THERMO KING

Specification Sheet



NMF-372

MANUFACTURED BY

KLINGE CORPORATION

4075 EAST MARKET STREET

YORK, PA 17402 USA

Phone: 1-717-840-4500

https://www.thermoking.com/klinge

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UNIT INFORMATION

Construction	The NMF-372 system is designed especially for mounting in customer built-in rooms or on ultra-low temperature insulated containers. The unit is designed for high reliability, providing two separate systems for cooling and hot gas defrosting to maintain cargo in a temperature range from -70° to -20°C (-94° to -4°F). Each system is equally capable of the necessary temperature control, redundancy is provided should a failure to one system occur. The electrical system consists of circuit breakers, relays, and controls for fully automatic operation of all functions (temperature control, defrosting, etc.). Changeover between systems is automatic, should a failure occur to one system or following a system defrost. The refrigeration unit frame is constructed of aluminum, treated to resist corrosion induced by salt spray atmosphere. All fasteners; bolts, screws, nuts, washers, hinges are stainless steel. All aluminum material is 5052H32. All operational components except the evaporator components and condenser coils are replaceable from the front of the unit.
Equipment design	The unit is designed to maintain temperatures in the container by automatically cooling and defrosting during operation. The unit can provide cargo temperature in the range from -70°C to -20°C (-94° to -4°F). The unit operates in ambient temperatures up to +50°C (122°F). To withstand and operate satisfactorily under sea-going and environmental conditions including: Rolling: Ocean environment: salt-laden air, sea spray, high humidity, and severe atmospheric conditions Pitching: Amplitude of 30 degrees on each side, period of 13 seconds Permanent list: Amplitude of 6 degrees, period of 8 seconds 10 degrees on each side Shock: Acceleration of 2 G in all directions Vibrations: Of the type encountered on ships or land vehicles and rails
Dimensions	Condenser Width: 2110 mm (83.1 in) Height: 1400 mm (55.2 in) Depth: 555 mm (21.9 in) Evaporator (each) Width 1000 mm (39.4 in) Height 665 mm (26.2 in) Depth 1191 mm (46.9 in)
Weight	921 kg
Power supply	
Main power	50 Hz; 360VAC min. - 460VAC max. 60 Hz; 400VAC min. - 500VAC max. The nominal frequencies of 50 Hz and 60 Hz shall have a tolerance of ± 2.5%.
Control Circuit	AC, 24/28 volt (from transformer)
Method of Defrost	Manual, on-demand, and automatic timer back-up

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Paint Color	White
Refrigerant	R134a High Temperature System (compressors 1 & 2) R23 Low Temperature System (compressor 3)

UNIT CAPACITY

Test method according to ARI standard no. 1110-69 approval

Unit capacity 60 HZ	Net cooling capacity at **37.8°C** ambient temperature at **60 Hz** power		
	Return air temperature	**Capacity**	**Power Requirement**
	-60°C	4,200 W	17,750 W

STANDARD INFORMATION

Machinery is designed for and suitable for transportation over long voyages of deep frozen, frozen, or chilled cargoes.
Machinery will be in full functional operation and work satisfactorily in ambient temperatures from -30°C to +50°C (-22°F to +122°F). Components are made to withstand temperatures up to + 70°C (158°F).
The unit is built to comply with standards and regulations of major Classification Societies such as: ARI - test method for rating refrigerated equipment. Machinery complies with International Customs Regulations for Containers. Machinery complies with relevant ISO Recommendations. Machinery complies with rules of B.V., ABS and Lloyds Register, but is certified to ISO 1496-2. Unit complies with Australia and New Zealand Health Requirements.

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REFRIGERATION SYSTEM INFORMATION

COMPRESSOR/CONDENSER SECTION			
Compressors	Copeland	**Type**	Hermetic scroll
		Displacement	727 CFH
		Oil	Mobile EAL Arctic 22 cc polyol ester oil
		Protection	Automatic reset
Condenser coil	Air cooled	**Tube / Fin Material**	Copper (DIN 1787) / Aluminum
		Orientation	Vertical
		Protection	Treated for protection against salt spray and marine environments
Condenser fan motor	TEAO	**Nominal Hp**	3/4
		Speed	1140 rpm
		Bearing	Ball, double-shielded
		Protection	Internal thermal automatic reset
Condenser fan		**Type**	Propeller
		No. of blades	10
		Material	Plastic
REFRIGERATION SYSTEM			
Heat Exchanger	Swep or equivalent	**TX valves**	Danfoss or equivalent
Shut off valve	Danfoss or equivalent	**Filter Driers**	Sporlan or equivalent
Moisture indicators	Danfoss or equivalent		
Suction pressure regulating valve		Danfoss or equivalent	
Condensing pressure regulating valve		Danfoss or equivalent	
REFRIGERATION SAFETY CONTROLS			
High pressure switch (R134a system)		Cut-out 24 bar, cut-in 17 bar	
High pressure switch (R23 system)		Cut-out 28 bar, cut-in 20 bar	
Hot gas maximum pressure regulator R23 system		Set to max. pressure at 15 bar	
Crankcase pressure regulator R23 system		Set to suction pressure maximum 3.5 bar	
Safety relief valve, R134a high pressure		29.3 bar	
Safety relief valve, R23 high pressure buffer tank		29.3 bar	
Safety relief valve, R23 low pressure		20.7 bar	
EVAPORATOR SECTION			
Evaporator coil	Air cooled	**Tube / Fin Material**	Copper rifled / Aluminum
Evaporator fan motor (2)	TEAO	**Nominal Hp**	1/3

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	Speed	1120 rpm
	Bearing	Ball, sealed
	Protection	Internal thermal automatic reset
Evaporator fan (2)	**Type**	Impeller
	No. of Blades	8
	Material	Plastic

ELECTRICAL SYSTEM INFORMATION

ELECTRIC SAFETY CONTROLS	
Control circuit breaker	5A
Main power circuit breaker	32A
Condenser and evaporator motors	Internal thermal automatic reset
INTERNAL ELECTRIC PANEL COMPONENTS	
Contactors	Compressor, condenser fan, evaporator fans
Circuit breakers	Main power, control power
Transformer	Primary: 480 V
	Secondary: 28 V main control power, 24 V controller logic
EXTERNAL ELECTRIC PANEL COMPONENTS	
Switch	Unit ON - OFF
Circuit breaker	Control circuit

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CONTROL INFORMATION

The microprocessor controller is based on the newest technology. System senses and controls discharge air from going below predetermined settings. Temperature settings are in 1°C increments from 0°C to -65°C. On demand defrost is controlled by a probe mounted in the center of the evaporator, which measures the temperature of the refrigerant in the copper tubes.
The controller is based on microprocessor technology and consists of 3 parts:

1. Operator control panel
2. Printed circuit board (PCB)
3. Temperature probes (3 pcs)

All parts are mounted in the control box except for the probes, which are mounted in the supply air, in the return air and fixed to the suction piping to measure defrost conditions. The microprocessor technology design provides permanent accuracy, reliability, and increased flexibility in functions.

OPERATION

The unit will run until the return air temperature reaches the set point, or for a minimum of 15 minutes, whichever is longer. Then the compressor and condenser fan motor will cycle off, the evaporator fans will continue to run. The controller will call for cooling if the return air temperature rises to 1°C above the set point, this will cause the compressor to cycle back on. When the compressor cycles off there is a 60 second time delay before the compressor can cycle back on. If the return air temperature falls to 2°C below the set point, the unit will stop and will not restart for a minimum of 10 minutes.

TEMPERATURE PROBES

Each temperature sensing probe is a thermistor placed in an epoxy filled metal tube, which is connected to a two-conductor shielded cable by an electrical connector. A temperature signal from the probe is relayed to the controller through the cable. One probe each is mounted in the supply air and return air to measure the temperature of the air being discharged from and returning to the system. The third probe is mounted to the suction piping to measure the temperature conditions during defrost cycles.

DEFROST

The defrost cycle can be activated in 3 different ways, manually (1) or automatically (2) by the controller:

1. Manual defrost, starts from the display panel.
2. Timer defrost, set under “config” in display, can be set from 3 to 99 hours.
3. Demand defrost;
    a. When unit is started, the first timer defrosting will begin after ¼ of the timer setting (timer set = 24 hrs., first defrost = 6 hrs.), or first time the return air temperature goes below -29°C, whichever comes first. If the unit has been disconnected from power for more than 30 minutes the timer setting will be reset.
    b. The unit will also start a defrost cycle if the supply air sensor is more than 10°C lower than the return air sensor, or if the defrost sensor is more than 15°C lower than the return air sensor.

Defrosting of the evaporator coil and drain pan operates on hot gas from the compressor. The condenser fan and the evaporator fans are stopped during the defrost cycle.

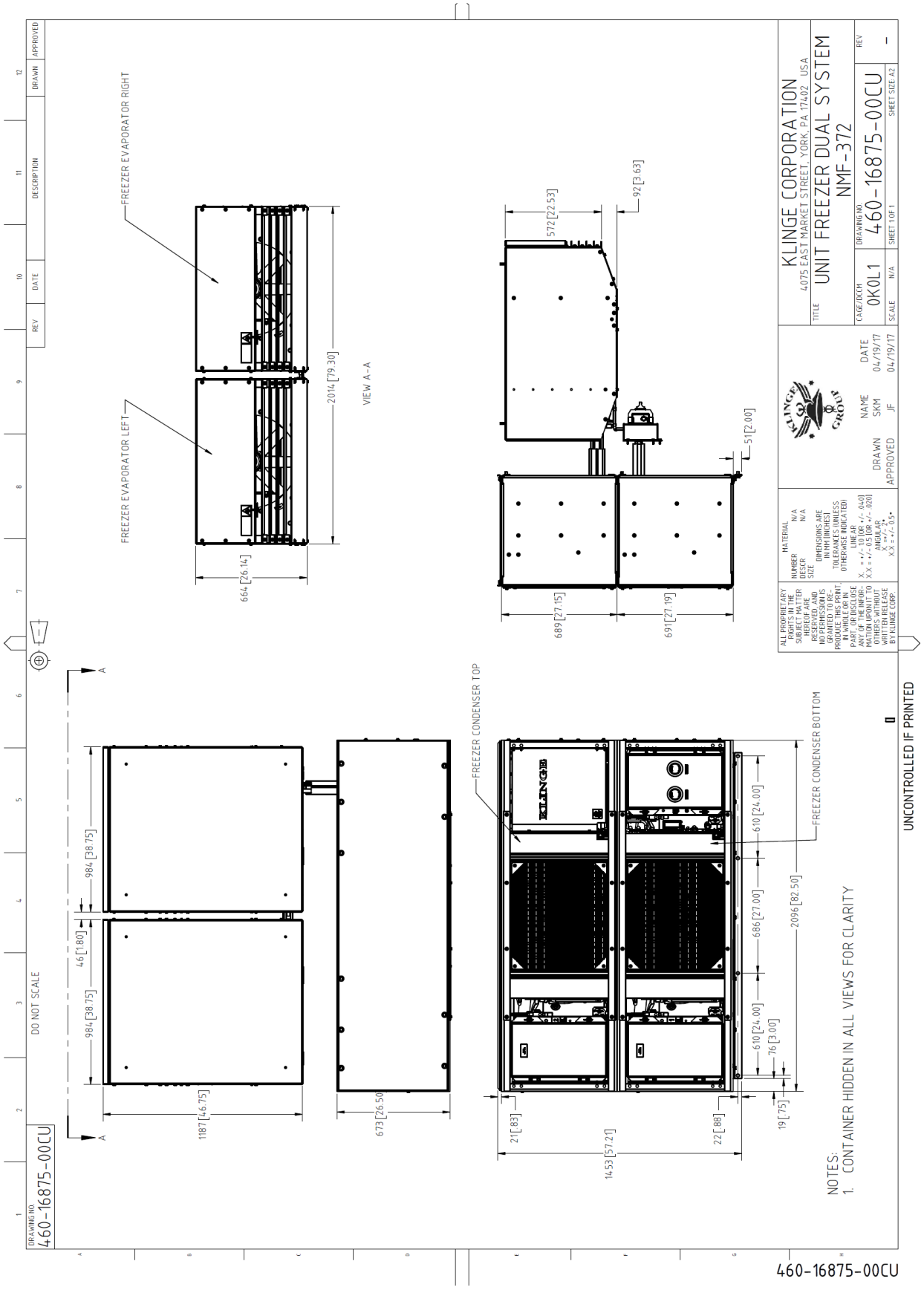
Termination of the defrost cycle is automatic, when the temperature of the defrost sensor (evaporator temperature) rises to the preset limit (can be set under “config” in display, from +5°C to +30°C), factory setting is 14°C.

The controller will restart the unit if the defrost is not complete in maximum defrost operating times (can be set in “config” in display from 15 to 99 minutes), factory setting is 45 minutes.

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SYSTEM ASSEMBLY DRAWING



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REVISION RECORD

Rev	Description	Date	Approved
-		2017/09/13	BES
A	Unit weight was 850 kg, page 1	2018/02/01	BES
B	Updated "UNIT CAPACITY" table per latest testing	2019/01/15	BES
C	Corrected Evaporator Motor information, page 5	2019/07/22	BES
D	Updated temperature range, page 3	2020/10/27	BES
E	Updates including range to -70°C and main power supply	2022/05/02	BES

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