OWNER'S MANUAL

Vane Axial Heater
INSTALLATION AND OPERATION
PNEG-012

Model #: _____

PNEG-012

✓OK

_____ 1. All wire connections
_____ 2. Spark plug gap .125
_____ 3. Pipe train tightness and gas leaks
_____ 4. Flame sensor tight
_____ 5. Fuse in place, extra fuse provided
_____ 6. Time delay reset
_____ 7. Indicator light
_____ 8. Pressure gauge
_____ 9. Regulator adjusted
_____ 10. Shut off valve operates correctly
_____ 11. Vapor high limit
_____ 12. Unit cycles on to off
_____ 13. Heat rise even across transition
_____ 14. Unit cycles hi to lo (hi-lo only)
_____ 15. Mod valve holds temperature within 1 degree (mod units only).
_____ 16. All decals and serial number tag
_____ 17. Aesthetic appearance
_____ 18. Manual

Tester Signature_____

Date_____

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SAFETY GUIDELINES

This manual contains information that is important for you, the owner/operator, to know and understand. This information relates to protecting ***personal safety*** and ***preventing equipment problems***. It is the responsibility of the owner/operator to inform anyone operating or working in the area of this equipment of these safety guidlines.To help you recognize this information, we use the symbols that are defined below. Please read the manual and pay attention to these sections. Failure to read this manual and it's safety instructions is a misuse of the equipment and may lead to serious injury or death.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

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

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

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

CAUTION **CAUTION** used without the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage.

NOTE **NOTE** indicates information about the equipment that you should pay special attention to.

Introduction

Thank you for choosing a GSI product. It is designed to give excellent performance and service for many years.

This manual describes the operation of the Vane Axial Heater. It is designed for low to medium temperature grain conditioning, and is ideal for the aeration of rice, popcorn or other select grains. It is available in both propane vapor and natural gas models.

The principal concern of the The GSI Group Inc. ("GSI") is your safety and the safety of others associated with grain handling equipment. This manual is written to help you understand safe operating procedures, and some of the problems that may be encountered by the operator or other personnel.

As owner and/or operator, it is your responsibility to know what requirements, hazards and precautions exist, and to inform all personnel associated with the equipment, or who are in the dryer area. Avoid any alterations to the equipment. Such alterations may produce a very dangerous situation, where serious injury or death may occur.

If a decal is damaged or missing contact:
The GSI Group Inc.
1004 E. Illinois St.
Assumption, IL 62510
217-226-4421
A free replacement will be sent to you.

Roof Damage Warning And Disclaimer

GSI DOES NOT WARRANT ANY ROOF DAMAGE CAUSED BY EXCESSIVE VACUUM OR INTERNAL PRESSURE FROM FANS OR OTHER AIR MOVING SYSTEMS. ADEQUATE VENTILATION AND/OR "MAKEUP AIR" DEVICES SHOULD BE PROVIDED FOR ALL POWERED AIR HANDLING SYSTEMS. GSI DOES NOT RECOMMEND THE USE OF DOWNWARD FLOW SYSTEMS (SUCTION). SEVERE ROOF DAMAGE CAN RESULT FROM ANY BLOCKAGE OF AIR PASSAGES. RUNNING FANS DURING HIGH HUMIDITY/COLD WEATHER CONDITIONS CAN CAUSE AIR EXHAUST OR INTAKE PORTS TO FREEZE.

Heater Access Door Decals

Part Number: DC-1225
Size: 4.875” x 2.25”
Located above Access Door on heater housing.

See note below.

Part Number: DC-1227
Size: 4.875” x 2.25”
Located above Access Door on heater housing.

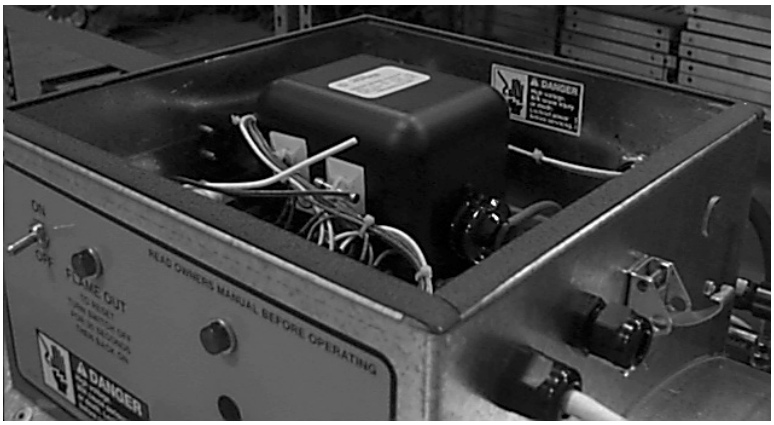
See note below.

Part Number: DC-113
Size: 4.75” x 1.625”
Located above Access Door on heater housing.

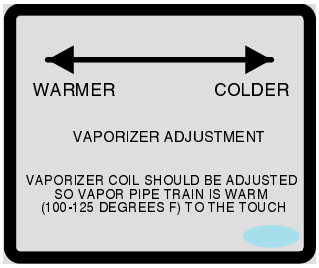
Note: May be substituted with DC-1559 Combination Decals

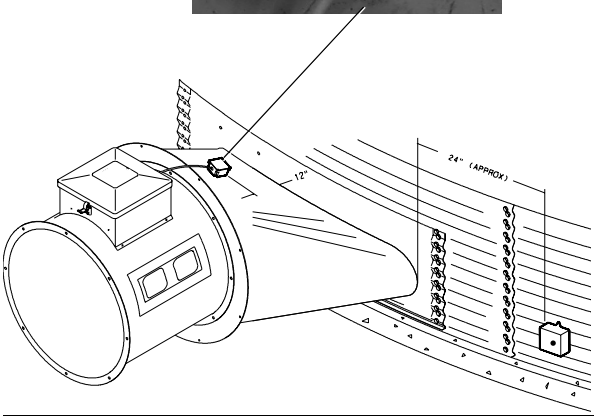
Control Box Decals

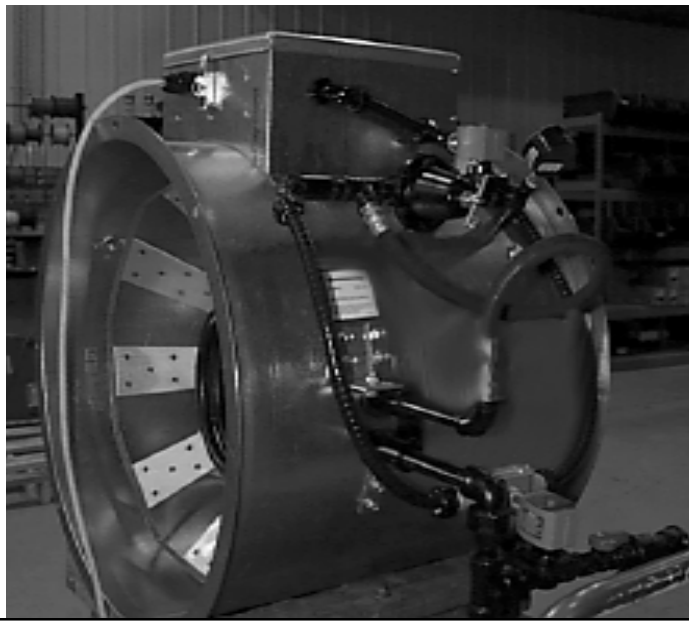
Part Number: DC-889
Size: 2.813” x 1.375”
Located in control box on side opposite switches.



Similar decal is incorporated into the Control Panel Decal.







Heater Specifications

Common Measurements

Fan Model	18"	24"	26"	28"
Inside Diameter (inches)	18-5/16	24-1/4	26-5/16	28-1/8
Bolt Circle Diameter (inches)	19-7/16	25-3/4	27-15/16	29-5/8
Length (inches)	22	22-1/2	22-1/4	25-1/4
Weight (pounds)	83	129	133	136

Vapor Models

Fan Model	18"	24"	26"	28"
Min. Operating Pressure (psi)	2	2	2	2
Max. Operating Pressure (psi)	15	10	15	20
Min. Supply Line (inches)	1/2	3/4	3/4	3/4
Medium Temp Orifice (inches)	11/64	15/64	15/64	15/64
Medium Temp BTU Rating @ Max. Pressure	1,400,000	2,100,000	2,700,000	3,000,000
Medium Temp Fuel Flow @ Max. Pressure (CFH)	585	877	1128	1253
Low Temp Orifice (inches)	3/32	3/32	3/32	3/32
Low Temp BTU Rating @ Max. Pressure	400,000	350,000	400,000	500,000
Low Temp Fuel Flow @ Max. Pressure (CFH)	167	146	167	208

Liquid Models

Fan Model	18"	24"	26"	28"
Min. Operating Pressure (psi)	n/a	2	2	2
Max. Operating Pressure (psi)	n/a	10	15	20
Min. Supply Line (inches)	n/a	3/8	3/8	3/8
Medium Temp Orifice (inches)	n/a	15/64	15/64	15/64
Medium Temp BTU Rating @ Max. Pressure	n/a	2,100,000	2,700,000	3,000,000
Medium Temp Fuel Flow @ Max. Pressure (CFH)	n/a	23	30	34
Low Temp Orifice (inches)	n/a	3/32	3/32	3/32
Low Temp BTU Rating @ Max. Pressure	n/a	350,000	400,000	500,000
Low Temp Fuel Flow @ Max. Pressure (CFH)	n/a	4	4.5	5.5

Natural Gas

Fan Model	18"	24"	26"	28"
Min. Operating Pressure (psi)	1	1	1	1
Max. Operating Pressure (psi)	7	4	5	7
Min. Supply Line (inches)	3/4	1	1-1/4	1-1/4
Medium Temp Orifice (inches)	17/64	3/8	3/8	3/8
Medium Temp BTU Rating @ Max. Pressure	1,400,000	2,100,000	2,700,000	3,000,000
Medium Temp Fuel Flow @ Max. Pressure (CFH)	1400	2100	2700	3000
Low Temp Orifice (inches)	11/64	15/64	15/64	15/64
Low Temp BTU Rating @ Max. Pressure	400,000	350,000	400,000	500,000
Low Temp Fuel Flow @ Max. Pressure (CFH)	400	350	400	500

Fuel Connection

DO NOT USE PROPANE TANKS WHICH HAVE PREVIOUSLY BEEN USED FOR AMMONIA UNLESS THEY HAVE BEEN PURGED ACCORDING TO PROCEDURES OF THE NATIONAL L.P. ASSOCIATION.

INVESTIGATE TO BE SURE THAT THE FUEL SUPPLY SYSTEM COMPLIES WITH ALL LOCAL CODES FOR L.P. GAS INSTALLATIONS.

Liquid Propane Models

1. LP models are designed to run on liquid pro pane, with liquid draw from the propane tank. Avoid using propane supply tanks that have been use for vapor draw for long periods of time. When using liquid draw systems any moisture that may be present in tank or lines may freeze when system is used in cold weather. To avoid this, the usual precaution is to purge the system with methanol.

2. Run proper size line (see specifications page) to pipetrain on heater. Have a qualified gas service person inspect installation to be sure everything is installed according to local codes and ordinances.

3. After installation is complete check all connections for leaks. Use liquid detergent or com parable substance. Wear rubber gloves and eye protection. Avoid contact with liquid propane. DO NOT USE FLAME FOR LEAK TESTING.

Propane Vapor Models

1. Propane vapor models are designed to run directly off of supply tank or from a separate external vaporizer.

2. Run proper size line (see specifications page) to pipetrain on heater. Have a qualified gas service person inspect installation to be sure everything is installed according to local codes and ordinances.

3. After installation is complete check all connections for leaks.

Natural Gas Models

1. Natural gas models are similar to vapor models, but have a larger orifice to accommodate lower pressure, sometimes found with natural gas.

2. Run proper size line (see specifications page) to pipetrain on heater. Have a qualified gas service person inspect installation to be sure everything is installed according to local codes and ordinances.

3. After installation is complete check all connections for leaks.

Standard Heater Electrical Installation

ALWAYS DISCONNECT AND LOCK OUT POWER
BEFORE WORKING ON OR AROUND HEATER.

Standard electrical safety practices and codes should be used when working with a heater. Refer to the National Electric Code Standard Handbook by the National Fire Protection Association. *A qualified electrician should make all wiring installations.*

Heater Power Connection

1. Connect power cord to fan control box.
2. Make field connections in fan box as shown below.
3. Connect deluxe thermostat control as shown below.

HEATER MUST BE INTERLOCKED
WITH FAN FOR SAFE OPERATION.

THERMOSTAT MUST BE INSTALLED
FOR SAFE OPERATION.

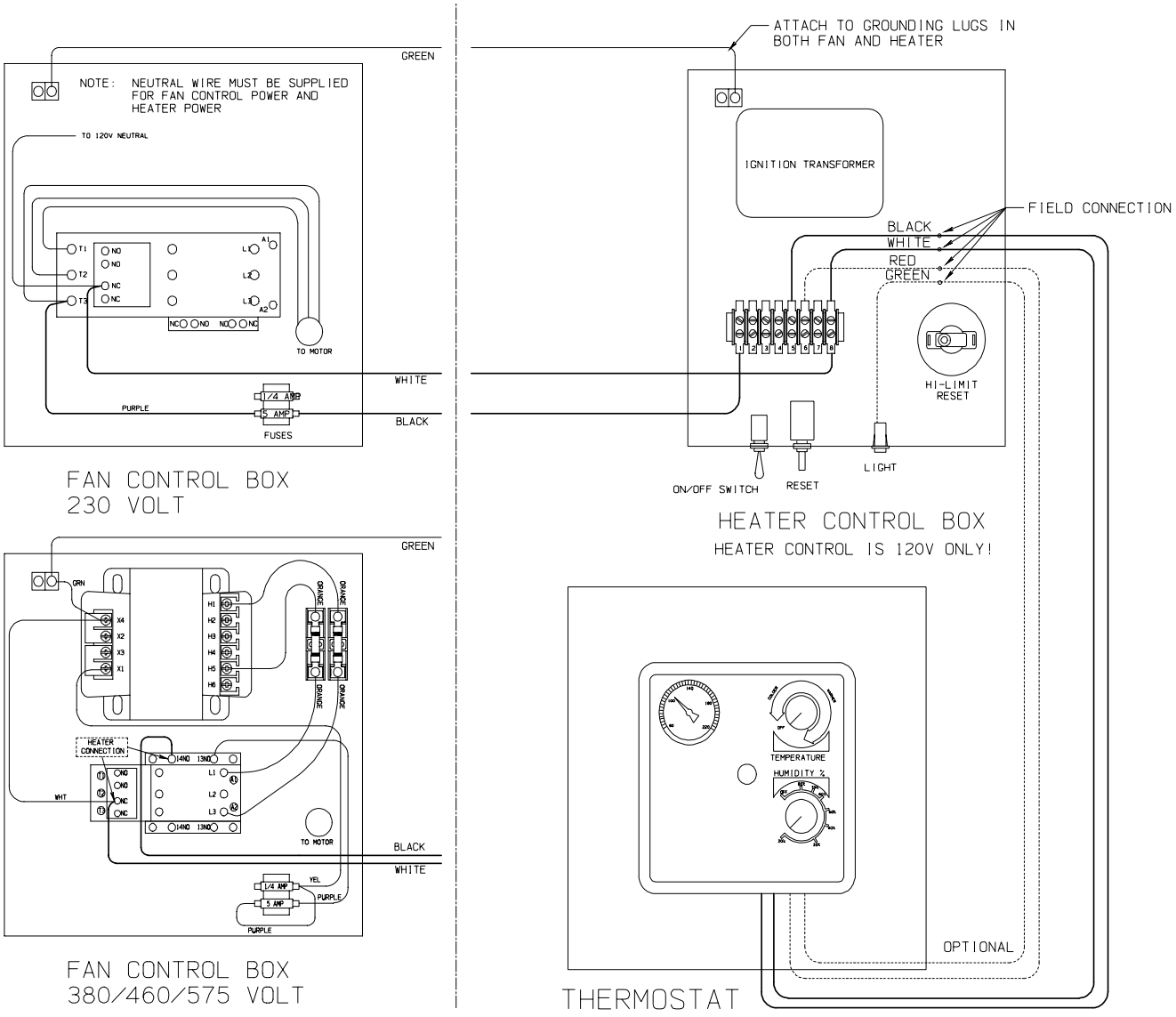


Illustration of Standard Vane Axial Heater wiring installation on a fan unit.

Standard Heater - Second Heater Installation

Two standard heaters may be connected to one grain drying system and wired so they cycle together. One of the heaters should have a thermostat connected to it as per the installation instructions. That heater will be referred to as the master. The other heater (without the thermostat) will be referred to as the slave.

1. Install relay base (TD-100283) in master heater control box.
2. Connect wire between terminal 13 on relay base to terminal 7 on terminal strip in master heater.
3. Connect wire between terminal 14 on relay base to terminal 8 on terminal strip in master heater.
4. Run 2 wires (18 gauge) between master and slave heater.
5. Connect wires to terminals 5 and 9 (points A and B) on relay base in master heater.
6. Connect wire from terminal 9 in master to terminal 5 (point F) in slave unit.
7. Connect wire from terminal 5 in master to terminal 8 (point G) in slave unit.
8. Install relay (TD-100282) in relay base.

Follow these additional steps for HI-LO units.

1. Install relay base (TD-100283) in master heater control box.
2. Connect wire between terminal 13 (point E) on relay base to green wire from HI-LO thermostat in master unit. Do not disconnect other wires from green wire 3. Connect wire between terminal 14 on relay base to terminal 14 on other relay base in master heater.
4. Run 2 wires (18 gauge) between master and slave heater.
5. Connect wires to terminals 5 and 9 (points C and D) on relay base in master heater.
6. Connect wire from terminal 9 in master to terminal 6 (point H) in slave unit.
7. Connect wire from terminal 5 in master to cycle solenoid and red light in slave unit. Do not connect wire to side of cycle solenoid and light that are connected to terminal.

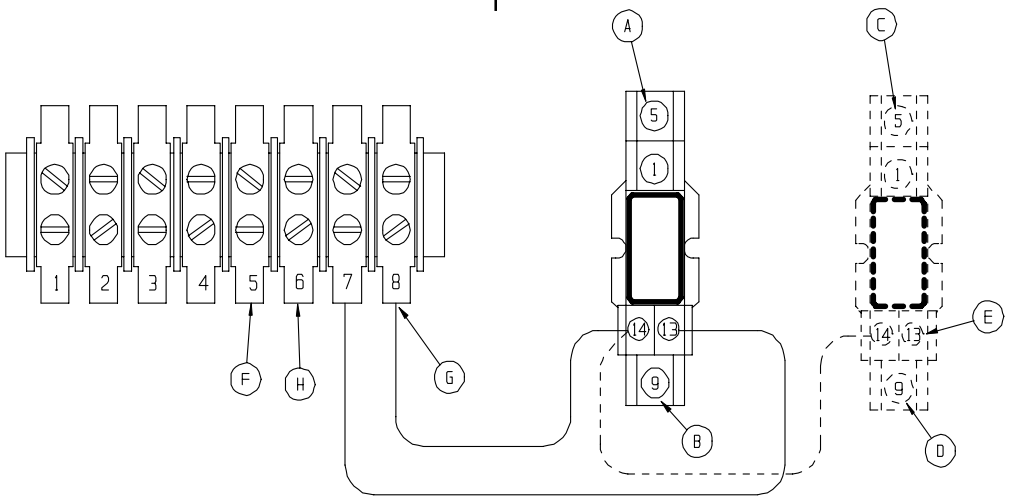


Figure 2: Illustration of second heater wiring.

Deluxe Heater Electrical Installation

ALWAYS DISCONNECT AND LOCK OUT POWER
BEFORE WORKING ON OR AROUND HEATER.

Standard electrical safety practices and codes should be used when working with a heater. Refer to the National Electric Code Standard Handbook by the National Fire Protection Association. *A qualified electrician should make all wiring installations.*

Heater Power Connection

1. Connect power cord to fan control box.
2. Make field connections in fan box as shown below.
3. Connect deluxe thermostat control as shown

HEATER MUST BE INTERLOCKED
WITH FAN FOR SAFE OPERATION.

THERMOSTAT MUST BE INSTALLED
FOR SAFE OPERATION.

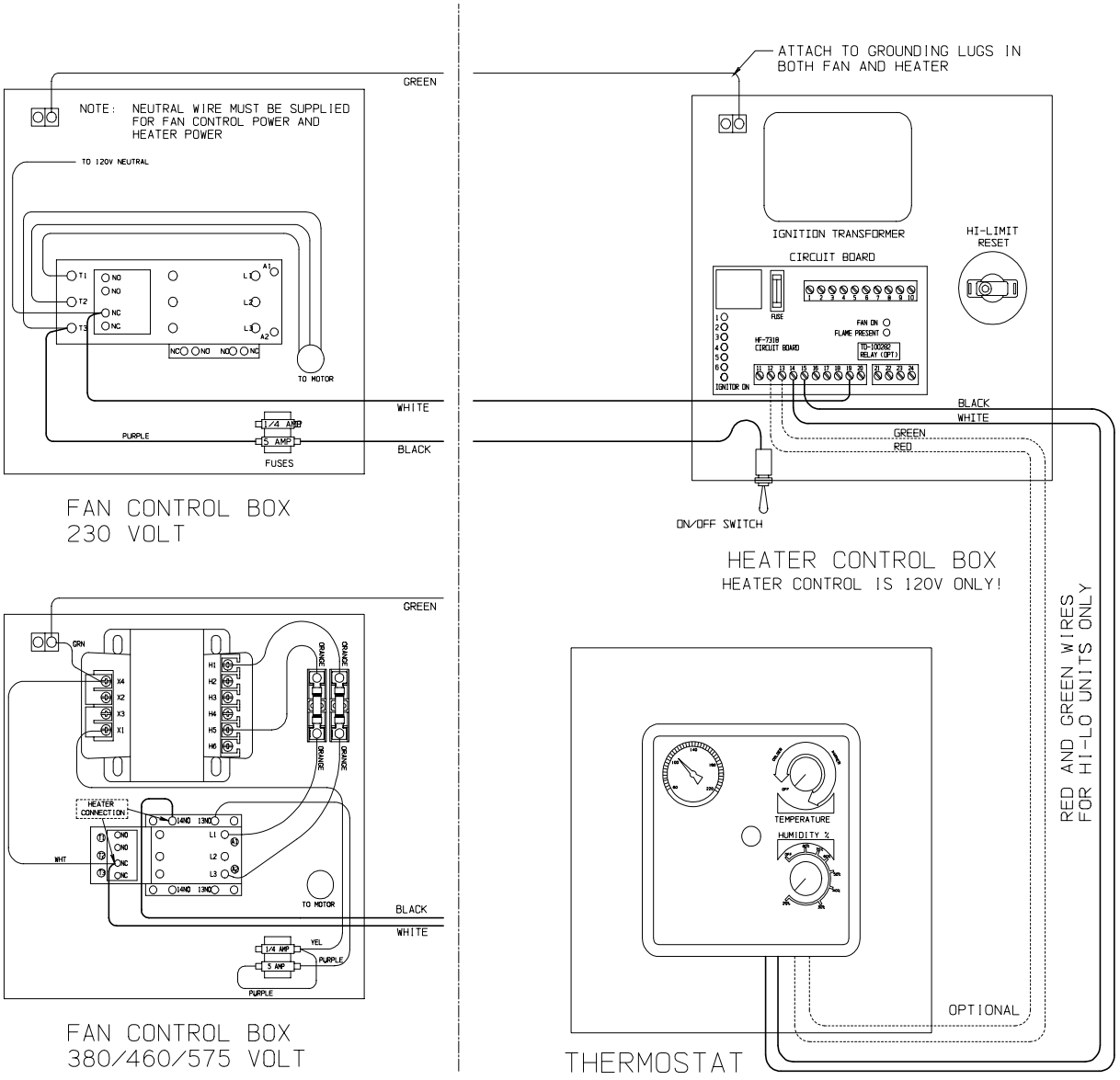


Illustration of Deluxe Vane Axial Heater wiring installation on a fan unit.

Deluxe Heater - Second Heater Installation

For Deluxe Units Using HF-7318 Control Board

2 Deluxe heaters may be connected to one grain drying system and wired so they cycle together. One of the heaters should have a thermostat connected to it as per the installation instructions. That heater will be referred to as the master. The other heater (without the thermostat) will be referred to as the slave.

Installation For On/Off Units

1. Install relay base (TD-100283) in master heater control box.
2. Connect wire between term 6 on circuit board and terminals 14 on relay base in master heater.
3. Connect wire between term 13 on relay base and terminals 8 on circuit board in master heater.
4. Run 2 wires (18 gage) between master and slave heaters.
5. Connect wires to terminal 5 and 9 (points A and B) on relay base in master heater.
6. Connect wire from terminal 9 in master to terminal 14 (point F) in slave unit.
7. Connect wire from terminal 5 in master to terminal 15 (point E) in slae unit.
8. Install relay (TD-100282) in relay base.

Additional Steps For Hi-Lo Units

1. Run 2 wires (18 gage) between master and slave unit.
2. Connect wires to terminals 21 and 22 (points C and D) on circuit board in main heater.
3. Connect wire from terminal 21 in master to terminal 12 (point H) in slave unit.
4. Connect wire from terminal 22 in master to terminal 13 (point G) in slave unit.
5. Install relay (TD-100282) in relay base.

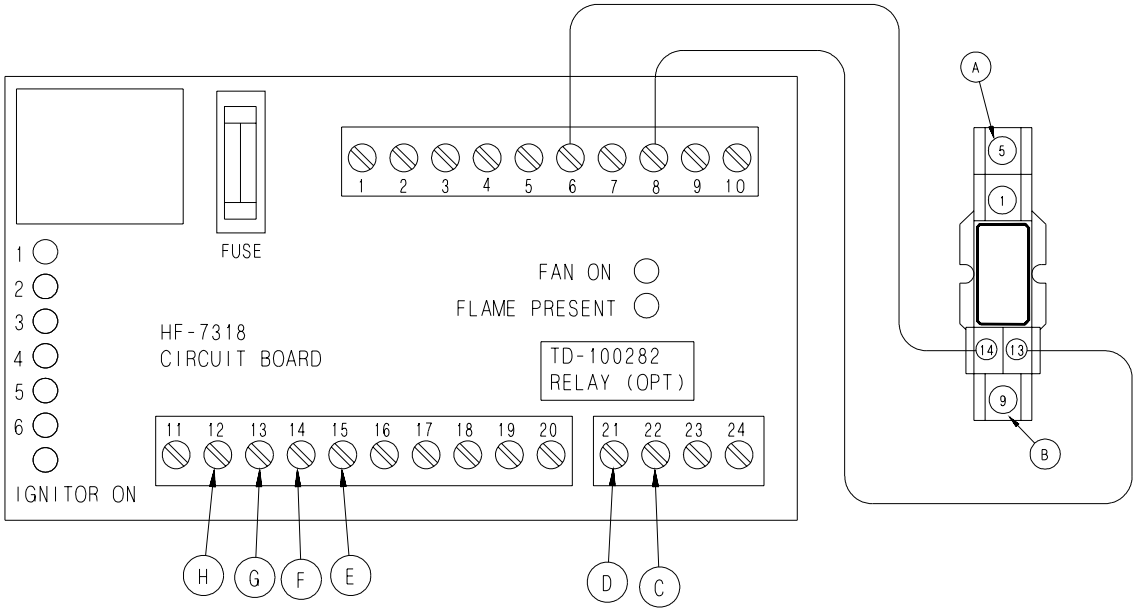
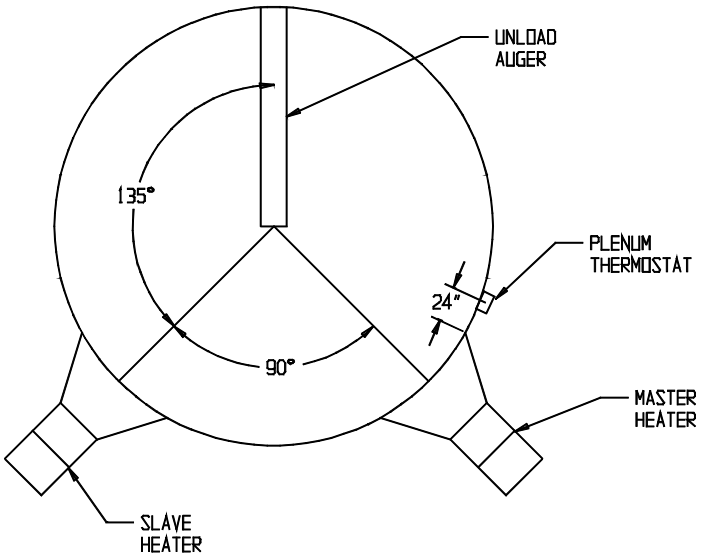


Figure 4: The HF-7318 control board.

Bin Configuration



WHEN MOUNTING (2) HEATERS ON A BIN IT IS IMPERATIVE THAT THEY BE SITUATED AS IN ABOVE DRAWING. PLENUM THERMOSTAT MUST BE TO THE RIGHT OF MASTER HEATER AND MASTER HEATER MUST BE TO THE RIGHT OF SLAVE HEATER.

Transition Hi-limit Installation

1. Mark location on transition one (1) foot up from the bottom (entrance collar) and centered in the transition.
2. Drill or knock out 7/8" diameter hole on marked location.
3. Install transition hi-limit using supplied self drilling screws.

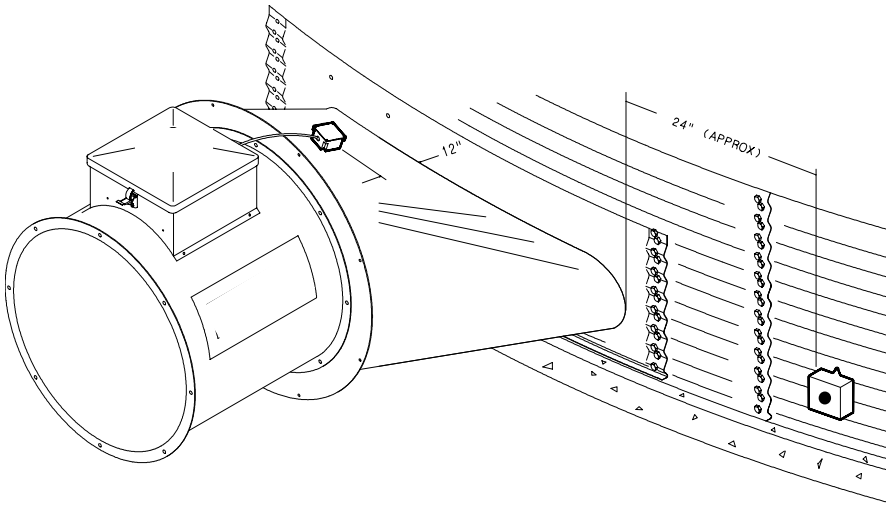


Figure 2: The transition connecting the Vane Axial Heater to the bin with the plenum sensor in place.

Plenum Thermostat Mounting

The plenum thermostat must be ordered separately from the heater unit.

1. Follow installation instructions provided with the Thermostat Assembly.

2. Position the housing so that the bolt flanges are vertical, and the cord exits the housing from the bottom. Mark position.

3. Use 6 (4.00") or 8 (2.66") self drilling screws to mount the housing to the bin sidewall. DO NOT TIGHTEN COM PLETELY. Insert corrugation seal into gap between housing and sidewall. Tighten screws.

4. Caulk between the housing and the sidewall to seal.

Plenum thermostat mounted on bin wall.

THERMOSTAT MUST BE INSTALLED FOR SAFE OPERATION.

Side view of themostat showing corrugation seal.

HILO Kit Installation

HILO Kit Contents

D03-0247	WIRE TIE 5"PANDUIT #PLT1.5M-M	EA	12
E106-1011	CRIMP,0.187"DISCONNECT SLIP-ON	EA	2
FH-7038	SEALTITE PVC 3/8"	EA	1
FH-7049	SEAL 3/8 STRAIGHT PVC W/NUT	EA	2
HF-7563	SEALANT TFE PIPE THREAD (3 OZ)	EA	1
TFH-2021	LIGHT RED NEON NO LEADS 125VAC	EA	1
WR-18BLK	WIRE 18 GA BLACK STRANDED	FT	1
WR-18WHT	WIRE 18 GA WHITE STRANDED	FT	1
HILO PIPETRAIN	HILO PIPETRAIN	EA	1

1. Remove contents from HILO package and verify that all contents are correct.

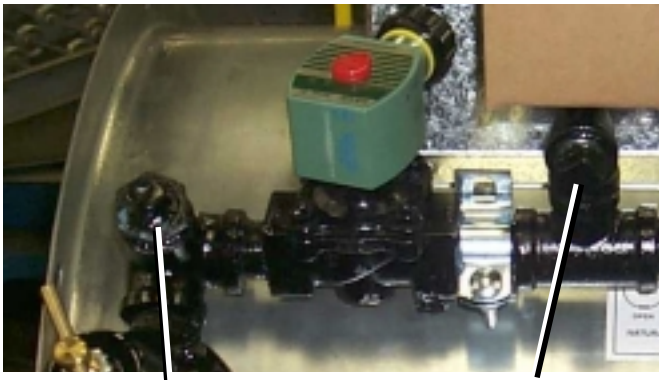


Photo 1

2. Remove TWO ½ ” NPT plugs from pipetrain on heater. (Plugs A & B, Photo 1)

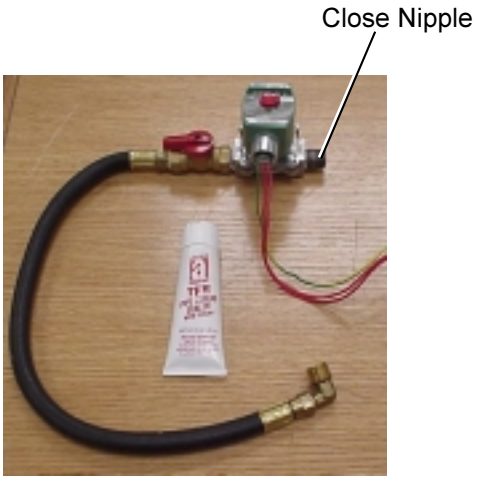


Photo 2

3. Apply a sufficient amount of pipe thread sealer to ½” close nipple on outgoing side of solenoid valve on HILO kit pipe train. (Photo 2)

4. Insert the Close Nipple (Photo 2) of the HILO pipetrain into heater pipetrain where Plug B (Photo 1) was removed. Tighten HILO pipetrain securely to heater pipetrain with a pipe wrench.

5. Apply pipe thread sealer to the ½” gas hose at the opposite end of the HILO train.

6. Insert gas hose where Plug A (Photo 1) was removed from the heater pipetrain. Tighten the hose securely to the heater pipetrain.

7. Assemble conduit and fittings onto the solenoid valve on the HILO pipe train.

8. Pull conduit and wires from solenoid up to control box and mark where the hole location will be.

9. Drill a 7/8” hole in the control box at this location and assemble conduit and wires through this hole.

10. Remove solenoid wire from terminal 8 (Photo 3) on the circuit board and move it to terminal 10 (Photo 3).

HILO Kit Installation

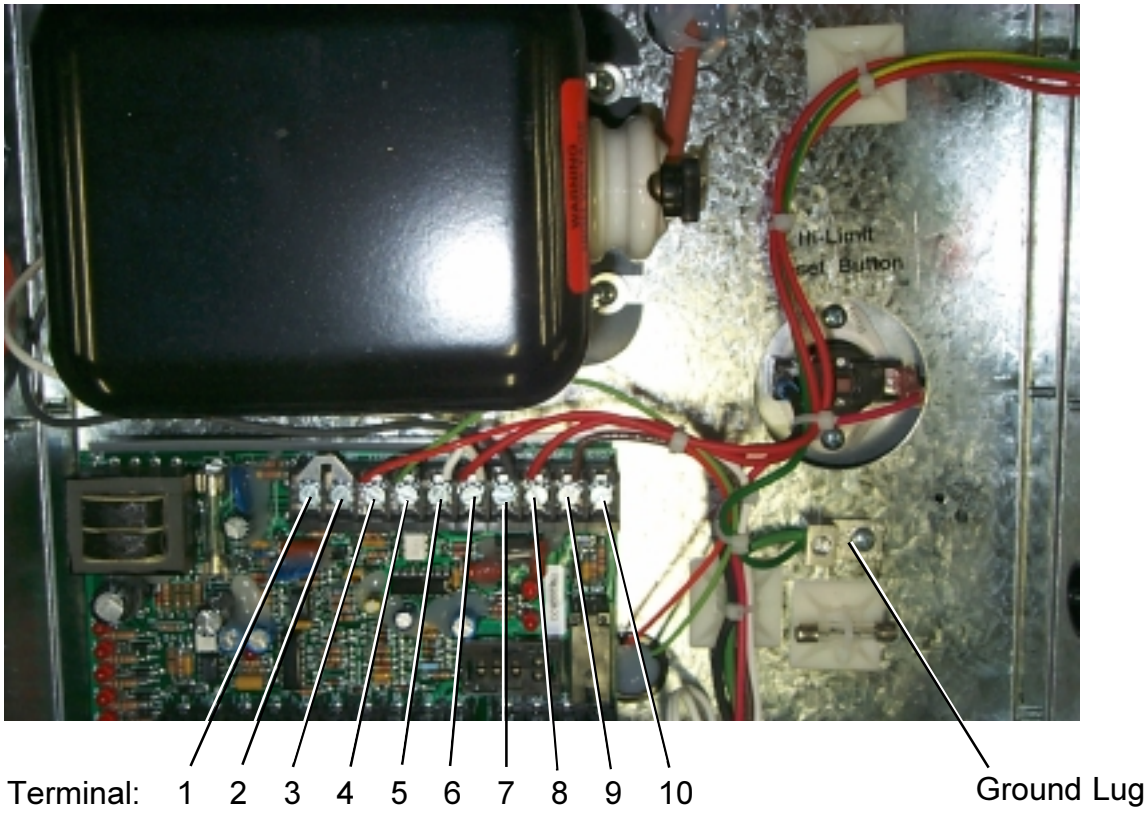


Photo 3

11. Place one of the red wires from the solenoid on the HILO pipetrain on terminal 8 (Photo 3) and the other red wire from that solenoid to terminal 5 or 6 (Photo 3). Place the green wire from the solenoid into one of the ground lugs located in the bottom of the control box.

12. You will now need to remove the black hole plug from the front of the control box located under the main indicator light. (see Photo 4)

13. Insert the red light into this hole.

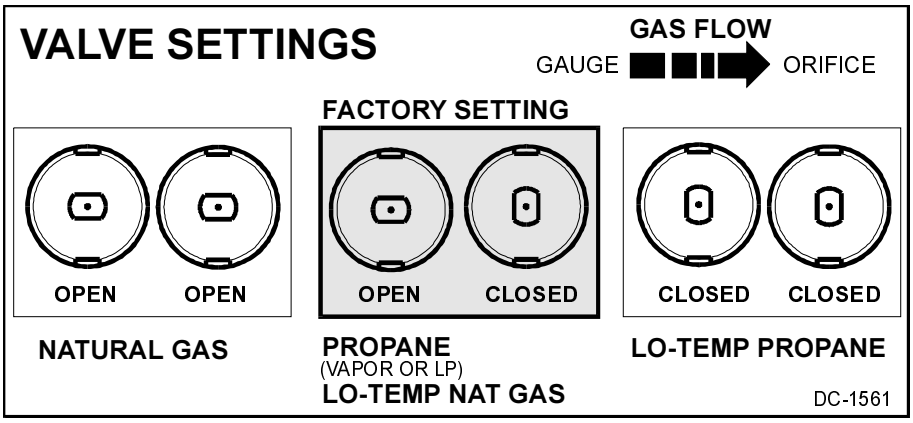
14. Connect one side of the light to terminal 10 (Photo 3) with the black wire and .187 female slip on provided in the kit. Connect the other side of the light to terminal 5 or 6 (Photo 3) with the white wire and .187 female slip on connector.

15. Your HILO kit is now installed. Be sure to check all connections for secureness and check pipe train for leaks.

Photo 4

QUAD HEATER VALVE SETUP

THE FACTORY HAS SET THE VALVES FOR PROPANE, HIGH TEMPERATURE.



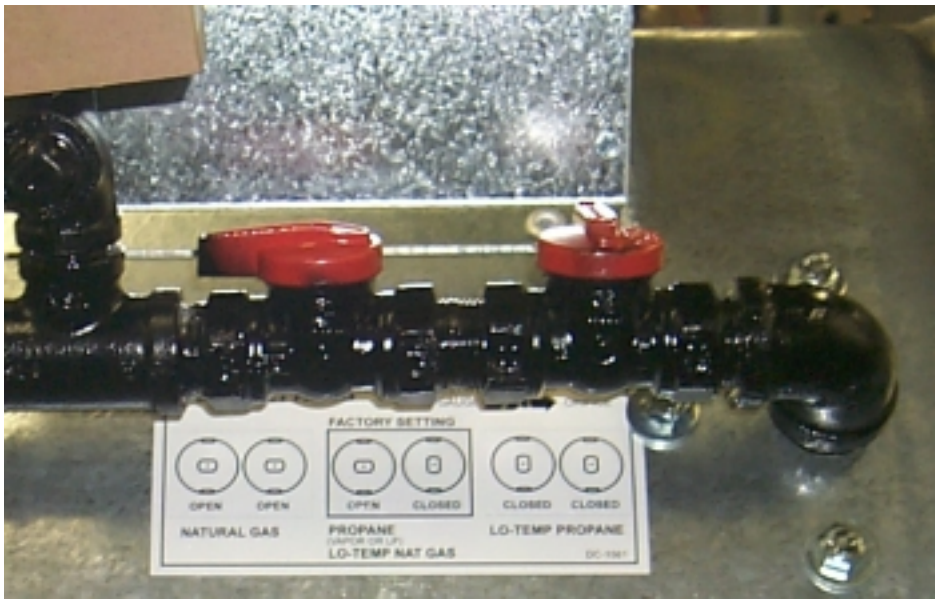
1. Determine the type of gas to be used. Propane or Natural Gas.

2. Determine the operating temperature ranges to be used. High or Low temp.

3. Remove Orifice Valve Cover from the heater.

4. Configure the heater to the proper gas type by aligning the valves with a wrench or pliers according to the Valve Settings Label or the chart at right.

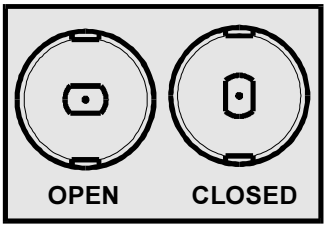
5. Replace the cover onto the heater and operate as instructed.



Orifice Valves installed on heater and configured for Propane.

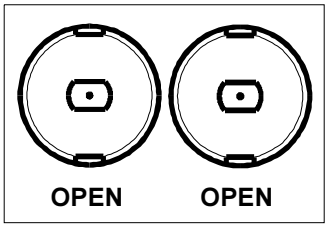
QUAD HEATER VALVE SETUP

Orifice Valve Settings



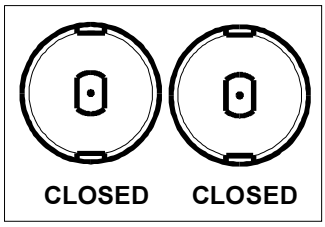
Propane / Low Temperature Natural Gas

The valve right is closed while the valve on the left remains open.



Natural Gas

Both valves are open.



Low Temperature Propane

Both valves are closed.

CAUTION DO NOT USE NATURAL GAS CONFIGURATION WITH PROPANE. PROPANE HAS A HIGHER BTU CONTENT THAN NATURAL GAS. EXCESSIVE HEAT RISE WILL DAMAGE GRAIN OR CAUSE FIRE.

Operating Temperature Table

THIS TABLE IS NOT INTENDED AS A DRYING GUIDE. IT SHOULD BE USED AS A REFERENCE FOR SETTING MAXIMUM PLENUM TEMPERATURE FOR SAFE OPERATION.

DO NOT EXCEED PLENUM TEMPERATURES LISTED IN TABLE

	LO-TEMP BATCH	HIGH-TEMP BATCH DRY NO STIRRING	HIGH-TEMP WITH STIRRING	CONTINUOUS FLOW (RECIRCULATING)
CORN	5-20^0 ABOVE AMBIENT TEMP	120^0	140^0	160^0
RICE	5-10^0 ABOVE AMBIENT TEMP	100^0	100^0	NOT RECOMMENDED
BEANS & WHEAT	5-20^0 ABOVE AMBIENT TEMP	110^0	120^0	NOT RECOMMENDED

Cycling Heater Operation

1. Thermostat must be wired into heater control box for heater to operate.
2. Open all manual shutoff valves to heater unit.
3. Start fan. This will supply power to heater.
4. Turn thermostat dial to its highest setting.
5. Turn toggle switch on.
6. Heater should now be lit. If not check to see that all gas is on.
7. Watch thermometer on plenum and when it reaches desired temperature turn thermostat back slowly until heater cycles off.
8. Gas pressure should be adjusted so burner is on 75% of the time.
9. Watch plenum temperature as burner goes through a few cycles, to be sure that it is operating properly.

Hi-Lo Heater Operation

1. Hi-limit and cycling thermostat must be wired into heater control box for heater to operate.
2. Open all manual shutoff valves to heater unit.
3. Start fan. This will supply power to heater.
4. Turn thermostat dial to its highest setting.
5. Turn toggle switch on. Both red lights should light up indicating power to the control circuit.
6. Heater should now be lit. If not check to see that all gas is on.
7. Open low-fire ball valve all the way.
8. Turn thermostat dial back slowly until heater cycles to low flame.
9. Adjust ball valve so that low-flame pressure is at desired setting. (As low as possible)
10. Turn thermostat dial to desired setting and wait for bin plenum to come up to temperature. Heater should cycle to low flame after a few minutes.
11. If heater does not cycle to low flame increase hi-flame gas pressure by adjusting the regulator.
12. High flame should be adjusted so the heater cycles 75% of the time. Low-flame should be adjusted so there is enough flame for unit to keep operating.
13. Watch as burner goes through a few cycles, to be sure that it is operating properly back to high flame.

Modulating Valve Operation

1. The modulating valve regulates gas flow through the heater based on sensing unit in the plenum, and maintains a constant drying air temperature.

2. The sensing bulb of the modulating valve should be mounted through the bin wall with the side reading "top" up. The bulb reacts to temperature. It changes the amount of gas (increase or decrease), burning warmer or cooler depending on the position of the valve SET POINT. If the bulb is cooler than it was at the SET POINT, the bulb senses the cooler temperature and opens the valve further so more heat is applied to the dry ing air. If the bulb is warmer than it was at the SET POINT, the valve closes further and reduces the temperature until the air is at the valve SET POINT.

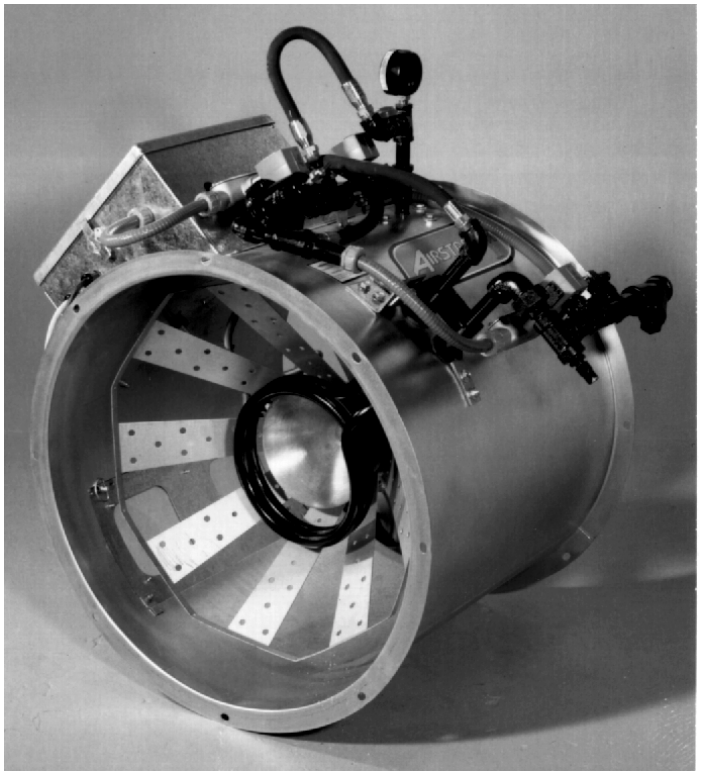
3. It is important that the pressure regulator be set high enough to allow the modulating valve to deliver enough gas to maintain the plenum temperature necessary. The regulator is normally factory set at 15 psi (propane units). To set the regulator, run the heater and turn the modulat ing valve T-handle in. This gets full line pressure to the burner. Then adjust regulator to read 15 psi (depending on the plenum temperature needed).

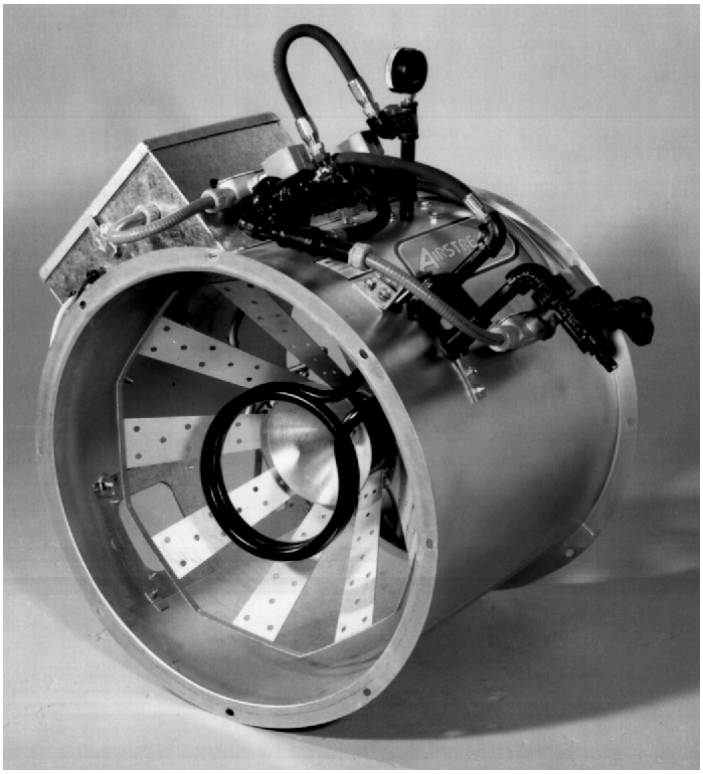
4. Turn the fan and heater on. To set the modulating valve, turn the T-handle out (counterclockwise) until loose and wait a few minutes for the plenum temperature to equalize. When the temperature under the bin has equalized, gradually turn T-handle in (clockwise) about 1/2 turn at a time. Wait until temperature under bin has equalized as before. If temperature under bin is less than the desired temperature, continue turning T-handle in, increasing gas flow and waiting for plenum temperature to equalize until the desired temperature is the stable temperature of the ple num. If temperature under bin is the same 10 minutes after you last made any adjustments to the T-handle you can be certain that the temperature under the bin is the SET POINT of the valve. **1 turn of the T-handle equals approximately 7 degrees F of temperature.**

5. The valve will now keep the plenum temperature at the set point regardless of ambient conditions as long as humidistat or thermostat do notshut down the heater. A bypass orifice is used to maintain a small flame when outside temperature is near or above the set point of the valve. The bypass insures steady application of heat at minimum gas flow operation. By pass orifice will only operate correctly if pressure regulator is set correctly.

6. To observe how the modulating valve increases the efficiency of bin drying, check the gas pressure of the unit in the morning and compare to the pressure read mid-afternoon. If the ambient (outside) temperature is significantly greater later in the day (as normal), the gas pressure will be less. Since less heat is re quired to maintain the same temperature in the plenum, the modulating valve will have re duced the amount of gas used by the heater.

Adjusting the Vaporizor





Adjusting the vaporizer coil on a liquid propane model. The top photo shows the setting in, and the bottom photo shows the coil out.

1. Vaporizer should be adjusted so the vapor pipetrain runs warm to the touch (100°-120°F).

2. Loosen 5/16" bolt on adjustment bracket.

3. Swivel vaporizer away from flame if running too hot, closer to flame if too cold.

4. Move vaporizer only 1" at a time and allow a few minutes for temperature to equalize.

5. Tighten 5/16" bolt and watch heater run for several minutes to verify adjustment.

BTUs Per Gauge Pressure (psi) - Propane Models (Approximate)

Medium Temperature

	Operating Pressure (psi)									
Diameter	**2**	**4**	**6**	**8**	**10**	**12**	**14**	**16**	**18**	**20**
18"	502,530	710,721	871,052	1,007,453	1,124,710	1,230,002	1,328,115	1,419,049	1,502,804	1,591,345
24",26",28"	935,663	1,318,543	1,617,668	1,868,933	2,091,482	2,285,315	2,467,183	2,637,086	2,792,631	2,955,355

Low Temperature

	Operating Pressure (psi)									
Diameter	**2**	**4**	**6**	**8**	**10**	**12**	**14**	**16**	**18**	**20**
All Models	148,366	210,584	258,444	299,125	335,020	366,129	394,845	421,168	447,491	473,814

Gauge Pressure (psi) Required to Maintain Temperatures (Approximate)

(Shaded Areas Represent Low Temperature Settings)

Fan Model	Static Pressure	Heat Rise Degrees F						
		60	**80**	**100**	**120**	**140**	**160**	**180**
3HP-18"	1"	10	2	3	4	5	7	8
	2"	6	10	2	2	3	4	5
	3"	2	3	5	6	8	10	14
5HP-24"	1"	10	1	1	1	2	2	3
	2"	6	10	14	1	1	1	2
	3"	2	3	4	6	8	10	14
7HP-24"	1"	2	3	4	5	7	9	12
	2"	2	2	3	4	5	6	8
	3"	1	1	2	3	3	4	5
	4"	5	9	14	20	1	1	2
10HP-24"	1"	2	3	5	6	8	12	14
	2"	2	3	4	5	7	9	12
	3"	1	2	3	4	5	6	7
	4"	12	20	1	1	2	3	3
	5"	4	7	12	15	20	1	1
15HP-26"	1"	3	4	6	9	12	14	20
	2"	2	3	5	7	10	12	16
	3"	2	3	4	5	7	9	12
	4"	1	2	3	3	5	6	7
	5"	14	1	1	2	2	3	4
15HP-28"	1"	4	7	10	14	20	25	30
	2"	3	6	8	12	16	20	25
	3"	3	5	7	10	14	18	20
	4"	2	4	5	8	10	14	16
	5"	2	3	4	5	7	9	12

BTUs Per Gauge Pressure (psi) - Natural Gas Models (Approximate)

Medium Temperature

	Operating Pressure (psi)						
Diameter	1	2	3	4	5	6	7
18"	562,000	798,000	975,000	1,125,000	1,258,000	1,379,000	1,490,000
24",26",28"	1,121,000	1,590,000	1,943,000	2,241,000	2,506,000	2,749,000	2,970,000

Low Temperature

	Operating Pressure (psi)						
Diameter	1	2	3	4	5	6	7
18"	235,000	334,000	408,000	471,000	527,000	578,000	624,000
24",26",28"	437,000	621,000	759,000	875,000	978,000	1,073,000	1,159,000

Gauge Pressure (psi) Required to Maintain Temperatures (Approximate)

(Shaded Areas Represent Low Temperature Settings)

Fan Model	Static Pressure	Heat Rise Degrees F						
		60	80	100	120	140	160	180
3HP-18"	1"	3	4	1	2	2	3	4
	2"	2	2	3	4	1	2	2
	3"	1	1	2	2	2	3	3
5HP-24"	1"	1	2	2	3	4	5	6
	2"	1	1	1	2	2	3	3
	3"	1	1	1	1	1	1	1
7HP-24"	1"	3	5	2	2	3	3	4
	2"	2	4	6	2	2	3	3
	3"	2	3	4	5	6	2	2
	4"	1	1	1	2	2	2	3
10HP-24"	1"	4	6	2	3	3	4	5
	2"	3	5	2	2	3	3	4
	3"	3	4	5	2	2	2	3
	4"	1	2	2	3	4	5	6
	5"	1	1	1	1	2	2	2
15HP-26"	1"	5	2	2	3	4	6	7
	2"	4	2	2	3	4	5	6
	3"	3	5	2	2	3	3	4
	4"	2	4	5	2	3	3	3
	5"	1	2	3	4	5	6	2
15HP-28"	1"	2	3	4	5	7	9	12
	2"	1	2	3	4	6	7	9
	3"	6	2	3	4	5	6	8
	4"	4	2	2	3	4	5	6
	5"	3	5	2	2	3	3	5

All heaters are constructed of durable weather-resistant materials, so a minimum amount of service should be required. Before the unit is started for the first time each season there are a few items that need to be checked out. All damaged parts should be repaired or replaced.

1. Disconnect and lockout power to fan and heater. Open control box lid and inspect all components for moisture, vibration or rodent damage. Inspect and tighten all loose terminal connections. Replace any damaged wiring.

2. Remove burner orifice tube and inspect for dirt or foreign material. Clean out if necessary.

3. Inspect holes in burner ring for possible corrosion or plugging with dirt or rust. Clean if necessary.

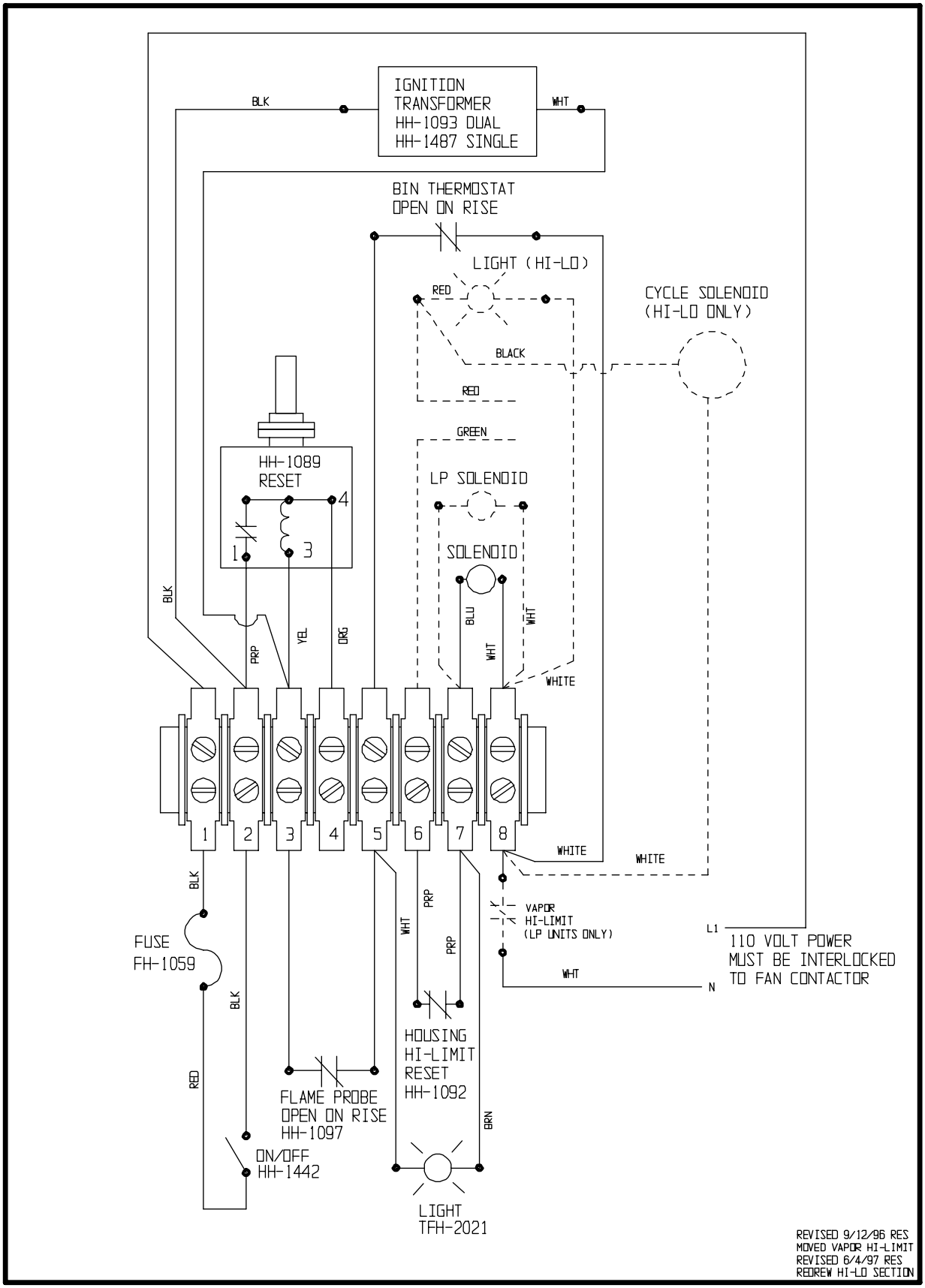
4. Be sure primary air inlet screen is intact and clean for proper burn.

5. Check perforated ring on natural gas models to be sure it is clean and no holes are plugged.

6. Inspect flame probe and ignitor and adjust or replace if necessary.

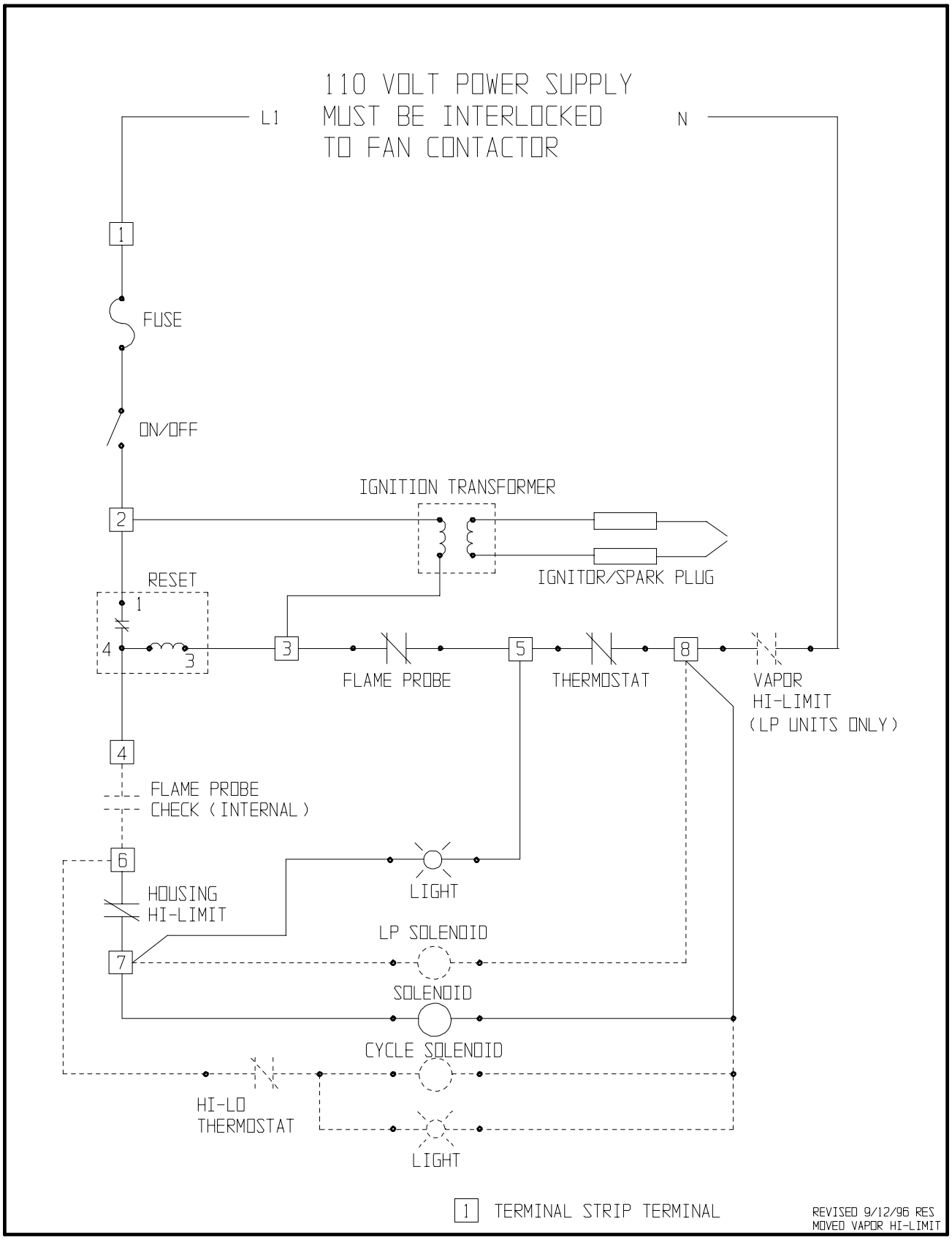
ALWAYS DISCONNECT AND LOCK OUT POWER BEFORE WORKING ON OR AROUND HEATER

Standard Heater Wiring



Note: Move transformer wire from terminal 3 to terminal 8 for contiunous spark.

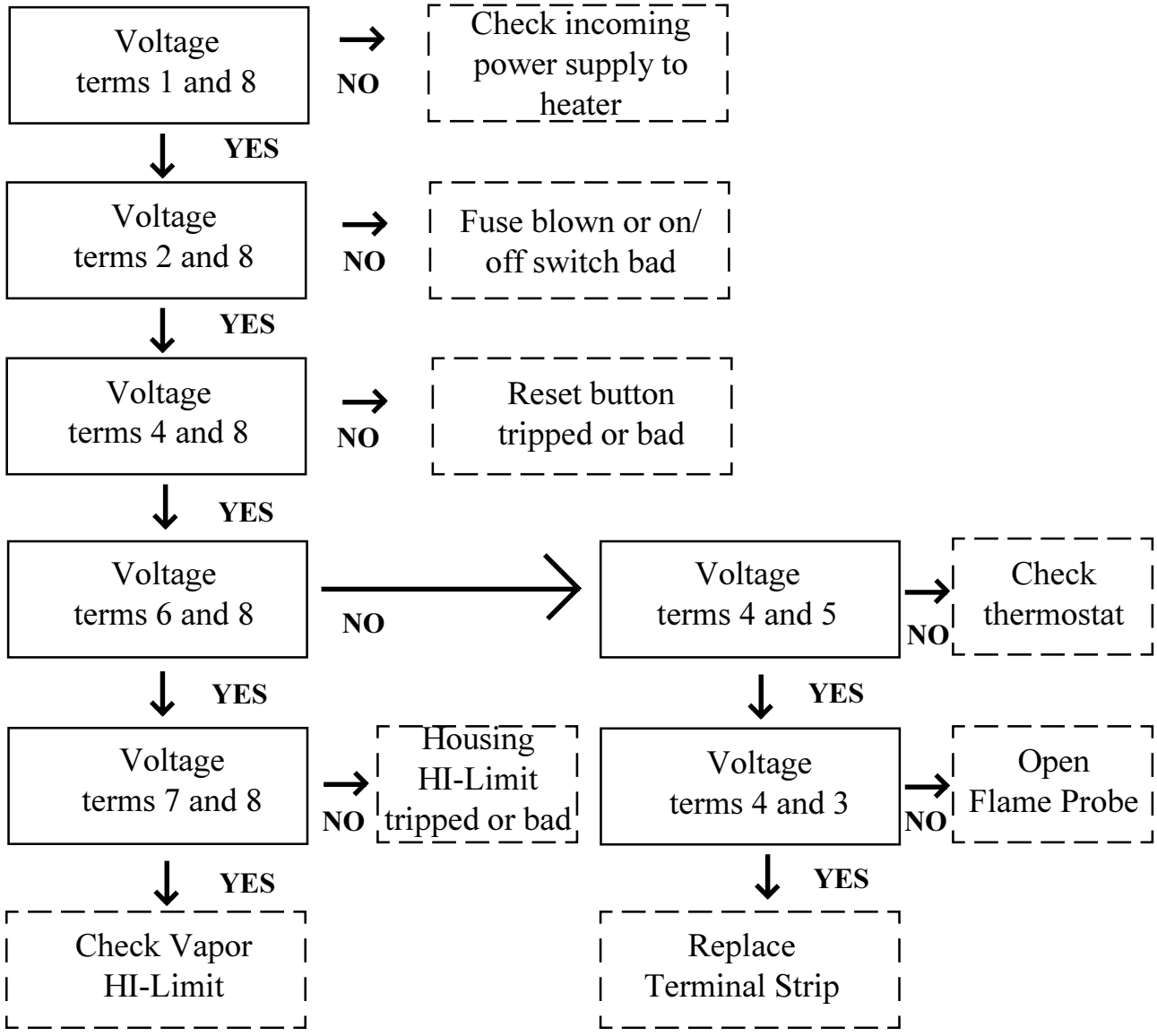
Standard Heater Schematic



Note: Move transformer wire from terminal 3 to terminal 8 for contiunous spark.

Standard Heater Troubleshooting Guide

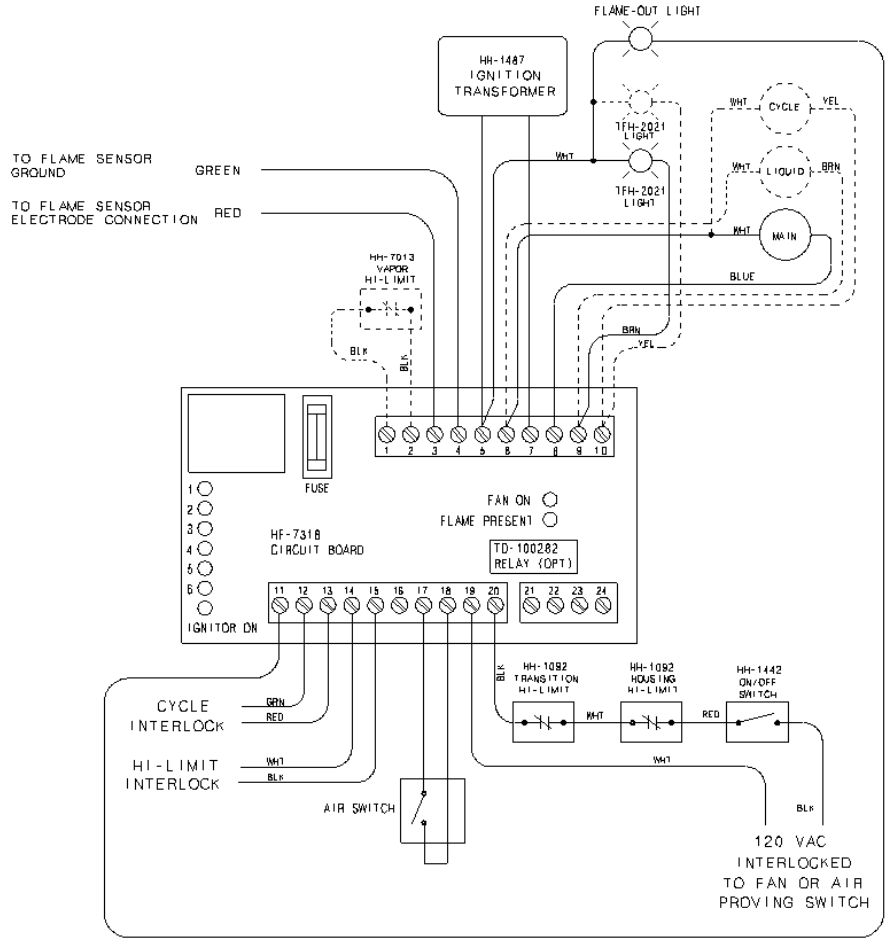
This chart should be used step by step to troubleshoot heater if heater does not start immediatly after turning on switch. This troubleshooting flow chart requires use of a voltmeter to check for 110 volts on designated terminals on terminal strip in heater. **Always use voltmeter to check between terminals that are designated not between terminals and ground.**



Standard Heater Troubleshooting Chart

Trouble	Probable Cause	Check-out Procedure
Burner will not fire. No gas pressure on gage. No ignition spark.	Heater not wired in	Visually check fan control box to see if wires are connected.
	Fan not running	Fan contactor must be energized for heater to run.
	Blown fuse Bad on/off switch	Visually check fuse. Check for power on terminals 2 and 8. If no power, check on/off switch.
Burner will not fire. No gas pressure on gage. Ignition spark is constant.	Housing high-limit switch	Reset switch. With fan running check for 110V power between terms 7 and 8.
	Flame probe open	Remove wires from flame probe and check with ohm meter. Probe should be closed when cold.
	Reset switch	Reset switch. If switch will not reset after 60 seconds replace. If reset button pops out again after 30-60 seconds check flame probe to see that it is getting hot. If flame probe appears to be getting hot, then replace the flame probe.
	Gas supply	Make sure all valves are on to heater and gas tank is not empty.
Burner will not fire. Gas pressure on gage. No ignition spark.	Terminal strip	Turn power off to heater. Connect flame probe wires together. Check for power on terms 6 and 8. If no power is present, check for power on terms 4 and 8. If power is present, replace terminal strip.
	Ignitor/spark plug	Turn gas off to heater. Check gap on ignitor. Check porcelain for any sign of cracks. Remove plug wire from spark plug/ignitor. Carefully holding plug wire by insulation. Try to get an arc between end of wire and heater housing (or other wire if using 2 pole transformer).
	Ignition transformer/plug wire	Turn gas off to heater. If no spark present after checking ignitor, remove spark plug wire from ignition transformer. Check for spark at ignition transformer with an insulated screwdriver. Spark should jump a minimum 1/4" gap. Replace transformer if no spark is established. If spark is established, replace the plug wires.
Burner will not fire or fires for 60 seconds and kicks out reset switch. Gas pressure on gage. Ignition is sparking.	Plugged orifice	Check for gas at burner. If no gas, remove pipetrain and check orifice and burner or burner ring for blockages.
	Flame probe	Check to be sure flame probe is in good condition and is located in flame. Flame probe contacts should open when probe gets hot.
	Incorrect supply voltage	Voltage to heater must be 110 volts AC.
	Regulator set too low	See that flame burns continuous and is not intermittent. On ring burners be sure flame burns completely around ring.
	Moisture in fuel	Have tank and lines checked by qualified gas service man.
	Heater hose gets very hot. Heater shuts down and reset button trips.	Adjust vaporizor out of flame. Move a small amount at a time and allow heater to equalize between adjustments. Also check fan inlet screen for plugging. If flame is very yellow it is due to lack of airflow to unit.

DELUXE HEATER WIRING DIAGRAM



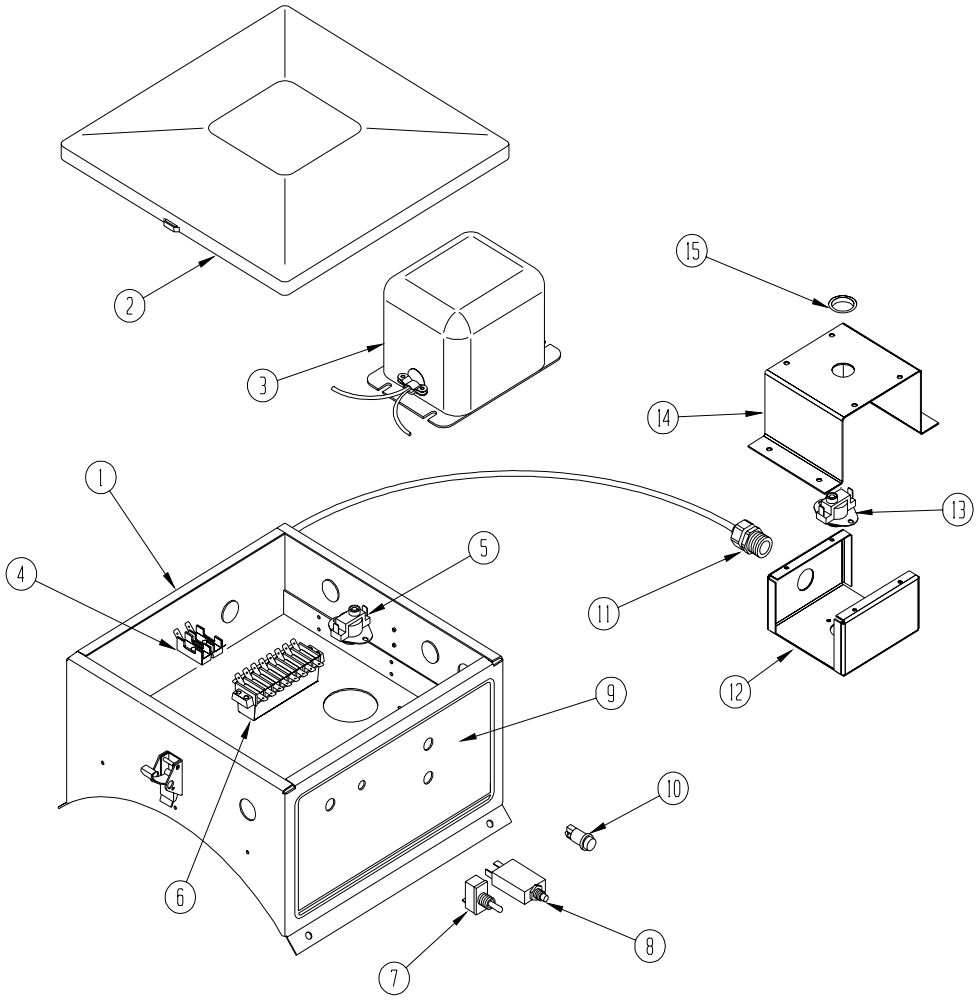
● INDICATES LIGHT ON ○ INDICATES LIGHT OFF

INDICATION	POSSIBLE CAUSE	POSSIBLE SOLUTION
○ ○ ○ ○ ○ ○ 1 2 3 4 5 6	Bad On/Off Switch	Replace Switch
	Heater Housing Hi-Limit	Reset Or Replace Hi-Limit
	Transition Hi-Limit	Reset Or Replace Hi-Limit
	No Power To Heater	Check Heater
● ○ ○ ○ ○ ○ 1 2 3 4 5 6	Blown Fuse	Replace Fuse
● ● ○ ○ ○ ○ 1 2 3 4 5 6	Flame Sensor (if flame present light on)	Clean Or Replace Flame Sensor
	Control Board	Replace Control Board
	Air Switch (if fan on light not on)	Check Air Switch
● ● ● ○ ○ ○ 1 2 3 4 5 6	Vaporizor Hi-Limit	Adjust Vaporizor Coil Replace Vapor Hi-Limit
● ● ● ● ○ ○ 1 2 3 4 5 6	Humidistat/Thermostat	Temperature Reached Replace Thermostat Or Humidistat
● ● ● ● ● ○ 1 2 3 4 5 6	Spark Plug	Clean Or Replace Spark Plug
	No Fuel To Burner	Check Fuel Supply
	Bad Solenoid	Replace Solenoid

● ● ● ● ● ○ 1 2 3 4 5 6 WAIT FOR 20 SECOND PURGE DELAY TO TROUBLESHOOT! INDICATING LIGHTS SHOWN ON LEFT SHOULD BE LIT WHEN UNIT IS OPERATING PROPERLY

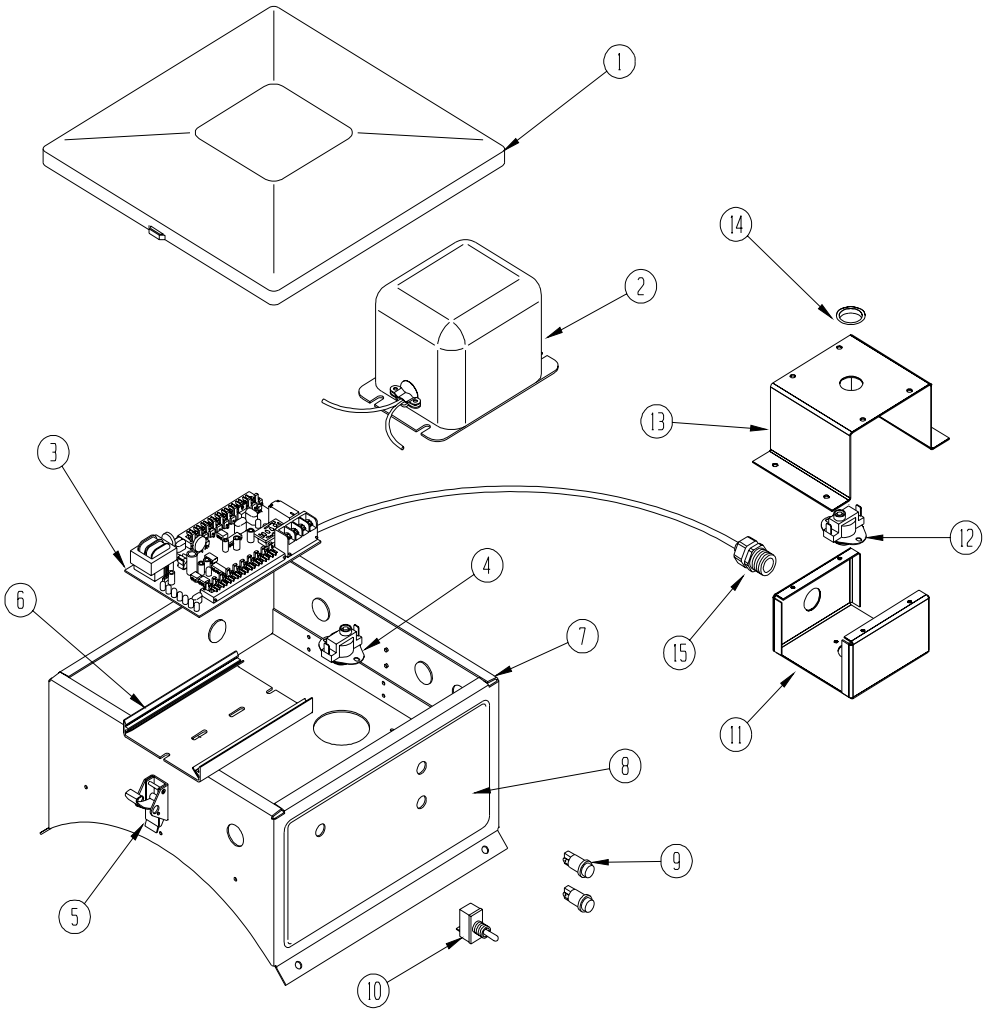
DC-1161

Standard Heater Control Box Parts



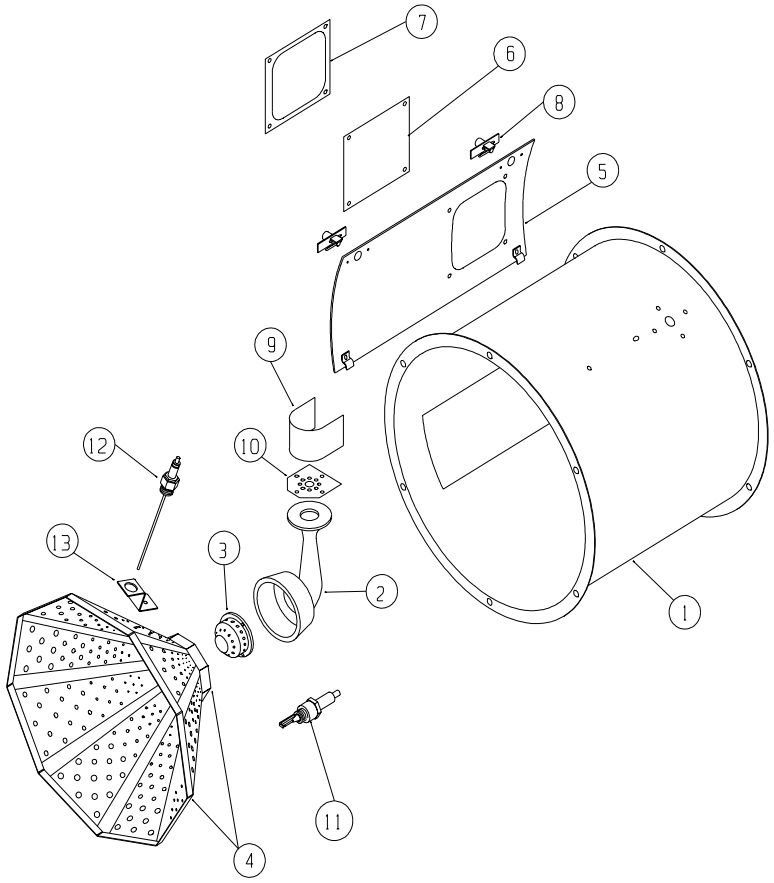
1	HF-7046	18" Control Box Housing
1	HF-7047	24" Control Box Housing
1	HF-7098	26" Control Box Housing
1	HF-7051	28" Control Box Housing
2	F-942	Control Box Lid
3	HH-1487	Igniton Transformer
4	FH-1059	5 Amp Fuse
4	FH-1058	Fuse Holder
5	HH-1092	High Limit Switch 180 Degree
6	HF-7356	Terminal Strip Flame Proving
7	HH-1442	Toggle Switch
8	HH-1089	Reset Time Delay
9	DC-1333	Decal Standard Heater Front Panel
10	TFH-2021	Red Light (110V)
11	FH-1310	Cord Connector
12	HF-7455	High Limit Switch Box Bottom
13	HF-7439	High Limit Switch 250 Degree
14	HF-7454	High Limit Switch Box Top
15	HF-7414	Recessed Plastic Plug

Deluxe Heater Control Box Parts



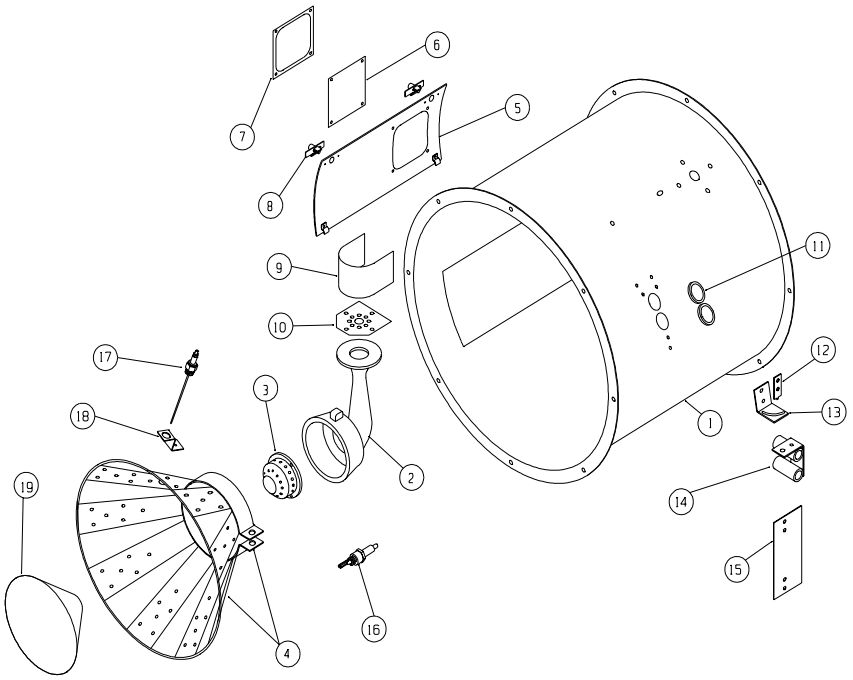
Key	Part Number	Description
1	F-942	Control Box Lid
2	HH-1487	Igniton Transformer
3	HF-7318	Circuit Board Assembly
4	HH-1092	High Limit Switch 180 Degree
5	FH-4429-1	Spring Latch
6	HH-7015	Snap trak
7	HF-7046	18" Control Box Housing
7	HF-7047	24" Control Box Housing
7	HF-7098	26" Control Box Housing
7	HF-7051	28" Control Box Housing
8	DC-1331	Decal Deluxe Heater Front Panel
9	TFH-2021	Red Light (110V)
10	HH-1442	Toggle Switch
11	HF-7455	High Limit Switch Box Bottom
12	HF-7439	High Limit Switch 250 Degree
13	HF-7454	High Limit Switch Box Top
14	HF-7414	Recessed Plastic Plug
15	TD-100282	Optional Relay
15	FH-1310	Cord Connector

18” Gas Heater Parts



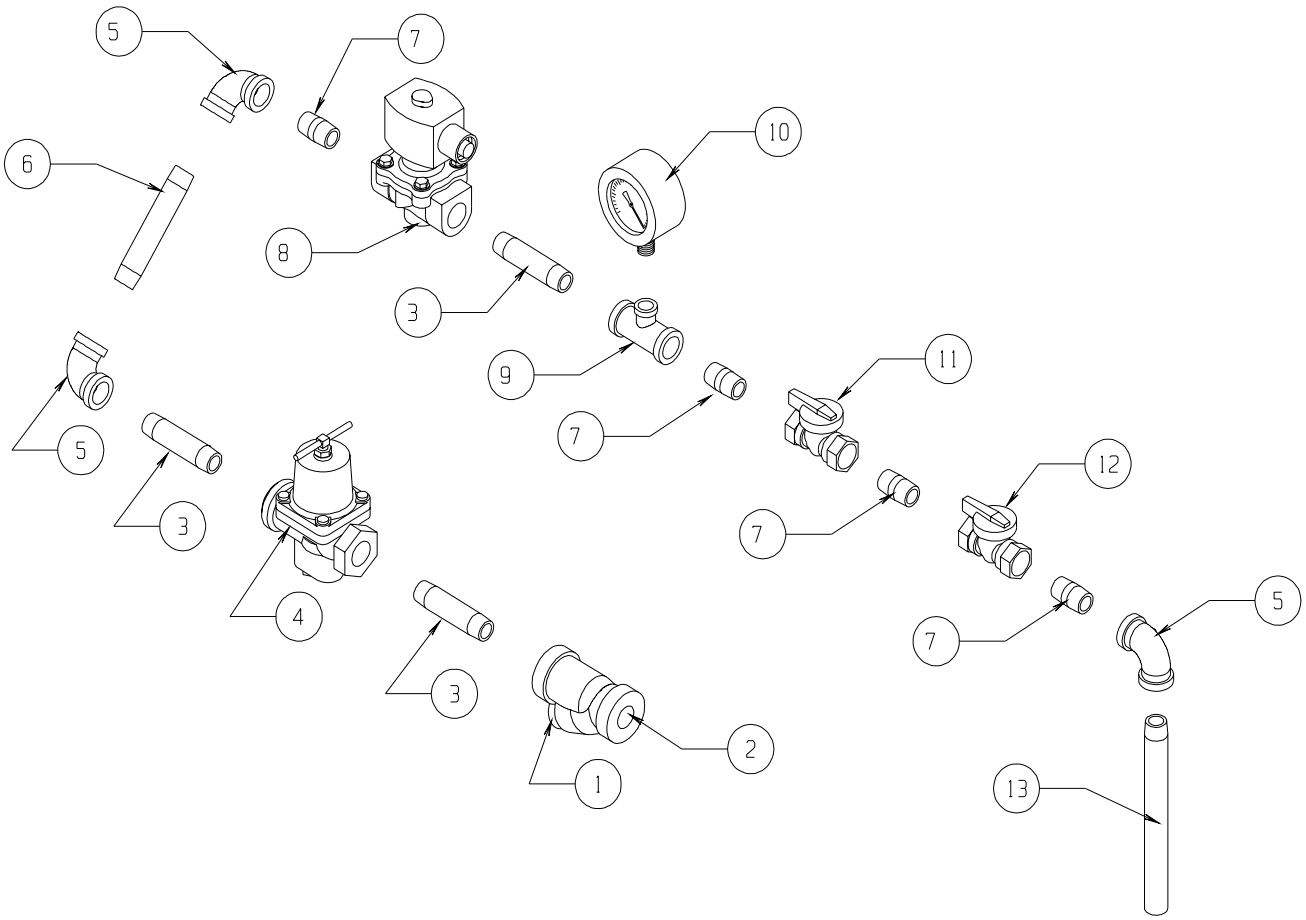
Key	Part Number	Description
1	HF-6785	Heater Housing
2	HH-3933	Burner Casting
3	HH-4410	Flame Spreader (Lo-Temp)
4	HF-7588	Flame Diverter Weldment
5	HF-6062-18	Access Panel (Deluxe)
6	HF-7380	Plastic View Window
7	HF-7379	Access Panel Cover Plate
8	TFH-2046	Access Panel Latch
9	HF-983	Burner Collector (18/24")
10	HF-978	Burner Collector Plate (18/24/26")
11	HH-1650	Spark Plug
12	THH-4179	Flame Sensor
13	CD-0187	Flame Sensor Bracket
NS	053-1004-0	Spark Plug Nut
NS	HF-7262	Flame Probe Wire Asy
NS	HF-7260	Spark Plug Wire Asy

24", 26", & 28" Gas Heater Parts



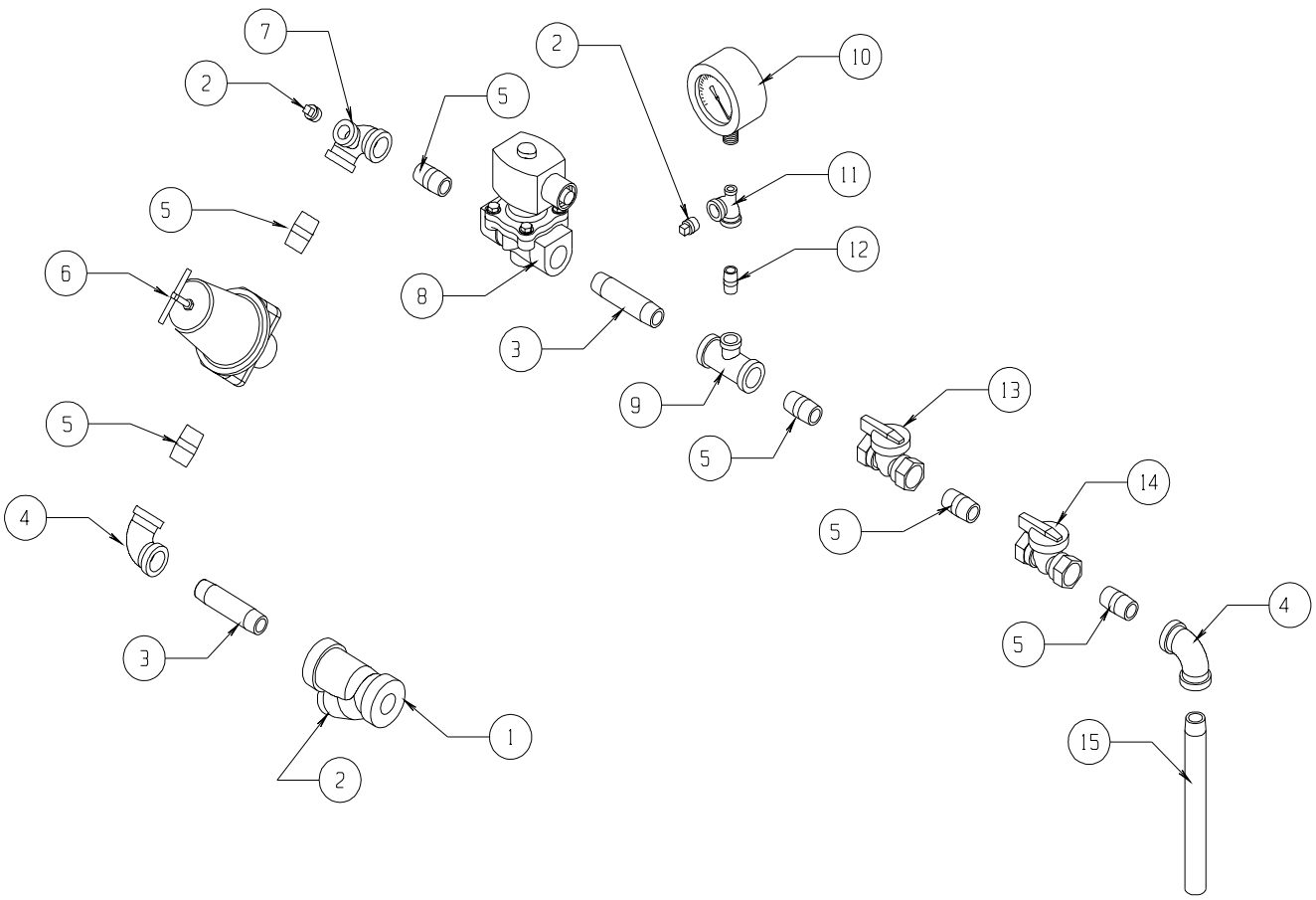
Key	Part Number			Description
	24"	26"	28"	
1	HF-6175	HF-6176	HF-6060	Heater Housing
2	HH-3934	HH-3934	HH-3934	Burner Casting
3	HF-6757	HF-6757	HF-6757	Flame Spreader (Lo-Temp)
4	HF-992	HF-992	HF-992	Flame Diverter Weldment
5	HF-7381-24	HF-7381-26	HF-7381-28	Access Panel (Standard)
5	HF-6065-24	HF-6065-26	HF-6065-28	Access Panel (Deluxe)
6	HF-7380	HF-7380	HF-7380	Plastic View Window
7	HF-7379	HF-7379	HF-7379	Access Panel Cover Plate
8	TFH-2046	TFH-2046	TFH-2046	Access Panel Latch
9	HF-983	HF-986	HF-7517	Burner Collector
10	HF-978	HF-978	HF-978	Burner Collector Plate
11	HH-7016	HH-7016	HH-7016	Rubber Grommet
12	HF-7056	HF-7056	HF-7056	Pivot Bracket
13	HF-7057	HF-7057	HF-7057	Adjustment Bracket
14	HF-7060	HF-7060	HF-7060	Vaporizer Support Weldment
15	THF-3237	THF-3237	THF-3237	Vaporizer Cover
16	HH-1650	HH-1650	HH-1650	Spark Plug
17	THH-4179	THH-4179	THH-4179	Flame Sensor (Deluxe)
17	HH-1097	HH-1097	HH-1097	Flame Probe (Standard)
18	CD-0187	CD-0187	CD-0187	Flame Sensor Bracket (Deluxe)
18	HF-4485	HF-4485	HF-4485	Flame Probe Bracket (Standard)
19	HH-7054	HH-7054	HH-7054	Burner Cone
NS	053-1004-0	053-1004-0	053-1004-0	Spark Plug Nut
NS	HF-7262	HF-7262	HF-7262	Flame Sensor Wire Asy (Deluxe)
NS	HH-5430	HH-5430	HH-5430	Flame Probe Wire Asy (Standard)
NS	HF-7260	HF-7260	HF-7260	Spark Plug Wire Asy

18” VAP/NG PIPETRAIN ASSEMBLY



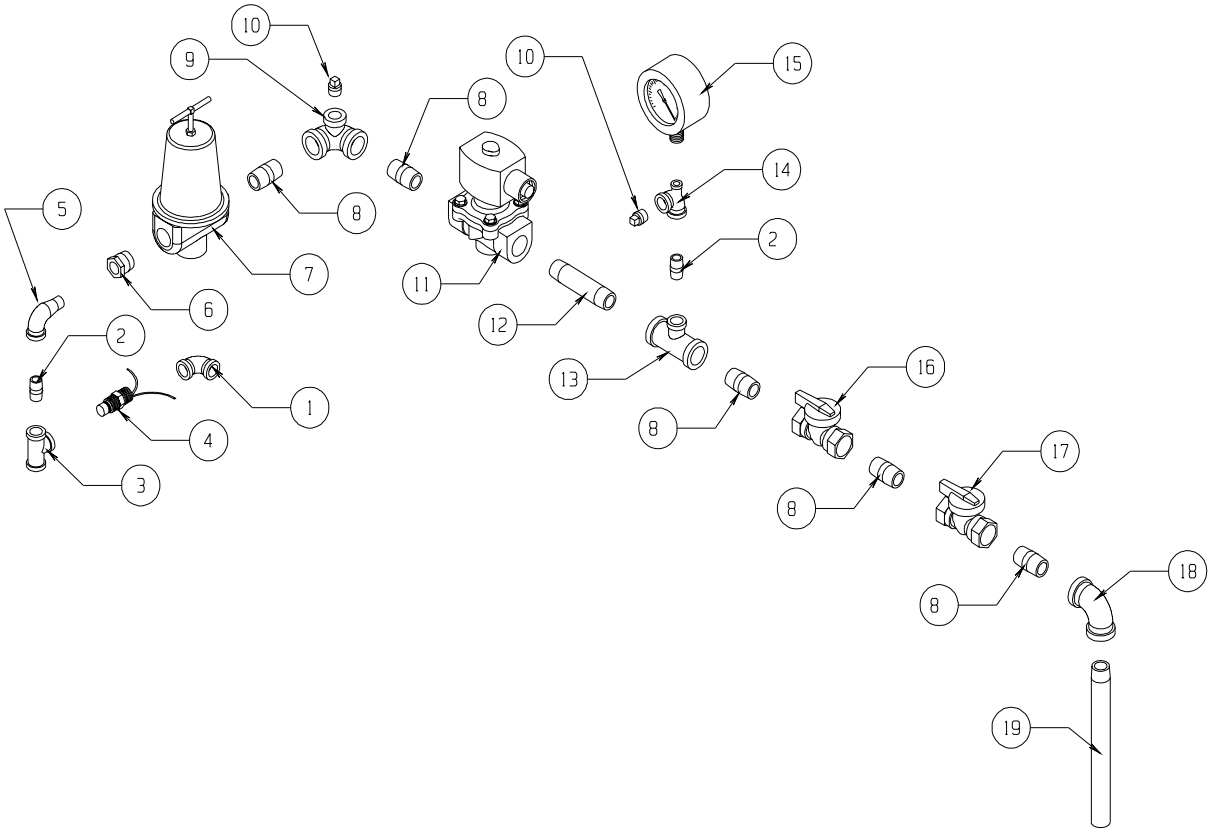
Key	Part Number	Description
1	THH-4126	Plug 1/4" Square
2	HH-1251	Strainer 1/2"
3	THH-4128	Nipple 1/2" x 2"
4	TFC-0023	Regulator 1/2" NPT (0-30 psi)
5	THH-4071	Elbow 1/2" 90°
6	THH-4061	Nipple 1/2" x 3-1/2"
7	THH-4032	Nipple 1/2" Close
8	TFC-0032	Solenoid Valve
9	HH-4846	Tee 1/2" x 1/2" x 1/4"
10	HH-2984	Gauge 0-30# LP
11	HF-7524	Orifice Valve (1/2"): 3/32"
12	HF-7526	Orifice Valve (1/2"): 11/64"
13	HF-7587	Nipple 1/2" x 5-1/2" NPT / Tapped
NS	HF-7521	Orifice (1/2) Drilled 17/64"

24", 26", & 28" VAP/NG PIPETRAIN ASSEMBLY



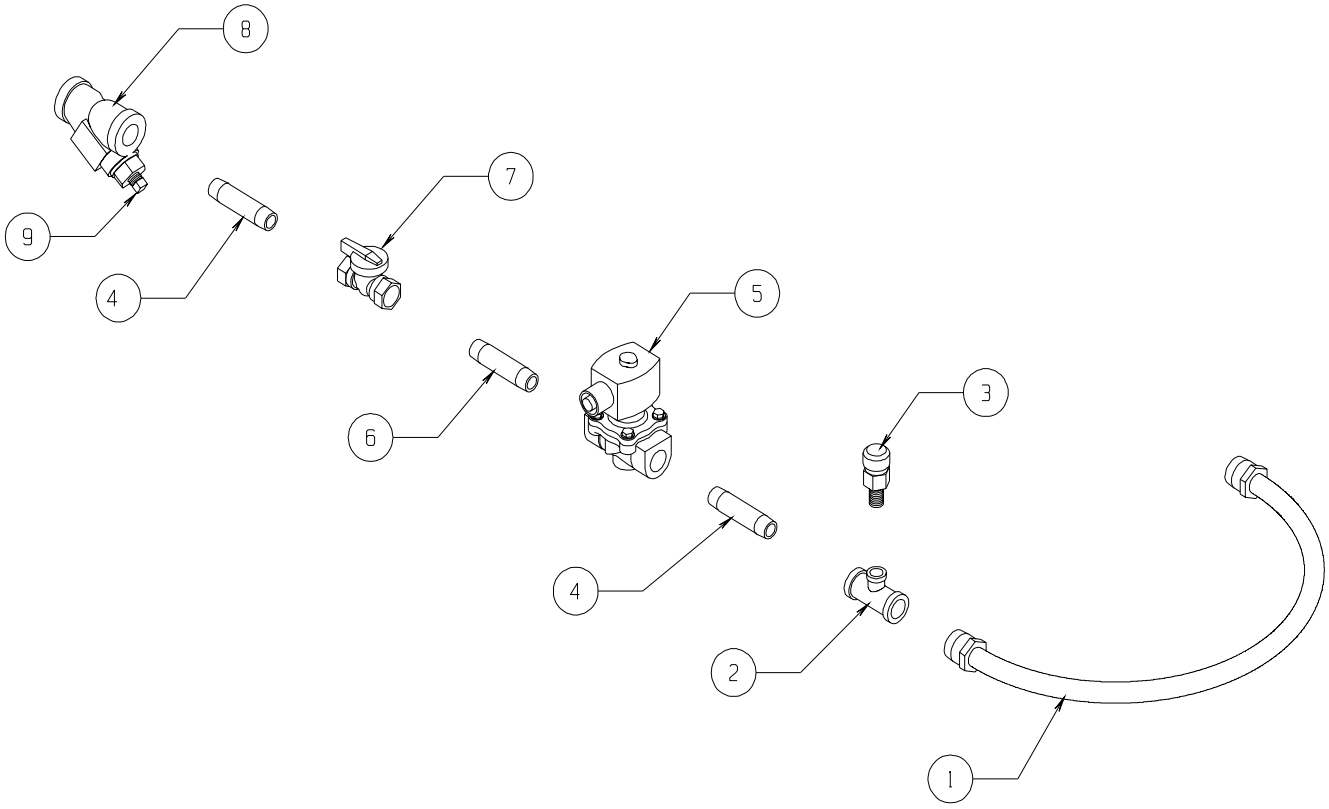
Key	Part Number			Description
	24"	26"	28"	
1	D67-0008	D67-0008	D67-0008	Strainer 3/4"
2	D07-0024	D07-0024	D07-0024	Plug 1/2" Pipe
3	THH-4136	THH-4136	THH-4136	Nipple 3/4" x 3"
4	THH-4120	THH-4120	THH-4120	Elbow 3/4" 90°
5	THH-4121	THH-4121	THH-4121	Nipple 3/4" Close
6	HF-7567	HF-7567	HF-7567	Regulator 3/4" Hi-Temp
7	HF-7537	HF-7537	HF-7537	Elbow 3/4" x 1/2" Side Outlet
8	TFC-0081	TFC-0081	TFC-0081	Valve 3/4" Solenoid
9	THH-4174	THH-4174	THH-4174	Tee 3/4" x 3/4" x 1/2"
10	HH-2984	HH-2984	HH-2984	Gauge 0-30# LP
11	S-3853	S-3853	S-3853	Tee 1/2" x 1/4" x 1/2"
12	THH-4032	THH-4032	THH-4032	Nipple 1/2" Close
13	HF-7525	HF-7525	HF-7525	Orifice Valve (3/4"): 3/32"
14	HF-7527	HF-7527	HF-7527	Orifice Valve (3/4"): 15/64"
15	HH-7026			Nipple 3/4" x 5-1/2" NPT / Tapped
15		HH-7027		Nipple 3/4" x 6-1/2" NPT / Tapped
15			HF-7539	Nipple 3/4" x 7" NPT / Tapped
NS	HF-7126	HF-7126	HF-7126	Orifice (3/4") Drilled 3/8"

24", 26", & 28" LP PIPETRAIN ASSEMBLY



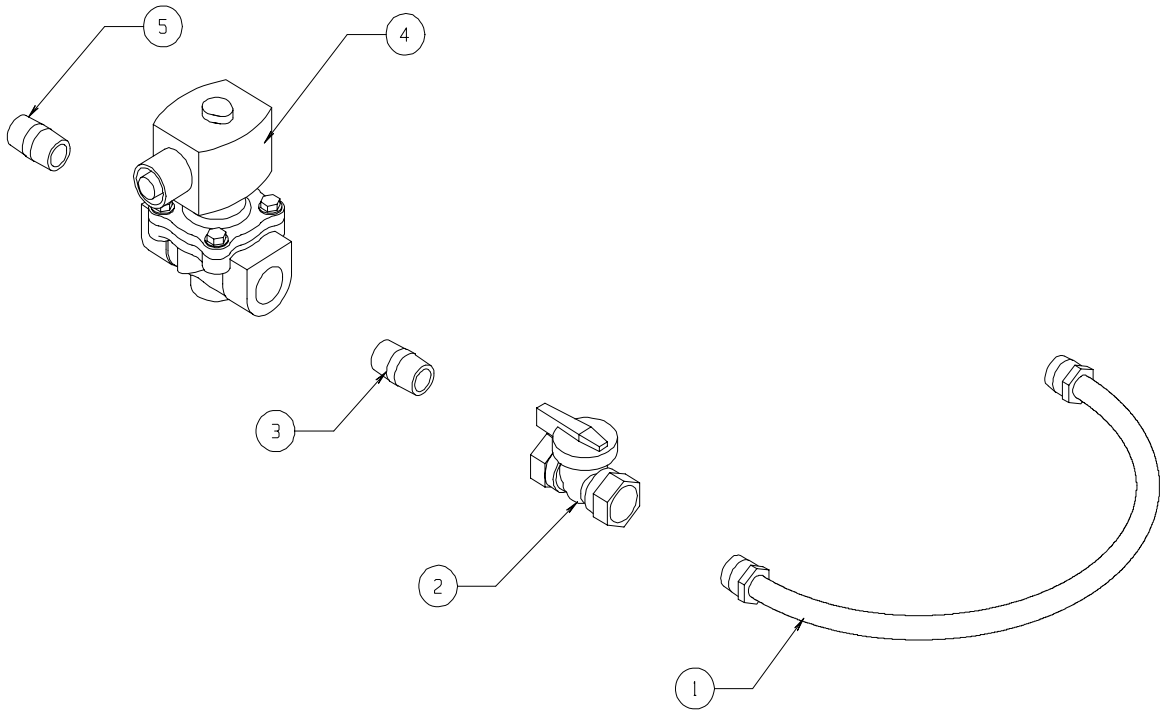
Key	Part Number			Description
	24"	26"	28"	
1	THH-4071	THH-4071	THH-4071	Elbow 1/2" 90°
2	THH-4032	THH-4032	THH-4032	Nipple 1/2" Close
3	HH-1453	HH-1453	HH-1453	Tee 1/2" x 1/2" x 1/2"
4	HH-7013	HH-7013	HH-7013	Switch Screw-in Vapor Hi-Limit
5	D07-0022	D07-0022	D07-0022	Elbow 1/2" 90° Street
6	D07-0028	D07-0028	D07-0028	Reducer 3/4" x 1/2" Hex Bushing
7	HF-7567	HF-7567	HF-7567	Regulator 3/4" Hi-Temp
8	THH-4121	THH-4121	THH-4121	Nipple 3/4" Close
9	HF-7537	HF-7537	HF-7537	Elbow 3/4" x 1/2" Side Outlet
10	D07-0024	D07-0024	D07-0024	Plug 1/2" Pipe
11	TFC-0081	TFC-0081	TFC-0081	Valve 3/4" Solenoid
12	THH-4136	THH-4136	THH-4136	Nipple 3/4" x 3"
13	THH-4174	THH-4174	THH-4174	Tee 3/4" x 3/4" x 1/2"
14	S-3853	S-3853	S-3853	Tee 1/2" x 1/4" x 1/2"
15	HH-2984	HH-2984	HH-2984	Gauge 0-30# LP
16	HF-7525	HF-7525	HF-7525	Orifice Valve (3/4"): 3/32"
17	HF-7527	HF-7527	HF-7527	Orifice Valve (3/4"): 15/64"
18	THH-4120	THH-4120	THH-4120	Elbow 3/4 90°
19	HH-7026			Nipple 3/4" x 5-1/2" NPT / Tapped
19		HH-7027		Nipple 3/4" x 6-1/2" NPT / Tapped
19			HF-7539	Nipple 3/4" x 7" NPT / Tapped
NS	HF-7126	HF-7126	HF-7126	Orifice (3/4") Drilled 3/8"

LP SUPPLY PIPETRAIN ASSEMBLY



Key	Part Number	Description
1	HF-7509	Hose 1/2" x 18" LP Gas Asy
2	HH-4846	Tee 1/2" x 1/2" x 1/4"
3	TFC-0027	Valve 1/4" NPT 250 psi Relief
4	HF-7586	Nipple 1/2" x 2"
5	TFC-0092	Valve 1/2" Solenoid
6	D07-0019	Nipple 1/2" x 1-1/2"
7	TFC-0030	Valve 1/2" Ball, Bronze
8	HH-1251	Strainer 1/2"
9	THH-4126	Plug 1/4" Square

HI-LO PIPETRAIN ASSEMBLY



Key	Part Number	Description
1	HH-7019	Hose Asy 1/2" x 18"
2	TFC-0030	Valve 1/2" NPT Ball, Bronze
3	THH-4032	Nipple 1/2" Close
4	TFC-0032	Valve 1/2" Solenoid LP
5	THH-4128	Nipple 1/2" x 2"
NS	D07-0022	Elbow 1/2" 90° Street

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