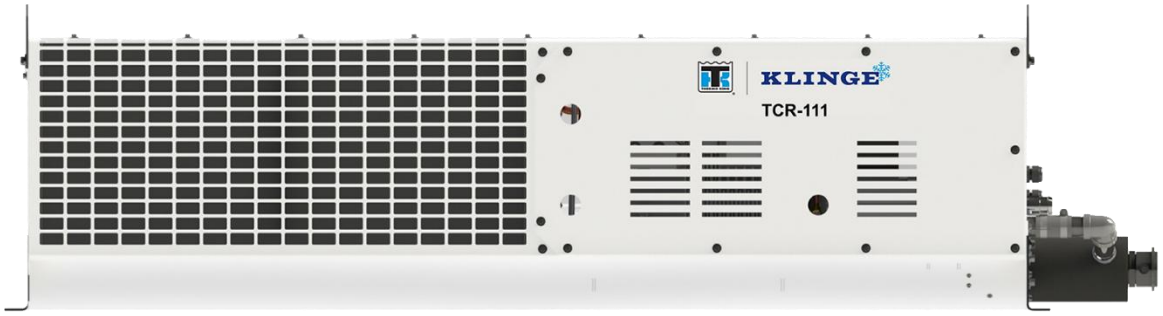
Specification Sheet



TCR-111

MANUFACTURED BY

KLINGE CORPORATION

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YORK, PA 17402 USA

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https://www.thermoking.com/klinge

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UNIT INFORMATION

General	The TCR-111 is a refrigeration unit designed to provide high reliability in extreme ambient temperature. The refrigeration unit consists of a compressor, refrigerant piping, condenser coil, thermal expansion valve, evaporator brazed plate heat exchanger, pump, condenser fan motor, electric control panel, and expansion tank. The electrical control panel and expansion tank are mounted separately. There are numerous options to accommodate various tank types, food and hazardous cargoes, extreme conditions etc. The specification here is for the single unit working, the various options and customized features are listed at the end of this document. The machine is designed to work by pumping a heat transfer fluid around existing steam and glycol coils or wrap around plates provided by the tank builder. Generally, the cooling medium is glycol.
Construction	The frame is constructed of aluminum alloy 5052-H32, treated to resist corrosion induced by salt spray atmosphere. All fasteners; bolts, screws, nuts, washers, hinges are stainless steel.
Equipment design	The TCR-111 is designed to withstand and operate satisfactorily under sea-going and environmental conditions including: Environment: Salt-laden air, sea spray, high humidity and severe atmospheric conditions. Rolling: Amplitude of 30 degrees on each side, period of 13 seconds. Pitching: Amplitude of 6 degrees, period of 8 seconds. Permanent List: 20 degrees on each side. Shock: Acceleration of 2 G in all directions Vibration: Of the type encountered on ships or land vehicles and rail systems.
Tank Unit Dimensions	Width: 2191 mm (86.25 inches) Height: 586 mm (23.06 inches) Depth: 542 mm (21.34 inches)

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Weight	244 kg (538 lbs.)
Control Box Dimensions	Width: 294 mm (11.57 inches) Height: 613 mm (24.13 inches) Depth: 137 mm (5.39 inches)
WEIGHT	**33 KG (73 LBS.) – INCLUDING ASSOCIATED CABLES**
POWER SUPPLY **MAIN POWER** **CONTROL CIRCUIT**	**50 HZ; 360VAC MIN. - 460VAC MAX.** **60 HZ; 400VAC MIN. - 500VAC MAX.** **AC, 24 VOLTS @ 400 V PRIMARY (TRANSFORMED FROM 3 PHASE POWER)**
METHOD OF HEATING	**ELECTRICAL IMMERSION RESISTANCE HEATER 12 KW**
PAINT	**POWDER COATED WHITE**
REFRIGERANT	**R-513A (PREFERRED) OR R-134A**
POWER PLUG	**4 POLE, 380/460V, 50/60 HZ GROUND AT 3 O'CLOCK, 32A** **AS PER IEC 60947-1**

UNIT CAPACITY

UNIT CAPACITY: **480V @ 60 HZ**	**NET COOLING CAPACITY AT 30°C AMBIENT TEMPERATURE AT 60 HZ POWER** **R-513A / R-134A**

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	CARGO TEMPERATURE	CAPACITY	POWER REQUIREMENT
	0°C	10 KW	6,300 W
	-5°C	7.75 KW	5,720 W
	-10°C	6.30 KW	5,120 W
	-15°C	5.20 KW	4,560 W
	-20°C	4.05 KW	4,060 W

HEATING CAPACITY IS 12KW.

STANDARD INFORMATION

Machinery is designed for and suitable for transportation over long voyages of deep frozen, frozen, chilled, or heated cargoes.
Machinery is designed to maintain cargo and cooling liquid temperatures in the following ranges: No Heat -20°C (-29°F) to +29°C (84°F) 50/50 Glycol Standard mix Heat: -20°C (-29°F) to +85°C (185°F) 50/50 Glycol Standard mix Extended: -20°C (-29°F) to 105°C (221°F) 70/30 Glycol Standard mix, High Temperature Option Machinery will be in full functional operation and work satisfactorily in ambient temperatures from -30°C to +50°C (-4°F to +122°F). Components exposed to transfer fluid are made to withstand temperatures as low as -30°C and up to 120°C (248°F), if higher temperatures are required special seals will need to be utilized.

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The unit is built to comply with:

Standards and regulations of major classification societies such as: B.V., ABS and Lloyds Register

ISO 1496-2.

TIR - International Customs Regulations for Containers.

Australia and New Zealand Health Requirements.

Zone 2, Group IIB ATEX hazardous location standards

AHRI - test method for rating refrigerated equipment.

UNIT INFORMATION, REFRIGERATION SYSTEM

COMPRESSOR/CONDENSER SECTION		
Compressor	**Type**	Reciprocating
	Displacement 50/60Hz	36.13 / 43.61 m^3/hr
	Oil	Mobile EAL Arctic 22 cc Polyolester Oil
	Protection	Automatic Reset
	Protection	Automatic Reset
Condenser Coil	**Type**	Tube and Fin
	Tube / Fin Material	Copper / Aluminum
	Fin Spacing	10 Fins Per Inch
	Protection	Coil is constructed of copper and aluminum which are E-coated for resistance to corrosion induced by salt spray atmosphere and UV protection
Condenser Fan Motor	**Type**	AC
	Class	F
	Nominal HP	2 x 0.5 hp
	Speed	3430 rpm
	Bearing	Sealed Ball Bearings
	Protection	Internal Thermal Automatic Reset
Condenser Fan	**Type**	Axial
	Diameter	2 x 250 mm

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	Material	Plastic	
	Air flow	2400 m^3/hr	
REFRIGERATION SYSTEM			
Pump and Motor Assembly		**Type**	Centrifugal – ultra-low temperature pump
		Power	0.75 kW
		Speed	3500 RPM
		Impeller Diameter	95.25mm [3.75in]
Chiller	Brazed Plate	**Material**	Stainless Steel
Heat Exchanger	Klinge	**TX valve**	Mechanical
Receiver	Klinge	**Filter Drier**	Sporlan or Similar
Moisture indicator	Sporlan or Similar	**Pressure Relief Valve**	Henry Technologies or Similar
Suction pressure regulating valve		Sporlan or Similar	
REFRIGERATION SAFETY CONTROLS			
High Pressure Switch		27.6 BAR [400 PSI] Cut Out 20.7 BAR [300 PSI] Cut In	
Low Pressure Switch		-0.50 BAR [-7.25 PSI] Cut Out 0.60 BAR [8.70 PSI] Cut In	
High Pressure Relief Valve		32.75 BAR [475 PSI] Blow Off	
Discharge Temperature Cut Out		130°C	
Fusible Plug (Receiver)		221°C	

UNIT INFORMATION, ELECTRICAL SYSTEM

ELECTRIC SAFETY CONTROLS	
Control Circuit Breaker	4 Amp (1 each for 12 and 24 Volt Circuit)
Main Power Circuit Breaker	32 Amp (Adjustable)
INTERNAL ELECTRIC PANEL COMPONENTS	
Contactors	Compressor, Condenser Motor, Pump, Heater and Phase Changers

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Temperature Control	Microprocessor Controller and Display Panel
Circuit Breakers	Main Power CB
Power Supply	Primary 480 VAC Secondary 24 VAC
Switch	Power On-Off Function Test
EXTERNAL ELECTRIC PANEL COMPONENTS	
Circuit breaker	Control Circuit CB
Temperature Control	Display Panel
Alarm Light	LED Alarm Light

CONTROL SYSTEM

GENERAL INFORMATION

The control system is an electronic solid-state device consisting of three parts:

1. Microprocessor Controller (Thermostat)
2. Display Panel (Temperature Selector)
3. Temperature Sensing Probes

The above components are contained as part of the electrical control box with the exception of the cargo and glycol temperature probes, which are mounted in thermal wells in the tank container and glycol piping. If there is no bulb well in the tank to receive the thermostat probe it may be attached under the insulation to the shell of the tank.

Indicator LEDs are provided to determine correct functions and as an aid for servicing the unit. The indicator LEDs mounted on the thermostat are visible from the front of the electric control panel when the door is closed.

When the unit ON/OFF switch is in the ON position, the display will show the Cargo Probe Temperature. With the Test Switch depressed the temperature that is shown will be the Glycol Temperature

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The set point is entered using the membrane switches on the display panel. It is stored in non-volatile memory and will always be intact, even in case of power failure. In order to prevent false entry or changes of values, both selector buttons have to be depressed simultaneously for a new set point to be entered into the memory.

DISPLAY PANEL

General Description

The display panel consists of three membrane switches and a three digit alpha-numeric LED display. The display indicates the temperatures as derived from the temperature probes.

Temperature Selection

Once a set point is entered, the thermostat controls the actions of the TCR-111 system so that it will achieve and maintain the requested setting.

Entering a temperature set point:

1. Pressing the UP (^) or DOWN (V) key causes the display to show the current set point.
2. After the current set point is displayed, the pressing of one of these keys will increase or decrease the display by one whole degree.
3. Holding a key pressed will cause the display to change one degree each half second.
4. Once the desired Set Point is achieved both the UP (^) and DOWN (V) key are pressed simultaneously for the new set point to be saved.
5. The display automatically returns to normal mode approximately 5 seconds after the last key pressed.

Changing Temperature Unit of Measure:

1. The thermostat can operate in either degrees Centigrade (C) or degrees Fahrenheit (F).
2. Pressing the C/F key causes the display to indicate the current mode. This is indicated by a C or F in the right character of the display. The right most decimal point in the display is also illuminated when in Fahrenheit (F) mode.
3. Each pressing of the C/F key causes the mode to change.
4. After selecting degrees C or degrees F, pressing either the up or down key will cause the currently selected mode to be saved and the display will immediately return to normal mode.
5. The display automatically returns to normal mode approximately 5 seconds after the last key pressed.

TEMPERATURE SENSING PROBES:

Proper functionality of the unit depends on proper probe location and mounting.

The system is adaptable to customer requirements. The location of the thermo-well is determined by the customer, but in general, for tanks designed to carry full loads, is 1/3rd of the way up the height of the liquid and some distance from any heating or cooling coils.

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The thermostat allows for two control probes, one in the cargo and one in the cooling medium to cool or heat the cargo. The heat transfer medium, by definition, must be higher in temperature than the cargo. The temperature of the cargo may be varied by raising or lowering the temperature of the glycol. Locally sub-cooling or overheating the cargo at the point at which the glycol first comes in contact with the tank may be a problem with some cargoes. The glycol limit setting prevents this local over heating of sensitive cargo.

Setting the Glycol Limit:

The setting is an "off-set" limit on either side of the entered set point. In a case when it is not required or when the cargo will not be affected by local sub-cooling or overheating, set the bandwidth limit high. It is suggested, in this case, to have the "off-set" limit at 15 degrees or more. The minimum setting is 2°C (4°F).

To enter Glycol Limit:

Hold the Glycol Temp / Set Limit toggle switch while adjusting the touch pad as described above for entering a temperature set point.

MICROPROCESSOR THERMOSTAT CONTROLLER:

The Microprocessor Controller (MPC) is equipped with various Inputs and Outputs. The MPC serves as the brains of the Heating System.

Input signals to the Thermostat consist of the following:

1. Cargo temperature probe
2. Glycol temperature probe
3. Set point as entered from display panel
4. Glycol Limit as entered from display panel
5. Glycol Safety Switches
6. Signal to initiate function test

Output signals from the Thermostat are by means of eight relays. Four relays are single pole single throw normally open and four are single pole double throw. The outputs from the Thermostat consist of the following:

1. Heater On (Heating)
2. Glycol Pump On
3. Alarm Light
4. Alarm Horn

Each output relay has a red LED mounted on the circuit board adjacent to the relay to indicate if that relay is energized.

GLYCOL EXPANSION TANK

A small atmospheric expansion tank must to be fitted.

This simple atmospheric tank can be fabricated as part of the container structure; or the Klinge standard aluminum pipe tank version can be provided. This separate item is located at a convenient high point on the tank framework.

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HEAT TRANSFER FLUIDS

The unit can handle a wide range of heat transfer fluids.

1. For chemical cargoes at near freezing point of water temperature a standard 50/50 ethylene-based glycol is used.
2. For food cargoes at near freezing point of water temperatures a standard 50/50 propylene based glycol is used.
3. For cargo temperatures less than -30°C (-22°F) a synthetic compound is used.

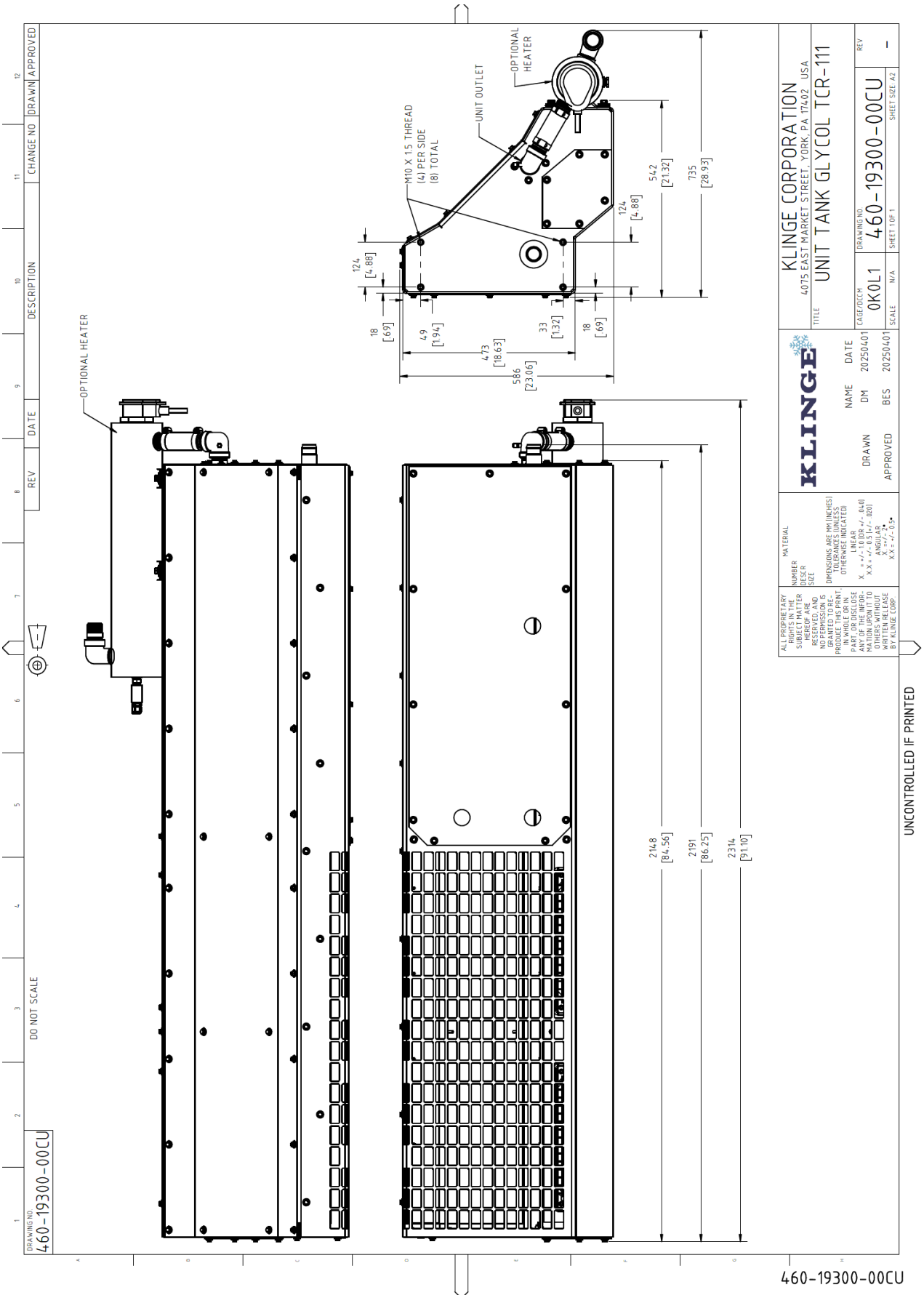
The glycols have built-in corrosion inhibitors and low viscosity in water solutions.
The oils are not corrosive.

OPTIONS

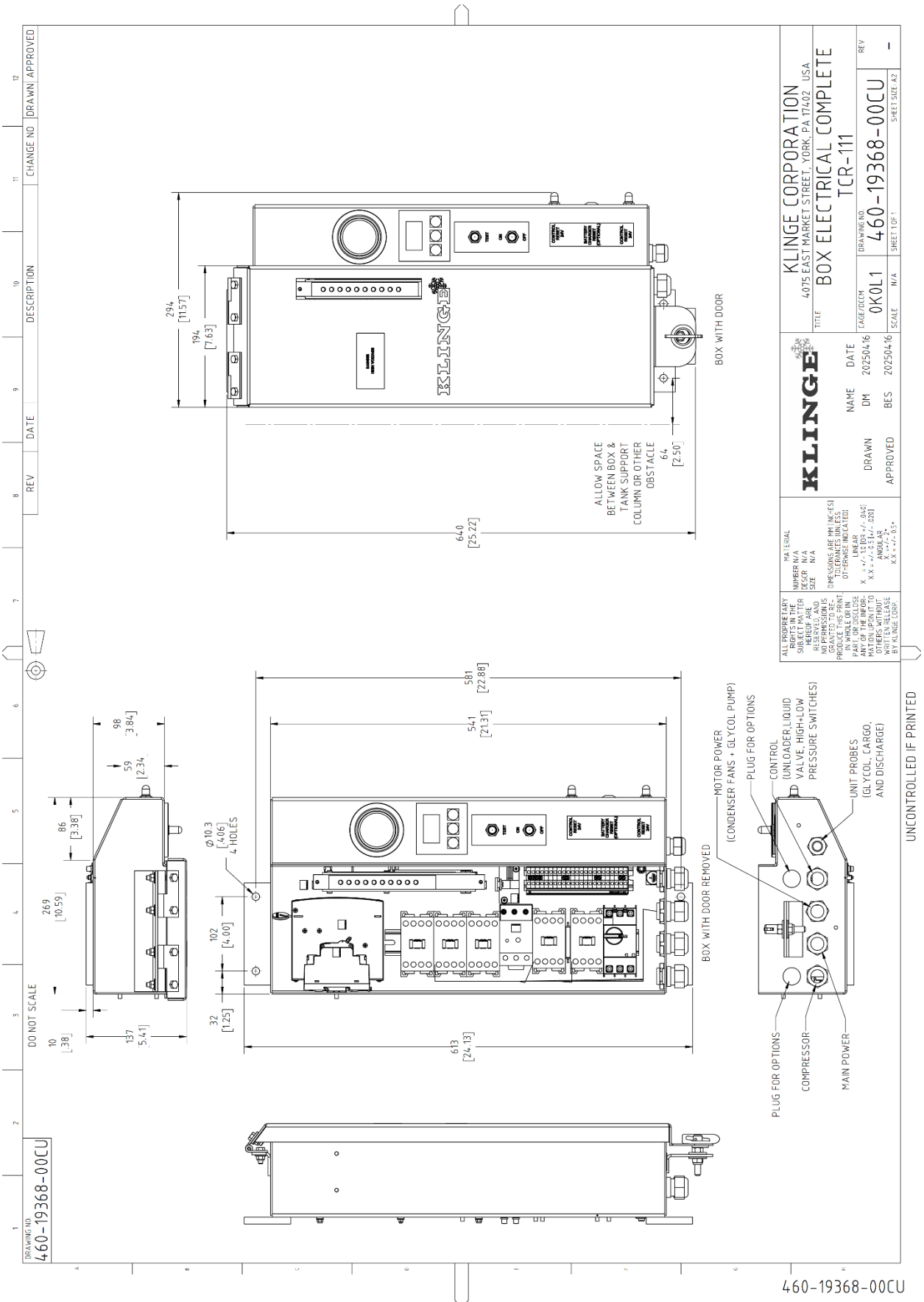
Data logger	A self-contained 6 channel electronic data logger with printer housed either in its own enclosure or mounted in the control box with or without the temperature limits integrated into the alarm system that can be printed out or downloaded.
12 kW heater	This is normally bolted to the rear of the unit and hard piped to the inlet of the pump within the machine. However, it may be remotely located if the space below the tank is not convenient.
Horn	A horn can be mounted on the electrical box to allow for audible notification when an alarm condition is noted.
Frame or Beam Tank Mounting	The machine is designed to mount on either the bottom rail of the tank or to be suspended from the stiffening rings of a beam tank.
GSM or Satellite Communication	Retrofitted or fitted as original equipment the machine can be fitted with a GSM or Satellite transponder able to transmit location and a combination of signals via ModBUS output options.
Dual System	For high hazardous cargoes two machines may be fitted to one tank giving 100% redundancy of parts – in the event of one unit failing or under reporting the appropriate alarm will sound and the machine automatically changes over to the other machine to maintain the temperature.
Log Show	This option gives you the ability to download “events” describing the operating condition of the unit.

Other options have been arranged and can be considered – whatever combination of features is selected, the operating instructions on the outside of the control box are customized accordingly as are the circuit diagram and troubleshooting information inside the control box door.

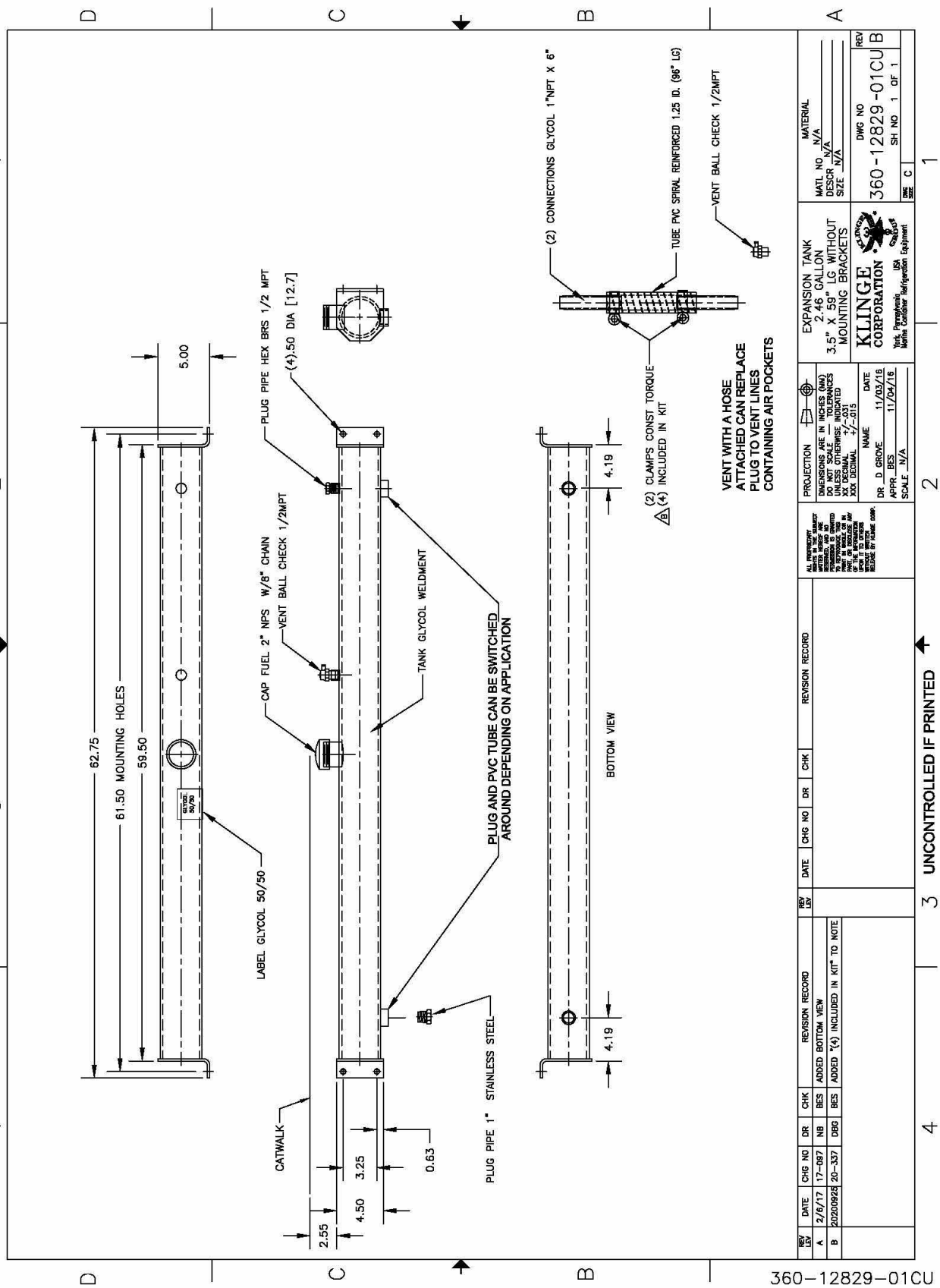
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REVISION RECORD

Rev	Description	Date	Approved
B	Removed Power Plug and Power Cable from Unit Information	2018/07/17	BES
C	Corrected high pressure switch and relief valve values (page 5), added system drawings, removed references of a system heater.	2021/07/30	BES
D	Updated ATEX string and unit drawings	2023/08/30	BES
E	Updated operating temperature ranges	2024/01/15	BES

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