Ruffneck™

WARNING! Read all important information notices.

Electric Forced Air Heaters for Hazardous Locations

FE2 Series

Installation, Operation, & Maintenance Instructions

Model Coding

FE2 - 220 1 50 - 025 - W - T

- FE2 – Model Series (2nd Generation)
- 220 – Heater Voltage
- 1 – Phase
- 50 – Hertz
- 025 – Heater Kilowatts
- W – Welded Core
- T – Built-in thermostat
- D – Built-in disconnect switch
- C – Heresite® coating
- A – Stainless steel cabinet
- U – Continuous fan
- B – Low ambient option -58°F (-50°C)
- M25 – M25 adapter field entry
- L – Large junction box

Ex II2 G Ex d IIB T3 Gb
DEMKO 10 ATEX 0910365X
-20°C ≤ Tamb ≤ 40°C (Standard)
-50°C (-58°F) ≤ Tamb ≤ 40°C (104°F)*
EAC 1Ex d IIB T3 Gb X
IP55

EAC

CE

*For models with suffix 'B'
Consult with factory for specific lowest temperature.

Low Ambient Part No. 13933 Dec 2020 Printed in Canada

TABLE OF CONTENTS

A. HEATER MAINTENANCE CHECKLIST

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Heater Model _____ Date of Maintenance _____

Serial Number _____ Maintenance Done By _____

Comments _____

WARNING

Disconnect heater from power supply at integral disconnect or fuse box before opening enclosures or servicing heater.

IF INTEGRAL DISCONNECT IS BEING SERVICED, verify that power has been disconnected at fuse box or main panel.

Lock the switch in the **"OFF"** (open) position and/or tag the switch to prevent unexpected power application.

This heater should only be serviced by personnel with heating and hazardous location equipment experience.

A.1 Preventative Maintenance Grid

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

		Regular Service				Severe Service			
To-Do	Description	Annual Start Up	Monthly	Every 3 Months	Every 6 Months	Annual Start Up	Monthly	Every 3 Months	Every 6 Months
Clean	Remove dust using compressed air. Do not spray with water or solvents. Do not immerse in water or solvents. Clean the following: 1. Motor 2. Louvers 3. Finned Tubes 4. Fan 5. Fan Guard	☐		☐		☐		☐	
Check	1. Motor for smooth, quiet operation 2. Louvers for proper angle and tightness 3. All explosion-proof covers for tightness 4. Pressure relief device for signs of leakage. See Figure 1, page 5 and refer to the A.3 Annual, page 4for further instructions.	☐				☐		☐	
Electrical Inspection	1. Inspect all terminal connections and conductors:* Tighten loose connections. Replace conductors with damaged insulation and frayed wiring.*	☐			☐	☐		☐	
	2. Inspect contactor contacts: If badly pitted, burned or welded shut, replace with factory supplied contactor.*	☐			☐	☐		☐	
	3. Check fuses: The correct fuse rating and type are printed on the circuit board. Always ensure a backup fuse is available on the PCB.*	☐			☐	☐		☐	
Mechanical Inspection	1. Fluid leakage: Inspect the Pressure Release Valve (PRV) label indicator for signs of rupture and degradation. If any fluid leakage occurs from the heater, disconnect it from the power supply and replace the core immediately.*		☐			☐	☐		
	2. Enclosures: The interiors of each enclosure must be clean, dry, and free of foreign materials.*	☐				☐		☐	
	3. Motor shaft bearing and play: If the motor does not run quietly and smoothly and has excessive play, replace the motor.*	☐				☐		☐	

*For drilling rigs, this should be done every rig re-location.

Photocopy this page for reuse.

A.2 Periodic (before and as required during heating season)

- Clean
  - ☐ Motor
  - ☐ Louvers
  - ☐ Finned Tubes
  - ☐ Fan
  - ☐ Fan Guard
- Check
  - ☐ Motor for smooth, quiet operation
  - ☐ Louvers for proper angle and tightness
  - ☐ All explosion-proof covers for tightness
  - ☐ Pressure relief device for signs of leakage. See Figure 1, page 5 and refer to A.3 Annual, page 4 (below) for further instructions.

A.3 Annual (before heating season)

- Mechanical Check
  - ☐ Fluid leakage. The heater core is vacuum charged and contains water and corrosion inhibitors. Inspect the Pressure Relief Valve label indicator for signs of rupture and degradation. If the paper is torn, disintegrated or otherwise compromised this is an indication that fluid has leaked from the core. If any fluid leakage occurs from the heater, disconnect it from the power supply and have the core replaced. A factory supplied exchange core can be shipped immediately from stock. Refer to Section I. Repair & Replacement, page 18 for details.
  - ☐ All enclosures. Interior of enclosures must be clean, dry and free of foreign materials. Threaded covers must be installed and hand tight.

  NOTE: Enclosure joints are metal to metal. Do not use gasket material or sealant in joints. A grease is applied to the joints at the factory and should be left intact.
  - ☐ Motor shaft bearing play. Replace motor if play is excessive, or if motor does not run quietly and smoothly. Motor bearings are permanently lubricated.
  - ☐ Fan. Replace immediately if cracked or damaged.
  - ☐ Louvers. Screws should be tight. Louvers shall not be fully closed or override stops.
  - ☐ Tightness of all hardware. All nuts and bolts, including mounting hardware, must be tight.
  - ☐ Turn heater on for a minimum of five minutes. Check for warm air exiting heater through louvers. Crackling or pinging noises within heater during start-up are normal.
- Check
  - ☐ All terminal connections and conductors. Tighten loose connections. Conductors with damaged insulation must be replaced.
  - ☐ Inspect contactor contacts. If badly pitted, burned or welded shut, replace with factory supplied contactor. For severe duty conditions such as arctic duty or drilling rigs, Thermon recommends the contactor be replaced every two years.
  - ☐ Fuses. Fuse rating and type are on printed circuit board. Correct fuse must be in the active fuse clip. It is recommended that a spare fuse be stored in the spare fuse clip.
  - ☐ All explosion-proof conduits. Replace damaged conduits. All threaded conduit connections must have a minimum 5 turns engagement. Straight threaded conduit must protrude a minimum of 1/16" (1.6 mm) inside enclosures. Taper threaded connections must be at least hand tight.
  - ☐ Electrical resistance on all load side legs. Reading should be balanced (± 5%).

B. IMPORTANT NOTICES

WARNING Read and adhere to the following. Failure to do so may result in severe or fatal injury. WARRANTY WILL BE VOID.

1. Read and follow all instructions in this manual.
2. Heater is to be used only in atmospheres having an ignition temperature higher than the heater's maximum rated operating temperature as shown on the heater data plate. Refer to applicable electrical codes for additional information.
3. Heater to be used only in the hazardous locations indicated on the heater's data plate.
4. Heater is for dry indoor use only. Do not immerse in water. Do not store or use in areas exposed to rain or snow.
5. Heater is to be connected and serviced only by a qualified electrician experienced with hazardous location equipment.
6. Installation and wiring of the heater must adhere to all applicable codes.
7. Disconnect heater from power supply at integral disconnect or fuse box before opening enclosures or servicing heater. IF INTEGRAL DISCONNECT IS BEING SERVICED, verify that power has been disconnected at fuse box or main panel. Lock the switch in the **"OFF"** (open) position and/or tag the switch to prevent unexpected power application.
8. This heater is equipped with a single bimetal over temperature high-limit. It is of the automatic reset type and therefore the heater may restart without warning. The heater is not to be operated with the high-limit disabled or disconnected from the control circuit.
9. Venting pressure of the pressure relief valve is factory set. Do not tamper with lock nut.
10. Do not tamper or remove warning label indicator on the PRV.
11. Operate the heater only while it is permanently mounted in an upright position. Refer to the Section D. Installation, page 7 for details.
12. Heater must be kept clean. When operating in a dirty environment, regularly clean the finned tubes, fan, and fan guard. Follow the recommended maintenance procedures. Refer to the Section A. Heater Maintenance Checklist, page 3.
13. The heater core is vacuum charged and non field servicable. If any fluid leakage occurs from the heater, disconnect it from the power supply and have the core replaced with a factory supplied core. Refer to the Section I. Repair & Replacement, page 18 for details.
14. Do not operate the heater with any of the louvers fully closed or overriding their stops.
15. Do not operate the heater in atmospheres corrosive to steel or aluminum.
16. Do not operate heater in ambient temperatures above 40°C (104°F).
17. Unused apertures shall be closed with suitable blanking elements. All cable entry devices and blanking elements shall be certified in type of explosion protection flameproof enclosure "d", suitable for the conditions of use and correctly installed.
18. Installer to provide certified Ex "d" sealing fittings and stopping boxes for the same gas groups as the apparatus.
19. The distance from the face of the seal closest to the enclosure (or intended end-use enclosure) and the outside wall of the enclosure (or intended use-enclosure), shall be as small as practical, but in no case more than the size of the conduit or 50 mm, whichever is the lesser.
20. Use factory approved replacement parts only.
21. See applicable electrical codes for seal requirements in field installed conduits. Factory installed conduits require no further sealing.
22. Crackling or pinging noises within the heater core during start up may occur. This is normal.
23. Air discharge near the bottom of the heater may be warmer than the top. This is normal.
24. If there are any questions or concerns regarding the heater, contact the factory. Refer to the last page of this manual for details.
25. Contact original manufacturer for information on the dimensions of the flame proof joints.
26. Heater must be permanently mounted in a level, upright position for operation. See mounting section or mounting instructions label located on the heater's control box.

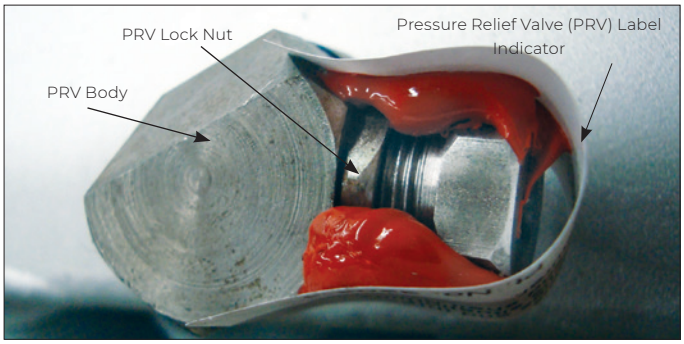


Figure 1

C. TROUBLESHOOTING TIPS

1. Heater is not operating
   - 1.1 Check all fuses in heater control box.
   - 1.2 Check remote disconnect switch and circuit breaker.
   - 1.3 Check voltage supplied to the heater – refer to the heater data plate for voltage requirements.
   - 1.4 Check thermostat by turning it and check continuity with a multimeter.
   - 1.5 Verify that there is a jumper wire present between terminals 5 and 6 on the terminal block located in the control box.
2. Contactor is chattering
   - 2.1 Check supply voltage.
   - 2.2 Check wiring connections. Tighten all loose electrical connections.
   - 2.3 Check thermostat for continuity (1.4, page 6). If thermostat does not break continuity replace thermostat.
3. Contactor is burned or welded
   - 3.1 Check the contactor for burn marks and blackening. Replace the contactor.
   - 3.2 Check incoming power to the heater to ensure there are no voltage fluctuations.
4. Heat exchanger is dirty
   - 4.1 Clean the heat exchanger using compressed air.
5. PRV has released
   - 5.1 If there are signs that the PRV has released fluid, PRV indicator is broken, blackening around the PRV exit hole, or there are fluid stains visible on the top louver, shut the unit down immediately.
   - 5.2 Check for restricted air flow, bad motor, broken thermostat or malfunctioned high limit.
6. Heater is cold on top and warm on bottom
   - 6.1 The core may have lost its vacuum. Check the PRV for signs of loss of fluid and verify that the PRV label indicator is not broken. If PRV has released, send the unit in for repair or replace the core.
   - 6.2 If the PRV does not indicate loss of fluid, the heater should operate normally.
   - 6.3 The ambient temperature may be too low. If the ambient temperature is very cold the top of the core will be colder than the bottom – this is normal.
7. Unit cycles on high limit – unit turns on and turns off within less than 5 minutes.
   - 7.1 Check and see if the PRV has released fluid. Core may have lost most or all of its fluid. If PRV has released, send the unit in for repair or replace core.
   - 7.2 The core may be dirty, fan may not be working or may be turning the wrong way (the fan must rotate clockwise as seen from the front of the unit) objects may be stuck in the heat exchanger for drying or warming up – remove any items from the exchanger.
8. The Ground Fault Interrupter (GFI) trips on the main panel, or heater blows fuses.
   - 8.1 Check that you have a fuse of the proper amperage rating.
   - 8.2 Check for loose or frayed wiring.
   - 8.3 If condition is not observable, send heater in for repair.
   - 8.4 Change sensitivity of GFI.
9. The fan is turning but very little air comes from the front of the heater.
   - 9.1 Check fan rotation and ensure that the fan turns clockwise as seen from the front of the heater. Refer to the Installation section below for more information.
   - 9.2 Check motor winding resistance and verify that they are balanced.
   - 9.3 Check fan blade set screws to ensure fan blade is not loose on the motor shaft.

D. INSTALLATION General Guideline for Installation and Wiring

All applicable codes must be adhered to. For optimum heating, the heater should be installed as follows:

D.1 Mechanical

1. Location

For optimum heating, the heater should be installed as follows:

1.1 There are no obstructions that may impede the heater's air inlet or discharge.

1.2 The air discharge is directed into open areas and not at occupants.

1.3 The air discharge is not directed at a thermostat.

1.4 The air discharge is directed across areas of heat loss, such as doors and windows (see Figure 2, page 7).

1.5 The air discharge is directed along and at a slight angle toward exterior walls (see Figure 2, page 7).

1.6 If equipment freeze protection is important, direct air discharge at equipment.

1.7 Air discharge streams support each other and create a circular air flow. It is not required that the heater's air throw reaches the next heater (see Figure 2, page 7).

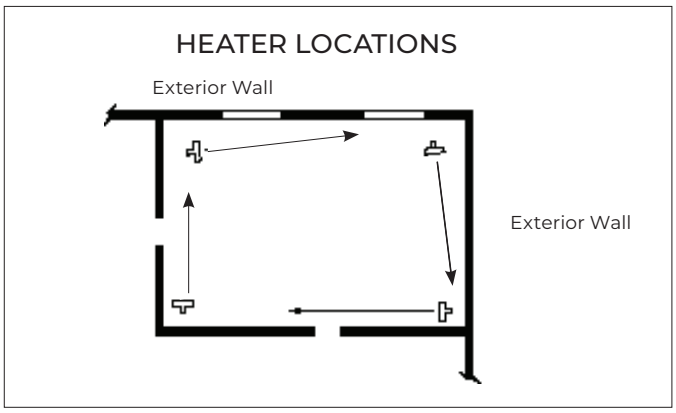


Figure 2

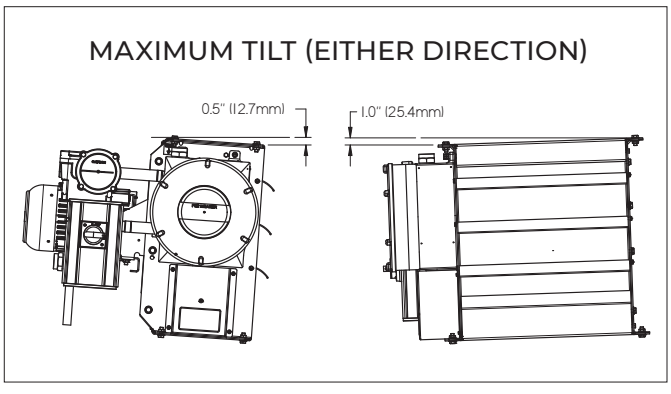


Figure 3

2. Mounting

2.1 The heater must be permanently mounted in a level, upright position for operation. See Figure 3 and Figure 4, page 7 and Figure 5, page 8 for maximum tilt angles, installation clearances, and physical dimensions. For ease of installation, a variety of mounting kits are available from the factory.

2.2 The mounting structure must be strong enough to:

- Support the heater's weight, refer to Section F. Specifications, page 14 to 15
- Provide sufficient stiffness to prevent excessive vibration
- Withstand harsh situations such as transportable installations.

2.3 Do not install conduit below heater (see Figure 3, page 7).

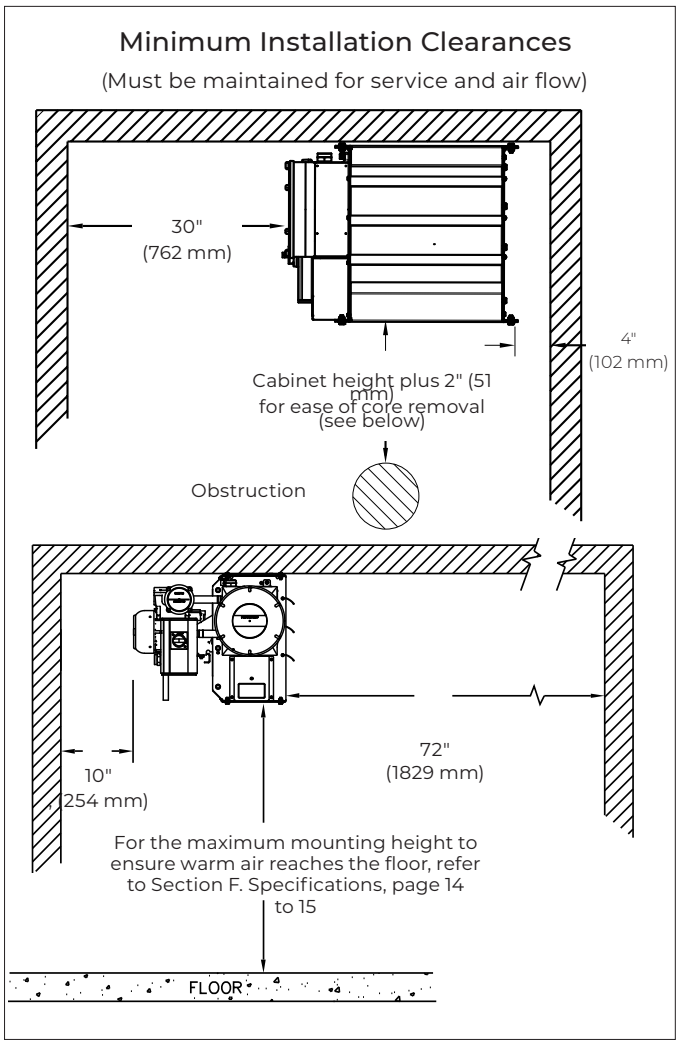
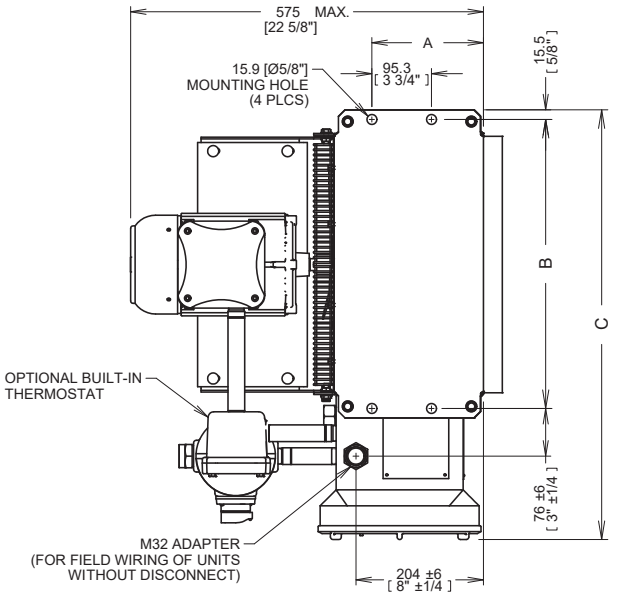
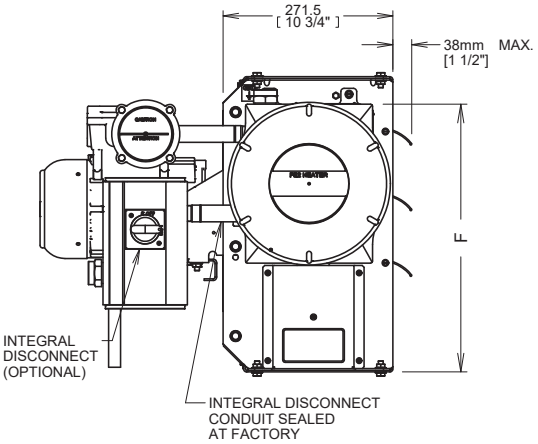


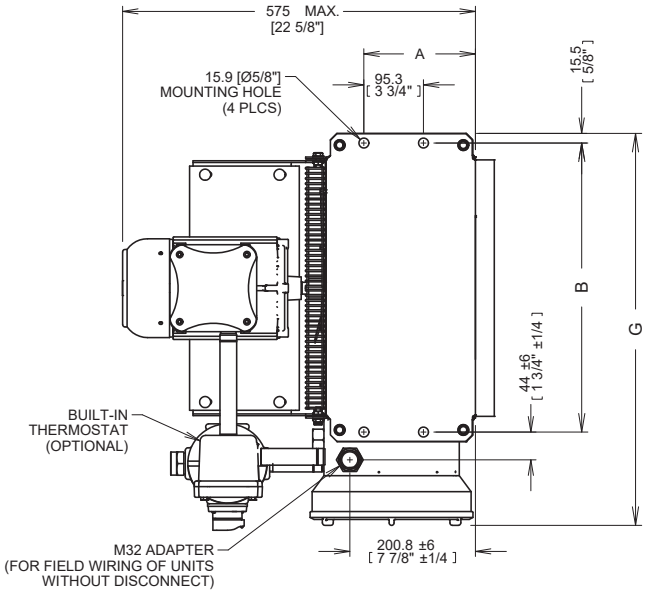
Figure 4

DIMENSIONAL TOLERANCES ±1/8" [±3mm]
UNLESS OTHERWISE SPECIFIED.

DIM. \ kW		2.5-10	12.5-20	20.9-35	DIM. TOL. ±
A	in.	7	7	7	1/8
	mm	178	178	178	3
B	in.	18-3/16	22-5/16	26-1/4	1/8
	mm	462	566	667	3
C	in.	27	31	35	3/16
	mm	686	787	889	4
D	in.	19	23	27	1/8
	mm	484	586	688	3
E	in.	19-7/16	23-7/16	27-7/16	3/8
	mm	492	596	697	10
F	in.	17-1/2	19-1/2	21-13/16	5/16
	mm	444	495	554	8
G	in.	24-5/8	28-5/8	32-5/8	3/16
	mm	625	727	828	4







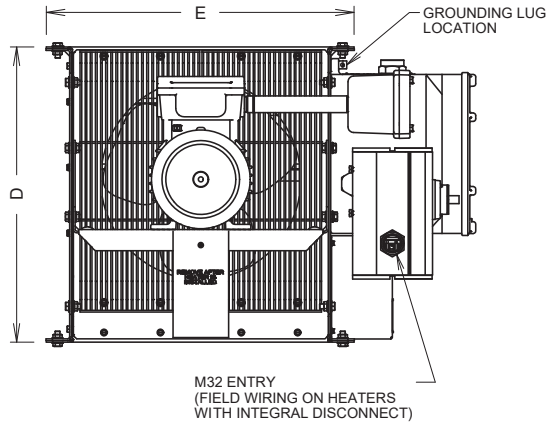


Figure 5

D.2 Electrical

WARNING. Disconnect heater from power supply at integral disconnect or fuse box before opening enclosures or servicing heater. Lock the switch in the **"OFF"** (open) position and/or tag the switch to prevent unexpected power application. IF INTEGRAL DISCONNECT IS BEING SERVICED, verify that power has been disconnected at fuse box or main panel. Lock the switch in the **"OFF"** (open) position and/or tag the switch to prevent unexpected power application. Installation and wiring of the heater must adhere to all application codes.

1. General

1.1 Use only copper conductors and approved explosion-proof wiring methods during installation. Refer to Section E. FE2 Technical Data, page 12 to 15 and heater data plate for conductor rating.

1.2 External overcurrent protection is required. Refer to Section E. FE2 Technical Data, page 12 to 15 and heater data plate for voltage, frequency amperage, and phase. Supply voltage is to be within 10% of the data plate voltage.

1.3 The heater must be installed by qualified personnel in strict compliance with electrical codes.

1.4 All heaters come factory prewired and ready for direct connection to the power supply leads.

1.5 The heater must be individually fused, preferably with Class J time-delay fuses for maximum safety. Unless stated otherwise in your local code, fuse size shall be 125% of line current or next size larger.

2. Field Wiring

2.1 The supply conductors, ground conductor, and room thermostat conductors all pass through the M32 or M25 opening (Figure 6, page 9) and are to be wired into the control enclosure (Figure 7, page 9).

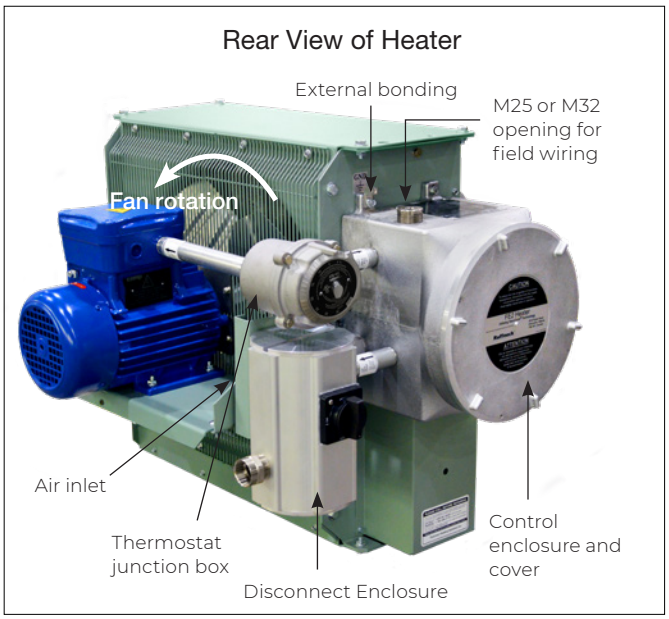


Figure 6

2.2 Heater may be supplied with a factory installed built-in room thermostat (see Figure 9, page 10). On heaters not supplied with this option, it is recommended that a remote room thermostat be used. Connect the remote room thermostat conductors to the printed circuit board terminal block marked "TSTAT".

Any thermostat used with this heater must:

- Be of an explosion-proof type
- Be rated 125V minimum
- Have a minimum 2 amp capacity
- Open on temperature rise.

2.3 Heater may be supplied with a factory installed built-in integral disconnect. (See Figure 7, page 9)

Field Wiring for Integral Disconnect:

- Power Supply conductors and Ground conductor pass through M32 opening of Disconnect Enclosure (Figure 7, page 9). Supply conductors to be wired to Disconnect Switch inside. Ground conductor to be wired to Ground Lug fastened to inside of Disconnect Enclosure.
- If applicable, Remote Room Thermostat conductors pass through 1" NPT opening (see Figure 7, page 9) and are to be wired to printed circuit board terminals marked "T'STAT".
- To reduce risk of ignition of hazardous atmospheres, conduit runs must have a sealing fitting connected within 18" (457 mm).

2.4 Factory installed conduits require no further sealing. Integral Disconnect is sealed at factory.

- The internal grounding terminal in the control enclosure shall be used as the equipment grounding means. An external bonding terminal (Figure 6, page 9) is provided for a supplementary bonding connection where local authorities permit or require such a connection.

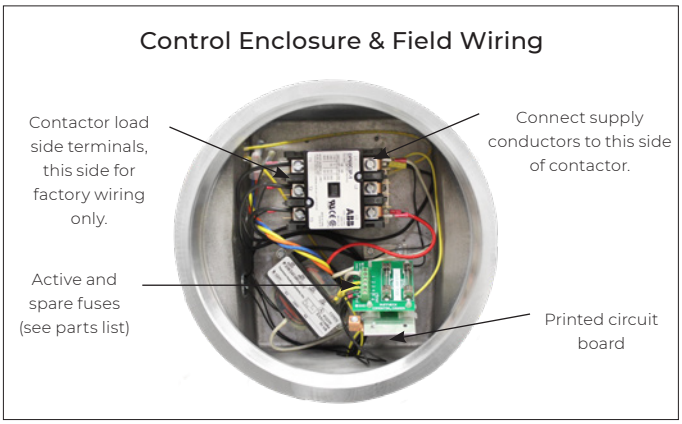


Figure 7

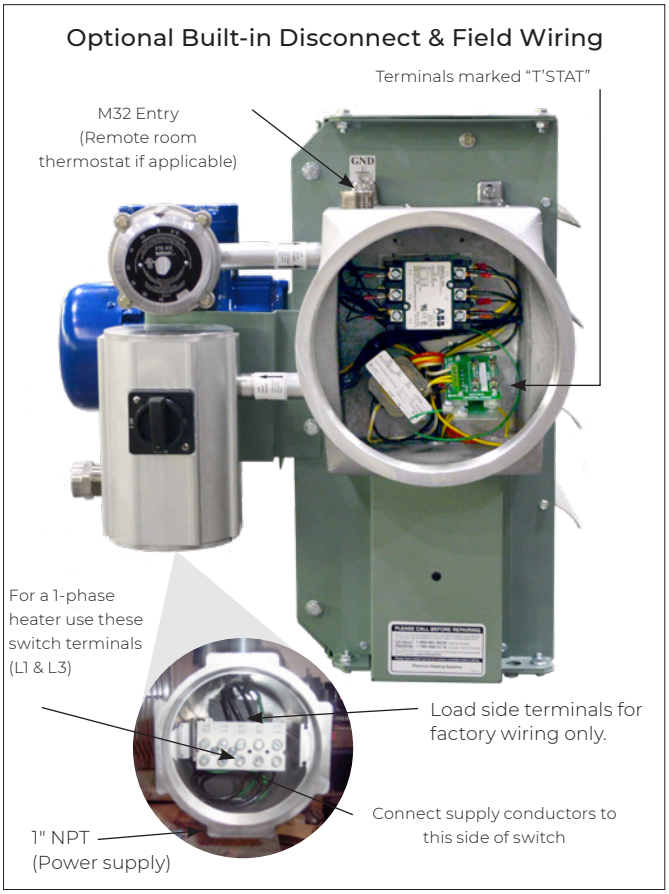


Figure 8

Figure 9

2.5 Anti-condensation heaters: If the motor is fitted with anti-condesation heaters, their power supply must be separated from that of the motor, using the terminals housed in the terminal box.

WARNING

WARNING. The supply of the heater is always monophase and the voltage is different from that of the motor. Check that it corresponds to the one indicated on the plate.

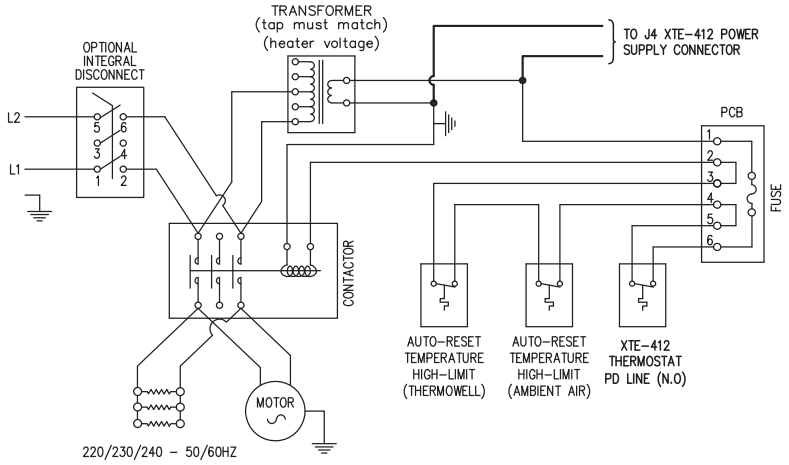
3. Final Inspection

Before application of electrical power:

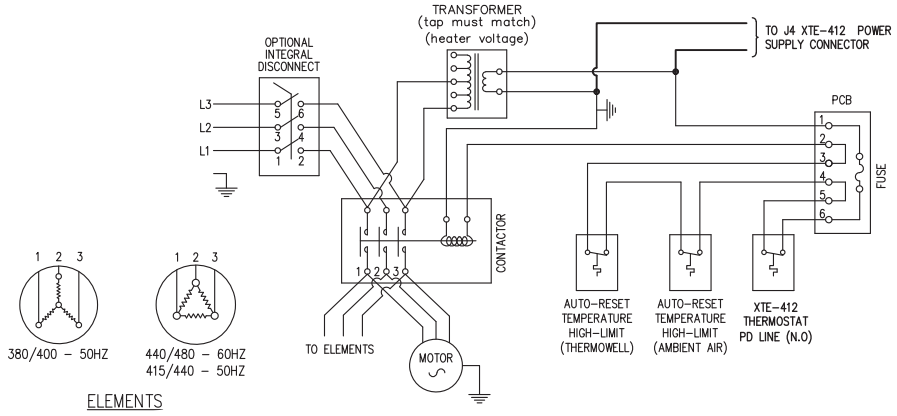
- Check that all connections are secured and comply with the applicable wiring diagram (see D.3 Wiring Schematics, page 11) and code requirements
- Confirm that the power supply is compatible with the data plate rating of the heater
- Remove any foreign objects from the heater
- Install all covers and verify that all enclosures are well secured
- Ensure that the fan rotates freely. See Figure 6, page 9 for proper direction of fan rotation.

D.3 Wiring Schematics

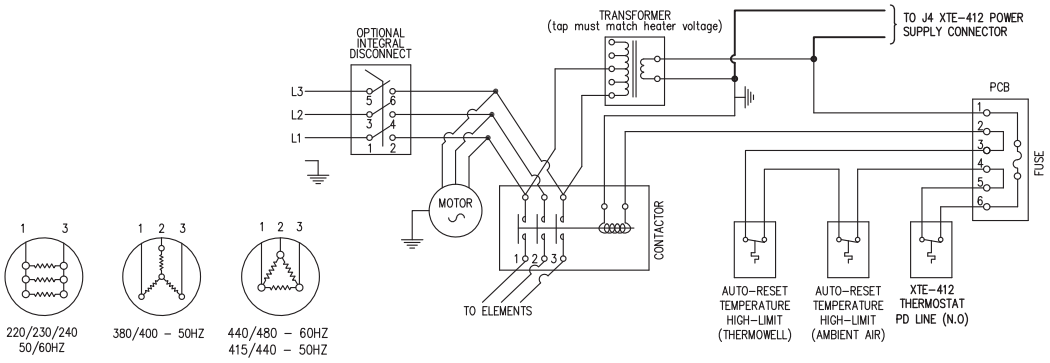
1-Phase



3-Phase



3-Phase
Continuous Fan Option



E. FE2 TECHNICAL DATA

E.1 50 Hz Electric Heaters

Model	Voltage	Nominal Wattage	Heater Wattage	Phase	Max. Motor Nameplate Current	Total Current	Minimum Circuit Ampacity	Supply Wire	Maximum Fuse Size	Temperature Rise		Contactor Part Number
	V	kW	W		A	A	A	AWG	A	°C	°F	
FE2-220150-025	220	2.5	2,270	1	2.72	11.4	14.3	14	15	19.2	10.6	3619
FE2-220150-042	220	4.2	3,950		2.72	19.1	23.9	10	25	32.2	17.9	
FE2-220150-063	220	6.3	6,050		2.72	28.6	35.8	8	40	28.4	15.8	
FE2-220150-084	220	8.4	8,140		2.72	38.2	47.8	6	50	37.8	21.0	
FE2-220150-126	220	12.6	12,100		2.72	57.3	71.6	4	75	27.6	15.3	
FE2-230150-028	230	2.8	2,480		3.30	12.2	15.3	12	20	21.6	12.0	
FE2-230150-046	230	4.6	4,320		3.30	20.0	25.0	10	25	35.6	19.8	
FE2-230150-069	230	6.9	6,610		3.30	30.0	37.5	8	40	31.4	17.4	
FE2-230150-092	230	9.2	8,900		3.30	39.9	49.9	6	50	41.8	23.2	
FE2-230150-138	230	13.8	13,230		3.30	59.9	74.9	4	80	30.5	17.0	
FE2-240150-030	240	3.0	2,700		3.10	12.5	15.6	12	20	23.1	12.8	
FE2-240150-050	240	5.0	4,701		3.10	20.8	26.0	10	30	38.5	21.4	
FE2-240150-075	240	7.5	7,200		3.10	31.2	39.0	8	40	33.9	18.8	
FE2-240150-100	240	10.0	9,690		3.10	41.7	52.1	6	60	45.2	25.1	
FE2-240150-150	240	15.0	14,400		3.10	62.5	78.1	4	80	32.9	18.3	
FE2-380350-025	380	2.5	2,260	3	1.66	3.8	4.8	16	5	20.1	11.2	
FE2-380350-042	380	4.2	3,930		1.66	6.4	8.0	16	10	33.7	18.7	
FE2-380350-063	380	6.3	6,020		1.66	9.6	12.0	14	15	29.7	16.5	
FE2-380350-084	380	8.4	8,100		1.66	12.8	16.0	12	20	39.7	22.0	
FE2-380350-125	380	12.5	12,030		1.66	19.0	23.8	10	25	28.7	15.9	
FE2-380350-167	380	16.7	16,220		1.66	25.4	31.8	8	35	38.3	21.3	
FE2-380350-209	380	20.9	20,230		1.66	31.8	39.8	8	40	23.3	12.9	
FE2-400350-028	400	2.8	2,500		1.60	4.0	5.0	16	5	22.1	12.3	
FE2-400350-046	400	4.6	4,350		1.60	6.6	8.3	14	10	36.3	20.2	
FE2-400350-069	400	6.9	6,670		1.60	10.0	12.5	14	15	32.1	17.8	
FE2-400350-093	400	9.3	8,970		1.60	13.4	16.8	12	20	43.2	24.0	
FE2-400350-139	400	13.9	13,330		1.60	20.1	25.1	10	30	31.4	17.4	
FE2-400350-185	400	18.5	17,970		1.60	26.7	33.4	8	35	41.8	23.2	
FE2-400350-231	400	23.1	22,420		1.60	33.3	41.6	8	45	25.4	14.1	
FE2-415350-037	415	3.7	3,510		1.65	5.1	6.4	16	10	29.1	16.2	
FE2-415350-075	415	7.5	7,240		1.65	10.4	13.0	14	15	34.6	19.2	
FE2-415350-149	415	14.9	14,510		1.65	20.7	25.9	10	30	33.4	18.6	
FE2-415350-187	415	18.7	18,097		1.65	26.0	32.5	8	30	41.9	23.3	
FE2-415350-224	415	22.4	21,820		1.65	31.2	39.0	8	40	24.4	13.6	
FE2-415350-262	415	26.2	25,565		1.65	36.4	45.6	8	45	28.6	15.9	
FE2-440350-042	440	4.2	3,950		1.45	5.5	6.9	16	10	34.8	19.3	
FE2-440350-084	440	8.4	8,140		1.45	11.0	13.8	14	15	39.2	21.8	
FE2-440350-168	440	16.8	16,310		1.45	22.0	27.6	8	30	37.9	21.0	
FE2-440350-210	440	21	20,340		1.45	27.6	34.4	8	35	22.9	12.7	
FE2-440350-252	440	25.2	24,528		1.45	33.1	41.3	8	45	27.4	15.2	
FE2-440350-294	440	29.4	28,738		1.45	38.6	48.2	8	50	32.0	17.8	

Notes

1. Minimum conductor size for 30˚C ambient. Derate conductor for ambient temperature. Use minimum 90˚C insulation.
2. Heater is functioning normally if at rated voltage the amp draw is within 10% of the value in this table.
3. Operation at lower voltages will result in reduced heat output and amp draw.
4. Add “T” to model number when adding a built-in thermostat.
5. Add "D" to model number for units with disconnect switch option.
6. Add "C" to model number for units with Heresite® coated panels and core.
7. Add "A" to model number for units with stainless steel cabinet.
8. Add "U" to model number for units with continuous fan option.
9. Add "B" for minimum ambient temperature of -50˚C. Contact factory for available models.
10. Add "M25" for M25 adapter field entry.
11. Add "L" to model number for units with large box option.

E.2 60 Hz Electric Heaters

Model	Voltage	Nominal Wattage	Heater Wattage	Phase	Max. Motor Nameplate Current	Total Current	Minimum Circuit Ampacity	Supply Wire	Maximum Fuse Size	Temperature Rise		Contactor Part Number
	V	kW	W		A	A	A	AWG	A	°C	°F	
FE2-220160-025	220	2.5	2,270	1	2.72	11.4	14.2	14	15	15.6	8.7	3619
FE2-220160-042	220	4.2	3,950		2.72	19.1	23.9	10	25	26.2	14.6	
FE2-220160-063	220	6.3	6,050		2.72	28.6	35.8	8	40	23.1	12.8	
FE2-220160-084	220	8.4	8,140		2.72	38.2	47.7	6	50	30.8	17.1	
FE2-220160-126	220	12.6	12,100		2.72	57.3	71.6	2	75	22.5	12.5	
FE2-230160-028	230	2.8	2,480		3.30	12.2	15.2	12	20	17.3	9.6	
FE2-230160-046	230	4.6	4,317		3.30	20.0	25.0	10	25	28.5	15.8	
FE2-230160-069	230	6.9	6,613		3.30	30.0	37.5	8	40	25.2	14.0	
FE2-230160-092	230	9.2	8,899		3.30	40.0	50.0	6	50	33.6	18.6	
FE2-230160-138	230	13.8	13,225		3.30	60.0	75.0	2	80	24.5	13.6	
FE2-240160-030	240	3.0	2,700		1.98	12.5	15.6	12	20	18.8	10.4	
FE2-240160-050	240	5.0	4,701		1.98	20.8	26.0	10	30	31.3	17.4	
FE2-240160-075	240	7.5	7,200		1.98	31.3	39.1	8	40	27.5	15.3	
FE2-240160-100	240	10.0	9,690		1.98	41.7	52.1	6	60	36.7	20.4	
FE2-240160-150	240	15.0	14,400		1.98	62.5	78.1	2	80	26.8	14.9	
FE2-440360-042	440	4.2	3,950	3	1.45	5.5	6.9	16	10	29.0	16.1	
FE2-440360-084	440	8.4	8,142		1.45	11.0	13.8	14	15	34.1	18.9	
FE2-440360-168	440	16.8	16,310		1.45	22.0	27.6	8	30	33.1	18.4	
FE2-440360-210	440	21	20,343		1.45	27.6	34.4	8	35	20.1	11.2	
FE2-440360-252	440	25.2	24,530		1.45	33.1	41.3	8	50	24.1	13.4	
FE2-440360-294	440	29.4	28,740		1.45	38.6	48.2	6	50	28.1	15.6	
FE2-480360-030	480	3	2,700		1.63	3.6	4.5	14	15	19.8	11.0	
FE2-480360-050	480	5	4,701		1.63	6.0	7.5	14	15	33.0	18.3	
FE2-480360-075	480	7.5	7,200		1.63	9.0	11.3	14	15	29.1	16.1	
FE2-480360-100	480	10	9,690		1.63	12.0	15.0	14	15	38.8	21.5	
FE2-480360-150	480	15	14,400		1.63	18.0	22.6	10	25	28.3	15.7	
FE2-480360-200	480	20	19,410		1.63	24.1	30.1	8	35	37.7	20.9	
FE2-480360-250	480	25	24,210		1.63	30.1	37.6	8	40	22.9	12.2	
FE2-480360-300	480	30	29,190		1.63	36.1	45.1	8	50	27.5	14.6	
FE2-480360-350	480	35	34,200		1.63	42.1	52.6	6	60	32.0	17.1	

Notes

1. Minimum conductor size for 30˚C ambient. Derate conductor for ambient temperature. Use minimum 90˚C insulation.
2. Heater is functioning normally if at rated voltage the amp draw is within 10% of the value in this table.
3. Operation at lower voltages will result in reduced heat output and amp draw.
4. Add “T” to model number when adding a built-in thermostat.
5. Add "D" to model number for units with disconnect switch option.
6. Add "C" to model number for units with Heresite® coated panels and core.
7. Add "A" to model number for units with stainless steel cabinet.
8. Add "U" to model number for units with continuous fan option.
9. Add "B" for minimum ambient temperature of -50˚C. Contact factory for available models.
10. Add "M25" for M25 adapter field entry.
11. Add "L" to model number for units with large box option.

F. SPECIFICATIONS

F.1 50 Hz Models

			Nominal kW							
			2.5 – 3.0	3.7 – 5.0	6.3 – 7.5	8.4 – 10.0	12.5 – 13.9	14.9 – 20	20.9 – 21	22.4 – 29.4
Altitude (max.)	ft		12,000	8,000	10,000	7,000	10,000	7,000	10,000	7,000
	m		3,658	2,438	3,048	2,134	3,048	2,134	3,048	2,134
Air Flow (min.)	@ 70°F (CFM)		387		678		1,404		2,905	
	@ 21°C (m^3/hr)		658		1,152		2,385		4,936	
Horizontal Air Throw	ft		13		25		35		60	
	m		4.0		7.6		10.7		18.2	
Maximum Mounting Height (to underside)	ft		7		10		10		20	
	m		2.1		3.0		3.0		6.1	
Motor Speed (min.)	RPM		1360							
Fan Diameter	in		12				16		20	
	mm		305				406		508	
Net Weight	without DS5	lbs	174				202		235	
		kg	79				92		107	
	with DS5	lbs	186				214		247	
		kg	84				97		112	
Shipping Weight	without DS5	lbs	228				252		286	
		kg	103				114		130	
	with DS5	lbs	240				264		298	
		kg	109				120		135	

Specifications for all 50 Hz and 60 Hz Models

1. Temperature Code Rating — T3 (200°C).
2. Enclosures — IP55 rated, indoor use only. Do not immerse in water.
3. Motor Type — Explosion-proof. Thermally protected. Permanently lubricated ball bearings. IP55 rated.
4. Fan — Aluminum blade. Steel spider and hub with 3/4" (19 mm) bore.
5. Fan Guard — Split design with close wire spacing. 1/4" (6.3 mm) diameter probe will not enter.
6. Mounting Holes — Four 5/8". (15.9 mm) diameter holes at top.
7. Heating Elements — Three long-life, low watt-density, high grade metal-sheathed elements.
8. Temperature High-Limit — Automatic reset type, snap-action bimetal, open on temperature rise. Rated 100,000 cycles at 10 amps, handles 0.130 amps.
9. Control Circuit — 115V, 0.130 amps, 15 VA. (Grounded).
10. Optional Built-in Thermostat — Explosion-proof. 0°C to 40°C .
11. Control Transformer — Multi-tap primary, 115V secondary, 50 VA.
12. Contactor — 75 amps. Rated for 1,000,000 mechanical operations. 120V, 15 VA coil (separately fuse-protected).
13. Heat Transfer Fluid — Water and corrosion inhibitors.
14. Cabinet Material — 12 ga. (2.60 mm) steel. Epoxy coated with five-stage pretreatment, including iron phosphate.
15. Core — Steel with integral aluminum fins, vacuum charged and hermetically sealed.
16. Conduit Material — Heavy walled, 3.1 mm steel.
17. Overpressure Protection — Preset 100 psig (690 kPa) seep pressure relief valve, aluminum body, no field serviceable parts.
18. Operational Temperature Limitations — -20°C to 40°C. -50°C available on most 3 phase models.
19. Storage Limitations — -50°C to 80°C, short term to 120°C. Do not immerse in water. Do not expose to rain or snow.

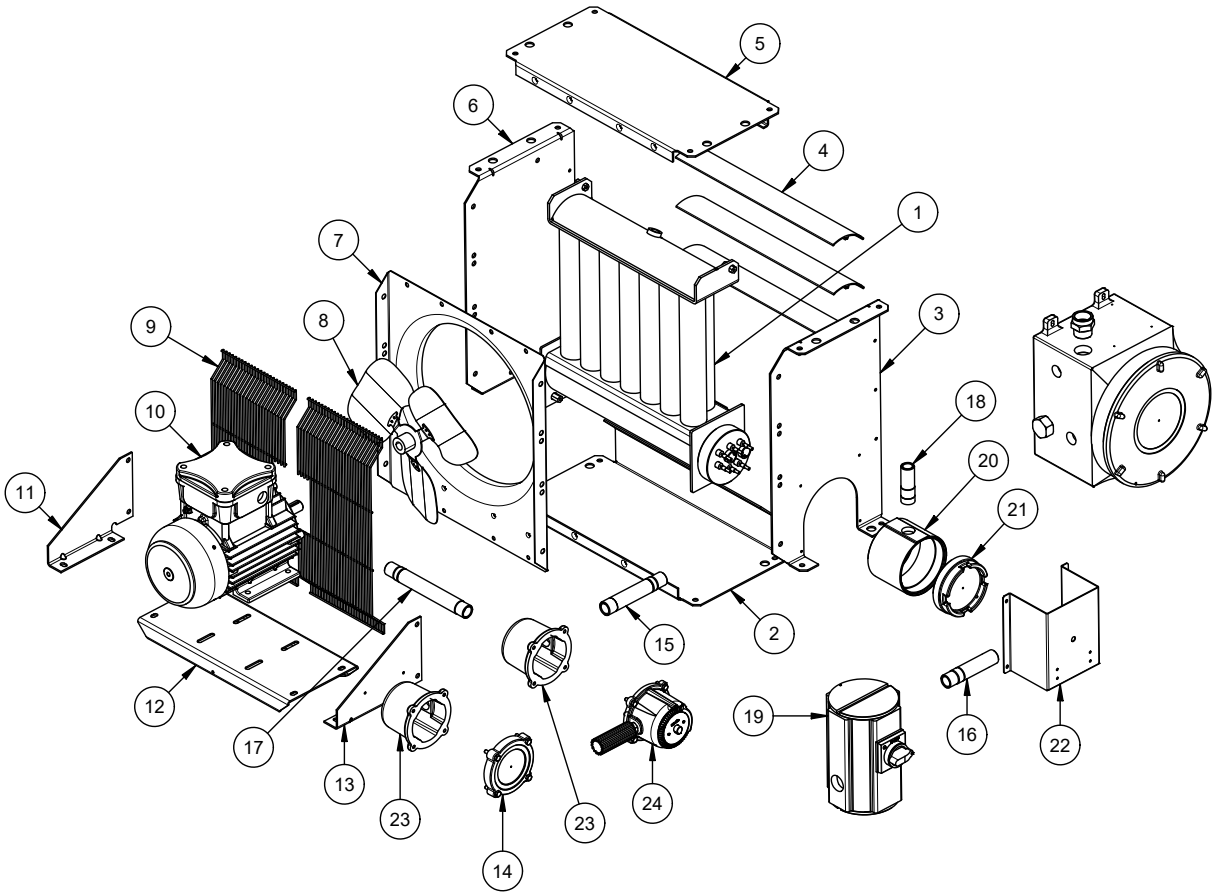
F.2 60 Hz Models

			Nominal kW							
			2.5 – 3.0	3.7 – 5.0	6.3 – 7.5	8.4 – 10	12.5 – 13.9	14.9 – 20	20.9 – 21	22.4 – 35.0
Altitude (max.)	ft		12,000	8,000	10,000	7,000	10,000	7,000	10,000	7,000
	m		3,658	2,438	3,048	2,134	3,048	2,134	3,048	2,134
Air Flow (min.)	@ 70°F (CFM)		394		670		1,380		2,838	
	@ 21°C (m^3/hr)		669		1138		2,345		4,822	
Horizontal Air Throw	ft		15		30		40		70	
	m		4.6		9.1		12.2		21.3	
Maximum Mounting Height (to underside)	ft		7		10		10		20	
	m		2.1		3.0		3.0		6.1	
Motor Speed (min.)	RPM		1360							
Fan Diameter	in		12				16		20	
	mm		305				406		508	
Net Weight	without DS5	lbs	174				202		235	
		kg	79				92		107	
	with DS5	lbs	186				214		247	
		kg	84				97		112	
Shipping Weight	without DS5	lbs	228				252		286	
		kg	103				114		130	
	with DS5	lbs	240				264		298	
		kg	109				120		135	

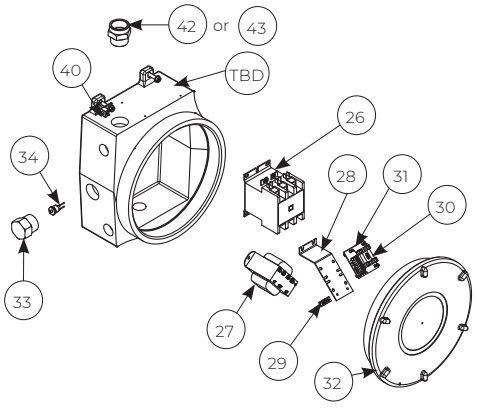
Specifications for all 50 Hz and 60 Hz Models

1. Temperature Code Rating — T3 (200°C).
2. Enclosures — IP55 rated, indoor use only. Do not immerse in water.
3. Motor Type — Explosion-proof. Thermally protected. Permanently lubricated ball bearings. IP55 rated.
4. Fan — Aluminum blade. Steel spider and hub with 3/4" (19 mm) bore.
5. Fan Guard — Split design with close wire spacing. 1/4" (6.3 mm) diameter probe will not enter.
6. Mounting Holes — Four 5/8". (15.9 mm) diameter holes at top.
7. Heating Elements — Three long-life, low watt-density, high grade metal-sheathed elements.
8. Temperature High-Limit — Automatic reset type, snap-action bimetal, open on temperature rise. Rated 100,000 cycles at 10 amps, handles 0.130 amps.
9. Control Circuit — 115V, 0.130 amps, 15 VA. (Grounded).
10. Optional Built-in Thermostat — Explosion-proof. 0°C to 40°C .
11. Control Transformer — Multi-tap primary, 115V secondary, 50 VA.
12. Contactor — 75 amps. Rated for 1,000,000 mechanical operations. 120V, 15 VA coil (separately fuse-protected).
13. Heat Transfer Fluid — Water and corrosion inhibitors
14. Cabinet Material — 12 ga. (2.60 mm) steel. Epoxy coated with five-stage pretreatment, including iron phosphate.
15. Core — Steel with integral aluminum fins, vacuum charged and hermetically sealed.
16. Conduit Material — Heavy walled, 3.1 mm steel.
17. Overpressure Protection — Preset 100 psig (690 kPa) seep pressure relief valve, aluminum body, no field serviceable parts.
18. Operational Temperature Limitations — -20°C to 40°C. -50°C available on most 3 phase models.
19. Storage Limitations — -50°C to 80°C, short term to 120°C. Do not immerse in water. Do not expose to rain or snow.

G. PARTS ASSEMBLY DIAGRAM

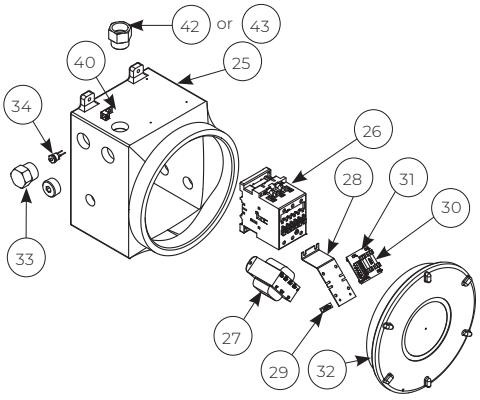


Slim Control Enclosure



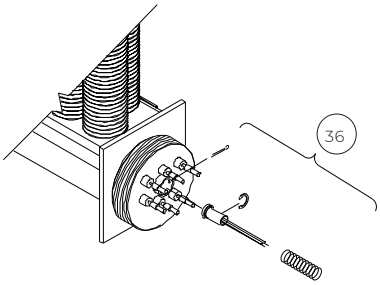
Bus-Bar Configuration for all
1-Phase Models

Large Control Enclosure

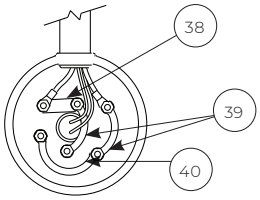


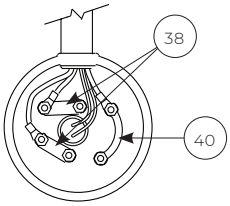
Bus-Bar Configuration
for all 3-Phase
(Except 380V & 400V 50 Hz Models)

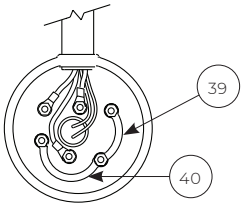
High Limit



Bus-Bar Configuration
for all 3-Phase
(380V & 400V 50 Hz Models)







H. FE2 PARTS LIST

Please have model and serial number available before calling

Item	Description	2.5 – 5.0 kW	6.3 – 10 kW	12.5 – 20 kW	20.9 – 35.0 kW
1	Core	**			
2	Panel, Bottom	Painted: 12694-02 S.S.: 12694-03		Painted: 12699-02 S.S.: 12699-03	Painted: 12704-03 S.S.: 12704-03
3	Panel, Left Side	Painted: 12341-02 S.S.: 12341-03		Painted: 12342-02 S.S.: 12342-03	Painted: 12343-02 S.S.: 12343-03
4	Louver Kit, c/w screws	4075		4076	4077
5	Panel, Top	Painted: 12693-02 S.S.: 12693-03		Painted: 12698-02 S.S.: 12698-02	Painted: 12703-02 S.S.: 12703-03
6	Panel, Right	Painted: 12344-02 S.S.: 12344-03		Painted: 12345-02 S.S.: 12345-03	Painted: 12346-02 S.S.: 12346-03
7	Panel, Fan Shroud	Painted: 12347-02 S.S.: 12347-03		Painted: 12348-02 S.S.: 12348-03	Painted: 12349-02 S.S.: 12349-03
8	Fan Blade	12488	12489	12490	12491
9	Fan Guard Kit	Painted: 4078 S.S.: 9504		Painted: 4079 S.S.: 9505	Painted: 4080 S.S.: 9506
10	220/230V 1Ph 50 Hz	12350			
	380V – 440V 3Ph 50 Hz	12351			
11	Bracket, Motor Mount Right	Painted: 12337-02 S.S.: 12337-03			
12	Channel, Motor Mount	Painted: 12338-02 S.S.: 12338-03			
13	Bracket, Motor Mount Left	Painted: 12336-02 S.S.: 12336-03			
14	Cover, Thermostat Enclosure	5371			
15	Conduit, Control Enclosure	-			
16	Conduit, Integral Disconnect	-			
17	Conduit, Motor	-			
18	Conduit, Element Enclosure	-			
19	Assembly, Integral Disconnect	12398			
20	Enclosure, Element	9679			
21	Cover, Element Enclosure	7392			
22	Panel, Element Enclosure Guard	Painted: 12695-02 S.S.: 12695-03			
23	Enclosure, Thermostat	4983			
24	Thermostat, Built-in Kit, CE	13591			
25	Enclosure, Control	-			
26	Contactor	3619			
27	Transformer	12290 (60 Hz) / 11295 (50 Hz)			
28	Bracket, Printed Circuit Board	3809			
29	Terminal, 6-14 Ga. Screw Lug	1876			
30	Fuse, Buss MDQ - 1/2 amp	9357			
31	Assembly, Printed Circuit Board	3514			
32	Cover, Control Enclosure	9158			
33	Thermowell, Ambient High-Limit	9267			
34	High-Limit, Ambient Temperature	-			
35	Plug, 1" NPT Explosion Proof	12812			
36	Temperature High-Limit Kit	-			
37	Bus-Bar, Straight	Provided with Core Kits**			
38	Bus-Bar, Small Curved				
39	Bus-Bar, Large Curved				
40	Kit, DS5 Assembly	-			Kit, DS5 Assembly
41	Terminal, 6-14 Ga. Lug, 1/4 Mtg. Hole	7401			
42	Adapter, 1.0 NPT to M32 ATEX	12814			
43	Adapter, 1.0 NPT to M25 ATEX	12813			

** See technical data table for part numbers. Note: For items not shown, contact factory.

I. REPAIR & REPLACEMENT

WARNING

Disconnect heater from power supply at integral disconnect or fuse box before opening enclosures or servicing heater.

IF INTEGRAL DISCONNECT IS BEING SERVICED, verify that power has been disconnected at fuse box or main panel.

Lock the switch in the **"OFF"** (open) position and/or tag the switch to prevent unexpected power application.

This heater should only be serviced by personnel with heating and hazardous location equipment experience.

1. After repairing any component:
   - 1.1 Check that electrical connections are correct and secure (see D.3 Wiring Schematics, page 11).
   - 1.2 Remove any foreign material from enclosures
   - 1.3 Install and secure all covers
   - 1.4 Ensure that all fasteners are tight
   - 1.5 Remove all foreign objects from heater
   - 1.6 Ensure air exits through louvers and fan rotates counterclockwise when viewed from rear of heater (see Figure 14, page 19).
2. Core
   - 2.1 The heater core is vacuum charged and not field repairable.

     For core removal:

     – Remove cabinet bottom and element enclosure cover.
   - 2.2 Disconnect all wires entering element enclosure (see Figure 10, page 18).
   - 2.3 Slightly loosen all cabinet bolts shown in Figure 10, page 18, to prevent the core from binding.
   - 2.4 With an assistant supporting the weight of the core, remove the 3 core mounting bolts. Carefully lower the core out of the cabinet (see Figure 11, page 18).
   - 2.5 To return core to factory, use crate supplied with exchange core to protect the element terminals and plate threads.
   - 2.6 To reinstall, lift the core up into cabinet while an assistant guides the element wires into the element enclosure conduit.
   - 2.7 Position the core and tighten the 3 core mounting bolts. Tighten the remaining cabinet bolts.
3. Temperature High-Limit
   - 3.1 Remove temperature high-limit assembly and clean the inside of the thermowell (Figure 12, page 18). A clean thermowell will ensure good thermal contact.
   - 3.2 Use only a factory supplied temperature high-limit to ensure safe operation.
   - 3.3 Apply a small drop, 3/32" (2 mm) diameter, of heat sink compound to the center of the metal cap but do not spread. This is critical for proper thermal contact between the temperature high-limit and the thermowell (Figure 12, page 18).

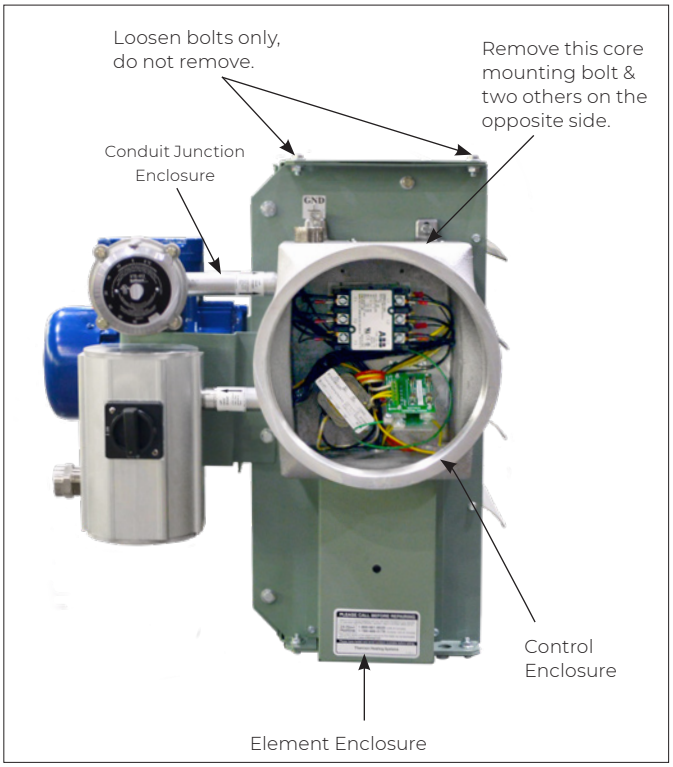


Figure 10

Figure 11

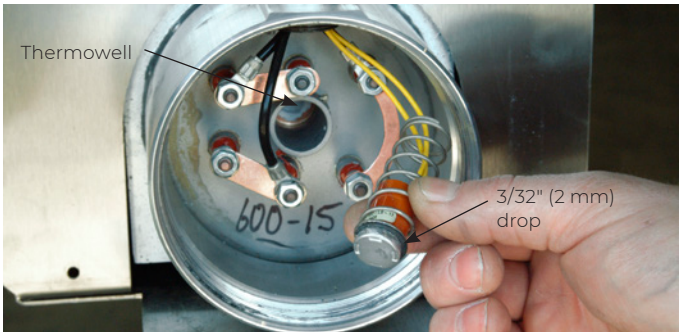


Figure 12

3.4 Reinstall the temperature high-limit assembly with the snap ring and spring into the thermowell without damaging the insulating tube. Secure in place with the cotter pin (see Figure 13, page 19).

4. Motor, Fan, & Fan Guard

4.1 Remove bolts holding the motor to the motor mount. On units with a built in thermostat, remove the bolts on the back of the thermostat enclosure.

4.2 Remove conduit #1 located between motor junction box and control enclosure by turning it in the direction illustrated (see Figure 14, page 19).

NOTE: Conduits #1 and #2 are not interchangeable and have left hand threads on one end, this end is indicated by a machined groove.

4.3 Remove the two-piece fan guard assembly (see Figure 15, page 19).

4.4 Lift the motor assembly off the motor mount.

4.5 Before removing the fan, measure and record the location of the fan hub on the motor shaft (see Figure 16, page 19. If difficult to remove, use a gear puller on the fan hub.

4.6 To reassemble, place motor assembly onto motor mount and fasten the fan guard to cabinet.

4.7 Simultaneously engage and tighten both ends of conduit #1 into enclosures. Leave a 1/16" to 3/16" (1.6 to 4.8 mm) gap between the motor and fan guard (Figure 16, page 19). Adjust conduit #2 to center the fan in the shroud.

4.8 To ensure a minimum 5 thread engagement, threaded ends of conduits must protrude a minimum of 1/16" (1.6 mm) into enclosures. The groove on conduit #2 must not be more than 7/8" (22 mm) from motor coupling (see Figure 14, page 19).

4.9 Bolt motor to motor mount. Manually spin the fan blade to ensure fan rotates freely.

4.10 Air must exit through louvers and fan must rotate counterclockwise when viewed from rear of heater (see Figure 14, page 19).

5. Printed Circuit Board

5.1 After removing the printed circuit board (P.C. Board) bracket assembly from the control enclosure, separate the P.C. Board from the bracket by cutting off the plastic spacers (Figure 18, page 20)

5.2 Reinstall a new factory supplied P.C. Board onto the mounting bracket using new non-conducting spacers of the same length. Spacers are supplied with a new P.C. Board. Reinstall the control circuit ground wire to the printed circuit board bracket (see D.3 Wiring Schematics, page 11).

6. Industrial Contactor

6.1 Replace with a factory supplied contactor of the same rating.

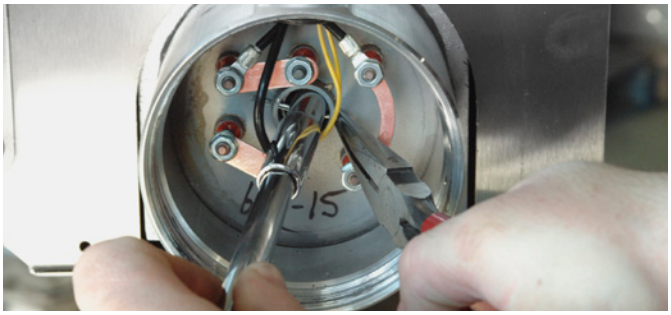


Figure 13

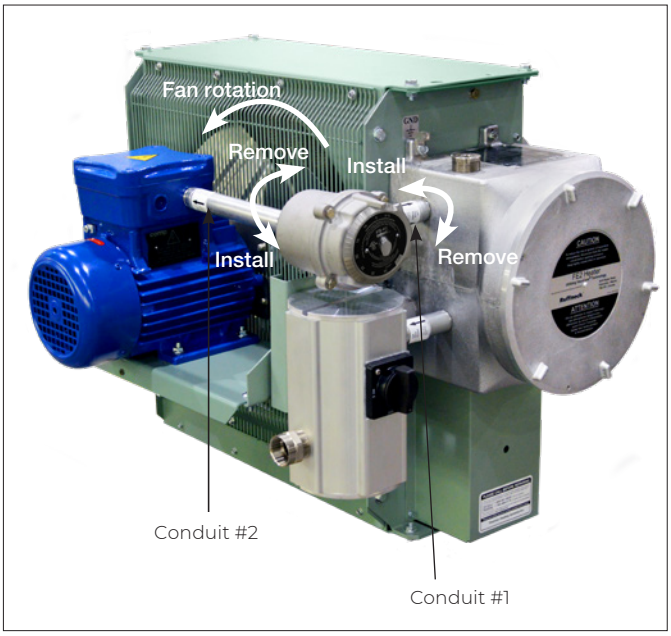


Figure 14

Figure 15

Figure 16

7. Transformer

7.1 Replace with a factory supplied transformer of the same rating.

7.2 On the new transformer, select primary wires to match heater voltage.

7.3 Ensure that the correct transformer secondary lead is grounded (D.3 Wiring Schematics, page 11). Individually terminate all unused wires using closed end connectors.

8. Fuse

8.1 Replace fuse with one of the same type and rating as indicated on P.C. Board or refer to parts list. An extra fuse should be stored in the clips marked “SPARE”.

9. Heating elements

9.1 Heating elements are an integral part of the vacuum charged core. A factory exchange core can be shipped immediately from stock. Refer to 2. Core, page 18 for details.

10. Cabinet panels

10.1 Bolt-on cabinet panels are individually replaceable.

11. Thermostat Cover Screws

11.1 Replace thermostat cover bolts with four plated steel hex head bolts, M6 x 20 mm long property class 9.8, 720 MPa minimum yield strength.

Figure 17

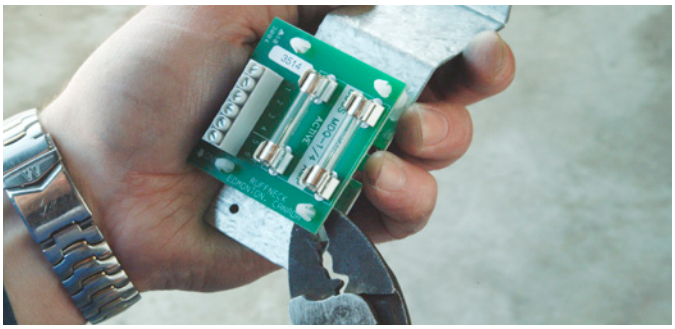


Figure 18

NOTES

NOTES

Directive 2003/108/EC ammendment to the Directive 2002/96/EC of the European Parliament and of the Council on Waste Electrical and Electronic Equipment (WEEE).

1. The equipment that you bought is WEEE marked and has required the extraction and use of natural resources for its production. It may contain substances that could impact health and the environment. As such it is a requirement not to dispose of WEEE marked equipment as unsorted municipal waste and to collect such WEEE marked equipment separately.
2. In order to avoid the dissemination of those substances in our environment and to diminish the pressure on natural resources, we encourage you to use the appropriate take-back systems in your area. Those systems will reuse or recycle most if not all of the materials of your equipment in a sound way.
3. The crossed-out wheeled bin symbol on this equipment invites you to use those systems.
4. If you need more information on collection, reuse and recycling systems in your area, please contact your local or regional waste management administration.

Ruffneck™

PLEASE ADHERE TO INSTRUCTIONS IN THIS MANUAL

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

For further assistance, please call 24hr hotline: 1-800-661-8529 (U.S.A. and Canada)
Please have model and serial numbers available before calling.

WARRANTY: Under normal use the Company warrants to the purchaser that defects in material or workmanship will be repaired or replaced without charge for a period of 18 months from date of shipment, or 12 months from the start date of operation, whichever expires first. Any claim for warranty must be reported to the sales office where the product was purchased for authorized repair or replacement within the terms of this warranty.

Subject to State or Provincial law to the contrary, the Company will not be responsible for any expense for installation, removal from service, transportation, or damages of any type whatsoever, including damages arising from lack of use, business interruptions, or incidental or consequential damages.

The Company cannot anticipate or control the conditions of product usage and therefore accepts no responsibility for the safe application and suitability of its products when used alone or in combination with other products. Tests for the safe application and suitability of the products are the sole responsibility of the user.

This warranty will be void if, in the judgment of the Company, the damage, failure or defect is the result of:

- Vibration, radiation, erosion, corrosion, process contamination, abnormal process conditions, temperature and pressures, unusual surges or pulsation, fouling, ordinary wear and tear, lack of maintenance, incorrectly applied utilities such as voltage, air, gas, water, and others or any combination of the aforementioned causes not specifically allowed for in the design conditions or,
- Any act or omission by the Purchaser, its agents, servants or independent contractors which for greater certainty, but not so as to limit the generality of the foregoing, includes physical, chemical or mechanical abuse, accident, improper installation of the product, improper storage and handling of the product, improper application or the misalignment of parts.

No warranty applies to paint finishes except for manufacturing defects apparent within 30 days from the date of installation.

The Company neither assumes nor authorizes any person to assume for it any other obligation or liability in connection with the product(s).

The Purchaser agrees that all warranty work required after the initial commissioning of the product will be provided only if the Company has been paid by the Purchaser in full accordance with the terms and conditions of the contract.

The Purchaser agrees that the Company makes no warranty or guarantee, express, implied or statutory, (including any warranty of merchantability or warranty of fitness for a particular purpose) written or oral, of the Article or incidental labour, except as is expressed or contained in the agreement herein.

LIABILITY: Technical data contained in the catalog or on the website is subject to change without notice. The Company reserves the right to make dimensional and other design changes as required. The Purchaser acknowledges the Company shall not be obligated to modify those articles manufactured before the formulation of the changes in design or improvements of the products by the Company.

The Company shall not be liable to compensate or indemnify the Purchaser, end user or any other party against any actions, claims, liabilities, injury, loss, loss of use, loss of business, damages, indirect or consequential damages, demands, penalties, fines, expenses (including legal expenses), costs, obligations and causes of action of any kind arising wholly or partly from negligence or omission of the user or the misuse, incorrect application, unsafe application, incorrect storage and handling, incorrect installation, lack of maintenance, improper maintenance or improper operation of products furnished by the Company.

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