Fastrax™
Track and Switch Heaters

Certified System ISO 9001

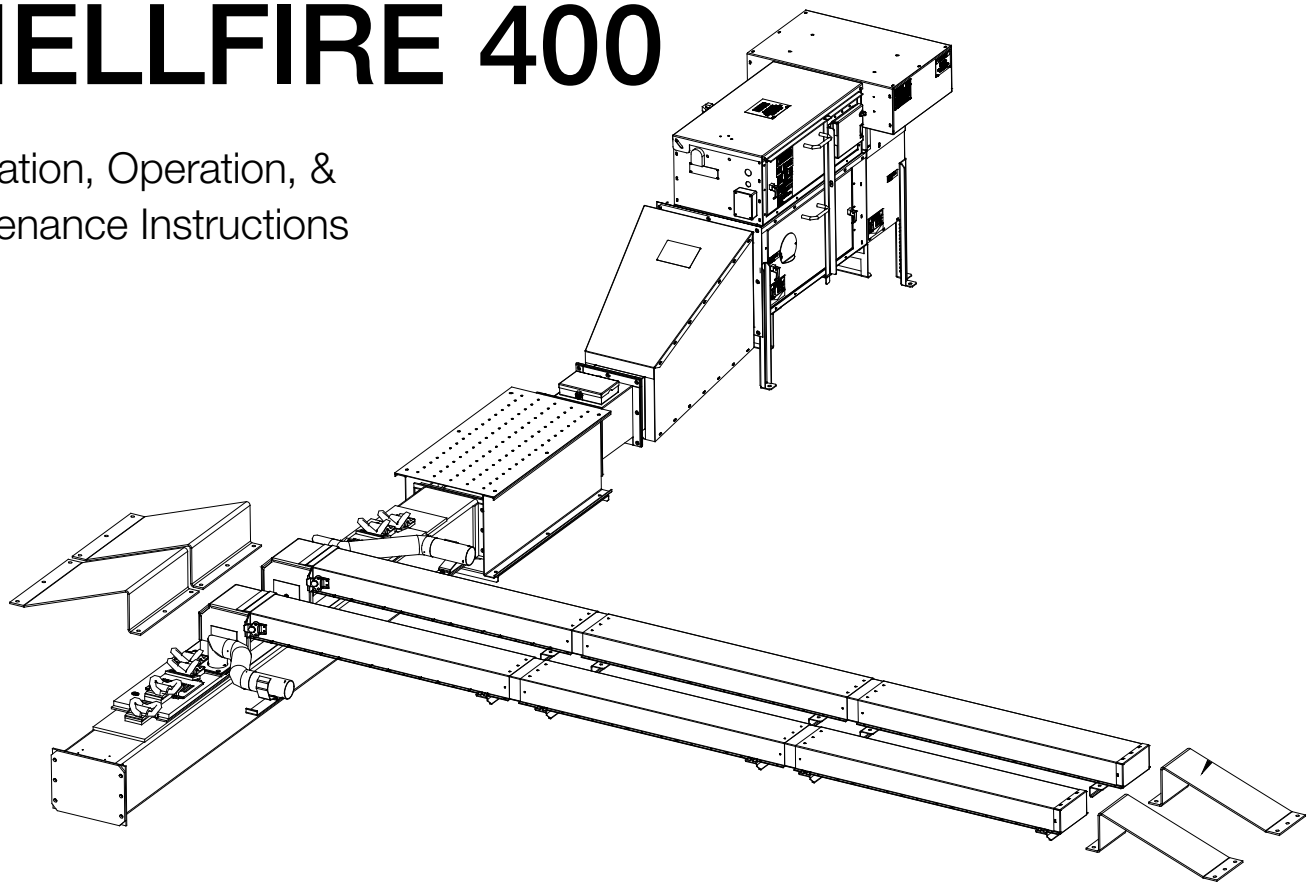
IMPORTANT INSTRUCTIONS - SAVE THESE INSTRUCTIONS

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 400

Installation, Operation, & Maintenance Instructions



ANSI Z83.7b-2009 / CSA 2.14b-2009
Gas Fired Unvented Construction Heaters (Unattended Type)

CCI Thermal Technologies INC.
Heating and Filtration Solutions

Part No. HF18601Rev.4.00 Issued March 2017 Printed in Canada

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A. IMPORTANT NOTICES AND WARNING SYMBOLS

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 the manufacturer.

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/CGA 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 of gas source. Call qualified service technician to repair leak.
	Retain manual for future reference.

B. SPECIFICATIONS

B.1 Performance

The HELLFIRE 400 switch heater is recommended for clearing ice and snow from switches with no longer than 18 - 40 ft of moving rail from heel to point of switch. It is rated with an output of 200,000 to 400,000 BTU/HR, on propane or natural gas.

The fan is direct driven at 3450 rpm, which draws 7 amps maximum at 240Vac and delivers 1500 scfm.

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)	200,000 - 400,000 (58.5 - 117)	200,000 - 400,000 (58.5 - 117)
Manifold pressure, Inches of water (kPa)	1.3 - 5.0 (0.32 - 1.23)	2.3 - 11.0 (0.56 - 2.69)
Inlet pressure, psig (kPa)	7 - 14 (1.72 - 3.45)	12 - 14 (2.95 - 3.45)

Gas Conversions

1. 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 in Table 1 - Firing Specifications. 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	7.5	60
208	3	7.3	60
460	3	3.6	60
575	3	3.0	60

Construction

- 14 ga galvanized steel blower, intake, and duct work
- Stainless steel combustion chamber / transition duct
- Direct drive centrifugal fan
- Match balanced motor and impeller sets to less than 0.2 ips peak to peak

B.3 Gas Supply

- Allowable nominal supply pressure, 12 - 14 in. H_20 with all connected loads operating. Inlet gas fitting, ¾" NPT female. Supply not to exceed 20 in. H_2O. Higher pressures prevent gas from opening.

B.4 Controls

- Direct Spark Ignition System
- 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 3000Vac 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. Loss of flame - The Ignition Module closes the gas valve, if after the trial for ignition period of 6 seconds no flame is sensed, or if flame detection is lost for more than 1 second during normal operation.

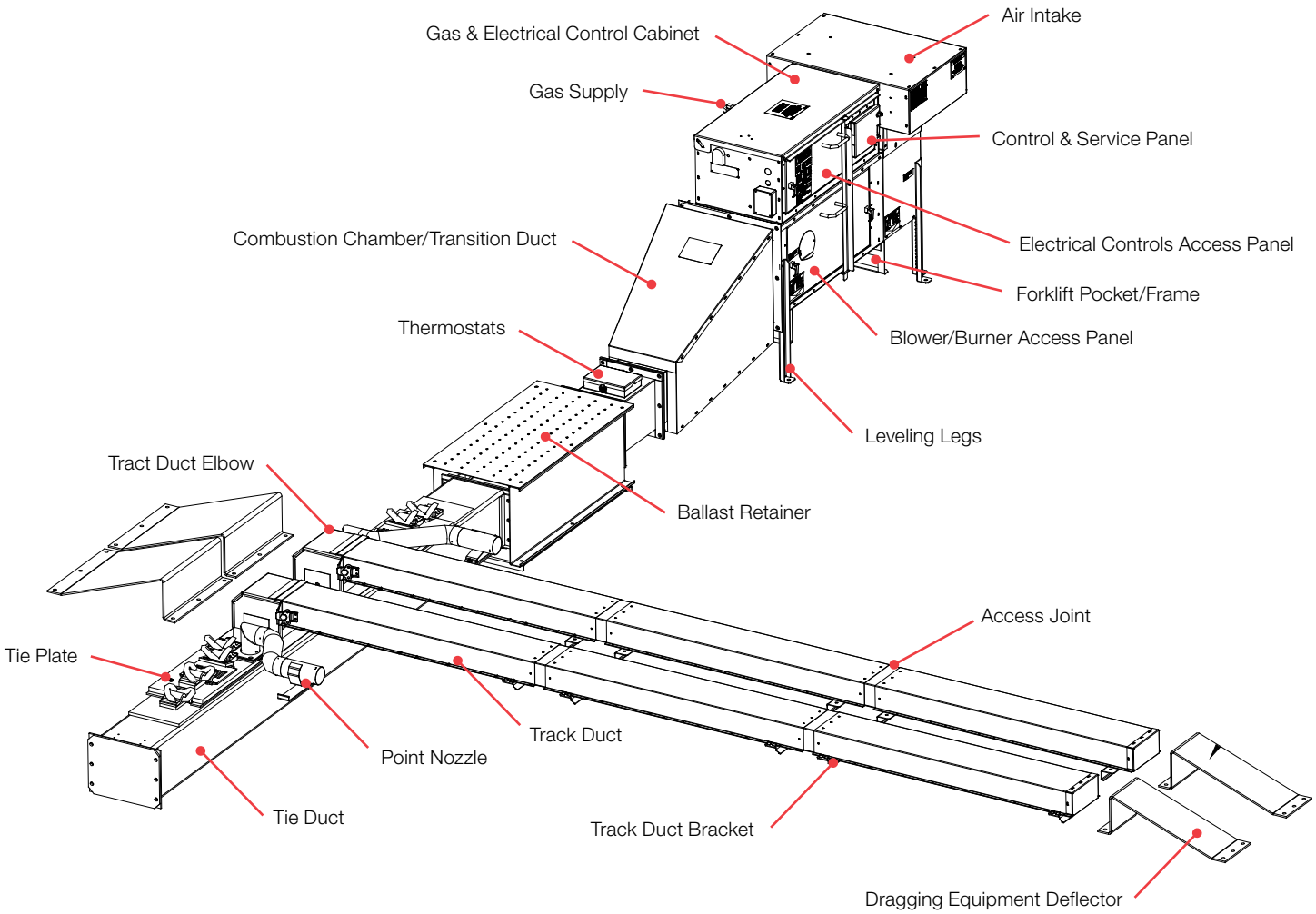
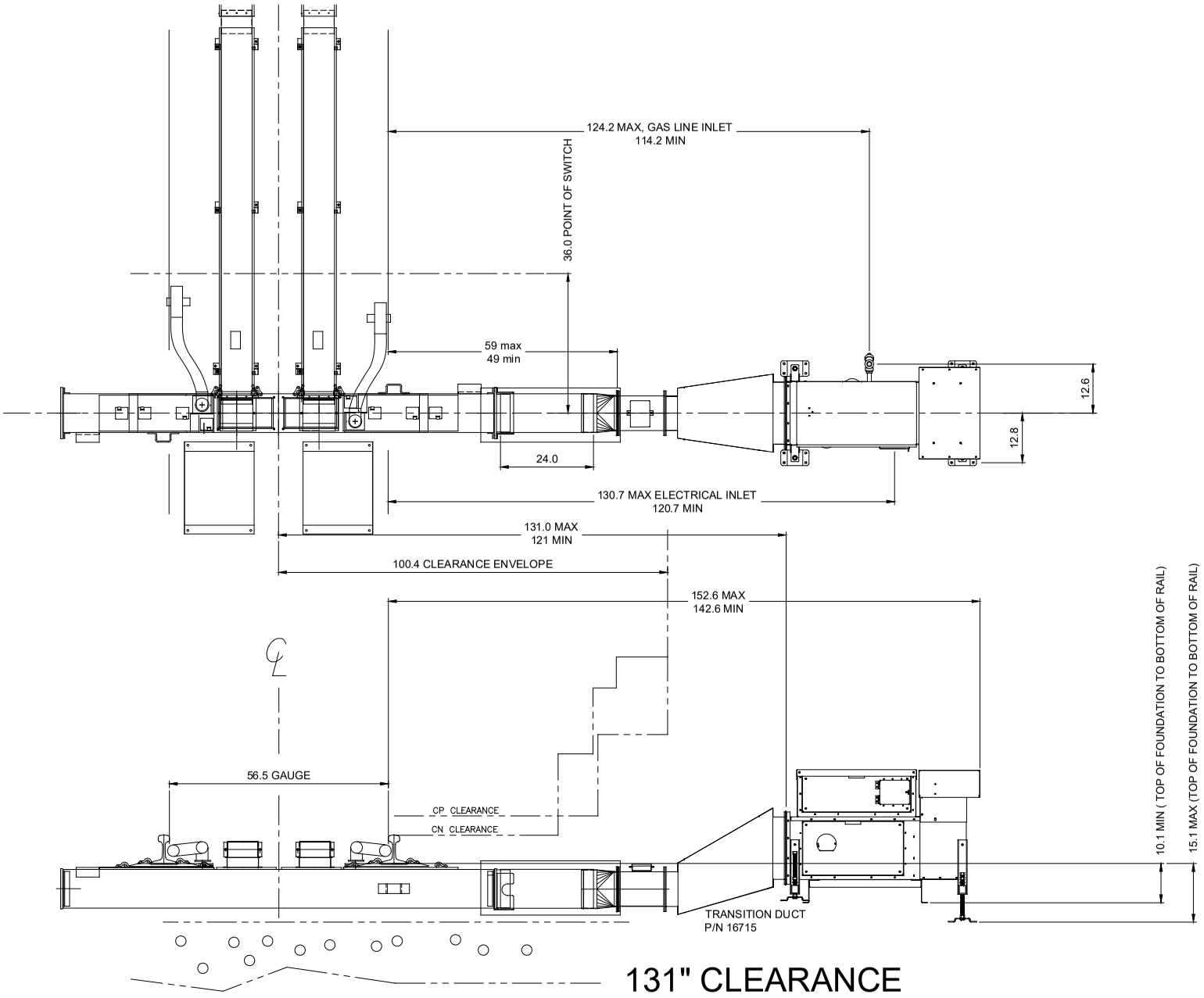
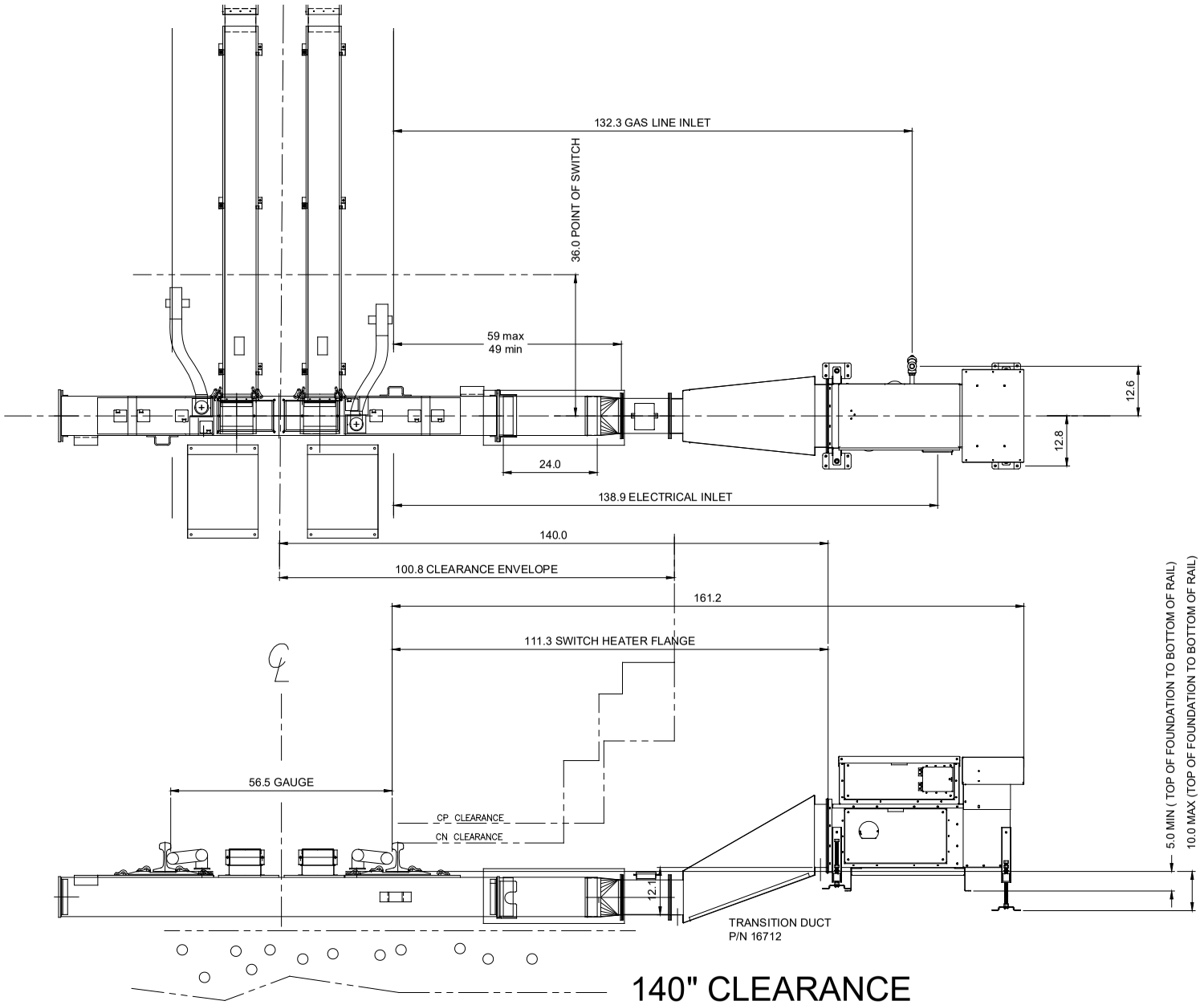


Figure 1 – HELLFIRE 400 Diagram

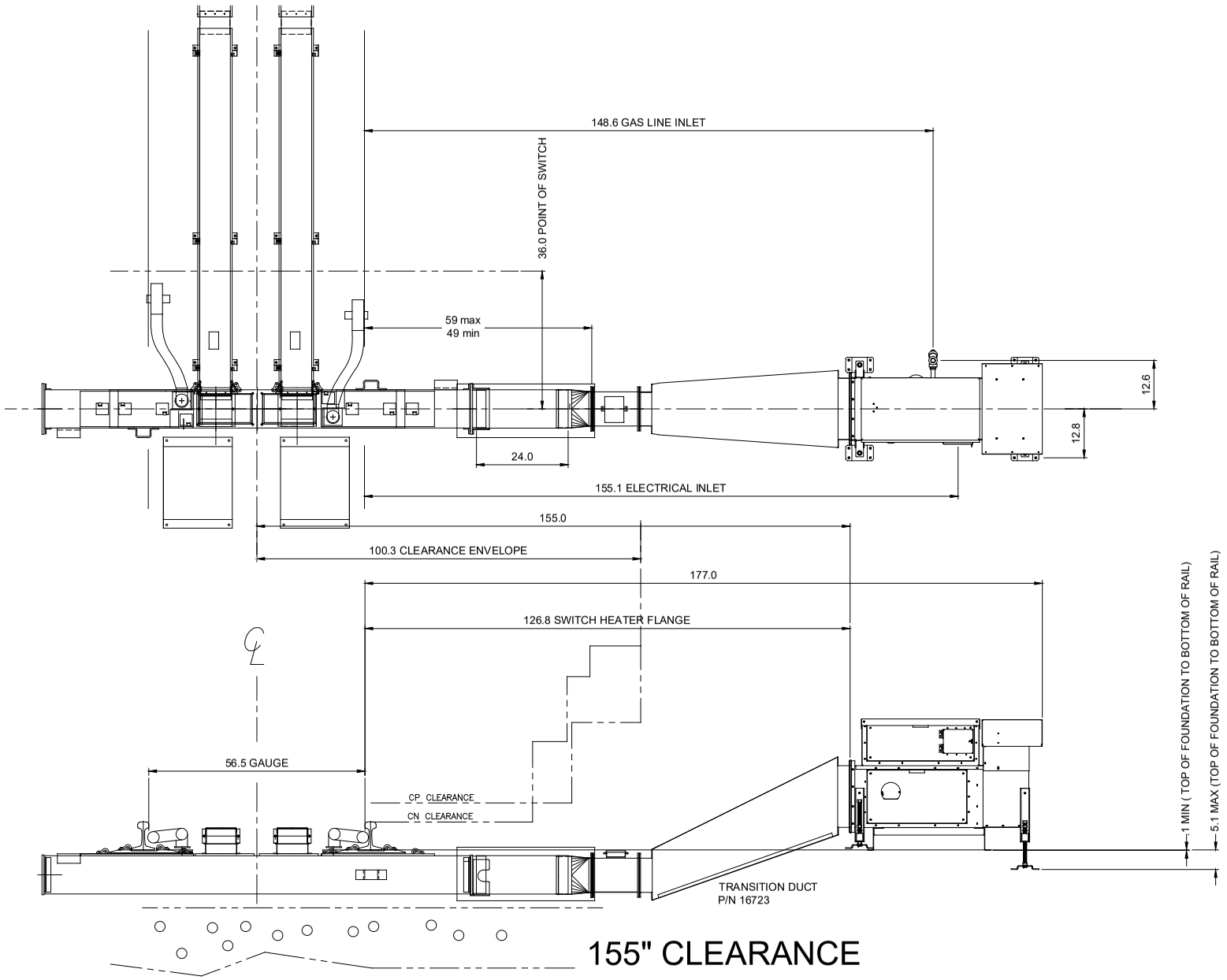


131" CLEARANCE



140" CLEARANCE

Part No. HF18601



155" CLEARANCE

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 ¾" 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

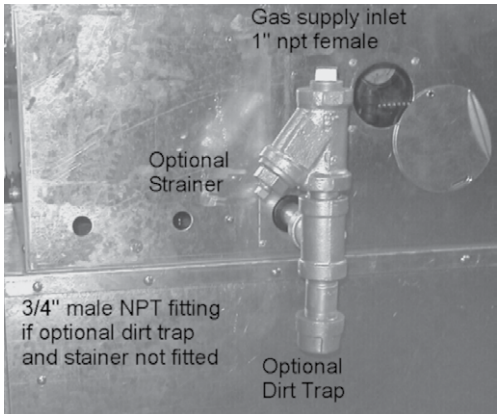
1. Heater ships on a pallet separate from the cross and track ducting.
   - 1.1 Remove heater from packaging.
   - 1.2 Lift heater, 435 lbs, using the lift pockets and place on foundation.
   - 1.3 Adjust leveling legs to level heater and align the flange with the transition duct flange.
   - 1.4 Fasten 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 The recommended supply gas pressure is 7 - 14 in. H_2O, with all connected loads operating.
   - 1.2 The minimum recommended supply pipe size is ¾". The actual pipe size should be determined based on the length of run, the total demand of all the connected loads, and a maximum pressure drop of 10%.

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

   - 1.3 The heater is supplied with an internally mounted combination valve/regulator and an external ¾" NPT male fitting. Correct installation will include a dirt trap and strainer that may be supplied as an option with the Hellfire 400.
   - 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.

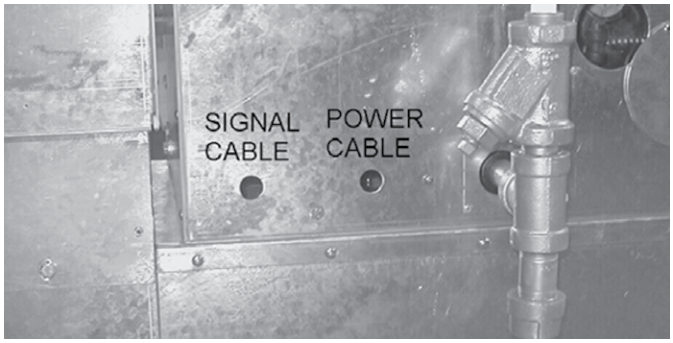
C.7 Wiring

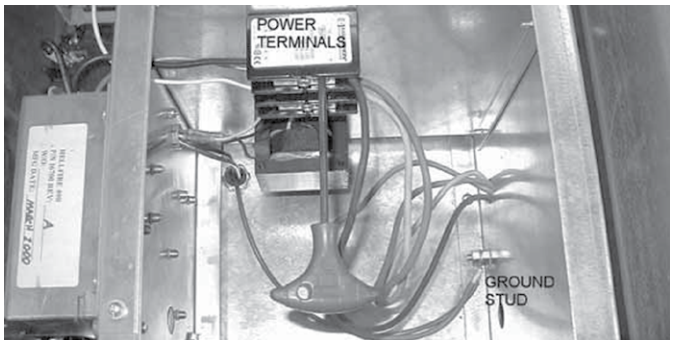
WARNING. Disconnect power at source.

1. Single Phase and Three Phase Wiring

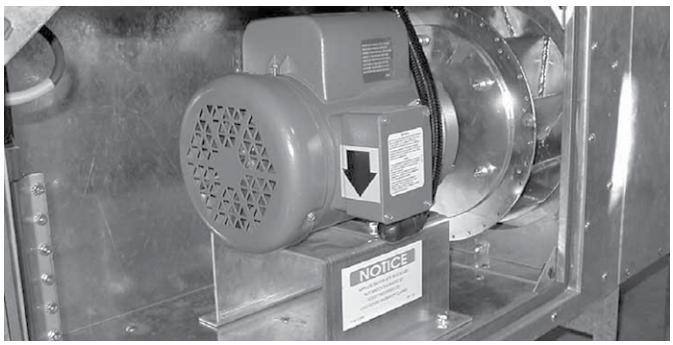
1.1 Bring power and signal cables to the rear of the unit. A 7/8" diameter hole is provided, punch a larger opening if required to suit conduit.

1.2 Pass signal wires through opening to the electrical panel, to the AAR terminal strip of the unit. Terminate power cables to terminal block and ground to grounding stud.





NOTE: Verify correct fan rotation with three phase power.



1.3 Turn off power to control panel by disconnecting the 5 amp panel breaker. Open the combustion chamber access panel. Note the fan rotation arrow.

1.4 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.

2. Power Service Conductor Sizing

2.1 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 Wiring Size, AWG *1					Recommended Circuit Breaker Size *4
	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

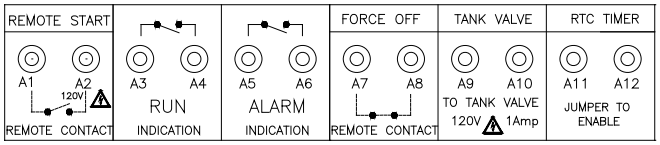
*1 - Standard SH power terminals will accept #14 to #2 AWG copper wire.

*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

3. Signal Wiring



3.1 Connect the signal cable to the AAR terminal block.

3.2 A contact closure across A1 and A2 starts the heater.

3.3 Provide an isolated contact for each heater. Do not gang A1 AND/OR A2 terminals together.

3.4 A3 and A4 provide RUN indication with a contact closure.

3.5 A5 and A6 provide an ALARM indication with a contact closure.

3.6 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.

3.7 A9 and A10 provide a switched 120V, 1 amp supply to operate a tank solenoid valve (only available with 240V and 208V systems).

3.8 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.

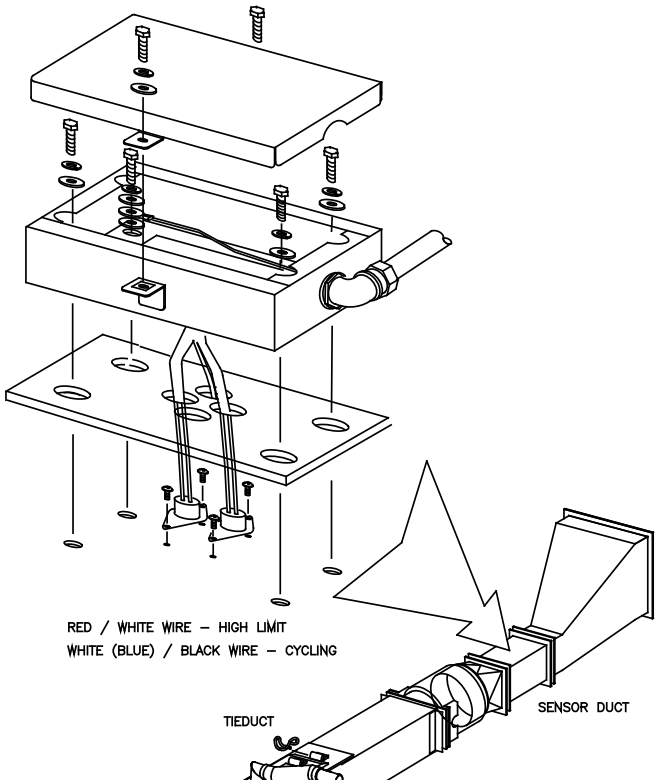
4. Local Safety Grounding

4.1 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 Thermostats

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.

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.

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:
   - 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.

   - 1.4 Adjust the spring to the midway point of the regulator.
   - 1.5 Turn on the gas supply 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 higher 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 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 ¼”
- ☐ 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 12 - 15 in. H_2O 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 Direct Spark Ignition (DSI) 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
     - Direct Spark Ignition trial for ignition sequence initiates
     - Main valve opens.
     - Flame established.
     - Run indication contact A3 to A4 closes

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 DSI is removed
- Main valve closes
- Flame extinguishes
- Fan continues to run
- When the temperature drops below the cycling thermostat set-point of 340°F the trial for ignition initiates
- Run indication to RTC stays on. A3 to A4 remains closed

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 DSI is removed
- Main valve closes
- Flame extinguishes
- Post purge time (approximately 4 minutes)
- Fan turned off
- Run indication to RTC stays on. A3 to A4 remains closed

Once the rail temperature drops below the set point of 38°F the heater follows the start up 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 DSI is removed.
- Main valve closes
- Flame extinguishes
- Post purge time (approximately 4 minutes)
- Fan turns 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:

- DSI automatically starts sparking and attempts to ignite the flame again
- If flame established
    - Main and safety solenoid valve opens
    - Heater runs

D.2 If no flame signal is established:

- DSI closes the main valve
- DSI activates the ALARM relay
- Alarm light lit
- LOGO removes request for heat
- Post purge time
- Fan off
- RUN Indication contact opens A3 to A4
- ALARM Indication contact closes A5 to A6

D.3 No flame signal on start up:

- DSI closes main valve, de-energize ignition transformer
- DSI activates ALARM relay
- Alarm light lit
- LOGO removes request for heat
- Post purge time
- Fan off
- RUN Indication contact opens A3 to A4
- ALARM Indication contact closes A5 to A6

D.4 Air switch opens during RUN period:

- LOGO removes request for heat
- Main valve closes
- Post purge time
- Fan off
- RUN Indication contact opens A3 to A4
- ALARM Indication contact closes A5 to A6

D.5 Motor thermal overload breaker trips:

- LOGO removes request for heat
- Main solenoid valve close
- Post purge time
- Fan off
- RUN Indication contact opens A3 to A4
- ALARM Indication contact closes A5 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 Heaters equipped with EMS or RESET module:

1. If the heater is equipped with an EMS or a reset module, the DSI will be reset up to three times within two minutes and then lock out. After the third attempt the heater will indicate Alarm to dispatch. The sequence of events is as follows:

- Normal running
    - FSR goes in alarm (no flame, air switch etc.)
    - Fan continues to run
    - Delay 20 seconds
    - EMS or RESET module resets DSI (Alarm indication light extinguished)
    - Normal start up and trial for ignition
- This can occur up to three times within 2 minutes. After that the EMS or RESET module locks out and will not reset the heater anymore. The LOGO shuts down the heater in the following sequence:
    - Request to DSI off
    - Post purge time
    - Fan off
    - RUN Indication contact opens A3 to A4
    - ALARM Indication contact closes A5 to A6

2. **CLEAR THE ALARM AND RESET THE HEATER BY TURNING PANEL POWER OFF OR RESET THE AGGRESSIVE RETRY MODULE.**

3. **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	DSI 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

4. 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

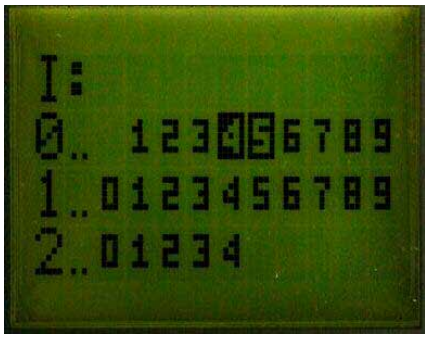
Table 4 – RTC Timer Configuration

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

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.

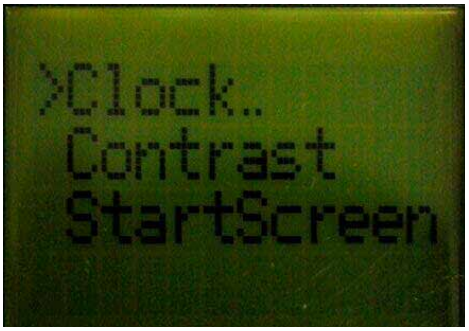
When a voltage is present on an input, or an output relay is energized, they are displayed as a black box with a light number inside, i.e. I4 and I5 shown.

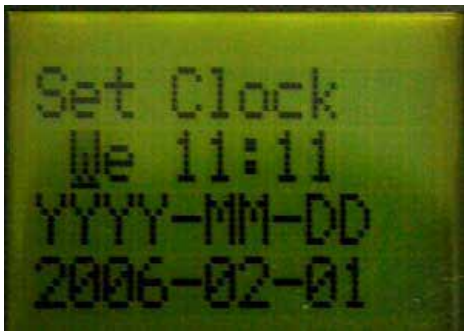
1. Set Time and Date:

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.

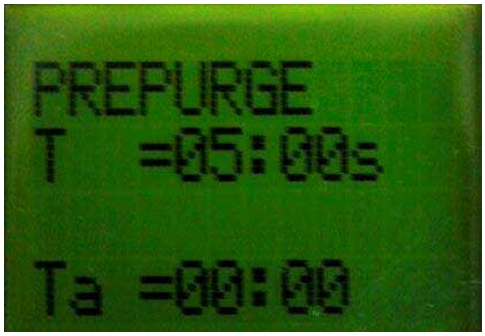
2. To access the field adjustable parameters, such as the timers and enables:

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.

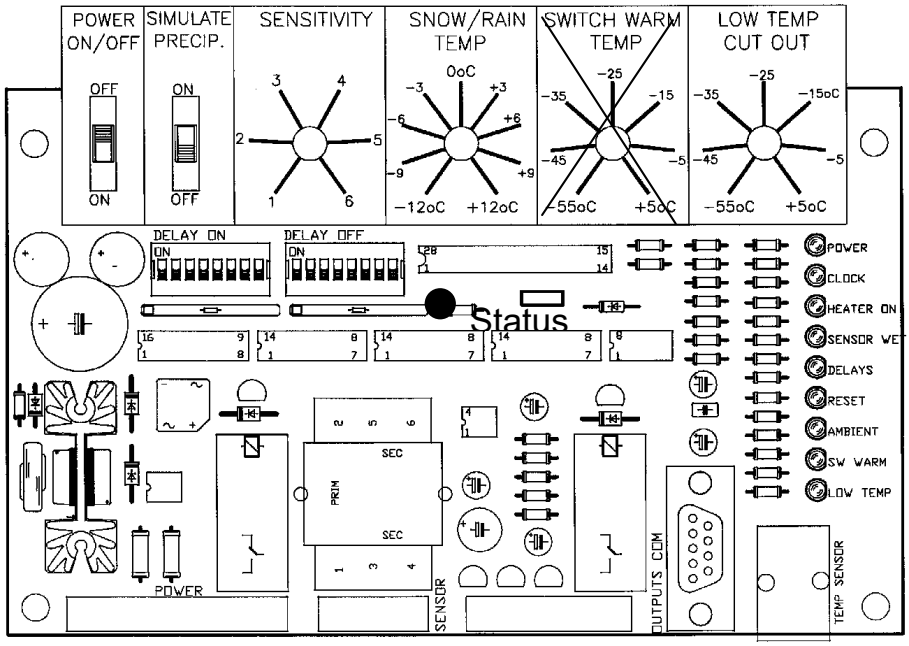
Table 5 – LOGO Displays

4 ALARMS FROM FSR, TURN POWER OFF ON	RAIL TEMP SWITCH OPEN, VER. 18504 C	CYCLING SWITCH OPEN
ALARM FSR CHECK GAS, FLAME ROD, SPARK PLUG	HIGH LIMIT SWITCH ON, CHECK HEATER	FSR DEFECT, NO POWER ON MAIN 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

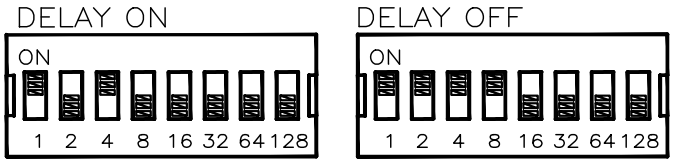
The EMS monitors the environmental conditions, by referencing the ambient temperature and a number of set points and will turn the heater on and off. It also includes an aggressive retry function that provides up to three resets of the FSR.

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.



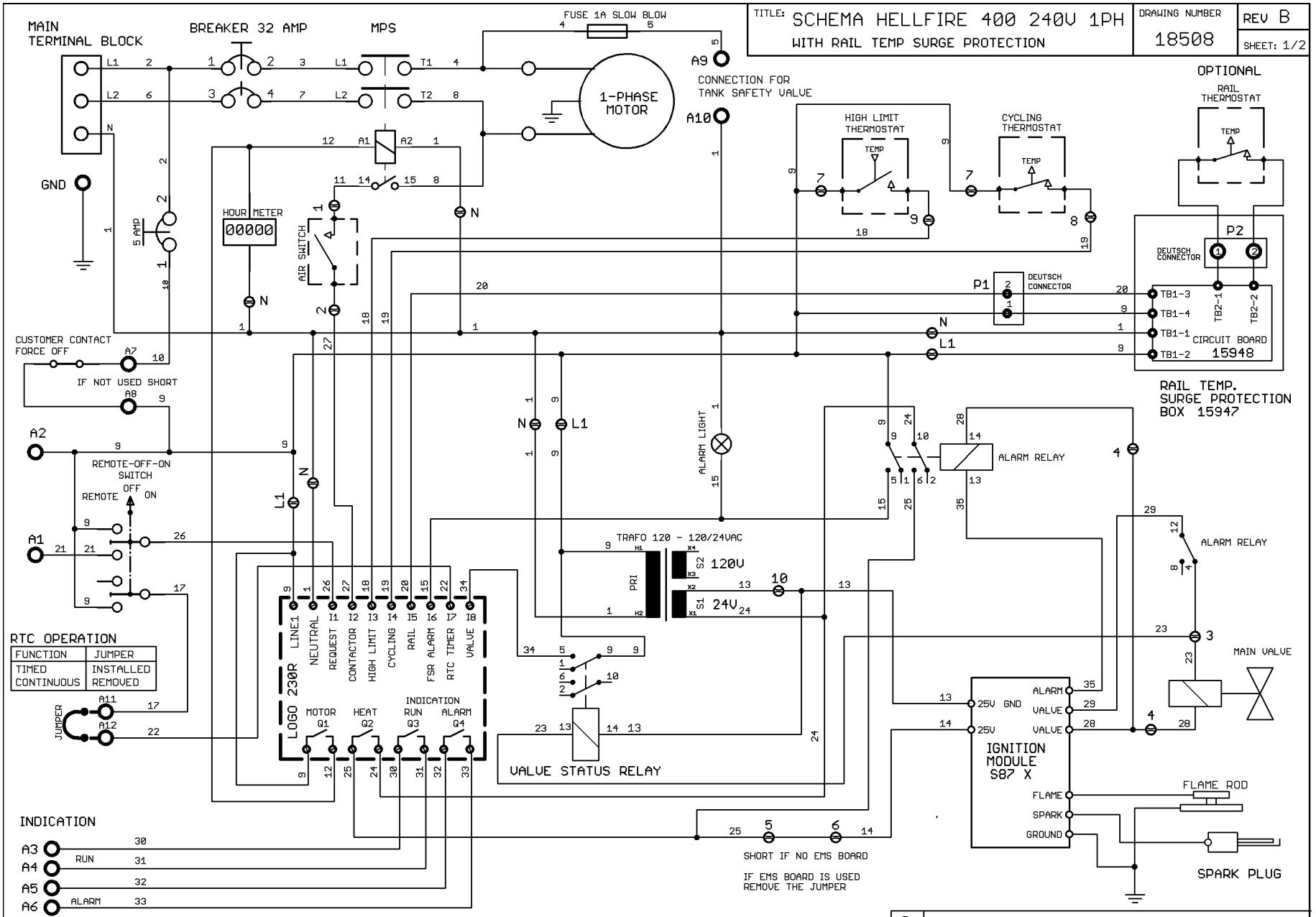
F.1 Switches and Dials

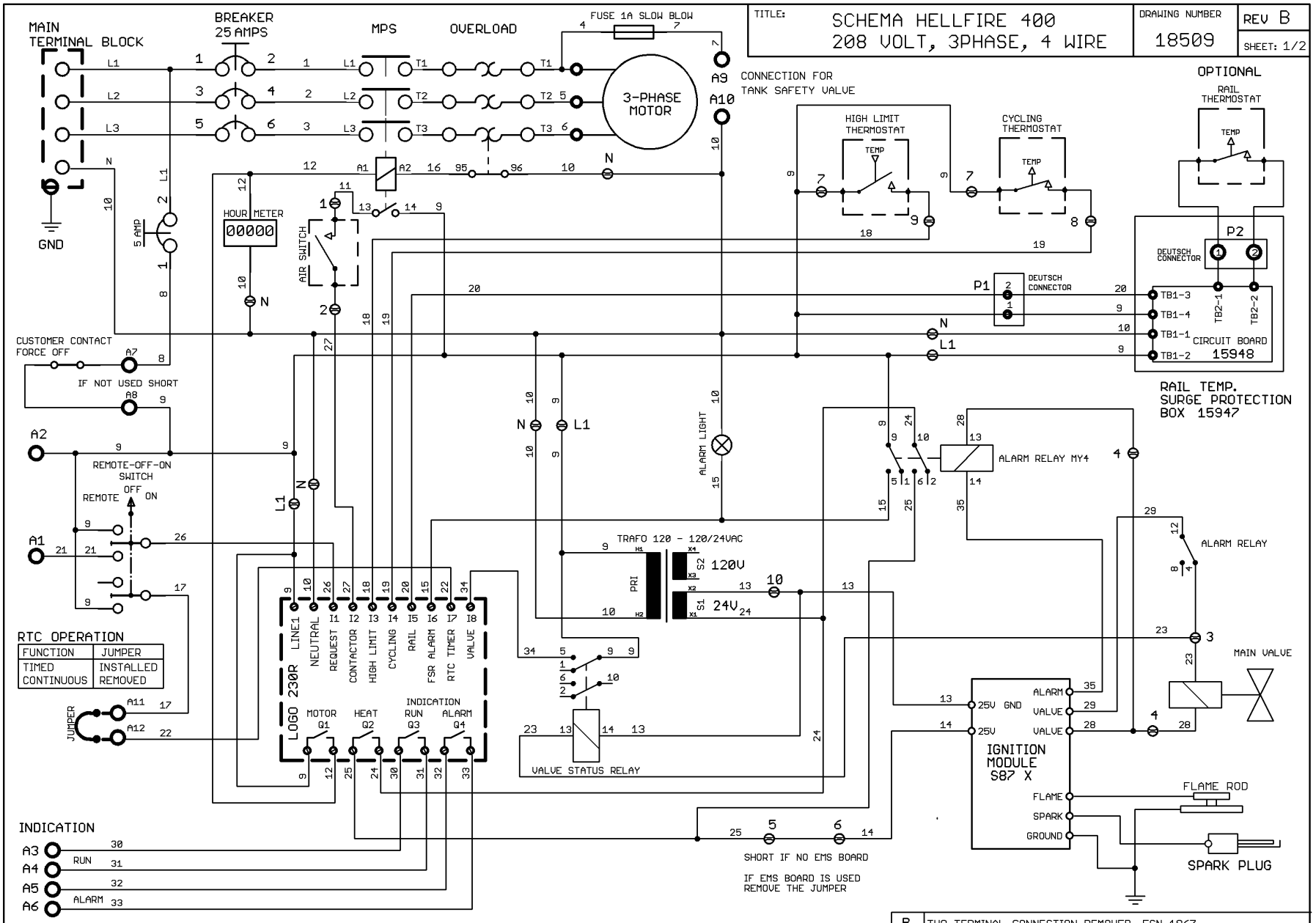
1. Power ON/OFF - This allows you to turn OFF / ON the EMS with all the functions of the EMS including aggressive retry of the heater. This switch is also used to reset the EMS in case of a lockout.
2. Simulate Precipitation ON/OFF - This is normally off. To simulate moisture (snow or rain) you can switch 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°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°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°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.



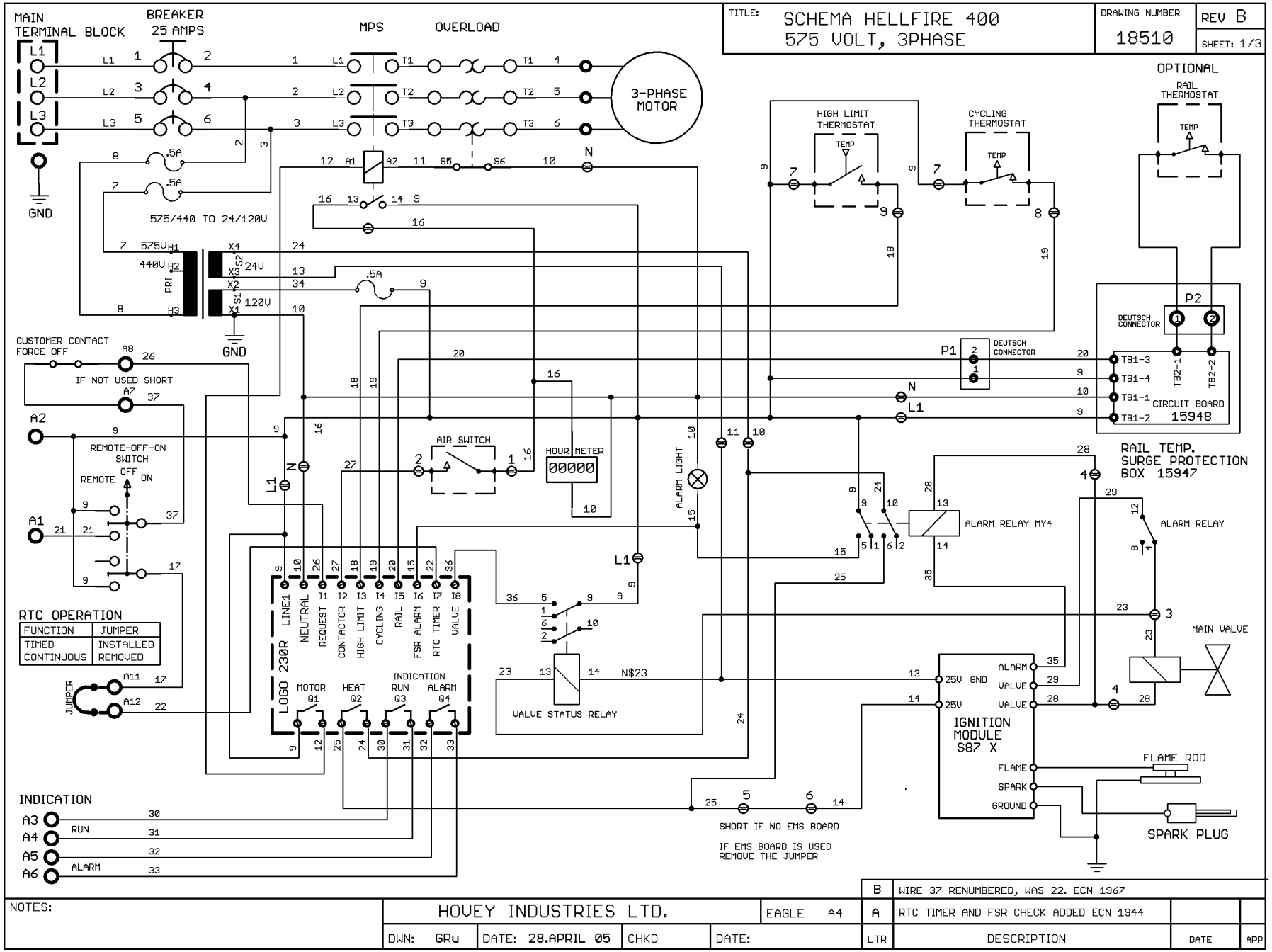
F.2 Status LED's

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

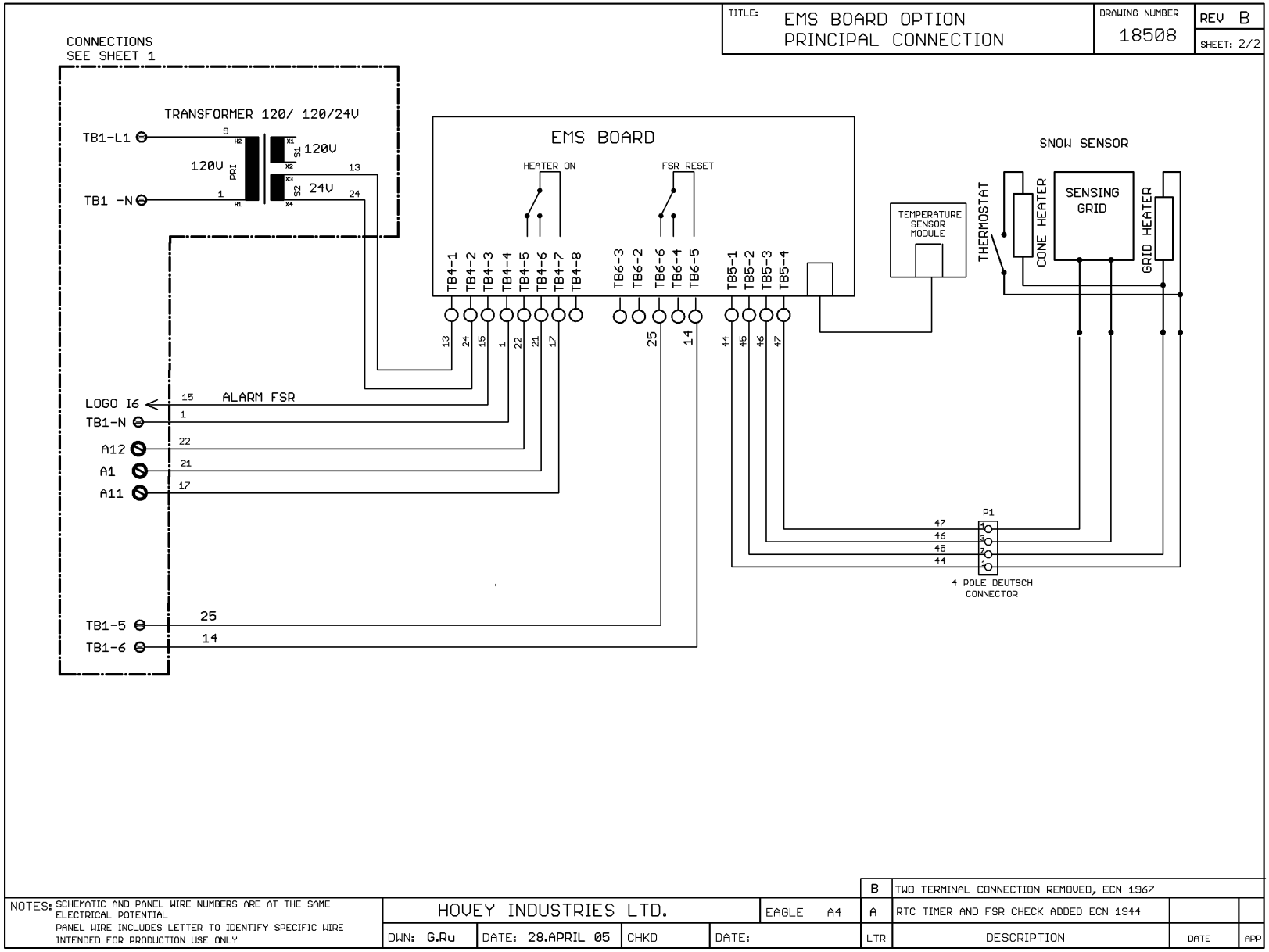

TITLE: SCHEMA HELLFIRE 400 240V 1PH
WITH RAIL TEMP SURGE PROTECTION
DRAWING NUMBER 18508
REV B
SHEET: 1/2
MAIN TERMINAL BLOCK
BREAKER 32 AMP
MPS
FUSE 1A SLOW BLOW
1-PHASE MOTOR
CONNECTION FOR TANK SAFETY VALVE
HIGH LIMIT THERMOSTAT
CYCLING THERMOSTAT
OPTIONAL
RAIL THERMOSTAT
HOUR METER
00000
AIR SWITCH
5 AMP
GND
DEUTSCH CONNECTOR
TB1-3
TB1-4
TB1-1
TB1-2
TB2-1
TB2-2
CIRCUIT BOARD 15948
RAIL TEMP. SURGE PROTECTION BOX 15947
CUSTOMER CONTACT FORCE OFF
IF NOT USED SHORT
REMOTE-OFF-ON SWITCH
REMOTE OFF ON
ALARM LIGHT
ALARM RELAY
TRAFO 120 - 120/24VAC
120V
24V
LOGO 230R
LINE1 NEUTRAL REQUEST CONTACTOR HIGH LIMIT CYCLING RAIL FSR ALARM RTC TIMER VALVE
MOTOR Q1 HEAT Q2 RUN Q3 ALARM Q4
INDICATION
VALVE STATUS RELAY
MAIN VALVE
IGNITION MODULE S87 X
25V GND
25V
ALARM
VALVE
FLAME
SPARK
GROUND
FLAME ROD
SPARK PLUG
RTC OPERATION
FUNCTION | JUMPER
TIMED | INSTALLED
CONTINUOUS | REMOVED
JUMPER
SHORT IF NO EMS BOARD
IF EMS BOARD IS USED REMOVE THE JUMPER
INDICATION
RUN
ALARM
NOTES:
HOVEY INDUSTRIES LTD.
EAGLE A4
DWN: GRu
DATE: 28.APRIL 05
CHKD
DATE:
B TWO TERMINAL CONNECTION REMOVED, ECN 1967
A RTC TIMER AND FSR CHECK ADDED ECN 1944
LTR DESCRIPTION DATE APP



Part No. HF18601


TITLE: SCHEMA HELLFIRE 400
575 VOLT, 3PHASE
DRAWING NUMBER 18510
REV B
SHEET: 1/3
MAIN TERMINAL BLOCK
BREAKER 25 AMPS
MPS
OVERLOAD
3-PHASE MOTOR
GND
575/440 TO 24/120V
.5A
HIGH LIMIT THERMOSTAT
CYCLING THERMOSTAT
TEMP
OPTIONAL
RAIL THERMOSTAT
P2
DEUTSCH CONNECTOR
TB1-3
TB1-4
TB1-1
TB1-2
TB2-1
TB2-2
CIRCUIT BOARD 15948
P1
CUSTOMER CONTACT FORCE OFF
IF NOT USED SHORT
REMOTE-OFF-ON SWITCH
REMOTE
OFF
ON
AIR SWITCH
HOUR METER
00000
ALARM LIGHT
ALARM RELAY MY4
ALARM RELAY
RAIL TEMP. SURGE PROTECTION BOX 15947
RTC OPERATION
FUNCTION | JUMPER
TIMED | INSTALLED
CONTINUOUS | REMOVED
JUMPER
LOGO 230R
LINE1
NEUTRAL
REQUEST
CONTACTOR
HIGH LIMIT
CYCLING
RAIL
FSR ALARM
RTC TIMER
VALVE
INDICATION
MOTOR Q1
HEAT Q2
RUN Q3
ALARM Q4
VALVE STATUS RELAY
N$23
MAIN VALVE
IGNITION MODULE S87 X
25V GND
25V
ALARM
VALVE
FLAME
SPARK
GROUND
FLAME ROD
SPARK PLUG
SHORT IF NO EMS BOARD
IF EMS BOARD IS USED REMOVE THE JUMPER
INDICATION
A3
A4 RUN
A5
A6 ALARM
NOTES:
HOVEY INDUSTRIES LTD.
EAGLE A4
DWN: GRu
DATE: 28.APRIL 05
CHKD
DATE:
B WIRE 37 RENUMBERED, WAS 22. ECN 1967
A RTC TIMER AND FSR CHECK ADDED ECN 1944
LTR DESCRIPTION DATE APP

Wiring diagram for EMS Board Option



(240V transformer connections shown)

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.

G.2 Gas Supply Pressure

1. All HELLFIRE switch heaters are factory tested at 14 in. H_2O 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 12 - 14 in. H_2O, adjust supply pressure as required. Operating pressures above 14 or 12 in. H_2O may necessitate readjustment of manifold gas pressure.

NOTE: Gas valve will not open when gas supply exceeds 20 in. H_2O.

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 Direct Spark Ignitor (DSI)

1. Ensure that adequate gas pressure is available.
2. Voltage to the DSI should be between 20.5 and 28.5 Vac.
3. Ensure that all wiring connections are clean and tight.
4. Check that the fuse on the control module is not blown.
5. As a further check, close the manual gas valve, during normal operation. The FLAME will go out, and within 3 seconds, the red ALARM LED will light, and the DSI will safety shutdown and lockout. Open the manual gas shutoff valve, the DSI will remain locked out, the main gas valve will remain closed, and the burner will remain unlit.
6. For further information, see the Honeywell S87 series direct spark ignitor 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 microammeter set to measure 0 - 25 icoamps. Disconnect the ground wire at the DSI. Connect the positive meter lead to the free end of the ground wire. Connect the negative meter lead to the quick-connect ground terminal on the DSI. With no flame present the meter will read 0 microamps, this value will increase to between 2 and 10 microamps when a flame is established.

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 DSI and the heater will restart.

G.7 Air Switch Calibration

2. 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 DSI to safety shutdown. Remove the air intake blockage, replace the red dust cap and reset the heater by opening the 5 amp breaker for at least 10 seconds.

G.8 High Temperature Limit

1. Turn the service breaker “Off”.
2. 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.
3. Open the 5 amp breaker, reconnect the cycling thermostat, and close the 5 amp breaker.

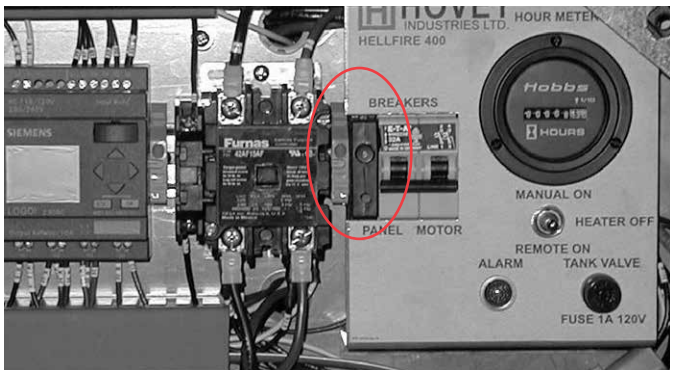
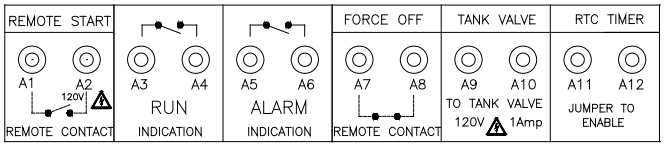


Figure 1 – High Limit Reset Button

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

1. Shorting A1 and A2 together will start the heater when the mode selector switch is in “REMOTE”. Check for 120VAC on terminal A1. 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.
1. When the heater is in alarm, check for continuity between A5 and A6. Resetting the alarm will open the contact across A5 to A6.
1. 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.
1. Check for 120V across A9 and A10 when the heater is running. This is valid only on 240V and 208V systems.
1. With the jumper in place, between A11 and A12, the RTC request for heat will be timed. This time is adjustable in the LOGO timer B50. If jumper is removed the heater will run as long as it is requested from RTC, EMS or MANUAL switch.



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 and empty any dirt build up. Replace cap. Turn on gas supply 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 Lubercation

The motor has sealed bearings and does not require lubrication.

H.3 Flame Rod and Spark Igniter Removal

WARNING. Disconnect power to unit.

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

Figure 2 – Flame Rod and Spark Removal

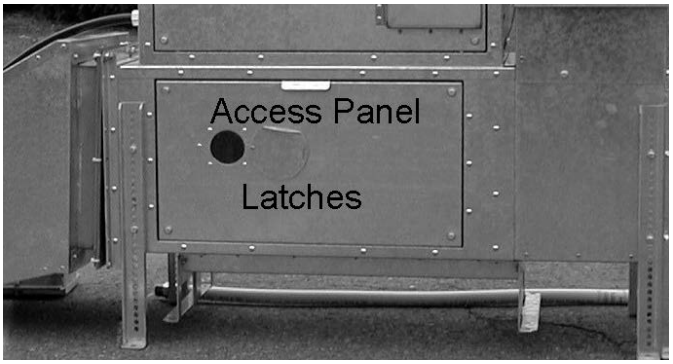


Figure 3 – Flame Rod and Spark Removal

2. Using a ½" wrench loosen the 4 latches (bolts) and remove the access panel from the side of the combustion chamber. If the panel is fitted with quick release handle, pull and turn them to remove the access panel.

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.

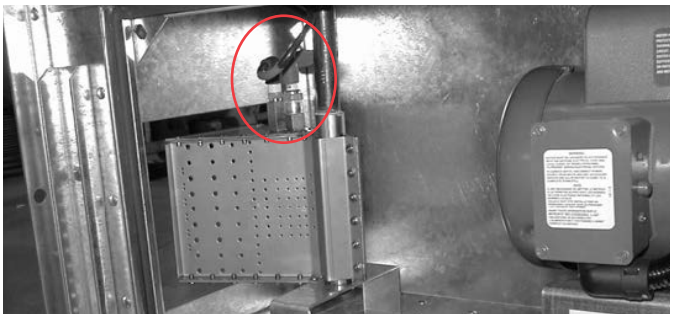


Figure 4 – Flame Rod Location

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.

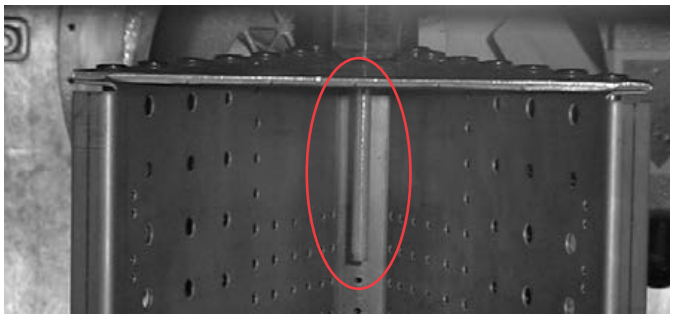


Figure 5 – Spark Ingitor

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.

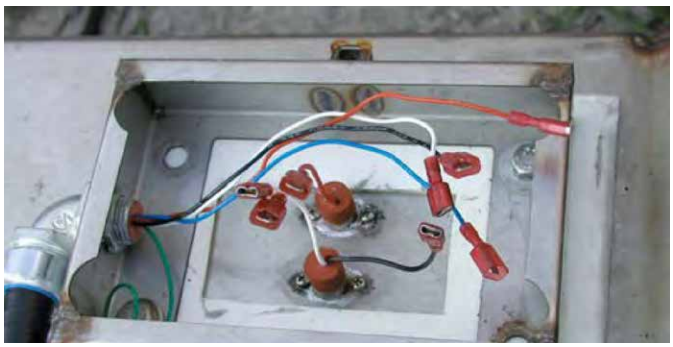


Figure 6 – Thermostat Wire Connections

Figure 7 – 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.

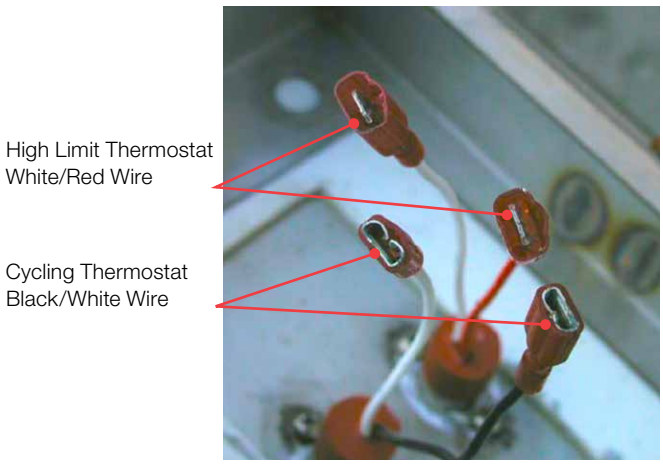


Figure 8 – Thermostat Wire Connections

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

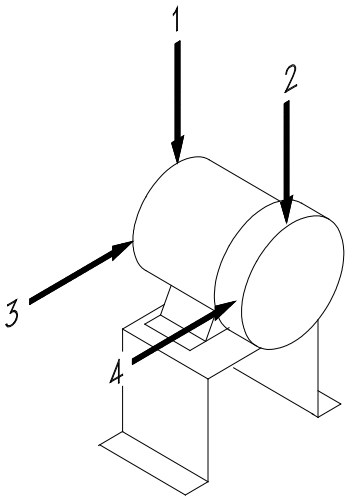


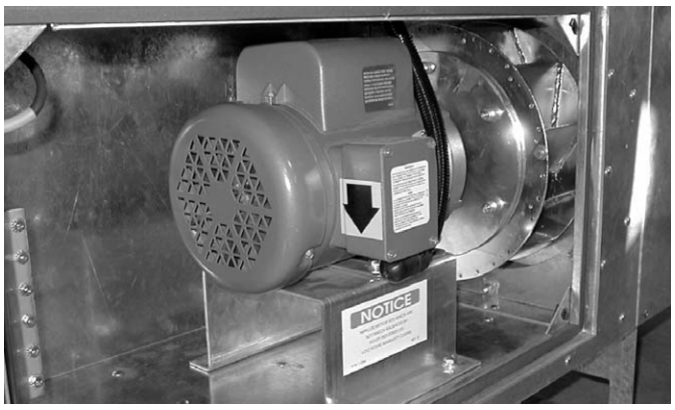
Figure 9 – Motor Reference

- 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 locations1, 2, 3 and 4 on motor to ensure repeatable measurements for trend analysis.
- Do not measure on covers or guards.

H.6 Motor/Impeller Removal

WARNING. Disconnect power prior to removal.

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



1. Combustion ChamberRemove the combustion chamber access panel to gain access to the motor. Open the motor junction box and disconnect all wiring.

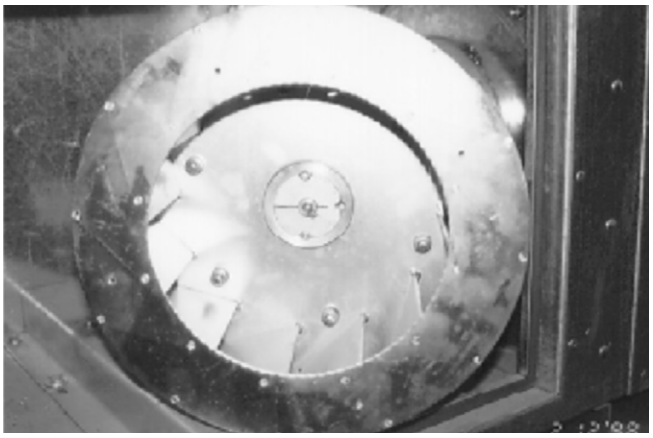


Figure 10 – Motor/Impeller Assembly

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

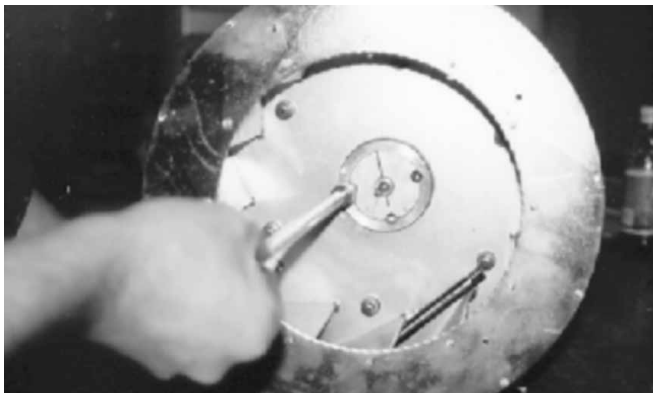


Figure 11 – Motor/Impeller Assembly Removal

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.

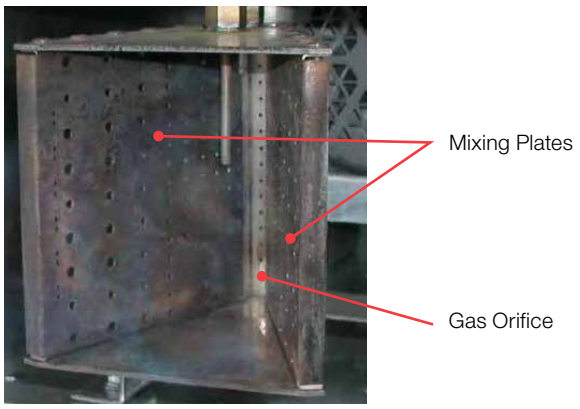


Figure 12 – Burner Maintenance

I. ACCESSORY INSTALLATION

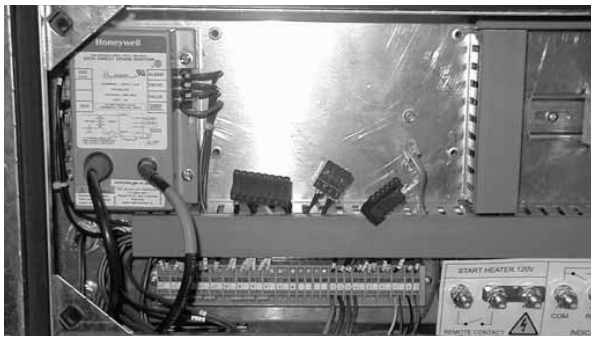
I.1 Energy Management System (EMS)

The HELLFIRE 400 comes pre-wired ready to accept EMS options.

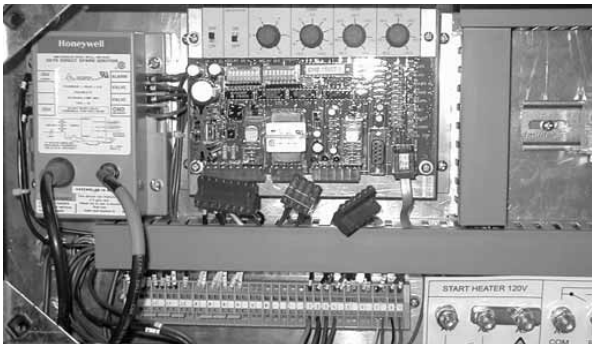
WARNING. Disconnect power prior to installation of any EMS options.

1. EMS Printed Circuit Board (PCB)

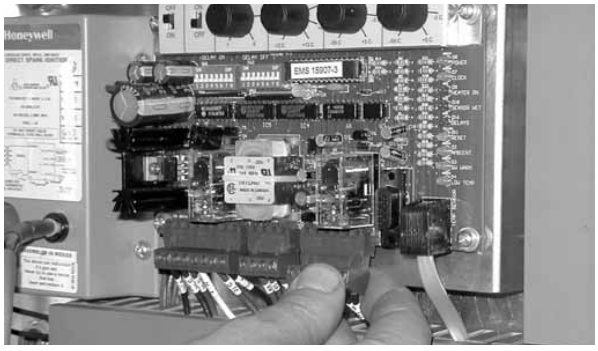
1.1 Remove access panel and raise lid.



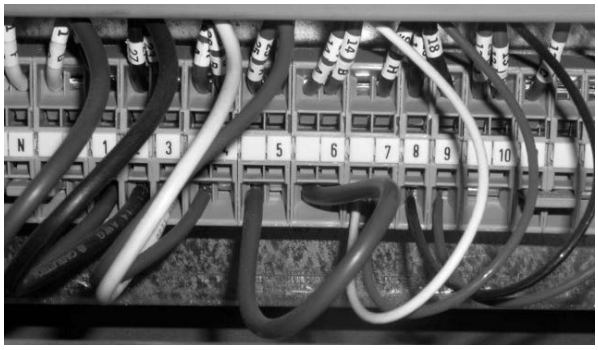
1.2 Mount the EMS circuit board in the space provided, right of the Direct Spark Ignition module.



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

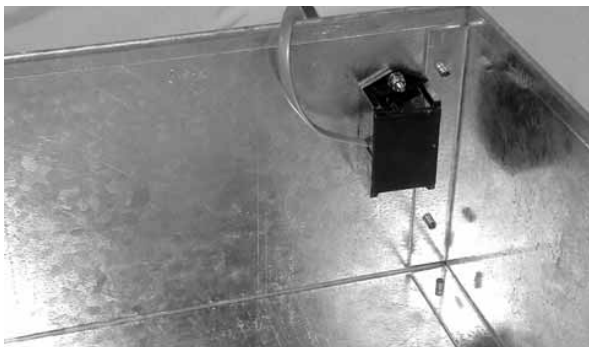


1.4 Remove jumper wire on TB1 (grey WECO terminal block) contact 5 to 6. This enables the EMS to reset the DSI in case of an alarm situation.



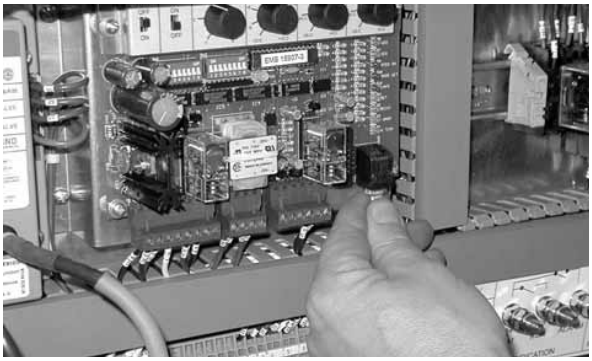
2. Ambient Temperature Sensor

2.1 Mount the temperature sensor inside the control panel on the two studs.



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

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



3. Precipitation Detector

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

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

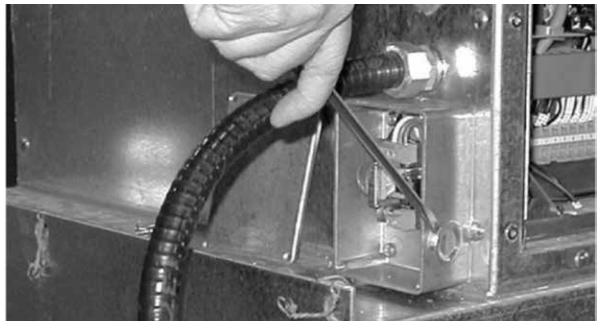
3.2 Insert jack into mating connector.

3.3 Mount the detector on the transition duct to sensor duct flange.

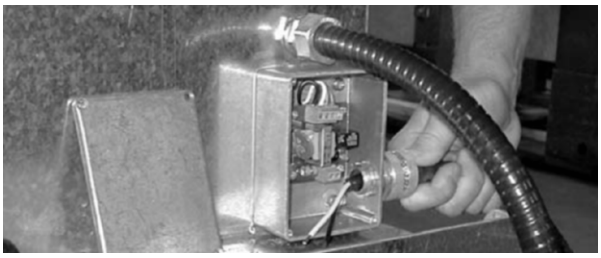
4. Rail Thermostat

This option works independently of the snow detection. The EMS board is not required. The rail thermostat regulates the heater by turning it off when the rail temperature exceeds 45°F and turns the heater back on when the rail temperature drops below 37°F.

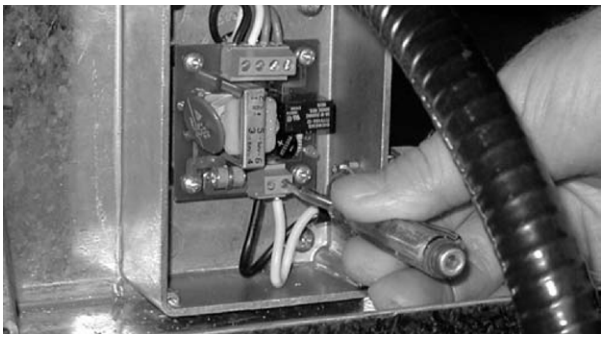
4.1 Remove the four (4) phillips screws, the cover, and the plug from the hole in the rail temperature surge protection box.



4.2 Pass the two (2) wires from the rail temerature sensor through the hole, install the locknut and tighten.



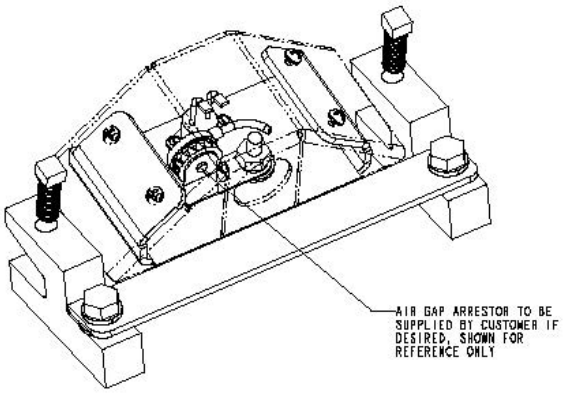
4.3 Insert, one each of the bared wires into the two terminals (green) on the surge suppression circuit board, and tighten the locking screws. Polarity is not critical.



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

4.5 A jumper for troubleshooting and summer testing is located inside the electrical component area, hanging immediately under the DSI.

4.6 If, the optional air gap arrester is installed, as per assembly drawing 17894, connect the ground wire to one of the board mounting screws.



4.7 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.

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

4.9 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 Main Service Surge Arrester

The optional Main Service Surge Arrester is to be installed in parallel with the main 240 Vac power supply. Please contact CCI Thermal for recommended arresters for other voltages.

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

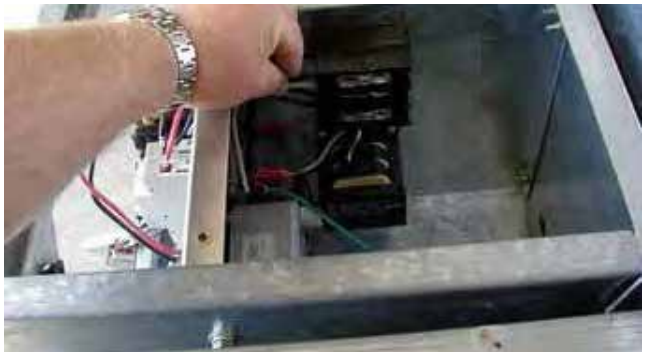
1. Remove the four (4) phillips screws securing the sub-electrical panel, and gently shift this panel out of the way.

2. Secure the EDCO surge arrester unit to the rear of the electrical panel by passing the supplied nipple through a 7/8” hole in the electrical panel, and screwing it into the centre rear mounting location on the EDCO box.

3. The 7/8” hole required may have to be punched in the field. If so it should be 4.25” from the bottom of the panel and 2.50” from the side of the panel.

4. Replace the sub-electrical panel, and tighten the four (4) phillips screws.

5. The wire leads from the surge arrester must be kept as short as is practical. Connect them to the load side of the main service terminal block. (Black to Black, Black to Red, and White to White). Connect the green lead to the grounding stud located on the rear inner wall of the unit.



J. TROUBLESHOOTING

Troubleshooting HELLFIRE 400

Problem	Conditions	Probable Cause	Solution
Heater Does Not Start	-Mode selector switch toggled to “Manual” -Fan motor does not start -The LOGO display screen is blank	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 notstart -The LOGO display screen is operational	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 -The LOGO display screen is operational. -LOGO display shows: HIGH LIMIT SWITCH ON	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. Air blockage intake side.	To verify, remove the cycling thermostat from the duct, disconnect the leads and check for continuity. Heat up cycling switch to 400°F. Switch must open. If it fails, switch is defective. Replace. Check air intake of heater, If necessary clean from obstruction.
	-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.
	-Snowing -Heater LED not lit -Ambient temp LED not lit	Snow/Rain Temp set point too low.	Raise Snow/Rain Temp set point near freezing on EMS board.
	-EMS not requesting heat. -Precipitation simulator switch on	Snow/Rain Temp set point too low.	Raise Snow/Rain Temp set point near freezing on EMS board.
Fan is Running, But No Heat Produced	-Mode selector switch toggled to “Manual”	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 AMBIENT LED is lit	Snow/Rain Temp set point too high	Reduce set point near freezing on EMS board.
	-EMS HEATER LED lit -Delay LED blinking	EMS Delay Off set too long	Reduce delay off time with dip switches on EMS board

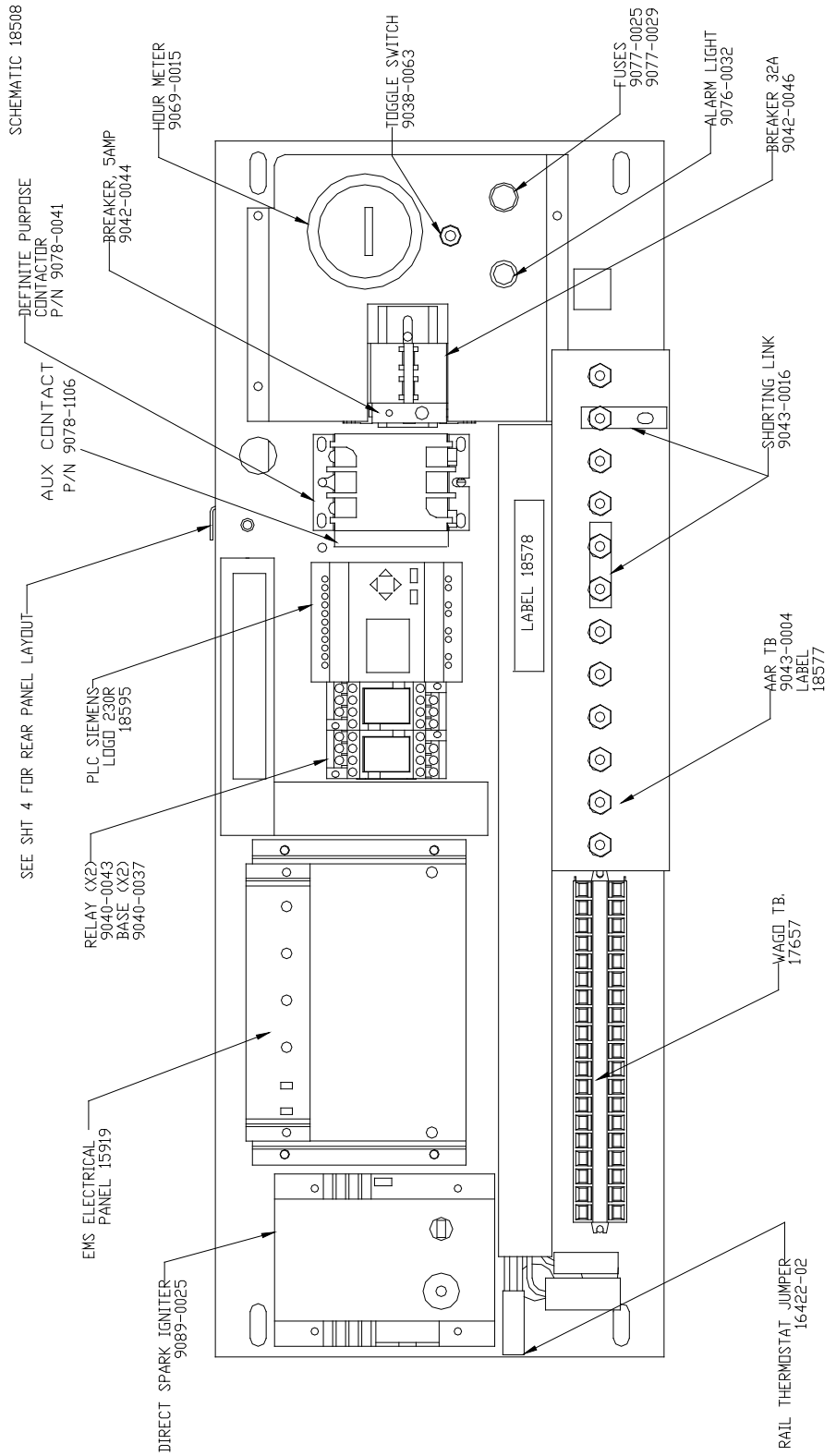
Troubleshooting HELLFIRE 400

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". -Alarm light is lit.	Inadequate gas pressure	1) Verify there is adequate supply pressure, between 12 – 14 in. H_2O. 2) Verify that the gas manual shutoff valve is in the "ON" position. 3) Verify that the solenoid gas shutoff valve is energizing and opening.
		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 ignition terminal of the DSI. Reset and start the heater. If there is a spark between the terminal 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 Direct Spark Ignition Module.
	-Flame present before shut down occurs	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.
	-LOGO input #2 fails to come on	Air switch out of adjustment and is not closing.	Calibrate air switch as per the instructions in the service check section of this manual.
Heater Has Stopped After Having Been Running Normally	-Mode selector switch is toggled to "Manual" -The LOGO display screen is functioning.	The DSI has experienced a system fault and has executed a Safety Shutdown and Lockout.	The DSI can be reset and the heater immediately restarted by opening the 5 amp breaker for approx. 10 sec. 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 10.0)	-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.
	-Alarm contact closed -Alarm light is NOT lit. -LOGO indicates High limit exceeded.	Water in thermostat box	Dry out thermostat and replace gaskets.
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 Track Duct Field Modifications Manual, 11237"

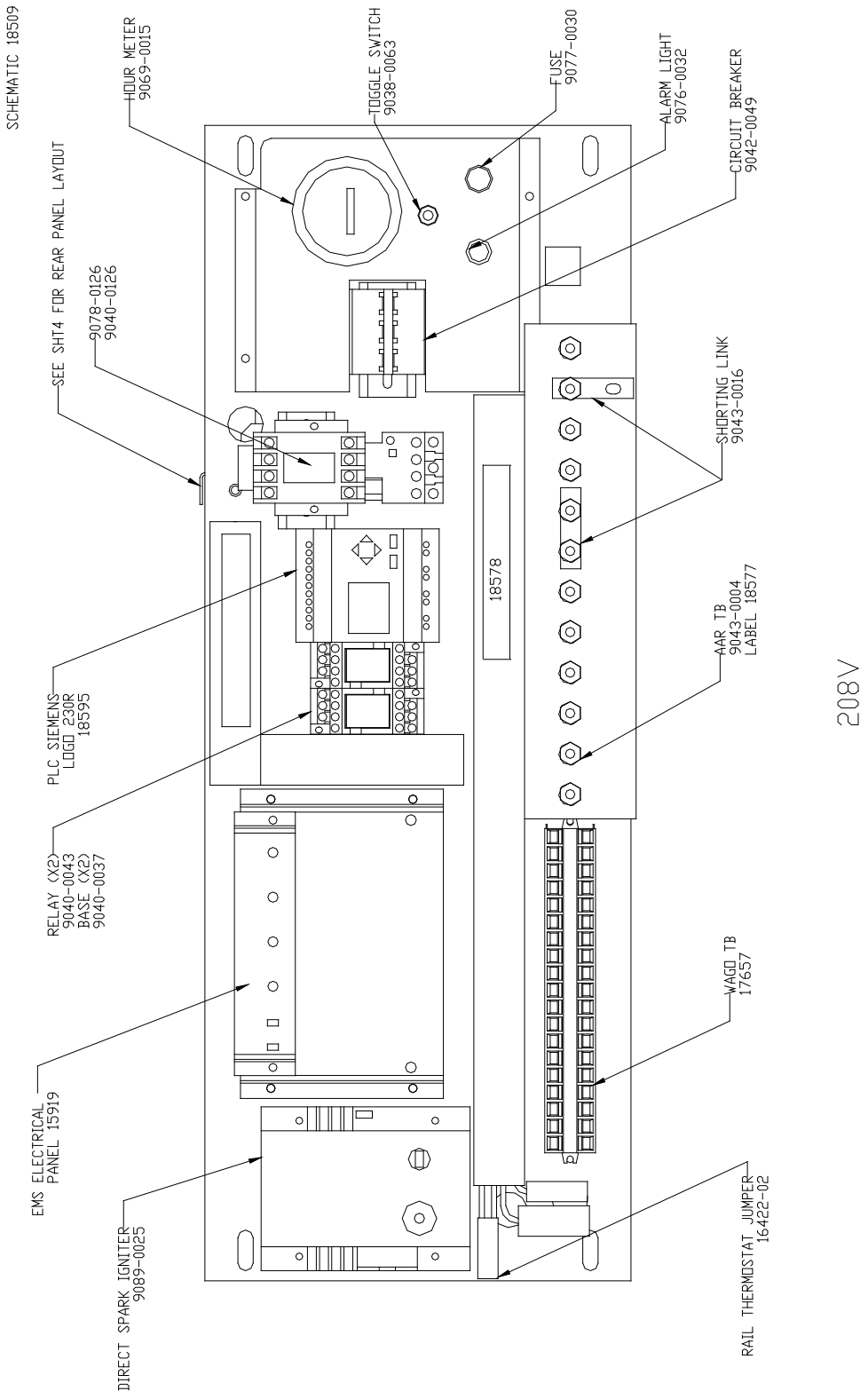
K. SPARE PARTS

K.1 Electrical

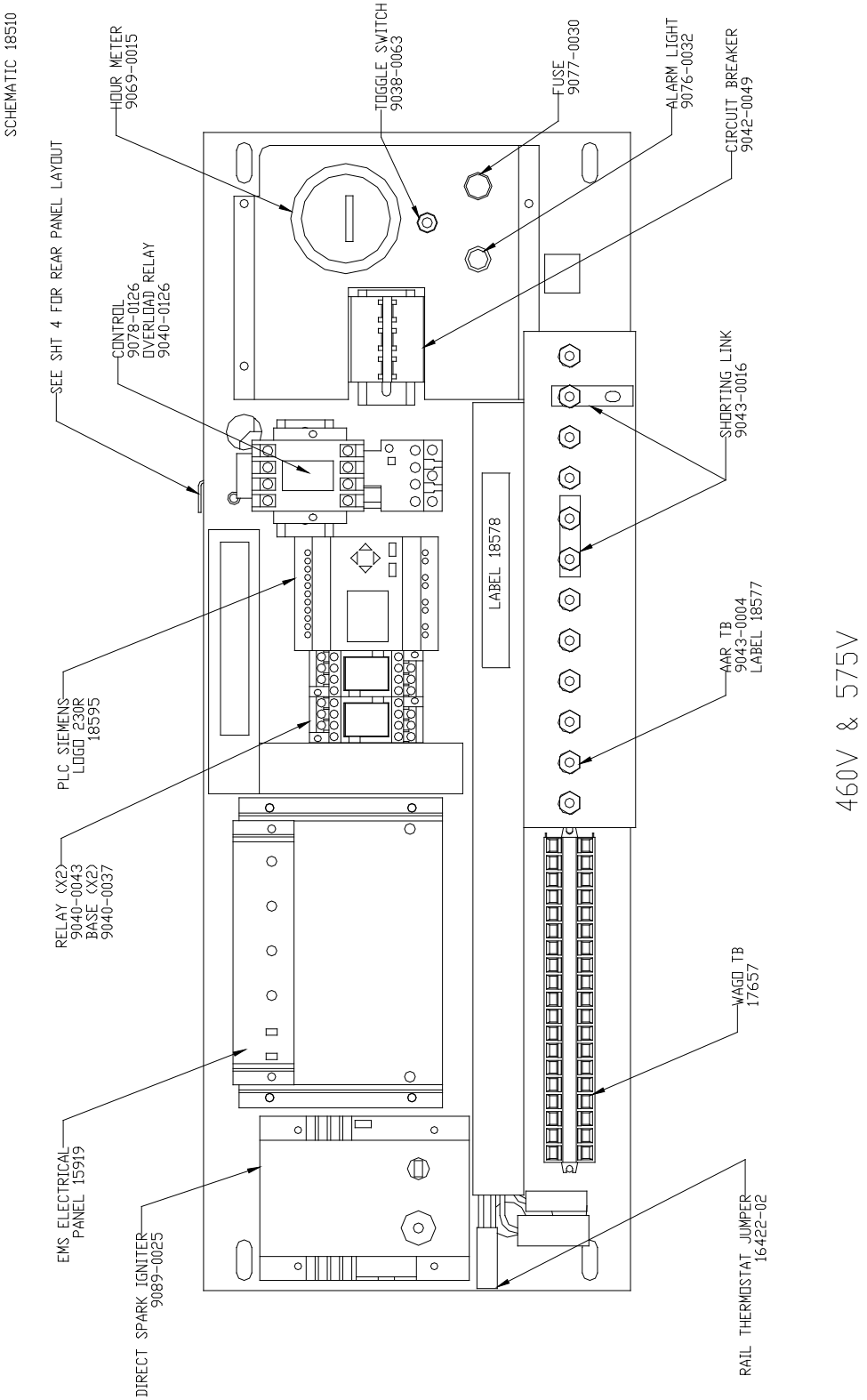
1. Electrical Panel Components - 240V with EMS

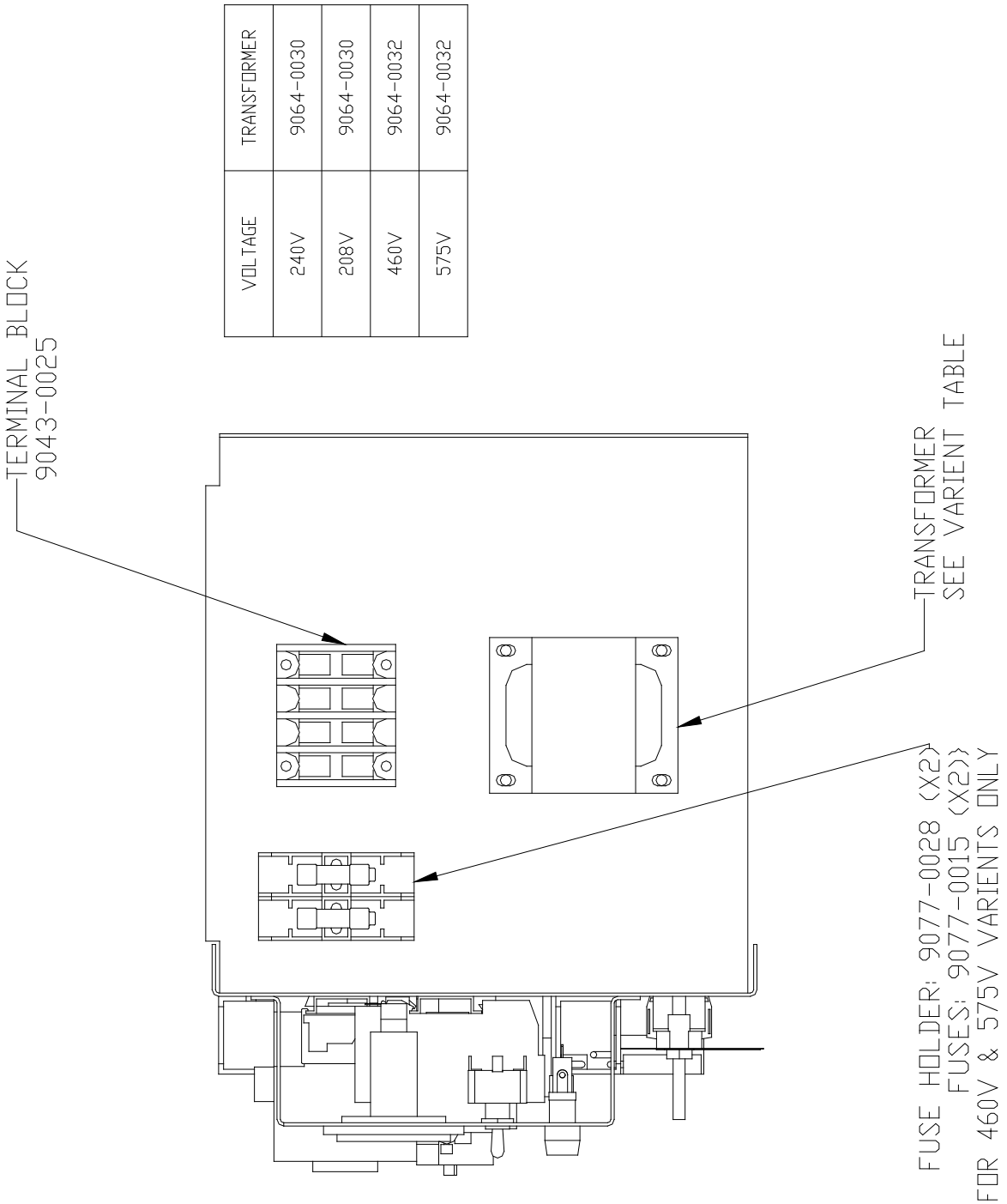


2. Electrical Panel Components - 208V with EMS



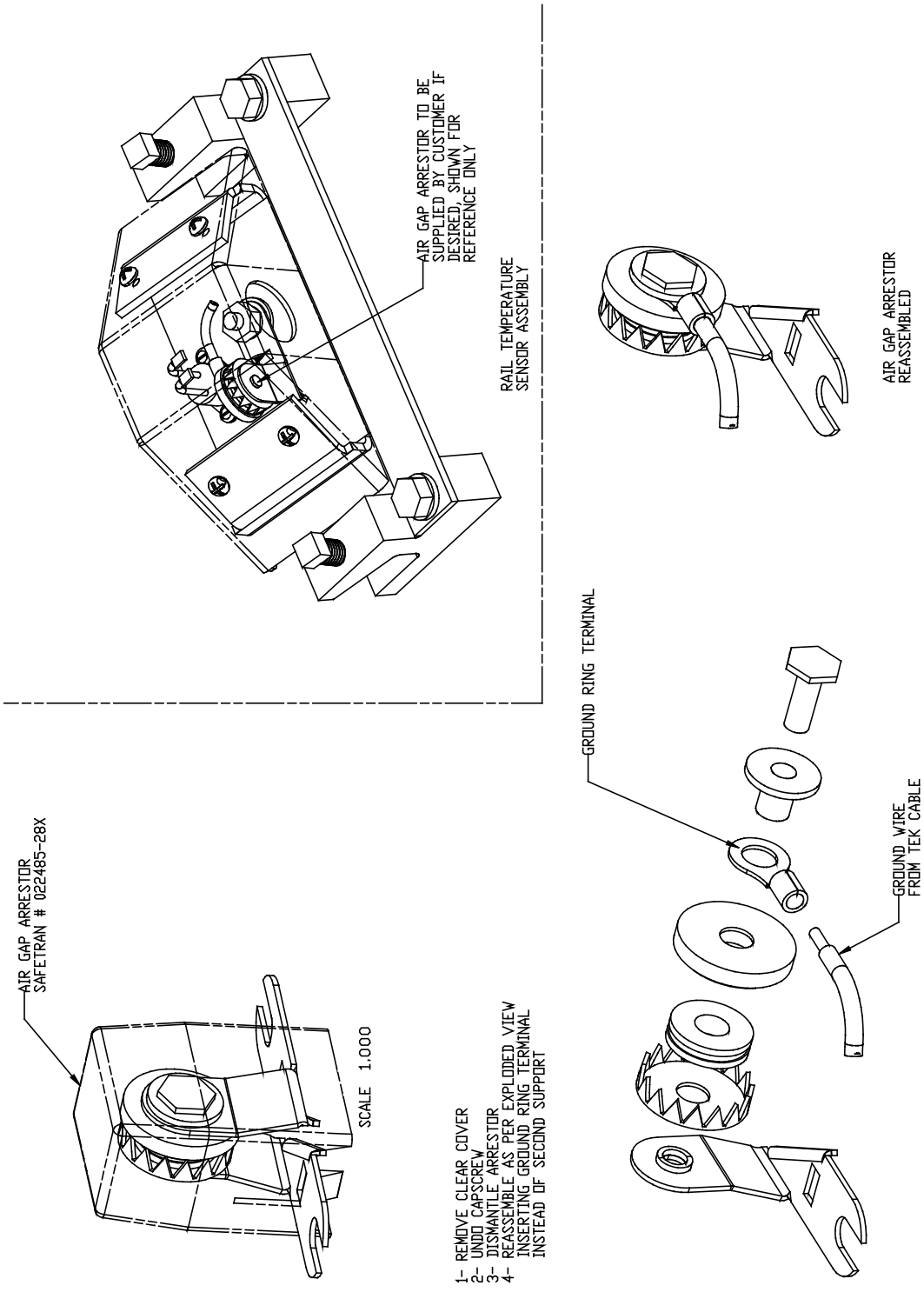
3. Electrical Panel Components - 460/575V with EMS





VOLTAGE	TRANSFORMER
240V	9064-0030
208V	9064-0030
460V	9064-0032
575V	9064-0032

K.2 Air Gap Arrester Optional Installation - Reference Drawing 17894



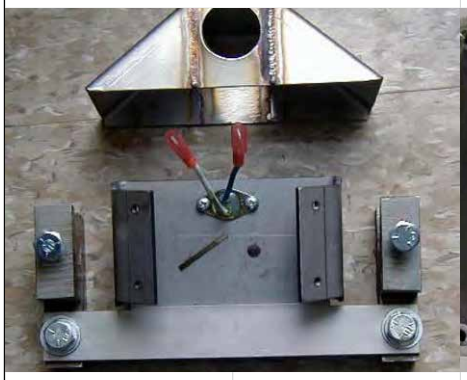
Precipitation Detector, Part # 16441-01

Precipitation Detector

Head Only - Part # 16707

Grid Only - Part #17695

Rail Thermostat comes with Cable - Part # 16442-03



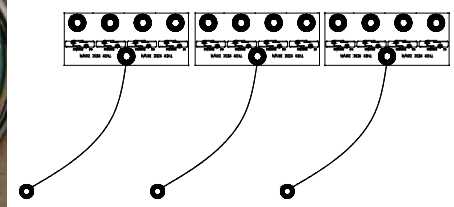
Rail Thermostat Only - Part # 13340-03

Enclosure Only - Part # 17895

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

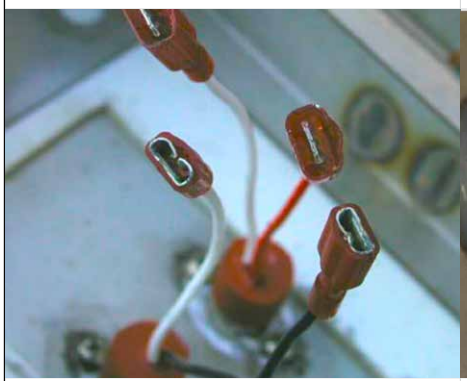
Rail Thermostat Jumper - Part # 16422-02

Electrical service surge arrester - Part # 15344



AAR terminal surge arrester kit - Part # 15343

Ambient temperature sensor - Part # 16426



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

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

Match balanced motor, impeller, and base 240Vac single phase Part # 16748

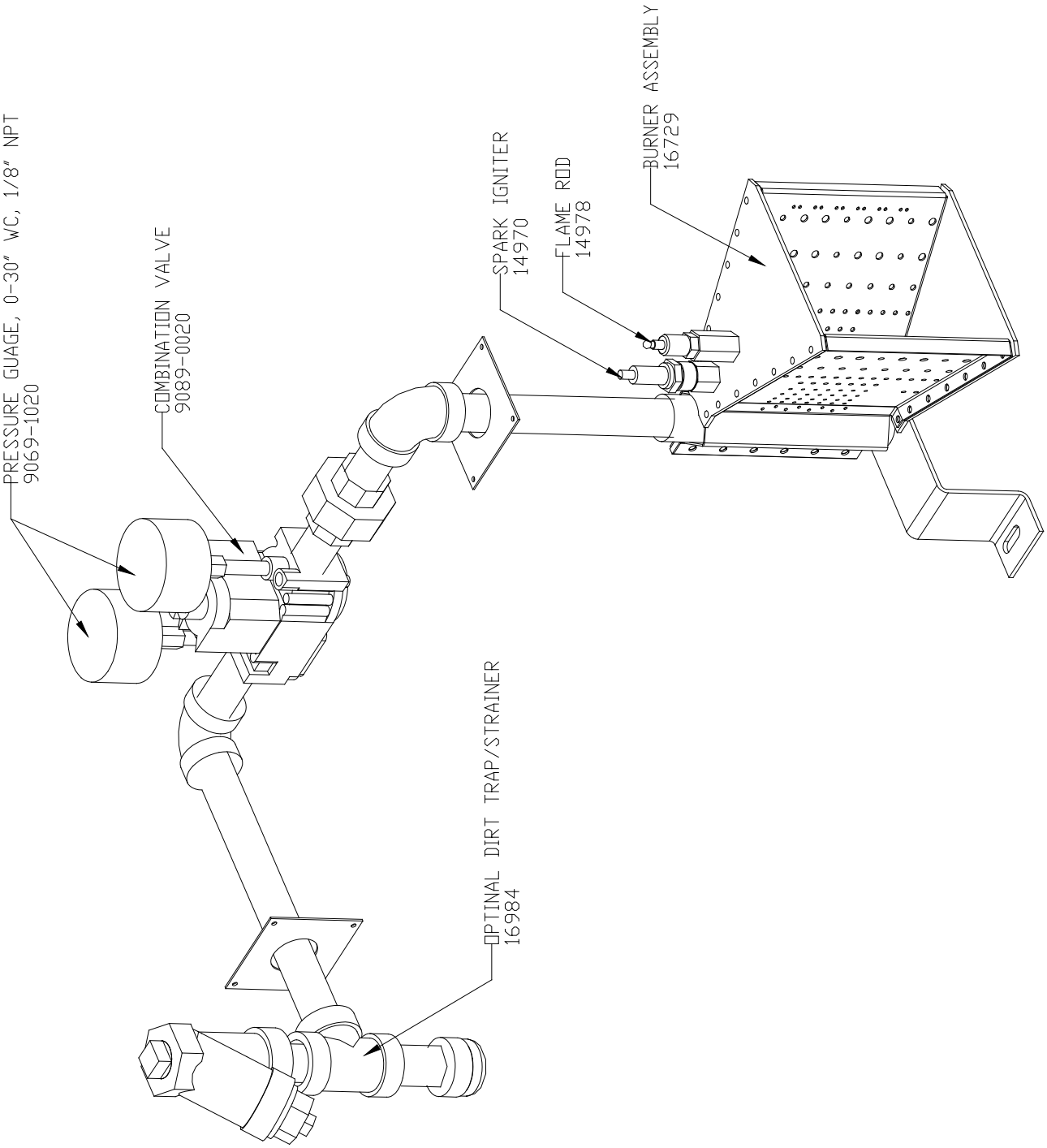
208/460Vac 3 phase Part # 16748-02

575Vac 3 phase Part # 16748-04

Other Parts

- Alarm Light, red Part # 9076-0032
- Hour meter Part # 9069-0013
- Ignition wire assembly, 17” long, Part # 13142-05
- Flame rod wire assembly, 22” long, Part # 15165-04

K.3 Gas Components



NOTES

NOTES

Fastrax™
Track and Switch Heaters

PLEASE ADHERE TO INSTRUCTIONS IN THIS MANUAL

Failure to do so may be dangerous and may void certain provisions of your warranty.

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.

CCI Thermal Technologies INC.
Heating and Filtration Solutions

1500 W. Campus Drive
Littleton, CO 80120 USA

1-855-244-3128
1-303-979-7339
F 303-979-7350