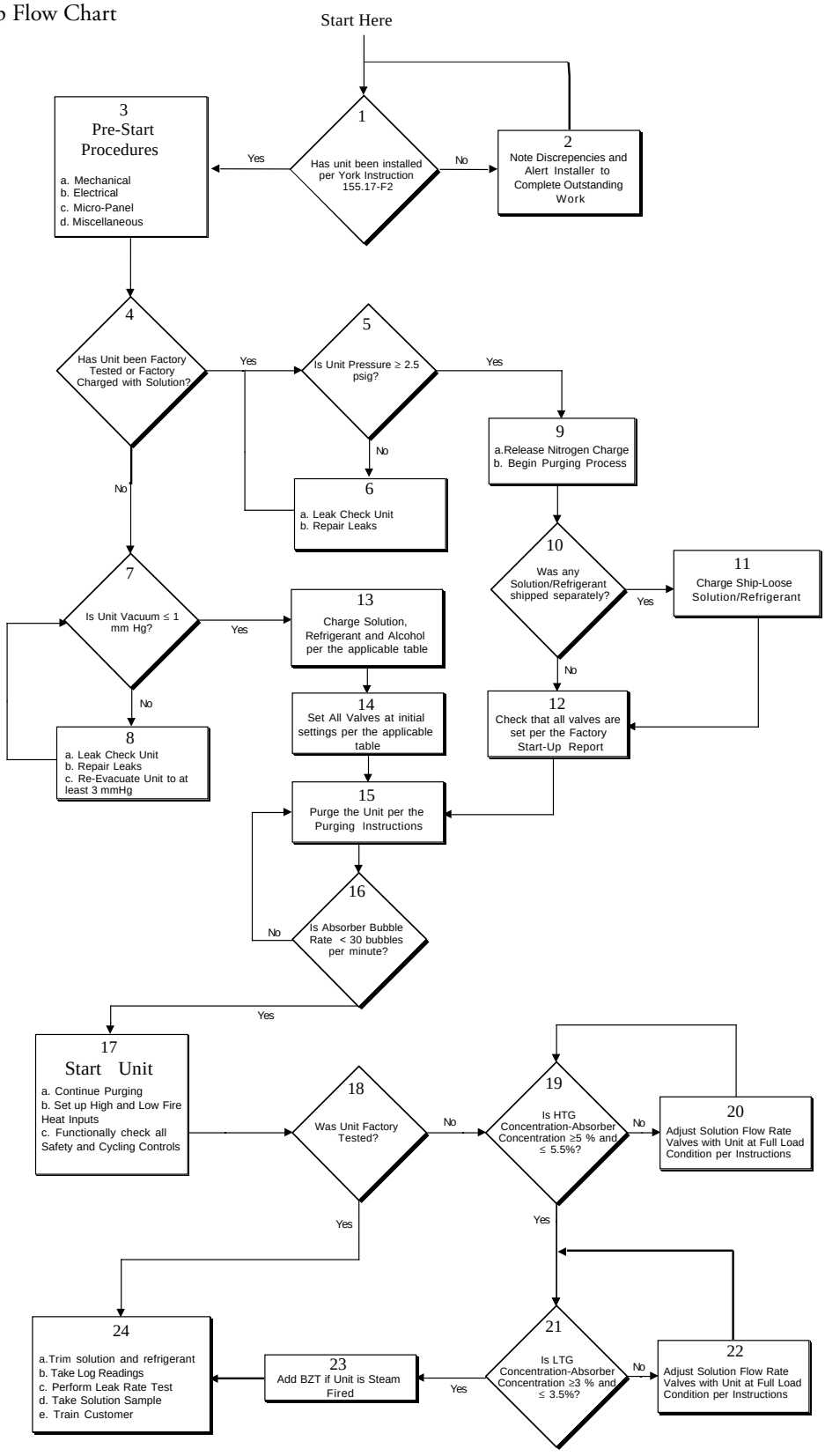
Figure SU1 - Start-Up Flow Chart



ParaFlow™ Pre-Start Procedures

The following instructions correspond to the Start-Up Flow Chart located on the previous page.

1. Has The Unit Been Installed Per York Instruction (Refer to Form 155.17-F2)?

Refer to installation section of this manual for proper installation procedures. If all work is performed as per Form 155.17-F2 (Pre-Start Check List), proceed to step 3. Otherwise, continue with next step.

The Pre-Start Check List is located in Appendix A (Forms).

The Pre-Start Burner checklist located in the burner section of this manual should also be filled out at this time (Direct-Fired Units Only).

2. Note Discrepancies and Alert Installer to Complete Outstanding Work.

Work not performed or completed as stated in Form 155.17 - F2 and the installation section of this manual should immediately be brought to the attention of the installer.

The installer should make any necessary modifications or additions before proceeding to step 3.

3. Start-Up Preparations

Warning: Before attempting a unit start-up, make sure that all fuel, electrical, exhaust and control systems are properly installed, meet all applicable codes and are safe to operate.

Always turn off and **lock out** all electrical disconnects to the chiller when troubleshooting electrical wiring or components, when doing modifications or when installing or removing any jumpers.

Visual Inspection

Check the unit thoroughly for any signs of damage.

Note: Damage to unit during shipping or rigging is not covered under warranty.

Mechanical

a) Check vacuum indicator connections. (Install mercury manometer or optional absolute pressure gauge if one has not already been installed. **Refer to Figure SU2** for typical manometer location.

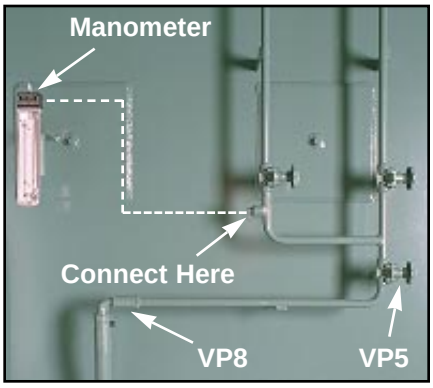


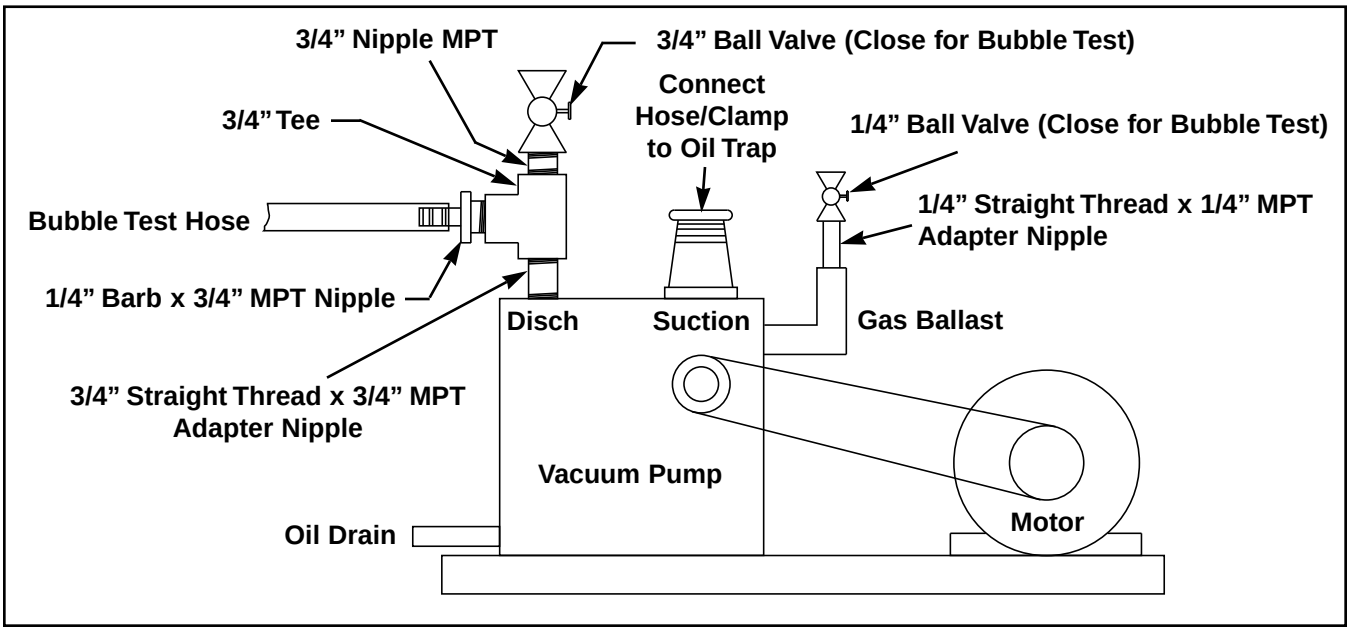
Figure SU2 - Manometer location

Attach plastic hose from manometer to pipe connection (use barbed fittings and hose clamps supplied with ship loose items).

b) Check the installation (*G*-units) and operation (All Units) of the purge (vacuum) pump.

Check oil level, rotation and belt tension

Figure SU3 - Model 1400 / 1402 Vacuum Pump



(between 1/4" and 1/2"). Check pump's capacity to draw vacuum.

Note: Acceptable performance is below 3mm Hg within 2 minutes.

Install necessary auxiliary piping to the purge pump in order to perform a bubble leak test (**refer to Figure SU3**).

Note: All items needed are located in the ship loose crate.

Check purge system piping for air leakage. No leakage is acceptable.

Check operation of purge check valve (VP8). The check valve is installed to prevent air from entering the machine through the purge valves in the event of a power or pump failure.

c) Check all thermowells. Make sure all sensors are in their appropriate locations. If unsure of location contact York Factory Service for guidance. Fill thermowells with heat conductive compound such as *Thermal Mastic* by Virginia Chemicals if not already filled from Factory testing.

For thermowells located on the high temperature generator, a high temperature anti-seize compound should be used in place of the thermal mastic.

Electrical

Check operation of all controls and interlocks.

Warning: The safety controls on *ParaFlow*™ units must be functionally tested and each proven to shut the unit down prior to operation. Calibration and functional check out of the controls should be repeated once per year.

a) Check **Low Refrigerant Temperature Cut Out** (**LRT**) using an ice bath.

The control should trip the unit at 35°F. Make sure the sensing bulb is properly positioned in its well and that the well has adequate heat conductive compound installed.

Although the unit should not be insulated at this point, **it is very important to insulate the LRT thermowell and surrounding area with at least 2" of Armaflex or similar insulation. Do not operate the unit without the insulation installed. Evaporator tube freeze up may result.**

b) Check that the **Refrigerant Temperature Thermistor** (**RT10**) is properly installed in its thermowell and adequate heat conductive compound has been installed.

The area around the refrigerant temperature thermistor should be well insulated before running the unit in the cooling mode.

c) Check that the **Chilled Water Flow Switch** (**CHFLS**) is properly installed and that it will trip the unit at low or no flow conditions.

The **CHFLS** should stop the unit any time the chilled water flow drops below 50% of design.

Warning: Under no circumstances should the unit be operated without a properly functioning **CHFLS.**

d) Confirm that the **Condenser Water** (**absorber**) **Flow Switch** (**CWFLS**) is properly installed and shuts down the unit with low or no flow.

The **CWFLS** should stop the unit any time the condenser water flow drops below 50% of design.

e) Confirm that the **Hot Water Flow Switch** (**HWFLS**) is properly installed and shuts down the unit (in the heating mode) with low or no flow.

The **HWFLS** should stop the unit anytime the hot water flow drops below 50% of design.

Note: Installed on units equipped with optional hot water heat exchanger only.

f) Check that the High Temperature Generator's **High Pressure Cut Out** (**HP1 and** (**HP2 YPC-DF-20G units only**)) trips the unit at 13.7 PSIA.

To check, pressurize the unit with nitrogen until 13.7 psia is reached.

g) Confirm that the High Temperature Generator's **High Temperature Cut Out** (**HT1 and** (**HT2 YPC-DF-20G units only**)) is properly installed in its thermowell and that it trips the unit at a temperature of 330°F or greater.

This control is calibrated at the factory. It can be tested using a laboratory oven or oil bath with an accurate temperature measuring device. If these devices are not available, perform a function only test by slowly heating up the sensing bulb until it trips.

Warning: The bulb should not be over heated as damage to control may occur.

h) On direct-fired units, check the operation of the **Low Solution Level Cut Out Switch** (**LS**). This switch can be checked before the unit is charged. If the unit was charged at the Factory, remove wire going to the sensor in generator. This should confirm that the control is functioning properly.

i) On direct fired units, check for proper installation and operation of the **High Stack Temperature Cut Out Switch**. The switch is located in the burner panel. A thermocouple (furnished with burner) should be installed in the breeching, as close to the exhaust flange as possible.

The control should trip when the flue gas temperatures exceed 700°F. This temperature limit will be reduced to 600°F in the near future. The temperature cut out point is written on face of controller.

To perform a function only test, heat the

sensing bulb up slowly with a low intensity torch tip, until the control trips.

Warning: The thermocouple may be damaged if it is overheated.

j) On **steam fired units**, check the operation of the main steam control valve as well as condensate piping and auxiliary equipment.

If a factory start-up test was performed, confirm steam valve stroke and setting of minimum valve position limit switch. If a start-up test was not performed, these settings will have to be adjusted in the field (refer to Steam section for further information).

k) Check the settings related to the steam valve control or burner and perform any applicable functions. See the Micro-Panel Operations Manual for specific instructions.

Micro-Panel

a) Verify that all program jumpers on the Micro Board and I/O expansion board are in the correct positions for the application. Remove or install program jumpers as required. **(Refer to Form 155.17-O2 - Micro-Panel Operations Manual for details).**

b) Start the Real Time Clock. Put the program jumper **J57** in the **CLKON** position.

c) Program System Setpoints:

1. The setpoints keys are located on the Control Center's Keypad (refer to Form 155.17-O2 - Micro-Panel Operations Manual for details).

2. The design (minimum allowed, refer to " Special Set Points and Programming Procedures Section" of Form 155.17-M2 - Micro-Panel Service Manual) **LEAVING CHILLED WATER** setpoint is factory set to the value listed on page 4 of the "Factory Test Report". Verify that the correct value has been programmed.
If a factory test was not performed on the unit, input the design chilled water leaving temperature as called out on the Sales Order Form.

This value is programmable between 42 and 77°F.

3. The design **LEAVING HOT WATER setpoint** (refer to " Special Set Points and Programming Procedures Section" of Form 155.17-M2 - Micro-Panel Service Manual) is factory set to the value listed on page 4 of the "Factory Test Report". Verify that the correct value has been programmed.

If a factory test was not performed on the unit, input the design leaving hot water temperature as called out on the Sales Order Form.

This value is programmable between 90 and 175°F.

d) Check **SOLUTION PUMP DELAY setpoint** (Models 19GL-22G and 16SL-19S only).

Factory set to the value listed on page 4 of the "Factory Test Report"

(Refer to " Special Set Points and Programming Procedures Section" of Form 155.17-M2 - Micro-Panel Service Manual)

This value may be programmed between 30 and 120 seconds.

If a factory test was not performed on the unit, set the solution pump delay to 60 seconds. It may have to be changed later.

e) Check the **AUTO-TEMP CONTROL RESET TIME setpoint** (gas/oil fired units only). This value should be set initially for 20 minutes.

(Refer to " Special Set Points and Programming Procedures Section" of Form 155.17-M2 - Micro-Panel Service Manual)

f) Check **AUTO TEMP CONTROL DELAY setpoint** (gas/oil fired units only).

Factory set to the value listed on page 4 of the "Factory Test Report".

(Refer to " Special Set Points and Programming Procedures Section" of Form 155.17-M2 - Micro-Panel Service Manual)

This value may be programmed between 0 and 10 minutes.

If a Factory test was not performed on the unit, set the delay to 4 minutes. It may have to be changed later.

g) Automatic Purge System (units equipped with EPROM version A.01F.09 or later and auto purge hardware consisting of purge pump transducer PT3, purge tank transducer PT4, purge tank solenoid 1SOL and purge pump electrically actuated ball valve 2SOL).

1. Enable auto-purge hardware by removing I/O Expansion Board Jumper JP1.

2. Using instructions in Form 155.17-O2, select Manual Purge Operation. The auto purge system must be enabled after start-up.

h) Check **MAXIMUM ALLOWED ENTERING CONDENSER WATER TEMP** setpoint.

Factory set to the value listed on page 4 of the "Factory Test Report".

(Refer to " Special Set Points and Programming Procedures Section" of Form 155.17-M2 - Micro Panel Service Manual)

This value is programmable between 75-95 °F.

If a factory test was not performed on the

unit, input a value of 1°F above design entering condenser water temperature. It may have to be changed later.

i) Enable **SOLUTION CONCENTRATION display** (units equipped with EPROM Version A.01F.09 or higher).

(Refer to " Special Set Points and Programming Procedures Section" of Form 155.17-M2 - Micro-Panel Service Manual).

This feature requires an additional condensed refrigerant temperature sensor (RT12).

j) Check **MAXIMUM ALLOWED LOADING** setpoint.

(Refer to " Special Set Points and Programming Procedures Section" of Form 155.17-M2 - Micro Panel Service Manual)

Note: *The "Factory Test Report" referenced above is supplied to the appropriate sales/service office. This report lists those setpoints that are established by the design of the unit and programmed by factory personnel prior to unit shipment. These setpoints* ***must be logged*** *and stored for future reference in a safe location at the customer's facility.*

Replacement of the Micro Board or Micro Board RTC chip (IC-U16) will cause these setpoints to be lost. If any of these components are replaced, a qualified service technician will have to re-enter these setpoints.

Miscellaneous

a) Mark all valves using color coded identification tags shipped with unit. Use valve location diagrams to find appropriate valves.

Note: More valve tags may be shipped with unit then are actually needed.

b) On units equipped with an optional hot water heater (Direct Fired Models Only), check that the proper relief valve has been installed in the hot water piping of the hot water heat exchanger.

Once all these procedures have been performed, proceed to next step.

4. Has the unit been Factory Tested or Charged with Solution?

Ways to determine if a factory start-up test was performed or the unit was shipped with Solution:

a) A Factory Test Report was furnished with the equipment.

A Sample Test Report is shown in Appendix B. The report will list design as well as full load test conditions.

b) A unit shipped with solution will have approximately a 2.5 PSIG nitrogen holding charge. Units shipped without a charge, will be shipped in a vacuum.

Page three of the test report will list the unit factory charge amounts and the amount of charged removed for shipping. The charge removed will be shipped in 30 gallon polyethelyne drums.

If the unit was Factory Tested or Shipped with a solution charge continue to the next step, otherwise, proceed to step 7.

5. Is Unit Pressure Greater Than or Equal to 2.5 PSIG?

Check unit pressure. All units charged with solution or Factory Tested are shipped from York charged with nitrogen to approximately 2.5 PSIG. The pressure is indicated by a mark on the face of the high pressure gauge. There may be a small variation from this setting due to changes in ambient temperature.

If the unit arrives with a pressure greater than or equal to 2.5 PSIG proceed to step 9, otherwise, proceed to the next step.

6. Leak check the unit and repair any leaks found.

If there is no pressure, check the unit for leakage. Look for any visible problems that could cause a loss of pressure such as removal of the rupture disk blanking flange, open purge valves, etc. If no visible cause for the loss of pressure is found, leak test the unit with nitrogen or argon gas to locate the cause of the leak. If the leak is minor, repair and continue with start-up. If the leak is due to serious damage, contact York for instructions.

Warning: The following limits must be adhered to when pressurizing the unit for leak testing.

<u>Carbon Type Rupture Disk</u>

Do not leak test unit with more than 4 psig of pressure with the carbon rupture disk installed. The carbon rupture disks burst pressure is 7.0 psig ± 0.75 psi.

<u>Inconel (Metal) Rupture Disk</u>

Do not leak test unit with more than 9 psig of pressure with the Inconel rupture disk installed. The new style Inconel rupture disk is rated for 12 psig ± 2.0 psi.

Note: A means of equalizing the pressure across the rupture disk or rupture disk removal is necessary when pressurizing to higher pressures. In either case, never pressurize unit above 12 psig.

Repair any leaks found and put a 2.5 psig holding charge in unit. If pressure remains at this level for at least 3 hours, proceed to step 9, otherwise repeat leak test procedure until all leaks are located and repaired.

7. Is the Vacuum Less Than or Equal to 1 mm Hg

If the unit was shipped without solution, it should arrive in a vacuum. The vacuum should be below 1 mm Hg Absolute. If the pressure is within this range, proceed

to step 12, otherwise, continue on.

8. If the vacuum in the unit was greater than 1 mmHg abs. the unit may have developed a leak during transport or rigging.

If the unit has lost its vacuum, check the unit for leakage. Look for any visible problems that could cause an increase in pressure such as removal of the rupture disk blanking flange, open purge valves, etc. If no visible cause is found, leak test the unit with nitrogen or argon gas to locate the cause of the leak. If the leak is minor, repair and continue with start-up. If the leak is due to serious damage, contact York for instructions.

Warning: The following limits must be adhered to when pressurizing the unit for leak testing.

Carbon Type Rupture Disk
Do not leak test unit with more than 4 psig of pressure with the carbon rupture disk installed. The carbon rupture disks burst pressure is 7.0 psig ± 0.75 psi.

Inconel (Metal) Rupture Disk

Do not leak test unit with more than 9 psig of pressure with the Inconel rupture disk installed. The new style Inconel rupture disk is rated for 12 psig ± 2.0 psi.

Note: A means of equalizing the pressure across the rupture disk or rupture disk removal is necessary when pressurizing to higher pressures. In either case, never pressurize unit above 12 psig.

Repair any leaks found and re-evacuate unit to at least 3 mmHg.

9. Release nitrogen charge and begin purging process.

a) Nitrogen charge should be released through the purge piping. Temporarily remove manometer connection and open VP2 and VP4. Keep VP5 closed during this procedure.

b) Begin Purging Process

After warming the purge pump up for approximately 20 minutes, begin evacuation of the unit.

Note: The following purging instructions apply to evacuation during start-up or evacuation after pressurization for other reasons. Insure all purge valves are placed back in their proper positions after evacuation.

During all purging procedures, unless performing a bubble leak test procedure, the purge pump gas ballast should be wide open. A cold trap may be temporarily installed in the purge pump suction to prevent purge pump oil contamination. Change purge pump oil as necessary. Do not allow LiBr or free water to remain in the purge pump if accidentally ingested. Flush pump immediately.

NOTICE
Observe Absorber Solution Level

*On **G series** units, do not purge from the absorber if the absorber solution level is in the top sight glass of the absorber shell or solution may be drawn into the vacuum pump. The absorber on **S series** units can be purged regardless of level in sight glass.*

Cold Purging

Open VP2, VP3, VP4, VP5, VP6 and VP9 and purge from all sections simultaneously. (If unit has no hot water heat exchanger there will be no VP6 or VP9 – only 20G direct fired units will have VP9). If the unit is equipped with *SmartPurge*™, the Manual Purge mode must be selected on the Micro-Panel so that the automatic valves will open.

Solution may be circulated during this purging process to expedite the removal of dissolved non-condensables. **Do not run the refrigerant pump.**

10. Was Any Solution and/or refrigerant shipped separately.

Refer to Page 3 of the "Factory Start-Up Report". This page lists the Unit Factory Charge Amounts and the Amount of Charge Removed for Shipping. This removed charge will be shipped in separate 30 gal drums.

If any charge was shipped separately, proceed to next step, otherwise proceed to 12.

11. Charge Ship Loose Solution/ Refrigerant.

Refer to Maintenance section of this manual for charging procedures.

The quantity to be charged is that amount that was removed for shipping (Refer to page 3 of the "Factory Start-Up Report")

12. Check that all valves are set per the Factory Start-Up Report.

Refer to Page 5 of the "Factory Start-Up Report". Check to make sure that all valves are set to their specified positions.

Use positions specified in the Final Settings (Turns Open) column for 100% load.

Proceed to step 15.

13. Begin Purging Process

After warming the purge pump up for approximately 20 minutes, begin evacuation of the unit.

Note: The following purging instructions apply to evacuation during start-up or evacuation after pressurization for other reasons. Insure all purge valves are placed back in their proper positions after evacuation.

During all purging procedures, unless performing a bubble test procedure, the

Figure SU4 - Typical Charge Quantities

Unit Model	Alcohol Gal. (l)	Refrigerant Quantity Gal. (kg)		Solution Quantity lb. (kg)		BZT lb. (g)
		Steam	Direct Fired	Steam	Direct Fired	(Steam Only)
12SC/13S	14.3 (54)	N/A	132 (500)	N/A	2975 (1349)	N/A
13SC/14S	14.3 (54)	N/A	119 (450)	N/A	3718 (1686)	N/A
14SC/15S	14.3 (54)	N/A	156 (590)	N/A	4483 (2033)	N/A
15SL	9.5 (36)	N/A	264 (1000)	N/A	5226 (2370)	N/A
16S	9.5 (36)	N/A	264 (1000)	N/A	5226 (2370)	N/A
16SL	14.3 (54)	335 (1270)	295 (1120)	5072 (2300)	6593 (2990)	0.22 (98)
17S	14.3 (54)	335 (1270)	295 (1120)	5072 (2300)	6593 (2990)	0.22 (98)
18S	14.3 (54)	364 (1380)	356 (1350)	6174 (2800)	7916 (3590)	0.26 (119)
19S	19.0 (72)	475 (1800)	414 (1570)	6174 (2800)	9217 (4180)	0.26 (119)
16G	9.51 (36)	193 (732)	181 (686)	4781 (2168)	8499 (3855)	0.20 (92)
16GL	9.51 (36)	236 (894)	174 (660)	5440 (2467)	9349 (4240)	0.23 (105)
17G	9.51 (36)	229 (868)	165 (625)	5652 (2563)	9562 (4336)	0.24 (109)
18G	14.27 (54)	262 (993)	255 (966)	8181 (3710)	12536 (5685)	0.35 (158)
19G	14.27 (54)	266 (1008)	201 (762)	9030 (4095)	18698 (8480)	0.38 (174)
19GL	14.27 (54)	607 (2300)	416 (1577)	12536 (5685)	20611 (9347)	0.53 (242)
20G	14.27 (54)	501 (1899)	471 (1785)	14236 (6456)	22948 (10407)	0.61 (274)
21G	14.27 (54)	549 (2080)	N/A	16212 (7353)	N/A	0.69 (312)
22G	14.27 (54)	490 (1857)	N/A	22000 (9977)	N/A	0.94 (424)
22GL	36.98 (140)	490 (1857)	N/A	23500 (10658)	N/A	1.00 (453)

Note: Refer to Factory Test Report for actual charge quantities. If a Factory Performance Test was not performed, start with the quantities above and make adjustments as necessary.

purge pump gas ballast should be wide open. A cold trap may be temporarily installed in the purge pump suction to prevent purge pump oil contamination. Change purge pump oil as necessary. Do not allow LiBr or free water to remain in the purge pump if accidentally ingested. Flush pump immediately.

Cold Purging

Open VP2, VP3, VP4, VP5, VP6 and VP9 and purge from all sections simultaneously. (If unit has no hot water heat exchanger there will be no VP6 or VP9–only 20G direct fired units will have VP9). If the unit is equipped with *SmartPurge*™, the Manual Purge mode must be selected on the Micro-Panel so that the automatic valves will open.

Charge Solution, Refrigerant and Alcohol per **Figure SU4**. Charge should be sent separately in 30 gal drums for both the solution and refrigerant. The alcohol will arrive in 5 gal containers.

Refer to maintenance section of this manual for charging procedures.

Once solution is charged, it may be circulated during the cold purging process to expedite the removal of dissolved noncondensables. **Do not run the refrigerant pump.**

14. Set all valves at the initial settings per the appropriate table.

Valve setting tables are listed in Sections two and three of this manual. Choose appropriate table and set valves to their initial cooling positions. This should be done whether or not the unit will be operating in the cooling or heating mode. It is necessary to initially set the valves in their cooling positions for adequate purging of the unit.

Certain flow setting valves may have to be adjusted to achieve proper design operating conditions. These valves are shaded in the tables.

15. Purge the unit per the purging instructions.

Continue cold purging the unit until the internal unit pressure is close to the saturation pressure equivalent to the plant room temperature. Use the absolute pres-

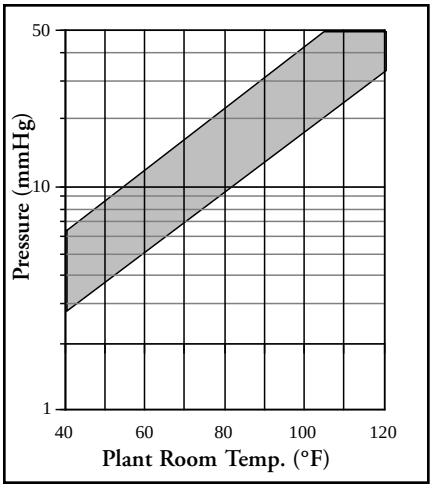


Figure SU5

sure gauge to check the absorber pressure and compare the results to **Figure SU5**. If the measured pressure is in the shaded area of the chart,begin hot purging, otherwise continue with cold purging procedure.

Hot Purging

Close all purge valves. Allow the purge pump to continue running with the gas ballast fully open.

Continue circulating solution by running all the applicable solution pumps. Tower water may be circulated through the unit during this process so that refrigerant is generated, however more heat will be required to maintain the solution temperature and the unit pressure may be reduced which will slow the purging process somewhat. It is recommended that if additional refrigerant is needed to start the unit, that the tower water is circulated through the unit at the end of the hot purging process until a sufficient refrigerant level is visible in the refrigerant tank.

The refrigerant pump should not be running during this step.

On steam fired units, jumper the automatic shut-off valve and condensate drain valve. Place the unit in Service Mode and open the steam control valve slightly using the Load and Unload keys on the Micro-Panel. Do not allow the solution temperature in the HTG to exceed 200°F (93.3°C). Regulate the steam control valve using the Load and Unload keys on the Micro-Panel to maintain this temperature.

On direct fired units, operate the burner periodically by jumpering the start terminals in the burner control panel (terminals 4 & 5). Do not allow the solution temperature in the HTG to exceed 200°F (93.3°C)

Purge the unit from the absorber only. (VP4 and VP5 open) (VP19 and VP20 open also on units with SmartPurge™).

Periodically check the purge tank pressure. If the purge tank pressure exceeds 60 mm Hg, evacuate it to 30 mm Hg. **Do not evacuate the purge tank below 30 mm Hg.**

16. Is Absorber Bubble Rate Less Than 30 Bubbles Per. Minute.

Note: Purge pump must have leak test kit installed (refer to step 3 of this Start-Up section).

Periodically check the bubble rate of the purge pump when purging from the absorber. To do this, follow the procedure listed below.

Bubble Rate Test Procedure

1. Close purge pump gas ballast valve completely.

2. Close the ball valve on the purge pump discharge so that all flow goes through the clear plastic tube on the tee upstream of the discharge ball valve.

3. Put the end of the clear plastic hose just so that it is submerged in a bucket of water. Be sure that the pump is not leaking by closing VP4 and observing that all bubbles stop. If bubbles still occur after several minutes there is a leak in the purge pump suction piping somewhere. Find and repair the leak.

Count the number of bubbles produced in a 60 second interval.

4. Open gas ballast and discharge ball valves.

When the bubble rate from the absorber drops below 30 bubbles per minute, the unit is ready for initial operation (proceed to next step), otherwise continue hot purging (this step).

17. Unit Start-Up

Purging during initial operation

Remove all electrical jumpers used during the hot purging operation.

Insure that all water flows through the unit are within design specifications.

Start the unit and hold the heat input at minimum.

a) Continue Purging

Purge the unit from the absorber only. (VP4 and VP5 open)(VP19 and VP20 open also on units with *SmartPurge*™).

Periodically check the purge tank pressure. If the purge tank pressure exceeds 60 mm Hg, evacuate it to 30 mm Hg. **Do not evacuate the purge tank below 30 mm Hg.**

b) Set-Up Low and High Fire Heat Inputs.

Refer to either the Burner or Steam Start-up Sections for details.

Once high and low fire heat inputs are set-up, gradually increase the firing rate of the unit keeping watch on the HTG pressure.

1. Run the unit at the highest firing rate possible for 20 minutes.

2. Blow down the refrigerant.

3. Shut down the unit and allow it to go through a dilution cycle, keeping watch on the purge tank pressure.

4. Restart the unit after the dilution cycle ends.

Repeat the above steps until the unit can be run at a sustained high fire rate without encountering a high pressure condition.

The unit should be thoroughly purged at this point, however, absorber and purge tank purging may need to done on a frequent basis in a manual fashion for the first 40 hours or so of operation. After that, the unit should only need to be purged from the purge tank when the purge tank pressure exceeds 60 mm Hg. If the unit is equipped with *SmartPurge*™, that will be done automatically providing *SmartPurge*™ is selected from the Micro-Panel.

Force Purging the Absorber to Quicken the Purging Process

If, troubleshooting procedures indicate full fire performance problems are being caused by non-condensables in the absorber, the ability of the continuous integral absorber purge system may be hampered by too high of a solution level in the absorber.

If the solution level is too high in the absorber a vortex will not form as the solution drains out of the main shell into the solution tank. Then, instead of being drawn out of the absorber via the solution vortex, non-condensables will be trapped above the liquid level in the absorber. As non-condensables accumulate, unit performance will suffer.

Many times in this situation, the purge pump is not effective at removing the non-condensables due to their location. Only the swirling solution vortex can remove the final pockets of non-condensables hovering just above the liquid level in the absorber. If the absorber solution level stays high enough so that the vortex cannot form, performance will continue to suffer.

Vortex formation is more sensitive to high solution level in *G* units than it is to high absorber solution level in *S* series units. In many cases too much solution has been charged at start-up. Occasionally the high solution level is caused by the inability of the unit to fire at high fire because of high temperature or pressure in the HTG.

To rid the absorber of accumulated non-condensables, it is necessary to force the solution level lower in the absorber so that a vortex will form in the outlet of the absorber main shell. The non-condensables will then be drawn into the vortex and get carried to the HTG and LTG by the solution flow.

The absorber can be force purged several different ways.

If the solution level is only slightly high and the unit is a direct fired type, it may only be necessary to shut the unit off, putting it into a dilution cycle. The instant the burner shuts off, the bubbles in the solution boiling in the HTG collapse. This causes the level to drop which in turn makes the HTG solution float valve open wide. When the float valve opens, the solution pump pumps at a higher flow rate, and in many cases the solution level in the absorber shell drops enough to produce a vortex.

This procedure can be repeated several times.

During the initial phase of the dilution cycle, the absorber will purge just as well as it would during fired operation, provided the vortex has formed.

If the unit is steam fired or if the level is too high in the absorber to take advantage of simply putting the direct fired unit into a dilution cycle, it may be possible to temporarily stack solution in the HTG or LTG. Stacking or raising the level of solution in the HTG or LTG allows the solution level in the absorber to drop which allows a vortex to form and the non-condensables to be drawn out.

To stack solution in the HTG, put the unit into a dilution cycle and quickly close valve VC or VS1. Slowly open the valve slightly as the level drops in the absorber so that the level in the solution tank is visible in the top sight glass. **Do not allow the solution pump to run dry or attempt this procedure with the burner on.** Watch the purge tank pressure. As the vortex forms, the non-condensables will be transported through the unit and be removed from the condenser by the purge eductor system. The purge tank pressure will go up as the non-condensables are pumped there by the purge eductor system. An increase in purge tank pressure indicates a successful force purge. After the absorber has purged itself, readjust valve VC or VS1 to its normal setting.

To stack solution in the LTG, put the unit into a dilution cycle and quickly open valve VS2. Throttle the valve as the level drops in the absorber so that the solution level in the solution tank is visible in the top sight glass. **Do not allow the solution pump to run dry or attempt this procedure with the burner on.** Watch the purge tank pressure. As the vortex forms, the non-condensables will be transported through the unit and be removed from the condenser by the purge eductor system. The purge tank pressure will go up as the non-condensables are pumped there by the purge eductor system. An increase in purge tank pressure indicates a successful force purge. After the absorber has purged itself, readjust valve VS2 to its normal setting.

Do not over stack solution into either the HTG or LTG as severe refrigerant contamination will occur.

If the solution level is so high so that solution cannot be safely stacked in either the HTG or LTG the unit is probably overcharged. If that is the case, there is no alternative but to remove solution from the unit. Put solution in plastic containers until the absorber level drops into the top sight glass of the solution tank.

A properly charged unit with normal non-condensable accumulation will seldom, if ever, require force purging of the absorber. The need for constant force purging on a mature unit (after a week or so of operation) indicates the unit is leaking, has a solution chemistry imbalance, or both.

19-22 Valve Adjustment

The solution flows should be adjusted using mainly VS1 and VS2. The goal is to make capacity with the least amount of heat input per ton keeping in mind that lower concentrations in the low and high temperature generators are ultimately better. Generally speaking, as the solution flow to the low and high temperature generators is decreased, more capacity can be obtained with a constant heat input. The danger involved with this is that over-concentration in the high temperature generator can lead to crystallization. It would always be better to obtain capacity with the lowest concentration possible in the high temperature generator, provided this could be done without paying a penalty in heat input.

VS1 and **VS2** should be adjusted so that the concentration split between the absorber and the high temperature generator is between 5 and 5.5 %. Also the split between the absorber and the low temperature generator should be between 3 and 3.5%.

For example, if the absorber concentration at full load is 58% (without any non-condensables), the concentration in the high temperature generator should be between 63 and 63.5% while the concentration in the low temperature generator should fall between 61 and 61.5%.

Note: Always set valves to the typical settings shown in the appropriate valve chart (Sections 2 and 3) to start with.

VS1: The adjustment of VS1, formerly V2, controls the amount of solution flow from the outlet of the High Temperature Generator. The level in the Generator is controlled by a spillover weir. The solution that spills over the weir flows into the float chamber, out the outlet pipe, through the tube side of the high temperature heat exchanger, and into VS1 before passing through the tube side of the low temperature heat exchanger. Therefore, by closing VS1 the flow will back up into the float chamber, the float(s) will rise and close off the inlet flow to the High Temperature Generator. Consequently, opening or closing VS1 controls the weak solution flow to the High Temperature Generator. There is an exception to this. When the float chamber is empty or nearly empty, further opening of VS1 will have no effect. This is due to the fact that the quantity of solution spilling over the weir is insufficient to back up into the float chamber. Ideally, the float valve(s) should be in control, however, sometimes under full load conditions, the float valve(s) may be barely open. Possibly, under this condition, too much solution is being sent to the Low Temperature Generator.

Too much solution flow to the High Temperature Generator will result in weaker than normal concentrated solution leaving the generator, which means less capacity for any given heat input. Usually, the solution pump is sized close enough so that if too much solution is being sent to the high temperature generator, the low temperature generator is being starved. This will be evident in the higher than normal temperature of the outlet solution of the 2nd Stage Generator as well as the 1st Stage Generator pressure being higher than normal. The amount of solution flow to the 1st Stage Generator should be sufficient to produce the predicted outlet concentration at the design heat input or predicted high temperature generator temperature and pressure.

Too little flow will cause the high temperature generator to over-concentrate at 100 per cent load and possible crystallize if the flow is too low. ***The maximum LiBr concentration in the HTG should not exceed 65%.***

VS2: The adjustment of VS2 formerly V3 controls the amount of weak solution flow into the LTG. The low temperature generator solution level is also controlled by a spillover weir at the outlet. On some units (20G and 21G), the outlet box has a float valve in it. The float valve is in series with VS2, so as the level in the outlet box rises, the float rises and reduces the inlet flow to the low temperature generator. There is also a bypass valve around the float.

The solution flow to the low temperature generator acts as the condensing medium for the HTG since the refrigerant vapor from the HTG passes through the tubes of the low temperature generator.

Therefore, too little flow to the 2nd Stage Generator will cause higher than normal HTG pressure, much the same as too little cooling water would cause higher than normal head pressure on a conventional air conditioning system. Too little solution flow to the LTG will also cause higher than normal solution concentration in the LTG.

Too much solution flow to the LTG will cause a back-up in the outlet box which will eventually back flow into the alcohol trap, contaminating the refrigerant and causing major problems. Too much solution to the LTG will also cause weaker than normal concentrated solution leaving the LTG. The result of this is reduced capacity for any given heat input.

VS4 (ST 19GL - 22GL): The adjustment of VS4, formerly V4, controls the weak

solution flow through the Steam Condensate Drain Cooler # 1 and into the HTG. This valve is normally fully open (4 turns) but may be adjusted to maintain the required steam condensate outlet temperature. Closing VS4 will tend to increase the leaving steam condensate temperature, increase the weak solution flow rate through the solution to solution heat exchangers as well as the flow to the low and high temperature generators.

VS26 (DF-19GL and ST 21G - 22GL): The adjustment of VS26, formerly V26, controls the amount of weak solution flow into the weak solution absorber sprays (discharge flow of Spray Pump P4). Initially this valve will be set for full open, however it may be adjusted to maintain equal solution levels in the ends of the absorber shell. Closing VS26 will have the effect of reducing the pump capacity and will tend to lower the solution level accumulating in the absorber shell sight glass at the weak solution spray end of the absorber shell (tower water entering end). This valve and valve VS28 are both used for similar purposes. Watch the unit capacity when regulating the valve. If a decrease in capacity is seen, the flow has been reduced to much. In any case, either V28 or V26 should be fully open and the other adjusted to match the flow rate of the fully open one.

VS28 (DF - 19GL and ST 19GL - 22GL): The adjustment of VS 28, formerly V28, controls the amount of strong solution flow into the absorber sprays on the tower water leaving end of the absorber (P2 discharge). Initially this valve will be set for full open, however it may be adjusted to maintain equal solution levels in the ends of the absorber shell. Closing VS28 will have the effect of reducing the pump capacity and will tend to lower the solution level accumulating in the absorber shell sight glass at the strong solution spray end of the absorber shell. This valve and valve VS26 are both used for similar purposes. Watch the unit capacity when regulating the valve. If a decrease in capacity is seen, the flow has been reduced to much. In any case, either VS28 or VS26 should be fully open and the other adjusted to match the flow rate of the fully open one.

VS29 (DF-19GL and ST 21G - 22GL): The adjustment of VS29, formerly V29, controls solution flow balance between the two solution spray pumps (P2 and P4). Generally the discharge pressure of P4 will be higher than P2, therefore opening VS29 will tend to weaken the concentrated solution sprays. VS29 can be used to help balance the solution levels in either end of the absorber shell.

VR3: The adjustment of VR3, formerly V38, controls the amount of refrigerant flow into the evaporator sprays. This valve will normally be fully open, however there may be a case where excessive refrigerant flow to the sprays causes premature evaporator pan spillover.

This can be determined by observation of a visible level in the refrigerant tank while spillover is occurring. Closing VR3 one turn at a time until spill over stops while observing that the capacity of the unit is not reduced is the proper way of adjusting this valve.

VD1 and VD2: The adjustment of these valves control the amount of steam condensate flow through the unit. They should be adjusted to match the required condensate flow rate when the Steam Control Valve is at 100 per cent opening and the back pressure is at the required design value (normally 15 psig). The adjustment of these valves should be set and marked at the 100 per cent capacity run and never readjusted.

23. Add BZT If Unit Is Steam Fired.

The amount of Benzotriazole (BZT) to add will be determined by the final total amount of solution that is in the unit. Benzotriazole is a whitish-yellow powder. When added to the unit, BZT protects the first stage generator tubes from corrosion. It does this by forming a coating on the surface of the tubes. During the process of forming the coating, non-condensables are produced. The process of producing the non-condensables will take some time to subside. Therefore, do not add the BZT until the testing of the unit is complete.

The correct amount of BZT was shipped with the unit in the ship loose items.

Addition of BZT:

BZT should be added when the unit is running at relatively low load such as the 20 per cent capacity condition.

5 gallons of fresh refrigerant should be heated between 194°F and 212°F, the BZT can be added and mixed. Use caution when handling the hot refrigerant and BZT mixture. The BZT/refrigerant mixture can be added to the 1st Stage Generator through VR37, taking care not to allow air to enter the unit when adding the mixture.

Note: The BZT should be mixed into the refrigerant just prior to adding the mixture to the unit.

After adding the BZT, the unit must continue to run for at least 30 minutes.

24A. Trimming Solution and Refrigerant Charges

Trimming of the refrigerant and solution charges requires operating the machine at high fire (full load) for an extended period of time. Make sure there is sufficient load on the machine before adjusting charges.

If the machine is started during a period in which full load conditions are not possible to obtain, the technician should return at a later date to trim the refrigerant and solution charges.

Note: Do not adjust charges until all

non-condensables have been removed from the unit. Perform a Bubble Leak Test to verify this (Refer to purge section for test procedure).

The solution and refrigerant charges should be trimmed so that the amounts of both in the unit are correct. Record quantities of solution/refrigerant added or removed on a separate log sheet. It is important that the actual amount of solution and refrigerant charges is known for future addition of chemicals.

Solution Trimming

The correct amount of solution at 100 per cent load with design solution concentration and no refrigerant spillover is when the solution level is visible in the **upper** sight glass of the solution tank (*G*-Series Units) and solution sump sight glass (*S* - Series Units) . This level will fluctuate slightly, but ideally as long as a level is visible in the glass for the majority of the time, small excursions above and below are acceptable.

To remove solution, hook up a hose to sample valve VS14 on the P1 Solution Pump discharge and remove solution into an empty drum. There will be a positive pressure present at this valve as long as the solution pump is running. Measure the volume of the solution removed as well as its specific gravity and log it on a separate log sheet.

Caution: During removal of solution, be prepared to close valve VS14 should a power failure or any other type of pump failure occur. If the solution pump should shutdown, air will be drawn into the unit.

To add solution, refer to Maintenance section of this manual for proper procedures.

Refrigerant Trimming

The correct amount of refrigerant can be determined only at full load conditions. Operate the machine at full fire until operation is stabilized and solution and refrigerant levels remain constant.

***G* Series Units**

To adjust the refrigerant charge on G series units, refrigerant should be added until a slight evaporator pan spillover is present as observed in the Evaporator Pan Sight Glass. Only a small amount of visible weeping need be visible. Be careful that small pressure surges in the unit are not giving a false periodic spill. Once a slight spill has been confirmed, remove just enough refrigerant to stop the spill. This will not be much if the spill is only slight.

Note: If evaporator pan is spilling already, remove refrigerant in small amounts until spilling stops.

Spilling refrigerant is only used to indicate when the refrigerant quantity is sufficient. The spill itself is detrimental in two ways. It reduces unit efficiency and will eventually cause absorber tube galvanic corrosion and subsequent tube failure.

***S* Series Units**

Remove refrigerant at a slow rate and observe level in evaporator shell sight glass. Continue to remove refrigerant until the level in sight glass just begins to drop.

Note: If the level begins to fall immediately or a level is not visible in the sight glass, reverse procedure and add refrigerant in small quantities until level stops rising. Mark this point. Remove refrigerant until the level just begins to drop again.

The refrigerant level at full load should range between 1/4 and 1/2 full.

Removal of Refrigerant

The Refrigerant Removal Tank which holds approximately 2.5 gallons should be used. Hook up the tank to valve VR11 but do not open VR11 yet. Hook the other end of the tank to the Vacuum Pump and begin to evacuate the tank. When the tank internal pressure as indicated on the vacuum indicator of the manometer is less than mm Hg, crack open valve VR11 and allow refrigerant to flow into the removal tank.

If refrigerant must be added to unit, refer to maintenance section of this manual for details.

B. Checking For Refrigerant Contamination

The refrigerant should not be contaminated with solution. The specific gravity of the refrigerant should remain below 1.006. If refrigerant samples show higher than 1.006, blow down the refrigerant using valve VR8. Take additional samples. Continue blowing down refrigerant until the specific gravity is below 1.006. Run the unit without blowdown while periodically taking refrigerant samples (once per hour) and monitoring the specific gravity. If the refrigerant specific gravity continues to increase, contact York Factory Service.

C. Take Log Readings

Log readings should be recorded on Forms 155.17-LS1 (Direct Fired) and 155.17-LS2 (Steam Fired). Readings should be taken at full load operating conditions.

Make sure all applicable spaces are filled in.

Note: If full load conditions are not available, data should be taken at a reduced firing rate.

A copy of the above listed forms should be mailed along with a copy of the start-up check list to York Factory Service at the address below.

York International Corp.
631 S. Richland Ave.
Door 100 - 36BE
York, PA 17403

ATTN: Paraflow Product Service Manager

Warranty will not be honored after the start-up period, if these log readings have not been received.

D. Perform Leak Rate Test

A leak rate test should be performed on the unit and the rate recorded on the Appropriate Data Log Sheet.

Refer to Purge Section of this manual for leak test procedure.

E. Take Solution Sample

Follow the procedure outlined in the Solution Maintenance section of this manual and send to Analysts Inc.

F. Train Customer

The customer should be trained in the operation of their model ParaFlow unit. The following should be covered as a minimum.

1. Basic Absorption Theory
- a. How it Works
- a. Solution Chemistry
- b. Crystallization

2. Maintenance Procedures
- a. Purging the unit
- b. Solution Sampling and importance.
- c. Water and steam treatment and testing.
- d. Leak Checking Techniques.
- e. Pump Rebuilds (Vacuum and System pumps).
- f. Operating and safety control checkout.
- g. Tube Cleaning

3. Operation
- a. Burner Operation (where applicable).
- b. Steam Valve Operation and control (where applicable).
- c. Pump Operation and inter locks.
- d. Micropanel operation.
  1. Settings
  2. Messages
  3. Safety Shutdowns
- e. Log Readings.

4. Basic Troubleshooting
5. Component Identification - Identify major system components on installed unit.
6. Question and answer period

Training should take approximately 4 hours.