Series 2000
Vane Axial Heater
Installation And
Operating Instructions

MODEL # VH__ - __ __ - __ __ - 2 __

MODEL # VL__ - __ __ - __ __ - 2 __

Owner's Manual

PNEG-553

GSI

a division of

THE GSI GROUP

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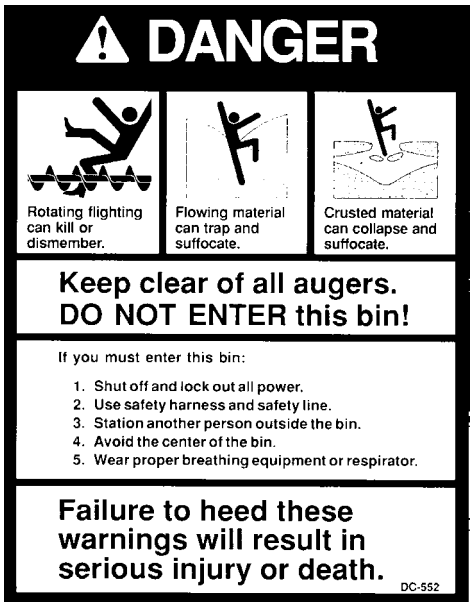
Roof Damage Warning And Disclaimer

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



Heater Operation

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 GSI Series 2000 Vane Axial Heater. Models are built to accommodate low, medium and high temperature grain conditioning, and are available in 18" through 28" diameter in both propane vapor and natural gas.

The principal concern ofThe GSI group 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 area. Avoid any alterations to the equipment. Such alterations may produce a very dangerous situation, where serious injury or death may occur.

Safety Alert Symbol

The symbol shown is used to call your attention to instructions concerning your personal safety. Watch for this symbol; it points out important safety precautions. It means "ATTENTION", "WARNING", "CAUTION", and "DANGER". Read the message and be cautious to the possibility of personal injury or death.

WARNING! BE ALERT!
Personnel operating or working around electric fans should read this manual. This manual must be delivered with the equipment to its owner. Failure to read this manual and its safety instructions is a misuse of the equipment.

The GSI Group Inc. recommends contacting your local power company, and having a representative survey your installation so the wiring is compatible with their system, and adequate power is supplied to your unit.

Safety decals should be read and understood by all people in the grain handling area. The bottom right decal should be present on the inside bin door cover of the two ring door, 24" porthole door cover and the roof manway cover.

If a decal is damaged or is missing contact:

The GSI Group Inc.
1004 E. Illinois St.
Assumption, IL 62510
217-226-4421

A free replacement will be sent to you.

High Temperature Heater Specifications

		18"	24"	26"	28"
All models	Inside diameter Bolt circle diameter Length BTU rating Weight	18.5/16" 19.7/16" 22" 1400000 81	24.1/4" 25.3/4" 22.1/2" 2100000 110	26.5/16" 27.15/16" 22.1/4" 2700000 115	28.1/8" 29.5/8" 25.1/4" 3000000 140
Liquid models	Maximum fuel flow (GPH) Orifice Modulating valve bypass orifice Minimum operating pressure Maximum operating pressure Minimum line size	N/A N/A N/A N/A N/A N/A	23 3/16" Blue 2 20 3/8"	30 7/32" Blue 2 20 3/8"	34 15/64" Aluminum 2 20 3/8"
Vapor models	Maximum fuel flow (CFH) Orifice Modulating valve bypass orifice Minimum operating pressure Maximum operating pressure Minimum line size	585 5/32" Green 2 20 1/2"	877 3/16" Blue 2 20 3/4"	1128 7/32" Blue 2 20 3/4"	1253 15/64" Aluminum 2 20 3/4"
Natural gas models	Maximum fuel flow (CFH) Orifice Modulating valve bypass orifice Minimum operating pressure Maximum operating pressure Minimum line size	1473 1/4" Blue 1 7 3/4"	2210 5/16" Aluminum 1 7 1"	2842 23/64" Aluminum 1 7 1.1/4"	3157 3/8" Aluminum 1 7 1.1/4"

Low Temperature Heater Specifications

		18"	24"	26"	28"
All models	Inside diameter Bolt circle diameter Length BTU rating Weight	18.5/16" 19.7/16" 22" 400000 81	24.1/4" 25.3/4" 22.1/2" 500000 110	26.5/16" 27.15/16" 22.1/4" 500000 115	28.1/8" 29.5/8" 25.1/4" 500000 140
Vapor models	Maximum fuel flow (GPH) Orifice Modulating valve bypass orifice Minimum operating pressure Maximum operating pressure Minimum line size	167 5/64" Red 2 20 3/8"	292 3/32" Yellow 2 20 3/8"	292 3/32" Yellow 2 20 3/8"	292 3/32" Yellow 2 20 3/8"
Natural gas models	Maximum fuel flow (CFH) Orifice Modulating valve bypass orifice Minimum operating pressure Maximum operating pressure Minimum line size	421 9/64" Yellow 1 7 1/2"	736 5/32" Green 1 7 1/2"	736 5/32" Green 1 7 1/2"	736 5/32" Green 1 7 1/2"

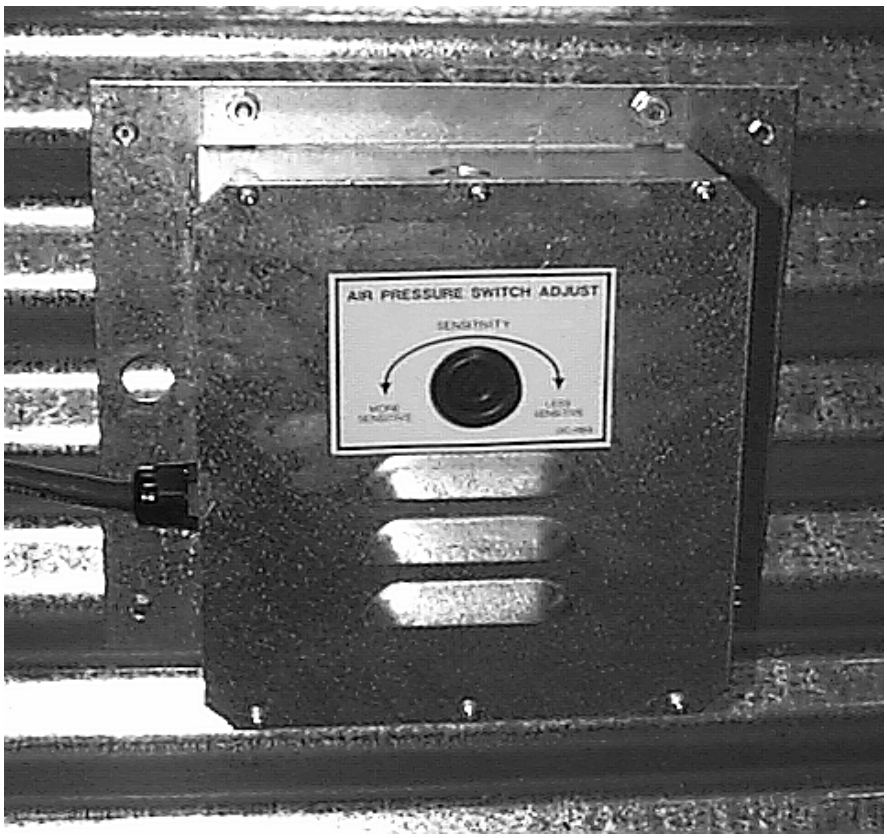
Air Pressure Switch and Temperature Sensor Box Installation

1. Using air switch box as a guide, mark 2 holes on plenum side wall appproximately 24" to right of transition centered up and down in plenum.

2. Drill air switch filter hole 5/8" diameter for snug fit. Drill temperature sensor hole 5/8" or larger to accommodate mounting nut.

3. Mount Box to Bin using (4) self drilling screws

4. Caulk between housing and sidewall to seal.



Air Switch Box Assembly

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.

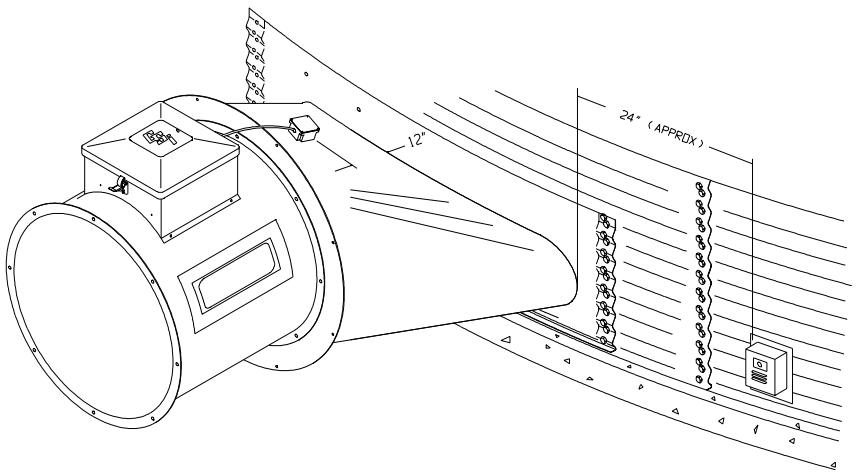
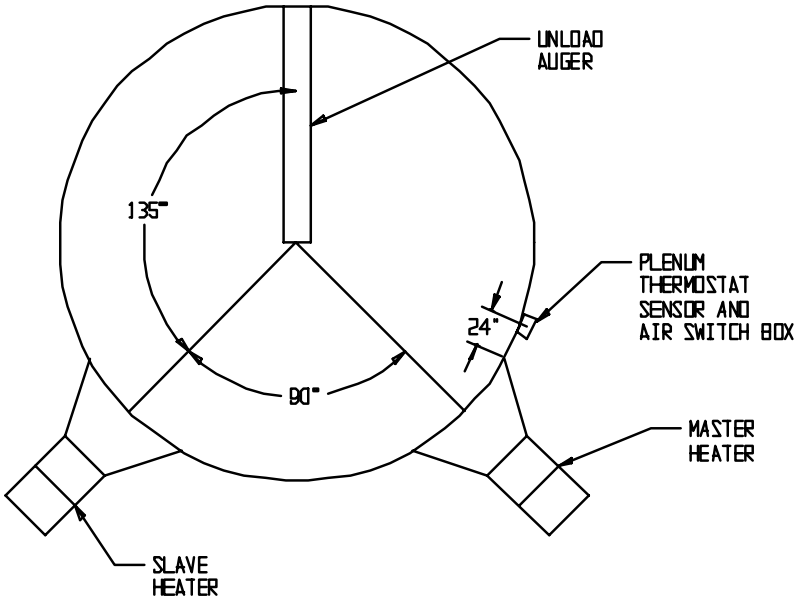


Figure 1: The transition connecting the Series 2000 Heater to the bin with the plenum sensor in place.

Bin Configuration



IMPORTANT! When mounting (2) heaters on a bin it is imperative that they be situated as illustrated in this drawing. Plenum thermostat must be to the right of master heater and master heater must be to the right of slave heater.

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

Operating Temperature Table

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

IMPORTANT!
DO NOT EXCEED PLENUM TEMPERATURES LISTED IN TABLE

Heater Unit

1. Be sure fan unit is installed and wired to meet local codes. Be sure equipment is well grounded (see page 10).

2. A separate neutral is required for 120 volt heater circuit in 220 volt 1PH and 3PH fan units. For 460 volt fan units a separate 120 volt power supply or transformer is required.

3. Run 5-wire black cord from heater unit to fan unit and secure to fan.

4. Orange and red wires should be connected in series with coil in fan. When contacts in heater between these wires open fan shuts down. Recommended wiring is shown in Figure 2.

5. Black and white wires should be connected to a fused 120V power supply as shown. Green wire should be connected to ground in fan. Heater should have power, even with fan off.

Wiring

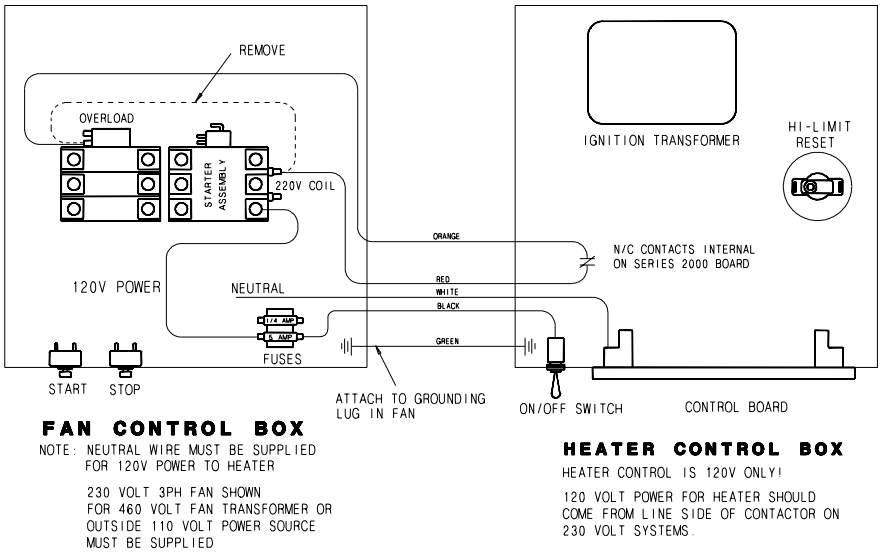


Figure 2: Wiring diagram for the fan and heater unit.

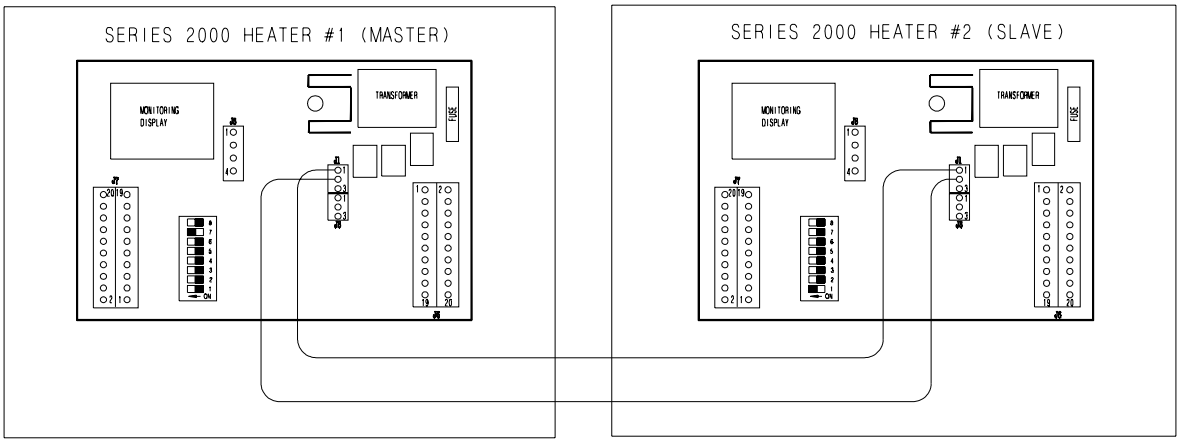


Figure 3: Secondary heater wiring diagram.

SECONDARY HEATER UNIT

1. Secondary heater unit runs as a slave of heater unit #1 and requires no plenum temperature sensor.

2. Run (2) 20 gauge (minimum) wires from secondary heater unit (slave) to heater unit #1 (master).

3. Connect wires as shown in Figure 3.

4. Third heater unit may also be added to system. If adding third unit, run connections to master unit #1 and connect them in parallel with sec ondary heater unit.

Machine To Earth Ground

It is very important that a machine to earth ground rod be installed at the fan. This is true even if there is a ground at the pole 15 feet away. This ground needs to be as close to the fan as possible, but no more than 8 feet away. The ground rod should be connected to the fan control panel with at least a #6 solid bare copper ground wire, or in accordance with local requirements. The machine to earth ground provides additional safety if there is a short. It also provides the grounding necessary for long life and operation of the solid state circuit boards used on control circuits and the electronic ignition systems.

Dig a hole large enough to hold 1 or 2 gallons of water. Work the ground rod into the earth until it is completely in the ground.

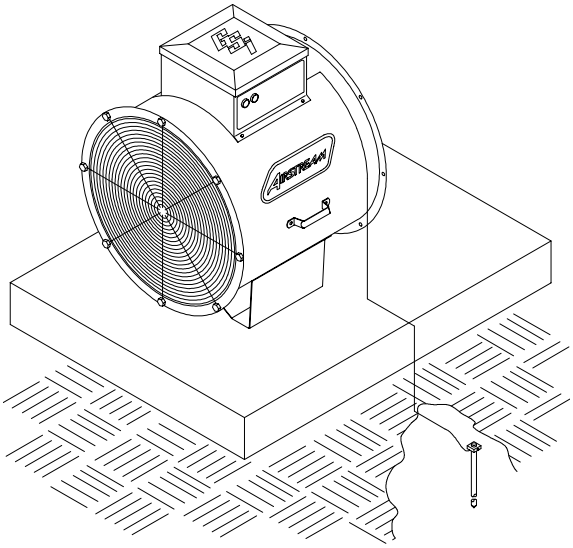


Figure 4: Use a #6 or approved size bare copper ground wire. Install a 5/8" diameter 8' long copper-clad ground rod, 2' away from the foundation and 1' below the surface of the ground or in accordance with local requirements.

Proper Installation Of The Ground Rod

(Ground rods and wires are not supplied by Airstream). It is recommended that the rod not be driven into dry ground. The following steps ensure proper ground rod installation:

1. Dig a hole large enough to hold 1 to 2 gallons of water.
2. Fill hole with water.
3. Insert rod through water and jab it into the ground.
4. Continue jabbing the rod up and down, the water will work its way down the hole, making it possible to work the rod completely into the ground. This method of installing the rod gives a good conductive bond with the surrounding soil.
5. Connect the bare copper ground wire to the rod with the proper ground rod clamp.
6. Connect the bare ground wire to the fan control boxes with a grounding lug. See figure 4.
7. Ground wire must not have any breaks or splices. Insulated wire is not recommended for grounding.

Previously Installed Units

It is recommended that previously installed units be checked to see that a machine to earth ground has been installed by an electrician.

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.*	 **ALWAYS DISCONNECT AND LOCK OUT POWER BEFORE WORKING ON OR AROUND HEATER**	IMPORTANT! Do not use propane tanks that have previously been used for ammonia unless they have been purged according to procedures of the National L.P. Association. Fuel supply system must comply with local codes for L.P. gas installation.

Fuel Connection

Liquid Propane Models

1. L.P. models are designed to run on liquid pro pane with liquid draw from the propane tank. Avoid using propane supply tanks that have been used 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 situation, purge the system with methanol.

2. Run proper size line (see specification on page 7) to liquid pipetrain on heater. Have a qualified gas service person inspect installation to be sure that everything is installed according to local codes and ordinances.

3. After installation is complete check all connections for leaks with liquid detergent or comparable. 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 a supply tank or from a separate external vaporizer.

2. Run proper size line (see specifications on page 7) to pipetrain on heater. Have a qualified gas service person inspect installation to be sure that everything is installed according to local codes and ordinances.

3. After installation is complete check all connections for leaks. DO NOT USE FLAME FOR LEAK TESTING.

Natural Gas Models

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

2. Run proper size line (see specification on page 7) 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. DO NOT USE FLAME FOR LEAK TESTING.

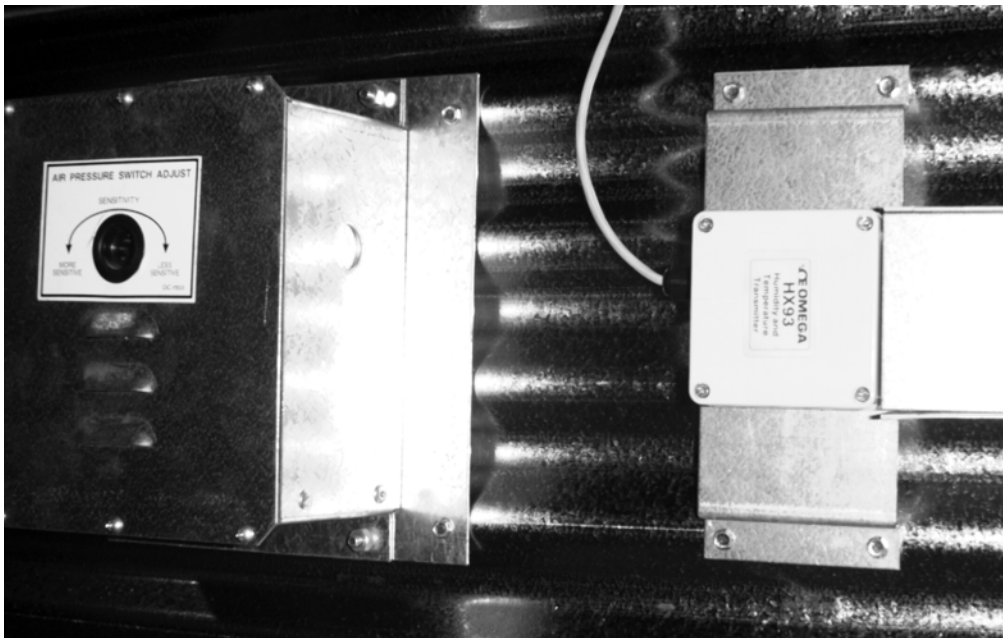


Figure A

Installing Optional Humidity Sensor

1. Humidity sensor should be mounted 6-8" right of the airswitch/temperature sensor box. See Figure A.

2. Using sensor as a guide drill or knock-out 7/8" diameter hole in the center of the plenum on the bin sidewall. If you are using sensor to sense drying air humidity.

3. Insert pipe nipple from sensor housing through hole in side wall and use self-drilling screws to mount to sidewall. Figure B

4. Do not caulk sensor box openings on side of box, they are for air escape.

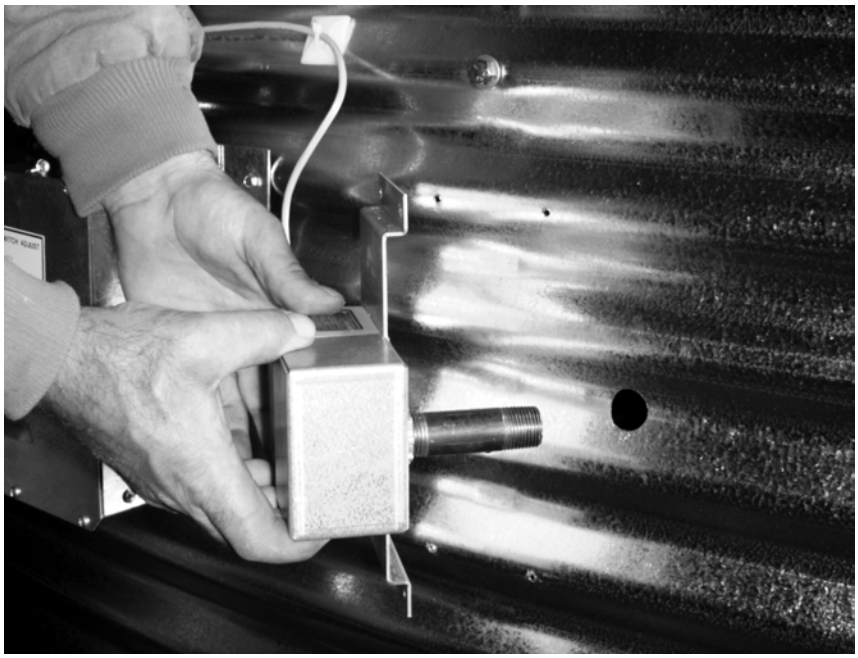


Figure B

The control panel display showing initial start up.

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.*

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

Power Up

All safety and high limit switches are checked upon power up. If a safety or limit is open, the control displays it. The control cannot operate with a safety switch error, and the fan cannot turn on with an error condition. There is no way to bypass an error condition. It must be fixed. (See errors on page 21)

The air switch is also checked on power up. The air switch must indicate no airflow. This is necessary to check the function of the air switch. However, if the operator forgets and turns the fan on before the controller has been powered up, The controller locks up with the main display alternating between a "FAN" and "ON" message. This may be bypassed by depressing and holding the "FAN BYPASS" switch (lower right switch). Normal operating procedure should be to power up the controller with the fan off.

If multiple heaters are tied together, and the master detects that the slave fan is on (the air switch stuck?), the master will lock up displaying "SLA ERROR". This condition may be bypassed with the "FAN BYPASS" switch.

Normal Operating Displays With Heater Not Running

The main display shows the plenum temperature. If the dryer has not been running, the display should show outside temperature. The control is preset at the factory to display temperature in centigrade or fahrenheit.

"AIRFLOW" or "NO AIRFLOW" is displayed if air is flowing or not flowing. "RX TX" (receive, transmit) is displayed if multiple heaters are connected.

All safeties or high limits are continuously checked during the off mode. A limit switch open, or any other error condition will cause the display to show the limit or error condition.

When drying is not occurring, and the limit or error condition is corrected, the display returns to its normal output. This is not the case with an error or limit condition during the drying operation. This causes the display to lock up in the error display mode. This is to keep the display locked up with the condition illuminated. (see section on "Running the Dryer" for mode explanation on page 17).

The heater display with fan on (airflow).

Starting The Dryer

After heater power is turned on, the fan must be turned on. Attempting to start the dryer without the air switch indicating there is airflow will cause an airflow alarm to go off when the start switch is depressed. The airflow alarm is simply the entire display going blank, and the "NO AIRFLOW" message flashing for a few seconds. The display must show "AIRFLOW" before the dryer can be started.

To start the dryer, just push the "START" switch. The first message to come up will be the "PURGE" message--the drying process begins with a 10 second purge.

When multiple heaters are connected together, drying may be started from any heater control.

Setting Gas Pressure

1. At heater turn toggle switch to "ON" position.

2. Press the "PROGRAM TEMPERATURE" button.

3. Use the increase or decrease button to set the "PLENUM HIGH LIMIT SET POINT" to desired setting (100°-160°*).

4. Press the "PROGRAM TEMPERATURE" button to continue to set the "CYCLE SETPOINT". (hi-lo units only)

5. Use the increase or decrease buttons to set the "CYCLE SET POINT" to desired setting (90°-150°*) (hi-lo units only).

6. Press "programs temperature" button to continue to set the desired "relative humidity" setting, lower setting will run heater longer. (humidity sensor units only) Use arrow keys to set.

Programming the temperature differential.

7. Press the "PROGRAM TEMPERATURE" button to continue to set the "TEMPERATURE DIFFERENTIAL".

8. Use the increase or decrease buttons to set the "TEMPERATURE DIFFERENTIAL" to 10°*.

9. Press "progam temperature" button to continue to set "relative humidity differential". Use arrow keys to adjust to 5%. (Hudidity sensor units only).

10. Open all manual gas shut off valves, on and to the heater unit.

11 Start the fan unit.

12. Make sure that the blade is spinning in the right direction. If not place the toggle switch in the "OFF" position and correct the problem.

13. After the fan reaches full speed the display should read "AIRFLOW" in the upper right hand corner. If not adjust air switch. (See page 19)

14. Press the start button on the heater control.

15. After 10 seconds the burner should ignite. If not, turn "OFF" the toggle switch and then back "ON". Repeat 12-15.

*Temperatures are fahrenheit.

16. When the burner ignites the display should read "HI-FLAME " at the left of the display. Loosen the nut on the main regulator and turn screw in, to increase pressure and out to decrease pressure. The pressure gauges should be set at 10-15 lbs. for LP units, or 4-6 lbs.. for natural gas units. (use the charts on the following pages to set pressure)

17. Press the "PROGRAM TEMPERATURE" button to change the high limit set point. Press it again to change the "CYCLE SET POINT". (hi-lo units only)

18. Decrease the "CYCLE SET POINT TEM PERATURE" until the heater cycles to low flame. (hi-lo units only)

19. Open or close the low cycle ball valve until the gas pressure is 3-5 lbs. for LP, or 1-2 lbs. for natural gas. (hi-lo units only)

20. Increase the cycle set point to return to high flame. (hi-lo units only)

21. Watch heater run several minutes to make sure it cycles between hi and lo flame or on and off properly.

22. Hi-flame pressure should be adjusted so plenum reaches cycling temperature easily.

23. Adjust pressure on on/off units so that unit is on approximately 75% of the time.

Btu's Per Gauge Pressure (PSI) Propane Models (Approximate)

High Temperature

Diameter	Operating Pressure (PSI)									
	2	4	6	8	10	12	14	16	18	20
18"	416380	588680	720290	832760	930880	1019420	1107800	1174960	1244360	1340080
24"	598250	844730	1036170	1198890	1340080	1464520	1581770	1689460	1787570	1892860
26"	816010	1148640	1409480	1632030	1825860	1995762	2153700	2302070	2436070	2577260
28"	935660	1318540	1617670	1868930	2091480	2309250	2467180	2649050	2792630	2955360

Low Temperature

Diameter	Operating Pressure (PSI)									
	2	4	6	8	10	12	14	16	18	20
18"	102900	145970	181870	208190	234510	253660	275200	294340	311090	335020
24-28"	148370	210580	258440	299130	335020	366130	394850	421170	447490	473810

Gauge Pressure (PSI) Required to Maintain Temperture (Approximate) (High Temperature Units only)

Fan Model	Static Pressure	Heat Rise Degrees F						
		60	80	100	120	140	160	180
3HP-18"	1"	2	3	4	5	6	8	9
	2"	1	1	2	3	4	5	6
	3"	low-temp	low-temp	1	2	2	3	3
7HP-24"	1"	2	4	6	8	10	14	17
	2"	1	3	4	5	7	9	11
	3"	low-temp	low-temp	1	2	3	3	4
	4"	low-temp	low-temp	low-temp	low-temp	1	2	3
10HP-24"	1"	4	6	9	13	18	22	26
	2"	3	5	8	10	14	18	22
	3"	2	3	4	6	8	9	11
	4"	1	2	3	4	5	6	8
15HP-26"	1"	2	4	6	8	11	14	18
	2"	2	4	5	7	9	13	16
	3"	1	3	4	5	7	10	13
	4"	1	3	4	5	7	9	11
	5"	low-temp	1	2	3	3	4	5
15HP-28"	1"	3	4	7	9	12	16	20
	2"	2	4	6	8	11	14	18
	3"	2	3	4	5	8	10	13
	4"	1	2	3	4	6	8	10
	5"	low-temp	1	2	3	3	4	5

Btu's Per Gauge Pressure (PSI) Natural Gas Models (Approximate)

High Temperature

Diameter	Operating Pressure (PSI)						
	1	2	3	4	5	6	7
18"	454180	644780	787970	909260	1016880	1115380	1204750
24"	710450	1006850	1231200	1419980	1587790	1741920	1881456
26"	938450	1331520	1627920	1876896	2099420	2302800	2487940
28"	1022350	1450080	1772020	2043790	2285470	2507090	2708640

Low Temperature

Diameter	Operating Pressure (PSI)						
	1	2	3	4	5	6	7
18"	144100	205200	250800	289100	322850	353860	383040
24-28"	177840	251710	308260	355680	397632	435936	470590

Gauge Pressure (Psi) Required To Maintain Temperature (Approximate)
(High Temp Units Only)

Fan Model	Static Pressure	Heat Rise Degrees F						
		60	80	100	120	140	160	180
3HP-18"	1"	1	1	2	2	3	3	4
	2"	1	1	1	1	2	2	3
	3"	low-temp	low-temp	1	1	1	1	31
7HP-24"	1"	1	2	2	3	4	5	6
	2"	1	1	1	2	2	3	4
	3"	low-temp	low-temp	1	1	1	1	2
	4"	low-temp	low-temp	low-temp	1	1	1	1
10HP-24"	1"	2	2	4	5	6	7	8
	2"	1	2	3	3	4	6	7
	3"	1	1	1	2	2	3	4
	4"	low-temp	1	1	1	1	2	2
15HP-26"	1"	1	2	2	3	4	5	7
	2"	1	1	2	3	3	4	5
	3"	1	1	2	2	3	3	4
	4"	1	1	1	1	2	2	3
	5"	low-temp	low-temp	1	1	1	1	2
15HP-28"	1"	1	2	3	4	5	7	8
	2"	1	2	2	3	4	5	6
	3"	1	1	2	2	3	4	5
	4"	1	1	1	1	2	2	3
	5"	low-temp	low-temp	1	1	1	2	2

Adjusting the Air Pressure Switch

1. Air pressure switch must be adjusted so that it will activate with lowest level of grain that will be dryed in bin.

2. Put grain in bin to level desired (low).

3. With heater on and fan off display on heater should read "no airflow".

4. Start fan. Heater display should now read "airflow".

5. If display does not read "airflow" remove cap from adjustment port and slowly turn screw counter clockwise until display does read "Airflow". Figure C

6. Shut fan off display should read "no air flow" when fan gets to half speed. If not repeat step 5.

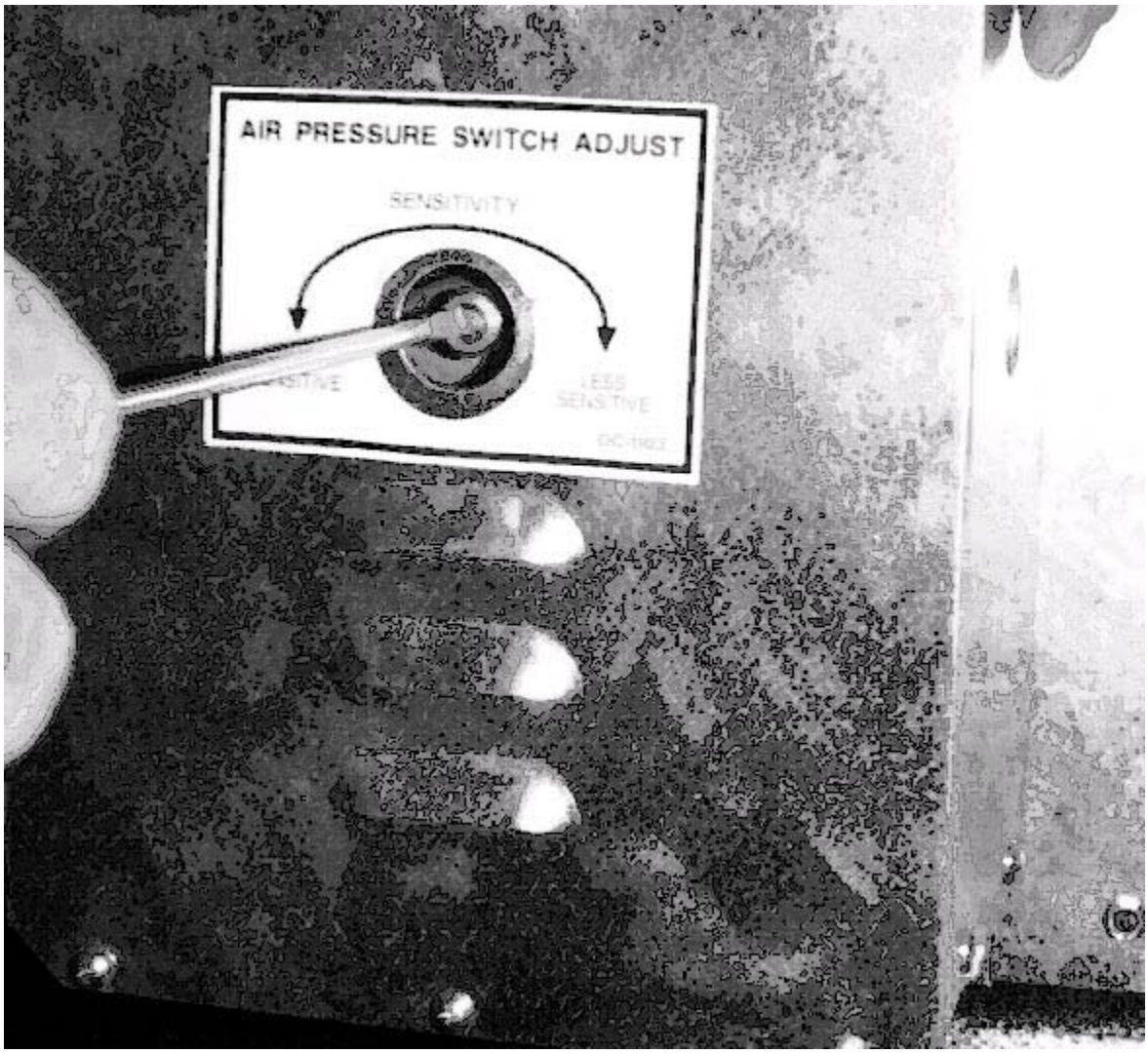
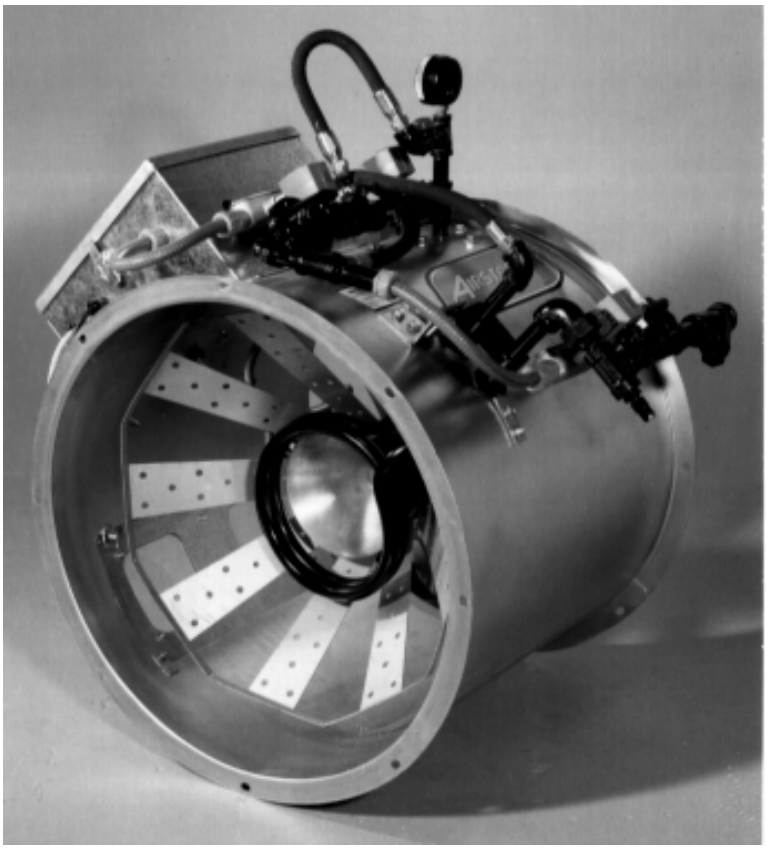
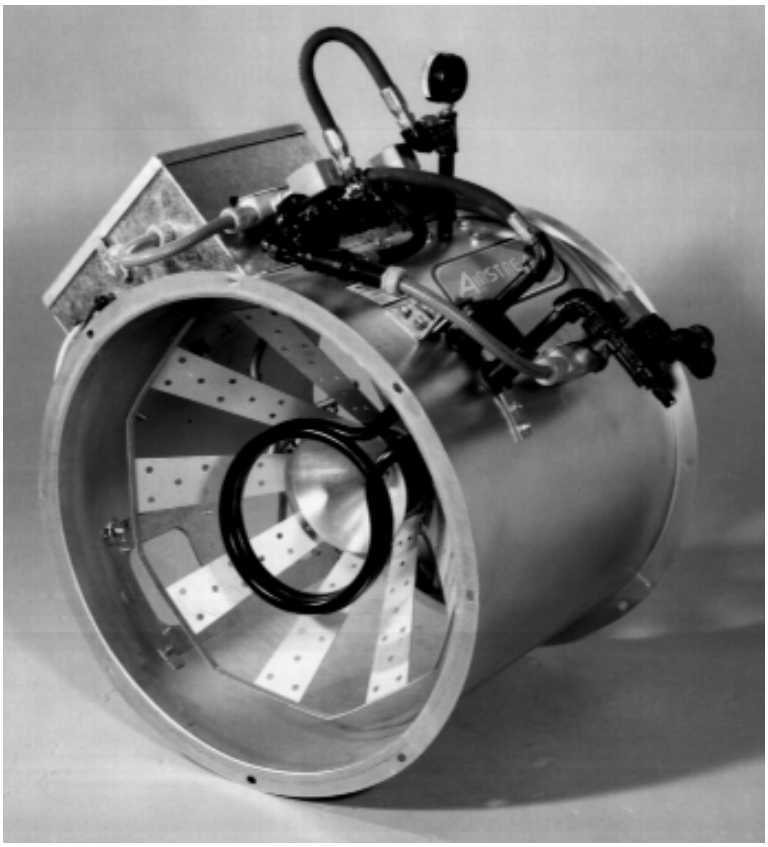


Figure C





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

Adjusting The Vaporizor

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 tem perature to equalize.

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

Running The Dryer

The display will indicate "FLAME" when flame is sensed. If no flame is sensed, the "FLAME" message will be off. The display indicates what part of the cycle it is in. If the unit is a hi-lo dryer, the display will indicate whether it is in the "HI-FLAME" or "LO-FLAME" part of the cycle. (See "programming set points" page 21 for setting the hi-lo flame temperature). If the temperature is above the high temperature setting, the flame will be off, the "FLAME" message will be out and the display will be flashing "OFF-CYCLE".

If the flame is shut off because of the humidity sensor (humidistat), the display flashes "OFF-CYCLE HUMIDISTAT".

The limits are continuously checked during the drying operation. A limit switch open or any other error condition will cause the dryer to shutdown, and the fan will be shutdown. **If a limit opens, or an error condition occurs during drying, the control will lockup in the error display mode. Power must be shut off and back on to the control to clear the error condition--even if the error or limit that caused the shutdown has been corrected.** This is to keep the display locked up with the condition that caused the error, allowing the operator time to determine what caused the shutdown.

Programming Set Points

Depressing the "PROGRAM" switch (lower left) causes the display to enter the program mode. Each item below is programmed by using the up and down arrow switches. Holding down these up and down arrow switches for about 2 seconds will cause the numbers to increase/decrease rapidly until the switch is released. When finished programming an item, depressing the "PROGRAM" switch again will cause the new setting to be entered into memory, and the display will advance to the next function to be programmed.

Programming may be done at anytime (unless an error condition exists) even while the dryer is in operation.

Programming a system with Multiple heaters may be done at any heater control console. The information programmed is automatically transmitted to all other heaters when the programming is complete.

Hi Limit Set Point--The upper left cursor is flashing indicating the mode. If the plenum temperature increases above this point, the flame is shut off--"OFF-CYCLE" is displayed on screen.

Cycle Set Point--The upper 2nd from left cursor is flashing indicating the mode. **If the dryer is not a hi-lo dryer, this function is skipped.** If the plenum temperature increases above this point, the flame reduces to "LO-FLAME".

Humidity Set Point--The upper 2nd from right cursor is flashing indicating the mode. If the humidity is above this point the dryer operates normally--flame on and off at the high limit and cycle set points. If the humidity is below this point the dryer goes into the "OFF-CYCLE" mode.

Temperature Differential--The upper right cursor is flashing indicating the mode. If the flame shuts off because the temperature is greater than the high limit set point, the temperature must fall below the (Set Point minus Temperature Differential) for the flame to come back on.

Programming the high-limit set point.

On hi-lo units when the unit reaches cycle set point, the flame will switch to lo-flame and unit will not cycle back to hi-flame until (Set Point minus Temperature Differential) is reached.

Temperature differential would normally be set for 10-15 degrees F for high temp units, and 2-5 degrees F for lo-temp units.

Humidity Differential--The upper right cursor is flashing indicating the mode. If the flame shuts off because the humidity set point, the humidity must rise above the (Set Point plus Humidity Differential) for the flame to come back on. (Normally set to 5%)

Programming Hours To Shutdown

To change the hours to shutdown, depress and hold the "SHUTDOWN HOURS" switch. While holding in on the switch, depress the up and down arrow switches to alter the hours. Setting range is 0 to 200 hours.

Setting the cycle set point.

Drying Grain In The Hours To Shutdown Mode

While drying grain, depress and hold the "SHUTDOWN HOURS" switch. While holding in on that switch, depress the "START" switch. After depressing the start switch one time, the heater is in the shutdown mode. Then, the fan and heater shutdown when the time expires. This is indicated by the lower left cursor flashing.

Depressing the start switch again (while holding in on the "SHUTDOWN HOURS" switch) will cause only the heater to shut off. This leaves the fan on when the time expires. This is indicated by the 2nd from lower left cursor flashing. Depressing the start switch one more time returns the heater into the continuous--non-shutdown mode.

Run Hours Display

Run hours are recorded when the controller detects that the fan is on (airflow). The hours may be viewed by depressing the "HOURS" to get hours and "HOURS X 1000" to get the number of 1000 hours accumulated.

Multiple Heater Notes

When multiple heaters are connected together, the temperature and humidity sensors must be connected to the master.

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 drying 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).

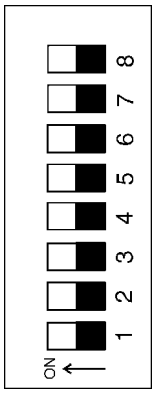
4. Turn the fan and heater on. To set the modulating valve, turn the T-handle out (counterclockwise) until loose and wait a few minutes for the plenum temperature to equalize. When the temperature under the bin has equalized, gradually turn T-handle in (clockwise) about 1/2 turn at a time. Wait until 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 not shut 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. Bypass 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 pres sure will be less. Since less heat is required to maintain the same temperature in the plenum, the modulating valve will have reduced the amount of gas used by the heater.

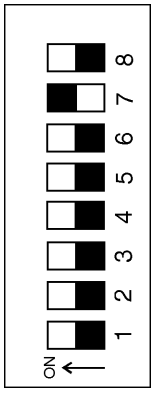
Configuration Dip Switches (Normally Done At GSI)

These switches are used to configure the heater control for various types of heaters.

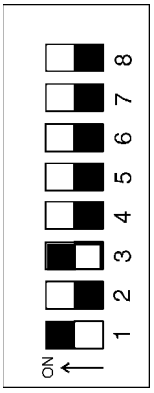


Stand alone heater with no slaves, all dip switches in the off state.

Multiple heaters connected together through the serial link.

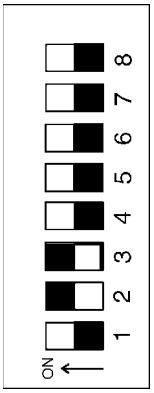


Master with one slave-dip switch 7 on/all others off.



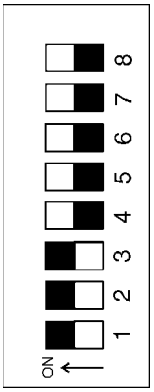
Slave #1-dip switch one and three on/all others off.

Master with two slaves-dip switch 8 on/all others off.

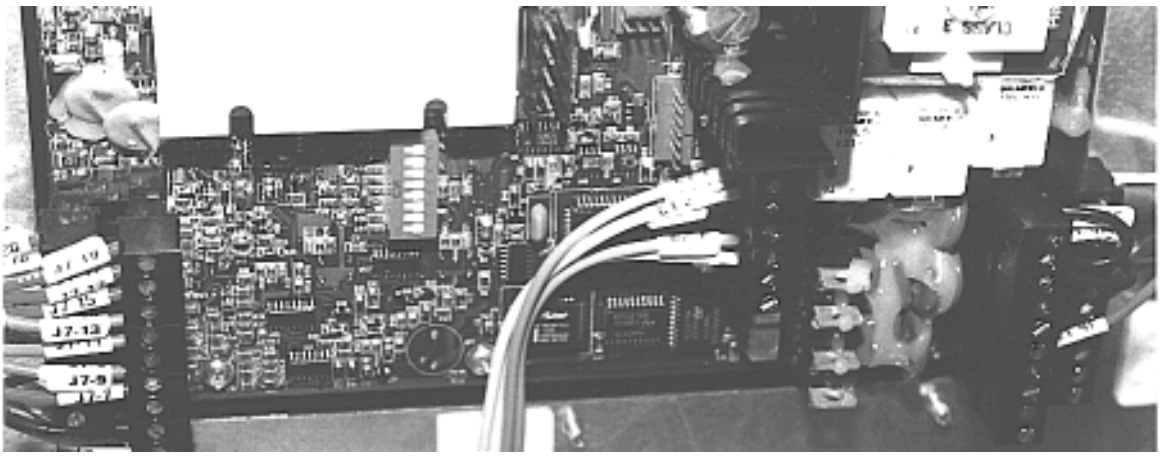


Slave #2-dip switch two and three on/all others off.

Master with 3 slaves-dip switch 7 & 8 on/all others off.



Slave #3-dip switch one, two and three on/all others off.



The backside of the control board, showing the dip switch placement.

Limit Switches

The following limit switch errors light up individually on the heaters LCD screen: PLENUM, HOUSING, VAPOR, TEMP HI LIMIT.

Note: When a shutdown does occur due to an error condition, the amount of time elapsed since the shutdown can be viewed by pressing the down arrow switch (up to 218 Hours).

Multiple Heater Error Conditions

If two or more heaters are connected together through the serial link, and the master cannot communicate with a slave controller, the master will display "SLA" on the main display and the "RX" "TX" symbols will be flashing.

If a limit switch error or one of the error numbers 1 through 8 occurs, that error is displayed on the slave where the error originates. The master displays "SLA ERROR".

Misc Error Numbers

1 Temperature probe 1 open.

2 Temperature probe 1 short.

3 Temperature probe 2 open.

4 Temperature probe 2 short.

5 Airflow open.

6 Airflow short.

7 Illegal flame sense.

Error 7 is most likely caused by stuck open solenoid. Error 7 will not shutdown fan until loss of flame is detected by control.

8 Flame probe short error.

9 Slave #1 inconsistent with master with either the drying grain flag or the LP main solenoid or cycle solenoid.

Most likely the slave got reset powering up with the solenoids off.

10 Slave #2 inconsistent.

Same as error 9 for slave #1.

11 Slave #3 inconsistent.

Same as error 9 for slave #1.

12 Wrong voltage.

Dip switch #5 is the voltage selector switch. If dip switch #5 in "ON" that selects 240 VAC. If the unit has only 120 VAC applied, error 12 will show up. If dip switch #5 is "OFF" that selects 120 VAC. If the unit has 240 VAC applied error 12 will show up.

This is important because if the fan heater is set up at GSI for 120 VAC and the customer connects to 240 VAC the heater control will work, but if allowed to operate the solenoids will have 240 VAC applied to them which will damage solenoids.

13 +11 volt DC shorted to ground.

000 This indicates that one of the other on screen errors (vapor, plenum or housing temp hi-limit or flame out or no airflow has occurred).

(Errors 9 through 11 are displayed only if multiple heaters are tied together through serial link).

Note: Temperature sensor connection-the temperature sensor (bolt) must always be connected to the master.

The heater control display showing error #7.

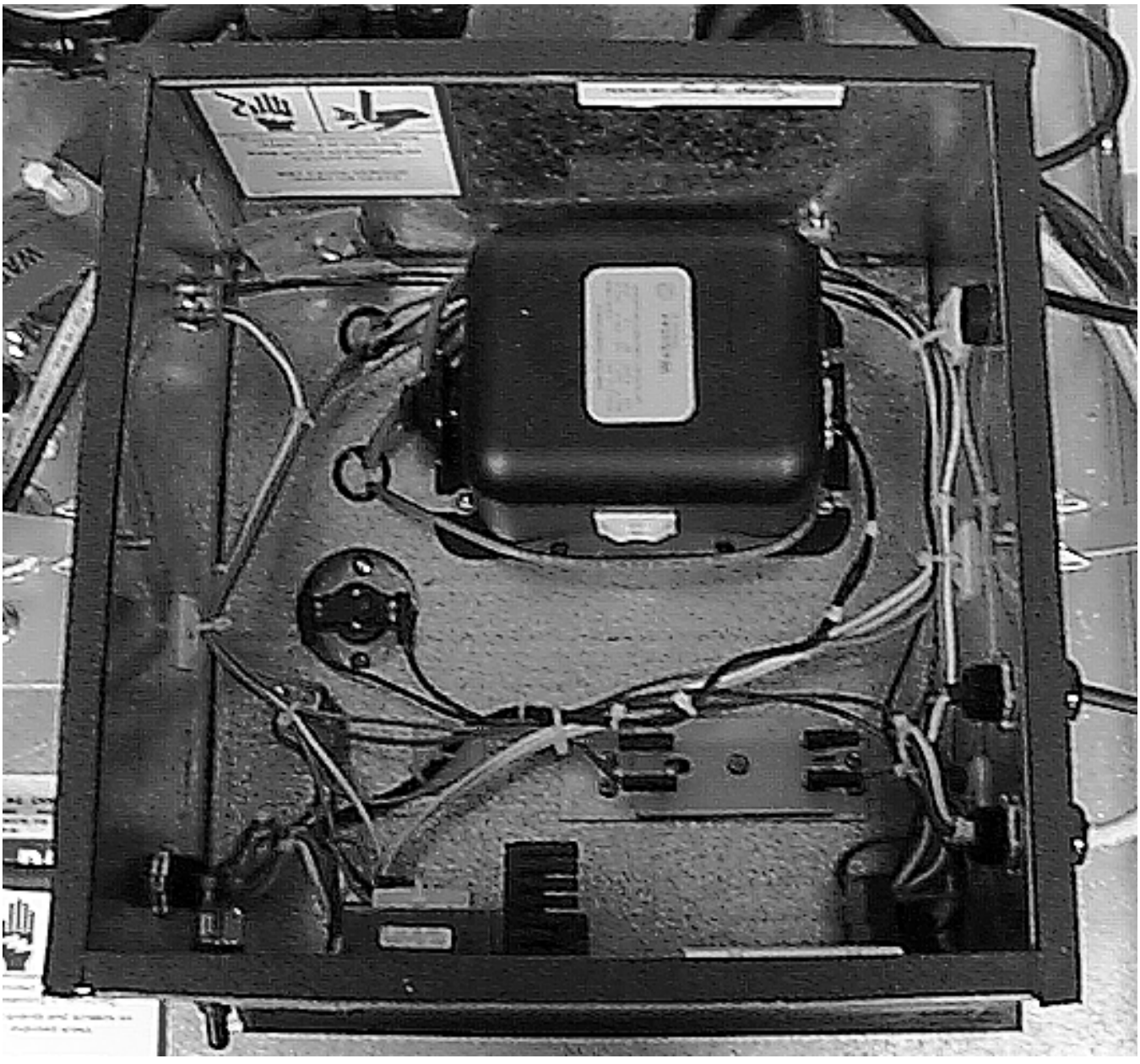
All Airstream heaters are constructed of durable weather-resistant materials, so a minimum amount of service should be required; however before the unit is started for the first time each season there are a few items that need to be checked out. All damaged parts should be repaired or replaced.

1. Disconnect and lock out 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.

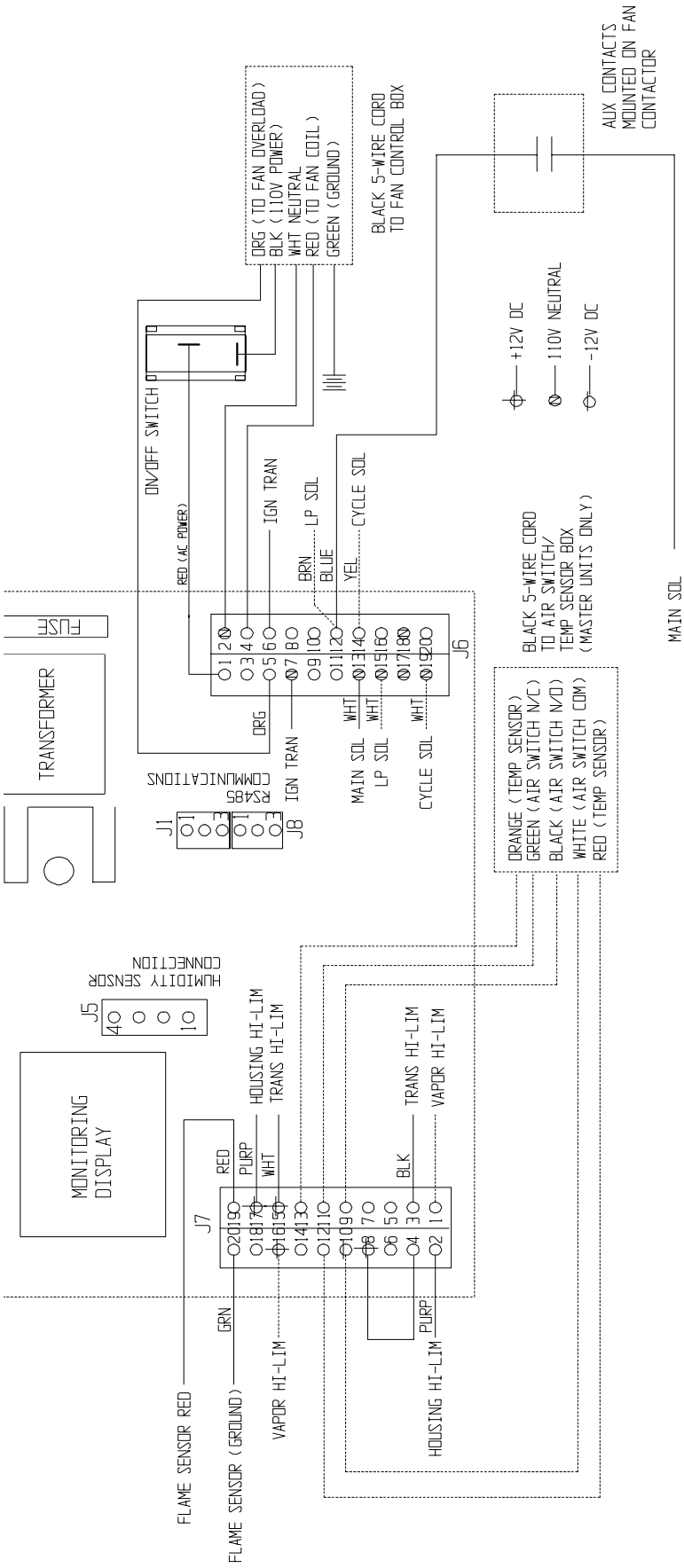
2. Remove burner orifice tube and inspect for dirt or foreign material. Clean out if necessary.

3. Inspect burner for wear or foreign material in any of the ports. Clean or replace parts if necessary.

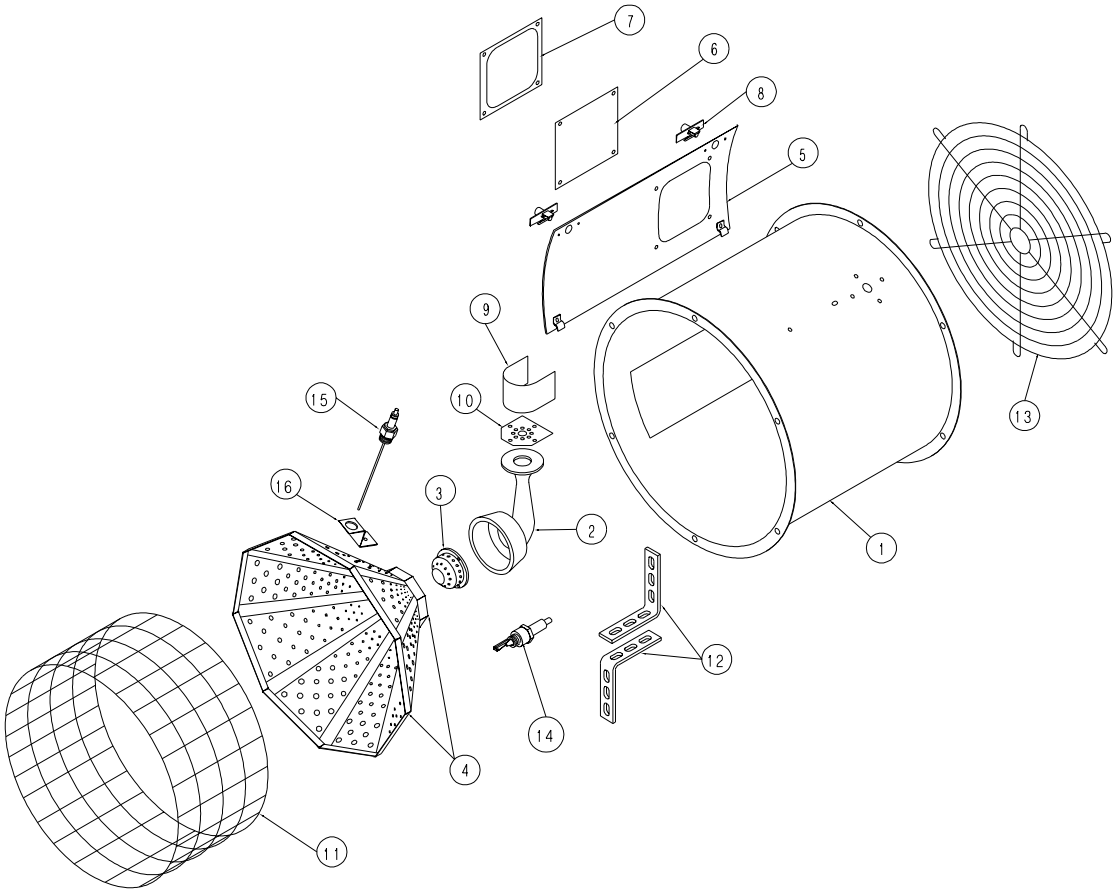
4. Inspect the spark plug and flame probe for corrosion and damage. Clean or replace if necessary.



The Series 2000 control box.

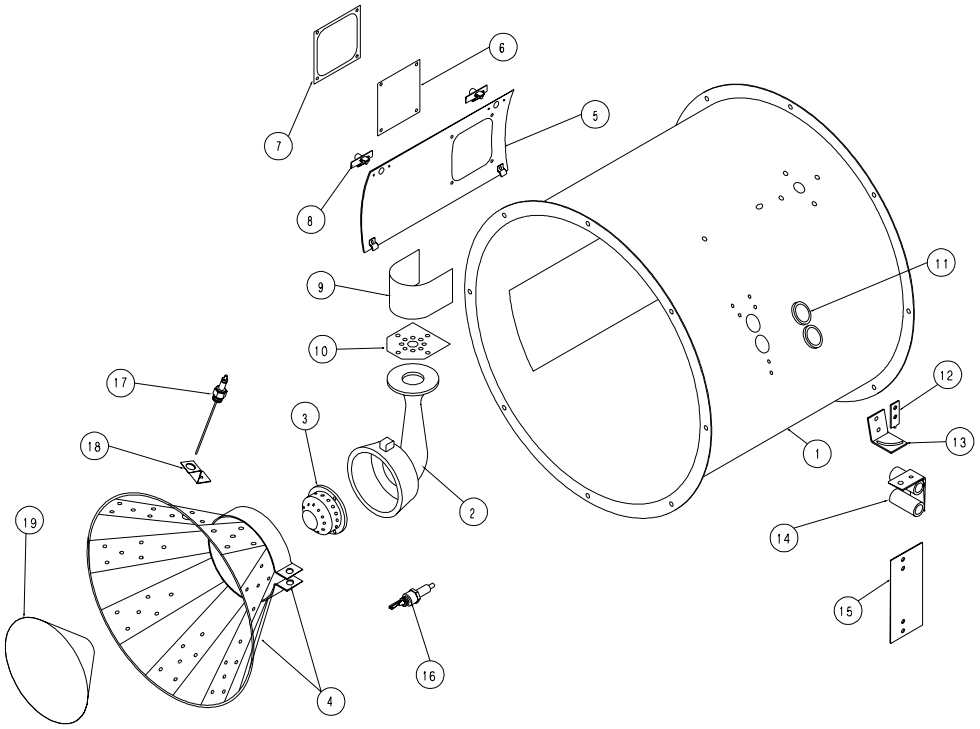

AUX CONTACTS
MOUNTED ON FAN
CONTACTOR
ORG (TO FAN OVERLOAD)
BLK (110V POWER)
WHT NEUTRAL
RED (TO FAN COIL)
GREEN (GROUND)
BLACK 5-WIRE CORD
TO FAN CONTROL BOX
+12V DC
110V NEUTRAL
-12V DC
ON/OFF SWITCH
RED (AC POWER)
IGN TRAN
BRN
LP SOL
BLUE
YEL
CYCLE SOL
MAIN SOL
BLACK 5-WIRE CORD
TO AIR SWITCH/
TEMP SENSOR BOX
(MASTER UNITS ONLY)
TRANSFORMER
FUSE
J6
ORG
WHT
WHT
WHT
MAIN SOL
LP SOL
CYCLE SOL
ORANGE (TEMP SENSOR)
GREEN (AIR SWITCH N/C)
BLACK (AIR SWITCH N/O)
WHITE (AIR SWITCH COM)
RED (TEMP SENSOR)
RS485
COMMUNICATIONS
J1
J8
IGN TRAN
HUMIDITY SENSOR
CONNECTION
J5
MONITORING
DISPLAY
J7
RED
PURP
WHT
BLK
HOUSING HI-LIM
TRANS HI-LIM
TRANS HI-LIM
VAPOR HI-LIM
FLAME SENSOR RED
FLAME SENSOR (GROUND)
GRN
VAPOR HI-LIM
PURP
HOUSING HI-LIM

18" Gas Heater



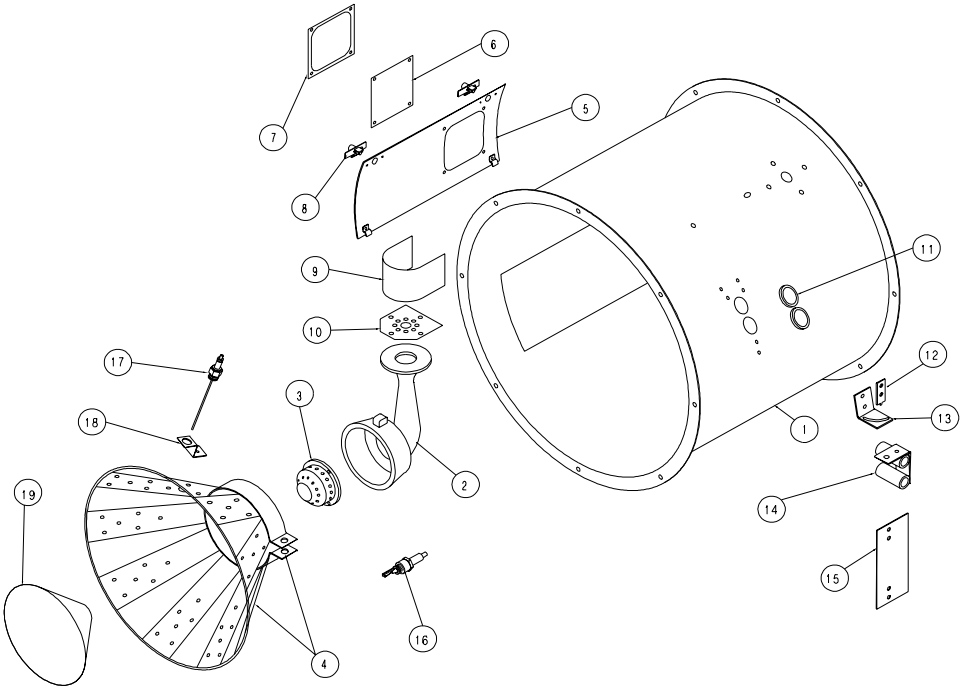
Key	Part Number	Description
1	HF-6785	18" Heater Housing
2	HH-3933	18" Burner Casting
3	HH-1180	18" Flame Spreader
3	HH-4410	18" Lo-temp Flame Spreader
4	HF-7078	18" Flame Diverter
4	HF-7073	18" Lo-temp Flame Diverter
5	HF-6062-18	18" Access Panel
6	HH-2020	Plastic view window
7	HF-2025G	Access panel cover plate
8	TFH-2046	Access panel latch
9	HF-983	18/24" Burner collector
10	HF-978	18/24/26" Burner collector plate
11	HH-4416	Drum grill guard (LTD)
12	HH-4421	Stand-off bracket (LTD)
13	F-983	18" Grill guard (LTD)
14	HH-1650	Spark plug
NS	HF-1810	Spark plug nut
NS	HF-7260	18-28" Heater spark plug wire
NS	HF-7262	18-28" Heater flame probe wire
15	*THH-4179	Flame Sensor
16	CD-0187	Flame sensor bracket

24" & 26" Gas Heater



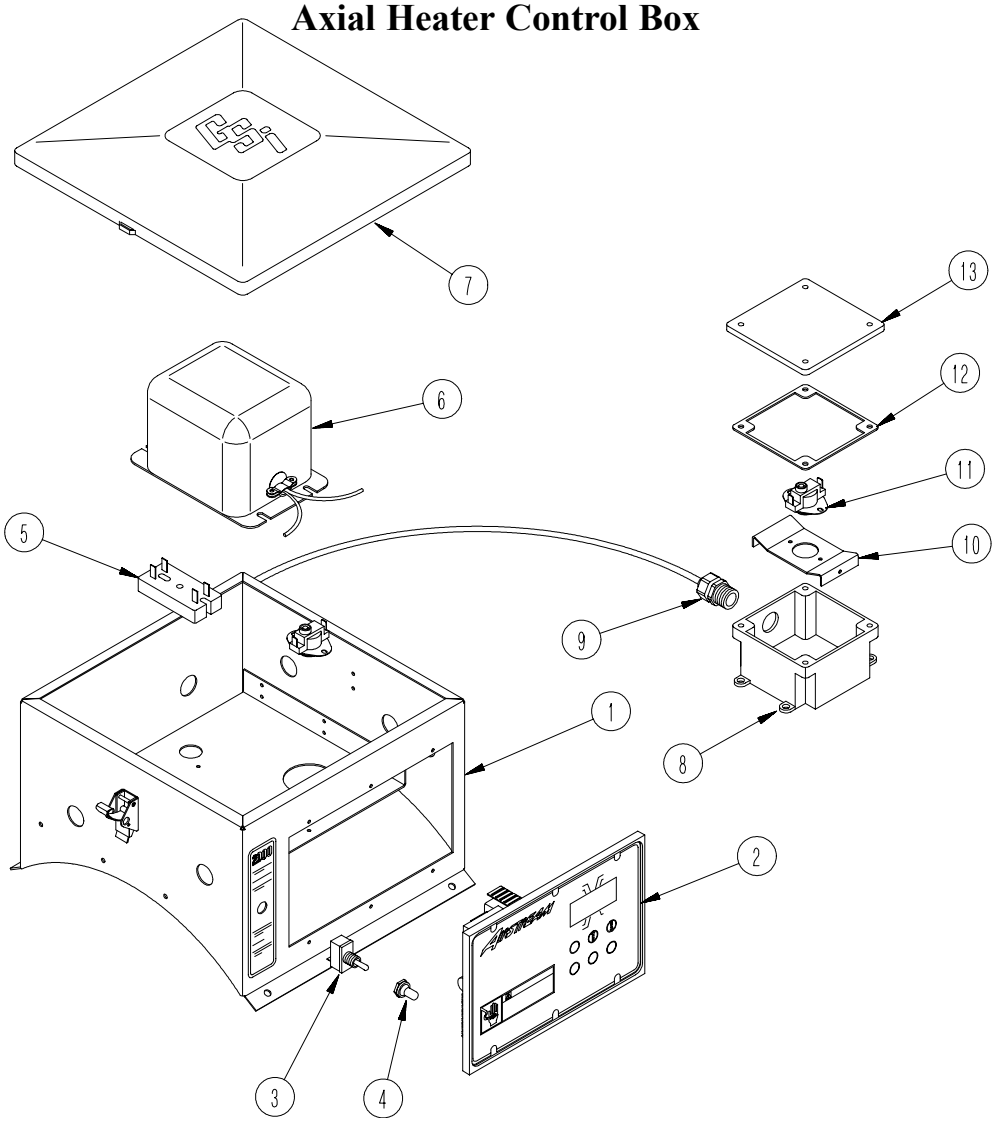
Key	Part Number	Description
1	HF-6175	24" Heater Housing
1	HF-6176	26" Heater Housing
2	HH-3934	24/26" Burner casting
3	HH-1179	24/26" Flame spreader
3	HF-6757	24/26/28" Lo-temp flame spreader
4	HF-7103	24/26" Flame diverter
4	HH-7107	24/26/28" Lo-temp flame diverter
4	HH-7104	24/26" Diverter collar
5	HF-6062-24	24" Access panel
5	HF-6062-26	26" Access panel
6	HH-2020	Plastic view window
7	HF-2025G	Access panel cover plate
8	TFH-2046	Access panel latch
9	HF-983	18/24" Burner collector
10	HF-978	18/24/26" Burner collector plate
11	HH-7016	Rubber grommet
12	HF-7056	Pivot bracket
13	HF-7057	Adjustment bracket
14	HF-7060	Vaporizer support weldment
15	THF-3237	Vaporizer cover
16	HH-1650	Spark plug
NS	HF-1810	Spark plug nut
NS	HF-7260	18-28" Heater spark plug wire
NS	HF-7262	18-28" Heater flame probe wire
17	THH-4179	Flame Sensor
18	CD-0187	Flame Sensor Bracket
19	HH-7054	24-26" Burner cone (propane only)

28" Gas Heater



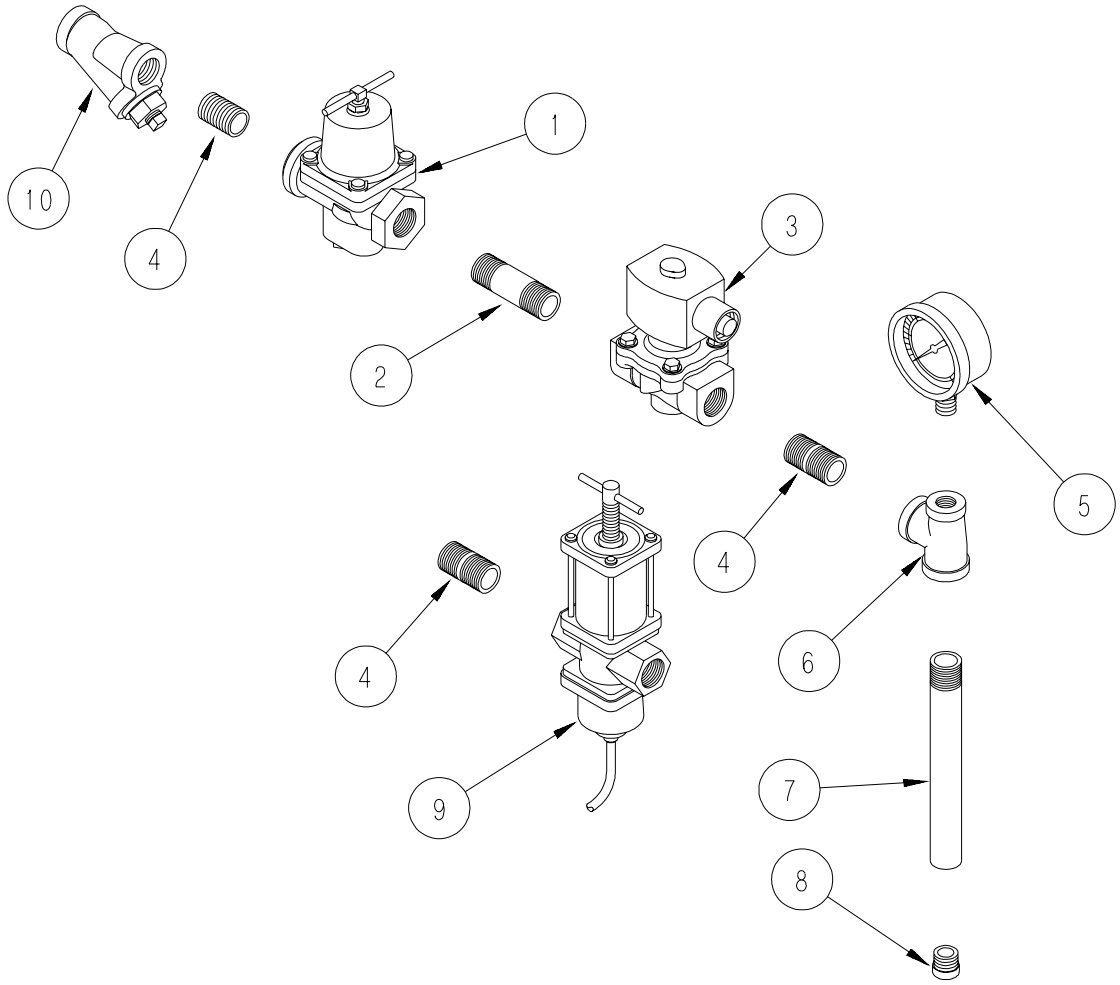
Key	Part Number	Description
1	HF-6060	28" Heater housing
2	HH-3934	24/26" Burner casting
2	THF-3141	28" Burner casting
3	THF-3144	28" Flame spreader
3	HF-6757	24/26/28" Lo-temp flame spreader
4	HF-7105	28" Flame diverter
4	HF-7107	24/26/28" Lo-temp flame diverter
4	HF-7106	28" Diverter collar
4	HF-7104	24/26" Diverter collar
5	HF-6062-28	28" Access panel
6	HH-2020	Plastic view window
7	HF-2025G	Access panel cover plate
8	TFH-2046	Access panel cover plate
9	THF-3101	28" Burner collector
9	HF-986	26" Burner collector
10	HF-7092	28" Burner collector plate
10	HF-978	18/24/26" Burner collector plate
11	HH-7016	Rubber grommet
12	HF-7056	Pivot bracket
13	HF-7057	Adjustment bracket
14	HF-7060	Vaporizer support weldment
15	THF-3237	Vaporizer cover
16	HH-1650	Spark plug
NS	HF-1810	Spark plug nut
NS	HF-7260	18-28" Heater spark plug wire
NS	HF-7262	18-28" Heater flame probe wire
17	THH-4179	Flame sensor
18	CD-0187	Flame sensor bracket
19	HH-7055	28" Burner cone (propane only)

Axial Heater Control Box



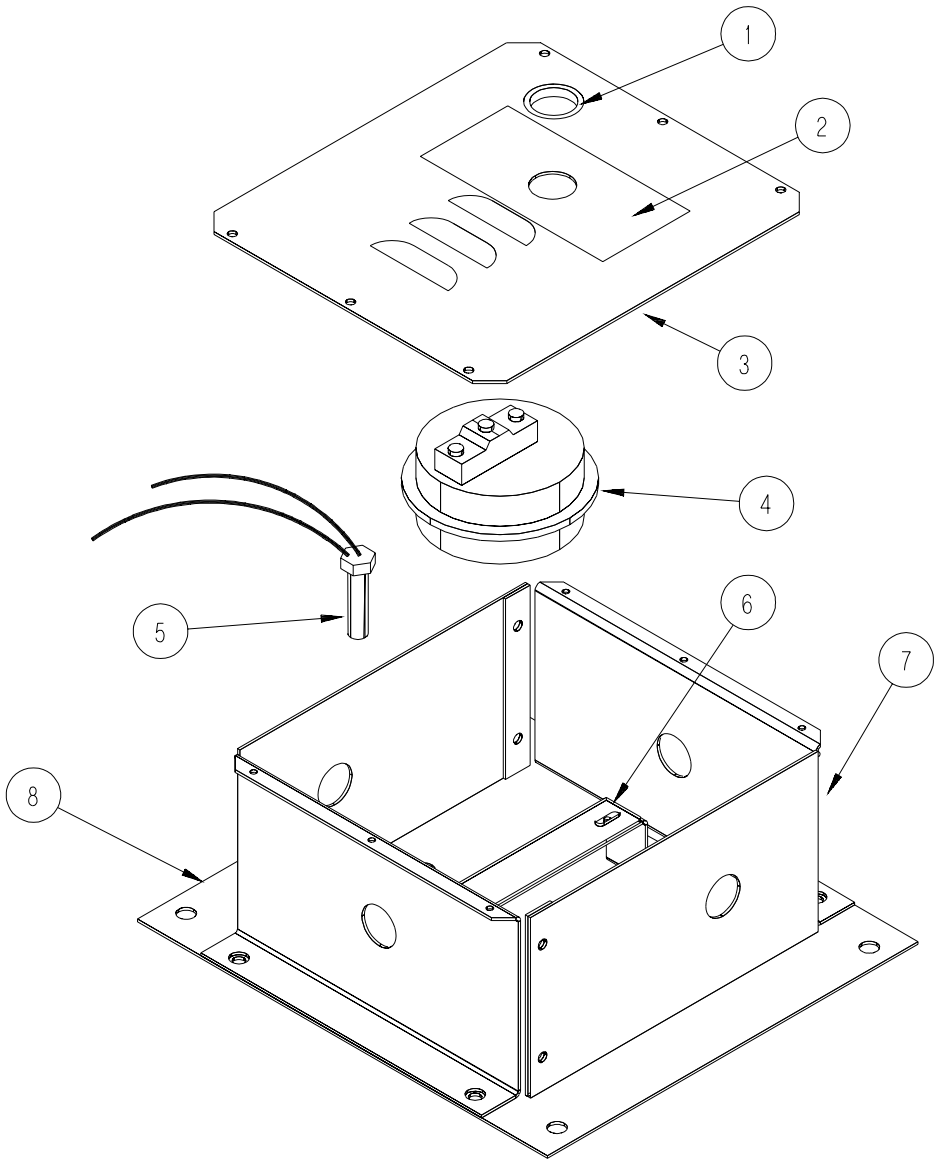
Key	Part Number	Description
1	HF-7242	18" Control Box Housing
1	HF-7241	24" Control Box Housing
1	HF-7240	26" Control Box Housing
1	HF-7239	28" Control Box Housing
2	HF-7276	Control board assembly
3	HH-1442	Toggle switch
4	HF7277	Switch boot
5	HF-7255	Ballast Resistor
6	HH-1487	Ignition transformer
7	F-942	Control box lid
8	FLX-2688	Control box bottom
9	FH-1310	Cord connector
10	HF-7184	Hi-limit bracket
11	HH-1092	High limit switch 190°
12	FLX-2690	Box gasket
13	FLX-2689	Box lid

Axial Propane Vapor Pipetrain



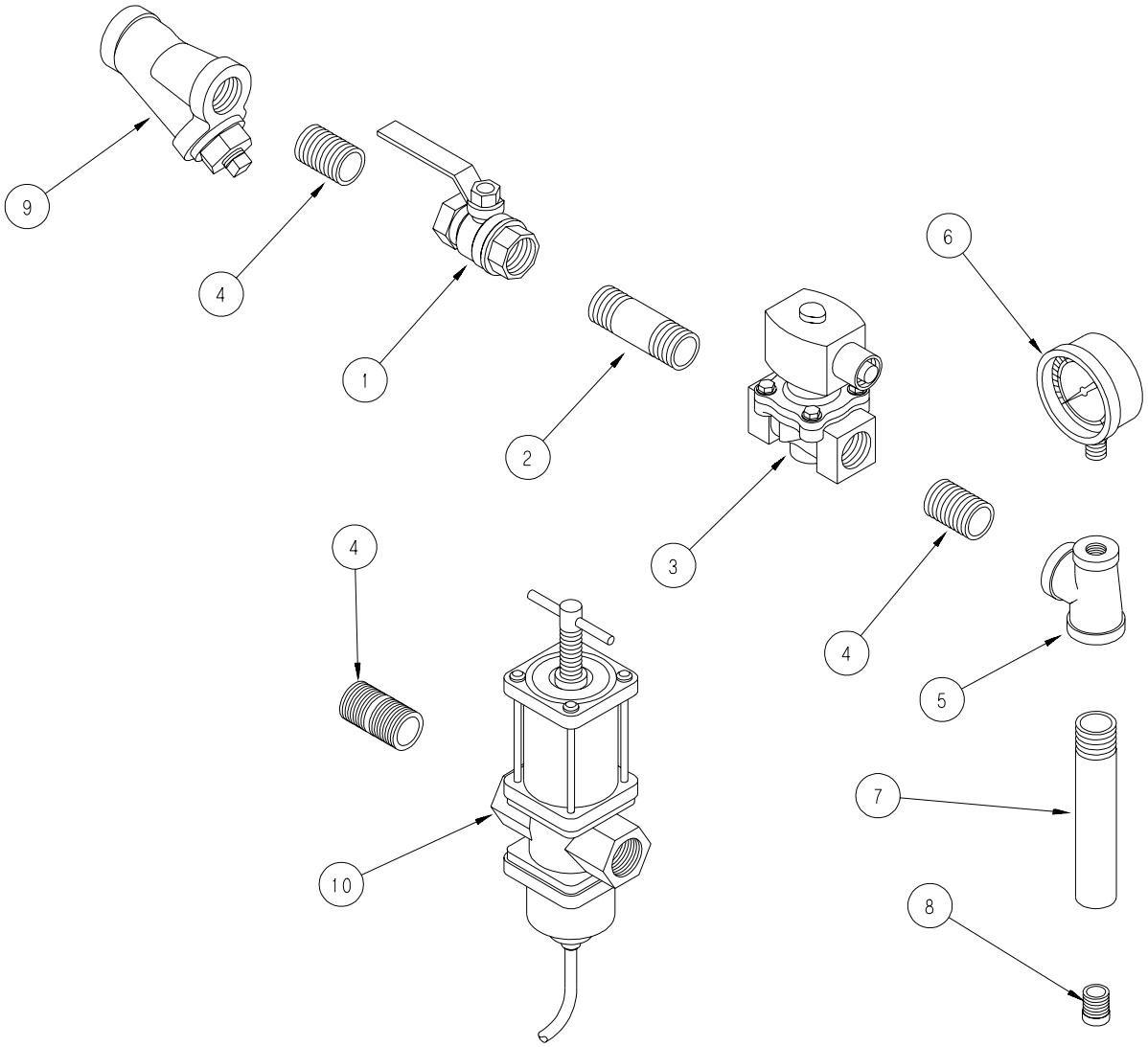
Key	Part Number	Description
1	HH-1077	1/2" regulator
2	HH-3670	1/2" x 2-1/2" nipple
3	TFC-0032	1/2" solenoid
4	HH-2029	1/2" x 1-1/2" nipple
5	HH-2984	1/4" gauge 30PSI
6	S-3853	1/2" x 1/4" x 1/2" tee
7	HH-1083	18/24/28" Orifice pipe
7	HH-1107	26" Orifice pipe
8	HF-7036	5/32" Orifice plug (18" Standard)
8	CD-0149	5/64" Orifice plug (18" lo-temp)
8	HF-7086	3/16" Orifice plug (24" Standard)
8	HF-7084	3/32" Orifice plug (24/26/28" lo-temp)
8	HF-7087	7/32" Orifice plug (26" Standard)
8	HF-7088	15/64" Orifice plug (28" Standard)
9	HH-2653	Modulating valve (optional)

Air Switch Temperature Sensor Box



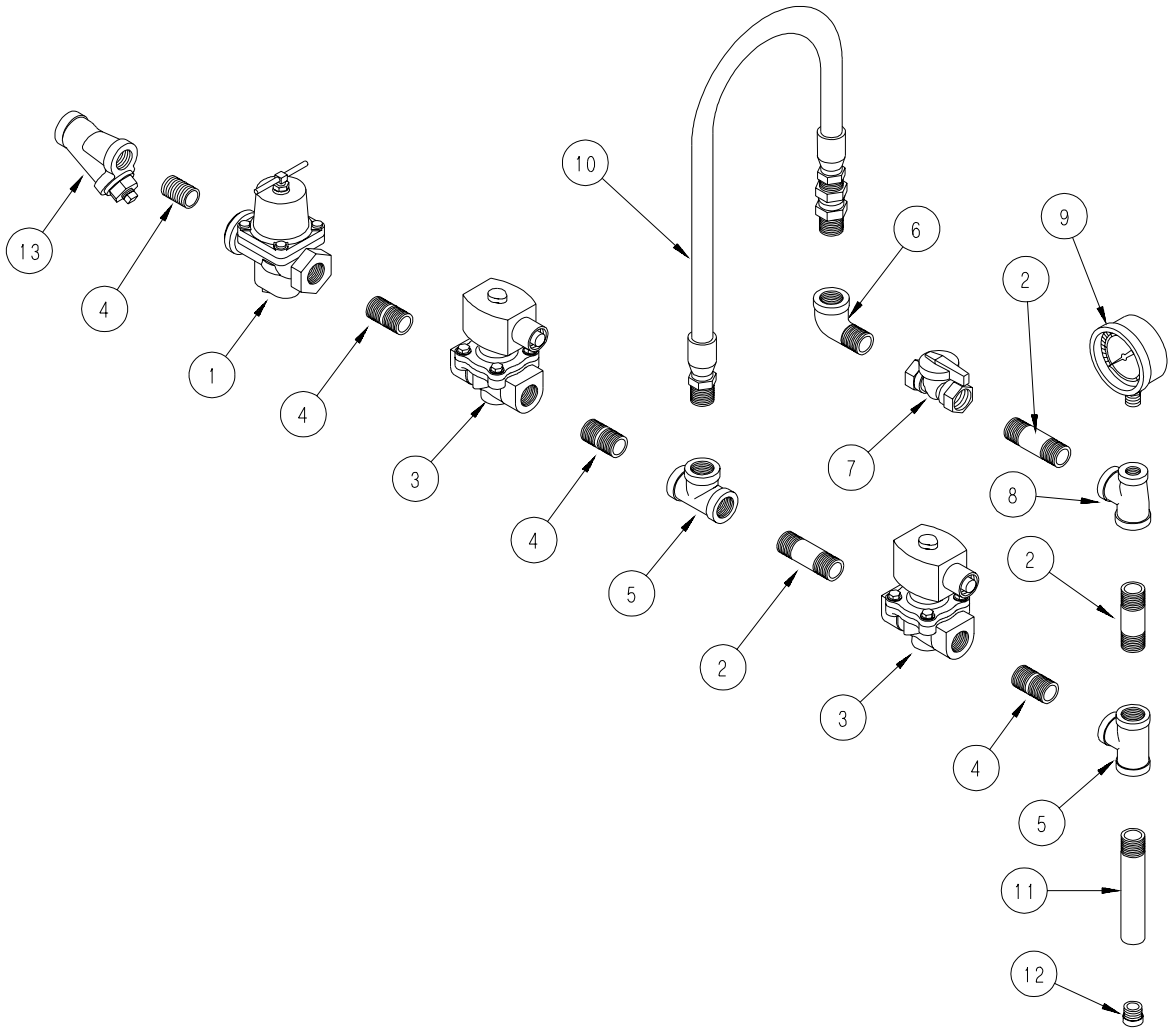
Key	Part Number	Description
1	HF-7414	Recessed Plastic Plug
2	DC-1103	Adjustment Decal
3	HF-7461	Box Lid
4	HH-7063	Air Pressure Switch
5	HF-7236	Thermistor Temp Sensor
6	HF-7460	Switch Mounting Bracket
7	HF-7458	Box Half (Requires 2)
8	HF-7459	Bin Mounting Plate
NS	D03-0322	Filter
NS	HF-7462	Air Switch Assembly w/ Temp Sensor
NS	HF-7471	Air Switch Assembly w/o Temp Sensor

Axial Natural Gas Pipetrain



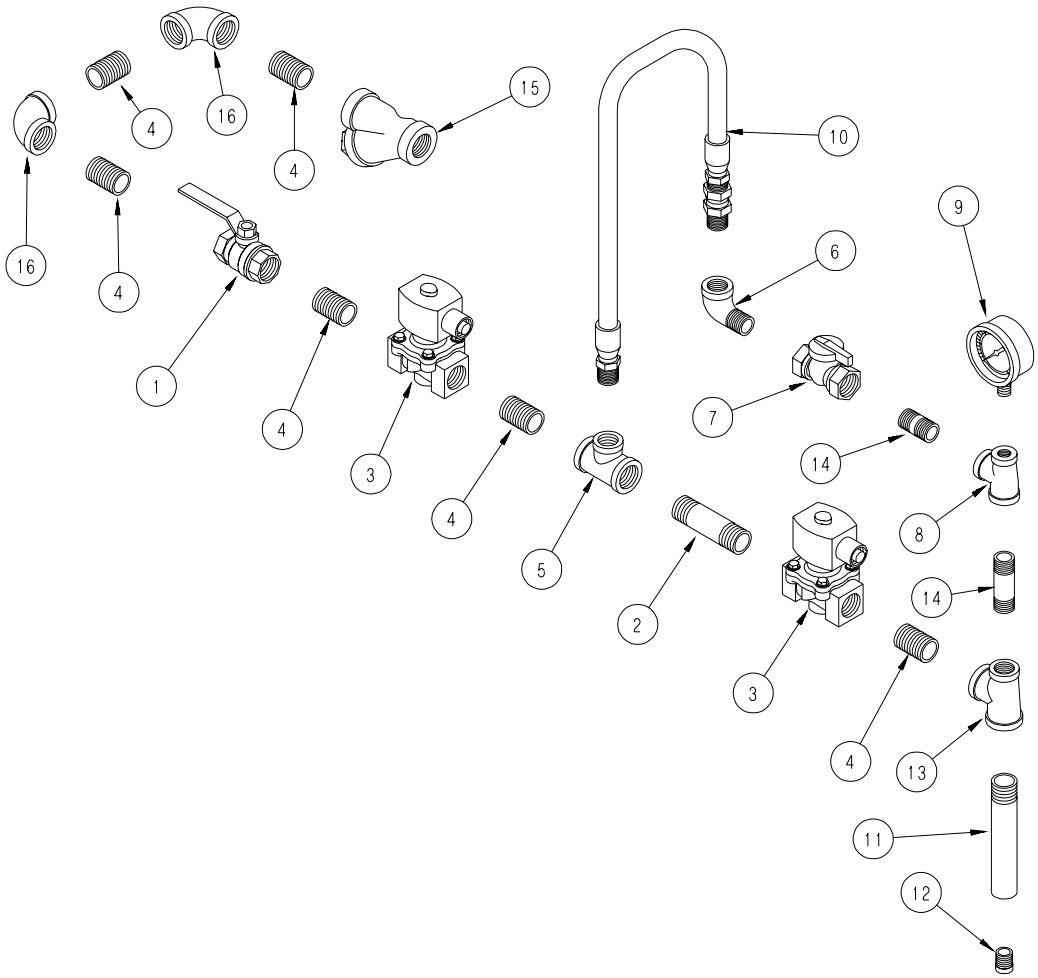
Key	Part Number	Description
1	TFC-0051	3/4" Ball valve
2	THH-4136	3/4" x 3" Nipple
3	TFC-0081	3/4" Solenoid
4	THH-4121	3/4" Close nipple
5	THH-4158	3/4" x 1/4" x 3/4" Tee
6	D08-0022	15PSI gauge
7	HH-7026	3/4" 18/24/28" Orifice pipe
7	HH-7027	3/4" 26" Ofifice pipe
8	HF-7123	1/4" Orifice plug (18" standard)
8	HF-7124	5/16" Orifice plug (24" standard)
8	HF-7125	23/64" Orifice (26" standard)
8	HF-7126	3/8" Orifice (28" standard)
9	D67-0008	3/4" Strainer

Axial Propane Vapor Hi-lo Pipetrain



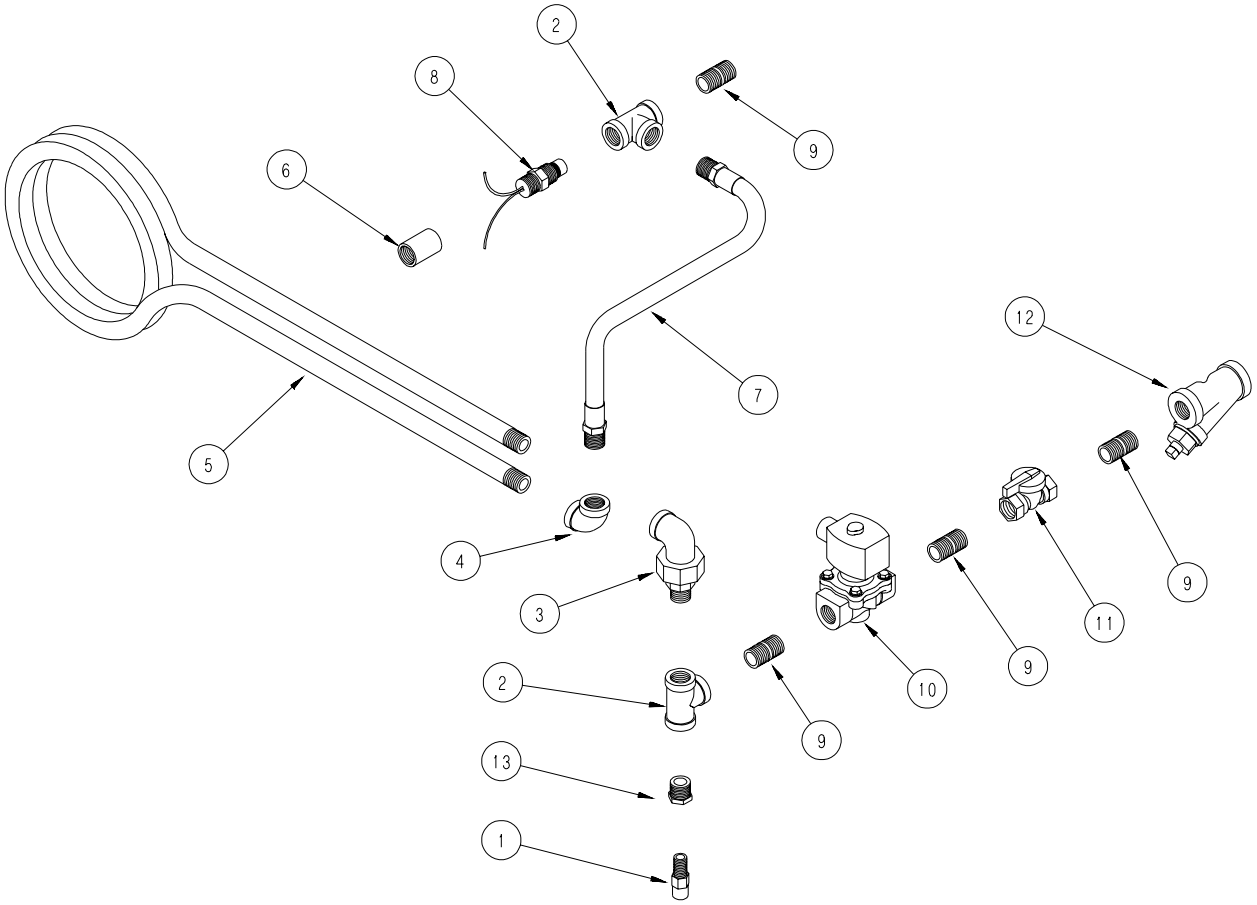
Key	Part Number	Description
1	HH-1077	1/2" 0-30 PSI regulator
2	HH-3670	1/2" x 2-1/2" nipple
3	TFC-0032	1/2" solenoid
4	HH-2029	1/2" x 1-1/2" nipple
5	HH-1453	1/2" x 1/2" x 1/2" Tee
6	THH-4067	1/2" street elbow
7	THH-4007	1/2" ball valve
8	S-3853	1/2" x 1/4" x 1/2" Tee
9	HH-2984	30 PSI gauge
10	HH-7019	1/2" gas hose
11	HH-1107	26" Orifice pipe
11	HH-1083	18/24/28" Orifice pipe
12	HF-7036	5/32" Orifice plug (18" Standard)
12	HF-7086	3/16" Orifice plug (24" Standard)
12	HF-7087	7/32" Orifice plug (26" Standard)
12	HF-7088	15/64" Orifice plug (28" Standard)

Axial Natural Gas Hi-lo Pipetrain



Key	Part Number	Description
1	TFC-0051	3/4" Ball valve
2	THH-4136	3/4" x 3" nipple
3	TFC-0081	3/4" solenoid
4	THH-4121	3/4" close nipple
5	THH-4174	3/4" x 3/4" x 1/2" Tee
6	D07-0022	1/2" street elbow
7	TFC-0030	1/2" Ball valve
8	S-3853	1/2" x 1/4" x 1/2" Tee
9	D08-0022	15 PSI gauge
10	HH-7019	1/2" gas hose
11	HH-7026	3/4" 18/24/28" Orifice pipe
12	HF-7123	1/4" Orifice plug (18" Standard)
12	HF-7124	5/16" Orifice plug (24" Standard)
12	HF-7125	23/64" Orifice plug (26" Standard)
12	HF-7126	3/8" Orifice plug (28" Standard)
13	D18-0002	3/4" x 1/2" x 3/4" Tee
14	HH-3670	1/2" x 2-1/2" Nipple
15	D67-0008	3/4" Strainer
16	THH-4120	3/4" Elbow

Axial Lp Pipetrain



Key	Part Number	Description
1	CD-0198	Vaporizer coil
2	D67-0005	1/2" Pipe coupler
3	HH-7013	200 degree vapor high limit
4	HH-1453	1/2" x 1/2" x 1/2" tee sh.40
5	HH-2029	1/2 x 1-1/2" nipple sh.40
6	TFC-0032	1/2" Regulator
7	HH-3670	1/2 x 2-1/2 Nipple
8	TFC-0032	1/2" Regulator
9	HH-2984	0-30 PSI gauge
10	S-3853	1/2" x 1/4" x 1/2" tee
11	HH-1107	26" Orifice Tube
11	HH-1083	18/24/28" Orifice Tube
12	D07-0009	5/16" x 24" gas hose
13	THH-4071	1/2" Elbow sh.80
14	THH-4089	1/2" Male union elbow
15	D07-0019	1/2" x 1-1/2" Nippple sh.80
16	HH-1251	1/2" Strainer
17	HH-1376	1/2" Gas shut-off
18	TFC-0092	1/2" LP Solenoid
19	THH-4058	1/2" x 1/2" x 1/2" Tee sh .80
20	THH-4023	1/2" x 1/4" Reducer bushing
21	HH-4845	1/4" relief valve

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