TCube mini 270

The Smallest 270W Recirculating Chiller on the Planet

Product Manual

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

Table of Contents

SAFETY PRECAUTIONS ____ 4

SECTION 1 ____ 5

INTRODUCTION ____ 5

SECTION 2 ____ 6

SPECIFICATIONS ____ 6

SECTION 3 ____ 8

HOOK UP ____ 8
3.1 ELECTRICAL CONNECTIONS (SEE FIGURES 3A AND 3B) ____ 10
3.2 PLUMBING CONNECTIONS (SEE FIGURE 3A AND 3B) ____ 11
3.3 AIR CONSIDERATIONS ____ 11
3.4 COOLANT FILL ____ 11
3.5 PRIMING THE PUMP ____ 12

SECTION 4 ____ 12

START UP ____ 12

SECTION 5 ____ 13

OPERATION ____ 13
5.1 SIMPLE OPERATION ____ 13
5.2 ADVANCED OPERATION ____ 13
5.3 ALARM SIGNAL ____ 15

SECTION 6 ____ 16

SYSTEM ALARMS/TROUBLESHOOTING ____ 16

SECTION 7 ____ 17

RS-232 COMMUNICATION ____ 17
7.2 COMMUNICATION PROTOCOL ____ 17
7.3 RS232 COMMUNICATION EXAMPLES ____ 20

SECTION 8 ____ 20

TECHNICAL SUPPORT ____ 20

SECTION 9 ____ 21

SDS FOR COOLANTS ____ 21
9.1 KOOLANCE (27% PROPYLENE GLYCOL/WATER) ____ 21
9.2 ETHYLENE GLYCOL ____ 26

WARRANTY POLICY ____ 33

CE Declaration of Conformity

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

declare under our sole responsibility that the

TCube Mini 270

meets the provisions of the directives:

Emissions:
CFR Title 47 FCC Part 15 Subpart B, Class A
ICES-003, Issue 6, Class A
EN 61326-1: 2013 per EN 55011:2009 + A1: 2010 Group 1 Class A
ACMA AS/NZS CISPR 11:2009 + A1:2010

Immunity:
EN 61326-1: 2013 Electrical Equipment for Measurement, Control, and Laboratory Use - EMC
EN 61000-3-2 Harmonics Emissions
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 3rd Edition Low Voltage Directive Safety requirements for electrical
UL 61010-1: 2012 equipment for measurement, control, and laboratory use.
CAN/CSA C22.2 No. 61010-1 2012

Lloyd F Wright Chief Technology Officer	
Date	March 19, 2018

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 opening the cover for any reason.

CAUTION

- Never disassemble the chiller as irreparable damage may occur.
- Never store the chiller over 60 °C.
- Never operate the chiller in ambient temperatures of 40 ºC or greater.
- Never operate the chiller within 2 ºC of the coolant's freezing point.
- Never use alcohol (methanol, ethanol or isopropanol) based coolants.
- 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 TCube mini. If your system has copper cold plates/tubing, select the TCube mini copper models. Stainless steel may be used with either material.

Symbols Used in this Manual

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.

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.

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

PRODUCT MANUAL

TCUBE MINI 270

THERMOELECTRIC CHILLER

SECTION 1
INTRODUCTION

The TCube mini recirculating chiller is a new product, built upon the legacy of our Ultra Compact (UC) family of thermoelectric recirculating chillers offering 270 Watts of cooling capacity @ 20°C (20°C ambient) without the use of compressors or refrigerants.

Still the world's smallest, air cooled recirculating chillers, the TCube mini offers even more capacity than the UC160-190 chillers with a new, larger (~180 ml) screw-top fluid reservoir.

TCube mini is the ideal solution for a variety of applications, including precision lasers, analytical equipment, medical equipment, lab equipment, low-light CCD cameras, microtiter testing, or any other application requiring precise, point of use temperature control. Using our latest long-life gear pump, TCube mini provides 750 ml/min of constant temperature coolant with a stability of ±0.1°C. With fewer moving parts, the system is highly reliable and energy efficient.

The chiller ships with the items listed below. Please locate them prior to discarding the shipping box.

(1) TCube mini Recirculating Liquid Chiller
(1) 360 watt 27 VDC Table Top Power Supply
(1) AC Line Cord
(1) 250 ml Squirt Bottle
(2) Valve quick disconnect fittings, 1/8th inch hose barb

SECTION 2
SPECIFICATIONS

Operating Range (Set Point):	2°C to 45°C
Ambient Temperature Range:	10°C to 40°C non-condensing
Stability / Repeatability:	±0.1°C with constant load (even near ambient)
Cooling Capacity (typical[1]):	270 Watts @ 20°C in 20°C ambient air
Noise Level (at 1 meter):	< 58 dBA
Coolant / Process Fluid:	Koolance (27% propylene glycol / water mix) or 27-50% ethylene glycol / water mix (contact SSCS for advice on other fluids)
Process Fluid Fittings:	1/8" female CPC quick connect with shut-off valve
Process Fluid Flow Rate:	~0.75 lpm @ 10 psi
Pump:	Long life magnetically coupled gear pump
Tank Volume:	~180 ml with level sensor with screw top
Wetted Materials:	Aluminum + polymers (Options available for Copper or SS)
Dimensions (L x W x H):	7.5” x 5” x 9” (19cm x 13cm x 23cm)
Weight:	10.1 lbs (4.6 kg)
Power Input (external supply):	Universal: 100-240 VAC, 50/60 Hz, 2.4 amps max
Electrical Connections:	Plug in AC adaptor
Power Consumption:	290 Watts maximum
Operating Voltage:	27 VDC, 11 amps max
Controls:	Digital PID controller for heating and cooling
Communications:	Keypad or RS232 interface
Alarms	Temperature, fluid level, system or component failure (display, RS232 and dry contact)
Standards	TUV listed to UL, CAN/CSA and EN 61010-1, CE 61010-1, RoHS 2 Compliant
Warranty	2 years

Note 1: Cooling capacities shown are typical. Actual cooling capacity may vary with configuration.

Figure 1: TCube mini 270 Cooling Capacity in 20°C Ambient (compared with UC160-190)

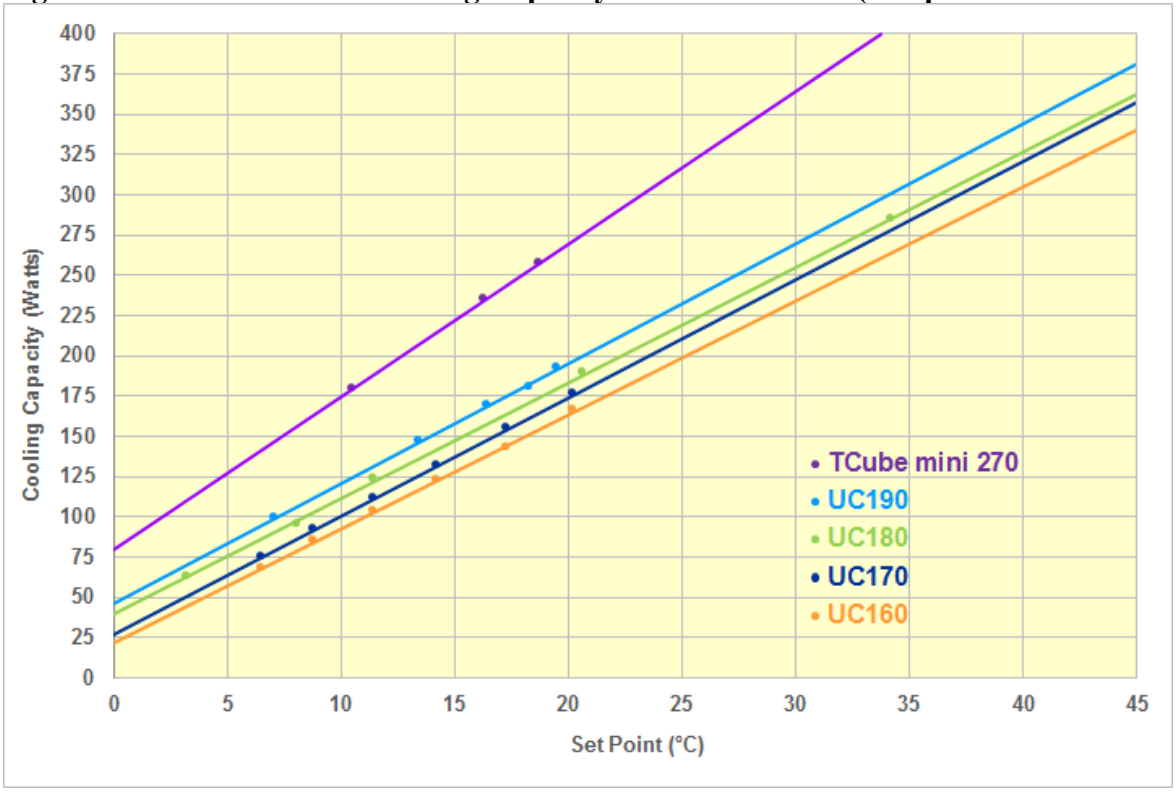
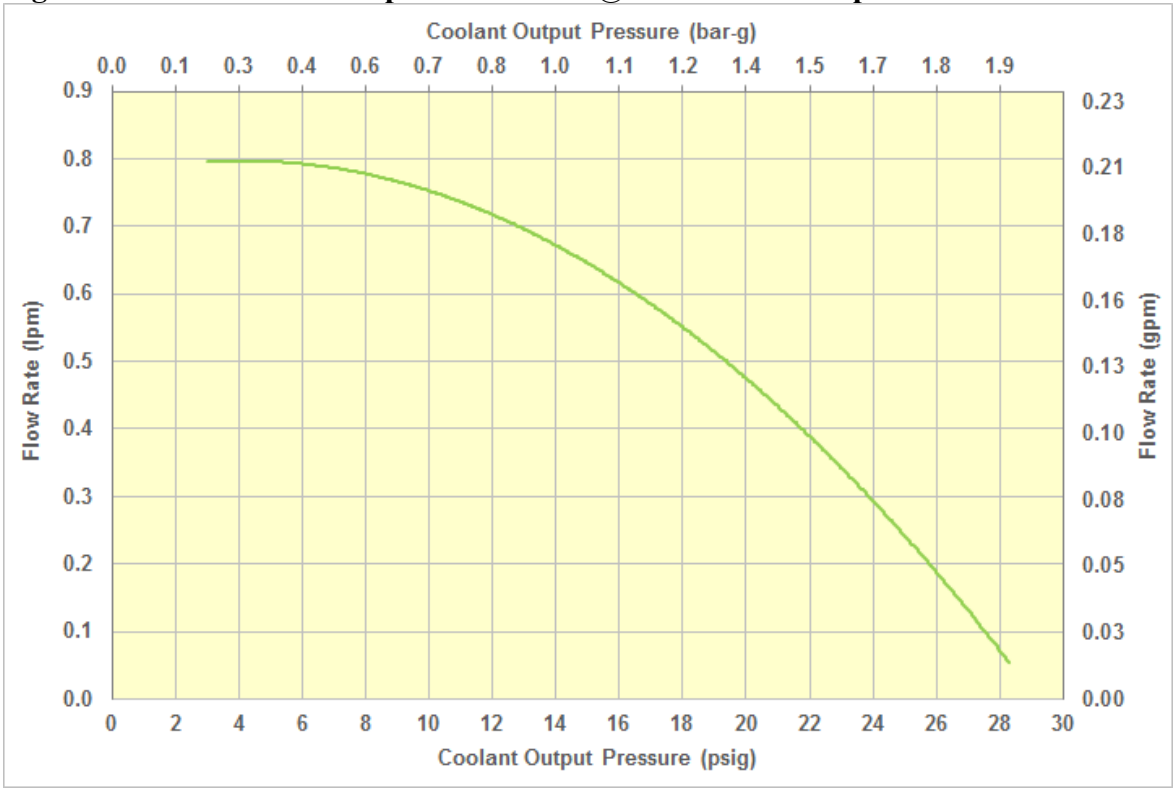


Figure 2: TCube Mini Pump Performance @ 20°C Fluid Temperature



Notes:

1) Pump to pump variation is +/- 10%.
2) The minimum recommended pump flow rate is 500 ml/min (0.5 lpm, 0.13 gpm) – approximately 19 psig. Below this flow rate temperature control may become unstable.

SECTION 3
HOOK UP

Figure 3A: Top View

Figure 3B: Back View

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

WARNING

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

Power: TCube mini comes with a 360w 27 VDC bench top power supply. Plug the DC output connector into the TCube mini DC connector and rotate clockwise until the connector latches. The systems power switch is located on this power supply.

The DC Power connector is a TE Connectivity CPC PN 211401-4. The external mating connector is PN 211399-1 with socket pins 1-66360-6 and clamp 206966-7. The Pin-out is shown below:

Pin 1	27 VDC (+)
Pin 2	27 VDC (+)
Pin 6	27 VDC (–)
Pin 7	27 VDC (–)

Alarms: TCube mini has one 250 VAC 1 amp dry contact relay to indicate a system alarm or temperature out of range. Connect to this dry contact on the 9-pin dsub connector as follows:

System/Temp Alarm: Pin 1
Alarm Signal Return: Pin 6

RS 232: TCube mini comes with a RS-232 communication link. See Section 7 for details on the RS-232 connection and protocol.

A wide variety of power cords are available to support universal power operation:

Code	Country / Region	Part Number
-P1	USA/Canada	22-22333-1
-P2	Europe	22-22333-2
-P3	Japan	22-22333-3
-P4	UK	22-22333-4
-P5	Israel	22-22800-1
-P6	Australia	22-23213-1
-P7	Korean	22-23526-1
-P8	China (3 prong)	22-23661-1
-P9	Brazil	22-25122-1
-P10	India/South Africa Type D - 5A	16-23918-1
-P11	India/South Africa Type M - 15A	16-23918-2
-P20	IEC C13 to C14 39”	22-26026-1

3.2 PLUMBING CONNECTIONS (SEE FIGURE 3A AND 3B)

CAUTION

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

The TCube mini has two Colder Products compatible 1/8" valved quick disconnect coolant fittings. Two mating valved quick disconnect inserts are included with 1/8" ID hose barb fittings for convenience.

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 TCube mini. If your system has copper cold plates/tubing, select the TCube mini copper models. 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 TCube mini unit or system being controlled.

3.3 AIR CONSIDERATIONS

Restricting airflow into or out of the TCube mini unit will impair performance. Maintain at least 3" of clearance around the air inlet and outlet to ensure no restriction of airflow.

3.4 COOLANT FILL

WARNING

Read the Coolant SDS Prior to filling the chiller

The coolant fill cap is located at the top of the unit. Unscrew the cap and use the 250 ml bottle (shipped with the chiller) to fill reservoir prior to starting unit. Turn on the TCube mini chiller and add additional coolant as necessary to maintain the liquid level at the bottom of the tank neck.

Very occasionally the TCube Mini 270 tank level float gets stuck or flipped on its edge upon initial filling. This will cause the display to show Tank Level Low even though the tank if full. Should this occur, use a small screwdriver or other long probe to tap the tank level sensor as shown until the float comes loose or flips back horizontally.

CAUTION

Use only recommended coolants

Solid State Cooling Systems recommends Koolance LIQ-702CL-B (27% propylene glycol and water) with corrosion inhibitors and algaecides. (Note: propylene glycol is non-toxic). This coolant has the added benefit of extending the TCube mini chiller's pump life.

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 NOTE: Use of methanol, ethanol or isopropanol as coolants, either by themselves or in water mixtures will damage the TCube mini pump.

3.5 PRIMING THE PUMP

Normally, the TCube mini pump primes immediately upon power up. Occasionally at initial start-up, or when starting up the TCube mini after not having run for a long period of time, the TCube mini pump will not prime and no coolant will flow out. If this occurs, use the following procedure to prime the pump:

1) Turn off the TCube mini 270.
2) Disconnect the Coolant Supply line.
3) Create a drain tube by pushing a piece of 1/8" ID tubing onto one of the 1/8" quick disconnect fittings supplied with the TCube mini chiller. This tube needs to be long enough for coolant to be pumped into a bucket or other collection container.
4) Plug this drain tube into the coolant supply quick disconnect fitting.
5) Remove the tank screw cap top and turn on the TCube mini chiller until coolant begins to come out of the drain tube, then turn the TCube mini off.
6) Replace the drain tube with your coolant line disconnected in step 2. The TCube mini pump is now primed and ready for operation.

SECTION 4
START UP

WARNING

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

Start-up the chiller using the following steps:

1) Connect 1/8" ID hose to fluid connections located on the back side, labeled Coolant Supply and Coolant Return.
2) Open the reservoir cap on top. Using the 250 ml bottle provided, fill the reservoir to just below the bottom of its neck with coolant.
3) Plug in the 27.0 VDC table top power supply or connect 27.0 VDC power to the DIN connector (wired as shown in section 3.1).
4) Optional: connect the alarm signal to the 9-pin dsub connector as shown in section 3.1.
5) Turn on switch located on the external power supply. The front display should read the current coolant temperature. If the front display reads "TANK LOW", add coolant to the reservoir until the display changes to read the coolant temperature.

Important Note:

1) The TCube mini system performs a self-diagnostic check for 10 seconds after turn-on. If the tank level low alarm persists, or if another alarm is displayed, consult section 6.0 of this manual.

SECTION 5
OPERATION

The chiller is operated via the control panel located on the top of the unit. The control panel has an 8-character LCD display and three input keys: UP, DOWN, and ENTER. 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 changes the LCD display menu.

5.1 SIMPLE OPERATION

TCube mini 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 chiller and wait for display to read TEMP: XX.X°C
2) Press the UP or DOWN keys to change SETTEMP1 to the desired set point.
3) Press the ENTER key.
   The chiller will now control to the set point temperature. To change the set point temperature just press the UP or DOWN keys again to change SETTEMP1 to the new set point, followed by the ENTER key.

5.2 ADVANCED OPERATION

TCube mini has two menus: the Status Menu and the Parameter Input Menu. The Status Menu shows the current temperature of coolant leaving the chiller (see Figure 4). The Status Menu also allows input of new coolant temperature set points when the cycling feature is off. The Parameter Input Menu allows input of set point temperatures; soak times, number of cycles if cycling between two temperatures, an alarm temperature, a temperature offset, and a password to enter the Parameter Input Menu. (The default password is 0000 until changed by the user.) Press and hold the enter key for 3 seconds to enter the parameter menu.

Note: While in the Parameter Input Menu, if no keys are pressed for 30 seconds the display will revert to the status menu.

Figure 4: 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 (see notes 1+2)
PRESS ▼OR ▲ (change set point)		↵
SETTEMP1 XX.X°C		SETTEMP1 XX.X°C
↵		↵
TEMP: XX.X°C (current temp)		ALRM TMP +/-X.X°C
		↵
		OFFSET +/-X.X°C
		↵
		CHNG PWD Y/N (change password)

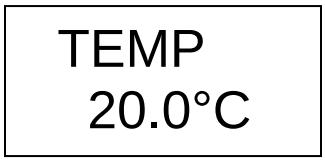
Allowable Value Ranges:

SETTEMP1	2 TO 45 °C
ALRM TMP	1 TO 9 °C in 0.1°C increments
OFFSET	-5 °C TO 5 °C in 0.1°C increments
CHNG PWD	Y OR N

NOTES:
1. When entering the PASSWORD, enter one digit at a time
2. The default password is 0000, until changed by the user

Status Menu: The status menu displays the chiller operating status and coolant temperature.

TCube mini Display – Status menu



Parameter Input Menu: The parameter input menu allows input of operating temperatures, soak times, number of cycles desired, temperature units desired, time units desired, the alarm temperature range and an offset temperature to change the displayed temperature.

SETTEMP1 = Coolant set point
ALRM TMP = +/- Alarm temperature set point. If the current temperature is outside of the set point +/- the dry contact alarm will open.
OFFSET = Used to adjust the current temperature displayed. Entering 5 ºC will increase the displayed temperature by 5 ºC. Typically used to match temperatures with an external sensor. Also adjusts RS-232 temperature reported.
CHG PWD = Y/N Entering Y allows user to change the parameter input menu password.

5.3 ALARM SIGNAL

TCube mini has one normally closed dry contact alarm for temperature out of range or system failure, located on pins 1 & 6 of the 9-pin dsub connector.

A list of system failures causing the dry contact alarm to open can be found in Section 6. In the event of a 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. The use of chemical splash resistant gloves and eye protection is recommended
2. Insert the proper mating male fitting with approximately 12 inches of tubing attached into both the "**coolant supply**" and "**coolant return**" fittings on the back of the TCube mini chiller.
3. Place the tubing attached to the "**coolant supply**" fitting into a container to catch the draining fluid.
4. While holding a finger over the end of the tubing attached to the "**coolant return**" fitting, Turn the unit on (making sure to hold the drain hose in place) and run for 5 seconds. (Note: this will create a vacuum to cause the fluid in the internal plumbing to be drained)
5. After 5 seconds, release finger from blocking the tube attached to the "coolant return" fitting and continue to run chiller until fluid stops draining.
6. When fluid stops draining, turn off unit.
7. Unscrew and remove tank cap and inspect to make sure that most of the fluid is drained.
8. Dispose of the coolant in a manner consistent with local regulations.

SECTION 6
SYSTEM ALARMS/TROUBLESHOOTING

WARNING

Electrical Shock Hazard: Always unplug the unit before removing the cover.

WARNING

Do not attempt to service or repair the unit beyond the troubleshooting checks described in this section without first contacting Solid State Cooling Systems

TCube mini has the following warning or alarms that when triggered will show on the display. When an alarm is displayed the heat exchanger will be turned off and the system will not heat or cool the coolant.

TANK LEVEL LOW (Warning): Liquid reservoir level is too low. Since this is a Warning, not an Alarm, the heat exchanger will not be turned off. *Unless filling for the first time, check all outside plumbing lines for leaks. Once all leaks are sealed, remove the tank cap and add more process fluid until the alarm disappears.* ***Note: If the tank becomes empty, the display may read "pump fail".***

RTD OPEN or RTD SHORT (Alarm): The temperature sensor has failed or its connector has come loose. *Contact SSCS for an RMA number to return the unit for RTD replacement.*

PUMP FAIL (Alarm): An internal sensor detects reduced or no fluid flow, indicating an issue with the pump or a cutoff of flow. *Either the pump has failed, or the external coolant lines are blocked. Check that there are no obstructions/closed valves or kinks in the coolant lines. Also check that the coolant lines are fully inserted into the CPC shut-off fittings on the TCube mini. If the coolant lines are not blocked, contact SSCS for an RMA number to return the unit for pump replacement.*

IMPORTANT NOTE: The tank level low alarm will automatically reset when the tank is filled. The RTD failure alarm will not reset until the system power is turned off.

OTHER ISSUES:

COOLING CAPACITY INSUFFICIENT: *If the chiller is not providing sufficient cooling, check that the air inlet and outlet are not restricted and that the fan is running. If airflow is not restricted, contact SSCS technical support.*

RS-232 COMMUNICATION NOT WORKING: *If the RS-232 communications does not seem to be working, first check your wiring matches that of Section 7 Table 1A, that your baud rate is 9600, your protocol matches that shown in Section 7, and your commands are in Hex, not ASCII. If the wiring and protocol is correct, try cycling the power to reset the communications. If the problem persists, call SSCS technical support 845-296-1300.*

SECTION 7
RS-232 COMMUNICATION

TCube mini comes with a modified (pin-out) RS232 communication port. The chiller uses this port to communicate a comprehensive set of control parameters with a Host PC - these parameters are outlined in Section 7.2. This port is a 9-pin female d-sub connector and is found on the front of the chiller.

Note also that pins 1 and 6 on this port are connected to a dry contact relay and thus the RS-232 connecting cable must be customized. This relay is "closed" when the unit is functioning properly and the RTD temperature is within the Alarm Range. The relay is “open” when the RTD temperature is outside the Alarm Range or any other fault exists.

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

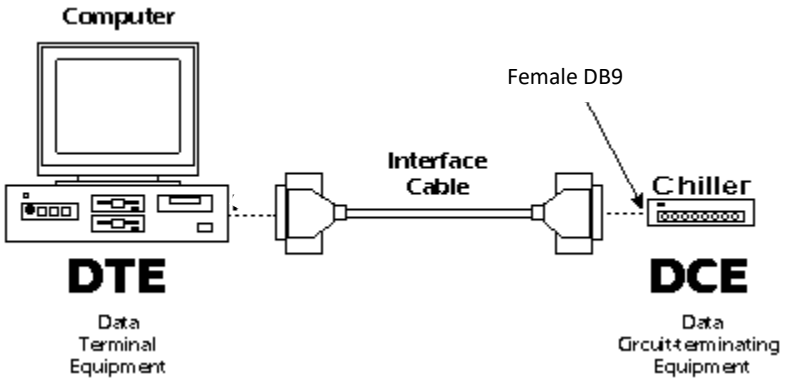


Table 1A: Signal definition and wiring for Host wired as DTE

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 (Hex)
Number of Stop bits:	1
Parity:	None
Transmission Breakdown:	One command byte followed by zero, one, or two data bytes depending on the parameter.
Master/Slave:	The TCube mini is always the SLAVE (DCE)
Interrupts Reported:	None, must be polled for status
Transmission Length:	$\leq$ 15 meters
Maximum Polling Frequency:	Two commands per second

7.2 COMMUNICATION PROTOCOL

Table 2: Command and Data Bytes (Hex)

	Bit Position	Description	Bit =1	Bit = 0
Command Byte	Bit 7 (MSB)	Set Remote Control	remote control	local control (chiller)
	Bit 6	Remote On/Off	chiller On	chiller in standby
	Bit 5	Communication Direction	remote to chiller (command from master)	chiller to remote (status from chiller)
	Bits 4 – 0	Parameters being communicated (see table 2)		
Data Bytes	1 or 2 bytes depending on parameter (see tables 3 and 4)			

Timing: TCube mini can accept a maximum of two commands per second

Table 3: Control Parameter[1]

Bits 4 – 0	Parameter	No of Data Bytes	Hex	
			Put	Get
00001	Chiller set point temperature	2	E1	C1
01001	Current temperature at chiller coolant output	2		C9
01000	Faults from chiller (fan, RTD failure, etc.)	1		C8
11110	% of Maximum thermoelectric power[2]	3		DE
01011	Software part number and revision	14		D7
11111	Reset alarms and restart chiller	0	FF	

Note 1: TCube mini echoes all commands prior to sending data except for the reset alarms command; the first byte returned is always the command byte, followed by data byte(s) for GET commands.
2: See Table 6 for details.

Table 4: Temperature Data Bytes (2 bytes)

The 2 data bytes for the temperature set point and transmission of the current temperature represent the value of the temperature in 0.1°C increments. Data is transmitted Low Byte First, then High Byte

Temperature (examples)	Low Byte	High Byte	Hex
0.1 °C	00000001	00000000	01 00
1.0 °C	00001010	00000000	0A 00
10.0 °C	01100100	00000000	64 00
20.0 °C	11001000	00000000	C8 00
30.0 °C	00101100	00000001	2C 01
40.0 °C	10010000	00000001	90 01

Table 5: Faults Data Byte (1 byte)
0 = OK, 1 = Fault If multiple faults exist, more than one bit will =1

Bit Position	Fault Assigned	Hex value when fault is present
7 (MSB)	Temperature below alarm range	80
6	unassigned	N/A
5	Pump fault	20
4	RTD fault	10
3	unassigned	N/A
2	Temperature above alarm range	04
1	unassigned	N/A
0	Tank Level Low	01

Table 6: DE Command % TE Power Data Bytes (4 bytes)

The %TE power command returns four (4) data bytes: an echo of the command, a sign byte that communicates heating or cooling, and two bytes of data from which the %TE power is calculated as follows:

Byte 0 = DE
Byte 1 = Mode, Cooling or Heating. If bit 7(MSB) = 0, then the system is cooling, if bit 7 = 1, then the system is heating. Ignore the remaining bits, they are arbitrary. (HEX<80 = cooling, HEX≥80 = heating)

Bytes 2 & 3 = %TE Power = (61784-(Byte2+256*Byte3))/12.72

Mode	%TE Power	Byte 1 (Heat/Cool) Hex	LSByte 2 Hex	LSByte 2 Dec	MSByte 3 Hex	MSByte 3 Dec	Calculation
Cooling	10	<80	D8	216	F0	240	%TE= (61784-(183+256*240))*100/1272=10
Cooling	25	<80	1A	26	F0	240	%TE= (61784-(254+256*239))*100/1272=25
Heating	50	≥80	DC	220	EE	238	%TE= (61784-(202+256*238))*100/1272=50
Heating	75	≥80	9E	158	ED	237	%TE= (61784-(149+256*237))*100/1272=75
Cooling	100	<80	60	96	EC	236	%TE= (61784-(96+256*236))*100/1272=100

Notes

1) The TCube mini handles RS232 bytes as they come in - i.e. it has no message data buffer. Therefore you must wait for a response from the TCube mini – even if it's just a command echo acknowledge, before sending the next message.
2) An acknowledgement of the transmission will be sent back to the master when the TCube mini reads the data. In the case of data transmitted to the TCube mini Controller only, the acknowledgement will be the command byte. In the case of data requested by the master, the acknowledgement will be the command byte plus the data byte(s) requested.
3) If RS-232 communications does not seem to be functioning, cycle the main power to reset.

Software Number and Revision

The D7 command returns the software part number and revision in ASCII as follows:

ASCII: x*60-12832-6XX^ where XX= the software revision number

The hex values for this string are:

Hex: D7 2A 36 30 2D 31 32 38 33 32 2D 36 XX YY 5E where XX YY = the software revision number

7.3 RS232 COMMUNICATION EXAMPLES

Example	Communications Sequence
1) Send set point of 25°C to chiller	Host sends command byte = E1 (hex)
	Host sends LOW data byte = FA (hex)
	Host sends HIGH data byte = 00 (hex)
	Chiller sends command byte = E1 (hex)
2) Read chiller set point	Host sends command byte = C1 (hex)
	Chiller sends command byte = C1 (hex)
	Chiller sends LOW data byte = set point value in hex (LB)
	Chiller sends HIGH data byte = set point value in hex (HB)
3) Read the actual temperature	Host sends command byte = C9
	Chiller sends command byte = C9
	Chiller sends LOW data byte = actual temp in hex (LB)
	Chiller sends HIGH data byte = actual temp in hex (HB)
4) Read the faults table	Host sends command byte = C8
	Chiller sends command byte = C8
	Chiller sends faults data byte = fault data in hex
5) Reset Alarms/Restart Chiller	Host sends command byte = FF
	Chiller sends command byte FF
6) Read % TE Power	Host sends command byte DE
	Chiller sends command byte DE
	Chiller sends heating/cooling data byte <80=cool, >80=heat
	Chiller sends Low data byte = decimal used to calculate %TE
	Chiller sends High data byte = decimal used to calculate %TE
7) Read Software Number Revision	Hose sends D7
	Chiller sends ASCII: x*60-12832-6M1^ Hex: D7 2A36 30 2D 31 32 38 33 32 2D 36 XX YY 5E

SECTION 8
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, weekdays
Telephone: (845) 296-1300
Fax: (845) 296-1303
E-mail: info1@sscooling.com

SECTION 9
SDS FOR COOLANTS
9.1 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.

9.2 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

Prepared By
Regulatory Affairs
Thermo Fisher Scientific
Email: EMSDS.RA@thermofisher.com

Creation Date 02-Feb-2010
Revision Date 17-Jan-2018
Print Date 17-Jan-2018
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

The TCube mini chiller 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.