



Centrifugal Fans & Heaters

Downstream Heater Solid State

Owner's Installation and Operation Manual

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<u>DATE</u>	<u>REVISIONS</u>	<u>PAGES</u>
04/03/2018	- Updated warranty -----	3
	Revised MAX. BTU/hr* (from M to MM)-----	8
	Updated Comp. # for Ref. #1 (Motor – 3ph) -----	46

SAFETY SECTION



Read manual before installing or using product. Failure to follow instructions and safety precautions in manual can result in death or serious injury. Keep manual in a safe location for future reference.



On safety decals, this symbol and the signal words Danger, Warning, Caution and Notice draw your attention to important instructions regarding safety. They indicate potential hazards and levels of intensity.



DANGER

RED - **DANGER** indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.



WARNING

ORANGE - **WARNING** indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.



CAUTION

YELLOW - **CAUTION** indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

NOTICE

BLUE - **NOTICE** alerts you to practices unrelated to personal injury, such as messages related to property damage.

IMPORTANT: To prevent death or serious injury to you or your family, it is essential that safety decals are clearly visible, in good condition, and applied to the appropriate equipment.

FOLLOW MANUAL & SAFETY DECAL MESSAGES

Carefully read this manual and all safety decals on your equipment.

Safety decals must be kept in good condition. Replace missing or damaged safety decals free of charge by contacting Sukup Manufacturing Co. via mail at PO Box 677, Sheffield, Iowa USA 50475; by phone at 641-892-4222; or by e-mail at info@sukup.com.



It is the responsibility of the owner/operator to know what specific requirements, precautions, and work hazards exist. It is also the responsibility of owner/operator to inform anyone operating or working in the area of this equipment of hazards and safety precautions that need to be taken to avoid personal injury or death. Always keep children away from bins and vehicles with flowing grain.

Make no unauthorized modifications to machine. Modifications may endanger function and/or safety of unit. Keep unit in good working condition. Repair and/or replace worn parts.

Keep shields in place. Replace worn or missing shields free of charge by contacting Sukup Manufacturing Co.

GRAIN BIN SAFETY

When entering a bin, owners/operators are responsible for following site-specific confined space entry procedures. OSHA's confined space entry procedures (29CFR 1910.146) can be found at www.osha.gov.

If you must enter bin for repair or maintenance:

- Use a safety harness, safety line and respirator
- Station another person outside of bin
- Avoid the center of the bin
- Wear appropriate personal protective equipment
- Keep clear of all augers and moving parts



DANGER: Never enter bin unless all power is locked out and another person is present.

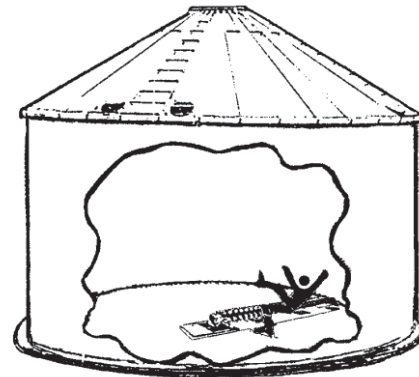


Rotating augers can kill or dismember!

NEVER enter bin when augers are running!

When bin is nearly empty, sweep auger will travel at an increasingly fast speed. Keep away from sweep and sump augers to avoid entanglement.

Failure to follow precautions above will result in death or serious injury.



DANGER: Flowing grain may trap and suffocate. If you enter a bin of flowing grain you can be completely submerged in grain in about 8 seconds.



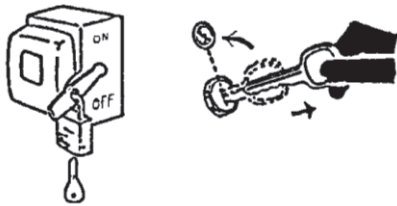
Failure to heed this warning will result in death or serious injury

To avoid electric shock or electrocution, all equipment must be properly wired and grounded according to electrical codes. Have unit wired by qualified electrician.



Have an electrician install a main power disconnect switch capable of being locked only in OFF position. Mark disconnect clearly as to equipment it operates. Always lock out main power disconnect switch whenever equipment is not in use.

Service Disconnect



WARNING: Heater must be electrically interlocked with fan. When this is not possible, an air switch kit needs to be added to heater.

NEVER operate heater without airflow.

Failure to do so may cause a fire, resulting in death or serious injury.

WARNING: When servicing equipment, never enter bin unless all power is locked out and another person is present. Always LOCK OUT all power and always check with voltage meter before servicing.

Failure to do so could result in death or serious injury.

NOTE: Refer to OSHA’s typical minimal lockout procedures (29CFR 1910.147 App A) at www.osha.gov to establish a written plan for your work site.

Frequently inspect all mechanical and electrical components. Ensure all electrical wires are in good condition.



WARNING: KEEP CLEAR OF ALL MOVING PARTS.

Keep people (ESPECIALLY YOUTH) away from equipment, particularly during operation.

Keep away from all moving parts. Keep all shields in place. SHUT OFF AND LOCK OUT all power before servicing. Keep inlet guard in place and in good working condition.

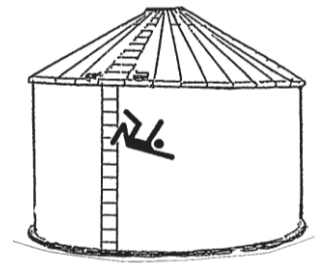


If fan is wired for suction, outlet must be shielded to protect individual from moving parts.

Failure to follow precautions above could result in death or serious injury.



WARNING: Metal is slippery when wet. To avoid falls, never carry items if climbing on bin. Maintain secure hand and foothold if climbing on bin. Failure to do so could result in death or serious injury.



CAUTION: Metal edges are sharp. To avoid injury, wear protective clothing and handle equipment and parts with care.

Failure to do so may result in minor or moderate injury.

PERSONAL PROTECTIVE EQUIPMENT



Refer to OSHA 1910.132 (Personal Prot. Equip.)

Owners/Operators are responsible for developing site-specific personal protective equipment standards. OSHA’s personal protective equipment standards (29CFR 1910.132) can be found at www.osha.gov.



**WARNING:
PREVENT EXPLOSION OR FIRE**

- Carefully review operator's manual.
- Clean under floor, as fines may cause a bin fire.
- Check for gas leaks, (spray soapy solution on piping and joints.)
- Run fan at least a half minute before starting heater.
- NEVER start heater if you smell gas or hear a hissing sound.
- NEVER run heater with inspection door open.
- Check fan blade, hub and shaft for cracks.
- Replace immediately if cracks are visible.



Failure to heed these warnings may cause serious injury or death.

EMERGENCIES – KNOW WHAT TO DO

Have emergency numbers and written directions to work site readily available in case of emergency. An area for emergency phone numbers to be recorded is provided below and at end of this manual.

Ambulance • Fire • Police: 9-1-1
Farm rescue team: _____
Local EMS team: _____
Address of work site: _____
Directions to work site: _____

Safety Decal Placement for Centrifugal Fans & Heaters

Safety decals are mounted at factory when possible.

Yearly and prior to equipment use, please check that all decals and shields are in place according to drawings below and are legible. To order a replacement decal or shield free of charge, contact Sukup Manufacturing Co., PO Box 677, Sheffield, IA USA 50475. Please specify computer number.

IMPORTANT: If suggested locations are not clearly visible, place safety decals in a more suitable area. Never cover up any existing safety decals.

Make sure location area for decal is free from grease, oil and dirt. Remove backing from decal and place in proper position.

1. **DECAL L0281 – WARNING:** Follow general safety regulations.



2. **DECAL L0165 – WARNING:** Disconnect electricity; Bleed gas



3. **WARNING – Decal L0166 –** Keep guards and shields in place; Disconnect electricity; Check fan blade for tightness.



4. **DANGER - Decal L0204**

Do not operate with door removed.



5. **WARNING - Decal L0284**

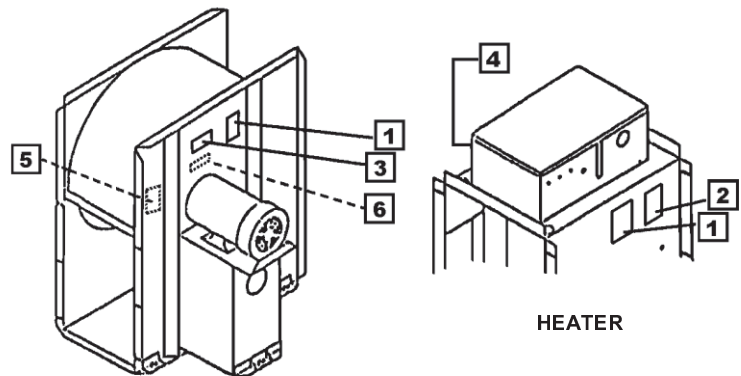
Keep away from all moving parts (Decal located on belt drive)



6. **DANGER – Decal L0271 - Shield Missing** (Decal located inside - on belt drive)



Numbers on drawings below refer to location of safety decals listed above.



SINGLE & DOUBLE INLET FANS

HEATER

SOLID STATE HEATER OPERATION

NOTE: Check piping before each use to ensure components are properly connected and in good working order.

1. Heater power cord must be plugged into burner receptacle on fan for safe operation. This interlocks the fan with heater, assuring fan will be on before the heater. Never operate the heater without airflow.
2. After heater is switched on, a 25-second purge delay will occur. Then the red light on control panel will come on, indicating power to solenoid valves and ignition transformer. This 25-second purge delay allows the fan to blow out any gas that may be in the bin.
3. After the purge delay, the solenoids will open and ignition should occur.
4. If flame is not detected within 10 seconds, the solid state board will "lockout." The purpose of this is to prevent raw gas from entering the bin. The circuit is reset by turning the toggle switch off for 2 seconds. (The only time the red light goes off is if lockout occurs.)
5. Solenoid Valves are electrically operated shut-off valves, opening when energized. A sharp snap will be heard when valves open. (An arrow on solenoid body indicates direction of gas flow.)
6. Regulator delivers a constant pressure to the burner. Turn handle clockwise to increase pressure. (Regulator ports are marked to indicate direction of fuel flow.)
7. Spark Plug relieves high voltage energy necessary to ignite fuel.
8. Burner High Limit is located inside the burner housing. It trips upon excessive heat in burner. It is reset with pencil from inside electrical box.
9. Transition High Limit detects high temperature in transition. Manually reset by depressing red reset button.
10. Plenum Control regulates drying temperature (See Plenum Control section.)

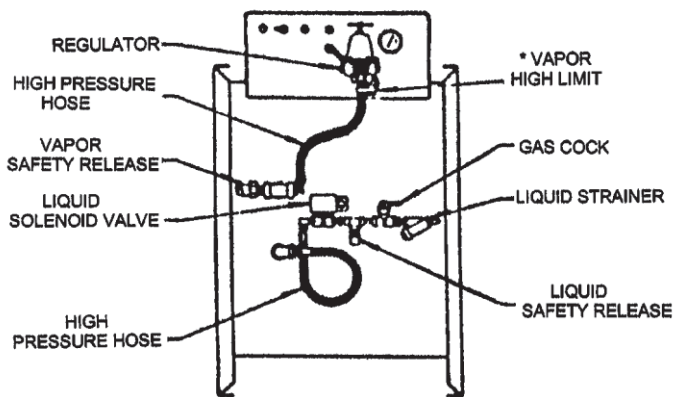
LIQUID HEATERS ONLY

1. Coiled vaporizer converts liquid propane into vapor propane by using heat from burner. Upper hose should be warmer than lower hose. **There should not be frost on regulator or on piping inside control box.** Loosen bolts in locking collars and slide vaporizer in for warmer operation. **Vapor high limit** shuts gas off if upper hose is too hot. Slide vaporizer out if very hot. Vapor high limit is open on temperature rise. Vapor high limit with red reset button must be manually reset if tripped. Vapor high limit without red reset button will reset automatically. Vaporizer must be adjusted before operating. Loosen bolts in locking collar and slide vaporizer out; approximately 8-9" downstream; 3-4" vane axial. Vaporizer pipe should be warm to the touch but not so hot you can't hold onto it. For more information on vaporizer installation, see page 33.

2. **Y (Wye) fuel strainers** filter fuel. Remove plug to clean screen.

3. **Pressure relief valves** bleed excessive pressure in piping.

***Note: Vapor high limit with auto reset is located as shown. Vapor high limit with manual reset is on pipe train in control box.**

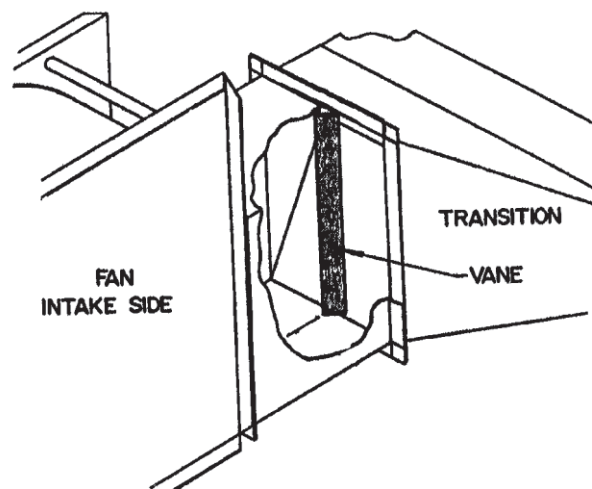


AIR DEFLECTING VANE ADJUSTMENT

The downstream heater is equipped with an air-deflecting vane. The purpose of this vane is to distribute heat evenly across the transition. The vane is factory-set so that center of vane is 1/2" to the right of locking bolt. In many cases no further adjustment is necessary. However, due to differences in floor supports, angle of floor in relation to fan and heater, and multiple fan and heater installations, no two bins are exactly alike. This is why the temperature across transition should be checked on each new installation and if needed, the following adjustment made.

Procedure for vane adjustment:

1. Start fan and heater. Allow unit to operate until plenum chamber reaches desired temperature.
2. Using caution, use your hand to feel temperature on top of transition where transition meets bin wall.
3. If one side is distinctly warmer than the other, shut off fan and heater. Open inspection door on heater. Using a wrench, loosen locking bolt and slide vane approximately 1" toward warmer side of transition. Tighten locking bolt, replace inspection door, and repeat steps 1 and 2.
4. Continue above procedure until temperature across transition feels even.



PLENUM CONTROL

Thermostat Operation

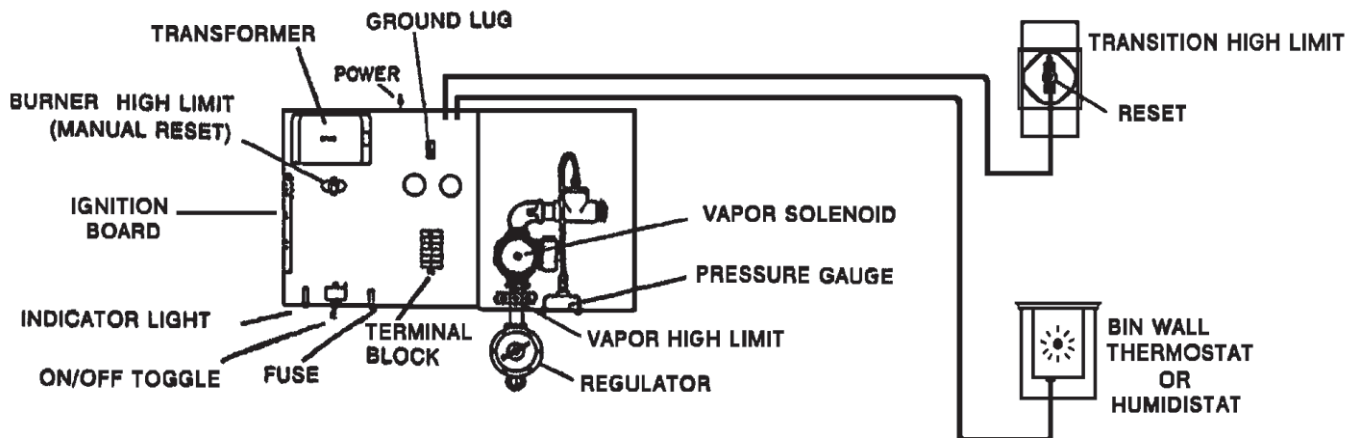
1. Open fuel supply valve (and gas cock on liquid models).
 2. Loosen regulator lock nut. Turn regulator handle counterclockwise to minimum setting.
 3. Set plenum thermostat at desired temperature.
 4. Start fan.
 5. Turn on heater. Wait for 25-second delay.
 6. Red light comes on.
 7. Adjust regulator until flame is on longer than off. Tighten lock nut.
 8. Check vaporizer (liquid models only). See page 24.
- Operator's troubleshooting guide starts on page 33.

SHUT-OFF PROCEDURE:

1. Close fuel supply valve. Wait for fuel to burn out of line.
2. Test flame detection device. Solid state board should lock out if flame probe is operating properly.
3. Turn off heater.
4. Turn off fan.

Solid State

THERMOSTAT OR HUMIDISTAT



(Humidistat Operation on following page)

HUMIDISTAT OPERATION

1. Open fuel supply valve (and gas cock on liquid models).
2. Loosen regulator lock nut. Turn regulator handle counterclockwise to minimum setting.
3. Set humidistat at lowest setting.
4. Start fan.
5. Turn on heater. Wait for 25-second delay.
6. When red light comes on, turn regulator handle clockwise until ignition occurs.
7. Adjust regulator to pressure between 2 and 4 psi. Pressure may be adjusted further if a smaller or larger temperature rise is desired. Tighten lock nut.
8. Check vaporizer (liquid models only). See page 24.
9. Adjust humidistat to desired relative humidity of the drying air. Heater will remain on if relative humidity of drying air is above this setting.

Operator's troubleshooting guide is found on page 33.

SHUT-OFF PROCEDURE

1. Close fuel supply valve. Wait for fuel to burn out of line. Close gas cock (on liquid models).
2. Test flame detection device. Solid state board should lock out if flame sensor is operating properly.
3. Turn off heater.
4. Turn off fan.

MODULATING VALVE OPERATION

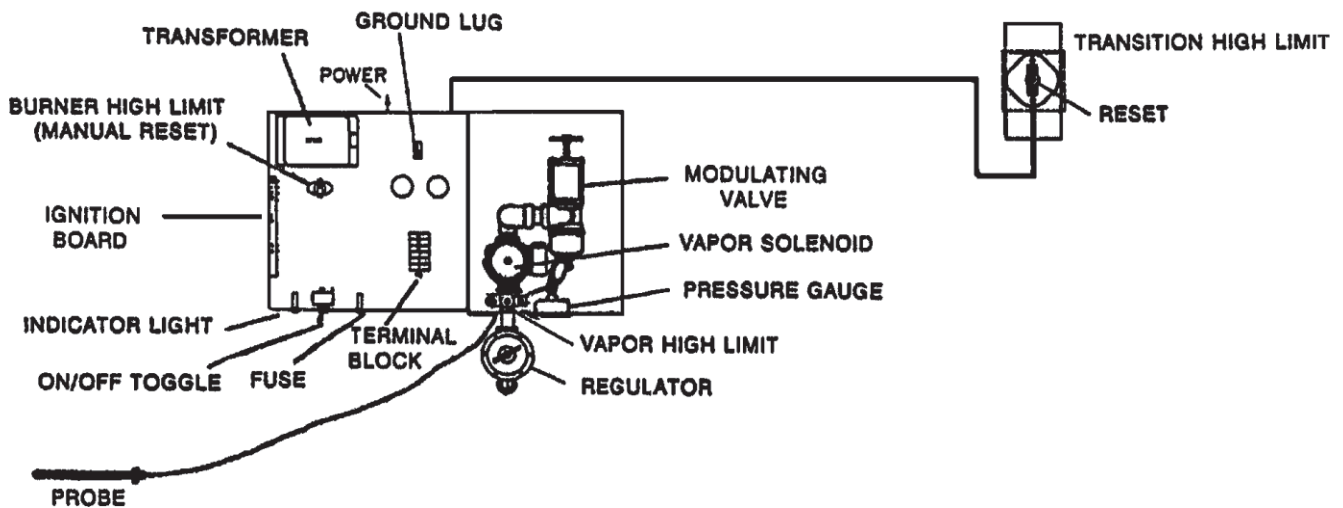
1. Open fuel supply valve (and gas cock on liquid models).
2. Turn modulating valve counterclockwise to minimum setting. **Never adjust regulator** (factory-set at 15 psi).
3. Start fan.
4. Turn on heater. Wait for 25-second delay.
5. Red light comes on.
6. Adjust modulating valve until dial thermometer in bin stabilizes at desired drying temperature.
7. Check vaporizer (liquid models only). See page 24.

Operator's troubleshooting guide starts on page 33.

SHUT-OFF PROCEDURE:

1. Close fuel supply valve. Wait for fuel to burn out of line.
2. Test flame detection device. Solid state board should lock out if flame sensor is operating properly.
3. Turn off heater.
4. Turn off fan.

SOLID STATE MODULATING VALVE



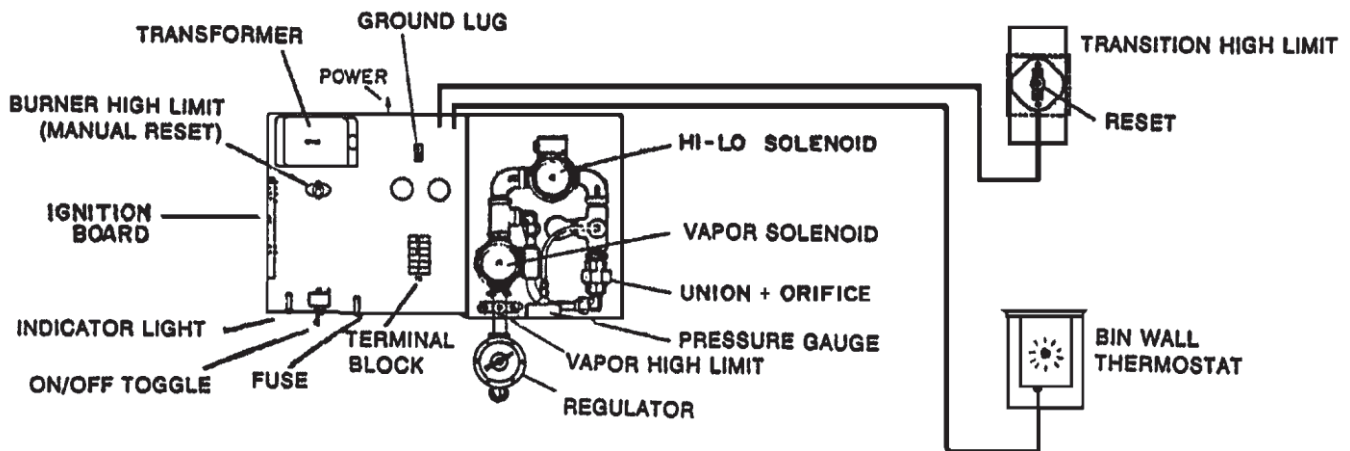
HIGH-LOW OPERATION

1. Open fuel supply valve (and gas cock on liquid models).
 2. Loosen regulator lock nut. Turn regulator handle counterclockwise to minimum setting.
 3. Set high-low thermostat at desired drying temperature
 4. Start fan.
 5. Turn on heater. Wait for 25-second delay.
 6. Red light comes on. Turn regulator handle clockwise until ignition occurs.
 7. Adjust regulator until heater cycles evenly between high and low flame (watch pressure gauge). If flame cycles off, regulator is set too high. If flame does not cycle from high to low, regulator is set too low. Tighten regulator locknut.
 8. Check vaporizer (liquid models only). See page 24.
- Operator's troubleshooting guide starts on page 33.

SHUT-OFF PROCEDURE:

1. Close fuel supply valve. Wait for fuel to burn out of line.
2. Test flame detection device. Solid-state board should lock out if flame sensor is operating properly.
3. Turn off heater.
4. Turn off fan.

SOLID STATE HI-LO



SOLID STATE OPERATOR'S GUIDE

1. Start fan and turn heater on.
2. If operating light comes on immediately, thermostat is open. To proceed, turn thermostat up. After a 25-second purge delay, operating light will come on. The gas solenoids should snap open and spark should occur.
3. Operating light will remain on as long as heater operates and cycles properly. If this light is off, the heater is locked out.
4. If solenoids do not snap open or operation light does not glow...
 - a. Are heater and fan on?
 - b. Is heater plugged to fan outlet?
 - c. Check both the fuses in the fan and at the heater. 3-amp fuses are used. Never over-fuse.
 - d. Is thermostat (or modulating valve) calling for heat?
 - e. Reset transition high limit.
 - f. Reset burner high limit.
5. Operating light is on. Solenoids snap open, but no spark...
 - a. Check the spark plug. Adjust gap to 1/8" (check spark gap periodically throughout drying season).
 - b. Check spark plug wire for grounding or an open condition.
6. Operating light is on, spark is present, but no ignition occurs...
 - a. Is gas being supplied to the burner? Check gauge. Are fuel valves open? Adjust regulator. Check storage tank.
 - b. Are solenoids opening? Put hand on valve and turn heater on. After a 25-second delay, you should feel valve snap open.
 - c. Is there an obstruction in the line? Check strainers and orifice.
7. Heater starts properly, but locks out after 10 seconds...
 - a. Check condition of flame rod. If cracked or burned off, replace it.
 - b. Check flame sensor wires and electrical connectors.
 - c. Flame rod needs only to make contact with the flame. Flame is sensed directly with electronics. It is not a heat sensor.
8. Freezes up while starting...
 - a. Start on minimum pressure and increase after ignition.
 - b. Moisture in fuel. Call gas supplier.
9. Frost on regulator or inside control box. Upper hose is not warmer than lower hose. Flame is present...

Vaporizer is not hot enough. Adjust vaporizer in. See page 24.
10. Upper hose very hot. Gas shuts off...
 - a. Vaporizer is too hot. Adjust vaporizer out. If vapor high limit has red reset button, reset manually by depressing button. See page 24.
 - b. Is tank hooked up for vapor rather than liquid? Call gas supplier.
11. Fan will not start...

Is power supply to fan turned on? Is thermal overload button depressed?
12. Fan vibrates...
 - a. Is there foreign material (dirt, etc.) on blade? Blade must be clean to be in balance.
 - b. Check to be sure housing is solid and level.
13. Overload continues to kick out...

Have serviceman check fan.
14. Do not operate heater with service door removed.

HEATER TROUBLESHOOTING GUIDE

SOLID STATE

Sukup Ignition Board

Check and Correction Procedure

(Refer to electrical schematics beginning on page 38)

The procedures outlined below are for use **ONLY** by qualified service personnel.



WARNING! Shut off fuel supply and bleed all lines before servicing. Run fan several minutes to purge gas from heater. Failure to heed this warning could cause a fire, resulting in death or serious injury.

1. Start fan and heater. After 25-second delay, visually check red light on control panel and also for spark at burner.

OPERATING LIGHT IS NOT ON:

2. Connect one lead of voltmeter to neutral (wire #2) at terminal block. This will remain connected throughout procedure.
3. Check power supply. Connect lead to wire (L1) (Power) at toggle switch.

If meter does not show voltage, check power supply to heater and heater fuse. (See fan trouble-shooting guide).

4. Check on-off toggle switch: Connect lead to wire #5 for vapor unit, wire #3 on liquid unit, at switch while switch is **ON**.

If meter does not show voltage, replace toggle switch.

For liquid LP unit with vaporizer, check vapor high limit. Connect voltmeter to wire #5 at burner high limit. Be sure vapor high limit is reset. If still no voltage, replace vapor high limit.

5. Check heater high limit: Connect lead to wire #6 at heater high limit terminal. Be sure the heater high limit is reset. If still no voltage, replace heater high limit.
6. Check transition high limit: Connect lead to wire #7 at terminal block. If meter does not show voltage, push the reset. If there is still no voltage, replace transition high limit.
7. Check thermostat: Connect lead to wire #8 at terminal on ignition board. If meter does not show voltage, adjust thermostat to higher setting. If there is still no voltage, replace thermostat. If power is present at terminals #7 and #8, the 25-second delay time has passed, and NO power has come out at terminals #9 and #10, replace the solid state circuit board.

TAKE PRECAUTIONS!! CIRCUIT BOARD MAY BE DAMAGED BY STATIC ELECTRICITY. Before handling circuit board, ground yourself by touching the heater to discharge any static potential that may have built up. Transport circuit board in a static shielding bag. Following these procedures will ensure maximum life span for the board.

LIGHT IS ON, BUT THERE IS NO SPARK:

8. Check for power at terminal #9 during trial for ignition period.



WARNING! HIGH VOLTAGE! Stay clear of end of ignition wire. If arc is obtained, replace igniter. If arc is not obtained replace ignition wire. Failure to take precautions when working around electricity could result in death or serious injury.

9. Disconnect ignition wire from transformer. Ground one end of screwdriver to heater housing. Bring screwdriver shaft to about 1/8" from transformer high voltage terminal to produce an arc. If no arc is obtained, replace transformer.
10. Connect ignition wire to transformer. Disconnect ignition wire from spark plug. Carefully using insulated pliers, hold ignition wire by insulation, and try to produce an arc between wire and heater housing.

SPARK IS PRESENT, BUT NO FLAME:

11. Check for power at terminal #10 during trial for ignition period.
12. Check solenoid valves: Remove screw from top of valve. Coil will lift off easily. Insert screwdriver into hole in bottom of coil. Screwdriver should be "grabbed" magnetically.
If coil fails to "grab" screwdriver, check electrical connections or replace coil.

BURNER IGNITES, BUT LOCKS OUT IN 10-20 SECONDS:

13. Look for cracked porcelain on the flame-sensing rod. If cracked, replace.
14. Check flame-sensing rod wire for grounding or weak connection. Check burner ground for weak connection.
15. Check current in the flame-sensing circuit.
Test equipment required: Volt-Ohm meter with a 50 micro-amp, DC scale

PROCEDURE:

- a. Insert meter (set at the 50 micro-amp, DC scale) in series with the flame sensor.
- b. Turn on heater unit
- c. Observe meter reading:
 - (1) During lighting period the meter may move erratically due to spark interference.
 - (2) After the spark ceases the meter reading should be constant and should read between 10 and 25 micro-amps.

Note: A reading of at least 3 micro-amps is needed to maintain operation. Any reading below 3 micro-amps will cause lockout.

- d. If amp meter readings are above 3 micro-amps, but lockout still occurs, replace solid state circuit board.

BURNER IGNITES AND OPERATES, BUT NUISANCE LOCKOUT OCCURS:

16. Replace spark plug or gap at 1/8".
17. Check transformer spark plug, and ignition wire as in #s 8, 9, and 10 on previous page.
18. Check tank pressure, line, and strainer for blockage. On vapor heaters a manual (*shut off valve*) and a 100-mesh gas strainer (*supplied by customer*) should be installed between heater pipe train and fuel supply line.
19. Is there possible freezing-up of regulator? If so, allow heater to warm up. Adjust vaporizer, if vaporizer is still not warm.

IMPORTANT! Check all piping joints for leaks with soapy solution before operating heater.