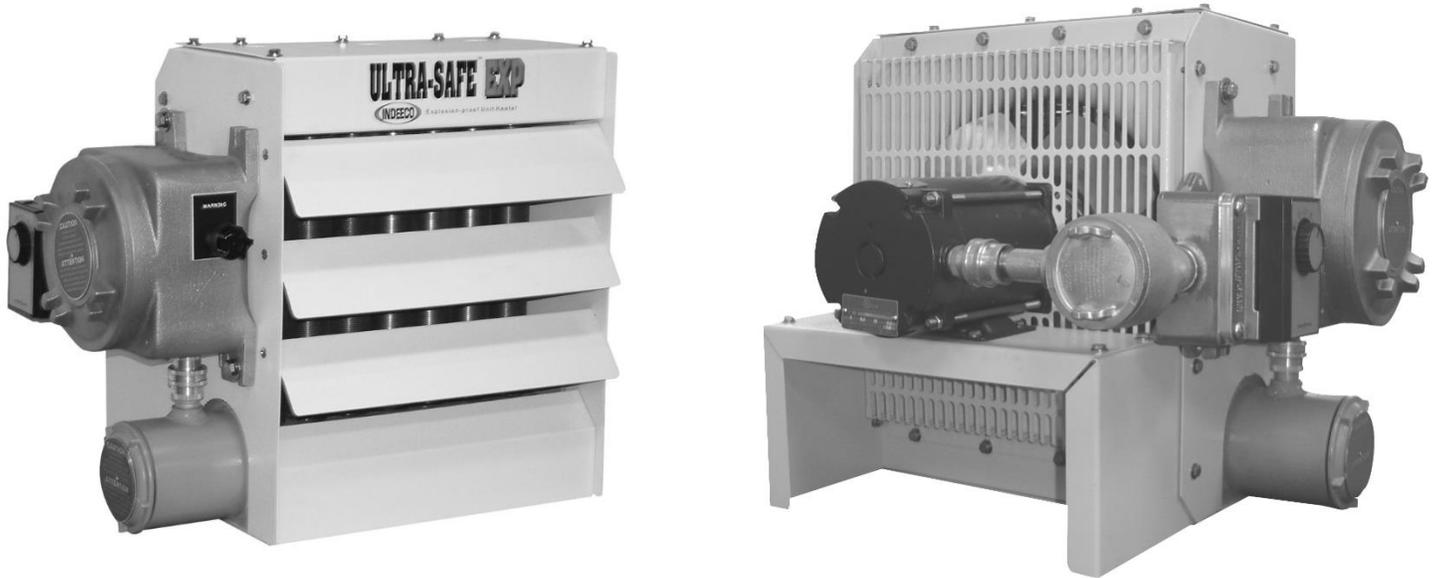




Owner's Manual

ULTRA-SAFE EXP Series Electric Forced Air Heater for Hazardous Locations



This manual covers installation, maintenance and repair parts.

CSA Approved for the following classified areas:
Class I, Divisions 1 & 2, Groups C & D
Class II, Divisions 1 & 2, Groups F & G
Operating Temperature Code T3C - 320°F (160°C)
Alternate Markings: Class I, Zones 1 & 2, Group IIB, T3 or T(160)
or
Class I, Divisions 1 & 2, Groups C & D
Class II, Divisions 1 & 2, Groups E, F & G
Operating Temperature Code T3C - 320°F (160°C)
Alternate Markings: Class I, Zones 1 & 2, Group IIB T3 or T(160)
See Data Plate for Specific Area Classification

For details on the particular hazardous environments having the potential for explosion, refer to Articles 500 through 516 of the National Electric Code, and/or Section 18 of the Canadian Electric Code, Part I.



WARNINGS

Installation and maintenance personnel should familiarize themselves with this manual and all the **WARNINGS** before installing or working on this heater to avoid potential hazardous conditions, severe property damage, personal injury or death.

1. To reduce the risk of ignition of hazardous atmospheres: Do not install where the operating temperature code limit exceeds the ignition temperature of the hazardous atmosphere.
2. Potentially lethal voltages are present. Be sure to lock the branch circuit disconnect switch in the OFF position and tag the circuit "Out for Maintenance" before working on this equipment.
3. Keep electrical enclosure covers tightly closed while in operation.
4. Hazard of Electric Shock. Heater must be grounded in accordance with the N.E.C. and/or C.E.C.
5. This heater should be installed by qualified personnel familiar with the National Electric Code and/or the Canadian Electrical Code requirements for hazardous locations. It is the responsibility of the installer to verify the safety and suitability of the installation.
6. Disassembly of the unit, for installation, is not required or authorized.
7. When connecting the room thermostat, be sure that the thermal cutouts remain connected in series with the controlling contactor. The unit must not operate without the thermal cutouts properly connected in the circuit.
8. Do not attempt to install a "Fan Only" switch on a standard unit heater and do not try to field modify a standard unit heater for this option. The heater must have been ordered for this option to have the necessary internal controls.
9. Replacement of electrical components should only be done by qualified personnel familiar with the requirements of maintaining electrical equipment in hazardous locations.
10. Replacement electrical components must be obtained from the factory in order to maintain the hazardous location rating.
11. The heat exchanger is a factory vacuum-sealed unit. Do not attempt to loosen or tighten any of the fill or drain plugs or attempt to operate the pressure relief valve. A loss of vacuum could cause nuisance tripping of the cutouts or high pressures which will cause the relief valve to actuate with an accompanying loss of liquid. Should leakage occur, remove unit from service and investigate cause.
12. The heat exchanger is filled with a mixture of water and inhibited propylene glycol. Contact with the fluid at operating temperatures may produce a burn hazard. The Material Safety Data sheets indicate that there is not a health hazard from coming in contact with the inhibited propylene glycol. Suggested first aid consists of flushing eyes with plenty of water and to wash off skin in flowing water or a shower.
13. Install and operate in an upright position only. Failure to comply will cause the overtemperature thermal cutouts to trip.
14. Installation minimum mounting clearances on nameplate must be maintained.
15. Use copper wire for supply connections according to size and rating on nameplate.
16. Do not attempt to override louver stops or operate unit with louvers fully closed.
17. "Warning Light", if supplied, will turn on if the high temperature thermal cutout opens. This could result if the heat exchanger is dirty, inlet air is obstructed, vacuum loss in heat exchanger, fan not turning or incorrect supply voltage. Disconnect power to unit before servicing.
18. Crackling noises within the heat exchanger at startup are normal.

WARRANTY WILL BE VOID IF INSTRUCTIONS ARE NOT FOLLOWED.

GENERAL

The air heaters are designed for comfort heating and should not be used in ambient temperatures exceeding 104°F (40°C). The units may be wall, pole or ceiling mounted. They utilize a hermetically sealed, liquid-to-air heat exchanger containing immersion type electric heating elements. A mixture of nontoxic propylene glycol and water is placed in the heater core to act as a heat transfer fluid. The propylene glycol provides freeze damage protection to -49°F (-45°C). The unit is designed to give years of safe, trouble-free operation when properly installed and maintained.

INSTALLATION

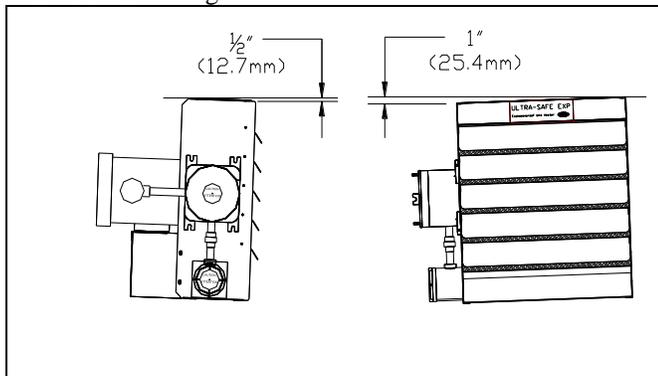
A. Site Selection:

The Heaters should not be mounted close to drapery or similar materials which could lay on the cabinet, or block the inlet or outlet of the heater. The heaters are intended for elevated mounting locations so that they blow warm air down to the floor area. A mounting height should be selected so that the heater is out of the way of possible moving equipment or personnel, yet low enough to deliver warm air to the selected area. See mechanical installation instructions for recommended installation heights.

B. Mechanical Installation:

Once an acceptable location has been determined, follow these instructions to complete the mechanical installation.

1. The Heaters are designed for use only while permanently mounted in an upright, level position. See figure below maximum tilt angles:



2. To ensure proper heating of floor surfaces, observe the following recommended maximum mounting heights (to bottom of heater):

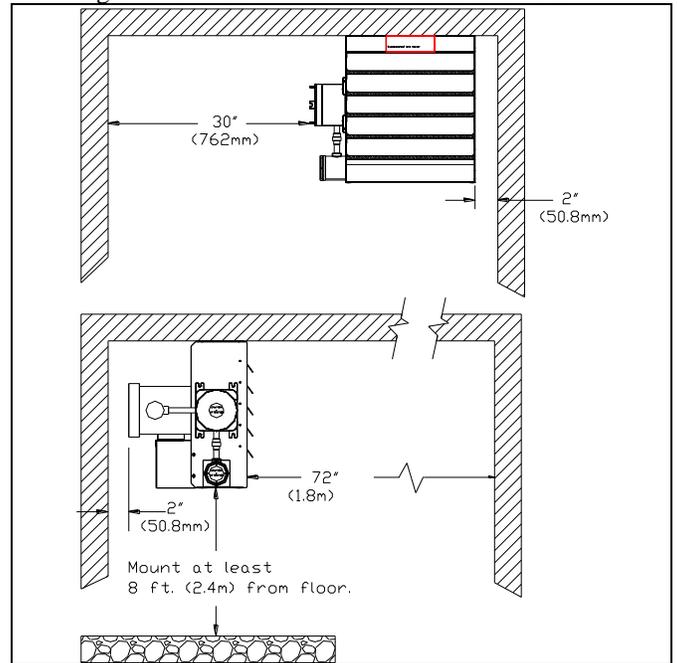
Maximum Mounting Height from Floor:

233-FA	233-FB	233-FC
9 ft.	10 ft.	13 ft.
(2.7m)	(3.0m)	(4.0m)

3. The supporting structure that the heater is attached to must have adequate strength to safely support the heater and be sufficient to keep the heater in its proper upright operating position. The maximum unit weights are:

MODEL	lbs	(kgs)
233-FA	150	68
233-FB	200	91
233-FC	250	114

4. See figure below for minimum installation clearances:



5. The heater may be suspended from overhead beams or mounted to a side wall or a 4" pipe using one of the approved mounting kits. Use of non-approved mounting kits voids all warranties, expressed or implied.
6. Wall mounting should be to structural steel. If the wall construction is plasterboard with wooden 2 X 4 framing or similar, it must be reinforced with angle iron or wooden cross braces.
7. Lock washers should be used on all mounting nuts and bolts to ensure they don't vibrate or work loose due to fan vibration or other vibration transmitted to the heater.

C. Electrical Installation:

Follow these instructions to complete the electrical installation:

1. External branch circuit protection is required. See nameplate ratings and follow Code recommendations.
2. Use only an approved explosion-proof means of wiring, such as mineral insulated cable or copper conductors in rigid conduit with conduit seals as required to make connection to the heater.
3. Follow the NEC and/or CEC and any local electrical and building codes related to the installation and intended use of the heater in an explosion-hazard area. NOTE: The heaters are suitable for installation into Division 2 areas but only when wiring and sealing per Division 1 requirements. Also, the heaters are suitable for installation into Zone 2 locations but only when wiring and sealing per Zone 1 requirements
4. When doing any work on a heater, including the initial electrical connection, disconnect the electrical current at the main branch circuit switch, and lock the switch in the off (open) position and tag the circuit "Out for Maintenance" to prevent potential lethal shock hazards.

5. Confirm that the electrical power supply matches the nameplate voltage, phase, amperage and frequency rating of the heater to be connected.
6. Ensure conductors are of appropriate gauge size. The minimum gauge is stamped on the nameplate. Size all input conductors according to accepted standards consistent with the temperature rating of the wire being used. Use minimum 75°C rated wire.
7. Proper installation of the heater requires that an adequate grounding conductor be connected to the ground terminal. This terminal is painted green or marked with the letter "G" and is located on the inside of the control enclosure next to the power input opening.
8. Check and confirm all connections are securely fastened.
9. Before application of electrical power, check all connections to ensure compliance with the wiring diagram and any code requirements. Remove any foreign objects from the control boxes. Reinstall covers tightly.
10. On all 3-phase heaters, it is necessary to verify that the fan is rotating in the proper direction. If air delivery is not from the front of the heater, exchange any 2 input wires at the main contactor terminal located in the control enclosure.
11. The explosion-proof control box is designed with threaded joints and metal-to-metal contact at the lid or cover joint to prevent an explosion. Do not attempt to install gasket material of any type at these joints. A light coating of anti-seize compound is applied to the threads to prevent seizing.
12. See section titled "operation" before energizing the heater.

D. Field Installed Controls:

1. Power Disconnect Switch:

The NEC requires that a power disconnect switch be mounted within sight of the heater. The CEC or local codes may require a disconnect switch within sight of the heater. Refer to the electrical diagram and follow these steps:

- a.) The remote power disconnect switch must be an explosion-proof disconnect switch rated for the area classification.
- b.) The switch must be indicating and have a locked off position.
- c.) The switch must be rated for the nameplate voltage and current per the NEC, CEC and any local codes.
- d.) Follow steps 6 through 12 of the electrical installation instructions to complete the installation.

2. Room Thermostat:

Refer to the electrical wiring diagram and follow these steps:

- a.) Connect the remote thermostat across the leads marked "C" and "C1". The external thermostat will then be in series with the heater thermal high-limit switches and correct operation of the heater will result.
- b.) The wiring to the remote thermostat must be copper wire, 16 gauge minimum (for Class II) or 14 gauge minimum (Class I) and run in explosion-proof

conduit with appropriate conduit seals installed per the NEC, CEC and any local codes.

- c.) Any room thermostat used with this heater must be of an explosion-proof type rated for the area classification, open on temperature rise, rated minimum 120VAC, 75VA inductive capacity.

3. 'Fan Only' Switch:

Refer to the electrical wiring diagram and follow these steps:

- a.) Do not attempt to install a "Fan Only" switch on a standard unit heater and do not try to field modify a standard unit heater for this option. The heater must have been ordered for this option to have the necessary internal controls.
- b.) Connect the remote 'fan only' selector switch across the leads marked "C" and "F".
- c.) The wiring to the fan selector switch must be copper wire, 16 gauge minimum (for Class II) or 14 gauge minimum (for Class I) and run in explosion-proof conduit with appropriate conduit seals installed per the NEC, CEC and any local codes.
- d.) Any selector switch used with this heater must be an explosion-proof switch rated for the area classification, maintained 2 position selector switch rated minimum 120VAC, 75VA inductive.

OPERATION

The unit heater may be operated normally at ambient temperatures of 104°F (40°C) or less and at altitudes of 3,300 feet (1000m) or less in atmospheres containing less than 21% oxygen by volume, and as classified on the nameplate. All of these conditions must be met before attempting to operate the heater. The heater should never be operated in an oxygen-enriched atmosphere or at ambient temperatures above 104°F, (40°C). The heater may be operated at higher altitudes if the ambient temperatures are below 104°F, (40°C).

A. Initial Operation:

Check to make sure the mechanical and electrical installation is complete and that it is safe to operate the heater.

- 1.) Heater without built on or remotely mounted fan switch:
 - a.) Set the temperature control thermostat to a setting above the current room temperature.
 - b.) Energize the heater electrical supply circuit.
 - c.) The heater and fan should come on and in 5 to 15 minutes reach a stable operating temperature. If the room temperature is high and the installation is above 3,300 feet, the unit heater may cycle on the thermal high limits of the motor or the heater.
 - d.) Check out and report any unusual or questionable operating characteristics, such as noise, vibration, loss of fluid, etc. Note that crackling noises coming from the heat exchanger during warm up are normal.
 - e.) Set the temperature control thermostat to the desired room temperature setting.
 - f.) De-energize the heater electrical supply circuit until heater operation is required.
- 2.) Heater with fan switch:

- a.) Place the fan switch in the fan position.
- b.) Set the temperature control thermostat to a setting below the current room temperature.
- c.) Energize the heater electrical supply circuit.
- d.) The heater fan should come on but the heater should remain off.
- e.) Place the fan switch in the auto position.
- f.) The fan should go off.
- g.) Set the temperature control thermostat to a setting above the current room temperature.
- h.) The fan and heater should operate. If the room temperature is high and the installation is above 3,300 feet (1000m), the unit heater may cycle on the thermal high limit cutouts of the motor or the heater.
- i.) Check out and report any unusual or questionable operating characteristics, such as noise, vibration, loss of fluid, etc.
Note that crackling noises coming from the heat exchanger during warm up are normal.
- j.) Set the fan switch and temperature control thermostat to the desired operating positions.

B. Normal Operation:

Prior to the start of the heating season, perform the electrical and mechanical steps outlined in the section titled “maintenance”.

1. Perform the Operation steps for the applicable temperature control option.
2. Place all switches in their normal operating position and place the unit heater in service.

MAINTENANCE

Maintenance and repair must be performed by qualified personnel only.

A. Electrical:

1. Inspect all terminal connections, contactor and conductor insulation for damage, looseness, fraying, etc., as applicable. Tighten any loose terminals and replace or repair wire with damaged or deteriorated insulation. If contactor contacts are badly pitted, welded together, or burned, replace the contactor. Check all explosion-proof conduit for visible damage and tightness.
2. If reduced heat output is suspected, perform the mechanical checks. If low heat output is still suspected after completing the mechanical checks, verify the condition of the heating elements by using an amperage meter to check the current draw of each input line. All input lines should draw approximately equal current which should agree with nameplate rating. If they do not, one or more of the heating elements could be burned out and the heater/core assembly should be replaced.
3. The electric motor is permanently lubricated and thermally protected. Check for smooth and quiet running at all inspections. Replace motor if excessive bearing play is detected. Contact the factory for instructions.

B. Mechanical:

1. Never attempt to fill, drain or check the liquid level of the heat exchanger or check the action of the pressure relief valve. Contact the factory for instructions.
2. The explosion-proof control box is designed with threaded joints and metal-to-metal contact at the lid or cover joints to prevent an explosion. Do not attempt to install gasket material of any type at these joints. A light coating of anti-seize compound is applied to the threads to prevent seizing.
3. Annually check the tightness of all visible bolts and nuts, in particular the support structure bolts and nuts. Similarly check the motor mounting bolts and nuts.
4. Periodically, check the motor, fan and heater core fins for cleanliness. A dirty heat exchanger can cause the unit to over heat and cycle on the thermal cutouts. If the dirt is loose dust, clean with a vacuum or by air jet. If the dirt can't be vacuumed or blown off, use a warm water spray directed to the inlet side of the heat exchanger then to the outlet side. Units may also be ordered with upgraded features to support “IP55” wet location construction. A soft bristled brush may be required to loosen stubborn deposits. Be careful not to bend the aluminum fins on the heat exchanger or the fan blade propeller. Allow unit to dry before re-energizing.
5. Check louvers for position tightness and equal angle settings. Check motor and fan for smooth running operation. Any unusual noise or vibration must be investigated and rectified.
6. Should there be any evidence of fluid leakage from the heater core, the heater should be repaired immediately. The heater will not operate properly with a low fluid level. Contact the factory for replacement core.

REPAIR AND REPLACEMENT

Maintenance and repair must be performed by qualified personnel only.

A. Replacing the Heat Exchanger Core:

The heat exchanger core is not field repairable. Contact factory for replacement.

1. Disconnect the heater electrical power supply, unwire and lower the heater from its mounting location. Set heater face down on a table or on the floor.
2. Remove the cabinet bottom, cabinet top, wiring and heater enclosure covers.
3. Disconnect all heater wires from the contactor in the wiring enclosure. Disconnect the control wiring from thermal cutout.
4. Thread conduit into wiring enclosure to disconnect the heater terminal box.
5. With an assistant supporting the weight of the heat exchanger, remove the 3 heat exchanger mounting bolts. Carefully remove the heat exchanger out of the bottom of the cabinet.
6. Locate rating tag on the heat exchanger and verify that electrical ratings of the core to be installed match the electrical ratings on the heater nameplate.

7. To reinstall, slide the core through the bottom of the cabinet while an assistant lines up and installs the 3 heat exchanger mounting bolts.
8. Guide the heater lead wires back into the wiring enclosure.
9. Reconnect the heater lead wires to the contactor and the conduit.
10. Reattach the cabinet bottom and enclosure covers before mounting heater and energizing.

B. Replacing the Temperature High-Limit Cutouts:

1. Disconnect the heater electrical power supply and remove the heater enclosure cover.
2. Remove the wire barrier to expose the high limit cutout.
3. Disconnect the wires from the high limit cutout and mark their location.
4. Remove the two nuts used to attach the temperature high limit cutout.
5. Lift and remove the sheetmetal mounting plate.
6. Carefully lift and remove the temperature high limit cutout.
7. Use only factory supply parts for safe operation.
8. Lightly coat the new manual and automatic cutout bulbs with the supplied thermal transfer compound. This is critical for proper cutout operation.
9. Carefully slide the automatic cutout bulb into the **left** thermowell and the manual cutout bulb into the **right** thermowell.
10. Reinstall the sheetmetal plate. Note that the sheetmetal plate also acts as a stop to keep the cutout bulbs from backing out of the wells.
11. Carefully install the temperature high limit control to avoid putting kinks into the capillary.
12. Reattach the wires to the cutout and reinstall the wire barrier.
13. Ensure heater enclosure cover is in place before energizing heater.

C. Resetting the Manual Cutout:

All unit heaters contain a built-in manual reset thermal cutout with or without backup contactor.

1. Disconnect the heater electrical power supply and remove the heater enclosure cover.
2. Determine the reason for the manual reset thermal cutout actuating and rectify the situation. See section titled "maintenance".
3. Reset the manual reset thermal cutout by pressing on the red stem in the center of the control.
4. Replace the heater enclosure cover securely.
5. Energize the heater electrical supply circuit.
6. The heater and fan should come on and in 5 to 15 minutes reach a stable operating temperature.

7. Check out and report any unusual or questionable operating characteristics, such as noise, vibration, loss of fluid, etc.
8. If heater operation appears normal, place the unit into normal operation.

D. Replacing the Fan Motor and Blade:

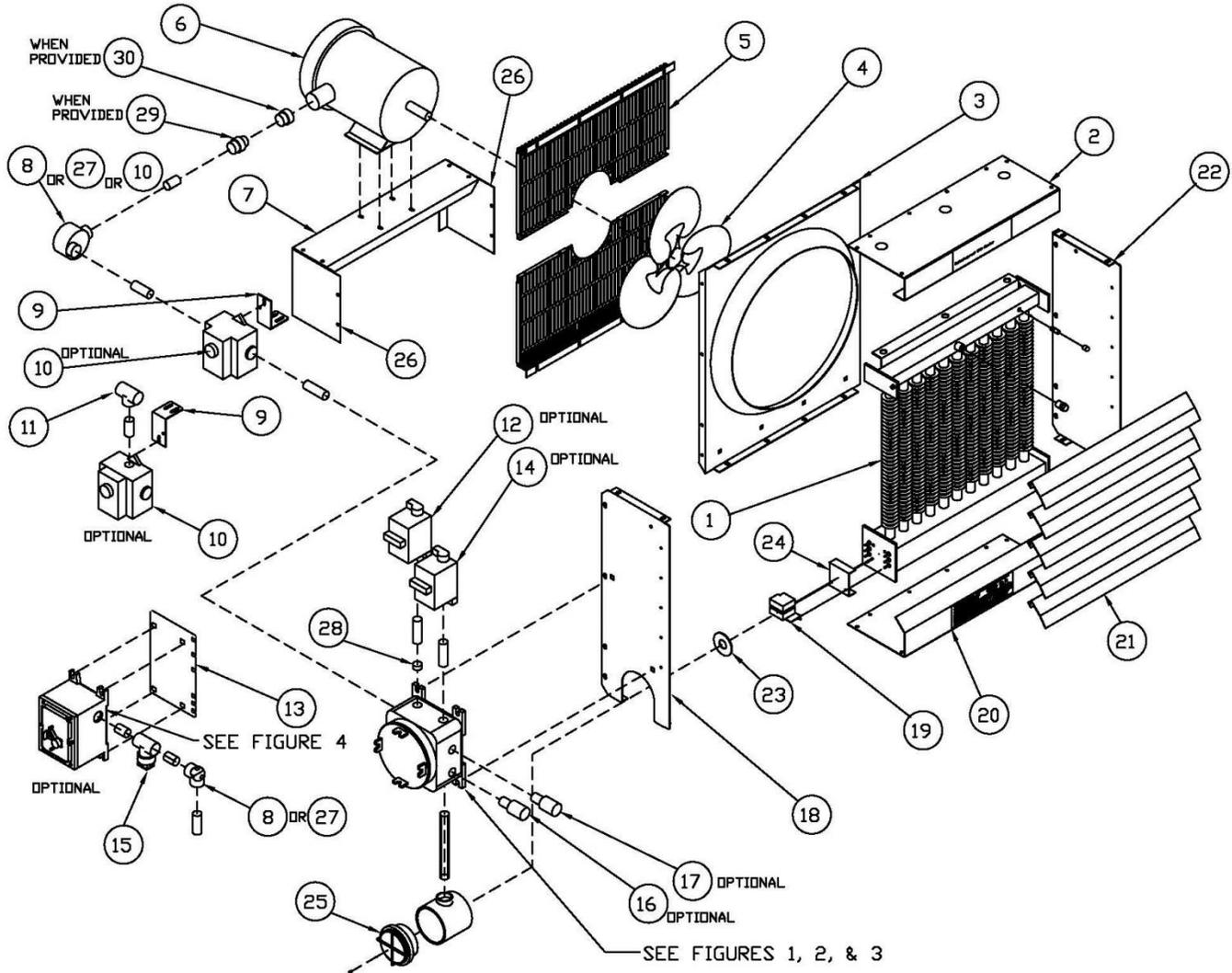
The fan motor is permanently lubricated and does not require any maintenance. If the fan motor is defective, a replacement must be obtained from the factory.

1. To replace the fan motor:
 - a. Disconnect the heater electrical power supply.
 - b. Disconnect the motor supply wires from the contactor in the wiring enclosure.
 - c. Disassemble the conduit union located at the motor wiring hub.
 - d. Remove top fan guard and motor mounting bolts.
 - e. Lift motor out of heater assembly.
 - f. Remove fan blade and conduit union from defective motor and install on new motor.
 - g. Install new motor to heater using existing motor mounting hardware.
 - h. Reinstall top fan guard and ensure that the fan blade rotates freely.
 - i. Feed motor wires through conduit and into wiring enclosure.
 - j. Reattach conduit union. Reconnect motor wires to contactor.
 - k. Check fan rotation by momentarily energizing heater. Airflow should exit from front of heater cabinet. If rotation is incorrect, disconnect electrical power supply and reverse two of the motor lead wires at the contactor.
 - l. Reattach wiring enclosure cover before placing heater back in service.
2. To replace the motor fan blade:
 - a. Remove the top fan guard.
 - b. Remove the four motor mounting bolts and disconnect the conduit union at the motor.
 - c. Loosen the bolt that connects the fan blade to the motor shaft.
 - d. Slide the motor back and tilt in order to remove the old blade & install a new one.
 - e. Tighten the fan blade attachment bolt to the motor shaft.
 - f. Reattach the motor conduit union and the four motor mounting bolts.
 - g. Reinstall the top fan guard and ensure that the fan blade rotates freely.

REPLACEMENT PARTS

1. All replacements must be factory supplied to ensure safe heater operation.
2. Mark wires and refer to wiring diagram to ensure proper electrical connections.

Reference heater catalog number and item number in figures below when contacting factory for replacement parts. Contact factory for items not shown.



ITEM	DESCRIPTION
1	Heat Exchanger Core Assy.
2	Cabinet – Top
3	Fan Venturi
4	Fan Blade
5	Fan Guard
6	Fan Motor
7	Motor Support – Top
8	Motor Junction Box
9	Thermostat Support Bracket
10	Thermostat
11	Conduit Tee
12	Disconnect Switch – Small
13	Large Disconnect Support Bkt.
14	Fan Switch
15	Conduit Seal
ITEM	DESCRIPTION

16	Pilot Light – Bottom
17	Pilot Light – Top
18	Cabinet – Left Side
19	High Limit Cutout Assembly
20	Cabinet – Bottom
21	Cabinet - Louver
22	Cabinet – Right Side
23	High Limit Barrier
24	High Limit Mounting Bridge
25	Heater Enclosure Cover
26	Motor Support – Side
27	Conduit Pull Elbow
28	Reducer Bushing
29	Conduit Union
30	Reducer Bushing

Select the Figure that corresponds to your heater.

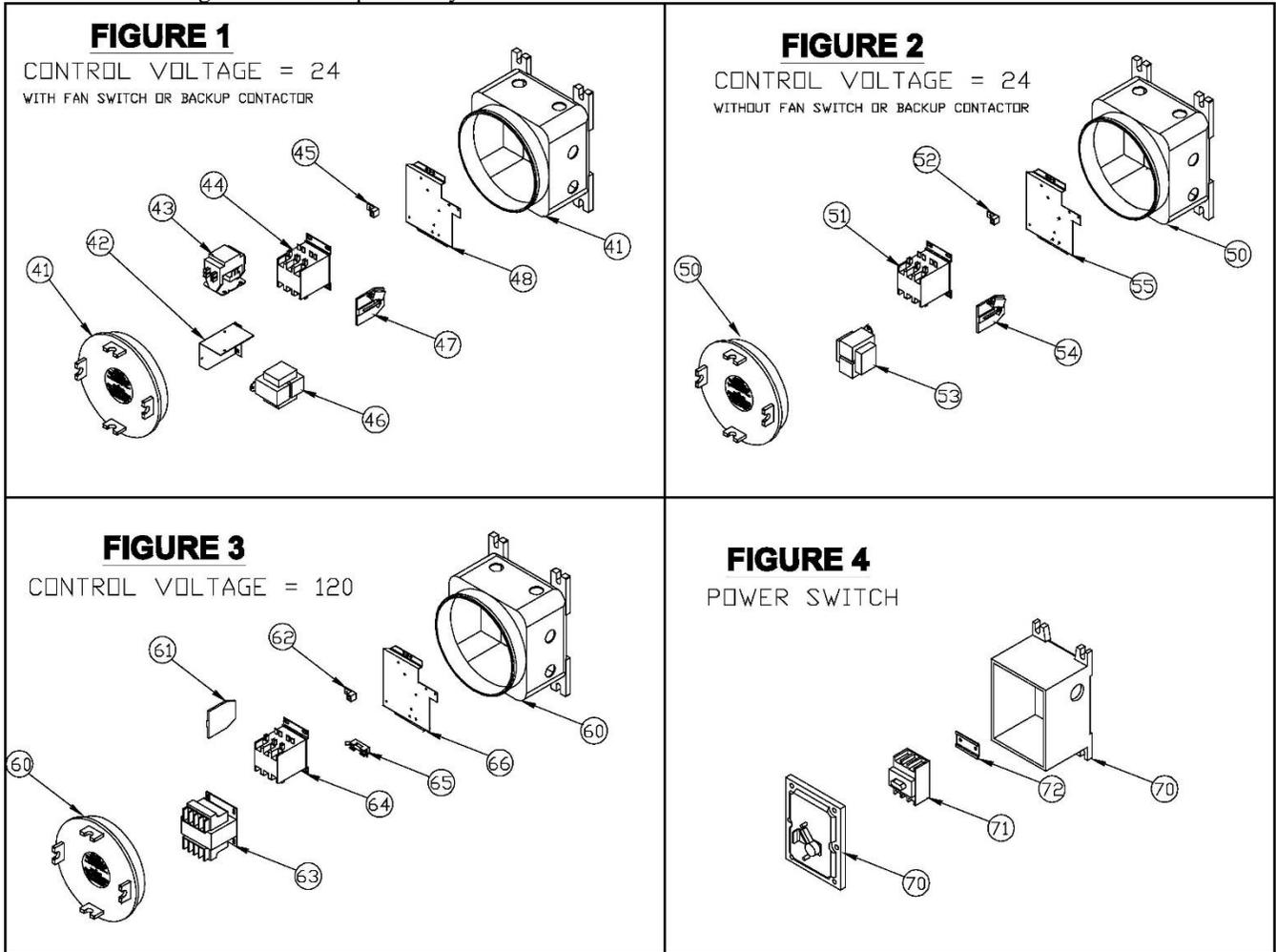


FIGURE 1:

ITEM	DESCRIPTION
41	Wiring Enclosure and Cover
42	Option Mounting Bridge
43	Option Contactor
44	Main Contactor
45	Ground Lug
46	Transformer
47	Auxiliary Contact
48	Main Mounting Bridge

FIGURE 2:

ITEM	DESCRIPTION
50	Wiring Enclosure and Cover
51	Main Contactor
52	Ground Lug
53	Transformer
54	Auxiliary Contact
55	Main Mounting Bridge

FIGURE 3:

ITEM	DESCRIPTION
60	Wiring Enclosure and Cover
61	Auxiliary Contact
62	Ground Lug
63	Transformer
64	Main Contactor
65	Transformer Fuse & Fuse Block
66	Main Mounting Bridge

FIGURE 4:

ITEM	DESCRIPTION
70	Switch Enclosure and Cover
71	Disconnect Switch
72	Disconnect Switch Track