Rammstein Air Heater System Startup manual

11-27-2015

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1 Disclaimer

This manual is not a substitute for experience with spray booths and spray booth heating systems. Only qualified people shall work on this equipment. Please refer to the Installation and Commissioning manual for definition of a qualified person.

Not every detail can be included in a manual such as this one. This manual is not a substitute for experience and common sense.

2 Electrical/Mechanical checks

2.1. Before powering up the equipment

1. Check continuity from each phase to ground.

If you have continuity for any phase to ground, do not power up equipment.

2. Check your line voltage at the disconnect or at the electrical panel. Make sure your voltage is within +-10% of the line voltage. Contact the electric company if voltage is not within specs.
3. Verify proper gas pressure. If unit is rate to 1/2psi (14"WC) the diaphragm in the pilot valve will be inverted if you connect a 2psi or a 5psi gas supply.

2.2. After powering up the equipment

1. **Transformer wiring**

Check the control voltage between H and N in the heater. It should be approximately 120V. If you have a higher voltage, the wires on the transformer primary are probably not connected to the correct terminals.

Verify that primary wires are connected to the correct terminals on the step down transformer.

1. **Motor rotation**

Bump the motors and check rotation. Do not run the motors for a long time.

- Intake: there is an arrow on the blower housing that shows proper rotation
- Exhaust(s): there is an arrow on the exhaust fan housing that shows motor rotation
- Combustion blower: Rotation is from the wide part of the housing towards the narrower part of the housing.

Looking down on the cooling fan of the motor:
Counterclockwise: R1, R1+, R2, R3
Clockwise: R5

2. **Amp draw**

Check amp draw of all motors. Compare actual amp draw to the FLA is listed on motor plates.

Amp draw is the most important factor in determining correct system operation.

- Intake motor

- Exhaust motor
- Combustion blower motor

Generally the following procedure is needed:

- Make sure booth has all filters installed.
- Make sure all filters are new.
- Set up exhaust motor so that it is pulling FLA at about 60Hz on the VFD.
- Turn VFD down to about 45Hz-50Hz.
- Set up intake motor so that it produces enough air to keep the booth neutral or slightly negative when exhaust VFD is at around 45Hz.

3. **Manual Balancing of booth pressure**

1. Tighten door hardware to specifications.
2. Turn Fan On and observe booth pressure gauge.
3. If booth is positively pressurized and doors blow open, adjust intake time delay.
   Refer to manual on procedure.
   Generally somewhere around 8-11 seconds of on delay is a good place to start.
4. Check accel/decel time on exhaust VFD. If there is no auto balance, this should be about 5s.
5. If there is an intake VFD, slow down intake VFD accel/decel time.
6. Repeat until doors stay closed during startup.
7. Turn selector to Bake Mode and check booth pressure during the transition.
8. Adjust as necessary.
9. Check transition to and from all other modes if system has, for example, a Prep Mode.

3 Gas Checks

The heater needs two things on the gas supply side: Gas pressure and gas flow rate. There are actually two gas pressures: static and dynamic. Static gas pressure is the pressure you measure when the heater is not running. Dynamic pressure is the pressure you measure when the heater is running. You can actually figure out that you have a flow rate problem if you see a great difference between static and dynamic gas pressure. If the heater is in high fire and your dynamic pressure is very low, the piping to the heater is too small. When the flow rate is too small compared to what the burner needs, the gas pressure drops.

1. Check gas inlet pressure with unit running:
   Check the heater name plate for inlet pressure min and max.
   Verify that the inlet pressure is within specs.
2. Verify that gas supply piping is the correct size.

4 Ductwork

As we stated earlier air flow related issues are the most common causes of spray booth problems. Ductwork is many times the culprit. There are two general things to check:

1. **Duct size – air velocity in duct**

We generally size the ductwork to have between 1,500-2,000fm of air velocity in the duct.

Example:

10,000cfm heater

30x30 duct = 6.25sq ft

10,000cfm/6.25sq ft = 1,600fm

Many times we se installation where the discharge duct on the heater is sized to the blower discharge opening. This may be OK if the discharge duct is not more than about 3' long. However, a long discharge duct sized to the blower discharge opening will "choke" the airflow down considerable.

Example:

10,000cfm heater

Discharge opening is 24x24 = 4 sq ft

10,000cfm/4sqft = 2,500fm This air velocity is will create high static pressure and will reduce air flow rate.

2. **Elbows, diffusers, transitions, offsets and other restrictions**

Excessive number of elbow and other restrictions will increase static pressure and reduce air flow rate through the system.

5 Burner Setup

2. Check burner manifold pressure

3. Set low fire

   Proper low fire will give us about a 10F temp rise in a booth.

4. Set high fire/temp rise

   You need to pick a time when ambient temperature is around 50F-70F.

   - Turn system on with Heat Off. Check ambient temperature.
   - Turn Heat On
   - Put system into high fire
     - EXA valve: Hold down outside button for 3s, red LED will turn on solid
     - MR212 valve: Increase set point temperature by about 120F.

       Monitor PLC analog out on V1 and C1 to make sure we are getting 10VDC.

       You can also monitor the signal on top of the MR212 to make sure you have a steady 24VDC.

       The goal is to make sure valve is getting full voltage and is fully open.

       Adjust high fire screw to get a temperature rise that is specified for the heater.

     Visually check flame height and color using sight glass.

     The temperature rise is 100F for R1s and 90F for all other heaters.

5. Check temperature difference between heater discharge temperature sensor and actual booth temperature
   - Check in Spray Mode
   - Check in Bake Mode

Temperature difference is usually about 10F-15F.
If you have a greater temperature difference, the air flow rate is probably low.
Amp out the intake motor to make sure it moves enough air.
This is easiest to see in Bake Mode.
If airflow is verified, then adjust temperature offset in the PLCs setup screens.

5. Check for heat stratification
Hot air rises. The temperature inside a spray booth is usually about 10F warmer under the ceiling than it is at the floor.

6 Booth airflow – even heat

Check for hot and cold spots in the booth.

7 Trouble shooting

Trouble shooting sometimes involves jumpering out interlocks. NEVER leave any interlocks jumpered out! There is a danger of fire, explosion. Bodily injury and death may happen to personnel.

The Rammstein air system provides feedback on the status of interlocks.
The PLC gives error messages if one of the following interlock does not prove:
   - Fire suppression
   - Door switches
   - Exhaust air flow switch

The flame controller interlock lights (5 optional green LED lights either in heater or on the side of the control panel) indicate the status of the 5 interlocks that are had wired into the flame controller:
   - Exhaust VFD on
   - Combustion blower air pressure
   - Heater high temp limit switch
   - Booth high temp limit switch
   - Heater low air flow switch

These interlocks are wired in series.
If one light goes off, other lights after it will also be off.
Fix the issue that causes the first light to be off.
If light comes on after issue is fixed, proceed to the next interlock which has its indicator light off.

1. Causes of booth temp too high when not calling for heat

- low fire adjusted too high
- pilot flame is too high
- Low airflow through booth

2. Causes of air temp is much higher under the ceiling than at floor

3. Causes of discharge air temperature is much higher than booth temperature

4. Causes of intake filters flutter

5. Causes of hot and cold spots in booth

6. All flame controller lights are on and flame controller has power (green power LED is blinking on Honeywell and Honeywell is not in a lockout mode) but burner does not light or burner lights but turns off and then lights again.

- Most of the time the issue is marginal airflow of the low airflow switch.
- Sometimes you can see that the low air flow indicator light turns off for a fraction of a second that it turns back on.
- Sometimes it turns off and on quickly and you cannot see the flicker of the indicator light.
- To test air flow switch for this issue, jumper it out.
- If flame controller lights burner, low air flow switch needs to be readjusted.

7. Gas pressure in high fire is much less than the gas pressure when burner is off.

- Heater does not produce enough heat. Temperature rise is low.
- Monitor inlet pressure. If inlet pressure drops dramatically, that means burner is starved for gas. This can be cause by a regulator with insufficient capacity, a gas line that is too small, obstruction in the gas supply system.

8. Control signal voltage drop over long runs

8 Heater commissioning sheet

Rammstein Air Heater Commissioning Sheet													
3/11/2015													
Please scan and email to sales@californiapulse.com													
Dealer:													
Job Name:	Job Address:												
Installer:													
Installation date:													
Heater serial number:													
Read and understood Installation and Commissioning Manual													
Voltage:													
Intake:	Rotation correct:	HP:		FLA:		Overload value:		Actual current draw:		VFD Hz:			
Exhaust:	Rotation correct:	HP:		FLA:		Overload value:		Actual current draw:		VFD Hz:			
Combustion blower:	Rotation correct:	HP:		FLA:		Overload value:		Actual current draw:					
Gas inlet pressure:													
Checked gas tightness (with heater running in Spray Mode):													
Checked operation of safety circuits as per manual:													
Re tightened power connections:													
Checked belt tension:													
All warning labels in place:													
Customer trained how to operate equipment:													
Installer explained to customer what customer's resposnibilities are (Installation Manual, Section 3):													