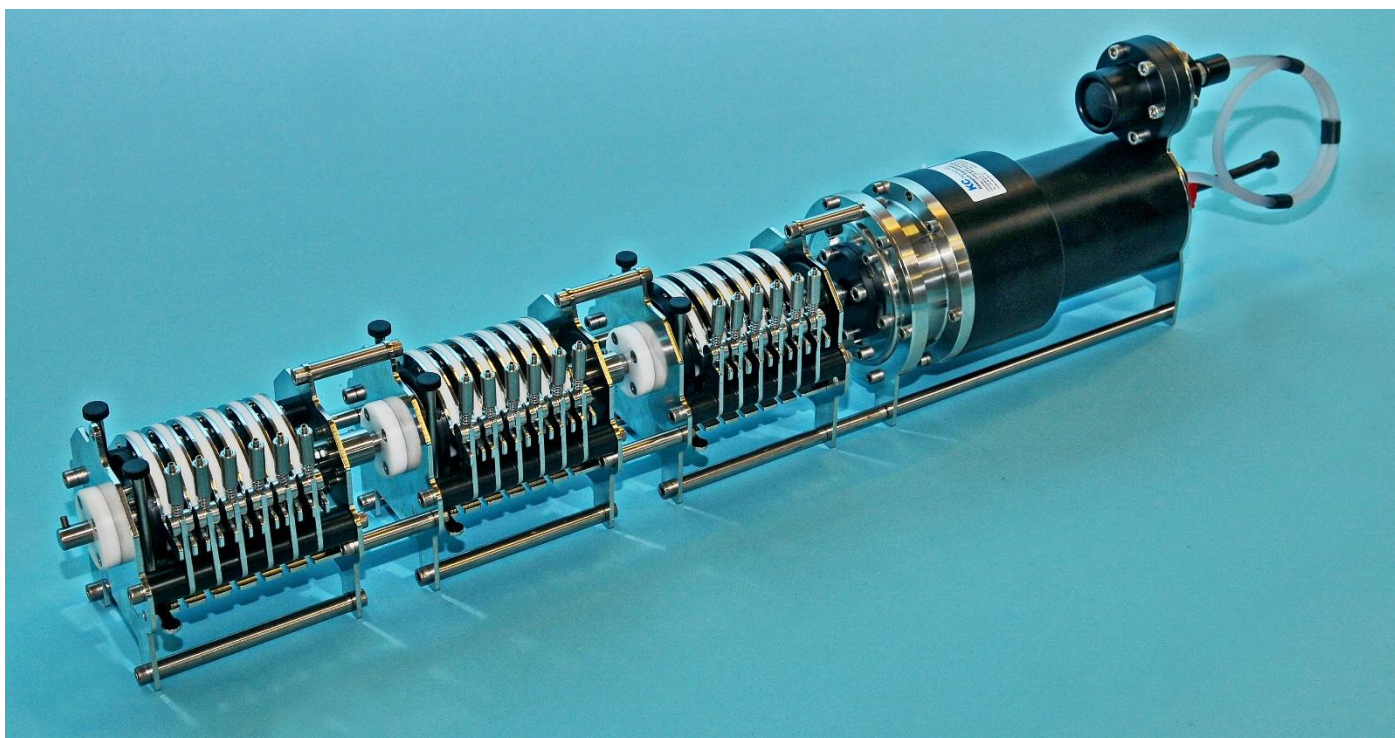




Peristaltic pump (11.370) with 18 separate channels

Peristaltic Pump 11.350/11.360/11.370

Manual

KC Denmark A/S

Research Equipment
Limnology • Oceanography • Hydrobiology

Manual - Peristaltic Pump 11.350/11.360/11.370

General:

The peristaltic pump is pressure-compensated for operation at depths of up to 6000 m, depending on the battery configuration. Operation requires battery cylinder 100.217 for depths up to 4000 m or 100.226 for depths up to 6000 m. The pump is manufactured from AISI 316 stainless steel and is suitable for multi-channel water sampling in oceanographic and environmental research.

The standard configuration includes 6 channels; alternative configurations are available on request. The standard delivery does not include a power supply or a time-lapse trigger. For continuous pumping, connect a 24 V DC battery power source.

Installation

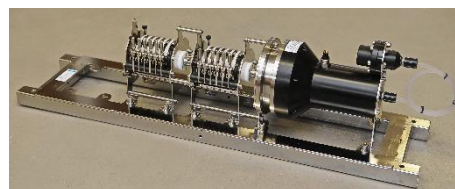
Mechanical Installation

The pump should be securely mounted to a frame, lander, or ROV structure using appropriate stainless-steel fixtures.

Ensure the pump is positioned to allow easy access to tubing connections and the Subconn connector.

Verify that tubing runs are free from sharp bends or kinks that could restrict flow or damage the tubing.

The frame must be ordered separately.
Custom-designed frames or brackets can be made on request.



Battery Cylinder Installation

Select the appropriate battery cylinder based on maximum operating depth:

100.217 for deployments up to 4000 m

100.226 for deployments up to 6000 m

Install the battery cylinder according to the manufacturer's instructions, ensuring all O-rings are properly lubricated and seals are intact.

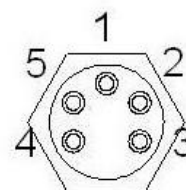
Connect the battery cylinder to the pump using the Subconn MCBH5M connector, ensuring a secure, water-tight connection. For proper handling of SubConn connectors, see pages. 13-16.



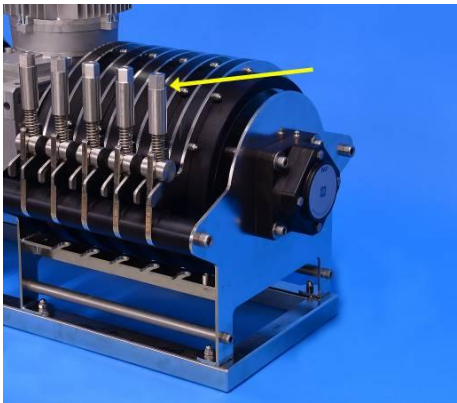
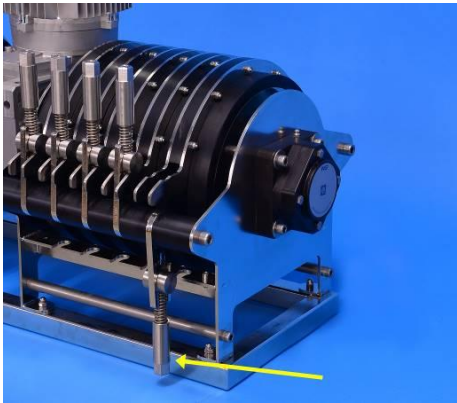
Electrical Connection

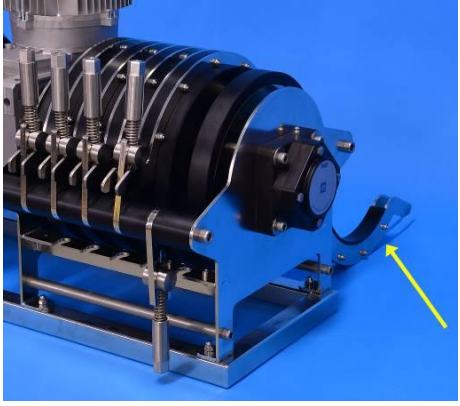
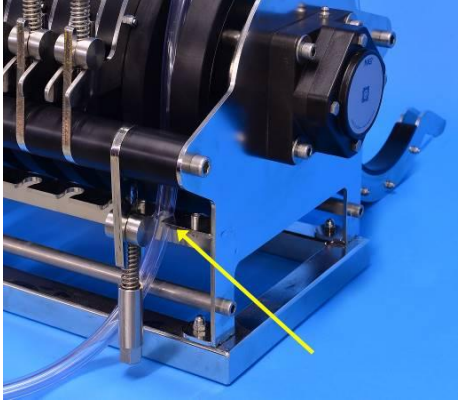
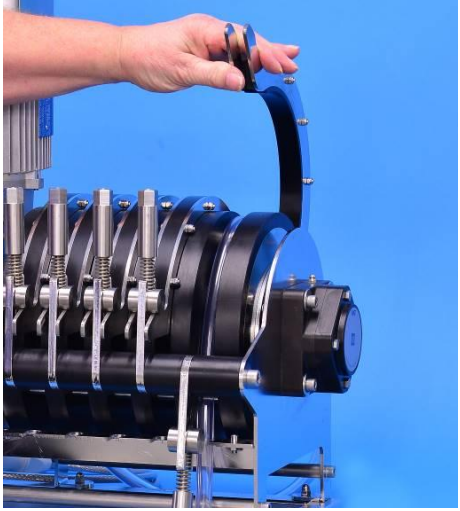
The pump operates on 10–24 V DC power. For continuous pumping, connect a battery power source capable of supplying 10–24 V DC. Flow rate can be adjusted by varying the input voltage within the 10–24 V DC range.

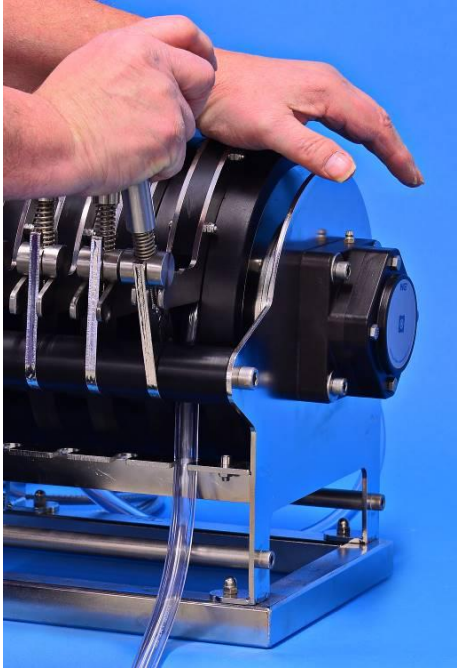
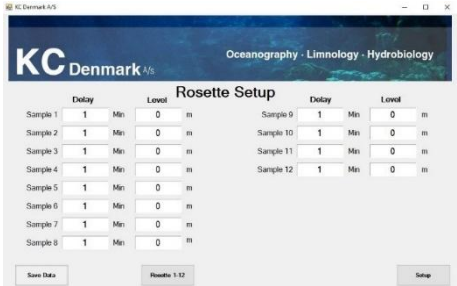
SubConn connection: Pin 1: + (positive) and Pin 2: - (negative). See schematic on page 8.

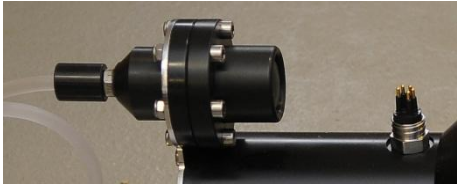
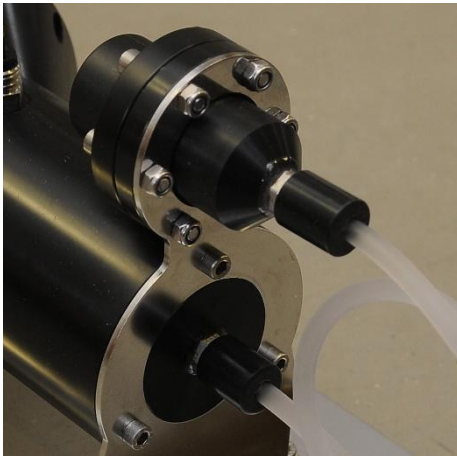


MCBH5M Male face view

4	Standard delivery does not include a power supply or time-lapse trigger. These must be ordered separately if required. For programmable sampling, the pump can be prepared for mounting of an encoder to control pumped volume. Verify polarity before connecting power to avoid damage to the motor.	
5	Tubing Installation Use silicone or similar flexible tubing with an inner diameter between Ø1,5 and 3,0 mm and a wall thickness of 0,5 mm. Insert tubing through the pump channels, ensuring even tension across all rollers. For optimal flow, avoid over-tightening or excessive compression of the tubing. Replace tubing regularly to maintain accurate flow rates and prevent contamination between samples.	
6	Pull the handle towards you. The spring-loaded tube holder will then release the tube. <i>Note: All photos in points 6-12 show a larger pump using hoses with an outer diameter of 15,9 mm.</i>	
7	The handle is in the vertical position.	

8	Open the tube holder.	
9	Before inserting the tube, you can apply silicone grease to reduce friction between the tube and the rollers in the mechanism. Insert the tube by squeezing it into the slotted hole.	
10	For some types of tubing, it may be necessary to fit an additional sleeve with adhesive to prevent the tubing from being drawn through the peristaltic mechanism.	
11	Close the tube holder.	

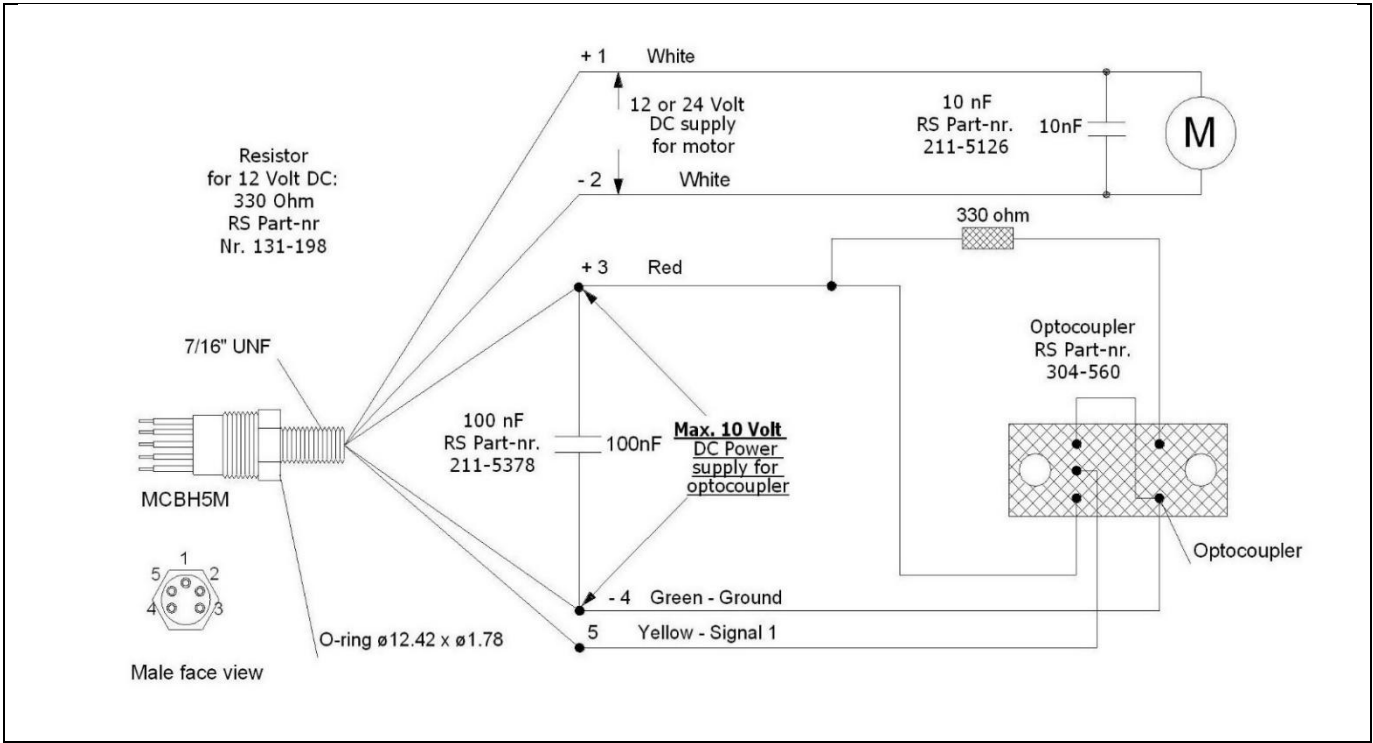
12	While pressing down the tube holder, push the locking knob to secure the tube holder.	
13	Programmable Sampling If equipped with a time-lapse trigger or encoder, the pump can be programmed for timed or volume-based sampling. Intuitive programming interface. A time-lapse trigger (e.g., KC Denmark type 60.010) can be installed in the battery cylinder for automated sampling sequences.	
14	Multi-Channel Configuration The standard 6-channel configuration can be extended to 12 or 18 channels by adding pump modules (3 or 6 channels each). Ensure all channels are evenly loaded to maintain balanced motor performance.	
15	Maintenance Inspect the tubing before and after each deployment for signs of wear, cracking, or deformation. Rinse the pump with fresh water after use in saltwater environments to prevent corrosion. Check all electrical connectors for corrosion or damage before each deployment. Lubricate O-rings on battery cylinders and connectors with an appropriate silicone grease.	

16	Safety and Handling Do not exceed the rated depth for the selected battery cylinder. The unit contains a pressure compensation system with a rubber membrane that can be tested. Press lightly on the membrane. See photo. Handle the pump with care during installation to avoid damage to tubing or electrical components. For certain items (PVC, rubber bands, and rubber membrane etc.), prolonged exposure to direct sunlight or failure to rinse off salt water may affect the durability and integrity of the products and will not be covered by the warranty.	
17	Filling with Fluorinert In addition, there is an important market factor you should be aware of: 3M has officially phased out its entire production of Fluorinert and Novec products. If you need to replace the fluid now, you must either use existing remaining stock or switch to an approved alternative.	
18	Since 3M has completely ceased production of PFAS-containing fluids, the industry is now using direct “drop-in” replacements that closely match the physical properties, chemical inertness, and dielectric strength of the original fluids. Direct alternatives: Products such as <i>Solvay Golden® PFPE</i>, <i>BestSolv®</i>, or the <i>TMC</i> range are available—for example, replacements for the traditional FC-3283 or FC-40 fluids or similar. Miscibility: <i>Always verify that the selected replacement fluid is 100% miscible with the existing Fluorinert fluid if the system cannot be completely drained.</i>	
19	Step-by-step guide to replacement in a pressure-compensated system. Pressure-compensated systems - often fitted with a flexible rubber bladder or compensation bellows - are sensitive to microscopic air bubbles. Air will compress under seabed pressure and may potentially damage the bellows or motor.	

20	1. Preparation and draining Environment and cleanliness: Fluorinert, as well as its alternatives, is extremely expensive. Work in a scrupulously clean environment to prevent contamination from dust and moisture. Draining: Open the system's lowest drain plug and the vent screw at the top. Drain the fluid into a clean container. Compensator check: Gently press the compensation bellows/bladder to force the remaining fluid out of the system. Reclamation: Used fluorinated fluids can often be sent for reclamation, since they do not chemically degrade during normal use.	
21	2. Flushing the system <i>(Required in the event of contamination or a fluid change)</i> If the old fluid is dark, contains particles, or you are changing to an entirely new fluid brand, the system should be flushed. Flush the system with a small amount of the new, clean fluid to collect any remaining residues and particles, then drain it again.	
22	3. Filling and vacuum deaeration <i>(Critical step)</i> Vacuum filling — strongly recommended: To avoid trapped air in the motor windings and compensator, evacuate the system with a vacuum pump before drawing in the fluid. This removes atmospheric air from the system. Manual filling — if vacuum filling is not possible: Fill very slowly to minimize foaming and bubble formation. Manually rotate the motor shaft through several revolutions during filling to release air bubbles trapped inside the rotor and stator.	

23	4. Setting the compensation volume Once the motor system is full, set the compensation bellows to the correct pre-load relative to the current ambient temperature. The bellows must be neither fully extended nor completely collapsed at room temperature, as it must be able to contract when exposed to cold seawater, where the fluid volume decreases. Seal the system using the correct O-rings and tighten all components to the specified torque values.	
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Troubleshooting		
Problem	Possible Cause	Solution
No flow	Power not connected	Check power supply and polarity
Uneven flow between channels	Tubing tension uneven	Adjust tubing tension evenly across rollers
Motor not running	Battery depleted or connector fault	Check battery charge and connector integrity
Leakage at connector	O-ring damaged or improperly seated	Inspect and replace O-ring; re-seat connector



Schematic for the motor and the optocoupler system

Product information for Fluorinert



Fluorinert™ Electronic Liquid FC-77

Product Information

Introduction

3M™ Fluorinert™ Electronic Liquid FC-77 is a thermally stable, fully-fluorinated liquid that has long been used as a heat transfer fluid in a variety of industries.

The inertness of Fluorinert liquid FC-77 permits its use as a direct contact single and two-phase coolant in supercomputers and sensitive military electronics. Its high dielectric strength and electrical resistivity are ideal for applications in high voltage transformers and power electronics.

In the semiconductor manufacturing industry, its wide liquid range makes Fluorinert liquid FC-77 ideal for cooling ion implanters, dry etchers and CVD machines. Its low pour point also permits its use in thermal shock and test equipment.

Physical Properties

Not for specification
purposes

All values determined
at 25°C unless
otherwise specified

Properties	FC-77
Appearance	Clear, colorless
Average Molecular Weight	416
Boiling Point (1 atm)	97°C
Pour Point	-110°C
Calculated Critical Temperature	495 K
Calculated Critical Pressure	1.58×10^6 pascals
Vapor Pressure	5.62×10^3 pascals
Latent Heat of Vaporization (at normal boiling point)	89 J/g
Liquid Density	1780 kg/m ³
Kinematic Viscosity	0.72 centistokes
Absolute Viscosity	1.3 centipoise
Liquid Specific Heat	1100 J kg ⁻¹ °C ⁻¹
Liquid Thermal Conductivity	0.063 W m ⁻¹ °C ⁻¹
Coefficient of Expansion	0.00138 °C ⁻¹
Surface Tension	13 dynes/cm
Refractive Index	1.28
Water Solubility	13 ppmw
Solubility in Water	<5 ppmw
Ozone Depletion Potential	0

3M™ Fluorinert™ Electronic Liquid FC-77 Electrical Properties

Properties	FC-77
Dielectric Strength	40 kV, 0.1" gap
Dielectric Constant	1.9
Electrical Resistivity (ASTM D-257)	1.9×10^{15} ohm cm

Heat Transfer Properties

The following formulas can be used to calculate the specific heat, thermal conductivity and density of 3M™ Fluorinert™ Electronic Liquid FC-77 at various temperatures.

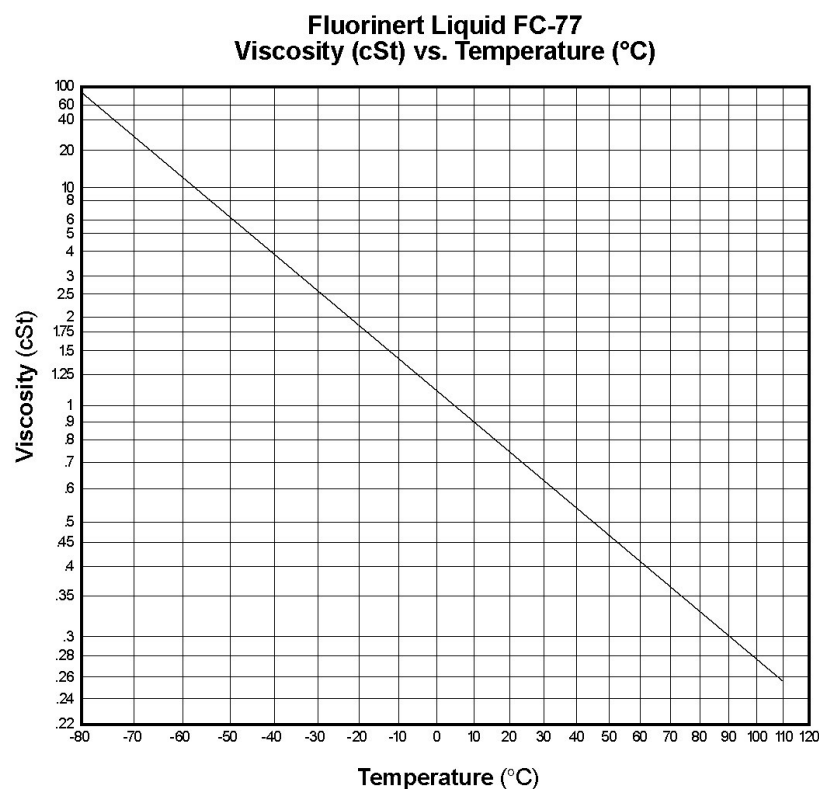
$$\text{Specific Heat (J kg}^{-1} \text{ }^{\circ}\text{C}^{-1}) = 1014 + 1.554 (T, ^{\circ}\text{C})$$

$$\text{Thermal Conductivity (W m}^{-1} \text{ }^{\circ}\text{C}^{-1}) = 0.065 - 0.00008 (T, ^{\circ}\text{C})$$

$$\text{Density (kg/m}^3) = 1838 - 2.45 (T, ^{\circ}\text{C})$$

$$\text{Log}_{10}(\text{Vapor Pressure (pascals)}) = 10.216 - (1928/(T, \text{K}))$$

The following graph can be used to determine the viscosity of Fluorinert liquid FC-77 over the indicated temperature range.



3M™ Fluorinert™ Electronic Liquid FC-77 Materials Compatibility

3M™ Fluorinert™ Electronic Liquid FC-77 is compatible with most metals, plastics and elastomers.

Toxicity Profile

Fluorinert liquid FC-77 is non-irritating to the eyes, minimally irritating to the skin, and is practically non-toxic orally and dermally. The product also demonstrates very low acute and sub-chronic inhalation toxicity. It is not a mutagen (ames) or skin sensitizer. A Material Safety Data Sheet is available upon request.

Safety and Handling

Before using this product, please read the current product Material Safety Data Sheet (available through your 3M sales or technical service representative) and the precautionary statement on the product package. Follow all applicable precautions and directions. Fluorinert liquid FC-77 is nonflammable, and is highly resistant to thermal breakdown and hydrolysis in storage and during use. Recommended handling procedures are given in the Material Safety Data Sheet.

Environmental Properties

Fluorinert liquid FC-77 has zero ozone depletion potential. The material is not defined by the U.S. EPA, nor is it regulated, as a volatile organic compound (VOC). FC-77 liquid does not contribute to ground-level smog formation.

Fluorinert liquid FC-77, a perfluorocarbon (PFC), has a high global warming potential and a long atmospheric lifetime. As such, its use should be carefully managed to minimize emissions.

3M recommends that users of Fluorinert liquid FC-77 further limit emissions by employing good conservation practices, and by implementing recovery, recycling and/or proper disposal procedures. 3M offers a program for used fluid return.

Environmental Policy

3M will recognize and exercise its responsibility to:

- prevent pollution at the source wherever and whenever possible
- develop products that will have a minimal effect on the environment
- conserve natural resources through the use of reclamation and other appropriate methods
- assure that its facilities and products meet and sustain the regulations of all Federal, State and local environmental agencies
- assist, wherever possible, governmental agencies and other official organizations engaged in environmental activities

3M™ Fluorinert™ Electronic Liquid FC-77 Used Fluid Return Program

3M offers a program for free pickup and return of used 3M Specialty Materials in the U.S. through Safety-Kleen Corporation. A pre-negotiated handling agreement between users and this service provider offers users broad protection against future liability for used 3M product. The fluid return program is covered by independent third-party financial and environmental audits of treatment, storage and disposal facilities. Necessary documentation is provided. A minimum of 30 gallons of used 3M Specialty Materials is required for participation in this free program.

Safety-Kleen Corporation has a network of 156 branch service centers in the U.S. This large fleet will provide timely, economical fluid disposal service.

For additional information on the 3M Used Fluid Return Program, contact Safety-Kleen Corporation at this toll-free line: 1.888.932.2731.

Resources

3M™ Fluorinert™ Electronic Liquid FC-77 customers are supported by global sales, technical and customer sales resources, with fully staffed technical service laboratories in the U.S., Europe, Japan, Latin America and Southeast Asia. Users benefit from 3M's broad technology base and continuing attention to product development, performance, safety and environmental issues.

For other 3M global offices and additional information on Fluorinert electronic liquid FC-77 in the U.S., call 3M Performance Materials, 800.833.5045, or visit our web site at: www.3m.com/fluids

Important Notice to Purchaser: The information in this publication is based on tests that we believe are reliable. Your results may vary due to differences in test types and conditions. You must evaluate and determine whether the product is suitable for your intended application. Since conditions of product use are outside of our control and vary widely, the following is made in lieu of all express or implied warranties (including the warranties of merchantability or fitness for a particular purpose): 3M's only obligation and your only remedy is replacement of product that is shown to be defective when you receive it. In no case will 3M be liable for any special, incidental, or consequential damages based on breach of warranty or contract, negligence, strict tort, or any other theory.



Specialty Materials

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98-0212-2309-8 (HB)



SubConn®

Handling instructions

Follow these instructions carefully to ensure correct use of your SubConn® connectors.

Handling

- Connectors must be greased with Molykote 44 Medium before every mating
- Always grease O-rings on BH, BCR and FCR connectors with Molykote 111
- Disconnect by pulling straight out, not at an angle
- Do not pull on the cable and avoid sharp bends at cable entry
- When using a bulkhead connector, ensure that there are no angular loads
- Make sure to apply the recommended torque when tightening bulkhead nuts
- SubConn® connectors should not be exposed to extended periods of heat or direct sunlight. If a connector becomes very dry, it should be soaked in fresh water before use

Scan to access
SubConn® greasing
and cleaning
instruction videos



Greasing products



Molykote 44 Medium

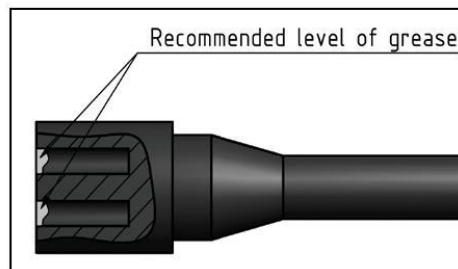


WD-40
or similar products



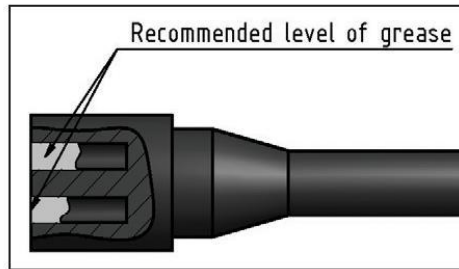
Compound
or similar greasing
products

Greasing and mating above water (dry mate)



- Connectors must be greased with Molykote 44 Medium before every mating
- A layer of grease corresponding to a minimum of 1/10 of the socket depth should be applied to the female connector
- The inner edge of all sockets should be completely covered, and a thin transparent layer of grease left visible on the face of the connector
- After greasing, fully mate the male and female connector in order to secure optimal distribution of grease on all pins and in the sockets
- To confirm that grease has been sufficiently applied, de-mate and check for grease on every male pin. Then re-mate the connector

Greasing and mating under water (wet mate)



- Connectors must be greased with Molykote 44 Medium before every mating
- A layer of grease corresponding to approximately 1/3 of a socket depth should be applied to the female connector
- All sockets should be completely sealed, and a transparent layer of grease left visible on the face of the connector
- After greasing, fully mate the male and female connector and remove any excess grease from the connector joint

Cleaning products



See below *



Liquid soap and hot water



Acetone or similar products



Gasoline or similar products

- * General cleaning and removal of any accumulated sand or mud on a connector should be performed using spray based contact cleaner (isopropyl alcohol)
- New grease must be applied again prior to mating

Use of Loctite

- Always use Loctite 5910 to lock non-metallic (PEEK) connectors
- For locking metallic connectors, the use of Loctite 243 is recommended



COAX connector

- Only grease the rubber parts - do not grease coax pin and socket
- Do not mate under water. To be used with locking sleeves only

Bulkhead Connectors - Tightening force

Type	Material	Rec. Torque - Nm
3/8" - 24 UNF	Brass, aluminium	4.0
	Stainless steel, titanium	6.0
	PEEK	2.0
7/16" - 20 UNF	Brass, aluminium	10.0
	Stainless steel, titanium	14.0
	PEEK	4.2
1/2" - 20 UNF	Brass, aluminium	15.0
	Stainless steel, titanium	21.0
	PEEK	5.2
5/8" - 18 UNF	Brass, aluminium	29.0
	Stainless steel, titanium	41.0
	PEEK	10.0
3/4" - 16 UNF	Brass, aluminium	44.0
	Stainless steel, titanium	63.0
	PEEK	15.0
7/8" - 14 UNF	Brass, aluminium	60.0
	Stainless steel, titanium	80.0
	PEEK	20.0
1" - 14 UNF	Brass, aluminium	75.0
	Stainless steel, titanium	100.0
	PEEK	25.0

Recommended oil for pressure balanced systems

- MacArtney recommend DC-200/350 or PMX-200/350 in oil compensated systems

11-2018

KC Denmark A/S

Research Equipment
Limnology • Oceanography • Hydrobiology

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