



S I N G L E P H A S E
Evaporator Fan
Control System

Installation and Owner Manual

WARNING

The installation of this device should be done only by competent personnel, experienced in electrical wiring, and familiar with electrical codes. Contact with lethal voltages is possible during installation. Turn off the cooling system power and check with a voltmeter to determine that no voltage is present before beginning the installation.

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Overview of the Frigitek

The Frigitek is a patented product, designed to be retrofit into walk-in refrigerators and freezers. Real-world tests show that it can save 20 to 45 percent of the operating cost of the refrigerator, depending on the pre-Frigitek duty cycle of the system.

The Frigitek functions by sensing the operational status of the cooling system, and controlling the speed of the evaporator fans.

It has been determined that the evaporator fan motors contribute a significant amount of heat inside the refrigerated space. By operating the fans at a low speed when no cooling is called for, and at high speed only when the system is actively cooling the refrigerator, much less heat is introduced into the refrigerator.

This saves energy in the cooled room in two ways:

- 1 Slowing the fan speed results in a significant saving in evaporator fan motor power.
- 2 The reduction in fan motor heat generated causes the refrigeration system to operate less, saving additional energy at the compressor.

The Frigitek consists of three major parts:

- 1 The Frigitek Control Unit
- 2 A Signal Sensor
- 3 An Ice Sensor

The Control Unit contains the electronics which switches the fan speed between high and low circuitry to monitor the Ice Sensor, and a "Bypass" relay.

The Signal Sensor is used to monitor the cooling system and provide a signal to the Control Unit indicating whether the cooling system is actively cooling the room, or is idle. There are two types of Signal Sensors:

- 1 **SST:** This Signal Sensor Tee is used to monitor the current which controls a solenoid-operated valve. This is the most commonly used Sensor.
- 2 **TDS:** This Temperature Differential Sensor operates by detecting the temperature difference across the expansion valve in the coil. It is used where a solenoid-operated valve is not installed, or is inconveniently located.

The Ice Sensor (used only in above-freezing rooms) monitors the coil for frost. If frost is detected, the Control Unit will operate the fans at high speed until the frost is dissipated.

Installation Sequence

IMPORTANT

Turn off the cooling system power and check to see that no voltage is present before beginning work!

Frigitek installation and testing should be done in this sequence:

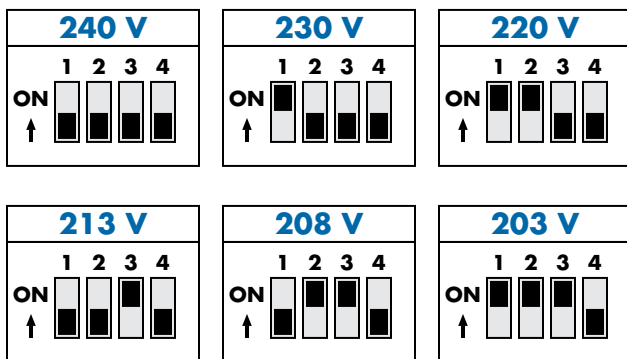
- 1** Determine the correct location for mounting the Frigitek (See page 8)
- 2** Drill the mounting holes (See page 8)
- 3** Mount the Frigitek (See page 9)
- 4** Connect the power wiring (See page 11)
- 5** Install the Sensor (SST: see page 14, TDS: see page 17)
- 6** Install the Ice Sensor (See page 22)
- 7** Test the Frigitek (SST: see page 26, TDS: see page 19)
- 8** Observe the Frigitek for one complete cycle of normal operation (See page 24)

Operating Voltage Setup

IMPORTANT

This setup applies to 208–240V units only!

All 208–240 Volt units are factory preset for 240V. If the operating voltage is not 240 Volts, the DIP switches must be set for the actual voltage, so that the low-speed setting of the fans will be correct. The switch is accessible through a hole in the back cover of the Frigitek. **Do not remove the back cover.**



Location and Mounting of Frigitek

The preferred location for the Frigitek is on the front face of the coil case, at the end of the case which has the coil wiring inside.

Typical evaporator coils have the refrigerant lines on the right end of the coil and the electrical wiring at the left end. Thus, the preferred location for the Frigitek is usually the left end of the coil.

Upon removing the end panel, the wiring to the motors will be exposed. You will also observe a second panel that separates the wiring enclosure from the finned portion of the coil. You must determine if the depth of this compartment is sufficient for the Frigitek to be mounted in the horizontal position as shown in Photo #1. Use the Installation Template for this purpose.

The concern is, "Can the mounting holes be drilled through the front of the case far enough from the cross sectional panel giving adequate clearance for the mounting nut to turn?" If there is not room enough for a horizontal installation, perhaps there is room for a vertical installation.

In some cases, there is not sufficient mounting space available on the front of the evaporator case. In this event, the end panel is the logical alternate location (see Photo #2).

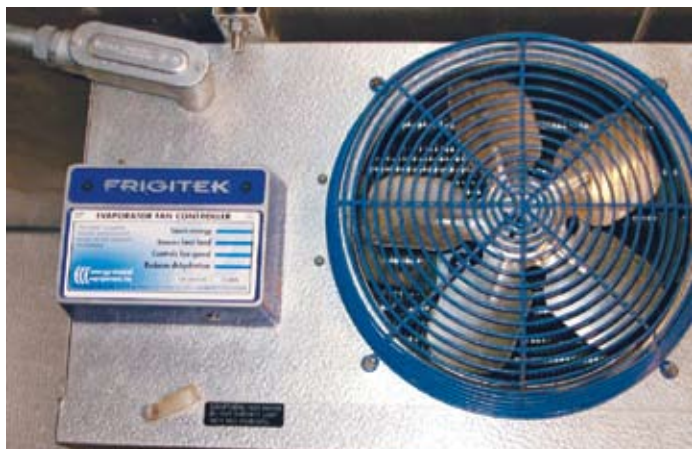


Photo 1: Evaporator Coil Front Mount



Photo 2: Evaporator Coil End Mount

In some instances, the best location for the Frigitek is on the wall. Optional brackets are available for wall mounting

IMPORTANT

Wall mounting brackets must never be used to mount a Frigitek to a ceiling in a horizontal (back plate up) position.



Photo 3: Wall Mount

When the Frigitek is mounted on the evaporator, use the “crack and peel” Installation Template as a guide for hole spacing. A sheet-metal step drill is an ideal tool for drilling these holes.

Install the Frigitek on the evaporator case by feeding the wires and the bushings through the drilled holes. When installing the nuts on the bushings, tighten them only slightly more than finger tight.

Power Wiring

The diagrams on the next two pages show typical wiring of the evaporator fans and thermostatically-actuated solenoid for walk-in refrigerators and freezers. The two diagrams show 120 V and 203-240 V systems.

The diagrams show the wiring in original configuration, and with the Frigitek installed. The installer must locate the wires where the connections are indicated, and splice in the Frigitek wires at the correct locations. Usually, existing wire-nutted connections can be used to install the Frigitek.

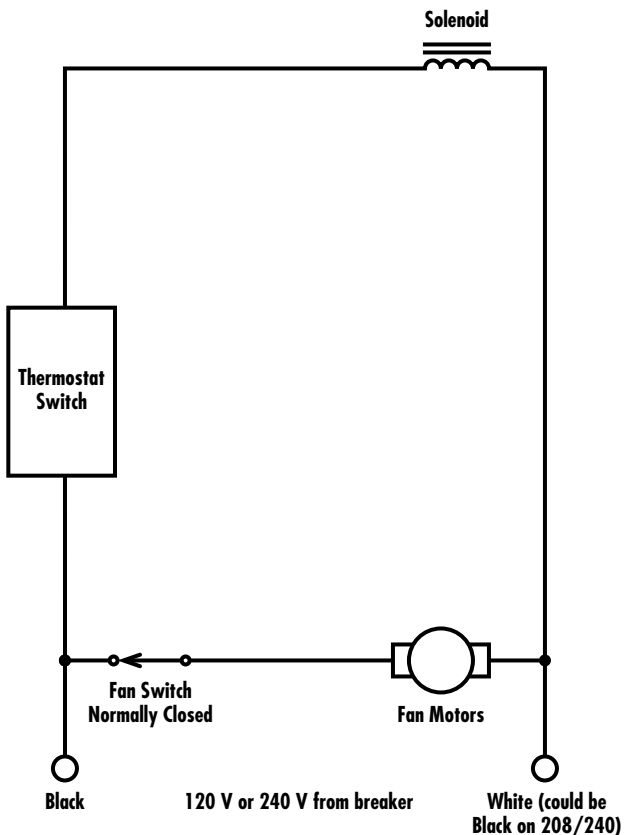
In evaporators which use heating elements for defrosting, the installation must be made in a manner that does not interfere with the function of the defrost controls. Be sure that the Frigitek wiring is not connected in a way that will cause the defrost current to flow through the Frigitek.

This is specific to the defrost controls in the wiring cavity in the end of the coil. This eliminates the use of one Frigitek serving two or more coils in freezers or in medium temp boxes that are equipped with coils using defrost, resistance elements.

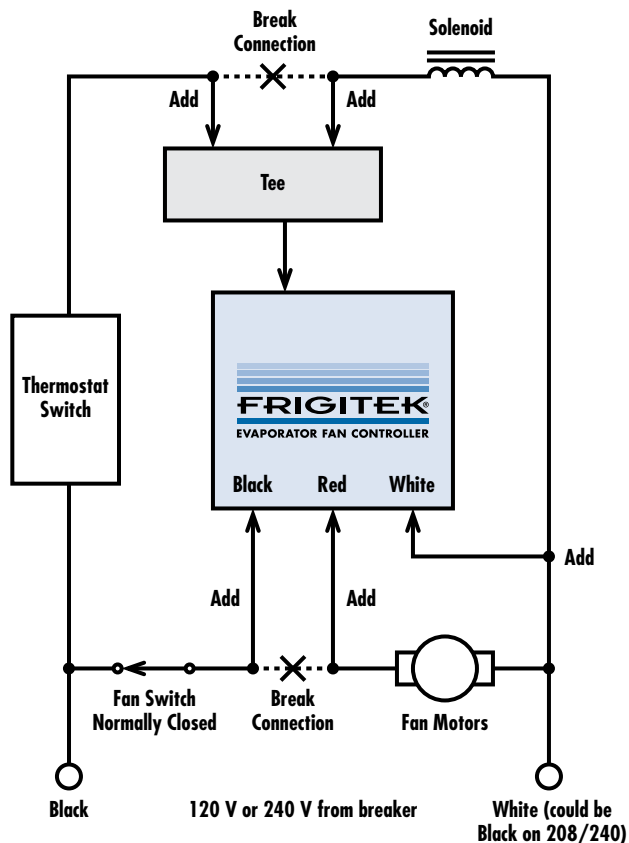
IMPORTANT

Wherever resistance elements are used, special care must be taken to assure that none of the Frigitek power or control wires can come in contact with the heating elements.

Original wiring



Wiring with Frigitek added



Note: The installation of the “Tee” wiring shown is described in detail later in this manual.

Signal Wiring

The following sections describe installation of the Signal Sensor Tee (SST), the Temperature Differential Sensor (TDS) and the Ice Sensor wires. These wires must be secured so that they are protected from physical damage and from moisture. Clips are provided to route the wire along the back lip of the evaporator pan.

It is through the SST or the TDS that the Frigitek determines if fans should be running at high or low speed. Frigitek's are set up at the factory to operate on one or the other of these two systems and the proper sensor is packaged with the specific type of unit. The SST system should always be used where the thermostat/solenoid circuit is readily available.

SST Installation

The SST is usually installed on the solenoid valve that gates the refrigerant into the evaporator coils. There is often a spare knockout hole on the side of the solenoid cover into which the SST can be installed. If that is inconvenient, the Tee can be installed into the same knockout hole that is already being used for the solenoid wiring, and the original wiring re-routed out of the third leg of the SST, as illustrated in Photo #4.

In wiring the SST, remove one of the wire nuts connecting the solenoid wires, separate the wires and reconnect each of the two wires to one of the Tee's wires, thus putting the Tee in series with the solenoid wiring

WARNING

Installing the Tee in parallel with the solenoid coil will cause a short and may destroy the Tee.

Insert the two-pin connector on the cable labeled Signal Sensor into the mating connector on the Tee. Run this cable to the Frigitek.

IMPORTANT

Do not run the sensor cable in a conduit with any power wires.

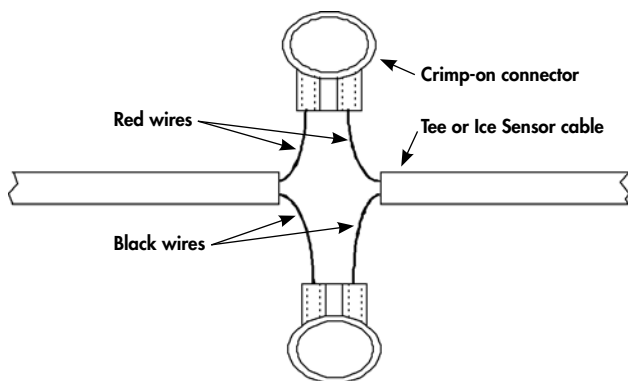


Photo 4: Signal Sensor Tee Installation

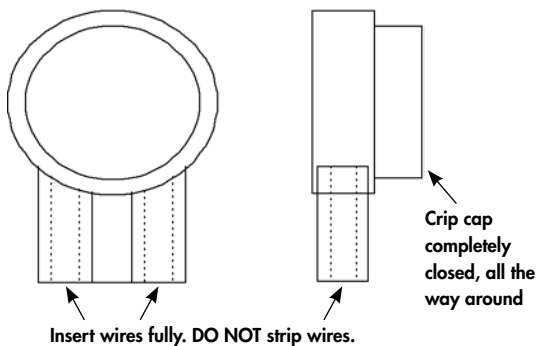
Connect the sensor cable to the Signal Sensor wires coming out of the Frigitek. Use the ScotchLok crimp-on connectors supplied (see the drawings on the next page).

Be sure that the wires do not touch the defrost heating elements in the bottom of the tray. Clips are furnished for this purpose.

Frigitek Signal and Ice Sensor Connections



ScotchLok® Crimp-on Connector



TDS Installation

Introduction

The Temperature Differential Sensor (TDS) for the Frigitek allows the Frigitek to be used in refrigeration systems where there is no solenoid-operated refrigerant valve, or where the valve is difficult to access. It operates by monitoring the temperature difference across the evaporator expansion valve, and generating a control signal to the Frigitek whenever the difference exceeds a pre-set threshold.

Installation

The TDS is installed near the expansion valve in the evaporator. It may be installed either inside or outside the evaporator case, whichever is more convenient.

The TDS has two permanently-attached wires coming out of a cable clamp at one end (the temperature sensor wires), and a three-pin connector at the other.

The three-pin connector is the connection to the Frigitek. An included cable has the mating three-pin connector attached to it for this connection.

Remove the end panel of the evaporator case (where the refrigerant piping is connected), and determine the most convenient and appropriate location for the TDS.

The TDS is designed to be attached to a side wall of the evaporator case by means of the screw in the side of the TDS. A small hole will need to be drilled for the screw installation.

The two permanently-attached wires are the temperature sensors. The ends of these wires (where the sensors are located) must be clamped to the copper tubing attached to the expansion valve. The soft Styrofoam sections are used to hold the ends of the wires onto the tubing, and are pre-slit for easy installation. Short tie-wraps hold the Styrofoam in place. **Note: Do the tests described in the "Testing the TDS" section before fastening the sensor cable ends in place.**



Photo 5: Temperature Differential Sensor

The location points for the sensor cable ends are not critical, as long as one is on one side of the expansion valve, and one on the other side.

Also, the selection of the sensor ends is not critical. Either sensor end may be used at either location.

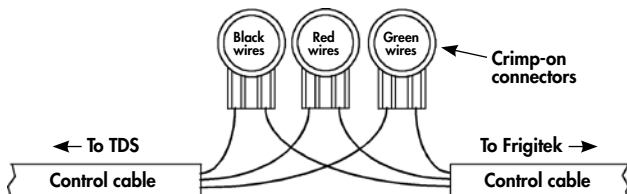
TDS Signal Cable Wiring

Insert the three-pin connector on the cable labeled "Signal Sensor" into the mating connector on the TDS. Run this cable to the Frigitek. Do not run the sensor cable in a conduit with any power wires.

Connect the sensor cable to the three signal sensor wires coming out of the back of the Frigitek. Use the ScotchLok type "UY" crimp-on connectors supplied to connect the individual wires in the two cables.

IMPORTANT

Be sure to match the wire colors on the two cables.



Testing the TDS

It is very easy to test the operation of the TDS. This check list will verify proper operation and help identify any problems.

- 1 With the Frigitek turned on, and the sensor cables removed from the copper tubing for a few minutes, the Frigitek should be in low speed. If not, do step 2. If so, skip to step 3.
- 2 With the three-pin connector disconnected from the TDS, the Frigitek should be in low speed. If not, the Frigitek has a problem.

If step 1 failed, but step 2 did not, the TDS may be bad.

- 3 Cool (or warm) one of the sensor cable ends. In a few seconds (15 to 30), the Frigitek should switch to high speed. If it does not, the TDS may be bad.
- 4 Allow the two sensor cable ends to reach the same temperature. (In air, this may take a couple of minutes). The Frigitek should switch to low speed. If not, the TDS may be bad.

NOTE: Be sure that the three-wire cable between the TDS and the Frigitek is properly connected before calling for replacement parts. Failure of test 1, test 3 and test 4 could be caused by bad cable connections.

Observing TDS Operation

When the thermostat calls for cooling (or the pressure-operated valve opens), the refrigerant will begin flowing to the evaporator. The temperature of the tubing on the downstream side of the expansion valve will begin to drop.

After about 15 to 30 seconds, the difference in temperature will be enough to trigger the TDS. It will then send a signal to the Frigitek to switch to High Speed mode. The green Hi-Speed light on the Frigitek will illuminate and the fans will switch to high speed.

When the cooling cycle is complete (satisfied) the flow of refrigerant will be cut off. The temperature on the downstream side of the expansion valve will begin to rise. After a minute or two, the temperatures will be about the same, and the TDS will send a signal to the Frigitek to switch to Low Speed mode. The Hi-Speed light will go out, and the fans will switch to low speed.

Dual-Evaporator Installation

Multiple evaporators controlled by one Frigitek

Frequently, the larger model Frigitek's are used to control more than one coil. This is possible only where the coils served by a single unit are controlled by the same thermostat and are on the same electrical circuit.

Where the electrical conduit connecting more than one coil is installed inside the refrigerator box, there will likely be a

junction box at the entry point. This is a convenient location for wall mounting a Frigitek when serving multiple coils. It is for this purpose that the 15-Amp model is shipped with wall mounting brackets and two ice sensors as standard equipment. (See Photo #3).

There is a limiting factor to this practice. As is always the case, it is essential that the rated capacity of the Frigitek (5A, 10A, 15A or 25A) not be exceeded.

IMPORTANT

Wall mounting brackets must never be used to mount a Frigitek to a ceiling in a horizontal (back plate up) position.

Multiple Frigiteks controlled by one SST

In some refrigerators, a single solenoid is used to gate refrigerant to more than one evaporator. In such installations, a single Signal Sensor Tee (SST) can be used to control more than one Frigitek. When this is done, a Splitter Cable is used. This is an optional accessory that can be ordered from ECE. A single Signal Sensor Tee should not operate more than three Frigiteks.

Ice Sensor

The Ice Sensor is only used in systems where the thermostat setting is above freezing (33° F).

IMPORTANT

It should never be used in freezers, or in refrigerators equipped with a mechanical defrost system. It is strongly recommended that ice sensors be used on all other systems.

In boxes without a mechanical defrost system a high premium is paid in energy costs to maintain the box close to the freezing temperature. Persistent icing can have a number of causes. It can be the result of the thermostat being set too low for the system. It can be the result of dirty coils or doors being left open, or low refrigerant or even an under-sized system.

Because of their ability to be used to control multiple evaporators, the 15A and 25A Frigiteks are provided with two Ice Sensors.

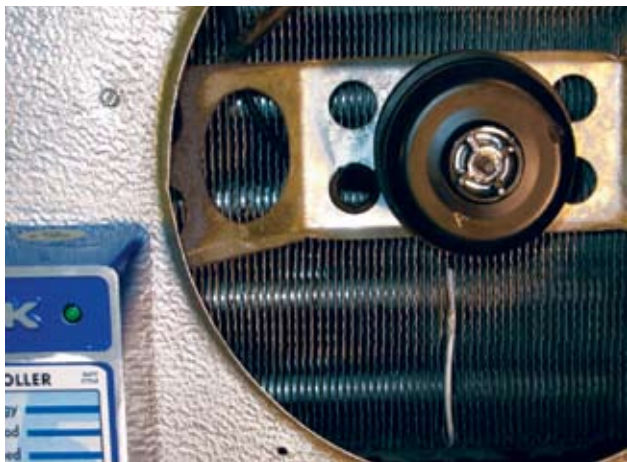


Photo 6: Ice Sensor Installation

Ice Sensors are installed into the coil by inserting the black Sensor tip between the evaporator coil fins, immediately behind the fan motor nearest the Frigitek. Crimp the fins lightly over the wire to hold it in position as illustrated in Photo #6.

Route the Ice Sensor wire back to the wiring compartment so that it can be connected to the Frigitek but do not connect it or remove the ScotchLok connector, until the procedures under "A Final Check" page 26 have been completed. Once the Final Check is done, remove the factory installed ScotchLok connector from the Ice Sensor wire at the back of the Frigitek and connect the Ice Sensor, (see page 16).

Care must be taken to be sure that all connections are well above any water that might accumulate in the bottom of the evaporator pan.

As shipped from the factory, the conductors of each Ice Sensor wire is connected with a small crimp-on connector. The evaporator fans will not run at low speed unless these Ice Sensor wires are connected together, or the Ice Sensor is installed and sensing an evaporator coil temperature of 33° F or higher.

Observing Frigitek operation

The Frigitek has a power switch on the top, near the left side. This switch turns the Frigitek On (right position) or Off (left position). If the Frigitek is Off, the evaporator fans are returned to full-time operation at their original high speed.

When the Frigitek is On, the green Power Light (on the left) will always be illuminated.



The Duty Cycle light (on the right) will be illuminated when the Frigitek is operating the fans at high speed, indicating that the refrigeration system is actively cooling the room or that the Ice Sensor has detected that the temperature in the coil is below freezing. This light will be off when the fans are at low speed.

Evaporator Operation

In most refrigerators, it is normally difficult to observe when the refrigeration system is cooling, and when it is idle. The Frigitek makes this cycling visible, because of its control of the fan speed.

When the thermostat calls for cooling, the Frigitek will switch the fans to high speed, and continue to run them at

high speed as long as cooling is called for. The green Duty Cycle light (on right front of the Frigitek) is on during this period.

When the thermostat switches the cooling system to idle mode, the Frigitek will continue to run the fans at high speed for approximately 30 to 45 seconds, then switch them to low speed. During this brief period, the green Duty Cycle light will slowly dim, until it goes out completely and the fans shift to low speed. This delay allows the system to purge refrigerant from the evaporator coils, and helps prevent icing.

Evaporator Fans

In some refrigerators after installation of a Frigitek unit, one or more of the evaporator fans may run slower than the others, or, sometimes, stop running altogether when the Frigitek switches to low speed. This is an indication that the affected fan motors are failing, and should be replaced as they waste energy. If all of the fan motors stop or run too slowly, this could indicate a low inlet voltage condition.

To change the low speed setting of the fans, remove the chrome-plated button on the bottom of the Frigitek and rotate the potentiometer shaft clockwise until the proper speed setting (approximately 340 RPM) is obtained.

Note: In some circumstances, due to box configuration or the type of product stored, it may be advisable to increase the slow fan speed setting. In reach-in boxes, it is recommended to rotate the potentiometer control approximately one turn.

A Final Check

Proper operation of the Frigitek should be checked after the Frigitek installation. It is recommended that this be done without cycling the compressor or moving the thermostat setting.

When the installation is complete and the circuits are reenergized, the temperature in the box will usually have risen to the point where the thermostat will be controlling the compressor. This means that the Frigitek should come to high speed, with the Duty Cycle light illuminated, when it is switched on.

To test the low-speed shift of the Frigitek, remove the two or three pin connector from the Signal Sensor Tee or the Temperature Differential Sensor. This will send a false signal to the Frigitek. In about 30 to 45 seconds the fan motors should shift to low speed assuming the unit is properly wired and the Frigitek switch is in the On position. This should be done before the factory installed ScotchLok is removed from the Ice Sensor wire or before the Ice Sensor is connected.

Specifications

120 VAC Units

- Input Voltage: 120 VAC, single phase, 60 Hz
- High Speed Output Voltage: Same as Input Voltage
- Low Speed Output Voltage: 40 VAC
- Maximum Continuous Load: 5A, 10A, 15A, 25A

240 VAC Units

- Input Voltage: 203–240 VAC, single phase, 60 Hz
- High Speed Output Voltage: Same as Input Voltage
- Low Speed Output Voltage: 80 VAC
- Maximum Continuous Load: 5A, 10A, 15A, 25A

Note: See page 4 for Input Voltage Settings for 208–240V Units.

460 VAC Units

- Input Voltage: 460 VAC, single phase, 60 Hz
- High Speed Output Voltage: Same as Input Voltage
- Low Speed Output Voltage: 160 VAC
- Maximum Continuous Load: 10A

Signal Sending Tee (SST)

- Maximum Load: 3.5A
- Minimum Required Output: 100 mV per attached Frigitek Unit

Temperature Differential Sensor (TDS)

- Input Voltage: 12 VDC (Supplied by the Frigitek)
- Input Current: 10 mA Typical
- High Speed Output Voltage: >10 VDC (no load)
- Low Speed Output Voltage: < 2 VDC

120/208-240V Units (up to 15A)

Size: 6.75"W x 4.75"H x 2.3"D

Weight: 3 Lbs

120/208-240V 25A Units:

Size: 8"W x 8"L x 4"D

Weight: 10.5 lbs

460 Volt 10A Units

Size: 10"W x 10"L x 4"D

Weight: 11.5 lbs



Note: The 25 Amp 120/240 Volt and 10 Amp 460 Volt Frigitek models are enclosed in a water-resistant NEMA box, with dimensions of 8"W x 8"L x 4"D.

This case should be mounted to a wall, and appropriate conduit run from it to the evaporator wiring interconnections.

ENERGY CONTROL EQUIPMENT, INC. LIMITED WARRANTY

The Frigitek® Evaporator Fan Controller ("Unit") is warranted for Five (5) years from the date of original installation against defects in materials or workmanship. Energy Control Equipment, Inc., ("Manufacturer") will repair or replace this Unit, at its option and at no charge, with new or reconditioned parts or will exchange the Unit with a reconditioned Unit if found to be defective during the limited warranty period specified above. All replaced parts and/or replaced units become the property of Manufacturer and must be returned to Manufacturer. Replacement parts or units assume the remaining original warranty, or ninety (90) days, whichever is longer. Manufacturer authorized representatives must perform all warranty service, unless otherwise specified by Manufacturer. To seek warranty service, purchaser must first contact Manufacturer for problem determination and service procedures.

Coverage

This limited warranty covers manufacturing defects in materials and workmanship encountered in normal use of this Unit and, as determined by Manufacturer, shall not apply to the following, including, but not limited to: damage which occurs in shipment; applications and uses for which this Unit was not intended; failures or problems which are caused by products or equipment not supplied by Manufacturer; accidents, misuse, abuse, neglect, misapplication, fire, water, lightning or other acts of nature; incorrect electrical line voltage, fluctuations or surges; damage caused by unauthorized installation, improper installation, or improper removal and reinstallation of the Unit; damage caused by failure to follow operating instructions; Unit alteration or modification; improper or unauthorized repair; cosmetic damage or Unit with altered serial numbers; use of non-Manufacturer or unauthorized parts, supplies, consumables, accessories or equipment which damage this Unit or result in service problems; failures or problems due to incompatibility with other equipment.

Limits and Exclusions

There are no express warranties other than those listed and described above, and no warranties whether express or implied, including, but not limited to, any implied warranties of merchantability or fitness for a particular purpose, shall apply after the express warranty period stated above. No other warranty or guaranty given by any person, firm or corporation with respect to this Unit shall be binding on Manufacturer.

Manufacturer shall not be liable for loss of revenue or profits, failure to realize savings or any other benefits, or any other special, incidental or consequential damages caused by the use, misuse or inability to use this Unit, even if Manufacturer has been advised of the possibility of such damages. No recovery against Manufacturer of any kind shall be in an amount greater than the purchase price of the Unit sold by Manufacturer and causing the alleged damage.

Without limiting the foregoing, purchaser assumes all risk and liability for loss, damage or injury to purchaser, purchaser's goods and property, and to others and their property, arising out of the use, misuse or inability to use this Unit sold by Manufacturer not caused directly by the negligence of Manufacturer.

This limited warranty shall not extend to anyone other than the original purchaser of this Unit, is nontransferable and states your exclusive remedy.

Because some states do not allow the exclusion of limitation of liability for consequential or incidental damages, the above limitation may not apply to the purchaser. In such states, Manufacturer's liability is limited to the greatest extent permitted by law.



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