

IMPORTANT INSTRUCTIONS - SAVE THESE INSTRUCTIONS

Read all instructions before preventative maintenance or starting the heater. Please adhere to instructions published in this manual for proper inspection & parts replacement. Failure to do so may be dangerous and may void certain provisions of your warranty. This manual should be used in conjunction with the heater's operations manual.

HELLFIRE 400 & 900 2014 Gas Fired Blowers and Ducting System

Maintenance Manual

Preventative Maintenance & Assessment



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

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A. ORDERING OEM PARTS

A.1 Replacement Parts Available at Thermon

Please contact the Customer Service Department at 1.855.244.3128 or visit Fastraxind.com for more information.

A.2 Warranty Information

If the heater is still covered under warranty, be sure that any replacement parts purchased - regardless of the source, do not invalidate the warranty. Please contact the Customer Service Department at 1.855.244.3128 or see Fastrax® warranty at the back of this manual.

B. MAINTENANCE TECHNIQUES & COMPONENT DISASSEMBLY

B.1 Maintenance Techniques

There are several techniques involved in maintenance and repair that will be referred to throughout this manual. Application of these techniques will enable field personnel to be more efficient, better organized and capable of performing the various tasks properly, which will ensure that the repair job is thorough and complete.

B.2 Component Disassembly

Component disassembly should be done with care and purpose to help ensure that the parts go back together properly. Always keep track of the sequence in which parts are removed.

B.3 Lock-Out Procedure

1. Prior to replacing any components or inspecting any of the electrical components found within the control or motor, ensure that the power to the heater has been turned off at the circuit breaker or disconnect switch for the heater.
2. Lock-out the heater per your company's lock-out procedure or per the relative local electrical code procedures. Prior to performing any work, do a voltage test at the supply wire connections in the heater to ensure the circuit has been de-energized.

B.4 Wiring Schematics

Review the wiring schematics found in Section M - Electrical before assessing or repairing the heater.

C. STRUCTURAL ASSEMBLY

C.1 HELLFIRE Heater Diagram

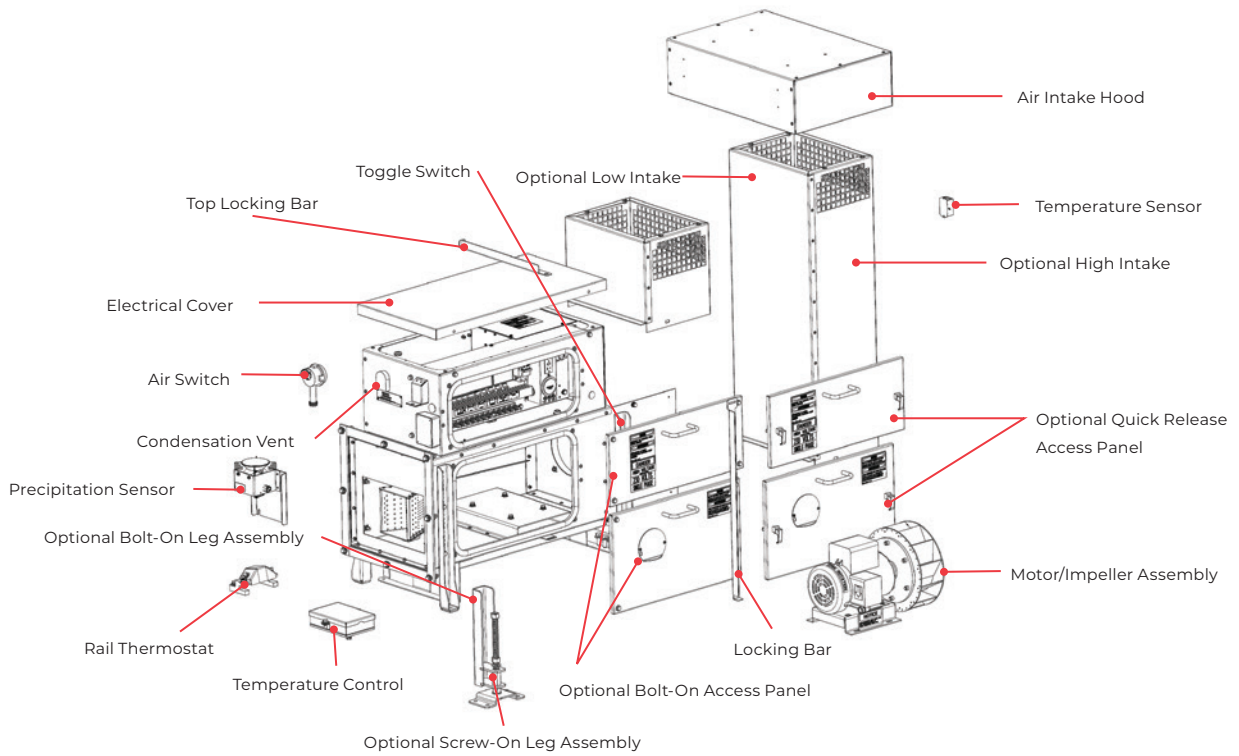


Figure 2 – HELLFIRE 400 Gas Fired Blower

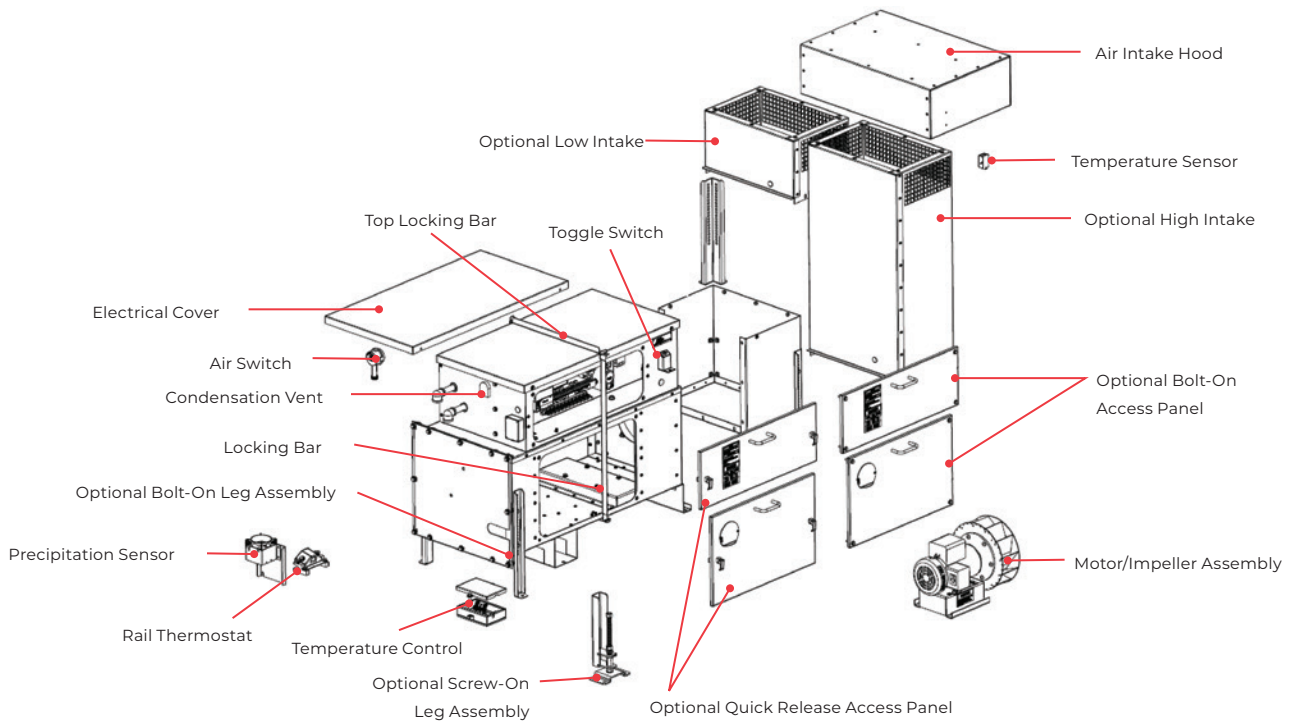


Figure 1 – HELLFIRE 900 Gas Fired Blower

C.2 Heater Overview

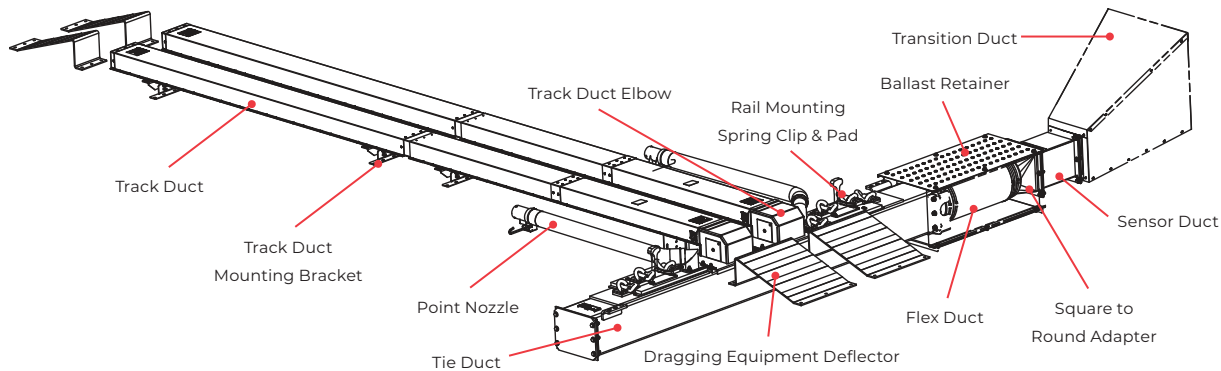
1. The HELLFIRE is a gas fired blower, designed to melt snow and ice which would otherwise interfere with the proper operation of railway points. It blows hot air over the points and rails to melt the snow, ice and evaporates moisture.
2. There are two versions of the device:
 - 2.1 HELLFIRE 400 which puts out up to 400,000 BTU of heat.
 - 2.2 HELLFIRE 900 which puts out up to 900,000 BTU of heat.



HELLFIRE 400

HELLFIRE 900

C.3 HELLFIRE Tie Duct System Construction



1. The HELLFIRE heating system for tie applications is made up of the following components:

1.1 HELLFIRE Heater

Heat is generated in this part of the device.

1.2 Transition Duct

The first duct connected to the heater. It is called a transition because it connects to the large heater flange at one end, offsets down to the level of the duct, and connects to the smaller duct flange at the other end.

1.3 Sensor Duct

The sensor duct is connected to the transition duct. The heated air passes through the sensor duct where cycling and high limit thermostats limit the maximum air temperature delivered to the switch.

1.4 Flex Duct & Ballast Retainer

The flex duct is connected to the sensor duct. It is designed to isolate vibration from passing trains from the heater component.

The flex duct includes a square-to-round adapter, fiberglass/silicone hose with wire helix, EPDM wear resistant sleeve and ballast retainer.

1.5 Tie Duct

The tie duct is connected to the flex duct. The tie duct is a hollow, thermally insulated structural steel tie that takes the place of a tie. Typically replacing the second or third tie in front of the points.

The tie is electrically isolated from the rails using rail pads, tie plate and spring clip insulators. There are four insulated joints between rails, each provides electrical isolation of 3000V. Provides redundancy.

1.6 Point Nozzles

A pair of point nozzles directs heated air at the points to clear snow from between the point and the stock rail. Each one is composed of an elbow that attaches to the tie duct tie plates, a rail mounted nozzle and a flexible hose that connects the two.

1.7 Track Duct

The track duct distributes air down the length of the switch.

Vents direct air at tie plates and gauge rods.

Mounting brackets support track duct.

Adjustable height allows for minimum height to clear track hardware and to keep top of track duct below the top of rail.

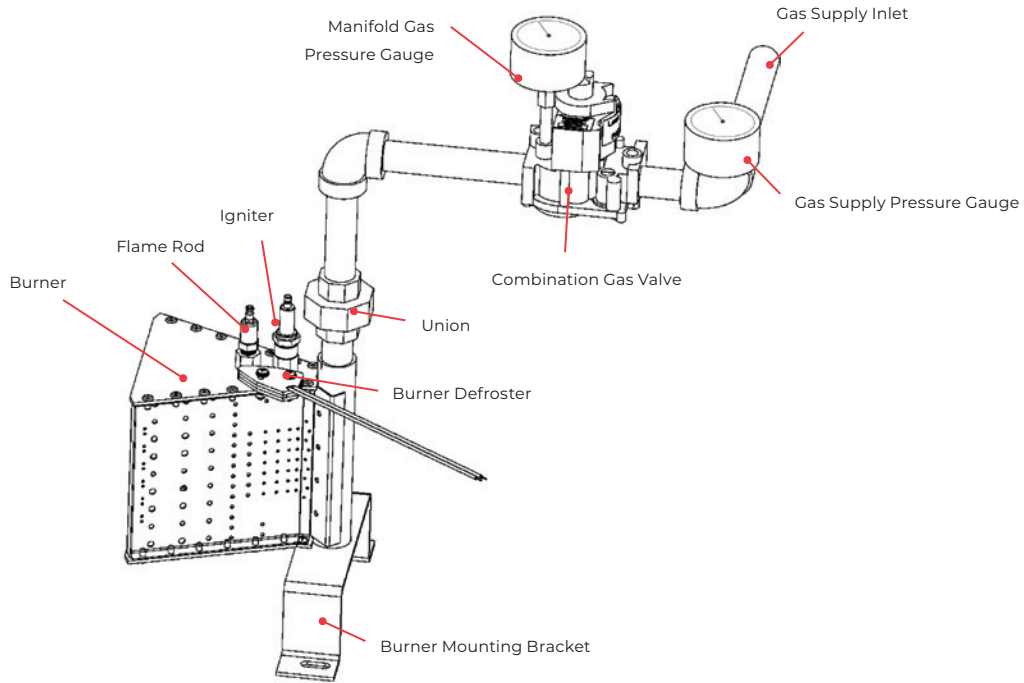
Track duct elbows fasten to the tie duct and connect to the track duct. The elbows float to accommodate desired mounting height and relative movement between tie duct and adjacent ties.

1.8 Dragging Equipment Deflectors

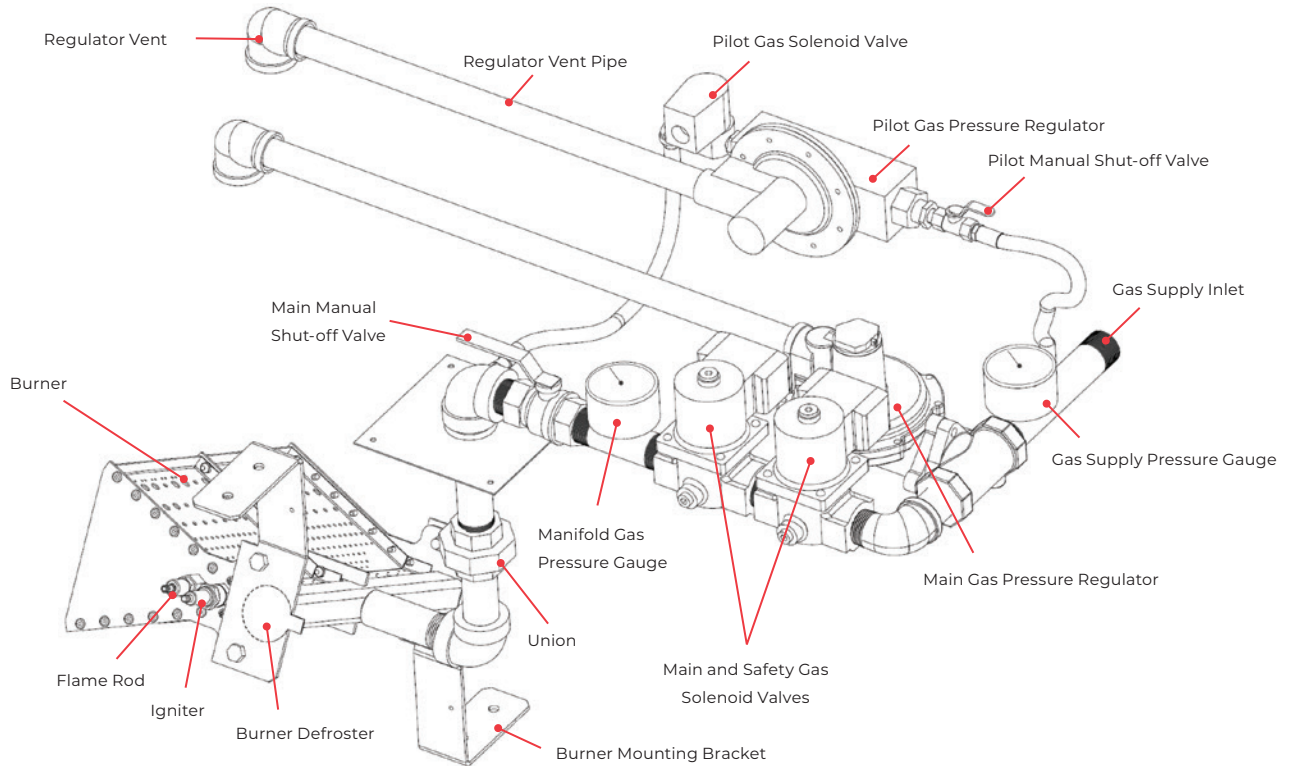
Dragging equipment deflectors protect the track ducts from damage by dragging equipment.

D. GAS SYSTEMS

D.1 HELLFIRE 400 Gas Train

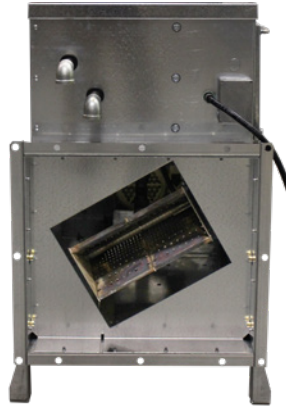


D.2 HELLFIRE 900 Gas Train





HELLFIRE 400



HELLFIRE 900

D.3 Gas Train Construction

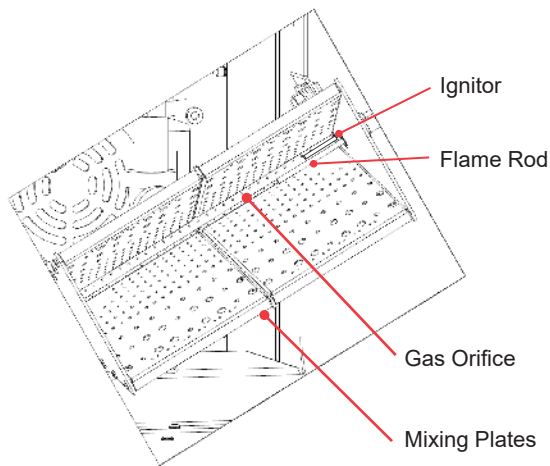
1. The gas train is made up of a burner and gas manifold.

Heat is generated by burning gas in a burner, either natural gas or propane.

The gas escapes through holes in a gas orifice manifold.

- The flame rod length is 3" for the HELLFIRE 400 and HELLFIRE 900.
- The HELLFIRE 400 delivers 200,000 to 400,000 BTU/hr and 1500 scfm.
- The HELLFIRE 900 delivers 300,000 to 900,000 BTU/hr and 2000 scfm.

D.4 Burner



1. Components include:

- 1.1 Gas Orifice - The gas orifice is the injection point of gas into the burner.
- 1.2 Mixing Plates - Mixing plates inject and mix combustion air with gas.
- 1.3 Profile Plate - The profile plates controls air flow across the burner.
- 1.4 Igniter - The igniter ignites the gas-air mixture.

D.5 Flame Detection Mechanism

1. Flame Rod



Part of the control mechanism for the flame is the flame rod which:

- Detects flame presence.
- Is part of the flame sensing circuit.
- Is composed of a metal rod, porcelain bushing and nut.
- The rod is electrically insulated from the burner by the porcelain bushing.
- Moisture can short-circuit the sensing circuit if water bridges the porcelain.
 - This can happen inside and outside the burner.

2. Igniting the Flame

To light the flame, an igniter is used, which:

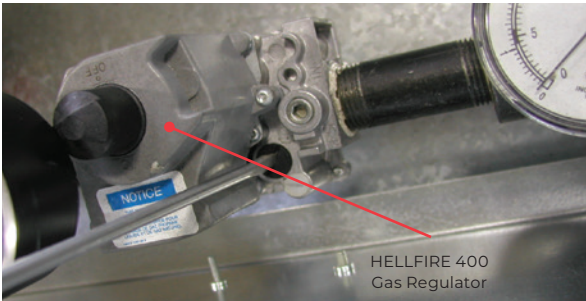
- Is part of the ignition circuit.
- Is composed of a metal rod, porcelain bushing, nut and ground electrode.
- When energized by the ignition transformer, a spark is generated at the tip.
- The HELLFIRE 400 has a simple direct spark ignition system.
- The HELLFIRE 900 uses a pilot ignition system. Once the pilot flame is established, the main solenoid valve opens for full output.



Igniter

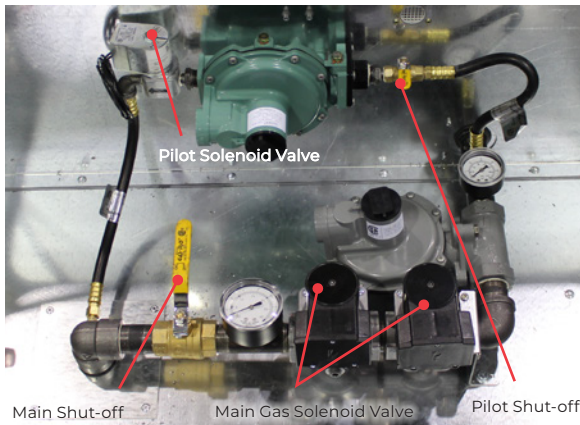
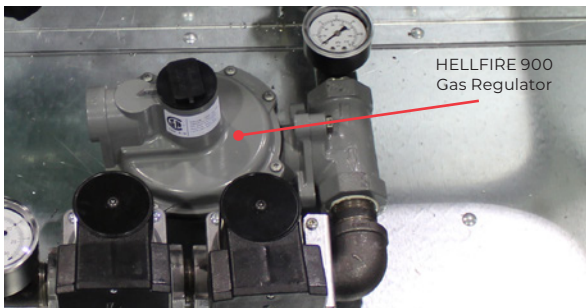
D.6 Gas Regulator

1. To maintain steady and correct flow for the gas to the burner, we have a gas regulator. This regulator is different for the HELLFIRE 400 and HELLFIRE 900.
2. HELLFIRE 400 Gas Regulator
 - HELLFIRE 400 is fitted with a combination valve which is a solenoid shut-off valve, manual shut-off valve, and a gas pressure regulator combined. This combination valve:
 - Opens or closes the burner supply.
 - Adjusts and maintains manifold gas pressure.
 - Adjusts heat output.



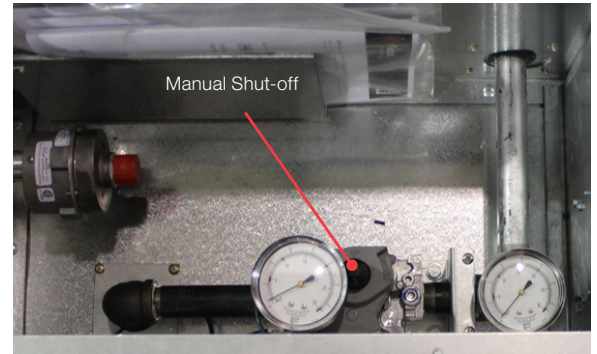
3. HELLFIRE 900 Gas Regulator

The HELLFIRE 900 is comprised of a pilot manifold complete with solenoid regulating valve, ignition system and redundant main gas solenoid valve.



HELLFIRE 900 Gas System

4. For both the HELLFIRE 400 and HELLFIRE 900, the manual shut-off valve comes standard, and required in the event of a gas leak caused by the solenoid valve failing to close and seal.



HELLFIRE 400 Gas System

D.7 Pressure Gauges

1. For both the HELLFIRE 400 and HELLFIRE 900, gauges indicate supply pressure and manifold pressure (refer to D.1 and D.2 HELLFIRE Gas Train).
 - 1.1 Supply Pressure
 - Supply pressure gauge indicates gas pressure supplied to the heater.
 - Supply pressure must be within nameplate rating to ensure reliable ignition and full heat output range.
 - 1.2 Manifold Pressure
 - Manifold pressure gauge indicates gas pressure delivered to the burner.
 - Manifold pressure must be within nameplate operating range and correspond with heat output.

D.8 Burner Defroster

The burner defroster prevents moisture accumulation due to condensation and snow ingestion on the flame rod and igniter, while the heater is idle.



HELLFIRE 400 - Burner Defroster Kit



HELLFIRE 900 - Burner Defroster Kit

E. ELECTRONIC CONTROLS

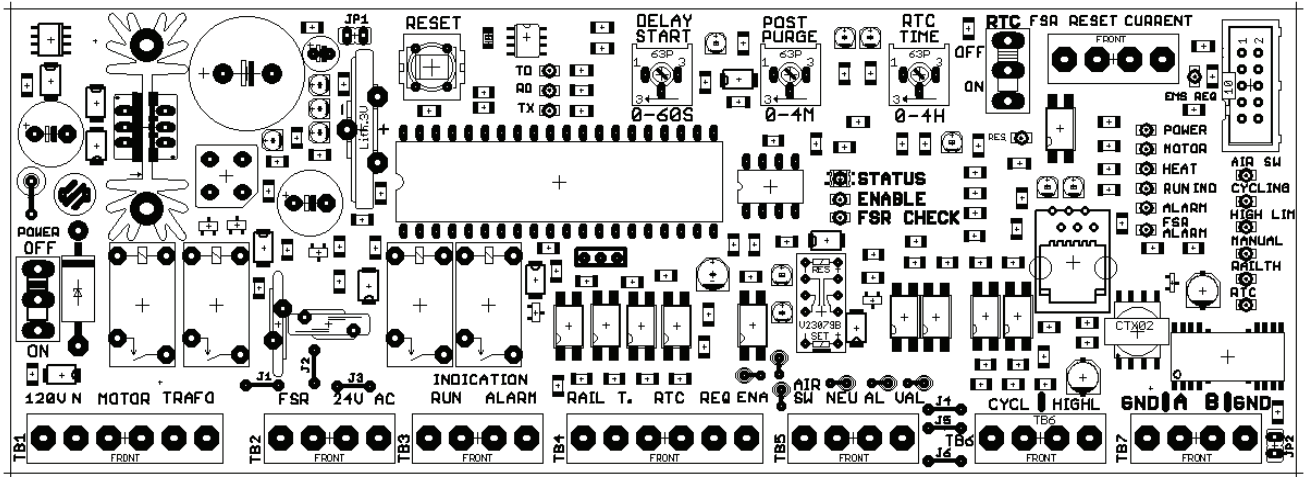
E.1 Controller LED Descriptions

LED Name	Description	State	Indication
TD, RD, TX	RS-485 communications	TD, RD on and pulsing TX off and pulsing	Heater in REMOTE SCADA mode.
		TX off TD and RD on	Heater in LOCAL AUTO mode.
		TD, TX off and pulsing RD on	8N1 COM communications mode.
Status	Processor status	Solid green with a red pulse	Normal operation.
		Alternating red and green	FSR failure alarm. Aggressive retry mode in process.
		Solid red	Failure alarm. Note any alternating LEDs and refer to Section F - Troubleshooting. Controller must be reset.
		Solid green or off	Processor has stopped functioning.
ENABLE	Heater enable	On	Mode selector switch is either in MANUAL or REMOTE/AUTO position. Heater can be started in AUTO REMOTE RTC or REMOTE SCADA modes.
		Off	Mode selector switch is in OFF position. Heater is in OFF mode and will not start.
FSR CHECK	Flame Safety Relay/DSI check	On	Gas valve energized. Used to confirm correct operation of DSI/FSR.
		Alternating	The DSI/FSR did not energize the main gas solenoid valves when expected.
RES	FSR Reset	On	Controller clears DSI/FSR control module alarm.
EMS REQ	EMS request	On	EMS module request for heater to run. Heater only acts on this request if in AUTO mode.
		Pulsing	Local EMS mode. Installed EMS module can request heater operation ON or OFF.
POWER	Power supply	On	Controller energized.
MOTOR	Motor	On	Contact closed, motor turned on.
HEAT	Controller request for heat	On	DSI control module/FSR requested. Ignition sequence started or burner operating.
RUN IND	Heater run indication	On	Indication contact closed. Turns on after 60 seconds of normal operation.
ALARM	Heater alarm indication	On	Alarm indication contact closed. Heater off and locked out. Controller must be reset manually.
FSR ALARM	FSR/DSI alarm	On	DSI/FSR control module in ALARM, or controller is preventing its operation.
		Alternating	DSI/FSR control module in ALARM. Heater failed 4 times in 5 minutes.
AIR SW	Air pressure switch	On	Contact closed. Sufficient air flow to allow burner operation.
		Alternating	Air switch did not operate as intended. Air switch either did not close with fan ON or did not open with fan OFF.
		HF400 - On or off with pulse	FAN MODE enabled locally.
		HF400 - On or off with 2 pulses	FAN MODE enabled remotely by SCADA CEMS.
		HF900 - Off with pulse on	Continuous fan mode with selector switch in OFF position.
CYCLING	Cycling thermostat	On	Thermostat closed. Heated air temperature is BELOW set point.
		Alternating	Cycling thermostat open for more than 10 minutes.

LED Name	Description	State	Indication
HIGH LIM	High limit thermostat	On	Thermostat closed. Heated air temperature ABOVE set point.
		Alternating	High limit thermostat closed momentarily indicating air temperature exceeded set point.
MANUAL	Manual operation	On	Selector switch in "MANUAL" position. Heater in MANUAL mode.
RAIL TH	Rail thermostat	On	Thermostat open. Rail temperature is BELOW set point (normal mode COR).
		On or off with pulse	Rail thermostat configured for OOR (reverse mode).
RTC	Rail traffic control mode	On	Indicates selector switch is in "REMOTE/AUTO" position and AAR terminals 1 and 2 are closed.
		Off with pulse on	Indicates selector switch is in "REMOTE/AUTO" position and requested by RCMS.
		On with pulse off	Indicates selector switch is in "REMOTE/AUTO" position and requested by RCMS and AAR terminals 1 and 2 are closed.

E.2 Fault Condition Codes and LED States

Code	Alarm Type	Fault Condition	LED	State
1	Minor	Selector switch left in OFF position for more than 60 minutes.	ENABLE	Dark
2	Major	Air switch does not open after fan motor turned off.	AIR SW	Alternating
3	Major	Air switch does not close after fan motor turned on.	AIR SW	Alternating
10	Major	Flame failure at start up.	FSR ALARM	Alternating
11	Major	Loss of flame signal while running.	FSR ALARM	Alternating
12	Major	4 FSR alarms within 2 minutes.	FSR ALARM	Alternating
13	Major	Gas valve does not energize when expected.	FSR CHECK	Alternating
14	NA	FSR in alarm.	FSR ALARM	Solid Red
20	Minor	Cycling thermostat failed to close after 10 minutes.	CYCLING	Alternating
21	Major	Maximum output air temperature exceed. High limit thermostat closed momentarily.	HIGH LIM	Alternating
30	Minor	Controller in configuration mode. JPI jumper shorted.	-	-
31	Minor	EMS module TEST switch on.	SENSOR WET	Solid Red



HELLFIRE Controller

E.3 Mode Selector Switch

1. Both the HELLFIRE 400 and HELLFIRE 900 units have a mode selector switch, which has 3 modes:
 - 'MANUAL' allows for local operation of the heater.
 - 'OFF' disables the heater.
 - 'REMOTE' allows RTC or EMS to control heater operation.



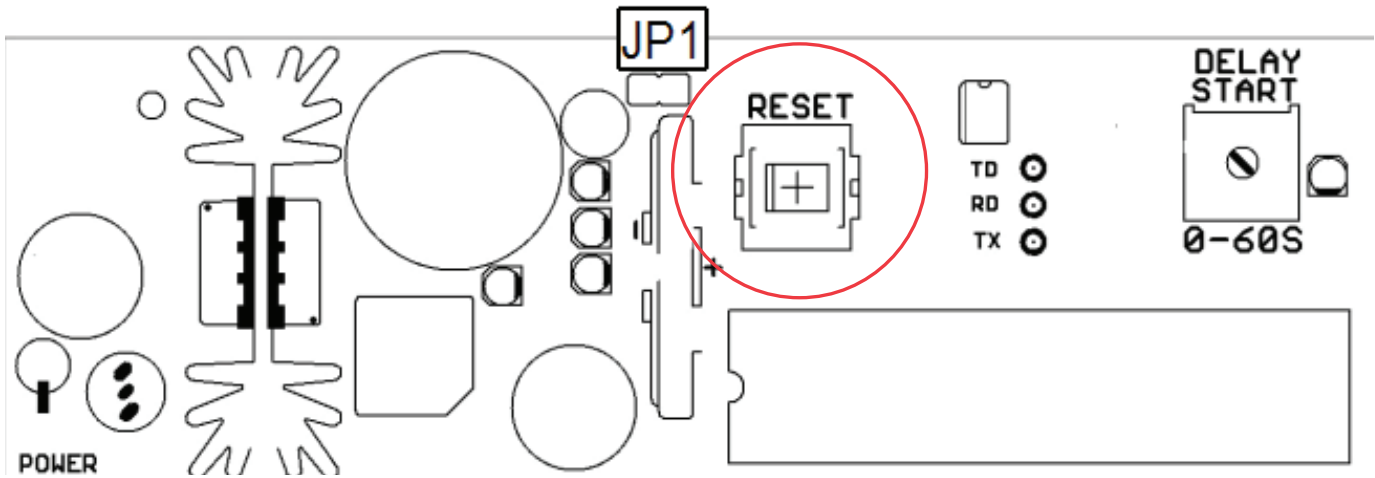
HELLFIRE 400



HELLFIRE 900

E.4 Electronic Controller

1. The Controller provides the following functions:
 - Monitors and controls the operation of the heater.
 - Provides the control logic based on inputs and programming.
 - Displays input and output status, heater status and alarm conditions.
 - Adjustable parameters include, delay start time, pre and post purge time.
 - RS485 communications port and remote operation by SCADA systems using MODBUS RTU control protocol.
2. Provides automatic operation when equipped with the EMS option.



E.5 Resets

If the HELLFIRE shuts down because of an alarm condition, there are resets required to reset the heater. The resets are:

Breaker	Description
Panel Breaker (5 Amp)	<ul style="list-style-type: none"> - Most common required reset - Open breaker to de-energize panel, then close to reset.
High Limit	<ul style="list-style-type: none"> - When tripped indicates an air over temperature condition occurred. - Requires manual reset of controller. De-energizing panel by opening breaker will not clear fault.
Motor Overload	<ul style="list-style-type: none"> - When tripped indicates a motor overload condition. - Requires manual reset. De-energizing panel by opening breaker will not clear fault. - The manual reset is located on the motor junction box for 240V configurations. On 3 phase systems press the reset button on the overload mounted in the electrical panel.
FSR Reset (RM7895)	<ul style="list-style-type: none"> - FSR alarm must be reset either manually or by the controller. - Manual reset located on the front face of the burner controller (FSR). - The controller will reset the FSR, a maximum of three times in a row. If the FSR indicates alarm after all 3 retries, then the controller must be reset.

F. HELLFIRE 400 2014 TROUBLESHOOTING

*The resets made by aggressive retry function are not described in the conditions.

**Reset controller only after observing the condition of all status indicators then follow reset instructions.

Problem	Conditions*	Possible Cause	Remedy**
Heater not running when expected. NO ALARM indications.	No LEDs are on.	No line power.	<ul style="list-style-type: none"> Verify panel and motor breakers are closed. Verify supply voltage at power terminal block.
	<ul style="list-style-type: none"> Selector switch in MANUAL position. Controller and FSR POWER LEDs are on. RUN LED on. Ambient temperature is above the rail temperature 9°C (48°F). 	Rail thermostat is closed.	<ol style="list-style-type: none"> Wait for ambient and rail temperature drop below rail thermostat set point. To verify heater operation, toggle selector switch OFF, then back to MANUAL. The heater starts, disregarding the rail thermostat status for the first 2 minutes of operation.
	<ul style="list-style-type: none"> Selector switch in REMOTE/AUTO. EMS module installed. Controller, EMS POWER LEDs are on. Controller in LOCAL mode. Snowing. 	EMS module SNOW-RAIN set point below -1°C (30°F) and ambient temperature sensor disconnected.	Install, plug in, ambient temperature sensor. Raise set point above 0°C (32°F).
		SNOW-RAIN set point too low, i.e. -12°C (10°F).	Raise set point to 3°C (37°F).
		Precipitation detector damaged.	Replace detector/cable.
		Precipitation detector disconnected.	Verify connection to panel.
	<ul style="list-style-type: none"> Selector switch in REMOTE/AUTO. EMS module installed. Controller, EMS POWER LEDs are on. Controller in LOCAL mode. Snowing. LOW TEMP LED on. 	Controller to EMS ribbon cable not connected. 24V AC not connected.	Verify connection of cable and 24V AC.
LOW TEMP set point too high.		<ul style="list-style-type: none"> Verify set point on EMS module. For natural gas installations set to minimum, -55°C (-67°F). For LPG installations without tank heaters, set to -30°C (-22°F). 	
Fan running. No heat. No ALARM.	<ul style="list-style-type: none"> Selector switch in REMOTE/AUTO position. Controller and EMS LEDs are on. EMS REQ LED on. 	Controller in REMOTE/SCADA mode and RCMS has not requested heater.	Contact RCMS software to operate the heater.
	<ul style="list-style-type: none"> Controller LEDs <ul style="list-style-type: none"> POWER on. MOTOR on. AIR SW on, pulsing off. 	Controller in CONTINUOUS FAN mode.	Disable CONTINUOUS FAN mode.
Fan running. No heat. No ALARM.	<ul style="list-style-type: none"> Contollers LEDs <ul style="list-style-type: none"> POWER on. MOTOR on. AIR SW on. HEAT on. RUN IND on. CYCLING off. MANUAL, RTC or EMS REQ LED on. 	Cycling switch open. (Motor will run for 10 minutes before controller indicates ALARM and shuts down).	Wait for cycling switch to cool (close). If in ALARM: <ul style="list-style-type: none"> Inspect cycling thermostat and wiring connections. Replace failed cycling switch. Repair any damaged wire. Connect any disconnected terminals.

Problem	Conditions*	Possible Cause	Remedy**
Heater operating but does not deliver adequate heat. No ALARM.	Manifold pressure at maximum for propane gas.	Heater connected to natural gas.	<ul style="list-style-type: none"> • Increase manifold pressure to within natural gas limits. • The delivered heater is set for LPG.
	Manifold pressure at maximum for appropriate fuel.	Duct system restricted. Gauge shows high back pressure when only the motor is running.	Clear blockage/debris from duct system. Inspect tie duct and flex duct.
		Corrosion, dirt or other debris restrict burner orifices.	<ul style="list-style-type: none"> • Service burner. • Clear, drill out each orifice with a #48 drill (0.076").
	Gas manifold and supply pressure slowly drop while operating.	Vapour withdrawal causes refrigeration effect that lowers LPG tank pressure.	Remove snow accumulation on propane tanks.
Heater fails to start. ALARM indicated.	<ul style="list-style-type: none"> • Fan does not start. • Controller LEDs <ul style="list-style-type: none"> – POWER on. – ALARM on. – AIR SW alternating. 	Motor thermal overload relay open.	<ol style="list-style-type: none"> 1. 240V single-phase models: Reset overload located on motor junction box. 2. Three-phase models: Reset thermal overload relay located on control panel below contactor. 3. Check running amps.
		Motor breaker open.	Close breaker.
		• Air switch closed when expected open.	Inspect air switch.
		• Air switch jumped.	Remove jumper.
		• Air switch frozen.	Clear any ice or debris from air switch.
		• Air switch out of calibration.	Recalibrate air switch.
	<ul style="list-style-type: none"> • Fan does not start. • Controller LEDs <ul style="list-style-type: none"> – POWER on. – ALARM on. • High limit alternating. 	Cycling thermostat loose inside sensor duct and high limit thermostat limit reached.	Fasten cycling thermostat in place.
		Cycling thermostat leads shorted and high limit thermostat limit reached.	<ol style="list-style-type: none"> 1. Remove any test jumper. 2. Verify leads are not shorted together between sensor box and control panel. 3. Inspect wire insulation for damage and verify no shorts to ground. 4. Verify manifold pressure is within nameplate limits. 5. Verify interior of sensor box is dry. 6. Seal or replace any damaged or missing gaskets. Close lid.
		High limit thermostat leads shorted.	
	<ul style="list-style-type: none"> • Fan starts, runs briefly then stops. • Controller LEDs <ul style="list-style-type: none"> – POWER on. – ALARM on. – AIR SW alternating. 	Heater NOT connected to duct system.	Complete heater installation.
		Air intake severely blocked.	Clear intake screen of blockage, i.e. ice, snow, paper.
Air switch fails to close when fan operating.		<ul style="list-style-type: none"> • Calibrate air switch. • See Owner's manual for instructions. 	

Problem	Conditions*	Possible Cause	Remedy**
Heater fails to start. ALARM indicated. (continued)	<ul style="list-style-type: none"> Fan starts. Controller LEDs <ul style="list-style-type: none"> POWER on. MOTOR on. HEAT on. Followed by: <ul style="list-style-type: none"> Heat off. After 3 resets from the controller: <ul style="list-style-type: none"> ALARM on. FSR ALARM alternating. <ul style="list-style-type: none"> Fan runs for post purge duration then stops. 	Inadequate gas pressure.	<ul style="list-style-type: none"> Verify supply pressure is within nameplate rating. Verify manual shutoff valve on top of combination valve is open. Arrow in line with body. Check wiring to combination valve.
		Air in line.	Purge air from gas supply line.
		No spark.	<ul style="list-style-type: none"> Inspect igniter and ignition wire. Replace any damaged items, fouled igniter, corroded wire, connector or cracked boot.
		Inadequate flame signal.	<ul style="list-style-type: none"> Inspect flame rod and wiring. Verify correct connections. Replace any damaged items, fouled rod, corroded wire, connector or cracked boot.
	<ul style="list-style-type: none"> Controller LEDs <ul style="list-style-type: none"> POWER on. ALARM on. FSR CHECK alternating. 	DSI missing.	Install DSI control module.
		<ul style="list-style-type: none"> DSI failed. DSI LED on. Unable to energize combination gas valve. 	Replace DSI control module.
Open circuit between DSI 'VALVE' terminals and combination valve.		Trace wiring. Repair damaged wires. Tighten any loose connections.	
Heater starts, runs for 10 minutes with no heat, stops and then ALARM indicated.	<ul style="list-style-type: none"> Controller LEDs <ul style="list-style-type: none"> POWER on. ALARM on. CYCLING alternating. 	Cycling thermostat failed open.	Replace cycling thermostat. Note: If thermostat closes the ALARM is cleared and the heater resumes normal operation.
		Cycling thermostat disconnected.	<ul style="list-style-type: none"> Connect cycling thermostat. Inspect for damaged wiring between sensor box and control panel.
Heater cycles excessively. Short cycle time. No ALARM.	<ul style="list-style-type: none"> Controller LEDs <ul style="list-style-type: none"> POWER on. MOTOR on. HEAT on. CYCLING on. Followed by: <ul style="list-style-type: none"> CYCLING off. HEAT off. 	<ul style="list-style-type: none"> Manifold pressure too high. Over firing the heater. Heater set for natural gas but connected to LPG gas. 	Reduce the manifold pressure to within nameplate rating according to the gas.
		Air intake blocked.	Clear air intake.

Problem	Conditions*	Possible Cause	Remedy**
Heater starts and runs normally for a period of time then stops unexpectedly. ALARM indicated.	<ul style="list-style-type: none"> Controller LEDs <ul style="list-style-type: none"> POWER on. MOTOR on. HEAT on. FSR ALARM on. HEAT off. DSI LED 3 flashes. Then solid red. After 10 seconds off. Repeated 3 times. The fourth time DSI LED off. Controller LEDs <ul style="list-style-type: none"> POWER on. ALARM on. FSR ALARM alternating. 	<ul style="list-style-type: none"> Marginal flame signal. Dropping below 1.5 micro amps. 	<ul style="list-style-type: none"> Measure flame signal. Inspect flame rod and wiring connections. Replace any damaged items.
		Manifold gas pressure set too high. Flame blown passed the flame rod.	Reduce manifold gas pressure to within nameplate rating.
	Gas supply and manifold pressure slowly drop while operating.	Vapour withdrawal causes refrigeration effect to lower LPG tank pressure.	Remove snow accumulation on propane tanks.
		Inspect first stage gas regulator on gas supply. In very cold weather this can freeze up.	Try to warm up the regulator with hot air. NO OPEN FLAME.
Heater runs continuously.	<ul style="list-style-type: none"> Unable to stop the heater remotely. Mode selector switch in manual position. 	Heater accidentally left on.	Toggle selector switch to REMOTE/AUTO position.
	<ul style="list-style-type: none"> Mode selector switch in REMOTE/AUTO position. Controller LEDs <ul style="list-style-type: none"> POWER on. MOTOR on. HEAT on. RUN on. RTC on. 	RTC has requested the heater.	Notify RTC dispatcher.
	<ul style="list-style-type: none"> Mode selector switch in REMOTE/AUTO position. Controller LEDs <ul style="list-style-type: none"> POWER on. MOTOR on. HEAT on. RUN on. RTC with a green flash. 	Heater requested by SCADA.	Notify SCADA personnel.

G. HELLFIRE 900 2014 TROUBLESHOOTING

* The resets made by aggressive retry function are not described in the conditions.

**Reset controller only after observing the condition of all status indicators then follow reset instructions.

Problem	Conditions*	Possible Cause	Remedy**
Heater not running when expected. NO ALARM indication.	No LEDs are on.	No line power.	<ul style="list-style-type: none"> Verify panel and motor breakers are on. Verify supply voltage at power terminal.
	<ul style="list-style-type: none"> Selector switch in MANUAL position. Controller and FSR POWER LEDs are on. RUN LED on. Rail temperature is above set point. 	Rail thermostat is closed.	<ol style="list-style-type: none"> Wait for rail temperature to drop and open rail thermostat. To verify heater operation, toggle selector switch OFF, then back to MANUAL. The heater starts, disregarding the rail thermostat status for the first 2 minutes of operation.
	<ul style="list-style-type: none"> Selector switch in REMOTE/AUTO. EMS module installed. Controller, EMS POWER LEDs are on. FSR POWER LEDs on. Controller in LOCAL mode. Snowing. 	EMS module SNOW-RAIN set point below -1°C (30°F) and ambient sensor disconnected.	<ul style="list-style-type: none"> Install, plug in ambient temperature sensor. Raise set point above 0°C (32°F).
		SNOW-RAIN set point too low, i.e. -12°C (10°F).	Raise set point, i.e. 3°C (37°F).
		Precipitation detector damaged.	Replace detector head and/or cable.
		Precipitation detector not connected.	Verify connection to panel.
		<ul style="list-style-type: none"> Controller / EMS ribbon cable disconnected. 24V AC not connected. 	Verify presence of cable and connections.
		SENSITIVITY set point too low.	Raise set point to increase sensitivity.
	<ul style="list-style-type: none"> Selector switch in REMOTE/AUTO. EMS module installed. Controller, EMS POWER, and FSR POWER LEDs are on. Snowing. LOW TEMP LED on. 	Controller in LOCAL mode and On EMS module LOW TEMP set point too high.	<ul style="list-style-type: none"> Verify set point. For natural gas installations set to minimum, -55°C (-67°F). For LPG installations without tank heaters, set to -30°C (-22°F).
	<ul style="list-style-type: none"> Selector switch in REMOTE/AUTO. Controller, EMS and FSR POWER LEDs are on. EMS REQ LED on. 	Controller in REMOTE SCADA mode and RCMS has not requested heater.	Contact RCMS software operator and verify status.
Fan running. No heat. No ALARM.	<ul style="list-style-type: none"> Controller LEDs <ul style="list-style-type: none"> POWER on. MOTOR on. HEAT on. RUN IND on. AIR SW on. CYCLING on. MANUAL, RTC or EMS REQ on. FSR LEDs <ul style="list-style-type: none"> POWER on. PILOT on. FLAME on. MAIN on. 	<ul style="list-style-type: none"> Main ball valve closed. Pilot ball valve open. 	Open main ball valve.
		Main and/or safety solenoid valve not opening.	Verify operation of solenoid valves.

Problem	Conditions*	Possible Cause	Remedy**
Fan running. No heat.	<ul style="list-style-type: none"> Controller LEDs <ul style="list-style-type: none"> POWER on. MOTOR on. RUN IND on. AIR SW on. MANUAL, RTC or EMS REQ on. FSR LEDs <ul style="list-style-type: none"> POWER on. 	Cycling thermostat open. (Heater will operate for 10 minutes before controller indicates ALARM).	<ul style="list-style-type: none"> Wait for cycling switch to cool (closed). Inspect cycling thermostat and wiring connections. Replace failed thermostat. Repair any damaged wiring. Connect any disconnected terminals.
Heater operating but does not deliver adequate heat. No ALARM.	Manifold pressure at maximum for propane.	Heater connected to natural gas.	The "as delivered" heater is set for LPG operation. Increase manifold pressure to within natural gas limits.
	Manifold pressure at maximum for appropriate fuel.	Corrosion, dirt or other debris blocks orifices.	<ul style="list-style-type: none"> Service burner. Drill out each orifice with #47 drill (0.0785" diameter or 5/64ths bit)
		Duct system restricted.	Inspect tie duct for blockage.
	Gas manifold and supply pressure slowly drop while operating.	Vapour withdrawal causes refrigeration effect that lowers LPG tank pressure.	Remove snow accumulation on propane tanks.
Heater fails to start. Alarm indicated.	<ul style="list-style-type: none"> Fan does not start. Controller LEDs <ul style="list-style-type: none"> POWER on. ALARM on. AIR SW alternating. 	Motor thermal overload relay open.	<ol style="list-style-type: none"> 240V single-phase models: Reset overload located on motor junction box. Three-phase models: Reset thermal overload relay located on control panel below contactor. Check running amps.
		Motor breaker open.	<ul style="list-style-type: none"> Close breaker. Check running amps.
		Air switch closed when expected open.	Inspect air switch.
		Air switch jumped.	Remove jumper.
		Air switch frozen.	Clear any ice or debris from air switch ports.
		Air switch out of calibration.	Calibrate air switch.
	<ul style="list-style-type: none"> Fan does not start. Controller LEDs <ul style="list-style-type: none"> POWER on. ALARM on. HIGH LIMIT alternating. 	Cycling thermostat loose inside sensor duct and high limit thermostat limit reached.	Fasten thermostats in place.
		Cycling thermostat leads shorted and high limit thermostat limit reached.	<ol style="list-style-type: none"> Remove any test jumper shorting thermostat leads. Verify leads are not shorted together between sensor box and control panel. Inspect wire insulation for damage and verify no shorts to ground. Verify manifold pressure is within nameplate limits. Verify interior of sensor box is dry. Seal or replace any damaged or missing gasket. Close lid.
		High limit thermostat leads shorted.	
	<ul style="list-style-type: none"> Fan starts, runs briefly then stops. Controller LEDs <ul style="list-style-type: none"> POWER on. ALARM on. AIR SW alternating. 	Heater NOT connected to duct system.	Complete heater installation.
		Air intake severely blocked.	Clear intake screen of blockage, i.e. ice, snow, paper.
		Air switch fails to close when fan operating.	Calibrate air switch. See Owner's manual for instructions.

Problem	Conditions*	Possible Cause	Remedy**
Heater fails to start. Alarm indicated. (cont'd)	<ul style="list-style-type: none"> • Fan starts. • Controller LEDs <ul style="list-style-type: none"> – POWER on. – MOTOR on. – HEAT on. • FSR LEDs sequence: <ul style="list-style-type: none"> – POWER on. – PILOT on. – PILOT off. – ALARM on. • Controller LEDs <ul style="list-style-type: none"> – POWER on. – ALARM red. • Fan runs for post purge time then stops. 	Inadequate gas pressure.	<ul style="list-style-type: none"> • Verify supply pressure is within nameplate rating. • Verify pilot solenoid valve operation. • Verify manual pilot bulb valve is open. Handle in line with gas pipe.
		Air in line.	Purge air from gas supply line.
		No spark.	<ul style="list-style-type: none"> • Inspect igniter and ignition wire. • Replace any damaged items, fouled igniter, corroded wire or cracked boot.
		Inadequate flame signal.	Inspect flame rod and wiring. Replace any damaged items, fouled rod, corroded wire or cracked boot.
	<ul style="list-style-type: none"> • Controller LEDs <ul style="list-style-type: none"> – POWER on. – ALARM red. – FSR CHECK alternating. 	FSR missing.	Install missing FSR in sub base.
		FSR failed. Unable to energize solenoids.	Replace FSR.
Heater starts, runs for 10 minutes with no heat, stops, and indicates ALARM.	<ul style="list-style-type: none"> • Controller LEDs <ul style="list-style-type: none"> – POWER on. – ALARM on. – CYCLING alternating. • FSR LEDs <ul style="list-style-type: none"> – Power on. 	Cycling thermostat failed open.	Replace cycling thermostat. Note: If thermostat closes the alarm is cleared and the heater resumes normal operation.
		Cycling thermostat disconnected.	<ul style="list-style-type: none"> • Connect thermostat. • Inspect for damaged wiring between control panel and thermostat box.
Heater cycles excessively. Less than 30 second cycle time. No ALARM.	<ul style="list-style-type: none"> • Fan starts. • Controller LEDs <ul style="list-style-type: none"> – POWER on. – MOTOR on. – HEAT on. • FSR LEDs sequence: <ul style="list-style-type: none"> – POWER on. – FLAME on. – MAIN on. – MAIN off. – FSR sequence repeats indefinitely. 	Marginal flame signal. <ul style="list-style-type: none"> – PILOT signal above 1.2V – MAIN signal below 1.2V 	<ul style="list-style-type: none"> • Inspect flame rod and wiring. • Replace any damaged items, fouled rod, corroded wire or contact broken.
		Manifold gas pressure to high.	Reduce gas pressure to within nameplate ratings.
		Air intake blocked.	Clear air intake screen.
		Orifices in burner clogged.	<ul style="list-style-type: none"> • Service burner. • Drill each orifice with #47 drill (0.0785" diameter or 5/64ths bit).

Problem	Conditions*	Possible Cause	Remedy**
Heater starts and runs normally for a period of time then stops unexpectedly. ALARM indicated.	<ul style="list-style-type: none"> Controller LEDs <ul style="list-style-type: none"> POWER on. MOTOR on. HEAT on. FSR ALARM on. HEAT off. 	Marginal flame signal PILOT and MAIN signal occasionally drop below 1.2V.	<ul style="list-style-type: none"> Measure flame signal. Inspect flame rod and wiring. Check crimp on connector for corrosion. Replace any damaged items.
	<ul style="list-style-type: none"> FSR LEDs sequence: <ul style="list-style-type: none"> POWER on. PILOT on. PILOT off. ALARM on. Repeated three times. The fourth time will not be reset. Controller is now locked out. 	Manifold gas pressure too high.	<ul style="list-style-type: none"> Reduce manifold pressure to nameplate rating.
	<ul style="list-style-type: none"> FSR LEDs sequence: <ul style="list-style-type: none"> POWER on. PILOT on. PILOT off. ALARM on. Repeated three times. The fourth time will not be reset. Controller is now locked out. Controller LEDs <ul style="list-style-type: none"> POWER on. ALARM on. FSR ALARM alternating. 	FSR reset module not connected. No retries possible.	<ul style="list-style-type: none"> Verify reset module is correctly plugged in and connected.
	<ul style="list-style-type: none"> Gas supply and manifold pressure slowly dropping while operating. 	FSR defect, faulty.	<ul style="list-style-type: none"> Leave heater in ALARM. Install FSR display module. Review fault history and refer to Honeywell® documentation for further instruction.
Heater runs continuously. No ALARM.	<ul style="list-style-type: none"> Unable to stop the heater remotely. 	<ul style="list-style-type: none"> Mode selector switch in MANUAL position. Heater accidentally left on. 	<ul style="list-style-type: none"> Toggle selector switch to the REMOTE/AUTO position.
	<ul style="list-style-type: none"> Mode selector switch in the REMOTE/AUTO position. Controller LEDs <ul style="list-style-type: none"> POWER on. MOTOR on. HEAT on. RUN on. RTC on. 	RTC has requested the heater.	Notify RTC, Dispatcher.
	<ul style="list-style-type: none"> Mode selector switch in the REMOTE/AUTO position. Controller LEDs <ul style="list-style-type: none"> POWER on. MOTOR on. HEAT on. RUN on. RTC with a green flash. 	Heater requested by SCADA.	Notify SCADA personnel.

H. HELLFIRE 400 MAINTENANCE



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

In the absence of local codes, installation must comply with CAN/CSA-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.

For outdoor use only.

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



WARNING. To be installed in accordance with railroad and all applicable local governing regulations by persons approved by the railroad having authority.



WARNING. If you smell gas; immediately extinguish all sources of ignition and turn off gas source. Call qualified service technician to repair leak.



WARNING. Do not attempt to manually light burner. Heater equipped with an automatic electronic ignition system.



WARNING. Risk of cutting fingers or hand. Disconnect fan power prior to removing combustion chamber access panel or air intake.



WARNING. Heater can start automatically. Exercise caution when in close proximity.



WARNING. Burn hazard / hot surfaces. Do not touch track ducts, nozzles or any non-insulated duct connected downstream of heater during operation



WARNING. Cut hazard. Sheet metal edges can be sharp. Wear protective clothing when handling track duct, insulated ducts and any other sheet metal components.

Refer to Appendix A - HELLFIRE Unit & Ducting System Maintenance Checklist.

H.1 Thermostat Removal

1. Remove cover from thermostat box 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.
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. Using a 9/16" socket, remove the 4 mounting bolts that hold the enclosure to the sensor duct. Remove the thermostat box and gasket.
4. Remove the two screws that fasten each thermostat to the sensor duct. Remove thermostats.
5. The high limit and cycling thermostats are not interchangeable. Each has unique connectors to prevent interchange.
6. Reverse procedure to install.

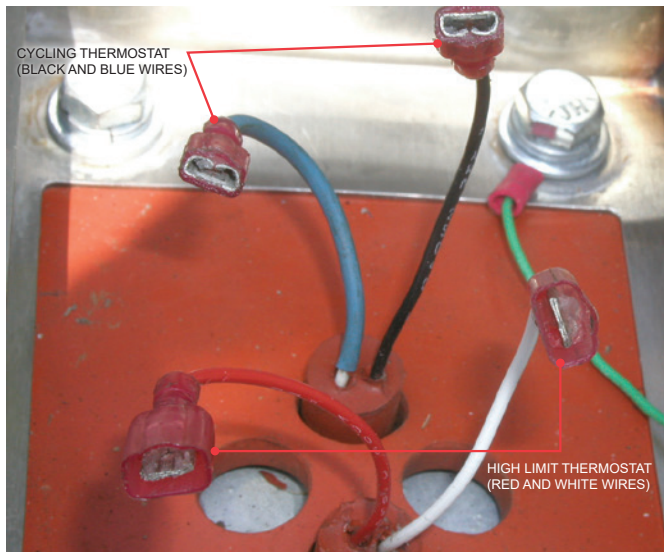


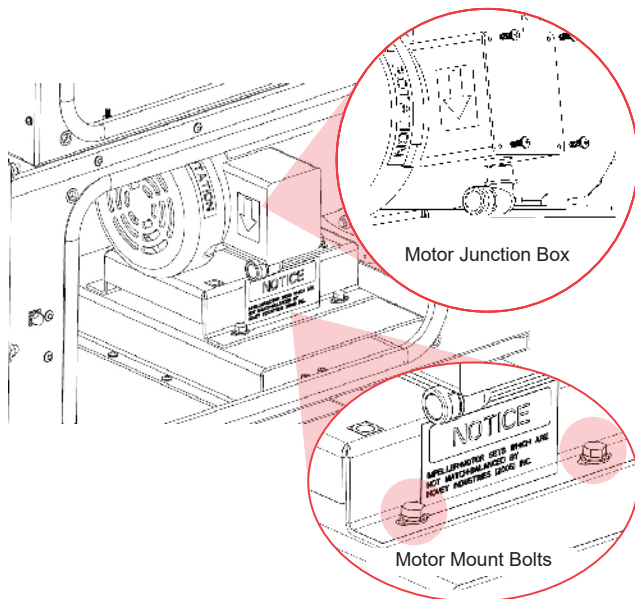
Figure 1 – Thermostat Wire Connections

H.2 Motor/Impeller/Base Removal



WARNING. Risk of cutting fingers or hand. Disconnect fan power prior to removing combustion chamber access panel or air intake.

1. Remove the combustion chamber access panel to gain access to the motor.
2. Open the motor junction box and disconnect all wiring and conduit elbow.
3. Remove the four motor mount bolts and remove the motor/impeller assembly from the combustion chamber.
4. Install replacement motor/impeller/base assembly, following reverse order.

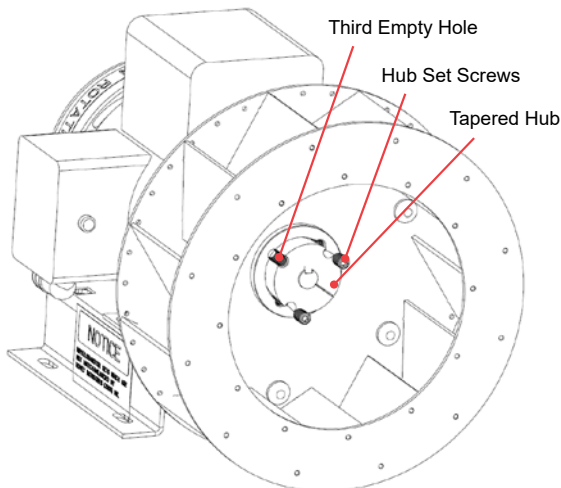


H.3 Impeller Removal

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

NOTE: Replacement of motor or impeller only. Dynamically balance the motor/impeller and base assembly to vibration levels of 0.2 in/sec or less in the bearing planes.

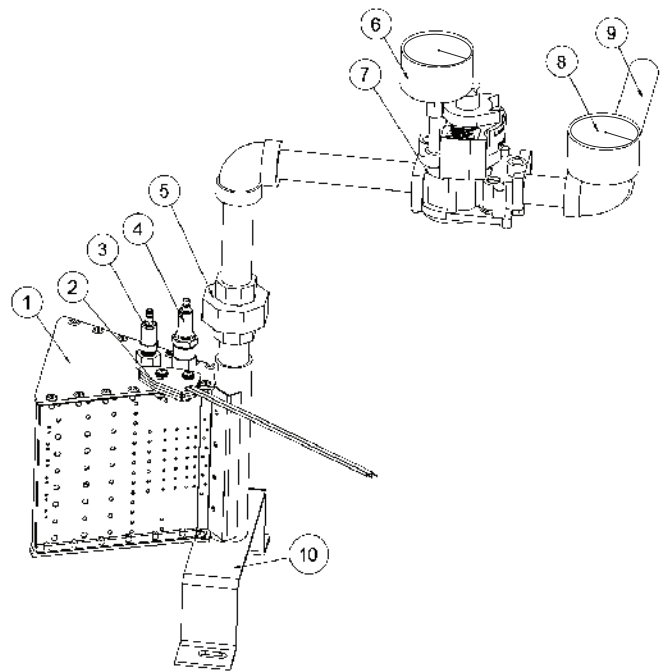
NOTE: Mark the position of the impeller on the shaft before removing.



The impeller is fitted with a taper lock bushing. To remove impeller from motor shaft:

1. Clamp the motor and anchor the impeller using a suitable bar.
2. Remove the two hub set screws.
3. Insert a set screw into the third previously empty hole and tighten.
4. Tap the outer half of the hub with a hammer and bar to knock the impeller off the tapered hub.
5. Slide hub off shaft, then remove impeller.
6. To install the impeller, reverse sequence except step 4.

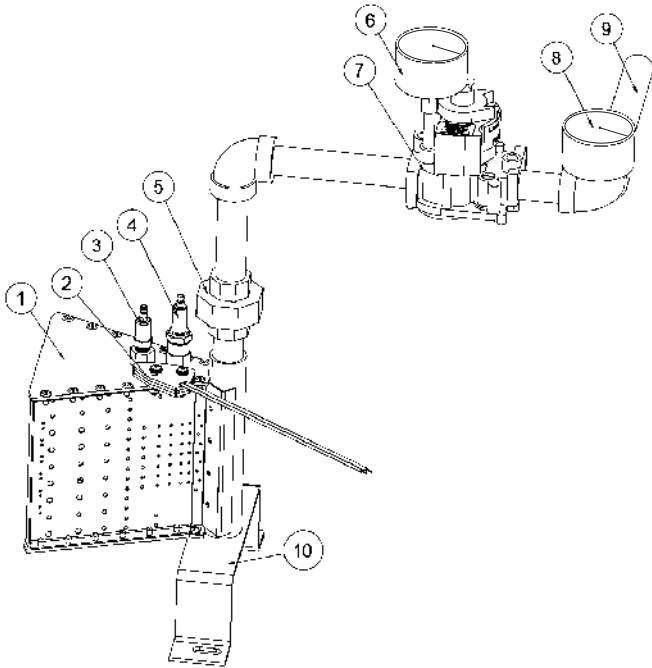
H.4 Flame Rod and Spark Igniter Removal



If the flame rod (3) or spark igniter (4) requires inspection or replacement, remove them as follows:

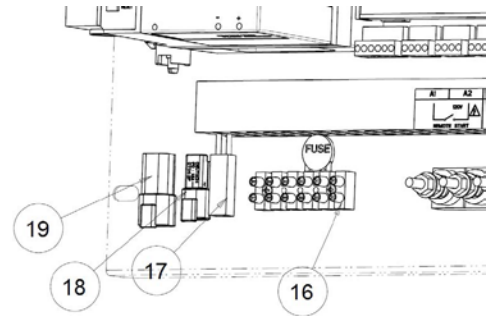
1. Gain access to the burner (1) by first removing the combustion chamber access panel.
2. The flame rod is to the left of the spark igniter. Gently pull the wire from the terminal. Use a 7/8" deep socket to unscrew and remove the flame rod. Apply a high temperature anti-seize compound to threads prior to reinstallation.
3. The spark igniter is 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.
4. Reinstall the flame rod and ignition wires. A red band identifies the flame rod wire.

H.5 Burner Removal



1. Turn heater OFF and disconnect power.
2. Once impeller is at a complete stand still, remove combustion chamber access panel.
3. Remove nut and bolts holding defroster (2). Remove cable straps holding wire to pipe. Let defroster hang.
4. Open pipe union (5).
5. Remove bolts fastening both mounting brackets (10) to the combustion chamber. Leave brackets attached to the burner.
6. Remove burner.
7. Reverse procedure to reinstall.

H.6 Burner Defroster Removal



NOTE: The defroster circuit is protected with a reset-enabled fuse. If tripped, open then close the panel breaker to reset.

1. Turn heater OFF and disconnect power.
2. Once impeller is at a complete stand still, remove combustion chamber access panel.
3. Remove nut and bolts holding defroster (2). Remove cable straps holding wire to pipe. Let defroster hang.
4. Open electrical access panel. Trace defroster wires to terminal block (16), terminals 5 and 6. Disconnect last two wires on the bottom furthest right of terminal block.
5. Reverse procedure to reinstall.

I. HELLFIRE 900 MAINTENANCE

I.1 Thermostat Removal

1. Remove cover from thermostat box 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.

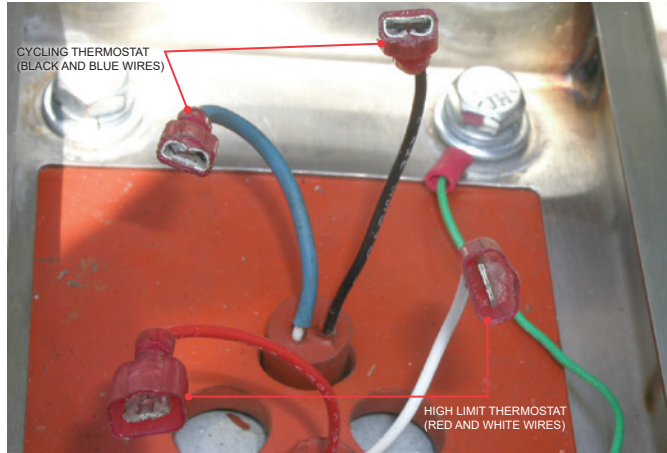


Figure 1 – Thermostat Wire Connections

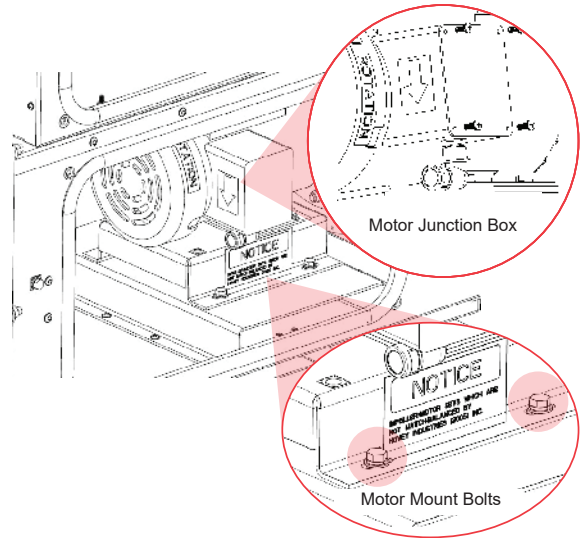
2. The wires are connected by means of quick disconnects. To disconnect, grip the terminals on each side of the connection and pull firmly.
3. Using a 9/16" socket, remove the 4 mounting bolts that hold the enclosure to the sensor duct. Remove the thermostat box and gasket.
4. Remove the two screws that fasten each thermostat to the sensor duct. Remove thermostats.
5. The high limit and cycling thermostats are not interchangeable. Each has unique connectors to prevent interchange.
6. Reverse procedure to install.

I.2 Motor/Impeller/Base Removal



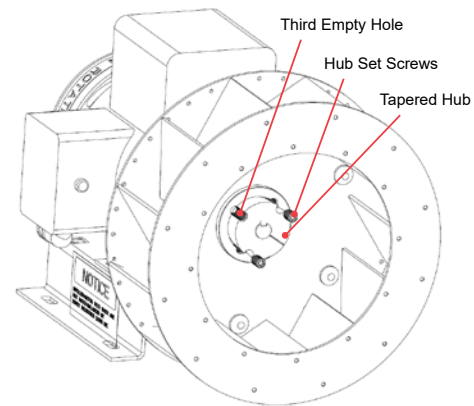
WARNING. Risk of cutting fingers or hand. Disconnect fan power prior to removing combustion chamber access panel or air intake.

1. Remove the combustion chamber access panel to gain access to the motor.
2. Open the motor junction box and disconnect all wiring and conduit elbow.
3. Remove the four motor mount bolts and remove the motor/impeller assembly from the combustion chamber.
4. Install replacement motor/impeller/base assembly, following reverse order.



I.3 Impeller Removal

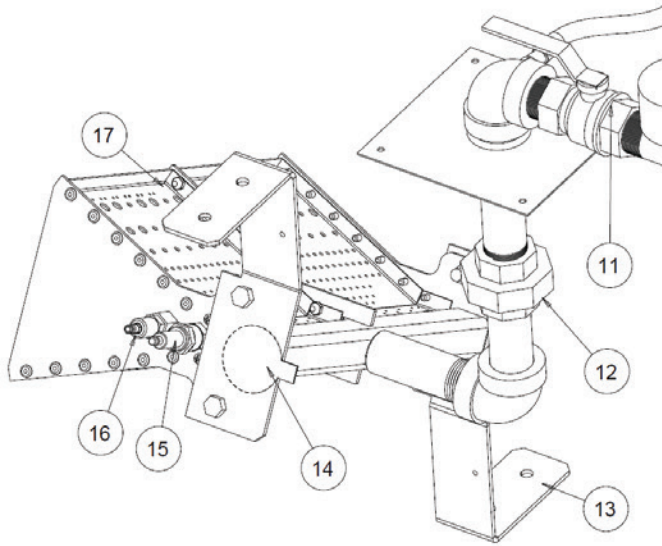
- NOTE:** Motor/impeller sets not match balanced by CCI Thermal void future warranty claims.
- NOTE:** Replacement of motor or impeller only. Dynamically balance the motor/impeller and base assembly to vibration levels of 0.2 in/sec or less in the bearing planes.
- NOTE:** Mark the position of the impeller on the shaft before removing.



The impeller is fitted with a taper lock bushing. To remove impeller from motor shaft:

1. Clamp the motor and anchor the impeller using a suitable bar.
2. Remove the two hub set screws.
3. Insert a set screw into the third previously empty hole and tighten.
4. Tap the outer half of the hub with a hammer and bar to knock the impeller off the tapered hub.
5. Slide hub off shaft, then remove impeller.
6. To install the impeller, reverse sequence except step 4.

I.4 Flame Rod and Spark Igniter Removal



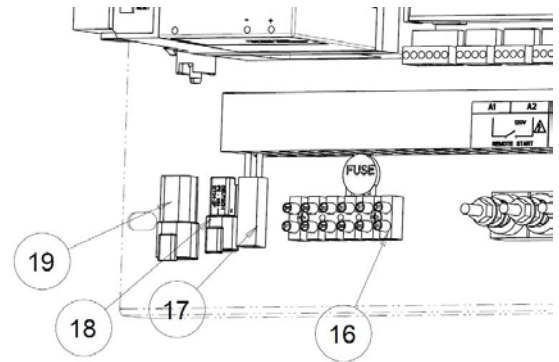
If the flame rod (16) or spark igniter (15) requires inspection or replacement, remove them as follows:

1. Gain access to the burner (17) by first removing the combustion chamber access panel.
2. The flame rod is to the left of the spark igniter. Gently pull the wire from the terminal. Use a 7/8" deep socket to unscrew and remove the flame rod. Apply a high temperature anti-seize compound to threads prior to reinstallation.
3. The spark igniter is 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.
4. Reinstall the flame rod and ignition wires. A red band identifies the flame rod wire.

I.5 Burner Removal

1. Turn heater OFF and disconnect power.
2. Once impeller is at a complete stand still, remove combustion chamber access panel.
3. Remove spring wedge holding defroster (14). Remove cable strap from mounting bracket. Pull defroster out and let it hang.
4. Open pipe union (12).
5. Remove bolts fastening both mounting brackets (13) to the combustion chamber. Leave brackets attached to the burner.
6. Remove burner.
7. Reverse procedure to reinstall.

I.6 Burner Defroster Removal



NOTE: The defroster circuit is protected with a reset-enabled fuse. If tripped, open then close the panel breaker to reset.

1. Turn heater OFF and disconnect power.
2. Once impeller is at a complete stand still, remove combustion chamber access panel.
3. Remove spring wedge holding defroster (14). Remove cable strap from mounting bracket.
4. Pull defroster out and let it hang.
5. Open electrical access panel. Trace defroster wires to terminal block (16), terminals 5 and 6. Disconnect last two wires on the bottom furthest right of terminal block.
6. Reverse procedure to reinstall.

J. HELLFIRE 400 SERVICE



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

In the absence of local codes, installation must comply with CAN/CSA-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.

For outdoor use only.

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



WARNING. To be installed in accordance with railroad and all applicable local governing regulations by persons approved by the railroad having authority.



WARNING. If you smell gas; immediately extinguish all sources of ignition and turn off gas source. Call qualified service technician to repair leak.



WARNING. Do not attempt to manually light burner. Heater equipped with an automatic electronic ignition system.



WARNING. Risk of cutting fingers or hand. Disconnect fan power prior to removing combustion chamber access panel or air intake.



WARNING. Heater can start automatically. Exercise caution when in close proximity.

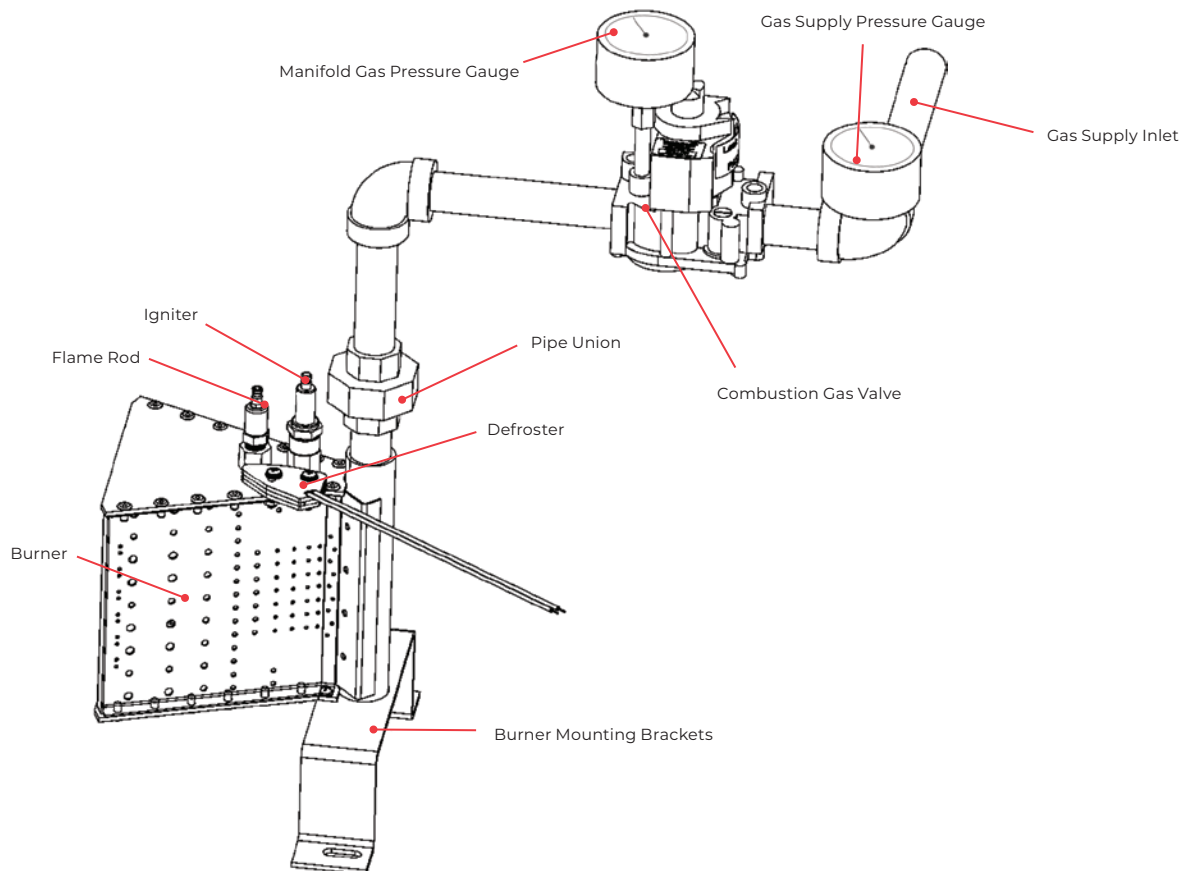


WARNING. Burn hazard / hot surfaces. Do not touch track ducts, nozzles or any non-insulated duct connected downstream of heater during operation



WARNING. Cut hazard. Sheet metal edges can be sharp. Wear protective clothing when handling track duct, insulated ducts and any other sheet metal components.

Refer to Appendix A - HELLFIRE Unit & Ducting System Maintenance Checklist.



J.1 Gas Supply Pressure



WARNING. All persons employed in handling propane or natural gas shall be trained in proper handling and operating procedures, as required by local authorities having jurisdiction.

1. Heater is factory tested on propane at 15 in/w.c supply pressure.
2. With the heater on and all connected loads operating, verify that the supply pressure, indicated on supply pressure gauge, is between 12 - 20 in/w.c.
3. Natural gas pressures below 12 in/w.c or LPG pressures below 7 in/w.c will limit the maximum capacity of the heater.

J.2 Gas Supply Leak Test

1. With the heater "OFF", paint all the gas pipe connections between the supply inlet to the gas source with leak testing solution. If a gas leak is detected, replace any cracked fittings or components, tighten any leaking pipe connection, or disassemble, reapply pipe thread sealant, and reassemble.

J.3 Manifold Leak Test

1. With the heater "OFF", paint all the gas pipe connections between the main, pilot, gas solenoid valves and the supply inlet with leak testing solution.
2. With the heater operating in "MANUAL" mode and the burner lit, paint all pipe connections between the main and pilot gas solenoid valves to the elbow with leak test solution.
3. If a gas leak is detected, turn heater "OFF". Replace any cracked fittings or components, tighten any leaking pipe connection, or disassemble, reapply pipe thread sealant, and reassemble.

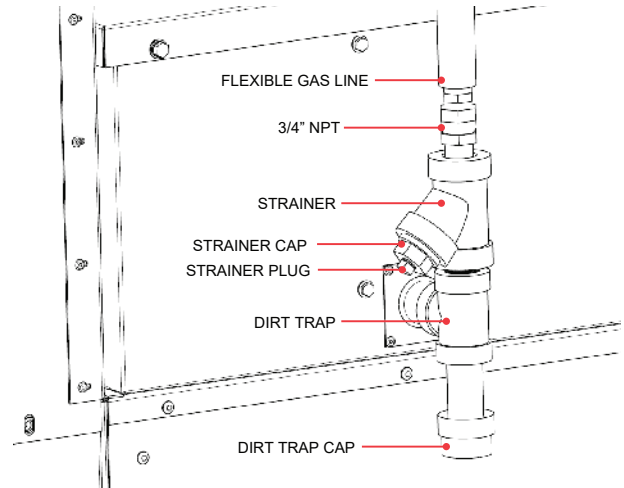
J.4 Combination Gas Valve Seat Leak Test

1. Turn heater OFF.
2. Verify supply pressure is between 14 – 20 inches water column.
3. Close the manual shut off on top of valve. Close the supply manual shutoff external to heater, typically mounted on the gas line riser.
4. After 10 minutes there should be no decrease of pressure on the supply pressure gauge. If there is, refer to the Honeywell gas valve manual in the component bulletin section at the end of this manual, for service information.

J.5 Dirt Trap And Strainer



WARNING. All persons employed in handling propane or natural gas shall be trained in proper handling and operating procedures, as required by local authorities having jurisdiction.



1. If a dirty supply line is suspected, turn off the local gas supply, remove the dirt trap cap and inspect for dirt and moisture.
2. If a strainer is installed, remove center plug and inspect for blockage. If evidence is found, locate source and correct problem.
3. If the strainer screen is clogged, remove the cap and screen. Old gasket is not reusable. Clean screen. Apply sealant to plug threads. Reinstall cleaned screen, cap with new gasket, and plug.
4. Inspect manifold and clean if necessary.
5. Empty cap of any dirt or moisture. Apply thread sealant and reinstall cap.
6. Turn on gas supply and leak test dirt trap.
7. Perform Combination Gas Valve Leak Test to ensure valve seats seal.

Motor

Running amps greater than 115% of the motor rated full load amps can indicate failed bearings, excessive air leaks in the ductwork, inadequately sized power supply wires, or poor electrical connections.

Voltage	Phase	Motor FLA Rating*	FLA X 1.15**
240	1	7.5	8.6
208	3	7.3	8.4
460	3	3.6	4.1
575	3	3.0	3.5

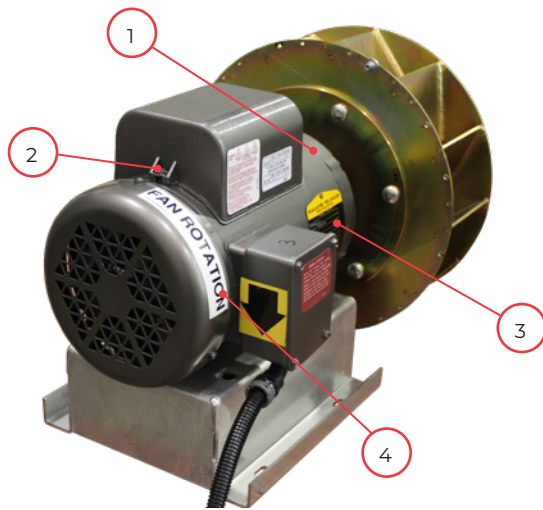
* FLA (Full Load Amperage), as shown on motor nameplate.

** Maximum current draw under design operating conditions of -40°C/°F ambient temperature at sea level and supply voltage. Current draw drops with temperature, elevation or voltage increase.

NOTE: Measure current between motor and contactor, not at the supply terminals.

J.6 Vibration Specifications and Measurement

1. All motor/impeller/base sets are match balanced with vibration levels lower than 0.20 in./sec RMS, at the four points depicted.



2. Do not measure on covers or guards.
3. Mark locations 1, 2, 3 and 4 on motor to ensure repeatable measurements for trend analysis.
4. Take measurements vertically at points 1 and 2, and horizontally at 3 and 4.

Vibration Level (in./sec)	
Acceptable	Less than 0.20
Tolerable	0.21 to 0.29
Excessive	0.30 to 0.71
Extreme	0.72 or more

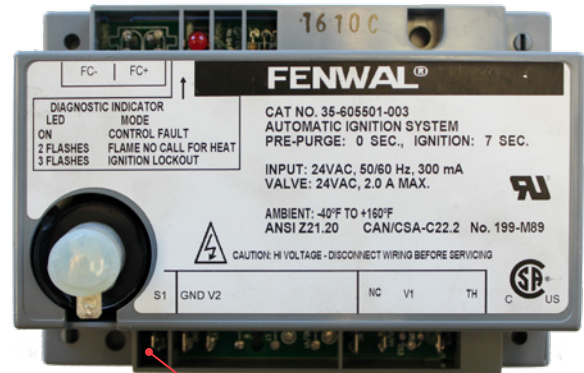
J.7 Lubrication

1. The motor has sealed bearings and does not require lubrication.
2. When installing flame rod or igniter always apply high temperature anti seize compound to threads.

J.8 Direct Spark Ignition Control Module (DSI)

1. This module has no serviceable parts.
2. To replace, disconnect the flame rod and ignition wires. Remove 4 mounting screws that fasten it to the panel. Install new DSI by reversing sequence.
3. For further information see the Fenwal 35-60J manual in the component bulletins section at the end of the Heater Operations Manual.

J.9 Flame Signal



Flame Signal Wire Connection, S1

NOTE: Flame signal strengths:

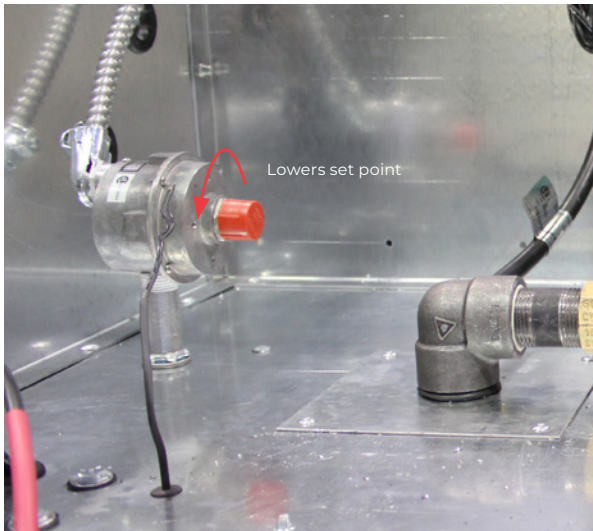
GOOD - 3.0 or greater, fluctuating less than 0.5 micro amps DC

WEAK – between 0.8 and 2.9 micro amps and / or fluctuating more than 0.5 micro amps DC

INSUFFICIENT – below 0.7 micro amps DC

1. The flame signal strength can be monitored using a voltmeter set to measure 0 - 10 micro amps DC, or using the Honeywell W136 test meter.
2. When using an ammeter, disconnect the flame rod wire and connect the red (+) lead to the DSI flame signal terminal, S1, and the black (-) into the flame rod wire.
3. Amperage is 0.0 with no flame, and a maximum of 10.0 with flame.
4. Signals between 1.5 to 2.9 micro amps and / or fluctuating more than 0.5 micro amps are weak. They allow the heater to continue to operate, however investigation and probable maintenance of flame rod, wiring, manifold pressure and burner is required. Expect irregular nuisance shutdowns.
5. Flame signals dropping below 1.5 micro amps cause the DSI to extinguish the burner and indicate alarm. DSI LED will flash 3 times every 3 seconds.
6. Inspection and probable maintenance of flame rod, wiring, manifold pressure and burner is required.

J.10 Air Switch



1. To check the air switch operation, while operating the unit, block 80% of the air intake screens openings with a sheet of cardboard. The heater continues to operate.
2. Now block 90%. The DSI extinguishes the burner and indicates alarm with the "FSR ALARM" LED lit.
3. Remove the blockage and reset the controller. The heater starts.

J.11 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.
2. Raise the set point by turning the screw clockwise until the switch opens and causes the DSI to extinguish the burner.
3. Remove blockage and reset controller.

J.12 High Temperature Limit

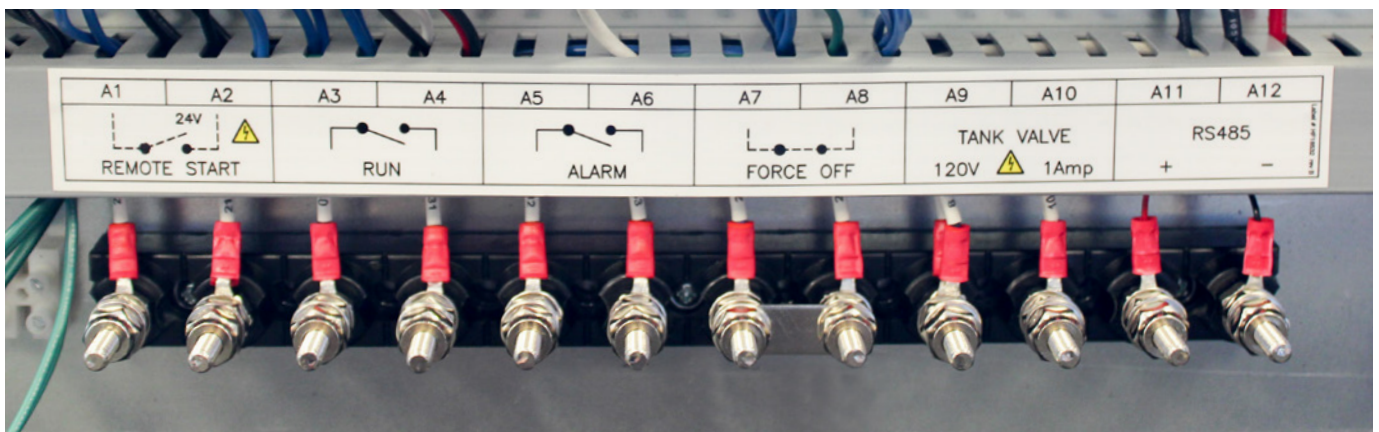
NOTE: The heater can not under normal circumstances raise the air temperature to the point of closing the high limit thermostat.

The thermostat and the circuit can be individually tested as follows:

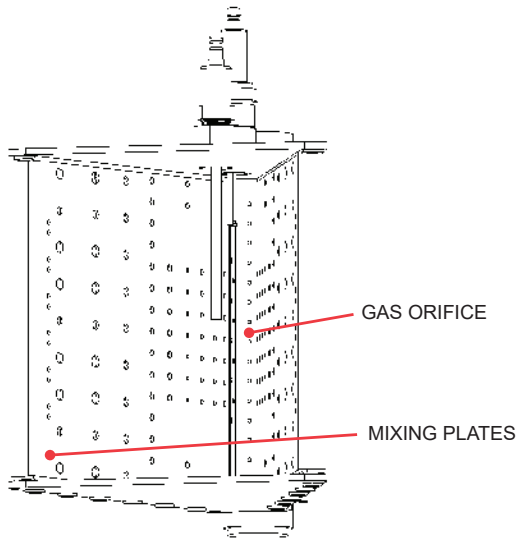
1. Turn the mode selector switch "OFF".
2. Open the thermostat box located on the sensor duct. Disconnect the red and white leads of the high limit thermostat.
3. At temperatures below 210°C (410°F) the high limit thermostat contact is open. Use a multimeter to measure continuity. Replace it if it is closed.
4. To verify the circuit and controller operation, simulate a high limit by shorting the red and white wires that connect to the panel. The controller indicates alarm with STATUS LED red, FSR ALARM LED red, ALARM LED red and HIGH LIM LED alternating.
5. Reconnect the thermostat and reset the controller.
6. Return the mode selector switch to desired mode.

J.13 AAR Terminals, Signals, and Communications

1. To verify REMOTE START:
 - 1.1 Place the heater in REMOTE RTC mode, and make a contact closure across AAR terminals A1 A2. The heater starts after the delay on period.
2. To verify RUN indication:
 - 2.1 Measure continuity across AAR terminals A3 A4.
 - 2.2 Closed contact indicates run, open indicates stopped. Confirm against actual heater state.
3. To verify ALARM indication:
 - 3.1 Measure continuity across AAR terminals A5 A6.
 - 3.2 Closed contact indicates alarm, open indicates normal operation. Confirm against actual heater state.
4. To verify FORCE OFF:
 - 4.1 Place the heater in MANUAL mode, open contact closure across AAR terminals A7 A8.
 - 4.2 The heater will stop after the post purge period.
5. To verify the tank valve switch:
 - 5.1 Measure the voltage across terminals A9 A10. With fan running the voltage is 120Vac.
6. To verify RS-485 communications:
 - 6.1 Refer to controller LED indications for TD, RD, and TX.



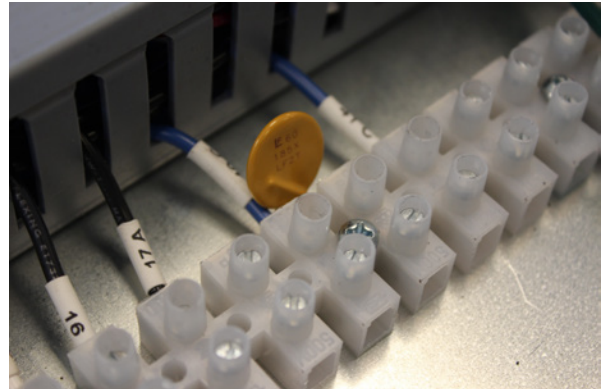
J.14 Burner



1. Visually inspect mixing plates for cracks or blockage. Remove any blockages. If cracks are found replace the burner.
2. Over time corrosion and or dirt restrict the burner orifice.
3. Inspect burner for blocked gas orifice, if:
 - 3.1 Signal strength is low even after replacing the flame rod and wire,
 - 3.2 Pilot pressure has to be raised significantly to get a good signal,
 - 3.3 Manifold pressure is above the maximum pressure setting, a minimum 60°C (140°F) increase of output air temperature can not be achieved.
4. To correct the problem, remove the burner, flame rod and igniter, following the removal instructions in the maintenance section.

5. Drill out any blocked gas orifice using a #48 (.076) drill bit.

J.15 Defroster



1. The defroster applies 25 watts of heat to the burner next to the flame rod and igniter. This is enough to raise the temperature of the end plate by approximately 32°C (90°F). It can be difficult to tell it is heating by sense of touch, therefore measure the current draw using a clip on ammeter. The current draw is 0.9 amps. A "Reset Enabled" fuse mounted on the terminal block protects this circuit.

If there is no current draw, open the 5-amp panel breaker, then close it to reset the fuse. If there is still no current draw, inspect defroster for damage.

K. HELLFIRE 900 SERVICE



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

In the absence of local codes, installation must comply with CAN/CSA-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.

For outdoor use only.

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



WARNING. To be installed in accordance with railroad and all applicable local governing regulations by persons approved by the railroad having authority.



WARNING. If you smell gas; immediately extinguish all sources of ignition and turn off gas source. Call qualified service technician to repair leak.



WARNING. Do not attempt to manually light burner. Heater equipped with an automatic electronic ignition system.



WARNING. Risk of cutting fingers or hand. Disconnect fan power prior to removing combustion chamber access panel or air intake.



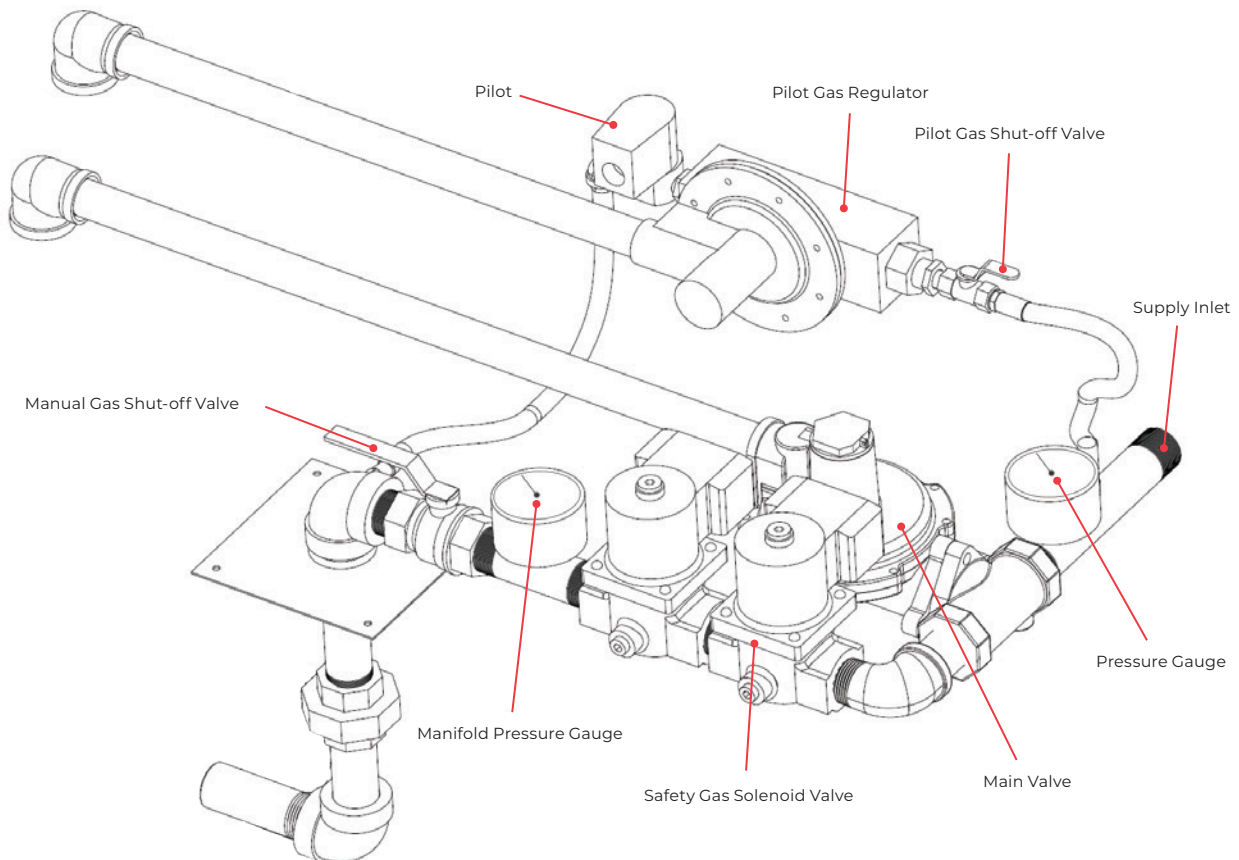
WARNING. Heater can start automatically. Exercise caution when in close proximity.



WARNING. Burn hazard / hot surfaces. Do not touch track ducts, nozzles or any non-insulated duct connected downstream of heater during operation



WARNING. Cut hazard. Sheet metal edges can be sharp. Wear protective clothing when handling track duct, insulated ducts and any other sheet metal components.



K.1 Gas Supply Pressure



WARNING. All persons employed in handling propane or natural gas shall be trained in proper handling and operating procedures, as required by local authorities having jurisdiction.

1. Heater is factory tested on propane at 10 psi supply pressure.
2. With the heater on and all connected loads operating, verify that the supply pressure, indicated on supply pressure gauge, is between 5 - 20 psi.
3. Natural gas pressures below 5 psi or LPG pressures below 2 psi will limit the maximum capacity of the heater.

K.2 Gas Supply Leak Test

1. With the heater "OFF", paint all the gas pipe connections between the supply inlet to the gas source with leak testing solution. If a gas leak is detected, replace any cracked fittings or components, tighten any leaking pipe connection, or disassemble, reapply pipe thread sealant, and reassemble.

K.3 Manifold Leak Test

1. With the heater "OFF", paint all the gas pipe connections between the main, pilot, gas solenoid valves and the supply inlet with leak testing solution.
2. With the heater operating in "MANUAL" mode and the burner lit, paint all pipe connections between the main and pilot gas solenoid valves to the elbow with leak test solution.
3. If a gas leak is detected, turn heater "OFF". Replace any cracked fittings or components, tighten any leaking pipe connection, or disassemble, reapply pipe thread sealant, and reassemble.

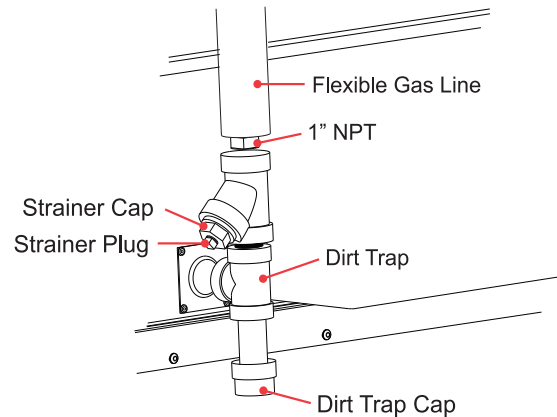
K.4 Main And Safety Gas Solenoid Valves Leak Test

1. Turn heater OFF.
2. Verify supply pressure is between 5 – 20 psi.
3. Close the manual pilot gas shut off valve upstream of the pilot gas regulator, with the handle perpendicular with the pipe.
4. With the manifold pressure gauge reading "0", close the manual gas shut off valve, downstream of the main and safety gas solenoid valve.
5. After 10 minutes there should be no increase of pressure on the downstream gauge. If there is an increase, refer to the Honeywell gas valve manual in the component bulletin section at the end of the Heater Operations Manual, for service information.

K.5 Dirt Trap And Strainer



WARNING. All persons employed in handling propane or natural gas shall be trained in proper handling and operating procedures, as required by local authorities having jurisdiction.



1. If a dirty supply line is suspected, turn off the local gas supply, remove the dirt trap cap and inspect for dirt and moisture.
2. If a strainer is installed, remove center plug and inspect for blockage. If evidence is found, locate source and correct problem.
3. If the strainer screen is clogged, remove the cap and screen. Old gasket is not reusable. Clean screen. Apply sealant to plug threads. Reinstall cleaned screen, cap with new gasket, and plug.
4. Inspect manifold and clean if necessary.
5. Empty cap of any dirt or moisture. Apply thread sealant and reinstall cap.
6. Turn on gas supply and leak test dirt trap.
7. Perform Main And Safety Gas Solenoid Valves Leak to ensure valve seats seal.

K.6 Motor

Running amps greater than 115% of the motor rated full load amps can indicate failed bearings, excessive air leaks in the ductwork, inadequately sized power supply wires, or poor electrical connections.

Voltage	Phase	Motor FLA Rating*	FLA X 1.15**
240	1	12.5	14.4
208	3	7.9	9.1
460	3	3.6	4.1
575	3	3.0	3.5

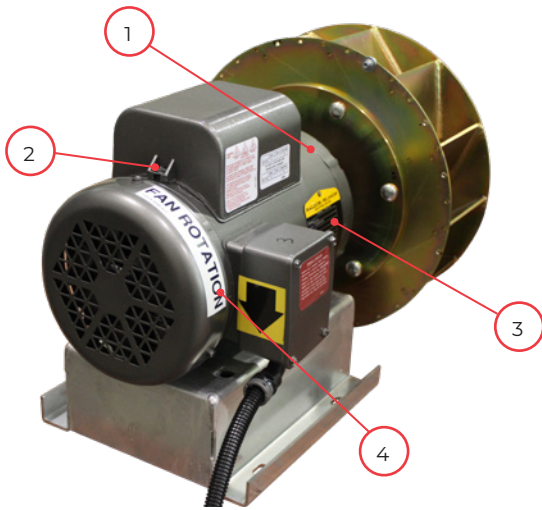
* FLA (Full Load Amperage), as shown on motor nameplate.

** Maximum current draw under design operating conditions of -40°C/°F ambient temperature at sea level and supply voltage. Current draw drops with temperature, elevation or voltage increase.

NOTE: Measure current between motor and contactor, not at the supply terminals.

K.7 Vibration Specifications and Measurement

1. All motor/impeller/base sets are match balanced with vibration levels lower than 0.20 in./sec RMS, at the four points depicted.



2. Do not measure on covers or guards.
3. Mark locations 1, 2, 3 and 4 on motor to ensure repeatable measurements for trend analysis.
4. Take measurements vertically at points 1 and 2, and horizontally at 3 and 4.

Vibration Level (in./sec)	
Acceptable	Less than 0.20
Tolerable	0.21 to 0.29
Excessive	0.30 to 0.71
Extreme	0.72 or more

K.8 Lubrication

1. The motor has sealed bearings and does not require lubrication.
2. When installing flame rod or igniter always apply high temperature anti seize compound to threads.

K.9 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:
 - 3.1 With adequate power, the green POWER will be lit and will blink every 4 seconds, indicating standby mode.
 - 3.2 Turn the mode selector switch to "MANUAL". The blower will start, followed by the trial for ignition. The yellow PILOT LED will light.
 - 3.3 Once the burner is lit and a flame signal is established, the red FLAME LED lights.
 - 3.4 After 10 seconds, the yellow MAIN LED lights, leaving four lit LEDs, the POWER, FLAME, PILOT and MAIN.
 - 3.5 The LEDs maintain this status until the cycling thermostat reaches its set point and turns off the request for heat.

4. As a further check, close the manual gas valve. The FLAME LED goes out, followed by the MAIN and PILOT LED, the red ALARM LED lights. Open manual gas valves. Reset controller, which in turn resets FSR.
5. For further information see the Honeywell 7800 series RM7895A Relay manual in the component bulletins section at the end of this manual.

K.10 Flame Signal



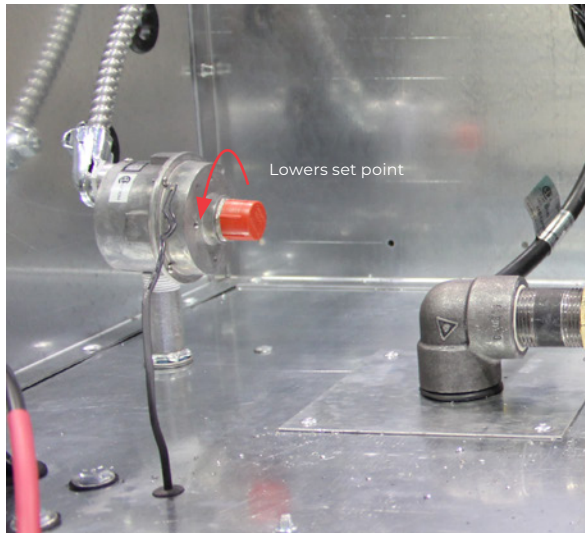
NOTE: Flame signal strengths:

- GOOD - 2.5V or greater, fluctuating less than 0.5V
 - WEAK – between 1.2V and 2.5V and / or fluctuating more than 0.5V
 - INSUFFICIENT – below 1.2V
1. The flame signal strength can be monitored using a voltmeter set to measure 0 - 10V DC, or using the plug in Honeywell display module.
 2. When using a voltmeter, insert the red lead into the positive (+) jack and the black into the negative of the flame signal amplifier located on beneath the FSR.
 3. Voltage is 0.0 with no flame, and a maximum of 5V with flame.
 4. Signals between 1.2V to 2.5V and / or fluctuating more than 0.5V are weak. They allow the heater to continue to operate, however investigation and probable maintenance of flame rod, wiring, manifold pressure and burner is required. Expect irregular nuisance shutdowns.
 5. Flame signals dropping below 1.2V cause the FSR to extinguish the burner and indicate alarm.
 6. Inspection and probable maintenance of flame rod, wiring, pressure and burner is required.

K.11 Air Switch

1. To check the air switch operation, while operating the unit, block 80% of the air intake screens openings with a sheet of cardboard. The heater continues to operate.
2. Now block 90%. The FSR extinguishes the burner and indicates alarm.

- Remove the blockage and reset the controller. The heater starts.



K.12 Air Switch Calibration

- 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.
- Remove blockage and reset FSR.

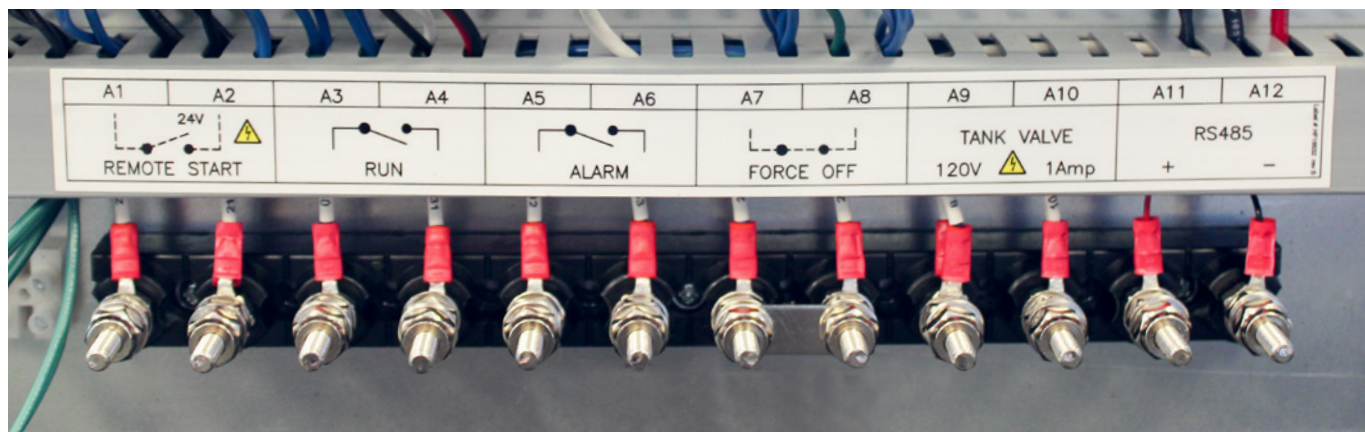
K.13 High Temperature Limit

- Turn the mode selector switch "OFF".
- Open the thermostat box located on the sensor duct. Disconnect the blue and black leads of the cycling thermostat.
- Use a jumper and short them together.
- Turn the heater on, "MANUAL", and let it run.

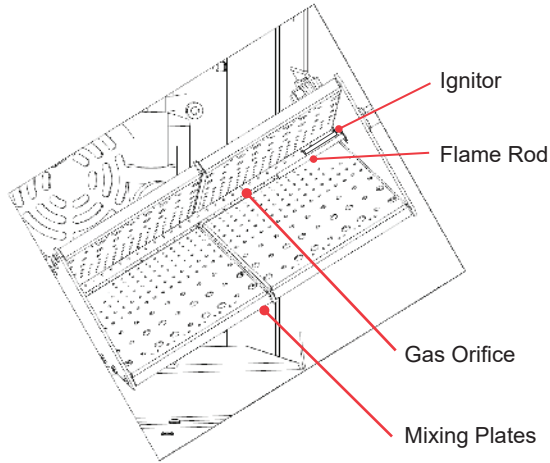
- Increase the manifold pressure to the maximum rated setting. Once the air temperature exceeds the 216°C (420°F) set point, the controller removes the request for heating, HEAT LED off, indicates alarm with STATUS LED red, FSR ALARM LED red, ALARM LED red and HIGH LIM LED alternating. The fan continues to run for 4 minutes of post purge.
- Return the mode selector switch to desired mode.
- Reconnect the cycling thermostat and reset the controller.

K.14 AAR Terminals, Signals, and Communications

- To verify remote start:
 - Place the heater in REMOTE RTC mode, and make a contact closure across AAR terminals A1 A2. The heater starts after the delay on period.
- To verify RUN indication:
 - Measure continuity across AAR terminals A3 A4.
 - Closed contact indicates run, open indicates stopped. Confirm against actual heater state.
- To verify ALARM indication:
 - Measure continuity across AAR terminals A5 A6.
 - Closed contact indicates alarm, open indicates normal operation. Confirm against actual heater state.
- To verify FORCE OFF:
 - Place the heater in MANUAL mode, open contact closure across AAR terminals A7 A8.
 - The heater will stop after the post purge period.
- To verify the tank valve switch:
 - Measure the voltage across terminals A9 A10. With fan running the voltage is 120Vac.
- To verify RS-485 communications:
 - Refer to controller LED indications for TD, RD, and TX.

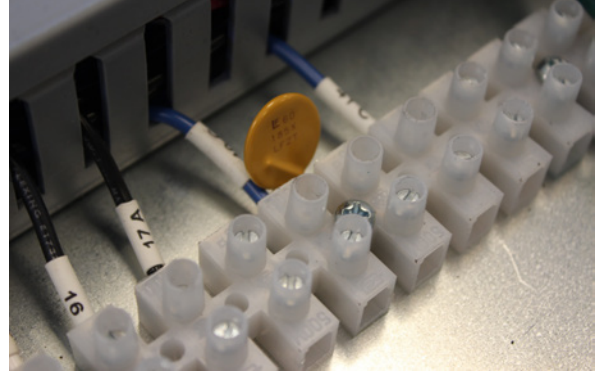


K.15 Burner



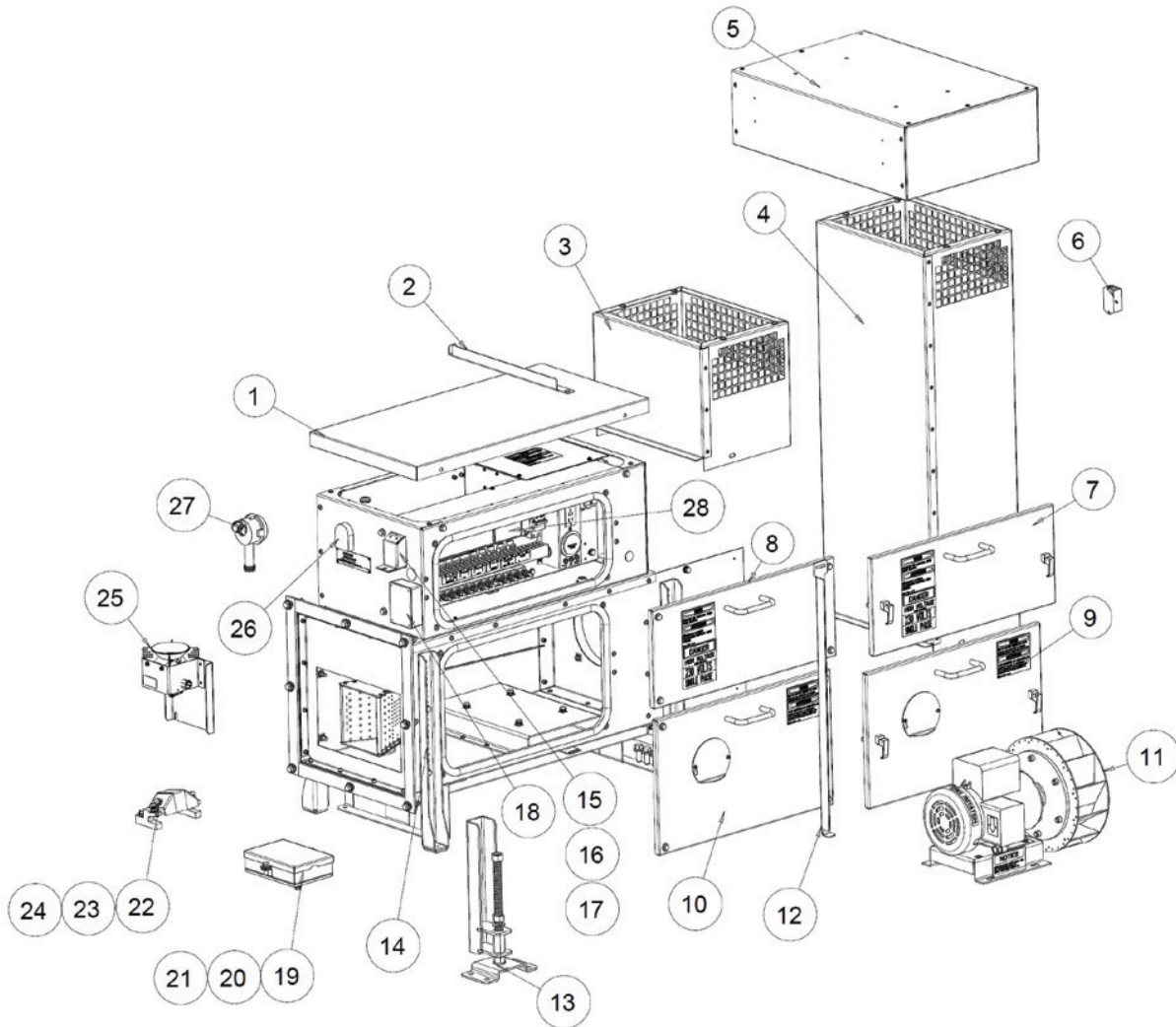
1. Visually inspect mixing plates for cracks or blockage. Remove any blockages. If cracks are found replace the burner.
2. Over time corrosion and or dirt restrict the burner orifice.
3. Inspect burner for blocked gas orifice, if:
 - 3.1 Signal strength is low even after replacing the flame rod and wire,
 - 3.2 Pilot pressure has to be raised significantly to get a good signal,
 - 3.3 Manifold pressure is above the maximum gas pressure setting to achieve a 121°C (250°F) increase of output air temperature.
4. To correct the problem, remove the burner, flame rod and igniter, following the removal instructions in the maintenance section.
5. Drill out any blocked gas orifice using a #47 (.0785) drill bit.

K.16 Defroster



1. The defroster applies 30 watts of heat to the burner next to the flame rod and igniter. This is enough to raise the temperature of the end plate by approximately 90°F. It can be difficult to tell it is heating by sense of touch, therefore measure the current draw using a clip on ammeter. The current draw is 1.25 amps. A resettable fuse mounted on the terminal block protects this circuit.
If there is no current draw, open the 5-amp panel breaker, then close it to reset the fuse. If there is still no current draw, inspect defroster for damage.

L. HELLFIRE 400 PARTS



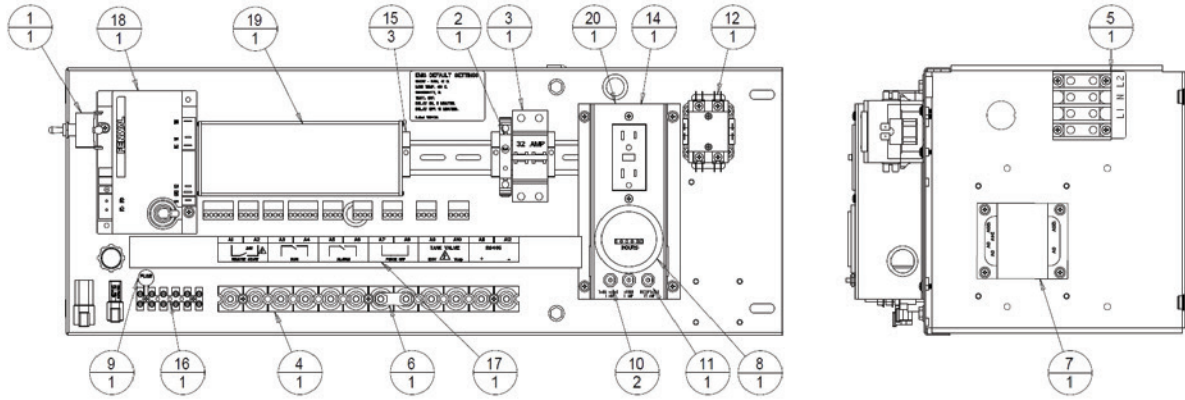
L.1 Parts - Heater Body

Table 1 – Heater Body Parts List

Index	Part No.	Description
1	13746	LID, ELECTRICAL COMPARTMENT
2	17436-03	LOCKING BAR, TOP
3	16679	EXT, INTAKE W/SCREEN, 13"H HF400
4	16679-04	EXT, INTAKE W/SCREEN, 43"H HF400
5	16680	HOOD, INTAKE, HF400, 26.5*18.18"W
6	16426	TEMP SNSR ASSY, AMB W/ATTACHED WIRING
7	14516-XX	PANEL, ACCESS, ELEC. CHMBR, ASSY., QIK. RLSE.
	-01	240V Single phase
	-02	208V 3 Phase
	-03	460V 3 Phase
8	14517-XX	PANEL, ACCESS, ELEC. CHMBR, ASSY., BOLT ON
	-01	240V Single phase
	-02	208V 3 Phase
	-03	460V 3 Phase
9	14519	PANEL, ACCESS, COMB CHMBR, ASSY., QIK. RLSE.
10	14520	PANEL, ACCESS, COMB CHMBR, ASSY., BOLT ON
11	19293	MOT/IMPLR ASSY, HF400 240VAC 1PH
or	19293-02	MOT/IMPLR ASSY, HF400 208/230/460VAC 3PH
or	19293-04	MOT/IMPLR ASSY, HF400 575VAC 3PH

Index	Part No.	Description
12	17436-02	LOCKING BAR, FRONT
13	16685	LVL LEG ASSY, HF900/400, SCREW
14	16076	LEG, FRONT, HF400/900, BOLT ON
15	17344	BOX, TOGGLE SW LOCK OUT
16	9038-0057	SW TOGGLE, SPDT ON-OFF-ON
17	9038-0060	SW BOOT, BLACK NEOPRENE
18	15948	SURGE ISOLATOR, RAIL THERMO W/ CMPNTS
19	13032	BOX, TEMP PROBE
20	13340-01	THERMO ASSY, TEMP CNTRL, HI LIMIT
21	13340-02	THERMO ASSY, TEMP CNTRL, CYCLING
22	17895	ENCL, SNAP SW, RAIL W/ MTG
23	13340-04	THERMOSTAT ASSY, RAIL, COR
24	17056	THERMOSTAT ASSY, RAIL, COR, C/W 40' CABLE
25	16441	PPT SNSR, C/W 6' CABLE ASSY
or	16707	PPT SNSR HEAD
or	17695	KIT, PC BOARD, PPT SNSR W/CMPNTS
26	9021-0005	VENT, CONDENSATION
27	16708-03	SW AIR, HF400, CALIBRATED
28	18784	EMS MODULE

Note: This list identifies the major components only. Recommended spare parts highlighted red.



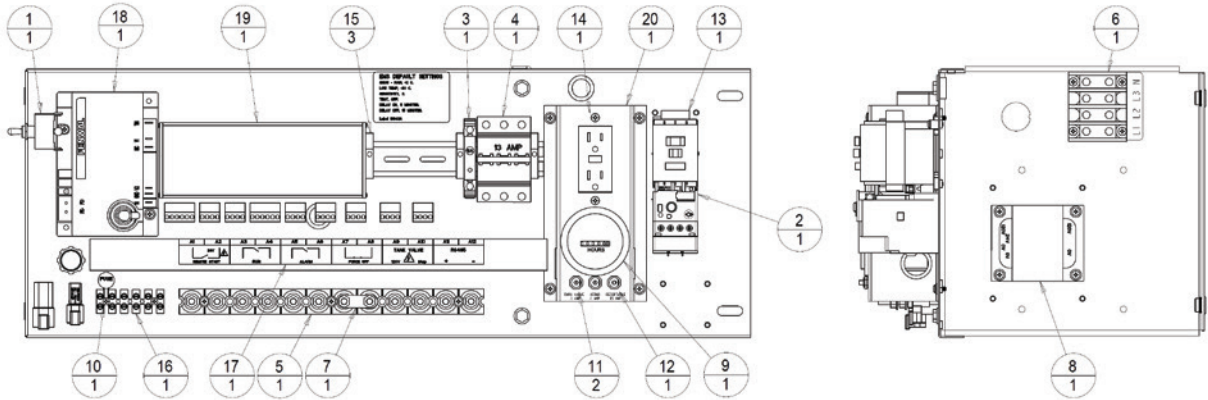
L.2 Parts - Control Panel, 240V Single Phase

Table 1 – Control Panel Parts List

Index	Part No.	Description
1	9038-0067	SW TOGGLE, DPDT ON-OFF-ON, SCREW TERM
2	9042-0044	CB, 1 POLE 5 A
3	9042-0046	CB, 2 POLE 32 A DIN RAIL MNT
4	9043-0004	BLOCK, TERM AAR 12 POLE C/W HDW
5	9043-0025	BLOCK, TERM 4 POLE, 600V 115A
6	9043-0027	JUMPER, AAR TERMINAL BLOCK
7	9064-0030	TRFRMR, CONT 120>24V & 120V 100 VA
8	9069-0015	METER, ELAPSED TIME HRS, 120VAC 60HZ
9	9077-0033	FUSE, RESETTABLE, 1.85AHOLD, 60V MAX, 3.7 TRIP CURRENT
10	9077-0034	CIRCUIT BREAKER, 1 AMP, PANEL MOUNT
11	9077-0035	CIRCUIT BREAKER, 15 AMP, PANEL MOUNT

Index	Part No.	Description
12	9078-0043	CONTACTOR, DEFINITE PURPOSE, 2 POLE, 25AMP, 3HP, 1PH
13	9078-0044	PROTECTIVE COVER, CONTACTOR, 2 POLE
14	9079-0004	RCPT, DUPLEX 15A-125V, GFCI SMARTLOCK
15	9088-1001	STOP, END, PLASTIC, 10MM W, DIN RAIL
16	17968	TB, TUBULAR, 6 POLE
17	18532	LABEL, AAR CONNECTOR, VINYL
18	18666	IGNTR MDL, GAS CNTRL W POTTED IGNITION TERMINAL
19	18679	CONTROLLER, HEATER, 24VAC I/O C/W DIN RAIL CARRIER
20	18931	BRKT, CIRCUIT INTERRUPTS & HR METER

Note: This list identifies the major components only. Recommended spare parts highlighted red.



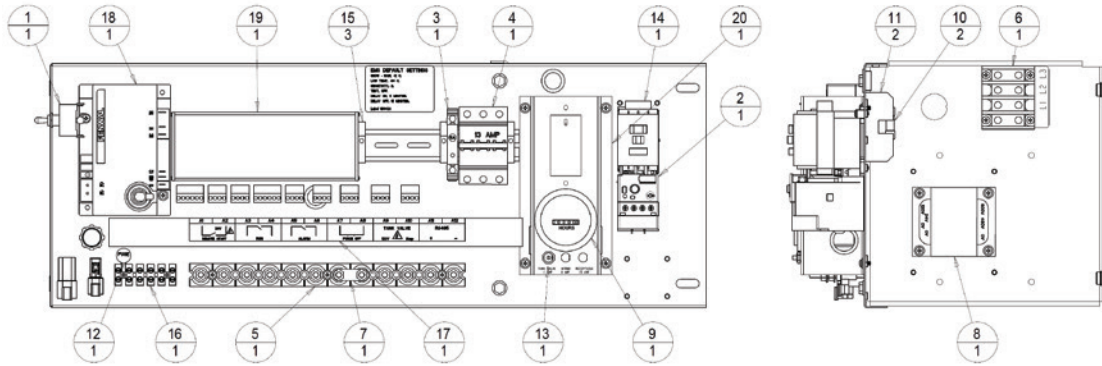
L.3 Parts - Control Panel, 208V Three Phase

Table 1 – Control Panel Parts List

Index	Part No.	Description
1	9038-0067	SW TOGGLE, DPDT ON-OFF-ON, SCREW TERM
2	9040-0151	THERMAL OVERLOAD RELAY, 3.2 - 16.0 A, 3PHASE
3	9042-0044	CB, 1 POLE 5 A
4	9042-0049	CB, 3 POLE 13A
5	9043-0004	BLOCK, TERM AAR 12 POLE C/W HDW
6	9043-0025	BLOCK, TERM 4 POLE, 600V 115A
7	9043-0027	JUMPER, AAR TERMINAL BLOCK
8	9064-0030	TRFRMR, CONT 120>24V & 120V 100 VA
9	9069-0015	METER, ELAPSED TIME HRS, 120VAC 60HZ
10	9077-0033	FUSE, RESETTABLE, 1.85AHOLD, 60V MAX, 3.7 TRIP CURRENT
11	9077-0034	CIRCUIT BREAKER, 1 AMP, PANEL MOUNT
12	9077-0035	CIRCUIT BREAKER, 15 AMP, PANEL MOUNT

Index	Part No.	Description
13	9078-0126	CONTACTOR, 12A C/W 120V COIL
14	9079-0004	RCPT, DUPLEX 15A-125V, GFCI SMARTLOCK
15	9088-1001	STOP, END, PLASTIC, 10MM W, DIN RAIL
16	17968	TB, TUBULAR, 6 POLE
17	18532	LABEL, AAR CONNECTOR, VINYL
18	18666	IGNTR MDL, GAS CNTRL W POTTED IGNITION TERMINAL
19	18679	CONTROLLER, HEATER, 24VAC I/O C/W DIN RAIL CARRIER
20	18931	BRKT, CIRCUIT INTERRUPTS & HR METER

Note: This list identifies the major components only. Recommended spare parts highlighted red.



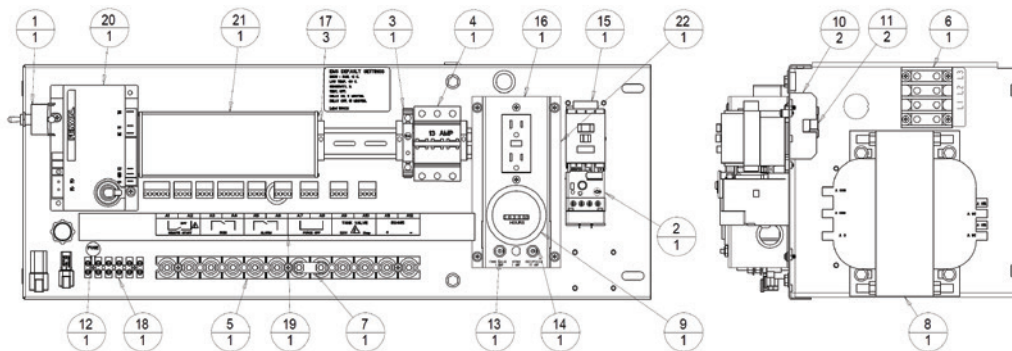
L.4 Parts - Control Panel, 460 - 575V Three Phase

Table 1 – Control Panel Parts List

Index	Part No.	Description
1	9038-0067	SW TOGGLE, DPDT ON-OFF-ON, SCREW TERM
2	9040-0150	THERMAL OVERLOAD RELAY, 1.0 - 5.0 A, 3PHASE
3	9042-0044	CB, 1 POLE 5 A
4	9042-0049	CB, 3 POLE 13A
5	9043-0004	BLOCK, TERM AAR 12 POLE C/W HDW
6	9043-0025	BLOCK, TERM 4 POLE, 600V 115A
7	9043-0027	JUMPER, AAR TERMINAL BLOCK
8	9064-0032	TRFRMR, CONT 460/575>24V 4A/120V .166A
9	9069-0015	METER, ELAPSED TIME HRS, 120VAC 60HZ
10	9077-0015	FUSE, 1/2 AMP 600V
11	9077-0028	FUSE HOLDER, PANEL MOUNT
12	9077-0033	FUSE, RESETTABLE, 1.85AHOLD, 60V MAX, 3.7 TRIP CURRENT
13	9077-0034	CIRCUIT BREAKER, 1 AMP, PANEL MOUNT

Index	Part No.	Description
14	9078-0126	CONTACTOR, 12A C/W 120V COIL
15	9088-1001	STOP, END, PLASTIC, 10MM W, DIN RAIL
16	17968	TB, TUBULAR, 6 POLE
17	18532	LABEL, AAR CONNECTOR, VINYL
18	18666	IGNTR MDL, GAS CNTRL W POTTED IGNITION TERMINAL
19	18679	CONTROLLER, HEATER, 24VAC I/O C/W DIN RAIL CARRIER
20	18931	BRKT, CIRCUIT INTERUPTS & HR METER

Note: This list identifies the major components only. Recommended spare parts highlighted red.



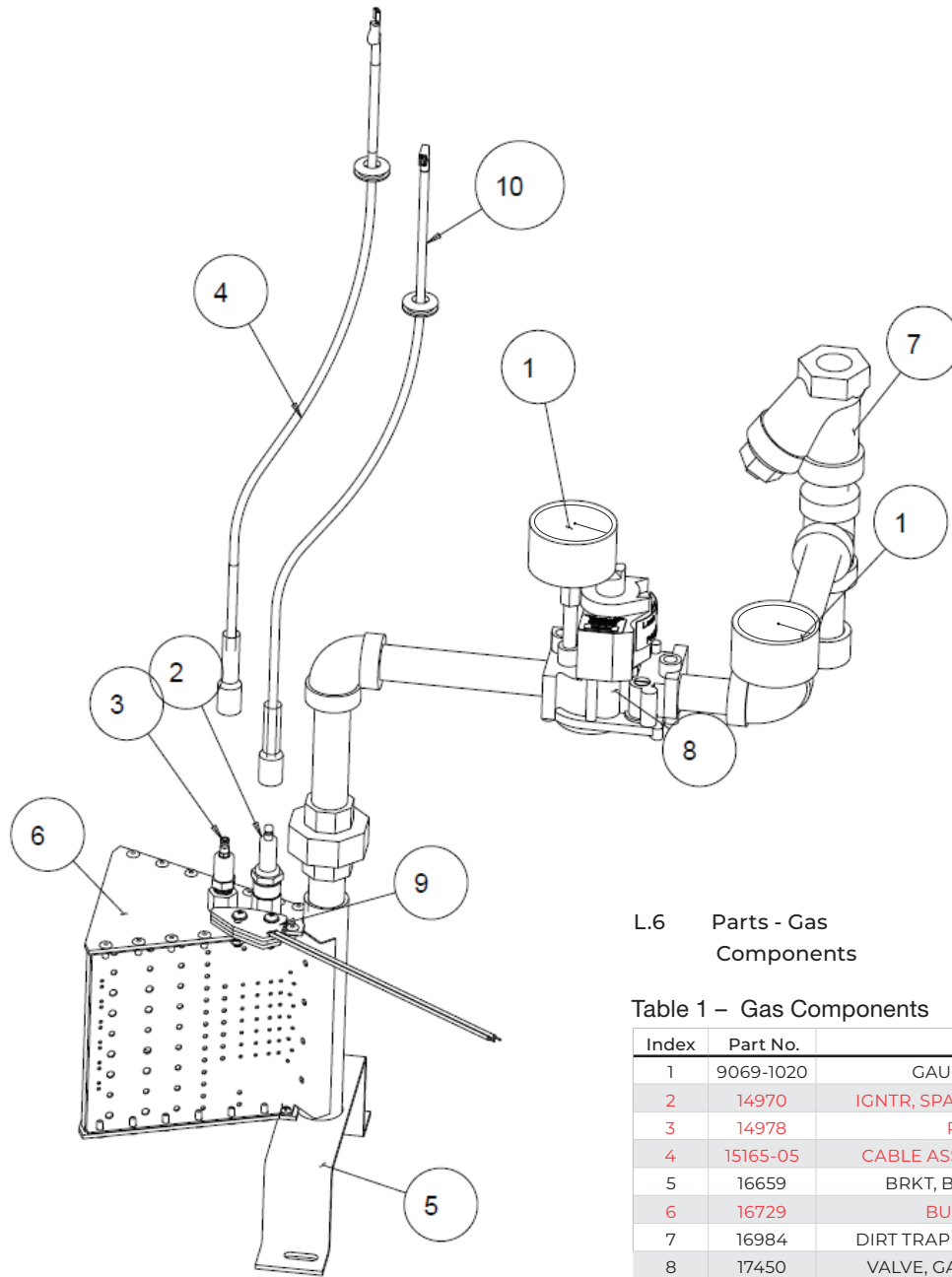
L.5 Parts - Control Panel, 460V/575V Three Phase with 120V Duplex Receptacle

Table 1 – Control Panel Parts List

Index	Part No.	Description
1	9038-0067	SW TOGGLE, DPDT ON-OFF-ON, SCREW TERM
2	9040-0150	THERMAL OVERLOAD RELAY, 1.0 - 5.0 A, 3PHASE
3	9042-0044	CB, 1 POLE 5 A
4	9042-0049	CB, 3 POLE 13A
5	9043-0004	BLOCK, TERM AAR 12 POLE C/W HDW
6	9043-0025	BLOCK, TERM 4 POLE, 600V 115A
7	9043-0027	JUMPER, AAR TERMINAL BLOCK
8	9064-0033	TRFRMR, CONT 460/575>120V 15A/24V 4A
9	9069-0015	METER, ELAPSED TIME HRS, 120VAC 60HZ
10	9077-0028	FUSE HOLDER, PANEL MOUNT
11	9077-0032	FUSE, 5 AMP 600V TIME DELAY FUSE
12	9077-0033	FUSE, RESETTABLE, 1.85AHOLD, 60V MAX, 3.7 TRIP CURRENT
13	9077-0034	CIRCUIT BREAKER, 1 AMP, PANEL MOUNT

Index	Part No.	Description
14	9077-0035	CIRCUIT BREAKER, 15 AMP, PANEL MOUNT
15	9078-0126	CONTACTOR, 12A C/W 120V COIL
16	9079-0004	RCPT, DUPLEX 15A-125V, GFCI SMARTLOCK
17	9088-1001	STOP, END, PLASTIC, 10MM W, DIN RAIL
18	17968	TB, TUBULAR, 6 POLE
19	18532	LABEL, AAR CONNECTOR, VINYL
20	18666	IGNTR MDL, GAS CNTRL W POTTED IGNITION TERMINAL
21	18679	CONTROLLER, HEATER, 24VAC I/O C/W DIN RAIL CARRIER
22	18931	BRKT, CIRCUIT INTERUPTS & HR METER

Note: This list identifies the major components only. Recommended spare parts highlighted red.



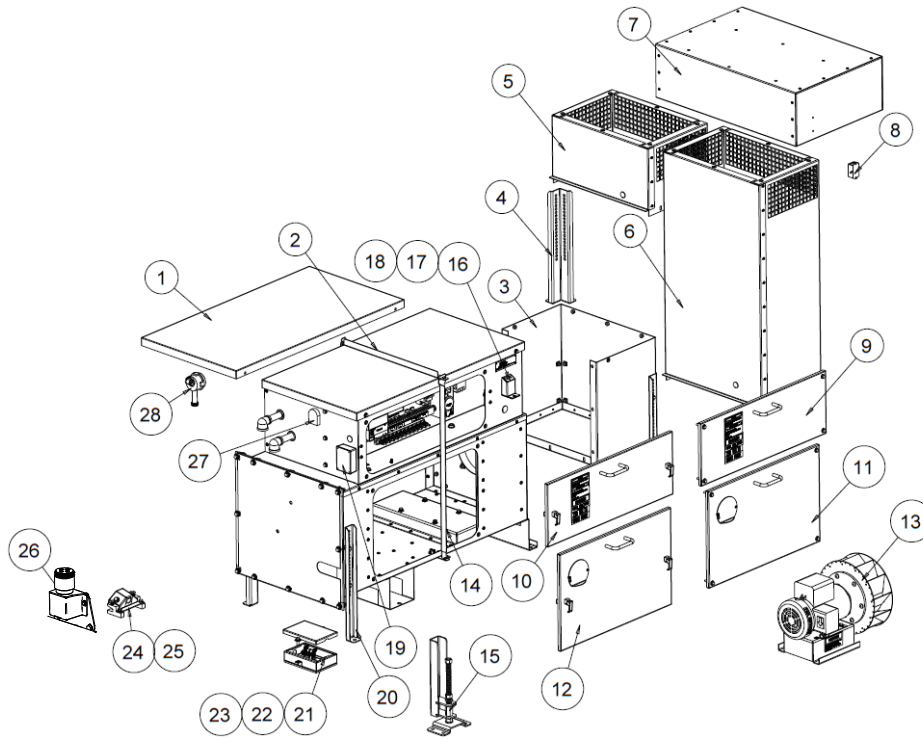
L.6 Parts - Gas Components

Table 1 – Gas Components

Index	Part No.	Description
1	9069-1020	GAUGE, PRESS, 0-30"WC 1/8NPT
2	14970	IGNTR, SPARK GENERAL, COATED W/BORON
3	14978	ROD, FLAME 3"L 1/4"NPT
4	15165-05	CABLE ASSY, FLAME ROD 22"L P/NG HF400
5	16659	BRKT, BURNER, HF400 COMB CHMBR
6	16729	BURNER ASSY, 400 KBTU/HR
7	16984	DIRT TRAP GAS INTAKE 3/4" NPT C/W Y-STRN
8	17450	VALVE, GAS CONTROL, DIRECT SPARK IGN
9	17981	HEATER, SURF. MNT. 30W, 24VAC W/ LEADS
10	19033	CABLE ASSY, IGN 17"L P/NG HF400 2014, FENWAL

Note: This list identifies the major components only. Recommended spare parts highlighted red.

M. HELLFIRE 900 PARTS



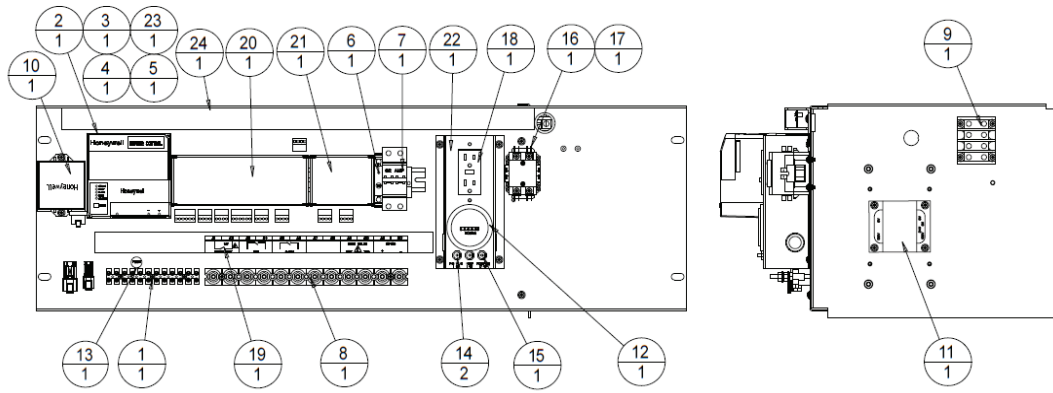
M.1 Parts - Heater Body

Table 1 – Heater Body Parts List

Index	Part No.	Description
1	18929	LID, ELECTRICAL COMPARTMENT
2	17437-01	LOCKING BAR, TOP
3	16058	PLENUM, INTAKE, HF900
4	16075	LEG, REAR, HF400/900
5	16067-01	EXT, INTAKE W/SCREEN, 13"L HF900
6	16067-02	EXT, INTAKE W/SCREEN, 43"H HF900
7	18930	HOOD, AIR INTAKE
8	16426	TEMP SNSR ASSY, AMB
9	18936-XX	PANEL, ACCESS, ELEC. CHMBR, ASSY., BOLT ON
	-01	240V Single phase
	-02	208V 3 Phase
	-03	460V 3 Phase
10	18935-XX	PANEL, ACCESS, ELEC. CHMBR, ASSY., QIK. RLSE.
	-01	240V Single phase
	-02	208V 3 Phase
	-03	460V 3 Phase
11	18939	PANEL, ACCESS, COMB CHMBR, ASSY., BOLT ON
12	18938	PANEL, ACCESS, COMB CHMBR, ASSY., QIK. RLSE.

Index	Part No.	Description
13	17439-XX	MOT/IMPLR ASSY
or	-01	HF900 240VAC 1PH
or	-02	HF900 208/230/460VAC 3PH
or	-03	HF900 575VAC 3PH
14	17437-02	LOCKING BAR, FRONT
15	16685	LVL LEG ASSY, HF900/400, SCREW
16	17344	BOX, TOGGLE SW LOCK OUT
17	9038-0057	SW TOGGLE, SPDT ON-OFF-ON
18	9038-0060	SW BOOT, BLACK NEOPRENE
19	15948	SURGE ISOLATOR, RAIL THERMO W/ CMPNTS
20	16076	LEG, FRONT, HF400/900, BOLT ON
21	13032	BOX, TEMP PROBE
22	13340-01	THERMO ASSY, TEMP CNTRL, HI LIMIT
23	13340-02	THERMO ASSY, TEMP CNTRL, CYCLING
24	17895	ENCL, SNAP SW, RAIL W/ MTG
25	13340-04	THERMOSTAT ASSY, RAIL, COR
26	16441	PPT SNSR, C/W 6' CABLE ASSY
or	16707	PPT SNSR HEAD
or	17695	KIT, PC BOARD, PPT SNSR W/CMPNTS
27	9021-0005	VENT, CONDENSATION
28	16708-02	SW AIR, HF900, CALIBRATED

Note: This list identifies the major components only. Recommended spare parts highlighted red.



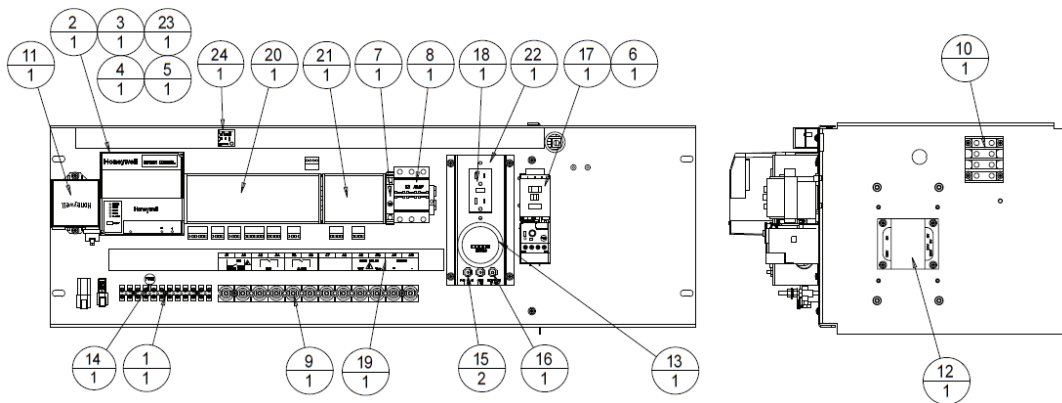
M.2 Parts - Control Panel, 240V Single Phase

Table 1 – Control Panel Parts List

Index	Part No.	Description
1	9012-0059	BUCHANAN TSB100012DS=TUBULAR BARRIER ST
2	9040-0018	RELAY, FS, BURNER CONTROL
3	9040-0022	AMPLIFIER, FS, MDL
4	9040-0023	CARD, FS, PURGE TIMER, 2 SEC
5	9040-0042	BASE, RELAY, FS, RM7800 PANEL MTG
6	9042-0044	CB, 1 POLE 5 A
7	9042-0046	CB, 2 POLE 32 A
8	9043-0004	BLOCK, TERM AAR 12 POLE C/W HDW
9	9043-0025	BLOCK, TERM 4 POLE, 600V 115A
10	9064-0021	TRFRMR, IGN, 120V PRI
11	9064-0030	TRFRMR, CONT 120>24V & 120V 100 VA
12	9069-0015	METER, ELAPSED TIME HRS, 120VAC 60HZ
13	9077-0033	FUSE, RESETTABLE

Index	Part No.	Description
14	9077-0034	CB, 1A, PNL MNT
15	9077-0035	CB, 15A, PNL MNT
16	9078-0043	CONTACTOR, 2 POLE, 25A, 120V COIL
17	9078-0044	PROTECTIVE COVER, CONTACTOR, 2 POLE
18	9079-0004	RCPT, DUPLEX 15A-125V, GFCI SMARTLOCK
19	18532	LABEL, AAR CONNECTOR, VINYL
20	18783-02	CONTROLLER, 900 HEATER
21	18784	EMS MODULE
22	18931	BRKT, FUSE & HR METER
23	18934	RESET MODULE
24	19018	PROGRAMMING KEY, CONTROLLER

Note: This list identifies the major components only. Recommended spare parts highlighted red.



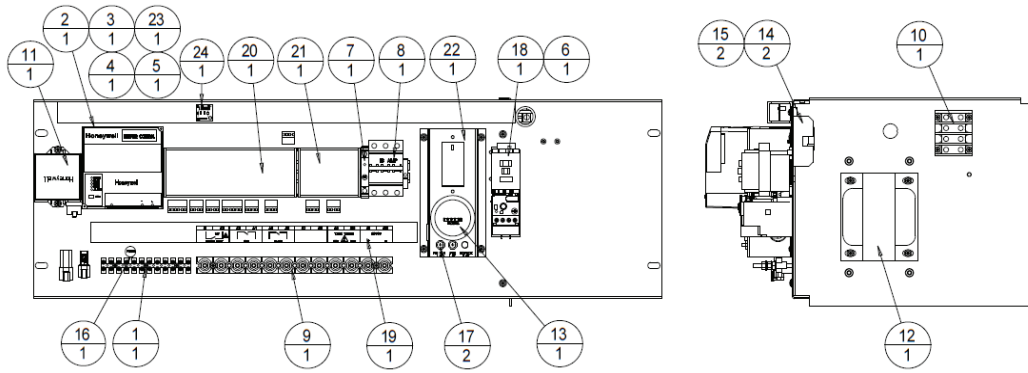
M.3 Parts - Control Panel, 208V Three Phase

Table 1 – Control Panel Parts List

Index	Part No.	Description
1	9012-0059	BUCHANAN TSB100012DS=TUBULAR BARRIER ST
2	9040-0018	RELAY, FS, BURNER CONTROL
3	9040-0022	AMPLIFIER, FS, MDL
4	9040-0023	CARD, FS, PURGE TIMER, 2 SEC
5	9040-0042	BASE, RELAY, FS, RM7800 PANEL MTG
6	9040-0151	THERMAL OVERLOAD RELAY, 3.2 - 16.0 A, 3PHASE
7	9042-0044	CB, 1 POLE 5 A
8	9042-0049	CB, 3 POLE 13A
9	9043-0004	BLOCK, TERM AAR 12 POLE C/W HDW
10	9043-0025	BLOCK, TERM 4 POLE, 600V 115A
11	9064-0021	TRFRMR, IGN, 120V PRI
12	9064-0030	TRFRMR, CONT 120>24V & 120V 100 VA
13	9069-0015	METER, ELAPSED TIME HRS, 120VAC 60HZ

Index	Part No.	Description
14	9077-0033	FUSE, RESETTABLE
15	9077-0034	CB, 1A, PNL MNT
16	9077-0035	CB, 15A, PNL MNT
17	9078-0126	CONTACTOR, 12A C/W 120V COIL
18	9079-0004	RCPT, DUPLEX 15A-125V, GFCI SMARTLOCK
19	18532	LABEL, AAR CONNECTOR, VINYL
20	18783-02	CONTROLLER, 900 HEATER
21	18784	EMS MODULE
22	18931	BRKT, FUSE & HR METER
23	18934	RESET MODULE
24	19018	PROGRAMMING KEY, CONTROLLER

Note: This list identifies the major components only. Recommended spare parts highlighted red.



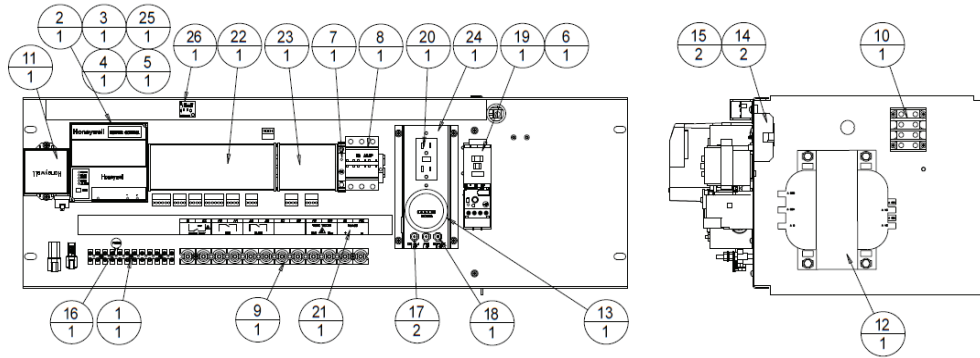
M.4 Parts - Control Panel, 460 - 575V Three Phase

Table 1 – Control Panel Parts List

Index	Part No.	Description
1	9012-0059	BUCHANAN TSB100012DS=TUBULAR BARRIER ST
2	9040-0018	RELAY, FS, BURNER CONTROL
3	9040-0022	AMPLIFIER, FS, MDL
4	9040-0023	CARD, FS, PURGE TIMER, 2 SEC
5	9040-0042	BASE, RELAY, FS, RM7800 PANEL MTG
6	9040-0151	THERMAL OVERLOAD RELAY, 3.2 - 16.0 A, 3PHASE (use with 460V configuration)
or	9040-0150	THERMAL OVERLOAD RELAY, 1.0 - 5.0 A, 3PHASE (use with 575V configuration)
7	9042-0044	CB, 1 POLE 5 A
8	9042-0046	CB, 2 POLE 32 A
9	9043-0004	BLOCK, TERM AAR 12 POLE C/W HDW
10	9043-0025	BLOCK, TERM 4 POLE, 600V 115A
11	9064-0021	TRFRMR, ICG, 120V PRI

Index	Part No.	Description
12	9064-0033	TRFRMR, CONT 460/575>120V 15A/24V 4A (shown) (for configurations with 120V duplex receptacle)
or	9064-0031	TRFRMR, CONT 460/575>120V 4A /24V 4A (for standard configuration, no receptacle)
13	9069-0015	METER, ELAPSED TIME HRS, 120VAC 60HZ
14	9077-0028	FUSE HOLDER, PANEL MOUNT
15	9077-0031	FUSE, 1.5 AMP 600V
16	9077-0033	FUSE, RESETTABLE
17	9077-0034	CB, 1A, PNL MNT
18	9078-0126	CONTACTOR, 12A C/W 120V COIL
19	18532	LABEL, AAR CONNECTOR, VINYL
20	18783-02	CONTROLLER, 900 HEATER
21	18784	EMS MODULE
22	18931	BRKT, FUSE & HR METER
23	18934	RESET MODULE
24	19018	PROGRAMMING KEY, CONTROLLER

Note: This list identifies the major components only. Recommended spare parts highlighted red.



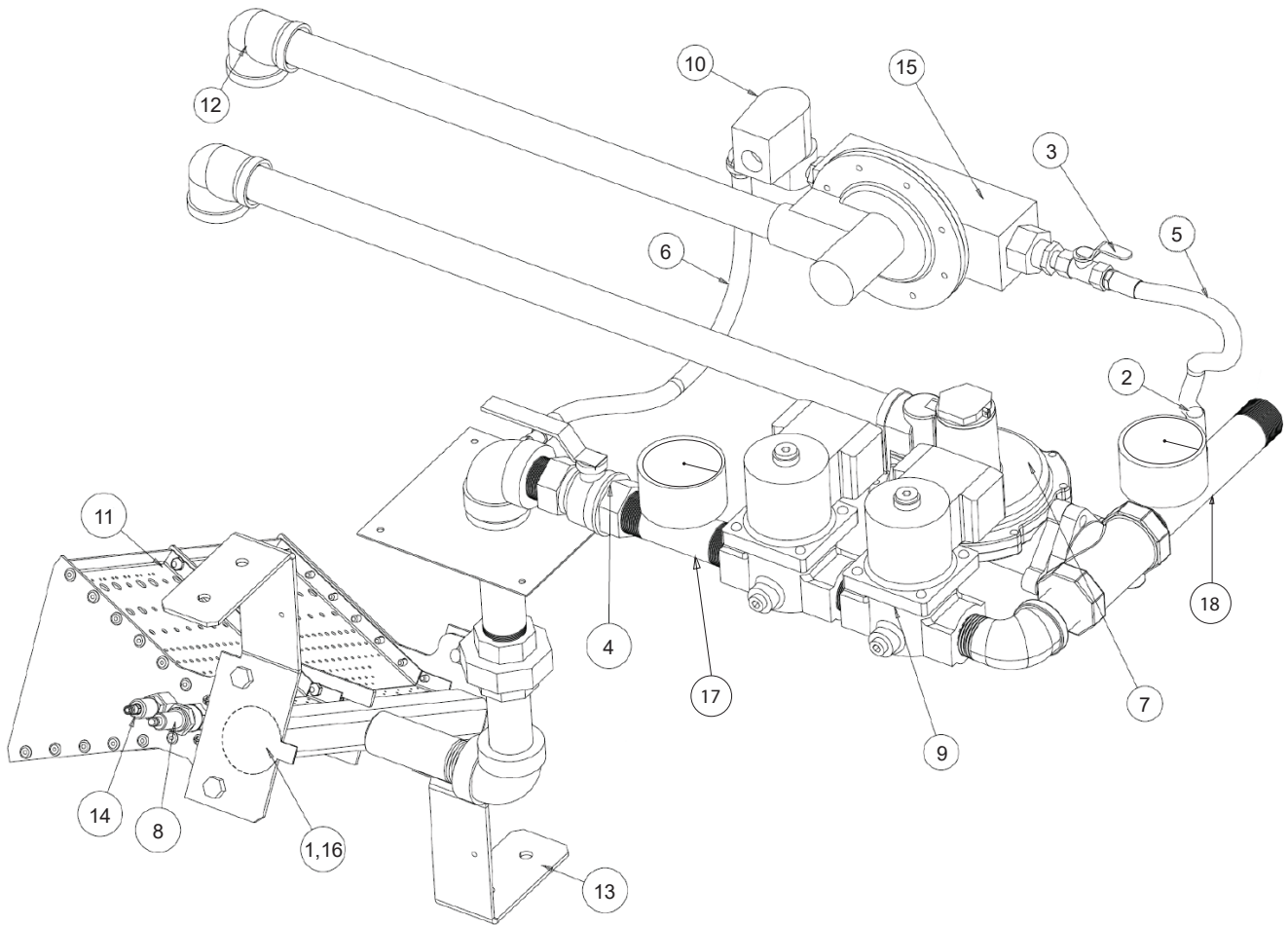
M.5 Parts - Control Panel, 460V/575V Three Phase with 120V Duplex Receptacle

Table 1 – Control Panel Parts List

Index	Part No.	Description
1	9012-0059	BUCHANAN TSB100012DS=TUBULAR BARRIER ST
2	9040-0018	RELAY, FS, BURNER CONTROL
3	9040-0022	AMPLIFIER, FS, MDL
4	9040-0023	CARD, FS, PURGE TIMER, 2 SEC
5	9040-0042	BASE, RELAY, FS, RM7800 PANEL MTG
6	9040-0151	THERMAL OVERLOAD RELAY, 3.2 - 16.0 A, 3PHASE (use with 460V configuration)
or	9040-0150	THERMAL OVERLOAD RELAY, 1.0 - 5.0 A, 3PHASE (use with 575V configuration)
7	9042-0044	CB, 1 POLE 5 A
8	9042-0046	CB, 2 POLE 32 A
9	9043-0004	BLOCK, TERM AAR 12 POLE C/W HDW
10	9043-0025	BLOCK, TERM 4 POLE, 600V 115A
11	9064-0021	TRFRMR, ICG, 120V PRI
12	9064-0033	TRFRMR, CONT 460/575>120V 15A/24V 4A (shown) (for configurations with 120V duplex receptacle)
or	9064-0031	TRFRMR, CONT 460/575>120V 4A /24V 4A (for standard configuration, no receptacle)

Index	Part No.	Description
13	9069-0015	METER, ELAPSED TIME HRS, 120VAC 60HZ
14	9077-0028	FUSE HOLDER, PANEL MOUNT
15	9077-0031	FUSE, 1.5 AMP 600V
16	9077-0033	FUSE, RESETTABLE
17	9077-0034	CB, 1A, PNL MNT
18	9077-0035	CB, 15A, PNL MNT
19	9078-0126	CONTACTOR, 12A C/W 120V COIL
20	9079-0004	RCPT, DUPLEX 15A-125V, GFCI SMARTLOCK
21	18532	LABEL, AAR CONNECTOR, VINYL
22	18783-02	CONTROLLER, 900 HEATER
23	18784	EMS MODULE
24	18931	BRKT, FUSE & HR METER
25	18934	RESET MODULE
26	19018	PROGRAMMING KEY, CONTROLLER

Note: This list identifies the major components only. Recommended spare parts highlighted red.



M.6 Parts - Gas Components

Table 1 – Gas Components

Index	Part No.	Description
1	19304	HTR, 2"DIA 30W 24VAC 18"L LEADS SI
2	9045-0085	CONN, 1/4TUBE MALE * 1/8NPTM, BR
3	9045-0160	VALVE, BALL 1/4" NPT 1/4 TURN
4	9045-1003	REGULATOR, PILOT 125PSI/9 - 13"WC
5	9069-1015	HOSE, PRPNE 1/4"NPTF F/SWVL* 12"L
6	9081-0066	REGULATOR, 12.5-20"WC (HSR)
8	14970	IGNTR, SPARK
9	9089-0026	VALVE, SOL, GAS, 1"NPT 120V (HONEYWELL)
10	9089-0028	VALVE, SOL, PILOT, GAS, 1/4"NPT 50CFH

Index	Part No.	Description
11	11700	BURNER, HF900
12	11712	VENT ELBOW
13	11739	BRKT, SUPPORT, HF 900 BURNER
14	14978	ROD, FLAME 3"L 1/4"NPT
15	16952	PILOT REGULATOR, MODIFIED
16	17927	SPRING WEDGE, 2"X2", SST, HF900 BURNER DEFROSTER
Not Shown	13142-04	CABLE ASSY, IGN 21"L P/NG HF900
Not Shown	15165-04	CABLE ASSY, FLAME ROD 22"L P/NG HF900

Note: This list identifies the major components only. Recommended spare parts highlighted red.

N. ELECTRICAL

N.1 Motor Resistances

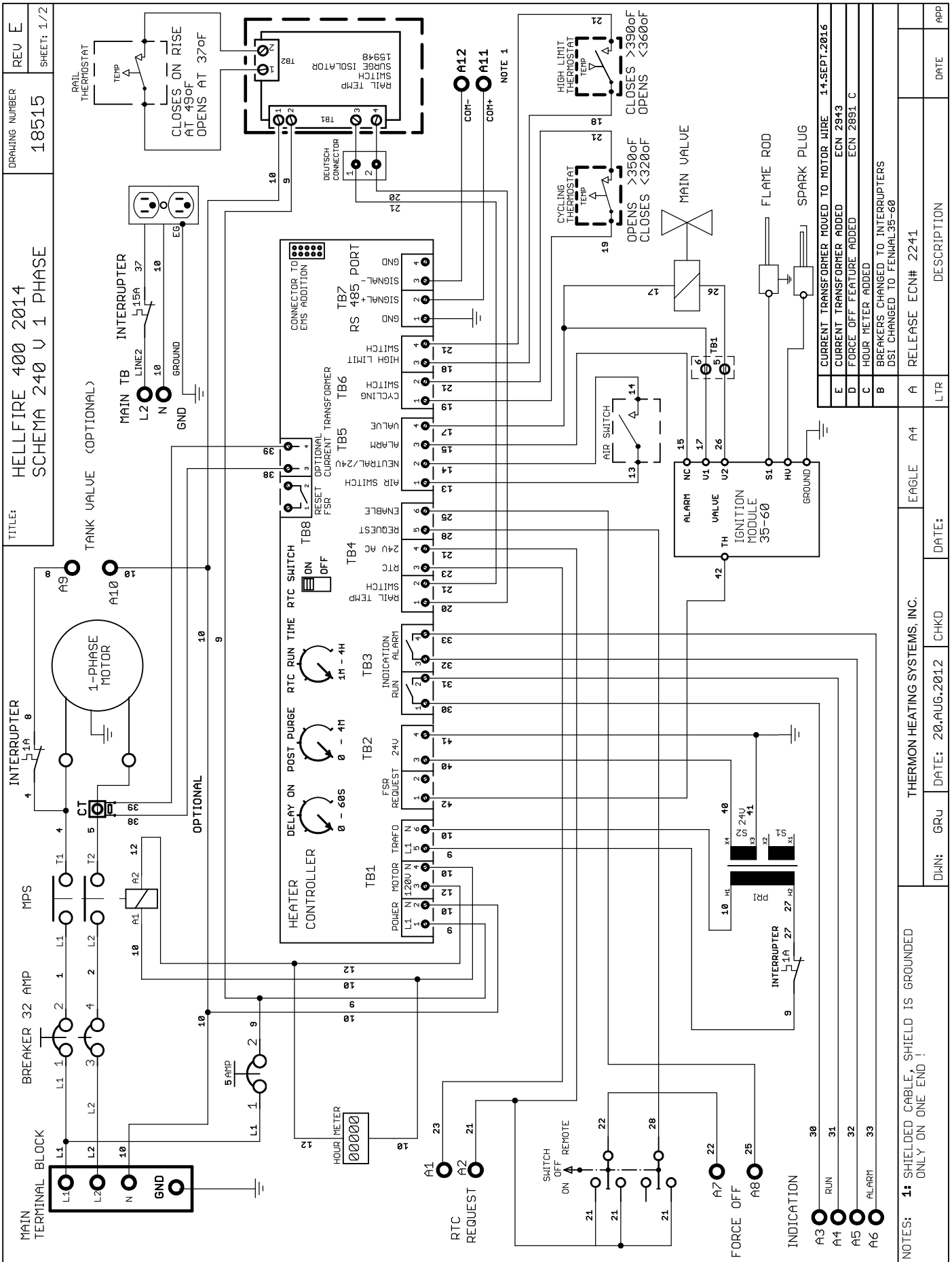
Motor				
Item	Description	Nominal	Low	High
HF9016-0001	MOTOR, 7.5HP 575V 60HZ 3PH 3525RPM	1.73	1.64	1.82
HF9016-0002	MOTOR 7.5HP 208/230/460V 60HZ 3PH, 3600	1.14	1.08	1.20
HF9016-0003	MOTOR, 7.5HP 240V 60HZ 1PH 3450RPM	0.98	0.93	1.03
HF9016-0007	MOTOR 5 HP 240V 60HZ 1PH 3450RPM	0.91	0.86	0.96
HF9016-0008	MOTOR 5 HP 208/480V 60HZ 3PH, 3600RPM	2.33	2.21	2.45
HF9016-0028	MOTOR 1.5HP 115-208-230V 1PH 3450RPM	1.58	1.50	1.66
HF9016-0030	MOTOR 5 HP 575V 3PH HIEFF, 3600RPM	3.57	3.39	3.75
HF9016-0058	Motor 3 HP 230V 60HZ 1PH 3450RPM	3.06	2.91	3.21
HF9016-0059	MOTOR 2 HP 230V 1PH 3450RPM	1.33	1.26	1.40
HF9016-0062	MOTOR 3 HP 208/230/460V 60HZ 3PH 3450	4.72	4.48	4.96
HF9016-0063	MOTOR 2 HP 575V 3PH 3450RPM	10.70	10.17	11.24
HF9016-0064	MOTOR 3 HP 575V 60HZ 3PH 3450RPM	7.47	7.10	7.84
HF9016-0066	MOTOR 2 HP 208/230/460V 3PH 3450RPM	6.88	6.54	7.22
HF9016-0069	MOTOR 2HP 240V 50HZ 1PH 2850 RPM 50C	6.88	6.54	7.22

N.2 Contactor Resistances

Contactor				
Item	Description	Nominal	Low	High
HF9078-0041	CONTACTOR, 25A 120V COIL, 3POLE	180.00	171.00	189.00
HF9078-0043	CONTACTOR, 25A 120V COIL, 2 POLE	237.00	225.15	248.85
HF9078-0120	CONTACTOR, 9A C/W 240V COIL	637.11	605.25	668.97
HF9078-0121	CONTACTOR, 12A C/W 240V COIL	637.11	605.25	668.97
HF9078-0122	CONTACTOR, 16A C/W 240V COIL	637.11	605.25	668.97
HF9078-0123	CONTACTOR, 23A C/W 240V COIL	404.23	384.02	424.44
HF9078-0124	CONTACTOR, 30A C/W 240V COIL	367.18	348.82	385.54
HF9078-0125	CONTACTOR, 43A C/W 240V COIL	327.48	311.11	343.85
HF9078-0126	CONTACTOR, 12A C/W 120V COIL	115.90	110.11	121.70

N.3 Transformer Resistances

Transformer				
Item	Description	Nominal	Low	High
HF9064-0009	TRFRMR, 120/24VAC 40VA			
	120v Primary	21.7	20.62	22.79
	24V secondary	0.69	0.66	0.72
HF9064-0028	TRFRMR, CONT 460/575 240V 100VA			
	480V Primary	16.80	15.96	17.64
	600V Primary	22.63	21.50	23.76
	240V secondary	10.90	10.36	11.45
HF9064-0030	TRFRMR, CONT 120>24V & 120V 100VA			
	120v Primary	2.71	2.57	2.85
	120V Secondary	11.15	10.59	11.71
	24V secondary	0.14	0.13	0.15
HF9064-0031	TRFRMR, CONT 460/575>120V 4A /24V 4A			
	480V Primary	5.60	5.32	5.88
	600V Primary	8.37	7.95	8.79
	120V secondary	0.53	0.51	0.56
	24V secondary	0.12	0.11	0.12
HF9064-0032	TRFRMR, CONT 460/575>24V 4A/120V .166A			
	480V Primary	38.00	36.10	39.90
	600V Primary	53.00	50.35	55.65
	120V secondary	15.00	14.25	15.75
	24V secondary	0.14	0.13	0.15
HF9064-0033	TRFRMR, CONT 460/575V>120V 15A/24V 4A			
	480V Primary	0.98	0.93	1.03
	600V Primary	1.32	1.25	1.39
	120V secondary	0.09	0.09	0.09
	24V secondary	0.08	0.08	0.08



TITLE: HELLFIRE 400 2014
SCHEMA 240 V 1 PHASE

DRAWING NUMBER: 18515
REV E
SHEET: 1/2

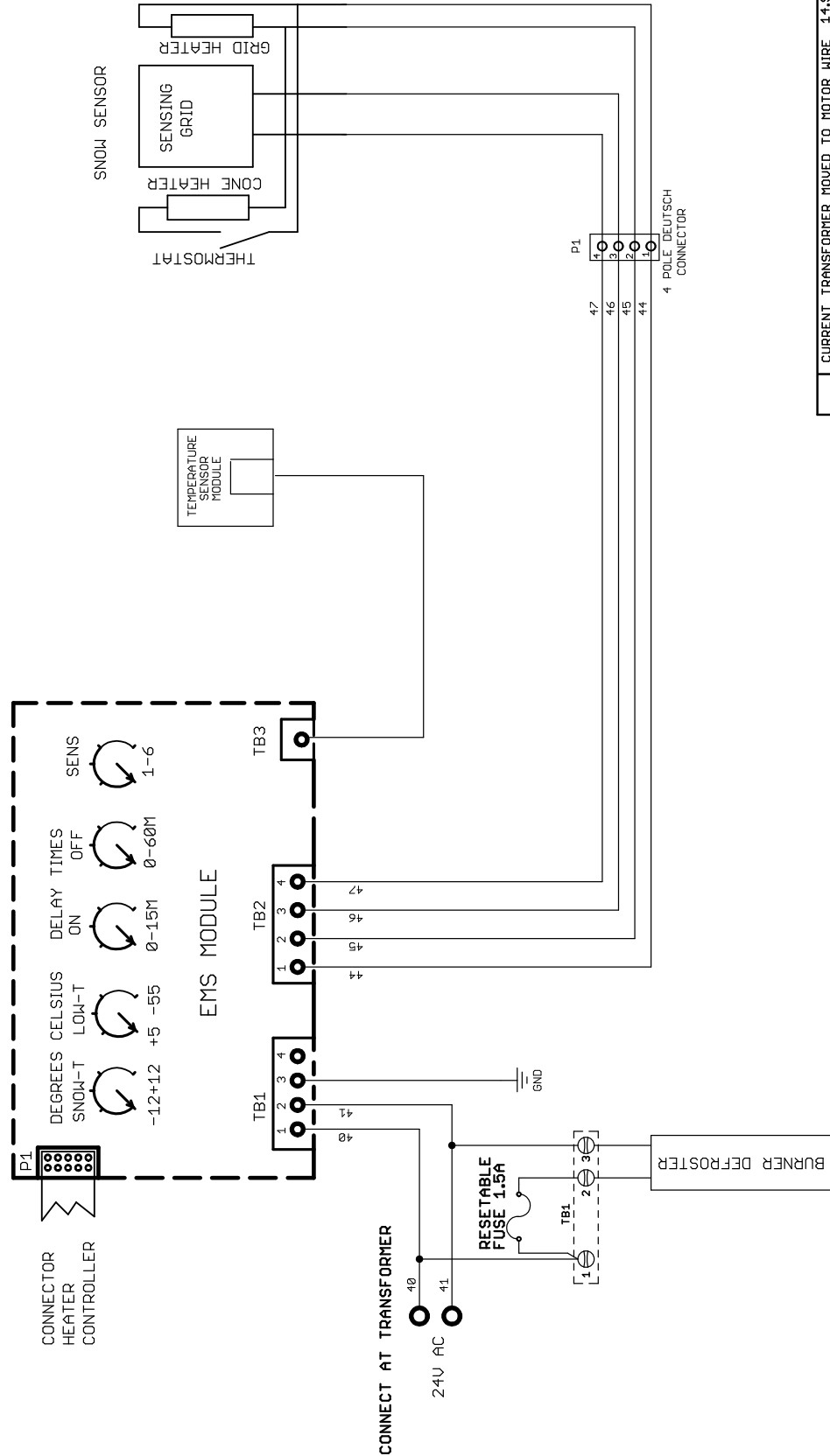
A	RELEASE ECN# 2241
B	BREAKERS CHANGED TO INTERRUPTERS DS1 CHANGED TO FENNAL35-60
C	HOUR METER ADDED
D	FORCE OFF FEATURE ADDED ECN 2891 C
E	CURRENT TRANSFORMER MOVED TO MOTOR WIRE 14. SEPT. 2016 ECN 2943

DATE:	20.AUG.2012	CHKD:	
DIAN:	GRU	DATE:	20.AUG.2012
DATE:	20.AUG.2012	CHKD:	
DATE:	20.AUG.2012	CHKD:	

NOTES: 1: SHIELDED CABLE, SHIELD IS GROUNDED
ONLY ON ONE END !

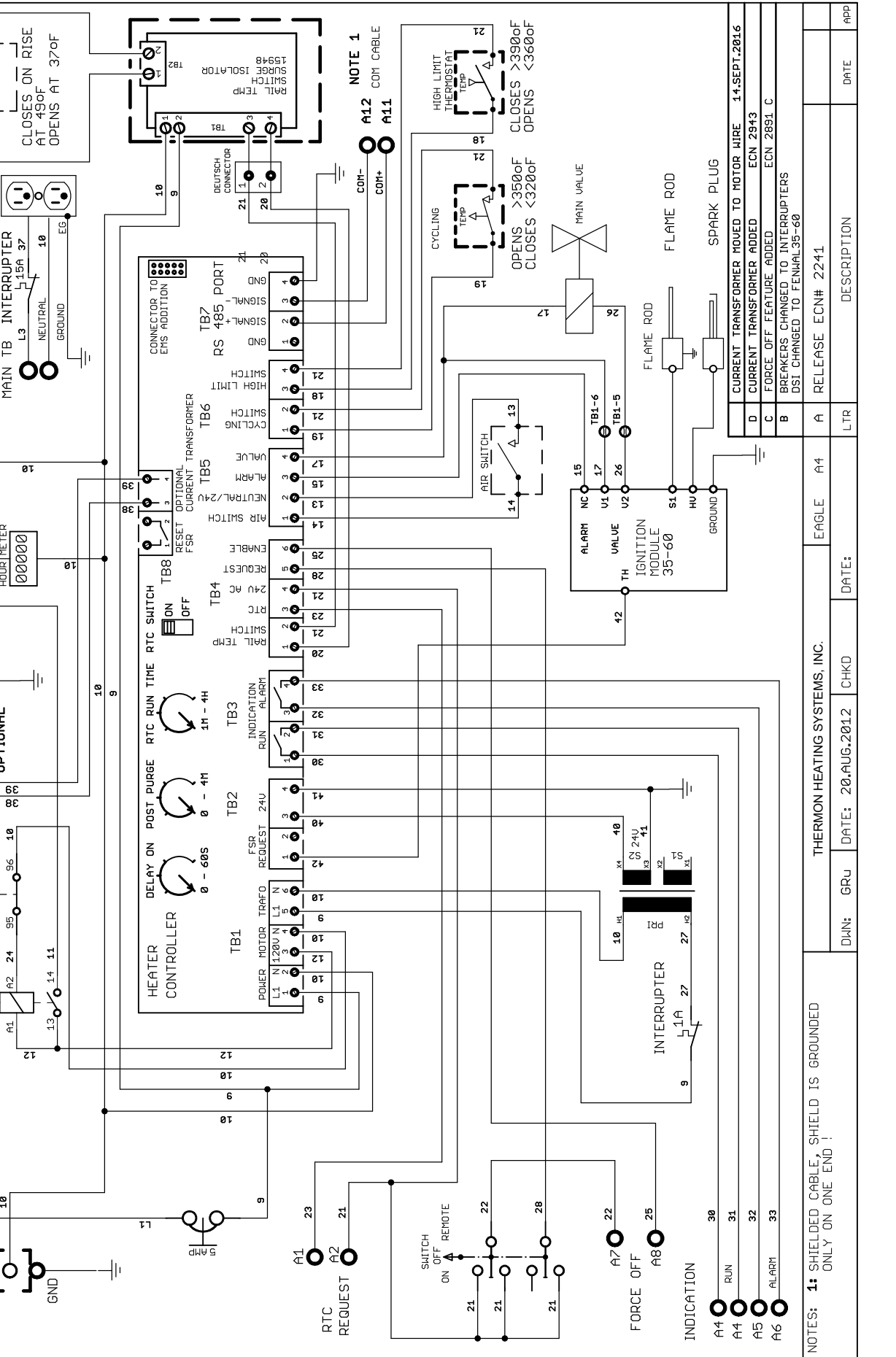
TITLE:	HELLFIRE 400 2014 SCHEMA 240 V 1 PHASE	DRAWING NUMBER	18515	REV	E
				SHEET: 2/2	

EMS BOARD OPTION PRINCIPAL CONNECTION



CURRENT TRANSFORMER MOVED TO MOTOR WIRE	14. SEPT. 2016
E	SEE SHEET 1 ECN 2943
D	FORCE OFF FEATURE ADDED ECN 2891 C
C	HOUR METER ADDED
B	BREAKERS CHANGED TO INTERRUPTERS DSI CHANGED TO FENAL35-60
A	RELEASE ECN# 2241

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	THERMION HEATING SYSTEMS, INC.	EAGLE A4	DATE: 20.AUG.2012	CHKD	DATE:
DHN: G,Ru					
LTR				DESCRIPTION	DATE
					APP

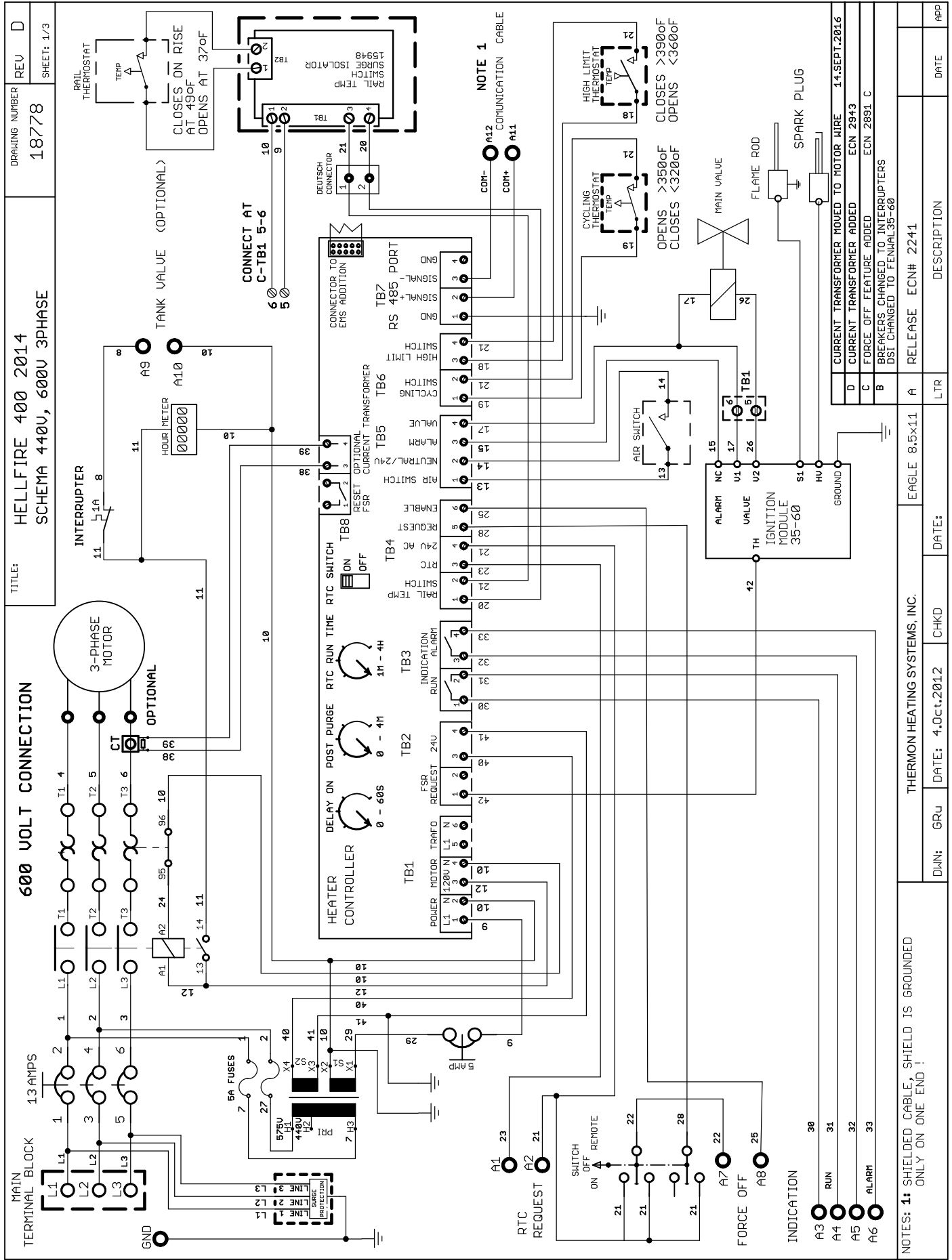


NOTES: 1: SHIELDED CABLE, SHIELD IS GROUNDED ONLY ON ONE END !

DESCRIPTION	DATE:	CHKD	GRU	DJN:
A	20.AUG.2012		GRU	
B				
C				
D				

DESCRIPTION: THERMON HEATING SYSTEMS, INC.
 RELEASE ECN# 2241

APP	DATE
APP	



TITLE: HELLFIRE 400 2014
SCHEMA 440U, 600U 3PHASE

DRAWING NUMBER
18778

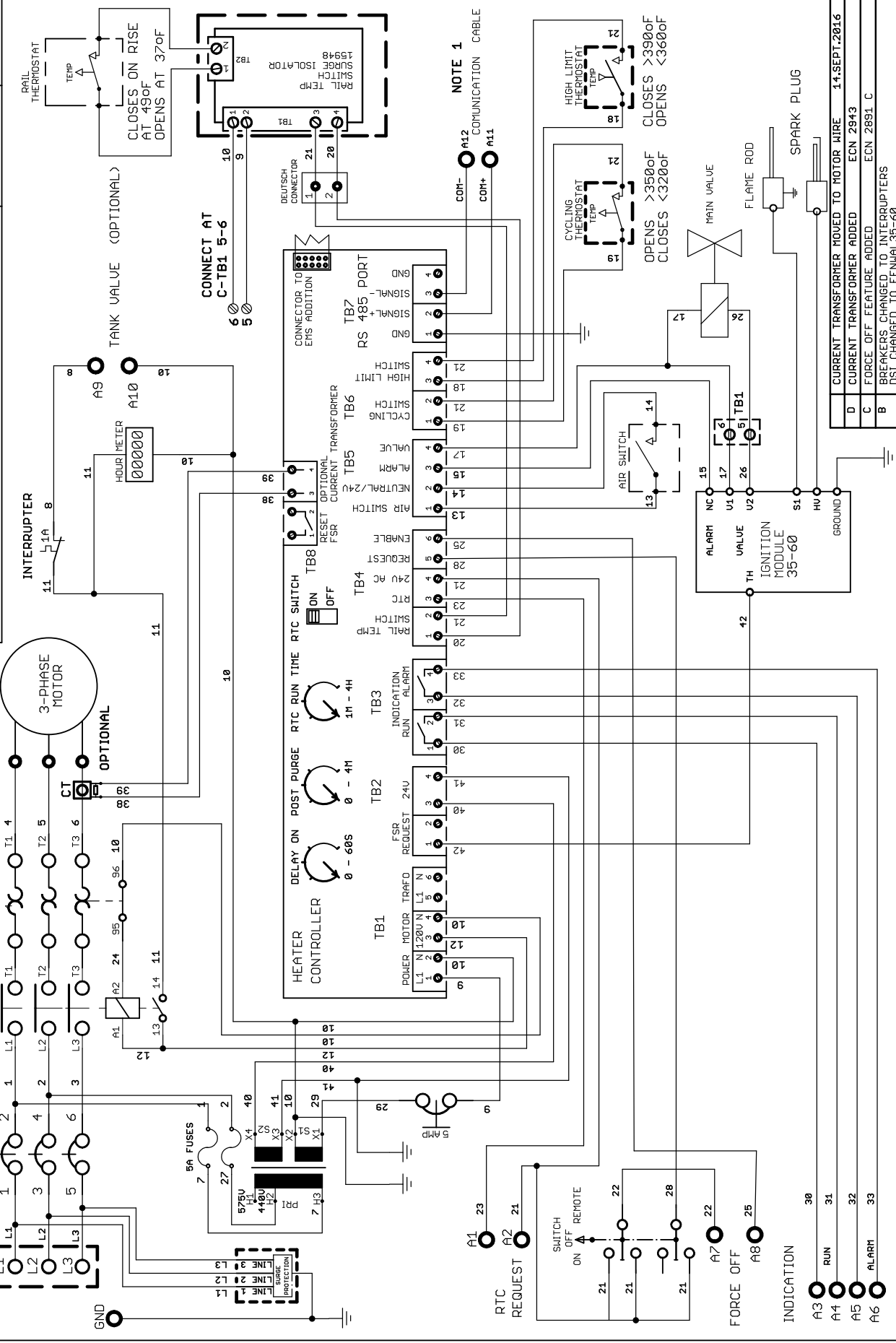
REV D
SHEET: 1/3

D	CURRENT TRANSFORMER MOVED TO MOTOR WIRE	14-SEPT-2016
C	CURRENT TRANSFORMER ADDED	ECN 2943
B	FORCE OFF FEATURE ADDED	ECN 2891 C
	BREAKERS CHANGED TO INTERRUPTERS	
	DSI CHANGED TO FENRAL 35-60	

DATE:	4.0ct.2012	CHKD:	GRU	DWN:	
DATE:	8.5x.11	DESCRIPTION:	EAGLE	RELEASE:	ECN# 2241
DATE:		DESCRIPTION:		RELEASE:	

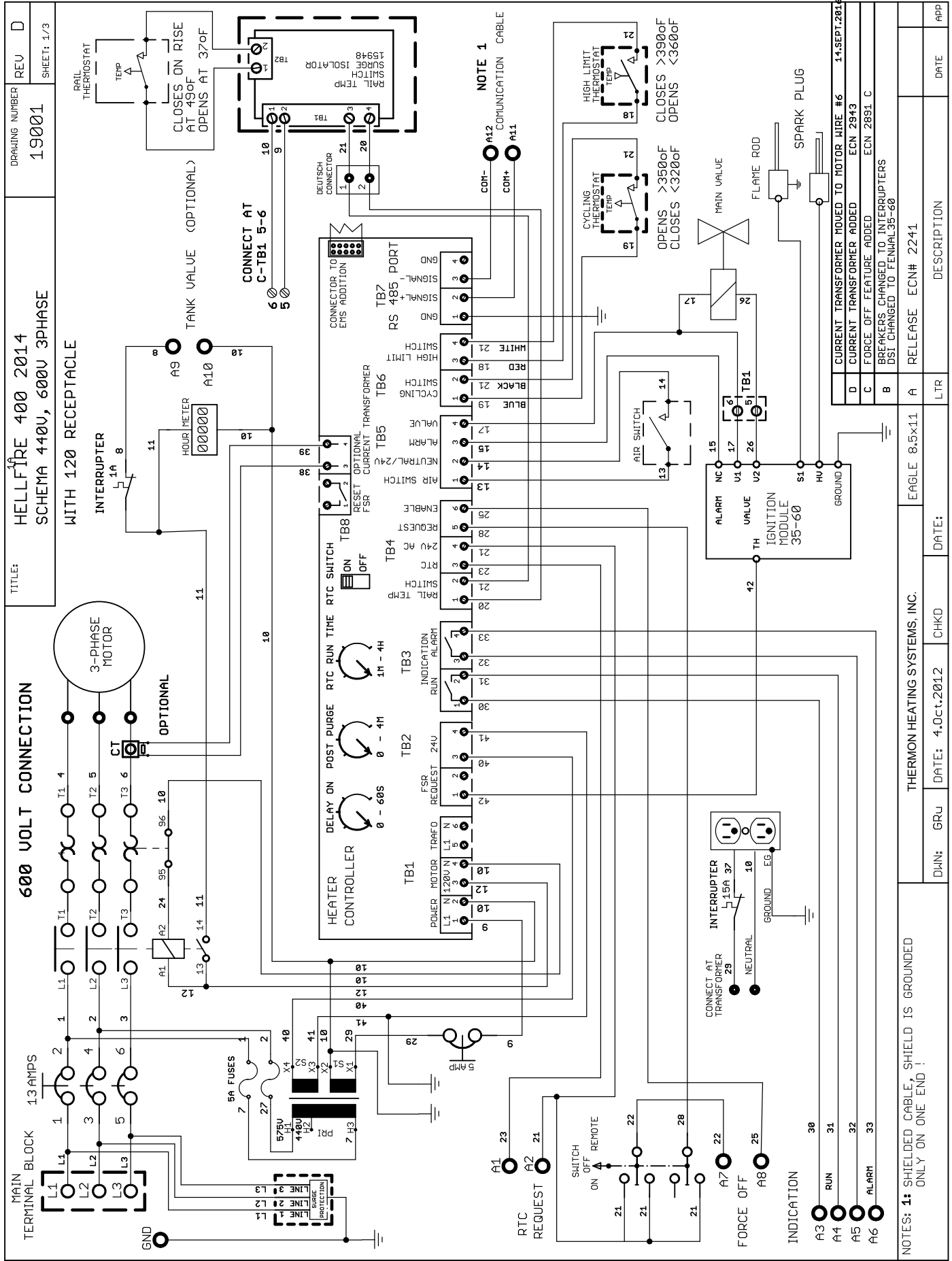
NOTES: 1: SHIELDED CABLE, SHIELD IS GROUNDED ONLY ON ONE END !

APP	DATE



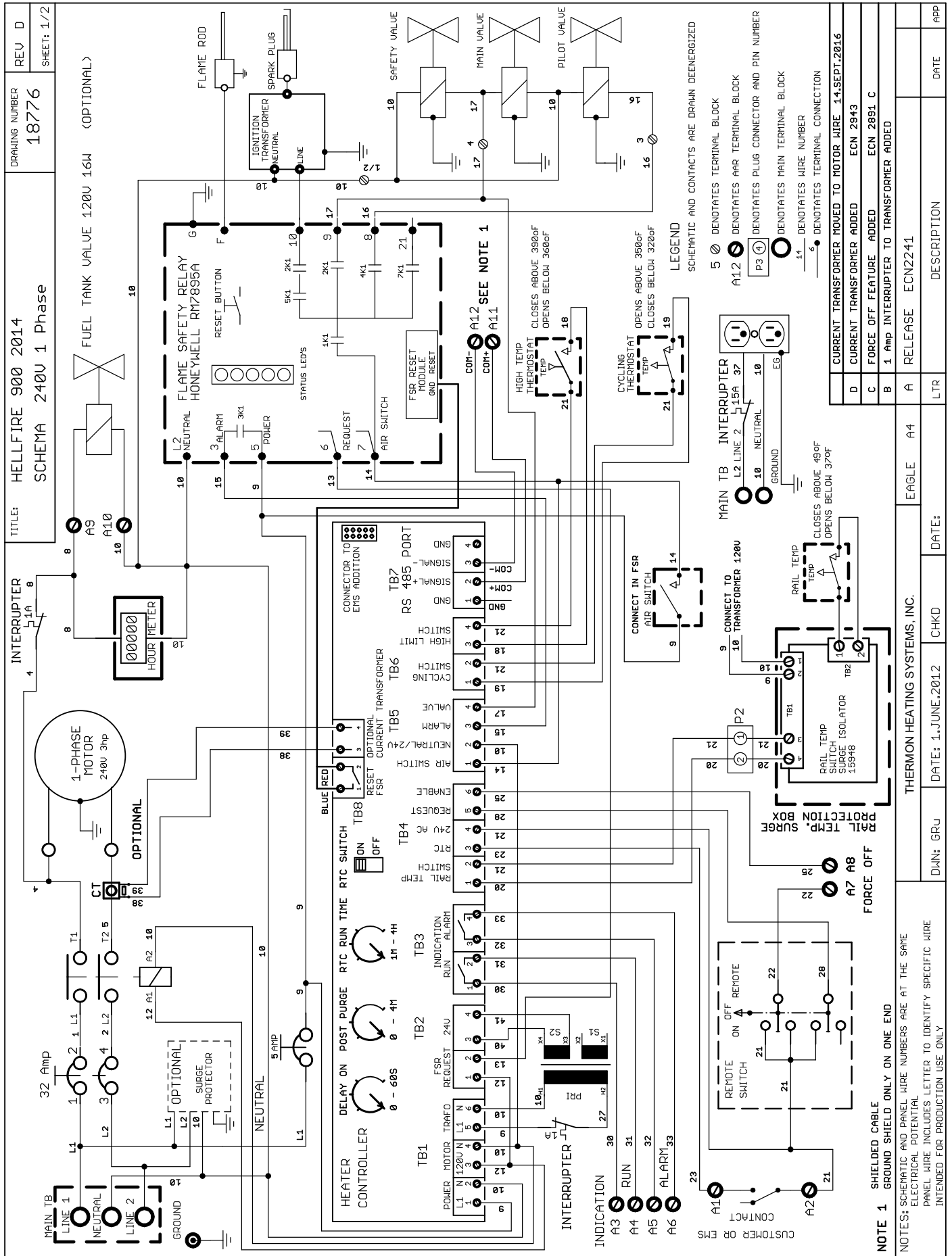
NOTES: 1: SHIELDED CABLE, SHIELD IS GROUNDED ONLY ON ONE END !

APP	DATE	DESCRIPTION	LTR
A	RELEASE ECN# 2241	EAGLE 8.5x11	
B	BREAKERS CHANGED TO INTERRUPTERS DSI CHANGED TO FENNAL35-60		
C	FORCE OFF FEATURE ADDED ECN 2891 C		
D	CURRENT TRANSFORMER MOVED TO MOTOR WIRE 14-SEPT-2016		



REV	DESCRIPTION	DATE	APP
D	CURRENT TRANSFORMER MOVED TO MOTOR WIRE #6	14-SEPT-2015	
C	CURRENT TRANSFORMER ADDED	ECN 2943	
B	FORCE OFF FEATURE ADDED	ECN 2891.C	
A	BREAKERS CHANGED TO INTERRUPTERS DST CHANGED TO FENNAL35-60		

DATE: 4.Oct.2012
CHKD: []
DATE: []
DESCRIPTION: []



D	CURRENT TRANSFORMER MOVED TO MOTOR WIRE 14-SEPT-2016
C	CURRENT TRANSFORMER ADDED ECN 2943
B	1 AMP INTERRUPTER TO TRANSFORMER ADDED ECN 2891 C
A	RELEASE ECN2241

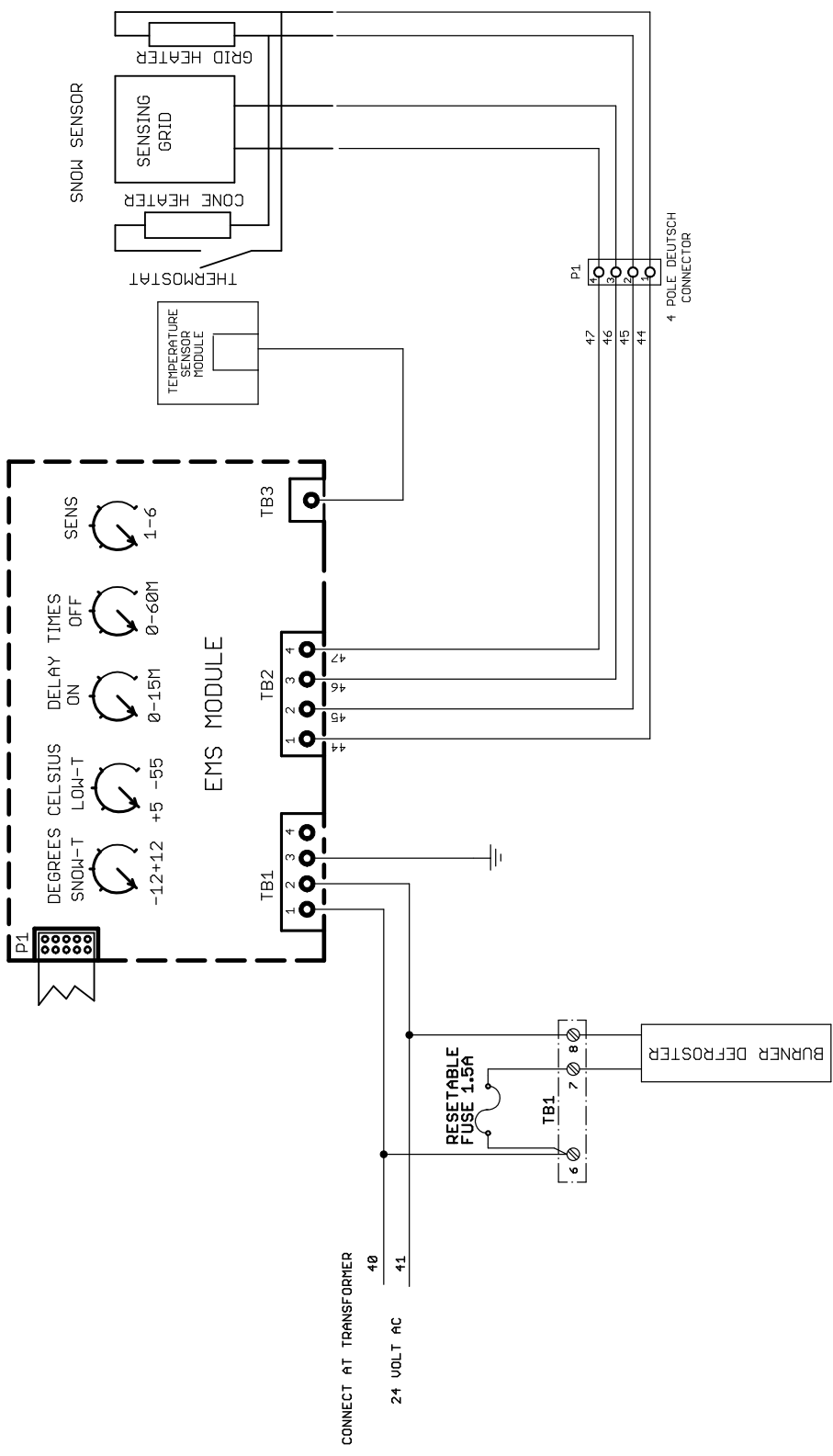
THERMON HEATING SYSTEMS, INC.	DATE: 1-JUNE-2012	CHKD	DATE:
EAGLE	A4	LTR	DESCRIPTION
DWN: GRU			DATE
			APP

TITLE: HELLFIRE 900 2014
 SCHEMA 240V 1 Phase

DRAWING NUMBER
 18776

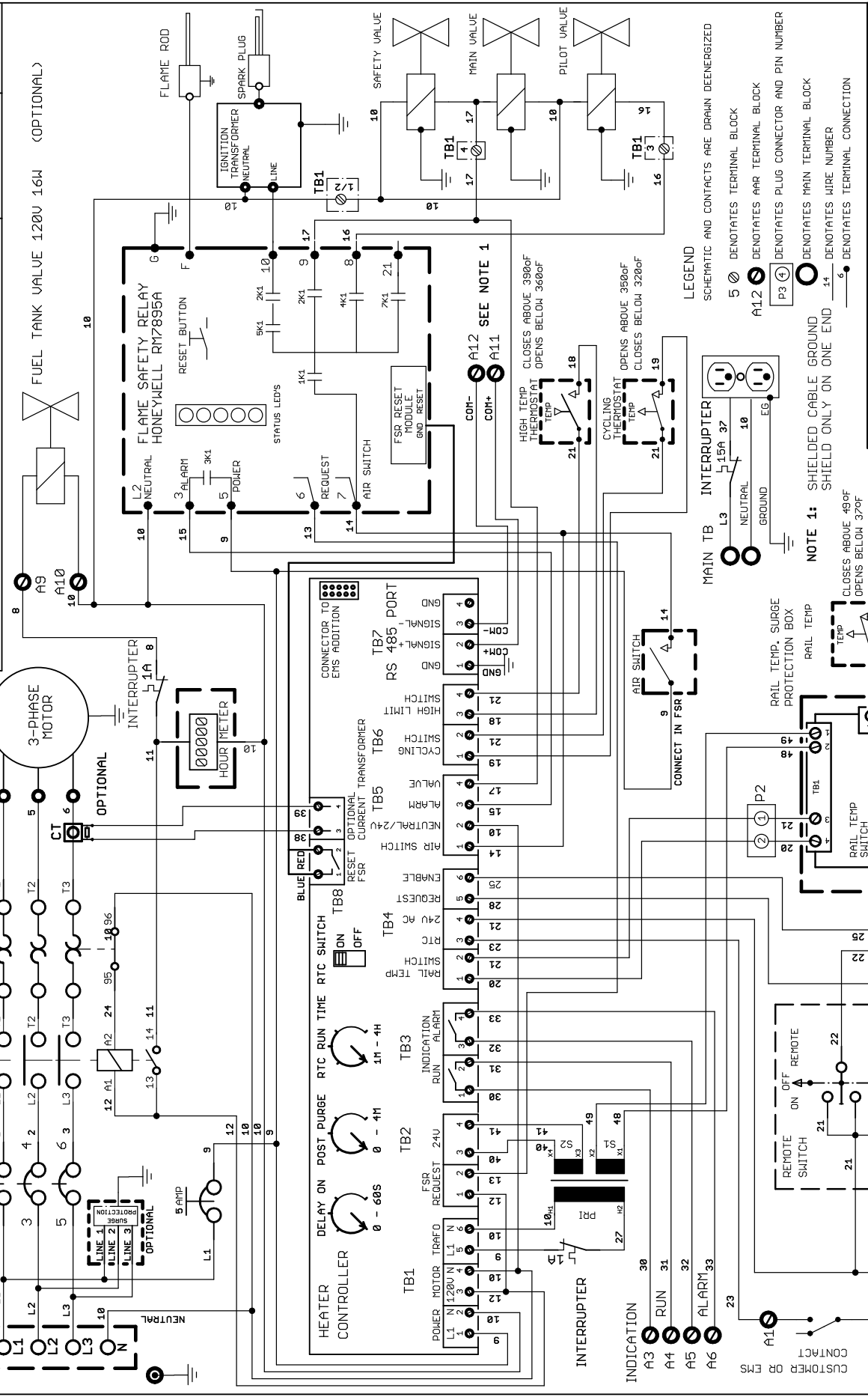
REV D
 SHEET: 2/2

EMS BOARD OPTION PRINCIPAL CONNECTION



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

THERMON HEATING SYSTEMS, INC.	EAGLE	A4	DATE:	1.JUNE. 2012	CHKD	GRU	DHN:
DESCRIPTION	RELEASE	ECN2241	DATE:				
B 1 Amp INTERRUPTER TO TRANSFORMER ADDED C FORCE OFF FEATURE ADDED ECN 2891 C D SEE SHEET 1 ECN 2943 CURRENT TRANSFORMER MOVED TO MOTOR WIRE 14. SEPT. 2016							



REV	DESCRIPTION	DATE	APP
D	RELEASE ECN2241		
C	CHANGED BREAKERS TO INTERRUPTERS		
B	FORCE OFF FEATURE ADDED		
A	RELEASE ECN2241		
C	FORCE OFF FEATURE ADDED		
D	CURRENT TRANSFORMER MOVED TO MOTOR WIRE	14. SEPT. 2016	
C	CURRENT TRANSFORMER ADDED	ECN 2343	
B	CHANGED BREAKERS TO INTERRUPTERS	ECN 2891 C	

LEGEND
 SCHEMATIC AND CONTACTS ARE DRAIN DEENERGIZED
 5 ⊕ DENOTES TERMINAL BLOCK
 A1.2 ⊕ DENOTES AIR TERMINAL BLOCK
 P3 ⊕ DENOTES PLUG CONNECTOR AND PIN NUMBER
 ⊕ DENOTES MAIN TERMINAL BLOCK
 ⊕ DENOTES WIRE NUMBER
 ⊕ DENOTES TERMINAL CONNECTION

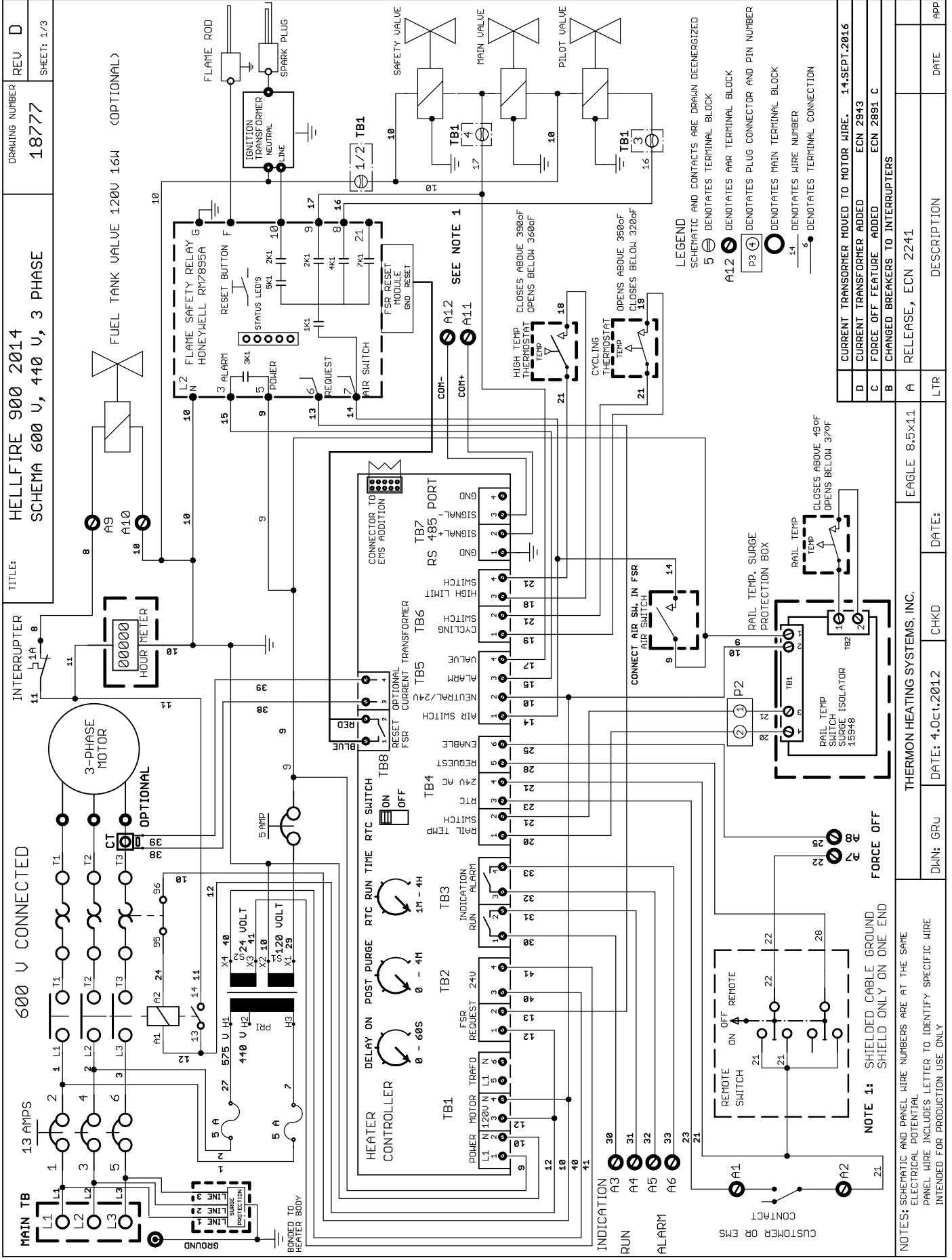
NOTE 1: SHIELDED CABLE GROUND SHIELD ONLY ON ONE END

LEGEND (continued)
 HIGH TEMP THERMOSTAT CLOSING ABOVE 390°F, OPENING BELOW 360°F
 CYCLING THERMOSTAT CLOSING ABOVE 350°F, OPENING BELOW 320°F
 RAIL TEMP SURGE PROTECTION BOX CLOSING ABOVE 48°F, OPENING BELOW 37°F
 RAIL TEMP SWITCH ISOLATOR 15948 CLOSING ABOVE 48°F, OPENING BELOW 37°F

TERMINAL BLOCKS:
 MAIN TB INTERRUPTER: L3 NEUTRAL, GROUND, EG
 TB7 485 PORT: SIGNAL, GND, COIL, COIL, GND
 TB8 FSP RESET CURRENT TRANSFORMER: BLUE RED, 1, 2, 3, 4
 TB5 TB6: VALVE, CYCLING SWITCH, HIGH LIMIT, AIR SWITCH, ALARM, NEUTRAL/24
 TB4: RAIL TEMP SWITCH, RAIL SWITCH, RTC, REQUEST, ENABLE
 TB3: INDICATION ALARM, RUN, RTC, AIR SWITCH
 TB2: FSR REQUEST 24V, RAIL TEMP SWITCH, RAIL SWITCH, RAIL SWITCH, RAIL SWITCH
 TB1: POWER MOTOR TRAF0, L1, L2, L3, N, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49

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

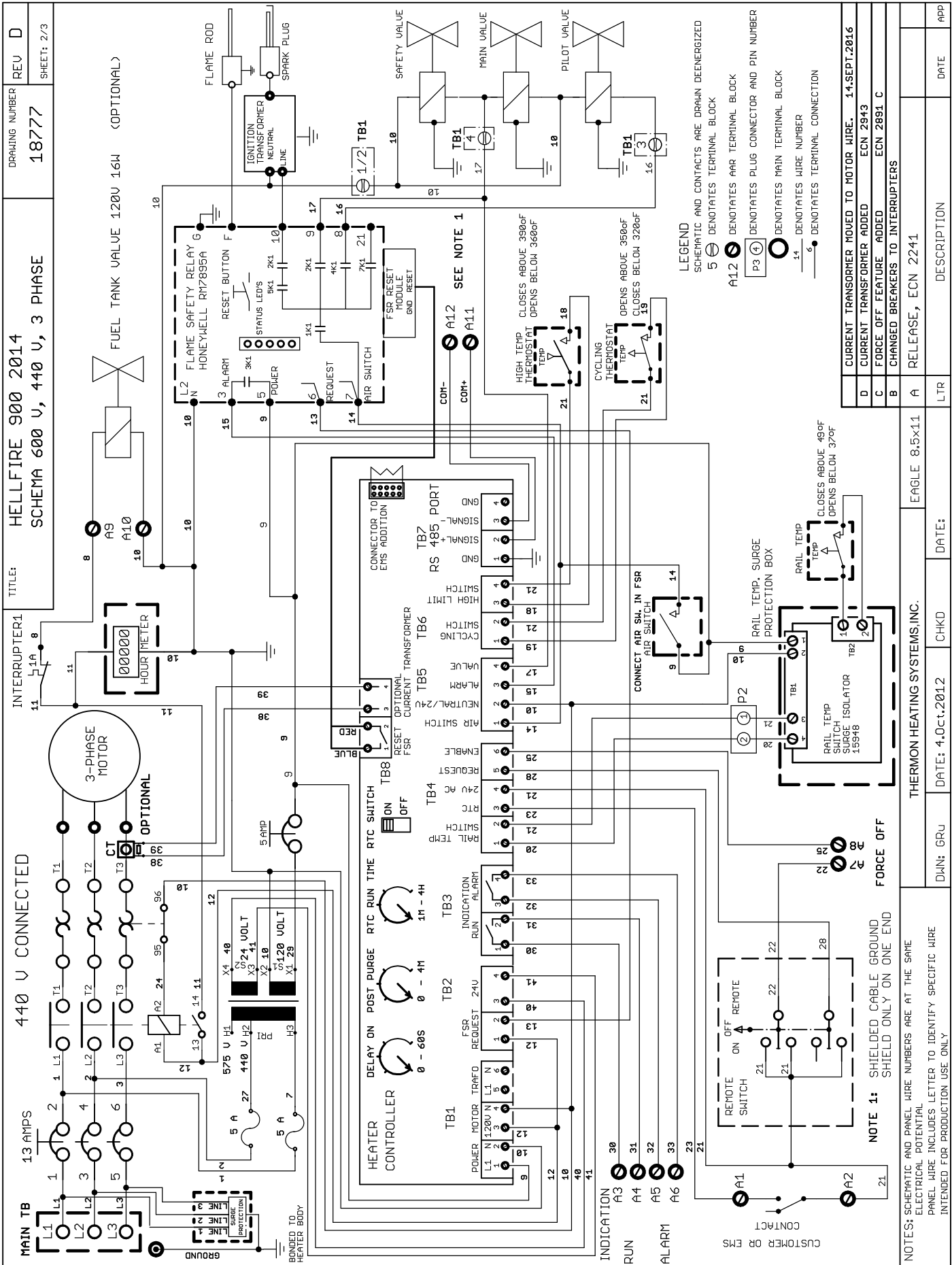
DATE: 1. JUNE. 2012
 CHKD: GRU
 DATE: 14. SEPT. 2016
 CHKD: [blank]

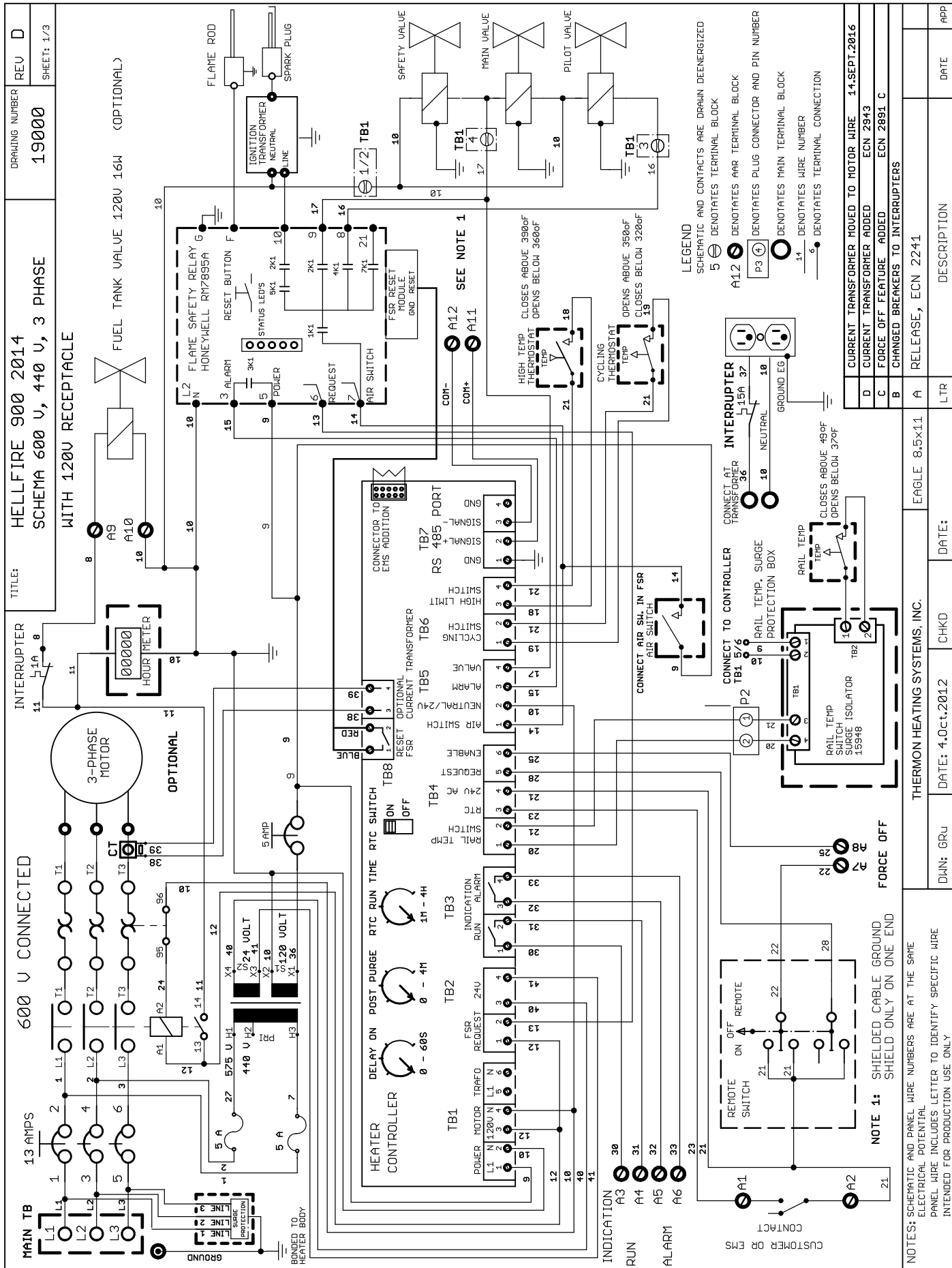


TITLE: HELLFIRE 900 2014
 SCHEMA 600 V, 440 V, 3 PHASE
 DRAWING NUMBER: 18777
 REV: D
 SHEET: 1/3

REV	DESCRIPTION	DATE	APP
D	CURRENT TRANSFORMER ADDED	14-SEPT.2016	
C	FORCE OFF FEATURE ADDED	ECN 2943	
B	CHANGED BREAKERS TO INTERRUPTERS	ECN 2891 C	
A	RELEASE, ECN 2241		

DATE:	CHKD:	DATE:	DESCRIPTION
4.0ct.2012	GRU	8.5x11	THERMON HEATING SYSTEMS, INC.





O. APPENDIX A - HELLFIRE UNIT MAINTENANCE CHECKLIST



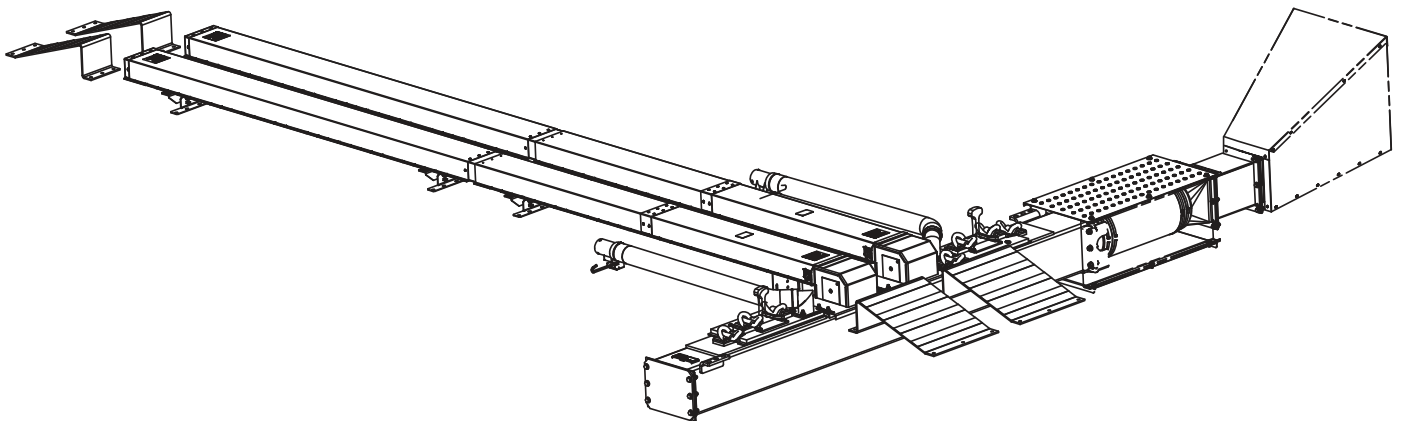
Location Name _____ Date of Maintenance _____
Switch No. _____ Maintenance Done By _____
Hour Meter Reading _____ Model No. _____
Site Photos (File #) _____ Serial No. _____

HELLFIRE Unit & Ducting System

Maintenance Checklist

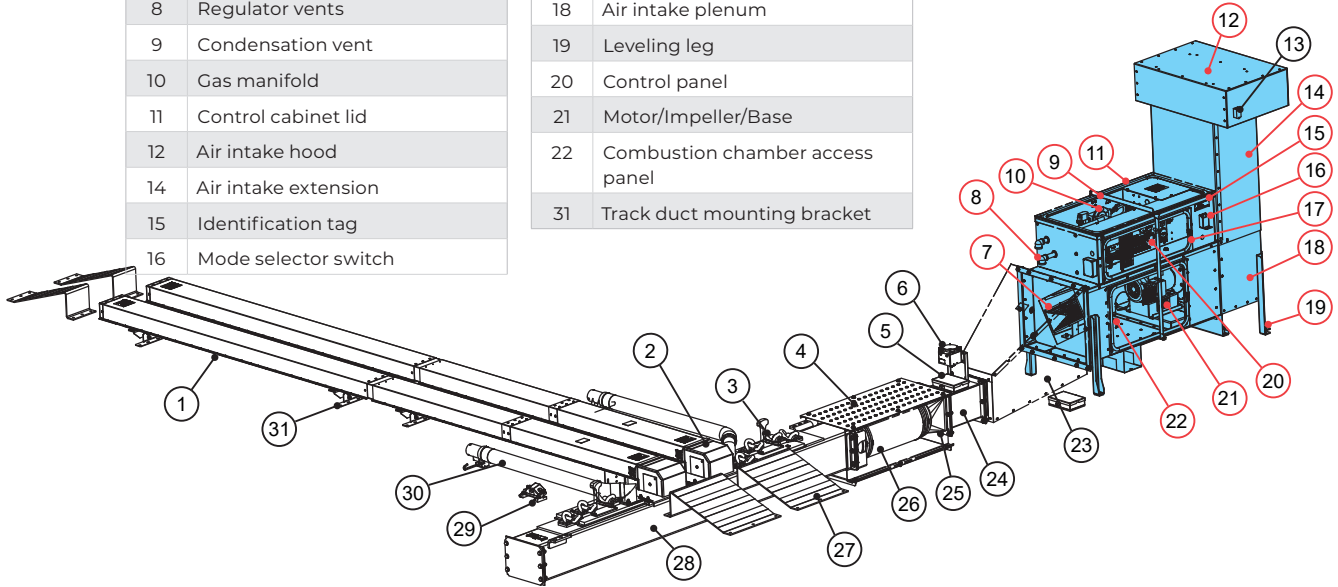
The intent of this checklist is to provide the user with a detailed and summarized method to perform service and maintenance on the HELLFIRE unit and ducting system.

This checklist must be used in conjunction with the Installation, Operation and Maintenance Instructions for the HELLFIRE unit and ducting packages.



P. HEATER MAINTENANCE

No.	Label	No.	Label
7	Burner	17	Electrical control access panel
8	Regulator vents	18	Air intake plenum
9	Condensation vent	19	Leveling leg
10	Gas manifold	20	Control panel
11	Control cabinet lid	21	Motor/Impeller/Base
12	Air intake hood	22	Combustion chamber access panel
14	Air intake extension	31	Track duct mounting bracket
15	Identification tag		
16	Mode selector switch		



Preventative Maintenance Grid

Cells of the grid with marked boxes ('X') inside are the minimum maintenance measures required to be performed at the indicated time periods.

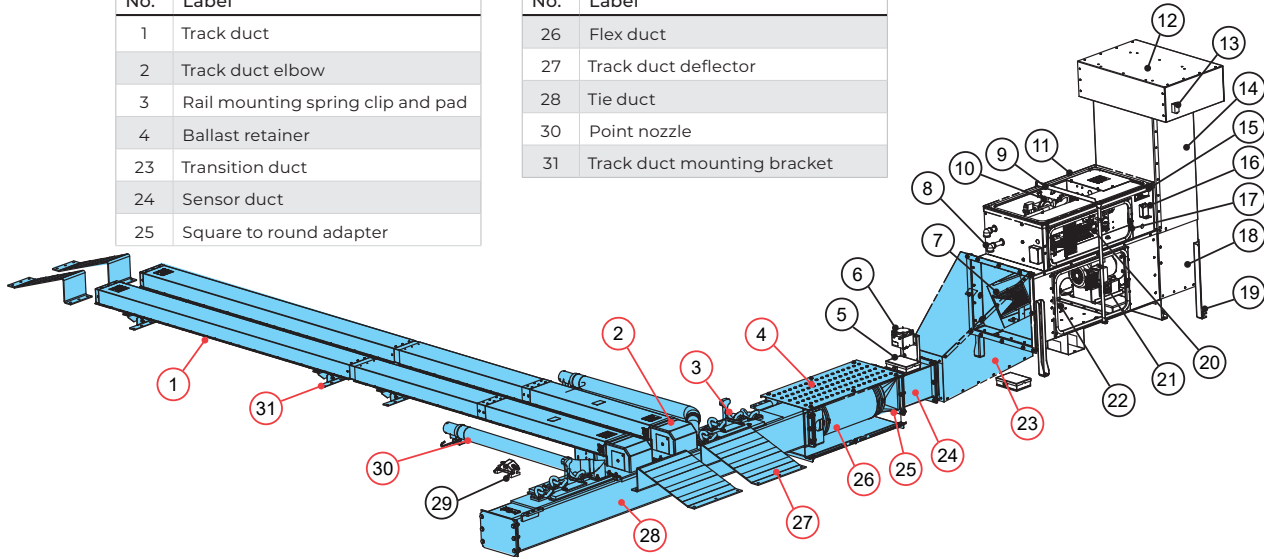
Prior to heater start-up, inspect the following components.

Inspect	Action	Annual Start-Up		
Area around heater & ductwork	Verify the area is clear and free from combustible material, gasoline and other flammable vapours and liquids.	X		
Flame rod and spark igniter	Remove and visually inspect for cracks in the ceramic, and evidence of soot. Replace any with cracked ceramic. If evidence of soot is found, clean rod and investigate condition of burner, gas manifold, and inspect tie duct, cross ducts and air intake for blockage.	X		
Flame rod and ignition wires	Inspect boot for degradation, cracks and poor seals. Replace if necessary. Inspect connectors for signs of corrosion. Clean connections, or replace wire if necessary.	X		
Combustion chamber	Verify it is clear of any obstructions or debris, ie. animal nests.	X		
Cycling and high limit thermostat installation	Verify thermostats are fastened and are in full contact with duct surface. Replace any with damaged wire insulation. Verify thermostat enclosure is sealed and dry inside.	X		
Service surge protection	Verify electric service has functioning surge protection.	X		
Air switch port and vent	Remove any obstruction.	X		
DSI control module (HELLFIRE 400 only)	Verify it is installed.	X		
Flame Safety Relay (HELLFIRE 900 only)	Verify the following are installed. Flame safety relay plugged into base, flame signal amplifier and purge card installed on the relay.			
Gas source	Verify propane tank is filled, or natural gas service is open and has pressure. Open all manual gas shut off valves and inspect all gas lines for leaks.	X		
Electrical service	Verify electric service power is on. Close supply circuit breakers.	X		
Flame Safety Relay Burner Control Fault Histories (HF900 Only)	Using Honeywell display module S7800A1001 (Part number 9040-0021). Review and record the last 6 stored fault history error codes. See Honeywell manual for description of faults.			
	H1 Code	Hour	Cycle	X
	H2 Code	Hour	Cycle	
	H3 Code	Hour	Cycle	
	H4 Code	Hour	Cycle	
	H5 Code	Hour	Cycle	
H6 Code	Hour	Cycle		

Inspect	Action	Annual Start-Up						
Electrical supply	Verify correct line voltages at each heater. Must be within +/- 5% of nominal voltage. Verify current draw is less than or equal to nameplate rating.	X						
Gas supply & manifold gas pressures	Perform gas supply and manifold leak tests. Replace any damaged parts. Verify supply and manifold gas pressures are within nameplate limits when heater and all connected loads are operating.	X						
Flame signal strength	Verify flame signal strength is stable (+/- 0.5) and between 3.0 and 8.0 micro amps DC (HELLFIRE 400) and between 3.0 and 5.0 Vdc (HELLFIRE 900). If signal strength is low: <ul style="list-style-type: none"> - Clean or replace flame rod. - Clean flame rod wire connections, or replace wire. If cleaning or replacement of flame rod and wire does not increase strength, have burner serviced or replaced.	X						
Burner	<u>Burner Operation:</u> Note current manifold pressure. Set manifold pressure to maximum nameplate setting, measure point nozzle temperature, if point nozzle temperature is 140°F or less above ambient air temperature have burner serviced or replaced. Return manifold pressure back to desired setting.	X						
	Service Burner	*Every 5 Years						
Air switch calibration	Block air intake 80%. Verify heater still operates. Then block 90% and verify FSR alarms. If heater fails with 80% or less blockage, recalibrate air switch.	X						
Control and indication wiring	Verify the correct control and indication wiring between the heater and the signal bungalow. Inspect and tighten all electrical terminations.	X						
Energy Management System (EMS)	If heater is operated automatically by an Energy Management System: <ul style="list-style-type: none"> - Verify EMS module is installed and connected with POWER LED lit. - Verify selector switch is in AUTO mode. - Verify precipitation detector and ambient temperature sensor installed and connected. - Verify rail thermostat is mounted on rail and connected to surge isolator. - Verify its operation. 	X						
Aggressive retry	Verify operation. Turn gas supply off, toggle heater to "Manual". Verify three attempts made followed by lockout. Return heater to desired operating mode. Open gas supply. Reset controller.	X						
After maintenance check	With the supply power turned off, tighten all mounting and electrical connections to the recommended tightening torque, shown in table below.	X						
	<p style="text-align: center;">Torque Recommendation for Heater Hardware</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Thread Size</th> <th>Tightening Torque (in./ lbs.)</th> </tr> </thead> <tbody> <tr> <td>8 - 32</td> <td>19</td> </tr> <tr> <td>10 - 32</td> <td>31</td> </tr> <tr> <td>1/4 - 20, Power Terminal Lugs and AAR Terminals</td> <td>75</td> </tr> </tbody> </table>		Thread Size	Tightening Torque (in./ lbs.)	8 - 32	19	10 - 32	31
Thread Size	Tightening Torque (in./ lbs.)							
8 - 32	19							
10 - 32	31							
1/4 - 20, Power Terminal Lugs and AAR Terminals	75							
Motor	Check impeller for any visible damage. During a motor run test, make note of any excessive vibration or bearing noise. For additional motor specifications, refer to Section K.7 to K.8 for HELLFIRE 900 and Section J.7 to J.8 for HELLFIRE 400 in the heaters Installation, Operation & Maintenance Instructions.	X						
Access panel gaskets	Inspect and replace any damaged access panel gaskets.	X						

No.	Label
1	Track duct
2	Track duct elbow
3	Rail mounting spring clip and pad
4	Ballast retainer
23	Transition duct
24	Sensor duct
25	Square to round adapter

No.	Label
26	Flex duct
27	Track duct deflector
28	Tie duct
30	Point nozzle
31	Track duct mounting bracket



Q. TIE DUCT/CROSS DUCT MAINTENANCE

Preventative Maintenance Grid

Cells of the grid with check boxes ('X') inside are the minimum maintenance measures required to be performed at the indicated time periods.

Inspect	Action	Annual Start-Up	Every 2 Months	Every 6 Months	
All cross & extension ducts	Visually inspect for damage and correct installation. Replace any damaged parts.	X	X		
Tie ducts only	Visually inspect for damage and correct installation. Replace any damaged parts. Visually inspect tie duct welds for cracks. Replace the tie duct if weld cracks are found.	X			
Interior of ducts	Remove track duct elbows. Inspect interior of the duct. If water and mud are present inside duct clean out. Inspect all gasketed joints, replace damaged gaskets or flex ducts, and tighten loose fasteners. Re-inspect at 6 month interval. If water ingress is found, replace duct.	X		X	
All tie duct components	<u>Spring Clips</u> : Inspect spring clips. Replace missing or damaged clips.	X	X		
	<u>Rail Pads</u> : Inspect rail pads. Replace missing, worn, or damaged rail pads.	X		X	
	<u>Adapter End Plate & Flex Duct Guard</u> : Inspect adapter end plate and flex duct guard for cracks, bends, or breaks. Replace damaged parts.	X		X	
All hardware	Inspect all hardware. Replace any missing or damaged parts. Tighten hardware according to table below.	X			
	Torque Recommendation for Ducting Hardware				
	Hardware Size				Torque (ft. lbs.)
	3/8" - 16 UNC	29			
	1/2" - 13 UNC	73			
Gaskets	With the heater running, inspect for leaking gaskets. Replace damaged gaskets.	X		X	
Rodent screens	Inspect rodent screens. Verify they are installed correctly and clear away any blockage.	X		X	

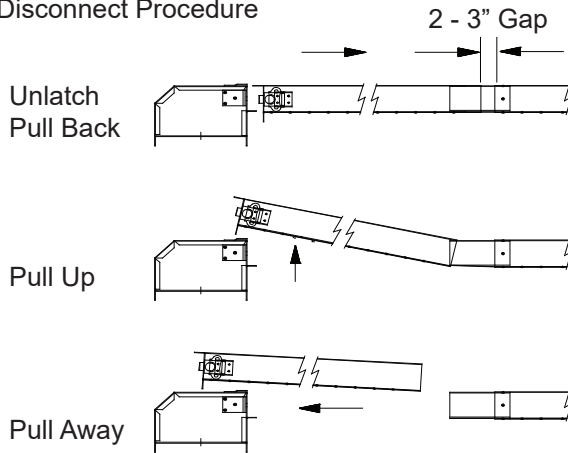
R. TRACK DUCT MAINTENANCE

Preventative Maintenance Grid

Cells of the grid with check boxes ('X') inside are the minimum maintenance measures required to be performed at the indicated time periods.

Inspect	Action	Annual Start-Up	Every 2 Months	Every 6 Months
Track duct mounting				
Track ducts & point nozzles	Visually inspect the track ducts and point nozzles damage and correct installation. Replace all damaged or missing parts.	X	X	
Track duct elbow rodent screens	Inspect track duct elbow rodent screens by removing the first section of track duct. See 'Quick Disconnect Procedure' diagram, below. <ul style="list-style-type: none"> Inspect point nozzle rodent screens, verify they are correctly installed and clear away any blockage. 	X		X
Track duct vents	Close vents that do not direct air at tie plates or rods. Set vent openings to 1/8" - 1/4" maximum.	X		
Track duct deflectors	Inspect track duct deflectors for damage or missing hardware. Replace damaged components.	X	X	
Hardware	Verify track ducts are secured to mounting brackets.	X		X
Nozzles, hoses & clips	Inspect nozzles and replace torn or broken nozzle hoses. Inspect and tighten nozzle clips and replace all damaged parts.	X	X	

Quick Disconnect Procedure



S. BALLAST RETAINER, FLEX DUCT, ELBOWS & OTHER DUCT MAINTENANCE

Preventative Maintenance Grid

Cells of the grid with check boxes ('X') inside are the minimum maintenance measures required to be performed at the indicated time periods.

Inspect	Action	Annual Start-Up	Every 2 Months	Every 6 Months
Elbows & transition duct welds	Visually inspect all elbows and transition duct welds for cracks and damage. Replace damaged parts.	X	X	
Gear clamps & hose	With ballast retainer duct cover removed, inspect the gear clamps for tightness. Inspect the hose for cracks, rips or tears. Replace damaged parts.	X	X	
Gaskets	Inspect all gaskets. Replace damaged gaskets.	X		X

Spare Parts Installed During Inspection

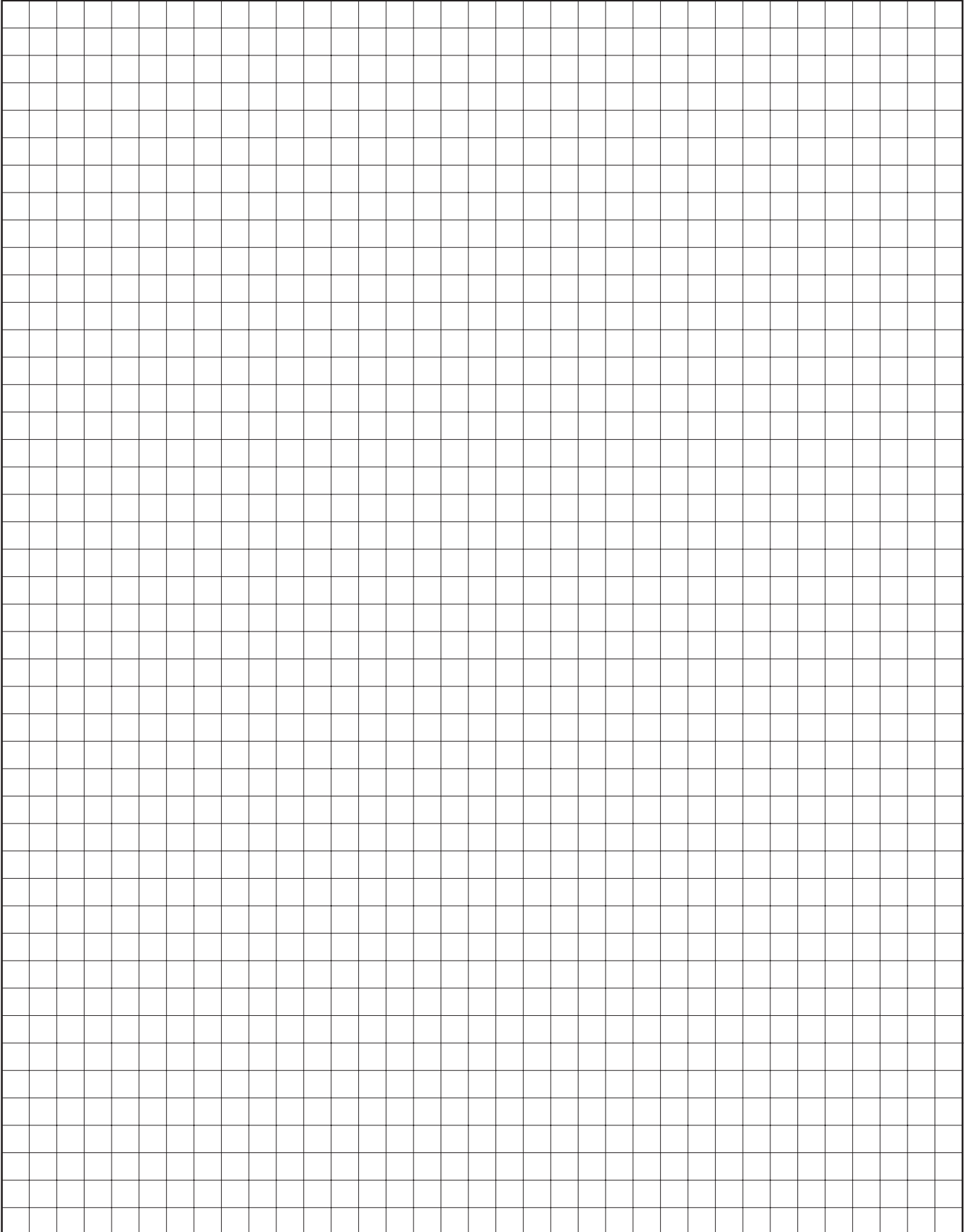
Description	Part #	Description	Part #

Required Additional Spare Parts (To be shipped at a later date)

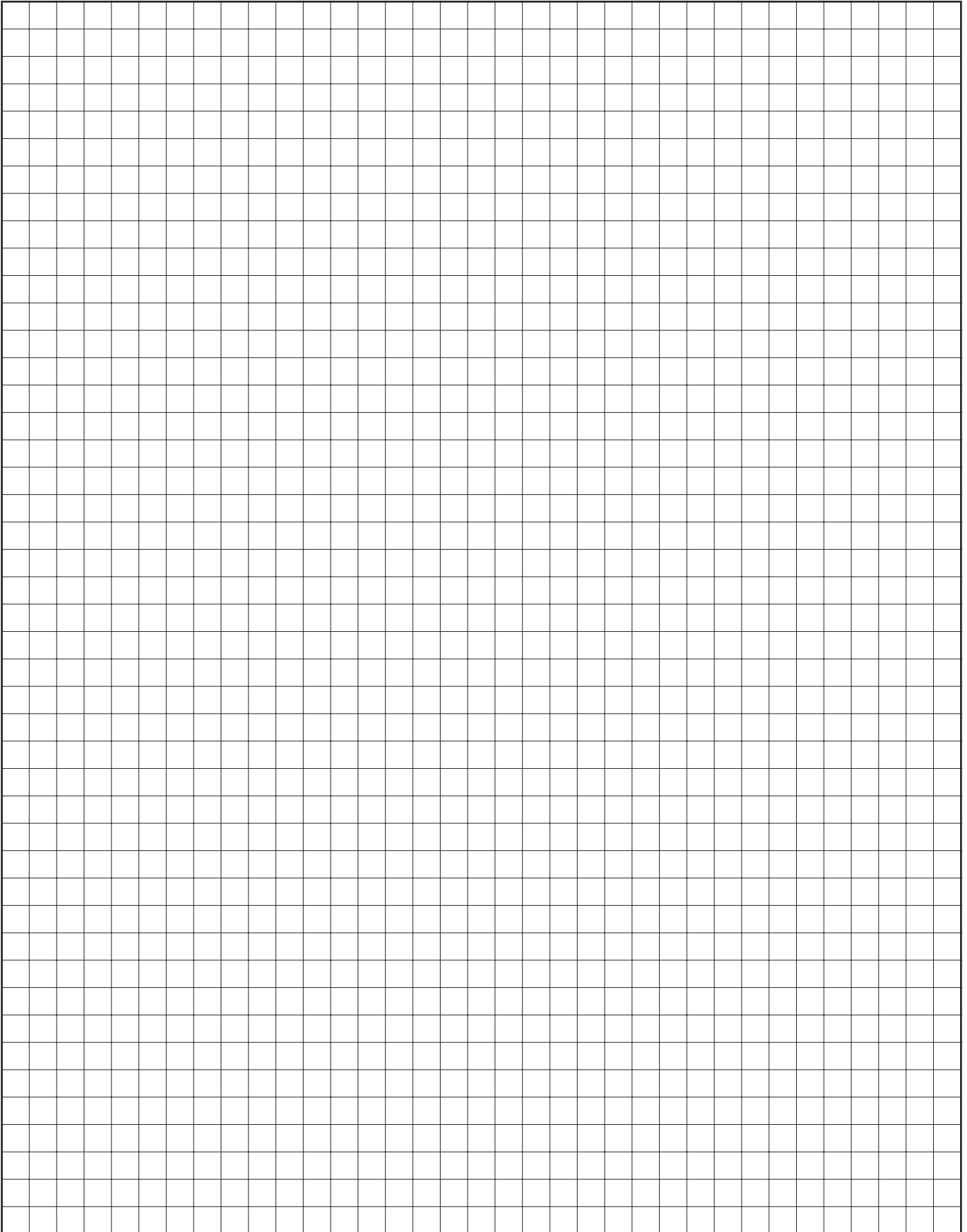
Description	Part #	Description	Part #

Comments

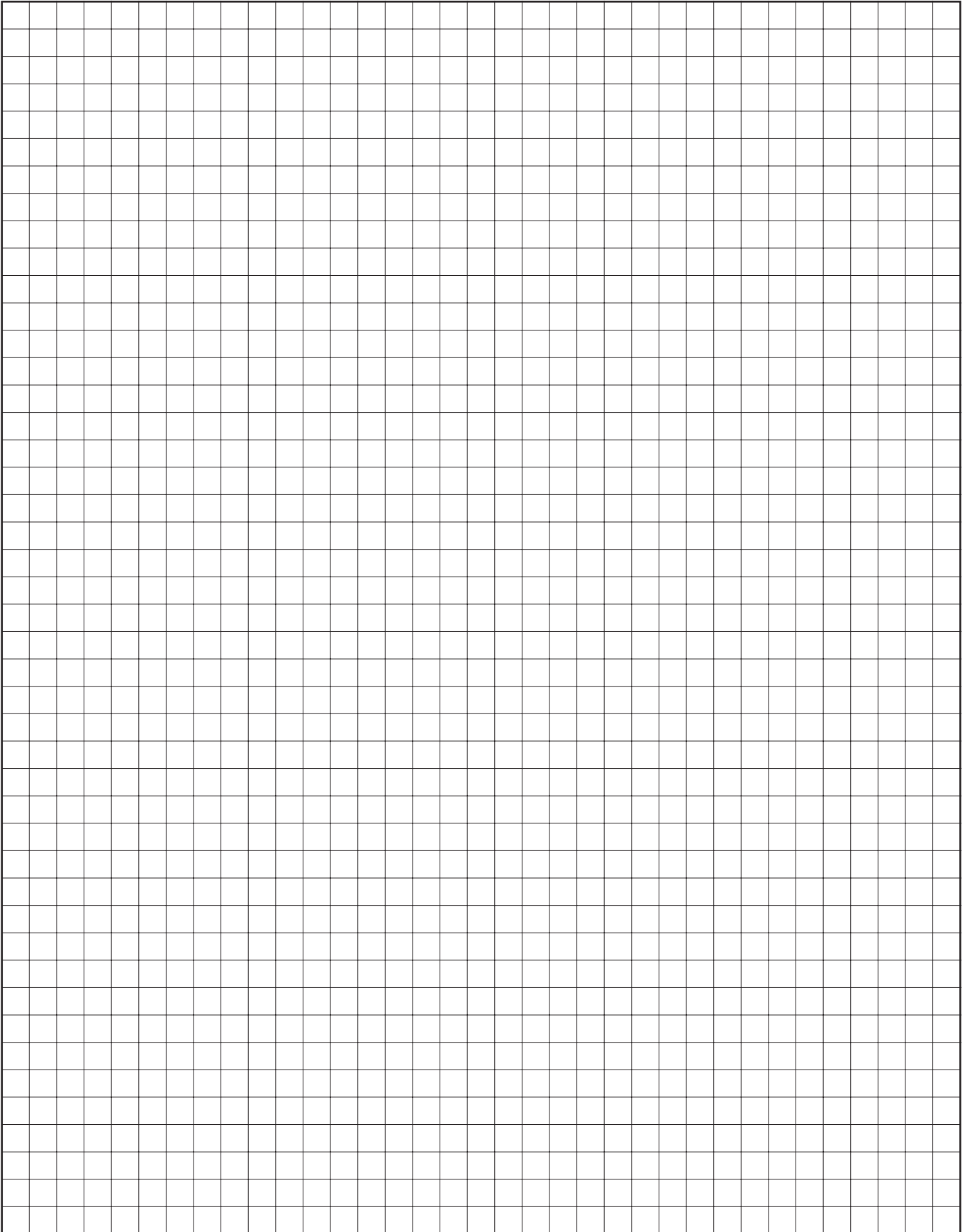
NOTES



NOTES



NOTES





Hellfire™

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 (from date of shipment) for a period of:

- 84 months - SwitchBlade® Heaters
- 60 months - DC Heaters
- 36 months - DC Control Panels
- 36 months - HELLFIRE Heaters, FEB Heaters
- 12 months - All other Fastrax® Products

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.