

Part Number	752485
Bulletin	464G
Effective	1/15/2012

CALDWELL HEATER INSTALLATION AND OPERATION MANUAL



THIS MANUAL IS FOR THE INSTALLATION, OPERATION
AND MAINTENANCE OF HEATER MODELS
#H33-NGE-PE, #H33-LPGE, #H28-NGE-PE, #H28-LPGE, #H28-LT-NGE-PE,
#H24-NGE-PE, #H24-LPGE, #H24-LT-NGE-PE, #H18-NGE-PE
WITH SERIAL NUMBERS 10A AND UP.

NOTICE

READ MANUAL THOROUGHLY BEFORE INSTALLING OR OPERATING HEATER.
KEEP THIS MANUAL IN A LOCATION FOR QUICK ACCESS AND REFERENCE.



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CALDWELL HEATER INSTALLATION AND OPERATION MANUAL

THIS MANUAL IS FOR THE INSTALLATION, OPERATION AND MAINTENANCE OF H33, H28, H24, AND H18 SERIES HEATERS WITH SERIAL NUMBER OF 10A AND UP. READ MANUAL THOROUGHLY BEFORE INSTALLING OR OPERATING YOUR CALDWELL HEATER. KEEP THIS MANUAL IN A LOCATION FOR QUICK ACCESS AND REFERENCE.

SPECIAL SERVICE NOTICE

If you are unable to remedy any service problem after thoroughly studying this manual, contact the dealer from whom you purchased the unit. YOUR DEALER IS YOUR FIRST LINE OF SERVICE. GIVE HIM THE INFORMATION REQUESTED BELOW AND EXPLAIN YOUR PROBLEM. If he is unable to correct the problem, refer to the factory. When calling the factory for service, ask for the **Customer Service Department**. Give the information requested below and explain your problem. If adequate information relating to the problem is given, the Service Department should be able to pinpoint the problem and suggest an immediate solution. CHIEF INDUSTRIES, INC., AGRI/INDUSTRIAL DIVISION SERVICE POLICY IS INCLUDED AT THE END OF THE MANUAL.

- *1. Heater Model Number _____
- *2. Heater Serial Number _____
- *3. Fan Model Number _____
- *4. Fan Serial Number _____
- *5. Type of Fuel _____
- *6. Type of External Plenum Control Used _____
- 7. Setting of External Plenum Control _____
- 8. Approximate Operating Pressure _____
- 9. Hours Unit has been in Operation _____
- 10. Size of Bin (Diameter) _____
- 11. Eave Height _____
- 12. Grain Depth _____
- 11. Kind of Grain _____
- 12. Moisture Content _____
- *12. Dealer Purchased From _____
- *13. Date Purchased _____

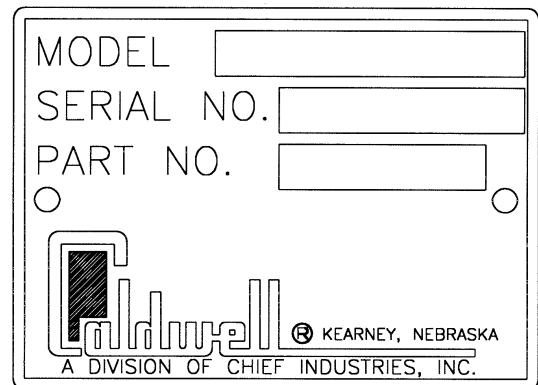


Figure 1. Typical Serial Number Plate

THE ABOVE INFORMATION MUST BE AVAILABLE BEFORE CONTACTING THE DEALER OR FACTORY FOR SERVICE. ASTERISKED (*) ITEMS SHOULD BE FILLED IN AT DATE OF PURCHASE.

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MODEL NUMBER DESCRIPTION

The heater model nomenclature distinguishes the application of the heater. The information includes a designation of the applicable fan and type of fuel to be utilized either natural gas, vapor propane, or liquid propane. The model number is stamped on the serial number plate and the definition of the model number nomenclature is as follows:

Example: **H** **28** - **LT** - **NGE-PE** - **M**
 (a) (b) (c) (d) (e)

- (a) **H** = Heater Unit
- (b) **28** = Housing Diameter
- (c) **LT** = Low Temperature
- (d) **NGE** = Type of Fuel to be Utilized
Where
NGE-PE Natural Gas or Propane Vapor Fuel (Electric)
LPGE Liquid Propane Gas Fuel (Electric)
- (e) **M** = with Modulating Valve

PACKING LIST

The shipment should contain the following items. Check carefully when unpacking and before installing. In case of any shortage, contact your dealer. In case of damage during shipment, file a claim with the carrier.

TABLE 1. PACKING LIST

QUANTITY	COMPONENT	DESCRIPTION
1	Heater	Heater Assembly
1	Warranty Registration Card	Bulletin
1	Manual	Bulletin (464G)
1	Bolt Bag	Assembly
1	Orifice	Package

NOTE: BEFORE STARTING THE INSTALLATION OF THE HEATER, CHECK TO SEE THAT ALL ITEMS CALLED OUT ON THE PACKING LIST HAVE BEEN RECEIVED.

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HEATER ACCESSORIES

1. A Humidistat, Thermostat, or Thermostat-Humidistat Control is not included with the standard heater. They are to be ordered separately. A dual Humidistat-Thermostat Kit can be ordered so that one control assembly can be used when two heater units are used on the same bin.
2. Caldwell requires using a fuel line strainer in the fuel line just before the fuel enters the heater plumbing. A line strainer is provided on LPGE units, but not on NGE-PE units. A line strainer can be obtained from Caldwell, or your gas company.

CAUTION: YOUR WARRANTY COULD BE JEOPARDIZED IF THE HEATER SHOULD MALFUNCTION DUE TO FOREIGN MATERIAL FOUND IN THE HEATER PLUMBING AND THE FUEL SUPPLY LINE DOES NOT HAVE A LINE STRAINER.

3. A Caldwell Vaporizer can be ordered and field installed on H24-NGE-PE and H28-NGE-PE units, to assure a supply of propane vapor to the heater when conditions are such that the supply tank does not supply a sufficient volume of vapor to the unit. The vaporizer is a standard component on H24-LPGE and H28-LPGE units.
4. When installing the heater on a centrifugal fan, a centrifugal cord/airswitch kit for an upstream heater must be ordered (part #9195864).
5. When wiring a heater to a 460 or 575 volt fan, a Step Down Transformer must be used to develop 115 volt, single phase, 60 cycle power (part #9717033).

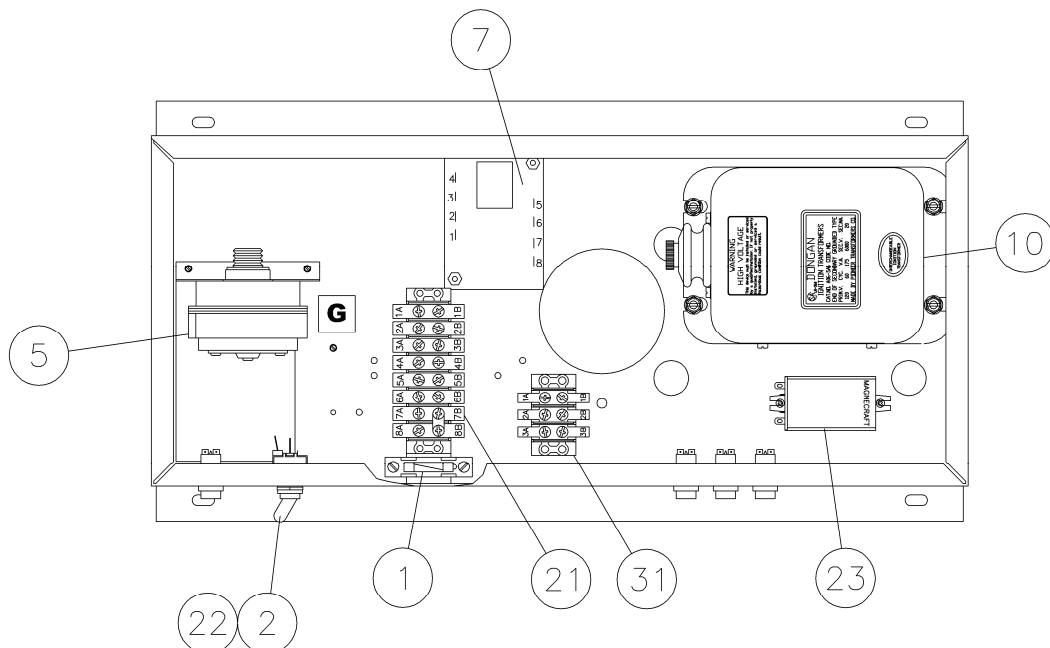


Figure 2. Control Enclosure Components

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HEATER COMPONENTS

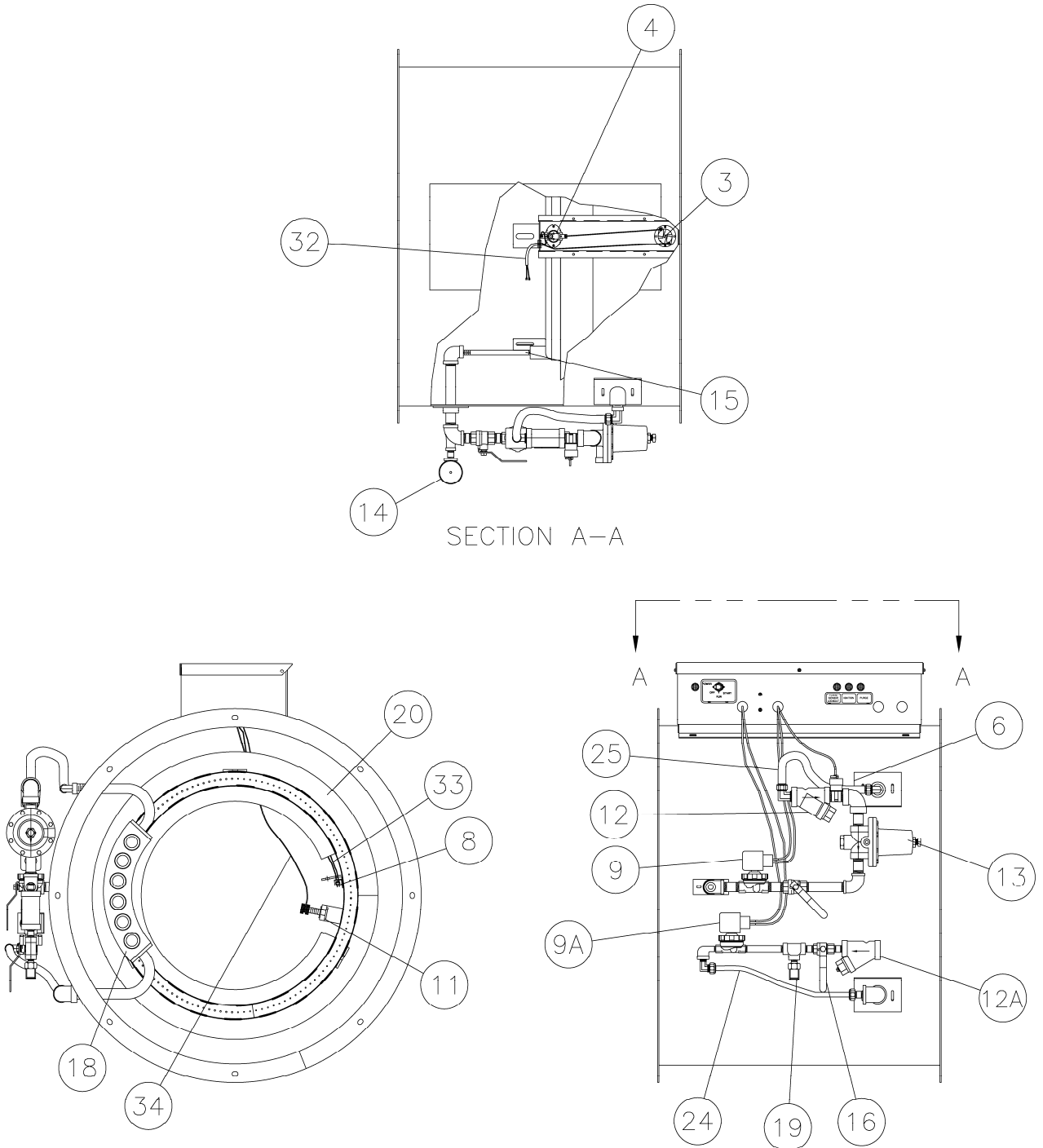


Figure 3. Heater Components

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TABLE 2. REPLACEMENT PARTS LIST

ITEM #	PART DESCRIPTION	PART NUMBER
Parts Common to All Models		
1	5 Amp Fuse	850412
2	Toggle Switch	710707
3	Burner Exhaust Limit	711093
4	Burner High Limit	712299
5	Air Switch	785691
6	Vapor Temperature Limit (LPGE units only)	157200
7	Flame Sensor Relay (30 sec. time delay)	719914
8	Flame Probe	749812
10	Ignition Transformer	851790
11	Spark Plug	851402
14	Pressure Gauge (Propane units)	851543
14A*	Pressure Gauge (Natural Gas units)	715011
21	Terminal Block (8 POLE)	749614
22	Toggle Switch Boot	712034
23	Start Relay	756692
24	Liquid Propane Hose	715276
25	Vapor Propane Hose	155820
31	Neutral Terminal Block (3 POLE)	850255
32	Burner High Limit Wire	9701961

Optional External Plenum Controls		
26	Nylon Humidistat Control (Not Shown)	9850982
27	Thermostat Control (Not Shown)	9851014
28	Humidistat-Thermostat Control (Not Shown)	9850974
29	Modulating Valve Kit (Propane) (Not Shown)	9701862
30	Modulating Valve Kit (Natural Gas)(Not Shown)	9767954

* For NGE-PE Heater using Natural Gas for fuel, there is a 0-15 psig pressure gauge (part number 715011) that can be used.

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TABLE 3. REPLACEMENT PARTS FOR SPECIFIC MODELS

ITEM #	PART DESCRIPTION	H18-NGE-PE	H24-NGE-PE	H24-LPGE	H24-LT-NGE-PE
		PART #	PART #	PART #	PART #
9	Vapor Solenoid Valve	789255	789255	789255	789255
9A	Liquid Solenoid Valve			851659	
12	Vapor Fuel Line Strainer			851626	
12A	Liquid Fuel Line Strainer			851634	
13	Regulator			721563	
15	Orifice **	9718387	9714980	9714980	9714964
16	Liquid Valve			714972	
17	Vapor Valve	714923	714923	714923	714923
18	Vaporizer			9702035	
19	Hydrostatic Pressure Relief Valve			716878	
20	Ring Burner	9702498	9702563	9702563	9757237
33	Flame Probe Wire	9730473	9730499	9730499	9730499
34	Spark Plug Wire	9701979	9701987	9701987	9701987

ITEM #	PART DESCRIPTION	H28-NGE-PE	H28-LPGE	H28-LT-NGE-PE	H33-NGE-PE	H33-LPGE
		PART #	PART #	PART #	PART #	PART #
9	Vapor Solenoid Valve	789263	789255	789263	789263	789255
9A	Liquid Solenoid Valve		851659			851659
12	Vapor Fuel Line Strainer		851626			851626
12A	Liquid Fuel Line Strainer		851634			851634
13	Regulator		721563			721563
15	Orifice **	9714956	9714956	9714964	9714956	9714956
16	Liquid Valve		714972			714972
17	Vapor Valve	714931	714923	714931	714931	714923
18	Vaporizer		9702035			9750208
19	Hydrostatic Pressure Relief Valve		716878			716878
20	Ring Burner	9701524	9701524	9757237	9701524	9701524
33	Flame Probe Wire	9730515	9730515	9730515	9730531	9730531
34	Spark Plug Wire	9701995	9701995	9701995	9745828	9745828

** On NGE-PE heater using natural gas for fuel, the Orifice is removed, except on models H18-NGE-PE, H24-LT-NGE-PE and H28-LT-NGE-PE a ¼" orifice (part #9714956) is used.

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EXPLANATION OF COMPONENTS

An understanding of the heater operation can be obtained by learning the function of each heater component. Refer to **Figures 2** and **3** on pages 7 and 8, and **Tables 2** and **3** on pages 9 and 10 while studying the following section. The figures illustrate each component.

Electrical

- 1. 5 Amp Fuse #850412**
The fuse protects the Heater Control Circuit from excessive current draw.
- 2. Toggle Switch #710707**
The Toggle Switch is the heater "On" and "Off" and "Momentary Start" switch.
- 3. Burner Exhaust Limit #711093**
The Burner Exhaust Limit, located at the end of the housing, is an automatic resetting temperature limiting control used to protect the heater, not the bin plenum, from too high of a temperature. The Burner Exhaust Limit is set to shut off the heater if the temperature at the thermostat exceeds 270° F (132° C). The control will automatically allow the heater to reignite after the heater cools.
- 4. Burner High Limit #712299**
The Burner High Limit Control, located just behind the burner, is a manual resetting temperature limiting control used to protect the heater, not the bin plenum, from flame generated behind the burner. The Burner High Limit Control is set to shut off the heater if the heater temperature reaches 160° F (71° C). To restart the heater, the operator must manually reset the Burner High Limit Control by pushing the button on top of the heater.
- 5. Air Switch #785691**
The Air Switch is a control that senses the flow of air from the fan to the heater. If, for any reason, the airflow is stopped, the Air Switch will shut off the heater. The Air Switch will keep the heater shut off until airflow from the fan is re-established. If the Air Switch cycles off from a lack of air, turn the heater toggle switch off before restarting the fan.
- 6. Vapor Temperature Limit #157200**
The Vapor Temperature Limit is an automatic resetting temperature limiting control used to protect the Solenoid Valve and Regulator from being damaged due to excessive gas temperature coming from the vaporizer. In addition, the Vapor Temperature Limit protects the vaporizer from re-cracking the propane and causing an oil film to deposit on the burner. The Vapor Temperature Limit is set to shut off the heater if the gas from the Vaporizer reaches a temperature of 160°F (71°C). The control will allow the heater to reignite after the Vaporizer cools. The Vapor Temperature Limit is only on LPGE Heaters.

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7. **Flame Sensing Relay with 30 sec Time Delay #719914**
The Relay with Time Delay has a 30 second delay and is used to break the circuit to the Solenoid Valves and Ignition Transformer if the Flame Probe does not establish the presence of the flame at the burner.
8. **Flame Probe #749812**
The Flame Probe is a switch that is sensitive to heat, and is used to establish the presence or absence of flame at the burner. The Flame Probe is used with the Flame Sensor Relay, as the Flame Safeguard Circuit of the heater. The switch is opened on temperature rise.
9. **Solenoid Valves**
Solenoid Valves are shut-off valves that are electrically operated. The valves are opened automatically when energized, and are closed automatically when de-energized.
10. **Ignition Transformer #851790**
The Ignition Transformer is a transformer used to create the 6000 secondary volts necessary for spark at the Spark Plug.
11. **Spark Plug #851402**
The Spark Plug is used to ignite the fuel at the burner. The Spark Plug will spark while the Ignition Transformer is energized.

Heater Plumbing

12. **Fuel Line Strainer**
The Fuel Line Strainer is used to remove foreign particles from the fuel before the fuel enters the heater plumbing. If these particles are not removed, possible operating difficulties could occur.
13. **Regulator #721563**
The Regulator on the LPGE Heater is used to regulate the amount of propane vapor from the vaporizer to the burner. **The Regulator is not used to regulate the fuel from the tank.** A separate Regulator should be used for regulating the fuel at the tank.
14. **Pressure Gauge**
The Pressure Gauge is used to indicate the gas pressure potential at the Orifice.
15. **Orifice**
The Orifice is an opening at the end of the Heater Plumbing that develops a restriction to gas flow, which allows the pressure gauge to develop a pressure reading, so that the firing rate of the heater can be field set.

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16. Liquid Shut-Off Valve #714972

The Liquid Shut-Off Valve is used as a manual shut-off valve and is used to shut off the fuel to the heater. The Liquid Shut-Off Valve has only two positions: open or closed. The Liquid Shut-Off Valve is only on LPGE Heaters.

17. Vapor Shut-Off Valve

The Vapor Shut-Off Valve is used as a shut off for the vapor line of the heater plumbing. Adjustment of firing rates is to be done at the regulator.

18. Vaporizer #9702035 or #9750208

The Vaporizer is used on LPGE Heaters only, and is used to convert the liquid propane gas to propane vapor gas by using the heat supplied by the burner.

19. Hydrostatic Pressure Relief Valve #716878

The Hydrostatic Pressure Relief Valve is used to protect the Heater Plumbing Components from excessive fuel pressure by relieving the excessive fuel pressure from gas trapped between shut off valves to the atmosphere. If a pressure relief valve opens, replace the hydrostatic relief valve.

20. Ring Burner

The Ring Burner is a ring-shaped component in the heater where the fuel and air are mixed and then burned.

21. Terminal Block (8 pole) #749614

The Terminal Block is used as a junction block for connecting the lead wires of the various electrical parts.

22. Toggle Switch Boot #712034

The Toggle Switch Boot is used to eliminate water entering the heater controls through the toggle switch.

23. Start Relay #756692

The Start Relay is used to prove Flame Probe function before the ignition process can proceed.

24. Liquid Propane Hose #715276

The Liquid Propane Hose is used to connect the liquid plumbing line to the inlet of the vaporizer.

25. Vapor Propane Hose #155820

The Vapor Propane Hose is used to connect the vaporizer to the vapor propane line.

31. Terminal Block (3 pole) #850255

This Terminal Block is used as a junction block to establish a common neutral for connection of the neutral leads.

32. Burner High Limit Wire #9701961

Wiring that connects the Burner High Limit and Burner Exhaust Limit to the control box.

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33. Flame Probe Wire

The Flame Probe Wire is used to connect the flame probe to the control circuit.

34. Spark Plug Wire

The Spark Plug Wire is used to connect the spark plug to the ignition transformer.

Optional External Plenum Control (*Not Shown*)

26. Humidistat Control

The Humidistat Control is an electrical operating control that is wired into the heater to cycle the heater "On" and "Off" with respect to the relative humidity of the drying air. The Humidistat Control is set at about 50-60% relative humidity of the drying air. When the relative humidity is higher than the humidistat setting, the heater is cycled "On" and is left on until the relative humidity is below the humidistat setting. If the relative humidity of the drying air is less than the humidistat setting, the heater is cycled "Off" until such time that the relative humidity would become greater than the setting of the humidistat. The Humidistat Control is for low temperature drying.

27. Thermostat Control #9851014

The Thermostat Control is an electrical operating control that is wired into the heater to cycle the heater "On" and "Off" with respect to the temperature of the drying air. The thermostat is set at a desired temperature, and if the temperature is higher than the thermostat setting, the heater is cycled "Off." If the drying air temperature is less than the thermostat setting, the heater is cycled "On," and is left on until such time that the drying air temperature is above the thermostat setting.

28. Humidistat-Thermostat Control #9870974

The Humidistat-Thermostat Control is an electrical operating control that is wired into the heater to cycle the heater "On" and "Off" with respect to both the drying air relative humidity and temperature. The Humidistat-Thermostat Control will cycle the heater on if either the drying air relative humidity is too high, or the drying air temperature is too low with respect to the humidity setting or temperature setting of the control.

NOTE: The optional external plenum controls (**26-28**) do not function like a thermostat for a furnace. When the bin plenum controls reach the set point, the heater is then shut off. In the off mode the bin's plenum temperature will drop below the set point of the control due to the rapid air changes from the fan. The controls do not sense the instantaneous change in air temperature but take time to reach the plenum control setting before controlling the heater operation.

NOTE: The firing rate must be set by the operator to make sure excessive temperature is not present in the plenum.

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29.-30. Modulating Valve Kit #9701862 or #9767954

The Modulating Valve is a non-electrical operating control. The Modulating Valve is placed in the heater plumbing, and controls the amount of fuel burned by the heater depending upon the temperature of the drying air. If the temperature of the drying air is lower than the temperature setting of the Modulating Valve, the Modulating Valve opens up and more fuel is burned to raise the drying air temperature. If the drying air temperature is higher than the temperature setting, the Modulating Valve restricts the amount of fuel to the heater.

The Modulating Valve has an interchangeable by-pass orifice to maintain continuous low heat operation regardless of Modulating Valve setting. The orifice is interchangeable for establishing lower or higher by-pass flow through the Modulating Valve, depending on conditions.

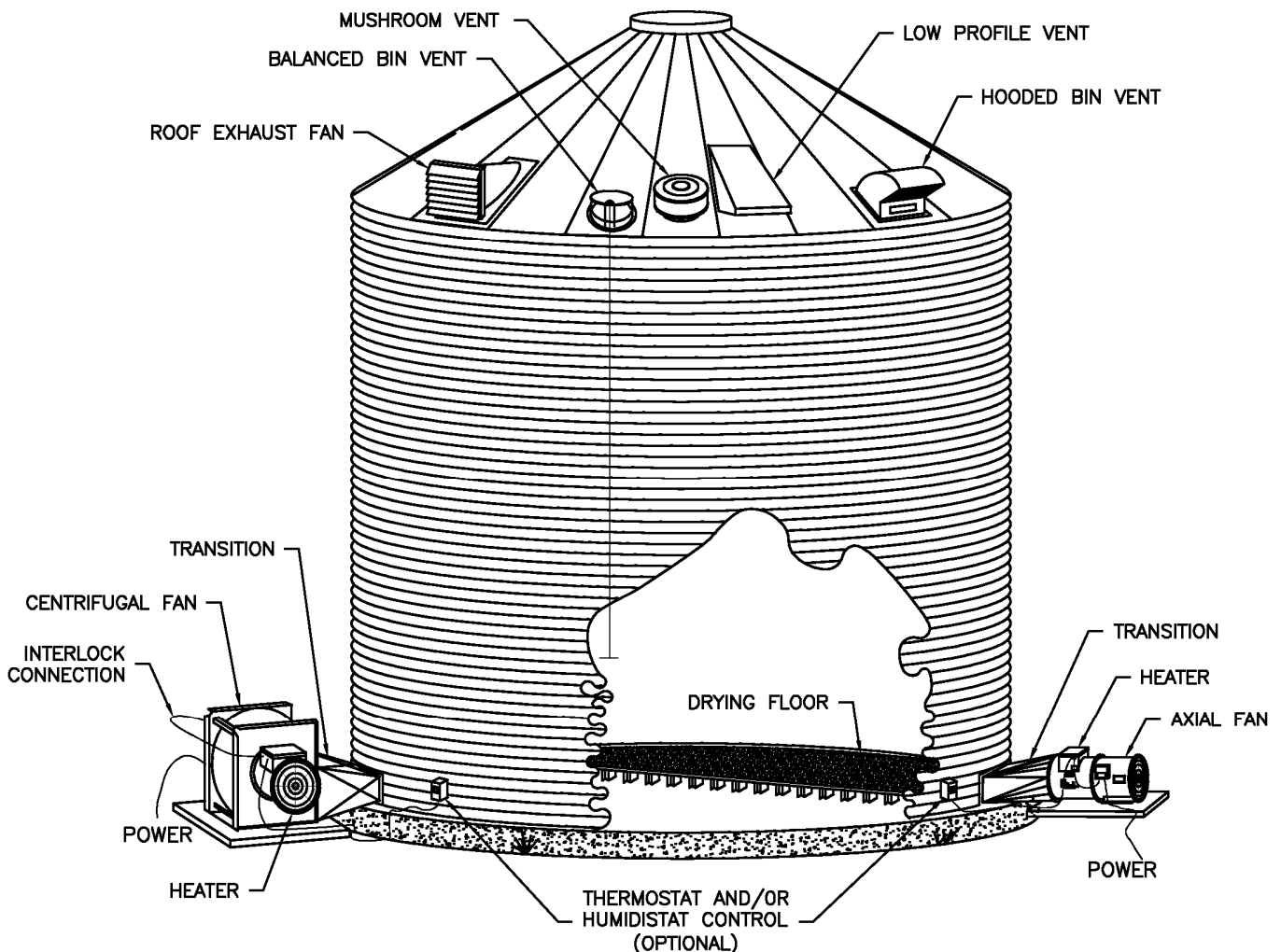


Figure 4. Typical Installation

Note: Axial Fan and Centrifugal Fan are shown on common bin, for the purpose of illustrating typical drying components only.

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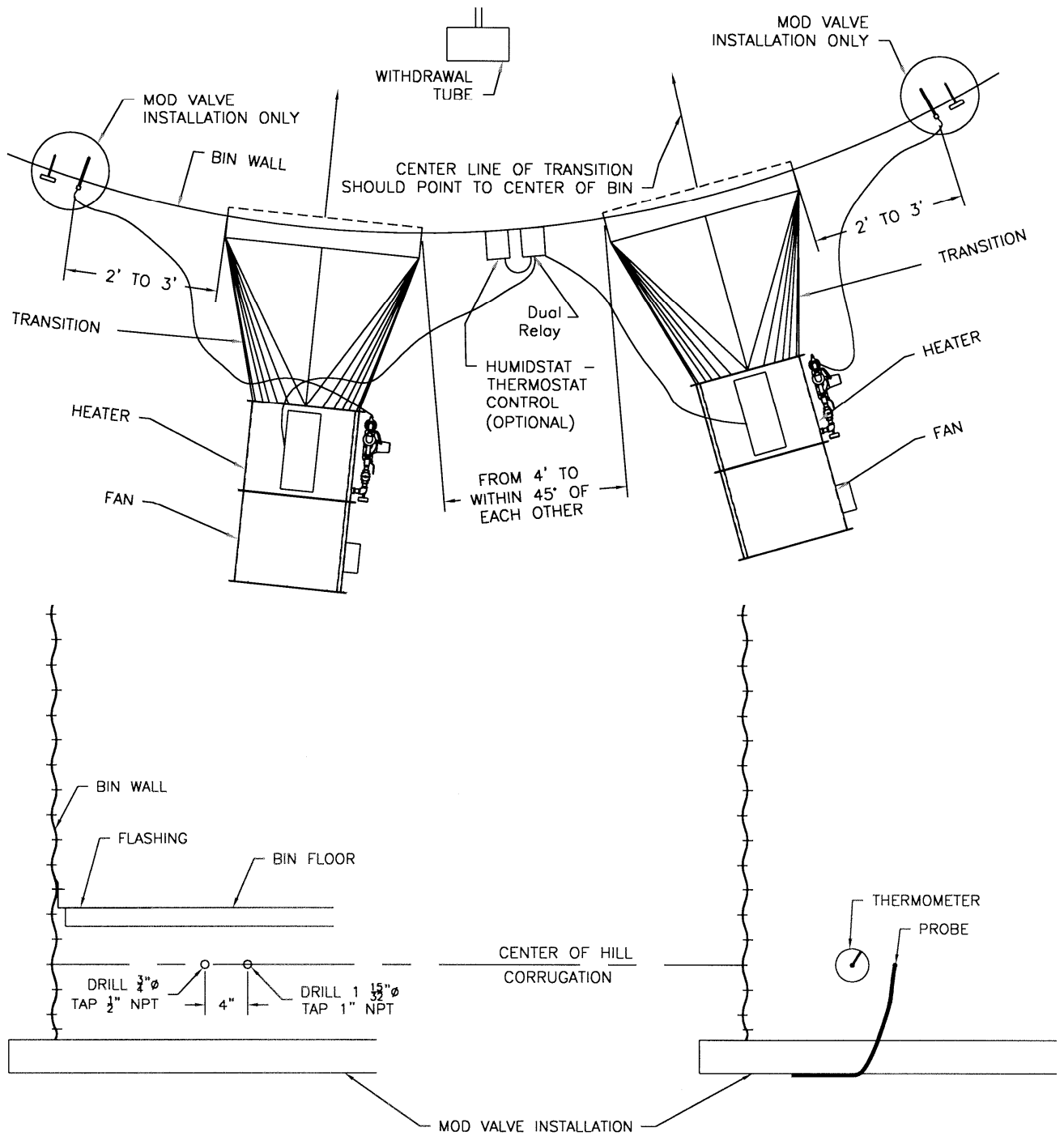


Figure 5. Typical Installation of Two Drying Units and Optional Plenum Controls

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FAN AND HEATER MOUNTING PADS AXIAL AND CENTRIFUGAL

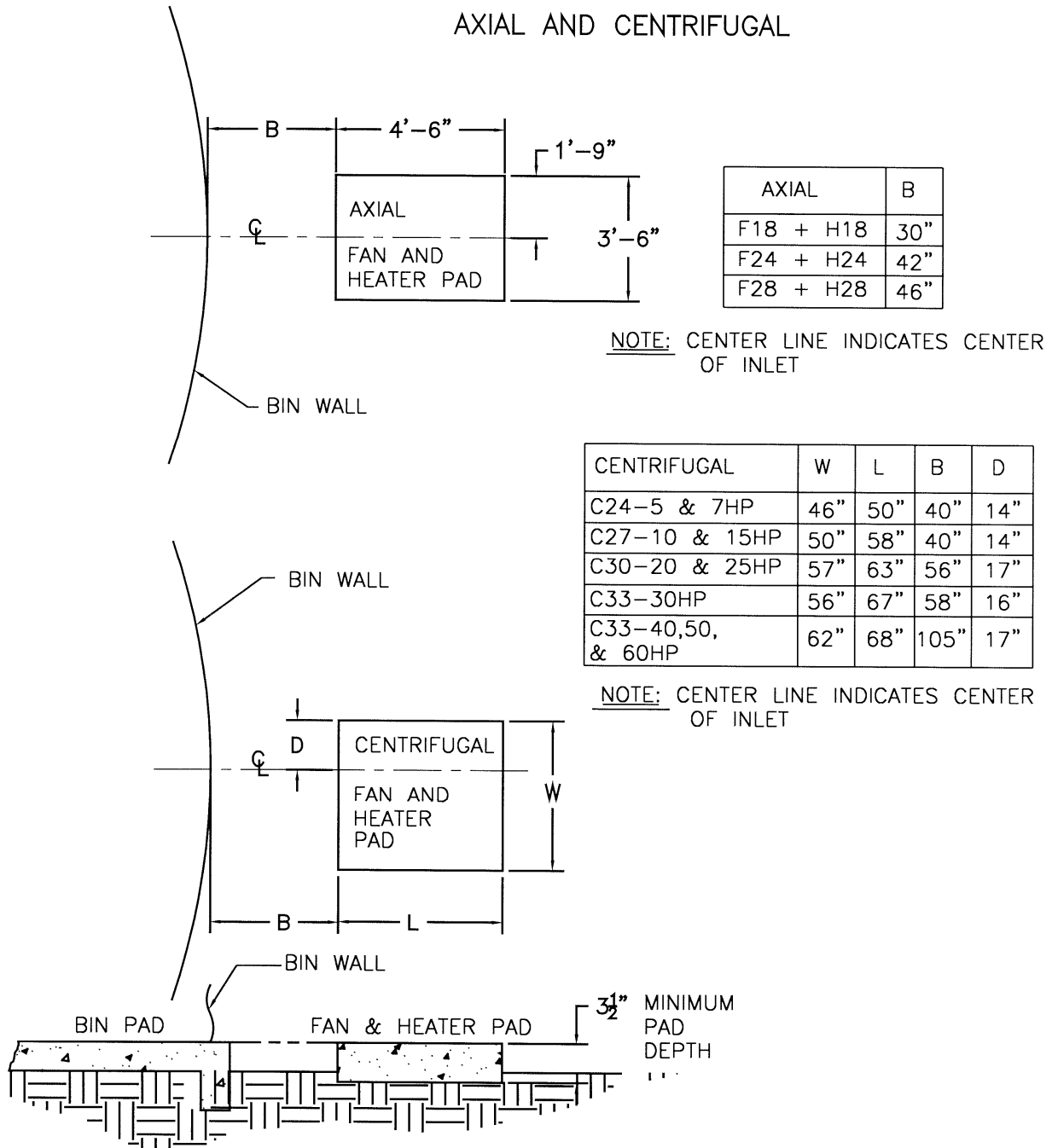


Figure 6. Fan and Heater Mounting Pads

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INSTALLATION INSTRUCTIONS

I. Application Determination of NGE-PE Units

A. The H18-NGE-PE, H24-NGE-PE, H24-LT-NGE-PE, H28-LT-NGE-PE, H28-NGE-PE and the H33-NGE-PE Units are shipped for propane fuel operation. Remove the fuel orifice for Natural Gas Operation of H24, H28 and H33 heaters. Use a 1/4" orifice for Natural Gas Operation of H18, H24LT and H28LT heaters.

II. Location and Foundation of the Heater

A. The drying unit (fan, heater, and transition) should be located such that the heated air can enter the bin plenum chamber uniformly. **Figure 4** on page 15 illustrates the components necessary for a typical installation. Make sure all the components needed for the drying system are present. The fan and heater should be located opposite the withdrawal tube for best air distribution.

B. If two drying units are used on the same bin (**Figure 5**), locate them from 4' to within 45° of each other and centered opposite the withdrawal tube. Locate any humidistat or thermostat control between the two heater units, making sure control senses heat from both units (order kit #9735035.)

C. For proper operation of heater, the fan and heater are to be mounted on a level pad. The pad should be the same height as the concrete floor. The size of the pad should be as indicated in **Figure 6** on page 17.

D. Before installing heater, make sure:

1. That the orifice is centered in the burner inlet. If necessary, loosen the setscrew securing the heater plumbing where it passes through the heater housing, adjust the orifice location, and retighten the setscrew.
2. That if installing an H24-LPGE or H28-LPGE or H33-LPGE make sure the burner is located within 1/4" of the vaporizer. If not, move the burner toward the vaporizer by loosening burner mounting carriage bolts, adjusting burner position and retightening the carriage bolts.
3. That the spark plug is gapped at 1/8". If not, gap to 1/8".
4. That the flame probe and spark plug wires are attached.
5. That all bolts, carriage bolts and screws are tight.

E. **On axial fan units**, the heater is installed on the air discharge end of the fan. Check airflow decals on the fan and heater to make sure heater is oriented properly. The installation should appear as illustrated in Figure 4. **On centrifugal fan units**, the heater is mounted on the inlet side of the fan. Make sure the airflow decal is pointing toward the fan. The installation should appear as illustrated on page 15.

F. Connect the fan and heater together using the 5/16" bolts provided in the heater bolt bag. **On axial units**, connect the heater to the transition with the bolts provided in the fan bolt bag. **On centrifugal units**, connect the fan to the transition with the bolts provided in the fan bolt bag.

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III. Gas Supply Installation

A. Propane Tank Installation:

1. A 1000-gallon tank is recommended as the minimum size to avoid frequent refilling. (Raising the air temperature 100°F on an airflow rate of 10,000 CFM would require approximately 300 gallons of liquid propane per day.) In addition, the larger tank will aid in the vaporization of the liquid propane.
2. Never, use an anhydrous ammonia tank as your LP gas tank. Contaminants in the tank can be harmful to the heater, and safety devices may not meet liquid propane storage codes.
3. The supply tank should be placed at least 50 feet from the heater. Some areas may require a greater distance; consult your local authorities.
4. The supply tank should be equipped with a liquid valve and vapor valve. The inlet of the liquid valve should be located 12 inches from the tank bottom to avoid impurities getting into the gas line and heater.
5. The liquid valve and vapor valve on the propane tank should be connected as illustrated in **Figure 7**. This allows the operator to run the H28-LPGE, H24-LPGE or H33-LPGE on vapor or liquid propane.
6. A regulator with a minimum outlet pressure of 60psig (part number 714816 if ordering from factory) is recommended to be located as shown. The regulator should be sized to the highest outlet pressure possible to avoid frosting of the plumbing line. The regulator allows a uniformity of flow, and reduces the pressure on the gas line from the regulator to the heater for added safety. The regulator is required on vapor and liquid propane installations. Make sure that the supply tank has a relief valve present and that it is properly sized and located (refer to NFPA Standard #58).

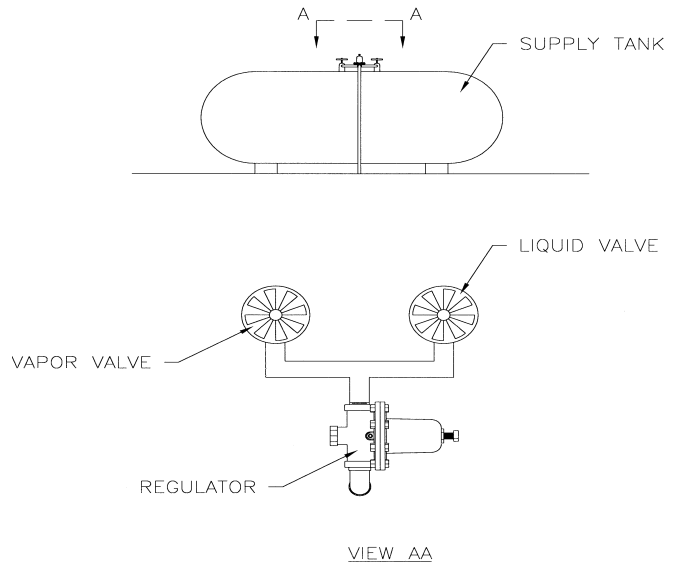


Figure 7. Propane Tank Plumbing Installation

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B. Natural Gas Installation:

1. The natural gas service should be able to provide (5) psig when the heater is operating. Check with your gas supplier to make sure that the supply pressure has the pressure potential to deliver natural gas for the length of the service line.
2. A line strainer must be located at the heater (order part #714709).
3. The natural gas service should be regulated. Contact your gas supplier. A regulator can be obtained from Caldwell (order part #753905).

C. Fuel Line Installation

1. The suggested tubing size to be used from the supply to the heater is 5/8" O.D. type K copper tubing or 1/2" black schedule 80 steel pipe. If copper tubing is used, make a loop in the tubing within three feet of the heater to absorb shock. If 1/2" steel pipe is used, run the plumbing to within about three feet of the heater, and use three feet of 3/8" minimum I.D. high pressure hose, (UL approved for propane). Be careful not to turn or twist the heater plumbing parts because the proper operation of the heater plumbing parts can be affected and leaks in joints can be developed. Make sure all foreign material is out of the gas line before connecting the line to the heater.
2. If your natural gas supply pressure is not adequate to maintain five psig at the heater, use a one-inch or larger service line. Install a line strainer between the natural gas heater and the service line.
3. Check all connections for leaks with a soap test. Open the supply valve at the source, use a liquid detergent, and brush all fittings and joints. If bubbles are generated at the fitting, gas is escaping from the joint. With the installation of the service line, inspect all parts added, and heater plumbing parts affected by the installation. Tighten the components if not sealing, or replace if cracked or defective. **DO NOT USE GALVANIZED PIPE FITTINGS.**

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IV. Electrical Installations

- A. Connect the fan unit to the electric power source following the recommended wiring procedure indicated in the fan manual. Make sure all wiring conforms to the National Electric code, and local requirements.
- B. The heater operates on 115 volt, single phase, 60 cycle power. For fans wired for 230 volt, make sure that the fan is wired with a neutral wire to the middle terminal of the fan terminal block, (#2), as well as a ground wire linked to the bottom terminal of the fan terminal block, (#3), as shown. The heater power cord is wired into the fan controls by connecting the black wire to the terminal (#1), the white wire to terminal (#2), and the green wire to terminal (#3) of the fan terminal block, as shown in **Figure 8**. With the heater wired into the fan circuitry, the fan must be operating before power is available to the heater. On H18-NGE-PE units, the fan terminal block is included with the heater. Follow the installation instructions provided in installing the fan terminal block into the fan controls.

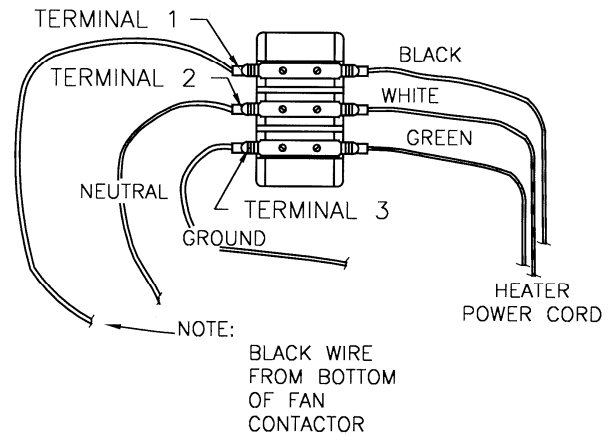


Figure 8. Heater Electrical Supply Connection

- C. For fans wired for 460 or 575 volt, a step down transformer must be used to convert the 460 or 575 volt system to 115 volt, single phase, 60 cycle power for the heater.
- D. When installing a thermostat, humidistat, or thermostat-humidistat control, the control power cord is wired into terminals five and six of the heater terminal block. Remove the jumper wire linking terminals five and six, and connect one lead of the control power cord to terminal five and the other lead to terminal six. The control leads can be interchanged.

V. Installation of Accessories

For the proper installation of a thermostat, humidistat, or thermostat-humidistat control to the bin, the installation of dual humidistat-thermostat kit, or the installation of vaporizer or modulating valve to the heater, refer to the installation instruction provided with each accessory.


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SAFETY

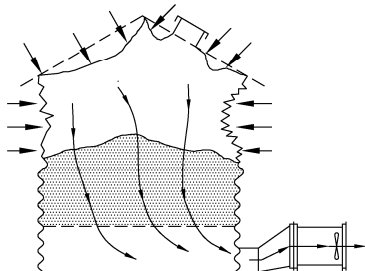
Before operating unit, perform the following checks:

1. Make sure the fan, heater, and transition units are bolted securely together. Make sure the screen guard is secured in place.
2. Make sure the units are wired in compliance with the National Electrical Code, and the ground wire is sized large enough to provide lightning protection.
3. Make sure the gas supply installation is according to instructions.
4. Provide sufficient bin exhaust vents or fans, and make sure they are open or operational before starting the drying system. The vents are necessary to provide an exhaust for moisture-laden air (to reduce condensation), and to prevent pressurization of the bin above the grain mass, causing added load on the bin. Do not operate units when conditions are such that freezing of the vents could occur.

HEED THE FOLLOWING WARNING:



WARNING



**TO PREVENT ROOF AND WALL
DAMAGE OF STRUCTURE**

- 1.) USE POSITIVE AERATION SYSTEM (PUSH SYSTEM).
- 2.) MAKE SURE ALL ROOF VENTS ARE SIZED PROPERLY, OPEN, AND UNOBSTRUCTED.
- 3.) IF USING ROOF EXHAUST FANS, WIRE ROOF AND SUPPLY FANS TO START SIMULTANEOUSLY OR MAKE SURE ROOF FANS ARE STARTED WHEN SUPPLY FANS ARE STARTED.
- 4.) DO NOT OPERATE YOUR AERATION SYSTEM WHEN CONDITIONS EXIST THAT MAY CAUSE ROOF VENT ICING.

VENTING ICING CAN OCCUR WHEN AMBIENT AIR TEMPERATURE IS BELOW 35° (2°C) AND AIR RELATIVE HUMIDITY IS 90% AND ABOVE. FOR ANY QUESTION AS TO POSSIBLE ICING CONDITIONS, SHUT DOWN THE SYSTEM AND CONTACT YOUR LOCAL WEATHER SERVICE.)

DETERMINE THE AIR FLOW FROM FAN PERFORMANCE CHARTS AT FREE AIR AND PROVIDE VENTS ACCORDING TO CHART (A).

CONSULT YOUR CALDWELL EQUIPMENT DEALER FOR AID IN SIZING POWER EXHAUST FANS AND/OR ROOF VENTS.

CHART (A)	
BIN VENT	CFM
LOW PROF	2670
HGBV-1.75	2670
BBV - 19	3000

03/05
740969

Figure 9. BIN VENT WARNING DECAL

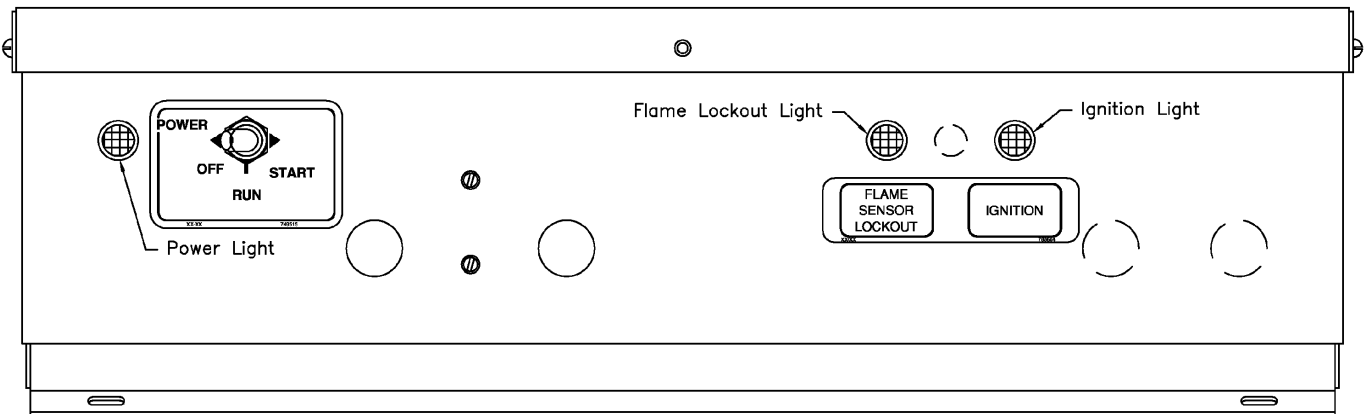
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OPERATING INSTRUCTIONS

I. Overview of Heater Control Operation

Information on the operation characteristics of the axial heater with the flame sensing system is outlined below. The flame sensing relay is reset by deenergizing the heater circuit under a condition of a loss of flame.



The operating characteristics of the flame sensing circuit is outlined as follows:

- A) The flameprobe is checked for proper functionality every time the heater is started. The heater toggle switch is pushed to the “START” position. If the flameprobe is in good condition, the power light is illuminated. If the flameprobe is not good, the flameprobe will require replacement.
- B) Once the flameprobe is checked, the remaining internal and external heater sensors have power available. If all sensors call for heater operation the transformers and solenoids are energized, and the ignition light is illuminated.
- C) If no flame is at the burner or the flameprobe is not positioned to monitor the flame, the flame sensing relay will deenergize the solenoids and transformer after approximately 30 seconds. The flame lock-out light will be illuminated. The condition that resulted in the loss of flame at the flameprobe needs to be addressed. The flame sensing relay is reset by switching the heater power switch to “OFF”.
- D) The heater then can be restarted by repeating the operation steps.

WARNING: THE HEATER IS DESIGNED TO WORK AT VARYING FIRING RATES. OPERATOR MUST ADJUST FIRING RATE FOR SYSTEM OPERATION BASED ON CONDITIONS PRESENT.

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II. Start-Up Procedure

- A. Make sure all roof vents are open and unobstructed. Note: If freezing of roof vents could occur, do not operate system.
- B. Make sure all controls are installed correctly.
- C. Turn fan on by placing fan switch to "On" position.
- D. Open Supply Valve at the Regulator:
 - 1. It is preferable to start liquid propane units on vapor fuel. (After warmup, open Liquid Valve on the supply tank approximately one turn, and close Vapor Valve.)
- E. Open Liquid Valve (on LPGE Heaters only).
- F. Check to make sure Burner High Limit Control Reset button is "In."
- G. Turn heater on by placing Toggle Switch to "Momentary Start" then "On" position.
- H. Open Valve slowly to two psig fuel pressure for low temperature start.
- I. Set Plenum External Controls for desired heater operation. (See adjustment section of this manual for more information.)
- J. The Regulator must be adjusted according to the information provided in the adjustment section (Part III). (On LPGE Heaters Only)
- K. If burner fails to ignite in the five seconds, close Valve and turn off the heater by placing Toggle Switch to the "Off" position. (Refer to service section of this manual for trouble shooting of heater.)
- L. If the Burner High Limit shuts the burner off, reset heater after cooling down by pushing in the button located on top of the heater. The cycling of the Burner High Limit is caused by excessive static pressure or lack of airflow. Reduce the static pressure or air blockage before refiring unit.

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III. Drying Temperature Recommendations

- A. To determine the appropriate drying temperature, the crop to be dried, as well as the system to be used, needs to be established. When this information is known, refer to the table below for recommended maximum plenum temperatures.
- B. In using **Table 4** below, keep the following considerations in mind:
1. The rate of drying is increased with increased temperature, however, susceptibility to grain damage also increases.
 2. Wet grain will remain relatively cool from the evaporation from the kernel; however, dry grain will warm to the drying temperature.
 3. The drying front moves from the base of the bin upward. When operated as a batch system and when a stirring machine does not reach the floor, significant over drying can occur at the base of the bin.
 4. When drying a grain with quality as a major consideration for the value of the product, use as low a plenum temperature as possible. (DO NOT AUTOMATICALLY SET THE PLENUM TEMPERATURE AT THE MAXIMUM RECOMMENDATION.)
 5. When the grain is nearly dry, reduce the plenum temperature to complete the drying. This will reduce the quantity of cracked grain generated and reduce the fire hazard.
 6. When drying sunflowers, great care needs to be taken as sunflowers are very flammable. Do **not** exceed the temperature recommendations. Also, be aware that the chaff from sunflowers is very flammable. Good housekeeping in the plenum chamber and around the bin is a **must**.

TABLE 4. DRYING TEMPERATURE RECOMMENDATION

RECOMMENDED DRYING TEMPERATURES OF NON-SEED CROPS (NOTE A)			
CROP	IN BIN CONTINUOUS	STIR DRYING	IN BIN BATCH
Corn	160°F (71°C)	140°F (60°C)	120°F (49°C)
Grain Sorghum	160°F (71°C)	140°F (60°C)	120°F (49°C)
Wheat	140°F (60°C)	120°F (49°C)	110°F (43°C)
Rice	105°F (40°C)	100°F (38°C)	90°F (32°C)
Oats	140°F (60°C)	120°F (49°C)	110°F (43°C)
Sunflowers	110°F (43°C)	110°F (43°C)	100°F (38°C)
Soybeans	120°F (49°C)	120°F (49°C)	110°F (43°C)
Pinto Beans	100°F (38°C)	100°F (38°C)	100°F (38°C)

NOTE A: Temperature recommendations are based on non-seed crops (to be marketed commercially). For seed crops, do not exceed 110°F; except for Pinto Beans do not exceed 100°F.

NOTE B: For other crops contact your extension service or Caldwell for Drying Temperature recommendations.

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IV. Adjustments

The following adjustments will have to be made, depending upon the kind of heater, and Plenum External controls being used. These adjustments cannot be made at the factory due to the differences in bin setups, drying methods, and weather climates. These adjustments should be checked at least twice a day or 6 hours of operation to make sure that the heater is functioning properly, and that the operator is getting the desired result.

A. Adjustment of Flame Probe

The Flame Probe should be adjusted so that the Flame Probe does not shut off the heater unnecessarily, and also does not prematurely shorten the life of the Flame Probe.

The Flame Probe is adjusted by loosening up one bolt and rotating the switch closer or farther away from the flame as shown in **Figure 10**. The ideal location of the Flame Probe is when the end of the flame is just barely touching the probe. This ideal location can be identified by a small dull red area on the probe. This red area is where the flame is just touching the switch. It should be noted that the Flame Probe should be adjusted to the highest heater plumbing pressure at which the heater will be operated. If the heater were ever operated at a higher heater plumbing pressure, then the Flame Probe would need to be readjusted.

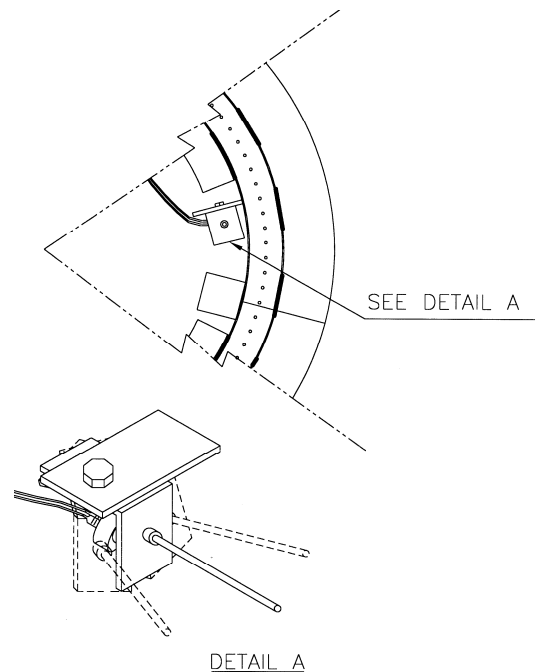


Figure 10. Flame Probe Adjustment

B. Adjustment of the Vaporizer (LPGE Heater only)

The vaporizer is used on LPGE units and is located in the flame established by the burner. The vaporizer uses heat from the burner to convert the liquid propane at the vaporizer entrance to vapor propane. The burner requires vapor propane for proper operation.

The vaporizer outlet is connected to the vapor plumbing line by a vapor propane hose. The temperature of the vapor plumbing line is sensed by a vapor limit thermostat, which will cycle the heater off if the temperature exceeds 160°F (71°C). The proper location of the vaporizer will establish a temperature of about 110°F (43°C) in the vapor plumbing line. At this temperature, the vapor plumbing line should be warm to touch. If the temperature of the vapor plumbing line is too low, move the vaporizer into the flame by loosening the square headed setscrew holding the vaporizer in place, adjusting the vaporizer location and retightening the setscrew. If the temperature of the vapor plumbing line is too high, the vaporizer should be moved out of the flame with the procedure indicated above.

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Note that the distance between the vaporizer and the burner should be maintained at $\frac{1}{4}$ ", and then the vaporizer should be moved in and out of the flame. If the distance between the burner and vaporizer is larger than $\frac{1}{4}$ ", the burner should be moved forward toward the vaporizer.

C. Adjustment of the Regulator

The Regulator should be set at the firing rate required. This can be done by first setting the heater to the desired firing rate with the vapor valve, then reopening the Vapor Valve and adjusting the Regulator by turning the adjusting screw until the pressure gauge shows the pressure at the desired firing rate pressure.

When setting the heater at the desired firing rate, the operator must take into account the heater size, the static pressure the fan is working against, the ambient temperature, orifice size, and fuel used and the type of plenum control. Refer to operation instructions for the humidistat, thermostat, or modulating valve. The Firing Rate Tables of this manual are set up to help the operator select the desired firing rate.

D. Adjustment of the Humidistat Control if used to Operate the Heater

Set the Humidistat Control at the desired setting (50-60% R.H. Recommended). To obtain even drying, adjust the firing rate of the heater unit so that the Humidistat maintains a constant humidity of the drying air. The heater should be set at a firing rate of approximately two psi gauge pressure for propane, or one psi gauge pressure for natural gas, and then adjusted to obtain operation of the heater the majority of the time. The heater firing rate must be checked as humidity conditions change.

E. Adjustment of the Thermostat Control if used to Operate the Heater

Set the Thermostat Control to the desired temperature setting. Initially, set the firing rate of the heater at two-psi gauge pressure for propane, or one-psi gauge pressure for natural gas. To obtain even drying, adjust the firing rate of the heater unit so that the thermostat calls for heat 90% of the time. The heater-firing rate must be checked as temperature conditions change. **WARNING! THE PLENUM THERMOSTAT IS USED AS A DRYING THERMOSTAT, NOT AS A PLENUM HIGH LIMIT.**

F. Adjustment of Humidistat-Thermostat Control if used to Operate the Heater

1. Using the Humidistat-Thermostat Control, as a Humidistat Control only:

Set the thermostat at the lower temperature limit. This is the temperature wanted for heater operation, whether the humidistat is calling for heat or not, (40-50°F is recommended). Set the humidistat and heater according to the humidistat instructions previously given.

2. Using the Humidistat-Thermostat Control as a Thermostat Control only:

Set the humidistat at 100% relative humidity. Then adjust the thermostat and heater controls according to the thermostat instructions given.

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3. Using the Humidistat-Thermostat Control as a combination:

Set the humidistat and thermostat at the desired operating conditions. Then adjust the firing rate of the heater according to the humidistat and thermostat instructions.

G. Adjustment of the Modulating Valve used as a Heater Control

The Modulating Valve is used to maintain a constant plenum temperature by allowing more gas to flow to the burner if the plenum temperature is lower than desired or by restricting the gas flow if the temperature is higher than desired.

To set the Modulating Valve, use the following procedures:

1. Determine what plenum temperature is desired.
2. Using the vapor valve, set the operating pressure at eight (8) psig for propane, or three (3) psig for natural gas.
3. Adjust the "T" Handle of the valve until the bin thermometer maintains the desired plenum temperature. The handle is turned in, (clockwise) to get a higher temperature, or out (counter-clockwise) to get a lower temperature.
4. Set the regulator two (2) psig higher than the Modulating Valve operating condition, by turning the Modulating Valve handle in two revolutions, adjusting the regulator to the desired pressure, and then resetting the Modulating to the desired plenum temperature.

V. Shut-Down Procedures

A. If heater is to be shut off for a prolonged period, carry out the following steps:

1. Close Fuel Valve at tank.
2. Allow the fuel to be burned out of the fuel line.
3. After the flame burns out, close Vapor Valve and Liquid Valve.
4. Turn off heater, placing Toggle Switch to "Off" position.
5. Allow fan to run for two minutes in order to cool off heater. Then shut fan off. Shut off the power at the fan service disconnect.
6. The Thermostat or Humidistat External Plenum Controls should be removed and stored in a clean, dry place.

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VI. Explanation of Firing Rate Tables

A. The following tables are to be used as a guide for setting the firing rate of the heater. The values are an estimate and actual values may differ, depending upon the bin setup and weather conditions. Once the predicted firing rate is obtained, a bin thermometer should be used to determine the actual plenum temperature, and the firing rate should be adjusted to obtain the desired plenum temperature. Use the following procedures in conjunction with the "Drying Temperature Recommendations" on page 25, in determining the firing rate needed for your application:

1. Determine the ambient temperature at which the heater operates (outside temperature).
2. Find the difference of the desired drying temperature and the ambient temperature. This value is the temperature rise desired.
3. Use a static pressure gauge to determine the static pressure at which the fan and heater are operating.
4. Refer to the table which lists the size of your heater, and the gas used, then for the temperature rise desired, read the firing rate required for the static pressure of operation.
5. If the ambient temperature is 50°F, then steps B and C can be skipped and the firing rate can be read for your heater, gas used, and plenum temperature for 50°F ambient air.

NOTE 1: AS CONDITIONS VARY, THE FIRING RATE SHOULD BE ADJUSTED TO OBTAIN THE DESIRED PLENUM TEMPERATURE.

NOTE 2: THE VALUES IN TABLES 7 AND 8 ARE BASED ON THE PERFORMANCES OF A 10 HP AXIAL FAN. FOR THE 7.5 HP AND 5 HP AXIAL FANS THE FIRING RATE WILL NEED TO BE SLIGHTLY LOWER FOR THE TEMPERATURE RISE DESIRED.

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TABLE 5. FIRING RATE FOR 18" PROPANE HEATER

Approximate firing rates for 18" heater with 3 HP Axial Fan operated on vapor propane with #25 drill size orifice. (Unit as shipped.)

FIRING RATE PSIG	STATIC PRESSURE INCHES OF WATER COLUMN)					
	1.5		2.0		2.5	
	TEMP. RISE (°F)	PLENUM TEMP. FOR 50°F AMBIENT AIR (°F)	TEMP. RISE (°F)	PLENUM TEMP. FOR 50°F AMBIENT AIR (°F)	TEMP. RISE (°F)	PLENUM TEMP. FOR 50°F AMBIENT AIR (°F)
0.5	38	88	41	91	45	95
1.0	54	104	58	108	64	114
2.0	77	127	82	132	90	140
3.0	94	144	100	150	110	160
4.0	108	158	116	166	127	177
5.0	121	171	129	179	142	192
6.0	133	183	142	192	155	205
7.0	143	193	153	203	168	218
8.0	153	203	163	213	180	230
9.0	163	213	173	223	190	240
10.0	171	221	183	233	201	251
11.0	181	230	192	242		
12.0	188	238	200	250		

TABLE 6. FIRING RATE FOR 18" NATURAL GAS HEATER

Approximate firing rates for 18" heater with 3 HP Axial Fan operated on natural gas with orifice change to a 1/4" diameter orifice.

FIRING RATE PSIG	STATIC PRESSURE (INCHES OF WATER COLUMN)					
	1.5		2.0		2.5	
	TEMP. RISE (°F)	PLENUM TEMP. FOR 50°F AMBIENT AIR (°F)	TEMP. RISE (°F)	PLENUM TEMP. FOR 50°F AMBIENT AIR (°F)	TEMP. RISE (°F)	PLENUM TEMP. FOR 50°F AMBIENT AIR (°F)
0.25	44	94	47	97	52	102
0.5	62	112	66	116	73	123
0.75	76	126	81	131	89	139
1.0	87	137	93	143	102	152
1.5	107	157	114	164	125	175
2.0	126	176	134	184	148	198
2.5	142	192	151	201	166	216
3.0	156	206	166	216		

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TABLE 7. FIRING RATE FOR 24" PROPANE HEATER

Approximate firing rates for 24" heater with 10 HP Axial Fan operated on vapor propane with 3/16" diameter orifice. (Unit as shipped.)

FIRING RATE PSIG	STATIC PRESSURE (INCHES OF WATER COLUMN)							
	1.5		2.0		2.5		3.0	
	TEMP. RISE (°F)	PLENUM TEMP. FOR 50°F AMBIENT AIR (°F)	TEMP. RISE (°F)	PLENUM TEMP. FOR 50°F AMBIENT AIR (°F)	TEMP. RISE (°F)	PLENUM TEMP. FOR 50°F AMBIENT AIR (°F)	TEMP. RISE (°F)	PLENUM TEMP. FOR 50°F AMBIENT AIR (°F)
0.5	24	74	25	75	26	76	28	78
1.0	34	84	35	85	37	87	40	90
2.0	48	98	50	100	52	102	57	107
3.0	59	109	61	111	64	114	69	119
4.0	69	119	70	120	74	124	80	130
5.0	77	127	78	128	83	133	89	139
6.0	84	134	86	136	90	140	98	148
7.0	91	141	93	143	98	148	106	156
8.0	97	147	99	149	104	154	113	163
9.0	103	153	105	155	111	161	120	170
10.0	108	158	111	161	117	167	126	176
11.0	114	164	116	166	122	172	133	183
12.0	119	169	121	171	128	178	138	188
13.0	124	174	126	176	133	183	144	194
14.0	128	178	131	181	138	188	150	200
15.0	133	183	136	186	143	193	155	205

TABLE 8. FIRING RATE FOR 24" NATURAL GAS HEATER

Approximate firing rates for 24" heater with 10 HP Axial Fan operated on natural gas with orifice removed.

FIRING RATE PSIG	STATIC PRESSURE (INCHES OF WATER COLUMN)							
	1.5		2.0		2.5		3.0	
	TEMP. RISE (°F)	PLENUM TEMP. FOR 50°F AMBIENT AIR (°F)	TEMP. RISE (°F)	PLENUM TEMP. FOR 50°F AMBIENT AIR (°F)	TEMP. RISE (°F)	PLENUM TEMP. FOR 50°F AMBIENT AIR (°F)	TEMP. RISE (°F)	PLENUM TEMP. FOR 50°F AMBIENT AIR (°F)
0.25	68	118	70	120	73	123	79	129
0.50	96	146	98	148	103	153	112	162
0.75	117	167	120	170	126	176	137	187
1.0	135	195	138	188	145	195	158	208
1.5	165	215	169	219	178	228	193	243
2.0	197	247	202	252	212	262	230	280
2.5	220	270	225	275	237	287		

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TABLE 9. FIRING RATE FOR 28" PROPANE HEATER

Approximate firing rates for 28" heater with 12.5 HP Axial Fan operated on vapor propane with 1/4" diameter orifice. (Unit as shipped.)

FIRING RATE PSIG	STATIC PRESSURE (INCHES OF WATER COLUMN)							
	1.5		2.0		2.5		3.0	
	TEMP. RISE (°F)	PLENUM TEMP. FOR 50°F AMBIENT AIR (°F)	TEMP. RISE (°F)	PLENUM TEMP. FOR 50°F AMBIENT AIR (°F)	TEMP. RISE (°F)	PLENUM TEMP. FOR 50°F AMBIENT AIR (°F)	TEMP. RISE (°F)	PLENUM TEMP. FOR 50°F AMBIENT AIR (°F)
0.5	38	88	40	90	42	92	44	94
1.0	54	104	56	106	59	109	63	113
2.0	76	126	79	129	84	134	89	139
3.0	93	143	97	147	102	152	108	158
4.0	107	157	112	162	118	168	125	175
5.0	120	170	126	176	132	182	139	189
6.0	131	181	138	188	145	195	153	203
7.0	142	192	149	199	156	206	166	216
8.0	152	202	159	209	167	217	177	227
9.0	161	211	168	218	177	227	188	238
10.0	170	220	178	228	187	237	198	248
11.0	179	229	186	236	196	246	208	258
12.0	186	236	194	244	205	255	217	267
13.0	193	243	202	252	213	263		
14.0	201	251	210	260				
15.0	208	258	217	267				

TABLE 10. FIRING RATE FOR 28" NATURAL GAS HEATER

Approximate firing rates for 28" heater with 12.5 HP Axial Fan operated on natural gas with orifice removed.

FIRING RATE PSIG	STATIC PRESSURE (INCHES OF WATER COLUMN)							
	1.5		2.0		2.5		3.0	
	TEMP. RISE (°F)	PLENUM TEMP. FOR 50°F AMBIENT AIR (°F)	TEMP. RISE (°F)	PLENUM TEMP. FOR 50°F AMBIENT AIR (°F)	TEMP. RISE (°F)	PLENUM TEMP. FOR 50°F AMBIENT AIR (°F)	TEMP. RISE (°F)	PLENUM TEMP. FOR 50°F AMBIENT AIR (°F)
0.25	60	110	63	113	66	116	70	120
0.5	85	135	89	139	94	144	99	149
0.75	104	154	109	159	115	165	121	171
1.0	120	170	126	176	132	182	140	190
1.5	147	197	154	204	162	212	171	221
2.0	175	225	183	233	193	243	204	254
2.5	196	246	205	255	216	266	229	279

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HEATER MAINTENANCE

The following procedures should be followed and maintenance performed before starting the unit at the beginning of every season, and during operation.

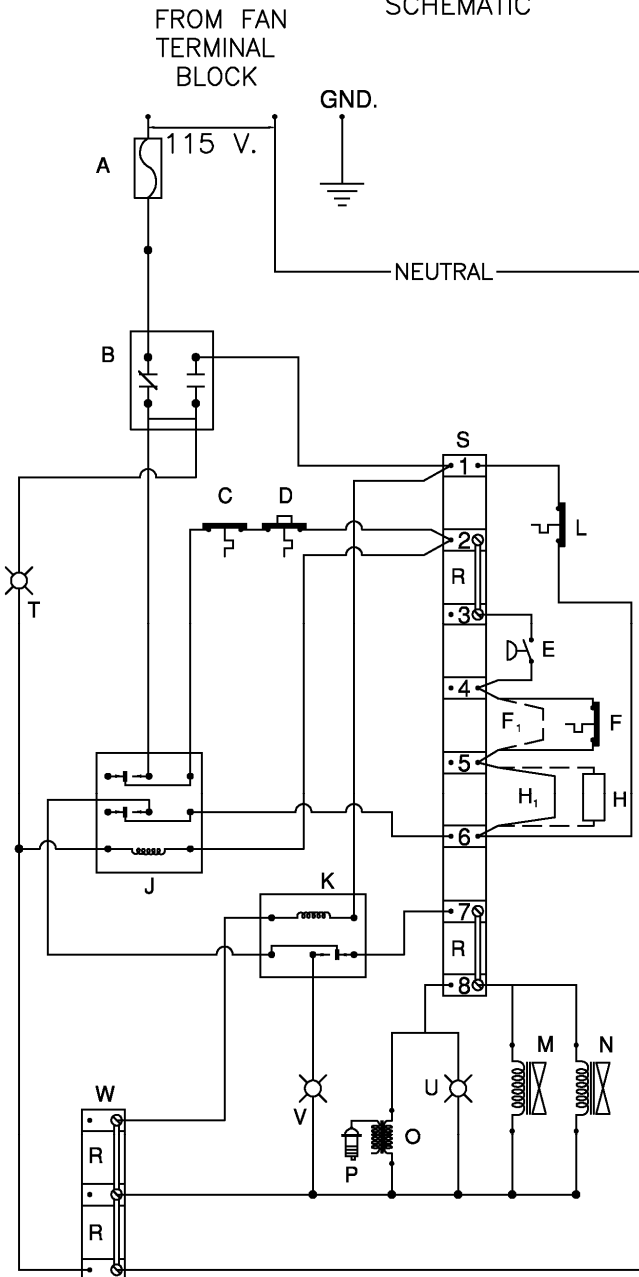
1. The fuel line strainers should be taken out and cleaned. A plugged screen will restrict the gas flow to the unit. On liquid propane units, liquid and vapor line strainers both should be checked. Warranty is void if the strainer or screen is removed, and not reinstalled after cleaning.
2. The burner ring should be checked to be sure that it is not plugged. Bugs and wasps can build nests in them. Use a piece of wire or drill bit that will fit the holes in the burner. To clean the inside of the ring, remove from the heater and tap lightly around the burner ring. Then pour the foreign material out of the Fuel Inlet Pipe.
3. The airswitch inlet screen should be cleaned. The screen keeps bugs and wasps from entering the airswitch; however, during operation the screen can become dirty.
4. Make sure the orifice and pipe are centered in the burner. It can be knocked out of adjustment. Loosen setscrew on heater plumbing bracket, adjust orifice and pipe, then retighten setscrew.
5. Check all plumbing joints for leaks using the "soap test." (See page 20 in installation instructions.)
6. Check all wires to see that they are not bare, causing a short. Mice eat away insulation if protection measures to control rodents are not taken (spark plug, flame probe, burner limit wires.)
7. Examine and gap spark plug. Through wear, the spark plug can go out of adjustment. Check during operation every two days. The gap of the plug should be 1/8 of an inch.
8. The flame probe needs to be checked to be sure that it has not burnt off due to not adjusting the flame probe in and out of the flame. The flame probe can also be broken. Check every two days during operation and replace or adjust as needed. (See adjustment section page 26).
9. Check all wire connections to be sure they are tight.
10. All external plenum controls (nylon humidistat and thermostat combination) should be inspected, cleaned, and checked every three days during operation.
11. Caldwell recommends that external plenum controls be removed and stored in a clean, dry place when not in use.
12. Check adjustment of vaporizer twice daily, or as changing weather conditions demand. (See page 26 in heater adjustment section).

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Heater Wiring Diagram

115 VOLT - 1 phase

FINAL ASSEMBLY
SCHEMATIC



NOTES:

- A.) FUSE (5 AMP AC)
- B.) HEATER TOGGLE SWITCH
- C.) BURNER EXHAUST LIMIT
AUTOMATIC RESET, 270°F.
- D.) BURNER HIGH LIMIT WITH
MANUAL RESET, 160°F.
- E.) AIR PROVING SWITCH
- F.) VAPOR TEMP. LIMIT, 160°F.
(ON LPGE MODELS ONLY)
- F₁.) JUMPER WIRE (REMOVED ON
LPGE
MODELS)
- H.) THERMOSTAT, HUMIDISTAT, OR
COMBINATION.
- H₁.) JUMPER WIRE (REMOVED
FOR FIELD APPLICATION OF
THERMOSTAT, HUMIDISTAT, OR
COMBINATION.)
- J.) START RELAY
- K.) FLAME SENSOR RELAY 30
SECOND
- L.) FLAME SWITCH, AUTOMATIC
RESET 200°F.
- M.) VAPOR SOLENOID VALVE
- N.) LIQUID SOLENOID VALVE
(LPGE MODELS ONLY)
- O.) IGNITION TRANSFORMER
- P.) SPARK PLUG
- R.) JUMPER CLIP
- S.) TERMINAL BLOCK
- T.) POWER LIGHT (AMBER)
- U.) IGNITION LIGHT (WHITE)
- V.) FLAME LOCKOUT LIGHT
(GREEN)
- W.) NEUTRAL TERMINAL BLOCK

NOTE 1: WHEN USED WITH A 460 or 575 VOLT FAN, A STEP-DOWN TRANSFORMER MUST BE USED TO DEVELOP 115 VOLT, 1 PHASE, 60 HZ POWER.

Figure 11. Heater Wiring Diagram

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SERVICE SECTION

The following will help you find any problems that may occur in a Caldwell unit and tips for repairing the heater. For servicing of electrical systems, open the control box cover. Inside the cover, you will find a wiring schematic or see **Figure 11** on page 34 to help you service the unit. Find the symptoms you are experiencing with your unit and go through the possible causes and remedies.

WARNING! UNLESS OTHERWISE INDICATED, CHECKS ARE MADE WITH THE POWER OFF USING VOLTMETER ON RESISTANCE SETTING.

Definition:

Continuity - The ability to move electricity from one point to another, a completed circuit.

I. SYMPTOM: TURN POWER SWITCH ON, NOTHING HAPPENS.

1. Lack of power going to the unit. (CHECK MADE WITH POWER ON).

- A. Take a voltmeter or continuity tester, put one lead to ground and the other on the top terminal of terminal block in fan control box. Power lead is the black wire on top terminal on terminal block. With the fan operating, it should indicate 115 volts on the voltmeter or light should come on with continuity tester.

2. Improper neutral.

- A. Check to be sure neutral wire is connected to the terminal block in the fan control box.
 1. Neutral needs to be provided from the disconnect to fan control box with the power supply.

3. Check for power at toggle switch in heater. (POWER ON).

- A. Put one lead of voltmeter to toggle switch where power cord is connected and the other lead to ground. If there is not any power, check cord and fuse.

4. Fuse may be blown.

- A. Visually check fuse.
 1. If dark in color, replace.
- B. Check fuse and holder.
 1. Put one lead on each side of the fuse on the fuse holder screws. Needle should show continuity through fuse.

5. Flame probe contacts may be in the "open" position

- A. Check the contacts at the flame probe, when the flame probe is cool, the contacts of the flame probe are "closed". Replace flame probe if contacts in flame probe are "open".

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6. Burner High Limit and/or Burner Exhaust Limit may be open.

- A. Use voltmeter and check for continuity between the two leads going to Burner channel.
 - 1. Leads are attached to No. 2 on the terminal block and the Start Relay.
- B. If there is not continuity.
 - 1. Reset high limit button.
 - 2. Remove channel from heater.
 - a. Check each switch individually by putting leads of meter to the two screws that have wires attached. The switch should show continuity. Replace switch if defective.
 - b. If switches are okay, then the burner limit wire is defective. Replace damaged wire.

7. Air Switch may be defective.

- A. Check to see if the air switch is the problem.
 - 1. Move vapor limit switch lead from terminal No. 4 to terminal No. 3 on block and then move the heater switch to the momentary start position. If unit starts, the problem is the air switch. Reconnect wires to the original position after the test.
- B. Make sure the air switch screen is not plugged. If the fan is working against 3" static pressure or higher, and any portion of the screen is open, the heater should run. Remove the screen and try operating the heater. If it runs without the screen, clean the screen and reinstall on the air switch intake.
- C. Be sure air intake of the switch is not plugged. If the air intake is not plugged, replace the air switch.
- D. Heaters applied on centrifugal fans require an air switch static pressure probe kit for operation.

8. The vapor limit switch may be defective.

- A. Use voltmeter and check between No. 4 on terminal block and No. 5 on terminal block. If there is not any continuity, replace switch. (Make sure that the vapor limit switch has had sufficient time to cool, and automatically reset.)

9. Thermostat or Humidistat Control May Be Open

- A. Use a voltmeter and check continuity across the terminal block where the 2 leads of the control are connected.
- B. If no Continuity is present
 - 1. Check that the control setting to call for heater operation.
 - 2. Check that the wires to the control are not broken. If either wire is damaged replace the wire.
 - 3. Replace entire Thermostat or Humidistat.

10. Flame Sensing Relay isn't completing the circuit.

- A. Turn off switch to deenergize the circuit.
- B. Once deenergized, check the continuity of the contacts of the Flame Sensing Relay. Check for continuity in the normally closed set of contacts. A lack of continuity indicates a defective Flame Sensing Relay. Replace the Flame Sensing Relay.

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11. **Check all wires and connections to be sure they are okay and correct.**
(See wiring schematic.)

II. SYMPTOM: NO IGNITION, LACK OF IGNITION SPARK, GAS PRESENT.

1. Transformer is defective. (POWER ON).

- A. Take the cap holding the spark plug wire off and remove the spark plug wire from the transformer. With the transformer energized, ground an insulated screwdriver and arc to the transformer post where spark was connected. **CAUTION: DO NOT TOUCH SCREW DRIVER SHAFT.**

1. If there is not any arc, or less than a 1/8" arc, replace transformer.

2. Spark plug wire is defective. (POWER ON).

- A. Take wire off spark plug and arc to heater. **CAUTION: DO NOT TOUCH SPARK PLUG WIRE MOUNTING TERMINAL.**

1. If it does not arc, replace wire.

3. Spark plug is defective.

- A. Check gap of plug. Gap is 1/8.
- B. If above steps 1 and 2 check okay, replace spark plug.

III. SYMPTOM: NO IGNITION, LACK OF GAS WITH SPARK PRESENT.

The check to make sure gas is present should be made after all the electrical component checks are made, and the electrical controls are confirmed to be functioning properly.

1. Lack of gas to heater.

- A. Check tank to see if ample pressure is available to start unit.
 1. Unit requires 35 psig of propane pressure and five psig of natural gas available at the unit for startup.
- B. Check to see if tank, regulator, or line going to the unit is blocked.

2. Check to see if solenoids are functioning. (POWER ON).

- A. Put your hand on the top of the solenoid and turn the heater toggle switch on and off several times.
 1. If you feel a click at the top of the solenoid, the coil is okay and the solenoid is functioning electrically.
 2. If there is not a click, the coil is defective. Replace part.
- B. Check solenoid to see if screen is plugged in the solenoid or the diaphragm is defective.
 1. Unscrew the top of the brass fixture and the screen and diaphragm are located just inside.
 - a. Be sure to reassemble properly. Reversing any parts in the solenoid will cause the solenoid not to function properly.
 - b. Keep all foreign material out of solenoid.

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3. Obstruction in the gas line.

Inspect the line strainers. Remove any foreign material found in the screens.

NOTE: FOR NATURAL GAS HEATER, GO DIRECTLY TO STEP C.

WARNING: THE CHECKS IN THESE SECTIONS MUST BE MADE WITHOUT ANY SPARK OR FLAME IN THE IMMEDIATE AREA. DISCONNECT SPARK PLUG WIRE FROM TRANSFORMER, AND EXTINGUISH ANY FLAMMABLE MATERIALS.

- A. Remove vaporizer hose where it is attached to the heater liquid solenoid. Leave gas supply on. Turn toggle switch on and then immediately off.
 - 1. If there is very little gas coming out the solenoid, the obstruction is in the heater liquid plumbing or in the tank and line coming to the unit.
 - a. Remove pressure relief valve. If there is pressure when the ball valve is open, the restriction is the solenoid.
- B. Disconnect the vaporizer hose at the vapor regulator with the hose reattached to heater liquid plumbing. Turn on the heater. Again, there should be a large volume of gas coming out the vaporizer hose.
 - 1. If the vapor line strainer is okay, the vaporizer must be plugged. Replace vaporizer.
- C. Obstruction is located in heater vapor plumbing.
 - 1. Shut off gate valve and remove the solenoid. Turn on switch and open the vapor valve.
 - a. If gas is present at the point where the solenoid is attached, the solenoid must be defective. Replace the solenoid.
 - b. If gas is not present, the regulator is defective. Replace the regulator.

4. If there is gas present at the pressure gauge, but the unit lacks gas for ignition.

- A. Check orifice to be sure it is clean and the correct size is in use. (See Firing Rate Tables.)
- B. Check burner ring.
 - 1. See that holes are not plugged.
 - 2. See that the tubing is not plugged by bugs or mice. (See maintenance section, page 33.)

IV. SYMPTOM: Flame Sensing Relay locks ignition out.

1. If ignition is not present.

- A. Refer to Symptom III, if spark is present and gas is not available.
- B. Refer to Symptom II, if gas is present and you are lacking spark.

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2. Ignition is present.

- A. Check position of the flame probe for proper adjustment. (See page 26 in adjustment section.)
- B. Defective flame probe.
 - 1. When flame is present, the Flame Probe contacts should be in an “open” position. If contacts are “closed”, replace the Flame Probe.
- C. Check the flame probe wire. If defective, replace.
 - 1. Check wire for bare spots and shorts to ground.
 - a. Flame probe should not show continuity from either wire to ground.
 - 2. Check the two wires in the flame probe wire assembly to see if they are shorting across in the assembly.
 - a. With the wires removed from the flame probe, there should not be any continuity.
- D. Defective Flame Sensing Relay. (POWER ON).
 - 1. If A, B and C check out okay, that leaves only the Relay with Time Delay to be defective. Replace this part.

V. SYMPTOM: BURNER HIGH LIMIT POPS OUT.

1. Fan inlet obstructed.

- A. Keep fan screen clean of all foreign material.

2. Fan motor failing.

- A. Have motor checked to see that it is coming up to full speed.

3. See if static pressure is too high. Use static pressure gauge.

- A. Check to be sure roof vents are open and the openings are sufficient in size.
- B. Check floor for plugged holes.
- C. Check grain depth, moisture content, and fines in grain. If any of these conditions are high, the grain level should be lowered.

VI. SYMPTOM: HEATER CYCLES WITHOUT ANY EXTERNAL PLENUM CONTROLS IN USE. (POWER ON).

1. Static pressure too high, causing Burner Exhaust Limit to cycle the unit.

- A. Remove vapor temperature limit from the vapor plumbing line. If unit continues to cycle, check the following.
 - 1. The vent area in the bin roof.
 - a. Are vents open?
 - b. Is the amount of openings sufficient?
 - 2. The firing rate is too high for the application. (See Firing Rate Tables.)
 - 3. Check the grain depth, fines and moisture content. If these conditions are high, the grain level should be lowered.

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2. The Vaporizer is too hot.

- A. Remove vapor temperature limit from plumbing line.
 - 1. If cycling stops, adjust vaporizer out of the flame. (See page 26 in adjustment section.)

VII. SYMPTOM: NOT ENOUGH HEAT

1. Orifice is too small or dirty.

- A. Check Firing Rate Tables for the proper size orifice for your unit and application.
 - 1. Natural gas unit requires the orifice to be removed on 24" and 28" units.
- B. Remove orifice and check for obstructions and then reinstall orifice.

2. Insufficient gas pressure.

- A. Refer to installation section page 19 for proper gas supply.

3. Vaporizer not hot enough.

- A. Vapor plumbing will be cold to touch.
 - 1. Refer to page 26 in adjustment section.

VIII. SYMPTOM: EXTERNAL PLENUM CONTROL NOT FUNCTIONING.

- 1. Check wiring schematic and be sure the control is wired into the heater properly.
- 2. Make visual check of the external plenum control cord to be sure it isn't cut or shorted.
- 3. Check the external plenum control setting. Adjust external plenum control for desired setting, using page 27 in adjustment section.

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PRODUCT SERVICE: Our top priority is to assure customer satisfaction on all Caldwell products. If a dealer requires assistance from Caldwell, contact our Service Department. The dealer purchasing a product from Caldwell will be responsible for the installation, operation, and service in accordance with Caldwell Service Policy. The dealer will also be responsible for all Standard Limited Warranty procedures in accordance with Caldwell Service Policy.

SERVICE POLICY

CALDWELL STANDARD LIMITED WARRANTY: DEALERS HAVE THE RESPONSIBILITY OF CALLING TO THE ATTENTION OF THEIR CUSTOMERS THE FOLLOWING LIMITED WARRANTY, PRIOR TO ACCEPTANCE OF AN ORDER FROM THE CUSTOMER FOR ALL COMPANY PRODUCTS.

Caldwell warrants to the purchaser for use that if any part of the product is proven to be defective in material or workmanship with **2 years** from date of original invoice from factory, and Caldwell is notified within 15 days after such defect is discovered, Caldwell, will (at company option) either replace or repair said part. This standard limited warranty does not apply to damage resulting from misuse, neglect, material wear, accident or improper installation or maintenance. Said part will not be considered defective if it substantially fulfills performance specifications. **THE FOREGOING LIMITED WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES OF MERCHANTABILITY, FITNESS FOR PURPOSE AND OF ANY OTHER TYPE, WHETHER EXPRESSED OR IMPLIED.** Caldwell neither assumes nor authorizes anyone to assume for it any other obligation or liability in connection with said part and will not be liable for incidental or consequential damages. **THE REMEDIES STATED HEREIN SHALL BE THE EXCLUSIVE REMEDIES AVAILABLE UNDER THIS STANDARD LIMITED WARRANTY. CLAIMS UNDER THIS STANDARD LIMITED WARRANTY SHALL BE HANDLED UNDER THE STANDARD SERVICE POLICY.** Caldwell will not be responsible for any charges incurred in repairing or servicing any Caldwell products except as such repairs are made at Caldwell or by Caldwell Field Service Personnel or as approved in writing from Caldwell Customer Service.

IN WARRANTY REPLACEMENT: The Caldwell Standard Limited Warranty Policy will cover any defective part of the product covered by the Standard Limited Warranty. Equipment involved in a warranty claim under the above Standard Limited Warranty shall have the ORIGINAL WARRANTY REGISTRATIOIN CARD on file in Kearney, Nebraska, and have been properly installed, maintained and operated according to the instructions provided by Caldwell.

WARRANTY CLAIM PROCEDURES: When a part failure occurs, that in your judgment meets the conditions of the above Standard Limited Warranty, contact your dealer to make arrangements for the shipment of a replacement item and the return of the defective equipment.

ELECTRIC MOTOR WARRANTY: The Manufacturers of all electric motors used by Caldwell carry a warranty for these items. If the motor fails under the conditions of the Caldwell Standard Limited Warranty Policy, and provided it was protected by the proper protective device, the motor manufacturer's nearest authorized service center will repair it. See catalog for motor manufacturers service centers. Any in warranty replacement motors not satisfactorily handled by motor manufacturer service centers and within the Standard Limited Warranty period and policy will be covered by Caldwell, Kearney, Nebraska. Contact Caldwell if you have any problems or questions.

OUT OF WARRANTY SERVICE: Products requiring Caldwell repair work will be repaired at the standard repair charge plus hourly charges after the first hour. Field service work will require a field service charge plus travel expenses. The repaired part will carry a 30 day limited warranty.

Your dealer will be responsible for warranty procedures in accordance with the Caldwell Service Policy. (See Dealer Policy.)