

FROST *Fighter*

GAS - FIRED CONSTRUCTION HEATER



MODEL
IHS700P (LP/NG)
(WITH PLC CONTROL)

Installation - Operation Maintenance Instructions and Parts List

READ INSTRUCTIONS PRIOR TO STARTING HEATERS



FROST FIGHTER INC.
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REV. 1.0.8.
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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.



100-1500 NOTRE DAME , WINNIPEG, MANITOBA
R3P 0E9, (204) 775-8252, 1-888-792-0374

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HAZARD DEFINITIONS

GENERAL HAZARD WARNING

FAILURE TO COMPLY WITH PRECAUTIONS AND INSTRUCTIONS PROVIDED WITH THIS HEATER CAN RESULT IN DEATH, SERIOUS BODILY INJURY AND PROPERTY LOSS OR DAMAGE FROM HAZARDS OF FIRE, EXPLOSION, BURN, ASPHYXIATION, CARBON MONOXIDE POISONING, AND/OR ELECTRICAL SHOCK.

ONLY PERSONS WHO CAN UNDERSTAND AND FOLLOW THE INSTRUCTIONS SHOULD USE OR SERVICE THIS HEATING UNIT.

IF YOU REQUIRE ASSISTANCE OR HEATER INFORMATION SUCH AS AN INSTRUCTION MANUAL, LABELS, ETC., CONTACT THE MANUFACTURER.

WARNING

FIRE, BURN INHALATION, AND EXPLOSION HAZARD. KEEP SOLID COMBUSTIBLES, SUCH AS BUILDING MATERIAL, PAPER AND/OR CARDBOARD A SAFE DISTANCE AWAY FROM THE HEATER AS RECOMMENDED BY THE INSTRUCTIONS. NEVER USE THE HEATER IN SPACES WHICH MAY CONTAIN VOLATILE OR AIRBORNE COMBUSTIBLES, OR PRODUCTS SUCH AS GASOLINE, SOLVENTS, PAINT THINNER, ACETONE, DUST PARTICLES AND/OR UNKNOWN CHEMICALS.

THIS PRODUCT IS NOT INTENDED FOR HOME OR RECREATIONAL VEHICLE USE.

FOR YOUR SAFETY

DO NOT USE THIS HEATER IN A SPACE WHERE GASOLINE OR OTHER LIQUIDS HAVING FLAMMABLE VAPOURS ARE STORED OR USED.

GENERAL NOTES:

STANDARD: ANSI Z83.7 - CSA 2.14

ALL GAS INSPECTION AUTHORITIES IN CANADA REQUIRE THAT THE INSTALLATION AND MAINTENANCE OF HEATER AND ACCESSORIES SHALL BE ACCOMPLISHED BY A QUALIFIED GAS FITTER.

THE INTENDED USE OF THIS HEATER IS FOR THE TEMPORARY HEATING OF BUILDINGS OR STRUCTURES UNDER CONSTRUCTION, ALTERATION OR REPAIR.

INSTALLERS RESPONSIBILITY

Installer please note: This equipment has been test fired and inspected. It has been shipped free from defects from our factory. However, during shipment and installation, problems such as loose wires, leaks or loose fasteners may occur. It is the installer's responsibility to inspect and correct any problems that may be found.

OWNERS RESPONSIBILITY

WARNING Installation and adjustment of the burner requires technical knowledge and the use of combustion test instruments. Do not tamper with the unit or controls. Call your qualified service technician. Incorrect operation of the burner could result in severe personal injury, death or substantial property damage.

Have your equipment inspected and adjusted annually by your qualified service technician to assure continued proper operation.

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.

SPECIFICATIONS

MODEL	IHS-700P LP/NG
FUEL TYPES	NATURAL GAS OR PROPANE
SUPPLY PRESSURES NATURAL GAS PROPANE	8" W.C. MIN. - 14" W.C. MAX. 10" W.C. MIN. - 14" W.C. MAX.
MANIFOLD GAS PRESSURE	3.7" W.C. NATURAL GAS 2.8" W.C. PROPANE
NORMAL AIR SETTING	6
APPROVAL AGENCY	

IHS-700P LP/NG FUEL CONSUMPTION	
FUEL TYPE	
PROPANE	272 cu.ft. per hour 8.1 US GPH 32.2 lbs. per hour
NATURAL GAS	667 cu.ft. per hour 680 Therms per hour

Manifold pressure settings and air settings may have to be adjusted to provide proper operation at different altitudes and temperatures.

To the owner-

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.

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.

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.

NOTICE High altitude installations – Accepted industry practice requires no derate of Burner capacity up to 2000 feet above sea level. For altitudes higher than 2000 Feet, derate burner capacity 4% for each 1000 feet above sea level.

This heater is not intended to be used at temperatures above 60°F (15°C). Use of this heater at above this temperature may result in the burner locking out on the high limit switch.

PRE-INSTALLATION CHECKLIST

LEVELING THE HEATER

- Ensure the surface the heater is to be placed on does not slope more than 5 degrees in any direction.
- If the surface slopes more than 5 degrees either level the surface or place supports under the heater base frame to ensure the heater is level.

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 B1139-M91 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, 18 inches from the flue (venting), and 36 inches from the burner access side. The unit must be installed on a level floor.

DUCT INSTALLATION

GENERAL NOTES:

1. The heater is designed and approved for use as a construction heater under ANSI Z83.7/CSA 2.14.
2. Frost fighter Inc cannot anticipate every use, which may be made of our heaters. CHECK WITH YOUR LOCAL FIRE AND SAFETY AUTHORITY IF YOU HAVE QUESTIONS ABOUT SAFE APPLICATIONS.
3. Other standards govern the use of fuel gases and heat producing products in specific applications. Your local authority can advise you about this issue.
4. Please retain this instruction manual for future reference.
5. The primary application of this heater is for temporary heating of construction sites and/or applications of this type.
6. Check Rating Plate on heater for set up specifications.
7. For information about replacement parts call toll free 1-888-792-0374

ELECTRICAL NOTES:

All electrical connections and grounding shall be in compliance with the National Electrical Code, ANSI/NFPA70 and/or the Canadian Electrical Code (CSA Standard C22.1).

ADDITIONAL INSTRUCTIONS FOR PROPANE GAS:

1. The installation must conform with local codes or in the absence of local codes with the Standard for the *Storage and Handling of Liquefied petroleum Gases, ANSI/NFPA 58* and/or the *National Standards of Canada CAN/CGA B149.2 installation codes for propane gas*.
2. The heater must be located more than ten (10) feet (3.05 meters) away from the propane source or propane tank.
3. When the heater is not in use insure to shut off the gas supply from the propane source or propane tank.
4. Disconnect the heater from the propane source or propane tank when storing the heater indoors.
5. Minimum tank size 400 lbs (360 litres)
6. Connect the tank to the unit using appropriately sized regulators to reduce the tank pressure to 11" w.c.
7. The heater must not discharge toward any propane gas container within 20 feet (6m).

CONNECTING THE PROPANE TANK

1. The gas connection on the heater is 1" NPT. Ensure you have the proper fittings to connect to the heater.
2. The maximum supply pressure to the heater is 14" W.C. (1/2 PISG).
3. Ensure the proper regulators are installed to reduce the tank pressure to 14"W.C. maximum, 10" minimum.
4. Perform gas leakage test. Close the main valve on the heater and open all manual valves upstream of the heater. Check all connections for leaks with soap solution. Formation of bubbles indicates gas leakage. Retighten and seal all connections or replace connectors if warranted.

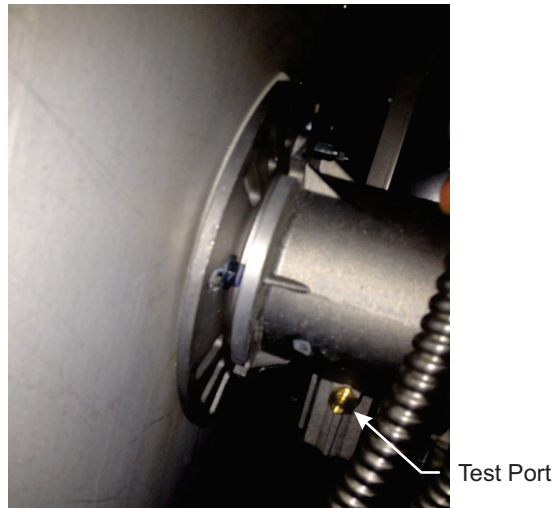
DISCONNECTING THE PROPANE TANKS

1. Close all fuel valve upstream of the heater including the valve at the tank.
2. Disconnect the fuel lines at the heater and the tank.

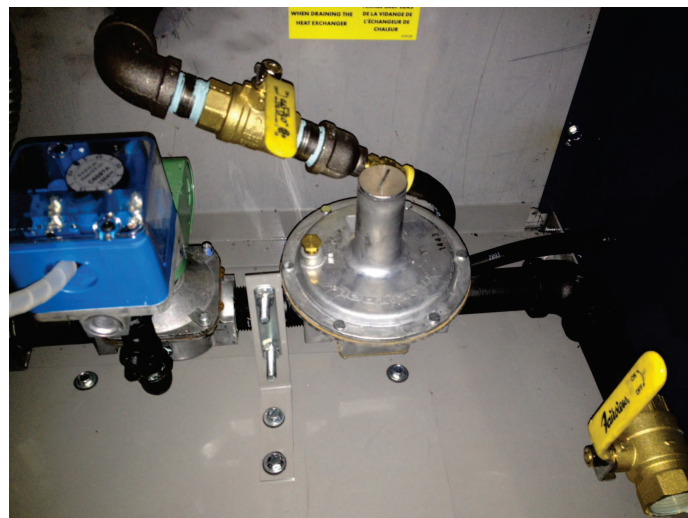
ADJUSTING THE INPUT RATE FOR NATURAL GAS AND PROPANE

Picture 1 shows the location of the manifold test port. To adjust the manifold pressure connect a pressure gauge (0-20" W.C.) to the test port and bring the heater to fire. Adjust the gas pressure at the regulator (See Picture 2) so the gauge reads the pressure recorded on the rating plate.

Picture 1



Picture 2



INSTALLATION INSTRUCTIONS:

1. The installation 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*.
2. Inspect the heater before each use and have it annually inspected by a qualified agency.
3. The hose assembly shall be visually inspected prior to each use of the heater. If it is evident there is excessive abrasion or wear, or the hose is cut, it must be replaced prior to the heater being put into operation. The replacement hose assembly shall be specified by the manufacturer. The hose assembly shall be protected from traffic, building materials and contact with hot surfaces both during use and while in storage.
4. When firing the unit in an enclosed area, five square feet (0.47 square meters) must be provided to allow free entry of the air required for operation.
5. Do not operate the unit in partly ventilated areas without a flue pipe connected to the unit.
6. Do not operate the unit in close proximity to combustible surfaces, materials, gasoline, and other flammable vapours and liquids.
7. After installation, check the manifold assembly for gas leaks by applying a water and soap solution to each connection.
8. The heater must be installed on level ground.
9. Minimum gas supply pressure is 7" W.C. (natural gas) or 10" W.C. (propane). Maximum gas supply pressure is 14" W.C. (1/2 PSIG)

GAS LEAKAGE TESTING

After removal for service or replacing components on the gas manifold a gas leakage test must be performed.

1. Close main gas firing valve on the gas manifold.
2. Connect your source gas to the gas manifold.
3. Once connections are tightened, open source gas, fire unit.
4. On each connection and fitting, apply soap solution and check for bubbles. This will indicate a gas leak if bubbles continue to form.
5. Fix any leaks that are found by applying pipe dope to the leaking fitting or connection and re-tighten. Check for leaks once repairs, if any, are made.
6. Open main gas firing valve and start the unit.
7. Once the unit is operating and burner is running, redo the soap test to insure gas fittings are tight.
8. Fix any leaks found.

DUCTING:

- Duct diameter is 16 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).
- Ducts should be rated for 300°F minimum.

HIGH LIMITS

- The heater is supplied with manual reset high limits located behind marked panels on the left side of the heater - SEE PAGE 12.
- The high limit contacts are normally closed and open on the high limit temperature condition.
- If a high limit trips allow the heater to cool down and reset. Reset the manual high limit by manually depressing the reset button located in the center of the high limit.

VENT SYSTEM

The flue gas venting system must be in good condition and must comply with all the applicable codes. The IHS 700 is a category III appliance.

OUTDOOR INSTALLATIONS:

For outdoor installation a vent cap must be installed and fastened.

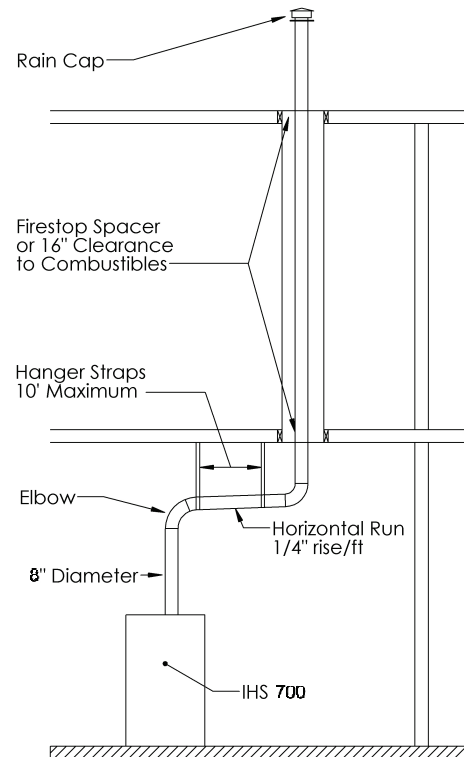
INDOOR INSTALLATIONS:

Must be done in accordance to NFPA 54 (or CSA B149) 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 than 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, (UNLESS NOTED).
5. Do not support the weight of the stack on the flue connection of the heating system.
6. The maximum flue gas temperature is 650 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 three (3) feet (1m) of vertical pipe is required. The top of the vent must extend at least two (2) feet (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 ten (10) feet (3m). Horizontal runs should be pitched upward $\frac{1}{4}$ " 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 feet (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 $\frac{1}{2}$ " (12.7mm) thick foil faced fibreglass, minimum 1 $\frac{1}{2}$ # 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.



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

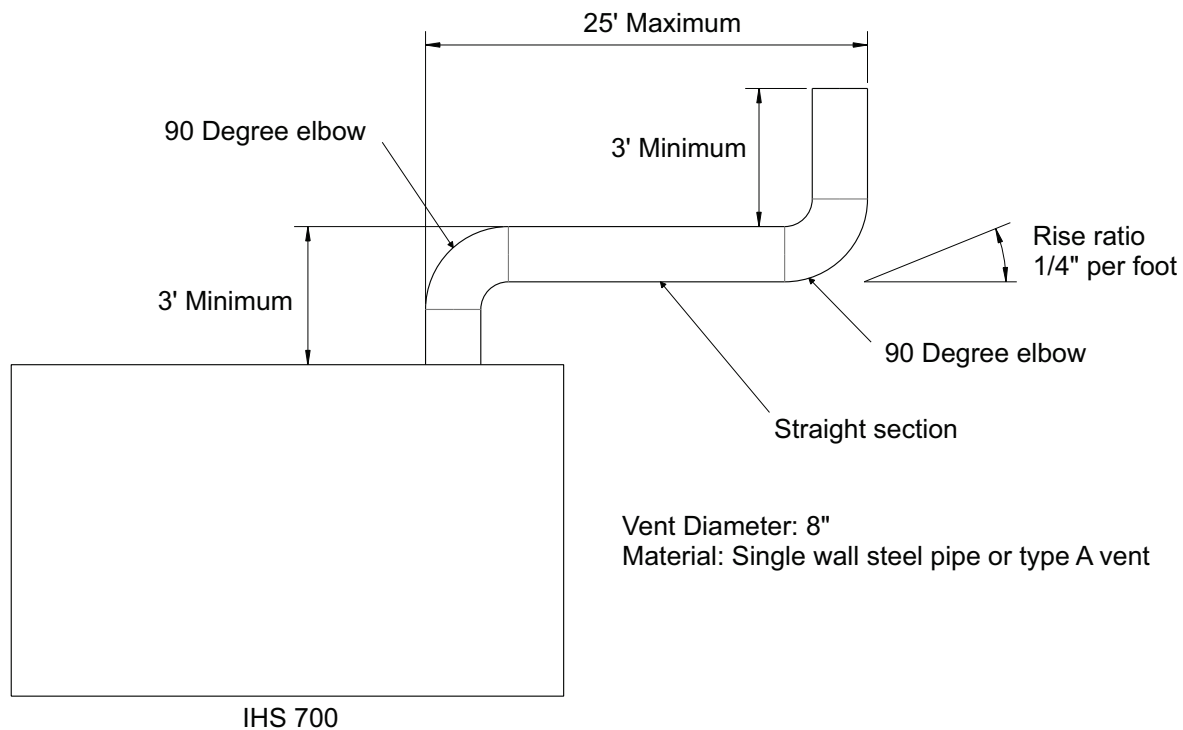
HORIZONTALLY VENTED UNITS

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 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

ELECTRICAL SUPPLY

- Verify that the power supply & connections available are correct for the unit. All power supplies MUST be grounded.
- 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 minimum and 10 AMPS.

WARNING THE REMOTE THERMOSTAT RECEPTACLE IS USED FOR INSTALLING THE THERMOSTAT ONLY! THIS IS NOT AN EXTRA POWER SOURCE.

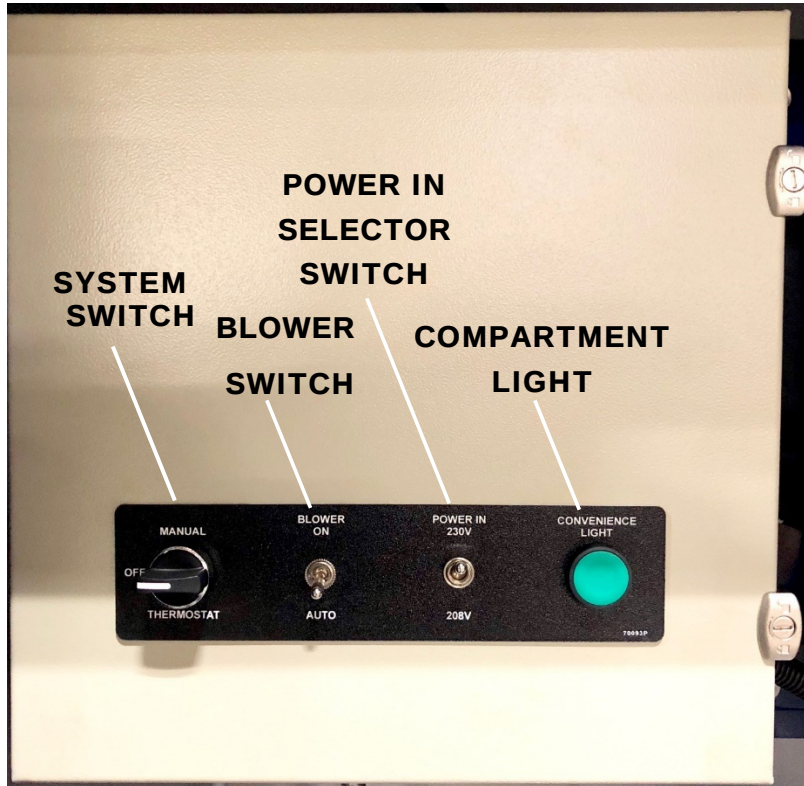
208V/230V 1PH/3PH MODELS



480V/600V 3PH ONLY MODELS



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 connected

BLOWER SWITCH

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

POWER IN SELECTOR

208V	Supplies optimum control voltage when incoming line voltage is 195VAC – 215VAC
230V	Supplies optimum control voltage when incoming line voltage is 220VAC – 240VAC

CONVENIENCE LIGHT

MOMENTARY PUSHBUTTON	Controls compartment convenience lighting
TO ACTIVATE LIGHTING:	
- Push once	Lighting provided with 5 min. automatic shut off delay
- Push and hold for 5 seconds	Lighting provided with 30 min. automatic shut off delay
- Push once when light is on	Turns lighting off at any time before delay has expired

OPTIONAL HIGH INTENSITY LED STATUS BEACON



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

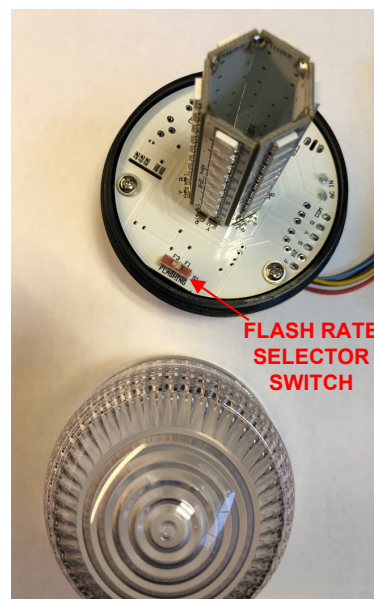


LED STATUS BEACON DISPLAY:

- 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.

Note: Versions prior to December 2018 may have FLASHING AMBER on call for heat during pre-purge in lieu of FLASHING GREEN.

The flash rate of RED ALARM alert 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



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.

(DEPENDING ON POWER SUPPLIED)

VFD DISPLAY NEW VERSION ATV320)



PLC DISPLAY BEHIND
MAIN CONTROL BOX
COVER.

LIGHTING INSTRUCTIONS IHS700P (LPNG)

TO START HEATER

- 1) Ensure the gas supply line is securely attached to the heater. Maximum fuel supply pressure is 14" W.C. Minimum fuel supply pressure is 7" W.C. (natural gas) and 11" W.C. (propane).
- 2) The gas supply must be bled up to the heater to ensure a steady gas supply is present at the heater.
- 3) Check the fuel conversion valve to ensure it is in the proper position. Refer to the label on the heater for proper positioning.
- 4) Ensure correct electrical power is supplied to the corresponding inlet receptacle electrical power supply. Refer to the heater rating plate for the required voltage.
- 5) Turn on the fuel and electrical supplies. Set the heater selector switch to manual or thermostat and the heater should begin operation. The PLC control inside the main control panel will display current sequence of operation.
- 6) If the heater does not start check for proper electrical and fuel supplies. Reset the burner control by pressing red illuminated button on burner for 3 seconds and allow heater to repeat the operation cycle.

TO STOP THE HEATER

- 1) Turn the heater selector switch to off. The supply fan will continue to run to cool down the heat exchanger.
- 2) To prevent damage to the heat exchanger do not disconnect the power supply until the supply fan stops.

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 of the burner or system, resulting in severe personal injury, death or substantial property damage.

Like all precision equipment, your burner will require periodic maintenance.

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:

- o Clean burner and blower wheel (to remove lint and debris).
- o Test ignition and combustion and verify air damper settings.
- o Test gas lines and all connections.
- o Inspect combustion air and vent systems.
- o Oil motor (if not permanently lubricated).

Additionally, you should have the burner checked as indicated below, by your local authorized dealer.

- o Check burner distributor head and mixing plates. Clean if necessary.
- o Check ignition electrode. Clean, adjust or replace as necessary.
- o Check the flame sensor rod (ionization rod) for dirt or carbon build up. Clean, adjust, or replace as necessary.
- o Check manifold gas pressure.
- o Check all burner adjustments.
- o Generally clean all exposed parts and components.
- o Repeat combustion tests.

EVERY 2 MONTHS

- o If your furnace has an observation port, visually check the flame.
- o Check and clean the air intake louver to remove any buildup of fluff, dust, pet hair, etc.

MONTHLY MAINTENANCE

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

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 contaminants 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 prelubricated 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 IHS700P will be operating within the 1500-2800 RPM range and will be at temperatures at or 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	3-5 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 belts 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 $\frac{1}{64}$ " for each inch of span length. Example- the required deflection for a 40" span would be $\frac{40}{64}$ " or $\frac{5}{8}$ ".
- 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

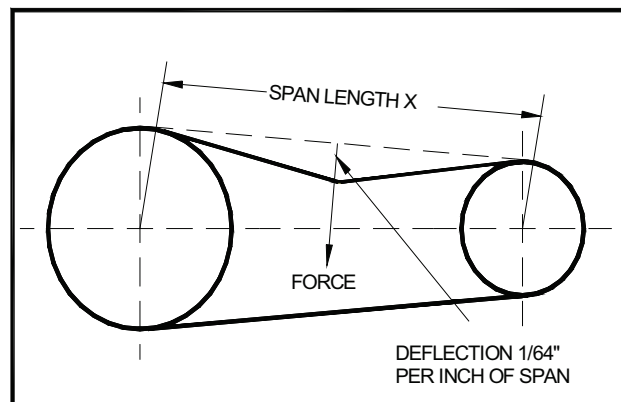


TABLE III

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.

NORMAL SEQUENCE OF OPERATION

1. Power is applied to the PLC control as soon as power is supplied with the main 1PH/3PH power selector switch. The PLC display will read "FROST FIGHTER – IHS700P GAS - STANDBY MODE".
2. The PLC in the control panel controls power to terminal 1 on the burner from PLC output Q2 and also controls the main blower fan operation through the VFD from PLC output Q3.
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 onto PLC input I1.
4. The PLC control will then supply from output Q2, through the limit switches and the low pressure gas switch to terminal #1 on the burner control to commence operation beginning with starting the burner motor and a preset Pre-Purge period before the burner control begins it's trial for ignition. This Pre-Purge sequence is displayed on the burner control with an amber illumination on the burner control reset button and the PLC will display "BURNER BLOWER PRE-PURGE" during this time. This Pre-Purge period will then be followed by a 4 second Trial for Ignition period where the burner control will energize the ignition transformer and open the gas valves and will also illuminate the green light on the exterior of the heater labeled "Burner On". The PLC control will display "BURNER STARTED - BLOWER ON DELAY - ACTUAL TIME - SET TIME" during this 4 second Trial for Ignition sequence.
 If the burner fails to fire during this 4 second Trial for Ignition period the burner control will lockout and solid red illumination will appear in the burner control reset button. The PLC control will display "CHECK BURNER - RESET IF LOCKOUT". This condition will remain until the burner control reset button is pressed for three seconds to clear the lockout. The PLC control continue to display CHECK BURNER - RESET IF LOCKOUT" until it the burner control has been reset and the PLC receives the next Burner On signal during the 4 second Trial for Ignition which once again opens the gas valves, energizes the ignition transformer and illuminates the green light on the exterior of the heater, at which point the PLC will once again read BURNER ON - BLOWER ON DELAY - ACTUAL TIME - SET TIME. If the burner ignites then the PLC will continue to count down the blower delay or if the burner fails to ignite then the cycle will be repeated again once the burner control is reset again.
 If the burner control is not reset within approximately 1 minute & 15 seconds from each time it goes into lockout, the optional beacon if attached will begin flashing red to indicate that the burner is in lockout and requires attention.
5. If the burner was successful at firing the reset button on the burner control will illuminate green and the PLC will continue to count down the 30 second Blower On Delay until it has completed, at which point the 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. The PLC will begin the heat exchanger Cool-down sequence when the call for heat has ended and will display "COOLDOWN - ACTUAL - SET" until the blower stops and the PLC will then return to displaying "FROST FIGHTER - IHS700P GAS - STANDBY"



BURNER CONTROL PRE-PURGE
AMBER



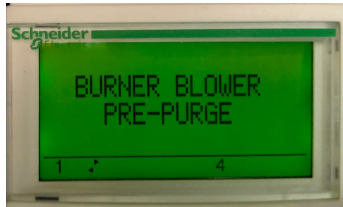
BURNER CONTROL TRIAL
FOR IGNITION OR FIRING
GREEN



BURNER CONTROL LOCKOUT
RED

TYPICAL SEQUENCES OF OPERATION AND DISPLAYS

PLC DISPLAY IN CONTROL BOX

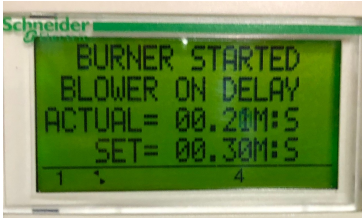


BURNER CONTROL PRE-PURGE
AMBER



VFD

PLC DISPLAY IN CONTROL BOX



BURNER CONTROL
TRIAL FOR IGNITION

OR



BURNER CONTROL FIRING
GREEN



VFD

PLC DISPLAY IN CONTROL BOX

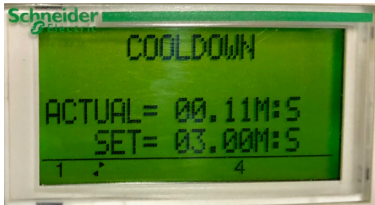


BURNER CONTROL FIRING
GREEN

VFD - Fan is operating

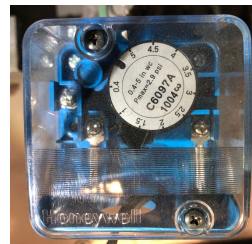


PLC DISPLAY IN CONTROL BOX



BURNER CONTROL OFF
NO LIGHT

VFD - Fan is operating



LOW PRESSURE GAS SWITCH



NO POWER SUPPLIED TO
BURNER CONTROL WHEN
LOW PRESSURE GAS SWITCH
CONTACTS ARE OPEN.

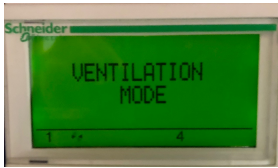
The IHS700P has a low pressure gas switch (70058). item #4 on page 28.

If insufficient gas pressure is supplied to the IHS700P when the "system switch" is placed in the "manual" or "Thermostat" position with a call for heat, the PLC will display "LOW GAS PRESSURE ALARM" and the optional beacon if connected, will display red. There will be no power supplied to the gas burner control and the burner will not operate.

If this condition occurs check to ensure the heater is being supplied with a minimum of 7" w.c. gas pressure. If the pressure is adequate and the condition persists check the setting on the low pressure gas switch to ensure it is correct. The correct setting is approximately 1" w.c. below the required manifold pressure. Also check that the switch functions properly and is not faulty.

OTHER DISPLAY SCREENS ON THE IHS700P PLC

VENTILATION MODE



The IHS700P has a "Blower On" switch (See page 8) which permits the fan to run continuously independent of the burner. The PLC will show VENTILATION when this switch is in the on position to indicate this. Note: The display will not indicate VENTILATION even with this switch in the On position when the burner is operating with the BLOWER ON DELAY activated as fan operation then overrides this delay

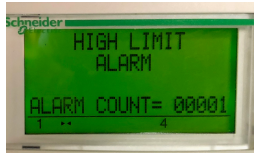
HIGH LIMIT ALARMS

The PLC in the IHS700P 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 count is also recorded each time one of the high limit switches has opened from such an event which provides information regarding possible problems which could be causing these high limit events such as restricted air flow cause by excess ducting lengths or obstructions in the air path.

Alarm count will begin showing as 00001 however this is the default and should be regarded as zero high limit events. This is due to the initial startup monitoring of the control which registers 00001 which equals zero high limit trips.

Any high limit trips will then be recorded as 00002 for the 1st trip, 00003 for the 2nd trip, 00004 for the 3rd trip and on the 4th subsequent trip of a high limit control the PLC will indicate a HIGH LIMIT ALARM which will stop operation of the burner until the heater has had a power down reset by placing the "System Switch" in the off position or disconnecting power using the Power Selector Switch.

It is possible that a HIGH LIMIT ALARM shows in the display immediately upon placing the "System Switch" into the Manual or Thermostat position. The IHS700P has three high limit switches in series and this could be caused by the manual reset limit switch being tripped previously and must then be manually reset. (See page 10 for limit switch locations)



LIMIT TRIP COUNT ZERO (No high limit trips)



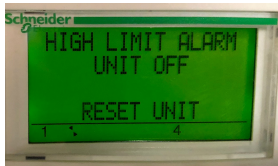
1ST LIMIT TRIP EVENT DURING
CONSTANT OPERATION



2ND LIMIT TRIP EVENT DURING
CONSTANT OPERATION



3RD LIMIT TRIP EVENT DURING
CONSTANT OPERATION

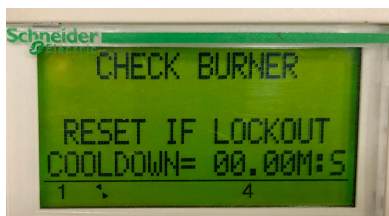


4TH LIMIT TRIP EVENT
DURING CONSTANT OPERATION
THIS TRIGGERS A HIGH LIMIT ALARM AND REQUIRES A POWER
DOWN (SYSTEM SWITCH SET TO OFF) TO CLEAR ALARM

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

NOTE: Limit trip occurrences are only counted during constant operation (System Switch in MANUAL position and with heater connected to power) Disconnecting the heater from a power source or placing the System Switch to OFF will clear all previously recorded high limit events. Also having the System Switch on THERMOSTAT with a thermostat connected will clear the recorded high limit trip event each time the thermostat stops calling for heat.

CHECK BURNER



When the PLC does not receive a signal from the gas valves after the pre-purge time period has been completed (4 second trial for ignition with gas valves open), the PLC will display "CHECK BURNER – RESET IF LOCKOUT" until the gas valve signal is re-asserted following a reset of the burner control and the 4 second trial for ignition period occurs again.

This PLC display can mean the burner has failed to fire and the burner control is in lockout (red illumination - Lockout) or the flame was lost during firing.

Once the gas valve signal is reapplied the PLC screen will return to displaying "BURNER ON - BLOWER ON" if the burner was running when the lockout occurred and was cleared before the blower stopped running or will display "BURNER ON – BLOWER DELAY" if the blower was not running.



BURNER CONTROL LOCKOUT
RED

TROUBLE SHOOTING GUIDE

The equipment has been electrically and fire tested prior to shipment. However, during transit, misadjustment of controls and loose wires could develop. Do not assume a control is defective until it and its associated wiring is checked.

This equipment has many items supplied to us by outside vendors. This manual is accompanied by information sheets on most of these items which should be referred to for detailed service information.

The following is an list of items that could cause field problems; however, it does not cover all problems encountered and is meant to be used as a guide only.

1. BURNER MOTOR FAILS TO RUN, CONTROL RELAY DOES NOT FUNCTION:

- A. Blown fuses. Power selector switch in OFF position.
- B. Control relay off on flame failure. Push reset button on control for 3 seconds.
- C. Thermostat or duct stat not calling for start-up. Defective control.
- D. Loose wire or low voltage.
- E. Controls in high limit circuit defective or tripped.
- F. Control transformer defective.
- G. Fuse on rear of burner control blown.
- H. Low gas pressure switch contacts open due to insufficient gas pressure.

2. BURNER MOTOR RUNS, NO IGNITION OR MAIN FLAME. PRIMARY RELAY WILL NOT INDICATE FLAME FAILURE.

- A. Misadjusted or defective burner air switch.

3. BURNER MOTOR RUNS, NO IGNITION OR MAIN FLAME. PRIMARY RELAY LOCKS OUT ON FLAME FAILURE.

- A. Fuel valve manually closed.
- B. Ignition transformer or pilot defective. Defective or improperly gapped ignition electrodes.

4. BURNER MOTOR RUNS, IGNITION AND MAIN FLAME. MAIN FAN MOTOR FAILS TO OPERATE.

- A. Motor overcurrent protector on VFD tripped. Check VFD display for codes.

5. INSUFFICIENT HEAT BEING DISCHARGED INTO AREA:

- A. High limit switch defective.
- B. Field mounted thermostat and/or duct stats improperly wired.

BURNER STARTING DIFFICULTIES AND THEIR CAUSES:

1. The burner goes to lockout after the prepurge period because the flame does not ignite.
 - a. Air has not been fully evacuated from the gas lines.
 - b. The gas valve is passing too little gas.
 - c. The ignition spark is irregular or not present.
 - d. The gas valve is defective.
2. The burner does not start when there is a call for heat.
 - a. The air pressure switch has failed.
 - b. There is no gas, insufficient pressure in the supply lines to activate the low pressure gas switch.
 - c. There is a blown fuse (check at rear of burner control).
 - d. The burner has gone off on safety (Lockout).
 - e. The low voltage contact or low voltage relay in the burner control are defective.
3. The burner goes through prepurge, ignition is established, the burner fires for 2 seconds, then goes to lockout.
 - a. The flame rectification rod (flame rod) has shorted to ground or is defective.
 - b. Polarity is reversed or the earth ground is not properly connected.
 - c. The ionization current is weak (lower than 2 micro-amps).

OWNER INFORMATION

SAFETY LOCKOUT

This burner is equipped with multiple interlocking safety devices. In the event of a failure in the flame, or any blockage of the combustion air supply, the burner will “lock out” in a safety condition. In such an event, an illuminated red button will show on the flame safeguard.

To restart the burner, press & hold the button for 3 seconds. If this lockout reoccurs press and hold the button again for 3 seconds. Should the burner return to the lock out condition again, call a qualified service technician or your gas company for assistance. In the case of loss of pressure in the gas supply line, the burner will go off on safety by the low pressure gas switch. The burner will simply switch off on low gas pressure, and start up again when the gas pressure returns to normal.

NOTE: Keep the area around the burner free and clear of all combustible materials, gasoline and other flammable vapours and liquids. Do not allow any obstructions, which may prevent the free, flow of air to the burner.

START-UP CYCLE DIAGNOSTICS

During start-up, indication is according to the following table:

COLOUR CODE TABLE

<u>Sequences</u>	<u>Colour Code</u>
Pre-purging	• • • • • • • • • • • •
Ignition phase	• O • O • O • O • O • O •
Operation, flame ok	□ □ □ □ □ □ □ □ □ □ □ □
Operating with weak flame signal.	□ O □ O □ O □ O □ O
Electrical supply lower than – 100V	• ♦ • ♦ • ♦ • ♦ • ♦ •
Lock-out	♦ ♦ ♦ ♦ ♦ ♦ ♦ ♦ ♦ ♦
Extraneous light	♦ □ ♦ □ ♦ □ ♦ □ ♦ □ ♦
<u>Index: O Off • Yellow □ Green ♦ Red</u>	

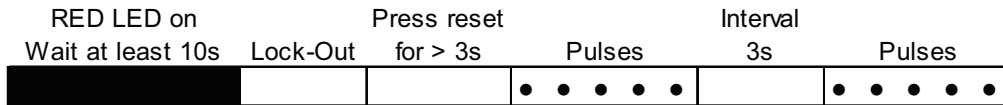
Note: A flashing yellow / red will also be displayed when supply voltage to the control is higher than 130VAC
Ensure the supply voltage on the secondary side of the transformer is between 105VAC and 125VAC

RESETTING THE CONTROL BOX AND USING DIAGNOSTICS

The control box features a diagnostics function through which any causes of malfunctioning are easily identified (indicator: RED LED).

To use this function, you must wait at least 10 seconds once it has entered the safety condition (lock-out), and then press the reset button. The control box generates a sequence of pulses (1 second apart), which is repeated at constant 3-second intervals.

Once you have seen how many times the light pulses and identified the possible cause, the system must be reset by holding the button down for between 1 and 3 seconds.



The methods that can be used to reset the control box and use diagnostics are given below.

RESETTING THE CONTROL BOX

To reset the control box, proceed as follows:

- Hold the button down for between 1 and 3 seconds.
The burner restarts after a 2-second pause once the button is released. If the burner does not restart, you must make sure the limit thermostat is closed.

VISUAL DIAGNOSTICS

Indicates the type of burner malfunction causing lock-out.

To view diagnostics, proceed as follows:

- Hold the button down for more than 3 seconds once the red LED (burner lock-out) remains steadily lit. A yellow light pulses to tell you the operation is done. Release the button once the light pulses. The number of times it pulses tells you the cause of the malfunction, indicated in the table below.

SOFTWARE DIAGNOSTICS

Reports the life of the burner by means of an optical link with the PC, indicating hours of operation, number and type of lock-outs, serial number of control boxes, etc...

To view diagnostics, proceed as follows:

- Hold the button down for more than 3 seconds once the red LED (burner lock-out) remains steadily lit. A yellow light pulses to tell you the operation is done.

Release the button for 1 second and then press again for over 3 seconds until the yellow light pulses again. Once the button is released, the red LED will flash intermittently with a higher frequency: only now can the optical link be activated.

Once the operations are done, the control box's initial state must be restored using the resetting procedure described above.

BUTTON PRESSED FOR	CONTROL BOX STATUS
Between 1 and 3 seconds	Control box reset without viewing visual diagnostics
More than 3 seconds	Visual diagnostics of lock-out condition (LED pulses at 1-second intervals)
More than 3 seconds starting from the Visual diagnostics condition	Software diagnostics by means of optical interface & PC (hours of operation, malfunctions, etc. can be viewed)

RESETTING THE CONTROL BOX AND USING DIAGNOSTICS cont.

The sequence of pulses issued by the control box identifies the possible types of malfunction, which are listed in the table below.

SIGNAL	PROBABLE CAUSE
2 pulses • •	The flame does not stabilise at the end of the safety time : -faulty ionization probe; -faulty or soiled gas valves; -neutral/phase exchange; -faulty ignition transformer -poor burner regulation (insufficient gas).
3 pulses • • •	Minimum air pressure switch does not close: -make sure VPS trips to produce lockout; -air pressure switch faulty; -air pressure switch incorrectly regulated; -fan motor does not run; -maximum air pressure switch operating.
4 pulses • • • •	Min. air pressure switch does not open or light in the chamber before firing: -air pressure switch faulty; -air pressure switch incorrectly regulated.
7 pulses • • • • • • •	Loss of flame during operations: -poor burner regulation (insufficient gas); -faulty or soiled gas valves; -short circuit between ionization probe and earth.
10 pulses • • • • • • • • • •	-Wiring error or internal fault.

CONFIGURING ATV320VFD TO DISPLAY VOLTAGE, FREQUENCY, CURRENT, ETC.)

MONITORING DISPLAYS CAN BE CONFIGURED AS SHOWN BELOW.

FOLLOW THE STEPS BELOW TO CONFIGURE THE DISPLAY PARAMETERS.

-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 "rdY".

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



READY

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

PRESS BUTTON ONCE



MONITOR MOTOR

ROTATE BUTTON
TO RIGHT



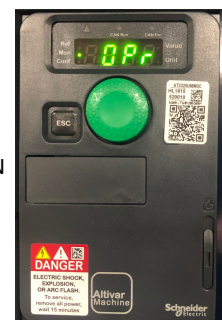
MOTOR SPEED RPM
ESTIMATED

ROTATE BUTTON
TO RIGHT



MOTOR VOLTAGE
ESTIMATED

ROTATE BUTTON
TO RIGHT



MOTOR POWER (ESTIMATED)
100% = NOMINAL MOTOR POWER

ROTATE BUTTON TO RIGHT



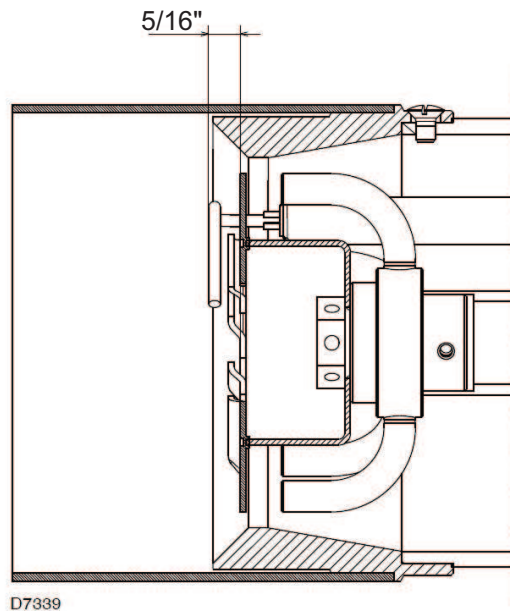
MOTOR TORQUE(ESTIMATED)
100% = NOMINAL MOTOR TORQUE

ROTATE BUTTON
TO RIGHT

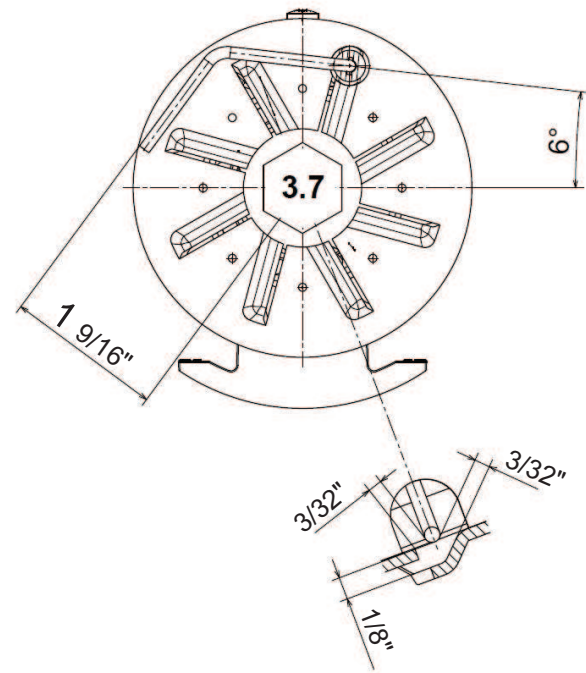


MOTOR CURRENT
ESTIMATED

ELECTRODE AND FLAME PROBE ADJUSTMENTS



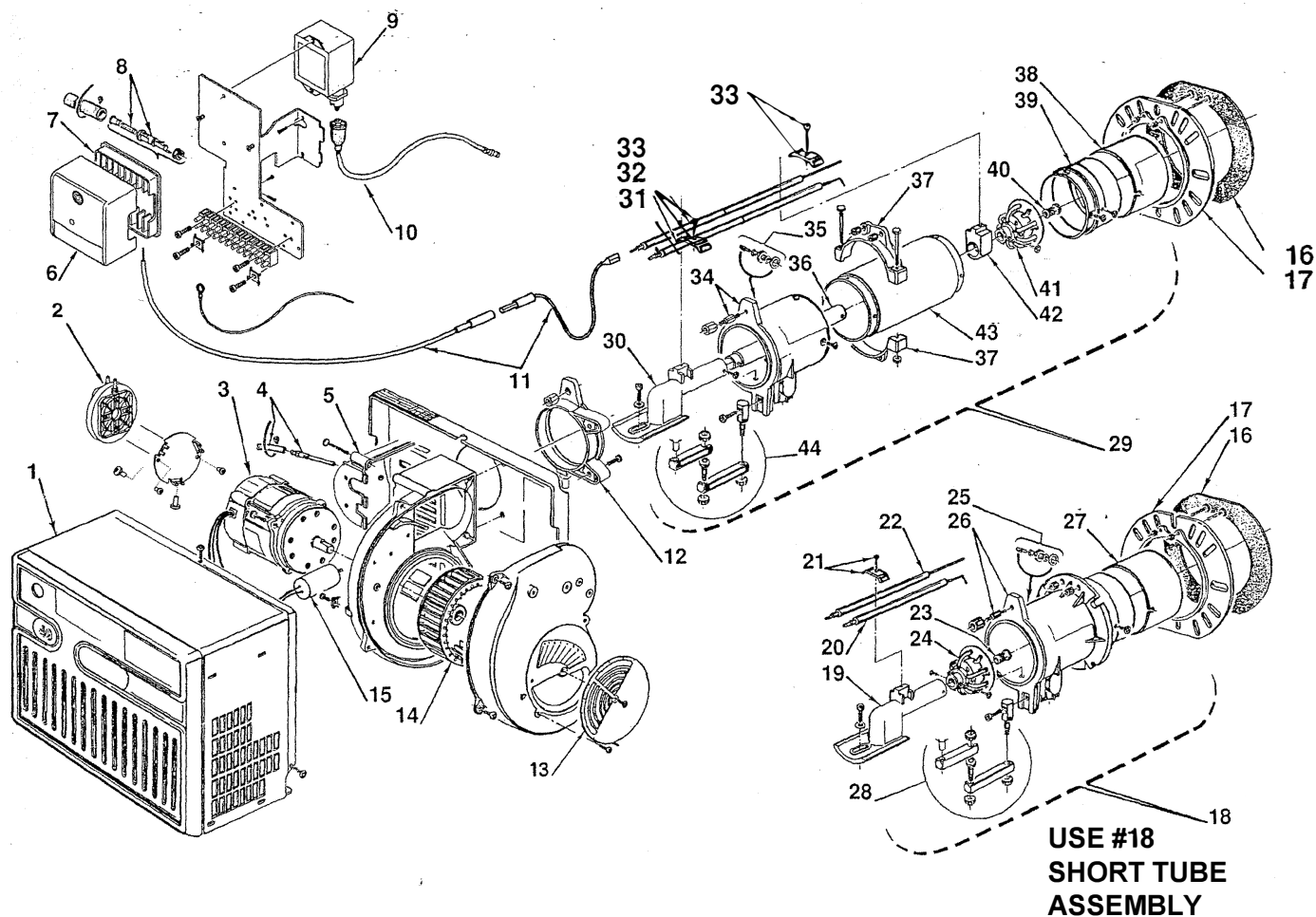
D7339



WARNING

Do not turn the ignition electrode. Leave it as shown in the drawing.
If the ignition electrode is put near the ionization probe, the amplifier control box may be damaged.

EXPLODED VIEW - SPARE PARTS

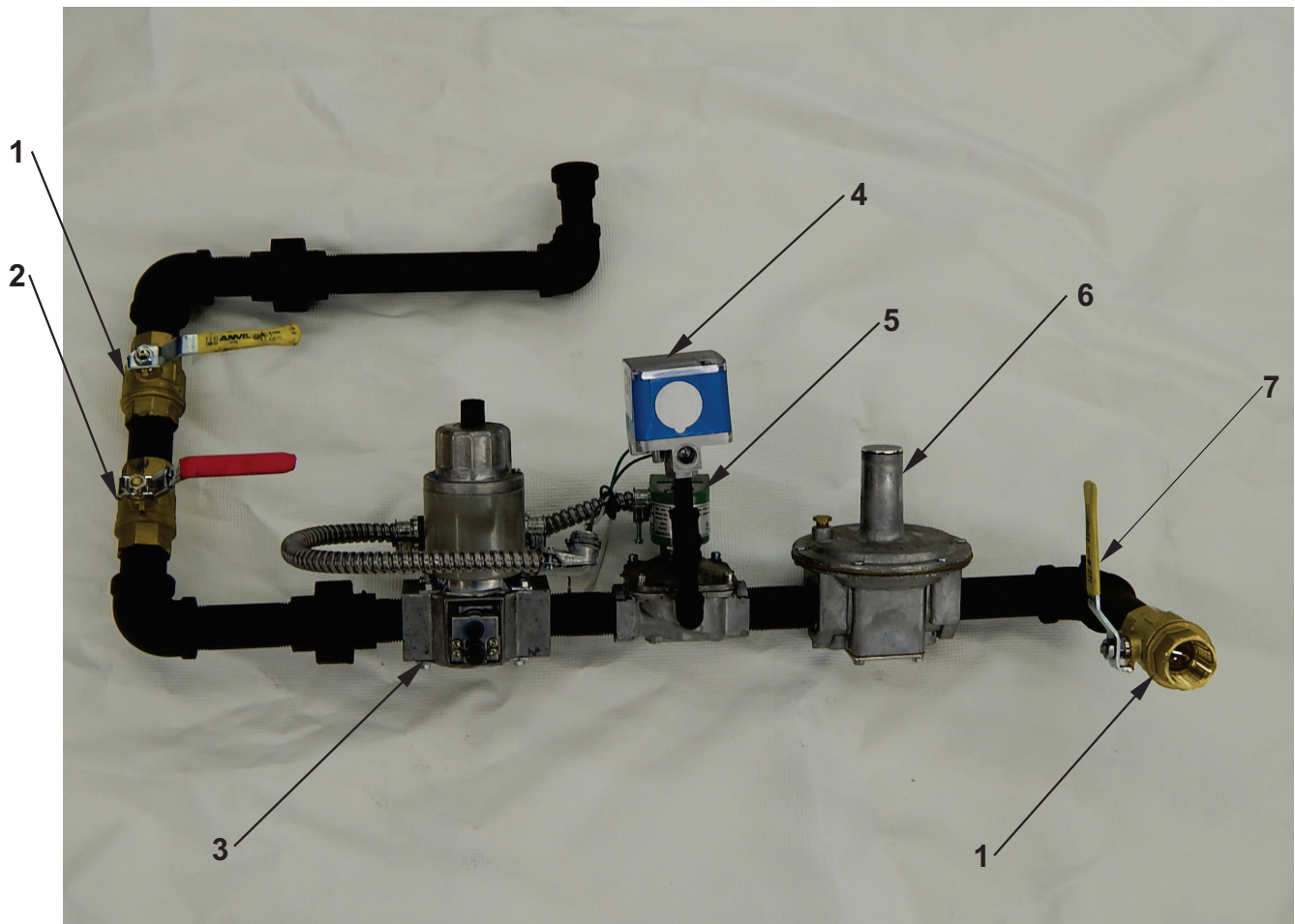


Frost Fighter Parts - IHS700 LP/NG - Riello Burner		
Ref. No.	Part No.	Description
2	70085	AIR PRESSURE SWITCH
3	700080	BURNER MOTOR
4	70085A	AIR SWITCH TUBE AND CONNECTOR
6	70076	PRIMARY CONTROL
NOT SHOWN	70076A	FUSE AT REAR OF PRIMARY CONTROL BOX
8	70086	FUSE 6.25A
	70086A	FUSE HOLDER FOR 6.25A FUSE
9	70077	IGNITION TRANSFORMER
10	70078	HIGH VOLTAGE LEAD
11	70079	IONIZATION LEAD
12	70094	CHASSIS
14	70082	FAN
15	70081	CAPACITOR 20uF
16	700033	MOUNTING GASKET
20	70083	ELECTRODE ASSEMBLY
22	70084	IONIZATION ASSEMBLY
23	700085B	NATURAL GAS DIAPHRAGM

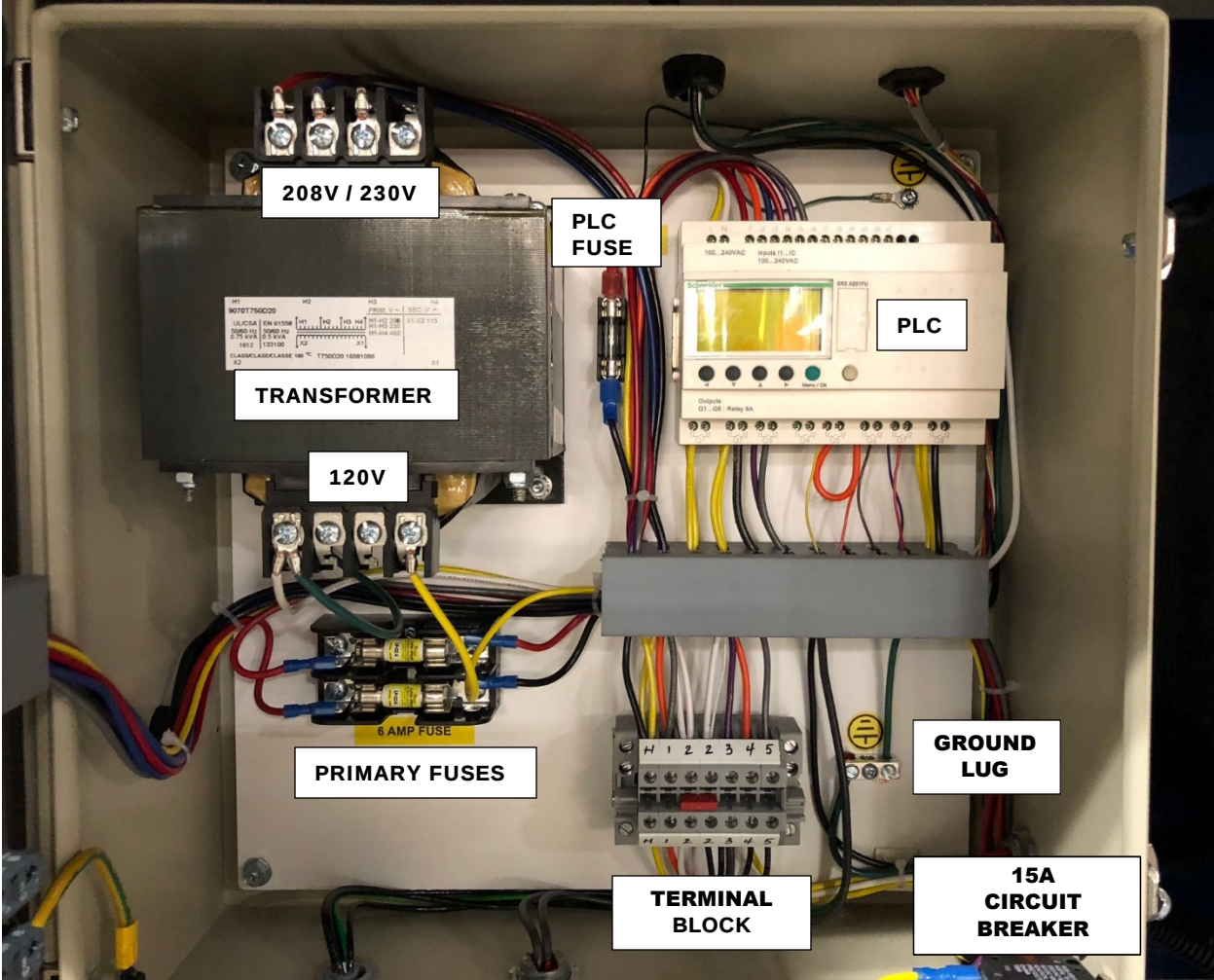
Manifolds

IHS 700

1	1" shut off ball valve -	70034	2	1" Conversion valve	70034A
3	Dungs shut off solenoid -	70275	4	Low pressure gas switch	70058
5	Asco shut off solenoid -	70274	6	RV-61 Regulator	700931
			7	1/8" NPT Sq.hd plug (Test Port)	881874

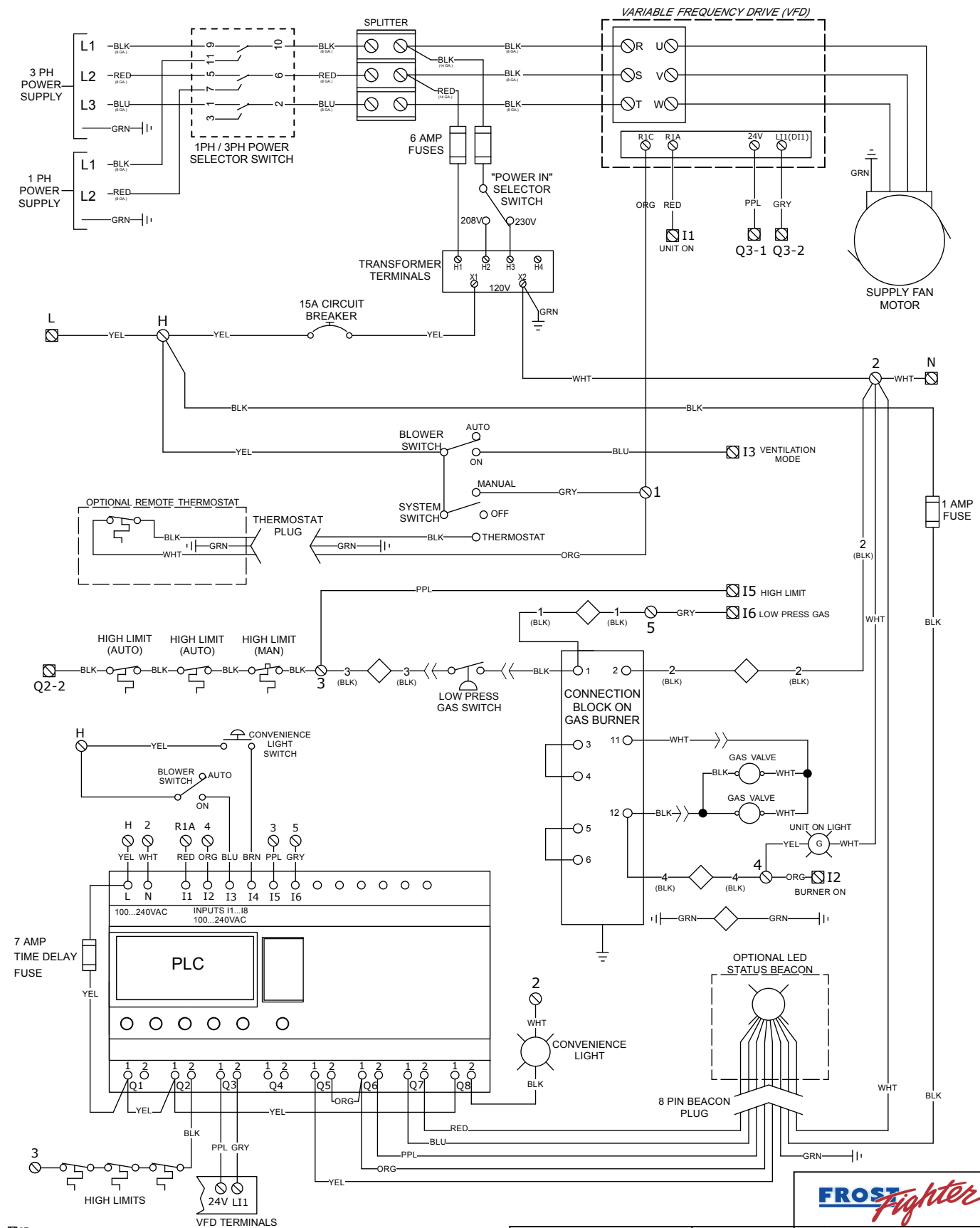


MAIN CONTROL PANEL



**480V 3PH ONLY MODELS
TRANSFORMER PRIMARY WIRING**

IHS700P LP/NG - WIRING DIAGRAM



- I5 — PLC INPUT TERMINAL
- Q2-2 — PLC OUTPUT TERMINAL
- 3 — CONNECTION BLOCK TERMINAL
- ◇ — BURNER CABLE CONNECTOR
- >> — CONNECTORS

PROPRIETARY AND CONFIDENTIAL

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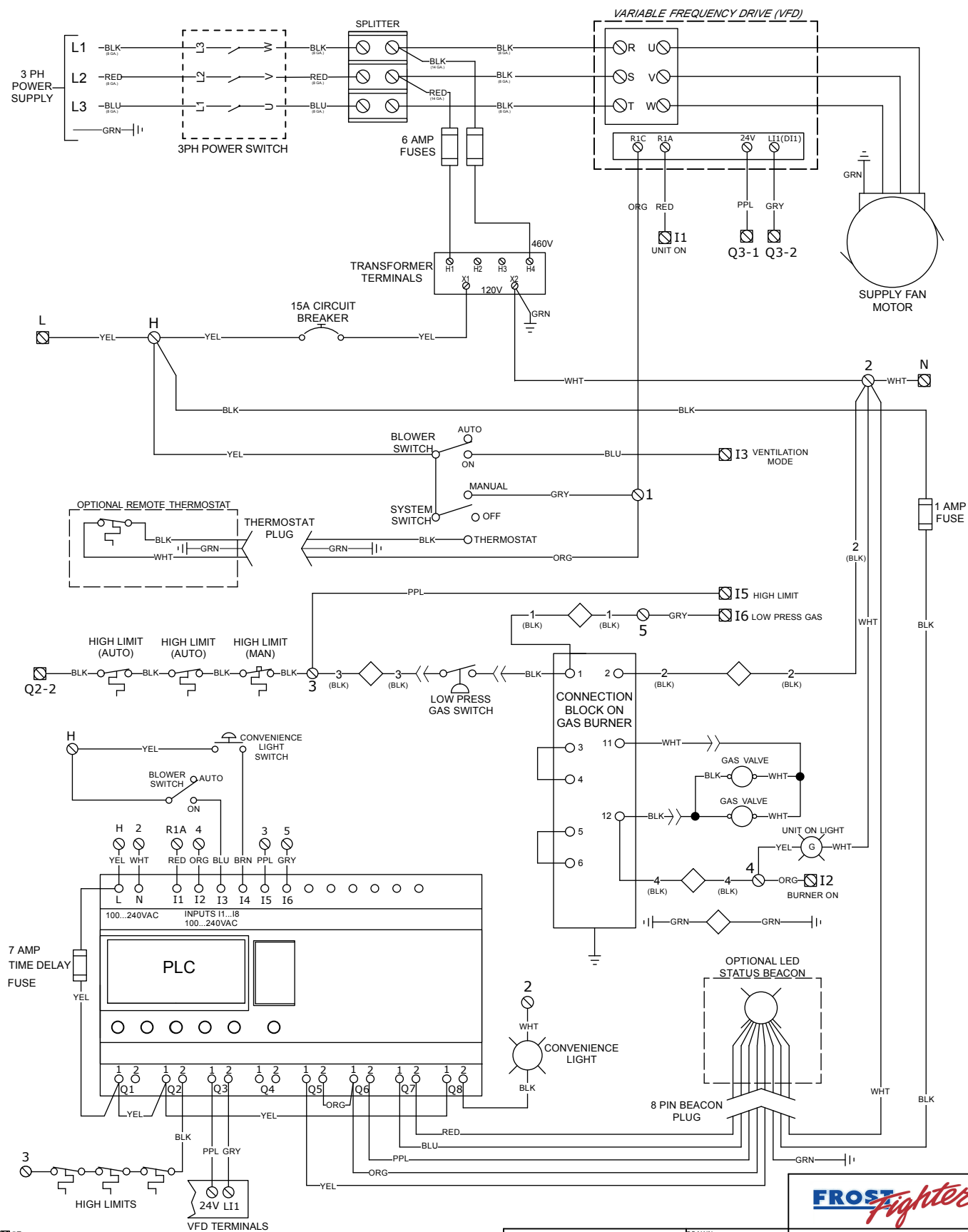
MATERIAL	N/A	DRAWN	E.H.
CUSTOMER		DESIGNED	
TOLERANCES		DATE	07/17/21
X.X ±.1	FRACTIONS ±1/32	SCALE	N/A
X.XX ±0.2	DRAFT ANGLE 3°	SIZE	A
X.XXX ±.005	RADIUS 1/8	PART # / DRWG #	IHS700P LP/NG

FROST
FIGHTER

IHS700 WIRING DIAGRAM
WITH PLC CONTROL

REV 3

IHS700P LP/NG - WIRING DIAGRAM 460V 3PH



 I5 — PLC INPUT TERMINAL
 Q2-2 — PLC OUTPUT TERMINAL
 3 — CONNECTION BLOCK TERMINAL
 — BURNER CABLE CONNECTOR
 — CONNECTORS

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MATERIAL		N/A		DRAWN		E.H.	
CUSTOMER				DESIGNED			
TOLERANCES				DATE			
X.X ± .1		FRACTIONS ±1/32		10/26/21			
X.XX ± 0.2		DRAFT ANGLE 3°		SCALE			
X.XXX ± .005		RADIUS 1/8					

FROST *Fighter*

IHS700 WIRING DIAGRAM

SIZE	PART # / DRWG #	REV
A	IHS700P LP/NG 460V 3PH	1

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