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SUBJECT: HEATING SYSTEM TROUBLESHOOTER'S CHECK LIST

1. NO HEAT

Open snap switch at burner. Open fire door. Set thermostat above room temperature. Reset safety switch. Close snap switch.

- a. Motor Starts But No Flame.
 - (1) Out of oil. (Stick tank, gauge may be wrong).
 - (2) Install pressure gauge. (Check pressure).
 - (3) Remove nozzle. (Clean or replace. See cleaning nozzles).
 - (4) Defective regulating valve. (Regulating Valve Test).
- b. Motor Runs But No Oil Pressure.
 - (1) Pump does not rotate. (Check coupling or belt).
 - (2) Valve in oil line closed. (Check all valves).
 - (3) Check valve or foot valve stuck. (Check with vacuum gauge. Vacuum Test).
 - (4) Air leak in suction line. (Oil pressure and air leak tests).
 - (5) Plugged filter or strainer. (Clean or replace).
 - (6) Plugged oil line. (May be dirt, sludge or ice).
 - (7) Plugged tank vent. (Vacuum Test).
 - (8) Pump defective. (Vacuum Test).
- c. Motor Runs With Oil Pressure But No Ignition.
 - (1) Improper electrode setting. (Check with manufacturer's diagram).
 - (2) Improper nozzle position. (Check with manufacturer's diagram).
 - (3) Porcelains cracked or shorted. (Ignition Test).
 - (4) Ignition cables shorted or disconnected. (Ignition Test).
 - (5) Loose or corroded transformer terminal posts. (Transformer Test).
 - (6) Loose transformer connections. (Transformer Test).
 - (7) Line voltage not correct or low. (Consult power company).
 - (8) Defective transformer. (Use Transformer Test).
 - (9) Ignition contacts in combustion control not made or dirty. (Intermittent ignition only).
- d. Motor Runs With Oil Pressure And Ignition But No Flame.
 - (1) Nozzle plugged.
 - (2) Oil pressure too low.
 - (3) Water in oil.
 - (4) Nozzle spray one-sided.
 - (5) Nozzle not tight in holder.
 - (6) Nozzle disc not properly seated.
 - (7) Improper electrode setting. (Check with manufacturer's instructions).
 - (8) Improper nozzle setting. (Check with manufacturer's instructions).
 - (9) Wrong grade of oil.

e. Burner Runs With Fire But Shuts Off On Safety.

- (1) Safety timing too short. (See control manufacturer's instructions).
- (2) Running circuit in relay not made.
 - (a) Helix or diaphragm sooted. (Stack relay).
 - (b) Helix, rod, or nut burned off. (High stack temperature. Stack relay).
 - (c) Insufficient heat to actuate helix. (Wrong location of helix or draft regulator. Stack relay).
 - (d) Wrong helix. (Low stack temperature. Use special helix. Stack relay).
 - (e) Photocell of electronic control dirty, sooty, or defective.
 - (f) Vacuum tube of electronic control loose or defective.
 - (g) Defective internal wiring. (Replace combustion control).
- (3) Running contacts greasy or dirty. (Clean).
- (4) Grounded thermostat wire. (Dampness: Staples in wire).
- (5) Limit control in wrong circuit. (Should be in hot line).
- (6) Polarity of house wiring system reversed. (Electric Circuit Test).
- (7) Water or air in oil line.
- (8) Pump partially seized.
- (9) Motor not up to speed. (Motor Test)
- (10) Poor flame adjustment. (Excess air: Partly plugged nozzle).
- (11) Defective safety switch.

f. Motor Does Not Start. (Electric Circuit Test).

- (1) Switches open.
- (2) Fuses blown. (See also User's Complaint 12).
- (3) Thermal overload switch on motor open. (Check cause. See also User's Complaint 12).
- (4) High limit control failure. (Mercury tubes may be cracked or contacts stuck in off position).
- (5) Off-On Low Water Control
 - (a) Low Water level.
 - (b) Float stuck in sludge. (Flush out control).
 - (c) Defective switch mechanism.
 - (d) Leaking Float.
- (6) Push In Burner Relay No. 1 By Hand. CAUTION: Make sure ignition contact on intermittent ignition burner is made or that No. 2 relay is in "out" position. If motor does not start, trouble is in motor or motor circuit.
 - (a) Dirty collector ring on motor. (Motor Test).
 - (b) Worn or broken brush or starting switch. (Motor Test).
 - (c) Loose wiring connections.
 - (d) Motor bearings dry or frozen.
 - (e) Windings burned out. (Rewind or replace motor).
 - (f) Defective starting switch.
 - (g) Defective capacitor. (Replace with same type).

If motor starts, trouble is in low voltage circuit. (See electric circuit test).

- (a) Broken connections or wires in circuits or instruments.
- (b) Dirty contacts in instruments.
- (c) Defective thermostat.
- (d) Defective low voltage transformer on combustion control or relay.
- (e) Combustion control fails to return to starting position due to low stack temperature, soot or corrosion on bearing; weak spring or incorrect helix, or heat sensitive element bent. (Stack relay).

g. Burner Operates Properly But No Heat Delivered.

Steam System.

- (1) Hand or motorized valve closed on main or radiator.
- (2) Electrical circuit defective on motorized valve. (Electric Circuit Test).
- (3) Too much water in boiler.

Hot Water System.

- (1) Hand or motorized valve closed.
- (2) Flow control valve stuck or locked in closed position.
- (3) Circulator not operating.
 - (a) Motor burned out.
 - (b) Belt or coupling broken.
 - (c) Electrical circuit defective. (Electric Circuit Test).

2. INSUFFICIENT HEAT

a. Oil Circuit.

- (1) Reduced fire size. (Dirty or carbonized nozzle).
- (2) Pump coupling or belt loose.
- (3) Faulty regulating valve, or loose nozzle producing carbon on floor-drooling. (Check cut-off action and tightness of nozzle. Pressure Regulating Valve Test.)
- (4) Fluctuating flame. (Pressure and Vacuum Tests).
 - (a) Sticking by-pass valve.
 - (b) Air leaks in oil circuit.
 - (c) Clogged strainers.
 - (d) Sludge in oil.
 - (e) Water in oil. (Indicated by hissing noise in combustion chamber).

b. Electrical Circuit.

- (1) Thermostat setting too low.
- (2) Thermostat adjustment. (Refer to control manufacturer's instructions. (See also Thermostat Troubles).
- (3) Thermostat in wrong location. (Too near lamp, radio, concealed risers, etc. See Thermostat Troubles).
- (4) Thermostat (or combustion control) contacts dirty.
- (5) Limit control set too low -- cuts out too soon.

- (6) Motor not up to speed. (Motor Test).
 - (a) Low voltage.
 - (b) Defective winding.
 - (c) Pump binding.
 - (d) Fan blades broken.

c. Flame Adjustment.

- (1) Nozzle too small.
- (2) Nozzle set too high or too close to combustion chamber floor.
(Check with manufacturer's instructions).
- (3) Poor atomization.
 - (a) Defective nozzle. (Bad smelling fire or soot on chamber walls).
 - (b) Dirty nozzle.
 - (c) Oil pressure too low.
 - (d) Excess air.
- (4) Combustion Chamber.
 - (a) Too small or too large.
 - (b) Too low or too high.
 - (c) Improper material.
 - (d) Obstructions--cement, dirt, scale, fallen brick.
- (5) Incorrect nozzle spray angle.
- (6) Draft conditions. (Draft and Chimney Test).
- (7) Dirty fan blades.

d. Heating Systems.

- (1) Undersized or poorly designed system.
 - (a) Boiler or furnace too small.
 - (b) Boiler or furnace unsuitable for oil firing.
 - (c) Steam riser too small or too low.
 - (d) Main or branch piping too small or too large.
 - (e) Defective or inadequate air vent valves. (Steam).
 - (f) Priming steam boiler -- dirty water, over active section.
 - (g) Insufficient radiation.
 - (h) Trapped pipe line.
 - (i) Improper radiator or register location.
 - (j) Radiator valves or orifice inserts too small.
 - (k) Cold air supply inadequate. (Warm air).
 - (l) Return air boot not shielded. (Gravity warm air).
 - (m) Free air opening of registers too small. (Warm air).
 - (n) Blower too small. (Warm air).
- (2) Poor building construction.
- (3) High infiltration of air.
- (4) Piping insulation inadequate. (Steam, hot water).
- (5) Excessive temperature requirements of occupants.
- (6) Excessive ventilation requirements.
- (7) Radiators covered or shielded.
- (8) Sooted boiler. (Clean surfaces and adjust fire).
- (9) Water line too high. (Steam).
- (10) Burner on and off on low water cut-off. (Steam)

- (11) Not enough water in hot water system.
- (12) Hot water radiators air bound.
- (13) Flow control valve only partly open. (Hot water system).
- (14) Domestic water demand excessive.

3. TOO MUCH HEAT

- a. Oil Circuit. (Regulating Valve Test).
 - (1) By-pass valve stuck closed, enlarging fire.
- b. Electrical Circuit
 - (1) Thermostat set too high.
 - (2) Thermostat improperly located or installed. (Thermostat Troubles)
 - (3) Thermostat out of adjustment or defective. (Thermostat Troubles)
 - (4) Low voltage of wiring defective. (Electric Circuit Test).
 - (5) Combustion relay short circuit.
 - (6) Relay sticks in running position.
 - (7) Limit control set too high.
 - (8) Limit control improperly installed.
 - (9) Limit control inoperative. (Stuck contacts).
 - (10) Wiring circuit wrong. (Check polarity).
 - (11) Domestic water control setting too high. (Operates burner after thermostat shuts off).
- c. Flame Adjustment.
 - (1) Nozzle too large.
 - (2) Atomizing pressure too high.
 - (3) Oil burns after burner shuts off.
 - (a) Loose nozzle.
 - (b) Pressure regulating valve not closing tightly.
- d. Heating Troubles.
 - (1) Building over-radiated.
 - (2) Boiler over-sized.
 - (3) Flow control valve stuck open. (Hot water systems).
 - (4) Circulator does not shut off. (Hot water systems).

4. HOUSE COLD BETWEEN HEATING CYCLES

- a. Electrical Circuit.
 - (1) Owner operating thermostat by hand.
 - (2) Wrong heat anticipating element in thermostat. (See control manufacturer's instructions).
 - (3) Thermostat improperly located. (Thermostat Troubles).
 - (4) Thermostat out of adjustment. (Differential too great).
 - (5) Wrong type of thermostat.
 - (6) Relay slow in returning to starting position.

- b. Flame Adjustment.
 - (1) Fire too small.
 - (2) Poor atomization.
- c. Heating System.
 - (1) Air vent valves slow in venting. (Steam).
 - (2) Dirty boiler water. (Causing time lag. Steam).
 - (3) Water line too high. (Steam).
 - (4) Piping system oversize. (Hot water--especially if converted from gravity to circulator operation).

5. UNEQUAL DISTRIBUTION OF HEAT

- a. Electrical Circuit.
 - (1) Thermostat improperly located. (Thermostat Troubles).
 - (2) Thermostat out of adjustment. (Differential too close).
 - (3) Limit control setting too low.
- b. Flame Adjustment.
 - (1) Fire too small.
- c. Heating System.
 - (1) Excessive air infiltration into certain rooms.
 - (2) Defects in radiator piping.
 - (3) Radiator valve not venting. (Steam).
 - (4) Hot water radiators air bound.
 - (5) Hot water system not full of water.
 - (6) Insufficient radiation in certain rooms.
 - (7) Improper radiator or register location.

6. BURNER STOPS AND STARTS TOO OFTEN

- a. Electrical Circuits.
 - (1) Thermostat differential too close. (Thermostat Troubles).
 - (2) Thermostat out of adjustment or contacts dirty.
 - (3) Thermostat improperly located.
 - (4) Thermostat wires of 3-wire thermostat reversed.
 - (5) Element in heat anticipating thermostat loose or of wrong size.
 - (6) Limit control setting too low.
 - (7) Limit control differential too close.
 - (8) Loose connection or loose fuse in wiring circuit.
 - (9) Aquastat differential too close.
 - (10) Dirty contacts or open circuit in combustion control.
- b. Flame adjustment.
 - (1) Boiler over-fired.

c. Heating System.

- (1) Low water cut-off. (Steam).
 - (a) Priming boiler.
 - (b) Sluggish returns.
 - (c) Water leaving boiler.

7. ODORS, SMOKE, SOOT OR CARBON

a. Oil Circuit.

- (1) Oil leaks--tank, piping, fittings or burner.
- (2) Spillage.
- (3) Regulating valve defective. (Regulating Valve Test).
 - (a) Cut-off valve leaking.
 - (b) By-pass valve stuck.
- (4) Nozzles. (Care and cleaning of nozzles).
 - (a) Orifice worn.
 - (b) Loose core.
 - (c) Loose in holder.
 - (d) Partly clogged.
- (5) Wrong grade of oil.
- (6) Improper nozzle spray angle.

b. Electrical Circuit.

- (1) Delayed ignition.
 - (a) Improper electrode setting. (Check with manufacturer's instructions).
 - (b) Improper nozzle setting. (Check with manufacturer's instructions).
 - (c) Low voltage.
 - (d) Transformer defective. (Transformer Test).
- (2) Short burner runs--thermostat differential too close.

c. Flame adjustment.

- (1) Excess or insufficient air.
- (2) Improper nozzle distance from combustion chamber floor. (Check with manufacturer's instructions).
- (3) Combustion Chamber.
 - (a) Too large.
 - (b) Too small.
 - (c) Too low.
 - (d) Air leakage into.
 - (e) Flame impingement.
 - (f) Obstructions to flame travel.
- (4) Overfiring.

- d. Draft. (Draft and chimney test).
 - (1) Insufficient. (May produce fluctuating fire).
 - (a) Defective chimney.
 - (b) Defective smoke pipe.
 - (c) Dirty fan.
 - (2) Insufficient air in boiler room.
 - (3) Boiler baffled too much. (Renovated boilers).
 - (4) Improper air shutter setting.
 - (5) Stack damper closed.
 - (6) Draft regulator stuck open.
 - (7) Back pressure over fire.
- e. Heating System.
 - (1) Boiler not properly sealed.
 - (2) Casting cracked.

8. OIL LEAKS

- a. Oil Circuit.
 - (1) Joints--tighten and if leak recurs replace with new materials.
 - (2) Porous pipe or fittings. (May be sand holes or cracks).
 - (3) Pump. (Pump Testing and Servicing).
 - (4) Pressure regulating valve--seal or threaded opening may leak. (Repair or replace).
 - (5) Tanks.
 - (a) Inside. (Replace tank, since it is hazardous to attempt repairs on a tank in the basement).
 - (b) Outside. (Repair or replace tank).
 - (6) Nozzle loose in holder.
 - (7) Nozzle not sealed due to burr on holder. (Reface holder in lathe; do not file).

9. NOISE

- a. Oil Circuit.
 - (1) Pump Noise.
 - (a) Worn gears. (Replace pump).
 - (b) High spot on gear or chip. (Replace pump).
 - (c) Air in line. (See Air Leak Test).
 - (d) High vacuum; i.e., above 10 inches. Restriction in suction line, plugged vent. (Vacuum Test).
 - (2) Oil line or tank noise.
 - (a) Pump noise. (Transmission through line).
 - (b) Suction and return lines in contact with each other.
 - (c) Burner supported on oil line or combustion chamber.

- b. Electrical Circuit.
 - (1) Alternating current hum.
 - (a) Relay.
 - (b) Transformer.
 - (c) Motor.
 - (d) Clock thermostat.
 - (2) Electrode setting too wide.
- c. Flame Adjustment.
 - (1) Overfiring.
 - (a) Nozzle too large.
 - (b) Oil pressure too high.
 - (2) Nozzle defective.
 - (3) Improper nozzle setting. (Check with manufacturer's instructions).
 - (4) Incorrect burner air tube setting.
 - (5) Combustion chamber of wrong proportions or size. (Rebuild).
 - (6) Excess Air.
 - (7) Pressure over fire.
- d. Draft. (Draft and Chimney Test).
 - (1) Excess Draft.
 - (2) Insufficient draft.
 - (3) Smoke pipe too large or too small.
 - (4) Too many elbows in smoke pipe.
 - (5) Chimney too large or too small.
 - (6) Other openings in chimney.
 - (7) Wrong draft regulator location.
- e. Mechanical.
 - (1) Motor bearing dry. (Oil).
 - (2) Pump and motor out of alignment.
 - (a) Bent shaft.
 - (b) Improperly adjusted coupling.
 - (3) Loose parts--burner feet or pedestal.
 - (4) Burner setting on metallic plate.
 - (5) Draft adjuster noise.
- f. Heating System.
 - (1) Steam.
 - (a) Trapped lines or radiator.
 - (b) Improper pipe line pitch. (May be too great or too little).
 - (c) Creeping pipes.
 - (d) Domestic hot water temperature too high.
 - (2) Hot Water.
 - (a) Creeping pipes.
 - (b) Noise in circulator.
 - (c) Rigid piping connections to circulator.

10. NOT ENOUGH DOMESTIC HOT WATER

- a. Electrical Circuit.
 - (1) Aquastat set too low.
 - (2) Aquastat defective.
 - (3) Aquastat installed in wrong location.
 - (4) Wrong type of aquastat installed. (Should be of the immersion type).
- b. Heating System.
 - (1) Indirect heater too small.
 - (2) Circulating line plugged or too small.
 - (3) Boiler water level too low.
 - (4) Valve in boiler water circulating line partly shut.
 - (5) Water storage tank too small.
 - (6) Water storage tank or piping not properly insulated.
 - (7) Cold water feed tube in tank defective or improperly located.
 - (8) Not enough boiler sections tapped.
 - (9) Mixing valve not properly set.
 - (10) Piping connections incorrect.
 - (11) Tankless heater too small.
 - (12) Boiler too small to carry tankless heater.
 - (13) Excessive main pressure.
 - (14) Wrong size or no flow restrictor installed.

11. BURNER SLOW IN IGNITING

- a. Oil Circuit.
 - (1) Loss of prime. (See Pressure or Vacuum Test).
 - (2) Air leaks in suction line. (See Air Leak Test).
 - (3) Dirty or defective nozzle. (See Nozzles - Care and Cleaning).
 - (4) Regulating valve sticking. (See Regulating Valve Test).
- b. Electrical Circuit.
 - (1) Electrode setting incorrect. (Check with manufacturer's instructions).
 - (2) Electrodes carbonized. (Check settings).
 - (3) Ignition cables shorted--insulations cracked or leaking. (See Transformer and Ignition Test).
 - (4) Porcelains cracked or leaking.
 - (5) Transformer defective or weak - terminals corroded or loose.
 - (6) Loose wiring connections.
- c. Flame Adjustment.
 - (1) Nozzle angle incorrect.
 - (2) Excess air.
 - (3) Low oil pressure.
 - (4) Improper nozzle position. (Check with burner manufacturer's instructions).

12. FUSES BURN OUT

- a. Electrical Circuit.
- (1) Fuses too small.
 - (2) Short circuit.
 - (3) Motor not on separate line.
 - (4) House circuit overloaded.
 - (5) Line voltage too high or too low.
 - (6) Burner motor overloaded.
 - (a) Sticking pump.
 - (b) Regulating valve stuck closed.
 - (c) Oil too heavy or cold.
 - (d) Oil pressure too high.
 - (e) By-pass not removed in one-pipe system.
 - (f) Motor bearing dry.

13. RADIO INTERFERENCE

Burners manufactured by some companies are equipped with radio interference eliminators. When radio interference from the burner is the customer's complaint, proceed as follows:

- (1) Isolate the burner from the electrical circuit by opening the burner switch on the meter board or by removing the fuse.
- (2) Operate the radio throughout its entire frequency range at full volume. If radio interference is still present, it is self-evident that the source is other than the burner.

If the radio is super-sensitive to all sources of interference, a radio serviceman should be called by the user.

Although outsider sources of radio interference are not the direct responsibility of the burner serviceman or installer, the following list of possible sources may be useful in aiding the user to locate the difficulty:

All Electric Appliances
Annunciators
Arc Lights
Automatic Railway Signals
Bad Connections in Home Lighting Systems
Battery
Breaks in Third Rails
Defective Light Sockets
Elevator Controls
Leaking Cables
Leaking Transformers

Long Radio Grounds
Loose Radio Connections
Generator Sets
Neon Signs
Telephone Dials
Violet-Ray Machines
X-Ray Machines
Power Lines
Pole Transformers
Automobiles
Pumping Station
Internal Defects in Radio

Radio interference from the above sources can sometimes be eliminated by reversing the electric supply plug of the radio.

If the interference is determined to be in the burner circuit, check the following: (Refer to Transformer and Ignition Test).

- (1) Ignition cables leaking.
- (2) Electrode porcelains cracked.
- (3) Electrode gap too wide.
- (4) Loose connection.
- (5) Poor transformer or filter ground.
- (6) Defective transformer. (Replace transformer).
- (7) Defective radio filter or condenser. (Replace).
- (8) Burner circuit not properly grounded, including burner chassis. (Loose BX).
- (9) Unequal ignition cable length.
- (10) Radio and burner on common ground. (Move burner ground to new location).

14. BASEMENT FLOODED WITH WATER

- (1) Advise user to open burner switch immediately.
- (2) Remove burner as soon as possible.
- (3) If electrical parts were wet, remove these parts and bake in oven. Do not exceed 180 degrees F.
- (4) Test transformer, motor and cable when thoroughly dry, replacing any parts necessary.

15. HIGH OIL CONSUMPTION

- a. Oil Circuit.
 - (1) Leaks in oil tank or lines. (Check return line especially).
 - (2) Wrong oil pressure.
- b. Electrical Circuit.
 - (1) Thermostat setting too high.
 - (2) Thermostat improperly located. (Thermostat Troubles).
 - (3) Thermostat manually operated by householder.
 - (4) Domestic aquastat set too high.
 - (5) Limit control set too high or too low.
- c. Flame Adjustment.
 - (1) Excess air.
 - (2) Poor atomization.
 - (3) Nozzle worn or defective.
 - (4) Improper combustion chamber.
 - (a) Wrong material.
 - (b) Wrong size or design.
 - (5) Excessive draft allowing draft regulator to withdraw too much basement air.
 - (6) Poor grade of oil.
 - (7) Fire not of proper size.
- d. Heating System.
 - (1) Boiler of poor design for oil.
 - (2) Boiler too large or too small.
 - (3) Trapped pipe lines.
 - (4) Warm air ducts too small.
 - (5) Insufficient radiation.
 - (6) Defective air valves.
 - (7) Insufficient cold air returns.
 - (8) Poor building construction.
 - (9) Excessive infiltration of cold air.
 - (10) Too much outside air. (Furnace systems).
 - (11) Radiation loss in basement too great.
 - (12) Boiler or furnace sooty.
 - (13) Boiler water dirty.
 - (14) Water line too high.

16. HIGH ELECTRIC CURRENT CONSUMPTION

- a. Oil Circuit.
 - (1) Oil pressure too high.
 - (2) Pump friction excessive.
- b. Electrical Circuit.
 - (1) Electrodes spaced too far apart. (Check with burner manufacturer's instructions.
 - (2) Improper wiring. (Check polarity).
 - (3) Short circuit or ground.
 - (4) Defective controls, motor, transformer, radio filter.
 - (5) Motor bearings not oiled.
- c. Flame Adjustment.
 - (1) Fire too small -- long burner runs.
- d. Other Sources.
 - (1) Burner stopping and starting often. (See User's Complaint 6).
 - (2) Circulator. (Check bearings or stuffing box).

17. BASEMENT TOO HOT OR COLD

- a. Too Hot.
 - (1) Boiler not insulated.
 - (2) Piping not insulated.
 - (3) Water storage tank not insulated.
 - (4) High stack temperature.
 - (a) Boiler over-fired.
 - (b) Soot in boiler.
 - (c) Dirty boiler water.
 - (5) Long, uninsulated smokepipe.
 - (6) Combustion chamber not insulated.
 - (7) Basement especially tight and well insulated.
 - (8) Air leakage from duct system or warm air unit.
- b. Too Cold.
 - (1) Insulation on pipes or boiler too effective.
 - (2) Excessive infiltration.
 - (3) Excessive air removed from basement through draft regulator.