



# Special Refrigerated Circulator

Operating Manual

If you have any feedback on Grant's products or services, we would like to hear from you.  
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**Country of Origin: UK**



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## 1.0 Use of products

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The following products are covered by this operating manual:

- Special Refrigerated Circulator

Serial Numbers :

006375002 Refrigeration unit fitted with Optima control unit 006375001  
006376002 Refrigeration unit fitted with Optima control unit 006376001  
006377002 Refrigeration unit fitted with Optima control unit 006377001  
006420002 Refrigeration unit fitted with Optima control unit 006420001  
006422002 Refrigeration unit fitted with Optima control unit 006422001  
006422004 Refrigeration unit fitted with Optima control unit 006422003  
006436002 Refrigeration unit fitted with Optima control unit 006436001  
006436004 Refrigeration unit fitted with Optima control unit 006436003  
006436006 Refrigeration unit fitted with Optima control unit 006436005  
006436008 Refrigeration unit fitted with Optima control unit 006436007  
Refrigeration unit and Optima Control units between 006439XXX to 06448XXX

These Special Refrigerator Circulators are designed for indoor laboratory use by a professional user.

Grant low temperature baths/circulators are designed to be used with a Grant Optima™ heating circulator (referred to as Optima control unit in text). They provide a source of cooling for many sensitive analytical procedures. Applications requiring the precision temperature control of samples include spectrophotometry, viscometry, refractometry and electrophoresis. Grant's range of more powerful chillers are ideally suited for applications requiring the removal of the mechanical or electrical heat produced in apparatus or machinery, combined with a higher pressure flow for faster heat removal within restricted systems.

## 2.0 How to use this operating manual

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This operating manual will allow you to unpack, set-up and operate the Special Refrigerated Circulator correctly and safely. Important safety information, symbols and warnings are listed below and should be read carefully. Section 4 gives information about how to unpack and install the product correctly. Section 5 gives provides operating information. Product technical specifications and tips are provided in sections 6 and 7. The warranty for this product is for THREE YEARS and is detailed in section 8 and should be registered by completing the on-line registration form at [www.grantinstruments.com](http://www.grantinstruments.com).

If there is a technical matter that this operating manual does not address, or any other question concerning this product, please contact Grant Instruments or your local distributor, who will be able to provide any additional information.

## 3.0 Safety information

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### 3.1 Safety compliance

The Grant low temperature bath/circulator meets the requirements of international safety standard IEC 61010: Safety requirements for electrical equipment for measurement, control, and laboratory use.

### 3.2 Safety symbols

The symbols below are marked on the equipment and throughout this manual to indicate:



Caution: Surfaces and heat transfer liquid can be hot during and after use.



Read this manual before using the bath.



Important safety warning.

### 3.3 Safety warnings



Read the whole of these instructions. Safety may be impaired if they are not followed.



Only use liquids specified in these operating instructions, within the specified temperature range. If the alarm lamp is illuminated the liquid temperature may be above its recommended maximum. Do not inhale the vapours given off as they may be toxic. Liquids should be safely discarded and replaced.



Do not use the unit with flammable heat transfer liquids.



Do not use the unit to heat any sample material that could cause a fire or any other kind of hazard.



Do not use the unit in an area where there are aggressive or explosive chemical mixtures.



If a potentially hazardous liquid is spilt onto or inside the equipment, disconnect it from the power supply and have it checked by a competent person.



Before moving, disconnect from the mains power supply



It is the user's responsibility to carry out appropriate decontamination if hazardous material is spilt on the equipment.



If the alarm lamp is illuminated do not touch the liquid or the tank base, they may be very hot. Refill carefully, a hot heater can cause a spattering of very hot water droplets and scalding steam.



Do not touch surfaces which become hot during high temperature operation.

## 4.0 Operating instructions

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### 4.1 Unpacking instructions

Standard equipment includes:

- Special Refrigerated Circulator with lid
- Special Optima heating circulator control unit
- Communications cable
- Mains cords with plug
- Operating manuals



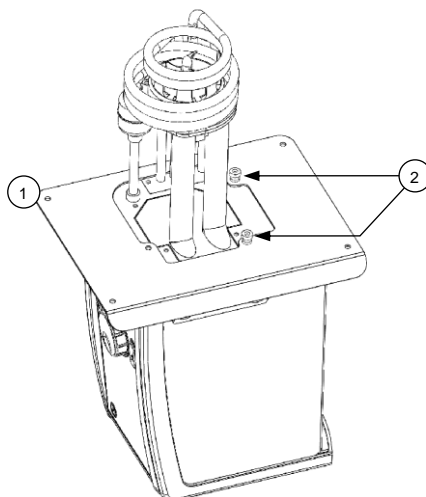
The Special Refrigeration Circulator weighs 47kg. Take necessary precautions when moving and lifting.

Remove packing materials carefully and retain them for future shipment or storage of the equipment.

### 4.2 Fitting the controller to the refrigeration unit

The Optima controller unit can be fitted in two orientations on the refrigeration unit facing over the tank opening or outwards

1. Remove the bridge plate from the refrigeration unit tank by unscrewing the four black thumb screws.
2. Fit the Optima controller unit through the hole in the bridge plate and align using the locating threads. Secure using the retaining nuts. Hand tighten only.
3. Re-attach the bridge plate onto the refrigeration unit, using the retained black thumb screws.



### 4.3 Recommended liquids

The following table lists the recommended liquids for different temperature ranges. Always ensure the liquid used is safe and suitable for your working temperature. If using non-recommended heat transfer liquids, it is the responsibility of the user to conduct an assessment to ensure the intended fluid is compatible with the refrigeration unit. If in doubt, please contact the Grant technical support team.



To ensure protection the overtemperature cut-out must be set appropriately for the heat transfer liquid selected (see table below).



If using non-recommended heat transfer liquids it is important to set the over-temperature cut-out to a value no higher than 25°C below the fire point of the liquid.



Use fume extraction when using silicone fluids at elevated temperatures

Temp range	Recommended liquid	Comments
-55°C to 50°C	Silicone oil – low viscosity	Bayer silicone M3. Follow the manufacturer's instructions. For safe disposal consult your local regulations.
-30°C to 30°C	50% water, 50% antifreeze (inhibited ethylene glycol)	WARNING: Ethylene glycol is toxic – follow the manufacturer's instructions. For safe disposal consult your local regulations.
0°C to 30°C	80% water, 20% antifreeze (inhibited ethylene glycol)	Use a lid to reduce the dilution of the mixture caused by condensing water vapour from the air, and to maintain the cool down rate.
5°C to 99.9°C	Water*	Water can be used but care should be taken above 60°C as hot vapour can be dangerous. Use a lid or polypropylene spheres above 60°C to ensure good performance & reduce evaporation. At temperatures approaching 99°C the temperature performance will be affected due to localised boiling. The units should not be used to boil water.
70°C to 120°C	Silicone fluid Viscosity ~20cs Flash point ≥230°C Fire Point ≥280°C	Dow Corning DC200/20 silicone fluid is a suitable liquid – follow the manufacturer's instructions. For safe disposal consult your local regulations.

\* See section 7.1 for further details

#### 4.4 Installation

After transportation, let the refrigeration unit stand in its intended working position for six hours. This is to allow the oil to drain to the bottom of the compressor. This is normal procedure for refrigeration compressors. Allow at least 100mm clearance from obstructions on all sides so that there is free air flow through the unit, from the front to the back (this also has the advantage that air is not blowing directly out of the sides onto instruments next to the refrigeration unit).



Place the unit on a level, non-combustible surface. Ensure that the mains plug and the switch at the rear of the unit are easily accessible.



If the equipment has been transported or stored in cold or humid conditions, condensation may form inside it. If that could have happened, allow time (at least 2 hours at room temperature) for the condensation to evaporate before using the equipment.



Do not block or restrict ventilation slots.



Do not connect to a power supply or switch on before filling the tank.



Drain before moving the unit. Before draining allow the liquid to cool below 50°C.



Do not touch the condenser fins, they are sharp and may cause injury.

#### 4.5 Electrical supply



Connect the refrigeration unit to a grounded (earthed) electrical power supply with voltage and frequency within the range specified on the serial number plate.



The refrigeration unit must only be connected to the mains using the mains cord supplied or one with an identical rating (see section 9.4)



Ensure the mains switch and isolating device (power supply connector) are easily accessible during use.

## 5.0 Operating procedures

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### 5.1 Operation

#### 5.1.1 Liquid level

Fill the tank to an appropriate level with a liquid suitable for your working temperature; see section 4.3 for liquid options. Allow for thermal expansion and contraction of the liquid during operation and for any liquid in external circulation paths. If using liquids that can evaporate then periodic checking and refilling should be completed. The low level float switch will alarm if the liquid level drops below the minimum required level and the unit will switch off the heater and stop temperature control.

#### 5.1.2 Operation above 60°C

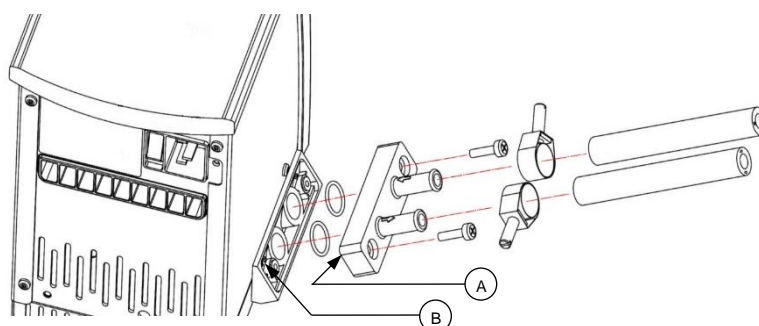
A lid or polypropylene spheres must be used above 60°C to maintain temperature control and to ensure that the bath fluid temperature reaches the set point. They will save energy by preventing excessive evaporation and reduce the frequency that the bath needs to be refilled.



Take care when lifting and removing the lid as it may be hot. Steam and hot vapours can cause scalding.

#### 5.1.3 Using the control unit pump

The Optima control unit allows liquid to be pumped around a closed external system (not open to the atmosphere). It cannot be used for circulation through an external open tank. The pump is fitted with a blanking plate as standard. Fit a pump connector plate as shown below. Ensure o-rings are located in the grooves, use silicone grease to hold the o-rings in place. Note: the blanking/connector plates have a locating hole (see A below) to assist correct alignment onto the pump moulding. It is important to verify the hole is aligned with the corresponding locating pin (see B below) on the pump moulding. Failure to do so will result in a leaking connection. Retain the blanking plate for refitting when the pump is no longer required.



Always use pump connectors and hoses that are suitable for the operating temperature and liquid used. Check the pipe connections are secure.



Never disconnect any pipes or hoses while they contain very hot or very cold liquids or while the Optima control unit is pumping.



Never use silicone oil with silicone tubing.

Pumping heat transfer liquid around an external system can lead to hazards that are outside the control of Grant Instruments. It is essential that the user conducts a risk assessment of the entire equipment installation to ensure that correctly rated materials have been used throughout and that the system can be used safely.

#### **5.1.4 Emptying the refrigeration unit**

The refrigeration unit tank should be emptied to a safe level prior to moving. A drain tap is included to allow convenient emptying. See section 5.2.3 for full details.



Allow the liquid temperature to fall below 50°C before emptying.

#### **5.1.5 Setting up and switching on**

Follow instructions in section 5.1.3 to attach the pump connector plate and insulated hose. Before filling and switching on, attach the open end of the hose to the application, taking care to note the inlet and outlet.



Ensure all hoses are connected securely. Liquid will begin pumping immediately once the equipment is switched on.

Add the appropriate working liquid to the bath to at least the minimum recommended fill level such that the float level switch is fully raised.

#### **Power supply for the Special Refrigerated Circulator**

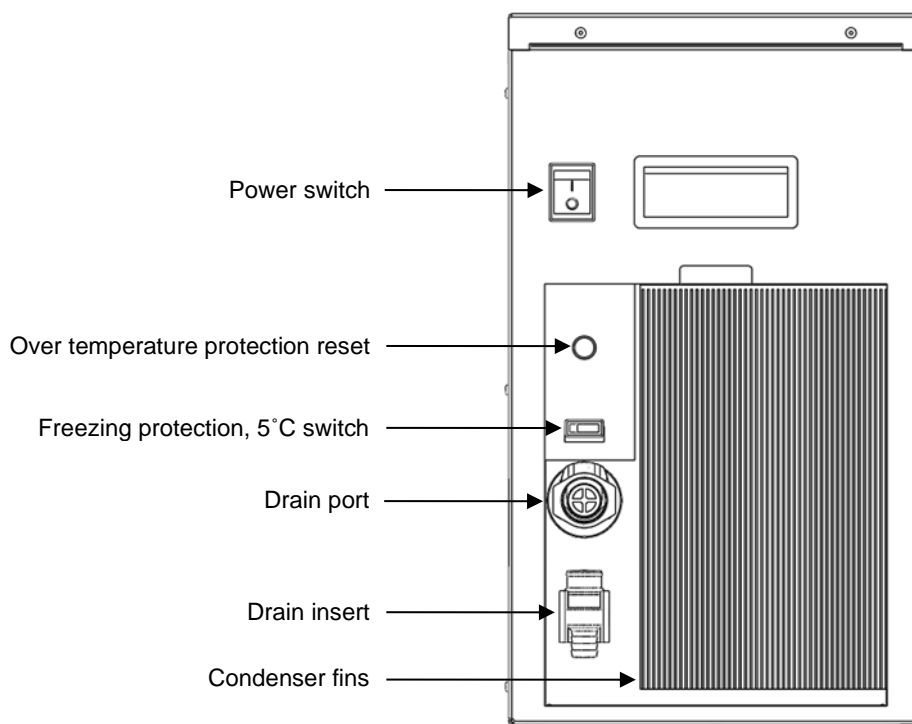
The Optima control unit is connected directly to the mains supply with the IEC cable supplied with the Optima unit. Connect the refrigeration unit directly to the mains using the IEC cable provided (see Section 5.2.2).

#### **Power supply for 120V models**

The 120V Optima control units and refrigeration units have separate fixed mains cords. Connect both to the mains supply.

## 5.2 Using the refrigeration unit

### 5.2.1 Product description, refrigeration unit front panel (grille removed)



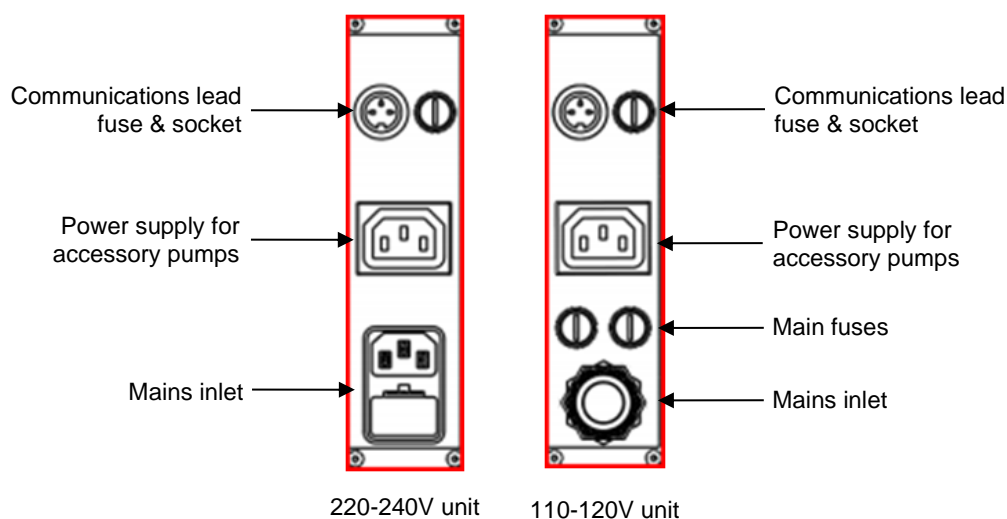
The over temperature protection reset: protects the unit from overheating by the over temperature cut-out. This will be actuated when the working fluid is raised above between 110°C and 120°C. The unit can be reset by waiting for the liquid to cool below 100°C, then unscrewing the black cap and pushing in the revealed button.

The freezing protection switch uses a low temperature thermostat to ensure the working fluid never drops below 5°C. With the switch in the depressed/in position the cooling will be switched off by a low temperature protecting thermostat. If water is used in the bath this will prevent it from freezing. In the out/off position the thermostat is bypassed allowing the unit to run at temperatures below 5°C.

The drain port and insert allow convenient emptying of the refrigeration bath. To drain the unit first remove the drain insert from the holder and connect a suitable length of hosing with a bore of 12.7mm (½") to the drain insert. Have the non connected end of tubing in a receptacle, suitable for the liquid to be drained. Push the drain insert into the drain port and let the liquid drain. To release the drain insert push down the grey button on the drain body and extract the drain insert. Liquid to be drained should not be below 10°C or above 50°C.



## 5.2.2 Refrigeration unit rear panel



## 5.2.3 Using the Optima control unit

The Special Refrigerated Circulator is designed for use with the supplied Special Optima TX150 or TXF200 control units.

For full instructions on the functionality and operation of the Optima control unit please consult the following manual:

- 30424 – TX150/TXF200 Operating manual.

Note the following amendments to the manual for the supplied Special Optima TX150 or TXF200 control units.

See Section 5.3.4 Selecting a liquid type

The lower temperature limit for Low Temp Oil and Override is -55°C

Liquid	Set temperature range
Water	0°C to 100°C
Water-Glycol	-30°C to 70°C
Low Temp Oil	-55°C to 50°C
High Temp Oil	70°C to 150°C (TX150) 70°C to 200°C (TXF200)
Override	-55°C to 150°C (TX150) -55°C to 200°C (TXF200)

Please read the entire manual to ensure safe operation.

## 6.0 Technical specifications

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### 6.1 Operating conditions

Ambient temperature range	5 to 40°C
Altitude above sea level	Up to 2,000m (6,500ft)
Operating environment	Indoor use only
Maximum relative humidity	80% RH up to 31°C decreasing to 50% RH at 40°C

### 6.2 Electrical details

Mains supply: 230V @ 50Hz or 120V @ 60Hz

Pollution degree: 2

Installation category: II

Mains supply voltage fluctuations are not to exceed  $\pm 10\%$  of the nominal supply voltage.

### 6.3 Specification

Specification		Special Refrigerated Circulator
Typical cooling power at an ambient of 20°C	@ 20°C	1100
	@ 0°C	1050
	@ -10°C	800
	@ -20°C	580
	@ -30°C	370
	@ -40°C	130
	@ -47°C	25
Minimum set temperature		-55°C
Maximum temperature		100°C
Refrigerant type		R404a
Refrigerant charge		500gm
Tank capacity		12L
Top opening		260/115mm
Liquid depth min/max		120/180mm
Drain		Yes
Switchable refrigeration		Yes
Safety 100°C limit		Cut-out
Safety freezing protection		5°C thermostat & switch
Safety (high pressure)		27 Bar
Max power consumption		1400W

## 7.0 Technical Tips

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### 7.1 Which water should you use in your Special Refrigerated Circulator tank?

For the long-term reliability of the equipment it is important to use oxygenated water that is free from ions and minerals that can cause corrosion of stainless steel. We recommend the use of distilled water and de-ionised water from modern ion exchange systems that do not use salt back flushing to regenerate the ion-exchange cartridges.

Stainless steel is protected from corrosion by a layer of chromium oxide. If the layer is damaged, oxygen present in water can reform the oxide layer. If the water is still or de-oxygenated, and the oxide layer is damaged, ions can corrode the stainless steel tank. If a water bath has been unused for some time, or water boiled, we recommend changing to fresh distilled water or correct de-ionised water.

Water normally contains calcium or magnesium ions. De-ionised water has most ions removed as indicated by its conductivity level; the purer the water the lower the conductivity. It is important to use only de-ionised water from an ion exchange system with replaceable cartridges. Do not use de-ionised water generated from an ion-exchange system that incorporates a salt back-flush system to regenerate the ion-exchange resin as this can leave sodium ions that are very corrosive to stainless steel.

### 7.2 How to prevent rust in Special Refrigerated Circulator tanks

Most Grant tanks, as well as immersed parts, are made from type 304 stainless steel, an extremely versatile general purpose grade of stainless steel. It is the excellent forming characteristic that has made this grade dominant in the manufacture of laboratory and industrial water baths, as well as domestic sinks and saucepans. Type 304 stainless steel is highly suitable for applications where hygiene is important; it exhibits good heat resistance and excellent resistance to corrosion.

However, despite resistance to general surface corrosion, stainless steel is susceptible to specific types of corrosion, in particular pitting (small pin hole style corrosion) and stress corrosion cracking. It can also undergo general corrosion in specific environments, such as one containing hydrochloric or sulphuric acids.

Stainless steel is protected by its high content of alloying elements, primarily chromium and nickel. Chromium is the most important with respect to corrosion resistance, although the nickel assists in allowing the chromium to do its job. The chromium forms an oxide layer on the surface of the steel, which inhibits further oxidation. This layer adheres extremely well to the metal substrate, but it is essential that it remains intact, and must be protected from various forms of damage.

If the surface chromium oxide layer becomes damaged, oxygen present in water can partially reform the oxide layer, so it is advisable to ensure that water is always fresh and well oxygenated. Baths that will be out of use for an extended period should be emptied, and all moisture should be wiped from the bottom of the tank.

In some cases a brown layer may appear on the surface of a stainless steel tank. In most of these cases this is not rust, but it may be a surface deposit of minerals from the local water supply, or ferrous particles or salts that have fallen into the tank. These surface deposits can usually be removed by using a household cleaner such as Duraglit or Silvo metal polish.

### 7.3 How to prevent algae and bacteria?

Water baths provide the ideal environment for the growth of micro-organisms. If left uncontrolled the growth of these organisms can result in a range of serious problems and health risks from pathogenic bacteria.

The growth of algae on the surface of parts will cause biofouling which can reduce performance.

Micro-organisms that produce acidic metabolic by-products can cause bio-corrosion by depolarisation of metal surfaces.

There are a number of biocides available on the market.

## 8.0 Warranty information

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When used in laboratory conditions according to this manual, this product is guaranteed for THREE YEARS against faulty materials or workmanship.

Extended warranty for years four and five can be purchased by contacting our sales department at [labsales@grantinstruments.com](mailto:labsales@grantinstruments.com).

## 9.0 Maintenance and service

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### 9.1 Cleaning

Regular maintenance of the Special Refrigerated Circulator unit is important to allow the unit to perform to its specification and is required for warranty validity.

The removable grille enables easy access to the condenser for cleaning. Cooling power will be reduced if the fins become clogged with dust. The condenser fins (see section 5.2.3) should be examined monthly and, if necessary, use a vacuum cleaner nozzle and soft brush to remove the dust.

Clean the outside of the equipment with a damp cloth, using water only. Do not use chemical cleaning agents. Before using any other cleaning or decontamination method, check with Grant Instruments or your local representative to make sure that the proposed method will not damage the equipment. Scale on immersed parts can be removed using chemical de-scaling products designed for use on equipment that has metal parts.



De-scaling products may be toxic and manufacturer's instructions should always be followed

### 9.2 Fuses

Fuse replacement should only be carried out by a competent person.

The refrigeration unit has externally accessible fuses that can be changed by a qualified technician. Disconnect the unit from the power supply socket. Remove the IEC power plug from the rear of the unit. Press down the fuse drawer catch and pull out. Check fuses and if necessary, replace. Push the fuse drawer back in until fully engaged and replace the IEC plug.

Replacement fuses must be 1.25" x 0.25" anti-surge ceramic type with 10AT rating.

### **9.3 Replacing the mains cord**

Any replacement mains cords used for the control unit or refrigeration unit must meet the same specification as the one originally supplied to maintain the safety of the unit.

All 230V mains cables (including the interconnect mains cable) must have the following markings; <HAR>, HO5VV-F 3Gx1mm<sup>2</sup> 70°C and be rated to carry 10A. The mains plug and IEC connector must carry approvals from a European certification body (e.g. BSI, VDE or equivalent).

The 120V refrigeration units have fixed mains cords which should not be replaced.

### **9.4 Routine safety tests**

If routine tests are to be made, we recommend a test of the integrity of the protective earth conductor and an insulation test at 500V DC. Routine flash tests are not recommended for any electrical equipment, because repeated high voltage tests degrade insulation materials.

### **9.5 Service**

If service is required, switch off the unit and contact Grant Instruments or your local representative for repairs.

Please note, all returned units must be accompanied by a Return Materials Authorisation (RMA) number, obtainable by contacting the Grant service department (details below).

Service Department  
Grant Instruments (Cambridge) Ltd  
Shepreth  
Cambridgeshire  
SG8 6GB  
UK

Tel: +44 (0) 1763 260 811

E-mail: [service@grantinstruments.com](mailto:service@grantinstruments.com)

## 10.0 Optional accessories

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### 10.1 Alternative pump

A pump comes as standard on Optima models TC120, TX150 and TXF200. If greater head (pressure) is required you can choose from two accessory pumps and the appropriate pump lid. Add L to pump part numbers for 120V (60Hz) versions. See the Grant website at [www.grantinstruments.com](http://www.grantinstruments.com) for full technical specifications.

Pump Product	Description
VTP1	Max head pressure: 1000mBar Max flow rate: 9 L/min
VTP2	Max head pressure: 1700mBar Max flow rate 12 L/min
17927	Pump lid for LTC2

A full listing of product accessories and options is available in the Grant Scientific Reference Catalogue (a copy of which is available upon request) and on the Grant website at [www.grantinstruments.com](http://www.grantinstruments.com).

## 11.0 Troubleshooting

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Symptom	Possible cause	Action required
Unit fails to cool	Compressor overheated causing internal over-temperature thermostat to operate	Wait for compressor to cool, when thermostat will reset and compressor will switch on again.
Unit failing to cool below 5°C	Freezing protection switch is on and is preventing further cooling	Switch off freezing protection (see section 5.2.3).
Unit not cooling at higher temperatures	Over temperature protection switch has tripped	Refrigeration unit may have temperatures in excess of 100°C. Leave the unit to cool and reset (see section 5.2.3)
Cooling performance reduced	Condenser fins clogged	Carry out routine cleaning (see section 9.1)

For any other errors or service requests, please contact Grant Instruments service department.

## 12.0 Contact Grant Instruments

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At Grant we are continuously trying to improve the performance we offer our customers. If you have any feedback on Grant's products or services we would like to hear from you. Please send all feedback to:

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Tel: +44 (0) 1763 260 811  
E-mail: support@grantinstruments.com

## 13.0 Compliance

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### WEEE directive

Grant Instruments complies fully with the Waste Electrical & Electronic Equipment (WEEE) regulations 2006. We are a member of the B2B compliance scheme (Scheme Approval Number WEE/MP3338PT/SCH), which handle our WEEE obligations on our behalf. Grant Instruments have been issued with a unique registration number by the Environmental Agency, this reference number is WEE/GA0048TZ.

For information regarding WEEE collections in the UK please contact our B2B Compliance Scheme directly on 01691 676 124.  
For other countries please contact your equipment supplier.

For General WEEE information please visit: [www.b2bcompliance.org.uk](http://www.b2bcompliance.org.uk)

### RoHS directive

All the products covered by this manual comply with the requirements of the RoHS Directive (Directive 2011/65/EC).

### Electrical safety and electromagnetic compatibility

All the products covered by this manual comply with the requirements of the Low Voltage Directive (2014/35/EC) for electrical safety and the EMC directive (2014/30/EC) for electromagnetic compatibility.

### REACH Regulations

This product does not contain any Substances of Very High Concern (SVHCs) at greater than 0.1% that have to be identified in accordance with Regulation (EC) No 1907/2006 and therefore does not have an entry in the SCIP database.

## Notes

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