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**WARNING: Use all Personnel Safety and Lockout/Tag-out Procedures**

**I. Environmental Inspections (Leave power OFF during this step)**

- A. Verify the equipment is installed level on its maintenance pad. For all 1-5 horsepower systems, verify there are vibration pads placed under the system at each location where there are mounting bolts. Verify that mounting bolts are installed on all systems at the proper locations and that they are snug.
- B. Verify that there is enough clearance around all sides of the system for proper ventilation and servicing of the equipment.
- C. Verify there is sufficient air ventilation within the equipment room and that the anticipated ambient temperature extremes are greater than 40 and less than 100 degrees Fahrenheit.
- D. Verify that the outside air intake is located as stated in NFPA 99
- E. Confirm with the electrician (if possible) that the system is phased correctly to the facility's emergency generator.

**Note: if the above specifications are not met, the warranty may be void unless written approval from Hill-Rom, Architectural Products.**

**II. Mechanical Inspection (Leave power OFF during this step)**

- A. Inlet Plumbing
  - 1. Verify the air location per NFPA 99.
  - 2. Verify that the air inlet is screened and turned down.
  - 3. Verify that the air inlet piping has not been reduced or restricted.
  - 4. Verify that each compressor has an air inlet filter.
- B. Outlet Plumbing
  - 1. Verify installation of the Source shut off valve. The Source valve must be in the closed position through out this procedure.
  - 2. Verify installation of system's sample port, dew point sensor, line relief valve and dual filter/regulator banks with isolation valves downstream of the receiver and upstream of the Source valve.
  - 3. Check all connections where piping may have come loose during shipping and installation.
  - 4. Verify installation of flex connectors at each compressor inlet-filter housing.
  - 5. Check all system components for damage.

**III. System Inspection (Leave power OFF during this step)**

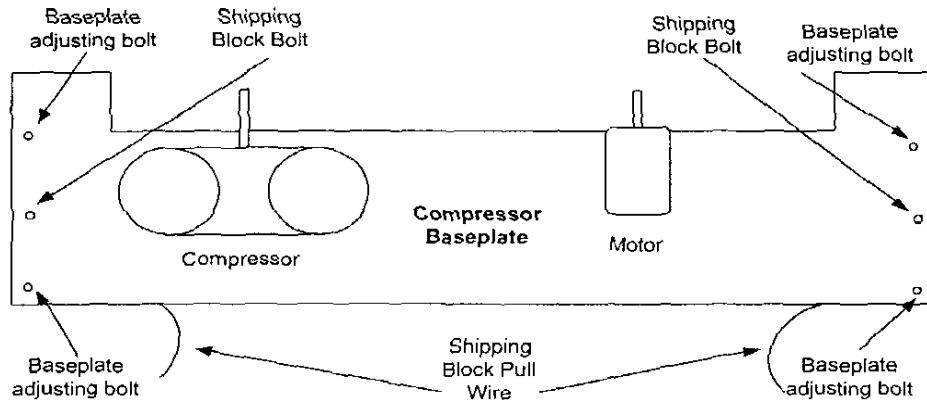
- A. Check all valve for full open and close travel.
- B. Place system valve in the following positions:
  - 1. All two-port valves are in the **Open** position except for the receiver drain, receiver bypass and sample port valves.
  - 2. Three-port dryer isolation valves in the dryer #1 position.
  - 3. Three-port receiver bypass valve in the receiver normal receiver normal in-service position.

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4. Three-port final filter and regulator isolation valves in either left or right bank position.
- C. Verify that the V-belt alignment and tension for each compressor are correct by applying pressure, using your finger, to one belt at its midpoint span and then verifying that the top of the belt aligns with the bottom of the adjacent belt.
- D. On 7.5 through 15 horsepower systems.
1. Check to make sure that the two wood shipping blocks, used for shipping purposes only, are removed. To remove, loosen the shipping block bolt at each end of the compressor baseplate until the bolt can be removed. Pull the shipping block wire protruding out of the slots.
  2. Use the baseplate adjustment bolts if the inner and outer bases are not flush.



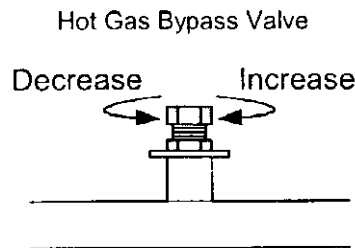
- E. Visually verify the installation of each compressor's relief valve.
- IV. Electrical System**
- A. Verify that the customer has copies of the electrical schematics.
  - B. Verify mounting integrity of all components in the electrical cabinet.
  - C. Tighten all wire connections in the electrical cabinet.
  - D. Ensure all H/O/A switches are OFF.
  - E. Turn the disconnect switch/es ON.
  - F. Verify and record the line voltage.
  - G. Check control voltage and output of each Control Circuit Transformer (CCT 1 & 2).
  - H. Verify the proper illumination of the PLC using table 1 and 2.

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- I. Turn the disconnect switch/es OFF.

## V. Initial Refrigerant Dryer Operation Verification

- A. Power
  1. Verify that the refrigerant dryers are plugged into a 120 VAC outlet.
  2. Turn both dryer power switches to the ON positions.
- B. Refrigerant Dryer Suction Pressure
  1. After the unit has been powered up for at least 5 minutes, verify that the suction pressure gauge (located on the outside of each refrigerant dryer next to the power switch) reads approximately 34 psig. Adjust the hot gas bypass valve (located inside the refrigerant dryer enclosure) if necessary.



## VI. Medical Air System Operation

**Note:** The following steps are for Unit1. Repeat steps A-H for each additional compressor unit that is part of the system.

- A. Ensure all H/O/A switches are OFF.
- B. Turn the disconnect switch/es ON.
- C. Using the red rotation indication arrow on the compressor motor, just bump the H/O/A switch for Unit 1 to the HAND position to verify proper rotation. If it is necessary to change rotation, place the disconnect switch/es to OFF and switch any two of the three motor leads wired at the motor starter.
- D. While Unit 1 is running in the HAND position, verify the compressor runs smoothly.
- E. Place the H/O/A switch to OFF and make any necessary repairs if the compressor was running rough.
- F. Turn the H/O/A switch to AUTO. Observe the pressure gauge on the control cabinet. The unit should run until the cut-out pressure is achieved (see tables 3, 4, 5 and 6 for proper cut-in and cut-out pressures along with PLC lamp indications).
- G. Verify the unloader solenoid valve located on inside the compressor module upstream of the compressor condensate trap, releases pressure when the cut-out pressure is achieved.

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- H. With an amp-probe, measure the current draw of Unit 1 while the compressor is running. Compare the measured current reading with the specified amperage rating on the motor's name plate. Record the readings for future motor operational comparisons. Turn the H/O/A switch to OFF.
- I. Thermal Malfunction Protection Device (TMPD)
  - 1. Turn all H/O/A switches to OFF.
  - 2. Open the control panel door and turn the disconnect switches to the ON position.
  - 3. Using an insulated probe, briefly short the sensor wire terminals located inside the control panel for Unit 1 (see table 7).
  - 4. Verify that Unit 1's HIGH TEMP indicator light is illuminated.
  - 5. Turn Unit 1's H/O/A switch to HAND.
  - 6. Verify that Unit 1 does not start.
  - 7. Push the illuminated HIGH TEMP indicator button and verify that Unit 1 starts and its HIGH TEMP indicator light extinguishes.
  - 8. Turn Unit 1's H/O/A switch to OFF
  - 9. Repeat step 1– 8 for each compressor.
- J. Place all disconnect switches ON and all H/O/A switches to AUTO.
- K. Allow the receiver pressure to increase up to 100 PSIG.
- L. Depress the Lag Reset button and verify input indicator #4 is ON while the button is depressed.
- M. Place a bleed at the system's sample port and observe that the compressors alternate after each cycle (see table 8).

## VII. Refrigerant Dryer Operation

- A. Verify that each dryer has its power light illuminated.
- B. Verify that each dryer's compressor fan operates either:
  - 1. continuous on model numbers HDRM 10
  - 2. cycles automatically on model numbers HDRM 15-35
  - 3. cycles automatically on model numbers HDRD 50-200

## VIII. Desiccant Dryer Operation

- A. Turn Dryer #1's ON/OFF switch to the ON position and Dryer #2's ON/OFF switch to OFF.
- B. Using a bleed at the system's sample port , allow the lead compressor to cycle ON and OFF.
- C. Using table 9, verify that each dryer cycle time is correct and the dryer is running only when the compressor is running and the dew point is less than -5 degrees C as indicated on the MedPlus DewPoint/CO monitor.
- D. Place the dryer isolation valves to the dryer #2 position.
- E. Turn Dryer #1's ON/OFF switch to the OFF position and Dryer #2's ON/OFF switch to ON and repeat steps B and C.

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## IX. Final Filter and Regulator Assembly

- A. Place the two three-port valves on both ends of the dual filter and regulator banks to the either the left or right bank (one handle up and the other down).
- B. Verify that the final pressure regulator is adjusted for 50 psig.
- C. Repeat for the other bank.

## 0X. Dew Point and Carbon Monoxide Monitor verification

- A. Verify that the monitor has power and the monitors ON/OFF switch (located on the back of the monitor) is ON.
- B. Record the dew point and CO reading. Use the MedPlus Dewpoint/CO manual for operation and troubleshooting.

## 1XI. Final System Leak Check and Shutdown

- A. Leak Test
  1. Verify that the source valve is off.
  2. Close the valve to the sample port and dew point sensor.
  3. Verify that all other valves in the system are in their normal positions.
  4. Turn one H/O/A switch to the HAND position and allow the system pressure to build up to 100 psig.
  5. Turn all disconnect switch/es OFF.
  6. Pressure should not visibly drop in 5 minutes. If there is a leak, use leak detection solution to locate and make repairs. A qualified plumbing contractor who is certified to install medical gas pipelines must repair any brazed joints.

**Table 1 PLC lamp illumination at less than 70 psig**

| PLC Input # | LED Status | Indication                                                         |
|-------------|------------|--------------------------------------------------------------------|
| X0          | ON         | PS -1 is closed                                                    |
| X1          | ON         | PS -2 is closed                                                    |
| X2*         | ON         | PS -3 is closed                                                    |
| X3*         | ON         | PS -4 is closed                                                    |
| X4          | ON         | Lag reset switch (on when pressed)                                 |
| X5*         | ON         | Triplex operating as duplex or<br>Quadrplex operating as a Triplex |
| X6*         | ON         | Quadrplex operating as duplex                                      |

\* if applicable

|                               |                                                                           |                              |                          |                                      |
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**Table 2 PLC lamp illumination at less than 70 psig**

| PLC Output # | LED Status | Indication                   |
|--------------|------------|------------------------------|
| Y0           | ON         | One Starter is energized     |
| Y1           | ON         | Two Starters are energized   |
| Y2*          | ON         | Three Starters are energized |
| Y3*          | ON         | Four Starters are energized  |
| Y4           | ON         | PLC Operational              |
| Y5           | ON         | Lag alarm activated          |

\* if applicable

**Table 3 Duplex cut-out pressures**

| PLC Input # | Record As  | PSI | Other Actions                                       |
|-------------|------------|-----|-----------------------------------------------------|
| X1          | Lag #1 Off | 95  | One compressor turns off and lag alarm can be reset |
| X0          | Lead Off   | 100 | Second compressor turns off                         |

**Table 4 Triplex cut-out pressures**

| PLC Input # | Record As  | PSI | Other Actions                                       |
|-------------|------------|-----|-----------------------------------------------------|
| X2          | Lag #2 Off | 90  | One compressor turns off and lag alarm can be reset |
| X1          | Lag #1 Off | 95  | Second compressor turns off                         |
| X0          | Lead Off   | 100 | Third compressor turns off                          |

**Table 5 Quadraplex cut-out pressures**

| PLC Input # | Record As  | PSI | Other Actions                                       |
|-------------|------------|-----|-----------------------------------------------------|
| X3          | Lag #3 Off | 85  | One compressor turns off and lag alarm can be reset |
| X2          | Lag #2 Off | 90  | Second compressor turns off                         |
| X1          | Lag #1 Off | 95  | Third compressor turns off                          |
| X0          | Lead Off   | 100 | Fourth compressor turns off                         |

**Table 6 cut-in pressures**

| Input # | Record As | PSI | Other Actions                                                    |
|---------|-----------|-----|------------------------------------------------------------------|
| X0      | Lead On   | 85  | One compressor on                                                |
| X1      | Lag #1 On | 80  | Second compressor on                                             |
| X2*     | Lag #2 On | 75  | Third compressor on, Lag alarm on if the system is a Triplex     |
| X3*     | Lag #3 On | 70  | Fourth compressor on, Lag alarm on if the system is a Quadraplex |

\*if applicable

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**Table 7 TMPD sensor terminal connections**

|        |                  |
|--------|------------------|
| Unit 1 | Terminals 1 & 12 |
| Unit 2 | Terminals 1 & 19 |
| Unit 3 | Terminals 1 & 26 |
| Unit 4 | Terminals 1 & 33 |

**2 Table 8 Compressor Run Sequence**

| Lead #1 | Lag #1                  | Lag #2                  | Lag #3 |
|---------|-------------------------|-------------------------|--------|
| Unit 1  | Unit 2                  | Unit 3                  | Unit 4 |
| Unit 2  | Unit 3 (Unit 1 duplex)  | Unit 4 (Unit 1 triplex) | Unit 1 |
| Unit 3  | Unit 4 (Unit 1 triplex) | Unit 1 (Unit 2 triplex) | Unit 2 |
| Unit 4  | Unit 1                  | Unit 2                  | Unit 3 |

**3 Table 9 Desiccant Dryer Cycle Timing Sequence**

| Dryer         | Drying     | Regeneration         | Repressurizing |
|---------------|------------|----------------------|----------------|
| HDHM 3-12     | 45 seconds | 33 seconds           | 12 seconds     |
| HDHM 16-50    | 90 seconds | 66 seconds           | 24 seconds     |
| HDH 0050-0150 | 5 minutes  | 4 minutes 40 seconds | 20 seconds     |
| HDH 200-2070  | 5 minutes  | 4 minutes 40 seconds | 20 seconds     |