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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.

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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.

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

<table>
<thead>
<tr>
<th>Duration</th>
<th>Pressure Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st 30 minutes</td>
<td>15 psig</td>
</tr>
<tr>
<td>2nd 30 minutes</td>
<td>30 psig</td>
</tr>
<tr>
<td>1 to 3 hours</td>
<td>60 psig</td>
</tr>
<tr>
<td>Reduce to 15 psig</td>
<td>if pressure charge is left on</td>
</tr>
</tbody>
</table>

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 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
Adding Fluid to System

Notes

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

Final fluid freeze-point for system _____
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

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
8. Note any variations from manufacturer’s specifications

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

10. Warm Fluid Defrost system
   a. Set master warm fluid balance valve to \( \frac{1}{2} \) 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

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
Set Balance Valves

Set Controls
- Valves Open
- Fill With Water
- Pressurize With Water
- Run Pumps
- Check Amperage
- Cycle System Switches

Start Rack
- Valves Open
- Fill With Propylene Glycol
- Check freeze-point
- Vent System
- Pressurize With Fluid
- Run Pumps
- Check Amperage
- Cycle System Switches

Record Settings
- 35% Propylene Glycol = 2°F
- Send List to Hill PHOENIX

Second Nature Start-Up
- Motors And Pumps
  - Pump Model
  - Motor HP
  - Motor RPM
  - Motor Amperage

Medium Temp Start-Up
- Valves Open
- Isolate Expansion Tank

Add Secondary Fluid
- Valves Open
- Fill With Propylene Glycol
- Check freeze-point
- Vent System
- Pressurize With Fluid
- Run Pumps
- Check Amperage
- Cycle System Switches

Drain Water
- Valves Open
- Isolate Expansion Tank

Pressure Test
- Differential Pressure Controls 5 psig
- Freeze-Stop 10°F
- Fluid Loss Alarm < 10 psig
- Critical Fluid Loss < 2 psig
- Chiller TEV Control
- Warm Fluid – Hot Gas 70°F

Water Flush
- Valves Open
- Fill With Water
- Vent System
- Pressurize With Water
- Run Pumps
- Check Amperage
- Cycle System Switches

Check Freeze-point
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 Field Service Engineer

Email: service@HillPHOENIX.com

Contact Information
Technician performing 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 |
12. Fluid Loss Alarm set-point at _____ psig
13. Critical Fluid Loss Alarm set-point at _____ psig
14. Confirm pump lock-out operation [ ]
15. Verify all controller set-points match manufacturer’s specs [ ]
16. 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 |
17. List variations from manufacturer specs
   ___________________________________________________
   ___________________________________________________
   ___________________________________________________
18. Enter these differential pressure values:

<table>
<thead>
<tr>
<th>1 pump on</th>
<th>2 pumps on</th>
<th>3 pumps on</th>
</tr>
</thead>
<tbody>
<tr>
<td>100% flow</td>
<td>[ ] [ ] [ ]</td>
<td></td>
</tr>
<tr>
<td>90% flow</td>
<td>[ ] [ ] [ ]</td>
<td></td>
</tr>
<tr>
<td>75% flow</td>
<td>[ ] [ ] [ ]</td>
<td></td>
</tr>
<tr>
<td>70% flow</td>
<td>[ ] [ ] [ ]</td>
<td></td>
</tr>
<tr>
<td>50% flow</td>
<td>[ ] [ ] [ ]</td>
<td></td>
</tr>
</tbody>
</table>
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: __________