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Heatcraft Subco Pty Ltd ABN 42 624 910 041

# ***Kirby Heavy Duty Evaporator “E” Series HANDBOOK***

***For Units up to 54 kW (Enhanced grooved tube version)***



**THANK YOU** for purchasing refrigeration products from Heatcraft. Please read and apply the following procedures carefully in order to fully utilize the equipment you purchased. This instruction booklet is only applicable to Kirby Heavy Duty Evaporators marketed as the Kirby KHDCE / KHDPE range.

## **IMPORTANT INFORMATION**

**REFER TO THE SECTIONS ON  
“WARNINGS AND SAFEGUARDS”, AND “INSTALLATION INSTRUCTIONS”  
BEFORE ATTEMPTING TO COMMISSION THIS EVAPORATOR.**

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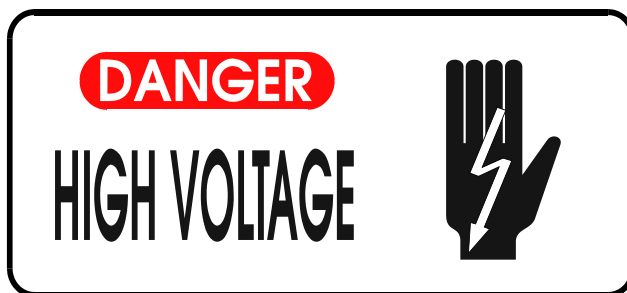
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## Warnings and Safeguards



**Under no circumstances should anyone other than a qualified person attempt to gain access to the interior of the unit without first ensuring electric power is disconnected.**

- Personal Protective Equipment such as gloves, eyewear and footwear should be used during any work carried out on this product.
  - Installation, commissioning, testing, decommissioning and service maintenance should be performed only by qualified personnel (refrigeration mechanics and/or electricians) who have sufficient knowledge in this type of equipment. It is the purchaser's responsibility to co-ordinate with qualified personnel as required.
  - All units are pressurised with dry air or Nitrogen gas. Care must be taken to discharge the pressurised gas carefully prior to installing or commissioning the equipment.
  - Avoid contact with sheet-metal edges and the coil fins. They can be sharp and are a potential personal injury hazard.
- Refrigerant can be harmful if it is inhaled and/or makes contact with exposed skin. Refrigerants used in this equipment are controlled substances, and must be used and recovered responsibly. It is against the law to deliberately discharge controlled substances into the environment. Extreme care must be taken when handling refrigerant, as personal injury or death may occur.
- All field wiring must conform to the requirements of the equipment and all applicable National and Local Codes. All power sources must be disconnected before the commencement of any service, maintenance or electrical work.
  - Avoid contact refrigerant pipes and heat transfer surfaces when the equipment is operating. Their extreme hot or cold surfaces may result in skin burns.
- **WARNING:** Do not insert any object into operating fans. Ignoring this warning may result in personal injury and/or severe equipment damage and consequences.
- Fans operate continuously even when the refrigeration system has 'cycled off'. The exception is on freezer models where the fans will cycle off during defrost.
  - Keep the floor of refrigerated rooms dry. Slippage due to ice formation on the floor is a potential personal injury hazard.

## Purpose

These Heavy Duty Evaporator ranges are standard OEM products of Heatcraft; they comprise both 'medium' and 'low' temperature ranges. They are intended for typical commercial sized cool room and freezer applications for the storage of vegetables, fresh meat, general foodstuffs, beverages, etc. They are not intended for environments that may have harmful, corrosive or flammable atmospheres or for the storage of corrosive or flammable chemicals. 'Marine' environments are considered corrosive; please consult Heatcraft before installing in this environment.

## Standard Design Conditions

**MAXIMUM ALLOWABLE PRESSURE (PS/PSS)**

UNIT DATA	
PS (kPag)	PSS (kPag)
3000	n/a

Medium temperature range evaporators (Kirby KHDCE series) are designed at  $-4^{\circ}\text{C}$  saturation suction temperature (SST) and 6 KTD to suit room temperature from  $+1^{\circ}\text{C}$  to  $+20^{\circ}\text{C}$  (refer to technical data for maximum and minimum allowed KTD for specific SST), for use in 'heavy duty' commercial cool room applications. For rooms below  $+1^{\circ}\text{C}$ , KHDCE range can be used as these evaporators are equipped with defrost heater as standard feature. R507/R404A is recommended refrigerant. For other refrigerants, please refer to sales data sheet for capacity variations.

Low temperature range evaporators (Kirby KHDFE series) are designed at  $-24^{\circ}\text{C}$  SST and 6 KTD to suit room temperatures from  $-4^{\circ}\text{C}$  to  $-32^{\circ}\text{C}$  (refer to technical data for maximum and minimum allowed KTD for specific SST), for use in 'heavy duty' commercial freezer room applications. R507 or R404A are the recommended refrigerants. For other refrigerants, please refer to sales data sheet for capacity variations. For lower temperatures design variations may be required.

These standard evaporators cannot use Ammonia ( $\text{NH}_3$ ) as refrigerant.

For special design requirements (non standard conditions and/or refrigerants such as Glycol, Hydrocarbons, etc), please inquire with your local representatives and/or Heatcraft local branches, or call our national telephone number 13 23 50 (Au) or 0800653330 (NZ) for your nearest available information resources.

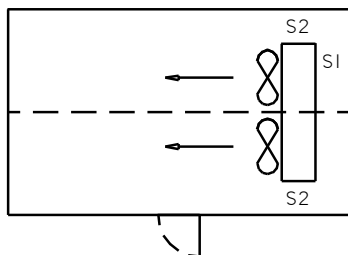
**Recommended Placement and Clearance**

Some general rules for evaporator placement shall be followed:

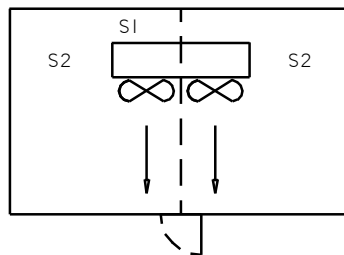
- The air pattern shall cover the entire room or effective area.
- Do **NOT** locate evaporators over doors.
- Locate aisles, racks, etc so as not to hinder the discharge or return airflow of the evaporator.
- Locate relative to compressors for minimum pipe runs.
- Locate condensate drains for minimum pipe runs.

Minimum clearance shall be guaranteed:

- S1 - Allow 600mm or more between the wall and air on side of the coil, for airflow.
- S2 - Allow 400mm or more between the wall and the access panel for service convenience.

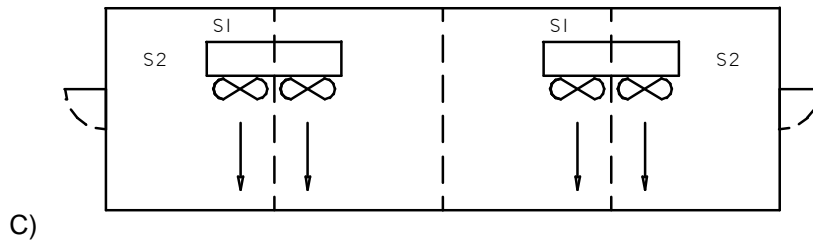
**Where one side of wall mounting is satisfactory.**

A)

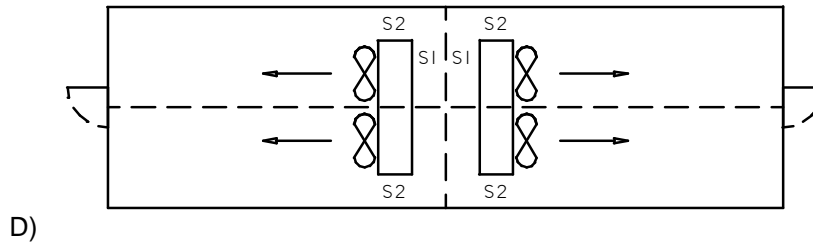


B)

A) is preferred placement. B) is an alternative, because it discharges air at the door. (However, it is still better than mounting over the door)

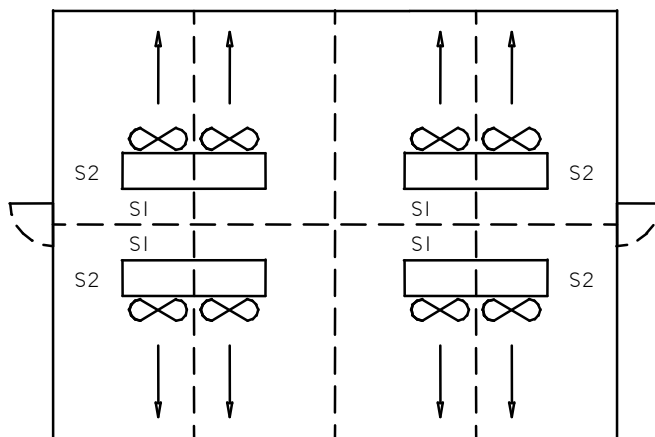


C) is preferred placement.

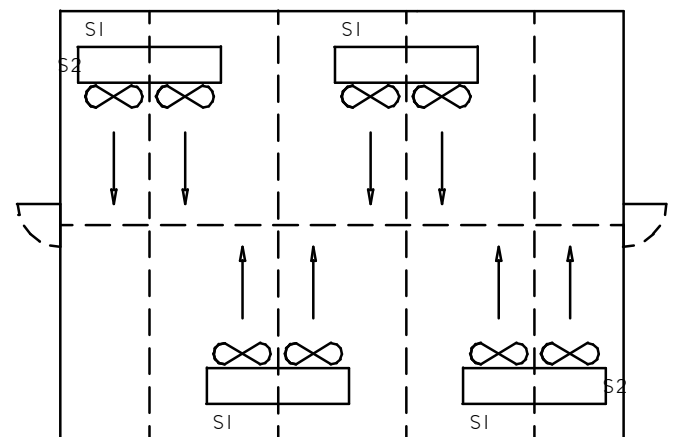


D) is an alternative for the same reason as B).

**Where one side of wall mounting will not accommodate all required units or air throw distance must be considered.**



Preferred Placement



Second Choice due to possible airflow collision and defrost difficulties



## **Installation Instructions**

This product must be installed and maintained in accordance with the following:

- AS/NZS5149:2016 – Parts 3 & 4 (as applicable)
- AS4041:1998 – Pressure Piping
- Refrigerant Handling Code of Practice, Part 2  
Useful information-
- Ozone Protection and Synthetic Greenhouse Gas Management Act 1989 (and amendments) and Regulations 1995
- AIRAH, DA19 – HVAC&R Maintenance
- CIBSE Code M - Commissioning Management

**NOTE-** There may be other applicable Codes and Standards that must be considered. It is the responsibility of the Installer and Owner to ensure all requirements are considered and complied with.

## a) Lifting of Unit



The weight of the unit ranges from 85 to 380kg. Always use the appropriate mechanical handling equipment to lift the unit into place.

## b) Unpacking of Unit

When unpacking, check for any damage to packing material or the unit itself, which may affect the unit's performance. **If any such damage is evident, please contact your Heatcraft branch.**

## c) Mounting the Unit

These evaporators can be mounted with threaded rods and bolts. As a general rule, the single 5/16" rod, and bolts and washers can lift the weight up to 110kg (250 lb), 3/8" for up to 270kg (600 lb). However it is the installer's responsibility to ensure the evaporators mounted securely and professionally.

To comply with HACCP and/or relevant regulations for food safety, the area above the evaporator must be sealed or exposed in such a way to facilitate hand cleaning without the use of tools. So depending on the end user's preference, the evaporators can be installed either,

- Using threaded rod and allow sufficient space between the top of the evaporator and the ceiling for cleaning, or
- Flush mount the evaporator to the ceiling, seal the gap between the top and the ceiling with food benign sealant to prevent accumulation of any foreign matter.

All evaporators shall be mounted professionally and levelled properly so that condensate drains from the evaporator efficiently. Adequate support must be provided to hold the weight of the evaporator plus the weight of the refrigerant and any frost that may accumulate on the coil surface. The use of weight lifting equipment is highly recommended whenever possible.

## d) Condensate Drain Line

Ensure that the installation complies with HACCP and/or relevant regulations for food safety, and the end user's preferences when choosing copper, stainless steel or PVC material for condensate drain lines. For low temperature applications, proper insulation and heating cable shall be provided to prevent the drainpipe from freezing. Provide a minimum 300mm per meter pitch to condensate drain lines for proper drainage. Drain lines should be at least as large as the evaporator drain connection. All condensate drain lines must be trapped to prevent outdoor air and odours entering the refrigerated room, and must never be connected directly to the sewer system. All traps must be located in a warm ambient to prevent water from freezing. It is recommended that the drain line be kept to a minimum length within the refrigerated room.

## e) Refrigerant Distributor and Nozzle

To obtain the best performance of the evaporator, the distributor body shall be mounted vertically to ensure refrigerant liquid being distributed evenly to all the circuits.

For each standard KHDCE and KHDFE unit, a carefully selected Sporlan-type orifice plate suitable for primary refrigerants R404A and R134a has been factory-fitted in the distributor.

## f) TX Valve, Sensor Bulb and External Equalisation Line

For best performance, the TX valve should be installed as close to the distributor as possible.

Locate the TX valve sensor bulb on the horizontal section of suction line and close to the suction header. For a satisfactory TX valve operation, good thermal contact between the sensor bulb and the

suction line is essential. Follow TX valve manufacturers recommendations when positioning TX valve and sensor bulb. Incorrect installation may result in poor evaporator performance.

The external equalisation line should be used to link the TX valve external equalisation port and the suction line, near the suction header. A ¼" tube brazed to the suction line is supplied for that purpose.

Note: With modern high quality TX valves, refrigerant leakage through the equalisation line is at a minimum and the TX valve operation is not affected. Thus the external equalisation connection could be made either upstream or downstream of the sensor bulb.

## g) Refrigeration Piping

Refrigeration piping work shall be carried out professionally by qualified refrigeration mechanics in accordance with applicable national and local regulations and in conformance with good engineering practices required for the proper operation of the refrigeration system.

All the evaporators supplied by Heatcraft are supplied clean and internally charged with dry air or nitrogen to prevent oxidation and ingress of moisture or foreign matter. Care shall be taken during installation of the piping to prevent entrance of foreign matter or moisture by minimising the time that the piping is uncapped.

The interconnecting refrigeration pipe size is not necessarily the same size as the outlet on the unit. The pipe sizes shall be selected/calculated based on the best compromise of minimizing refrigerant pressure drop and refrigerant velocity to ensure efficient oil return. Heatcraft can provide a software program to assist in the calculation of pipe sizes.

Horizontal suction lines shall slope away from the evaporators to allow the oil return freely to the compressor by gravity. A 1:100 slope is considered sufficient. It is a good engineering practice to fit an oil trap when the suction line rises above the evaporator.

If in doubt during the installation, please consult with your local sales representatives and/or application engineers from Heatcraft for technical support.

## Electrical Connection



**All electrical connections must be carried out by a licensed electrical technician and in accordance with the relevant regulations. Without prior permission from Heatcraft, all the provided electrical wiring shall NOT be modified. Failure to follow this procedure may cause death and void warranty.**

All evaporators are fitted with heater elements and Heater safety switch and are supplied with elements wired to "WAGO" terminal block located in the external electrical box of the evaporator. The wiring diagram is located on the inside of the electrical box cover. Refer to the unit Serial Plate for all the information regarding voltage and current for fan motors and element heaters.

Fan motors are wired up in DELTA connection from factory. After electrical installation, units should be tested for correct current draw and rotation of fan motors.

### **MOTORS WITH THERMAL OVERLOAD PROTECTION-**

Heavy Duty evaporator fans are equipped with thermal overload motor protection.

**Warning-** Non-running fans may restart unexpectedly if the overload has been activated. Do not assume a fan that is not running has been disconnected from the power supply. Always check for the presence of live voltage before removing the junction box lid and/or performing any work on the fans.

### **MOTORS WITH EXTERNALLY WIRED OVERLOADS-**

500mm three phase fans are equipped with externally wired overloads. These overloads will only control power to the motor when wired in to an external control circuit. Please refer to the following wiring schematic diagrams for details.

**Failure to wire the externally connected overloads in a suitable manner may lead to unnecessary failure of the motor and voiding of the unit warranty.**

## General Commissioning Guide

Refrigeration system commissioning shall be carried out professionally by qualified refrigeration technicians in conformance with good engineering practices required for the proper operation of the refrigeration system.

After all installation and electrical work is completed, the entire refrigeration system must be leak tested. After satisfactory testing the refrigeration system, then necessary refrigeration lines shall be insulated. The insulation located in outdoor environments shall be protected from UV exposure.

Before charging the refrigerant, the entire refrigeration system shall be evacuated by connecting a good, high vacuum pump to both the high-pressure side and low-pressure side service valves or ports.

Vacuum must be maintained sufficiently so as to minimise the occurrence of leaks when the system is charged. Refrigerant must not be charged into a system with known leaks. Should vacuum not be maintained, check for leaks with Nitrogen gas at a suitable pressure prior to charging.

Installing a liquid line drier and a sight glass in a refrigeration system is sound engineering practice. The liquid line drier will ensure all refrigerant supplied to the refrigeration system is clean and dry. The sight glass is a useful device to ensure sufficient refrigerant is supplied to the refrigeration system.

Refrigerant charging shall be in liquid form at the high-pressure side of the system such as condenser or liquid receiver. If the refrigerant charging must be carried out through the suction side of the compressor, charge in vapour form only.

Double-check all field wiring connections and factory terminals. Factory connections can vibrate loose during shipment. Ensure correct fan motor rotation, airflow is induced from coil side and forced out of fan motor side.

Check the room thermostat for normal operation and adjust if necessary.

## Advisory Defrost Guidelines

In order to maximise efficiency and airflow, the following advisory defrost data has been compiled. Defrost data is minimum number of defrosts required per 24 hrs for average room loads.

SST	-42	-36	-30	-24	-18	-12
DEFROSTS AT MAX. KTD	6	7	7	7	6	6
DEFROSTS AT 6KTD	6	5	5	4	4	4
DEFROSTS AT MIN. KTD	5	5	4	3	3	4

Advisory defrost timing for –18°C room

KTD	LIGHT LOAD		HEAVY LOAD			LIGHT LOAD		
	1	2	3	4	5	6	7	8
10	X	X	X	X	X	X		X
8		X	X	X	X	X		X
6		X		X		X		X
4			X		X			X

Each column represents a 3-hour period during the day. An X indicates the hour that a defrost should commence. "Heavy Load" represents the nominal 'working period' of each day.

## a) Defrost Termination Requirements

Defrost time for average loads should be approx. 20 - 25 minutes including drainage. Time will vary with varying degrees of ice build up.

Time Termination – should be set to ensure complete defrost at the heaviest load condition. Typically allow 25 - 30 minutes with safety reset at 35 minutes.

**Temperature Termination** – setting depends on frequency and severity of defrosts, and location of the sensing device. The standard defrost termination thermostat (Heatcraft #MCC143-1), is not recommended for use because of the temperature settings and the difficulty in finding a location for it on the coil that ensures proper defrosting. If using an electronic defrost controller, the temperature termination setting must be determined for each installation. The setting should not be less than 12°C cutout. Location of the sensor must be determined to suit each application. Fitting the sensor in the finned coil block requires higher settings, possibly 20°C or greater.

**Pressure Termination** – can be incorporated into the defrost in a number of ways. Whatever method is preferred, it must be noted that the temperature of the fins will be somewhat lower than the saturation temperature corresponding to the refrigerant pressure. Therefore a somewhat higher refrigerant temperature must often be allowed for when setting the pressure control. See table below. It is also not recommended to control the fan delay by pressure as very low pressure will be reached quite quickly after defrost on TX valve systems, when the fans are not running. It is preferable to combine the pressure termination with a time clock for fan delay.



**Heater Safety Thermostat** – Units are fitted with a Heater Safety Thermostat (Heatcraft #MCC126-1) as standard. Main purpose of this thermostat is to provide appropriate means to prevent excessive temperature / pressure developing resulting in overheating the unit and surrounding area in the advent of a controller or sensor failure.

**Fan Delay Requirements** – may vary with application, conditions and control method, but should not be more than 5 minutes.

**Coils** – 5FPI grooved tube coils (standard coils), should be operated to the above guidelines unless otherwise indicated on the installation concerned. Testing has indicated that 4FPI coils can operate satisfactorily with fewer defrosts than indicated above, depending on moisture load. Each installation should be treated on an individual basis.

## b) Control Setting Guidelines

Each application should be treated on its merits; however the following is given as a guide. During the commissioning, this data should be used as a reference initially. It is then necessary to fine-tune the control settings to achieve the satisfactory defrost results.

Termination Type	Sensor Location	Setting	Fan Delay
Time	n/a	25 – 30 mins	5 mins (max)
Temperature	Position & temperature settings must be determined for individual case		
Pressure (Gauge)	Header	770-790kPa R404A	n/a
		800-820kPa R507	n/a
		690-710kPa R407C	n/a
		340-360kPa R134a	n/a

The above guidelines allow for relatively heavy defrost loads. Shorter times or lower settings must be verified on the installation. Pressure termination given for R407C and R404A corresponds to the mid point at the required temperature. Refer to the applicable Heatcraft Pressure / Temperature Chart.

All data given is for defrost without refrigerant pump down.

Pump-down is not recommended for electric defrost using pressure and/or temperature control. There is clear evidence in testing that positive defrosting of the distributor, leads, header and suction line, can not



be achieved without refrigerant being present in the coil. Additional means, such as heater tape around these components, may be needed if using pump-down. Longer defrosting time and / or more frequent defrosting may also be necessary to ensure long-term ice built up does not occur. Pump-down may be used with time termination. The defrost time will be longer and requirements must be determined on individual systems.

Data above based on R507/R404A refrigerant. For other refrigerants, it may be necessary to vary the number of defrosts per day to maintain efficient performance.

#### **Medium Temperature Applications Requiring Electric Defrost**

The advisory defrost data has not been compiled for medium temperature applications. But generally you should use the low temperature application data as a guideline to start with, and make necessary alterations based on observation and monitoring during commissioning.



### **Routine Maintenance of Unit**

All Kirby Heavy Duty Evaporators are designed to have low service maintenance requirements. Based on normal operation conditions and working environment, a service maintenance schedule shall be established after the successful completion of commissioning, to ensure the evaporators operate efficiently and running costs are kept at a minimum. The following items shall be checked and recorded during service maintenance,

- Visually inspect the evaporators looking for corrosion, unusual vibrations, oil stains and drain tray blockage. The drain tray should be cleaned regularly with warm soapy water.
- Clean the evaporator fins by using a soft brush, low pressurised water and/or commercially available evaporator coil cleaner. Never use an acid based cleaner. Follow label directions for appropriate use. Flush and rinse coil until no residue remains.
- Coils supplied with 'Koil Kote' need special care so as not to damage the coating. The coils should not be cleaned with strong Alkaline Cleaners and/or with stiff brushes. Mild soapy solutions that are well rinsed after cleaning should be satisfactory.
- Check that each fan rotates freely and quietly, fan guards are free of airflow obstructions and fan screws are tight.
- Inspect electrical wiring, connections and components looking for damaged wiring, loose connections and worn components.
- Check that all coil heaters are in their original positions and properly secured, and that drain tray heater is in proper contact with the tray and located by the brackets.
- Ensure even coil frost formation pattern on the air off (fan) side of the coil during operation. An uneven frost pattern may indicate a distributor blockage or incorrect refrigerant charge. The air on side tubes may contain superheated vapour and may not frost completely.
- Look for abnormal accumulation of ice patterns and adjust the defrost cycles accordingly.
- Check the superheat and adjust TX valve accordingly.

All power must be disconnected before cleaning and/or service maintenance. The condensate drain tray also serves as a cover of hazardous (hot, cold, electrical and moving) parts. Operation of evaporators without condensate drain tray constitutes a safety hazard.

The service maintenance record as well as this "Kirby Heavy Duty Evaporators Handbook" shall be kept together in a safe place as a future reference.

### **General Decommissioning Guide**

In order to remove the evaporator from its mounting place, the following procedures need to be carried out professionally by qualified personnel. Failure to do so may result in personal injury or death, property damage by fire or explosion. Discharge of refrigerant to atmosphere is illegal and may result in heavy fines by relevant regulatory authorities.

- Pump down the entire refrigerant charge into the liquid receiver or appropriate container such as reclaim cylinder, and shut related valves. All reclaimed refrigerant that is not re-used must be

taken to an approved refrigerant recycling or destruction facility. Heatcraft Branches will accept the used refrigerant and return back to the manufacturer for you.

- Disconnect the power supply. Remove all necessary field electrical wiring and related components, leaving the earth wire to the last.
- Disconnect the drainpipe.
- Care must be taken when de-pressing the Schrader valve core in order to balance the pressure between the evaporator and ambient. There may be a small amount of refrigerant trapped in the oil, the pressure rise in the evaporator will boil and vaporise the refrigerant resulting in a potential personal injury hazard.
- Cut and solder seal the refrigeration liquid line and suction line pipe connections.
- Remove the evaporator from its mounting place. Adequate support must be provided to hold the weight of the evaporator. The use of weight lifting equipment is highly recommended whenever possible.

## Material Safety Data Sheets – M.S.D.S.

These are available from your nearest Heatcraft Branch for all refrigerants that this range of evaporators are approved for.

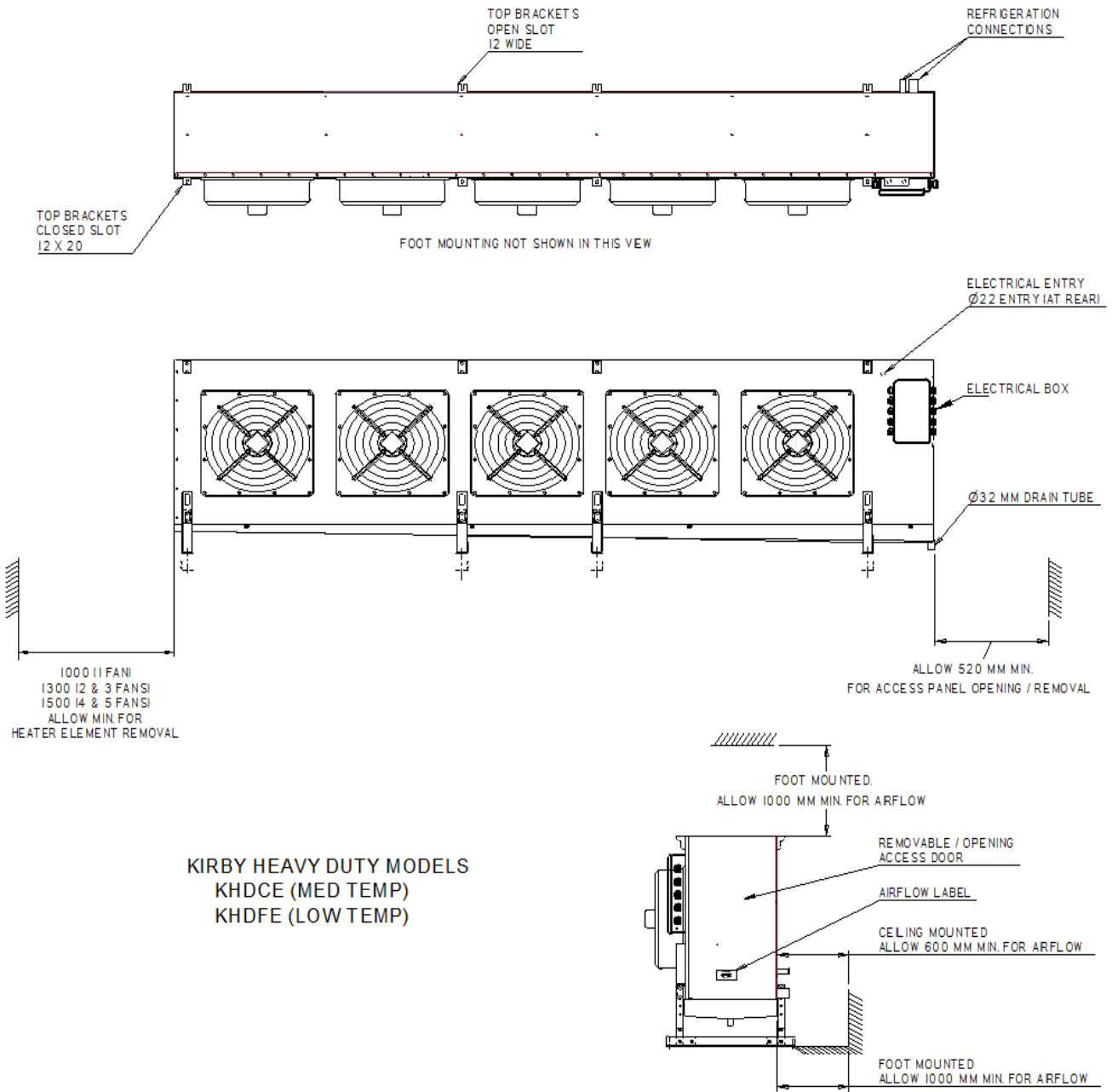
## Important Note

- To ensure Kirby Heavy Duty Evaporators operate efficiently and for a long working life, always obtain genuine replacement parts from your local Heatcraft Wholesale Branch. Genuine replacement parts are covered by the warranty. Refer to the Standard Terms & Conditions of Sale in the Price Guide for warranty statements.
- Continuous product improvement is our company policy. Heatcraft reserves the right to make changes in product specifications and/or this instruction manual without notice.

Heatcraft is dedicated to providing safe products and protecting the environment by complying with all applicable national laws and regulations governing environmental protection. New and used refrigerants cannot be vented into atmosphere. Reclaim all used refrigerants. EPA regulations are constantly updated. Ensure your refrigerant handling procedure follows correct regulations.



# General Arrangement Drawing

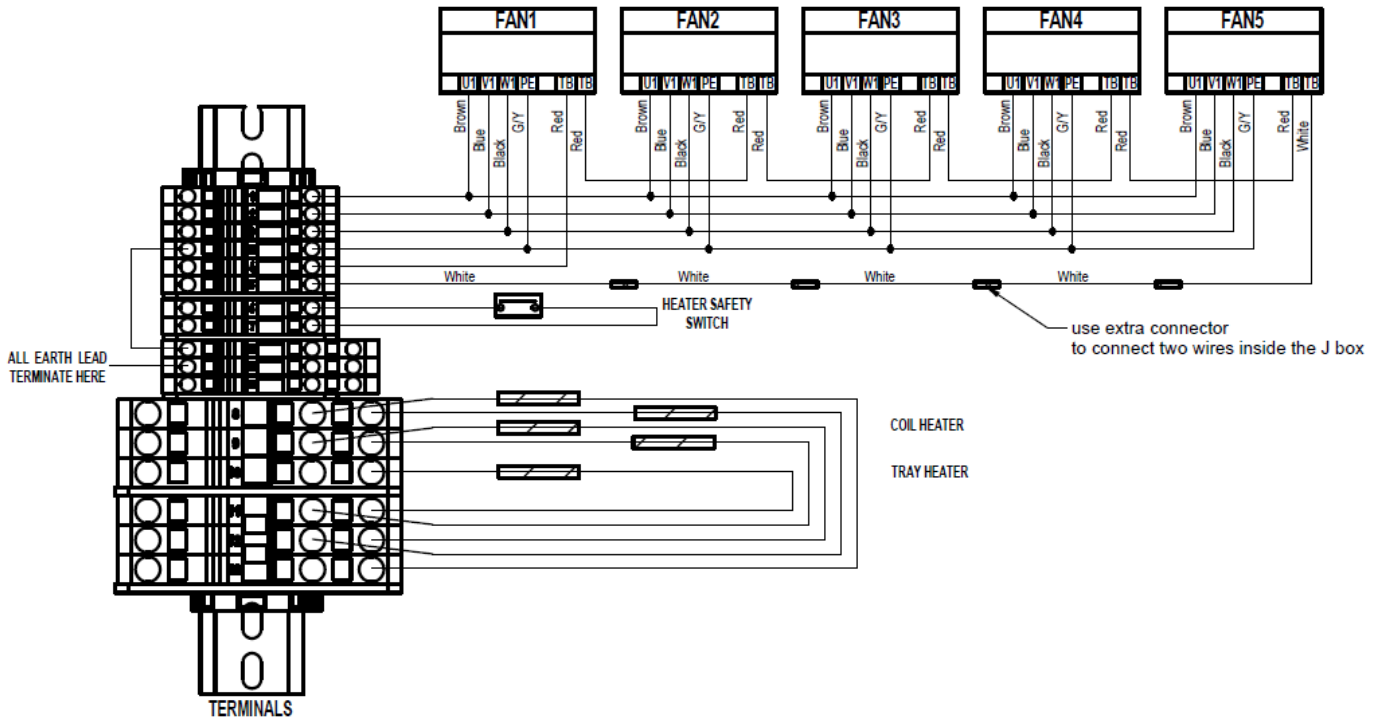




# General Electrical Schematic Drawings

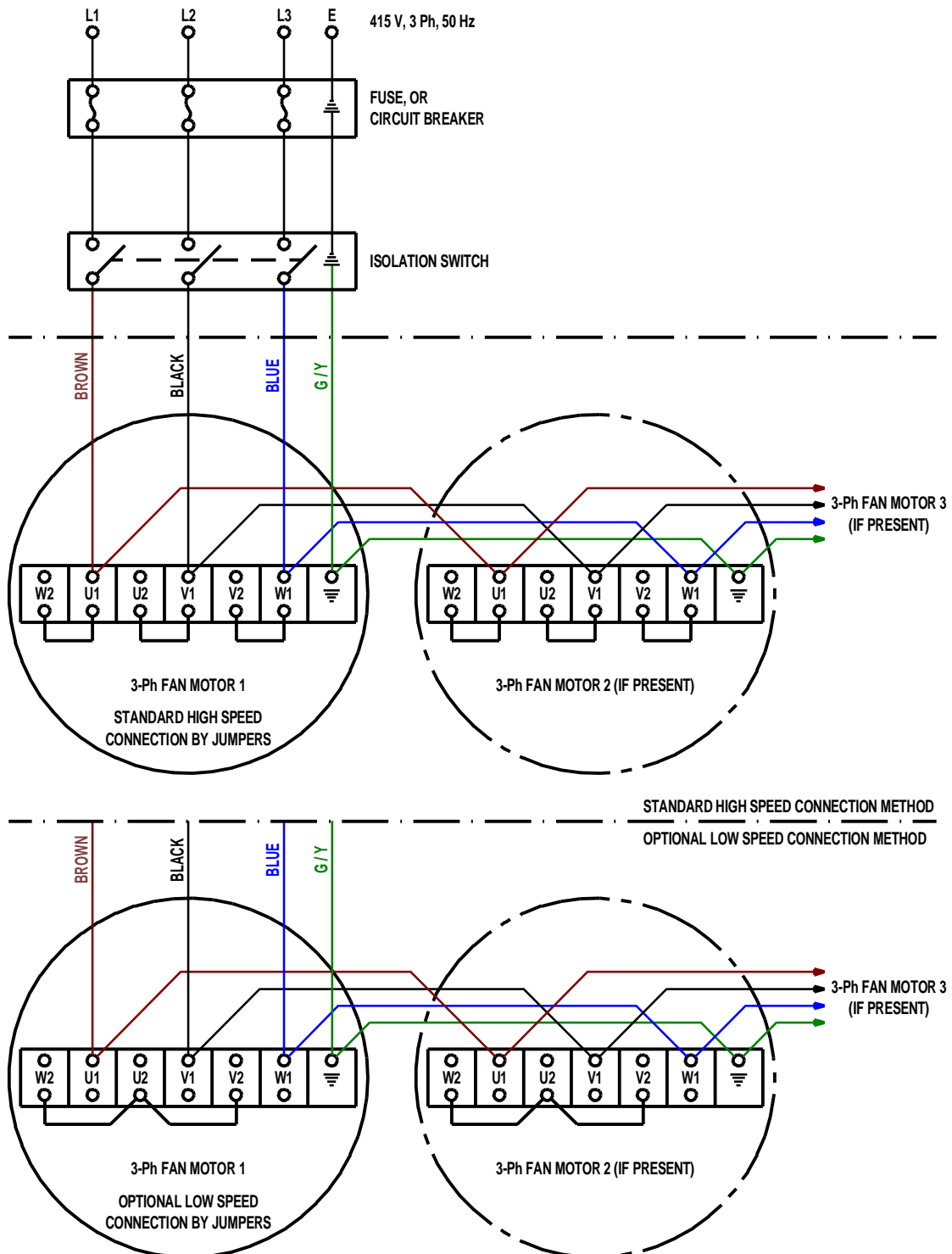
## 1. FACTORY FITTED COMPONENTS & ASSOCIATED WIRING

415V /3Ph/50HZ SUPPLY



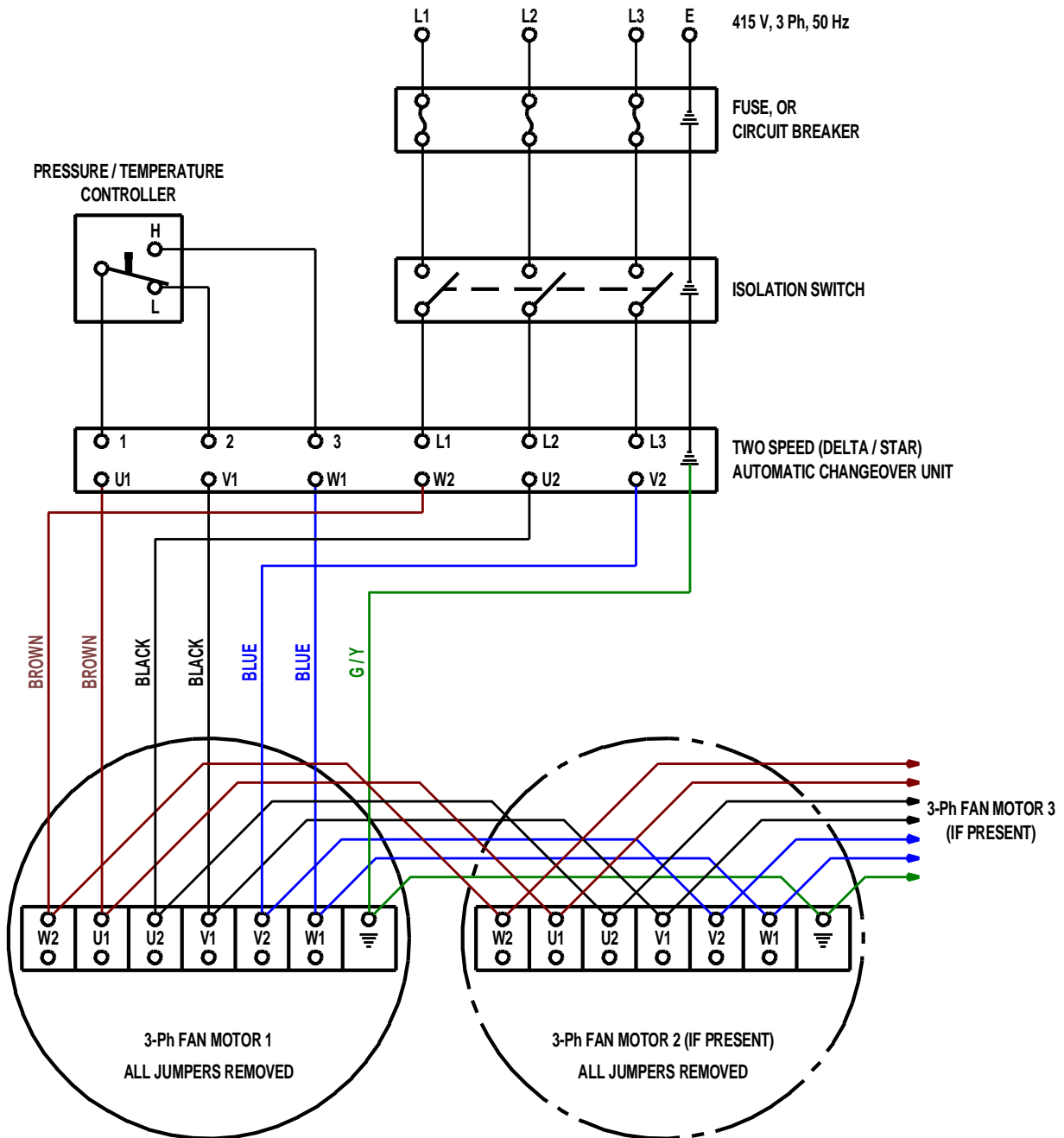
## 2. WIRING METHODS FOR SINGLE-SPEED FAN CONNECTION

**NOTE:** Fans are connected up to WAGO-Terminal in the electrical box



### 3. WIRING METHOD FOR TWO-SPEED FAN CONNECTION

**NOTE:** Fans are connected up to WAGO-Terminal in the electrical box



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