THERMORACK 800

Precision Thermal Control for Optimal Laser Performance and Stability

Product Manual

Solid State COOLING SYSTEMS

*Temperature Control...***Precisely.**

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Solid State COOLING SYSTEMS
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CE Declaration of Conformity

RoHS Compliant

We: Solid State Cooling Systems
167 Myers Corners Road
Wappingers Falls, NY 12590
USA

declare under our sole responsibility that the

ThermoRack 800 (All Models)

meets the provisions of the directives:

Electromagnetic Compatibility (EMC) Directive 2014/30/EU
Low-Voltage (Safety) Directive 2014/35/EU
RoHS Directive 2015/863/EU

Emissions:
EN 61326-1: 2013 per EN 55011:2009 + A1: 2010 Group 1 Class A

Immunity:
EN 61326-1: 2013 Electrical Equipment for Measurement, Control, and Laboratory Use - EMC
EN 61000-3-2 Harmonics Emissions Class A
EN 61000-3-3 Voltage Fluctuations and Flicker
EN 61000-4-2 Electro-Static Discharge
EN 61000-4-3 Radiated Radio Frequency (RF) Immunity
EN 61000-4-4 Electrical Fast Transient/Burst Immunity
EN 61000-4-5 Surge Immunity
EN 61000-4-6 Conducted RF Disturbance Immunity
EN 61000-4-11 Voltage Dips, Interruptions and Short Variations
EN 61000-6-2 Electromagnetic Compatibility Part 6-2: Immunity for Industrial Environments

Safety:
EN 61010-1: 2010/AMD1:2019 Low Voltage Directive Safety requirements for electrical Equipment for measurement, control, and laboratory use.

Lloyd F Wright Chief Technology Officer	
Date	July 5, 2019

SAFETY PRECAUTIONS AND SYMBOLS

Read the SDS for the coolant used and follow **all** safety precautions listed in the SDS prior to removing coolant tubes or opening the fill cap as this could result in contact with the coolant inside.

Caution! Risk of electric shock. Disconnect the power cord prior to servicing. This includes changing a fuse or opening the cover for any reason.

Earth Ground Safe operation of the ThermoRack 800 requires that earth ground be connected to the IEC-320 C20 power cord supplied with the system.

Note: Some internal components may be electrically live regardless of ON/OFF switch position. For the safety of the operator, only trained personnel may interact with internal components.

Caution! Heavy object. System weighs 55 lbs (25 kg). Two people are required to lift.

CAUTION

- Never disassemble the chiller as irreparable damage may occur.
- Any attempt to open or repair the unit will void the warranty
- Never store the chiller over 70 °C.
- Never operate the chiller in ambient temperatures of 40 ºC or greater.
- Never operate the chiller within 5 ºC of the coolant's freezing point.
- Always use only proper coolants as specified in manual. Solid State Cooling Systems recommends Koolance LIQ-702CL-B (27% propylene glycol and water)
- Never ship the chiller with coolant inside the liquid cold plate as freezing temperatures may be encountered which would damage the unit. Always pump all coolant out of the chiller prior to shipping.
- Always match wetted materials (metal) to the wetted materials in your system. If your system has aluminum cold plates/tubing, use the standard Oasis. If your system has copper cold plates/tubing, select the Oasis copper models. Stainless steel may be used with either material.

Symbols Used in this Manual

CAUTION

The red CAUTION equilateral triangle symbol appears throughout the manual. Please follow the important instructions accompanying this symbol to avoid significant damage to the chiller.

WARNING

The red WARNING equilateral triangle symbol appears throughout the manual accompanying certain maintenance and repair activities. Please follow the important instructions accompanying this symbol to avoid situations that could cause injury to the operator or other personnel.

DANGER

The red DANGER equilateral triangle symbol appears throughout the manual accompanying certain maintenance and repair activities. Please follow the important instructions accompanying this symbol to avoid injury to the operator. Only trained personnel should undertake any activity marked by the red DANGER triangle.

Solid State COOLING SYSTEMS
*Temperature Control...***Precisely.**

PRODUCT MANUAL

THERMORACK 800
THERMOELECTRIC CHILLER

SECTION 1
INTRODUCTION

The ThermoRack 800 19" rack-mount recirculating chiller utilizes thermoelectric technology to deliver up to 900 Watts of cooling capacity without the use of compressors or refrigerants. The system provides up to 3.5 liters per minute of constant temperature coolant, with PID control for both cooling and heating. With fewer moving parts, the system is highly reliable and energy efficient.

The ThermoRack 800 has been optimized for use in temperature control of precision scientific lasers, with ±0.05°C temperature stability and smooth fluid flow. It is equally well suited for many other applications, such as temperature control of analytical equipment, optics, medical equipment, laboratory equipment, aerospace & defense or any application requiring precise control.

From conception, The ThermoRack 800 has been designed for long life and ease of use. The internal thermoelectric modules have lifetimes greater than 200,000 hours.

SECTION 2
SPECIFICATIONS

Operating Range (Set Point):	5°C to 50°C standard
Ambient Temperature Range:	10°C to 40°C non-condensing
Stability / Repeatability:	±0.05°C with constant load (even near ambient)
Cooling Capacity (typical[1]):	700 Watts @ 20°C in 20°C ambient air with 100 to 240 VAC 1Phase 800 Watts @ 20°C in 20°C ambient air with 200 to 240 VAC 1Phase 900 Watts @ 20°C in 20°C ambient air with 200 to 240 VAC 1Phase + high speed fans
Noise Level (at 1 meter)[2]:	<63 dBA (50% load), <75 dBA (with full load)
Coolant / Process Fluid:	Koolance (27% propylene glycol / water mix) or 27-50% ethylene glycol / water mix (contact SSCS for advice on other fluids) **Note: Do not use water alone in copper systems with centrifugal pumps as water absorbs CO_2 from the air, causing its pH to become acidic. Acidic water dissolves copper which then plates out inside the magnetic drive of the centrifugal pump, causing the pump to seize after a few months of operation.**
Process Fluid Fittings:	3/8" NPT female. Brass for units with copper wetted parts and stainless steel for units with aluminum wetted parts.
Pumps:	3.5 lpm (0.9 gpm) @ 30 psig smooth flow centrifugal
Tank Volume:	0.8 liter with level sensor
Wetted Materials:	Aluminum, stainless steel and polymers, or Copper, stainless steel, brass and polymers (option)
Dimensions (W x D x H):	19" x 20" x 11" 6U (48cm x 51 cm x 27 cm)
Weight:	55 lbs (25.5 kg)
Power Input:	200-240 VAC 1 phase, 50/60 Hz, 8 amps max 100-240 VAC, 50/60 Hz, 16-8 amps max (700W model only)
Controls:	Digital PID controller for heating and cooling
Communications:	Keypad or USB interface
Alarms	Temperature, fluid level, system or component failure (display and USB)
Standards	TUV listed to UL, CAN/CSA and EN 61010-1, CE 61010-1, RoHS compliant
Warranty	2 years

Notes:
1) Cooling capacity will vary with configuration.
2) Typical configuration.

OPTIONS

ThermoRack 800 P/N: 10-TR XX – PP – OO
Unit Type / Pump Type / Other Options

TRXX = Unit Type (choose one):	
XX	Description
7C	~730 watts, 100-240 VAC, Copper Cold Plate
7A	~770 watts, 100-240 VAC, Aluminum Cold Plate
8C	~770 watts, 200-240 VAC, Copper Cold Plate
8A	~850 watts, 200-240 VAC, Aluminum Cold Plate
9C	~850 watts, 200-240 VAC, high speed fan, Copper Cold Plate
9A	>900 watts, 200-240 VAC, high speed fan, Aluminum Cold Plate

PP = Pump Type (choose one):	
PP	Description
-2C	3.5 lpm @ 30 psig smooth flow dual centrifugal pump
-3GXX	3 lpm @ 30 psig magnetic drive gear (low vibration, 25,000 hr MTBF) XX = adjusted flow rate (XX=20 for 2 lpm, XX=10 for 1 lpm, etc.) or XX=RF for 3 lpm with run/fill

OO = Other Options:	
PP	Description
-RS	RS232 Communications interface (replaces USB)
-LT	Low temperature operation (down to -5°C)
-##	Custom engineered special (sequential number assigned by Engineering)

Line 2: Power Cord

200-240 VAC Power Cord (select one)	
Country / Region	Part No.
US NEMA 6-15 208 Straight 250V	**22-26098-9**
US NEMA L6-15 208 Twist 250V	**22-26098-10**
Europe 250V	**22-25201-1**
UK 250V	**22-26098-4**
Israel 250V	**22-26098-5**
Australia 250V	**22-26098-6**
Korea 250V	**22-25201-1**
China (3 prong) 250V	**22-26098-8**

100-125 VAC Power Cord (TR7 ONLY)	
Country / Region	Part No.
US / Canada 125V	**22-25200-1** (TR7 ONLY)
Japan 125V	**22-26084-1** (TR7 ONLY)

Optional Fittings

Optional Fitting Kit (choose one):	
Fitting Type	Part Number
3/8" John Guest Push-fit	14-13232-2
3/8" Hose Barb	14-13232-4
3/8" Swagelok	14-13232-6
1/2" John Guest Push-fit	14-13232-8
3/8" CPC Quick Disconnect	14-13232-9

Fittings + Mesh Screen Filter

Optional Fluid Filter (choose one):	
Fitting Type	Part Number
3/8" John Guest Push-fit	14-13233-2
3/8" Hose Barb	14-13233-4
3/8" Swagelok	14-13233-6
1/2" John Guest Push-fit	14-13233-8
3/8" CPC Quick Disconnect	14-13233-9

Figure 1: ThermoRack 800 Cooling Capacity in 20°C Ambient

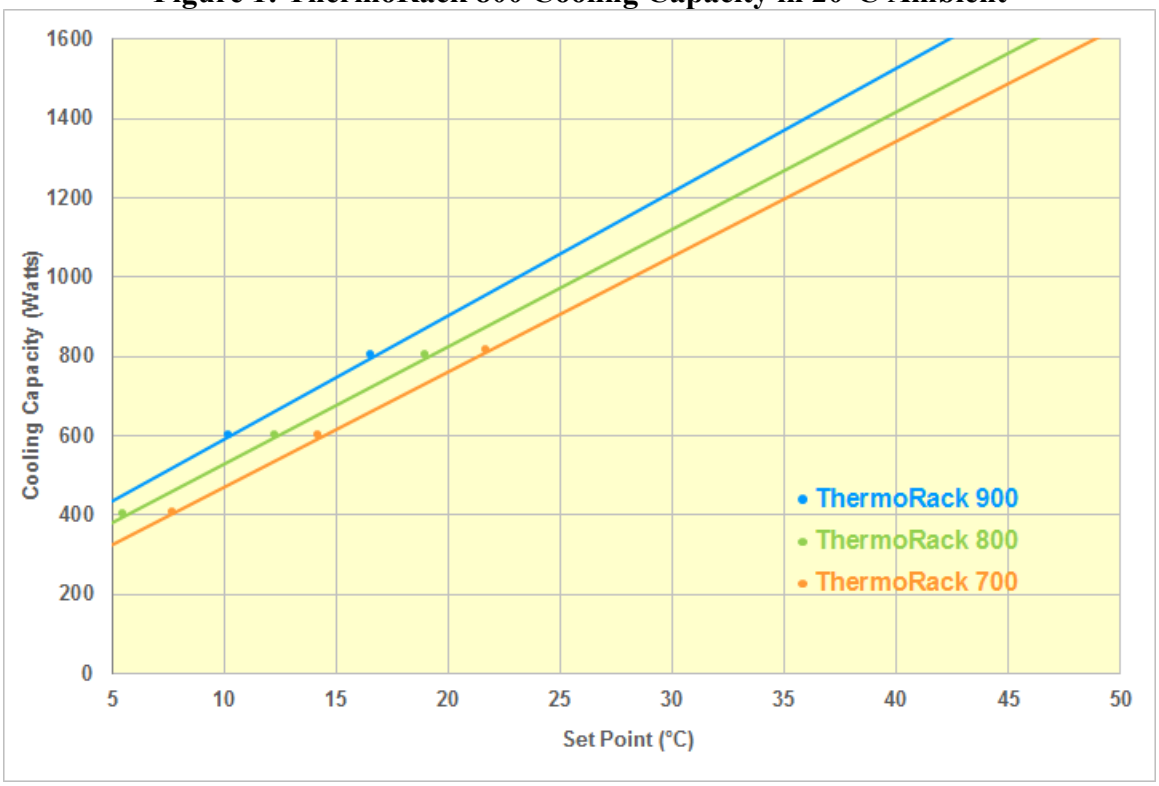
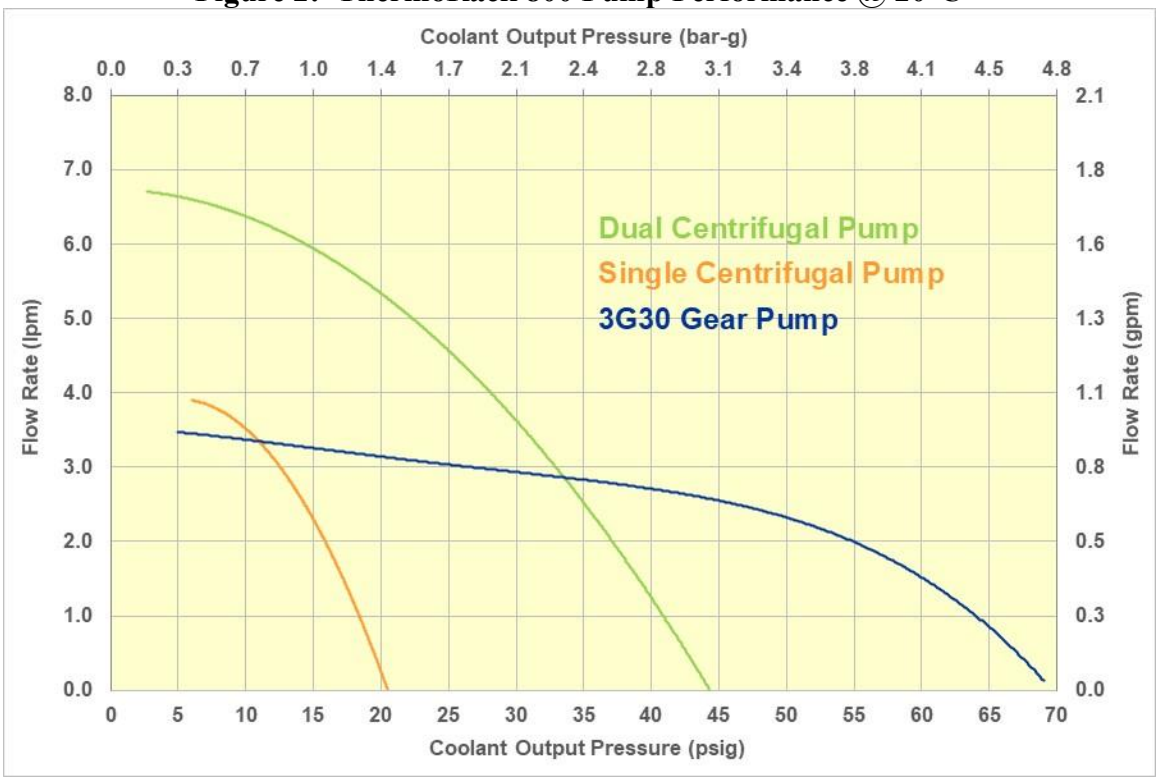


Figure 2: ThermoRack 800 Pump Performance @ 20°C



Pump Model	Operating Flow Range	Maximum Operating Pressure
-1C Centrifugal Pump	0.9 – 3.5 lpm	18 psig (1.25 bar)
-2C Centrifugal Pump	2.0 – 6.5 lpm	36 psig (2.5 bar)
-3G30 Gear Pump	1.5- 3.3 lpm	60 psig (4 bar)[1]

SECTION 3
HOOK UP

Figure 3A: Front View

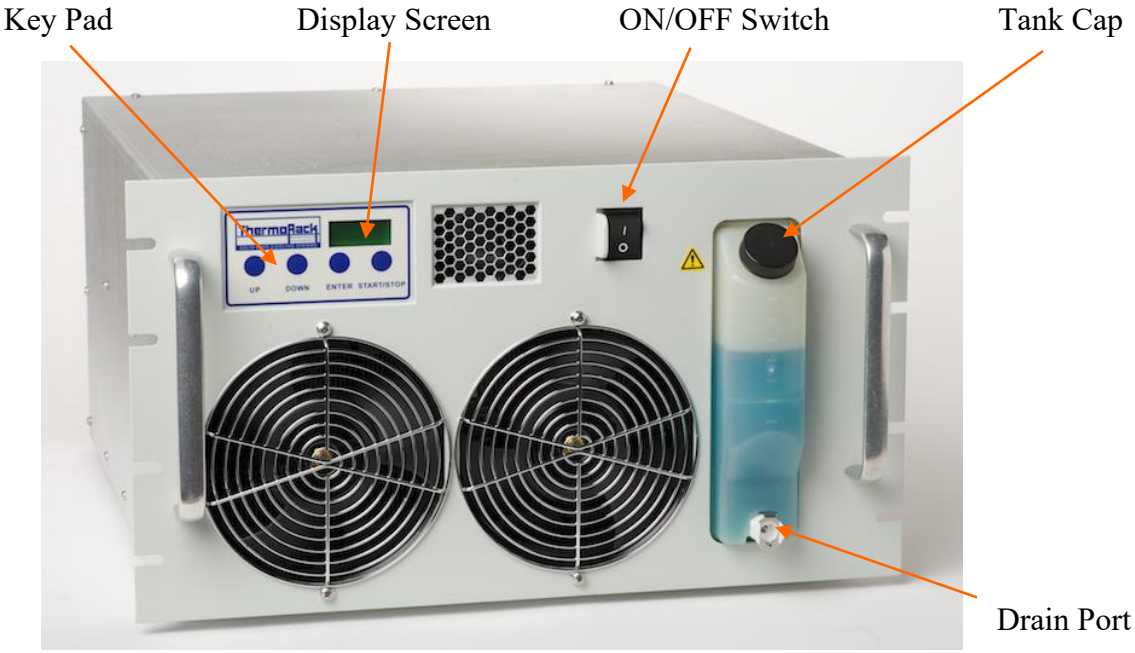
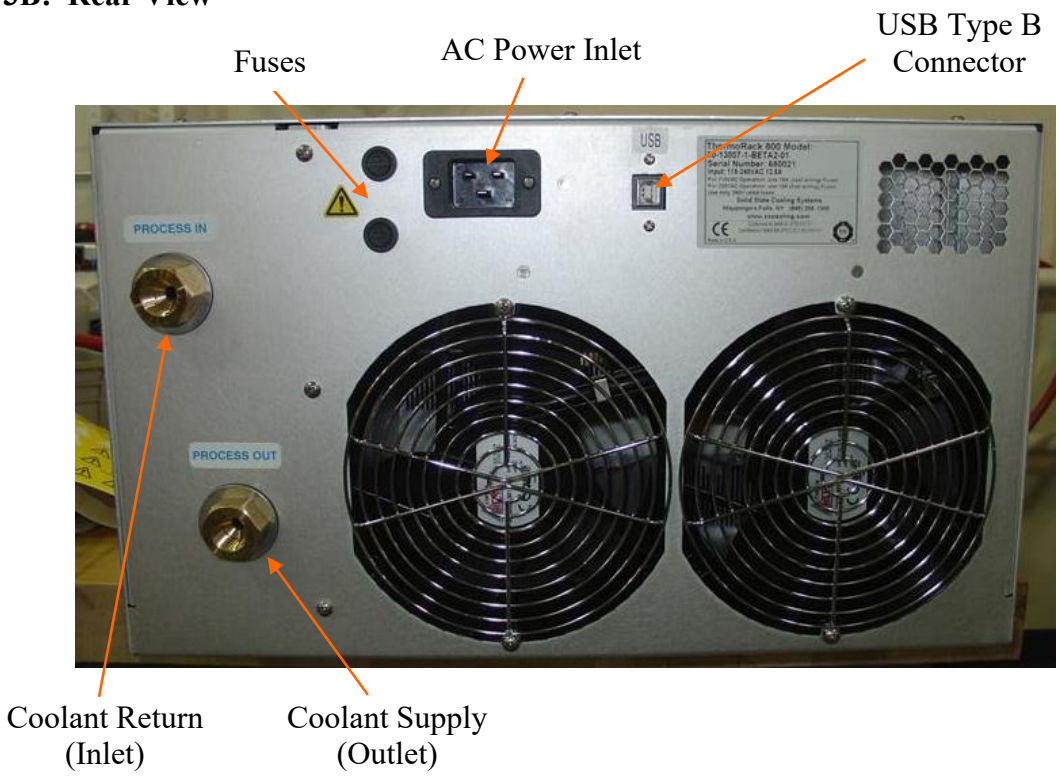


Figure 3B: Rear View



3.1 MECHANICAL INSTALLATION

The ThermoRack 800 is designed for installation into EIA-310-C standard 19 inch electronics rack. The chiller must rest on two rails, at least 16 inches in length, installed into the electronics rack. Rails may be purchased from SSCS, PN 30-22737-1, or from Allied Electronics PN 806-6880. Place the chiller on top of these rails and slide into place. Once in place, use four #10 mounting screws to fasten the chiller to the electronics rack. Easy access must be given to the power inlet (located above the plumbing connections on the back panel of the unit) to allow for service.

Air Considerations:
The air inlet and outlet are located on the front and back sides respectively. Restricting airflow into or out of the unit will impair performance. At least 6 inches of clearance is required in front and in back to ensure adequate airflow.

3.2 ELECTRICAL CONNECTIONS (SEE FIGURES 3A AND 3B)

WARNING

Electrical Shock Hazard: Never Plug in a Line Cord with Wet Hands

Power: The ThermoRack 800 AC power inlet is an IEC320-C20 socket. Plug the line cord provided into this socket and then into the appropriate power source. The standard line cord provided has an L6-15P plug for a 208/240 VAC 15 Amp 60 Hz outlet. To ensure safe operation of the unit, it is important to ensure that the AC power cord is properly grounded.

Various regional power cords are available to support universal power operation:

Country / Region	Part Number
US NEMA 6-15 208 Straight 250V	22-26098-9
US NEMA L6-15 208 Twist 250V	22-26098-10
Europe 250V	22-25201-1
UK 250V	22-26098-4
Israel 250V	22-26098-5
Australia 250V	22-26098-6
Korea 250V	22-25201-1
China (3 prong) 250V	22-26098-8
US/Canada 125V (TR7 Only)	22-25200-1
Japan 125V (TR7 Only)	22-26084-1

Fuse: 10 amp (5mm x 20mm F10A 250V) for 200-240 VAC
15 amp (5mm x 20mm F15A 250V) for 115-125 VAC

Remote Communication: Remote control of the unit may be achieved by connecting to the USB type B port on the rear panel. For more information, refer to section 7.2.

3.3 PLUMBING CONNECTIONS (SEE FIGURES 3A AND 3B)

CAUTION
Always match wetted materials to avoid potentially corroding your system or clogging the cold plates

The standard process fluid inlet (coolant return) and outlet (coolant supply) connections, located on the rear panel, are ¼" Brass Colder valved quick disconnect female fittings.

IMPORTANT NOTE: Always match wetted materials (metal) to the wetted materials in your system. If your system has aluminum cold plates/tubing, use the standard aluminum cold plates. If your system has copper cold plates/tubing, select the copper cold plate option. Stainless steel may be used with either material. Using copper/brass and aluminum in the same system with water coolants may result in corroded metals and clogging of the cold plates in the ThermoRack unit or system being controlled.

3.4 COOLANT FILL

WARNING
Read the Coolant SDS Prior to filling the chiller

Fill the ThermoRack 800 with coolant using the following procedure:

1. Remove tank cap
2. Carefully pour in coolant until the level reaches "Max".
3. Turn on the Thermorack, adding coolant as required to maintain the tank level just below maximum.
4. Replace tank cap

CAUTION
Use only recommended coolants

Recommended Coolants:

Solid State Cooling Systems recommends using Koolance, a pre-mixed 27% propylene glycol/water based coolant containing an algaecide and corrosion inhibitors. Though it comes in several colors, SSCS recommends the colorless or blue versions in 700 ml bottles, part number: LIQ-702CL-B (clear) or LIQ-702B-B (blue), as the dyes in the other colored versions can form small particulates when not well mixed.

Contact Koolance for details:
Koolance USA
2840 West Valley Highway North
Auburn, WA 98001
(253) 893-7551

Water or ethylene glycol/water mixtures are also acceptable as coolants. Note that algae growth can occur when water is used without at least 25% propylene or ethylene glycol.

Important: Do not use water alone in copper systems with centrifugal pumps as water absorbs CO_2 from the air, causing its pH to become acidic. Acidic water dissolves copper which then plates out inside the magnetic drive of the centrifugal pump, causing the pump to seize after a few months of operation.

SECTION 4
START UP

Note: In order to avoid injury or damage, operators must only use this product in the manner specified below.

WARNING

Electrical Shock Hazard: Never Plug in a Line Cord with Wet Hands

CAUTION

Running the ThermoRack 800 dry (no fluid) will damage the pump

Start-up the ThermoRack 800 and ensure priming of the pump, follow these steps:

1) Connect USB signal cable (optional).
2) Connect the drain hose (14-13851-1) to the process outlet fitting. Place the open end into a small bucket.
3) Remove the reservoir cap on top and add more coolant as necessary to bring the coolant level to maximum (per section 3.4). Replace cap.
4) Plug line cord into 100 - 240 VAC, 50/60 Hz.
5) Turn chiller on via the switch located on the front. Fluid should begin flowing into the bucket. If it does not, turn off the chiller, wait 30 seconds, then turn the chiller back on. Once fluid begins flowing, turn off the chiller.
6) Remove the drain hose.
7) Connect coolant tubing to fluid connections located on the rear panel, labeled Process Out (supply) and Process In (return).
8) Turn on the chiller. The front display should read the current coolant temperature. If the front display reads "TANK LEVEL LOW", add more coolant to the reservoir until the display changes to read the coolant temperature. If the tank level low alarm persists, or if another alarm is displayed, consult section 6.0 of this manual.

Important Notes:

1) The Thermorack 800 will start controlling automatically upon start-up unless the tank level is low or another alarm is present. If the tank level is low at start-up, upon filling the tank the Thermorack 800 will automatically start controlling.
2) If the tank level low alarm persists, or if another alarm is displayed, consult section 6.0 of this manual
3) ***Caution:*** Do not externally shut off the flow of coolant for more than a ten second period; pump damage will result if run deadheaded for extended periods of time.

SECTION 5
OPERATION

The ThermoRack 800 is operated via the control panel located on the front panel. The control panel has a 16-character LCD display and four input keys: UP, DOWN, ENTER, and START/STOP. These keys work as follows:

Key	Action
UP	Pressing the UP key raises the parameter value displayed.
DOWN	Pressing the DOWN key lowers the parameter value displayed
ENTER	Pressing the ENTER key momentarily enters the parameter changed.
ENTER	Pressing and holding the ENTER key for 3 seconds causes the chiller to ask for a password to enter the parameter menu.
START/STOP	Pressing the START/STOP key turns on temperature control.
START/STOP	Pressing the START/STOP key while the chiller is operating turns off temperature control.

5.1 SIMPLE OPERATION

The ThermoRack 800 comes with preset operating parameters that will work well for most applications. If temperature control at one temperature is desired, follow the steps below.

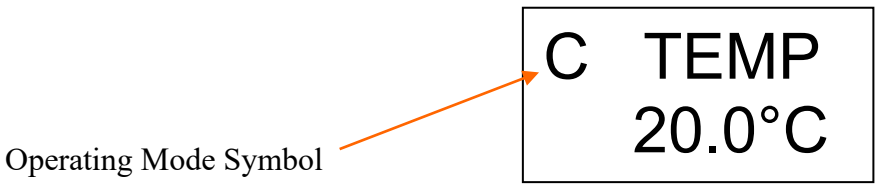
1) Turn on the chiller and wait for display to read TEMP.
2) Press the UP or DOWN keys to change SETTEMP to the desired set point.
3) Press the ENTER key.
4) ***Caution***: Do not externally shut off the flow of coolant for more than a ten second period; pump damage will result if run deadheaded for extended periods of time.

The chiller will now control to the set point temperature. To change the set point temperatures just press the UP or DOWN keys again to change SETTEMP 1 to the new set point, followed by the ENTER key.

5.2 ADVANCED OPERATION

The ThermoRack 800 has two menus: the Status Menu and the Parameter Input Menu. The Status Menu shows the chiller operating status and current temperature of fluid leaving the chiller. The Status Menu also allows input of new coolant temperature set-points. The Parameter Input Menu allows input of the Alarm Range, the temperature Offset, and the Back Light on/off command.

Figure 4 ThermoRack 800 Display – Status menu



Operating Modes:
* = Standby mode, no temperature control
H = Heating mode with temperature control within alarm range
C = Cooling mode with temperature control within alarm range
> = Cooling mode, coolant temperature is above the alarm range
< = Heating mode, coolant temperature is below the alarm range
The coolant outlet temperature is shown below TEMP in °C.

Pressing the UP or DOWN keys will change the set point temperature upon pressing the ENTER key.
The chiller has a parameter menu screen containing several user adjustable parameters. To access this menu press and hold the ENTER button for 3 seconds, and then enter password 0000 using the UP, DOWN and ENTER keys. This menu allows access to the following parameters:

MENU STRUCTURE:
NOMENCLATURE:
▲UP or Increase Value
▼Down or Decrease Value
↵ Press Enter Momentarily
⟶ Press & Hold Enter Key 3 Sec

SIMPLE OPERATION		ADVANCED OPERATION
(STATUS MENU)	press and hold enter key	(PARAMETER INPUT MENU)
TEMP: XX.X°C (current temp)	⟶	PASSWORD XXXX
PRESS ▼OR ▲ (change set point)	⟵	↵
SETTEMP1 XX.X°C		ALRM +/- XX°C
↵		↵
TEMP: XX.X°C (current temp)		OFFSET X.X°C
		↵
		TEMPUNIT °C/°F
		↵
		BK LIGHT ON/OFF
		↵
		(return to top of menu)

Press ENTER key once to scroll between menu items (↵).
Press and hold ENTER key for 3 seconds to enter the parameter input menu (⟶).
Note: If the user enters the temperature input or the parameter input menu and does not press a key for 10 seconds the display will revert back to the Status menu.

Status Menu: The status menu displays the chiller operating status and coolant temperature. The chiller operating mode is shown in the display's first character: (See Figure 4)

ALRM +/-: Alarm width, the acceptable coolant operating temperature range around set-point before an alarm is communicated via USB. For example, if set to 5°C with a 20°C set-point, an alarm will trigger if the coolant temperature rises above 25°C or falls below 15°C.

OFFSET: This parameter raises or lowers the chiller temperature reading to match a user's external temperature sensor. Enter the difference between the external sensor and the display. For example, if the user has a temperature sensor reading of 22 °C when the chiller display shows 20°C, entering 22°C – 20°C = 2°C will cause the chiller to shift its temperature calibration scale up 2°C to match the external sensor.

TEMPUNIT: Sets temperature units in degrees Celsius or Fahrenheit.

BKLIGHT: Setting this parameter to ON turns on the display back-light; setting this parameter to OFF turns off the display back-light.

5.3 ALARMS

Alarms are displayed on the front screen, and communicated through USB interface.

A list of system failure modes can be found in Section 6. In the event of a system failure, the alarm type will be shown on the front display.

5.4 DRAIN PROCEDURE

WARNING

Read the Coolant SDS prior to draining the chiller

1. Connect one end of a drain hose with a 1/4" male valved CPC fitting (Colder Products PLCD2204) into the front drain fitting (see figure 3A) and place the other end into a container with at least a 3 liter capacity.
2. Remove the tank cap.
3. Allow the tank to drain.
4. Disconnect coolant lines from the equipment being cooled and place the lines in a bucket.
5. Turn on the ThermoRack for 15-20 seconds, and then turn off.
6. A small amount of coolant will remain in the bottom of the tank. Removing this remainder (not necessary to ship the unit) requires lifting the rear of the chassis.
7. Remove the drain hose.
8. Replace the tank cap.

SECTION 6
SYSTEM ALARMS/TROUBLESHOOTING

WARNING

Do not remove cover or attempt to repair unit, as electrical shock hazards exist inside.

The ThermoRack 800 has four system alarms that when triggered will show on the display. When an alarm is displayed the system will not attempt to heat or cool the coolant, except under tank level low alarm.

Alarms:

Tank Level Low: Liquid reservoir level is too low. This is a warning and the unit will continue to control temperature under this condition. *Unless filling for the first time, check all outside plumbing lines for leaks. Once all leaks are sealed, remove the cap and add more coolant until the alarm disappears.*

RTD Open: The temperature sensor has failed. Temperature control will stop. *Turn off the chiller and disconnect the AC power cord. Contact SSCS for an RMA number to return the unit for RTD replacement.*

Fan Fail: The ThermoRack 800 checks fan operation at startup. Fan fail indicates the fan is supplying insufficient air to cool the thermoelectric devices. *Either the fan has failed or the airflow into or out of the system is blocked. Check that the front and rear air inlet and outlet gratings are not blocked. If airflow is not blocked, contact SSCS for an RMA number to return the unit for fan replacement.*

Pump Fail: The liquid heat exchanger plate temperature is either too hot or too cold, indicating a pump failure or a blockage in the external plumbing lines. Temperature control will stop. *Turn off the chiller and disconnect the AC power cord. Verify that no kinks or blockages exist in external plumbing line. If no coolant flow blockages exist, contact SSCS for a RMA number to return the unit for pump replacement.*

Other issues:

No Display: If the liquid crystal display does not display characters upon turning on the Thermorack 800, *call SSCS for a RMA number to return the unit for replacement of the temperature controller*

Temperature Control Poor: If no other alarms are present, poor temperature control can indicate blocked airflow or that the TE cooling/heating engine is not receiving power or has failed. If the chiller cools but cannot reach the set point, and the displayed temperature is higher than the set point, the heat load may be too great for the chiller, *Contact SSCS for technical support.*

Important: The tank level low alarm will automatically reset when the tank is filled. The RTD, Fan and Pump failure alarms will not reset until the system power is turned off.

SECTION 7
7.1 USB COMMUNICATIONS

The Thermorack 800 comes with a USB serial communications capability that can receive a remote set point, return the current temperature, and signal an alarm has occurred. Communicating with the chiller via USB with requires installing a Silicon Labs CP210x driver on the host computer. Call SSCS at 845-296-1300 ext. 324 to receive a copy of this along with installation instructions. USB communications software is also available.

Connector Type:	Type-B
Speed:	9600 baud
Number of Start bits:	1
Number of Stop bits:	1
Parity:	None
Maximum Polling Frequency:	One command every 500msec
Data Update Frequency:	Once per second
Host/Device:	Thermorack 800 is the device, PC is the host
Interrupts Reported:	None, must be polled for status
Data Format:	ASCII
	Insert a carriage return ($0x0D_{hex}$) at the end of each command string.
	A carriage return ($0x0D_{hex}$) is sent at the end of each response

Table 2 USB Commands

PARAMETER	GET Data Command	Response	PUT Data Command	Response
Show all parameters (see next page for details)	GETSET2	TEMP, SETTEMP, PUMPTEMP, PWM?, FANPWM, TLL, STAT1A, FLTS1A		
Show chiller identification information	IDN	Solid State Cooling, Product Name, Model#, Software Number & Revision, Serial Number		
Put chiller in LOCAL mode			LOCAL	
Chiller: run, stop	RUN?	RUNNING or STOPPED	RUN, STOP	
RTD temp	TEMP?	(-)XX.X		
Set-point Temperature	SETTEMP?	(-)XX.X	SETTEMP	(-)XX.X
Temperature Alarm width (+/-)	WIDTH?	XX.X	WIDTH	XX.X
RTD offset	RTDOFFSET?	(-)XX.X	RTDOFFSET	(-)XX.X
Display backlight on/off	-		BLON, BLOFF	
Pump temperature	PUMPTEMP?	(-)XX.X		
Actual TE PWM %	PWM?	(-)XX.X		
Status word 1 (5 ASCII bytes)	STAT1A?	0 - 65535		
Faults word 1 (5 ASCII bytes)	FLTS1A?	0 - 65535		
Reset All Alarms and Restart			RESTART	

NOTES:

1. All commands are case insensitive
2. The chiller will automatically begin operating in REMOTE mode upon initiation of USB communications. This will lock-out the keypad.
3. The chiller performs actions upon receiving LOCAL, RUN/STOP and BLON/BLOFF commands, but does not send back a USB response.

GETSET2 parameters: GETSET2 returns the following data w/o identifying prefix names.
Note: All data returned is in ASCII

- Cr defined at "carriage return" or $0D_{hex}$
- ETX defined as "end-of-text" or 03_{hex}

Data	Description	Format	Units	Range
TEMP<Cr>	Coolant Temperature	XX.X	°C	5.0 – 45.0
SETTEMP<Cr>	Set Point Temperature	XX.X	°C	5.0 – 45.0
PUMPTEMP<Cr>	Pump Temperature	XX.X	°C	0.0 – 50.0
PWM<Cr>	%PWM	XX.X	%	0 – 98.0
FANPWM<Cr>	%PWM	XX.X	%	40-100
TLL<Cr>	Tank Lev Low	XXXX	none	0 - 4096
STAT1A<Cr>	Status bits	XXXXX	none	0 - 65535
FLTS1A<Cr>	Fault bits	XXXXX	none	0 - 65535
<ETX>	ASCII "end of text", 03_{hex}	03	n/a	03

Example: Running, remote mode, ready, coolant temp 22.9°C, set-point 23.0°C, pump temp 17.0°C, 76.3% cooling, Fan Speed 69.2%, tank level low = 119, status: running in remote mode within alarm range, faults: none

22.9<Cr>23.0<Cr>17.0<Cr>-76.3<Cr>69.2<Cr>119<Cr>7<Cr>0<Cr><ETX>

STAT1A Bit Field Definition: convert decimal number sent into binary, read as follows:

```
|__ __ __ __ | __ __ __ __ | __ __ __ __ | __ __ __ __ |
  |  |  |  |    |  |  |  |    |  |  |  |    |  |  |  |___Chiller Running?          1 = RUNNING, 0 = STOPPED
  |  |  |  |    |  |  |  |    |  |  |  |    |  |  |_____Remote or Local           1 = REMOTE, 0 = LOCAL
  |  |  |  |    |  |  |  |    |  |  |  |    |  |________Chiller Ready?           1 = READY, 0 = NOTREADY
  |  |  |  |    |  |  |  |    |  |  |  |    |___________Temp low alarm          1 = Temp < SP - WIDTH
  |  |  |  |    |  |  |  |    |  |  |  |________________Temp high alarm         1 = Temp > SP + WIDTH
  |  |  |  |    |  |  |  |    |  |  |___________________Chiller Heating or Cooling  1 = HEATING, 0 = COOLING
  |  |  |  |    |  |  |  |    |  |______________________System Warning          1 = WARNING, 0 = NONE
  |  |  |  |    |  |  |  |    |_________________________System Alarm            1 = ALARM, 0 = NONE
  |________ rsvd ____|  |_____________________________ rsvd
```

The Warning bit is triggered by tank level low and a temperature outside of the +/- alarm width.
The Alarm bit is triggered by an RTD fault, a pump fault, or a fan fault.

FLTS1A Bit Field Definition (Fault="1") convert decimal number sent into binary, read as follows:

```
|__ __ __ __ | __ __ __ __ | __ __ __ __ | __ __ __ __ |
  |  |  |  |    |  |  |  |    |  |  |  |    |  |  |  |___  RTD
  |  |  |  |    |  |  |  |    |  |  |  |    |  |  |_____  Tank Level Low
  |  |  |  |    |  |  |  |    |  |  |  |    |  |________  Pump Fail
  |  |  |  |    |  |  |  |    |  |  |  |    |___________  Fan Fail
  |  |  |  |    |  |  |  |    |  |  |  |________________  rsvd
  |  |  |  |    |  |  |  |    |  |  |___________________  rsvd
  |  |  |  |    |  |  |  |    |  |______________________  rsvd
  |  |  |  |    |  |  |  |    |_________________________  rsvd
  |  |  |  |    |  |  |  |______________________________  rsvd
  |  |  |  |    |  |  |_________________________________  rsvd
  |  |  |  |    |  |_____________________________________  rsvd
  |  |  |  |    |________________________________________  rsvd
  |_ rsvd_|
```

7.2 RS-232 COMMUNICATIONS OPTION

The Thermorack 800 can come with optional RS-232 serial communications, instead of the standard USB, that can receive a remote set point, return the current temperature, and signal an alarm has occurred. The commands are identical to USB and the protocol is shown below.

Wiring: Proper wiring depends upon whether the equipment being cooled (the Host) is wired as Data Computer Equipment (DCE) or Data Terminal Equipment (DTE)

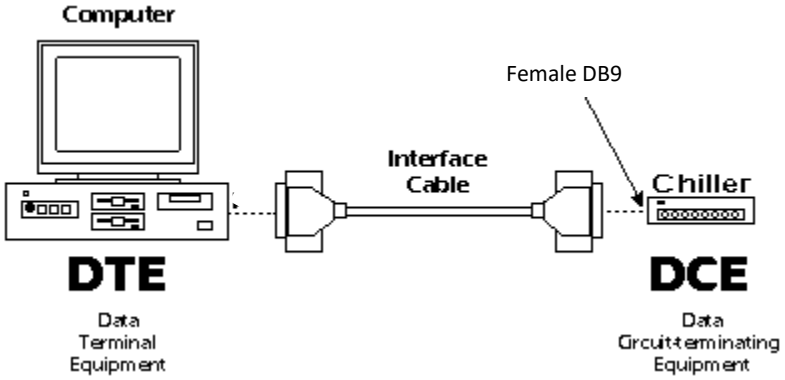


Table 1A: Signal definition and wiring for Host wired as DTE

Computer/Host/Master Male 9-Pin D-sub Pin #	**Chiller / Slave** Female 9-Pin D-sub Pin#
2 (Receive – RXD)	2 (Transmit – TXD)
3 (Transmit – TXD)	3 (Receive – RXD)
5 (Ground)	5 (Ground)

Note: Use a null modem cable if your RS-232 is set up as a DCE.

Communication Specification

Speed:	9600 baud
Data Flow Control:	None
Data Format:	8-bit serial
Number of Start bits	1
Number of Stop bits:	1
Parity:	None
Master/Slave:	The Thermorack 800 is always the SLAVE (DTE)
Interrupts Reported:	None, must be polled for status
Transmission Length:	≤ 15 meters
Data Update Frequency:	Once per second
Maximum Polling Frequency:	One command every 500msec
Data Format:	ASCII Insert a carriage return ($0x0D_{hex}$) at the end of each command string. A carriage return ($0x0D_{hex}$) is sent at the end of each response

Table 2 RS-232 Commands

PARAMETER	GET Data Command	Response	PUT Data Command	Response
Show all parameters (see below page for details)	GETSET2	TEMP, SETTEMP, PUMPTEMP, PWM?, FANPWM, TLL, STAT1A, FLTS1A		
Show chiller identification information	IDN	Solid State Cooling, Product Name, Model#, Software Number & Revision, Serial Number		
Put chiller in LOCAL mode			LOCAL	
Chiller: run, stop	RUN?	RUNNING or STOPPED	RUN, STOP	
RTD temp	TEMP?	(-)XX.X		
Set-point Temperature	SETTEMP?	(-)XX.X	SETTEMP	(-)XX.X
Temperature Alarm width (+/-)	WIDTH?	XX.X	WIDTH	XX.X
RTD offset	RTDOFFSET?	(-)XX.X	RTDOFFSET	(-)XX.X
Display backlight on/off	-		BLON, BLOFF	
Pump temperature	PUMPTEMP?	(-)XX.X		
Actual TE PWM %	PWM?	(-)XX.X		
Status word 1 (5 ASCII bytes)	STAT1A?	0 - 65535		
Faults word 1 (5 ASCII bytes)	FLTS1A?	0 - 65535		
Reset All Alarms and Restart			RESTART	

GETSET2 parameters: GETSET2 returns the following data w/o identifying prefix names.
Note: All data returned is in ASCII

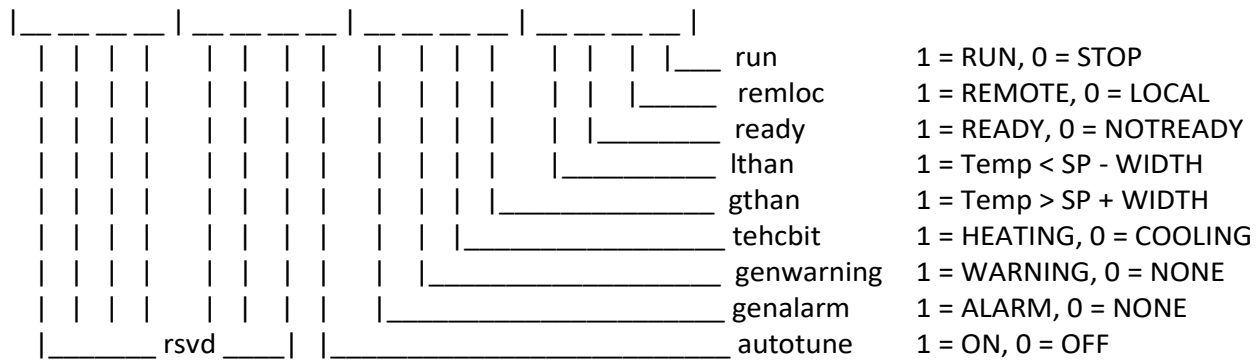
- Cr defined at "carriage return" or $0D_{hex}$
- ETX defined as "end-of-text" or 03_{hex}

Data	Description	Format	Units	Range
TEMP<Cr>	Coolant Temperature	XX.X	°C	5.0 – 45.0
SETTEMP<Cr>	Set Point Temperature	XX.X	°C	5.0 – 45.0
PUMPTEMP<Cr>	Pump Temperature	XX.X	°C	0.0 – 50.0
PWM<Cr>	%PWM	XX.X	%	0 – 98.0
FANPWM<Cr>	%PWM	XX.X	%	40-100
TLL<Cr>	Tank Lev Low	XXXX	none	0 - 4096
STAT1A<Cr>	Status bits	XXXXX	none	0 - 65535
FLTS1A<Cr>	Fault bits	XXXXX	none	0 - 65535
<ETX>	ASCII "end of text", 03_{hex}	03	n/a	03

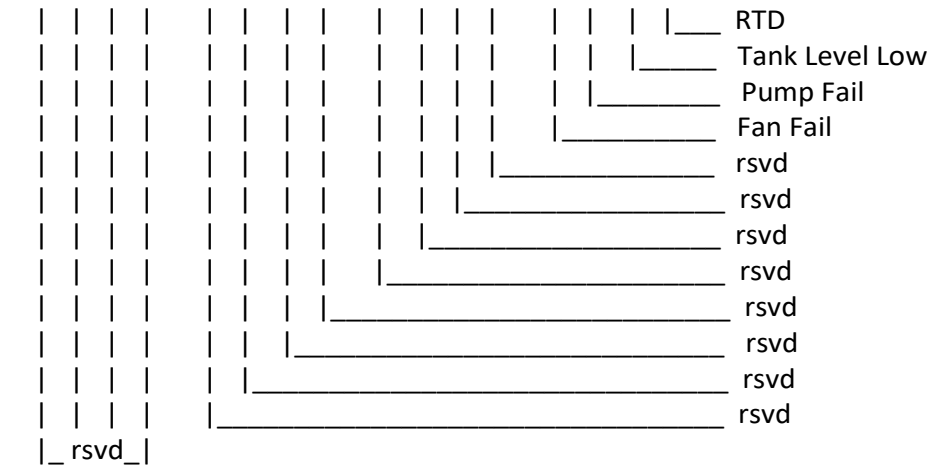
Example: Running, remote mode, ready, coolant temp 22.9°C, set-point 23.0°C, pump temp 17.0°C, 76.3% cooling, Fan Speed 69.2%, tank level low = 119, status: running in remote mode within alarm range, faults: none

22.9<Cr>23.0<Cr>17.0<Cr>-76.3<Cr>69.2<Cr>119<Cr>7<Cr>0<Cr><ETX>

STAT1A Bit Field Definition:



FLTS1A Bit Field Definition (Fault="1")



NOTES:

1. All commands terminate with a carriage return (0x0Dh)
2. All commands are case insensitive

SECTION 8
CLEANING YOUR CHILLER

The exterior surfaces of the ThermoRack 800 may be cleaned with a non-shedding wipe dipped in isopropyl alcohol.

SECTION 9
TECHNICAL SUPPORT

Delighting our customers is our highest priority. Please contact us immediately for technical assistance whenever you have questions or concerns.

Hours: 8 a.m. to 5 p.m. Eastern Time, Monday - Friday
Telephone: (845) 296-1300
Fax: (845) 296-1303
E-mail: info1@sscooling.com

SECTION 10
SDS FOR COOLANTS
10.1 KOOLANCE (27% PROPYLENE GLYCOL/WATER)

Safety Data Sheet – Last updated May 2016

1. IDENTIFICATION

Product: LIQ-702xx Coolant Fluid ("xx" signifies liquid color)
Manufacturer: Koolance Korea
Address: Koolance Bld, 40, Deokcheon-ro 34, Manan-gu, Anyang-si, Gyeonggi-do, Korea 14088
Telephone: (U.S.) +01 253-249-7669, Fax: (U.S.) +01 253-249-7453

Appearance: Liquid for cooling systems. Available in various colors and shipped in plastic bottles or containers.
Usage: For use in cooling systems only. Do not use in foodstuffs, beverages, or in other applications.

2. HAZARD IDENTIFICATION

Globally Harmonized System of Classification and Labeling of Chemicals (GHS)

- Physical Hazard: Not applicable
- Health Hazard: Skin Irritation – Category 2
  Eye Irritation – Category 2
- Environmental Hazard: Not applicable

Label elements including precautionary statements.

Symbol: Signal word: Warning

Hazard statement: H315 – May cause irritation to the skin.
H319 – May cause serious irritation to the eyes.

Prevention: P264 - Wash thoroughly after handling
P280 - Wear protective gloves, clothing, and eye protection.

Responses:

- P302+P352 If on skin: Wash exposure area with plenty of water and soap.
- P305+P351+P338 If in eyes: Rinse continuously with water for several minutes. Remove contact lenses if present and easy to do so. Continue rinsing.
- P337+P313: If skin or eye irritation persists, seek medical attention immediately.
- P362: Remove contaminated clothing and wash before reuse.

Storage / Disposal: P501: Refer to all federal, provincial, state, and local regulation prior to disposition of container and unused contents by reuse, recycle, or disposal.

NFPA Rating (estimated)
Health: 1
Flammability: 1
Reactivity: 0
Water Reactivity: 0

3. COMPOSITION / INFORMATION ON INGREDIENTS

Ingredients	CAS No.	EINECS No.	Conc. %
Distilled Water	7732-18-5	231-791-2	70 – 75
Propylene glycol	57-55-6	200-338-0	25 – 30
Others (Proprietary)	-	-	0.2 – 2.0

4. FIRST AID MEASURES

- In case of eye contact: Rinse thoroughly with plenty of water for at least 20 minutes. If irritation remains, consult a medical doctor immediately.
- In case of skin contact: Remove contaminated clothing. Wash with soap and plenty of water for at least 20 minutes. If irritation remains, consult a medical doctor immediately.
- If inhaled: Move person to fresh air. If not breathing, give artificial respiration and immediately contact emergency medical assistance.
- If ingested: Never give anything by mouth to an unconscious person. Rinse mount with water and consult a medical doctor immediately.

Other medical attention: Medical persons should be aware of protective measures for handling.
Potential health effects: May be harmful or fatal if swallowed.

5. FIRE-FIGHTING MEASURES

- Flash Point: 118°C (Cleveland open cup)
- Suitable extinguishing media: Water spray, alcohol-resistant foam, dry chemical, carbon dioxide
- Specific hazards arising from the chemical: No data available
- Special protective equipment for fire fighters:
  - Use water spray to cool unopened containers.
  - Fire fighters should enter area wearing respiratory protection and protective equipment.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions:

- Ensure adequate ventilation.
- Remove all sources of ignition.
- Avoid contact with skin and eyes.
- Avoid inhalation of vapor, mist, or gas.

Environmental Precautions:

- Follow local regulations.

Methods and materials for containment and clean-up:

- Collect with non-combustible absorbent materials (sand and soil).

7. HANDLING AND STORAGE

Precautions for safe handling:

- Wear protective gloves, clothing, and eye/face protection.
- Do not spray on an open flame or other ignition source.
- Provide forced air ventilation in tanks and confined spaces.
- Avoid contact with skin and eyes.
- Avoid inhalation of vapor, mist, or gas.
- Keep away from sources of ignition. No smoking.

Conditions for safe storage:

- Keep container tightly closed.
- Keep in a dry and well-ventilated place.
- Keep cool.
- Avoid direct sunlight, heat sources, and strong oxidizing agents.

8. EXPOSURE CONTROL / PERSONAL PROTECTION

Conditions for safe storage:

- KOSHA: No data available
- US ACGIH: No data available

Appropriate engineering controls:

- Respiratory protection: Approved respirator equipped with cartridge for organic vapors
- Eye protection: Protective goggles
- Hand protection: Chemical resistant gloves

9. PHYSICAL AND CHEMICAL PROPERTIES

- State: Liquid at 20°C
- Flash Point: 118ºC (Cleveland open cup). No flash occurred under 93ºC (Tag closed cup)
- pH: 7.0 – 8.0 at 20°C; Sample H2O = 1:5 (V/V)
- Viscosity: 2.3 mPa x s (cP) at 20°C
- Density: 1.03 at 20°C
- Water solubility: Soluble at 20°C
- Explosive properties: No self-reaction hazard; UN TDG test & criteria – Test E3
- Autoignition temperature: No spontaneous combustion under 300°C
- Boiling point (initial): >98ºC
- Melting range: No data available
- Vapor pressure: No data available
- Oxidizing properties: No data available
- Partition coefficient (n-octanol/water): No data available
- Evaporation rate: No data available
- Decomposition temperature: No data available
- Lower explosion limit / Upper explosion limit: No data available

10. STABILITY AND REACTIVITY

Chemical stability:

Stable under recommended storage conditions.

Conditions to avoid:

Direct sunlight, heat, flames, and sparks.

Materials to avoid:

Strong oxidizing agents.

Hazardous decomposition products:

Carbon oxides

11. TOXICOLOGICAL INFORMATION

- Acute toxicity (Calculated):

Oral	rat	LD50 : 23,779 mg/kg
Skin	rabbit	LD50 : 38,021 mg/kg
Inhalation	rat	LC50 : 145 mg/kg

- Skin irritation: Irritating (Calculated, Category 2)
- Eye irritation: Irritating (Calculated, Category 2)
- Respiratory sensitization: No data available
- Skin sensitization: No data available
- Germ cell mutagenicity: No data available
- Carcinogenicity: Not classifiable; from IARC / EC ESIS
- Reproductive Toxicity: No data available
- Specific target organ toxicity – single exposure (GHS): No data available
- Specific target organ toxicity – repeated exposure (GHS): No data available
- Aspiration hazard: No data available

12. ECOLOGICAL INFORMATION

- Acute toxicity (Calculated):

Fish	LC50 : 8,700mg/l 96hr Pimephales promelas
Crustacean	LC50: 7,921mg/l 48hr Daphnia magna
Bird	EC50: 1,634mg/l 72hr Selenastrum capricornutum

- Persistence and degradability: No data available
- Bioaccumulative potential: No data available
- Mobility in soil: No data available
- Other adverse effects: No data available

13. DISPOSAL CONSIDERATIONS

Disposal consideration:

Observe all environmental regulations.

Disposal precaution:

Avoid disposing in the environment.

14. TRANSPORT INFORMATION

- TSCA: All ingredients are listed on the TSCA inventory
- DOT Classification: Not a DOT controlled material (U.S.)
- UN TDG: Not dangerous goods
- IMDG: Not dangerous goods
- IATA: Not dangerous goods
- Marine pollution: Not applicable
- Special precaution:
  - Fire EmS Guide: F-E (Recommendation)
  - Spillage EmS Guide: Not dangerous goods

15. REGULATORY INFORMATION

- Korea Industrial Safety and Health Act (GHS): Eye irritation – Category 2
- Korea Industrial Safety and Health Act (GHS): Skin irritation – Category 2
- Korea Hazardous Materials Safety Control Act: Not hazardous material
- Korea Toxic Chemicals Control Act: Not a toxic chemical
- Korea Persistent Organic Pollutants Control Act: Not applicable
- US OSHA Hazards (GHS): Eye irritation
- US OSHA Hazards (GHS): Skin irritation

16. OTHER INFORMATION

Last Updated: March, 2015

References:

- GHS Classification: EC ESIS, US NLM
- Physical and chemical properties: EC ESIS, US NLM
- Transport information: EC ESIS, US NLM
- Toxic and ecological information: OECD SIDS, IUCLID, US NLM, IARC, EC ESIS, CCRIS

Acronyms and Websites:

- EC ESIS : European chemical Substances Information System, http://esis.jrc.ec.europa.eu/
- IUCLID : International Uniform Chemical Information Database, http://esis.jrc.ec.europa.eu/
- US NLM : U.S. National Library of Medicine, http://chem.sis.nlm.nih.gov/chemidplus/
- HSDB : US Hazardous Substances Data Bank, http://toxnet.nlm.nih.gov/
- CCRIS : US Chemical Carcinogenesis Research Information System, http://toxnet.nlm.nih.gov/
- IARC : International Agency for Research on Cancer, http://monographs.iarc.fr

This SDS is composed with reference to documents and criteria provided by KOSHA. The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Koolance be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Koolance has been advised of the possibility of such damages.

10.2 ETHYLENE GLYCOL

ThermoFisher SCIENTIFIC

SAFETY DATA SHEET

Creation Date: 02-Feb-2010 **Revision Date:** 17-Jan-2018 **Revision Number** 4

1. Identification

Product Name **Ethylene glycol**

Cat No. : **E177-4; E177-20**

CAS-No 107-21-1
Synonyms Monoethylene glycol; 1,2-Ethanediol

Recommended Use Laboratory chemicals.
Uses advised against Not for food, drug, pesticide or biocidal product use

Details of the supplier of the safety data sheet

Company
Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Emergency Telephone Number
CHEMTRECÒ, Inside the USA: 800-424-9300
CHEMTRECÒ, Outside the USA: 001-703-527-3887

2. Hazard(s) Identification

Classification
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Acute oral toxicity	Category 4
Specific target organ toxicity (single exposure)	Category 3
Target Organs - Central nervous system (CNS).	
Specific target organ toxicity - (repeated exposure)	Category 2

Label Elements

Signal Word
Warning

Hazard Statements
Harmful if swallowed
May cause drowsiness or dizziness
May cause damage to organs through prolonged or repeated exposure

Precautionary Statements
Prevention
Wash face, hands and any exposed skin thoroughly after handling
Do not eat, drink or smoke when using this product
Do not breathe dust/fume/gas/mist/vapors/spray
Use only outdoors or in a well-ventilated area
Response
Get medical attention/advice if you feel unwell
Inhalation
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Call a POISON CENTER or doctor/physician if you feel unwell
Ingestion
IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell
Rinse mouth
Storage
Store in a well-ventilated place. Keep container tightly closed
Store locked up
Disposal
Dispose of contents/container to an approved waste disposal plant
Hazards not otherwise classified (HNOC)

WARNING. Reproductive Harm - https://www.p65warnings.ca.gov/.

3. Composition/Information on Ingredients

Component	CAS-No	Weight %
Ethylene Glycol	107-21-1	>95

4. First-aid measures

Eye Contact	Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Get medical attention.
Skin Contact	Wash off immediately with plenty of water for at least 15 minutes. Get medical attention immediately if symptoms occur.
Inhalation	Move to fresh air. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Get medical attention immediately if symptoms occur. If not breathing, give artificial respiration.
Ingestion	Do not induce vomiting. Call a physician or Poison Control Center immediately.
Most important symptoms and effects	Breathing difficulties.
Notes to Physician	Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

Unsuitable Extinguishing Media No information available
Flash Point 111 °C / 231.8 °F
Method - DIN 51758

Autoignition Temperature 413 °C / 775.4 °F

Explosion Limits
Upper 15.30 vol %
Lower 3.20 vol %
Sensitivity to Mechanical Impact No information available
Sensitivity to Static Discharge No information available

Specific Hazards Arising from the Chemical
Thermal decomposition can lead to release of irritating gases and vapors. Keep product and empty container away from heat and sources of ignition.

Hazardous Combustion Products
Carbon monoxide (CO) Carbon dioxide (CO2)

Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA

Health	Flammability	Instability	Physical hazards
2	1	1	N/A

6. Accidental release measures

Personal Precautions Ensure adequate ventilation. Use personal protective equipment.

Environmental Precautions Should not be released into the environment. See Section 12 for additional ecological information.

Methods for Containment and Clean Up Soak up with inert absorbent material. Keep in suitable, closed containers for disposal.

7. Handling and storage

Handling Wear personal protective equipment. Ensure adequate ventilation. Do not breathe vapors or spray mist. Avoid contact with skin, eyes and clothing.

Storage Keep containers tightly closed in a dry, cool and well-ventilated place. Keep away from heat and sources of ignition.

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH	Mexico OEL (TWA)
ethylene glycol	TWA: 25 ppm STEL: 50 ppm STEL: 10 mg/m^3	(vacated) Ceiling: 50 ppm (Vacated) Ceiling: 125 mg/m^3		Ceiling: 100 mg/m^3

Legend

ACGIH - American Conference of Governmental Industrial Hygienists
OSHA - Occupational Safety and Health Administration

Engineering Measures	Ensure adequate ventilation, especially in confined areas. Ensure that eyewash stations and safety showers are close to the workstation location.

Personal Protective Equipment

Eye/face Protection	Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.
Skin and body protection	Wear appropriate protective gloves and clothing to prevent skin exposure.
Respiratory Protection	Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.
Hygiene Measures	Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Viscous liquid Liquid
Appearance	Colorless
Odor	Odorless
Odor Threshold	No information available
pH	5.5-7.5 50% aq. sol
Melting Point/Range	-13 °C / 8.6 °F
Boiling Point/Range	196 - 198 °C / 384.8 - 388.4 °F @ 760 mmHg
Flash Point	111 °C / 231.8 °F
Method -	DIN 51758
Evaporation Rate	No information available
Flammability (solid,gas)	Not applicable
Flammability or explosive limits	
Upper	15.30 vol %
Lower	3.20 vol %
Vapor Pressure	0.12 mmHg @ 20 °C
Vapor Density	2.14 (Air = 1.0)
Specific Gravity	1.113
Solubility	miscible
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	413 °C / 775.4 °F
Decomposition Temperature	> 500°C
Viscosity	21 cP (20°C)
Molecular Formula	C2 H6 O2
Molecular Weight	62.06

10. Stability and reactivity

Reactive Hazard	None known, based on information available
Stability	Hygroscopic.
Conditions to Avoid	Incompatible products. Excess heat. Exposure to moist air or water.
Incompatible Materials	Strong oxidizing agents, Strong acids, Strong bases, Aldehydes
Hazardous Decomposition Products	Carbon monoxide (CO), Carbon dioxide (CO2)
Hazardous Polymerization	Hazardous polymerization does not occur.
Hazardous Reactions	None under normal processing.

11. Toxicological Information

Acute Toxicity

Product Information
Component Information

Component	LD50 Oral	LD50 Dermal	LD50 Inhalation
Ethylene glycol	7712 mg/kg (Rat)	9530 µL/kg (Rabbit) 10600 mg.kg (Rat)	Not listed

Toxicologically Synergistic Products No information available
Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation May cause eye, skin, and respiratory tract irritation

Sensitization No information available

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico
Ethylene glycol	107-21-1	Not listed	Not listed	Not listed	Not listed	Not listed

Mutagenic Effects No information available

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure Central nervous system (CNS)
STOT - repeated exposure Kidney Liver

Aspiration hazard No information available

Symptoms/effects, both acute & delayed No information available

Endocrine Disruptor Information No information available

Other Adverse Effects The toxicological properties have not been fully investigated.

12. Ecological Information

Ecotoxicity
Do not empty into drains.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
Ethylene glycol	EC50: 6500 - 13000 mg/L, 96h (Pseudokirchneriella subcapitata)	LC50: = 16000 mg/L, 96h static (Poecilia reticulata) LC50: 40000 - 60000 mg/L, 96h static (Pimephales promelas) LC50: = 40761 mg/L, 96h static (Oncorhynchus mykiss) LC50: = 41000 mg/L, 96h (Oncorhynchus mykiss) LC50: 14 - 18 mL/L, 96h static (Oncorhynchus mykiss) LC50: = 27540 mg/L, 96h static (Lepomis macrochirus)	Not listed	EC50: = 46300 mg/L, 48h (Daphnia magna)

Persistence and Degradability Persistence is unlikely

Bioaccumulation/ Accumulation No information available.

Mobility Will likely be mobile in the environment due to its water solubility.

Component	log Pow
Ethylene glycol	-1.93

13. Disposal considerations

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

14. Transport information

DOT Not regulated
TDG Not regulated
IATA Not regulated
IMDG/IMO Not regulated

15. Regulatory information

All of the components in the product are on the following Inventory lists: X = listed

International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	IECSC	KECL
Ethylene glycol	X	X	-	203-473-3	-		X	X	X	X	X

Legend:
X - Listed
E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.
F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.
N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.
P - Indicates a commenced PMN substance
R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.
S - Indicates a substance that is identified in a proposed or final Significant New Use Rule
T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.
XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B).
Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.
Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b) Not applicable

SARA 313

Component	CAS-No	Weight %	SARA 313 Threshold Values %
Ethylene glycol	107-21-1	>95	1.0

SARA 311/312 Hazard Categories See section 2 for more information

CWA (Clean Water Act) Not applicable

Clean Air Act

Component	HAPS Data	Class 1 Ozone Depletors	Class 2 Ozone Depletors
Ethylene glycol	X		-

OSHA Occupational Safety and Health Administration Not applicable

CERCLA This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
Ethylene glycol	5000 lb	-

California Proposition 65 This product does not contain any Proposition 65 chemicals

U.S. State Right-to-Know Regulations

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Ethylene glycol	X	X	X	X	-

U.S. Department of Transportation

Reportable Quantity (RQ): Y
DOT Marine Pollutant N
DOT Severe Marine Pollutant N

U.S. Department of Homeland Security
This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade Slight risk, Grade 1

16. Other information

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Revision Summary This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS).

Disclaimer

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text

End of SDS

WARRANTY POLICY

This Solid State Cooling Systems Product is covered under a two-year parts and labor warranty from the date of shipment, assuming proper use and maintenance of the unit. All warranty work shall be performed at Solid State Cooling Systems' facility, currently located in Wappingers Falls, NY, USA and requires pre-authorization by SSCS. Malfunctioning products should be returned to Solid State Cooling Systems by the method described below. Solid State Cooling Systems will provide a Failure Analysis Report to the customer and will determine if the problem is covered under the warranty.

Warranty Coverage:

Products with defects in components or manufacturing which are reported to Solid State Cooling Systems before the end of the warranty period will be repaired or replaced at no cost (see below for reporting requirements). The warranty period begins on the date the product was initially shipped from Solid State Cooling Systems' factory.

Excluded from Warranty:

Excluded from warranty is any damage caused to the product occurring during, but not limited to, such events as shipment, installation, storage, or usage occurring during a situation specifically cautioned against or noted in the product manual.

Specific situations, which invalidate the warranty, include (but are not limited to):

- Removing the serial number label.
- Any disassembly (partial or complete) of the product.
- Changing any components of the product.
- Subjecting the product to temperatures below the freezing point of the coolant used.
- Subjecting any product to temperature, voltage, current, or pressure (internal or external) greater than that specified in the product manual.
- Any actions prohibited in the "Caution" section of the product manual.

Returned Goods Procedure and Reporting Requirements

Before a failed product is returned to the factory, a Returned Materials Authorization (RMA) number must be obtained from Customer Service at (845) 296-1300. The date the RMA is requested will be the reporting date noted and relevant to the warranty. Products, which have received an RMA, must be received at SSCS's factory, within 30 days or the reporting date will be moved ahead 30 days and a new 30-day waiting period will begin. Customers shall pay shipping cost of returning any unit to SSCS and SSCS shall pay shipping cost of returning any unit repaired under warranty to the customer.

All out of warranty returned goods will require an evaluation purchase order prior to receipt at Solid State Cooling Systems. The evaluation costs will depend on product model and will be deducted from the cost of any repairs required.