a fingertip and press it over the pure water outlet adapter. Bubbles indicate a side-to-side leak. This means air is leaking from the feed side of the plate and out the other side of the plate through the pure water.
To find a side-to-side leak, follow the procedure to disassemble the core. Keeping the plates in order, examine each plate's gaskets around the flow holes. Run your fingernail over a gasket to check for air bubbles or a cut. Also look for loose bonds. When you find the

problem replace the plate, reassemble the core and retest.

Differential (Delta-P) Pressure Test

This test measures the difference in pressure between the evaporator (where feedwater boils) and the condenser (where steam condenses to pure water). All readings are in inches of water (28 inches = 1 psi).

The delta-p test is used to determine:

- How much water is being produced, by looking at how much work the compressor is doing, or how much steam it is moving.
- Whether the evaporator pressure is high enough to push out wastewater.

Materials Required

- an evaporator pressure probe
- a T-connection
- a condenser pressure probe
- a simple manometer, consisting of a clear 8-foot long hose half-filled with water (Figure 16)
- a tape measure
- two pinch clamps
- hose connectors
- 3/32 Allen wrench
- screwdriver

The Test

1. Shut down the unit and allow it to cool. The next steps involve removing a hose and a plug. Be careful doing this as the unit is not completely cool since some pressure may still remain in the E/C.
2. Remove the hose that connects the pressure switch to the E/C pressure tap (Figure 17).
3. Remove the plug from the compressor pressure port (Figure 17) with a 3/32 Allen wrench.
4. Remove the control box cover by unscrewing its eight screws.
5. Install the condenser pressure probe in the compressor port. Route it through one of the two holes in the insulation around the control box, then through the gap between the control box and the outside insulation (Figure 17).
6. Install the evaporator pressure probe via a T-connection in the hose connecting the pressure switch and the E/C pressure tap. It must be routed as was the other probe, through one of the two holes in the insulation around the control box, then through the gap between the control box and the outside insulation (Figure 17).

7. Pinch clamp the end of both probes outside the V-300 (Figure 17).
8. Be sure all hoses are clamped in place and marked evaporator or condenser.
9. Replace the covers, then start the V-300. Allow it to warm up and stabilize until there is a constant flow of water.
10. Slightly open the clamp on the evaporator pressure probe, to bleed any excess water from the hose, which could cause a false reading.
11. Plug the evaporator pressure probe into the manometer.
12. With a tape measure, measure the difference between the levels of water in the hose (Figure 18) and record it. This gives you the pressure in the evaporator in inches of water. It should be at least 19 inches.
13. With the evaporator probe still plugged into the manometer, slightly open the clamp on the condenser probe to bleed of excess water.
14. Plug the condenser probe into the other side of the manometer. It will probably take 30-60 seconds for the water column to stabilize. Measure the distance between the two water levels (Figure 19). This measurement gives delta-p, the differential pressure. It should be 22 to 27 inches.
15. Determine the condenser pressure:
$$\text{condenser pressure} = \text{evaporator pressure} + \text{differential pressure}$$
16. Remove the probes and return the unit to its normal configuration.

Gaskets

Gaskets which are cut, nicked, gouged or have air bubbles will cause leaks and must be replaced. Leaky gaskets cannot be repaired except under a few circumstances (see below). **Only attempt repair if replacement plates are not available.**

Evaporator/Condenser Plates

- The support dots are strictly for support. If they come loose or are damaged they can be glued with silicon gasket sealer.
- The silicon channeling that connects does are only to facilitate the molding process. If any come loose, just cut it away.

Heat Exchanger Plates

- Don't worry about nicks on the inside channelling but the gaskets must be anchored to insure proper alignment of gaskets. If loose, glue them down with silicon gasket sealer.

Outside Gaskets for Evaporator/Condenser or Heat Exchanger Plates

- If there is a bonding problem with an outside gasket, it may be glued with silicon gasket sealer to anchor it to a plate, so long as the problem area is 1 inch long or less. If it is nicked it cannot be repaired.

Heat Exchanger

The following steps make removal of the heat exchanger as easy as possible. Before disassembling the heat exchanger, please notify Polar Bear's customer service department of the heat exchanger's log number, stamped or inked on the side of the polypropylene dividers. This will help us keep records about heat exchanger performance up to date.

Materials Required

- knife
- screwdriver
- drain hose
- compressor pump
- 7/16-inch socket and open wrench
- 1/2-inch socket and open wrench
- stand for heat exchanger to sit on so you can work under it
- two large C-clamps
- two 18-inch solid metal rods, 3/8-7/16 inches in diameter (optional)
- replacement plates

Heat Exchanger Removal

1. Turn off the main power switch and unplug the V-300. Remove the covers and allow the machine to cool.
2. Remove and disconnect the following:
3. Remove the control box cover.
4. Remove the rear cover and cut the nylon tie wraps that hold the harnesses to the control box insulation.
5. Unplug the two control wire harnesses: one goes to the motor, the other to the wiring harness.
6. Remove the ground wire.
7. Remove the insulation on the back of the control box. First remove the four screws located on the four corners of the inside of the control box. Next remove the three screws on the outside of the insulation. (These three screws hold the insulation against the outside frame of the control box).
8. Drain and remove all six connecting hoses from the top and bottom fittings of the heat exchanger (Figure 20, page 4-33). Remove the top fittings first, then the bottom fittings, emptying out the lines as you go. Mark each hose to help you remember where to replace it.

9. Using 7/16 and 1/2 inch sockets or open-end wrenches, remove the two 1/4-20 and one 5/16-18 mounting nuts holding the heat exchanger to the frame.
10. Find someone to help lift the heat exchanger up and out of the machine. It is best to lift the heat exchanger out through the rear panel opening.

Disassembly

1. If possible, place the heat exchanger on a stand so you can work underneath it, then drain out any remaining water.
2. Remove the alignment pins (not to be confused with the alignment rods).
3. Clamp the heat exchanger with two large C-clamps evenly between the studs, tight enough to remove torquing pressure from the studs.
4. With the 7/16 inch and 1/2 inch wrenches, remove the four 1/4-20 and the four 5/16-18 stud nuts and place them in a container.
5. Remove the studs and, if present, any spacers.
6. Evenly loosen the C-clamps, then remove them.
7. Remove the metal back plates and the polypropylene back plates. **Caution: Wet hands and sharp plates require extreme care in handling.**
8. Lift the heat exchanger plates straight out, one at a time, very carefully. **The gaskets can stick from torquing, the plates are very sharp and bent metal will keep the gaskets from sealing when you reassemble the heat exchanger.** Lift evenly around the edges until the outside gaskets are separated, then lift off. Once removed, stack the plates on a flat surface in proper sequence.
9. Next examine the plates that have been or are suspected of leaking. Be careful to keep the plates in the correct order. As each plate is examined, restack in order, inserting the rods through the alignment holds (Figure 20) to keep the plates in alignment. Replace any plates that have been marked as leaking. If plates were in the wrong order, correct the order. Be sure to keep the plates in order as you examine each plate's gaskets around the flow holes. Run your fingernail over a gasket to check for air bubbles or a cut. Also look for loose bonds.

Heat Exchanger Assembly

1. Stack the aluminum back plates and thermal dividers in the correct order.
2. Place the four 1/4-20 studs on the outside corner of the backing plate holes and the four 5/16-18 studs into the remaining holes. Put the washer, lock washer and nut on the top threads of the studs.
3. Center the C-clamps evenly between the studs and clamp down. Torque the heat exchanger down to near its specified measurement (below).
4. Place the washer, lock washer and nut on the bottom threads. Figure 21, page 4-34, shows that the threads must be up on three of the studs to allow for proper mounting of the heat exchanger in its mounting.

5. Tighten the heat exchanger down evenly until the spacers are touching both end plates. Then tighten the end plates down to the spacers.
6. Install the alignment pins.
7. Pressure test the heat exchanger while it's still on the bench.

Heat Exchanger Installation

1. Get help lifting the reassembled heat exchanger into place.
2. Replace the three nuts that hold the heat exchanger in place.
3. Replace the control box.
4. Replace the hoses on the approximate fittings of the heat exchanger (Figure 20, page 4-33).
5. Restart the V-300.

Heat Exchanger Pressure Test

For the V-300 to function, pressure must be maintained in various places and all flow paths must be sealed from each other. Pressure tests show if there are leaks, which indicate that pressure is not being maintained.

The heat exchanger must be pressure tested to be sure the three flow paths - feedwater, pure water and wastewater - are sealed against each other. Usually you'll test the feedwater flow first, since every plate has a feed side which makes the feedwater flow the most prevalent.

Heat exchanger plates will leak if out of sequence (for example, two gasketed or two blank plates together, a thermal divider or endplate on wrong). It is very important to keep plates in the right order when disassembling or reassembling the heat exchanger.

Materials Required

- rubber hoses
- clamps to attach hoses to adapters and to clamp hoses shut
- compressor pump with psi gauge and shut-off valve before the gauge
- soapy water (to locate leaks)

The Test

1. Attach a close-fitting hose to the feed adapter on the bottom of the heat exchanger, clamping it in place if necessary. Clamp shut the open end of the hose (Figure 22).
2. Attach the top feed adapter to the compressor pump, clamping it in place if necessary to get a tight seal (Figure 22).
3. Turn on the compressor, open the valve, bring the pressure up to 14 psi, then shut off the valve. While running, the system will have only 2-4 psi, but during start-up the feed psi may reach 12-13 psi.

4. Check the psi gauge for a drop in pressure. Wait at least 60 seconds and listen. You may be able to hear a leak.
5. If the psi remains steady, remove the hoses, etc. and proceed with step 6.
6. Attach the hoses etc. to the next pair of adapters (pure water or wastewater) and follow steps 1-5 above. Only 6 psi is needed to test the pure water and wastewater flows.

If There Is A Leak

- Total failure on the psi test (pressure drops to zero immediately and/or you can also hear such a leak):
You may have plates in the wrong sequence. Look at the sides of the plates. Two gasketed plates together show a larger distance between plates and two blank plates show no distance at all.
Mark these plates, then follow the procedure to disassemble the heat exchanger, page 4-34. Replace the leaking plates, reassemble the heat exchanger and retest.
- Slow leakage (psi drops in small increments):
You probably have a cut gasket or an air bubble in a gasket.
Finding the leak is similar to looking for a leak in a tire. Bring the psi up to specification, then spray soapy water all around until a bubble reveals the leak.
Mark this plate. Then follow the procedure to disassemble the heat exchanger, replace the leaking plate and reassemble the heat exchanger. When you're done, retest the heat exchanger's pressure.
- Other (leak not revealed by the soapy water test for a slow leak):
You probably have a side-to-side leak from the feed section to either the pure water or wastewater. Put some soapy water on a fingertip and press it over one of the pure water adapters, then over a wastewater adapter: If there is a side-to-side leak, one of the adapters will bubble. This means air is leaking from the feed side of the plate and out the other side of the plate, through either the pure water or wastewater.
This leak is usually a cut or air bubble in the gaskets surrounding the flow holes. To find the leak, follow the procedure to disassemble the heat exchanger. Then inspect every plate for cuts, air bubbles or silicone flash on the gaskets. If you find a damaged plate replace it.
Keep the plates in order as you examine each plate's flow hole gaskets. Run your fingernail over a gasket to check for air bubbles or a cut. Look for loose bonds. When you find the problem, replace the plate, reassemble the heat exchanger and retest.

Maintenance of Heat Exchanger

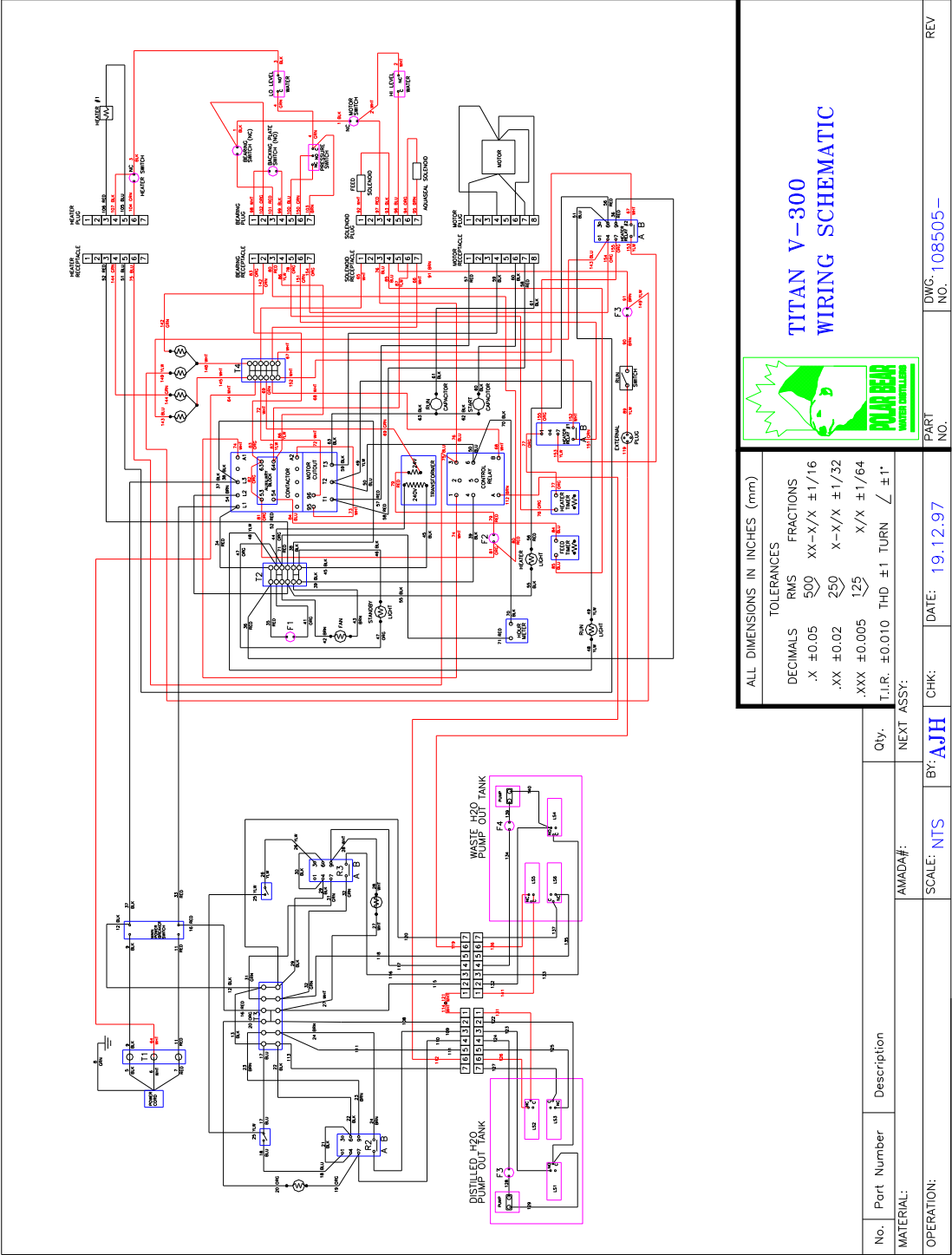
There are four 1/4-20 inch and four 5/16-18 inch threaded studs holding the heat exchanger assembly together. The nuts on three of these studs require periodic tightening.

1. Turn off the V-300 and unplug the power cord.
2. Remove the front and back covers, and locate the three studs which are midway (NOT the studs at the corners) on each of the three visible sides of the heat exchanger. There is a stud midway on the fourth side, however the nuts are under the control box insulation and not visible.

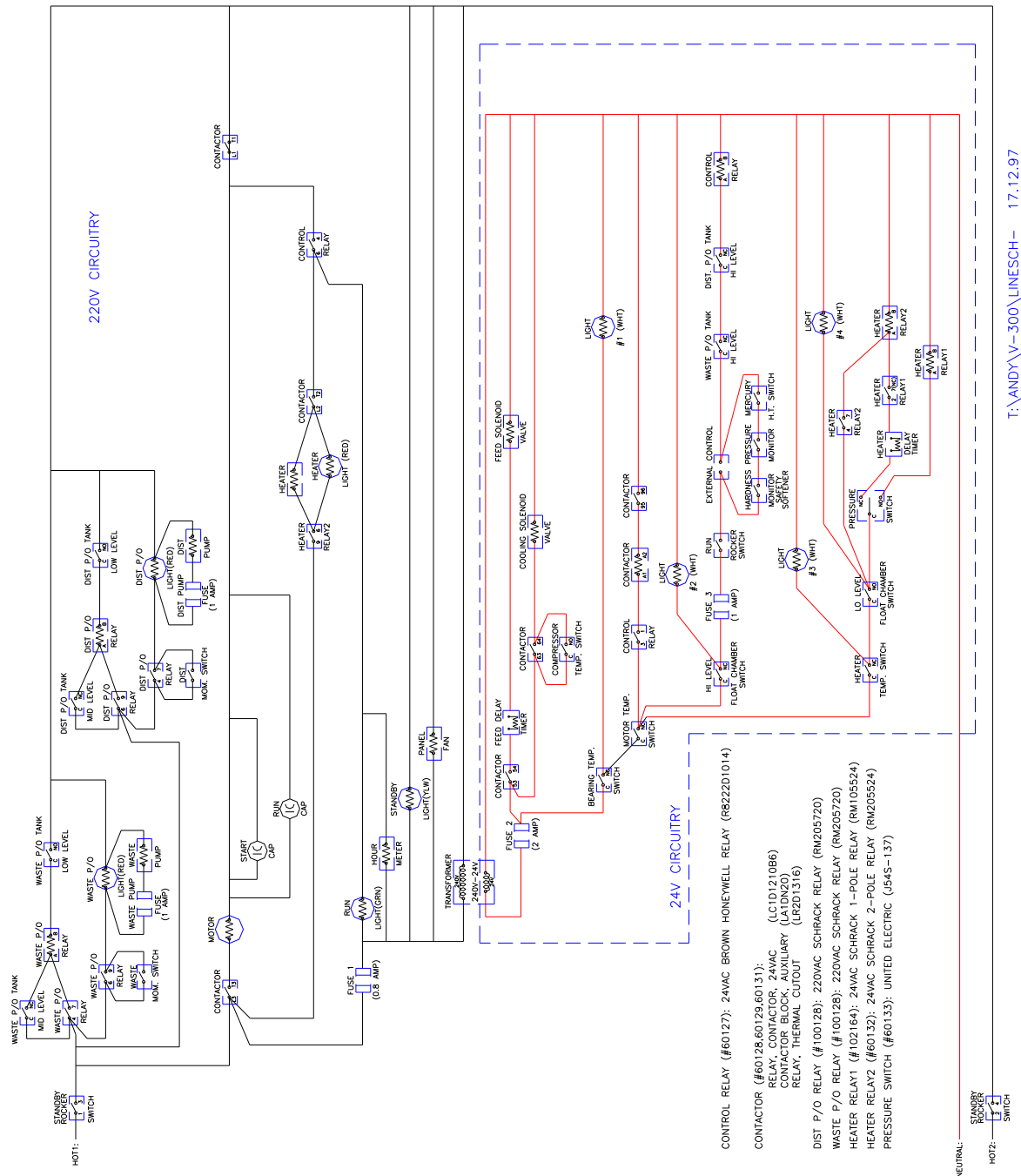
3. Using two 1/2 inch wrenches, hold the nut on one end of each stud and tighten the nut on the other end one full turn.
4. Replace the covers and plug in the power cord. The next time the V-300 is operated, remove the front covers briefly and inspect the heat exchanger for leaks.
5. If the heat exchanger is leaking, repeat the tightening procedure. If one more turn on the nuts does not stop the leakage, call your Polar Bear customer service representative for advice.

Electrical Schematics and Controls

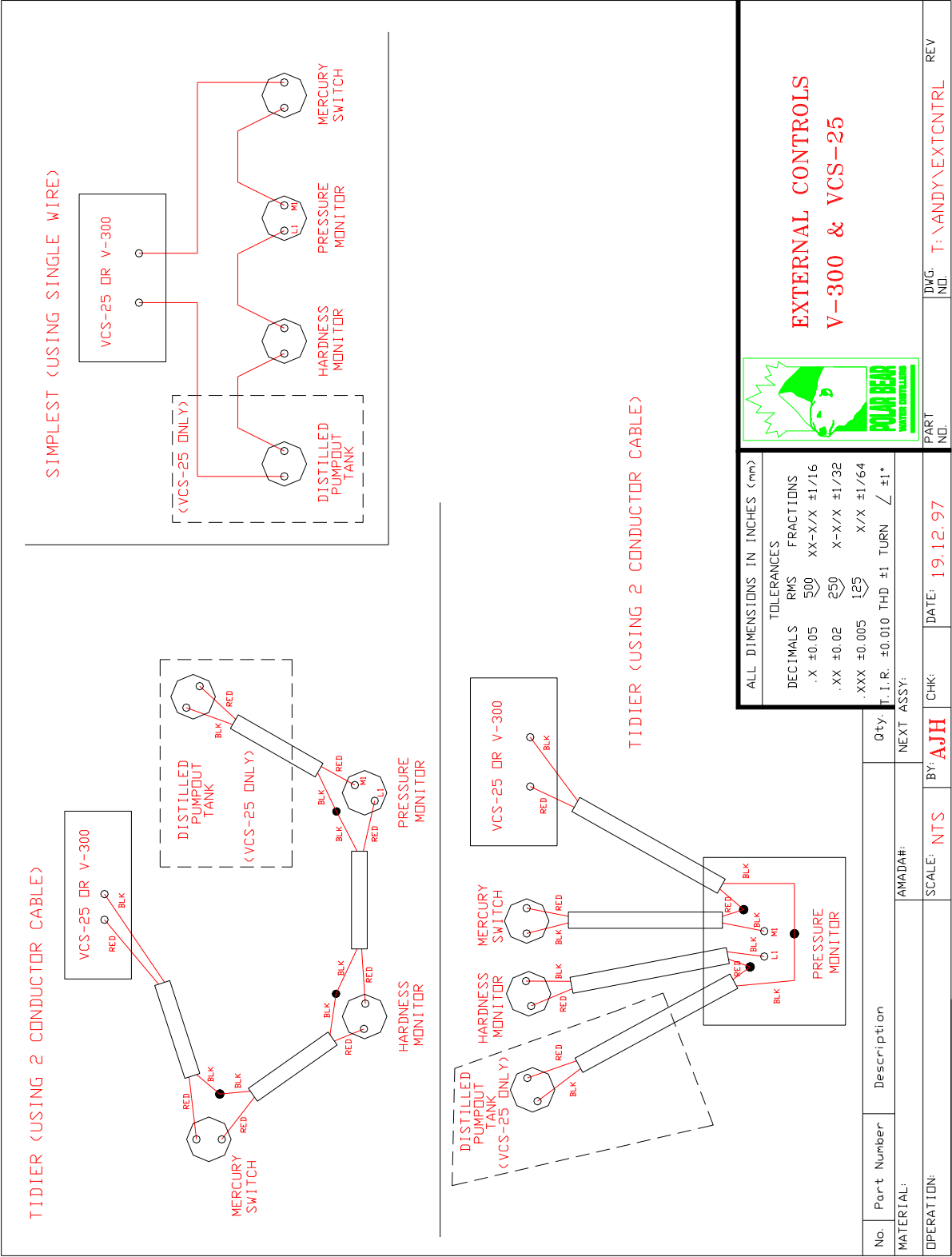
Wiring Diagram



Electrical Schematic

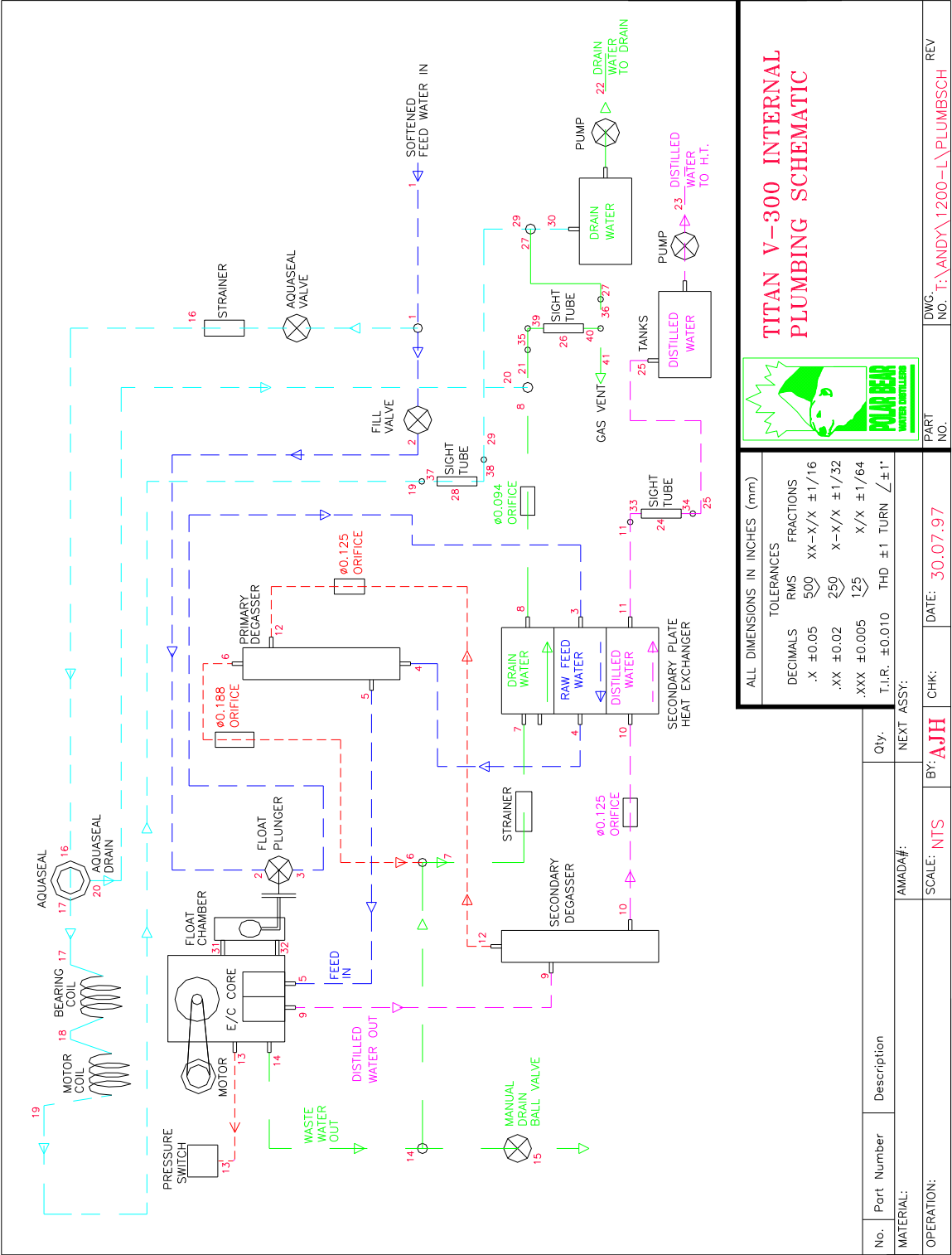


External Controls

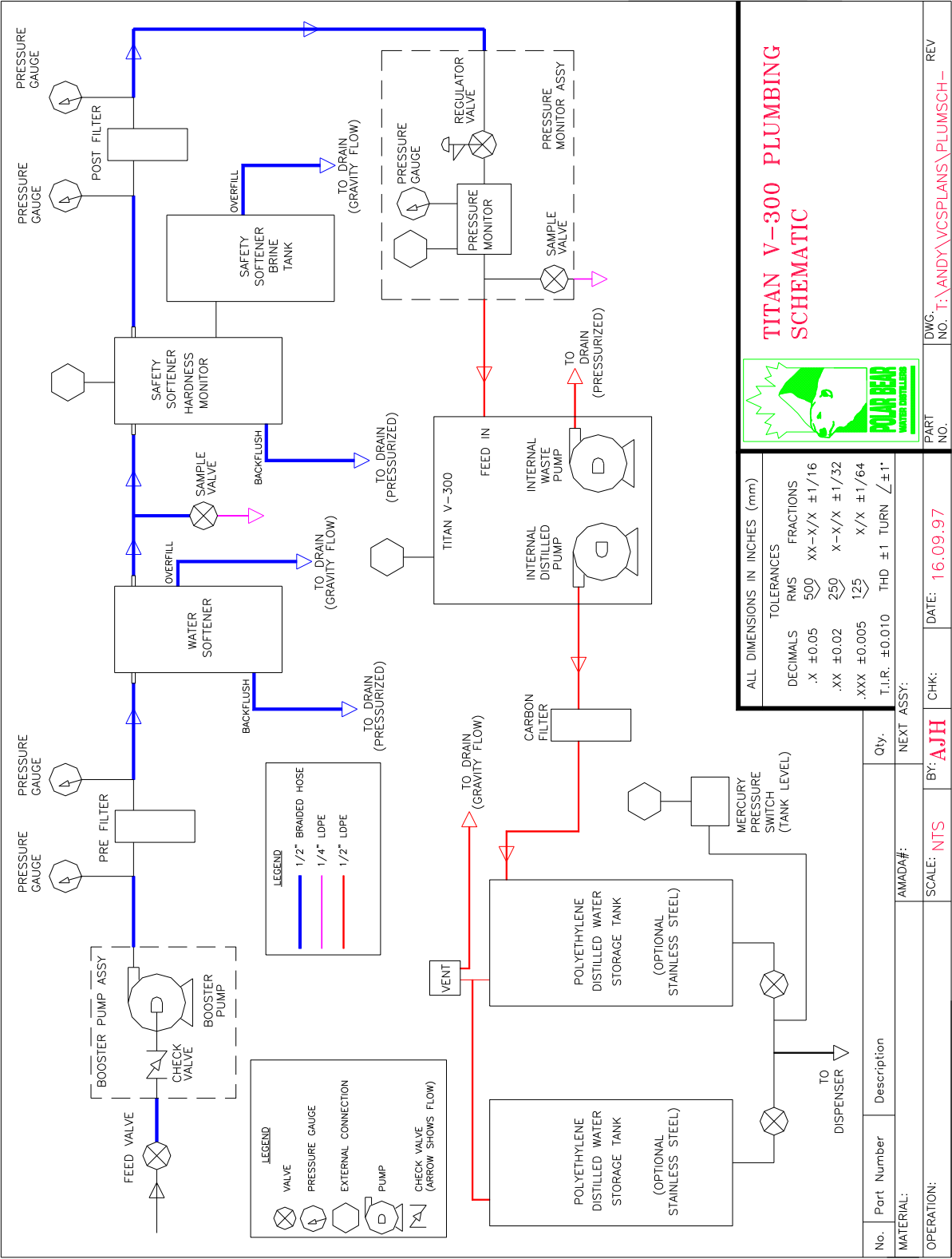


Plumbing Schematics

Internal Plumbing Schematic



External Plumbing Schematic



Warranty

POLAR BEAR WATER DISTILLERS MFG. CO. LTD. warrants to the original purchaser, their products against defects in materials for a period of one (1) full year on all parts and labor thereof manufactured by it, and one (1) year on all stainless steel parts.

If the unit is found to have defective stainless steel components within the first year, the parts will be repaired or replaced at no cost to the customer. Components not manufactured by POLAR BEAR WATER DISTILLERS MFG. CO. LTD. but furnished in the unit (motors, relays, heaters, etc.) will be warranted by Polar Bear only to the extent of the component manufacturer's warranty. The purchaser is responsible for all shipping charges to and from the service center. The manufacturer, dealer or service center is not responsible for damages incurred during shipping.

POLAR BEAR WATER DISTILLERS MFG. CO. LTD. shall not be liable for any loss of profit, loss by reason of plant shutdown, non-operation or increased cost of operation, loss of product or materials, or other special or consequential loss or damages.

This warranty is invalid if the damage or defect is caused by accident, Act of God, customer abuse, unauthorized alteration or repair, vandalism or misuse.

This warranty is made in lieu of any other express warranty and except for the foregoing warranty which is exclusive, there is no other express warranty being made.

Specifications

SIZE & WEIGHT:

Height: 48" (120 cm)

Length: 37" (94 cm)

Width: 20" (51 cm)

Machine Dry Weight: 460 lb (208 kg)

Shipping Weight 550 lb (250 kg)

POWER REQUIREMENTS 208-240 volt

Single Phase

20 amp Breaker

60 Hz (50 Hz Optional)

MAX. CONTINUOUS LOAD: 20A / 230V

AVERAGE POWER CONSUMPTION: 1.8 kW

FEEDWATER REQUIREMENTS: 1.0 PPM Hardness max

3000 PPM TDS Max.

40 PSIG Min. Pressure

(Booster Pump Optional if required)

4-38°C (39-100°F) Temperature

DISTILLED WATER CONTACT MATERIALS:

Boiler/Preheater 316/304 Stainless Steel

Other Metal Parts 316/304 Stainless Steel, Titanium

Gaskets Silicone Rubber

Fittings Nylon, Stainless Steel, Polypropylene

PRESSURES:

Distilled Out (gravity feed) 0 PSI

Waste Out (gravity feed) 0 PSI

TEMPERATURES

Boiler 97-102°C (207-216°F)

Condenser 99-104°C (210-219°F)

Waste Out ~ 5-10°C (9-18°F) Above Feedwater

Distilled Out ~ 5-10°C (9-18°F) Above Feedwater

DISTILLED WATER OUT

Production 12-15 USGal/h (300 USGal/Day)

Max. TDS 5 PPM

Cost (depending on power cost) ~1.0¢/USGal

EVAPORATOR WASTE WATER OUT 6-12 USGal/h

COOLING WASTE WATER OUT 8-12 USGal/h

TOTAL FEEDWATER REQUIREMENTS 26-39 USGal/h