Refrigeration, Heating & Air Conditioning

Electric Furnace Troubleshooting Tables

Bard Manufacturing Company
Bryan, Ohio 43506

Since 1914...Moving, ahead just as planned.

Manual No.: 2100-063 Rev. A
Date: 09/13/95

The customer's complaint will virtually always fall under one or more of the following headings. This provides the first clue. It narrows the area of trouble.

I. No Heat

II. Not enough heat

III. Too much heat

IV. Noise

V. Odor

VI. Cost of operation

From this knowledge, the serviceman can further reduce the possibilities and begin to zero in on the problem with a few observations of his own. All it requires is for him to "turn up the thermostat and start the furnace." Simply by looking and listening he adds to his knowledge of the trouble and the outline expands as follows:

I. No heat

A. Furnace fails to heat

II. Not enough heat

A. Furnace cycles too often

B. Furnace runs continuously

III. Too much heat

A. Heating cycles are too long

B. Furnace runs continuously

IV. Noise

A. Mechanical noise

B. Air noise

V. Odor

VI. Cost

Now between the customer's complaint and his own observation, the serviceman has in a very few minutes classified the problem. At this point, he is ready to take action within the specific problem area.

I. Complaint: No Heat — **A. Fault: Furnace Fails to Heat**

	SOURCE	PROCEDURE	CAUSES	CORRECTION
1	Thermostat	Check thermostat settings	A. Thermostat switched to "Off" or "Cool"	Switch to "Heat"
			B. Thermostat set too low	Turn thermostat up
2	Power	Check main disconnect, furnace disconnect and unit fuses	A. Disconnect switch open at unit	Close disconnect switch Check for cause of overload
			B. Blown fuse or tripped breaker	Replace fuse or reset breaker
3	Transformer	Check voltage at low voltage transformer (Should be 24 volts) **(OBSERVATION)** **If there is no voltage or low voltage (less than 22 volts) check primary.**	A. 24V fuse blown (fused transformer)	Replace fuse
			B. Low voltage (more than 10% below 24 volts)	If primary voltage is low, call the power company. If secondary is low, replace the transformer
			C. Faulty transformer	Replace transformer
4	Junction Box	Check out wiring in low voltage junction box. **Color coding must be observed to determine which wires are used for first stage or second stage heat.**	A. Broken or loose thermostat wires	Repair or replace wires
			B. Thermostat wires connected to wrong leads	Check out wiring from thermostat to low voltage junction box
5	Heating Elements	Turn off power and check heating element for breaks (run continuity check with ohmmeter)	A. Broken element or bad thermal fuse	Replace element or fuse
			B. Loose terminals or broken wires	Tighten terminals or replace wires
6	Heating Contactor	Check heating contactor for proper operation (run a continuity check)	A. Faulty contactor coil	Replace contactor
			B. Burned contacts	Replace contactor

II. Complaint: Not Enough Heat — **A. Fault: Furnace Cycles Too Short**

SOURCE		PROCEDURE	CAUSES	CORRECTION
1	Thermostat	Check thermostat	A. Heat anticipator set incorrectly	Correct heat anticipator setting
			B. Thermostat not level	Level thermostat
		Check for second stage operation	C. Vibration at thermostat	Correct source of vibration
			D. Thermostat in warm air draft	Shield thermostat from draft or relocate
			E. Thermostat on warm wall or near heat producing appliance	Remove cause of heat or relocate thermostat
2	Outdoor Thermostat	Check outdoor thermostat	A. Temperature set too low	Set to higher temperature
			B. Contacts fail to close	Replace outdoor thermostat
			C. Sensing bulb in sunlight	Relocate sensing bulb
3	Limit Control	Check return air filter	A. Dirty air filter	Replace or clean filters
			B. Faulty limit control	Replace limit control
		Check limit control	C. Blower running too slow	Speed up blower for 50 to 70°F
			D. Restrictions in return air system	Correct cause of restriction
			E. Blower wheel dirty	Clean blower wheel
			F. Restrictions in supply air system	Remove restrictions
			G. Blower wheel in backwards	Reverse blower wheel
			H. Wrong motor rotation	Reverse motor rotation or replace with motor or correct rotation
			J. Blower motor seized or burned out	Replace motor
			K. Blower bearings seized	Replace bearings and shaft
4	Thermal Fuse	Check thermal fuse	A. Fuse blown	Replace thermal fuse
5	Power	If voltage is less than 240 volts (10% under rated voltage) or fluctuates then fault is power source. Recheck voltage at power source.	A. Loose wiring connection	Locate and secure connection
			B. Low or fluctuation line voltage	Call power company
6	Heating Contactor	Check heating contactors for proper operation. (Take voltage reading across contacts)	A. Bad contactor coil	Replace contactor
			B. Burned contacts	Replace contactor
			C. Broken or loose wiring	Repair wiring

III. Complaint: Too Much Heat — **A. Fault: Furnace Cycles are Too Long**

SOURCE		PROCEDURE	CAUSES	CORRECTION
1	Thermostat	Check thermostat	A. Thermostat not level	Level thermostat
			B. Heat anticipator set too high	Correct heat anticipator setting
			C. Thermostat in cold draft	Correct cause of draft
			D. Thermostat on cold wall	Relocate thermostat
			E. Thermostat out of calibration	Recalibrate or replace thermostat
2	Blower Motor	Check Blower Speed	A. Blower running too fast	Adjust to slower speed Set at 50 to 70° temperature rise

III. Complaint: Too Much Heat — **A. Fault: Furnace Runs Continuously**

SOURCE		PROCEDURE	CAUSES	CORRECTION
1	Thermostat	Disconnect thermostat wires at terminal board if element turns off, fault is in thermostat circuit	A. Thermostat not level	Level thermostat
			B. Shorted or welded thermostat contacts	Repair or replace thermostat
			C. Stuck thermostat bi-metal	Clear obstruction or replace thermostat
			D. Shorted thermostat wires	Repair short or replace wires
			E. Thermostat out of calibration	Replace thermostat
			F. Thermostat in cold draft	Correct cause of draft
2	Heating Contactor	Check heating contactor for proper operation	A. Contacts welded closed	Replace contactor
			B. Control circuit shorted	Trace to source of trouble

IV. Complaint: Noise — A. Fault: Mechanical Noise

	SOURCE	PROCEDURE	CAUSES	CORRECTION
1	Blower	Remove blower compartment door, start blower and listen for source of noise. Stop blower by disconnecting power and check for noise source. **(OBSERVATION)** **Inspect blower and check for end-play and side-play of shaft**	A. Blower bearing loose allowing side play	Secure bearings
			B. Blower thrust collar set too far out on shaft allowing end-play	Reset thrust collar to eliminate end-play of blower shaft
			C. Blower bearing dry and squeaking	Inspect bearing. If bearing is undamaged then add lubrication
			D. Blower bearing damaged	Replace bearings. Inspect shaft for scoring or undercuts
			E. Blower wheel touching scroll	Center blower wheel in scroll
			F. Loose blower wheel	Check alignment and tighten set screws
			G. Cutoff plate loose	Tighten cutoff plate
			H. Blower wheel out of balance	Balance or replace wheel
			I. Loose metal or debris in blower scroll	Remove debris
2	Running Gear	Inspect running gear and move it back and forth by hand to check for loose connections	A. Loose running gear and mounts	Secure cushion mounts
			B. Worn or damaged blower belt	Replace belt
			C. Belt too loose causing slippage	Correctly tighten belt
			D. Motor and blower pulleys out of alignment	Align pulleys
			E. Loose blower and motor pulley	Tighten set screws
3	Blower Motor	Remove blower compartment door, start blower and listen for source of noise. Stop blower by disconnecting power and check for noise source. **(OBSERVATION)** **If cause is blower motor, then determine cause and effect correction.**	A. Damaged and noisy motor bearings	Replace motor
			B. Loose or defective motor cushion mounts	Tighten mounts or replace
			C. Loose and rattling (Greenfield) armored cable leads to motor	Isolate or secure Greenfield cable
			D. AC motor hum	Check resilient mountings
			E. Regenerative motor braking (capacitor motors)	Replace capacitor or replace motor and capacitor
4	Air Filter	Check filter assembly	A. Filter loose in mounting rails	Secure filter mounting
			B. Filter screen contacting blower or running gear	Bend screen or reposition filter to clean blower and running gear
5	Controls	Listen for source of noisy control and check control **(OBSERVATION)** **Check contactors, relay and transformers.** **Some contactors and controls may make a loud buzz or clacking noise when operated below their design voltage.**	A. Low voltage to relay coil more than 10% below rated voltage	Check transformer primary or replace the transformer
			B. Loose relay mounting	Tighten mounting or isolate relay from direct metal to metal contact
			C. Defective relay	Replace relay
			D. Low voltage to contactor coil more than 10% below rated voltage	Correct cause of low voltage or replace the transformer
			E. Stuck or defective contactor	Replace contactor
			F. Noisy contactor	Replace contactor
			G. Loose transformer mounting	Tighten mounting
			H. Noisy humming transformer (loose windings on core)	Replace transformer
6	Cabinet and Duct	Listen for source of noise and relate it to furnace operation **(OBSERVATION)** **Check furnace with elements heating and blower running**	A. Loose access door panels or casing panels	Properly seat panel, secure at point of engagement or provide a pad at that point
			B. Element rattling against cabinet or duct	Isolate element from contact with cabinet or duct
			C. Thermal expansion of metal causing "oil canning" or popping noise	Determine point of "oil canning" and stiffen or upset or fasten panel at that point to prevent an overcenter popping
			D. Loose blower or running gear causing noise transmission to cabinet or duct	Check blower bearings, pulleys, blower wheel, mounts and belt
			E. Loose duct work, duct hangers, unit hangers or connectors	Properly seat joints, seams and hangers. Isolate hangers or pads
			F. Oil canning of metal due to air pressure change when blower starts. Either in discharge side or return air side.	Determine point of "oil canning" and stiffen or upset or fasten panel at that point to prevent an overcenter popping
			G. Broken spotwelded joint	Secure joint with sheet metal screw

IV. Complaint: Noise		A. Fault: Air Noise		
	SOURCE	PROCEDURE	CAUSES	CORRECTION
1	Blower	Inspect blower and blower compartment for air obstruction or restriction. Turn blower on and listen for source of air noise	A. Loose or improperly positioned blower cutoff plate	Secure or reposition cutoff plate
			B. Blower running too fast	Slow blower down to 50° to 70° F. Temperature rise
			C. Extremely dirty or blocked air filters causing blower to stall	Clean or change filters or remove source of blockage
			D. Out of center blower wheel — too close to cutoff plate	Check blower running gear mounts and repair or reposition them to bring blower wheel back to center
			E. Loose debris in blower housing causing air whistle	Remove debris
2	Air Duct System	Turn blower on and listen for source of noise along duct system and at registers	A. Air leaks in cabinet joint or duct system	Secure joint or cover opening in ductwork
			B. Sharp metal obstruction in air stream causing whistling	Remove obstruction
			C. Joint edge facing into air stream	Cover edge of joint
			D. Overly restricted discharge system from dampers or outlets being closed or covered. Causes blower to stall	Remove restrictions, check temperature rise
			E. Return air grille close to blower compartment inlet	Line inlet duct with acoustical material

V. Complaint: Odor

SOURCE		PROCEDURE	CAUSES	CORRECTION
1	Air System	Check furnace compartments, filters and duct system for dirt, oily films, debris and moisture	A. Accumulated dirt and debris	Clean debris and vacuum duct system
			B. Oily film in and around blower or in duct system	Remove film and correct cause of film
			C. Water or moisture	Locate and correct cause of water or moisture
			D. Humidifier stagnant water or sludge	Clean humidifier and check operation
			E. Dirty filters	Clean or replace filters
2	Control Transformer	Check transformer	A. Shorted windings	Replace transformer
3	Wiring	Check wiring for hot spots	A. Overhead wiring	Check for source of shorts replace wiring

IV. Complaint: Cost of Operation

SOURCE		PROCEDURE	CAUSES	CORRECTION
1	Electrical	Check motors and transformers for excessive current draw, above nameplate rating. Check for low voltage.	A. Low voltage — 10% less than 240 volts	Call the power company
			B. Too low temperature rise. High blower motor load	Slow down blower for 50° to 70°F rise
			C. Blower motor — high amp draw	Replace blower motor
			D. Blower belt too tight	Loosen belt
			E. Dirty blower wheel	Clean wheel
2	Mechanical	Check temperature rise	A. Too high temperature rise	Correct cause of high temperature rise (adjust blower speed)
3	House Construction	Check for causes of excessive negative pressure in house from exhaust fans, fireplaces, etc. Check building insulation and check for abnormal air infiltration	A. Excessive negative pressure in building	Correct cause of excessive negative pressure or provide for outside makeup air
			B. Insufficient insulation or excessive air infiltration	Advise homeowner and recommend that it be corrected
			C. Check for proper humidity at design conditions	Adjust humidifier