FROST Fighter

OIL - FIRED CONSTRUCTION HEATER

MODEL

IHS1000 (OIL)

Installation - Operation Maintenance Instructions and Parts List

READ INSTRUCTIONS PRIOR TO STARTING HEATERS

FROST Fighter PORTABLE HEATERS

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C SA® US

REV. 1.1.0
SEPT 2024 TO PRESENT

FROSTFIGHTER WARRANTY

Frost Fighter Inc. warrants the Frostfighter heater to be free from defects in workmanship and materials for a period of twelve (12) months from date of initial service not to exceed fifteen (15) months from date of shipment.

If during the warranty period, the heat exchanger fails under normal use and service due to a defect in material or workmanship said heat exchanger will be repaired or replaced free of charge F.O.B. the Winnipeg Factory..

All mechanical and electrical components are covered by a one (1) year limited warranty. Normal maintenance items are excluded under the warranty. The warranty does NOT include any freight, labor or sales taxes incurred by the purchaser and is subject to the following conditions:

1. The heater shall be operated in accordance with the manufacturer's operating and maintenance manual.

2. The heater shall be subject to normal use in service and shall not have been misused, neglected, altered or other wise damaged.

3. The unit shall be operated within the rated capacities and with the prescribed fuel.

4. The unit has not been allowed to exceed its proper temperature limits due to control malfunction or inadequate air circulation.

5. There is no evidence that the unit has been subject to tampering or deliberate destruction.

No representative of Frost Fighter Inc., nor any of its distributors or dealers, is authorized to assume for Frost fighter Inc. any other obligations or liability in connection with this product, not alter the terms of the warranty in any way. This warranty is limited to the express provisions contained herein and does not extend to liability for labor costs incurred in replacing defective parts.

Parts can be obtained from Frost Fighter Inc., Winnipeg, Manitoba on the basis that credit will be issued if the defective parts returned qualify for replacement pursuant to the terms and conditions of this warranty. Authorization to return any alleged defective parts must be first obtained from the factory prior to transporting the part. The transportation charges for the alleged defective part must be prepaid by the owner. Frost Fighter Inc. will not accept charges for parts purchased unless the conditions of this warranty have been satisfied and prior authorization to purchase the parts has been received from the factory.

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R3P 0E9, (204) 775-8252, 1-888-792-0374

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INSTRUCTION MANUAL
INDIRECT FIRED CONSTRUCTION HEATER

HAZARD DEFINITIONS

The following will be used throughout this manual to bring attention to hazards and their risk factors, or to special information.

DANGER Denotes presence of a hazard which, if ignored, will result in severe personal injury, death or substantial property damage.

WARNING Denotes presence of a hazard, which, if ignored, could result in severe personal injury, death or substantial property damage.

CAUTION Denotes presence of a hazard, which, if ignored, could result in minor personal injury, or property damage.

NOTICE Intended to bring special attention to information, but not related to personal injury or property damage.

To the owner-

NOTICE - Concealed damage – If you discover damage to the burner or the controls during Unpacking, notify the carrier at once and file the appropriate claim.

WARNING - Read all the instructions before proceeding. Follow all instructions completely. failure to follow these instructions could result in equipment malfunction, causing severe personal injury, death or substantial property damage.

WARNING - Installation and adjustment of the burner requires technical knowledge and the use of combustion test instruments. This equipment must be installed, adjusted and started only by a qualified service technician, an individual or agency licensed and experienced with all the codes and ordinances, who is responsible for the installation and adjustment of the equipment. The installation must comply with all local codes and ordinances.

Never store gasoline or combustible materials near the heating equipment. This could result in explosion or fire, causing severe personal injury, death or substantial property damage.

WARNING - Never burn garbage or refuse in your heating appliance or try to light the burner by tossing burning material into the appliance. This could result in severe personal injury, death or substantial property damage. DO NOT burn waste oil in this appliance.

Never restrict air openings on the burner or to the room in which the appliance is located. This could result in fire hazard or flue gas leakage, causing severe personal injury, death or substantial property damage.

THE INSTALLATION OF THE UNIT SHALL BE IN ACCORDANCE WITH THE REGULATIONS OF THE AUTHORITIES HAVING JURISDICTION - Refer to CSA Standard B139 or NFPA 31, Installation Code for Oil-Burning Equipment for recommended installation practice.

SPECIFICATIONS

IHS1000 **OIL** SPECIFICATIONS	
FUEL TYPE	#1 Fuel Oil / Diesel Fuel / Kerosene
MAX. INPUT RATING	900,000 BTU/hr.
FUEL CONSUMPTION	6.4 US Gal / hr. 24 L / hr.
PUMP PRESSURE	135 PSI Pressure should be measured at 1/8" port on top of fuel pump.
NOZZLE SIZE	5.5 GPH 45 DEG. B
STANDARD BURNER AIR SETTINGS	AIR BAND - 5 AIR SHUTTER - 7 SLIDE - 2
POWER SUPPLY REQUIREMENTS	208V/230V 1 PH - 50 AMP. ------ 208V/230V 3 PH - 30 AMP. ------ IHS1000 1PH / 3PH UNITS 460V/480V 3 PH - 30 AMP. ------ IHS1000 480V 3PH UNITS 575V/600V 3 PH - 20 AMP. ------ IHS1000 600V 3PH UNITS
SUPPLY AIR PERFORMANCE	HIGH SPEED - 8000 SCFM* @ 2.0" w.c. LOW SPEED - 6000 SCFM* @ 2.0" w.c. *Per DIN 24163 MAXIMUM CFM (@250°F) - 12,300 CFM. MAXIMUM STATIC PRESSURE - 8.0" W.C.
AGENCY APPROVAL	C SA US
CLEARANCES TO COMBUSTIBLES	SIDES: 6 inches /15 cm TOP: 18 inches / 46 cm FLUE (VENTING): 18 inches / 46 cm DISCHARGE END: 48 inches / 1.2 m BURNER ACCESS: 36 inches / 0.9 m FLOOR: Combustible - Level and rated for load.

CAUTION - For operating conditions below 8°F (-14°C) and lower, it is recommended to reduce the nozzle size to a 5.0 GPH 45°B or a 4.5 GPH 45°B and make the appropriate air adjustments burner to compensate for the increased density of fuel oil and air at lower temperatures.

NOTICE High altitude installations – Accepted industry practice requires no de-rate of burner capacity up to 2000 feet above sea level. For altitudes higher than 2000 feet a rate reduction of 1.87% is required for every 1000 feet ASL.

Example: At 5000 ft. ⟶ 5 x 1.87 = 9.35 ⟶ 100% - 9.35 = 90.65% ⟶ 900,000 x .9065 = 815,800 BTU/hr.

This heater is not intended to be used at temperatures above 70°F (21°C). Operating the heater above this temperature may result in the burner locking out on the high limit switch.

PRE-INSTALLATION CHECKLIST

COMBUSTION AIR SUPPLY

The burner requires combustion air and ventilation air for reliable operation. Assure that the Building and/or combustion air openings comply with National Fuel Gas Code NFPA 54/CSA B149. For appliance/burner units in confined spaces, the room must have an air opening near the top of the room plus one near the floor, each with a free area at least one square inch per 1000 Btu/hr input of all fuel burning equipment in the room. For other conditions, refer to NFPA 31 (CSA B139 in Canada).

If there is a risk of the space being under negative pressure or of exhaust fans or other devices depleting available air for combustion and ventilation, the appliance/burner should be installed in an isolated room provided with outside combustion air.

CLEARANCES

The unit must be installed with minimum clearances of 6 inches on the sides, 18 inches from the top of the unit, 48 inches from the front and 36 inches from the burner access side. The unit can be installed on a level combustible floor. Flue clearance is 18" and at any point of any vent piping attached.

DUCT INSTALLATION

- Duct diameter is 16 inches or 20 inches.
- Use belt cuff ducting. Slide the cuff overtop of the duct inlet/outlet and tighten with the belt.
- The top two connections are the heated supply air into the building.
- The bottom two duct connections are for cold air or return air into the heater.
- The heater is approved use with or without ducting.
- Maximum duct length is 100 feet per supply opening. If return air ducting is used the length of the return air duct must be subtracted from the allowable supply ducting length (i.e. if the return air duct length is 30 feet the maximum supply duct length is reduced to 70 feet).
- Discharge Ducting should be rated for 300°F minimum and inlet ducting if used should be short pitch type suitable for negative pressures.

HIGH LIMITS

- The heater is supplied with high limits switches located behind marked panels on the left side of the heater
- The high limit contacts are normally closed and open on the over temperature condition
- If a high limit trips allow the heater to cool down. There are automatic resetting high limit switches as well as a manual high limit switch. The manual high limit switch is reset on the control panel of the heater.
- Determine the possible cause(s) of the high limit trip (excessive duct length, kinked ducts or excessive sharp bends, restricted inlets or discharges, excessive fuel pressure, etc.) and correct before resuming operation.

VENT SYSTEM

The flue gas venting system must be in good condition and must comply with all the applicable codes.

OUTDOOR INSTALLATIONS:

This heater is approved to operate outdoors. It is recommended that a 36" legth of single wall galvanized vent piping be attached to the fuel outlet c/w with a low restriction rain cap.

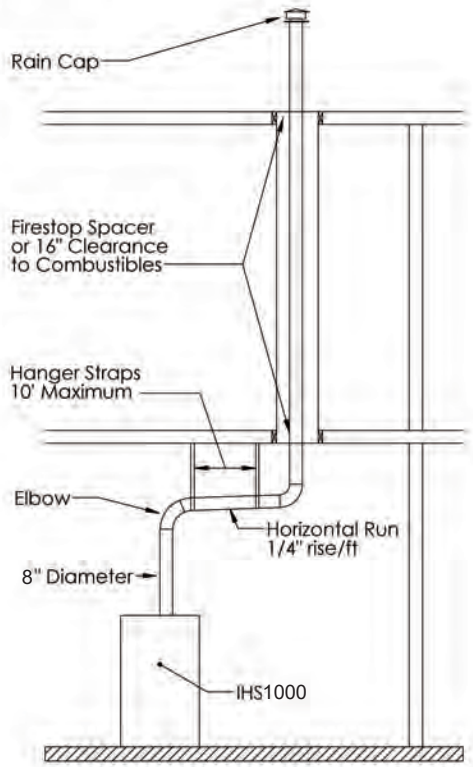
INDOOR INSTALLATIONS:

This heater is approved for use indoors when connected to suitable venting to direct the flue gases to the outdoors. All minimum clearances maintained and installation must be done in accordance to NFPA 54 (or CSA B139) with local authorities having jurisdictions.

1. The flue must be securely attached to the unit with tight joints.
2. The flue must not be sized to have a cross-sectional area less then that of the flue collar at the unit.
3. Other appliances must not be connected so as to vent through the vent of this unit.
4. Do not use 90-degree tees or elbows greater than 45 degrees.
5. Do not support the weight of the stack on the flue connection of the heating system.
6. The maximum flue gas temperature is +/- 600°F. “A” vent, or single wall steel pipe must be used.
7. Minimize connecting pipe length and the number of bends by locating the unit as close to the flue pipe as possible.
8. Maintain clearances between the flue pipe and combustible materials that are acceptable to the Federal, Provincial and local authorities having jurisdiction.
9. Unit must be connected to a flue having sufficient draft to ensure proper operation of unit.

VERTICALLY VENTED UNITS

1. Maximize the height of the vertical run of vent pipe. A minimum of 3 ft. (1m) of vertical pipe is required. The top of the vent must extend at least 2 ft. (0.61m) above highest point on the roof. A weatherproof vent cap must be installed to the vent termination.
2. Horizontal runs must not exceed 75% of the vertical height of the vent pipe, up to a maximum of 10 ft. (3m). Horizontal runs should be pitched upward ¼” per foot (21 mm) and should be supported at 3 foot (1m) maximum intervals.
3. Design vent pipe to minimize the use of elbows. Each 90° is equivalent to 5 ft. (1.5m) of straight vent pipe run.
4. Vent pipe should not be run through unheated spaces. If such runs cannot be avoided, insulate vent pipe to prevent condensation inside vent pipe. Insulation should be a minimum of ½” (12.7mm) thick foil faced fiberglass, minimum 1-½ lb. density.
5. Dampers must not be used in vent piping runs. Spillage of flue gases into the occupied space could result.
6. Vent pressure must be negative.
7. The vent must be terminated vertically.
8. The total run length should not exceed 25 ft. (7.6m)



Vent installations shall conform with local codes, or, in the absence of local codes, with the *National Fuel Gas Code, ANSI Z223.1/NFPA 54*, or the *National Gas and Propane Installation Code, CSA B149.1*

HORIZONTALLY VENTED UNITS

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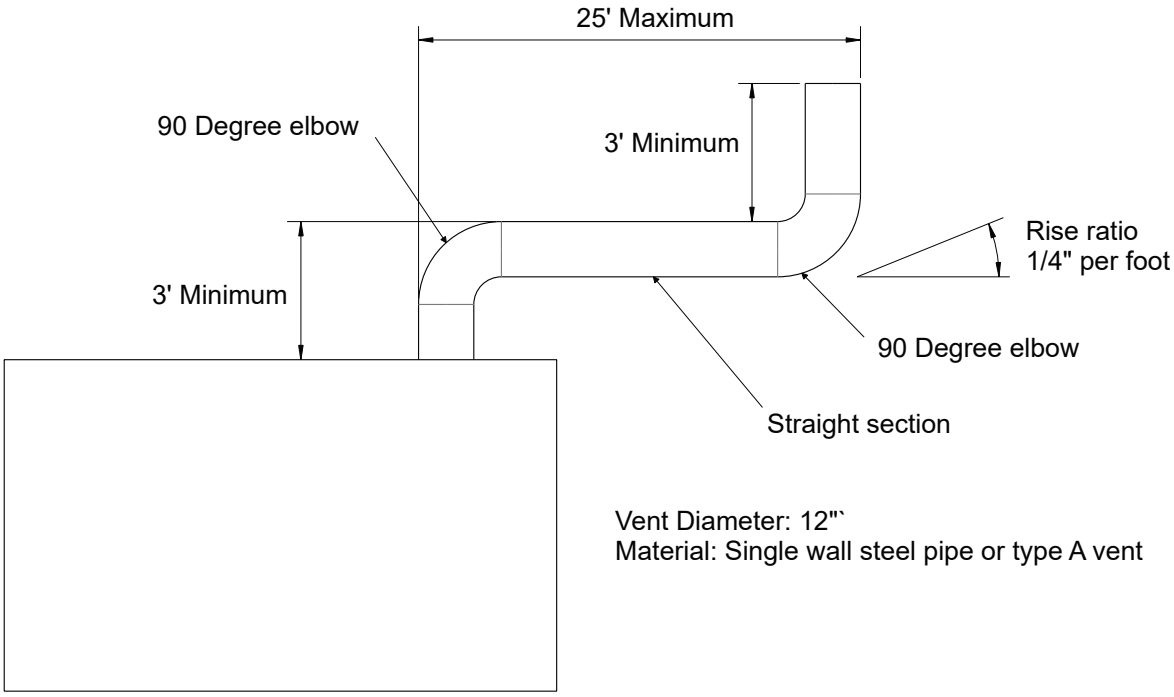
Pressures in Category 111 venting systems are positive and therefore care must be taken to avoid flue products from entering the heated space. Use only vent material and components that are UL listed and approved for Category 111.

WARNING: Do not use Type B vent within a building on horizontally vented units.

1. All vent pipe joints must be sealed to prevent leakage into the heated space.
2. An approved vent cap must be used.

HORIZONTAL FLUE VENTING



Vent Diameter: 12"`
Material: Single wall steel pipe or type A vent

IHS1000

Vent installations shall conform with local codes, or, in the absence of local codes, with the National Fire Protection Standard for Oil-Burning Equipment, NFPA 31, or oil-burning equipment installation Code, CSA B139-04

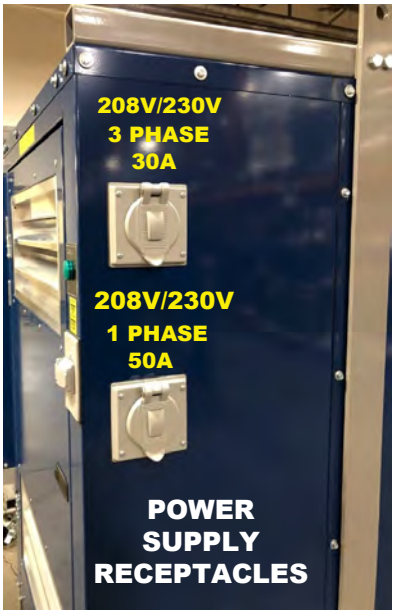
ELECTRICAL SUPPLY

- Verify that the power supply & connections available are correct for the unit. All power supplies MUST be grounded.
- 208V/230V 1PH/3PH models can operate from 200VAC to 240VAC. There are separate power inlets for 1PH or 3PH. The "Power Selector/ Disconnect Switch" has 3 positions "1PH/OFF/3PH) which selects which power inlet receptacle supplies power to the controls.
- 480VAC & 575/600VAC units are models are only capable of operating from 3PH power sources and are equipped with an "On/Off Power Disconnect Switch"
- All power must be supplied through the POWER SUPPLY RECEPTACLES and through the POWER SELECTOR /DISCONNECT SWITCH
- The selector / disconnect switch has three positions OFF / 1 PHASE / 3 PHASE. This selects between which power supply receptacle will be supplying power to the unit. Regardless of which type of power is being supplied, the VFD in the heater will always ensure correct fan rotation direction and reduce the power inrush by starting the fan motor slowly.

INSTALLING THE OPTIONAL THERMOSTAT

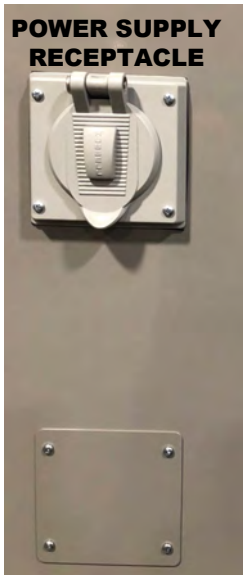
Plug the thermostat directly into the marked receptacle. The thermostat will control the burner through the PLC when the System Switch is in the THERMOSTAT position. The thermostat must be a line voltage type rated for 120VAC 10 AMPS minimum.

WARNING The remote thermostat receptacle is for connecting a remote thermostat ONLY. It is NOT a 120V power source



208V/230V 1PH/3PH MODELS

Refer to Specifications for Power Requirements



480V/600V 3PH ONLY MODELS

IHS1000 MAIN CONTROL PANEL

SYSTEM SWITCH

MANUAL	Turns on heating system (burner) to operate continuously.
OFF	Heat system (burner) is off. Blower may continue to operate in cool-down sequence.
THERMOSTAT	Heating system (burner) is controlled by remote thermostat when connected.

BLOWER SWITCH

ON	Main blower operates continuously (Ventilation Mode).
AUTO	Main blower operates based on the heating cycles with timing controlled by the PLC.

POWER IN SWITCH

208V	Supplies optimum control voltage when incoming line voltage is 200VAC – 215VAC.
230V	Supplies optimum control voltage when incoming line voltage is 220VAC – 240VAC.

FAN SPEED SELECTOR

LOW	Blower operates at 55.0 HZ producing lower air flow rate for max. heat rise & air outlet temp.
HIGH	Blower operates at 60.0 HZ to producing max. air flow rate for max. airflow and static pressure.

HIGH TEMPERATURE LIMIT Illuminates red if manual reset high limit is tripped. Press button to reset.

CONVENIENCE LIGHT Momentary pushbutton controls the compartment convenience lighting.

TO ACTIVATE LIGHTING:

- Push once	Lighting is provided for 5 minutes and will automatically shut off.
- Push and hold for 5 seconds	Lighting is provided for 30 minutes and will automatically shut off.
- Push anytime light is on	This will turn the lighting off.

OPTIONAL HIGH INTENSITY LED STATUS BEACON

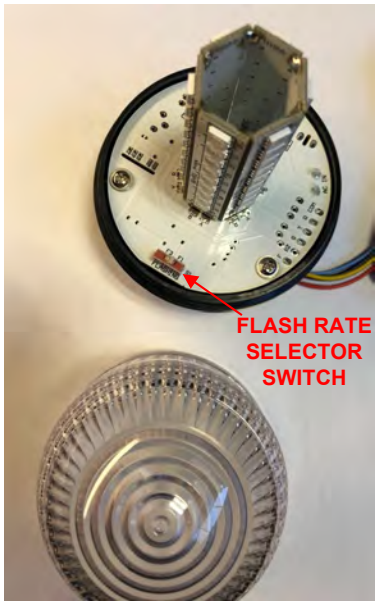
- Available with quick mount magnetic base or can be permanently mounted
- UL (US/CAN) Approved - IP65 weatherproof / RoHS
- Beacon can be added to heater at any time using connector on control box

LED STATUS BEACON DISPLAY:

- Displays SOLID AMBER when desired power is connected & power selector/disconnect switch is in 1PH or 3PH position.
- Displays FLASHING GREEN on a call for heat (Manual or Thermostat) during pre-purge when burner begins operating.
- Displays SOLID GREEN when burner is firing. (Fuel valve signal applied).
- Displays FLASHING AMBER (1 second ON & 1 second OFF) during cool-down cycle.
- Displays FLASHING AMBER (2 second ON & 2 seconds OFF) in ventilation mode.

- Displays FLASHING RED (after 75 sec.) if burner goes into Lockout or (immediately) when High Limit Alarm is triggered.

The RED ALARM flash rate can be changed if desired from 80 flashes/min to 240 flashes/ min with the switch under beacon's screw on lens.



HIGH LIMIT SWITCHES & LOCATIONS

FUEL LINE CONNECTIONS & PRECAUTIONS

CONNECTING THE OIL SUPPLY / RETURN LINES

Install the oil tank lines in accordance with all applicable codes.

Use continuous lengths of reinforced fuel rated hose routed away from and protected from traffic, where possible.

Install a high quality shut-off valve in an accessible location on the oil supply line. Locate one valve close to the tank.

WARNING

Install the oil lines using the following guidelines. Failure to comply could lead to equipment damage and present a risk of sever personal injury, death or substantial property damage due to leakage of oil and potential fire hazard.

Use only flare fittings at joints and connections. Never use compression fittings.

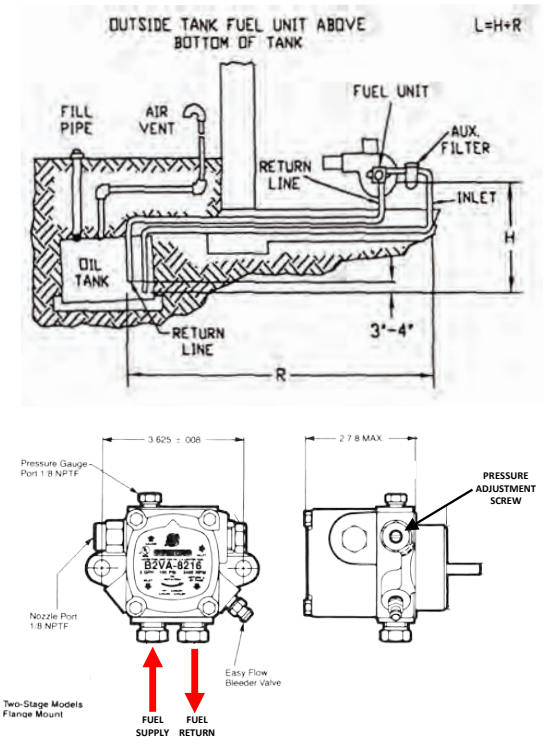
Install fittings only in accessible locations to assure any leak will be detected.

Where joint sealing is needed, use only pipes dope. Never use Teflon tape. Tape strands can break free and damage the fuel unit.

On two-pipe oil systems verify that the suction line vacuum does not exceed the fuel manufacturer's recommendation.

Do not operate the burner unless a return line or a by-pass loop is installed. Failure to follow this guideline and/or restricting or closing off the return line will cause damage to the fuel seals and consequent fuel leakage. This could result in severe personal injury, death or substantial property damage.

TWO-PIPE SYSTEM - (Bypass plug installed in pump)



TWO-STAGE TWO-PIPE **MAXIMUM** LINE LENGTH (H + R)

Lift "H"	3450 RPM Pump Speed
	3/8" OD Tubing @ 7 GPM
0'	80'
2'	73'
4'	66'
6'	59'
8'	52'
10'	45'
12'	38'
14'	31'
16'	80'

FUEL FLOW DIAGRAM

Connection to Fuel Supply Tanks Fuel Tanks

- The IHS1000 Oil fired heater requires a separate fuel supply tank. A bottom mounted integral 175 US. Gal. (675 Litre) fuel supply tank is available for this heater from Frost Fighter. Please contact Frost Fighter for details.

- This heater uses a two line (suction and return) fuel system which is self-priming. The lines must not be restricted or routed in areas where they could be subject to damage. See page 11 for sizing & maximum lengths.

- When using separate remote fuel tanks (fuel cubes) in areas where the lines may be exposed traffic or heavy equipment passing over them, it is critical that the lines are adequately protected from possible damage or rupture.

Optional Single Supply Line System for Remote Fuel Tanks

- For extra safety in installations requiring remote fuel supplies and there is a risk of possible damage to the lines, an optional single line system is available that retains all of the benefits of a two line system but eliminates the return line and also adds a PRV safety valve, thereby eliminating any possibility of spills due to fuel line damage. This system uses an integral fuel return and de-aeration system for improved burner performance.

- This system also eliminates the possibility of fuel pump damaged caused by inadvertently disconnecting shut off couplers while the heater is still operating.

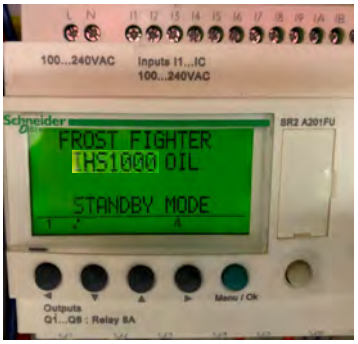
PREPARATION FOR START UP

TYPICAL START UP SCREENS DISPLAYED WHEN POWER SUPPLIED TO HEATER AND POWER SELECTOR SWITCH IS PLACED TO EITHER THE 1PH OR 3PH POSITION.

VFD will display 0.0 when power is supplied and main fan is not running

Display will indicate running frequency (speed) of the fan.
Fan is controlled by the heating cycle to run when the BLOWER switch is in the "AUTO" position or continuously with the switch in the "ON" position.

The speed selector will control the fan speed in both modes and will display 55.0 or 60.0 indicating the fan speed is either set to LOW (55.0 HZ) or HIGH (60.0 HZ)



PLC DISPLAY BEHIND MAIN CONTROL BOX COVER.

IHS1000 models will indicate IHS1000 on display as well as well as the the fuel type

STANDBY MODE displayed whenever heater is connected to power with main power selector on and the System Switch is in the "Off" position.

BURNER PRIMARY CONTROL DISPLAY

PREPARE THE BURNER FOR START-UP

Start-up checklist – Verify the following before attempting to start burner

- o Combustion air supply and venting have been inspected and verified to be free of obstruction and installed in accordance with all applicable codes.
- o Fuel connection to nozzle line assembly is secure.
- o Fuel supply line is correctly installed, the oil tank is sufficiently filled, and shut-off valves are open.

BEFORE STARTING THE BURNER

WARNING Do not proceed unless all prior steps in this manual have been completed. Failure to comply could result in severe personal injury, death or substantial property damage.

WARNING Do not attempt to start the burner when excess oil has accumulated, when the appliance is full of vapor or when the combustion chamber is very hot. Do not attempt to re-establish flame with the burner running if the flames should be extinguished during start-up, venting or adjustment. Allow the unit to cool off and all vapors to dissipate before attempting another start. Failure to comply with these guidelines could cause an explosion or fire, resulting in severe personal injury, death or substantial property damage.

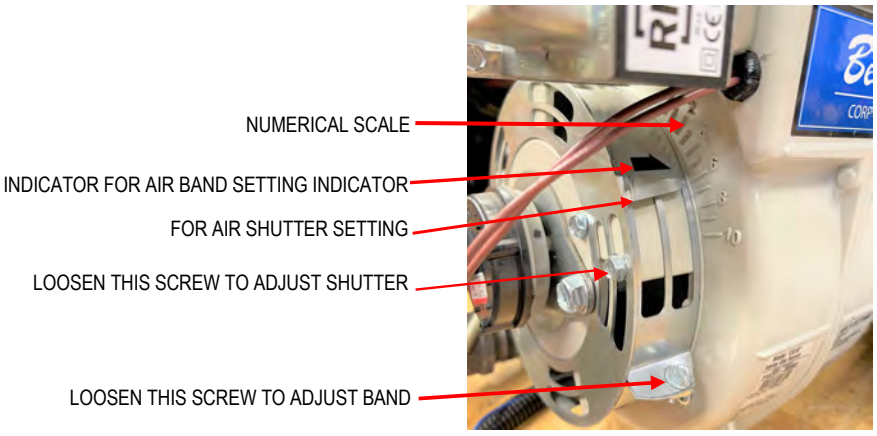
PUMP PRESSURE The pump pressure is 130 PSI to 140 PSI for the IHS1000. The pump pressure is checked at the port on top of the pump and adjusted on the side of the pump. (See page 11)

AIR SETTING

The air settings should be set to 5 on the band and 7 on the air shutter. In some cases these air-setting may need to be adjusted especially if a different size nozzle is installed or when operating in very cold conditions. For field setup a Bacharach smoke tester can be used to obtain a reading of between zero and #2 smoke.

Also a flue gas analyzer can be used to measure excess O2% and CO2% levels. Set your air shutter to bring your O2% levels between 3 - 5%. Your CO2% will be between 9 -12% and your CO levels should be less than 10 PPM

ADJUSTING AIR BAND & SHUTTER

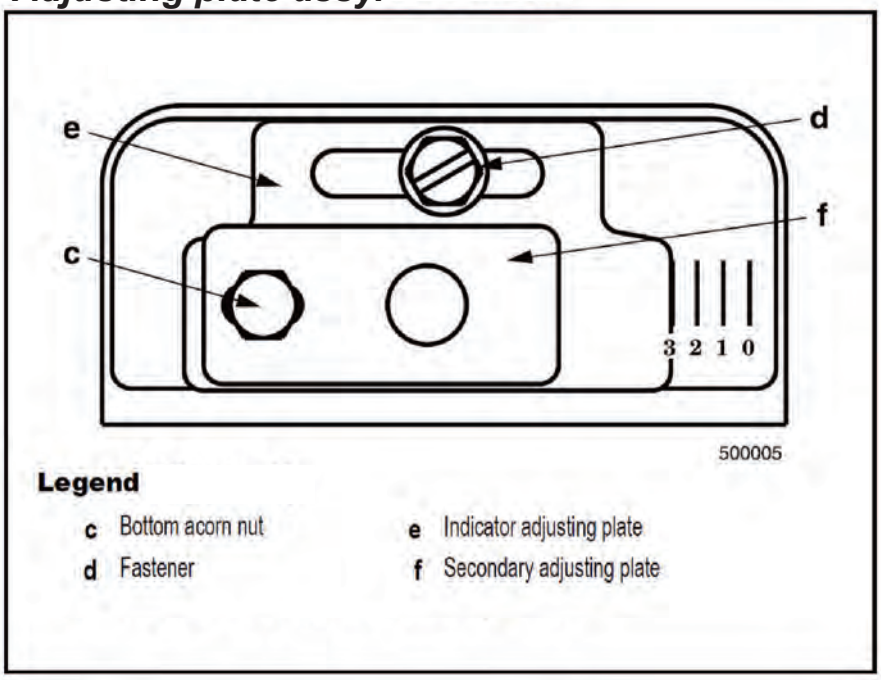


Larger air adjustments are made with with the AIR BAND
Smaller air adjustments are made with the AIR SHUTTER
Adjust the shutter first before adjusting the band to achieve proper combustion results.

SET "Z" DIMENSION

The air slider (z dimensions) settings should be set at 2 on the Adjusting plate assembly, which is located on the right hand side of the burner.

Adjusting plate assy.



MAINTENANCE / SERVICE

MAINTENANCE AND SERVICE

WARNING Operation and adjustment of the burner requires technical knowledge and the use of combustion test instruments. Do not tamper with the burner or controls. Failure to comply could result in failure or the burner or system, resulting in severe personal injury, death or substantial property damage.

PLC CONTROL OIL PRIMARY CONTROL

These two items require no maintenance or service. There are no user serviceable parts inside. Check for proper operation and function prior to each heating season.

ANNUAL SERVICE

Have the burner inspected; tested and started at least annually by a qualified service technician. This annual test inspection should include at least the following:

- Clean burner and blower wheel (to remove lint and debris).
- Test ignition and combustion and verify air damper settings.
- Test fuel lines and all connections
- Inspect combustion air and vent systems.
- Oil motor (if not permanently lubricated).
- Replace oil nozzle with one having the same specifications

MONTHLY MAINTENANCE

- Observe combustion air openings and vent system for integrity. Openings must be clean and free of obstructions.
- Check the fuel lines and fittings to verify there are no leaks.
- Replace fuel filter element
- Observe burner ignition and performance to verify smooth operation.
- Shut the system down if you observe abnormal or questionable operation. Call a qualified service agency for professional inspection and service.
- Grease the main supply blower bearings.

INSTALL NOZZLE

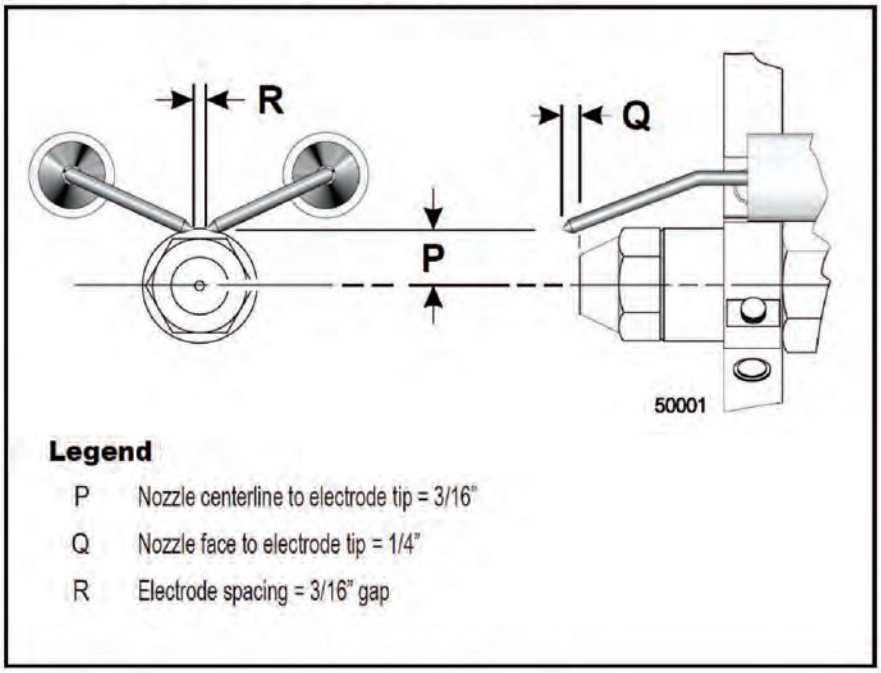
Install the oil nozzle in the nozzle adaptor. Use a open-end wrench to steady the nozzle adaptor and use a 5/8""open-end wrench to turn the nozzle. Tighten securely but do not over-tighten.

Ensure the nozzle being installed has the correct specifications as those shown on page 4 and is sized to account for the ambient temperature conditions that the heater will be operated in.

Verify that the oil tube assembly and electrodes are in good condition, with no cracks or damage.

WARNING Failure to properly set and maintain the electrode and nozzle spacing dimensions can cause incorrect burner ignition or poor combustion. This could result in severe personal injury, death or substantial property damage.

Nozzle and Nozzle Line Assembly



Legend

P	Nozzle centerline to electrode tip = 3/16"
Q	Nozzle face to electrode tip = 1/4"
R	Electrode spacing = 3/16" gap

BEARING INSTALLATION AND MAINTENANCE

NOTE: To prevent premature failure – please ensure greasing instructions below are applied. As well, tighten bearing set screws, collars, and wheel lugs every four to six months.

ENGINEERING – BALL & ROLLER BEARINGS LUBRICATION

For bearings that are equipped with a hydraulic grease fitting threaded into the housing for ease of lubrication, the proper amount of lubricant in the bearing is important. Both excessive and inadequate lubrication may cause failure. The bearings should be re-lubricated while they are rotating (if it is safe to do so);; the grease should be pumped in slowly until a slight bead forms around the seals..The bead in addition to acting as an indicator of adequate re-lubrication provides additional protection against the entry of foreign matter and helps flush out contaminates in the bearing.

If necessary to re-lubricate while the bearing is idle, refer to the recommended re-lubrication grease chart tables on the following page for various sizes of the bearings.

LUBRICANT- STANDARD BEARINGS

All bearing units are pre-lubricated at the factory This lubricant is satisfactory for an operating temperature range of -40° to +250° F.

Select synthetic or standard industrial grade greases that conform to the following specification for optimum bearing performance:

Premium Duty Ball & Roller;
58-75 SUS @ 210° F
50-750 SUS @ 100° F

Premium Duty Ball & Roller;
68-75 SUS @ 210° F
600-750 SUS @ 100° F

Premium Duty Ball & Roller;
82 SUS @ 210° F
886 SUS @ 100° F

NOTE: For heavy loaded roller bearing applications, grease with EP additives are often recommended for optimum performance.

TABLE I. RECOMMENDED LUBRICATION

Ball Bearings		**Roller Bearings**	
Shaft Size (inches)	Grease Charge (ounces)	Shaft Size (inches)	Grease Charge (ounces)
1 – 1 ½	0.15	1 – ½ to 1 – 1 1/16	0.32

A high quality synthetic wide temperature range grease is recommended.

Under most circumstances the fan bearings of the IHS1000 will be operating within the 2000 - 2800 RPM range and will typically be at temperatures well below 120°F - 130°F. Therefore typical lubrication frequency of the bearings will be every 2 to 5 months. In very dirty air environment the frequency of lubrication should increase.

The following chart gives the frequency of re-lubrication based upon continuous operation for various operating temperatures and can be used as a satisfactory guide for determining when bearings should be re-lubricated.

TABLE II. LUBRICATION FREQUENCY

Speed	**Temperature**	**Cleanliness**	**Greasing Interval**
1500 -2800 RPM	Up to 120° F	Clean	2-5 Months
1500 -2800 RPM	Up to 130° F	Clean	2 Months
1500 -2800 RPM	Up to 200° F	Clean	1 Month
Any speed	Up to 150° F	Dirty	1 Month
Any speed	Over 150° F	Dirty	1 - 2 weeks
Any speed	Any temperature	Extreme conditions	Weekly

TENSIONING V-BELT DRIVES

1. Ideal tension is the lowest tension at which the belt will not slip under peak load conditions.
2. Check tension frequently during the first 24-48 hours of operation.
3. Over-tensioning shortens the belt and bearing life under-tensioning reduces belt life and will decrease performance and waste energy.
4. Keep belts free from foreign material that may cause slip.
5. Make V-drive inspection on a periodic basis. Tension when slipping. Never apply belt dressing as this will damage the belt and cause early failure.

Check and tighten belt tension. The following procedure is recommended for tightening belts:

a) Measure span “X” shown in Figure A.
b) At the center of span length “X”, apply a force perpendicular to the span and large enough to deflect belt 1/64” for each inch of span length. Example- the required deflection for a 40” span would be 40/64” or 5/8”.
c) Compare the force applied with the values given in Table III. If force is between the minimum and maximum range shown, the drive tension should be satisfactory. A force below the minimum value indicates an under tightened belt and force that exceeds the maximum value indicates an over tightened belt.

FIGURE A

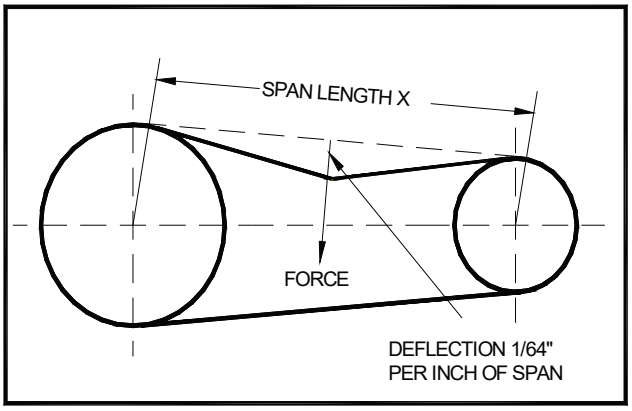


TABLE III

BELT CROSS SECTION (Marked on Belt)	MOTOR PULLEY PITCH DIAMETER	DEFLECTION FORCE	
		MINIMUM	MAXIMUM
B	4.4” – 5.6”	4.0 lbs.	5.87 lbs.

NOTE: The IHS1000 belt drive consists of these parts:

Drive (motor) pulley	- 2B64SDS + SDS bushing
Driven (fan) pulley	- 2B40SH + SH bushing
Belts (qty. 2)	- B53 / BX53

NORMAL SEQUENCE OF OPERATION

1. Power is applied to the PLC control and Genisys 7505 burner primary control L1 black terminal through the step-down transformer as soon as power is supplied with the main 1PH/3PH power selector switch. The display on the PLC display will read “FROST FIGHTER – IHS1000 OIL - STANDBY MODE".

2. The PLC in the control panel controls power to the Limit terminal on the 7505 control from PLC output Q2-2 through the two auto resetting limit controls. The main blower fan operation is controlled through the VFD from PLC outputs Q3 per the timing sequence and the blower speed is determined with outputs from Q3 & Q4 to the VFD

3. Placing the System Switch” to the MANUAL position or in the THERMOSTAT position with a thermostat connected and calling for heat supplies power through the VFD relay contacts R1C & R1A and to PLC input I1.

4. The PLC control will then supply from output Q2, through the auto limit switches to the Limit terminal on the 7505 causing the 7505 to commence operation beginning with starting the burner motor and ignitor and the preset “VALVE ON DELAY”. The PLC display will read “BURNER BLOWER PRE-PURGE” during this time. This Valve On Delay period will then be followed by a 15 second “TRIAL FOR IGNITION” period and the fuel valve is opened. The PLC will at that moment begin displaying “BURNER STARTED – BLOWER ON DELAY” plus it will display the 30 second delay time “SET” and the countdown “ACTUAL” time expired since the burner will typically ignite immediately upon the Trial For Ignition sequence. The 7505 will illuminate the green "FLAME" if the flame has been established. If the burner fails to establish a flame within this 15 second "trial for ignition" time, the 7505 control will go into a "soft lockout" and the red light will be flashing. The PLC control will indicate "CHECK BURNER - RESET IF LOCKOUT" and the red light/button on the 7505 control will have to be pressed for 1 second to resume the sequence from the beginning.

5. With the burner firing and the 30 second Blower Delay time completed, PLC output contact Q3 close and the VFD is initiated to start the main blower fan and the fan begins running.

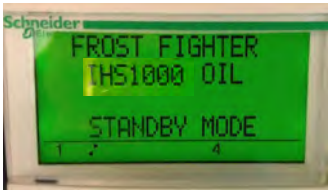
6. The burner will continue firing until the call for heat is stopped either by a thermostat or by placing the System Switch to OFF or a HIGH LIMIT ALARM has occurred and is displayed on the PLC screen. At this point the 7505 control will begin it’s Burner Off Delay. The PLC will begin the heat exchanger Cool-down sequence when the call for heat has ended and will display “COOLDOWN” plus the delay time “SET” and the “ACTUAL” time expired until the blower stops and the PLC will then return to displaying “STANDBY”.

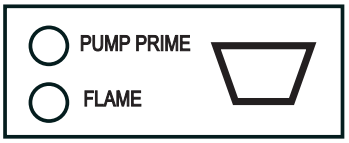
7. If during any heating cycle within the initial 15 second Trial for Ignition sequence the burner does not ignite, then the 7505 control will lockout and need to be reset. The PLC control will read “CHECK BURNER – RESET IF LOCKOUT” until it receives a fuel valve signal again such as would be in the case of a Recycle when the flame was lost during firing and the 7505 control attempted and successfully established a flame again.

8. If the 7505 control has been reset from a lockout three times due to a failure to fire, it will go into restricted "hard lockout" indicated by a solid red light. This can be reset by pressing and holding the red light/button for 30 seconds seconds or until the yellow "Pump Prime" light illuminates and can then be released which will begin another trial for ignition. In each case to reset the 7505 control from either a soft lockout or hard lockout the system switch must be in the 'Manual" position or "Thermostat" position with a thermostat calling for heat.

9. It is important to determine the cause of the failure to fire after three attempts have been made by the burner and the control is in hard lockout. Continuing to reset the control with failure to establish a flame will fill the heat exchanger with raw fuel oil and there is an increased risk of sever damage to the heater, risk of fire or explosion and risk of personal injury or death. Open the bottom drain on the heat exchanger to help facilitate draining of excess fuel that may have accumulated and dispose of in an environmentally safe manner.

TYPICAL SEQUENCES OF OPERATION AND DISPLAYS

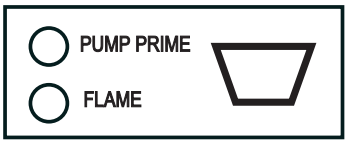




NO CALL FOR HEAT

System switch on "OFF" or System switch on "THERMOSTAT" & no call for heat by thermostat

ALL CONTROL INDICATOR LIGHTS ARE OFF



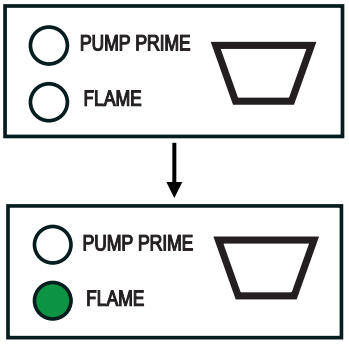
CALL FOR HEAT

System switch turned to MANUAL or call for heat by thermostat

Burner in pre-purge sequence - Approx 45 seconds

Fuel valve closed and burner fan is running, ignition is on and fuel pump is pumping all fuel back through return line

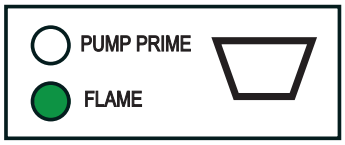
ALL CONTROL INDICATOR LIGHTS ARE OFF



TRIAL FOR IGNITION

Fuel valve opens and flame must be established within 15 seconds.

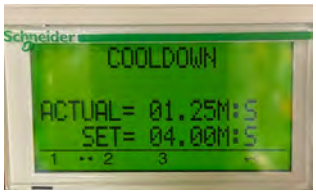
Green "FLAME" light will illuminate as soon as a flame is established

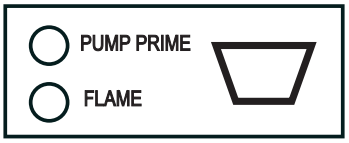


BURNER AND BLOWER ARE OPERATING

Green FLAME light is on

Burner and blower will continue to operate until the call for heat ends by turning the system switch to "OFF" or if the switch is in "THERMOSTAT" position the thermostat ends the call for heat.





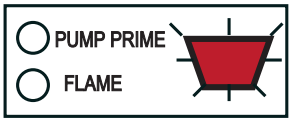
COOLDOWN PERIOD AFTER CALL FOR HEAT ENDS

The burner will continue to run in a post-purge cycle until sequence ends.

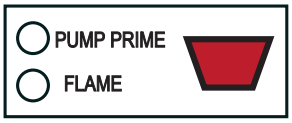
The main blower with run until the "COOLDOWN" period of 4 minutes has ended.

ALL CONTROL INDICATOR LIGHTS ARE OFF

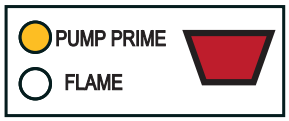
SOFT LOCKOUT - LIGHT FLASHING



HARD LOCKOUT - LIGHT STEADY



Press button for 30 sec or until Yellow "Pump Prime" illuminates



CHECK BURNER

When the PLC does not receive a fuel valve signal after the pre-purge time period has been completed or it recieves a valve signal but is lost after the 15 second trial for ignition period (failure to establish flame), the PLC will display CHECK BURNER and RESET IF LOCKOUT.

If the 7505 control has gone into a "soft lockout" the red light will be flashing. To clear the lockout press the red light/button for one or two seconds. The control will begin a new cycle. (note: the PLC will still indicate CHECK BURNER) until a valve signal is reasserted on this new cycle.

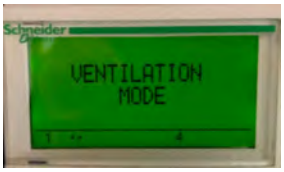
If failure to establish a flame has occurred three times then the control will go into a "restricted" or "hard lockout". This can be cleared by pressing & holding the red light/ button down for 30 seconds or until the yellow "PRIME PUMP" light illuminates & the sequence will begin again.

Once the valve signal is reapplied, the PLC screen will return to displaying BURNER ON - BLOWER ON message if the blower was already running or the BURNER STARTED - BLOWER ON DELAY if the blower was not yet running.

THE CAUSE OF A HARD LOCKOUT SHOULD BE DETERMINED BEFORE CONTINUING OPERATION. MULTIPLE RESETS WILL CAUSE FUEL ACCUMULATIONS WHICH CAN CAUSE A FIRE OR EXPLOSION WHEN IGNITED.

OTHER DISPLAY SCREENS ON THE IHS1000 PLC

VENTILATION MODE



The IHS1000 has a "Blower On" switch (See page **8**) which permits the fan to run continuously independent of the burner. The PLC will show "VENTILATION MODE" when this switch is in the ON position to indicate this. The PLC display will not indicate which fan speed is selected. Fan speed will bedisplayed on the VFD as either 55.0 (LOW) or 60.0 (HIGH)

Note: The display will indicate VENTILATION even with this switch in the AUTO position when the burner is operating with the BLOWER ON DELAY activated, as fan operation then overrides this display.

HIGH LIMIT ALARMS

The PLC in the IHS1000 monitors the high limit switch circuit providing a visual indication that one or more of the high limit switches has open contacts which will normally be caused by a high limit temperature condition. A high limit condition indicates that the heater is operating above the permitted maximum temperatures and this will stop the burner operation until the heater cools sufficiently for the high limit(s) to reset. The PLC will indicate this HIGH LIMIT ALARM condition and will return to the appropriate screen once burner operation resumes. The main blower fan will continue to operate if it has already been operating until the cool-down time expires. To help facilitate cooling the Blower switch can be placed in the ON position for constant operation.

An additional high limit switch is provided in the IHS1000 which will open the contacts should the other high limit switches fail to stop the burner in an over-temperature condition. This condition will indicate on the PLC control as MANUAL HIGH LIMIT ALARM as well as UNIT OFF and PRESS RESET BUTTON. This high limit alarm condition will not reset automatically and will also be indicated by a red light flashing in the "HIGH TEMPERATURE RESET BUTTON" on the control panel cover.

This condition requires that the reset button be pressed once the unit has cooled down to acceptable operating temperature. The reset cannot be performed and the light will continue to flash until the heater cools down regardless of attempts to reset it. The activation of the manual high limit alarm normally indicates a serious overheating condition and the cause of this must be determined and corrected before continuing operation.

CAUTION: Repeated automatic or manual reset high limit alarm conditions is an indication that there may be a problem with airflow which may be causing these high limit events or possibly a high limit switch malfunction and the cause of this should be determined and corrected before resuming operation.

Genisys Controller

Sequence of Operation

Burner States

Standby: The burner is idle, waiting for a call for heat.

Valve-On Delay: The igniter and motor are on while the control delays turning on the oil solenoid valve for 45 seconds.

Trial For Ignition: The oil solenoid valve is energized. A flame should be established within the factory set trial for ignition time ("lockout time").

Lockout: The control has shut down for one of the following safety reasons:
a. The trial for ignition (lockout) time expired without flame being established.
b. The cad cell detected flame at the end of the Valve On Delay state.

To reset the control from a lockout press the red button/light for 1 second.

NOTE: A reocurrence of the above failure modes or a failed or welded relay could cause the control to enter a Restricted Hard Lockout state that must be reset only by a qualified service technician. To reset from Hard Lockout, hold the reset button for 15 seconds until the yellow light turns on.

Run: The flame is sustained until the call for heat is satisfied. The burner is then sent to Motor-Off Delay, if applicable, or it is shut down and sent to Standby.

Recycle: If the flame is lost while the burner is firing, the control shuts down the burner,enters a 60 second recycle delay, and repeats the ignition sequence. The control will continue to Recycle each time the flame is lost, until it reaches a pre-set time allotment. The control will then go into Hard Lockout instead of recycle. This feature prevents excessive accumulation of oil in the appliance firing chamber.

Motor-Off Delay: If applicable, the oil solenoid valve is turned off and the control delays turning the motor off for the set motor-off delay time before the control returns to standby.

ATV320VFD

The ATV320 Frequency Drive is configured at the factory to display fan motor operating frequency

MONITORING DISPLAYS CAN BE CONFIGURED TO PROVIDE OTHER INFORMATION AS SHOWN BELOW.

FOLLOW THE STEPS BELOW TO CONFIGURE THE DISPLAY PARAMETERS. **(PROCEED ONLY IF YOU ARE CONFIDENT IN DOING SO.)**

TO SAVE THE DESIRED DISPLAY PARAMETERS - PRESS & HOLD THE BUTTON FOR 3 SECONDS UNTIL DISPLAY FLASHES THEN PRESS ESC (ESCAPE) AS MANY TIMES AS NEEDED TO RETURN TO THE HOME SCREEN "0.0"

DEFAULT DISPLAY WITH POWER APPLIED

PRESS BUTTON ONCE

REFERENCE

ROTATE BUTTON TO RIGHT

MONITORING

PRESS BUTTON ONCE

FREQ. REFERENCE

ROTATE BUTTON TO RIGHT

OUTPUT FREQUENCY INDICATES MOTOR FREQ.

Factory Setting for VFD Display

ROTATE BUTTON TO RIGHT

MAINS VOLTAGE

VOLTAGE FROM DC BUS.

ROTATE BUTTON TO RIGHT

MOTOR THERMAL STATE

TYPICALLY NOT RELEVANT

ROTATE BUTTON TO RIGHT

DRIVE THERMAL STATE

100%=NORMAL 118%=OHF THRESHOLD

ROTATE BUTTON TO RIGHT

MONITOR MOTOR

PRESS BUTTON ONCE

MOTOR SPEED RPM

ESTIMATED

ROTATE BUTTON TO RIGHT

MOTOR VOLTAGE

ESTIMATED

ROTATE BUTTON TO RIGHT

MOTOR POWER (ESTIMATED)

100% = NOMINAL MOTOR POWER

ROTATE BUTTON TO RIGHT

MOTOR TORQUE(ESTIMATED)

100% = NOMINAL MOTOR TORQUE

ROTATE BUTTON TO RIGHT

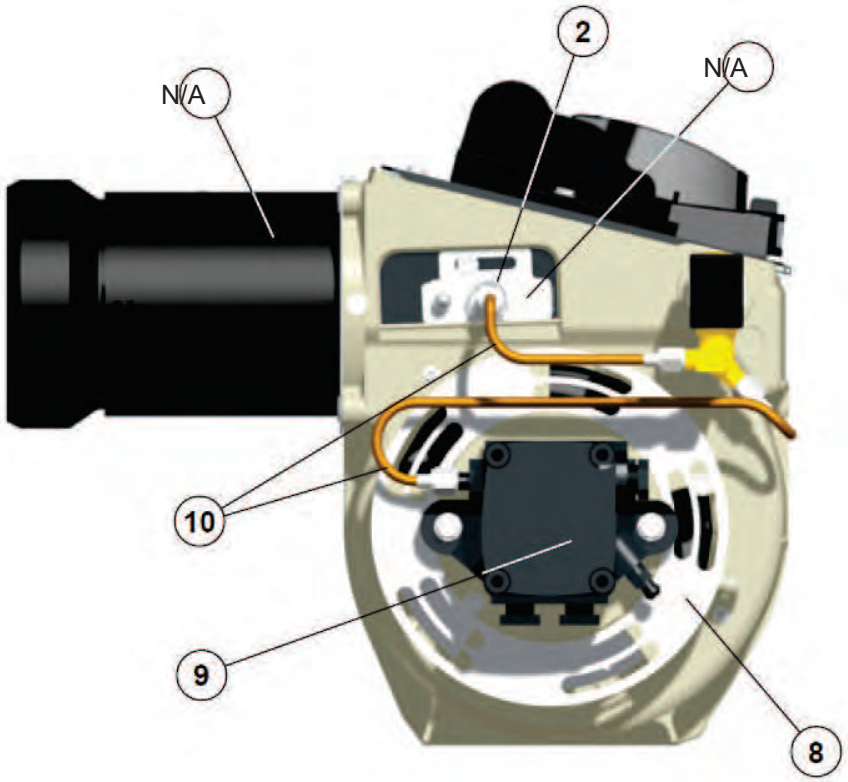
MOTOR CURRENT

ESTIMATED

ESC (Escape) can be pressed at any time to return back to the start & begin again.

CF800 BURNER

CF800 Burner REPLACEMENT PARTS

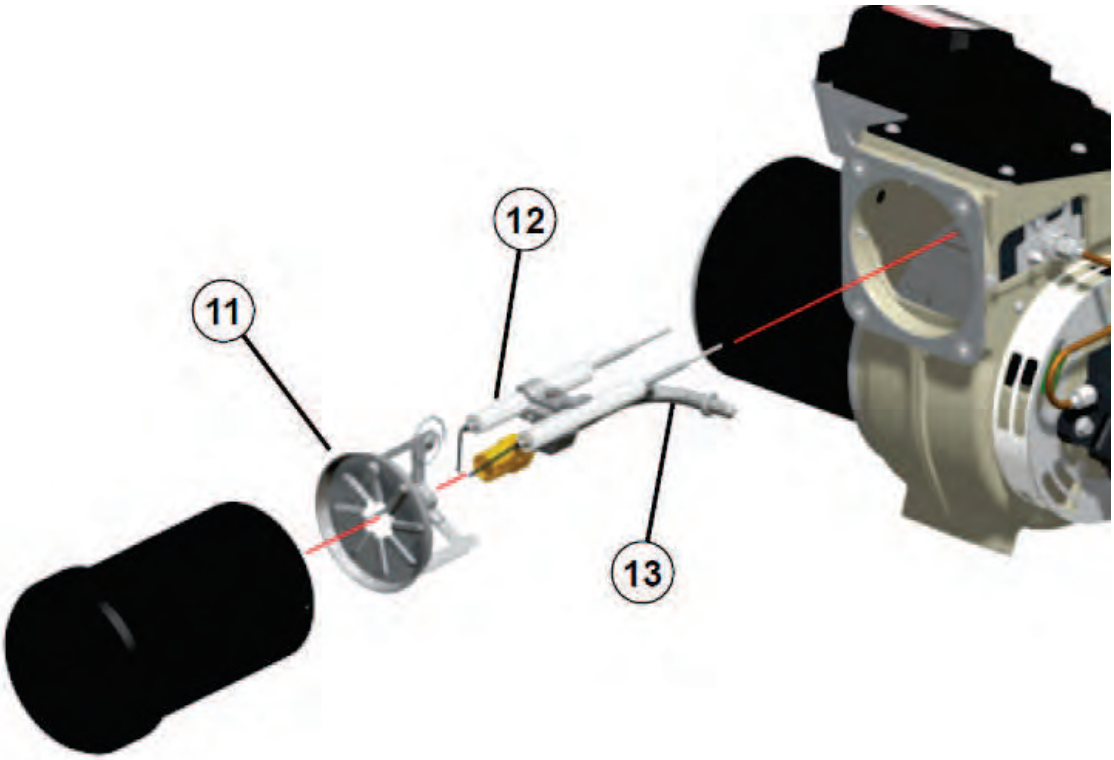


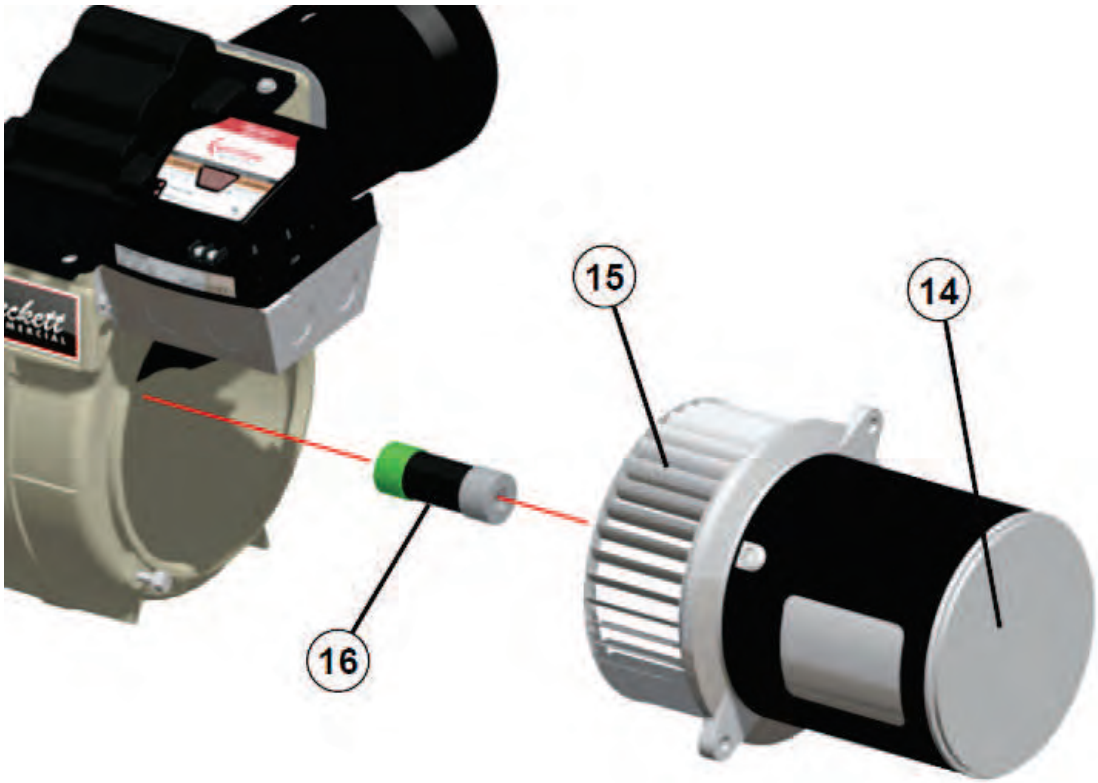
⚠ CAUTION

DO NOT USE GASOLINE, CRANKCASE OIL, OR ANY OIL CONTAINING GASOLINE

Firing range	CF800: 3.00 to 8.00 GPH
Motor	1/3 HP 3450 RPM 120/60 hz standard 4.8 amps @ 120 VAC
Igniter	120V/14,000v
Housing	Cast aluminum
Fuel unit	100 - 200 PSIG
Oil nozzle	45° - 70° solid
Shipping wt.	55 lbs.

REPLACEMENT PARTS

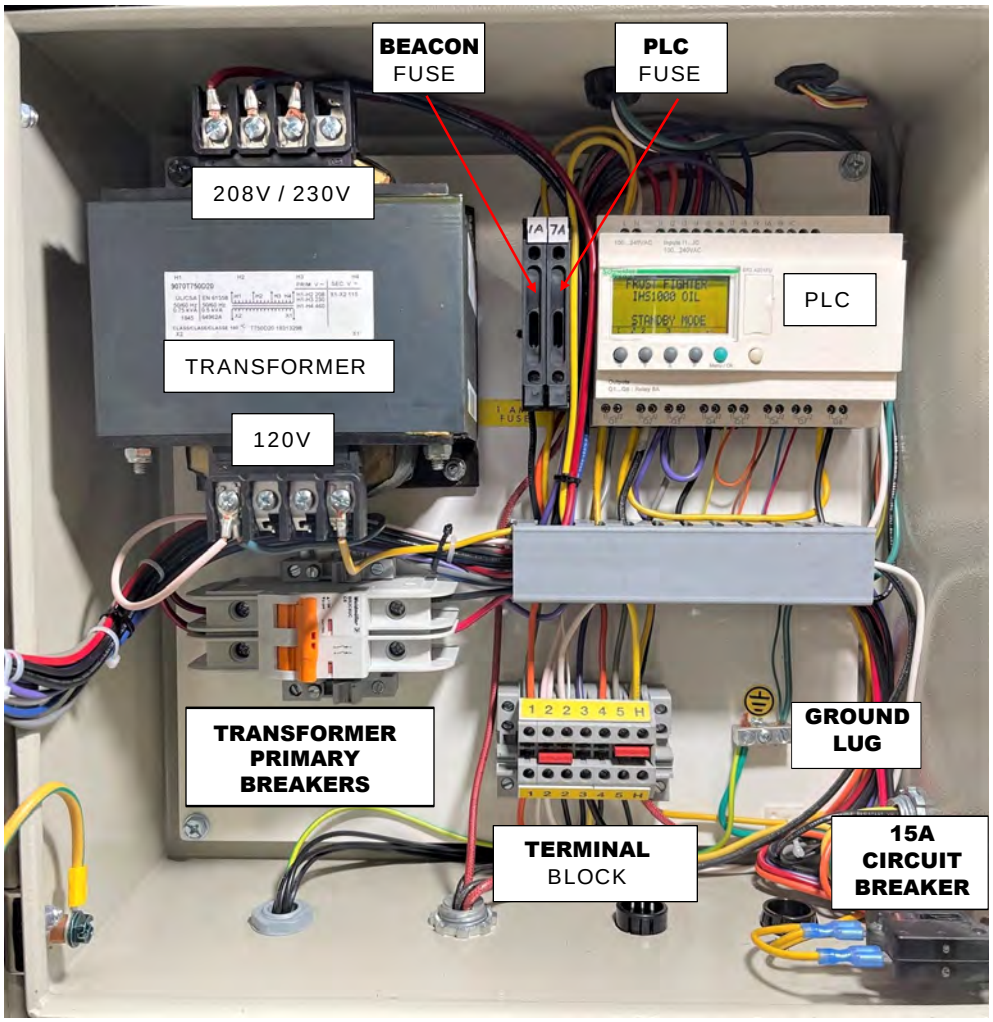


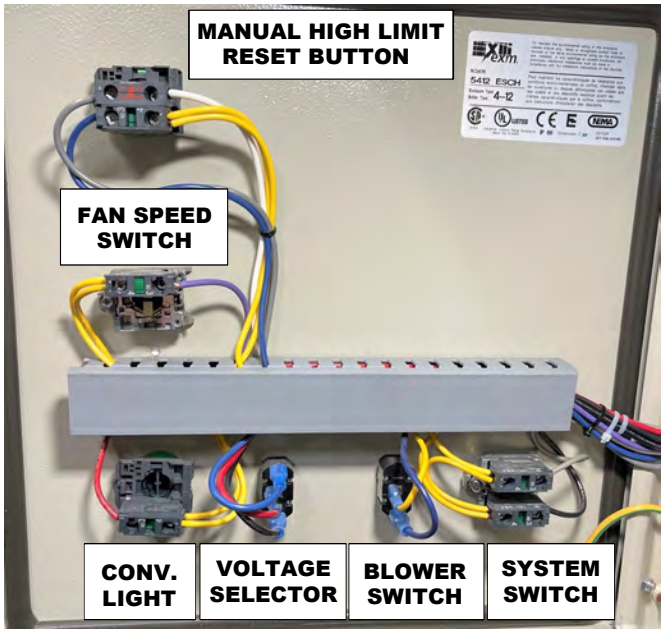


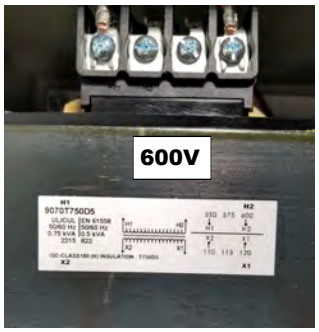
BURNER REPLACEMENT PARTS

ITEM #	PART #	DESCRIPTION
2	B48267	KNURLED NUT (BECKETT)
4	B30798	HSG MOUNT SOL VALVE - 21789U
5	B48138A	BECKETT IGNITER "S" 51824U
6	50147	CONTROLLER/GENISYS POTTED 120V
8	B48254	AIR SHUTTER
9	48139	SUNTEC "A" OIL PUMP 2591U
10	48152	8" OIL DELIVERLY TUBE 5394
11	B48264	HEAD ASSEMBLY
12	B70262	ELECTRODES IHS1000 OIL
13	B60256	6" AIR TUBE COMBO FOR CF800
14	48140	1/3 HP BURNER MOTOR
15	B30141A	BLOWER WHEEL - 21339U
16	48187	FLEX COUPLING
	70007A	190' AUTO RESET HIGH LIMIT DISCHARGE
	70007	200' MANUAL HIGH LIMIT DISCHARGE
	48110C	250' AUTO RESET HIGH LIMIT BLOWER
	B48154	CAD CELL
	70291	4.0 x 45 NOZZLE

MAIN CONTROL PANEL ELECTRICAL COMPONENTS

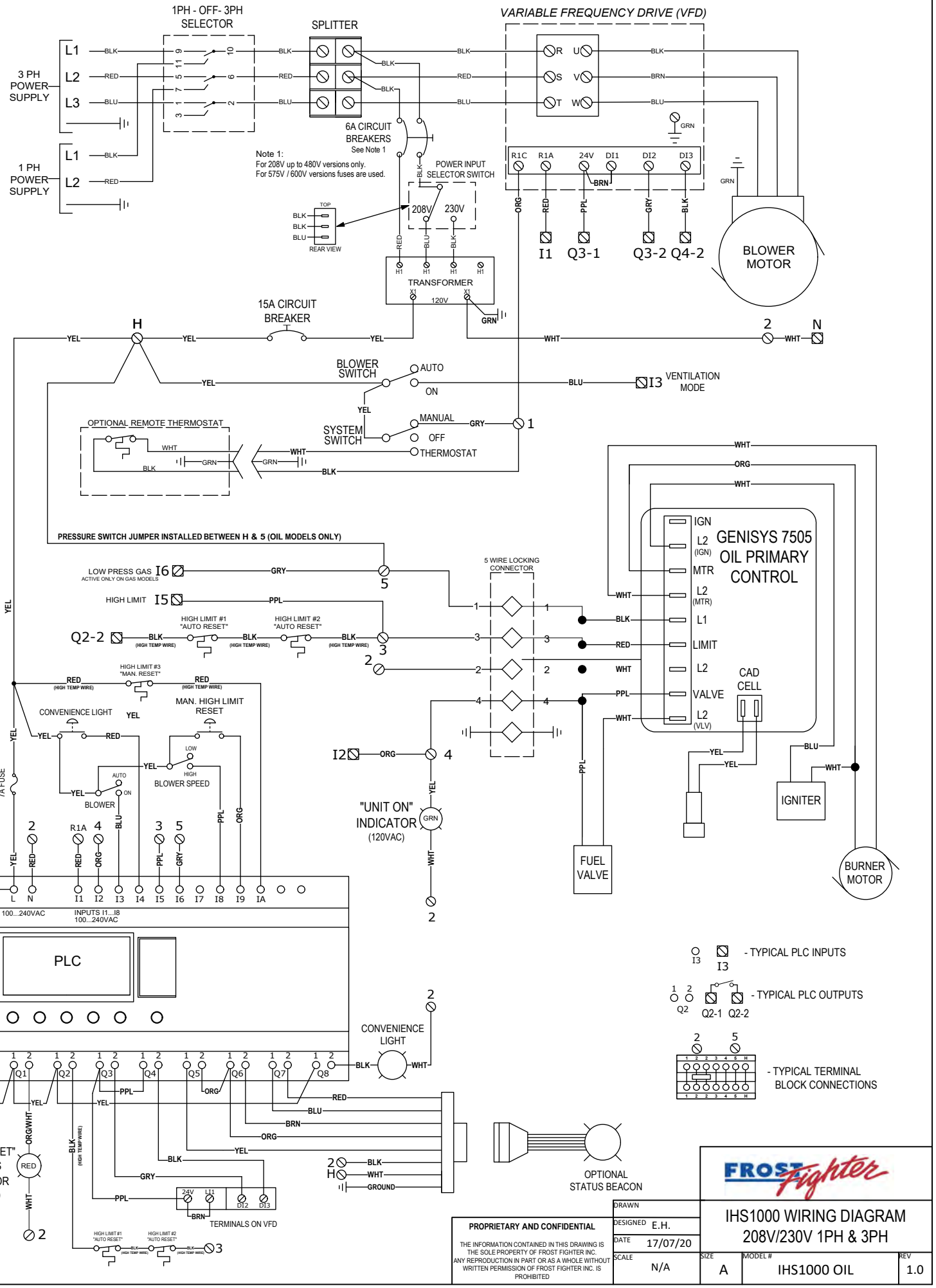






480V 3PH ONLY MODEL - TRANSFORMER PRIMARY WIRING
NO VOLTAGE SELECTOR SWITCH USED

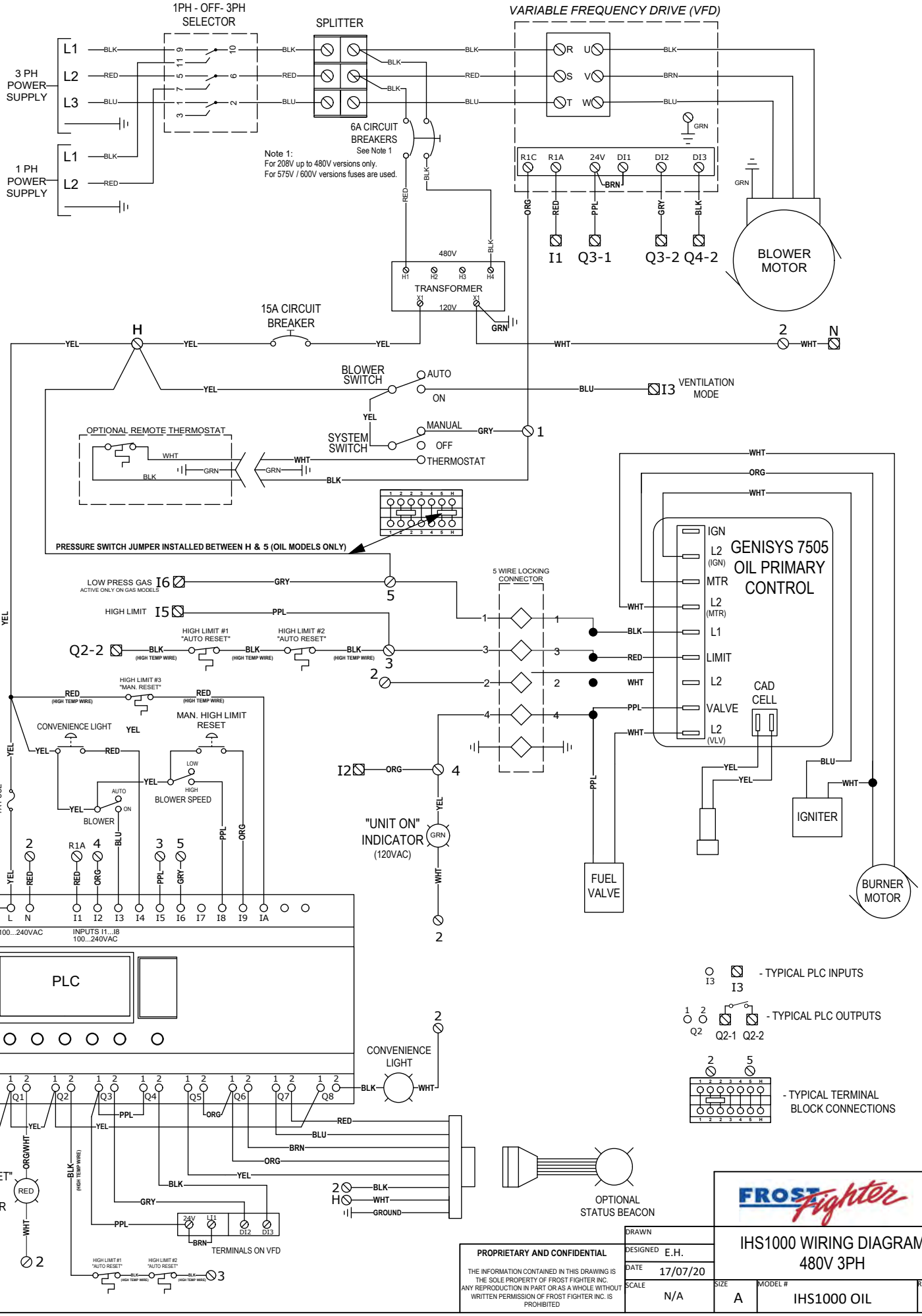
600V 3PH ONLY MODEL - TRANSFORMER PRIMARY WIRING
SINGLE INPUT TRANSFORMER USED



FROST Fighter

IHS1000 WIRING DIAGRAM 208V/230V 1PH & 3PH

DRAWN			
DESIGNED	E.H.		
DATE	17/07/20		
SCALE	N/A	SIZE A	MODEL # IHS1000 OIL
			REV 1.0



FROST Fighter

IHS1000 WIRING DIAGRAM 480V 3PH

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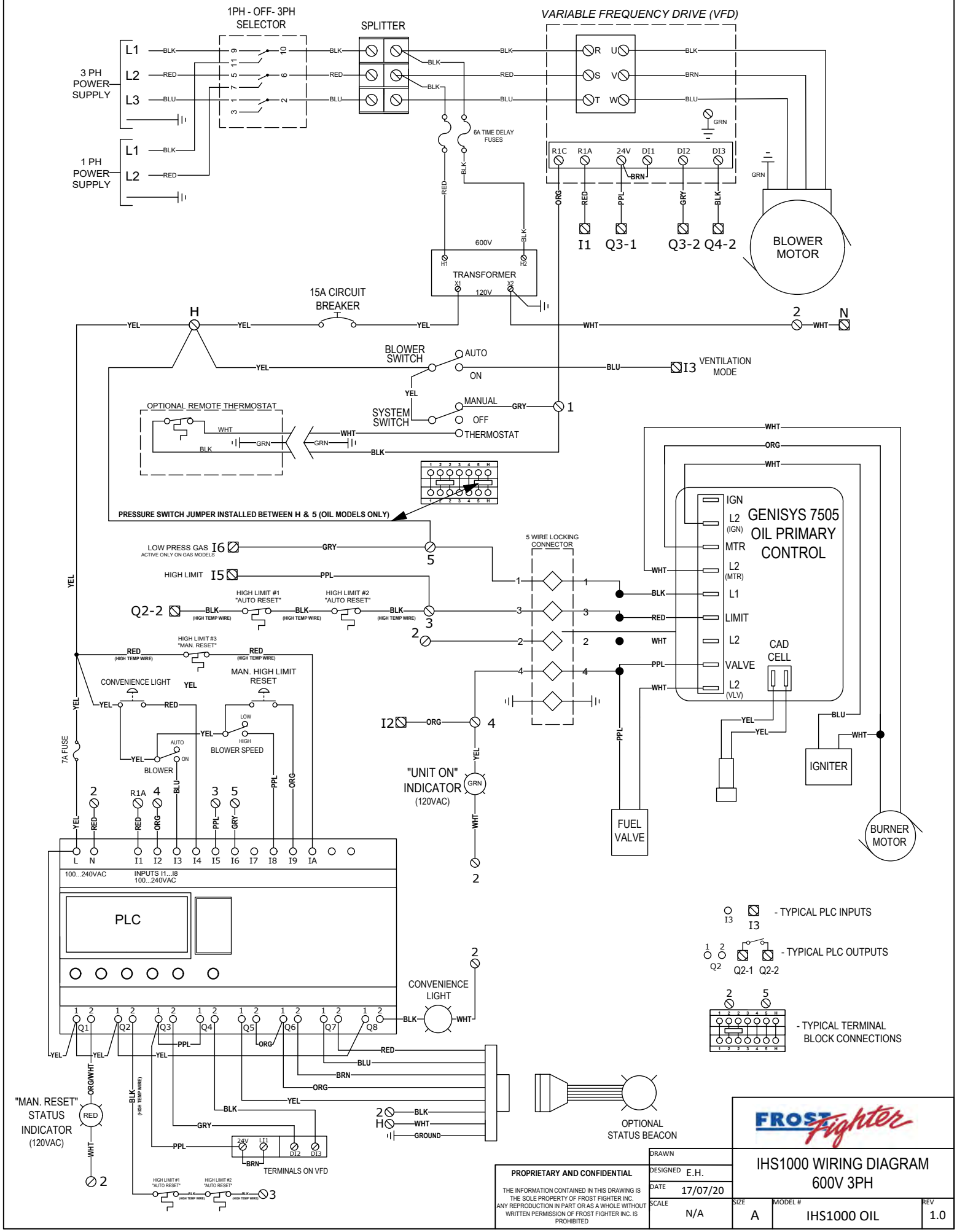
MODEL #	IHS1000 OIL
REV	1.0



FROST Fighter

IHS1000 WIRING DIAGRAM 600V 3PH

DRAWN				
DESIGNED	E.H.			
DATE	17/07/20			
SCALE	N/A	SIZE A	MODEL # IHS1000 OIL	REV 1.0

PROPRIETARY AND CONFIDENTIAL	IHS May 2009	MATERIAL N/A	FROST Fighter	
THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF FROST FIGHTER INC. ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT WRITTEN PERMISSION OF FROST FIGHTER INC. IS PROHIBITED	TOLERANCES X.X ±.1 FRACTIONS ±1/32 X.XX ±0.2 DRAFT ANGLE 3° X.XXX ±.005 RADIUS 1/8	DATE 05/09 SCALE N/A	SIZE A	MODEL # IHS700P / REV 0