

*Turbo air Speeds Up the Pace of Innovation*

REFRIGERATOR MANUFACTURER  
**Turbo air**

Part No. KUCTB2503

# Refrigeration System Installation & Operation Manual

*Please read this manual completely before attempting to install or operate this equipment !*

## Unit Cooler



## Condensing Unit



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## Safety Information

Be sure all power sources are turned off before checking the electric wiring or appliances to avoid electric shock.

Do not run fan if cover or case is removed. This is to avoid electric shock.

All units are pressurized with dry air or nitrogen gas. All units must be evacuated before charging the system with refrigerant. Keep finger away from moving parts.

Avoid touching refrigerant lines. Some parts are very hot and can cause burns.

Avoid contacting sharp edges or coil surface that are a potential injury hazard.

Avoid touching the units or electric box in wet hands to prevent electric shock.

Please call the specialized installation company or trained personnel when you installing, moving, operating of the unit.

Field wiring must confirm to the requirements of units' electric specification.

## Inspection

A person at the job site to receive material holds responsibility. Each shipment should be carefully inspected against the bill of lading. The shipping receipt should not be signed before careful inspection. Check carefully for concealed damage. Any shortage or damages should be reported to the delivering carrier. Damaged material becomes the delivering carrier's responsibility, and should not be returned to Turbo air unless prior approval is given. Check the serial tag information with invoice. Report any discrepancies to Turbo air sales representatives.

## Locating Unit Cooler.

### Minimum space required for Unit Cooler.

Figure 1. One evaporator

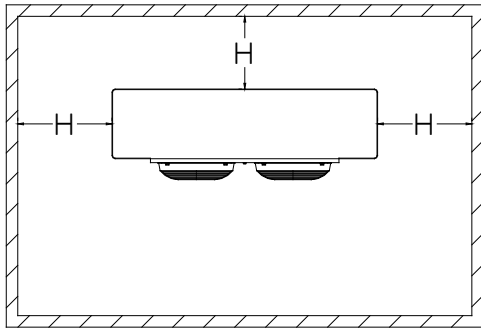
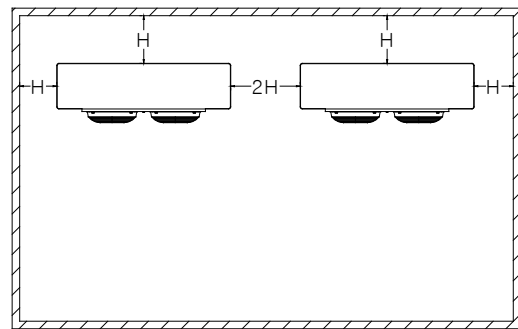


Figure 2. Two or more evaporators



※H=Space Required, Unit Cooler Height

### Recommended location methods of Unit Cooler.

1. Avoid placing Unit Cooler close to doors. Install like Figure 3 or Figure 4.
2. Avoid having them face each other when installing multiple units. Install like Figure 5
3. Recommended placement when installing multiple units see Figure 6.

( H= Sapce Required, Unit Cooler Height )

Figure 3

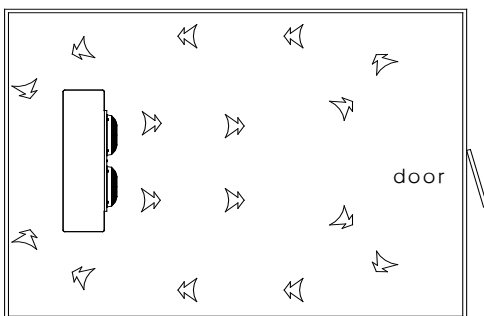


Figure 4

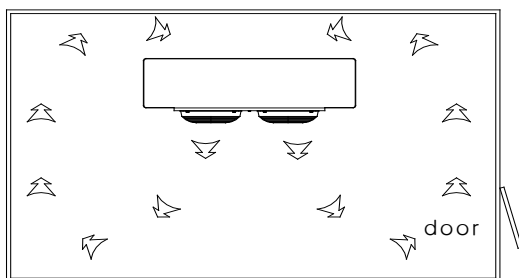


Figure 5

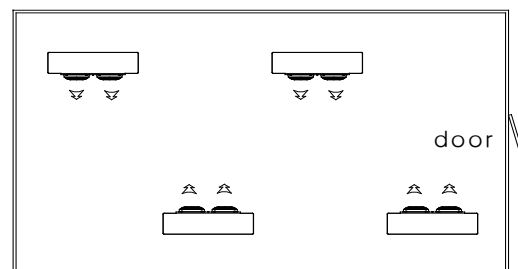
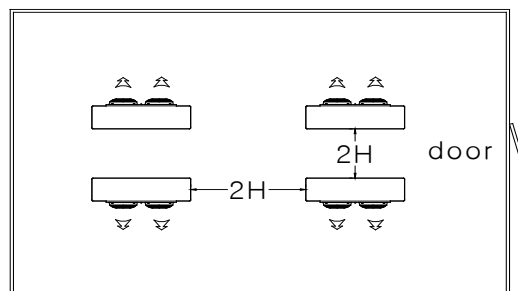


Figure 6



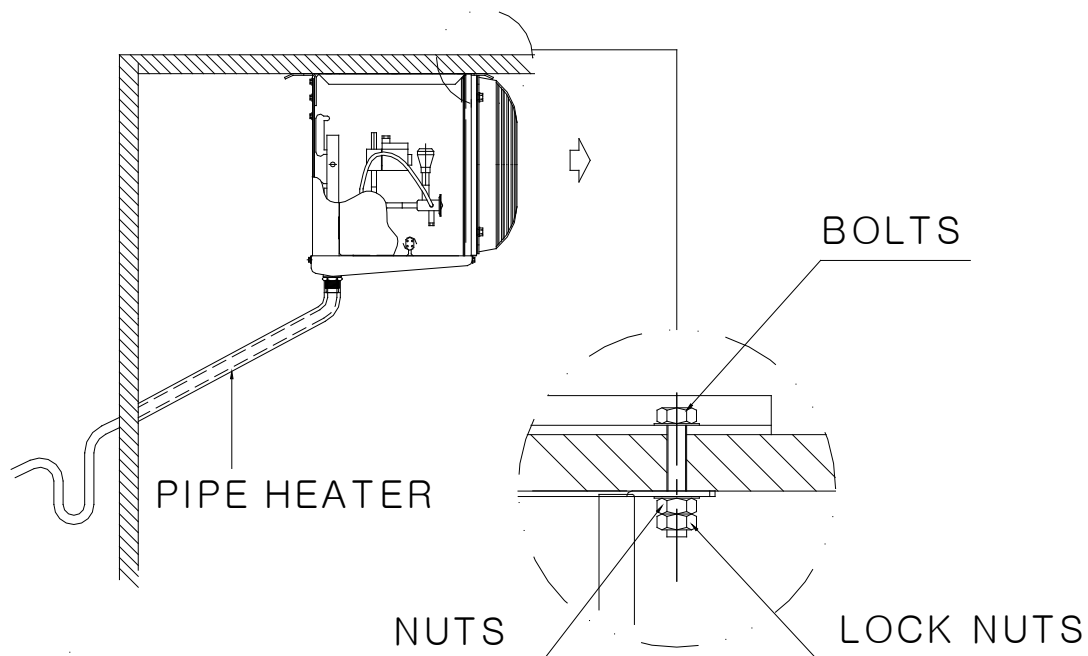
Locate evaporators so that air pattern covers all of the room. Do not restrict the inlet or outlet air stream. When installed, there should be 12" clearance from bottom of the unit. Always avoid placement of unit coolers directly above doors and door openings.

Most evaporators can be mounted with rod hangers, lag screws or bolts. (use 3/8" and 5/8" stainless steel bolts) Refer to Figure 7. Mount the unit level so that condensate drains properly. When using rod hangers, allow adequate space between the top of the unit and the ceiling. (NSF Standard 7). The area above the unit cooler must be sealed or exposed in such away to allow hand

cleaning without the use of tools. When lagging or bolting unit flush to the ceilings, seal the joint between the top and the ceiling with an NSF listed sealant. Ends of open hanger channels must be sealed to prevent accumulation of foreign material.

Refer to Figures 1 through 4. Air flow distance must be considered when coolers or freezers will not accommodate all required evaporators on one wall. Refer to Figure 7. Traps on low temperature units must be outside of refrigerated enclosures. Traps subject to freezing temperatures must be wrapped with heat tape and insulated.

**Figure 7. Unit Cooler Installation Diagram.**



## Unit Cooler Piping.

When brazing refrigerant lines, an inert gas should be passed through the line at low pressure to prevent scaling and oxidation inside the tubing. Dry nitrogen is preferred.

Use only a suitable silver solder alloy on suction and liquid lines. All piping must be adequately supported to prevent vibration and breaking.

Tube clamps should have a gasket surface to prevent abrasion.

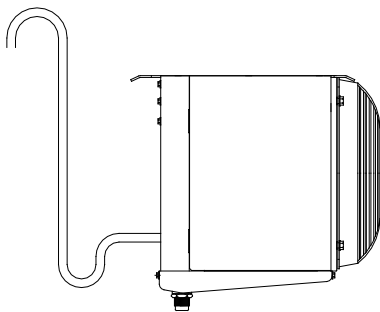
The system as supplied by Turbo air was thoroughly cleaned and dehydrated at the factory.

Foreign matter may enter the system by way of the evaporator to condensing unit piping.

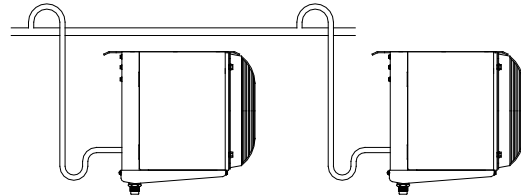
Therefore, care must be used during installation of the piping to prevent entrance of foreign matter.

Use only refrigeration grade copper tubing properly sealed against contamination.

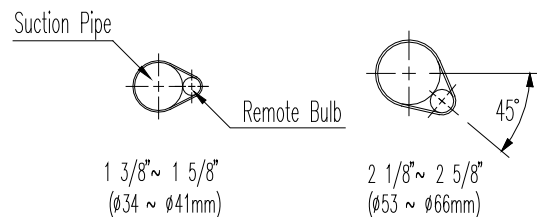
**Figure 8. Suction piping installation on an evaporator.**



**Figure 9. suction piping installation on multiple evaporators.**



**Figure 10. Installation of expansion valve bulb.**



Refer to Figure 8 through 9. Suction line risers must be carefully selected, have an oil trap at the bottom and at 15 foot intervals up the riser. They should be the same size as the vertical riser connected to its outlet. Riser should not be larger in diameter than horizontal runs.

Refer to Figure 10.

Expansion valves are supplied with clamp for securing bulb to the suction line. The bulb must be secured at the evaporator outlet, on the side of a horizontal run of suction line, before any trap.

Do not over tighten bulb clamps or deform the bulb in anyway. Install all refrigeration system components in accordance with applicable local and national codes and in conformance with good practice required for the proper operation of the system.

All piping must be protected where it passes through walls or ceilings. Precautions should be taken to see that the piping does not touch any structural

the transmission of vibration into the building.

The piping chase must be thoroughly sealed to protect the tube and prevent ambient air from entering the refrigerated space. Seal around the drain line where it passes through the wall. Air leaks can cause equipment problems. Damage the structure and product, increase load, increase operating cost, and can cause a safety hazard. Eliminate all air leaks.

## Expansion valve selection.

Expansion valve selection for each model (Table 1)

Table 1 refer to Sporlan and Alco, other expansion valve be referred to their catalogue.

**Table 1. Expansion Valve Specs by Model.**

MODEL	CAPACITY (BTUH)	Refrigerant	Evap. Temp (°F/°C)	EXPANSION VALVE	
				SPORLAN	ALCO
ADR042	4200	R-404A	25 / -4	SBFSE-A-C	HFESC-1/4-SC
ADR068	6800			SBFSE-A-C	HFESC-1/2-SC
ADR073	7300			SBFSE-A-C	HFESC-1/2-SC
ADR109	10900			SBFSE-A-C	HFESC-1-SC
ADR136	13600			SBFSE-A-C	HFESC-1 1/4-SC
ADR163	16300			SBFSE-B-C	HFESC-1 1/4-SC
ADR196	19600			SBFSE-B-C	HFESC-1 1/2-SC
ADR218	21800			SBFSE-B-C	HFESC-1 1/2-SC
ADR273	27300			SBFSE-C-C	HFESC-2-SC
ADR393	39300			SBFSE-C-C	HFESC-3 1/2-SC
LED042	4200	R-404A	-20 / -29	SBFSE-A-Z	HFESC-1/2-SZ
LED068	6800			SBFSE-A-Z	HFESC-1-SZ
LED082	8200			SBFSE-A-Z	HFESC-1-SZ
LED094	9400			SBFSE-A-Z	HFESC-1-SZ
LED126	12600			SBFSE-B-Z	HFESC-1 1/4-SZ
LED147	14700			SBFSE-B-Z	HFESC-1 1/2-SZ
LED168	16800			SBFSE-B-Z	HFESC-2-SZ
LED189	18900			SBFSE-B-Z	HFESC-2-SZ
LED210	21000			SBFSE-B-Z	HFESC-2-SZ
LED252	25200			SBFSE-B-Z	HFESC-3 1/2-SZ
LED300	30000			SBFSE-B-Z	HFESC-3 1/2-SZ

MODEL	CAPACITY (BTUH)	Refrigerant	Evap. Temp (°F/°C)	EXPANSION VALVE	
				SPORLAN	
ADM131	13100	R-404A	25 / -4	SBFSE-A-C	
ADM162	16200			SBFSE-A-C	
ADM248	24800			SSE3C	



ADM321	32100			SSE3C
ADM370	37000			SSE4C
ADM480	48000			SSE4C
ADM567	56700			SSE6C
ADM638	63800			SSE6C
MED105	10500	R-404A	-20 / -29	SBFSE-A-Z
MED144	14400			SBFSE-B-Z
MED207	20700			SSE-3-Z
MED275	27500			SSE-4-Z
MED317	31700			SSE-4-Z
MED410	41000			SSE-6-Z
MED513	51300			SSE-7-Z
MED547	54700			SSE-7-Z
MLD103	10300			SBFSE-A-Z
MLD165	16500			SBFSE-B-Z
MLD220	22000			SSE-3-Z
MLD253	25300			SSE-3-Z
MLD332	33200			SSE-4-Z
MLD388	38800			SSE-6-Z
MLD442	44200			SSE-6-Z
TTA056	5600	R-404A	25 / -4	SBFSE-A-C
TTA084	8400			SBFSE-A-C
TTA112	11200			SBFSE-A-C
TTA141	14100			SBFSE-B-C
TTA175	17500			SBFSE-B-C
TTE049	4900	R-404A	-10 / -23	SBFSE-A-Z
TTE074	7400			SBFSE-A-Z
TTE099	9900			SBFSE-A-Z
TTE124	12400			SBFSE-B-Z
TTE138	13800			SBFSE-B-Z

MODEL	CAPACITY (BTUH)	Refrigerant	Evap. Temp (°F/°C)	EXPANSION VALVE
				SPORLAN
TCA058	5800	R-404A	25 / -4	SBFSE-A-C
TCA087	8700			SBFSE-A-C
TCA106	10600			SBFSE-A-C

TCA140	14000			SBFSE-B-C
TCA178	17800			SBFSE-B-C
TCA197	19700			SBFSE-B-C
TCA213	21300			SBFSE-C-C
TCA284	28400			SBFSE-C-C
TCA356	35600			SBFSE-C-C
TCE058	5800	R-404A	25 / -4	SBFSE-A-Z
TCE087	8700			SBFSE-A-Z
TCE106	10600			SBFSE-A-Z
TCE140	14000			SBFSE-B-Z
TCE178	17800			SBFSE-B-Z
TCE197	19700			SBFSE-B-Z
TCE213	21300			SBFSE-B-Z
TCE284	28400			SBFSE-B-Z
TCE356	35600			SBFSE-B-Z

**Table 2. Recommended line size for suction diameter. ( R-404A)**

SYSTEM CAPACITY BTUH	SUCTION TEMPERATURE															
	+ 30. F				+ 20. F				+ 10. F				- 10. F			
	30'	75'	100'	150'	30'	75'	100'	150'	30'	75'	100'	150'	30'	75'	100'	150'
3000	3/8	3/8	1/2	1/2	3/8	1/2	1/2	1/2	1/2	1/2	1/2	5/8	1/2	5/8	5/8	5/8
4000	3/8	3/8	1/2	1/2	1/2	1/2	1/2	5/8	1/2	1/2	5/8	5/8	1/2	5/8	5/8	7/8
6000	1/2	1/2	5/8	5/8	1/2	5/8	5/8	7/8	1/2	5/8	5/8	7/8	5/8	5/8	7/8	7/8
9000	1/2	5/8	7/8	7/8	5/8	7/8	7/8	7/8	5/8	7/8	7/8	7/8	7/8	7/8	7/8	7/8
12000	1/2	5/8	7/8	7/8	5/8	7/8	7/8	7/8	5/8	7/8	7/8	7/8	7/8	7/8	7/8	1 1/8
15000	5/8	5/8	7/8	7/8	5/8	7/8	7/8	7/8	7/8	7/8	7/8	1 1/8	7/8	7/8	1 1/8	1 1/8
18000	5/8	7/8	7/8	7/8	7/8	7/8	7/8	1 1/8	7/8	7/8	1 1/8	1 1/8	7/8	1 1/8	1 1/8	1 1/8
24000	5/8	7/8	7/8	7/8	7/8	7/8	1 1/8	1 1/8	7/8	1 1/8	1 1/8	1 1/8	1 1/8	1 1/8	1 1/8	1 3/8
30000	7/8	7/8	7/8	1 1/8	7/8	1 1/8	1 1/8	1 1/8	1 1/8	1 1/8	1 1/8	1 3/8	1 1/8	1 1/8	1 3/8	1 3/8
36000	7/8	7/8	1 1/8	1 1/8	7/8	1 1/8	1 1/8	1 3/8	1 1/8	1 1/8	1 3/8	1 3/8	1 1/8	1 3/8	1 3/8	1 3/8
42000	7/8	1 1/8	1 1/8	1 3/8	1 1/8	1 1/8	1 3/8	1 3/8	1 1/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 5/8
48000	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8
54000	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8
60000	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8
66000	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8
SYSTEM CAPACITY BTUH	SUCTION TEMPERATURE															
	-20. F				-30. F				-40. F				LIQUID LINE SIZE			
	30'	75'	100'	150'	30'	75'	100'	150'	30'	75'	100'	150'	30'	75'	100'	150'
3000	1/2	5/8	5/8	5/8	1/2	5/8	5/8	7/8	5/8	5/8	7/8	7/8	3/8	3/8	3/8	3/8

4000	1/2	5/8	5/8	5/8	5/8	5/8	7/8	7/8	5/8	5/8	7/8	7/8	3/8	3/8	3/8	3/8
6000	5/8	7/8	7/8	7/8	5/8	7/8	7/8	7/8	7/8	7/8	1 1/8	1 1/8	3/8	3/8	3/8	3/8
9000	5/8	7/8	7/8	1 1/8	7/8	7/8	7/8	1 1/8	7/8	7/8	1 1/8	1 1/8	3/8	3/8	3/8	3/8
12000	7/8	7/8	1 1/8	1 1/8	7/8	7/8	1 1/8	1 1/8	1 1/8	7/8	1 3/8	1 3/8	3/8	3/8	3/8	3/8
15000	7/8	1 1/8	1 1/8	1 1/8	7/8	1 1/8	1 1/8	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8	3/8	3/8	3/8	1/2
18000	7/8	1 1/8	1 1/8	1 3/8	7/8	1 1/8	1 1/8	1 3/8	1 1/8	1 1/8	1 3/8	1 3/8	3/8	3/8	1/2	1/2
24000	1 1/8	1 1/8	1 1/8	1 3/8	1 1/8	1 1/8	1 3/8	1 3/8	1 1/8	1 1/8	1 5/8	1 5/8	3/8	1/2	1/2	1/2
30000	1 1/8	1 1/8	1 3/8	1 3/8	1 1/8	1 3/8	1 3/8	1 3/8	1 1/8	1 3/8	1 5/8	1 5/8	1/2	1/2	1/2	5/8
36000	1 1/8	1 3/8	1 3/8	1 5/8	1 3/8	1 3/8	1 3/8	1 5/8	1 3/8	1 3/8	1 5/8	1 5/8	1/2	1/2	1/2	5/8
42000	1 3/8	1 3/8	1 3/8	1 5/8	1 3/8	1 3/8	1 5/8	1 5/8	1 3/8	1 3/8	1 5/8	1 5/8	1/2	1/2	5/8	5/8
48000	1 3/8	1 3/8	1 5/8	1 5/8	1 3/8	1 3/8	1 5/8	1 5/8	1 3/8	1 3/8	1 5/8	1 5/8	1/2	1/2	5/8	5/8
54000	1 3/8	1 3/8	1 5/8	1 5/8	1 3/8	1 3/8	1 5/8	1 5/8	1 3/8	1 3/8	1 5/8	1 5/8	1/2	1/2	5/8	5/8
60000	1 3/8	1 3/8	1 5/8	1 5/8	1 3/8	1 3/8	1 5/8	1 5/8	1 3/8	1 3/8	1 5/8	1 5/8	1/2	1/2	5/8	5/8
66000	1 3/8	1 3/8	1 5/8	1 5/8	1 3/8	1 3/8	1 5/8	1 5/8	1 3/8	1 3/8	1 5/8	1 5/8	1/2	1/2	5/8	5/8

1. All line size are basic for O.D type L copper tube. The above table is maximum suction size and riser size should not exceed horizontal size.
2. Suction line size should be selected at pressure drop equivalent to 2. F, and reduce estimate of system capacity accordingly.
3. For easy oil return, use U trap in suction line.
4. Consider double suction risers, if capacity control can reduce capacity 35% below.

## DEFROST

Once ice forms in an evaporator coil it keeps building more ice and eventually will lead to equipment failure if not manually defrosted.

Some symptoms of ice forming in the coil are:

1. loss of air circulation and air throw
2. loss of room temperature.
3. no off-cycle time.
4. flood back.
5. water spitting out of the fans or coil on air defrost systems.

Long term ice formation will crush the refrigerant tubes in the coil causing leaks and major equipment problems. If ice formation is suspected, carefully check the interior rows of the coil with a good light. Ice formation usually starts at the bottom of the coil in the middle rows and can be difficult to detect.

For most applications, two to four defrost cycles per day should be adequate. The defrost requirements will vary on each installation so the defrost settings should be determined by observing the system operation.

### Air defrost

The normal “off cycle” of the compressor may be adequate to keep the evaporator

coil clear of frost. In other applications, a defrost timer may be necessary to help assure a clear coil in a medium temperature environment, "Air defrost" is initiated by the timer, but the evaporator

fans continue to operate to facilitate the melting of frost on the fan surface. Other types of defrost schemes require that the fans on the evaporator shut off during the defrost period.

### **Electric defrost**

The recommended electric defrost circuitry is typically using a defrost heater.

During defrost cycle, compressor and fan are stopped automatically by the timer at predetermined times.

In generally, electric defrost uses defrost timer for preventing over heating.

There are two kinds defrost timers. Turbo air uses bimetal method.

During the defrost cycle, if the room temperature rises above the desired setting, defrost heater will turn off

automatically and if the room temperature drops lower than desired temperature, Defrost heater will turn off.

If the defrost time finished, defrost timer will turn on and the compressor and fans will run continuously.

At this time, fan power is supplied later than compressor power by fan delay thermostat. If it does not, a partial defrost results and the residual water and slush will re-freeze into ice during the next cycle. Ice removal will require a manual defrost.

### **Defrost Thermostat**

#### **Bimetal Disc Type**

Turbo air uses Klaxon type thermostat made by Texas Instruments Company.

This thermostat terminates defrost at 50°F(10°C) and prevents the fans from running when the coil temperature is above 40°F(4.4°C). And defrost termination/fan delay thermostat terminates defrost at 55°F(12.8°C) after defrost is finished.

This will allow fan delay time for eliminating the residual water and slush in the evaporator coil.

Fan delay time can be eliminated by

jumping the fan switch contacts. This will allow the fans to start immediately after defrost termination. This will disable the fan delay.

When the coil temperature reaches approximately 40°F(1.7°C), fan delay is sends a signal to the control circuit, and it will run fan motor. If you wish to control fan delay time and defrost termination time, adjust the position of thermostat. If this method is used, it will result in higher temperature.

### Adjustable Type ( F25 Series )

The F25 Control terminates defrost and delays evaporator fan operation following a defrost cycle. The coil temperature rises during the defrost cycle to the control cut-out setting. At this setting the defrost cycle terminates and refrigeration starts. The fan remains off during the

initial start-up of the refrigeration cycle.

When the coil temperature drops to the control cut-in setting, the fan is turned on. The delayed fan operation prevents warm moist air from being circulated into the controlled space and danger of increased vapor pressure and product damage is eliminated.

### Defrost Timer Setting

Turbo air uses 8145-20B type timer made by Paragon company.

Timer should be set correctly. Determine the number of defrosts per day and the best time of day for it to occur. Insert pins accordingly. Set the fail-safe time to terminate the defrost a few minutes

beyond the estimated temperature termination time. Air defrost termination time is usually 30 to 50 minutes. The colder the room, the longer the fail-safe time required. Electric defrost systems normally have a 25 to 40 minute fail-safe time.

## Head Pressure Control

### A. Head Pressure Control Valve System (Standard Models)

The standard valve used on high pressure refrigerant systems controls the head pressure at approximately 180 PSIG.

### B. Fan Cycle Pressure Control System (Model “-A”)

Pressure Settings

Evaporator Temp.Range	Fan No	Pressure Switch 1 (PSIG)		Pressure Switch 2 (PSIG)	
		OFF	ON	OFF	ON
High (40 to 0 °F)	1, 2	157	228	-	-
Extended (30 to -25 °F) &	1	-	-	100	157
Extra Low (0 to -40 °F)	2	157	228	100	157

## Locating and Mounting Condensing Unit

### Locating Condensing Unit.

Condensing Unit must be located and installed where there is an unrestricted area. Avoid areas where there are corrosive vapors or flammable materials. Avoid locating units too close to walls. Fan intake and discharge air space should be at least 1m and 2m from wall. Other sides should be at least 0.5m from wall.

No impediments should be located in front of condensing units intake and discharge.

If above is not followed correctly noise and inadequate air flow may result.

Condensing units should be located away from general public and the street.

Make sure units are kept horizontal.

### Mounting Condensing Unit.

Mounting base should be concrete or steel sufficient to support between 2 to 5 times the weight of condensing unit.

the unit and tightened with spring washer and nuts.

Condensing units must be mounted using pads to avoid vibration or shifting.

The anchor bolts should be used to fix

### Spring Mounted Compressor.

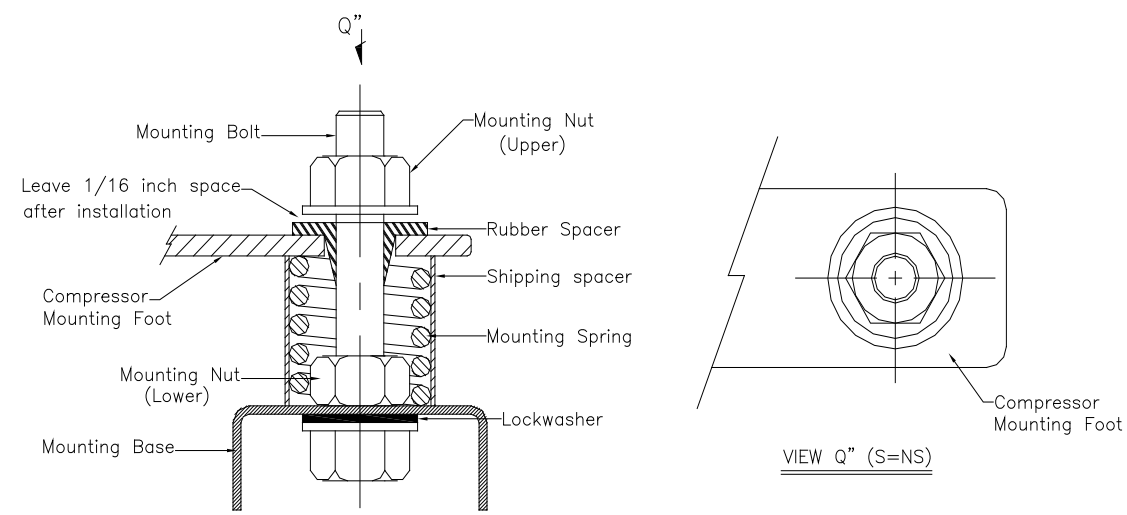
Semi-hermetic compressor unit use the mounting assembly shown in Figure 11, the shipping spacer is to be in place during shipment to insure maximum support for the compressor body during transit.

Before the unit is put in operation, the shipping spacer should be removed and discarded.

Before operating the unit, it is necessary to follow these steps.

1. Remove the upper nuts and washers.
2. Remove and discard the shipping spacers.
3. Install the rubber spacer. (rubber spacer tied to compressor.)
4. Replace the upper mounting nuts and washers.
5. Allow 1/16" between the upper nut and the rubber spacer as **Figure 11**.

Figure 11. Spring Mount.



## System Operation.

### Evaporator Superheat.

Evaporator superheat is generated from the compressor suction line reducing system efficiency.

Normally 6°F to 12°F is acceptable on most refrigeration systems. Preferably, 6°F to 8°F on low temperature systems and 8°F to 10°F on medium temperature systems are desired. For systems operating at higher temperatures, the superheat can be adjusted to 12°F to 15°F as required.

The method of measuring evaporator superheat is found by P-T method.

Obtain evaporator superheat by measuring the suction line temperature at

the expansion valve bulb. Obtain pressure at a Schrader fitting in the evaporator suction connection area, near the expansion valve bulb, and convert to temperature with a P-T chart.

Subtract the converted temperature from the measured temperature and the difference is superheat at the evaporator. Obtain the desired superheat by adjusting the expansion valve.

Evaporator superheat greater than 14°F can substantially reduce system capacity, while superheat less than 4°F has the potential for flood back.

### Compressor Superheat.

Compressor superheat has an effect on system capacity and efficiency. Compressor superheat affects compressor life and recommends a minimum of 20°F superheat at the compressor. Too low a compressor superheat can permit liquid return to the compressor causing damage.

Too high a compressor superheat can cause high discharge temperature, resulting in lubricant breakdown, compressor overheating and can lead to compressor damage or failure.

Compressor superheat can be changed by adjusting the expansion valve, adding a suction-liquid line heat exchanger.

Obtain compressor superheat by measuring the suction line temperature about 6 to 12 inches from the compressor service valve.

Obtain pressure at the suction service valve and convert to temperature with a P-T chart. Subtract the converted temperature from the measured temperature and the difference is superheat at the compressor.



## Refrigerant Charging.

When charging a system with refrigerant that is in a vacuum with vacuum pump, the above process is very important to remove moisture inside system. The moisture can cause system damage or failure.

Charge refrigerant into a system through a filter/drier in the charging line. This extra drier will insure that all refrigerant supplied to the system is clean and dry. Weigh the refrigerant drum before charging so an accurate record can be kept of the weight of refrigerant put in the system. Liquid refrigerant can be added directly into the receiver tank and

charging 90% of system refrigerant capacity.

Start the system and finish charging until the sight glass indicates a full charge and the proper amount have been weighed in.

If the refrigerant must be added to the system through the suction side of the compressor, charge in vapor form only.

Liquid charging must be done in the high side only and with liquid metering devices.

If R-404A is used, liquid must be charged and read up refrigerant explanatory.

## Start-up.

Use the following operating procedure after the installation has been completed,.

- 1) Check all electrical and refrigerant connections. Check if the electrical status is in manual and if there are no holes in the refrigerant lines. Start-up
- 2) Check all fans on the evaporator and condensing unit to be sure they are operational and turning the proper direction.
- 3) Check high and low pressure switch, pressure regulating valves, and adjust if necessary.
- 4) Continue charging until system has sufficient refrigerant for proper operation. Do not overcharge. Bubbles in a sight glass may be caused by a restriction as well as a shortage of refrigerant. Check service valve and open if refrigerant is sufficiently charged and you still have bubbles in the sight glass.
- 5) Observe system and do not leave unit unattended until the system has reached normal operating conditions.

WARNING : SCROLL COMPRESSOR IS DIRECTIONAL DEPENDENT. IF NOISY, SWITCH ANY TWO SUPPLY LINES.
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## Unit Cooler troubleshooting.

Symptoms	Possible causes	Solution
Cooling is insufficient. (Room temperature too high.)	Insufficient refrigerant	Add refrigerant
	Too much oil in unit cooler	Check the easy oil return in suction line.
	Superheat too high	Adjust expansion valve.
	Room thermostat set too high	Adjust thermostat
	Coil iced-up	Manually defrost coil. Check defrost time, period, controls.
	Defective distributor	Replace.
Uneven coil frosting.	Defective distributor	Replace
	Defective heater	Replace
	Defrost termination set too low	Adjust defrost termination setting higher and move defrost thermostat.
Ice build up in coil quickly	Fin spaced too narrow	Replace coil
	Evaporating temperature too low	Adjust expansion valve
	Decrease of air volume	Check fan and clean air filter
	Unit cooler capacity is too small	Replace unit cooler
Fan not operating	Main switch open	Close switch
	Blown fuses	Replace fuses. Check for short circuits or overload conditions
	Defective motor	Replace motor
	Defective timer or defrost thermostat	Replace defective component
	Unit in defrost cycle	Wait for completion of cycle
	Coil does not get cold enough to reset thermostat.	Adjust fan delay setting of thermostat.
Ice accumulating in drain panel	Defective heater	Replace heater
	Drain line plugged	Clean drain line
	Defective drain line heater	Replace heater
	Defective timer or defrost thermostat	Replace defective component.

Symptoms	Possible causes	Solution
Coil not clearing of frost during defrost cycle	Coil temperature not getting above freezing point during defrost.	Check heater operation
	Insufficient defrost period	Adjust timer or more defrost cycle
	Defrost cycle too short	Adjust defrost thermostat or timer for longer cycle
	Defective timer or defrost thermostat	Replace defective component
Ice accumulating on ceiling ,around evaporator, on fan guard, or blades.	Defrost time is too long	Adjust defrost termination thermostat.
	Not delaying fans after defrost period.	Check fan delaying thermostat
	Defective defrost thermostat or timer.	Replace defective component
	Too many defrosts	Reduce the number of defrosts

## System troubleshooting.

symptoms	Possible causes	Solution
Compressor not running	Main switch open	Close switch
	Blown fuse	Check electrical circuits and motor winding for shorts or grounds. Replace fuse after fault is corrected.
	Loose wiring	Check all wire junctions. Tighten all terminal screws.
	System cable shut down	Replace shutdown cable.
	Thermal overload tripped	Overloads are automatically reset. Check unit when unit come back on line.
	Defective contactor or contactor coil	Replace or repair
	System shut down by safety devices.	Check cause of shut down
	Liquid line solenoid not open	Repair or replace coil
Noisy Compressor	Flooding of liquid refrigerant into crankcase	Check expansion valve setting
	Improper piping support on suction or liquid line.	Relocate add hangers.
	Worn compressor.	Replace compressor
High discharge pressure.	Non-condensable in system.	Remove non-condensable.
	Too much refrigerant	Remove excess refrigerant
	Discharge shut off valve partially closed	Open valve
	Fan not running	Check electrical circuit and fuse.
	Dirty condenser coil	Clean condenser coil
Low discharge pressure.	Faulty condenser temperature controls	Check head pressure control
	Suction shut off valve partially closed	Open valve
	Insufficient refrigerant	Check leaks. Add charge.
	Low suction pressure	See corrective steps for low suction pressure.

symptoms	Possible causes	Solution
High suction pressure	Excessive loads	Reduce load.
	Expansion valve overfeeding.	Check bulb location and clamping. Adjust superheat.
Low suction pressure.	Lack of refrigerant.	Check for leaks. Add charge.
	Evaporator dirty or iced	Clean and defrost.
	Clogged liquid line filter drier.	Replace filter drier.
	Expansion valve malfunctioning.	Check and reset for proper superheat.
	Condensing temperature too low.	Check and replace head pressure control
	Improper expansion valve.	Check for proper expansion valve.
Compressor thermal protector switch open.	Operating beyond design conditions	Add facilities so that conditions are within allowable limits.
	Discharge valve partially closed	Open valve.
	Dirty condenser coil	Clean coil
	Overcharged refrigerant	Reduce charge.
Compressor loses oil	Lack of refrigerant	Check for leaks and add refrigerant
	Excessive compression ring blow by.	Replace compressor.
	Refrigerant flood back.	Maintain proper superheat at compressor.
	Improper piping or traps.	Correct piping.
Little or no oil pressure	Clogged suction oil strainer.	Clean.
	Excessive liquid in crankcase.	Check crankcase heater. Adjust expansion valve. Check the solenoid valve.
	Low oil pressure safety switch defective.	Replace.
	Oil pump reversing gear stuck in wrong position.	Reverse direction of compressor rotation.
	Worn bearings.	Replace compressor.
	Low oil level.	Add oil.
	Loose fitting on oil lines.	Check and tighten system.
	Pump housing gasket leaks.	Peplace gasket.

## Field Wiring.

Diagram 1. Typical wiring diagram for single evaporator with or without defrost timer.

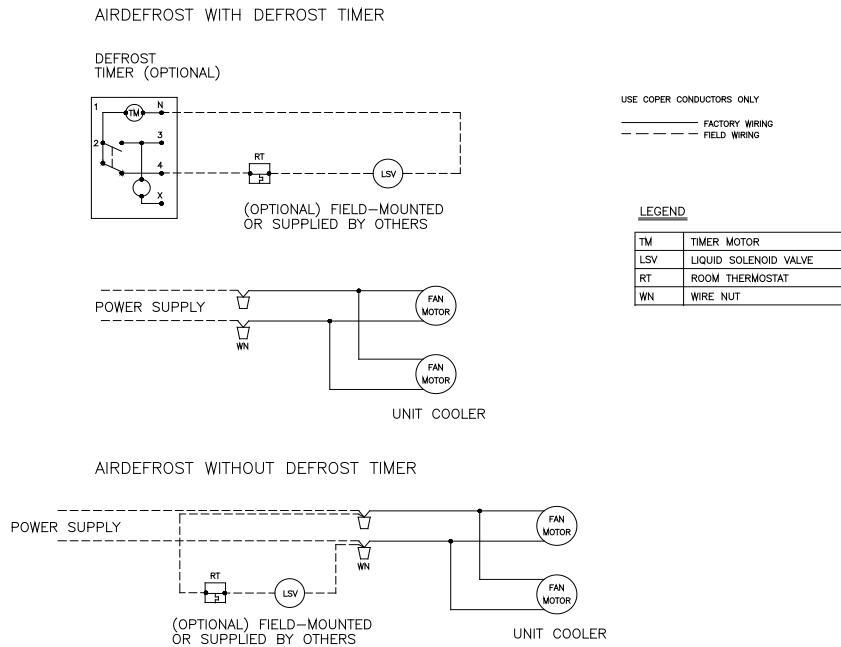
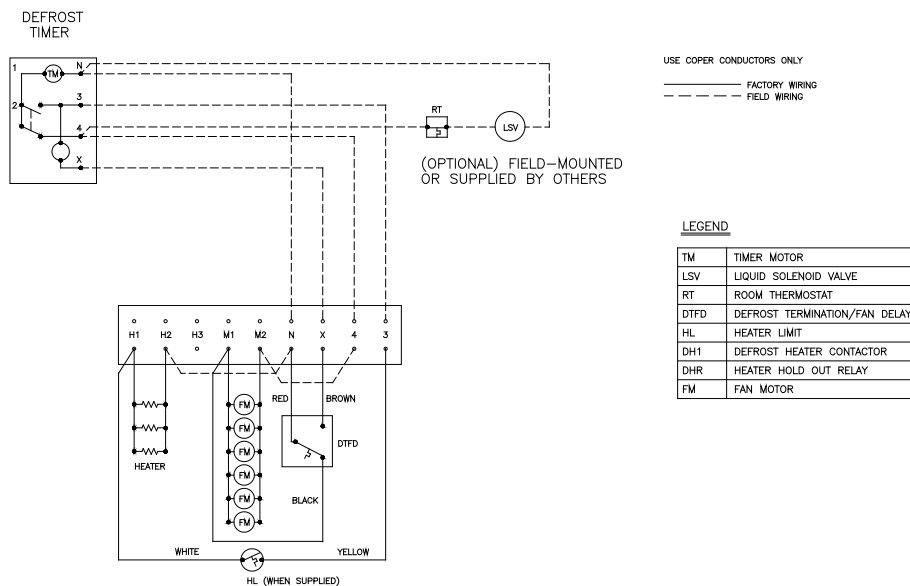


Diagram 2. Typical diagram for single evaporator defrost timer only.



DEFROST  
TIMER

1 2 3 4 X

120V

DHR

DH1

RT

LSV

(OPTIONAL) FIELD-MOUNTED  
OR SUPPLIED BY OTHERS

DH1

DHR, DH1  
(OPTIONAL)

H1 H2 H3 M1 M2 N X 4 3

HEATER

RED BROWN

DTFD

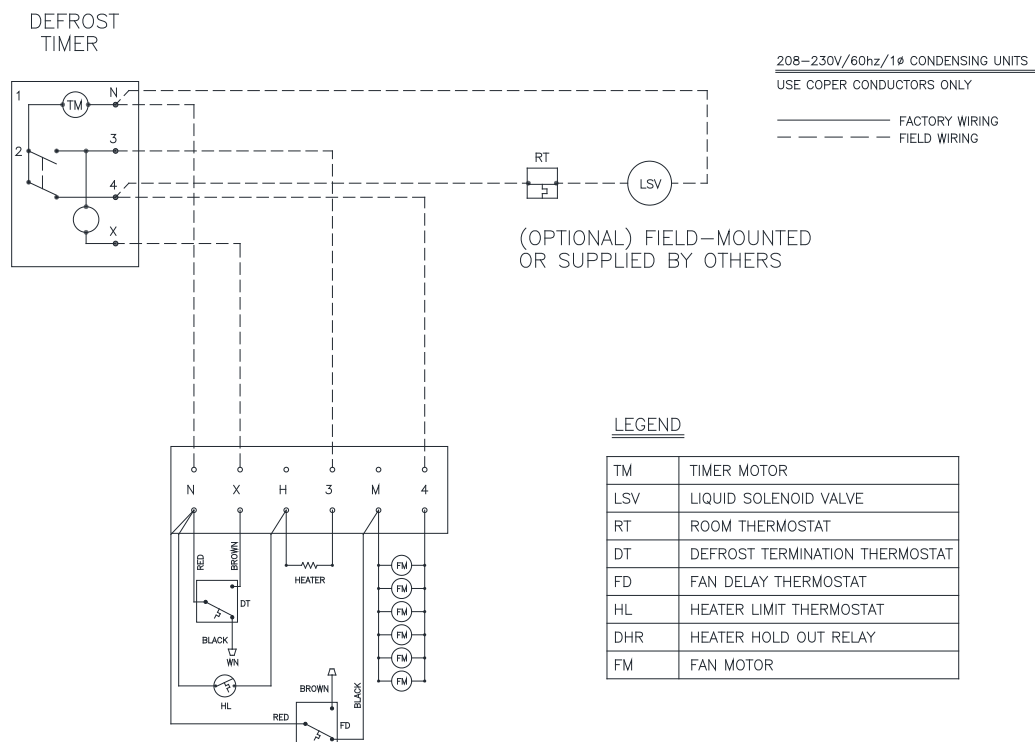
WHITE BLACK

YELLOW

HL (WHEN SUPPLIED)

[illegible]

Diagram 5. Typical diagram for single evaporator defrost timer only (TTE-TYPE).





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