Part Number	220491
Bulletin	464S
Effective	2/1/2002

SERVICE MANUAL

FOR

CH1015T, CH2025T SERIES HEATERS

&

CH18T, CH24T, CH28T SERIES HEATERS

A DIVISION OF CHIEF INDUSTRIES, INC.

P.O. Box 848
Kearney, NE 68848 USA
Phone (308) 237-3186
Fax (308) 237-2650

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CALDWELL HEATER
SERVICE MANUAL

THIS MANUAL IS FOR THE SERVICE AND MAINTENANCE OF HEATERS WITH SERIAL NUMBER OF 00A 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 pin-point 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 _____

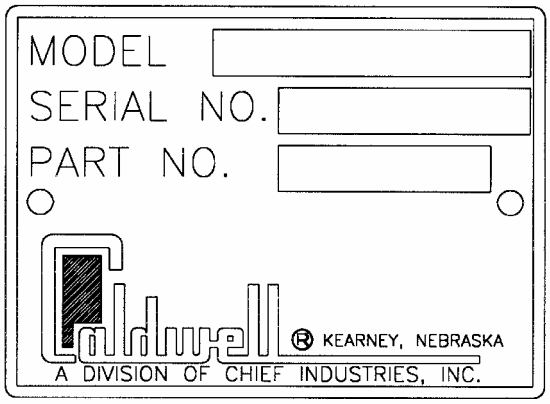


Figure 1. Typical Serial Number Plate

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

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:

Downstream Heater:

Example: **CH 1015 T - LPGEM**
(a) (b) (c) (d)

(a) **CH** = **H**eater Unit (**C**anadian)
(b) **1015** = Fan Model Required by Horsepower
Where **1015** = C27-10 or C27-15
2025 = C30-20 or C30-25
(c) **T** = **T**ransformer and Flame Probe Ignition System
(d) **LPGEM** = Type of Fuel to be Utilized
Where
NGE **N**atural **G**as Fuel (**E**lectric)
NGEM **N**atural **G**as Fuel (**E**lectric) with **M**odulating Valve
LPGE **L**iquid **P**ropane **G**as Fuel (**E**lectric)
LPGEM **L**iquid **P**ropane **G**as Fuel (**E**lectric) with **M**odulating Valve
VPGE **V**apor **P**ropane **G**as Fuel (**E**lectric)

Axial Heater:

Example: **CH 28 - T - NGE**
(a) (b) (c) (d)

(a) **CH** = **H**eater Unit (**C**anadian)

(b) **28** = Housing Diameter

(c) **T** = **T**ransformer and Flame Probe Ignition System

(d) **NGE** = Type of Fuel to be Utilized
Where
NGE **N**atural **G**as Fuel (**E**lectric)
NGEM **N**atural **G**as Fuel (**E**lectric) with **M**odulating Valve
LPGE **L**iquid **P**ropane **G**as Fuel (**E**lectric)
LPGEM **L**iquid **P**ropane **G**as Fuel (**E**lectric) with **M**odulating Valve
VPGE **V**apor **P**ropane **G**as Fuel (**E**lectric)

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. Chief requires using a fuel line strainer in the fuel line just before the fuel enters the heater plumbing. A line strainer is not provided on NGE or VPGE units. A line strainer can be obtained from Chief, 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 CH24T-VPGE and CHT28-VPGE 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 part on CH24T-LPGE and CH28T-LPGE units.

4. When wiring a heater to a 460 Volt, three phase, or 575 volt, three phase fan, a Step Down Transformer must be used to develop 115 volt, single phase, 60 cycle power (part #717033).

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 Canadian Electrical Code, and the ground wire is sized large enough to provide lightening 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:

Figure 2. BIN VENT WARNING DECAL

Downstream Heater Control Enclosure Components

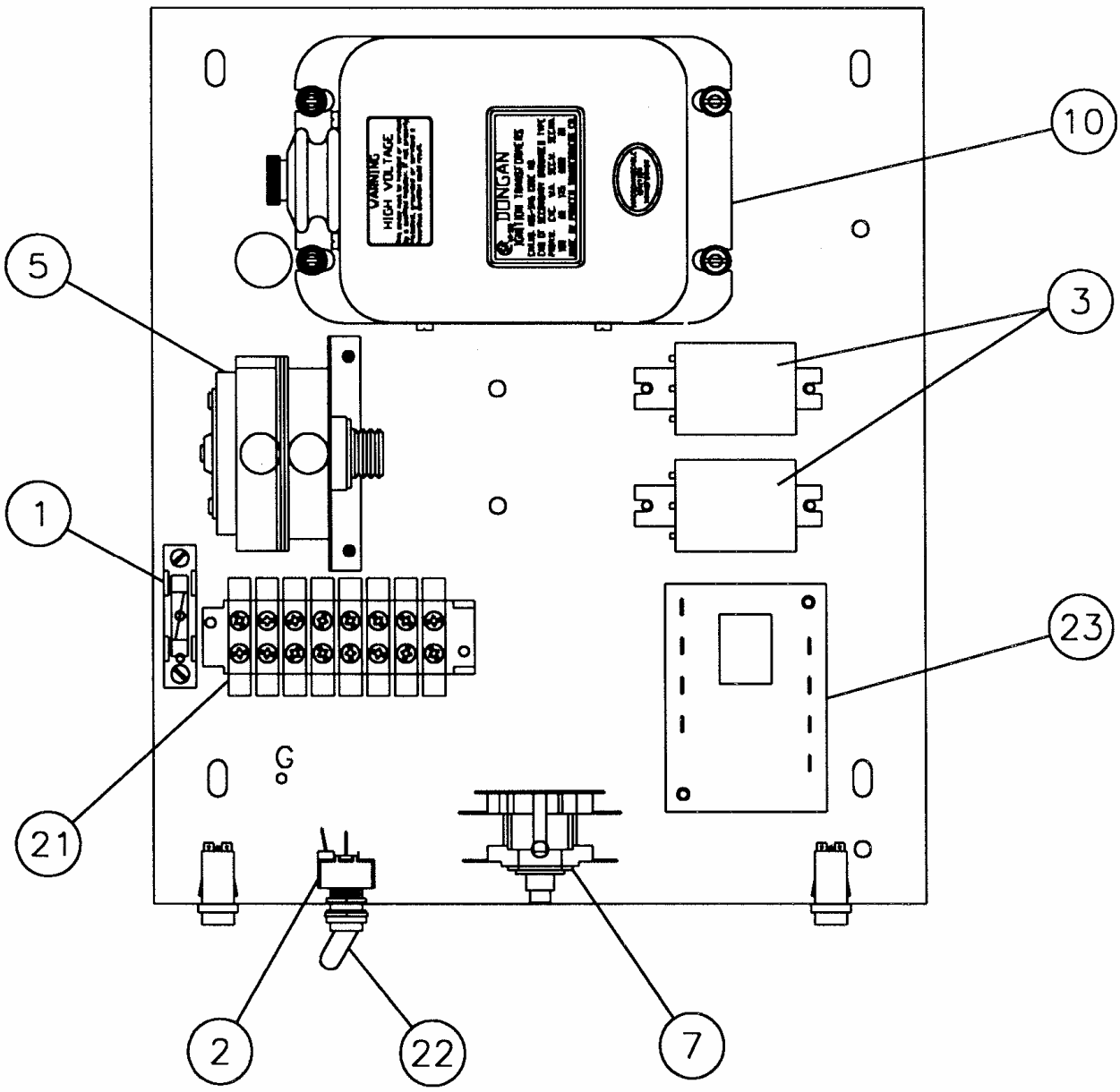


Figure 3. Control Enclosure Components For Downstream Heaters

DOWNSTREAM HEATER COMPONENTS

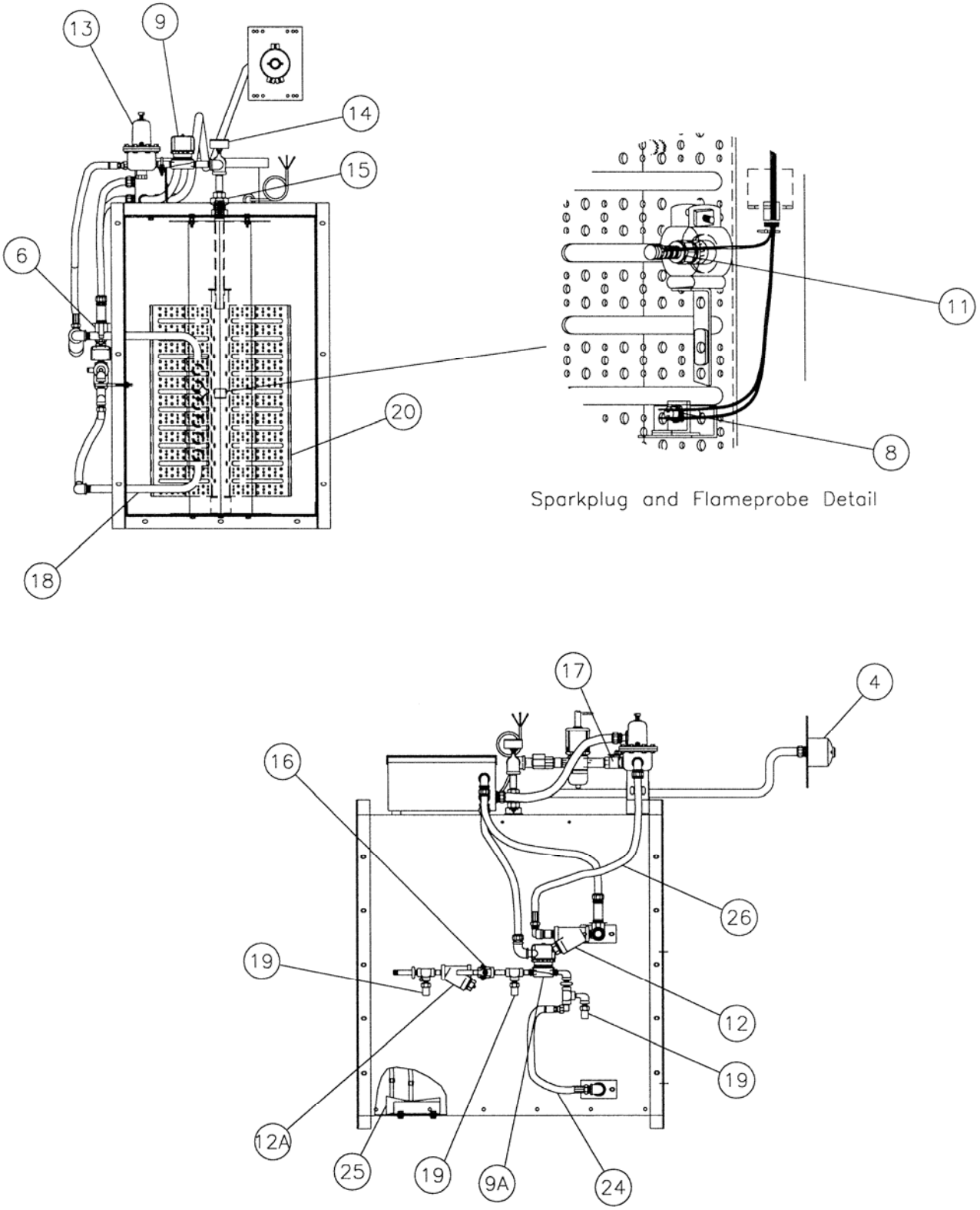


Figure 4. Downstream Heater Components

TABLE 1. DOWNSTREAM HEATER CONTROL REPLACEMENT PARTS LIST

ITEM #		PART DESCRIPTION	PART NUMBER
		Parts Common to All Models	
1		5 Amp Fuse	850412
2		Toggle Switch	710970
3		Slave Relay	756692
4		High Limit	776443
5		Air Switch	785691
6		Vapor Temperature Limit (LPGE units only)	157200
7		Flame Sensing Relay	753806
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	749614
22		Toggle Switch Boot	712034
23		Purge Delay	719914
24		Liquid Propane Hose	715276
25		Venturi (Air Switch)	415661
26		Vapor Propane Hose	155820
		Optional External Plenum Controls	
27		Nylon Humidistat Control (Not Shown)	850982
28		Thermostat Control (Not Shown)	851014
29		Humidistat-Thermostat Control (Not Shown)	850974
30		Modulating Valve (Propane) (Not Shown)	701862
31		Modulating Valve (Natural Gas) (Not Shown)	767954

TABLE 2. DOWNSTREAM HEATER REPLACEMENT PARTS FOR SPECIFIC MODELS

		CH1015T-NGE	CH1015T-VPGE	CH1015T-LPGE	CH1015T-LPGEM
ITEM #	PART DESCRIPTION	PART #	PART #	PART #	PART #
9	Vapor Solenoid Valve	789263	789255	789255	189255
9A	Liquid Solenoid Valve			753863	753863
12	Vapor Fuel Line Strainer			851626	851626
12A	Liquid Fuel Line Strainer			851634	851634
13	Regulator	753905	715003	715003	715003
15	Orifice	720516	422253	422253	422253
16	Liquid Valve			714949	714949
17	Vapor Valve	714931	714931	714931	714923
18	Vaporizer			752584	752584
19	Hydrostatic Pressure Relief Valve			716878	716878
20	Burner	175345	175345	175345	175345

		CH2025T-NGE	CH2025T-VPGE	CH2025T-LPGE	CH2025T-LPGEM
ITEM #	PART DESCRIPTION	PART #	PART #	PART #	PART #
9	Vapor Solenoid Valve	789263	789263	789263	789263
9A	Liquid Solenoid Valve			753863	753863
12	Vapor Fuel Line Strainer			851626	851626
12A	Liquid Fuel Line Strainer			851634	851634
13	Regulator	775502	715003	715003	715003
15	Orifice	719328	714881	714881	714881
16	Liquid Valve			714949	714949
17	Vapor Valve	714931	714931	714931	714931
18	Vaporizer			752584	752584
19	Hydrostatic Pressure Relief Valve			716878	716878
20	Burner	190422	190422	190422	190422

EXPLANATION OF COMPONENTS FOR DOWNSTREAM HEATER

An understanding of the heater operation can be obtained by learning the function of each heater component. Refer to **Figures 3 and 4**, and **Tables 1 and 2** 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 #710970**
   The Toggle Switch is the heater "On" and "Off" switch.
3. **Slave Relay for High Limit and Flame Probe #756692**
   The Slave Relay for the High Limit is activated when the High Limit reaches the 230° F (110° C) setting temperature. The slave relay shuts off the spark and fuel to the burner and maintains the "OFF" condition until the operator determines the cause of the High Limit reaching the setting temperature. With the High Limit cooled, the operator will be able to reset the slave relay by turning the heater toggle switch "OFF.
   A second slave relay is utilized to prove that the Flame Probe is functioning properly with every trial for ignition. If the Flame Probe is functioning properly the relay allows the purge to energize. If the Flame Probe is not functioning properly the Slave Relay prevents the initiation of the ignition process.
4. **High Limit #776443**
   The High Limit Control is located in the bin plenum. When the High Limit reaches a temperature of 230° F (110° C), it activates the slave relay to shut off and keep the heater "OFF" until the operator determines the reason the High Limit was activated. Refer to item 3 above. Note that the High Limit is not an operating control and the operator must utilize an operating control and set the firing rate for the desired drying plenum temperature. The High Limit is a limiting device such that the heater is locked off if the 230° F (110° C) temperature is obtained.
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 air flow is stopped, the Air Switch will shut off the heater. The Air Switch will keep the heater shut off until air flow 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 (LPGE units only) #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. Also, 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 re-ignite after the Vaporizer cools. The Vapor Temperature Limit is only on LPGE Heaters.

7. **Flame Sensing Relay #753806**
   The Flame Sensing Relay has a 20-50 second delay and is used to break the circuit to the Purge Delay, Solenoid Valves, and Ignition Transformer if the Flame Probe does not establish the presence of the flame at the burner. The operator is required to manually reset the Flame Sensing Relay before retrying for ignition.

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 Sensing 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.

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**
    The Regulator is used to regulate the amount of fuel (Propane or natural gas) going 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 amount of fuel pressure at the Orifice. The pressure is used as a tool to set the firing rate.

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.

16. **Liquid Shut-Off Valve #714949**
    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 Valve**
    The Vapor Valve is used for preliminary adjustment of the firing rate by opening and closing the valve to generate the proper plenum temperature. Once the proper firing rate is established, the regulator needs to be adjusted to the firing rate required.

18. **Vaporizer #752584**
    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 hydrostatic pressure relief valve opens, replace the relief valve.

20. **Burner**
    The Burner is the component in the heater where the fuel and air are mixed and then burned.

21. **Terminal Block #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. **Purge Delay #719914**
    The Purge Delay is a time delay relay used to delay the energizing of the Ignition Transformer and Solenoid Valves for 30 seconds after the heater is turned on to allow for the removal of any raw gas from the heater before ignition is tried. The Purge Delay calls for a 30 second delay before ignition regardless of which control turns the heater on.

24. **Liquid Propane Hose #715276**
    The Liquid Propane Hose is used to connect the liquid plumbing line to the inlet of the vaporizer.

25. **Venturi (Air Switch) #415661**
    The Venturi is used to sense the air velocity for the air switch operation.

26. **Vapor Propane Hose #155820**
    The Vapor Propane Hose is used to connect the vaporizer to the vapor propane line.

Optional External Plenum Control (*Not Shown*)

27. **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 typically 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.

28. **Thermostat Control #851014**
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.

29. **Humidistat-Thermostat Control #870974**
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 (**27-29**) do not function in the same manner as a thermostat in a house. 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 change in the plenum 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.

30-31. **Modulating Valve**
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.

AXIAL HEATER
Axial Heater Control Components

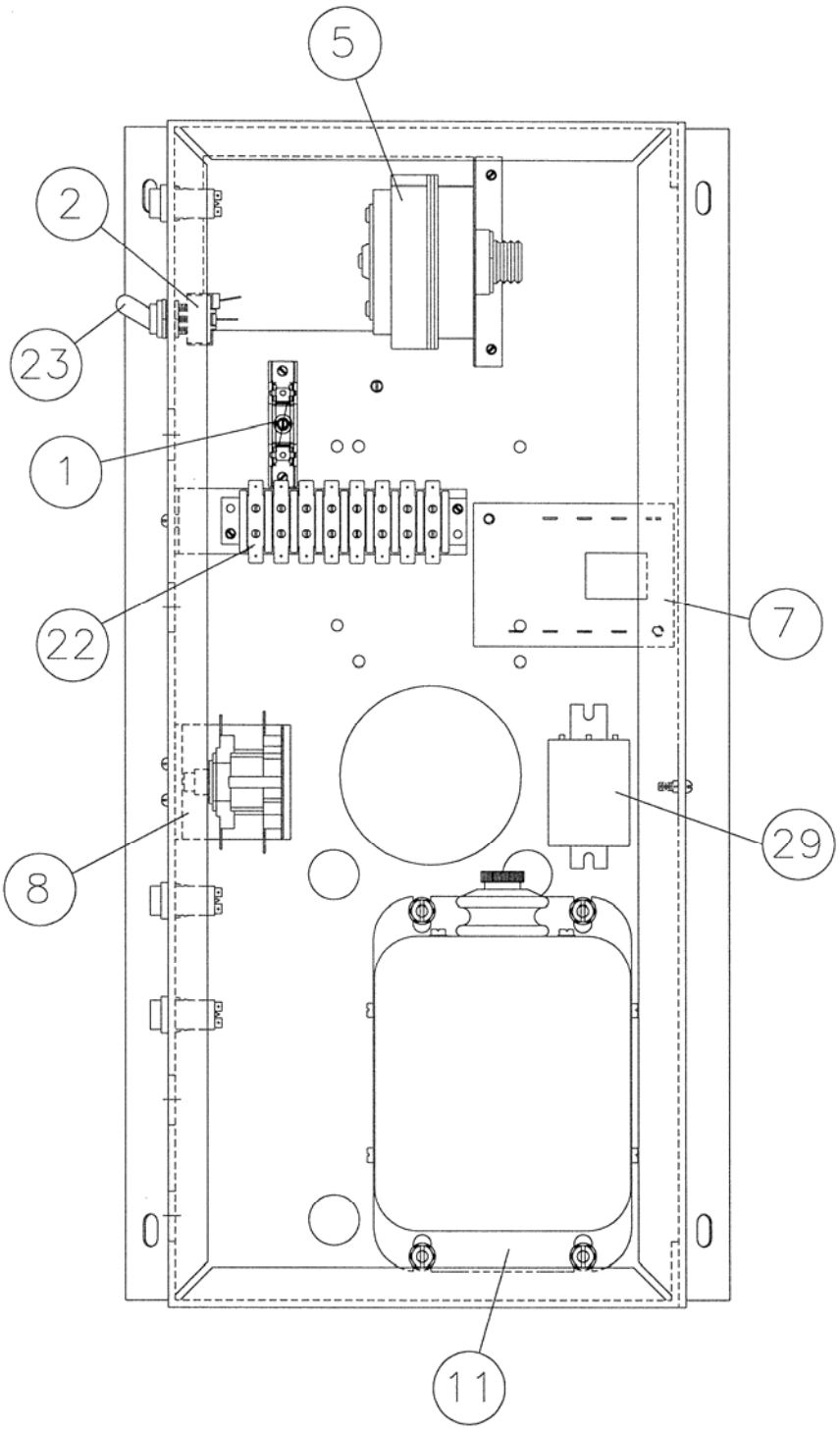


Figure 5. Axial Heater Control Enclosure Components

Axial Heater Components

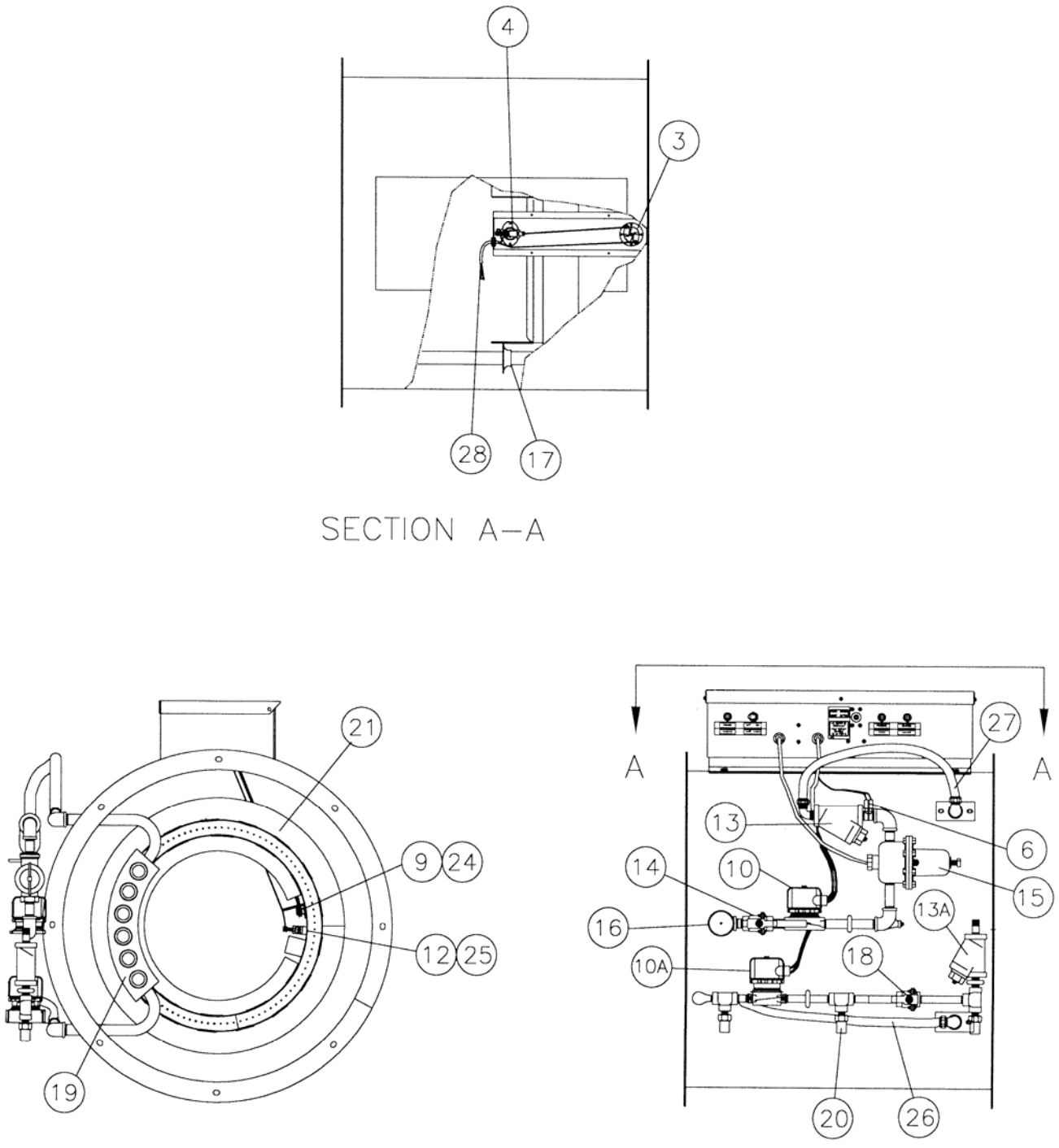


Figure 6. Axial Heater Components

TABLE 3. REPLACEMENT PARTS LIST FOR AXIAL CONTROL

ITEM #		PART DESCRIPTION	PART NUMBER
		Parts Common to All Models	
1		5 Amp Fuse	850412
2		Toggle Switch	710970
3		Burner Exhaust Limit	711093
4		High Limit	712299
5		Air Switch	785691
6		Vapor Temperature Limit (LPGE units only)	157200
7		Purge Delay	719914
8		Flame Sensing Relay	753806
9		Flame Probe	749812
11		Ignition Transformer	851790
12		Spark Plug	851402
22		Terminal Block	749614
23		Toggle Switch Boot	712034
26		Liquid Propane Hose	715276
27		Vapor Propane Hose	155820
28		Burner High Limit Wire	701961
29		Slave Relay	756692
		Optional External Plenum Controls	
30		Nylon Humidistat Control (Not Shown)	850982
31		Thermostat Control (Not Shown)	851014
32		Humidistat-Thermostat Control (Not Shown)	850974
33		Modulating Valve (Propane) (Not Shown)	701862
34		Modulating Valve (Natural Gas) (Not Shown)	767954

TABLE 4. REPLACEMENT PARTS FOR SPECIFIC AXIAL MODELS

		CH18T-NGE-PE	CH18T-VPGE	CH24T-NGE	CH24T-VPGE
ITEM #	PART DESCRIPTION	PART #	PART #	PART #	PART #
10	Vapor Solenoid Valve	789255	789255	789263	789255
10A	Liquid Solenoid Valve				
13	Vapor Fuel Line Strainer				
13A	Liquid Fuel Line Strainer				
14	Vapor Valve	714923	714923	714931	714923
15	Regulator	715003	715003	753905	715003
16	Pressure Guage	715011	851543	715011	851543
17	Orifice	714956	718387	714923	714980
18	Liquid Valve				
19	Vaporizer				
20	Hydrostatic Pressure Relief Valve				
21	Ring Burner	702340	702340	702332	702332
24	Flame Probe Wire	730473	730473	730499	730499
25	Spark Plug Wire	701979	701979	701987	701987

		CH24T-LPGE	CH28T-NGE	CH28T-VPGE	CH28T-LPGE
ITEM #	PART DESCRIPTION	PART #	PART #	PART #	PART #
10	Vapor Solenoid Valve	789255	789263	789263	789263
10A	Liquid Solenoid Valve	753863			753863
13	Vapor Fuel Line Strainer	851626			851626
13A	Liquid Fuel Line Strainer	851634			851634
14	Vapor Valve	714923	714931	714931	714923
15	Regulator	715003	753905	715003	715003
16	Pressure Guage	851543	715011	851543	851543
17	Orifice	714980		714956	714956
18	Liquid Valve	714949			714949
19	Vaporizer	702035			702035
20	Hydrostatic Pressure Relieve Valve	716878			716878
21	Ring Burner	702332	702357	702357	702357
24	Flame Probe Wire	730499	730515	730515	730515
25	Spark Plug Wire	701987	701995	701995	701955

EXPLANATION OF COMPONENTS FOR AXIAL HEATER

An understanding of the heater operation can be obtained by learning the function of each heater component. Refer to **Figures 5 and 6**, and **Tables 3 and 4** while studying the following section. The figures illustrate each component.

1. **5 Amp Fuse #850412**
   The fuse protects the Heater Control Circuit from excessive current draw.
2. **Toggle Switch #710970**
   The Toggle Switch is the heater "On" and "Off" 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 sensor exceeds 270° F (132° C). The control will automatically allow the heater to re-ignite 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 air flow is stopped, the Air Switch will shut off the heater. The Air Switch will keep the heater shut off until air flow 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 (LPGE Units Only) #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. Also, 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 re-ignite after the Vaporizer cools. The Vapor Temperature Limit is only on LPGE Heaters.
7. **Purge Delay #719914**
   Purge Delay is a time delay relay used to delay the energizing of the Ignition Transformer and Solenoid Valves for 30 seconds after the heater is turned on to allow for the removal of any raw gas from the heater before ignition is tried. The Purge Delay calls for a 30-second delay before ignition, regardless of which control turns the heater on.

8. **Flame Sensing Relay #753806**
   The Time Delay Relay has a 20-50 second delay and is used to break the circuit to the Purge Delay, Solenoid Valves, and Ignition Transformer if the Flame Probe does not establish the presence of the flame at the burner. The operator is required to manually reset the Flame Sensing Relay before retrying for ignition.

9. **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 Sensing Relay, as the Flame Safeguard Circuit of the heater. The switch is opened on temperature rise.

10. **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.

11. **Ignition Transformer #851790**
    The Ignition Transformer is a transformer used to create the 6000 secondary volts necessary for spark at the Spark Plug.

12. **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.

13. **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.

14. **Vapor Valve**
    The Vapor Valve is used for preliminary adjustment of the firing rate by opening and closing the valve to generate the proper plenum temperature. Once the proper firing rate is established, the regulator needs to be adjusted to the firing rate required.

15. **Regulator**
    The Regulator is used to regulate the firing rate of the heater. **The Regulator is not used to regulate the fuel from the fuel sources.** A separate Regulator should be used for regulating the fuel at the fuel source.

16. **Pressure Gauge**
    The Pressure Gauge is used to indicate the amount of fuel pressure at the Orifice. The pressure is used as a tool to set the firing rate.

17. **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.

18. **Liquid Shut-Off Valve #714949**
    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.

19. **Vaporizer #702035**
    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.

20. **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 hydrostatic pressure relief valve opens, replace the relief valve.

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

22. **Terminal Block #749614**
    The Terminal Block is used as a junction block for connecting the lead wires of the various electrical parts.

23. **Toggle Switch Boot #712034**
    The Toggle Switch Boot is used to eliminate water entering the heater controls through the Toggle Switch.

24. **Flame Probe Wire**
    The Flame Probe Wire is used to connect the flame probe to the control box.

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

26. **Liquid Propane Hose #715276**
    The Liquid Propane Hose is used to connect the liquid plumbing line to the inlet of the vaporizer.

27. **Vapor Propane Hose #155820**
    The Vapor Propane Hose is used to connect the vaporizer to the vapor propane line.

28. **Burner High Limit Wire #701961**
    Wiring that connects the Burner High Limit and Burner Exhaust Limit to the control box.

29. **Slave Relay #756692**
    A Slave Relay is utilized to prove that the Flame Probe is functioning properly with every trial for ignition. If the Flame Probe is functioning properly the relay allows the purge to energize. If the Flame Probe is not functioning properly the Slave Relay prevents the initiation of the ignition process.

Optional External Plenum Control (*Not Shown*)

30. **Humidistat Control #850982**
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 typically 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.

31. **Thermostat Control #851014**
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.

32. **Humidistat-Thermostat Control #870974**
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 (**30-32**) do not function in the same manner as a thermostat in a house. 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 change in the plenum 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.

33-34. **Modulating Valve**
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.

Heater Operational Adjustments

The following adjustments will have to be made, depending upon the kind of heater, and Plenum External controls being used. These adjustments can not 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 after 6 hours of operation to make sure that the heater is functioning properly, and that the operator is getting the desired result.

1. 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 7 & 8**. The ideal location of the Flame Probe is when the end of the flame is just barely touching the probe. A small dull red area on the probe can identify this ideal location. 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 re-adjusted.

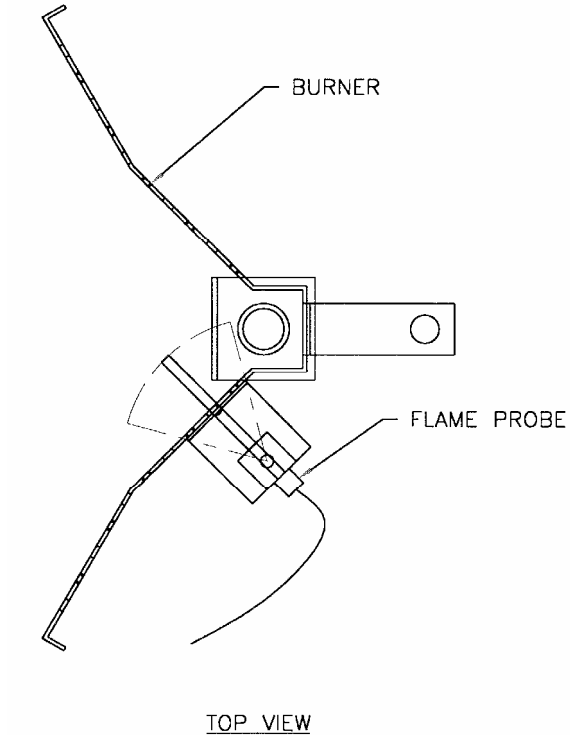


Figure 7. Flame Probe Adjustment For Down Stream Heaters.

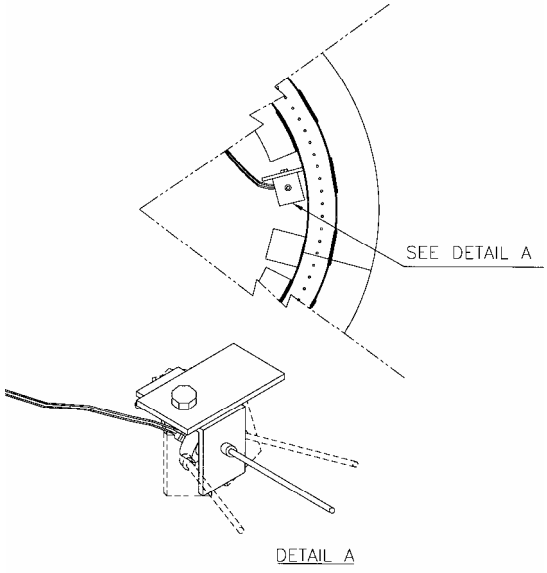


Figure 8. Flame Probe Adjustment For Axial Heaters.

2. 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). 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.

3. 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.

4. Adjustment of the Humidistat Control if used to operate the Heater

Set the Humidistat Control at the desired setting (typically 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.

5. 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 FUNCTIONS AS A DRYING THERMOSTAT, NOT AS A PLENUM HIGH LIMIT.

6. 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.

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.

7. 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 Valve to the desired plenum temperature.

Down Stream Heater Low Fire Adjustments

Low Fire/Natural Gas Applications Installation

1. **Low Fire Application/Low Temperature Rise**
   This application is to acquire a low temperature rise above ambient temperature. In order to accomplish this, some of the holes in the burner pipe may need to be plugged to allow a lower firing rating. Working from the top of the burner pipe place a quantity of 6 ($^5/_{16}$ X $^3/_4$) self tapping screws (960592) in the burner pipe and try adjusting the regulator pressure to get the temperature rise desired. If the temperature rise is still higher than desired and flame can not be maintained at a lower regulator pressure setting, continue to add two more screws starting at the bottom of the burner pipe and again check the firing rate for the desired application. **Note:** Avoid plugging the burner pipe holes directly in front of the spark plug; this will cause the burner to fail to ignite properly. The flame probe may need to be repositioned lower on the burner so that it is in an area of higher flame intensity after the installation of the screws.

2. **Natural Gas Applications/Low Inlet Gas Pressure**
   This application is when the gas supply is not sufficient to maintain a flame in the heater unit even when the gas regulator is fully open. Working from the top of the burner pipe place a quantity of 6 ($^5/_{16}$ X $^3/_4$) self tapping screws (960592) in the burner pipe with the regulator in a fully open position. If the flame is still not maintained repeat the process by continuing to add two more screws starting at the bottom of the burner pipe and again check the firing rate for the desired application. **Note:** Avoid plugging the burner pipe holes directly in front of the spark plug; this will cause the burner to fail to ignite properly. The flame probe may need to be repositioned lower on the burner so that it is in an area of higher flame intensity after the installation of the screws.

Note: In both cases the number of screws placed in the burner pipe will vary. Each individual case will be different for each customer to accomplish there given firing rate needed for his or her particular application.

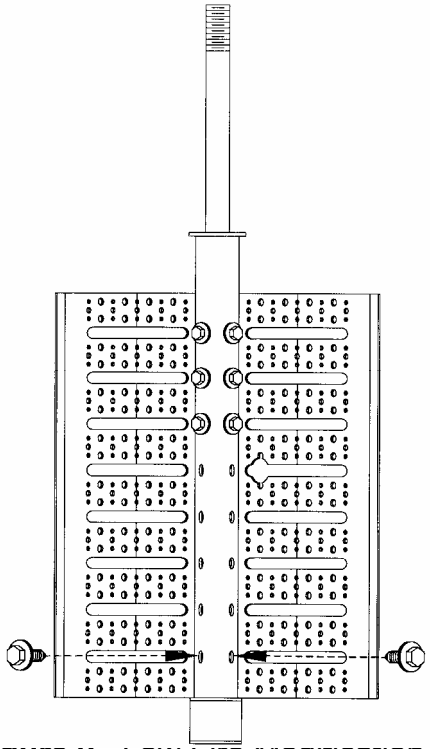


Figure 9. Low Fire Modification

HEATER MAINTENANCE

The following procedures should be followed and maintenance performed before starting the unit at the beginning of every season, and also 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 should be checked to be sure that 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 burner, remove from the heater and tap lightly around the burner. Then pour the foreign material out of the inlet.

3. The venturi of the air switch sensor on Down Stream Centrifugal Heaters or the air switch sensors on Axial Heaters should be checked and make sure it is not plugged.

4. Make sure the orifice and pipe are centered in the premix cone. 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."

6. Check all wires to see that they are not bare, causing a short. Mice eat away insulation if protection measures to control rodents aren't taken (spark plug, flame probe 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 hasn't 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).

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.

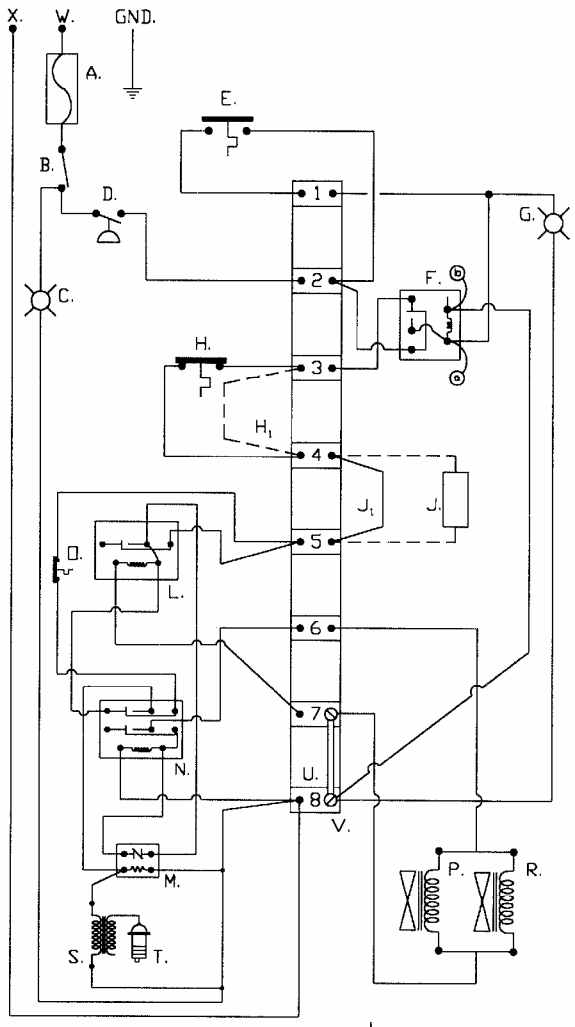
11. Caldwell recommends that external plenum controls be removed and stored in a clean, dry place when not in use.

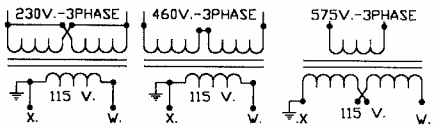
12. Check adjustment of vaporizer twice daily, or as changing weather conditions demand. (See heater adjustment section).

IV. 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.





NOTE:
CIRCLED LETTERS AND NUMBERS REFER TO RELAY CONNECTIONS.

A.) FUSE (5 AMP AC)

B.) HEATER TOGGLE SWITCH

C.) AMBER LIGHT

D.) AIR PROVING SWITCH

E.) HIGH LIMIT NORMALLY OPEN 230°F.

F.) HIGH LIMIT RELAY

G.) WHITE LIGHT

H.) VAPOR TEMP. LIMIT, 160°F. (LPGE MODELS ONLY)

H_1) JUMPER WIRE (REMOVED ON LPGE MODELS)

J.) THERMOSTAT, HUMIDISTAT, OR COMBINATION

J_1) JUMPER WIRE (REMOVED FOR FIELD APPLICATION OF THERMOSTAT, HUMIDISTAT, OR COMBINATION.)

L.) FLAMEPROBE RELAY

M.) FLAME SENSING RELAY MANUAL RESET

N.) PURGE DELAY 30 SEC.

O.) FLAME SWITCH, AUTOMATIC RESET 200°F.

P.) VAPOR SOLENOID VALVE

R.) LIQUID SOLENOID VALVE (LPGE MODELS ONLY)

S.) IGNITION TRANSFORMER

T.) SPARK PLUG

U.) JUMPER CLIP

V.) TERMINAL BLOCK

NOTE:
LES LETTRES ET CHIFFRES ENTOURÉES SE RÉFÉRENT AUX RACCORDEMENTS POUR LE RÉLAIS.

A.) FUSIBLE (5 AMP CA)

B.) INTERRUPTEUR A LEVIER DU RÉCHAUFFEUR

C.) LUMIÈRE DE FEU ORANGE

D.) INTERRUPTEUR D'EPREUVE DE L'AIR

E.) LA HAUTE LIMITE (230°F)

F.) RELAIS POUR LA HAUTE LIMITE

G.) LUMIÈRE DE FEU BLANC

H.) TEMPÉRATURE LIMITE DE LA VAPEUR: 160°F(71°C)(MODÈLES LPGE SEULEMENT)

H_1) FIL SAUTEUR (ENLEVÉ SUR LES MODELÈS LPGE)

J.) THERMOSTAT, HUMIDISTAT OU COMBINAISON

J_1) FIL SAUTEUR (ENLEVE POUR MONTAGE AU CHAMP DU THERMOSTAT, HUMIDISTAT OU COMBINAISON.)

L.) RÉLAIS POUR RÉGULATEUR DE FLAMME

M.) RELAIS ÉLÉMENT SENSIBLE MANUEL DE RALLUMAGE DE LA FLAMME

N.) DÉLAI DU PURGE 30 SEC.

O.) RÉGULATEUR DE FLAMME, REMISE EN MARCHE AUTOMATIQUE A200°F(88°C)

P.) SOUPAPE DE SOLENOIDE POUR VAPEUR

R.) ELECTROVALVE LIQUIDE (MODÈLES LPGE SEULEMENT)

S.) TRANSFORMATEUR D'ALLUMAGE

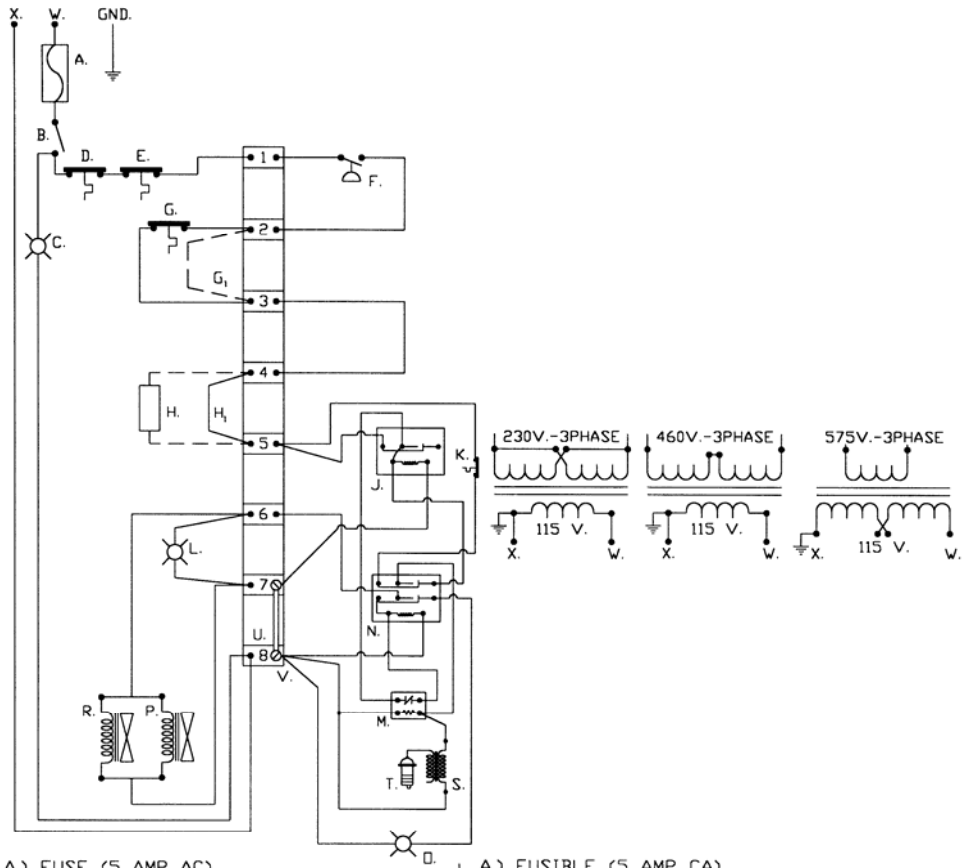
T.) BOUGIE

U.) PINCE DU SAUTEUR

V.) BLOC TERMINAL

Figure 10. Downstream Centrifugal Heater Wiring Diagram

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



A.) FUSE (5 AMP AC)
B.) HEATER TOGGLE SWITCH
C.) AMBER LIGHT
D.) BURNER EXHAUST LIMIT AUTOMATIC RESET 270°F.
E.) BURNER HIGH LIMIT MANUAL MANUAL RESET 160°F.
F.) AIR PROVING SWITCH
G.) VAPOR TEMP. LIMIT, 160°F. (LPGE MODELS ONLY)
G_1) JUMPER WIRE (REMOVED ON LPGE MODELS)
H.) THERMOSTAT, HUMIDISTAT, OR COMBINATION
H_1) JUMPER WIRE (REMOVED FOR FIELD APPLICATION OF THERMOSTAT, HUMIDISTAT, OR COMBINATION)
J.) FLAMEPROBE RELAY
K.) FLAME SWITCH, AUTOMATIC RESET 200°F.
L.) WHITE LIGHT
M.) FLAME SENSING RELAY MANUAL RESET
N.) PURGE DELAY 30 SEC.
O.) GREEN LIGHT
P.) VAPOR SOLENOID VALVE
R.) LIQUID SOLENOID VALVE (LPGE MODELS ONLY)
S.) IGNITION TRANSFORMER
T.) SPARK PLUG
U.) JUMPER CLIP
V.) TERMINAL BLOCK

A.) FUSIBLE (5 AMP CA)
B.) INTERRUPTEUR A LEVIER DU RÉCHAUFFEUR
C.) LUMIÈRE DE FEU ORANGE
D.) LIMITE D'ÉCHAPPEMENT DU BRÛLEUR REMISE EN MARCHE AUTOMATIQUE, 270°F.
E.) REMISE A ZERO MANUEL POUR LA HAUTE LIMITE (160°F) DU BRÛLEUR.
F.) INTERRUPTEUR D'EPREUVE DE L'AIR
G.) TEMPÉRATURE LIMITE DE LA VAPEUR: 160°F(71°C)(MODÈLES LPGE SEULEMENT)
G_1) FIL SAUTEUR (ENLEVÉ SUR LES MODÈLES LPGE)
H.) THERMOSTAT, HUMIDISTAT OU COMBINAISON
H_1) FIL SAUTEUR (ENLEVÉ POUR MONTAGE AU CHAMP DU THERMOSTAT, HUMIDISTAT OU COMBINAISON.)
J.) RÉLAIS POUR RÉGULATEUR DE FLAMME
K.) RÉGULATEUR DE FLAMME, REMISE EN MARCHE AUTOMATIQUE A200°F(88°C)
L.) LUMIÈRE DE FEU BLANC
M.) RELAIS ÉLÉMENT SENSIBLE MANUEL DE RALLUMAGE DE LA FLAMME
N.) DÉLAI DU PURGE 30 SEC.
O.) LUMIÈRE DE FEU VERT
P.) SOUPAPE DE SOLENOIDE POUR VAPEUR
R.) ELECTROVALVE LIQUIDE (MODÈLES LPGE SEULEMENT)
S.) TRANSFORMATEUR D'ALLUMAGE
T.) BOUGIE
U.) PINCE DU SAUTEUR
V.) BLOC TERMINAL

Figure 11.Axial Heater Wiring Diagram

NOTE 1: WHEN USED WITH A 575,460, OR 230 VOLT FAN, A STEP-DOWN TRANSFORMER MUST BE USED TO DEVELOP 115 VOLT, 1 PHASE, 60 HZ POWER.

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 enclosure. Inside the cover you will find a wiring diagram (**Figure 10**) this is the wiring diagram for a Downstream Heater or (**Figure 11**) this is the wiring diagram for an Axial Heater. 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.

The component checks that follow can be made on both the Downstream Centrifugal Heater or the Axial Heater, except where defined for one model of heater only.

The order of checking components for each particular system is consistent with the sequence of the power being delivered to the components.

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. 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. (Check made with 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. High Limit may be closed. (DOWNSTREAM HEATER ONLY)
- A. Use voltmeter and check for continuity between the two leads going to High Limit housing.
  1. Leads are attached to No. 1 on the terminal block and the No. 2 on the terminal block.

B. If there is continuity.
   1. Remove sensor from the bin.
      a. Check the switch by putting leads of meter to the two screws that have wires attached. The switch should not show continuity. Replace switch if defective.
      b. If switches are okay, then the limit wires are making contact with each other. Replace damaged wires.

5a. Burner High Limit and/or Burner Exhaust Limit may be open.(AXIAL HEATERS)

A. Use voltmeter and check for continuity between the two leads going to Burner Limit Channel.
   1. Leads are attached to No. 1 on the terminal block and to the Toggle Switch.

B. If there is <u>not</u> continuity. (Opposite the fuse side)
   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.

6. Air Switch may be defective.

A. Check to see if the air is the problem.
   1. With the fan running, check continuity across the air switch. If there is not continuity and the fan is delivering air, the problem is in the air switch or in the venturi.

B. Make sure the screen on venturi are not plugged. If the fan is working against 4" static pressure or lower, the heater should operate.

7. The vapor limit switch may be defective (LPGE units only.)

A. Use voltmeter and check between the two terminal blocks where the vapor limit is attached. If there isn't any continuity, replace switch. (Make sure that the vapor limit switch has had sufficient time to cool, and automatically reset.)

8. 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.

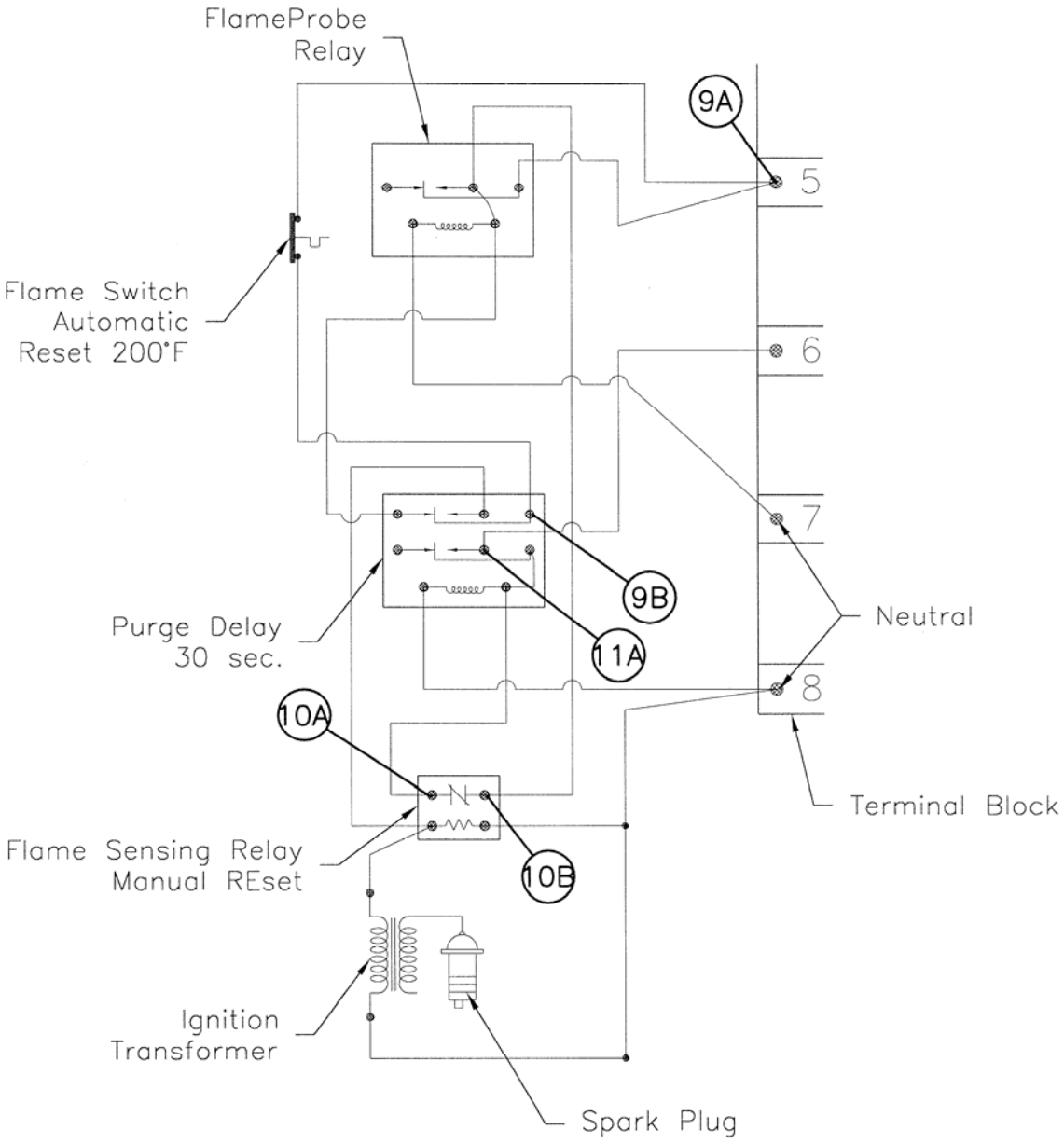


Figure 12. Downstream Heater Flame Sensing Circuits

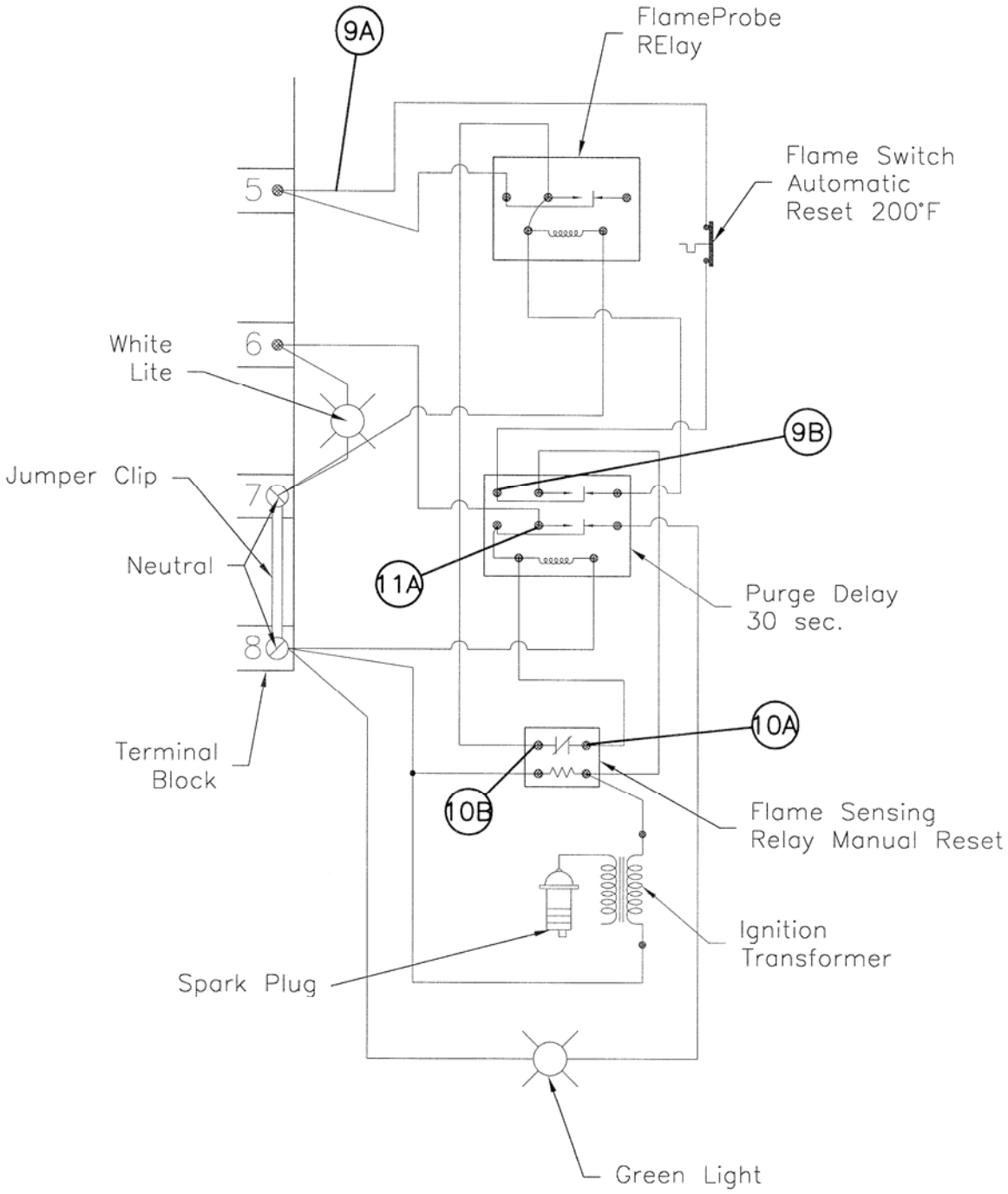


Figure 13. Axial Heater Flame Sensing Circuits

9. Flame Probe is in an open condition

The heater control is wired to check the status of the continuity of the Flame Probe each time the heater is started. If the Flame Probe is Probe is in an open condition,

the Flame Probe will prevent heater operation. Refer to **Figure 12** or **Figure 13** for a diagram of the flame sensing circuit and make sure all wires are connected according to the information in the appropriate figure.

A. Use a voltmeter and check for continuity across the Flame Probe (Check points are labeled 9A & 9B in **Figure 12** or **Figure 13.**
B. If no continuity is present
    1. Make sure that the Flame Probe has cooled to the ambient temperature. If the Flame Probe has cooled down, replace the Flame Probe
    2. Check the wires to the Flame Probe. If they are broken or burnt off, replace the Flame Probe wire.

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

A. Reset Manual Reset Button.
B. After resetting, check the continuity of the contacts of the Flame Sensing Relay labeled 10A & 10B in **Figure 12** or **Figure 13**. On the top contact points check for continuity. Make sure the Flame Sensing Relay has cooled, and then make sure the Manual Reset Button has been reset. If the Flame Sensing Relay has been reset, a lack of continuity indicates a defective Flame Sensing Relay. Replace the Flame Sensing Relay.

11. Purge Delay may be defective. (POWER ON)

Check power at the terminal labeled 11A on **Figure 12** or **Figure 13** of Purge Delay. After power has been supplied to Purge Delay for 30 seconds, power should be present at the terminal labeled 11A of Purge Delay. If not, replace Purge Delay.

12. Check all wires and connections to be sure they are okay and correct.

(See wiring schematics **Figures 10,11,12 & 13**.)

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 plug wire was connected**.** **CAUTION: DO NOT TOUCH SCREW DRIVER SHAFT.**
    1. If there isn't any arc, or less than an 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. Note: that the purge delay develops a 30 second delay for the solenoids to open.

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 10 psig of natural gas available at the unit for start up.
   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 allow 30 seconds for the purge.
      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 isn't 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.

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 the heater liquid plumbing. Turn on the heater and then immediately turn the heater off. Again, there should be a large volume of gas coming out the vapor 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.
   B. Check burner.
      1. See that holes are not plugged.
      2. See that bugs or mice don't plug the tubing of the burner.

IV. SYMPTOM: FLAME SENSING RELAY RESET BUTTON POPS OUT.

1. **If ignition isn't present.**
   A. Refer to Symptom III, if spark is present and gas isn't available.
   B. Refer to Symptom II, if gas is present and you are lacking spark.

2. **Ignition is present.**
   A. Check position of the flame probe for proper adjustment.
   B. Defective flame probe.
      1. Check the continuity of the Flame Probe. When cool the Flame Probe Electrical Circuit should be closed. When hot the Flame Probe Electrical Circuit should be open. If defective, 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. Shut off gas supply at vapor line valve. Push time delay button in. Turn on toggle switch and time the Flame Sensing Relay. Flame Sensing Relay button should pop out in 20 to 50 seconds. If the button doesn't pop out within this time span, replace the Flame Sensing Relay.
      2. If A, B and C check out okay, that leaves only the Flame Sensing Relay to be defective. Replace this part.

V. SYMPTOM: HIGH LIMIT LIGHT COMES ON. (Downstream Heater Only)

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.

4. **Firing Rate is too high.**
   A. Reduce the firing rate.

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.

(Axial Heater Only)

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.
   3. Check the grain depth, foreign material, and moisture content. If these conditions are high, the grain level should be lowered.

2. The Vaporizer is too hot.

A. Remove vapor thermostat from the vapor plumbing line.
   1. If cycling stops, adjust vaporizer out of the flame. (See adjustment section.)

VII. SYMPTOM: NOT ENOUGH HEAT

1. Orifice is too small or dirty.

A. Check service manual of the heater for the proper size orifice for your unit and application. Use the Firing Rate Table guide for setting the firing rate.
B. Remove orifice and check for obstructions and then reinstall orifice.

2. Insufficient gas pressure.

A. Make sure proper gas line size is installed to the heater.

3. Vaporizer not hot enough.

A. Vapor plumbing line on unit will be cold to touch.
   1. Refer to the adjustment section to adjust vaporizer to be in greater contact to the flame.

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. Refer to adjustment section.

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 ANY CALDWELL 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.)

NOTES