

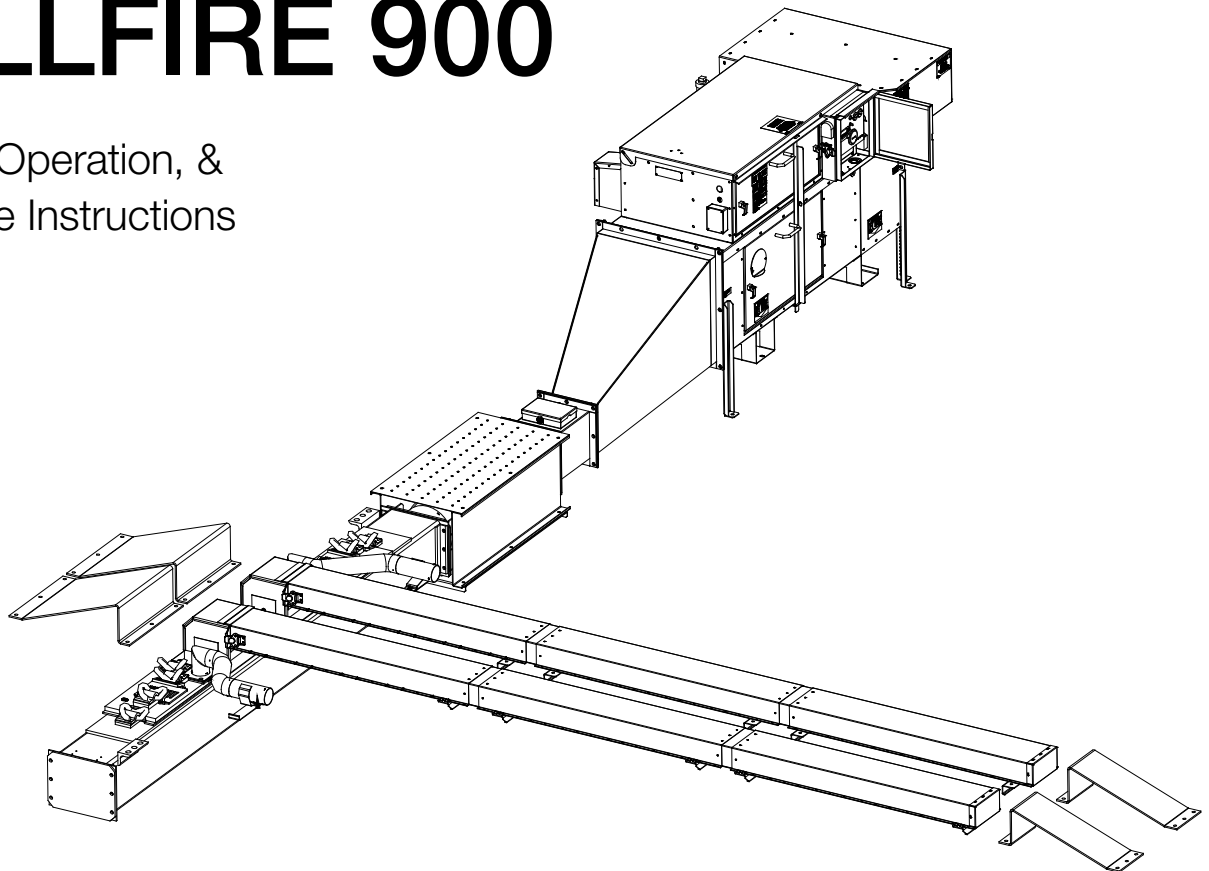
IMPORTANT INSTRUCTIONS - SAVE THESE INSTRUCTIONS

Read all instructions before installing or using the heater. Please adhere to instructions published in this manual. Failure to do so may be dangerous and may void certain provisions of your warranty.

Gas Fired Railway Switch Heater

2005 **HELLFIRE 900**

Installation, Operation, &
Maintenance Instructions



ANSI Z83.7-2011 / CSA 2.14-2011
Gas Fired Unvented Construction Heaters (Unattended Type)



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A. IMPORTANT NOTICES AND WARNING SYMBOLS

Keep this manual with the machine at all times. The purpose of this manual is to provide owners, operators, and installers with the precautions and procedures essential for the safe and proper operation for its intended purpose.



WARNING. Failure to comply with the precautions and instructions provided with this heater, can result in death, serious bodily injury and property loss or damage from hazards of fire, explosion, burn, asphyxiation, carbon dioxide poisoning, and/or electrical shock.

Only persons who can understand and follow the instructions should use or service this heater.

If you need assistance or heater information such as an instructions manual, label, etc. contact CCI Thermal.



WARNING. Fire, burn, inhalation, and explosion hazard. Keep solid combustibles, such as building materials, paper, or cardboard, a safe distance away from the heater as recommended by the instructions. Never use the heater in spaces which do or may contain volatile or airborne combustibles, or products such as gasoline, solvents, paint thinner, dust particles or unknown chemicals.



WARNING. Not for home or recreational vehicle use.



WARNING. For use with ductwork only.



WARNING. The heater is designed and approved for use as a Commercial Heater (gas) – Railway Switch, Class 2902 05 in accordance with ANSI Z83.7/CSA 2.14. Check with local authority, if you have questions about applications.

Symbol	Description
	Risk of electrical shock or electrocution. Disconnect electrical power prior to servicing.
	Warning heater can start automatically. Exercise caution when in close proximity.
	Burn Hazard/Hot Surface Do not touch track ducts, nozzles or any non-insulated duct connected downstream of heater during operation.
	Risk of cutting fingers or hand. Disconnect fan power prior to removing combustion chamber access panel or air intake.

Symbol	Description
	Cut Hazard Sheet metal edges can be sharp. Wear protective clothing when handling track duct, insulated ducts and any other sheet metal components.
	Do not attempt to manually light burner. Heater equipped with an automatic electronic ignition system.
	If you smell gas, immediately extinguish all sources of ignition and turn off gas source. Call qualified service technician to repair leak.
	Retain manual for future reference.

B. SPECIFICATIONS

B.1 Performance

The HELLFIRE 900 switch heater is recommended for clearing ice and snow from switches with no longer than 40 ft of moving rail from heel to point of switch. It is rated with an output of 300,000 to 900,000 BTU/HR, on propane or natural gas.

The fan is direct driven at 3450 rpm, and delivers 2000 scfm.

NOTE: Recommended heating per foot of track coverage is 10,000 to 22,500 BTU/hr, based on severity of local climate.

B.2 Ratings



WARNING. Install and use Heater in accordance with owners manual and local codes.



WARNING. In the absence of local codes, installation must comply with CAN/CGA-B149 Installation code and National Fuel Gas Code ANSI Z223.1 / NFPA 54, or Standard for the Storage and Handling of Liquefied Petroleum Gases, ANSI / NFPA 58.



WARNING. For outdoor use only.



WARNING. For use with ductwork only. Only duct work supplied by CCI Thermal shall be used with the heater. Minimum clearance from combustibles: 2 inches.

Table 1 – Firing Specifications

Fuel	Propane Gas Firing	Natural Gas Firing
Input Rating, BTU/hr (kW)	300,000 - 900,000 (88 - 264)	300,000 - 900,000 (88 - 264)
Manifold pressure, Inches of water (kPa)	2.5 - 8.0 (0.61 - 1.93)	3.0 - 16.0 (0.74 - 3.94)
Inlet pressure, psig (kPa)	5 - 20 (34 - 138)	

Gas Conversions

- Heaters are factory set for use with propane gas. To convert to natural gas change gas pressure regulator spring, with one supplied separately, and adjust within specifications detailed above. Affix separate gas type plate supplied. Reverse procedure to change back to original gas.

Table 2 – Electrical Specifications

Voltage	Phase	Running current amps	Frequency (Hz)
240	1	12.5	60
208	3	10.3	60
460	3	4.8	60
575	3	3.9	60

Construction

- 14 ga galvanized steel blower, intake, and duct work
- Stainless steel combustion chamber / transition duct
- 14 ga painted point end nozzles
- 18 ga galvanized sheet track ducting
- Direct drive centrifugal fan
- Match balanced motor and impeller sets to less than 0.2 ips pk-pk

B.3 Gas Supply

- Allowable nominal supply pressure, 5 to 20 psi, with no more than 20% pressure drop, with all connected loads operating. Inlet gas fitting, 1" NPT female.

B.4 Controls

- Continuous pilot
- Thermostatically controlled track duct nozzle outlet temperature, 340 - 380°F.
- Remote operation, requires a set of contacts rated for a minimum 120Vac, 0.5 amp.
- Remote run indication, provided by a set of normally open contacts rated at 8 amps resistive or 2 amps inductive, 240/120Vac or 24Vdc.
- Force off provided by a normally closed contact rated for a minimum of 120Vac, 0.5 amp.
- Programmable delay ON timer, 0 - 99 seconds, allows staggered start up of a series of heaters.
- Magnetic motor contactor
- Motor equipped with thermal overload protection
- Fused tank valve terminals on 240V single phase and 208V three phase only
- Rail Traffic Control (RTC) timer, limits maximum dispatcher requested run time.

B.5 Terminal Block Wire Sizes

- Power, #14 to #2 AWG Copper
- Control, 1/4" AAR terminal posts

B.6 Electrical Isolation

- Ducting and nozzle connections are electrically isolated to eliminate the possibility of short circuiting rails or conducting. Connections are designed and tested to withstand a maximum of 3000 Vac for 60 seconds per AAR standards part 14.5.1D.

B.7 Safety Features

1. Air pressure (flow) switch - Ignition is disabled until adequate air pressure is developed.

2. High temperature limited - In the event of thermostat failure and nozzle temperatures exceeding 420°F, the heater is shut off to avoid tie damage. Heater operation is restored by manual reset.
3. Loss of flame - The Ignition Module closes the gas valve, if after the trial for ignition period of 10 seconds no flame is sensed, or if flame detection is lost for more than 1 second during normal operation.

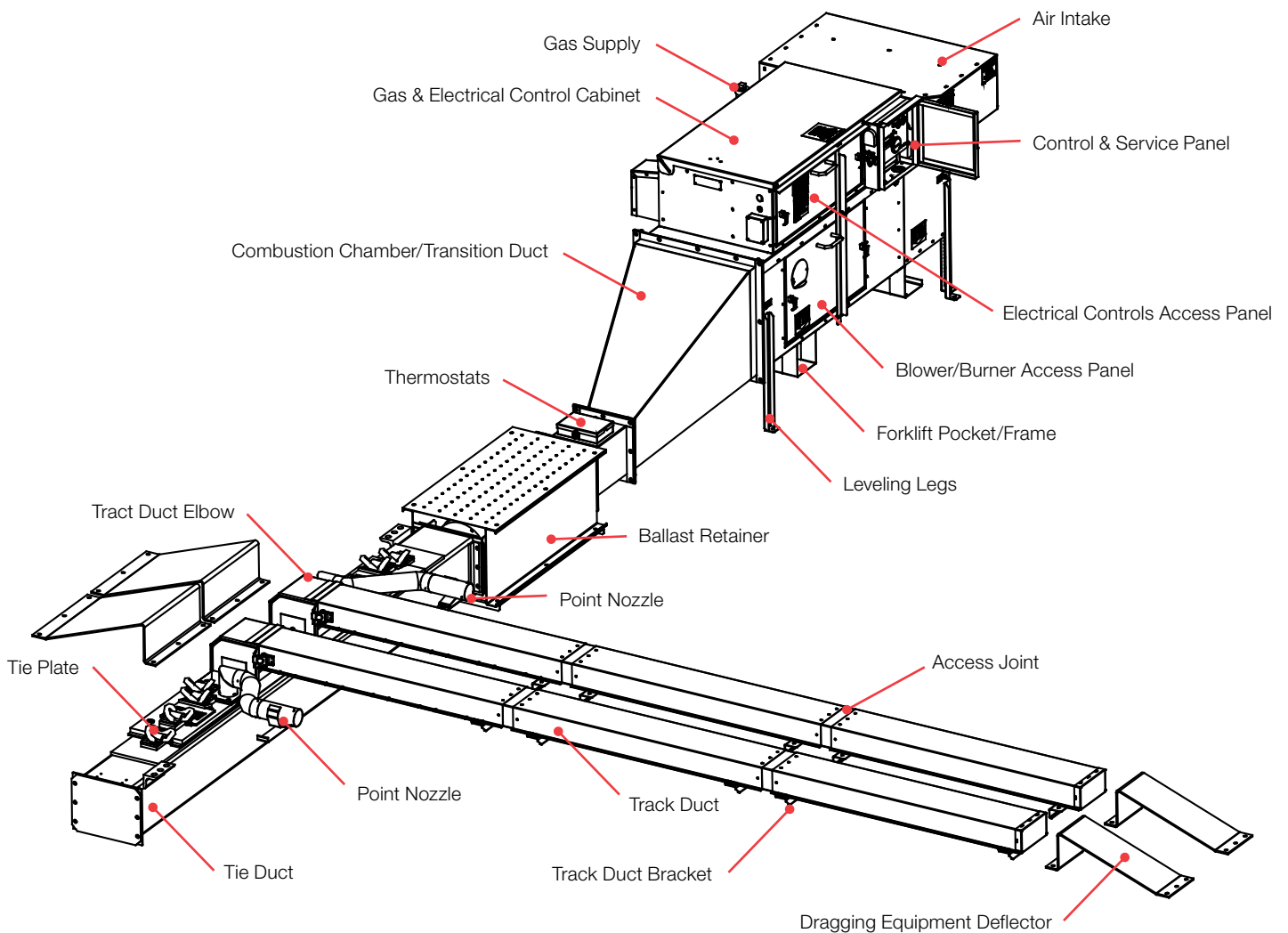
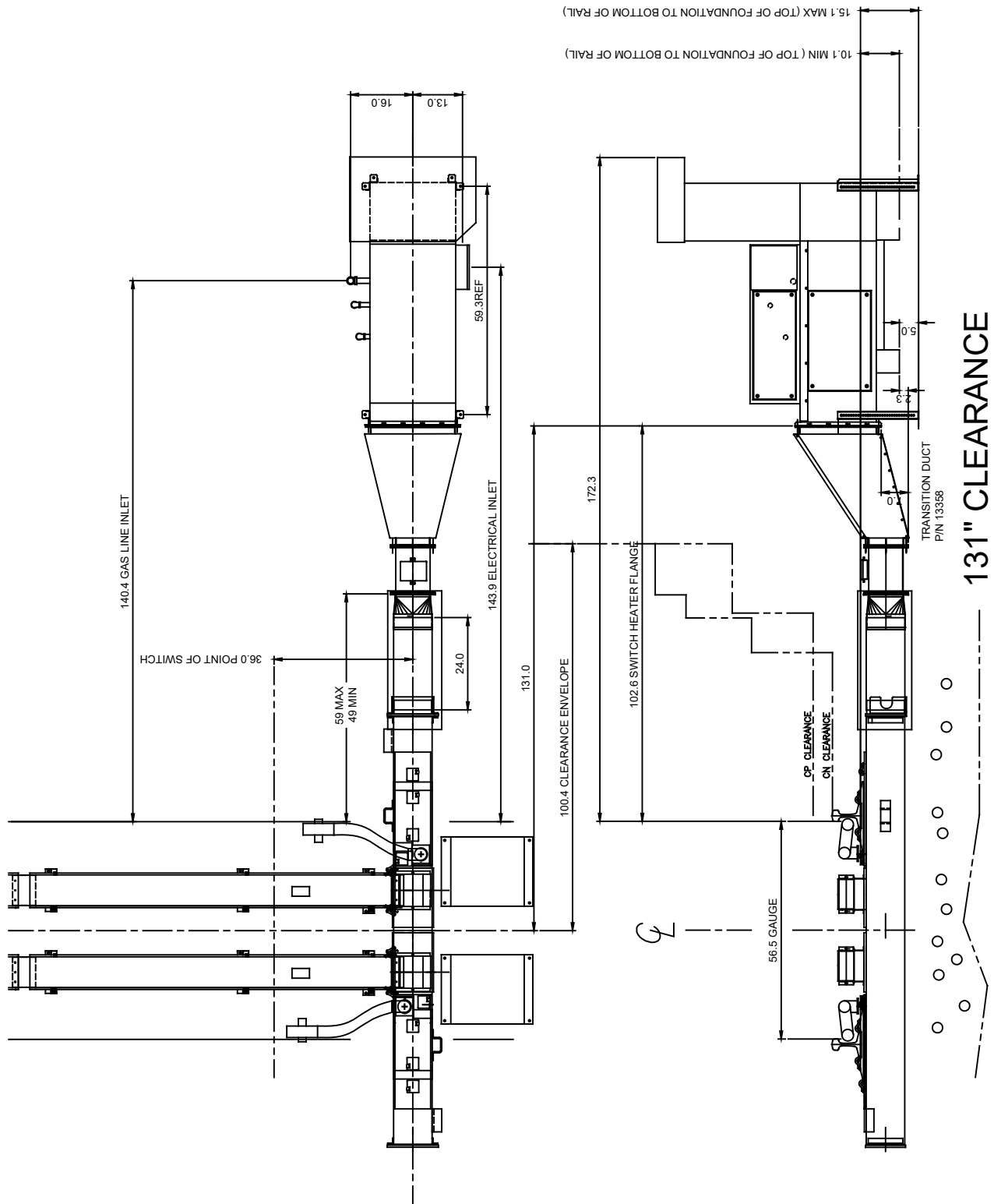
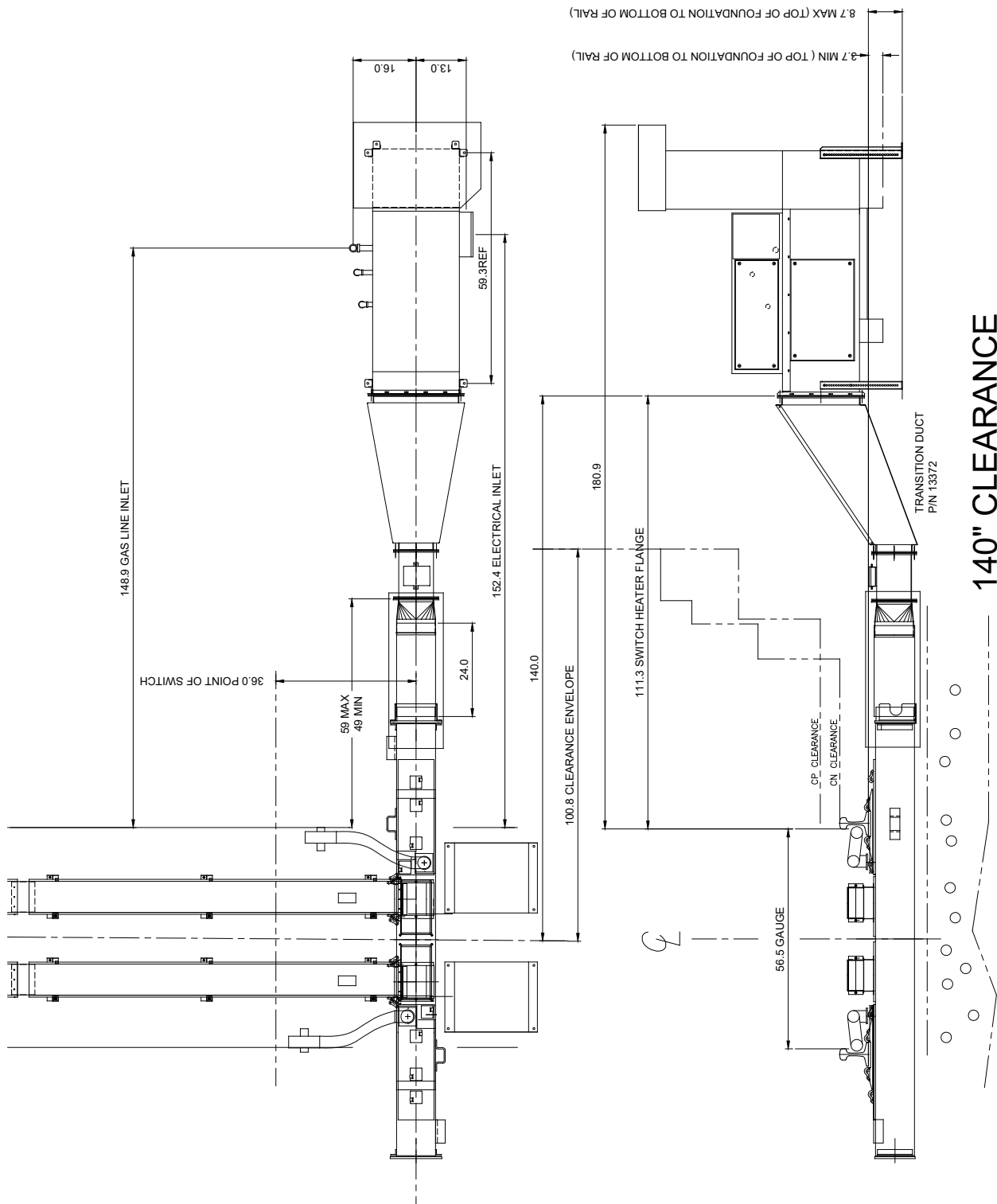
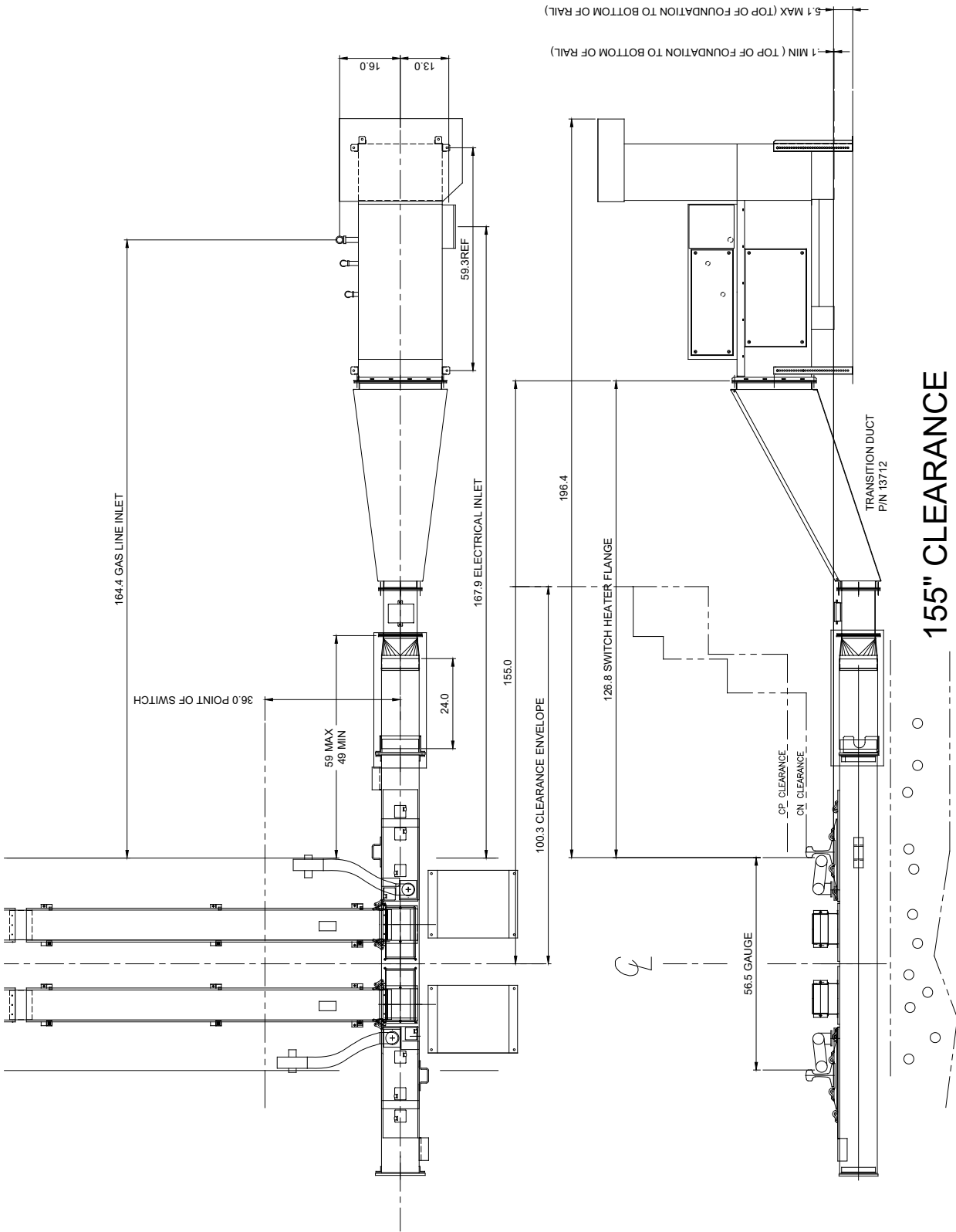


Figure 1 – HELLFIRE 900 Diagram







C. INSTALLATION

C.1 Overview

The following are general guidelines for the installation of typical HELLFIRE gas fired systems. They should be followed in conjunction with the specific site layout drawings provided with each heater.

C.2 Recommended Tools

- A source of power to operate drills (portable generator)
- Impact Drill, 1/2" drive with 1/2", 9/16" and 3/4" sockets
- Drill, 3/8" drive
- Two 9/16" wrenches and/or socket wrench
- Lining and Tamping bars
- Sledge hammer
- Shovels
- Cold chisel and hammer
- 3" duckbill pliers
- Measuring tape
- 4 foot level

C.3 Site Preparation

1. There are 3 typical clearances 131", 140", 155". Refer to the appropriate site layout drawing and prepare a foundation for the heater with ties, concrete pad, or other suitable level mounting structure. Note the location for the gas, electrical supply, and the signal cable lines.
2. Refer to the local gas and electrical authority in order to determine gas pipe and electrical line sizes. At the heater, the gas inlet is a female 1" NPT pipe thread, the power terminal block accepts #14 - #2 AWG wire sizes, and the control and indicate wires connect to AAR 1/4" post terminals.

C.4 Heater Installation

1. Heater ships on a pallet separate from the cross and track ducting.
 - 1.1 Remove heater from packaging.
 - 1.2 Lift heater, 565 lbs, using the lift pockets and place on foundation.
 - 1.3 Adjust leveling legs to level heater and align the flange with the transition duct flange.
 - 1.4 Fasten heater legs to foundation using lag screws supplied or suitable fasteners.
 - 1.5 Attach heater to transition duct of duct system.
 - 1.6 Backfill and tamp any open trenching.

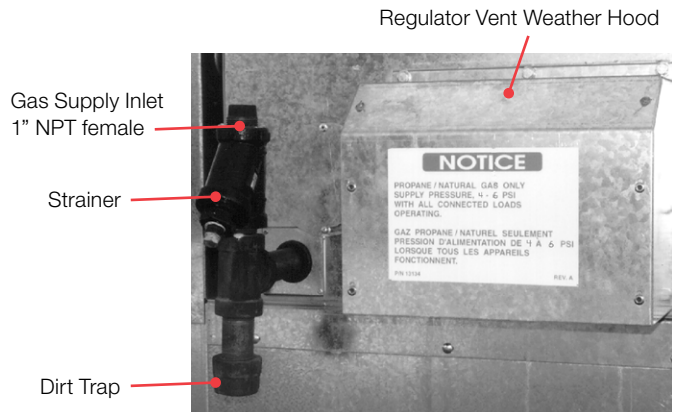
C.5 Gas Supply Piping and Minimum Pressure Drop

1. Connection of the gas line should be performed by personnel approved by the local gas authority.
 - 1.1 Allowable nominal supply pressure, 5 to 20 psi, with no more than 20% pressure drop, with all connected loads operating. Recommended supply gas pressure, 5 psi.
 - 1.2 The minimum recommended supply pipe size is 1". The actual pipe size should be determined based on the length of run, the total demand of all the connected loads.



CAUTION. Undersized gas piping will affect the light off reliability of any connected appliance.

- 1.3 The heater is supplied with an internally mounted supply regulator and an external dirt trap. The dirt trap inlet has a 1" NPT female fitting.
- 1.4 Install a flexible gas line between the customer supplied gas line and the dirt trap inlet.



- 1.5 Prior to firing the heater, bleed the gas lines of any air and dirt through the opened dirt trap.
- 1.6 Reinstall the dirt trap cap and check all joints for leaks.
- 1.7 Flexible gas hose installed between riser shut off valve and inlet strainer.



NOTE: Shut off valve on riser, strainer and dirt trap on inlet.

C.6 Electrical Connections

Connection of the electrical lines should be performed by personnel approved by the local electrical authority.

The electrical grounding of the appliance shall be in compliance with CSA C22.1, Canadian Electrical Code, Part 1, or National Electrical Code, ANSI/NFPA 70.



WARNING. Heaters must be wired in accordance with local electrical codes.

IMPORTANT NOTE

Surge Protection Recommendations

This switch heater utilizes a number of processor-based control systems, all of which are susceptible to damage from lightning and other electrical surges. While every effort has been made to ensure that the control systems have been adequately 'hardened', CCI Thermal's surge mitigation efforts can only be effective if ALL external remote circuits connecting to the switch heater have been protected by primary surge protection devices in accordance with the following generally accepted requirements for surge protection of wayside signal equipment:

- Provide primary surge protection devices (standard signal air gap arresters) on all external switch heater control I/O circuits. These arresters should be located "upstream" of the switch heater housing (within the signal housing, which interfaces to the switch heater). It is essential to protect ALL circuits entering or leaving the signal housing.
- Provide a primary surge protection device (commercial high capacity MOV type) on the external switch heater ac power feed. This surge protection device should be located "upstream" of the switch heater in conjunction with the electrical service entrance panel and main disconnect. Observe primary surge protector manufacturer's instructions for installation and circuit breaker protection (if required).
- Grounding of the switch heater metal housing as well as the ground terminals of the primary arresters is essential for personnel protection as well as surge protection. Grounding rods and conductors must be installed in accordance with the AREMA Signal Manual of Recommended Practice.
- Primary surge protection must be installed in accordance with the AREMA Signal Manual of Recommended Practice.
- Optional surge protection can be added by installing an AAR/AREMA air gap type arrester to protect the rail temperature thermostat in the rail thermostat enclosure as per assembly drawing 17894.

Additional surge protection options are available from CCI Thermal for locations of high surge intensity, see Spare Parts section of this manual. Contact us for additional information concerning these recommendations.

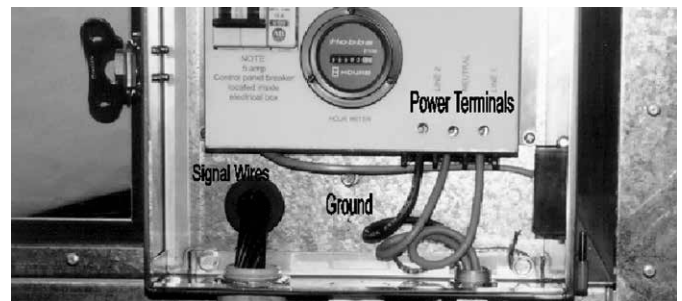
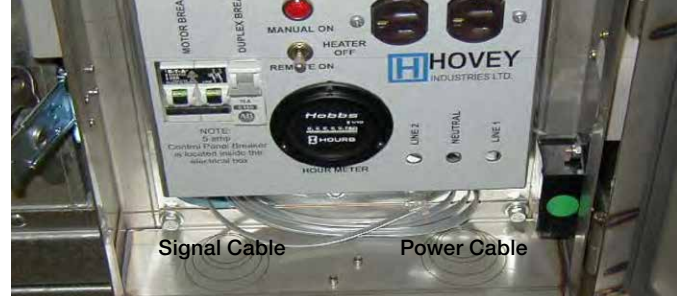
C.7 Wiring



WARNING. Disconnect power at source.

1. Single Phase Wiring

- 1.1 Bring 240 Vac power and signal cables into control box. A 7/8" diameter hole is provided, punch a larger opening if required to suit conduit.
- 1.2 Pass signal wires through opening to the electrical panel. Terminate power cables to terminal block and ground to grounding stud.



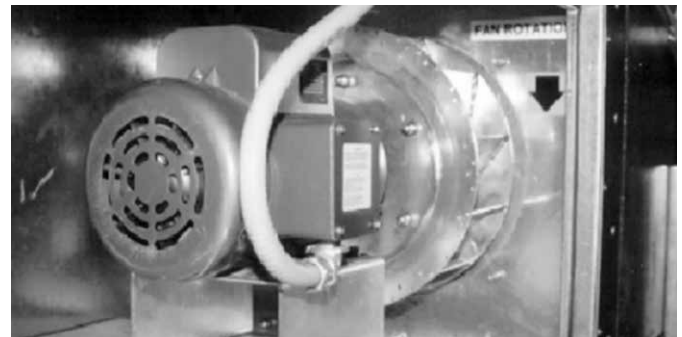
2. Three Phase Wiring



WARNING. For use with ductwork only.

- 2.1 Bring the power and signal cables into control box. A 7/8" diameter hole is provided, punch a larger opening if required, to suit conduit.
- 2.2 Pass signal wires through opening to the electrical panel. Terminate power cables to terminal block and ground to grounding stud.

NOTE: Verify correct fan rotation with three phase power.



- 2.3 Turn off power to control panel by disconnecting the 5 amp panel breaker. Open the combustion chamber access panel. Note the fan rotation arrow.
- 2.4 Turn on the main (customer supplied) breaker and the motor breaker. Manually close the motor contactor, by hand, for a second and release. The

motor will spin. Verify the correct rotation. If the rotation needs to be reversed, turn off the main breaker and interchange two of the supply phase wires at the terminal block.

3. Power Service Conductor Sizing

- 3.1 Use the following table to aid in your selection of the appropriate size power service conductors.

Table 3 – Voltage Drop vs Current Draw (for copper wire) and Recommended Circuit Breaker Sizes

Current (Amps)	Voltage Drop/1000 ft *2, *3					Recommended Circuit Breaker Size *4
	Wiring Size, AWG *1					
	10	8	6	4	2	
10	10.0	6.5	4.1	2.6	1.6	20
15	15.0	9.8	6.1	3.9	2.4	30
20	20.1	13.0	8.2	5.1	3.2	50
Ohms/ 1000ft	1.00	0.65	0.41	0.26	0.16	N/A

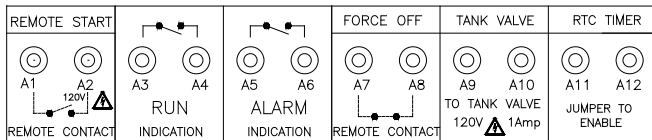
*1 - Standard SH power terminals will accept #14 to #2 AWG copper wire.

*2 - Allowable voltage drop to be determined by local authority

*3 - Recommended voltage drop of not more than 5%

*4 - As per Canadian Electrical Code, Part 1

4. Signal Wiring



- 4.1 Connect the signal cable to the AAR terminal block.
- 4.2 A contact closure across A1 and A2 starts the heater.
- 4.3 Provide an isolated contact for each heater. Do not gang A1 AND/OR A2 terminals together.
- 4.4 A3 and A4 provide RUN indication with a contact closure.
- 4.5 A5 and A6 provide an ALARM indication with a contact closure.
- 4.6 A7 and A8 provide a FORCE OFF with a contact opening. If FORCE OFF function is desired, remove shorting link and replace with customer supplied relay contact.
- 4.7 A9 and A10 provide a switched 120V, 1 amp supply to operate a tank solenoid valve (only available with 240V and 208V systems).
- 4.8 To configure the heater for timed RTC operation SHORT A11 to A12. Then set timer as per 'Parameters' section of this manual. Adjust Timer B50 to the desired run time.

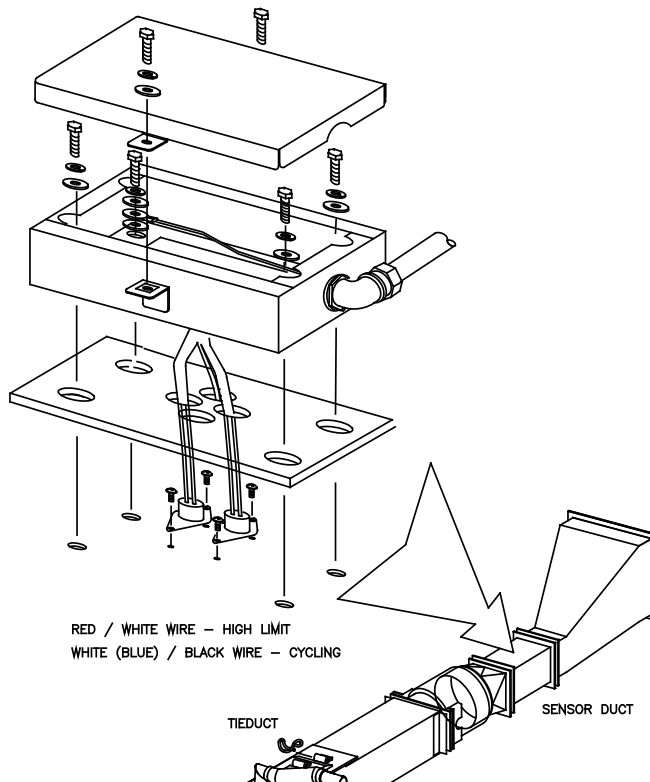
5. Local Safety Grounding

- 5.1 The service ground electrically grounds the heater. If a local safety ground is required, drive in at least one ground rod and connect it with a suitably sized stranded copper conductor, of at least #8 AWG, to one of the leveling leg bolts.

C.8 Thermostat Installation

Install the thermostat sensor box as per instructions below:

1. Remove combustion chamber shipping cover.
2. Detach thermostat box from shipping cover.
3. Secure thermostats to the duct using SST machine screws - ensure colour coded wires match.
4. Secure thermostat box to the sensor duct as depicted, with the ground wire under the head of a bolt and washers.
5. Install thermostat cover to box using hardware supplied.



C.9 Fuel Conversion

All HELLFIRE heaters are shipped from the factory configured for propane firing.

Units have been set up and tested on propane for maximum and minimum firing rates, while connected to a test ducting system.

1. Switch heaters can be converted for use on natural gas as follows:



WARNING. The conversion shall be carried out in accordance with C.G.A B149.1 and B149.2 in Canada, or the equivalent NFPA codes in the United States, and in accordance with the requirements of the local authorities having jurisdiction.

- 1.1 Turn the Mode Selector Switch to "Off".
- 1.2 The natural gas conversion kit contains gas regulator springs, a spring and orifice selection chart and a conversion label.
- 1.3 Using a flat head screwdriver, remove the main regulator adjustment screw cap and replace the spring presently in the regulator with the appropriate one from the kit. See the component bulletins at the back of this manual for detailed instruction.
- 1.4 Adjust the spring to the midway point of the regulator.
- 1.5 Turn on the gas and set the manifold pressures as per the natural gas limits on the heater nameplate. Do not fire above or below the nameplate limits. Typically the natural gas pressure is set to 5" more than the propane operating pressure.
- 1.6 If the burner fails to light after repeated attempts, it may be necessary to purge the main gas line of air.
- 1.7 After 15 minutes of running, check that the nozzle temperatures are in the range of 250°F above ambient. Adjust the manifold pressure as required, staying within the nameplate ratings.
- 1.8 Reinstall the cap to cover the regulator adjustment screws.



CAUTION. Failure to reinstall the cap will cause any vented gas to accumulate inside the heater and potentially ignite.

C.10 Inspection and Commissioning

Once the installation is complete review it against the following checklist.

Swivel Nozzles

- ☐ Installed
- ☐ Directed at, and tip within 2" to 6" of points, and clear of rail head by 2.5"
- ☐ Rodent screens installed between duct and silicone gasket under adaptor collars
- ☐ Electrical isolation shoulder washers installed

Track Duct

- ☐ Installed
- ☐ Rodent screens installed between duct and silicone gasket under elbows
- ☐ Access joint gap of 3"
- ☐ Appropriate vents open and directing air at switch plates and rods. Keep all openings closed between the ducts, except where the switch rods are located. Open vent openings no more than 1/4"
- ☐ Ductwork below top of rail and not interfering with switch operation
- ☐ Track duct deflectors installed, 18" wide at points protecting point nozzles and track duct and 8" at heel protecting track duct

Tie Duct

- ☐ All clips and insulators installed
- ☐ Flex ducts and ballast retainer installed

Electrical Power

- ☐ Voltage between 85 and 115% of nominal voltage with all connected loads operating
- ☐ Ground installed

Gas System

- ☐ Supply pressure at 5 to 20 psi with all connected loads operating
- ☐ Gas supply leak tested

Heater

- ☐ Level
- ☐ Heater functions in “Manual”
- ☐ “Run” indication function. With the heater running, the contact between terminals A3 and A4 will close. Check for continuity.
- ☐ “Alarm” indication function. Put the heater into alarm by turning the gas supply off. If the heater is equipped with an EMS let it retry three times. Then the FSR will indicate alarm, and the alarm light on the operator panel will light. The contact between terminals A5 and A6 will close. Check for continuity.
- ☐ Heater functions in “Remote” control. Toggle mode selector switch to “Remote”. If connected to dispatch, have dispatch start heater.
- ☐ If configured for timed dispatch input – short terminals A1-A2. Turn the selector switch to remote. Heater starts. On the LOGO, switch the display to the timer B50 and check that the timer counts.
- ☐ With heater running for at least 15 minutes, measure temperature rise at point nozzles. Should deliver 200 - 250°F above ambient. Adjust manifold pressure to your desired temperature if required.

EMS

- ☐ Precipitation detector installed on the transition duct, as low to the ground and as close to the switch as possible, and in the heated zone.
- ☐ Drop snow (or water) on precipitation detector sensing grid. Snow will melt and “Sensor wet” LED will light on EMS board.
- ☐ Ambient temperature sensor installed.
- ☐ Raise “Snow / Rain Temp” set point, if required, above the ambient temperature. The “ambient” LED will light.
- ☐ Rail temperature thermostat installed on rail flange, halfway between point and heel.
- ☐ Return set points to factory settings

C.11 Normal Operation

1. The following is the normal operating sequence.
2. When the heater receives a request for heat, either, Remotely, with the heater in “Remote” mode and terminals A1 and A2 connected with a contact closure provided by RTC (Rail Traffic Control) or the EMS (Energy Management System), or Locally by turning the heater to “Manual” mode, the heater goes through the following sequence:
3. Start Up
 - 3.1 Delay on time, allows for staggered start of multiple heaters on the same control circuit.
 - Motor contactor closed, fan on
 - Prepurge time (5 seconds)
 - Trial for ignition
 - Flame Safety Relay trial for ignition sequence initiated
 - Pilot valve and ignition transformer turned on (Note the PILOT LED illuminate on the FSR)
 - Flame established (Note the FLAME LED illuminate on the FSR)
 - Main valve opens (Note the MAIN LED illuminate on the FSR)
 - Indication to RTC established. Contact closure A3 to A4

Run

During the run period, the heat will turn off if the temperature in the ductwork exceeds the cycling thermostat set point of 380°F, or if the rail temperature exceeds the rail thermostat (option) set-point of 45°F.

In the case of high temperature in the ductwork the heat will cycle on and off. This serves to protect the ties, flex duct and gaskets from being burned.

- Request for heat to the FSR is removed
- Main and pilot valves close
- Flame extinguishes
- Fan continues to run
- When the temperature drops below the cycling thermostat set-point of 340°F the trial for ignition is initiated
- Indication to RTC stays on A3 to A4

If the rail temperature rises above the rail thermostat set-point of 45°F the heater turns off in the following order:

- Request for heat to the FSR is removed
- Main and pilot valves close
- Flame extinguishes
- Post purge time (approximately 4 minutes)
- Fan turns off
- Indication to RTC stays on A3 to A4

Once the rail temperature drops below the set-point of 38°F the heater follows the startup sequence without the delay on time.

Shutdown

When the request for heat is removed, either, Remotely, with the heater in “Remote” mode and the connection between terminals A1 and A2 opened by RTC (Rail Traffic Control) or the EMS(Energy Management System), or Locally by turning the heater to “OFF”, the heater goes through the following sequence:

- Run indication contact A3 to A4 opens
- Request for heat to the FSR is removed.
- Main and pilot valves closed
- Flame extinguished
- Post purge time (approximately 4 minutes)
- Fan turned off

D. ALARM CONDITIONS AND SHUTDOWN PROCEDURES

The HELLFIRE is equipped with several safety features, which in the event of abnormal conditions will cause the heater to shutdown operation and provide Alarm indication.

D.1 Flame signal lost during normal operation:

- Main, safety and pilot solenoid valves close
- Post purge time
- Open pilot valve and energize ignition transformer
- If flame established
 - Main and safety solenoid valve opens
 - Heater runs

D.2 If no flame signal is established:

- Close pilot valve and de-energize ignition transformer
- FSR alarms
- Request for heat removed
- ALARM Indication contact closes A5 to A6
- Post purge time
- Fan off
- RUN Indication contact opens

D.3 No flame signal on start up:

- Close pilot valve, de-energize ignition transformer
- FSR alarms
- ALARM Indication contact closes A5 to A6
- Post purge time
- Fan off
- RUN Indication contact opens

D.4 Air switch opens during RUN period:

- Close pilot valve
- Close main and safety solenoid valves
- FSR alarms
- Request for removed
- ALARM Indication contact closes A5 to A6

D.5 Motor thermal overload breaker trips:

- Main and pilot solenoid valves close
- FSR alarms
- Request to FSR off
- Post purge time
- Fan off
- RUN Indication contact opens
- ALARM Indication contact closes A4 to A6

1. Motor overload reset located on motor junction box for 240V configuration. On 3 phase systems, the reset is on the motor overload on the electrical panel.

D.6 High temperature limit exceeded:

- High limit thermostat closes
- High limit latching relay energized (must be reset manually with push button on heater)
- Alarm light on
- Request to FSR off
- All valves closed
- Post purge time
- RUN Indication contact opens
- ALARM Indication contact closes
- LOGO PLC locked and must be reset by turning power off for 10 seconds

D.7 Heaters equipped with the ‘Aggressive Retry Option’:

1. If the heater is equipped with an EMS and the aggressive retry option, the EMS will reset the FSR up to three times and then lock out. After three attempts the heater will indicate Alarm to dispatch. The sequence of events are as follows:
 - Normal running
 - FSR goes in alarm (no flame, air switch etc.)

- Fan continues to run
 - Delay 20 seconds
 - EMS resets FSR (Alarm LED off on FSR)
 - Normal start up and trial for ignition
2. This can occur up to three times within 5 minutes. After that the EMS locks out and shuts down the heater in the following sequence
- Request to FSR off
 - Post purge time
 - Fan off
- 2.1 RUN Indication contact opens
- 2.2 ALARM Indication contact closes LOGO PLC
3. **CLEAR THE ALARM AND RESET THE HEATER BY TURNING PANEL POWER OFF OR RESET THE AGGRESSIVE RETRY MODULE.**
4. **IN THE EVENT OF A HIGH LIMIT ALARM, PRESS HIGH LIMIT RESET.**
5. **Open 5 Amp breaker on electrical panel, wait 10 seconds, and close 5 Amp breaker again. LOGO, EMS and RESET module are now reset and normal function can continue.**

E. PROGRAMMABLE LOGIC CONTROLLER (PLC)

E.1 Inputs and Outputs

The LOGO has several inputs and outputs that work with the Flame Safety Relay to control the operation of the heater. To aid in the understanding of the heaters operation the inputs and outputs are described in the following table:

Inputs	Description
1	Heat request
2	Motor contactor closed
3	High limit thermostat
4	Cycling thermostat
5	Rail thermostat
6	FSR alarm
7	RTC Timer
8	Valve Status Relay

Outputs	Description
1	Motor contactor
2	Heat (FSR) request
3	Dispatch Run indication
4	Dispatch Alarm indication

E.2 Parameters

6. The LOGO PLC program is user configurable. The following table provides an overview for each timer:

Parameter	Name	Description	Default and Range
PREPURGE	Pre Purge Timer	Purges heater and duct work of any accumulated gas before starting the burner	5 Seconds Range 0.01 to 99.99 sec
POSTPRGE	Post Purge Timer	Purges heat from the heater and ductwork after heater is turned off	4.00 Minutes Range 1sec to 99.59 min
DELAY	Delay Start Timer	Allows staggered start up of multiple heaters controlled by the same start contact	5 Seconds Range 1 sec to 99.59 min
RTCTIMER	RTC Timer Enable	Enables or disables RTC run timer. (See RTC timer configuration table below for more details)	OFF (Disabled) ON Enable / OFF Disable
RTC TIME	RTC Run Time	Maximum run time allowed when RTC requests the heater, and "RTCTIMER" enabled, with terminals A11 - A12 set as per RTC Timer configuration table, below.	1HR 30 MINUTES Range 0hr: 01m to 99h:59m
HEARTBET	Heart Beat Enable	The heart beat function turns the heater on to verify the proper function and allow for regular scheduled operation, regardless of weather conditions. Heater operates according to RUN TIME 1, 2, and 3 when enabled.	OFF (Disabled) ON Enable / OFF Disable
RUN TIME 1	Heart Beat Run Timer 1	Defines the days of the week, start and stop times.	Mon, Wed, Fri weekly Mon, Tues, Wed, Thurs. Fri, Sat, Sun Start 4:00 – Stop 4:30am 0:00 – 24:00
RUN TIME 2	Heart Beat Run Timer 2	Defines the days of the week, start and stop times.	-----BLANK----- Mon, Tues, Wed, Thurs. Fri, Sat, Sun -----BLANK----- 0:00 – 24:00
RUN TIME 3	Heart Beat Run Timer 3	Defines the days of the week, start and stop times.	-----BLANK----- Mon, Tues, Wed, Thurs. Fri, Sat, Sun -----BLANK----- 0:00 – 24:00
CALENDAR	Heart Beat Period of Operation	Sets the start and end dates of the year when the heart beat function operates.	October 15 to April 1 Jan 1 to Dec 31
FEEDBACK	FSR Feedback Enable	Enables or disables the FSR feedback function. Disabling allows LOGO to be used on HELLFIRE heaters manufactured prior to 2005 as a spare part.	OFF (Enabled) OFF Enable / ON Disable

Table 4 – RTC Timer Configuration

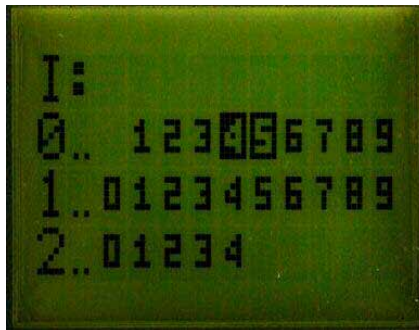
Is EMS installed?	To Enable		To Disable	
	Terminals A11 & A12	"RTC Timer" Parameter	Terminals A11 & A12	"RTC Timer" Parameter
Yes	Open	On	Open	Off
	Shorting link removed			
No	Closed	On	Open	On
	Shorting link installed			

E.3 Displays and Parameter Adjustments



The Logo has several displays. Only the time and date, inputs and outputs displays are used.

Press the left or right arrow key to scroll through the displays.



The INPUT display shows several inputs. The heater uses only the first eight inputs, I1 to I8 of row 0.

The OUTPUT display shows several outputs. The heater uses only the first four Q1 to Q4 of row 0.

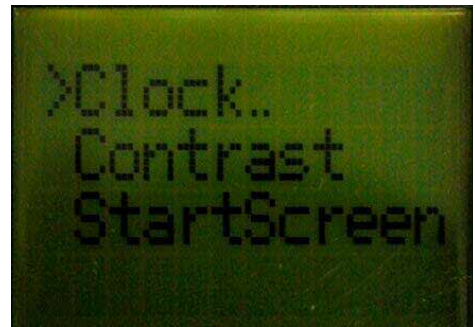
Inactive Inputs and Outputs are displayed as a black number on light background.

When a voltage is present on an input, or an output relay is energized, they are displayed as a black box with a light number inside, i.e. I4 and I5 shown.

1. Set Time and Date:



- 1.1 To set the time and date, press ESC.
- 1.2 With the up or down arrow key, move the pointer to Set, Press OK.
- 1.3 With the pointer on Clock, press OK.



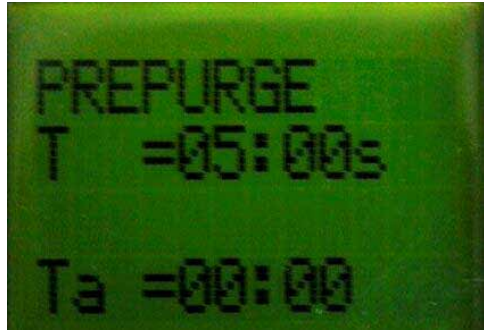
- 1.4 Press the up or down arrow key to change the day. To go to the next digit, press the right arrow key. This will move the cursor to the first time digit. Change the digit with the up or down arrow key to the right time. Do this with all the digits of the time and the date. Once satisfied, press OK to accept the time and date. Press ESC to exit and return to the top display.

2. To access the field adjustable parameters, such as the timers and enables:



- 2.1 Press ESC.
- 2.2 With the down or up arrow keys move the arrow to SET PARAM.
- 2.3 Press OK.

3. The display shows the first parameter, PREPURGE.



- 3.1 The default setting, T, is 5 seconds.
- 3.2 Ta=00:00s, accumulated time is 00.00 seconds.
- 3.3 Scroll to the appropriate parameter, by pressing the up or down arrow keys.
- 3.4 To change the value of the displayed timer, press OK.
- 3.5 The cursor blinks on the first digit of the time.
- 3.6 Press the up or down arrow key to change the value of this digit. To change another digit move the cursor with the left or right arrow key to the next digit and use the up or down arrow key to change the value.
- 3.7 Once the timer is adjusted, press OK to store the new time or press the ESC key to cancel and preserve the old time.

- 3.8 Exit this function by pressing ESC twice until the inputs and outputs are displayed again.

4. The LOGO features a total of 10 displays to aid understanding of the heater operation and that help with troubleshooting.

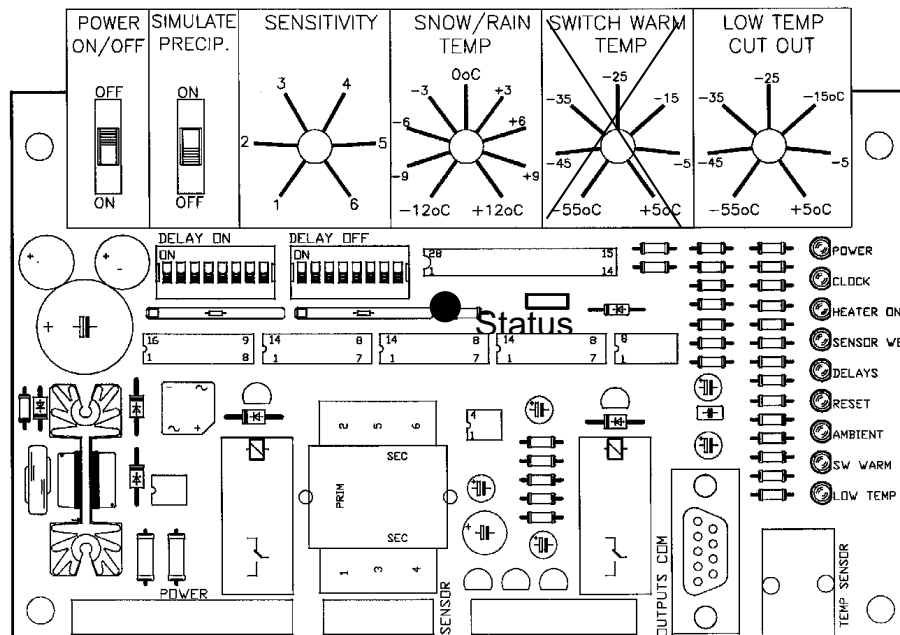
Table 5 – LOGO Displays

4 ALARMS FROM FSR, TURN POWER OFF ON	RAIL TEMP SWITCH OPEN, VER. 18504 C	CYCLING SWITCH OPEN
ALARM FSR CHECK GAS, FLAME	HIGH LIMIT SWITCH ON, CHECK HEATER	FSR DEFECT, NO POWER ON MAIN
ROD, SPARK PLUG		VALVE, POWER OFF /ON
HEART BEAT FUNCTION IS RUNNING		
RTC TIMER ENABLED, RTC RUN TIME ACTIVE	CONTINUOUS RUN, RTC TIMER DISABLED	RTC TIMER TIMED OUT, HEATER TURNED OFF

F. ENERGY MANAGEMENT SYSTEM (EMS) OPERATION AND ADJUSTMENTS

The EMS monitors the environmental conditions, by referencing the ambient temperature and a number of set points and will turn the heater on and off. It also includes an aggressive retry function that provides up to three resets of the FSR.

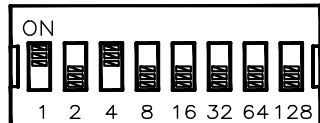
All set points are easily adjustable with the four dials on the top of the EMS board. Also a power switch and a moisture simulation switch are provided. On the right side of the board are a number of LED's that indicate the status of the EMS board.



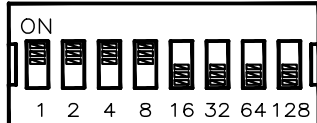
F.1 Switches and Dials

1. Power ON/OFF - This allows you to turn OFF / ON the EMS with all the functions of the EMS including aggressive retry of the heater. This switch is also used to reset the EMS in case of a lockout.
2. Simulate Precipitation ON/OFF - This is normally off. To simulate moisture (snow or rain) you can switch it ON and the EMS receives a signal the sensor is wet. Used to test and troubleshoot the EMS.
3. Sensitivity - This dial is used to adjust the sensitivity of the moisture sensor. 6 is maximum sensitivity and 1 least. Usually set between 3 and 4.
4. Snow Rain Temperature - Adjustable set point, from -12°C to $+12^{\circ}\text{C}$, to determine the snow to rain temperature. If the ambient temperature is below this set point, the EMS sees any moisture as snow and will turn on the heater. Above this set point it will see rain and not turn on the heater.
5. Switch Warm Temperature $+5^{\circ}\text{C}$ to -55°C (Not Available) - The SWITCH WARM function is initiated when the ambient temperature drops below this set point. The SWITCH WARM function is intended to operate the heater on a regular on/off cycle to clear undetected accumulation of drifting snow and fallen ice debris from passing trains. This feature can be disabled by lowering the Switch Warm Temp set point to its minimum setting, -55°C . See section E.2 for adjustment of the switch warm timers.
6. Low Temperature Cut Out $+5^{\circ}\text{C}$ to -55°C - This set point determines the temperature at which the heater will be turned off. Usually set to -35°C . Propane gas does not provide adequate vapour pressure below -40°C . By disabling the heater at temperatures below the set point, alarm shut down and manual resets are avoided. Natural gas fired heaters or propane tanks with tank heaters DO NOT require this feature and the set point can be lowered to the minimum of -55°C .
7. Delay On, Delay Off Dip Switches - These switches, located on the board below the sensitivity, are used to set the DELAY ON and DELAY OFF times for EMS operation. The value of the time is calculated by adding the binary code value of the actual switch. Minimum step is one minute. The value are 1, 2, 4, 8, 16, 32, 64, and 128 and any combination between and up to 255 minutes. Example shown has 5 minute delay on and 15 minute delay off.

DELAY ON

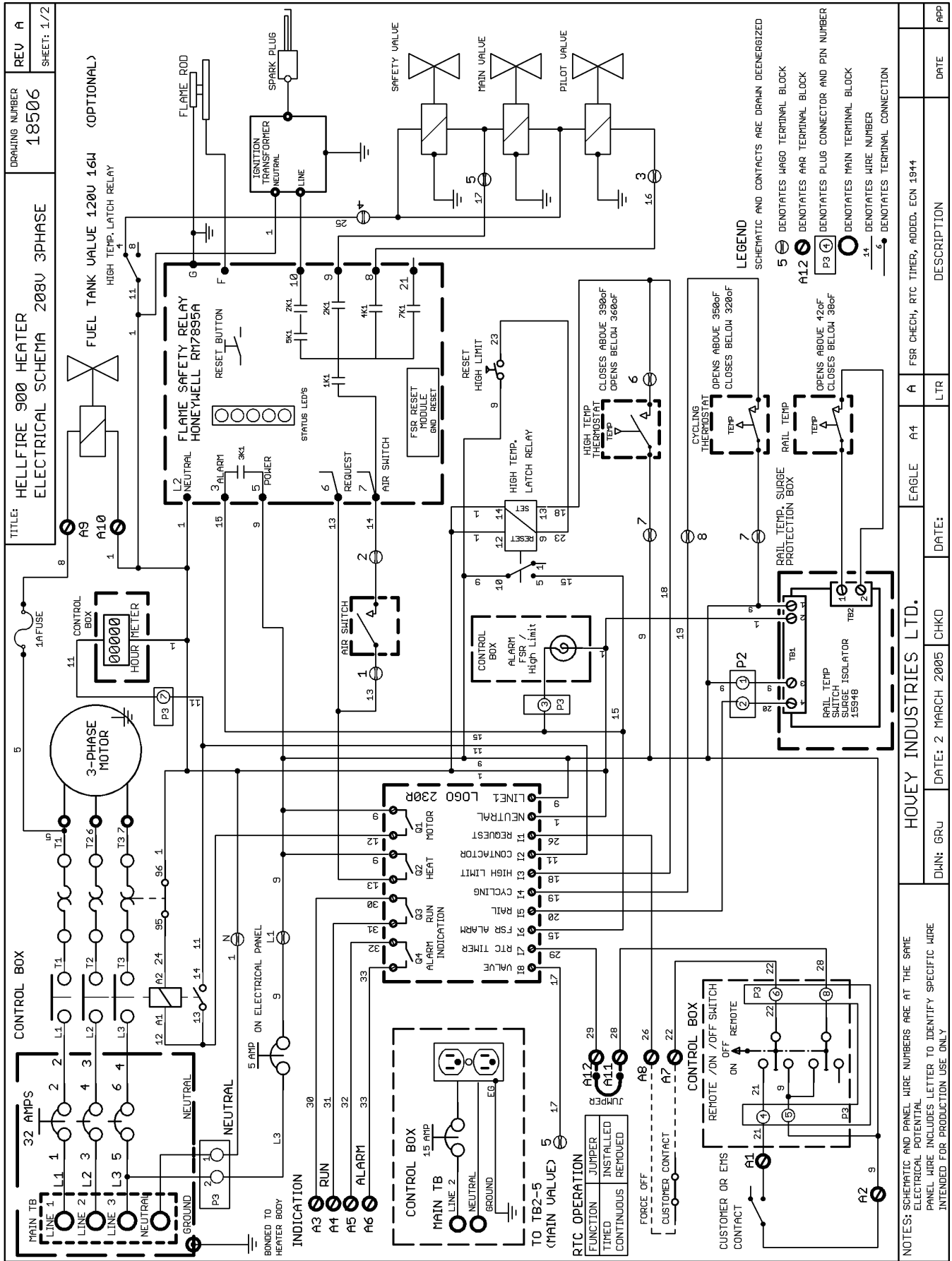


DELAY OFF

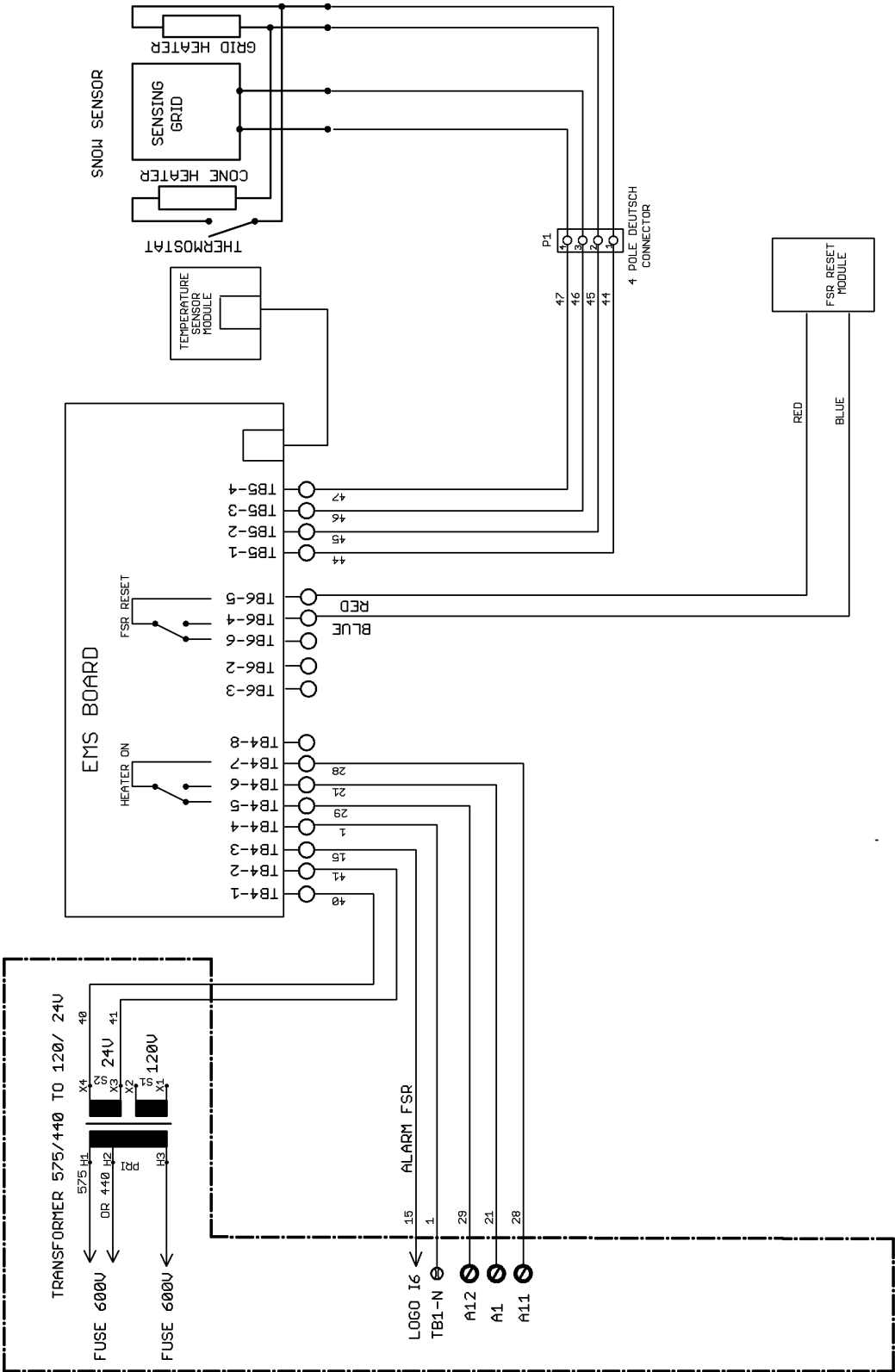


F.2 Status LED's

Power	Indicates 12V DC present on the board	
Clock	Clock on board is working, approx. 1 hertz	
Heater On	Heater on relay is energized (heater should run)	
Sensor Wet	Indicates when the sensor is wet or simulated wet	
Delays	Shows the active delays	
	Dark	No delay time active
	Lit	DELAY TIME ACTIVE. EITHER DELAY OFF OR DELAY ON TIME If HEATER ON LED is dark - delay on time active If HEATER ON LED is lit - delay off time active
	Blinking	Delay time reset to zero
Reset	Relay to reset direct spark ignition module, (aggressive retry)	
Ambient	Indicates ambient temperature is below snow/rain temperature and sensor is wet	
SW Warm	Not available.	
Low Temp	Indicates ambient temperature is below low temperature cut out set point. Heater on LED is dark (heater on relay de-energized). The heater can be turned on manually or remotely, but will not run automatically.	
Status	Aggressive retry (located center of board)	
	LED	Indicates
	Green with a flash of red	Normal
	Green and red, equal time	Heater has failed and awaiting reset
	Red	Heater has failed 3 consecutive times and EMS is locked







HOVEY INDUSTRIES LTD.				FSR CHECK, RTC TITER, ADDED, ECN 1944			
DATE: 2 MARCH 2005		CHKD	LTR	DATE:	DESCRIPTION	DATE	APP
DJN: G.Ru							

NOTES: SCHEMATIC AND PANEL WIRE NUMBERS ARE AT THE SAME ELECTRICAL POTENTIAL
PANEL WIRE INCLUDES LETTER TO IDENTIFY SPECIFIC WIRE
INTENDED FOR PRODUCTION USE ONLY

G. SERVICE CHECKS

G.1 Gas Leak

1. With the heater "OFF", paint all the gas pipe connections upstream of the main and pilot gas valves with leak testing solution. Bubbles indicate a gas leak.
2. With the heater operating in the "MANUAL" mode and the burner lit, paint all pipe connections between the main and pilot gas valves, and the burner with leak test solution.
3. If a gas leak is detected, Turn "OFF" the heater. Replace any cracked fittings or components, tighten any leaking pipe connection, or disassemble, reapply pipe thread sealant, and reassemble.
4. To leak test the main gas valve, turn the manual gas shut off valve, downstream of the main gas solenoid valve off, with the handle perpendicular with the pipe, and turn off the manual gas shut off valve upstream of the pilot gas valve. Leave the manual gas valve upstream of the regulator open. The pressure upstream of the main gas solenoid valve is between 5 to 15" of H₂O. The pressure downstream of the main gas valve should be 0". Leave the test for 2 hours. At the end of the test there should be no increase of pressure on the downstream gauge. If there is an increase, refer to the ASCO gas valve manual in the component bulletins section at the end of this manual, for service information.

G.2 Gas Supply Pressure

1. All HELLFIRE switch heaters are factory tested at 5 psi gas supply pressure, using propane for the test.
2. With the heater on and all connected loads operating, verify that the supply pressure is between 5 - 20 psi, adjust supply pressure as required. Operating pressures above 6 psi may necessitate readjustment of manifold gas pressure. Operating pressures below 5 psi will limit the maximum capacity of the heater.

G.3 Blower Motor

1. Using a clip on ammeter, measure the running amps. It is to be within 85 to 115% of the motors nameplate running amps. Running amps greater than 115% of the motor rated full load amps can indicate failed bearings, incorrect fan/intake clearance from an improperly installed fan, excessive air leaks in the ductwork, inadequately sized power supply wires, or poor electrical connections.

G.4 Flame Safety Relay (FSR)

1. Ensure that adequate gas pressure is available.
2. Note the 5 LEDs on the front face of the FSR.
3. The following is the normal expected status LED sequence.
4. With adequate power, the green POWER LED will be lit and will blink every 4 seconds, indicating standby mode. Turn the mode selector switch to "MANUAL". The blower will start, followed by the trial for ignition. The yellow PILOT

LED will light. Once the burner is lit and a flame signal is received, the red FLAME LED will light. After 10 seconds, the yellow MAIN LED will light, leaving four lit LEDs, the POWER, FLAME, PILOT and MAIN. The LEDs will maintain this status until the cycling thermostat reaches its set point and turns off the request for heat. As a further check, close the manual gas valve. The FLAME LED will go out, and within 3 seconds the MAIN and PILOT LED will go out, the red ALARM LED will light, and the FSR will safety shutdown and lockout. Open the manual gas shutoff valve, the FSR will remain locked out, the main and pilot gas valves will remain closed, and the burner will remain unlit.

5. For further information see the Honeywell 7800 series RM7895A Relay manual in the component bulletins section at the end of this manual.

G.5 Flame Rod

1. The flame rod operation can be monitored using a voltmeter set to measure 0 - 10 volts DC. The FSR is equipped with a flame signal amplifier located on the underside. Place the red lead into the positive (+) jack and the black into the negative. The voltage is 0 volts when no flame is present, and increases to 2.5 to 5.0 once exposed to the flame.



Figure 1 – Flame Signal Amplifier

G.6 Air Switch

1. Check the air switch operation, while operating the unit. Block 90% of the air intake. The FSR will safety shutdown and lockout. Remove the blockage, reset the FSR and the heater will restart.

G.7 Air Switch Calibration

1. With the heater operating, remove the red dust cover cap on the air switch set screw, and turn the set screw counter clockwise to lower the set point. Block 90% of the air intake with cardboard. Raise the set point by turning the screw clockwise until the switch opens and causes the FSR to safety shutdown.
2. Remove blockage and reset FSR.

G.8 High Temperature Limit

1. Turn the service breaker "Off". Disconnect the blue and black leads to the thermostat and short them together. Turn main breaker "On". Start the heater and let it run. Once the temperature exceeds the 420°F set point, which may require increasing the manifold pressure, the gas valves will close extinguishing the flame in the burner within 15 - 30 seconds, the heater ALARM indication contact will close, the ALARM light (shown) in the control panel will light, and the fan will continue to run for 4 minutes of post purge. Let the heater cool, and ensure that it will not start.

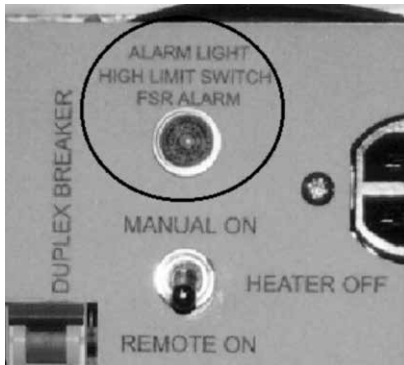


Figure 2 – Alarm Light

2. Turn the selector toggle switch to "HEATER OFF".
3. Manually reset the "HIGH LIMIT RESET BUTTON" and disconnect the 5 amp breaker to the left of the LOGO PLC. Reconnect the cycling thermostat and close the 5 amp breaker.

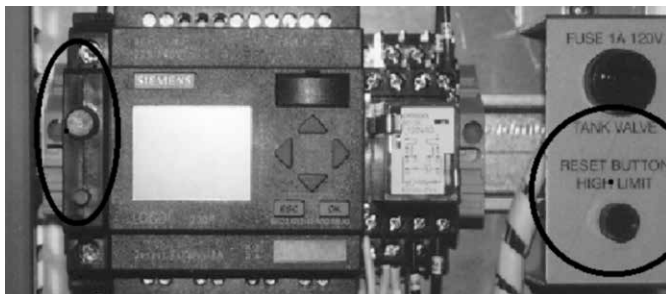
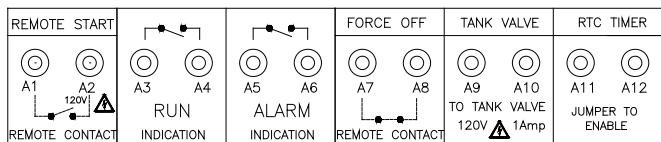


Figure 3 – High Limit Reset Button

G.9 Remote Start, Run and Alarm Indication, Tank Valve Switch

1. Check for 120Vac on terminals A2. Shorting A1 and A2 together will start the heater when the mode selector switch is in "REMOTE". Check for continuity between A3 and A4 and an open circuit between A5 and A6 when the heater is running normally. When the heater is requested to stop, i.e. toggle the mode selector switch to "OFF", the contact between A3 and A4 will open.
2. When the heater is in ALARM, check for continuity between A5 and A6. Resetting the alarm will open the contact across A3 to A4.
3. A7 and A8 are normally shorted to allow the heater to run. Removing the shorting link or opening the customer-supplied contact will stop the heater.
4. Check for 120V across A9 and A10 when the heater is running. This is valid only on 240V and 208V systems.



G.10 Power Failure

1. In the event of a power disruption, the heater is designed to initiate the trial for ignition without any form of resetting once power is restored.
2. Turn the service breaker "OFF". Allow the fan to come to a complete stop then restart by turning the breaker back to "ON". The heater will return to normal operation.

G.11 Dirt Trap

1. If dirty supply lines are suspected, turn off the local gas supply, remove the dirt pocket cap inspect for dirt and or moisture. If evidence is found, locate source and correct problem. Empty cap of any dirt or moisture and replace. Turn on gas supply and leak test dirt trap.

H. MAINTENANCE

H.1 General

1. Heater should be inspected at least annually by a qualified service person.
2. Ensure the air intake and all ductwork are not obstructed.
3. Keep area around heater clear and free from combustible material, gasoline and other flammable vapours and liquids.
4. Replace all damaged intake ducts, crossducts, swivel and trackduct nozzles since damaged ducts will degrade switch clearing ability.
5. With the supply power turned off, tighten all mounting and electrical connections to the recommended tightening torques, refer to Table 1 - Torque Specifications.

Table 1 – Torque Specifications

Thread Size	Tightening Torque (in.lbs)
8 - 32	19
10 - 32	31
1/4 - 20, Power Terminal Lugs and AAR Terminals	75

H.2 Lubrication

The motor has sealed bearings and does not require lubrication.

H.3 Flame Rod and Spark Igniter Removal

1. If the flame rod or spark igniter requires servicing or replacement, it can be removed as follows.



Figure 4 – Flame Rod and Spark Removal

2. Remove the access panel from the side of the combustion chamber.



Figure 5 – Flame Rod and Spark Removal

3. The flame rod is screwed into the burner, to the left of the spark igniter. Gently pull the wire from the terminal. Using a 7/8" deep socket, unscrew and remove the flame rod. Apply a high temperature anti-seize compound to threads prior to reinstallation.
4. The spark igniter is screwed into the burner, to the right of the flame rod. Gently pull the wire from the terminal. Using a 13/16" deep socket, unscrew and remove the spark igniter. Apply a high temperature anti-seize compound to threads prior to reinstallation.



Figure 6 – Flame Rod and Spark Removal

H.4 Thermostat Removal

1. Remove the cover mounted on the sensor mounting duct to gain access to the thermostats. There are two thermostats, the high limit, which has a red and a white wire connected to it, and the cycling thermostat, which has a black and a blue wire, connected to it.

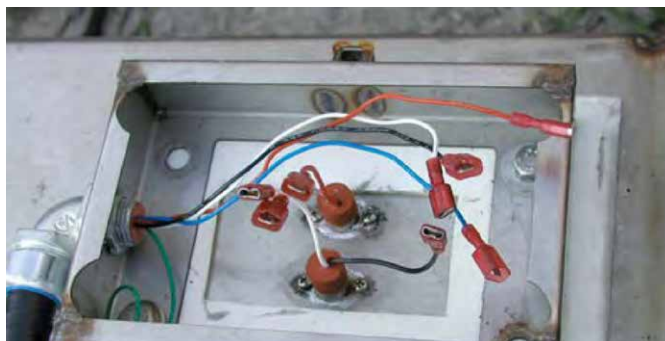


Figure 7 – Thermostat Wire Connections

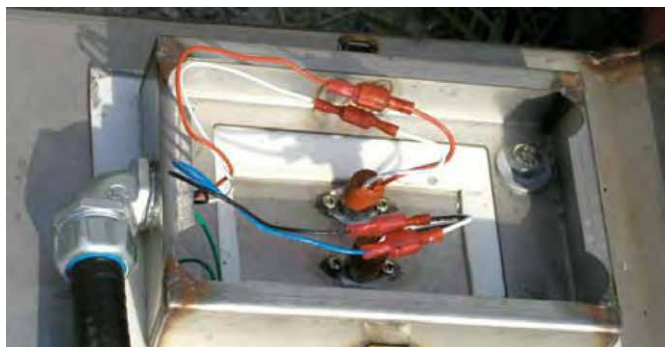


Figure 8 – Thermostat Wire Connections

2. The wires are connected by means of quick disconnects. To disconnect, grip the terminals on each side of the connection and pull firmly.
3. Once the wires are disconnected, unscrew the two screws that mount the thermostat to the crossduct. Remove the thermostat.

High Limit Thermostat
White/Red Wire

Cycling Thermostat
Black/White Wire

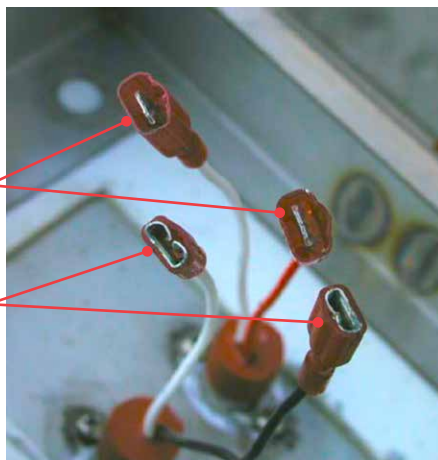


Figure 9 – Thermostat Wire Connections

NOTE: The high limit and cycling thermostats are not interchangeable. Each has unique connectors to prevent interchange.

H.5 Vibration Specifications and Measurement

1. All blowers are balanced to a vibration level lower than 0.20 inc/sec RMS, refer to table below:

Location	1, 2, 3, 4
Vibration Level (in/sec) RMS	0.04 to 0.12 Acceptable
	Lower than 0.20, maximum acceptable
	0.13 to 0.29 Tolerable
	0.30 to 0.71 Excessive
	0.72 or more Extreme

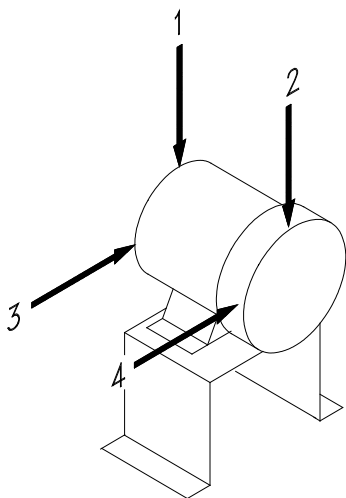


Figure 10 – Motor Reference

- A vibration PEN may be purchased from CCI Thermal to check the vibration level of the equipment, Part# 9074-0013.
- Motor bearing vibration levels (#1, 2, 3 & 4) can be charted on a graph vs time to predict when the motor requires replacement or maintenance.
- Mark locations 1, 2, 3 and 4 on motor to ensure repeatable measurements for trend analysis.
- Do not measure on covers or guards.

H.6 Motor and Blower Wheel Removal



WARNING. Disconnect power prior to removal.

NOTE: Motor/impeller sets which are not match balanced by CCI Thermal void future warranty claims.



Figure 11 – Combustion Chamber

1. Remove the combustion chamber access panel to gain access to the motor.

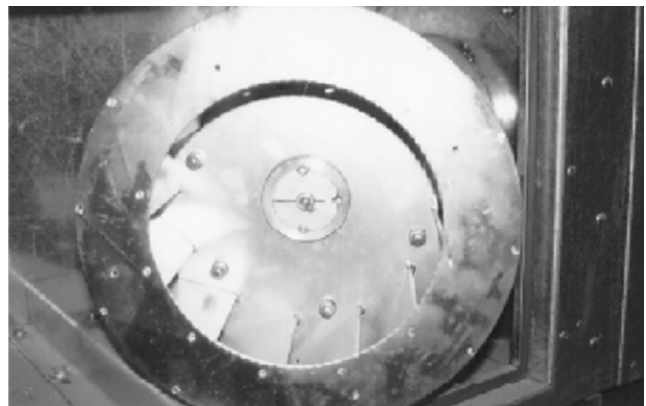


Figure 12 – Motor/Impeller Assembly

2. Remove the four motor mount bolts and remove the motor/impeller assembly from the combustion chamber.



Figure 13 – Motor/Impeller Assembly Removal

3. Install replacement motor/impeller assembly, following reverse order.

H.7 Heaters no longer under warranty and for which only the motor is to be changed:

NOTE: Have the motor replaced by a qualified technician, capable of dynamically balancing the motor/impeller and base assembly, to vibration levels of 0.2 in/sec or less, in the bearing planes.

NOTE: Mark the position of the blower wheel on the shaft before removing.

1. The blower wheel is fitted with a tapered shaft bushing with three tapped 3/8 – 16 UNC holes. Clamp the motor and anchor the impeller using a suitable bar. Remove the two hub set screws.
2. Insert a set screw into the third hole and tighten.
3. Using a hammer and bar, tap the outer half of the hub to knock the wheel off the tapered hub.
4. To install the blower wheel, reverse the sequence for removal.

NOTE: Ensure that the blower wheel is installed at the same position on the shaft as previously. Once installed, measure the running current with a clip on ammeter. Confirm the current is within 85 to 115% of the motors nameplate Full Load Amps (FLA), depending on the ambient temperature, see the following table.

Table 2 – Running Amperage vs Temperature

Ambient Temperature		Running Amps % of FLA
°C	°F	
20	68	85
10	50	90
5	41	93
0	32	95
-5	27	98
-10	14	100
-15	5	103
-20	-4	105
-25	-13	108
-30	-22	110
-35	-31	113
-40	-40	115

H.8 Burner Maintenance

1. Visually inspect mixing plates for cracks or blockage. Remove any blockages. If cracks are found replace the burner. Over time the gas orifices of the burner can be restricted by build up of corrosion and or dirt.
2. Inspect burner for blocked gas orifices, if:
 - the signal strength is low even after replacing the flame rod,
 - the pilot pressure has to be raised significantly to get a good signal,
 - the manifold pressure is above the maximum gas pressure setting to get the desired heat output.

3. To correct the problem gain access to the front of the burner. Either by removing the transition duct, or by removing the burner through the combustion chamber access panel. Drill out any blocked orifice using a #47 drill bit.

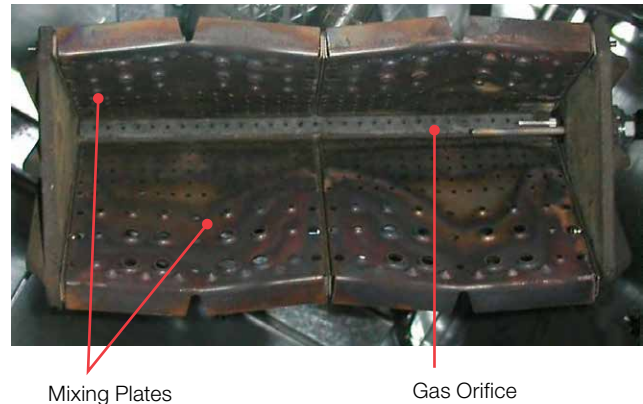


Figure 14 – Burner Maintenance

I. INSTALLATION OF OPTIONS

I.1 Energy Management System (EMS)

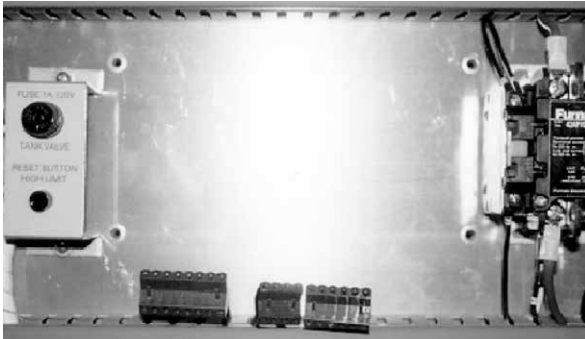
The HELLFIRE 900 comes pre-wired ready to accept EMS options.



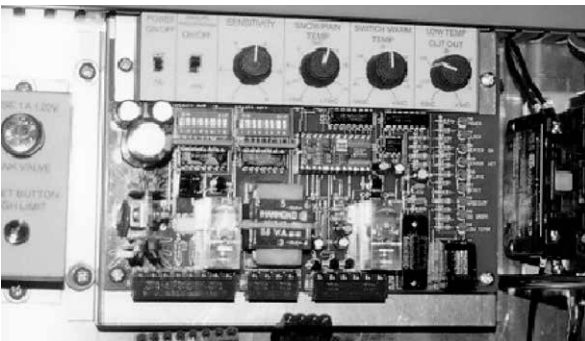
WARNING. Disconnect power prior to installation of any EMS options.

1. EMS Printed Circuit Board (PCB)

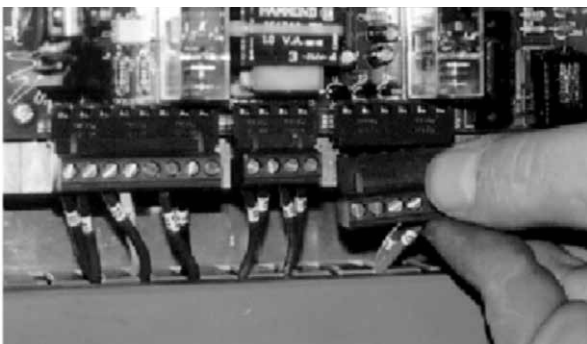
- 1.1 Remove access panel and raise lid.



- 1.2 Mount the EMS circuit board in the space provided, left of the motor contactor.

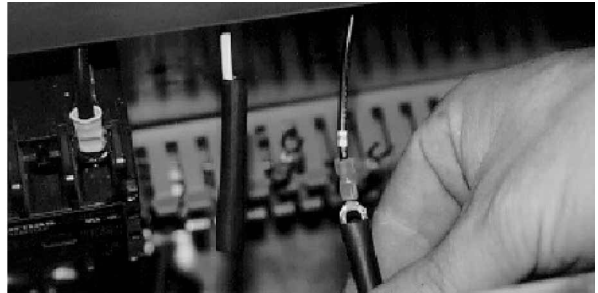


- 1.3 Connect the 3 connectors, a 4 pole (for the snow detector), a 6 pole (for the FSR reset), and an 8 pole (for the power and FSR connections).

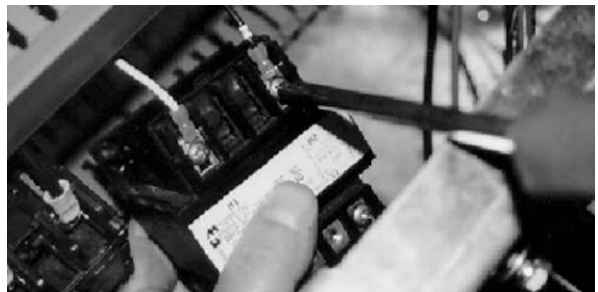


2. 24 Vac Transformer

- 2.1 The 24V transformer mounts on the panel to the right of the motor contactor.
- 2.2 The two leads from the upper wire trough provide 120V to the transformer primary. Remove the shrink tubing to expose the forks.



- 2.3 Connect 120V power leads to the transformer primary.



- 2.4 Withdraw the two leads from the lower wiretrough and connect these to the 24V secondary of the transformer.

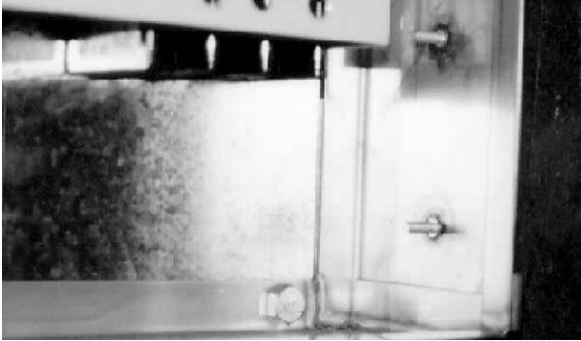


- 2.5 Mount the transformer to the inner panel using screw and nuts supplied.

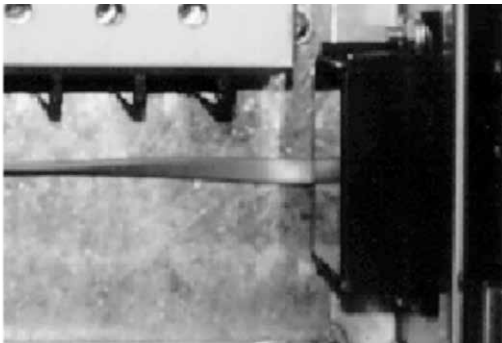


3. Ambient Temperature Sensor

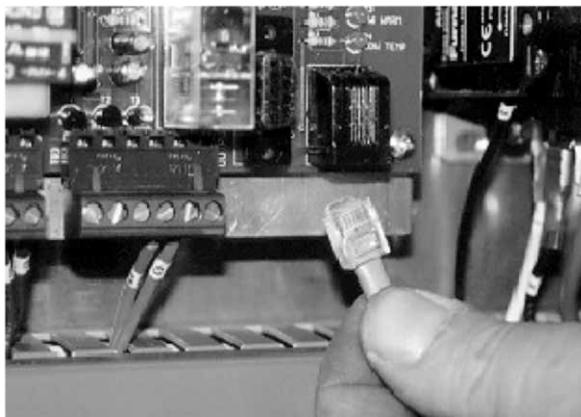
- 3.1 Mount the temperature sensor inside the control panel on the two studs.



- 3.2 Temperature sensor mounted. Ensure Good contact with surface. Run cable back to EMS board through the signal cable pass through.



- 3.3 Insert ambient temperature sensor jack into mating connector on the EMS board. Place cable inside lower wire trough.



4. Precipitation Detector

NOTE: The snow detection option requires that the EMS board be installed.

- 4.1 Remove the plug from the top hole marked "Precipitation Sensor". Pass the 4 pin connector through the hole, install locknut and tighten.



- 4.2 Insert jack into mating connector.



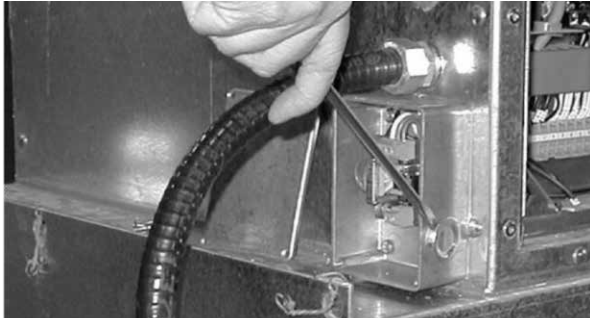
- 4.3 Mount the detector on the transition duct to sensor duct flange facing forward as shown, use the mounting holes and slots provided. Heat from the duct will keep it clear of ice and snow build up.



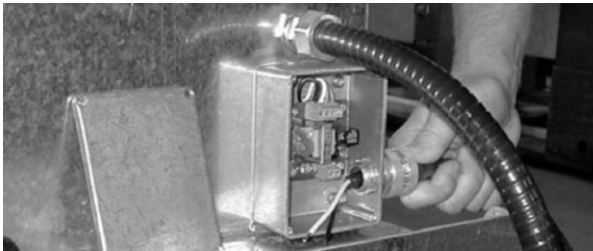
5. Rail Thermostat

This option works independently of the EMS board. It turns the heater off when the rail temperatures rises above 45°F, and leaves the run indication on. The heater is started again once the temperature drops below 37°F.

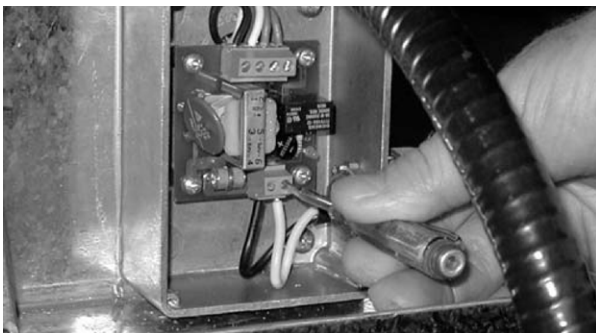
- 5.1 Remove the four (4) phillips screws, the cover, and the plug from the hole in the rail temperature surge protection box.



- 5.2 Pass the two (2) wires from the rail temperature sensor through the hole, install the locknut and tighten.



- 5.3 Insert, one each of the bared wires into the two terminals (green) on the surge suppression circuit board, and tighten the locking screws. Polarity is not critical. If the optional air gap arrester is installed as per assembly drawing 17894, connect the ground wire to one of board mounting screws.



- 5.4 Replace the cover, and tighten the four (4) phillips screws.



- 5.5 A jumper for trouble shooting and summer testing is located inside the electrical component area, hanging immediately under the FSR.

- 5.6 Select a convenient location on the stock rail, to mount the rail thermostat, roughly ½ the distance between the points and the heel of the switch.



- 5.7 Provide strain relief in the cable, by leaving adequate slack, as shown, to allow for the rail pumping.



- 5.8 Remove the yellow shim washers if it is to be installed on 115 lb rail or lighter. Loosen the two mounting bolts and attach the rail thermostat to the rail flange by tapping it on with a hammer. Once in place tighten mounting bolts to maximise grip.



WARNING. When installing switch covers, locate the thermostat underneath.

I.2 Aggressive Retry

1. The aggressive retry feature requires that the EMS board or aggressive retry module be installed.

- 1.1 The FSR reset module plugs into the Flame Safety Relay. To install, engage the top and rotate the bottom in.



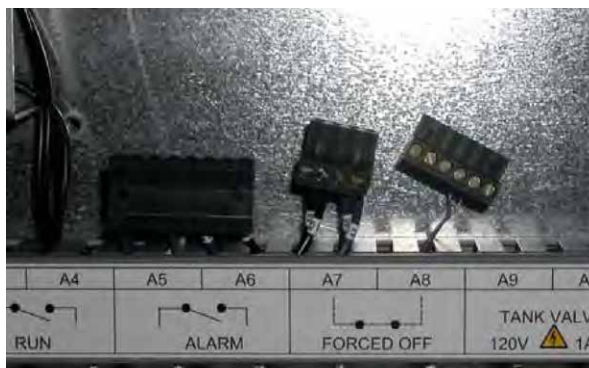
- 1.2 The EMS board includes the aggressive retry function.



- 1.3 The 6 pin connector with the two wires connects to the FSR remote reset module.



- 1.4 Heaters without the EMS option are prewired to accept the EMS components.



NOTE: The aggressive retry kit, 17666-02, is recommended for heaters that are order without the EMS. Installation instructions are not included in this manual, but are included with the kit.

I.3 Electrical Service Surge Arrester

The optional Electrical Service Surge Arrester, 15344, is to be installed in parallel with the main 240 Vac power supply. Please contact CCI Thermal for recommended arresters for other voltages. Before beginning installation ensure that all power to the unit has been shut off.

1. Remove the four (4) phillips screws securing the sub-electrical panel, and gently lower this panel out of the way.

The 7/8" hole required to mount the unit may have to be punched in the field. If so, it should be 2.50" from the right side of the panel and 2.75" from the top of the panel.



2. Remove the bushing from the end of the EDCO unit and thread the wires through the 7/8" hole in the inner electrical panel. Slip the bushing over the wires and secure the EDCO unit to the rear of the panel.



3. The wire leads from the surge arrester must be kept as short as is practical. Connect them on the load side of the main service terminal block. (Black to Black, Black to Red, and White to White).

The green lead should be passed back through the electrical panel and connected to the ground stud on the rear side.



4. Return the sub-electrical panel to the correct location and secure it with the four (4) phillips screws.



J. TROUBLESHOOTING CHART

Troubleshooting HELLFIRE 900

Problem	Conditions	Probable Cause	Solution
Heater Does Not Start	-Mode selector switch toggled to "Manual" -Fan motor does not start -None of the FSR LEDs are lit.	No line power	Ensure all supply breakers are "ON", and that there is voltage at the service panel.
	-Mode selector switch toggled to "Manual" -Fan motor does not start -Only the Power LED on the FSR is lit.	The fan motor breaker is switched "OFF", or has tripped.	Turn on or reset breakers in service panel.
	-Mode selector switch toggled to "Manual" -Fan motor does not start -Only the Power LED on the FSR is lit.	Rail thermostat is satisfied, ambient temp is above 45°F	Disconnect rail thermostat at panel and install jumper.
		The thermal overload switch on the motor has tripped.	Reset overload on motor. Measure the motor current draw, it must be within 115% of the motors FLA.
	-Mode selector switch toggled to "Manual" -Fan motor does not start -Only the Power LED on the FSR is lit. -The Alarm light in the control panel is lit.	The cycling thermostat has failed closed, and the air temperature has exceeded 420°F causing the high temperature limit thermostat to close putting the heater into Alarm.	To verify, remove the cycling thermostat from the duct, disconnect the leads and check for continuity. Continuity when cold (below 340°F) indicates a failed thermostat. Replace thermostat. Reset high limit, disconnect 5 amp panel breaker for 10 seconds then reset.
	-Snowing -Mode selector toggled to "Remote" -Power LED not lit on EMS	EMS not turned on.	Turn EMS on.
	-Snowing -Mode selector toggled to "Remote". -Power LED lit -Low temp LED lit	Low Temp Cut Out is set too high.	Reduce Temp Cut Out set point temperature on EMS board.
	-Snowing -Precipitation LED lit -Heater LED not lit -Ambient temp LED is lit -Delay LED is blinking	Delay On is too long.	Reduce delay on time with dip switches on EMS board.
Fan is Running, But No Heat Produced	-Mode selector switch toggled to "Manual" -Only the Power LED on the FSR is lit.	Electrical power supply is poor	Verify that the panel voltage is between 102 and 132Vac, and that the frequency is between 54 to 66Hz
		Pre or Post purge cycle set excessively long	Reprogram LOGO PLC
Heater Runs Continuously	-Not snowing	Mode selector on "Manual" in control access panel	Put switch to "Heater Off" or "Remote On" position
	-Not snowing -Mode selector toggled to "Remote"	Dispatch requesting heater on	Contact dispatch to turn unit off
	-Not snowing -EMS Power LED is lit -Ambient temperature below freezing -Precip LED is lit	-Precipitation simulator switch on	Turn "Simulate precipitation" switch off
	-Raining -EMS LED is lit	Snow/Rain Temp set point too high	Reduce set point near freezing on EMS board.

Troubleshooting HELLFIRE 900

Problem	Conditions	Probable Cause	Solution
Heater Starts Followed By Safety Shutdown and Lockout	Energy Management System requesting heater on	EMS Delay Off set too long	Reduce delay off time with dip switches on EMS board
	-Mode selector switch is toggled to "Manual". Note the sequence of LEDs on the FSR. 1) the PILOT lights 2) the FLAME does not light 3) the POWER and ALARM light remain lit.	Inadequate gas pressure	1) Verify there is adequate supply pressure, between 5 - 20 psi. 2) Verify that the pilot gas solenoid shutoff valve is energizing and opening. 3) Verify that the manual pilot gas shutoff valve is open
		Air in gas line	Purge air from line. For a small amount of air a couple of start up attempts will clear the line.
		Ignition system faulty, no spark.	To confirm, remove the lead from, but hold it close to the spark plug. Reset and start the heater. If there is a spark between the plug and the lead, and the burner still does not light, then inspect or replace the plug. If there is no spark then inspect or replace the ignition transformer.
		No flame signal	Remove flame rod and clean. Visually inspect for physical damage. To confirm, see the flame rod check instructions in the service check section of this manual.
		Intake severely blocked.	Clear intake of any snow or debris. Once cleared the air switch will close and the trial for ignition will proceed. Calibrate air switch as per the instructions in the service check section of this manual.
		Main or Safety gas solenoid valve not opening.	Cycle the heater by turning it off and on. Listen for the solenoids to "snap" when the FSR energizes them, as indicated by the "MAIN" LED. If no "Snap" is heard inspect the coil and wire terminations. If a "Snap" is heard service the gas valve.
Heater Has Stopped After Having Been Running Normally	-Mode selector switch is toggled to "Manual" -The Power and Alarm LED on the FSR are lit.	The FSR has experienced a system fault and has executed a Safety Shutdown and Lockout.	The FSR can be reset and the heater immediately restarted by pressing the reset button on the front face of the FSR. Refer to the normal sequence of events chart and note the steps as the heater goes through the trial for ignition. If the heater stops again refer to the troubleshooting items above.
		Low flame signal, Drops below 1.2 micro volts (Marginal signal 1.2 – 3.0 Good signal 3.0 to 5.0)	-Remove flame rod inspect for soot and moisture. Clean and dry. Visually inspect for hairline cracks and physical damage. To confirm, see the flame rod check instructions in the service check section of this manual. -Inspect flame rod wire lead for good contact at both ends. Replace lead if corroded.
	-Mode selector switch is toggled to "Manual" -LOGO display indicates HI LIMIT ALARM, but alarm light is not on.	High limit thermostat is wet. Significant moisture in thermostat box	Dry out thermostats and enclosure. Inspect , repair or replace enclosure seals.

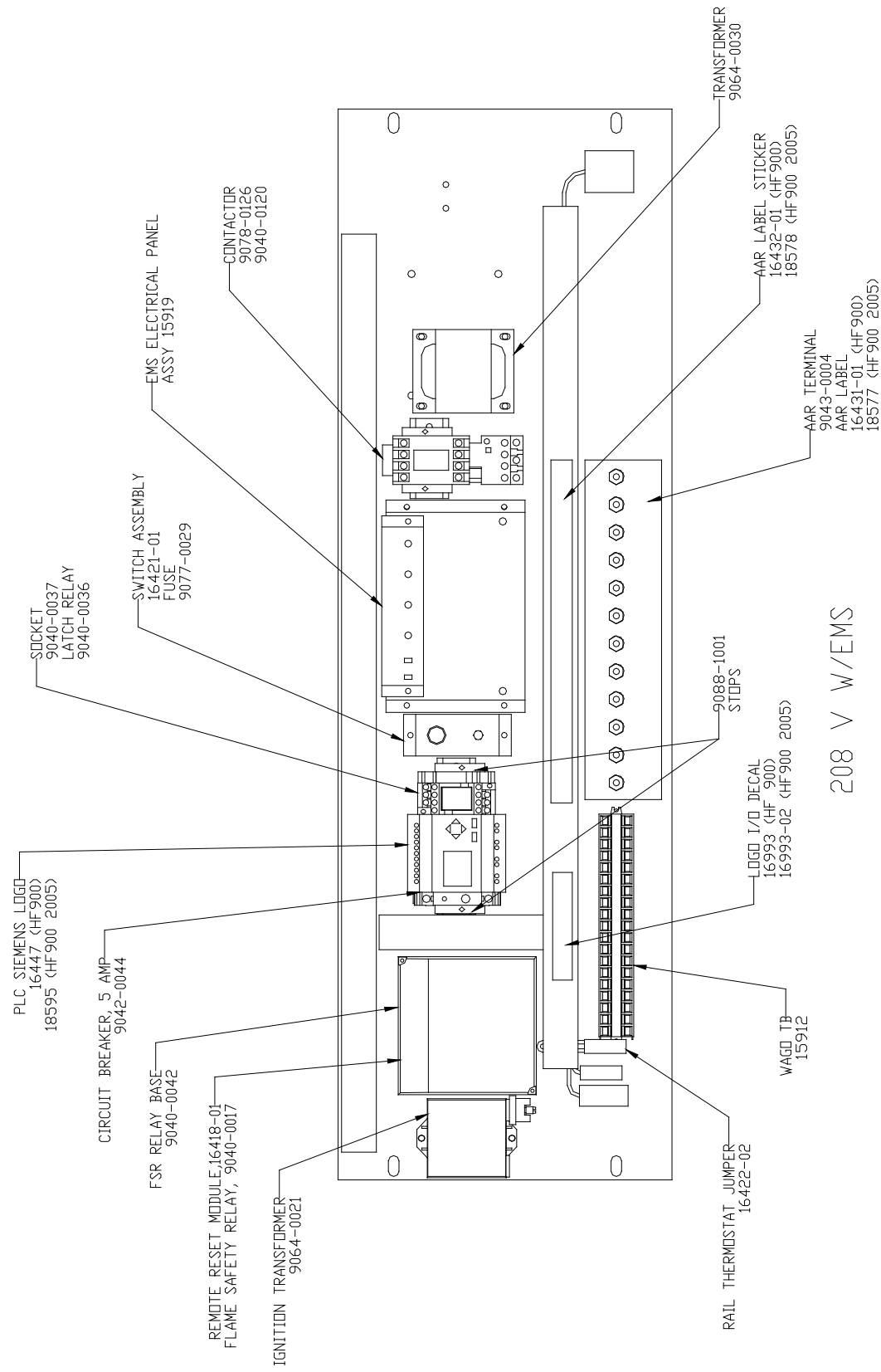
Troubleshooting HELLFIRE 900

Problem	Conditions	Probable Cause	Solution
Heater Cycles Excessively	Heater functions normally except the time between cycles is short, ie less than 30 seconds.	Gas manifold pressure exceeds nameplate rating	Turn down gas manifold pressure
		Air intake blocked	Clear intake
		Insufficient number of trackduct nozzles opened	Open trackduct nozzles as per "Switch Heater Trackduct Field Modifications Manual, 11237"
	Pilot solenoid energized. Flame signal detected. Main valve opens. Flame signal lost. Cycle repeats.	Low flame signal, drops below 1.2 micro volts (Marginal signal 1.2 – 3.0 Good signal 3.0 to 5.0)	-Remove flame rod inspect for soot and moisture. Clean and dry. Visually inspect for hairline cracks and physical damage. To confirm, see the flame rod check instructions in the service check section of this manual. -Inspect flame rod wire lead for good contact at both ends. Replace lead if corroded.
Heater Running But Does Not Provide Adequate Heat	Point nozzle temperature is less than 140°F above ambient. Manifold pressure is at or above maximum rating.	Burner orifices are restricted / plugged with corrosion or dirt.	Service burner. See Burner Maintenance section of manual.

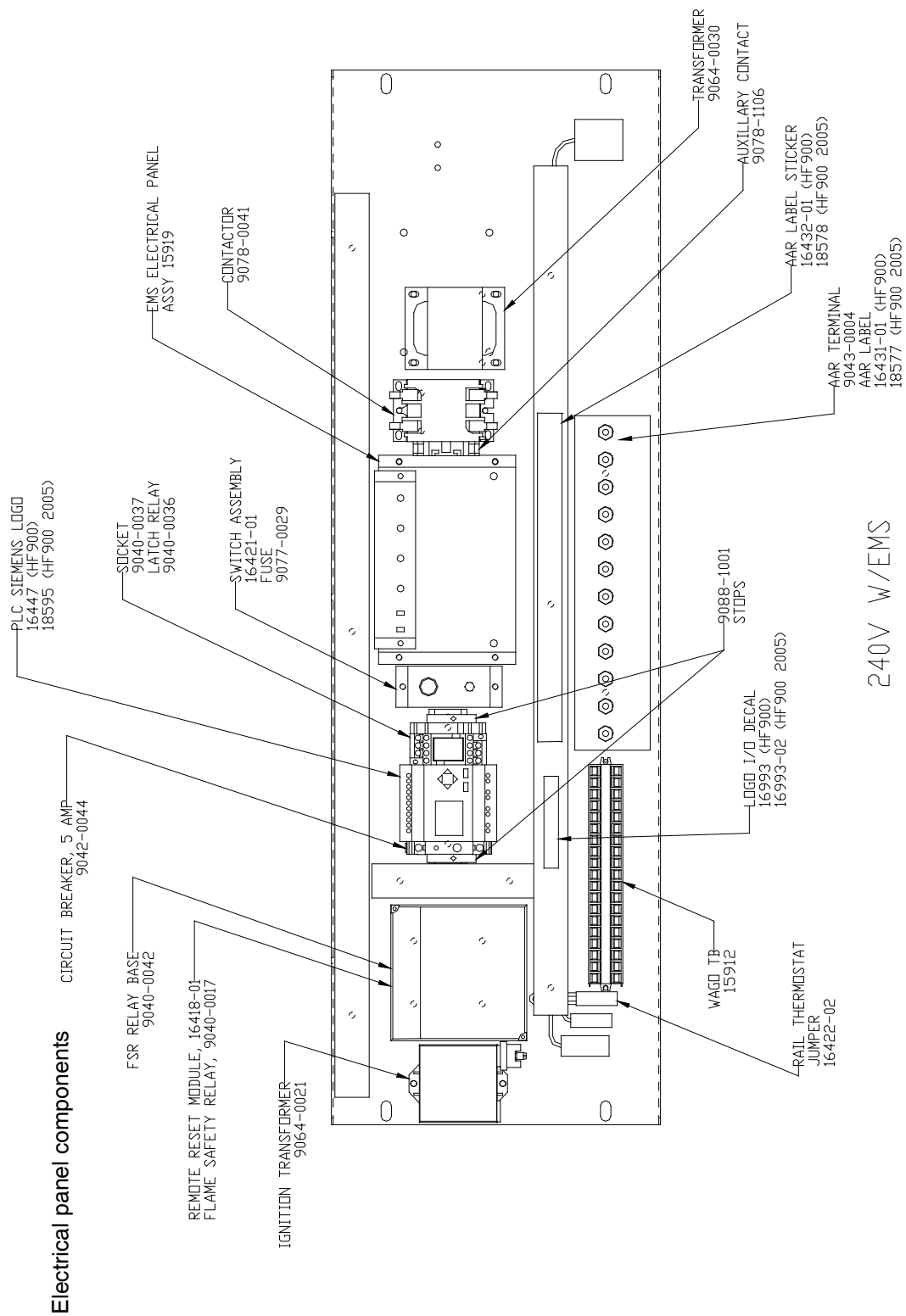
K. SPARE PARTS

K.1 Electrical

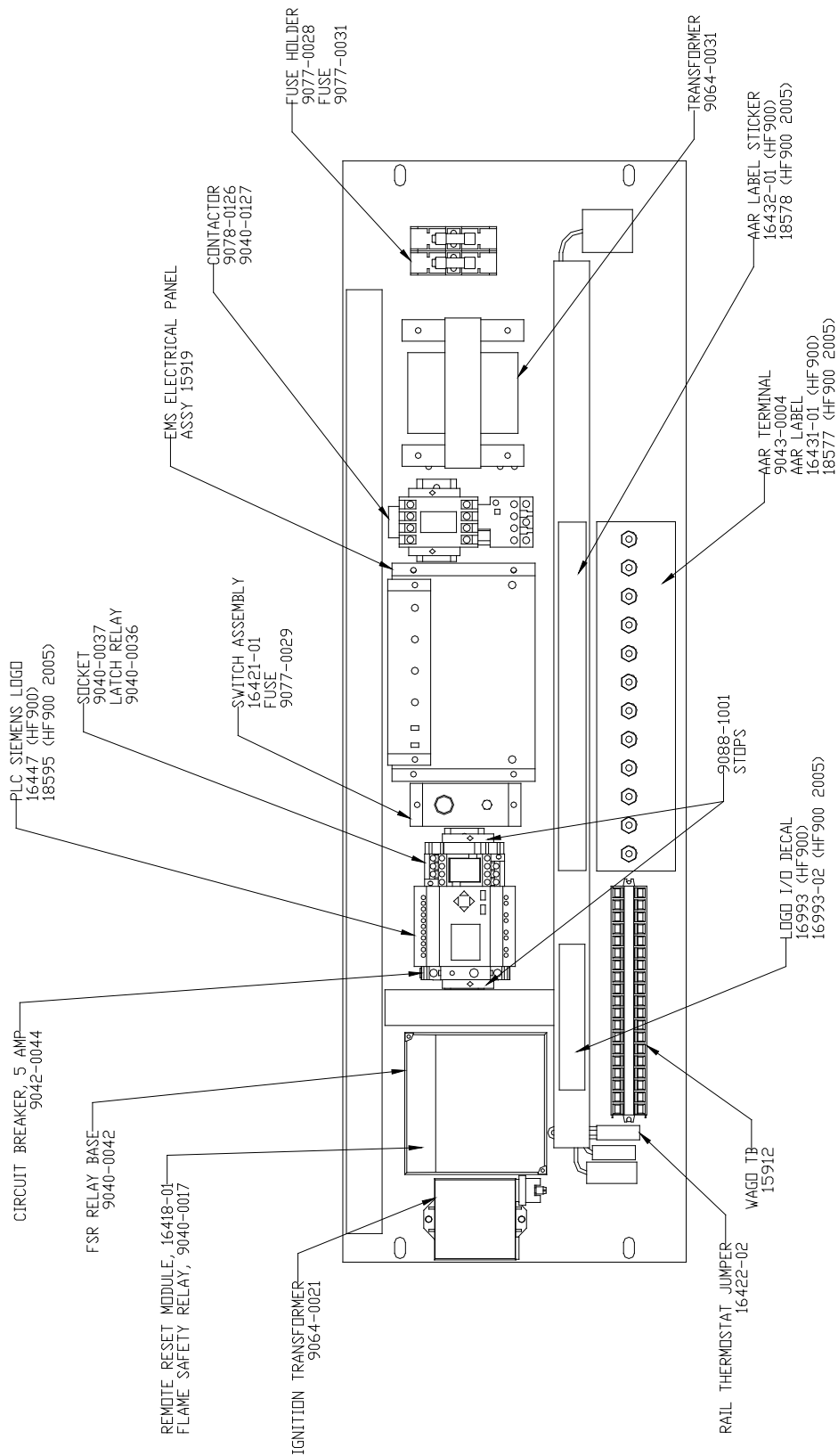
1. Electrical Panel Components - 208V with EMS



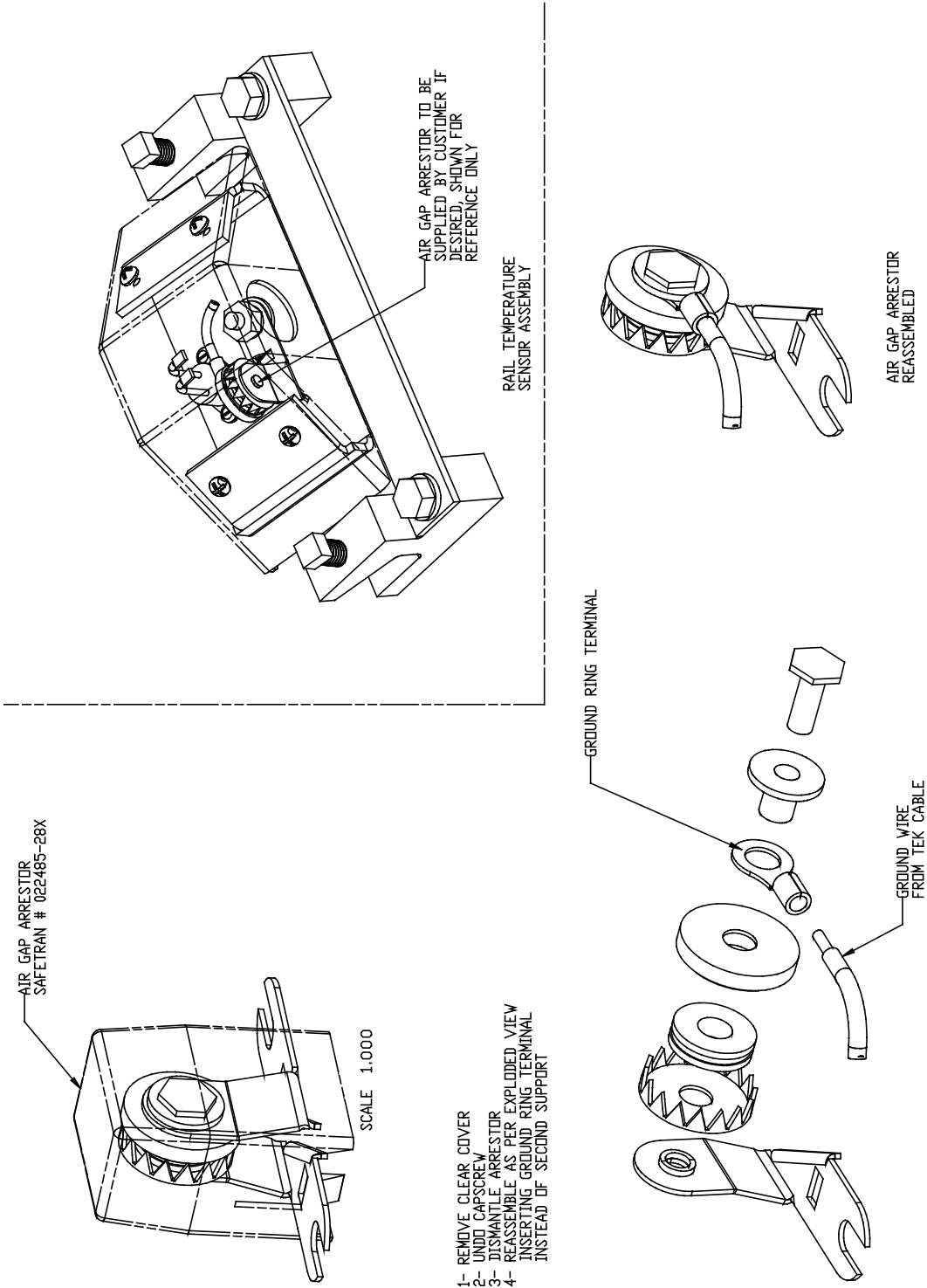
2. Electrical Panel Components - 240V with EMS



3. Electrical Panel Components - 460/575V with EMS



460/575V W/EMS





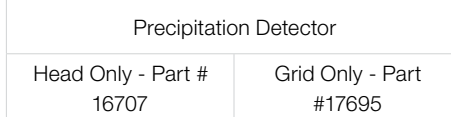
Precipitation Detector, Part # 16441-01



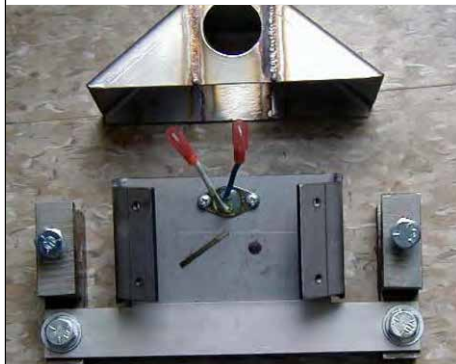
Head Only - Part #
16707



Rail Thermostat comes with Cable - Part #
16442-03



Grid Only - Part
#17695



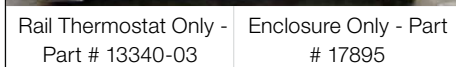
Rail Thermostat Only -
Part # 13340-03



Rail Thermostat Surge Isolator - Replacement
board only - Part # 15948



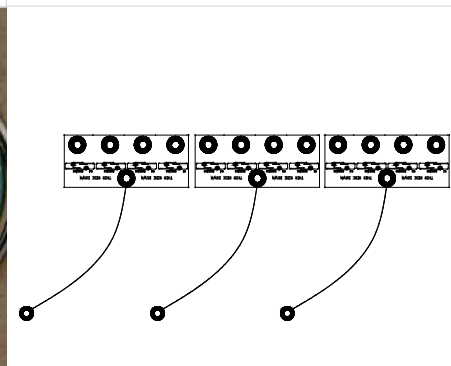
Rail Thermostat Jumper - Part # 16422-02



Enclosure Only - Part
17895



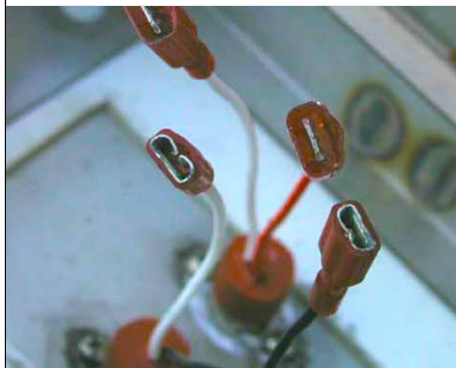
Electrical service surge Arrester
240VAC single phase - Part # 15344 (option)



AAR terminal surge Arrester kit - Part # 15343
(option)



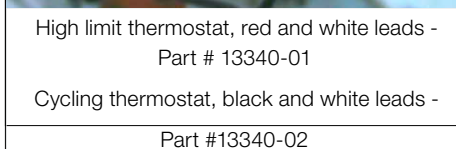
Ambient temperature sensor - Part # 16426



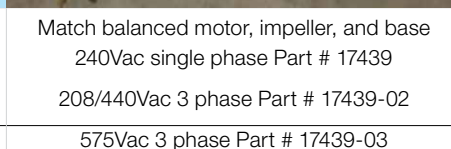
High limit thermostat, red and white leads -
Part # 13340-01



Match balanced motor, impeller, and base
240Vac single phase Part # 17439



Cycling thermostat, black and white leads -
Part # 13340-02



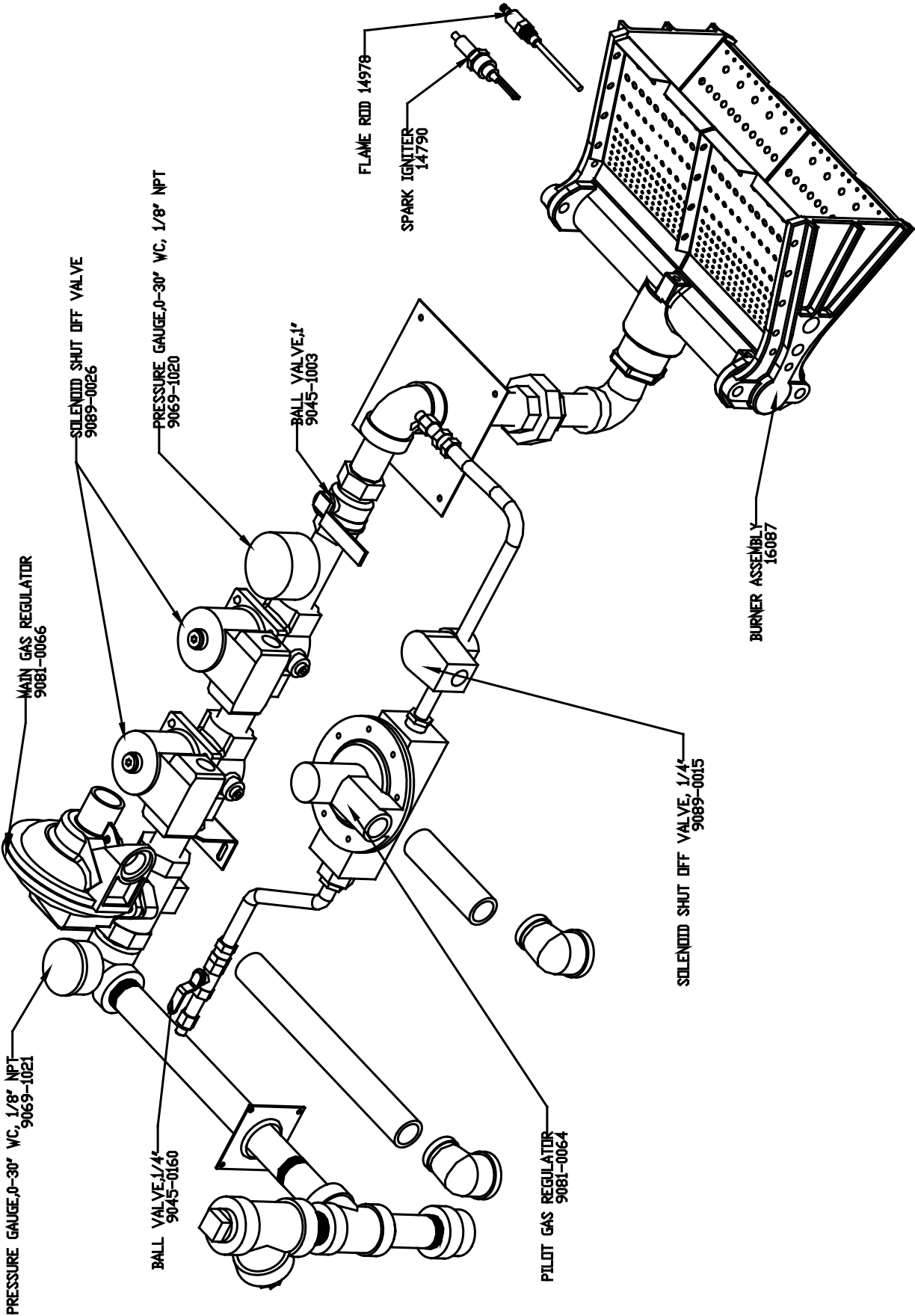
208/440Vac 3 phase Part # 17439-02



575Vac 3 phase Part # 17439-03

Other Parts

- Alarm Light, red Part # 9076-0032
- Hour meter Part # 9069-0013
- Ignition wire assembly, 21" long, Part # 13142-04
- Flame rod wire assembly, 22" long, Part # 15165-04



NOTES

This image shows a full page of blank graph paper. The grid consists of small, equal-sized squares formed by thin black lines. There are no margins, text, or other markings on the page.

For further assistance, please call 1.855.244.3128

WARRANTY: Under normal use the Company warrants to the purchaser that defects in material or workmanship will be repaired or replaced without charge for a period of 84 months on SwitchBlade® heaters, 60 months on control panels, and 12 months on all other Fastrax® products, from date of shipment. Any claim for warranty must be reported to the sales office where the product was purchased for authorized repair or replacement within the contract terms.

Subject to State or Provincial law to the contrary, the Company will not be responsible for any expense for installation, removal from service, transportation, or damages of any type whatsoever, including damages arising from lack of use, business interruptions, or incidental or consequential damages.

The Company cannot anticipate or control the conditions of product usage and therefore accepts no responsibility for the safe application and suitability of its products when used alone or in combination with other products. Tests for the safe application and suitability of the products are the sole responsibility of the user.

This warranty will be void if, in the judgment of the Company, the damage, failure or defect is the result of:

- Vibration, radiation, erosion, corrosion, process contamination, abnormal process conditions, temperature and pressures, unusual surges or pulsation, fouling, ordinary wear and tear, lack of maintenance, incorrectly applied utilities such as voltage, air, gas, water, and others or any combination of the aforementioned causes not specifically allowed for in the design conditions
- Or, any act or omission by the Purchaser, its agents, servants or independent contractors which for greater certainty, but not so as to limit the generality of the foregoing, includes physical, chemical or mechanical abuse, accident, improper installation of the product, improper storage and handling of the product, improper application or the misalignment of parts.

No warranty applies to paint finishes except for manufacturing defects apparent within 30 days from the date of installation.

The Company neither assumes nor authorizes any person to assume for it any other obligation or liability in connection with the product(s).

The Purchaser agrees that all warranty work required after the initial commissioning of the product will be provided only if the Company has been paid by the Purchaser in full accordance with the terms and conditions of the contract.

The Purchaser agrees that the Company makes no warranty or guarantee, express, implied or statutory, (including any warranty of merchantability or warranty of fitness for a particular purpose) written or oral, of the Article or incidental labour, except as is expressed or contained in the agreement herein.

LIABILITY: Technical data contained in the catalog or on the website is subject to change without notice. The Company reserves the right to make dimensional and other design changes as required. The Purchaser acknowledges the Company shall not be obligated to modify those articles manufactured before the formulation of the changes in design or improvements of the products by the Company.

The Company shall not be liable to compensate or indemnify the Purchaser, end user or any other party against any actions, claims, liabilities, injury, loss, loss of use, loss of business, damages, indirect or consequential damages, demands, penalties, fines, expenses (including legal expenses), costs, obligations and causes of action of any kind arising wholly or partly from negligence or omission of the user or the misuse, incorrect application, unsafe application, incorrect storage and handling, incorrect installation, lack of maintenance, improper maintenance or improper operation of products furnished by the Company.



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