Hill PHOENIX Second Nature™

Medium Temperature Secondary Refrigeration Start-Up Guide

Secondary Coolant System Start-Up Procedures

June 2006

Produced by the Hill PHOENIX Learning Center

DISCLAIMER

This guide is designed to provide only general information. If you need advice about a particular product application or installation, you should consult your Hill PHOENIX Representative. The applicable specification sheets, data sheets, handbooks, and instructions for Hill PHOENIX products should be consulted for information about that product, including, without limitation, information regarding the design, installation, maintenance, care, warnings relating to, and proper uses of each Hill PHOENIX product.

INFORMATION CONTAINED WITHIN THIS MANUAL, IS PROVIDED "AS IS," WITH ALL FAULTS, WITH NO REPRESENTATIONS OR WARRANTIES OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, QUALITY OF INFORMATION, QUIET ENJOYMENT, AND TITLE/NONINFRINGEMENT. HILL PHOENIX SPECIFICALLY DISCLAIMS ALL LIABILITY FOR ERRORS OR OMISSIONS IN, OR THE MISUSE OR MISINTERPRETATION OF, ANY INFORMATION CONTAINED IN THIS MANUAL. HILL PHOENIX DOES NOT WARRANT THE ACCURACY, COMPLETENESS OR TIMELINESS OF THE INFORMATION CONTAINED IN THIS GUIDE.

Second Nature™ Start-Up Guide

For Medium Temperature Propylene Glycol

Hill PHOENIX warrants all of the refrigeration systems and equipment it manufactures. In order for that warranty to have value to the customer and to ensure profitability to the company, it is essential that following installation the systems be properly started up. The procedures listed below describe the startup practices for Hill PHOENIX Second Nature™ refrigeration systems and equipment.

Careful execution of the start-up procedures for any refrigeration system is critical to the safe, effective, and efficient operation of the system. Every step must be followed in as much as possible the order and the way described in this guide, otherwise the equipment may not function properly. It is also critical that only the materials specified in the procedures be used.

The procedures for Second Nature™ start-up fall into 4 main areas of activity:

- Initial start-up steps (10 steps including pressure testing the system, flushing the system, and starting the system)
- Add fluid to the system (7 steps)
- Set-up of the balance valve
- System control strategy (8 steps including Pump strategy)
- System operation (4 steps)

This guide lays out the steps for each area. As you go through each of the steps, feel free to take advantage of the Notes space in the outside column of each page to add any information that will help your understanding of the procedures.

It is important to note that these procedures are intended only as guidelines to be followed as closely as the specifics of each installation allow.

Notes

As you proced through the steps in this startup guide, use the Notes column on the appropriate pages to record any settings, readings, or verifications that are described in the steps.

A checklist at the end of the guide, following a Quick Start Set-Up chart, provides space for confriming the settings, readings, and verifications you record in the guide. The completed checklist should then be submitted to Hill PHOENIX for validation of warranty coverage.

Notes

Initial Start-up Procedures

1. Set ¾ inch end of loop balance valves at 1.0. (Note: That the valve pictured shows a setting of 1.7. This is the only reference to the loop balance valves in these procedures which are hereafter excluded from any mention of valves for the remainder of the procedures.)


2. Verify that the control circuit is energized and fully open all:
   a. Balance valves
   b. Ball valves
   c. Solenoid valves



3. Close all:
   a. Vents
   b. Drains

4. Verify that the pre-charge pressure in the expansion tank is at 12 psig

5. Pressure test piping by isolating:
   a. the expansion tank
   b. the pumps
   c. any cases and/or components that are not rated for the test pressures that will be used

Notes

Use dry nitrogen, at the following durations and settings, once components a. through c. have been isolated.

1st 30 minutes	15 psig
2nd 30 minutes	30 psig
1 to 3 hours	60 psig
Reduce to 15 psig if pressure charge is left on	

6. Flush system by:

   a. Opening all system valves (including any closed in the preceding step)

   b. Closing a valve between the return and the supply on the pump skid in order to break the chiller loop which results in a one-way flow through the system.

      To create a one-way flow, connect the drain hose to the return side of the system and the supply hose to a point on the opposite side created by the closed valve.

   c. Fill the system with water to normal service pressure and allow water to flush through the drain until water runs clear

Note: All references to water assume acceptable quality regardless of source

   d. Stop draining water

   e. Open the valve referred to in step 6.b.

   f. Pressurize the system with water to approximately 30 psig

   h. Vent main loop lines to ensure loop is full of water (note: the number of loops may vary from system to system)

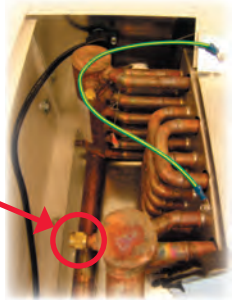
   i. Vent air from the system starting at the lowest vent points and moving continually to higher vent points until all air purged from system including main vent lines again

Notes

i. Lowest vent points are typically coils— all coils must be purged of air

ii. Remember to monitor and maintain approximately 30 psig water pressure through the system

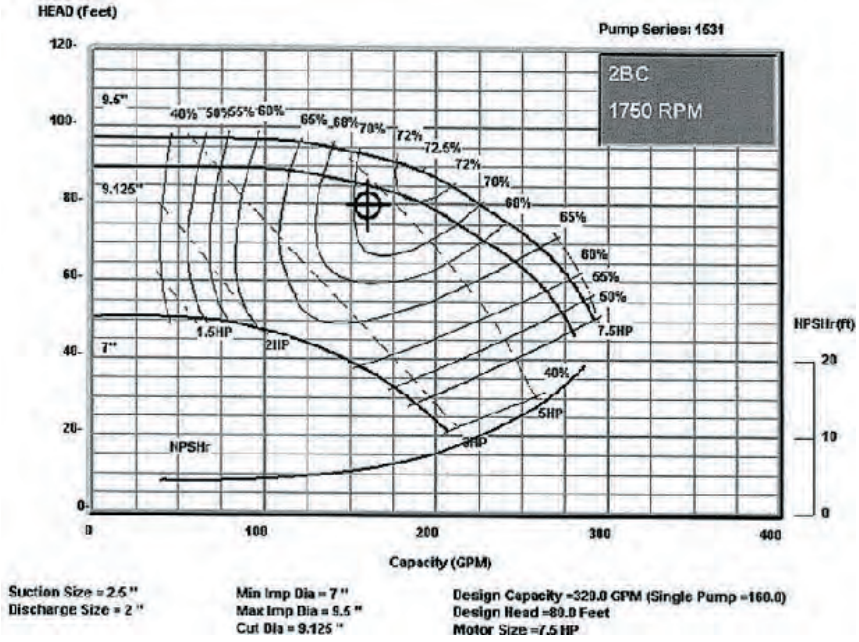
iii. Make sure to also purge air from pump skid since it is also part of the system



j. Turn off the water supply

7. Starting pumps

a. Verify that the correct pumps (model number, and motor hp, rpm, voltage) are installed– the pump curve provided by Hill PHOENIX indicates model number, hp, and rpm



b. Verify pumps are full of water by venting —never run pumps dry as seal damage will occur

c. Manually cycle pumps on and off one at a time to determine the direction of rotation is correct

d. Start pumps one at a time and check amperage for each pump

e. If amperage is too high, reduce by closing pump outlet balance valve until the proper amperage is reached

f. Start and run all pumps

g. From this point on, maintain return fluid pressure at 20 psig by adding water as needed

h. Cycle system switches so that each of the circuits is the only one turned on for a period of 1 minute to fully flush each coil

i. Cycle on and off warm fluid defrost solenoids

j. Turn on all systems and allow water to circulate for 2 hours

8. Drain

a. Once water is in the system it should never be drained until the system can immediately be filled with Secondary Fluid

b. Shut off the pumps

c. Drain all water from all drain points in the system and force out any water remaining with dry nitrogen

d. Check drain water for cleanliness and repeat flush process if drain water is dirty

Notes

Pump Amperage

Pump #1 Nameplate Amp ____

Pump #1 Actual Amp ____

Pump #2 Nameplate Amp ____

Pump #2 Actual Amp ____

Pump #3 Nameplate Amp ____

Pump #3 Actual Amp ____

Notes

e. Open pump strainers and remove the fine-mesh startup screen from around of the outside of the permanent strainer and reassemble

9. Pump secondary fluid into system from tank or barrel (drum)

a. Open all valves (but do not open vents and drains)

b. Using Refractometer, check freeze-point of each drum (tank or barrel) before installing into system

c. Pump 2 drums (or equivalent amount from tank or barrel) of 35% Secondary Fluid into system

d. Pump 1 drum (or equivalent amount from tank or barrel) of 100% Secondary Fluid into system

e. Finish filling system with secondary fluid in as much the same way as when filling system with water

i. Do not discard any secondary fluid—any secondary fluid that is purged from system should be returned to the fill tank to be reinstalled into system

f. Purge all air from system in much the same way as when the system was filled with water

i. Note that any secondary fluid purged with the air is kept and can be returned to the system via the fill tank

10. Restart Pumps

a. Verify that the pumps are full of fluid and all air has been removed

b. Verify that the pump balance valves are completely (100%) open

c. Start pumps one at a time checking amperage for each pump

Note: if any of the pumps are over amperage, repeat step 7.e.

d. From this point on, maintain a return pressure of 20 psig by adding secondary fluid as needed

e. Start and run all pumps

f. Allow fluid to circulate, maintaining a return pressure of 20 psig

g. Check the freeze-point of the system fluid using the Refractometer

Notes

Pump Amperage

Pump #1 Nameplate Amp ____

Pump #1 Actual Amp ____

Pump #2 Nameplate Amp ____

Pump #2 Actual Amp ____

Pump #3 Nameplate Amp ____

Pump #3 Actual Amp ____

Notes

Final fluid freeze-point for system ____

h. Cycle system switches so that each system is the only one turned on at a time for a period of 1 minute each to fully fill each coil

i. Repeat checking the the freeze-point of the system fluid

j. Turn on all systems and allow to circulate for 1 hour

k. Check the fluid freeze–point for the system once more

   i. If the freeze-point is too high—use 100% design fluid to adjust when adding to system

   ii. If the freeze-point is too low—use water to adjust when adding to system

Adding Fluid to System Using Fill Tank

Never add water to the system with the chillers on.

1. Add fluid to the fill tank making sure not to fill the tank above the overflow
2. Locate and slowly open the ball valve between the fill tank and the pump inlet line
3. Never let a pump pull air into the system through the fill tank
4. When a pump no longer pulls fluid from the fill tank, slowly close the pump return ball valve
5. If a return pressure of 20 psig cannot be obtained, shut off the other pumps and try again with only the pump running to which the fill system is connected
6. Always shut the ball valve between the fill tank and the pump inlet valve (referred to in step 2. above) when finished
7. Compensate for contraction as the system cools to operating temperature by adding more fluid

Balance Valve Setup

Balance valves can be set using either a flow meter or any approved method from the valve manufacture—refer to the the Hill PHOENIX Refrigeration Schedule to find the correct flow rates

1. Complete setting of balance valves

Controls Strategy

1. Set pressure relief valve on pump skid to 75 psig
2. Differential pressure control
   a. Set for 5 psi differential and check for operation by shutting off pumps
3. Freeze-stat
   a. Verify thermal grease in probe well
   b. Set freeze-stat to turn off liquid line solenoid at 10˚F with a 5˚F dead band
   c. Verify freeze-stat operation by confirming that the Freeze-stat alarm light lock-on works correctly
4. Verify that the rack low pressure switches are set to pressure equivalent to 8˚F
5. In the controller, verify that the Fluid Loss Alarm is set for when the return fluid pressure reaches < 10 psig
6. In the controller, verify that the Critical Fluid Loss Alarm (this setting is also to lock out the primary pump—the one with the fill tank attached) is set for when the return fluid pressure reaches < 2 psig
7. Verify that all setpoints in the controller for case temperatures, alarms, defrost times and termination temperatures match the manufacturer's specifications

Notes

Check off each of the next steps as you complete them.

- ☐ Balance valves set
- ☐ Pressure relief valve set
- ☐ Differential pressure control set
- ☐ Thermal grease in well
- ☐ Freeze-stat operational
- ☐ Low pressure switches set
- ☐ Fluid Loss Alarm entered
- ☐ Critical Fluid Loss Alarm entered
- ☐ All controller set-points match manufacturer's specs

Notes

8. Note any variations from manufacturer's specifications

_____

_____

_____

Target temperature ____ ˚F

9. Rack Floating – use common supply fluid probe – set for desired target temperature ˚F with a pressure float of + 6 psi

All Temperatures in °F					Sample Target Temp in °F			
		Calculate from desired target (float) temperature		Probe	20		24	
		Cut-out	Cut-in		Cut-out	Cut-in	Cut-out	Cut-in
Chiller #1	60%	-6	-2	Chiller #1 outlet	14	18	18	22
	100%	even	+2	Main Supply fluid	20	22	24	26
Chiller #2	60%	-4	-1	Chiller #2 outlet	16	19	20	23
	100%	+1	+3	Main Supply fluid	21	23	25	27

10. Warm Fluid Defrost system

a. Set master warm fluid balance valve to ½ of the flow of the largest system that requires warm fluid to a maximum of 12 gpm

b. Operate hot gas line solenoid valve controlled from the warm fluid outlet probe

i. cut-in 65˚F

ii. cut-out 75˚F

c. Set defrost differential valve to meet temperature requirements of largest gpm warm fluid defrost system

11. Pump Strategy

a. Record the listed flow rates.

2 Pump control

Notes

A. 100% flow – 2 pumps on _____ psi differential
B. 100% flow – 1 pump on _____ psi differential
C. 90% flow – 1 pump on _____ psi differential
D. 70% flow – 2 pumps on _____ psi differential
   i. C = pump on
   ii. D = pump off

3 Pump control

A. 100% flow – 3 pumps on _____ psi differential
B. 100% flow – 2 pumps on _____ psi differential
C. 100% flow – 1 pump on _____ psi differential
D. 90% flow – 2 pumps on _____ psi differential
E. 75% flow – 3 pumps on _____ psi differential
F. 70% flow – 1 pump on _____ psi differential
G. 50% flow – 2 pumps on _____ psi differential
   i. average of D and F = pump on _____
   ii. average of E and G = pump off _____

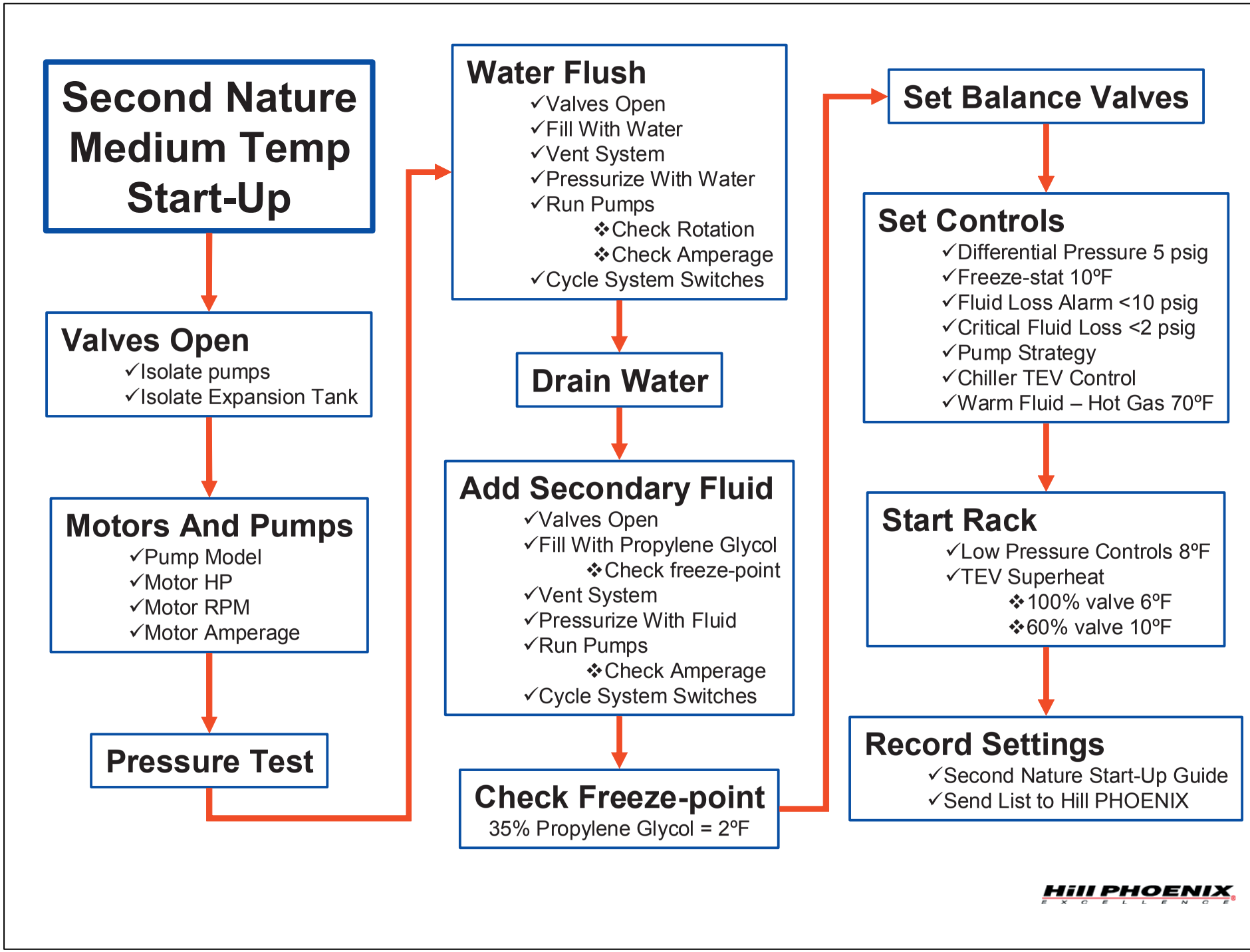
System Operation

1. Check high vents after a couple of days operation to check for any air trapped in system

2. Set superheat settings on Chiller TXVs
   i. 100% valve: 6˚F
   ii. 60% valve: 10˚F

3. Fine tune balance valves inside individual circuits, adjust to give equal discharge air temperatures

4. Fine tune system by finding the warmest fluid required to satisfy all cases


Second Nature Medium Temp Start-Up
Valves Open
✓Isolate pumps
✓Isolate Expansion Tank
Motors And Pumps
✓Pump Model
✓Motor HP
✓Motor RPM
✓Motor Amperage
Pressure Test
Water Flush
✓Valves Open
✓Fill With Water
✓Vent System
✓Pressurize With Water
✓Run Pumps
❖Check Rotation
❖Check Amperage
✓Cycle System Switches
Drain Water
Add Secondary Fluid
✓Valves Open
✓Fill With Propylene Glycol
❖Check freeze-point
✓Vent System
✓Pressurize With Fluid
✓Run Pumps
❖Check Amperage
✓Cycle System Switches
Check Freeze-point
35% Propylene Glycol = 2ºF
Set Balance Valves
Set Controls
✓Differential Pressure 5 psig
✓Freeze-stat 10ºF
✓Fluid Loss Alarm <10 psig
✓Critical Fluid Loss <2 psig
✓Pump Strategy
✓Chiller TEV Control
✓Warm Fluid – Hot Gas 70ºF
Start Rack
✓Low Pressure Controls 8ºF
✓TEV Superheat
❖100% valve 6ºF
❖60% valve 10ºF
Record Settings
✓Second Nature Start-Up Guide
✓Send List to Hill PHOENIX
Hill PHOENIX
EXCELLENCE

Hill PHOENIX Warranty Validation Checklist

This checklist provides space for confirming the settings, readings, and verifications you recorded in the guide. Sign and submit a copy of the completed checklist to Hill PHOENIX for validation of warranty coverage.

Mail: Systems Operations 709 Sigman Rd. Conyers, GA 30013 Fax: 770.285.3085 Email: service@HillPHOENIX.com Or: your local Fleld Service Engineer	Contact Information Technician perfroming checks: Name: _____ Phone: _____ Email: _____

1. Pump skid serial number _____

2. Pump #1 Nameplate Amps ____
   Actual Amps ____

3. Pump #2 Nameplate Amps ____
   Actual Amps ____

4. Pump #3 Nameplate Amps ____
   Actual Amps ____

5. Final fluid freeze-point of the system ____ ˚F

6. Balance valves confirmed set ☐

7. Pressure relief valve on pump skid set to ____ psig

8. Expansion tank precharge pressure ___ psig

9. Differential pressure control set for ____ psid

10. Thermal grease verified in probe well ☐

11. Enter these values:

Freeze-stat settings		
	Chiller #1	Chiller #2
Off	˚F	˚F
On	˚F	˚F

13. Fluid Loss Alarm set-point at _____ psig

14. Critical Fluid Loss Alarm set-point at _____ psig

15. Confirm pump lock-out operation ☐

16. Verify all controller set-points match manufacturer's specs ☐

17. List variations from manufacturer specs

_____

_____

_____

18. Enter these differential pressure values:

	1 pump on	2 pumps on	3 pumps on
100% flow			
90% flow			
75% flow			
70% flow			
50% flow			

19. Enter these values:

	Chiller #1	Chiller #2
60% valve cut-in	˚F	˚F
60% valve cut-out	˚F	˚F
60% valve superheat	˚F	˚F
100% valve cut-in	˚F	˚F
100% valve cut-out	˚F	˚F
100% valve superheat	˚F	˚F

20. Hot gas line solenoid cut-in set-point ____ ˚F
    Hot gas line solenoid cut-out set-point ____ ˚F

21. Final supply fluid with all cases calling for (requiring) refrigeration ____ psig
    Final return fluid with all cases calling for (requiring) refrigeration ____ psig

Signature: _____Date: _____