



Axial

Fans & Heaters

Owner's Installation and Operation Manual

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<u>DATES</u>	<u>REVISIONS</u>	<u>PAGES</u>
04/10/2019 - Updated warranty-----		3
	Replaced tran torque bushing information and table -----	32
12/05/2018 - Updated part number for Ref# 25, Motor – 1ph (1-1/8" shaft), 28", 10-15HP -----		42
10/23/2018 - Updated warranty-----		3
	Revised MAX. BTU/hr* (from M to MM)-----	8

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.



RED - **DANGER** indicates an imminently hazardous

situation which, if not avoided, will result in death or serious injury.



ORANGE - **WARNING** indicates a potentially

hazardous situation which, if not avoided, could result in death or serious injury.



YELLOW - **CAUTION** indicates a potentially

hazardous situation which, if not avoided, may result in minor or moderate injury.



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

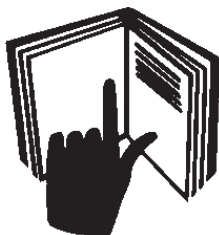
must be kept in good condition. Replace missing or damaged safety decals by

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 the 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.

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



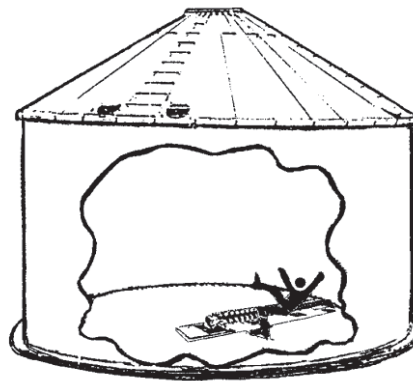
DANGER: Never enter bin unless all power is locked out and another person is present.



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 serious injury or death.



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.



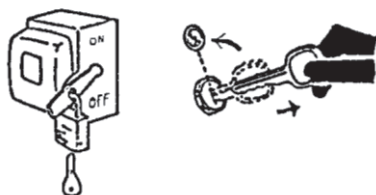
Failure to heed this warning will result in serious injury or death.

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.

Service Disconnect



Always lock out main power disconnect switch whenever equipment is not in use.



WARNING: Heater must be electrically interlocked with fan. When this is not possible (e.g. - direct engine drive fan), 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.

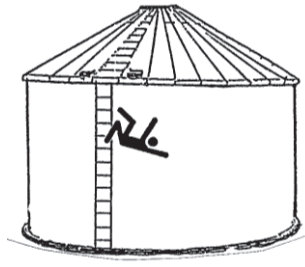


If fan is wired for suction, outlet must be shielded to protect individual from moving parts.

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



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 operators manual.
- Clean under floor; 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 death or serious injury.



CAUTION:
Wear hearing
protection when
near Axial Fan.

Failure to do so may result in hearing loss.



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 Axial Fans & Heaters

Safety decals and shields are mounted whenever possible at factory.

Yearly and prior to equipment use, please check that all decals are in place according to these drawings and in good legible condition. To order a replacement decal or shield free of charge, contact your dealer or Sukup Manufacturing Co. - P.O. Box 677 - Sheffield, IA, 50475. Please specify computer number.

IMPORTANT! The following safety decals should be mounted on your equipment as shown below. 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. **WARNING - L0281** - Safe operation decal.



2. **WARNING - L0165** - Disconnect Electricity; Bleed gas



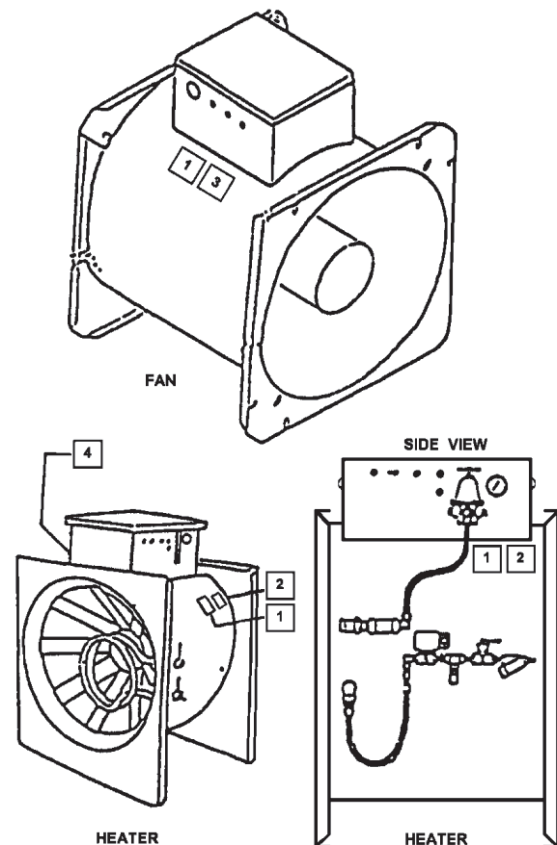
3. **WARNING - L0166** - Keep guards, shields in place; Disconnect electricity; Check fan blade for tightness.



4. **DANGER - L0204** - Do not operate with service door removed.



The numbers on the drawings below refer to the location of the safety decals listed above.



PROPANE

Local gas supplier will install tank and proper tank fittings. Inform supplier whether vapor or liquid service is required. Vapor is drawn from top of tank. On vapor heaters a manual (*shut-off valve*) and a 100-mesh gas strainer should be installed between heater pipe train and fuel supply line. Liquid is drawn from near bottom of tank.

LPG Tank Size (Gallons) for Vapor Withdrawal

BTU/HR ²	Lowest Average 24-HR Outdoor Temperature (°F)						
	32	20	10	0	-10	-20	-30
125,000	115	115	115	250	250	400	600
250,000	250	250	250	400	500	1000	1500
375,000	300	400	500	500	1000	1500	2500
500,000	400	500	750	1000	1200	2000	3500
750,000	750	1000	1500	2000	2500	4000	5000

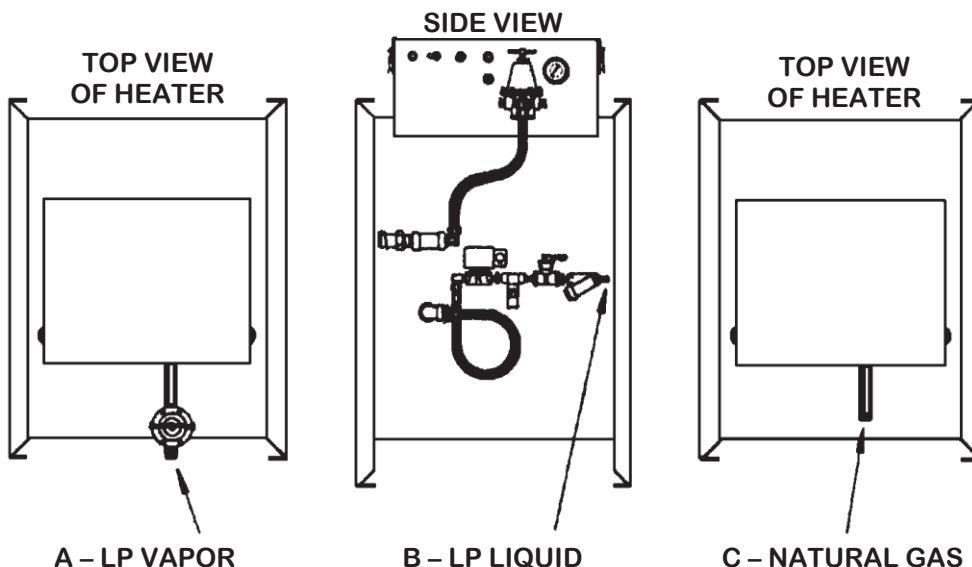
Source: LP Gas Handbook of Technical Data (Fisher Controls Co.)

1. Tank is assumed to be half full.
2. Average rate in 8-hour period.

For LP fuel line, use 5/8" OD type K copper tubing or ½" schedule 80 black steel pipe. Use 3-5 ft. of flexible LP hose between fuel line and heater. Before connecting to heater, purge gas line to blow out any dirt in pipe. Connect to vapor heater at regulator (point A in LP Vapor drawing below). Connect to liquid heater at Y strainer (point B in LP Liquid drawing below).

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

AFTER ADJUSTING REGULATOR, MAKE SURE NUT BELOW T-HANDLE IS TIGHTENED SO NO MOISTURE GETS IN.



NATURAL GAS

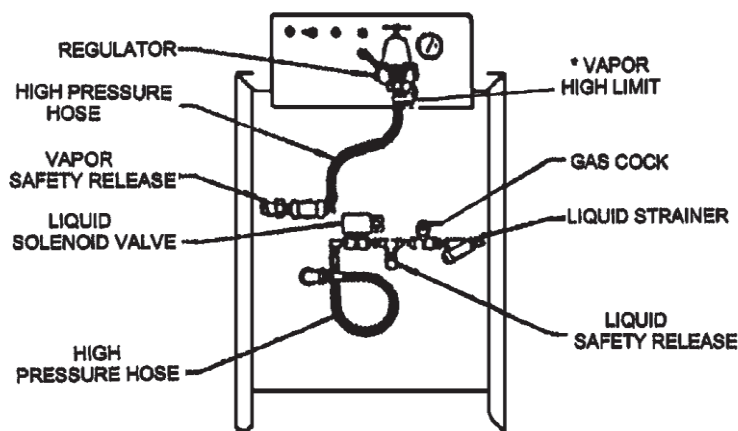
Check with gas company to determine fuel line size. Gas company will install regulator on fuel line. Regulator not included with natural gas models. Install gate valve (not included) in fuel line near heater to control heat output. A 100-mesh gas strainer should be installed between heater pipe train and fuel supply line.

SOLID STATE HEATER OPERATION

1. **Heater Power Cord** must be hardwired into 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 45-second purge delay will occur. Then the red light on control panel will come on, indicating power to solenoid valves and ignition transformer. This 45-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 be no frost on regulator or on piping inside control box.** Loosen bolts and adjust vaporizer closer to flame for warmer operation. **Vapor high limit** shuts gas off if upper hose is too hot. Adjust vaporizer out if very hot. Vapor high limit is open on temperature rise. Vapor high limit red reset button must be manually reset if tripped. Vaporizer must be adjusted before operating. Loosen bolts and adjust vaporizer; 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.
2. **Y 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.

PLENUM CONTROL

Thermostat Operation

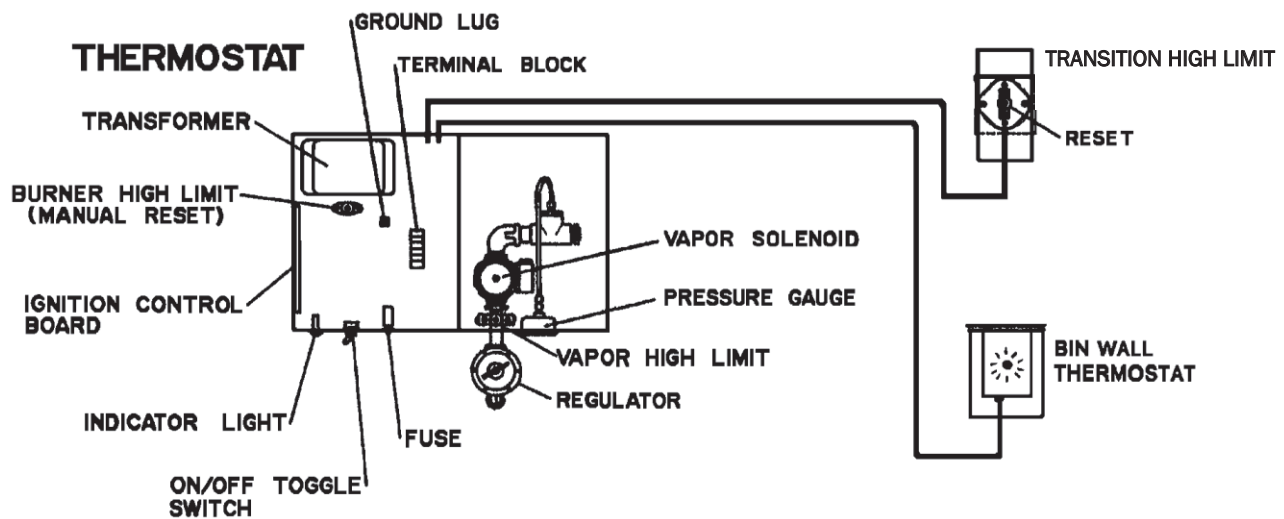
1. Open fuel supply valve (and gas cock on liquid models).
2. Loosen regulator lock nut. Turn regulator handle counterclockwise to minimum setting.
3. Set plenum thermostat at desired temperature.
4. Start fan.
5. Turn on heater. Wait for 45-second delay.
6. Red light comes on.
7. Adjust regulator until flame is on longer than off. Tighten lock nut.
8. Check vaporizer (liquid models only). See page 21.

Operator's troubleshooting guide starts on page 29.

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 for a properly-operating flame sensor.)
3. Turn off heater.
4. Turn off fan.

Solid State



Modulating Valve Operation

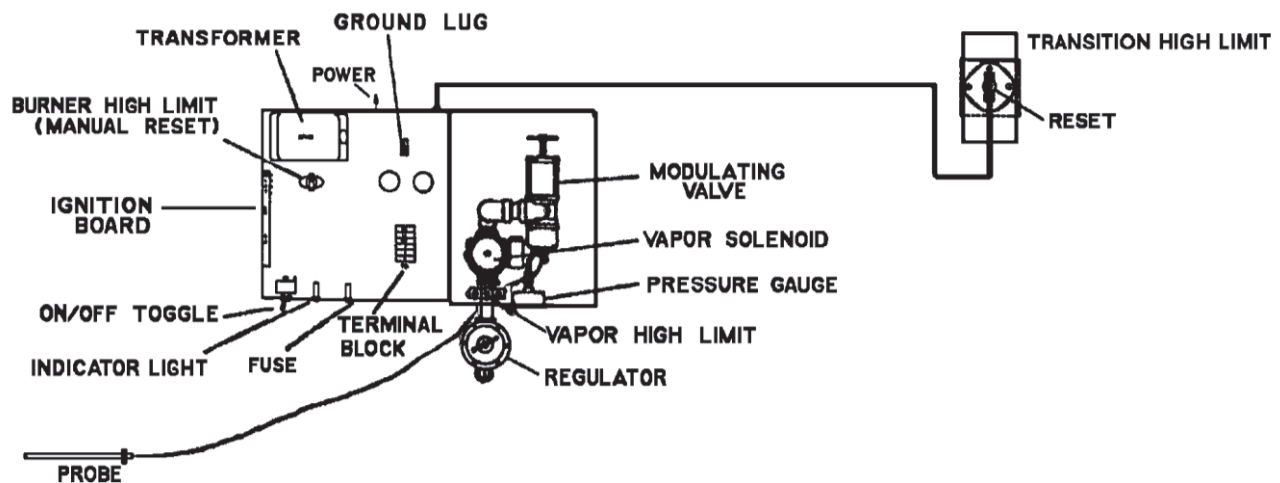
1. Open fuel supply valve (and gas cock on liquid models).
2. Turn modulating valve counterclockwise to minimum setting. Never adjust regulator (factory-set at 15psi).
3. Start fan.
4. Turn on heater. Wait for 45-second delay.
5. Red light comes on.
6. Adjust modulating valve until dial thermometer in bin stabilizes at desired drying temperature.
7. Check vaporizer (liquid models only). See page 21.

Operator's troubleshooting guide starts on page 29.

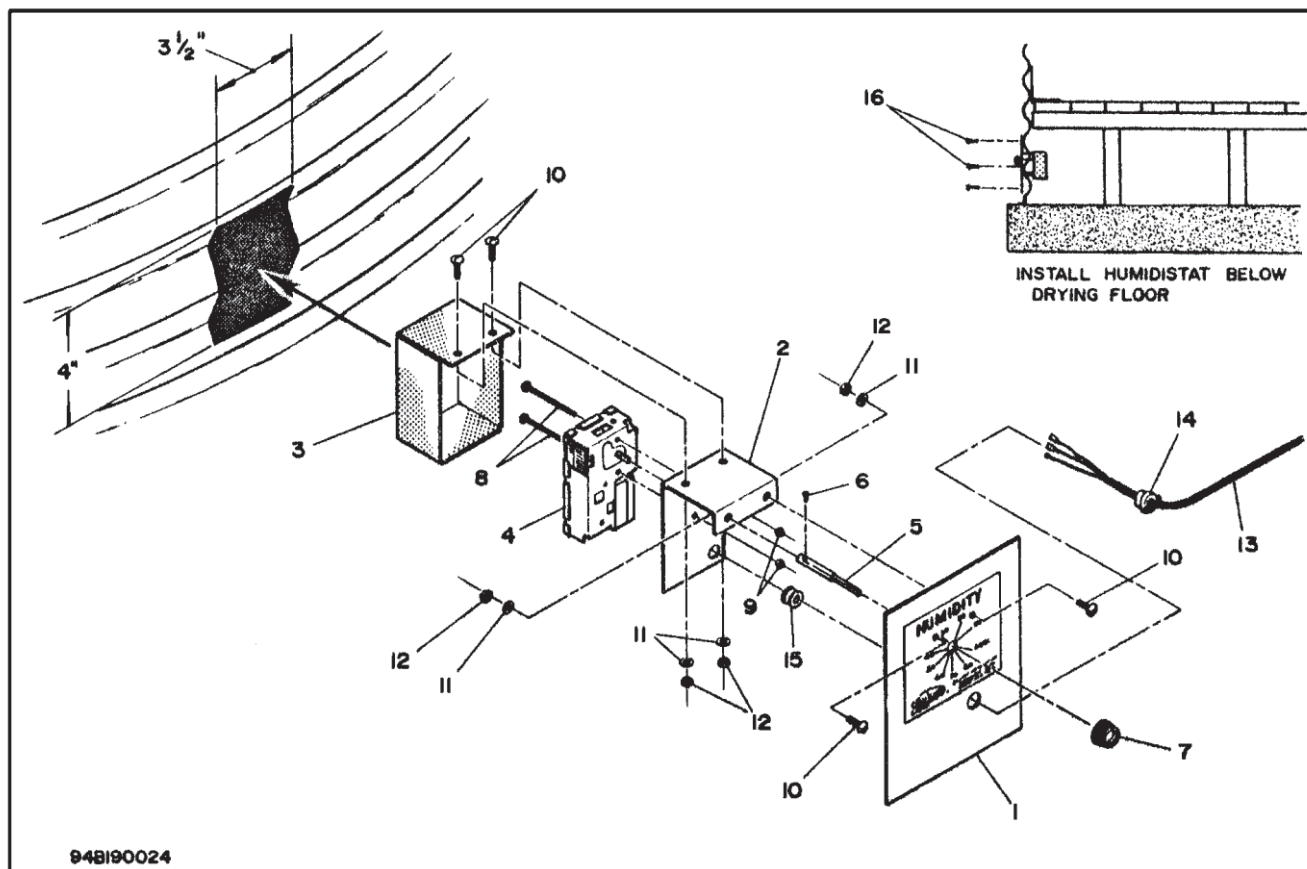
SHUT-OFF PROCEDURE:

1. Close fuel supply valve. Wait for fuel to burn out of line.
2. Test flame detection device. (Flame safety delay on dual relay or solid state board should lock out for a properly operating flame probe or flame sensor.)
3. Turn off heater.
4. Turn off fan.

Solid State



HUMIDISTAT



HUMIDISTAT PARTS & INSTRUCTIONS

HUMIDISTAT PARTS LIST Complete Humidistat D4029

REF#	PART#	DESCRIPTION	QTY
1	D4032	Mounting plate w/decal	1
2	D4031	Mounting plate	1
3	D4033	Screen	1
4	J5850	Humidistat	1
5	D4034	Regulator extension	1
6	J0455	Screw, #6-32 x 1/4" machine	1
7	J4160	Knob	1
8	J0450	Screw, #5-40 x 2" machine	2
9	J0980	Nut, #5-40, plated	2
10	J0480	Screw, #10-24 x 1/2" machine	4
11	J1190	Washer, #10-Lock star	4
12	J0985	Nut, #10-24, plated	4
13	D4035	Cord, 18-3, 11'	1
14	J5025	Heyco bushing, SP6P3-4	1
15	J4970	Rubber grommet, P4349-001	1
16	J0474	Screw, #10-16 x 1 self tap, #3TEK	6

HUMIDISTAT INSTALLATION & OPERATION

1. Locate humidistat approximately 3' to the right of entrance collar. Cut a rectangular hole in bin wall into plenum chamber. Hole should be 3 1/2" wide x 4" tall. See above.
2. Attach faceplate to bin wall, using 6 self-tapping screws. Use caulk or some other sealer to seal between mounting plate and bin wall.

3. To operate heater with humidistat:
 - 3.1 Open fuel supply valve (and gas cock on liquid models).
 - 3.2 Loosen regulator lock nut. Turn regulator handle counterclockwise to minimum setting.
 - 3.3 Set humidistat at lowest setting.
 - 3.4 Start fan.
 - 3.5 Turn on heater. Wait for 45-second delay.
 - 3.6 When red light comes on, turn regulator handle clockwise until ignition occurs.
 - 3.7 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.
 - 3.8 Check flame probe.
 - 3.9 Check vaporizer (liquid models only).
 - 3.10 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 begins on page 29.

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. (Flame safety delay on dual relay or solid state board should lock out for a properly operating flame probe or flame sensor.
3. Turn off heater.
4. Turn off fan.

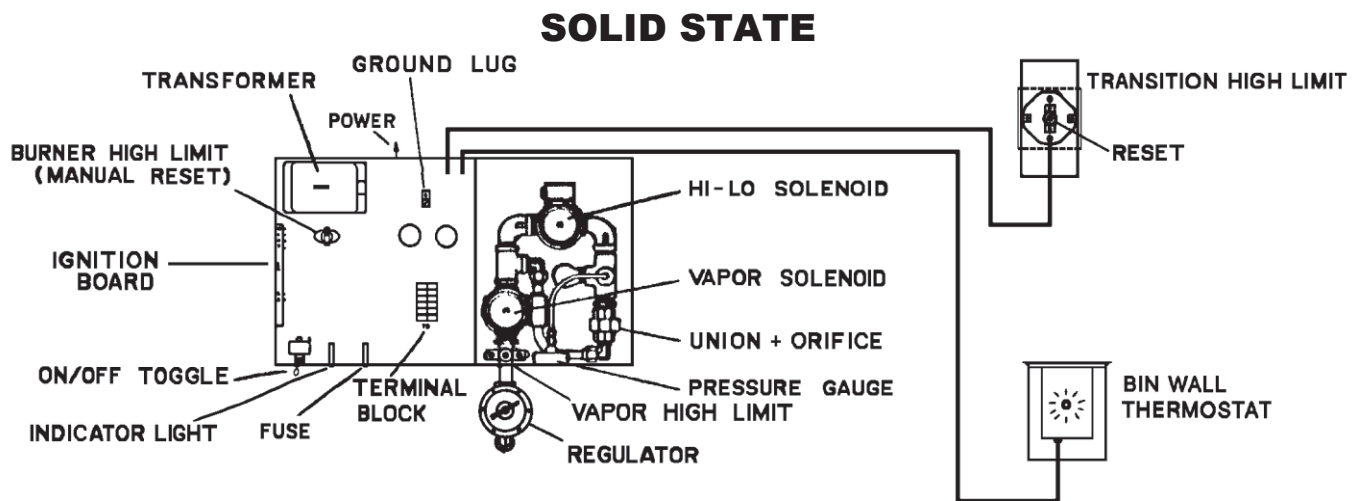
HIGH-LOW OPERATION

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 45-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 21.

Operator's troubleshooting guide starts on page 29.

SHUT-OFF PROCEDURE:

1. Close fuel supply valve. Wait for fuel to burn out of line.
2. Test flame detection device. (Flame safety delay on dual relay or solid state board should lock out for a properly operating flame probe or flame sensor.
3. Turn off heater.
4. Turn off fan.



Drying Precautions

IMPROPER USE OF EQUIPMENT MAY CAUSE A FIRE!

Carefully read all the information listed below. Failure to do so can cause fire damage to grain, equipment, storage units, and may result in serious injury or even death.

Table 11 – Max Plenum Temp.* For Corn to Avoid an In-Bin Fire and Maintain Grain Quality

	Max Plenum Temperature	
	10° F (5° C) above ambient (outside) air	
In-Bin Drying - without a Stirring Machine		
In-Bin Drying - with Stirring Machine	120° F	50° C
In-Bin Continuous Flow Drying	160° F	70° C
Portable Dryer	220° F	105° C

***NOTE:** The above temperatures are only recommendations. Drying temperatures for other grains vary due to ambient temperature, moisture content, and rate of drying. Consult your local extension office for further information on specific plenum temperatures when drying other grains.

Precautionary Steps to help prevent an in-bin fire.

- The maximum plenum temperature for drying without stirring should be no more than 10°F (5°C) above the ambient (outside) air. This will help prevent a fire as well as maintain grain quality.
- **DO NOT** combine drying equipment from various companies. Sukup designed heaters are intended to be used with Sukup designed fans only. Heaters have a variety of automatic controls to shut them down in case of ignition failure, high temperature limits, or airflow failure. Combining equipment from various companies may cause a lack of safety controls needed to cut power. Check these items regularly for proper operation to reduce the chance of fire.
- Keep area beneath perforated floor clean of all fines and foreign material as they may cause a bin fire. For even heat distribution, floor supports should not block transition.
- It is recommended that grain be screened before going into bin to avoid formation of fines and trash. The use of a grain spreader will help distribute the fines.
- Thoroughly ventilating the bins with the dryer fan before igniting the heater will reduce the risk of a fire or explosion from leaking fuel.
- Inadequate electrical wiring can also cause fires. Be certain that components are wired by a qualified electrician.

If a fire is suspected. Follow these basic fire safety procedures to ensure the safety of yourself, family, and employees.

- Always account for all co-workers, neighboring farmers, and first responders.
- Shut off gas at heater and supply tank. Shut off fan. Call Fire Department.
- Seal fan inlet and any other openings to smother fire.
- Remove fan and heater from transition. Sandbag transition opening. If possible, flood bottom of bin (plenum) with water to a depth of 4" (100 mm) above perforated floor. This will protect steel floor supports and may extinguish fire, depending upon its location.
- If fire is located higher in bin, a long pipe with small holes may be inserted through the bin wall or manhole and into grain to direct water at source of fire. This may help keep the fire in a centralized location, but it's nearly impossible to extinguish a fire in a grain bin by simply pouring water on it. These fires can only be extinguished by completely emptying the bin.
- Take note of bin surroundings to avoid heat transfer onto neighboring structures. Be extra observant of propane tanks and cool if necessary.
- **ALL GRAIN MUST BE REMOVED FROM BIN TO REACH POINT OF FIRE.** Do not cut holes in bin to remove grain. Do not enter a bin that is on fire. The danger of getting buried in flowing grain exists.
- Grain may smolder for days. Do not restart fan in hope that fire has gone out unless all grain has been removed from bin.

NOTE: These are general guidelines. Be sure to consult with your local extension office for your specific situation.

MAINTENANCE



WARNING! Keep all guards and screens in place when operating. Disconnect and LOCK OUT all power sources before doing any repair, maintenance or inspections! Failure to follow these precautions could result in death or serious injury.

BEGINNING OF EACH DRYING SEASON:

1. Remove inlet screen. Check for foreign material on fan blade. With power off, turn fan by hand to be sure it rotates freely.
2. Lubricate fan motor bearings with high temperature grease as indicated on motor nameplate or motor fact sheet. Do not over-grease. Check ventilation openings in motor for any blockage.
3. Check wiring of fan and heater. Look for loose connections, bare wires, or rodent damage. Be sure to check ignition wire and flame sensor wires for any damage.
4. Examine the flame rod for cracked insulation.
5. Examine the spark plug for proper gap. The gap should be approximately 1/8". Spark plug and flame rod should be examined periodically throughout drying season.
6. All plenum controls should be checked.
7. Check all plumbing connections for leaks, using soapy solution.
8. Check vaporizer adjustment daily. Weather condition changes can demand new adjustment.

AFTER DRYING SEASON:

The balance of a vane axial blade is very critical. Vibration can cause the fan housing to crack. To prevent this, check behind the blade for dirt, dust or foreign material.

Burn fuel out of lines and turn off at source.

Cover fan inlet to keep out weather, pests, and to prevent "windmilling" which can cause wear on the start switch in single phase motors.

DURING OFF SEASON:


Every six weeks, remove inlet cover and operate fan to redistribute grease in bearings. Let motor warm up enough to force out any accumulated moisture.

Make sure control box cover is in place and secured. Turn off power and fuel at source.

NOTE: One drop of liquid LP will expand 270 times as it converts to vapor. It would be very dangerous to have a vaporizer coil develop a leak during heater operation. **Be sure to check vaporizer coil yearly. Vaporizer should be replaced every 5 years.**

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 45-second purge delay, operating light will come on. The gas solenoids should snap open; 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 properly wired to fan? Is fan wired with a neutral?
 - 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 45-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. To adjust the vaporizer, loosen the 2 pivot bolts (1 top, 1 bottom) of the vaporizer adjustment bracket and then pivot the vaporizer either in or out of the flame as necessary to regulate the temperature at the vaporizer outlet. The U-bolts mounting the vaporizer to the adjustment bracket can also be loosened and vaporizer can be moved in and out to adjust. Viewing hole is present to watch vaporizer adjustment.
- 

CAUTION: Vaporizer should be replaced only by qualified service personnel. Shut off fuel supply and bleed all fuel lines. Run fan several minutes to purge gas from heater. Check all piping joints for leaks with soapy solution before operating heater after turning vaporizer.

Failure to take these steps may result in minor or moderate injury.
10. **Upper hose very hot. Gas shuts off...**
 - a. Vaporizer is too hot. Adjust vaporizer out. To adjust vaporizer, see #9 above. Vapor high limit has red reset button; reset manually by depressing button.
 - 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 service person check fan.
 14. **Do not operate heater with service door removed.**

Heater Troubleshooting Guide

Sukup Solid State Ignition Board

Check and Correction Procedure
(Refer to electrical schematic on pages 34-37)

IMPORTANT: Procedures outlined below are for use only by qualified service personnel.



CAUTION!

Shut off fuel supply and bleed all lines before servicing. Run fan several minutes to purge gas from heater. **Failure to take these steps may result in minor or moderate injury.**



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 use caution could result in death or serious injury.**

1. Start fan and heater. Visually check (after approximately 20 second delay) 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.
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 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 still no voltage, replace thermostat. If power is present at terminals #7 & #8, the 45-second delay time has past, and NO power has come out at terminals #9 & 10, replace the solid state circuit board.

IMPORTANT! CIRCUIT BOARD CAN 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 give maximum life span to the board.

LIGHT IS ON, BUT NO SPARK:

8. Check for power at terminal #9 during trial for ignition period.
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 establish 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, try to get 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. If vaporizer is still not warm, adjust vaporizer. Follow instructions on page 28, Item #9.

<p>NOTICE: Check all piping joints for leaks with soapy solution before operating heater.</p>
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