Starting Up a Heat Pump is More Than Flipping a Circuit Breaker

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How to Start a Heat Pump

Let’s do a Google Search For

“How to Start a Heat Pump”
How to Start a Heat Pump

Any Questions?
How to Start a Heat Pump

Step 1
How to Start a Heat Pump

- Get Trained!
- Understand the System
- Install Correctly
- Develop a Startup Routine
Training

- You can Never Get Too Much
- Manufacturers are Adapting
- Develop Support Network
- Use Your Training Credentials to Differentiate From Competitors
Understand the System

- OMG
- Water-to-Air w/ or w/o Zoning
- Water-to-Water w/ ? Distribution
- VRF w/ or w/o Heat Recovery
- Controls......again OMG
Install Correctly

- Details are Beyond Important!
- Haste Will Cost You
- Cleanliness is Essential
- “Call A Friend” is Better Than Guessing
- Hold Off on Adding Anti-freeze
Time to Flip The Breaker

☐ Verify Flows Before Starting the Compressor
☐ Have the Right Tools
Right Tools

Don’t Leave Home Without It

And...Of Course
Using Your Tools

- Manufacturer’s Diagnostic Tools
- Can Override System Controls
- Can Setup Operational Parameters
- Essential for Variable Speed Setup

Flow Rates (gpm & cfm)
Using Your Tools

- **Multimeter**
  - Required for Startup
    - AC Volts & Amps -> Power
  - For Troubleshooting
    - Ohm Meter
    - DC Volts
Using Your Tools

- **Pressure Gauge**
  - Must Have P/T Ports Installed
  - Used to Measure Pressure Drop Across the Heat Pump Heat Exchanger To Estimate Fluid Flow Rate (as well as measuring fluid temperature)
### Pressure Drop Across a Heat Pump

<table>
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<th>049 full load</th>
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Pressure Drop Across A Heat Pump

Now What?

Field Measurement Is 3.6 Psi

What’s the Flow Rate?

Gpm = 15 \times \left(\frac{3.6}{5.3}\right)^{0.5}

Gpm = 15 \times 0.824 = 12.4 \text{ gpm}
Using Your Tools

- Pressure Gauge & Brain
  - Is 12.4 gpm acceptable?
    - Being a Dual Capacity Heat Pump that Will Run ~70-80% of the Time on First Stage a flow rate of 2.25 gpm/ton on Second Stage is acceptable
Using Your Tools

- A 4 Ton x 2.25 = 9 gpm
- Therefore, 12.4 gpm is more than acceptable
- Let’s use our brain......
- What would the pressure drop be at 9 gpm?
Using Your Tools

- Pressure Drop = $5.3 \times (9/15)^2$
- Pressure Drop = $5.3 \times 0.36 = 1.9$ psi
- This is a 64% Decrease in Pressure Drop
- Could We Have Saved on Pump Energy?
Using Your Tools

✔ May Be Too Late At Startup, but....

Going from 2 pumps to 1 pump
Will save $100-$150 per year for the homeowner
Time to Flip The Breaker

- Verify Flows Before Starting the Compressor
- Have the Right Tools
- Let’s Start the Compressor
  - Cooling Mode First (~10 minutes to stabilize)
    - Won’t Freeze
    - Flow of Refrigerant through Filter/Drier before TXV
Using Your Tools

- Multimeter
  - Measure AC Volts & Amps
- Temperature Measurements
  - Source Water Temperature Rise
  - Load Side Air (or Water) Temperature Drop
- Compare to Manufacturer’s Data
Compare to Manufacturer's Data

Heat of Rejection (HR)

Q = 500 x gpm x ΔT

Field Measured ΔT = 9.8°F

Q = 500 x 12.4 x 9.8 = 60,760 BTU/Hr

Generally, 10% deviation is acceptable
Using Your Tools

- Compare to Manufacturer’s Data
  - Power
    - Watts = Volts x Amps x Power Factor
    - Field Measurements
      - Volts = 236 VAC
      - Amp Draw = 11.1 Amps
      - Assumed Power Factor = .85
Watts = 2,227 Watts = 2.28 KW

Generally, 10% deviation is acceptable

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Time to Flip The Breaker

- Heating Mode Second (~10 minutes to stabilize)
Using Your Tools

- Multimeter
  - Measure AC Volts & Amps
- Temperature Measurements
  - Source Water Temperature Drop
  - Load Side Air (or Water) Temperature Rise
- Compare to Manufacturer’s Data
Heat of Extraction (HE) Q = 500 x gpm x Delta T

Field Measured Delta T = 5.9 F degrees

Q = 500 x 12.4 x 5.9 = 36,580 BTU/Hr

Generally, 10% deviation is acceptable
Using Your Tools

- Compare to Manufacturer’s Data
  - Power
    - Watts = Volts x Amps x Power Factor
  - Field Measurements
    - Volts = 236 VAC
    - Amp Draw = 16.2 Amps
    - Assumed Power Factor = .85
**Model 049 - Full Load Dual Capacity with Variable Speed ECM or 5-Speed ECM (1550 cfm)**

<table>
<thead>
<tr>
<th>EWT °F</th>
<th>Flow Rate GPM</th>
<th>WPD</th>
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<th>COOLING - EAT 80/67 °F</th>
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<tr>
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<td>PSI FT/HD</td>
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<td>Airflow CFM</td>
<td>HC Mbtu/h</td>
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- **Compare to Manufacturer’s Data**
- **Power**
  - Watts = Volts × Amps × Power Factor
  - Watts = 236 × 16.2 × 0.85 = 3,222 Watts
  - Watts = 3,222 Watts = 3.22 KW
- **Generally, 10% deviation is acceptable**
An Hour is Insufficient

- Get Trained!
- Understand the System
- Install Correctly
- Develop a Startup Routine
What to Do?

- It’s a sad commentary on our industry when rebate providers are compelled to develop QA Standards and hire inspectors.
- Both IGSHPA/CSA Standards and manufacturers startup sheets are great tools but are not sufficient.
- You need to take ownership of developing startup procedures and documentation that improves your delivered quality.
- Only you know what’s best for your customers and your business.
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Any Questions?