THERMORACK 1000

Precision Rack-Mount Thermoelectric Recirculating Chiller

Note: Image shown is original TR1000. The Keypad has changed.

PRODUCT MANUAL

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

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

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

ThermoRack 1000 (all models)

meets the provisions of the directives:

2004/108/EC	EMC Directive
2006/95/EC	Low Voltage Directive
EN 61326-1: 2006	Emissions and Immunity
EN 61000-3-2: 2006	Harmonics Emissions
EN 61000-3-3: 2008	Voltage Fluctuations and Flicker
EN 61010-1: 2001 2rd Edition	Low Voltage Directive Safety requirements for electrical
UL 61010-1: 2008	equipment for measurement, control, and laboratory use.
CAN/CSA C22.2 No. 61010-1 2004	

Lloyd F Wright Chief Technology Officer	
Date	March 18, 2013

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.

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 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.

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.

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

PRODUCT MANUAL

THERMORACK 1000
THERMOELECTRIC CHILLER

SECTION 1
INTRODUCTION

ThermoRack 1000 delivers precise, Freon-free thermal control with repeatability of ±0.1C, even near ambient. This air-cooled system provides approximately 1000 Watts of cooling capacity at 20°C in a 20°C ambient environment, using full PID control for both cooling and heating. ThermoRack 1000 models are available for a variety of fluid types including Poly-Alpha-Olefin (PAO), Fluorinert / Galden or water-based coolants. Using a long-life magnetically driven rotary vane pump, the ThermoRack 1000 provides 12 to 14 lpm (3.2 to 3.7 gpm) of flow for stable temperature control of lasers, test equipment, avionics instruments and other types of industrial and scientific equipment. These systems have only two moving parts and do not use refrigerants, making them very reliable and environmentally friendly. The ThermoRack 1000 is also very energy efficient, only using power as needed for a given load. The system uses universal power input, so it can be used anywhere in the world.

Standard Models:

Fluid Type	Part Number
Poly-Alpha-Olefin (PAO)	10-12754-1
Fluorinert or Galden	10-12754-2
Water / Glycol	10-12754-3

SECTION 2
SPECIFICATIONS

Operating Range (Set Point): 0°C to 65°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]): 1000 watts @ 20ºC in a 20 ºC ambient (See Figure 1)

Coolant Type:

Part Number	Fluid Type
10-12754-1	Poly-Alpha-Olefin (PAO)
10-12754-2	Fluorinert or Galden
10-12754-3	Water / Glycol

Process Fluid Fittings: 3/8" swage

Pump (see pump curves):

Part Number	Pump Type	Flow Rate[2]
10-12754-1	Rotary Vane	>12 lpm @ 30 psig
10-12754-2	Centrifugal	~11 lpm @ 20 psig
10-12754-3	Centrifugal	~6 lpm @ 20 psig

Tank: 1.5 liter stainless steel tank with level sensor

System Proof Pressure: 200 psig

Wetted Materials: Aluminum, stainless steel and polymers (Viton for PAO unit)

Dimensions (W x D x H): 19" x 27" x 10.5" (6U) (48 x 69 x 27 cm)

Weight: ~96 lbs (44 kg)

Power Input: 200-240 VAC, 1 phase, 50/60 Hz, 10 amps max

Power Cord: 20ft power cord with stripped ends supplied.

Communications: Keypad or RS232

Alarms: Temperature, fluid level, system or component failure (display, RS232 and Dry Contact)

Safety Certifications: TUV listed to UL, CAN/CSA and EN 61010-1, CE 61010-1

Notes:
1) Cooling Capacity may vary with configuration and fluid type
2) Flow rates will vary with fluid type

Figure 1: ThermoRack 1000 Cooling Curves at 20°C Ambient

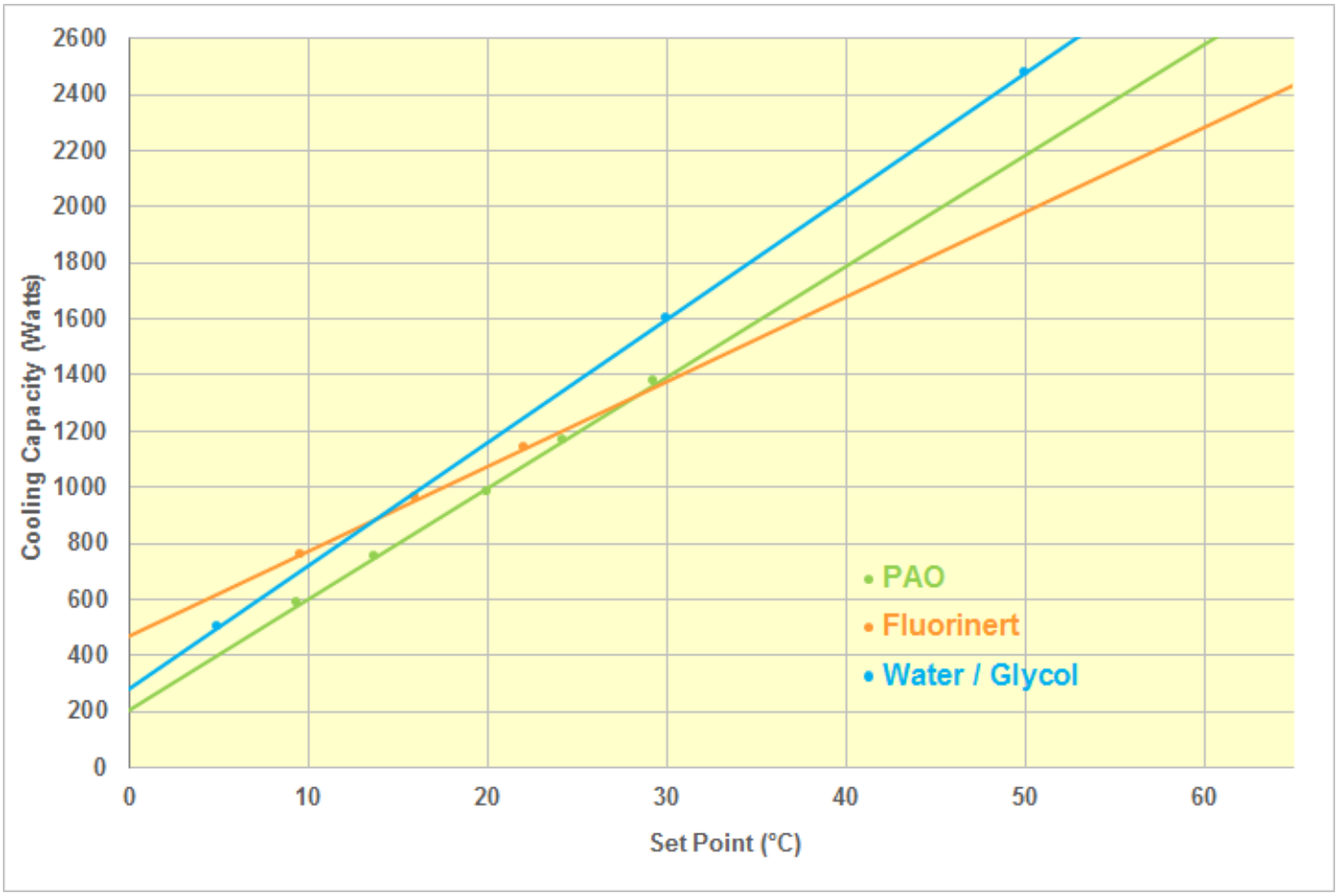
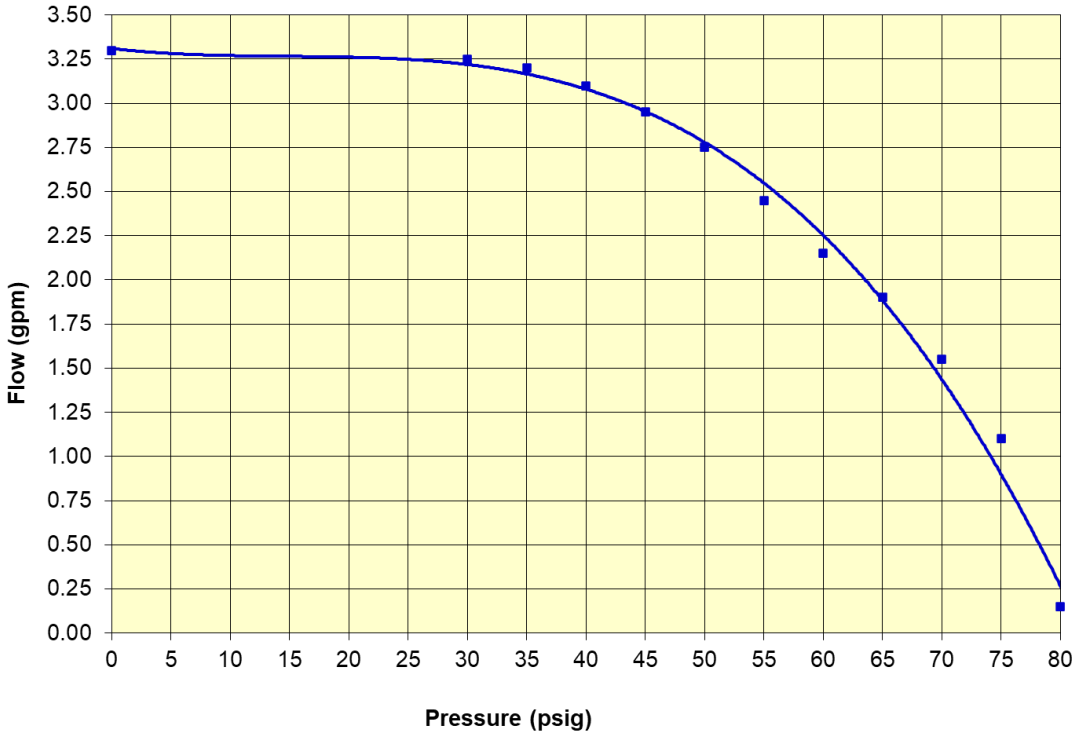
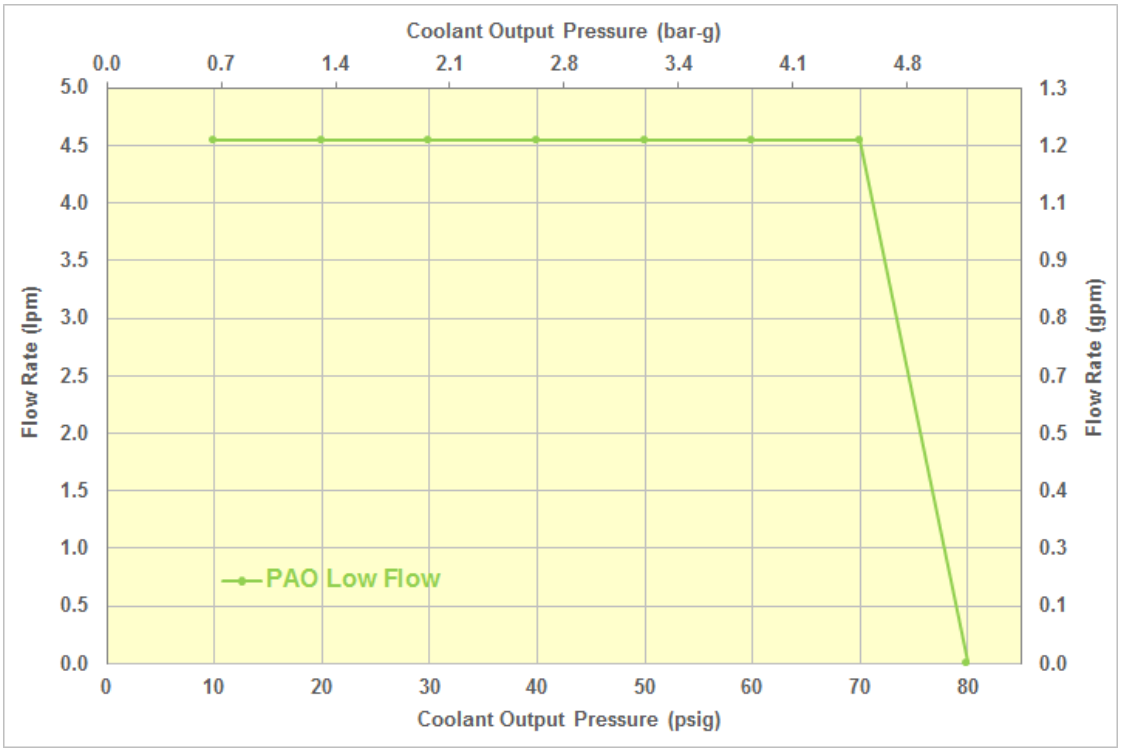


Figure 2A: Standard ThermoRack 1000 Pump Curves at 20°C (Not Density Corrected)



Note: The minimum recommended flow rate is 3.7 lpm (1 gpm)

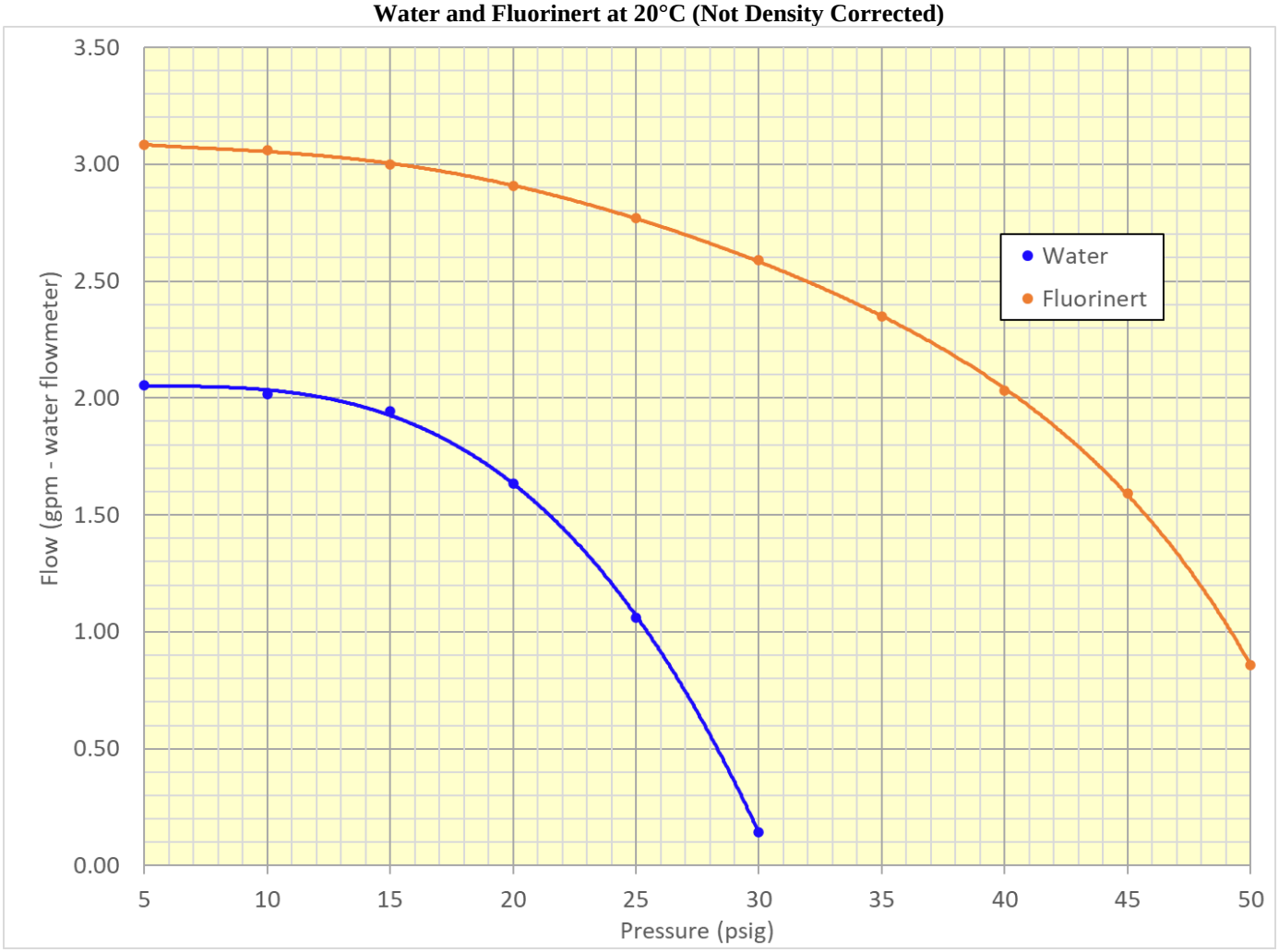
Figure 2B: ThermoRack 1000 PAO Low Flow Pump Curve (CES only)



Note: The minimum recommended flow rate is 3.7 lpm (1 gpm)

Figure 2C **Standard ThermoRack 1000 Centrifugal Pump Curves**

Water and Fluorinert at 20°C (Not Density Corrected)



SECTION 3
HOOK UP

3.1 INSTALLATION INTO A 19" ELECTRONICS RACK.

WARNING

Two Person Lift Only! The chiller weighs 87 lbs., serious injury may occur if one person attempts to install into a 19" rack

The ThermoRack 1000 will fit into any EIA standard 19" electronics rack. SSCS recommends using its optional 42" tall rack with integral drip pan and coolant filter. The instructions below are for installation with the external 5m filter into this rack.

1) Using two people, slide the ThermoRack 1000 into the 6U opening near the bottom of the 19" rack (see figure 2A).
2) Using 10-32 x ½" screws, fasten the ThermoRack 1000 to the 19" rack.
3) If located in a seismically active zone, the rear of the chiller must be strapped down to the 19" rack's rails.

FIGURE 3A FRONT VIEW OF THERMORACK 1000

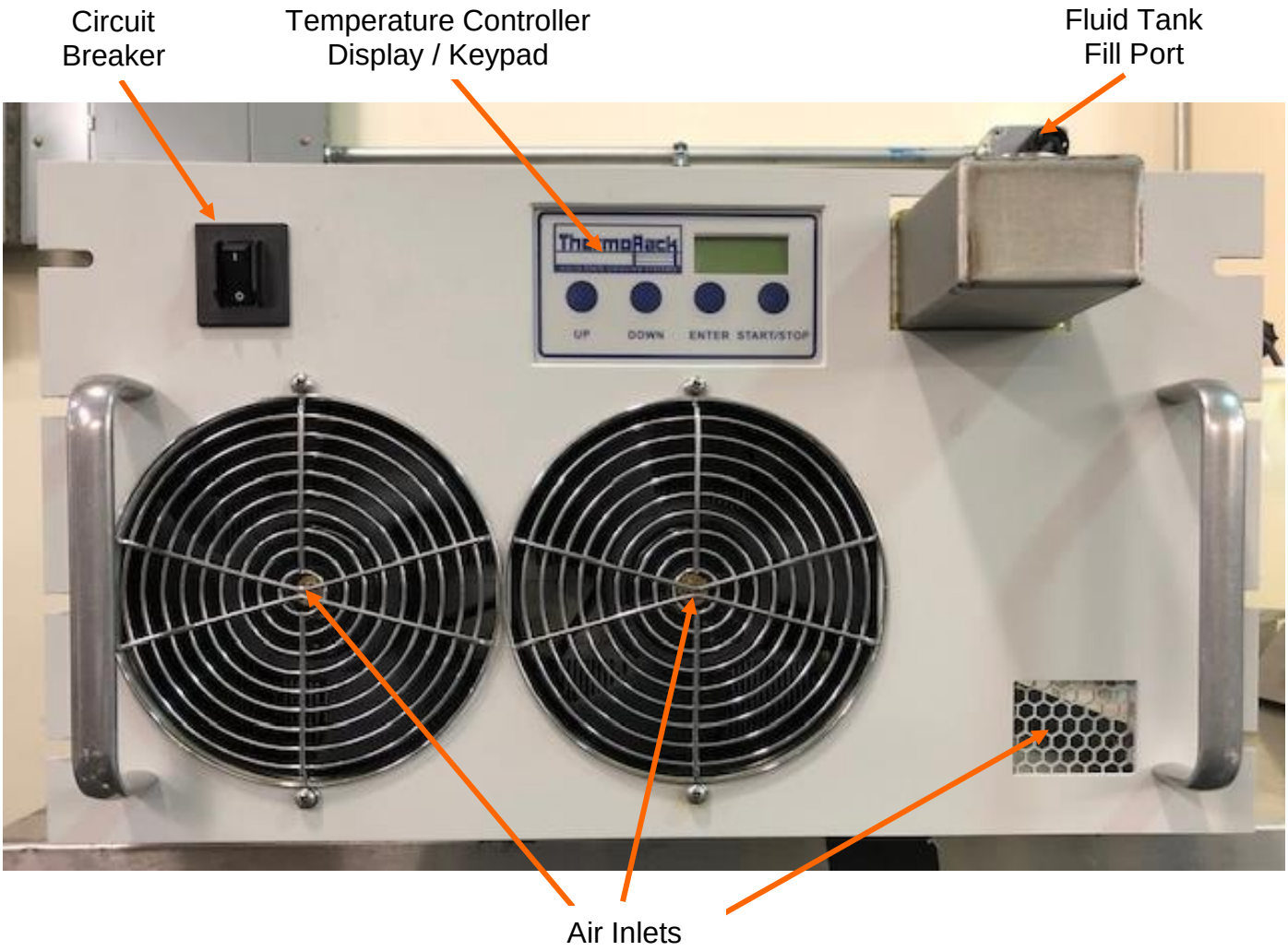
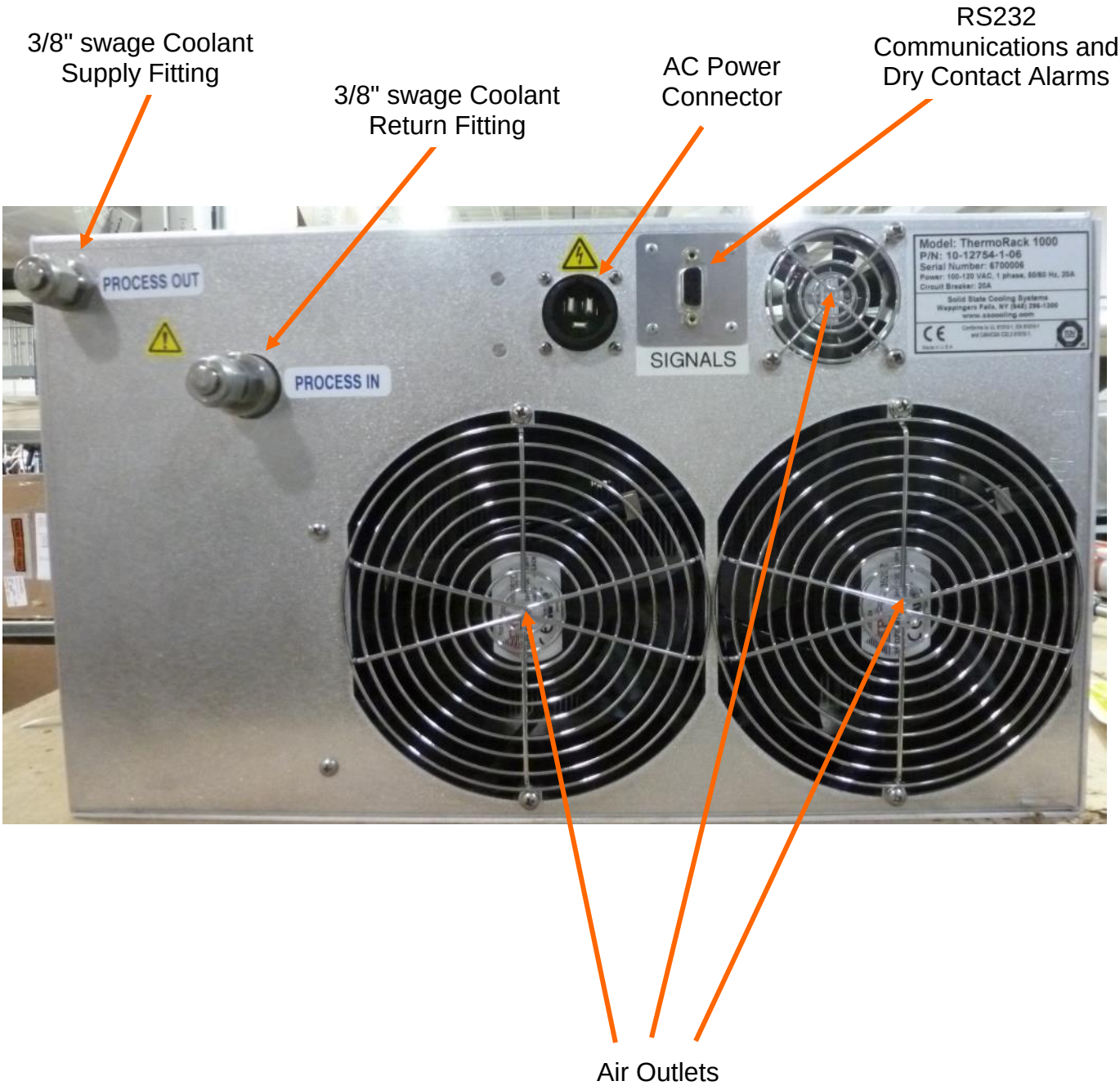


FIGURE 3B REAR VIEW OF THERMORACK



3.2 ELECTRICAL CONNECTIONS

All electrical connections are made on the rear panel (Figure 3B).

AC Power Connection: Connect 200-240 V~ power to the rear of the ThermoRack via the 20ft service cable provided. Connect bare end of service cable to the appropriate power plug or junction box as follows:

Black:	Line 1
White:	Line 2 (or neutral)
Green:	Earth ground

WARNING

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

The service cable connects to the ThermoRack 1000 via an Amp 3-pin CPC connector (shell size 7), Amp part number 206037-2 using pin part number 66740-2 (3x). Connector pin out: (for reference).

Pin 1: Line 1
Pin 2: Line 2 (or Neutral)
Pin 3: Earth Ground

Note: Safe operation of the ThermoRack 1000 requires earth-ground be connected to pin 3 of this plug.

Alarms: The ThermoRack 1000 has two normally closed 1 amp 250V dry contact alarms, one for system faults and one system warnings (temperature excursions outside of the alarm range and tank level low). These contacts are wired to the 9-pin dsub Signals connector as follows:

System Fault Alarm Common:	Pin 6
System Fault Alarm:	Pin 1
System Warning Common:	Pin 9
System Warning:	Pin 4

RS-232:
RS-232 communications are located on the 9-pin dsub connector of the rear panel, see section 7 for details.

3.3 PLUMBING CONNECTIONS

The PROCESS IN (coolant return) and PROCESS OUT (coolant supply) connections, located on the rear panel, are 3/8" swage fittings. Insert a 3/8” OD tube and tighten as per the instructions in section 9.

3.4 AIR CONSIDERATIONS

The air inlet and outlet are located on the front and rear of the unit. Restricting airflow into or out of the unit will impair performance. At least 1 foot of clearance is required in front and in back of the ThermoRack 1000.

3.5 COOLANT FILL

CAUTION

Use only fluids recommended for your specific configuration

The ThermoRack 1000 coolant fill cap is located at the front of the unit. Twist off the cap counter-clockwise to open, (use a 5/8" Allen wrench if removing the cap is difficult). Fill reservoir prior to starting unit. Leaving the cap open during start-up, continue filling the tank to the bottom of the threaded fill port as air is displaced from the system. Once all air is our of the system, run the unit at set point for 30 minutes with the tank vented, then tighten down the cap sealing the system.

.

IMPORTANT NOTE: Different ThermoRack models are configured for use with specific process fluids. Use only fluids which are recommended for your specific model:

Part Number	Fluid Type
10-12754-1	Poly-Alpha-Olefin (PAO)
10-12754-2	Fluorinert or Galden
10-12754-3	Water / Glycol

SECTION 4
START UP

4.1 START-UP STEPS

WARNING

Read the Coolant SDS Prior to filling the chiller

Start-up the ThermoRack 1000using the following steps:

1) Install the chiller into the 19" rack as per section 3.1.
2) Connect Alarm Signals/RS-232 as desired.
3) Remove the reservoir cap on top and fill the reservoir to just below the bottom of its neck with coolant.
4) Plug line cord into 230 VAC, 50/60 Hz.
5) Turn on the circuit breaker located on the front panel. The front display should read the current coolant temperature. Leaving the cap open, continue filling the tank to the bottom of the threaded fill port as air is displaced from the system. Once all air is our of the system, run the unit at set point for 30 minutes with the tank vented, then tighten down the cap sealing the system.

Important Notes:

1) If the tank level low alarm persists, or if another alarm is displayed, consult section 6.0 of this manual.
2) If the ThermoRack pump fails to start properly (no whining noise) check that all lines are fully connected with no blockages.

SECTION 5
OPERATION

The ThermoRack is operated via the control panel located on the front panel. The control panel has a 2x8-character LCD display and four input keys: UP, DOWN, ENTER, and START. 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.
START	Pressing the START key turns on temperature control.
START	Pressing the START key while the chiller is operating turns off temperature control.

5.1 SIMPLE OPERATION

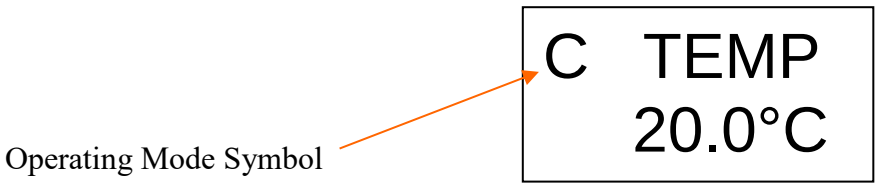
The ThermoRack 1000 comes with preset operating parameters that will work well for most applications. If temperature control at one temperature is desired, follow the steps below:

1) Turn on ThermoRack 1000 and wait for display to read TEMP.
2) Press the UP or DOWN keys to change SET TEMP 1 to the desired set point. Press ENTER.
3) Press the START key.
   The ThermoRack 1000 will now control to the set point temperature

5.2 ADVANCED OPERATION

The ThermoRack 1000 controller 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 1000 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 ThermoRack 1000 controller 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

Status Menu → Parameter Menu
Password 0000

Press the UP key to Increase SETTEMP

Press the DOWN to decrease SETTEMP

Press ENTER to accept SETTEMP

ALARM +/-
XX°C
↓
OFFSET
X.X°C
↓
TEMPUNIT
°C/°F
↓
BK LIGHT
ON/OFF
↓ *Return to top*

Press ENTER key once to scroll between menu items (↓).
Press and hold ENTER key for 3 seconds to enter the parameter 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.

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 ThermoRack temperature reading to match a customer's external temperature sensor. Enter the difference between the external sensor and the display. For example, if the customer has a temperature sensor reading 22 °C when the ThermoRack display shows 20°C, entering 22°C – 20°C = 2°C will cause the ThermoRack to shift its temperature calibration scale up 2°C to match the external sensor.

TEMPUNIT: Setting to select operation in 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 DRY CONTACT ALARMS

The ThermoRack chiller has two 250 VDC 1 amp dry contact alarm relays, one for temperature and one for system failure:

System Warning: Normally closed, open if the fluid temperature falls outside of the set point +/- the user programmable alarm range. (Default is +/- 5 °C) or if the tank level is low.

System Alarm: Normally closed if system is operating normally opens if a system alarm or failure has occurred

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

The Dry Contact alarms are located on the 9-pin dsub connector as follows:

System Fault Alarm Common:	Pin 6
System Fault Alarm:	Pin 1
System Warning Common:	Pin 9
System Warning:	Pin 4

SECTION 6
SYSTEM ALARMS/TROUBLESHOOTING

WARNING

Warning! Always disconnect the AC power cord before opening the ThermoRack cover, as electrical shock hazards exist inside.

The ThermoRack 1000 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.

1) Tank Level Low: Liquid reservoir level is too low. *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.*

2) RTD Fail: The temperature sensor has failed or its connector has come loose. C*ontact SSCS for technical support or for a RMA number to return the unit for RTD replacement.*

3) Fan Fail: Fan is supplying insufficient air to cool the thermoelectric. *Either the fan has failed or the airflow into or out of the system is blocked. Check that the side air inlet and outlet gratings are not blocked. The ThermoRack requires at least 1 foot of clearance around these gratings. If airflow is not blocked, contact SSCS for a replacement fan, or for a RMA number to return the unit for fan replacement.*

4) Pump Fail: The liquid heat exchanger plate temperature is either too hot or too cold, indicating pump failure or a blockage in the external plumbing lines. *Turn off the ThermoRack 1000 and disconnect the AC power cord. Verify that no kinks or blockages exist in the plumbing lines outside of the ThermoRack . If no blockages exist, check the external pump operation.*

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.

Other Observable Faults:

No Display: If the liquid crystal display does not illuminate upon turning on the ThermoRack 1000, either the 24VDC power supply has failed, or the LCD display has failed. *Contact SSCS for a replacement pump or power supply, or for a RMA number to return the unit for a power supply or display replacement.*

Poor Temperature Control: If no other alarms are present, poor temperature control indicates either the heat load is too great for the chiller, the TE cooling/heating engine is not receiving power, or thermoelectric modules have failed. C*ontact SSCS for technical support.*

SECTION 7
THERMORACK 1000 RS-232

The ThermoRack 1000 comes with RS-232 communications that can receive a remote set point, return the current temperature, and signal an alarm has occurred. 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)

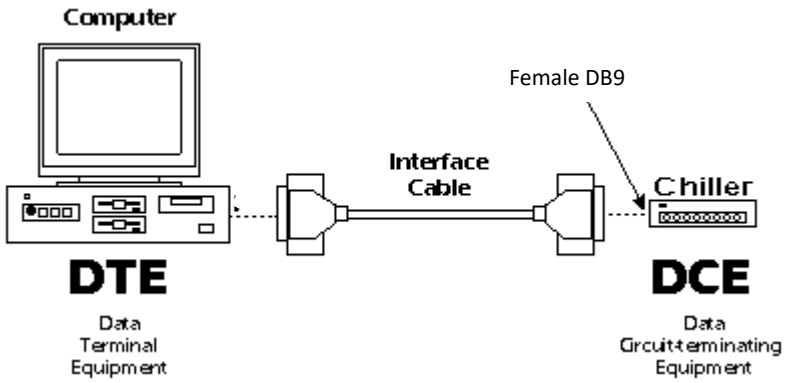


Table 1A: Signal definition and wiring for Host wired as DTE

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:	9,600 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 1000 is always the SLAVE (DTE)
Interrupts Reported:	None, must be polled for status
Transmission Length:	$\leq$ 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

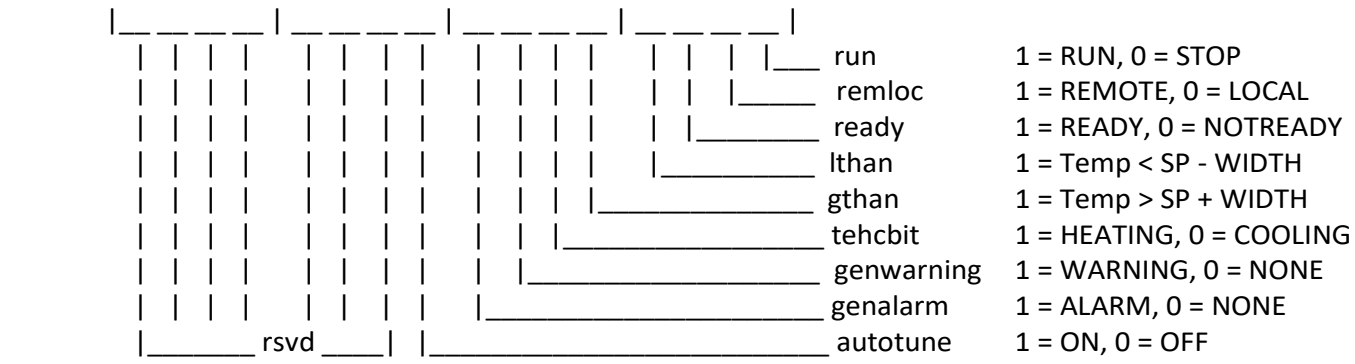
- Cr defined at "carriage return" or $0D_{hex}$
- ETX defined as "end-of-text" or 03_{hex}

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

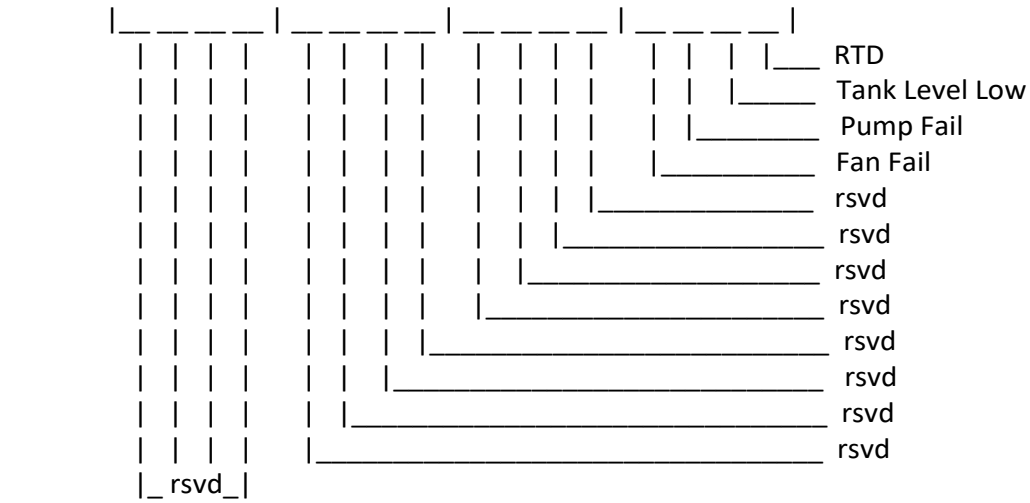
Example: Running, remote mode, ready, coolant temp 22.9°C, set-point 23.0°C, pump temp 17.0°C, 76.3% cooling, Fan Speed 69.2%, tank level low = 119, status: running in remote mode within alarm range, faults: none

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 ($0x0D_{hex}$)
2. All commands are case insensitive

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, Monday - Friday
Telephone: (845) 296-1300
Fax: (845) 296-1303
E-mail: info1@sscooling.com

SECTION 9
USING SWAGELOK FITTINGS

INSTALLATION INSTRUCTIONS

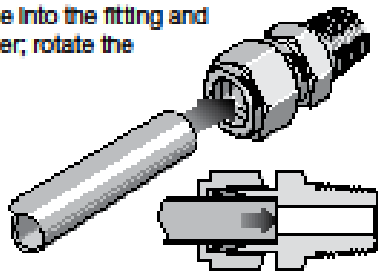
Swagelok Tube Fittings

Up to 1 in./25 mm

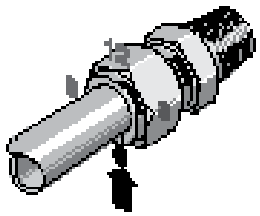
These instructions apply both to traditional fittings and to fittings with the advanced back-ferrule geometry.

Fully insert the tube into the fitting and against the shoulder; rotate the nut finger-tight.

High-pressure applications and high safety-factor systems: *Further tighten the nut until the tube will not turn by hand or move axially in the fitting.*

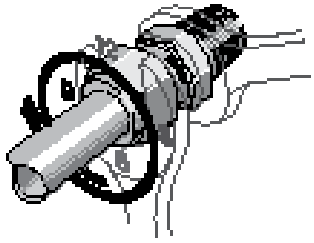


Mark the nut at the 6 o'clock position.



While holding the fitting body steady, tighten the nut one and one-quarter turns to the 9 o'clock position.

For 1/16, 1/8, and 3/16 in.; 2, 3, and 4 mm tube fittings, tighten the nut three-quarters turn to the 3 o'clock position.



SECTION 10

10.1 SDS FOR COOLANTS

Safety Data Sheet

ROYCO(R) 602

SECTION 1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Common Name : ROYCO(R) 602

Supplier : Anderol Inc.
215 Merry Lane
East Hanover, NJ 07936
Tel: (973) 887-7410
Fax: (973) 887-8422

Synonym : Not available.

Trade Name : ROYCO(R) 602

Material Uses : Lubricant.

Manufacturer : Anderol Inc.
215 Merry Lane
East Hanover, NJ 07936
Tel: (973) 887-7410
Fax: (973) 887-8422

SDS# : 740078-04

Validation Date : 8/26/2003

Print Date : 9/1/2003.

In Case of Emergency
CHEMTREC: 800-424-9300
(United States).

SECTION 2. COMPOSITION, INFORMATION ON INGREDIENTS

Name	CAS #	% by Weight	UN Number
1-Decene, Dimer, Hydrogenated	68649-11-6	70-100	Not applicable.

This material is classified hazardous under OSHA regulations in the United States, the WHMIS Controlled Product Regulation in Canada, the NOM-018-STPS-2000 in Mexico and Brazil NBR 14725:2001.
See Section 8 for Exposure Limits.
See Section 11 for Toxicological Data.

SECTION 3. HAZARDS IDENTIFICATION

Physical State and Appearance : Liquid. (Clear sparkling liquid)

Emergency Overview : CAUTION!
MAY BE HARMFUL IF INHALED.
Avoid breathing vapor or mist. Keep container closed. Use only with adequate ventilation.

Routes of Entry : Inhalation. Ingestion.

Potential Acute Health Effects

Eyes : Non-irritating to the eyes.

Skin : Non-irritant for skin. Non-sensitizer for skin.

Inhalation : Hazardous in case of inhalation.

Ingestion : Not available.

Potential Chronic Health Effects : Carcinogenic Effects: Not applicable.
Mutagenic Effects: Not available.
Teratogenic Effects: Not available.

Medical Conditions Aggravated by Overexposure	:	Repeated or prolonged exposure is not known to aggravate medical condition.
Overexposure /Signs/Symptoms	:	Not available.

See Toxicological Information (Section 11)

SECTION 4. FIRST AID MEASURES

Eye Contact :	Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 20 minutes. Cold water may be used. Get medical attention if irritation occurs.
Skin Contact :	In case of contact, immediately flush skin with plenty of water. Get medical attention.
Inhalation:	If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.
Ingestion :	Do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Have conscious person drink several glasses of water or milk.
Notes to Physician :	Not available.

SECTION 5. FIRE FIGHTING MEASURES

Flammability of the Product	:	May be combustible at high temperature.
Auto ignition Temperature	:	Not available.
Flash Points	:	OPEN CUP: 176.67°C (350°F) (Cleveland.).
Flammable Limits	:	Not available.
Products of Combustion	:	These products are carbon oxides (CO, CO2). Thermal decomposition products are dependent on temperature conditions.
Fire Hazards in Presence of Various Substances	:	Not available
Explosion Hazards in Present of various Substances	:	Risks of explosion of the product in presence of mechanical of impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.
Fire Fighting Media and Instructions	:	SMALL FIRE: Use dry chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.
Protective Clothing (Fire)	:	Fire fighters should wear positive pressure self-contained breathing apparatus (SCBA) and full turnout gear. Be sure to use a MSHA/NIOSH approved respirator or equivalent.
Special Remarks on Fire	:	Container explosion may occur under fire conditions or when Hazards heated. Cool closed containers exposed to fire with water.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Small Spill and Leak	:	Absorb with an inert material and put the spilled material in an appropriate waste disposal.
Large Spill and Leak	:	Absorb with an inert material and put the spilled material in an appropriate waste disposal. Do not allow any potentially contaminated water including rain water, runoff from fire fighting or spills to enter any

waterway, sewer or drain. Note: See section 8 for personal protective equipment and section 13 for waste disposal.

SECTION 7. HANDLING AND STORAGE

Handling : Avoid breathing vapors or spray mists. After handling always wash hands thoroughly with soap and water. Avoid contact with eyes skin and clothing. Use with adequate ventilation.

Storage : Keep container tightly closed. Store in a dry cool and well-ventilated area.

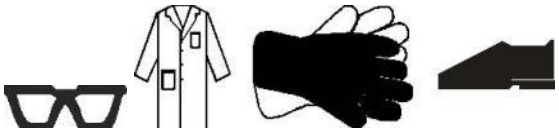
SECTION 8. EXPOSURE CONTROLS, PERSONAL PROTECTION

Engineering Controls: Good general ventilation should be sufficient to control airborne levels. Ensure that eyewash stations and safety showers are proximal to the work-station on location.

Personal Protection

Eyes : Safety glasses.
Body : Lab coat.
Respiratory : A respirator is not needed under normal and intended conditions of product use.
Hands : Chemical resistant gloves.
Feet : Shoes.

Protective Clothing : (Pictograms)



Personal Protection in Case of a Large Spill: Splash goggles. Full suit. Vapor respirator. Boots. Chemical resistant gloves. A self-contained breathing apparatus should be used to avoid inhalation of the product.

ROYCO(R) 602

Exposure Limits

1-Decene, Dimer, Hydrogenated	Not available.

Consult local authorities for acceptable exposure limits.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State and appearance	:	Liquid. (Clear sparkling liquid)
Color	:	Not available.
Odor	:	Odorless.
Molecular Weight	:	Not applicable
Molecular Formula	:	Not applicable.
pH (1% Soln/Water)	:	Not available.
Boiling/Condensation Point	:	Not available.
Pourpoint	:	-73.33°C (-100°F)
Specific Gravity	:	0.799 (Water = 1)
Vapor Pressure	:	Not available.
Vapor Density	:	Not available
Volatility	:	Not available.
Odor Threshold	:	Not available.
Evaporation Rate	:	Not available.
VOC	:	Not available
Viscosity	:	Not available.

LogK ow	:	Not available.
Solubility	:	Very slightly soluble in cold water, hot water.

SECTION 10. STABILITY AND REACTIVITY

Stability and Reactivity	:	The product is stable.
Conditions of Instability	:	Not available.
Incompatibility with Various Substances	:	Reactive with oxidizing agents.
Hazardous Decomposition Products	:	Not available.
Hazardous Polymerization	:	Will not occur.

SECTION 11. TOXICOLOGICAL INFORMATION

Toxicity Data

Ingredient Name	Test	Result	Route	Species
1-Decene, Dimer, Hydrogenated	LC50	1.17 mg/l (4 hours)	Inhalation	Rat

Chronic Effects on Humans	:	Not available.
Other Toxic Effects on Humans	:	Hazardous in case of inhalation. Non-irritant for skin. Non-sensitizer for skin. Non-irritating to the eyes.
Special Remarks on Toxicity to Animals	:	Not available.
Special Remarks on Other Toxic Effects on Humans	:	Not available.

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicity Data

Ingredient Name	Species	Period	Result
1-Decene, Dimer, Hydrogenated	Not available.	Not available.	Not available.

BOD and COD	:	Not available.
Biodegradable/OECD	:	Not available.
Mobility	:	Not available.

ROYCO(R) 602

Products of Degradation	:	Not available.
Toxicity of the Products of Biodegradation	:	Not available.
Special Remarks on the Products of Biodegradation	:	Not available.

SECTION 13. DISPOSAL CONSIDERATIONS

Waste Information Waste must be disposed of in accordance with federal, state and local environmental control regulations. Incinerate waste materials.
Consult your local or regional authorities.

SECTION 14. TRANSPORT INFORMATION

Regulatory Information	UN Number	Proper Shipping Name	Class	Packing Group	Label	Additional Information
United States (DOT)	Not regulated.	-	-	-		-
Canada (TDG)	Not regulated.	-	-	-		-
Mexico (NOM-004-SCT2-1994)	Not regulated.	-	-	-		-
Brazil	Not regulated.	-	-	-		-
IMDG Code	Not regulated.	-	-	-		-
IATA-DGR Class	Not regulated.	-	-	-		-

NAERG : Not applicable.

SECTION 15. REGULATORY INFORMATION

HCS Classification : Class: Toxic.

U.S. Federal Regulations : TSCA 8(b) inventory: All components listed.

SARA 302/304/311/312 extremely hazardous substances: No ingredient was found.
SARA 302/304 emergency planning and notification: No ingredient was found.
SARA 302/304/311/312 hazardous chemicals: No ingredient was found.
SARA 311/312 MSDS distribution - chemical inventory - hazard identification: 1-Decene, Dimer, Hydrogenated: Immediate (Acute) Health Hazard

SARA 313 toxic chemical notification and release reporting: No ingredient was found.
Clean Water Act (CWA) 307: No ingredient was found.
Clean Water Act (CWA) 311: No ingredient was found.
Clean Air Act (CAA) 112 accidental release prevention: No ingredient was found.
Clean Air Act (CAA) 112 regulated flammable substances: No ingredient was found.
Clean Air Act (CAA) 112 regulated toxic substances: No ingredient was found.

State Regulations :

California Prop. 65: No ingredient was found.

WHMIS (Canada) : Class D-1B: Material causing immediate and serious toxic effects (TOXIC). CEPA DSL: All components listed.
This product has been classified in accordance with the hazard criteria of the Canadian CPR, the United States OSHA, the Mexican NOM -018-STPS-2000 and the Brazilian NBR 14725:2001. This MSDS contains all the information required by the CPR, OSHA,

the American National Standard Institute (ANSI) Z400.1, NOM -018-STPS-2000 and NBR 14725:2001.

Hazardous Ingredients Classification of the Degree of Risk (Mexico)	:	Ingredient Name 1-Decene, Dimer, Hydrogenated Health 2 · Flammability 1 · Reactivity 0 · Other
International Lists	:	All components are listed on major international inventories or exempted from being listed in Australia (AICS), Europe (EINECS/ELINCS), Korea (TCCL), Japan (METI/MOL), Philippines (RA6969).

SECTION 16. OTHER INFORMATION

Label Requirements		MAY BE HARMFUL IF INHALED
Hazardous Material Information System (U.S.A.)	:	Health 2 · National Fire Protection Association (U.S.A.) · Fire Hazard 1 · Reactivity 0 · Personal Protection B
References	:	-Manufacturer's Material Safety Data Sheet. -Material Safety Data Sheet issued by: la Commission de la Santé et de la Sécurité du Travail du Québec. -Canada Gazette Part II, Vol. 122, No. 2 Registration SOR/88-64 31 December, 1987 Hazardous Products Act "Ingredient Disclosure List".- Provisional Domestic Substances List, Canadian Environmental Protection Act, Volume 1-Registry Number Index, April 1990; Environment Canada. - Official Mexican Standards NOM-018-STPS-2000 and NOM-004-SCT2-1994. -"Regulations respecting the handling, offering for transport and transporting of dangerous goods." Extract from the Canada Gazette Part II, dated February 6, 1985. Registration SOR/85-77 18 January, 1985. - 29CFR Part1910.1200 OSHA MSDS Requirements. - 49CFR Table List of Hazardous Materials, UN#, Proper Shipping Names, PG.
Other Special Considerations	:	Not available.
Responsible Name	:	Mr. Max Naggar
Date of Printing	:	9/1/2003.
Date of Issue		8/26/2003.
Date of Previous Issue	:	2003-01-31
Version	:	1.1

Notice to Reader: To the best of our knowledge, the information contained herein is accurate. However, neither the above named supplier nor any of its subsidiaries assumes any liability whatsoever for the accuracy or completeness of the information contained herein. Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

10.2 3M™ FLUORINERT™ FC-3283 ELECTRONIC LIQUID SDS

SAFETY DATA SHEET

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Document Group:	06-4521-8	**Version Number:**	31.06
Issue Date:	01/18/18	**Supercedes Date:**	06/26/17

SECTION 1: Identification

1.1. Product identifier
3M™ Fluorinert™ FC-3283 Electronic Liquid

Product Identification Numbers

ID Number	UPC	ID Number	UPC
98-0212-2908-7	00-51135-70349-6	98-0212-4878-0	000 51138 99254 5
98-0212-4879-8	000 51138 99255 2	98-0212-4880-6	000 51138 99256 9
HB-0042-0654-4		ZF-0002-1344-5	
ZF-0002-1345-2		ZF-0002-1356-9	

1.2. Recommended use and restrictions on use

Recommended use
For Industrial Use Only. Not Intended for Use as a Medical Device or Drug., Testing Fluid or Heat Transfer Fluid for Electronics
Restrictions on use
Fluorinert™ Electronic Liquids are used in a wide variety of applications, including but not limited to precision cleaning of medical devices and as lubricant deposition solvents for medical devices. When the product is used for applications where the finished device is implanted into the human body, no residual Fluorinert solvent may remain on the parts. It is highly recommended that the supporting test results and protocol be cited during FDA registration.

3M Electronics Markets Materials Division (EMMD) will not knowingly sample, support, or sell its products for incorporation in medical and pharmaceutical products and applications in which the 3M product will be temporarily or permanently implanted into humans or animals. The customer is responsible for evaluating and determining that a 3M
EMMD product is suitable and appropriate for its particular use and intended application. The conditions of evaluation, selection, and use of a 3M product can vary widely and affect the use and intended application of a 3M product. Because many of these conditions are uniquely within the user's knowledge and control, it is essential that the user evaluate and determine whether the 3M product is suitable and appropriate for a particular use and intended application, and complies with all local applicable laws, regulations, standards, and guidance.

1.3. Supplier's details

MANUFACTURER:	3M
DIVISION:	Electronics Materials Solutions Division
ADDRESS:	3M Center, St. Paul, MN 55144-1000, USA
Telephone:	1-888-3M HELPS (1-888-364-3577)

1.4. Emergency telephone number: 1-800-364-3577 or (651) 737-6501 (24 hours)

SECTION 2: Hazard identification

2.1. Hazard classification
Not classified as hazardous according to OSHA Hazard Communication Standard, 29 CFR 1910.1200.

2.2. Label elements
Signal word
Not applicable.

Symbols
Not applicable.

Pictograms
Not applicable.

SECTION 3: Composition/information on ingredients

Ingredient	C.A.S. No.	% by Wt
PERFLUORO COMPOUNDS, C5-18	86508-42-1	100 (typically 100)

SECTION 4: First aid measures

4.1. Description of first aid measures

Inhalation:
No need for first aid is anticipated.

Skin Contact:
Wash with soap and water. If signs/symptoms develop, get medical attention.

Eye Contact:
Flush with large amounts of water. Remove contact lenses if easy to do. Continue rinsing. If signs/symptoms persist, get medical attention.

If Swallowed:
Rinse mouth. If you feel unwell, get medical attention.

4.2. Most important symptoms and effects, both acute and delayed
See Section 11.1. Information on toxicological effects.

4.3. Indication of any immediate medical attention and special treatment required
Not applicable

SECTION 5: Fire-fighting measures

5.1. Suitable extinguishing media
Material will not burn. Use a fire fighting agent suitable for the surrounding fire.

5.2. Special hazards arising from the substance or mixture
Exposure to extreme heat can give rise to thermal decomposition.

Hazardous Decomposition or By-Products

Substance	Condition
Carbon monoxide	During Combustion
Carbon dioxide	During Combustion

5.3. Special protective actions for fire-fighters

When fire fighting conditions are severe and total thermal decomposition of the product is possible, wear full protective clothing, including helmet, self-contained, positive pressure or pressure demand breathing apparatus, bunker coat and pants, bands around arms, waist and legs, face mask, and protective covering for exposed areas of the head.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

Evacuate area. Ventilate the area with fresh air. For large spill, or spills in confined spaces, provide mechanical ventilation to disperse or exhaust vapors, in accordance with good industrial hygiene practice. Refer to other sections of this SDS for information regarding physical and health hazards, respiratory protection, ventilation, and personal protective equipment.

6.2. Environmental precautions

Avoid release to the environment. For larger spills, cover drains and build dikes to prevent entry into sewer systems or bodies of water.

6.3. Methods and material for containment and cleaning up

Contain spill. Working from around the edges of the spill inward, cover with bentonite, vermiculite, or commercially available inorganic absorbent material. Mix in sufficient absorbent until it appears dry. Remember, adding an absorbent material does not remove a physical, health, or environmental hazard. Collect as much of the spilled material as possible. Place in a closed container approved for transportation by appropriate authorities. Clean up residue with an appropriate solvent selected by a qualified and authorized person. Ventilate the area with fresh air. Read and follow safety precautions on the solvent label and SDS. Seal the container. Dispose of collected material as soon as possible in accordance with applicable local/regional/national/international regulations.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Do not breathe thermal decomposition products. Avoid skin contact with hot material. For industrial or professional use only. Store work clothes separately from other clothing, food and tobacco products. Do not eat, drink or smoke when using this product. Wash thoroughly after handling. Avoid release to the environment. No smoking: Smoking while using this product can result in contamination of the tobacco and/or smoke and lead to the formation of hazardous decomposition products.

7.2. Conditions for safe storage including any incompatibilities

Store away from heat.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Occupational exposure limits

No occupational exposure limit values exist for any of the components listed in Section 3 of this SDS.

8.2. Exposure controls

8.2.1. Engineering controls
Provide appropriate local exhaust when product is heated.

8.2.2. Personal protective equipment (PPE)

Eye/face protection
None required.

Skin/hand protection

Select and use gloves and/or protective clothing approved to relevant local standards to prevent skin contact based on the results of an exposure assessment. Selection should be based on use factors such as exposure levels, concentration of the substance or mixture, frequency and duration, physical challenges such as temperature extremes, and other use conditions. Consult with your glove and/or protective clothing manufacturer for selection of appropriate compatible gloves/protective clothing. Note: Nitrile gloves may be worn over polymer laminate gloves to improve dexterity. Gloves made from the following material(s) are recommended: Polymer laminate

Respiratory protection

During heating:

Use a positive pressure supplied-air respirator if there is a potential for over exposure from an uncontrolled release, exposure levels are not known, or under any other circumstances where air-purifying respirators may not provide adequate protection.

Thermal hazards
Wear heat insulating gloves when handling hot material to prevent thermal burns.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

General Physical Form:	Liquid
Specific Physical Form:	Liquid
Odor, Color, Grade:	Colorless, odorless liquid.
Odor threshold	*No Data Available*
pH	*Not Applicable*
Melting point	*Not Applicable*
Boiling Point	123 - 133 ºC
Flash Point	No flash point
Evaporation rate	< 1 [*Ref Std:*BUOAC=1]
Flammability (solid, gas)	Not Applicable
Flammable Limits(LEL)	None detected
Flammable Limits(UEL)	None detected
Vapor Pressure	14 mmHg [@ 23 ºC]
Vapor Density	18 [@ 23 ºC] [*Ref Std:*AIR=1]
Density	1.8 g/ml
Specific Gravity	1.8 [*Ref Std:*WATER=1]
Solubility in Water	Nil
Solubility- non-water	*No Data Available*
Partition coefficient: n-octanol/ water	*No Data Available*
Autoignition temperature	*No Data Available*
Decomposition temperature	*Not Applicable*
Viscosity	0.7 centistoke [@ 25 ºC]
Molecular weight	*No Data Available*
Volatile Organic Compounds	[*Details:*Exempt]
Percent volatile	100 %
VOC Less H2O & Exempt Solvents	[*Details:*Exempt]

SECTION 10: Stability and reactivity

10.1. Reactivity
This material may be reactive with certain agents under certain conditions - see the remaining headings in this section.

10.2. Chemical stability
Stable.

10.3. Possibility of hazardous reactions
Hazardous polymerization will not occur.

10.4. Conditions to avoid
Heat

10.5. Incompatible materials
Finely divided active metals
Alkali and alkaline earth metals

10.6. Hazardous decomposition products

Substance	Condition
Hydrogen Fluoride	At Elevated Temperatures - greater than 200 ºC
Perfluoroisobutylene (PFIB)	At Elevated Temperatures - greater than 200 ºC

Refer to section 5.2 for hazardous decomposition products during combustion.

If the product is exposed to extreme condition of heat from misuse or equipment failure, toxic decomposition products that include hydrogen fluoride and perfluoroisobutylene can occur.

SECTION 11: Toxicological information

The information below may not be consistent with the material classification in Section 2 if specific ingredient classifications are mandated by a competent authority. In addition, toxicological data on ingredients may not be reflected in the material classification and/or the signs and symptoms of exposure, because an ingredient may be present below the threshold for labeling, an ingredient may not be available for exposure, or the data may not be relevant to the material as a whole.

11.1. Information on Toxicological effects

Signs and Symptoms of Exposure

Based on test data and/or information on the components, this material may produce the following health effects:

Inhalation:
No known health effects.

Skin Contact:
Contact with the skin during product use is not expected to result in significant irritation.

Eye Contact:
Contact with the eyes during product use is not expected to result in significant irritation.
Ingestion:

Ingestion:

May be harmful if swallowed.

Additional Information:
A Material Toxicity Summary Sheet (MTSS) has been developed for this product. Please contact the address listed on the first page of this SDS to obtain a copy of the MTSS for this product.

Toxicological Data
If a component is disclosed in section 3 but does not appear in a table below, either no data are available for that endpoint or the data are not sufficient for classification.

Acute Toxicity

Name	Route	Species	Value
PERFLUORO COMPOUNDS, C5-18	Dermal		LD50 estimated to be > 5,000 mg/kg
PERFLUORO COMPOUNDS, C5-18	Inhalation-Vapor (4 hours)	Rat	LC50 > 41 mg/l
PERFLUORO COMPOUNDS, C5-18	Ingestion	Rat	

ATE = acute toxicity estimate

Skin Corrosion/Irritation

Name	Species	Value
PERFLUORO COMPOUNDS, C5-18	Rabbit	No significant irritation

Serious Eye Damage/Irritation

Name	Species	Value
PERFLUORO COMPOUNDS, C5-18	Rabbit	No significant irritation

Skin Sensitization
For the component/components, either no data are currently available or the data are not sufficient for classification.

Respiratory Sensitization
For the component/components, either no data are currently available or the data are not sufficient for classification.

Germ Cell Mutagenicity

Name	Species	Value
PERFLUORO COMPOUNDS, C5-18	In Vitro	Not mutagenic

Carcinogenicity
For the component/components, either no data are currently available or the data are not sufficient for classification.

Reproductive Toxicity

Reproductive and/or Developmental Effects
For the component/components, either no data are currently available or the data are not sufficient for classification.

Target Organ(s)

Specific Target Organ Toxicity - single exposure
For the component/components, either no data are currently available or the data are not sufficient for classification.

Specific Target Organ Toxicity - repeated exposure

Name	Route	Target Organ(s)	Value	Species	Test Result	Exposure Duration
PERFLUORO	Inhalation	heart | endocrine	Not classified	Rat	NOAEL	13 weeks
COMPOUNDS, C5-18		system | bone, teeth, nails, and/or hair | hematopoietic system | liver | immune system | nervous system | eyes | kidney and/or bladder | respiratory system			49,821 ppm	
PERFLUORO COMPOUNDS, C5-18	Ingestion	heart | endocrine system | hematopoietic system | liver | nervous system | kidney and/or bladder | respiratory system	Not classified		NOAEL 2,000 mg/kg/day	28 days

Aspiration Hazard
For the component/components, either no data are currently available or the data are not sufficient for classification.

Please contact the address or phone number listed on the first page of the SDS for additional toxicological information on this material and/or its components.

SECTION 12: Ecological information

Ecotoxicological information
Please contact the address or phone number listed on the first page of the SDS for additional ecotoxicological information on this material and/or its components.

Chemical fate information
Please contact the address or phone number listed on the first page of the SDS for additional chemical fate information on this material and/or its components.

SECTION 13: Disposal considerations

13.1. Disposal methods
Dispose of contents/ container in accordance with the local/regional/national/international regulations.

Dispose of waste product in a permitted industrial waste facility. Combustion products will include HF. Facility must be capable of handling halogenated materials. Empty drums/barrels/containers used for transporting and handling hazardous chemicals (chemical substances/mixtures/preparations classified as Hazardous as per applicable regulations) shall be considered, stored, treated & disposed of as hazardous wastes unless otherwise defined by applicable waste regulations. Consult with the respective regulating authorities to determine the available treatment and disposal facilities.

EPA Hazardous Waste Number (RCRA): Not regulated

SECTION 14: Transport Information

Not regulated per U.S. DOT, IATA or IMO.

These transportation classifications are provided as a customer service. As the shipper YOU remain responsible for complying with all applicable laws and regulations, including proper transportation classification and packaging. 3M transportation classifications are based on product formulation, packaging, 3M policies and 3M understanding of applicable current regulations. 3M does not guarantee the accuracy of this classification information. This information applies only to transportation classification and not the packaging, labeling, or marking requirements. The original 3M package is certified for U.S. ground shipment only. If you are shipping by air or ocean, the package may not meet applicable regulatory requirements.

SECTION 15: Regulatory Information

15.1. US Federal Regulations
Contact 3M for more information.

Physical Hazards
Not applicable

Health Hazards
Not applicable

15.2. State Regulations
Contact 3M for more information.

15.3. Chemical Inventories
The components of this material are in compliance with the provisions of Australia National Industrial Chemical Notification and Assessment Scheme (NICNAS). Certain restrictions may apply. Contact the selling division for additional information.

The components of this product are in compliance with the new substance notification requirements of CEPA.

The components of this material are in compliance with the China "Measures on Environmental Management of New Chemical Substance". Certain restrictions may apply. Contact the selling division for additional information.

The components of this material are in compliance with the provisions of the Korean Toxic Chemical Control Law. Certain restrictions may apply. Contact the selling division for additional information.

The components of this material are in compliance with the provisions of Japan Chemical Substance Control Law. Certain restrictions may apply. Contact the selling division for additional information.

The components of this material are in compliance with the provisions of Philippines RA 6969 requirements. Certain restrictions may apply. Contact the selling division for additional information.

The components of this product are in compliance with the chemical notification requirements of TSCA.

Contact 3M for more information.

15.4. International Regulations
Contact 3M for more information.

This SDS has been prepared to meet the U.S. OSHA Hazard Communication Standard, 29 CFR 1910.1200.

SECTION 16: Other Information

NFPA Hazard Classification
Health: 3 **Flammability:** 0 **Instability:** 0 **Special Hazards:** None

National Fire Protection Association (NFPA) hazard ratings are designed for use by emergency response personnel to address the hazards that are presented by short-term, acute exposure to a material under conditions of fire, spill, or similar emergencies. Hazard ratings are primarily based on the inherent physical and toxic properties of the material but also include the toxic properties of combustion or decomposition products that are known to be generated in significant quantities.

HMIS Hazard Classification
Health: 0 **Flammability:** 0 **Physical Hazard:** 0 **Personal Protection:** X - See PPE section.

Hazardous Material Identification System (HMIS® IV) hazard ratings are designed to inform employees of chemical hazards in the workplace. These ratings are based on the inherent properties of the material under expected conditions of normal use and are not intended for use in emergency situations. HMIS® IV ratings are to be used with a fully implemented HMIS® IV program. HMIS® is a registered mark of the American Coatings Association (ACA).

Document Group:	06-4521-8	**Version Number:**	31.06
Issue Date:	01/18/18	**Supercedes Date:**	06/26/17

Reason for Reissue
Conversion to GHS format SDS.

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End of SDS

10.3 SDS FOR 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

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WARRANTY POLICY

The ThermoRack 1000 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.