Grant
IN THE LABORATORY

Low temperature bath/circulator
R series

Operating instructions

Contents

1. Safety

1 Safety

The following symbols mean:-


Caution: Read these operating instructions fully before use and pay particular attention to sections containing this symbol.


Caution: Surfaces can become hot during use.


Always observe the following safety precautions.

☞ Use only as specified by the operating instructions, or the intrinsic protection may be impaired.

☞ After transport or storage in humid conditions, dry out the unit before connecting it to the supply voltage. During drying out the intrinsic protection may be impaired.

☞ Connect only to a power supply with a voltage corresponding to that on the serial number label.

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

☞ Connect only to a power supply which provides a safety earth (ground) terminal.

☞ Before moving, disconnect at the power supply socket.


Do not check the temperature by touch, use the temperature display (where applicable) or a thermometer.

☞ To reduce the risk of eye injury during high temperature operation, use safety goggles or spectacles.


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

☞ Ensure that the operating temperature is less than the maximum operating temperature of your sample material.

☞ Do not block or restrict ventilation slots.

☞ If liquid is spilt inside the unit, disconnect it from the power supply and have it checked by a competent person.

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

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


Take care when topping up or draining, as the liquid in the tank may be very hot or cold.


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.


Always use a lid or polypropylene spheres when operating above 60°C. Take care when raising and removing the lid, it may be hot. Steam and hot vapours can cause scalding.


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


Use only liquids specified in the 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.

☞ When pumping to external apparatus, always use connecting pipe or hose suitable for the operating temperature and liquid used, and check that the pipe connections are secure.

☞ Do not use Silicone tubing when pumping Silicone oil.

☞ Do not disconnect any pipes or hoses while they contain very hot or cold liquid.

☞ Refrigerated circulators are heavy, take care when lifting or moving; empty weights vary from 24kg to 88kg.


Do not touch condenser fins, they are sharp and may cut.

2. Getting started

2.1 Unit overview

Optima low temperature circulators provide a source of cooling for many sensitive analytical procedures. Applications requiring the precision temperature control of samples include spectrophotometry, viscometry, refractrometry 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.

2.2 Unpacking

Remove packing materials carefully, and retain for future shipment or storage of the unit. Packs should contain:

COOLER UNIT	R1	R2	R3	R4	R5	R1L	R2L	R3L	R4L
Lid	✓	✓	✓	✓	✓	✓	✓	✓	✓
Mains cable				✓	✓	✓	✓	✓	✓
Communications cable		✓	✓	✓	✓		✓	✓	✓
Interconnecting power cable	✓	✓	✓						
Operating instructions	✓	✓	✓	✓	✓	✓	✓	✓	✓
Operating voltage	240V	240V	240V	240V	240V	115V	115V	115V	115V

2.3 Installation

To avoid condensation on internal components, allow the unit to reach room temperature before switching it on.
Let the unit stand in its intended working position for 6 hours before switching on. This is to allow the oil to drain to the bottom of the compressor.
Position the equipment so that there is free air flow through it. Allow at least 100mm clearance from obstructions on all sides.

2.3.1 *Assembly - All models (see Fig 1)*

Remove the thermostat mounting plate from the tank by unscrewing the four black knobs located in the corners of the plate (1a).

Feed the Optima thermostat through the hole in the bridge plate, being careful not to force it. The thermostat can be located either facing forward or facing to the left. In either position three of the holes in the mounting plate will line up with holes in the thermostat unit (1b). Screw together using M3x6 stainless steel screws supplied with the thermostat unit.

Reattach mounting plate to unit (1c).

Fig 1a

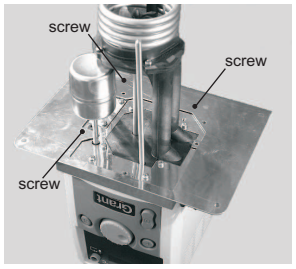

Fig 1b

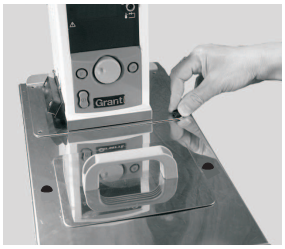

Fig 1c

2.3.2 *Power Supply R1, R2, R3 (see Fig 3a/3b)*

The Thermostat unit takes its power from the mains socket outlet (❷) on the rear of the cooler unit, via the interconnecting power cable.

Plug one end of this interconnecting cable into the power inlet socket on the rear of the Thermostat unit and the other end into the socket outlet (❷) mounted on the rear of the cooler unit.

Plug the mains cable (supplied with Optima thermostat) into the fused power inlet socket (❸) on the rear of the cooler unit.

Power Supply R4,R5 (see Fig 3c)

The Thermostat unit is connected from the twin fused power inlet socket directly to the mains with the IEC cable supplied with the Optima Thermostat. The refrigeration unit is connected from the twin fused power inlet socket (❸) directly to the mains with the IEC cable supplied with the Refrigeration unit.

Power Supply - 115v models (see Fig 3d/3e/3f)

The Thermostat unit is connected via its power cord directly to the mains . The refrigeration unit is connected via its power cord directly to the mains.

3. Operation

3.1 **Controls and features** (see Fig 2)

Ⓐ *Refrigeration unit power (mains) switch.*

Ⓑ *Over temperature protection re-set.*

The unit is protected from over heating by the over temperature cut-out. This will be actuated between 110°C and 120°C. To re-set the unit first wait for the liquid to cool below 100°C. Un-screw the black cap, under this is the re-set button, push in to re-set.

Ⓒ *5° Switch.*

With the switch in the ◉ position the minimum operating temperature is 5°C. Below this, 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 ◯● position the thermostat is bypassed allowing the unit to run at its minimum temperature.

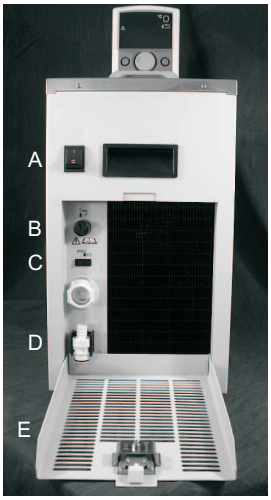

Fig 2

Ⓓ *Drain/ Drain insert (not fitted on R1/R1L Models).*

To drain the unit first 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 body and let the liquid drain. To release the drain insert push down the grey button on the drain body. Liquid to be drained should not be below 10°C or above 40°C.

Ⓔ *Removable grille*

Enables access to the condenser for easy cleaning.

3.2 Rear panel reference and description (see Fig 3)

❶ IEC outlet to accessory pump.
❷ IEC outlet to Optima Thermostat unit.
❸ IEC inlet to Refrigeration unit with integral twin fuse draw.
❹ Communications link socket. The refrigeration unit may be controlled with an Optima GR150 or GP200 thermostat unit. This is done by linking the thermostat to the refrigerator with the communications lead supplied. (See specific examples in section 4)
❺ Fuse protection for the Communications Lead.
❻ Mains input cable.
❼ Mains input fuse holders.

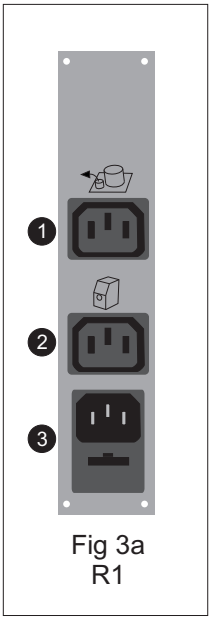

Fig 3a
R1

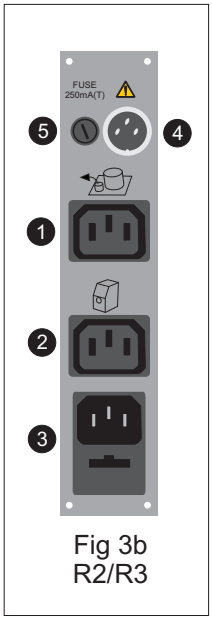

Fig 3b
R2/R3

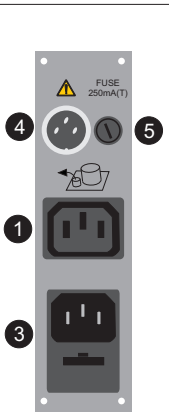

Fig 3c
R4/R5

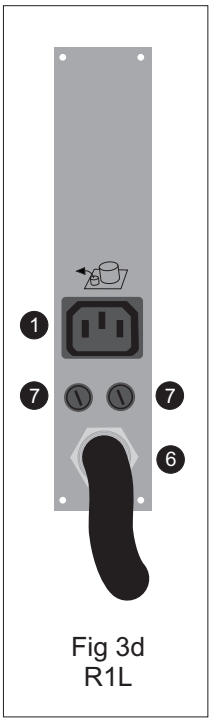

Fig 3d
R1L

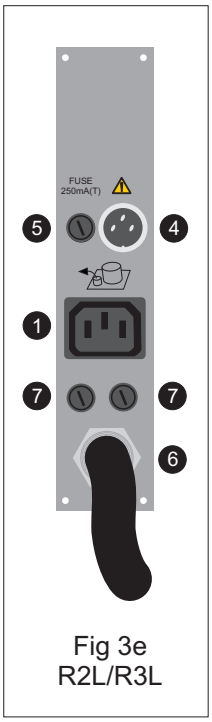

Fig 3e
R2L/R3L

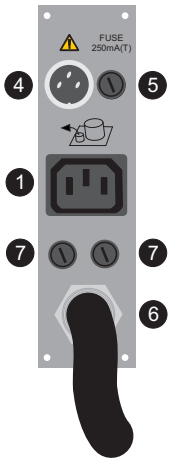

Fig 3f
R4L

3.3 Thermostat unit

Allowable temperature range with suitable Refrigeration Units:

OPTIMA UNIT	GA100	GD100	GD120	GR150	GP200
Max. temperature ºC	99	99	99	99	99
Min. temperature ºC	0	0	-20	-50	-50
Pump			✓	✓	✓
Use with communications cable				✓	✓

For information on operating the Optima Thermostat Units refer to the following operating instructions (as supplied with the units):

GA100, GD100, GD120.....Part No.17090
GR150, GP200.....Part No. 17091

REFRIGERATION UNIT	R1	R2	R3	R4	R5
Max. temperature ºC	100	100	100	100	100
Min. temperature ºC	-20	-20	-30	-30	-47

3.4 Filling

Before filling the tank, disconnect the mains power supply.
Allow for thermal expansion and contraction of the liquid and for any liquid in external circulation paths.

Temperature range	Specified liquids
-50 to 50ºC	*Silicone oil - low viscosity (Bayer silicone M3)* For safe disposal consult your Local Environmental Health Office
-30 to 30ºC:	*50% water, 50% antifreeze (inhibited ethylene glycol)* WARNING - TOXIC: Follow the manufacturer's instructions For safe disposal consult your Local Environmental Health Office
0 to 30º C :	*80% water, 20% antifreeze (inhibited ethylene glycol)* WARNING - TOXIC: Follow the manufacturer's instructions For safe disposal consult your local Environmental Health Office
+5 to 80º C:	*Water, recommended temperature range* Use a lid above 60ºC and below 10ºC
+80 to 99.9º C:	Water can be used, but care should be taken as hot water vapour can be dangerous, use a lid. At these temperatures the control of the temperature will not be as affective due to localised boiling, and there may be a large loss of water due to evaporation.

Note: Water from a drinking source and deionised water are suitable for use in the circulators. However, some older deionisers can create concentrated salt solutions for a short time after the ioniser is rejuvenated. This solution should not be used in the circulators as it may cause corrosion.

3.5 Switching on and setting up

WARNING: The equipment must be earthed (grounded). It is protected by internal electrical fuses. We strongly recommend that the power supply to any equipment for heating liquids should include a residual-current circuit breaker (earth leakage trip). Check that the voltage rating of the products, given on the serial number plate at the power cable entry, is correct for your supply.

DO NOT SWITCH ON before filling the tank.

Switch the power on at the front of the refrigeration unit and at the front of the Thermostat unit. Check that the display lamp is illuminated.

In section 4, are examples of setting up the refrigerator and the thermostat unit.

To perform programmed control functions on the Optima refrigeration units you require either a GR150 or GP200 Optima thermostat. All the refrigeration units can be controlled except the R1.

4. Specific examples

This section provides the user with specific examples of how the unit may be used to achieve certain requirements.

The refrigeration should not be switched (either **ON** or **OFF**) more than once during any five minute period.

WARNING *Before proceeding with a worked example please ensure you have read and understood the rest of this instruction manual.*

4.1 Example 1 - To control the liquid at 10°C, using a GD100 and R1

Equipment:

Any combination of Refrigeration unit and Thermostat can control a liquid at 10°C. As the refrigeration unit does not need to be switched on or off, the communications lead is not required.

Liquid:

As we are controlling at 10°C water can be used.

4.1.1

Procedure:

① Fill the bath with 4 litres of water.
② Using the IEC mains link, connect the Thermostat to the refrigeration unit. Connect the refrigeration unit to the mains power with the IEC cord. Switch refrigeration unit ON and switch the thermostat ON.
③ To set the temperature to 10°C press **S** so that **set point** temperature is flashing. Rotate the knob so that the required temperature is displayed. Press **S** again to set this temperature.

4.2 Example 2 - A four phase operation using a GP200 thermostat with either of the following units (R2/R2L, R3/R3L, R4/R4L, R5)

Requirement:

- Phase 1 Reduce the temperature to -20°C in 40 minutes.
- Phase 2 Keep the temperature at -20°C for 1 hour.
- Phase 3 Increase the temperature to 40°C in 40 minutes.
- Phase 4 Keep the temperature at 40°C for 20 minutes.

Equipment:

This type of complex thermal ramping requires the use of either a GR150 or a GP200 Optima thermostat. Any of the Refrigeration units can be controlled with the exception of R1/R1L. As this example will reduce the temperature down to -20°C, we can use any of these units. You will also require the Communications lead as supplied with the Refrigeration unit.

Liquid:

From the section on liquids you will see that the suitable type is 50% water and 50% glycol.

4.2.1 Procedure:

①Connect the socket end of the Communications lead to the Relay 1 connection on the rear of the GP200 and the plug end to the communications lead connection (❹) on the rear of the refrigeration unit.
Fill with liquid and turn on.
②Press **F** button on front of thermostat and rotate knob until [Selectliquid] is displayed. Press **S** and rotate knob to display [LowTempOil] and press **S.**
③Press **F** and rotate knob until [Programs] is displayed, press **S**. [P1] icon is displayed; rotate the knob until [Program Editor] is displayed and press select [Editprogram 1] Rotate knob so that [1Temp] is displayed.

Phase 1
①[1Temp] is displayed. Now press the **S** button so the temperature is flashing, rotate the knob to the required temperature of -20°C and press **S** to select.
②Rotate the knob so that [1Time] is displayed. Press **S** to adjust, the time will now flash, rotate the knob to the required time (in this case 40 minutes) and press **S** to select.

Phase 2
①Rotate the knob so that [1.InsertAfter] is displayed, press **S** and [2] will be displayed, introducing Phase 2.
②Rotate the knob so that [2Temp] is displayed and press **S,** the display will flash, adjust to -20°C then press **S** to accept.
③Rotate so that [2Time] is displayed and press the **S** button, adjust to 1 hour.

Phase 3
①Rotate the knob so that [2.InsertAfter] is displayed, press **S** and [3] will be displayed, introducing Phase 3.
②Rotate the knob so that [3Temp] is displayed and press **S** to adjust. Adjust to 40°C then press **S** to accept.
③Rotate so that [3Time] is displayed and press the **S** button to adjust to 40 minutes.
④As this example is heating to above ambient we do not now require the refrigeration unit to be on. Rotate the knob so that [3.Relays] is displayed, by pressing the **S** button you can activate the relays. A [*] next to the numbers [1] or [2] indicates whether that particular relay will be activated throughout Phase 3. Relay 1 needs to be activated, so press the **S** button until just the 1 [*] is displayed.

Phase 4

①Rotate the knob so that [3InsertAfter]is displayed, press **S** and another segment [4] will be displayed, introducing Phase 4.

②Rotate the knob so that [4.Temp] is displayed and press **S** to adjust. Adjust to 40°C then press **S** to accept.

③Rotate so that [4Time] is displayed and press the **S** button to adjust to 20 minutes.

④As we are still working at elevated temperatures we do not require the refrigeration. Rotate the knob so that [4.Relays] is displayed, by pressing the **S** button, activate relay [1].

⑤You have now finished programming. Press **F** (cancel) four times to bring you back to the display with [Int. Temp] and [SetPoint] on it. When the program has finished the thermostat unit will revert back to the **Set Point** temperature. To adjust this press **S** and adjust the temperature with the knob, then press **S** again.

⑥You can now run the program. Press **F** and rotate the knob until [Programs] is displayed. Press **S** to select [Program 1] and **S** again to start the program.

4.3 Example 3 - GR150/(R2/R2L, R3/R3L, R4/R4L, R5)

Requirement:

If the thermal ramping as described in example 1 is to be carried out with a GR150 thermostat, then Labwise software is required. Refer to Labwise Programming instructions (Grant Part No. 17093.0)

5. Fault diagnosis

Symptom	Possible cause	Action required
Unit does not operate	Unit not switched on	Switch on
	Unit not plugged into power supply	Plug in, switch on
	Fuse blown in unit or in plug (UK units only)	Check and replace
	Electrical power supply failure	Check that other electrical appliances on same circuit are working.
	Overtemperature cut-out has operated	Reset cut-out as described in thermostat Operating Instructions
Temperature does not rise when expected	Set temperature is lower than liquid temperature	Check set temperature
	Liquid level cut out has operated.	Check liquid level.
	Temperature control circuit fault	Have unit checked by competent person
Temperature continues to rise when not expected	Set temperature is higher than liquid temperature	Check set temperature
Unit fails to cool	Compressor over heated causing compressor internal overtemperature thermostat to operate	Wait for compressor to cool, when thermostat will reset and compressor will switch on again
	Temperature control circuit fault	Have unit checked by competent person

Symptom	Possible cause	Action required
Stirrer motor does not rotate or pump does not operate	Stirrer obstructed	Clear obstruction
	Pump obstructed	Clear obstruction
	If motor shaft rotates freely, then motor thermal fuse may have blown	Have unit checked by competent person

6. Technical specification

6.1 Technical Specification

This equipment is for indoor use and will meet its performance figures within an ambient temperature range of 10 to 35ºC with maximum relative humidity of 80%.

- •Installation Category II (Transient voltages).
- •Pollution degree 2 in accordance with IEC 664.
- •For operation at altitudes up to 2000 metres.

See following page for full specification

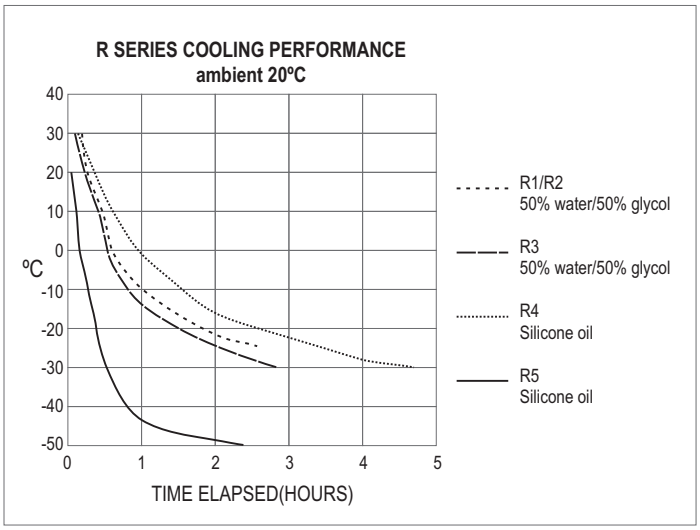

Fig 4 COOLING PERFORMANCE GRAPH

			R1	R2	R3	R4	R5
Temperature range	ambient 20°C	ºC	-20 to 100	-20 to 100	-30 to 100	-30 to 100	-47 to 100
Programmable			-	Refrigeration Switchable	Refrigeration Switchable	Refrigeration Switchable	Refrigeration Switchable
Typical cooling power ambient 20°C	@ 20°C	W	250	250	160	900	1100
	@ 0ºC	W	140	140	156	500	1050
	@ -10°C	W	100	100	120	300	800
	@ -20ºC	W	35	35	50	180	580
	@ -30°C	W	-	-	5	40	390
	@ -40ºC	W	-	-	-	-	130
	@ -47ºC	W	-	-	-	-	25
Refrigerant			R134a	R134a	R134a	R134a	R404a
Weight		Kg	19.2	19.2	19.2	37.8	47
Overall dimensions	w/d/h	mm	230/410/410	230/410/410	230/410/410	390/490/530	415/575/585
Tank capacity		L	5	5	5	20	12
Top opening		mm	110/145	110/145	110/145	230/305	260/115
Liquid depth	min/max	mm	80/140	80/140	80/140	80/140	120/180
Drain			no	yes	yes	yes	yes
Safety	100 deg C limit		Cut out	Cut out	Cut out	Cut out	Cut out
	H2O freezing protection		5°C T'stat and Switch	5°C T'stat and Switch	5°C T'stat and Switch	5°C T'stat and Switch	5°C T'stat and Switch
	Ref. Hi. Pres switch	W	-			27bar	27bar
Electrical power max	220-240V 110-120V	VA	334(50Hz) 328(60Hz)	334(50Hz) 328(60Hz)	354(50Hz) 370(60Hz)	850(50Hz) 850(60Hz)	1400 (50Hz) -
EMC emissions		Class	B	B	B	B	B

7. Pump specifications

7.1 Pumps

Pumps come as part of the GD120, GR150 and GP200 thermostats. For details on their operation please refer to the appropriate operating instructions (as supplied with the units):

GD120……..Part No.17090
GR159, GP200……Part No.17091

If greater head (pressure) is required you can choose from two accessory pumps and the appropriate pump lid.

VTP1 (head 10m/flow 9 litres/ min.).....240V 50Hz
VTP2 (head 17m/flow 12 litres/ min.).....240V 50Hz
VTP1L (head 10m/flow 9 litres/ min.).....110V 60Hz
VTP2L (head 17m/flow 12 litres/ min.).....110V 60Hz

Pump lid for R1/L, R2/L, R3/L
Pump lid for R4/L
Pump lid for R5

❶Pump attached to lid with four screws supplied.
❷Pump Lid (R1/L, R2/L, R3/L version shown).
❸Pump-output tube with internal bore suitable to fit 12.7mm diameter pump output. Secured with retaining clip.
❹Pump-return tube with internal bore suitable to fit 12.7mm diameter pump return. Secured with retaining clip.
The Pump and Lid assembly can now be attached to the Refrigeration unit using the two knobs supplied. The tubes can now be attached to the required equipment or apparatus.

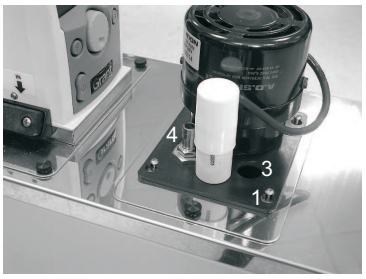

Fig 5 Pump in position

7.2 Performance graph

The graph below shows the shows the pressure and flow performance for the different pumps.

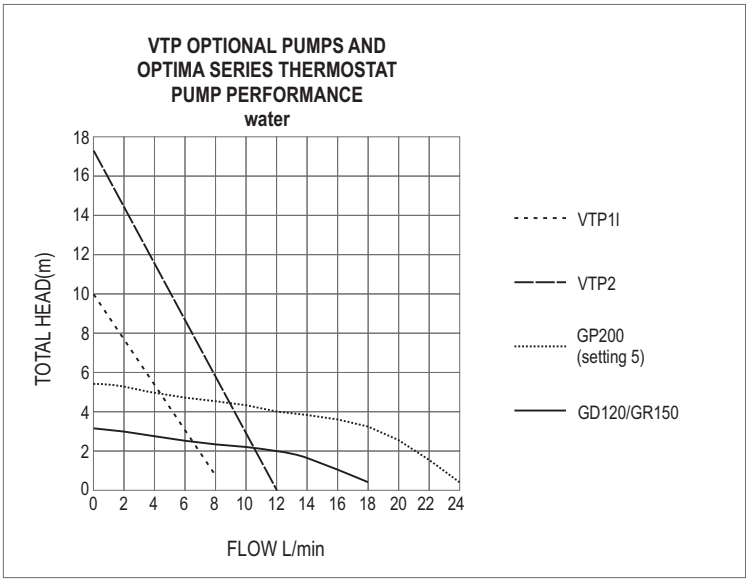

Fig 6 PUMP PERFORMANCE GRAPH

8. Maintenance

8.1. Cleaning

The case can be cleaned with a damp cloth after disconnection from the power supply. Do not use solvents. The immersed parts can be cleaned using proprietary heating element cleaners.

CAUTION: these may be toxic - follow the cleaner manufacturer's instructions.

Before using any decontamination or cleaning method other than recommended, check with our Service Department, or in other countries with our distributor, that the proposed method will not damage the equipment.

The removable grill enables easy access to the condenser for cleaning. Cooling power will be reduced if the fins become clogged with dust.
Examine monthly and, if necessary, use a vacuum cleaner nozzle and soft brush to remove the dust.

8.2. Replacement of fuses

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

Disconnect the unit from the power supply socket. Remove the IEC power plug from the rear of the unit. Press down the drawer catch (see Fig 3). Pull out the fuse drawer, check and replace with the correct value fuse:
Push back the drawer and replace the IEC PLUG.
On 110V versions where there is no IEC connector, there are however two fuse holders which can be unscrewed to access the fuses.

R1,2,3	15AT (1.25 x 0.25inch Anti surge ceramic)
R4	5AT (1.25 x 0.25inch Anti surge ceramic)
R5	10AT (1.25 x 0.25inch Anti surge ceramic)
R1L,2L,3L	5AT (1.25 x 0.25inch Anti surge ceramic)
R4L	10AT (1.25 x 0.25inch Anti surge ceramic)

9. Guarantee and service

9.1 Guarantee

When used in laboratory conditions and according to these operating instructions, this bath is guaranteed for THREE YEARS against faulty materials or workmanship.

9.2 Service

All Grant laboratory products are designed to comply with IEC1010-1 and can be flash tested. Some are fitted with radio frequency interference suppressors. Therefore it is recommended that only a dc test is performed.

No other routine maintenance is required.

Grant

Grant Instruments
(Cambridge) Ltd
Shepreth
Cambridgeshire
SG8 6GB England

Tel: +44 (0)1763 260811
Fax: +44 (0)1763 262410
www.grant.co.uk

Printed in England - Low temp bath circulator/R series/17908/UK