



FH16-D

Flow heaters

Operating instructions

Type: FH16 - D

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1 Safety

The following symbols marked on the equipment 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.
- 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 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 liquid in the system.
- Set the adjustable overtemperature cut-out after setting or changing the set temperature, and reset it at monthly intervals to check that the cut-out is operating correctly.
- Ensure that the mains switch is easily accessible during use.
- 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 system.
- Take care when topping up or draining, as the liquid in the system may be very hot or cold.
- If the **alarm** lamp is illuminated do not touch the liquid it 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 unit. 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.
- To prevent excessive pressure occurring during closed loop circulation, fill the system to a maximum of 95% of the total volume, to allow for liquid expansion.
- Do not disconnect any pipes or hoses while they contain very hot or cold liquid.

2 Installation

2.1 Unpacking

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

Packs should contain:

Flow heater

Operating instruction

2.2 Assembly

2.2.1 Open tanks

Connect the outlet pipe of FH to the input pipe at the bottom of the tank. Return to the FH from the top of the tank. Fill the tank, then fill the flow heater and tubing from a low pressure water supply or with a hand syphon pump. Disconnect the supply tubing under water to avoid letting air into the system.

2.2.2 Closed systems (BS15 cannot be used)

Fit a T-connection and a tap at the highest and lowest accessible points of the system. Fill through the lower tap from a low pressure water supply or with a hand syphon pump; clear air through the upper tap. Close the taps and switch on. Trapped air in the liquid can cause damage to the pump and reduce the flow rate. Ensure that all hose clips are tight or air may be drawn in at the joints. To clear air from the liquid, switch the circulator on and off at 15 second intervals. Repeat until no bubbles of air are seen to come out of liquid in the pipes and pump runs quietly.

To prevent excessive pressures occurring when circulating liquid in any closed loop system, allowances for the expansion of the liquid with temperature must be made. Therefore the system **should not** be filled to more than 95% of its total volume, thus leaving 5% for expansion at the top of the system.



2.2.3 Low volume

If the volume of liquid within the system is low, less than one litre, temperature control can be improved by adding an insulated reservoir between the flow heater output and the external apparatus.

2.2.4 Low flow rates

Use a BS15 bypass if the external apparatus has restrictions which reduce the flow rate below two litres per minute; connect the upper large pipe (15mm outside diameter) on the BS15 to the flow heater outlet and the lower to the inlet. Connect the small pipes (6 mm outside diameter) to the external apparatus. Fill by removing the top cap and filling through the small header/vent tank. Remove air as above, keeping BS15 the full by adding liquid as necessary.

2.2.5 Working below room temperature

When a BS15 bypass is used, connect the flow cooler between the BS15 and the FH inlet. FC1 water cooled flow cooler can be used for temperatures down to 15°C above tap water.

2.2.6 FH16 - D external temperature sensor

Use for improved control in external apparatus. Control is assumed by the external sensor when it is plugged in to the socket. The tip of the external sensor should always be immersed at least 25mm in the circulating liquid. Position the sensor at the point in the system at which optimum control is required.

3 Operation

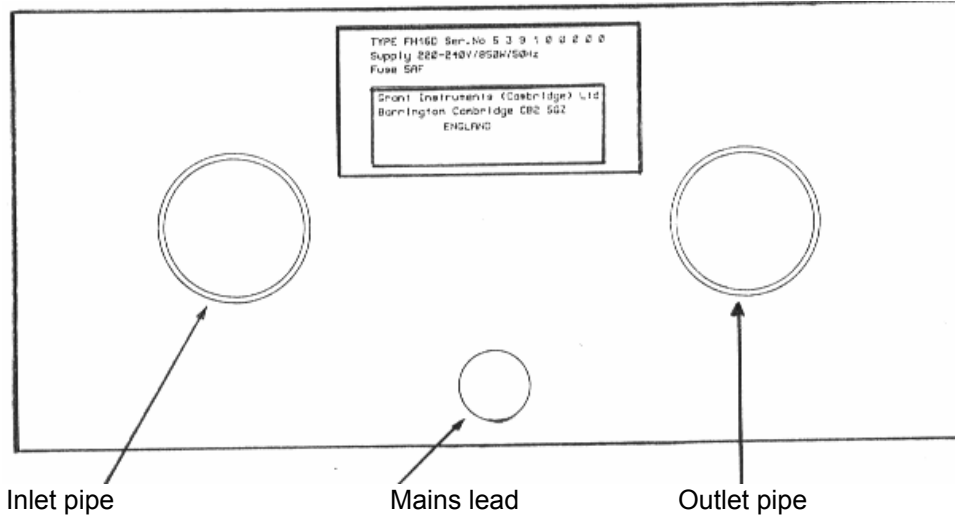
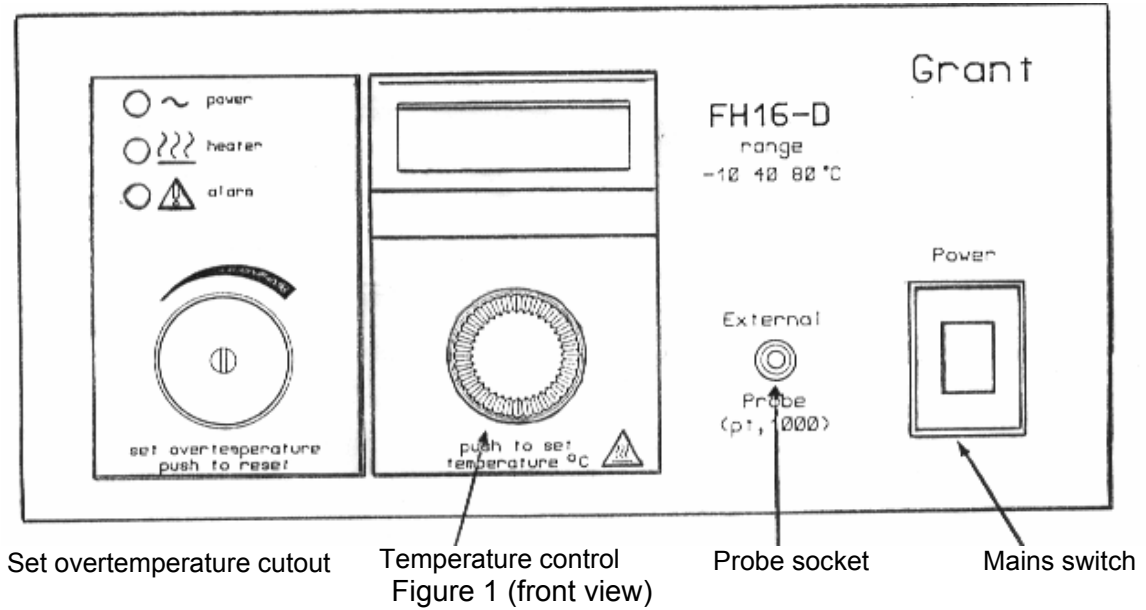


Figure 2 (rear view)

3.1 Controls and indicator lamps

3.1.1 Power

The **power** (mains) switch is located on the front panel. The switch is illuminated when the power is ON.

If the unit does not come on, check whether the "**alarm**" lamp is illuminated (see 3.1.6).

3.1.2 Power lamp

The **power** lamp on the front panel indicates that the mains power supply is on.

3.1.3 Heater lamp

The **heater** lamp (orange) on the front panel indicates when the heater is on. While the liquid is warming up, the lamp is on continuously, and it starts to flash as the temperature reaches set point. When the unit is controlling at set temperature it flashes intermittently.

3.1.4 Temperature display

Digital units

The **temperature** display normally shows the temperature in °C of liquid being controlled. It displays set temperature when the **push to set °C** knob is pressed.

Analogue units

The set **temperature** is indicated on the dial.

3.1.5 Set temperature knob

Digital units

Push to set °C

Press knob to change display from liquid temperature to set temperature, and at the same time rotate the knob to set the required operating temperature.

Analogue units

Turn the set temperature knob to required temperature.

3.1.6 Alarm lamp



The **alarm** lamp (red) on the front panel illuminates when the over temperature cut-out has operated.

When the **alarm** lamp is illuminated, first check the liquid level and refill if necessary, press the overtemperature cut-out button to reset the cut-out. If the **alarm** lamp does not go out, set overtemperature as described in 3.3.

3.1.7 Set overtemperature knob

Set overtemperature (push to reset) control. The cut-out operating temperature is adjustable. If the liquid temperature rises above the cut-out set temperature the heater and stirrer are switched off. The cut-out is re-set by pressing the knob.

Digital units

The front of the knob has a hole through which adjustment can be made with a screwdriver.

Analogue units

The control knob can be adjusted with fingers.

3.2 Filling

Before filling the bath, disconnect the mains power supply.

When the system is fully loaded, fill to the correct level (see 2.2.2).

+5 to 80°C Water, recommended temperature range.

Use a lid or polypropylene spheres above 60°C to reduce evaporation and heat loss when operating with an open load.

3.3 Switching on and setting up

3.3.1 Connection to supply

Connect the inlet and outlet pipes to your external circuit.
Connect the control unit to a grounded (earthed) electrical power supply with voltage and frequency within the range specified on the serial number plate.

DO NOT SWITCH ON BEFORE FILLING THE SYSTEM.

Running with no liquid in the pump can destroy the pump

Before switching on for the first time, turn the **set overtemperature** control fully clockwise. Press the knob to ensure that it is reset.

Switch the **power** on and check that the **power** lamp is illuminated.

3.3.2 Setting temperature

Press the **push to set °C** knob and rotate to set the required operating temperature.

Wait until the liquid temperature has stabilised at the operating temperature.

3.3.3 Over-temperature cut-out

After the temperature has stabilised at the required set temperature, adjust the **set overtemperature** control as follows:

Turn the control anticlockwise, using a screwdriver, until the **alarm** lamp comes on. Press the knob to reset it and turn slowly clockwise until the **alarm** lamp goes out. This gives an overtemperature trip point of approximately 30°C above set temperature.

If a trip temperature nearer to the set temperature is required, note the position of the **set overtemperature** control at the points where the alarm lamp comes on and where it goes off. Then turn the control anticlockwise three quarters of the way back towards the point where the **alarm** lamp came on. This prevents liquid temperature rising more than about 10°C above set temperature in the event of a malfunction.



4 Accessories

4.1 FC1

FC1 water-cooled heat exchanger is designed for use with tap water, and can be used when the required operating temperature is 2°C or more above the temperature of the tap water, down to a minimum of 15°C. Inlet and outlet pipes are 15mm o.d, cooling water connection 6mm o.d. If a lot of heat is produced in the external equipment, and FC1 flow cooler can be placed.

4.2 BS15 filler/de-aerator and bypass system

Good temperature control depends on an adequate flow through the flow heater. If narrow tubes or small cells restrict flow, a bypass system is required. The bypass ensures that most of the flow takes place in a large bore loop, with a smaller flow through the external circuit. The BS15 simplifies filling and de-aerating of closed systems; the top of the bypass chamber has a vent hole to release trapped air and the whole top can be removed for filling. Connecting pipes for the external circuit are 6mm o.d. connections to the flow heater are 15, o.d.

4.3 Pipe insulation PF2

PF2 foamed polyurethane tubing for insulating flexible pipes between flow heaters, coolers and other equipment; supplied in 2 metre lengths 16mm internal diameter and 9mm wall.

4.4 Remote temperature probes: FH16-D


Remote, plug-in temperature probes may improve the accuracy of control or display by sensing temperature in the external apparatus being controlled. Standard probes are fitted with two metres of cable.

Special probes can be supplied for use in corrosive liquids.

4.4.1 The FF17 probe has a very fast response, with the sensing element at the end of a flexible nylon probe 10mm long and 4.5mm external diameter.

4.4.2 The LL17 stainless steel probe is more robust but has a slower response. It is 125mm long and 5mm diameter.

5 Fault diagnosis

	<u>Symptom</u>	<u>Possible Cause</u>	<u>Action Required</u>
	Unit does not operate	Unit not switched on	Switch on
	Power lamp off	Unit not plugged into power supply	Plug in, switch on
		Fuse blown in the unit or, for UK units, in the plug	Check and replace
		Electrical power supply failure	Check that other electrical appliances on same circuit are working
	Alarm light on	Overtemperature cut-out has operated	Reset cut-out as described in 4.6
	Temperature does not rise when expected	Set temperature is lower than liquid temperature	Check set temperature
		Set temperature is too close to ambient	Raise the set temperature or fit accessory cooling
		Temperature control circuit fault	Have unit checked by a competent person
	Temperature continues to rise when not expected	Set temperature is higher than liquid temperature	Check set temperature
		Temperature control circuit fault	Have unit checked by a competent person
	Pump does not operate	Pump obstructed	Clear obstruction

6 Technical Specification

This equipment is for indoor use and will meet its performance figures within an ambient temperature range 10 to 35°C 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.

	FH16 - D
Temperature Range	Ambient 15°C to 80°C (FC1 is required for operation at or below ambient)
Stability (DIN 58966) at 37°C	± 0.004
Supply voltage range	220-240V 50/60 Hz 110-120V 50/60 Hz
Power rating - 230V	0.85kW
Heater power - 230V	0.75kW
Overall dimensions l/w/h (mm)	340/205/140
Overtemperature protection is by variable resettable cut-out.	
Pump Performance:	Max head 2.2m Max flow 19 lit/min at zero head. Pump bore 6mm

7 Maintenance and service

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

Inspect and replace where necessary any worn or damaged hoses.

The overtemperature cut-out should be checked periodically by turning the set overtemperature control anticlockwise until the alarm lamp comes on. The cut-out should then reset and set-up. If the alarm lamp fails to light with the knob fully turned anticlockwise the unit should be checked by a competent person.

No other routine maintenance is required.

DO NOT RETURN THE TANK

7.1 Cleaning

The cases can be cleaned with a damp cloth after disconnection. 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 except that recommended, check with our Service Department, or in other countries with our distributor, that the proposed method will not damage the equipment.

7.2 Replacement of fuses

Digital unit

Disconnect the unit from the power supply socket.

Locate the fuses on the front panel.

Use screwdriver of correct size to turn the fuse holder cap a quarter turn anti-clockwise to release the fuse holder cap.

Check and replace fuse if necessary.

Replace with the correct fuse: 1.25 x 0.25 inch ceramic quick acting.

Rating: 220-240 V 5 AF

115 V 15 AF (check on rating plate label)

8 Guarantee

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

9 Service

For service, return for repair to our Service Department in the UK or, in other countries, to our distributor.

Service Address: Grant Instruments (Cambridge) Ltd.
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