

HAAKE

Circulators

Instruction Manual
F3* • F3/H41 • F3-S • F3-M
F3-C • F3-CH • F3-K • F3-Q

****) Deals also with the use of the F3 in combination
with various bath bridges and large volume HAAKE
bath vessels as for instance W13, W19, W26 etc.***

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General Remarks





This device may only be operated with close adherence to the following instructions!

This instruction manual describes how this circulator is to be used.

The following should especially be kept in mind:

- ! The device should only be used by trained personnel in conjunction with the instruction manual.
- ! Only personnel with the particular know how should be allowed to carry out repairs.
- ! Only original parts and accessories should be used if repairs are carried out.
- ! The thermal liquids used should not have aggressive properties with a tendency to harm the stainless steel (V2A quality).
- ! This device should not be operated in rooms used for medical purposes and/or in the vicinity of patients. (IEC 601-1)

The symbols used in this manual and their meaning:

- ! Warns that damage to the device and injuries to the user are possible.
-  Denotes an important remark.
-  Indicates the next operating step to be carried out and ...
- ⇒ ... what happens as a result thereof.

Any questions?

Whenever you wish to make any inquiries concerning this device you should mention the type printed on the front side of the device (e. g. HAAKE "F3"; HAAKE "K") and also the information on the name plate.

Safety Hints



The following measures were taken for the protection of the operator:

- Protection Class I according to VDE 0106 T1
i. e. protection against electric shocks by grounding all parts within easy reach of the operator.

This necessitates the following:



The device must only be connected to mains receptacles with a protective ground.



The device must not be opened while it is still connected to the mains.

- Protection IP 30 according to DIN 40 050
i. e. regarding the protection against accidentally touching live parts and damage by foreign matter, it has been taken care that parts with a thickness or diameter of 2.5 mm cannot enter. Do not push wires or tools through any of the three openings.



No special precautions were taken against the penetration of water and dust. The device should therefore not be used in a dusty atmosphere or in the neighborhood of spray water which may penetrate.



Positive separation from the mains is required when:

- all dangers caused by this device are to be avoided.
- repairs or settings by authorized personnel are about to be made.

Positive separation means:

Pull out the mains plug!

Description of Device

1. Description

All devices correspond to the safety class 2 according to DIN 12879 and may be employed for unsupervised permanent operation.

1.1 F3, F3-S, F3-M and F3-W(...)

The circulator F3 can be used as bridge circulator for several open baths in combination with the bath bridges H41 or H44. In combination with the HAAKE bath "S", "M" and "W" (e.g. W13, W15) it becomes a heating bath and circulator for operation above ambient temperatures. The integrated cooling coil can be used for tap water cooling in a temperature range approx. 2° to 3°C above the given cooling water temperature.

Operating Temperature Range: + 45° → 250°C.

Effective Temperature Range (Setting Range): Down to -100°C (this requires suitable refrigerating means).

1.2 F3-C, F3-CH, F3-K, F3-Q and F3-V

All of these devices are combinations of the circulator F3 and refrigerating baths operated by cooling compressors. With these, the operating temperature can be extended clearly below the freezing point of 0°C (32°F). (-5°C for the "V" bath).

Mode of Function: controlled heating against permanent cooling.

There are three fields of use:

- A) Using cooling compressors for generating lower temperatures instead of costly tap water cooling.
- B) For obtaining low temperatures within the given operating temperature range.

Operating Temperature Range → F3-C: -20° → 150°C
→ F3-CH: -30° → 150°C
→ F3-K: -40° → 150°C
→ F3-Q: -60° → 50°C
→ F3-V: -5° → 150°C

- C) For bringing a heated bath quickly to a lower temperature level.

Description of Device

This instruction manual firstly describes how the F3 is put into operation and how it is operated when combined with the bridges and the baths "S", "M" or "Wxx".

All highlights regarding the operation of the refrigerated circulators and cryostats F3-C, F3-CH, F3-K, F3-Q and F3-V can be found on page 39.

1.3 Application

- Temperature controlling liquid samples (in containers) or solid samples in the bath of the circulator. The samples can be inserted through the bath opening.
- Temperature controlling of open and closed external vessels.

Open vessels = Baths or containers into which the thermal liquid is pumped. The liquid is sucked back from the surface thus creating a liquid circuit. It is recommended to use a level controller either in the circulator bath or in the external vessel. (Optional accessory from HAAKE.)

Closed vessels = Temperature jackets, heat exchangers and similar devices supplied with temperature controlled liquid in a circuit for which the pressure pump is sufficient.

1.4 Control Modes (see 9.5 p. 32)

- Controlling in the bath by means of the integrated Pt100 sensor.

The temperature and fluctuation (+/- accuracy) of the sensor are indicated at the display. The sensor is located at the most favorable position for good controlling action next to the heater coil. This means that the fluctuation range displayed is in reality, wider than what is actually the case within the bath or external vessel. (If the digital display shows "jumps" of several $1/10$ K, this is no malfunction!)

- Controlling in external vessels via external Pt100 sensor.

At the display the temperature and fluctuation of the external sensor are indicated, which might deviate considerably from the conditions within the circulator bath. This controlling mode is to be preferred for the temperature control of external vessels as here the constantly changing temperature differences between the circulator and the external vessel can be compensated for.

Description of Device

1.5 Temperature Presetting (see 9.3 p. 30)

- *"internally"* via an integrated digital setting device.
- *"externally"* via a programmer or interface (optional accessories), in order to enable time-linear and ramp-type temperature changes.

1.6 Application of the F3 with bridges

- F3 with bridge H44 in combination with HAAKE baths W13, W15, W19, W26, W45 or W46.
- F3 with bridge H41 in combination with other baths of any given width between 300 and 800 mm. (Adjustable with bridge extensions.)

When a HAAKE bath is used, the bridge is fastened to the rear edge with two screws where it is securely held. The F3 can be mounted prior to or after attaching the bridge to the bath.

The assembly is described in chapter 3.2

The remainder of the bath can be covered with lids (optional) of stainless steel or plastic (up to 60°C).

1 bath lid can cover an opening of 175 x 300 mm. The number of lids required can be calculated by dividing the total length of the opening in mm by 175 mm.

Example: Bath W19 with an opening of 500 x 300 mm.
The bridge H42 has a width of 150 mm.
The remainder of the opening = 350 x 300 mm
can be covered with 2 lids. ($350 / 175 = 2$)

Unpacking

2. Unpacking

Transportation damage?

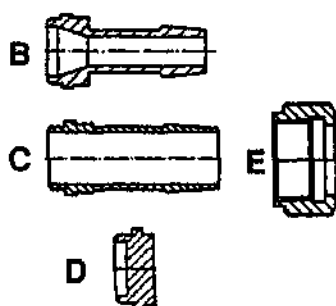
- Inform freight agent (Railroad, Post, UPS or other),
- Prepare protocol of the damage.

Prior to returning something:

- Inform sales agent or manufacturer (quite often minor things can be regulated without having to go through the costly motions of returning a shipment.

2.1 Contents (please check)

F3 with the bridge ordered and F3-S or F3-M:



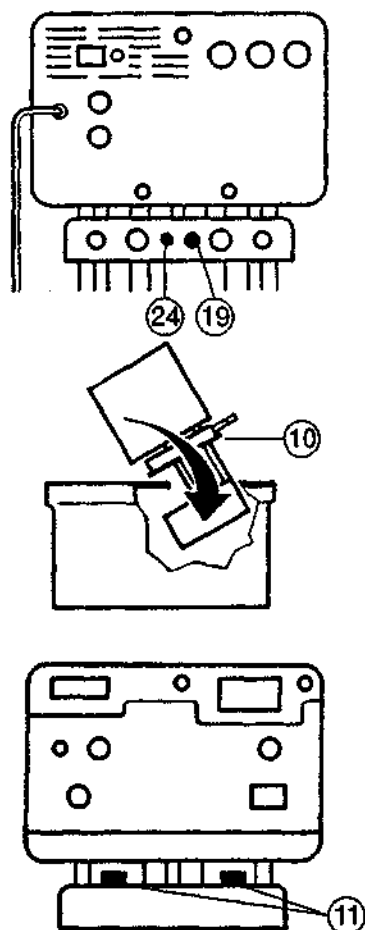
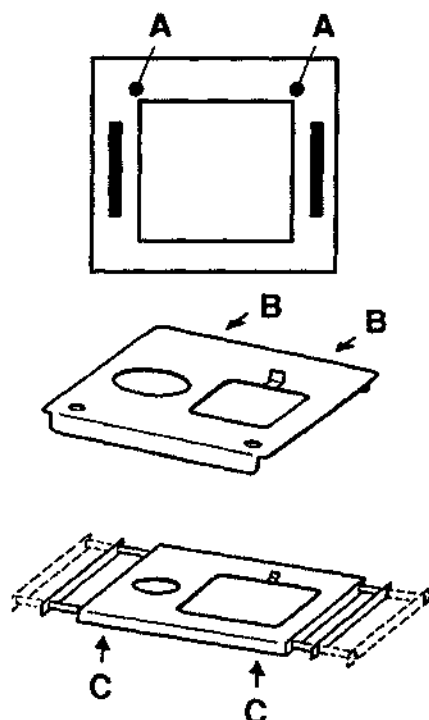
- | | |
|---|---|
| 2 Coupling Nuts (E),
(already assembled) | 1 Hose (Perbunan)
8 mm Int.-Ø, 2 m long, |
| 2 Plug pieces (D),
(already assembled) | 1 Hose (Perbunan)
12 mm Int.-Ø, 2 m long, |
| 2 Hose fittings
for hoses 8 mm Ø (B), | 4 Hose clamps, |
| 2 Hose fittings
for hoses 12 mm Ø (C) | 1 Instruction Manual |
| 1 Silicon Plug or bung, | 1 Warranty Card
(please fill out and return) |

F3-C; F3-CH; F3-K and F3-Q:

In addition to the accessories listed above:
2 x 2 m Foam rubber insulation for the hoses,
Connection cable between F3 and refrigerated bath.

! The standard hose is only suitable for temperatures up to 100°C!

Setting Up



3. Setting up

Assemble bridge: (only bridge circulator F3, open-bath circulators F3-W13, F3-W19 and F3-V and refrigerated bath F3-K)

3.1 Refrigerated Bath F3-K:

- 1 The bridge (with F3 ready assembled) is placed onto the rear end of the refrigerated bath and fastened with two screws at A on the cover plate.

3.2 Bridge Circulator F3: Open-bath Circulators F3-W13, F3-W19 and F3-V

3.2.1 Using HAAKE baths

- 1 Fasten bath bridge H44 at the rear end of the bath edge with two thumb screws B

3.2.2 Using other baths

- 1 Fit width of bridge to the width of the bath vessel by loosening and tightening the screws C. Place bridge onto the bath vessel.

3.2.3 Assemble F3 to the bridge

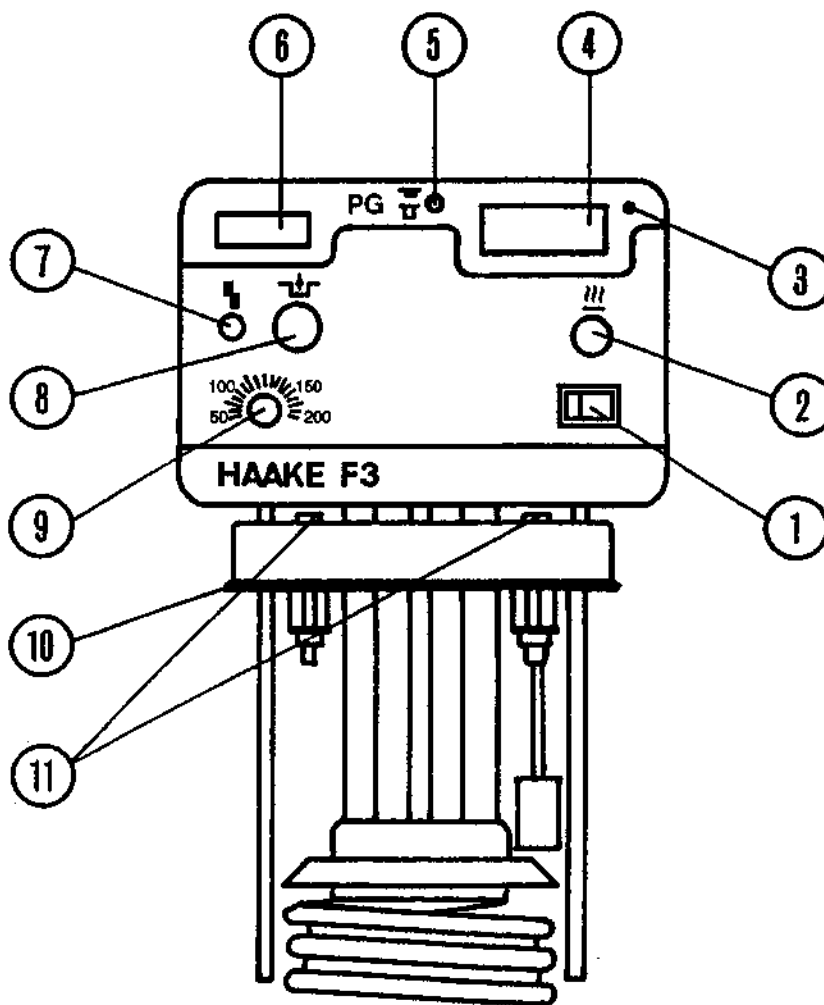
- 2 Turn the eccentric screw 19 so that its punch mark shows to the top.
- 3 Tilt F3 slightly and insert it into the opening as shown. Place it onto the surface (taking care that the profiled gasket 10 is uniformly pressed down on all four sides). The catches 11 must reach under the front edge of the cover plate.
- 4 Tighten fastening screw 24 lightly.
- 5 Turn the eccentric screw 19 so that its punch mark shows to the right.
- 6 Tighten fastening screw 24 completely.
- 7 Tighten the two clamping screws 11 with an 8 mm open end wrench. In doing so be careful, tightening these screws too much will destroy the gasket 10.

Reverse the sequence for disassembly.

Function and Operating Elements

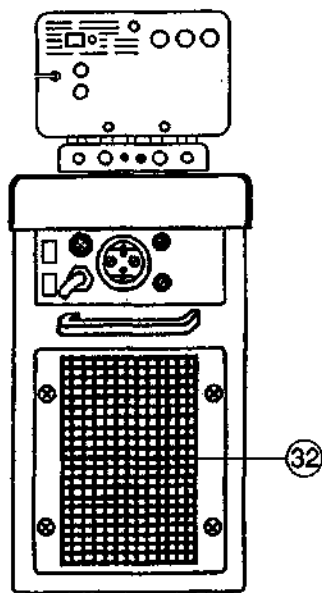
4. Function and Operating Elements

4.1 F3 - Front Panel



- 1 Mains switch with power control light (green)
- 2 Heater control light (yellow)
- 3 Potentiometer for temperature fine setting
- 4 Digital switch for temperature presetting
- 5 Toggle switch (inter/extern) for temperature presetting (external presetting e. g. via the programmer "PG")
- 6 Temperature display (LED)
- 7 Malfunction indicator (red)
- 8 Reset switch
- 9 Excess temperature limiter
- 10 Profile gasket
- 11 Clamping screws with clamps

Setting Up



3.3 Period of rest after transportation (pertains to refrigerated baths only)

Coolant/oil can get into the piping of the unit during transportation.

This, in turn, would hamper the lubrication of the compressor and cause possible damage.

➡ Set up the unit and allow a period of rest for 24 hours.

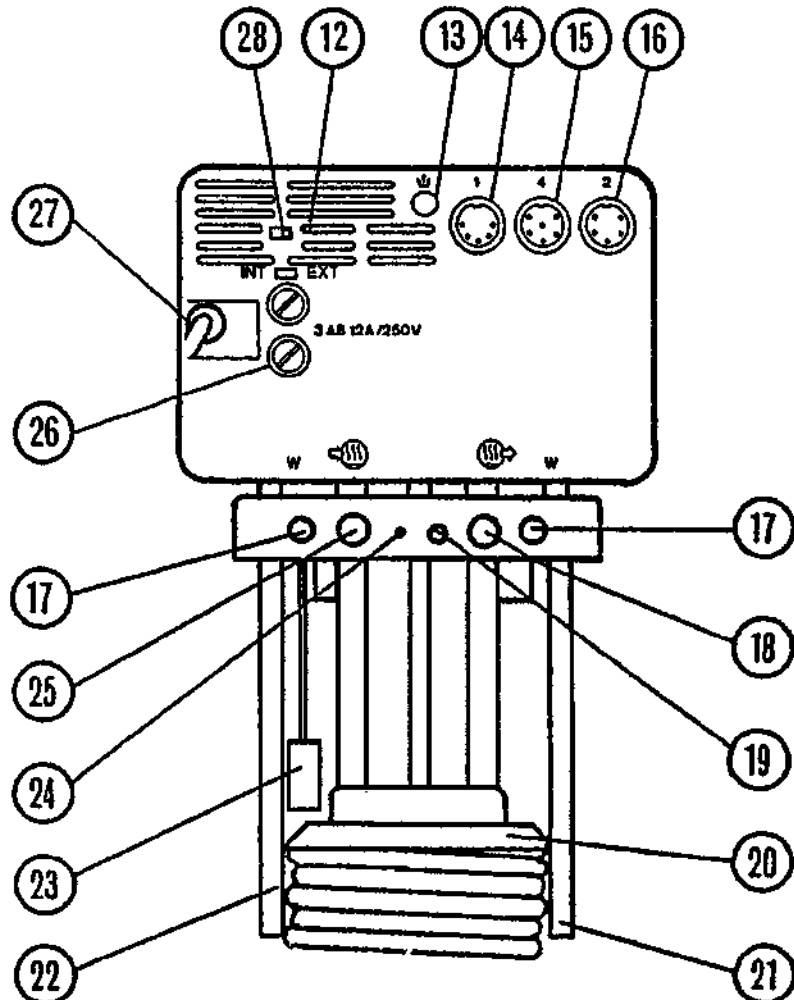
3.4 Air Circulation (pertains to refrigerated baths only)

➡ All venting grids (e. g. 32) should be kept open so that the air circulation is unobstructed.

! Clogged up venting grids will cause overheating of the unit and possible malfunction.

Function and Operating Elements

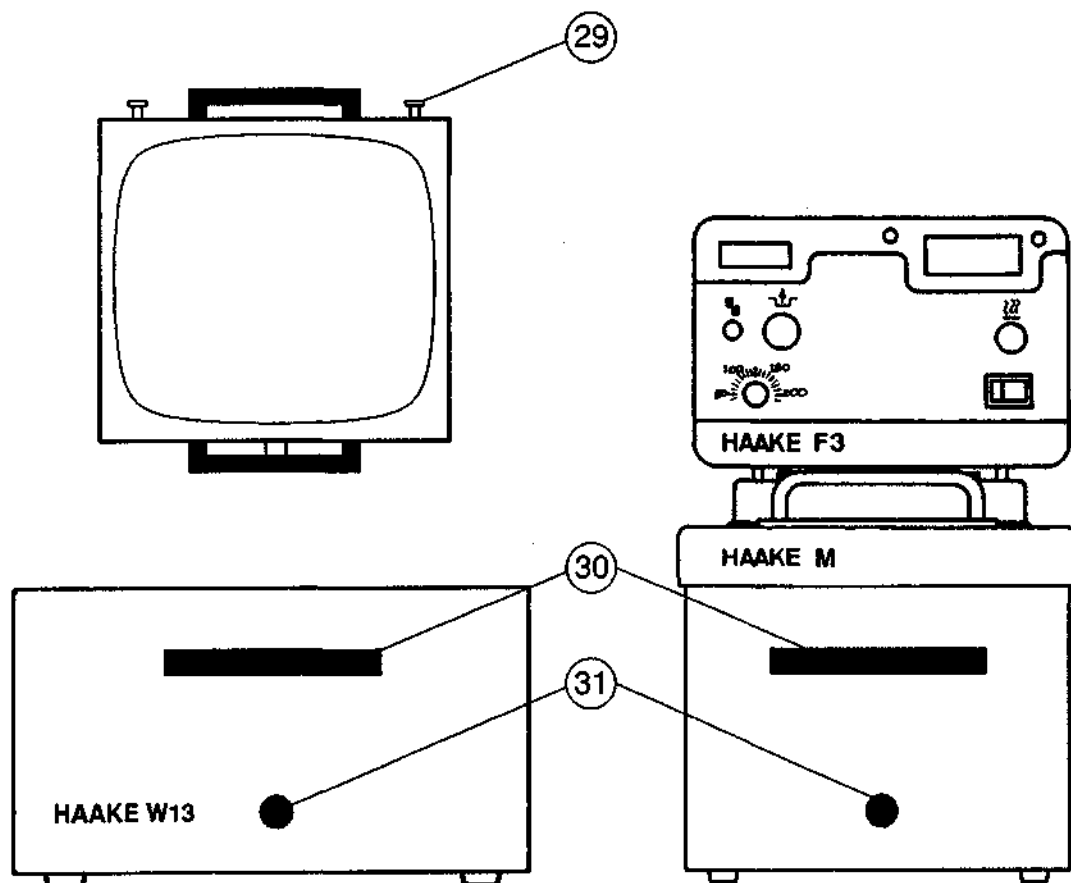
4.2 F3 - Rear Panel



- 12 Potentiometer for line length compensation when using an external Pt100 sensor
- 13 Jack plug socket (external release/reset)
- 14 Socket (1) for connect. external temperature controller and/or external Pt100 sensor
- 15 Socket (4) for control cable to a refrig. bath vessel
- 16 Socket (2) for monitoring functions
- 17 Cooling coil fittings (tap water cooling)
- 18 Pump pressure port fitting
- 19 Eccentric locking screw
- 20 Combined pressure/suction pump
- 21 Excess temperature sensor
- 22 Control and measuring sensor Pt100
- 23 Float for low liquid level switch
- 24 Fastening screw
- 25 Pump suction port fitting
- 26 Fuses
- 27 Mains cable with protective ground connector
- 28 Selector switch – Control mode (INT/EXT)

Function and Operating Elements

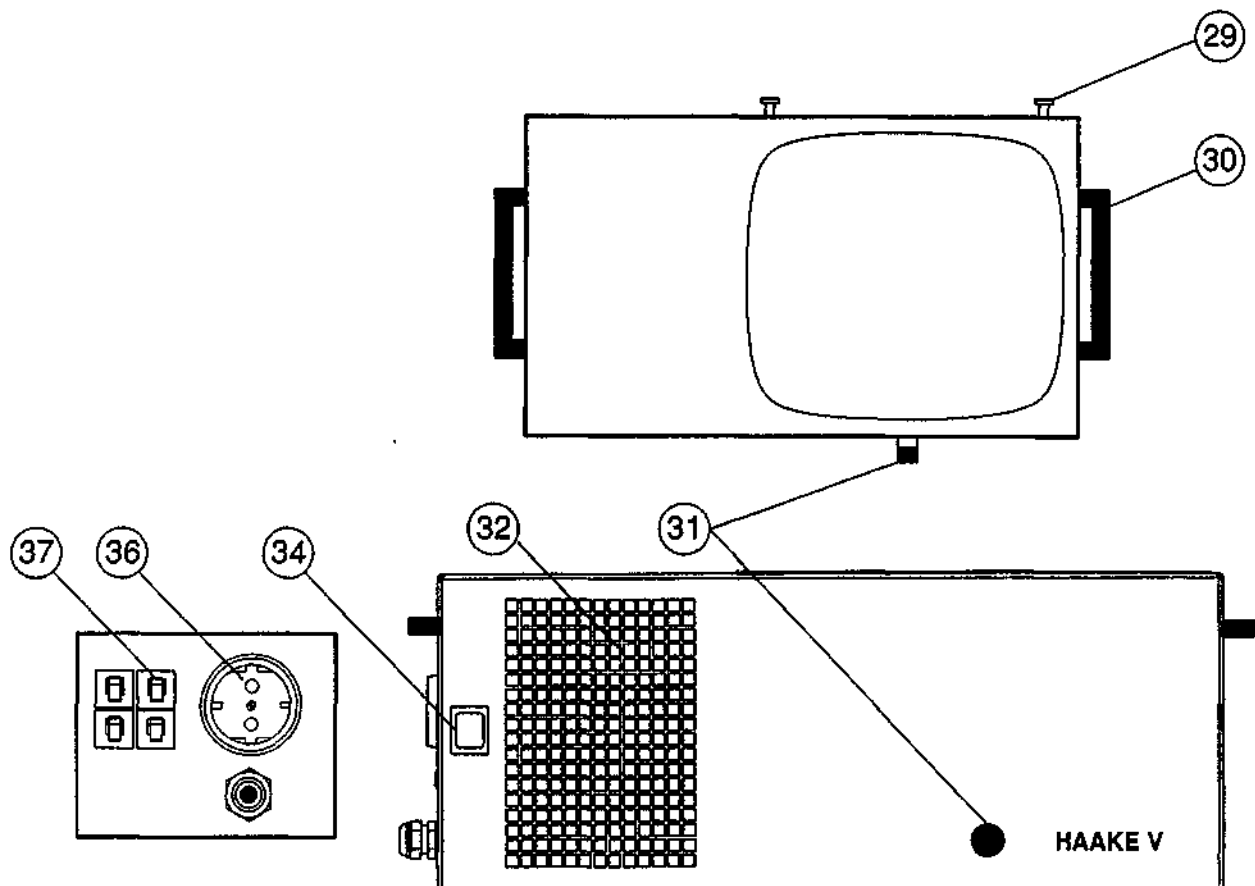
4.3 Bath Vessels "W" (exemplary) and "M"



- 29** Mounting screw for angle bracket
or bath bridge
- 30** Carrying handles
- 31** Drain plug

Function and Operating Elements

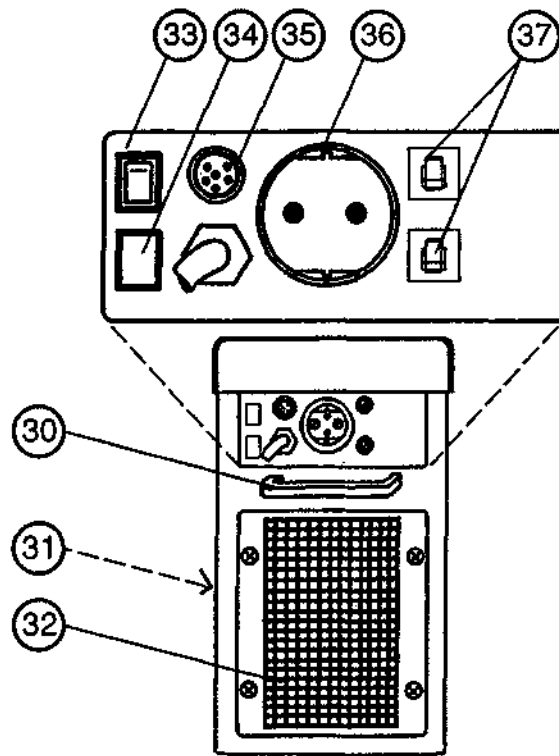
4.4 Bath Vessel "V"



- 29 Mounting screw for angle bracket or bath bridge
- 30 Carrying handles
- 31 Drain plug
- 32 Venting grid
- 34 Mains switch for cooling unit
- 36 Mains switch for temperature control unit
- 37 Safety cutouts (not intended for manual activation, manual triggering destroys the switching contact!)

Function and Operating Elements

4.5 Refrigerated bath "CH" (exemplary for C, K and Q)



- 30** Carrying handles
- 31** Drainage opening (at unit front)
- 32** Venting grid
- 33** Switch for autom. fan (F3-CH only)
- 34** Mains switch for cooling unit (not applicable for F3-Q)
- 35** Socket for control cable to the F3
- 36** Mains receptacle for the F3
- 37** Safety cutouts (not intended for manual activation, manual triggering destroys the switching contact!)

Electrical Connections

In case there are no connections to be made at the three rear sockets, continue at page 19!

In any case where a cooler unit is in use, the cable connection described in 5.5 applies.

5. Electrical Connections

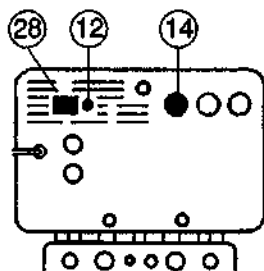
At the rear panel of the F3 there are three sockets for connecting auxiliary equipment.

Necessary plugs:

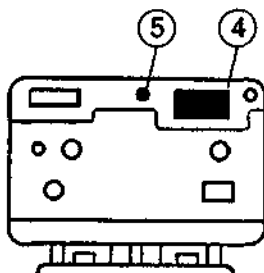
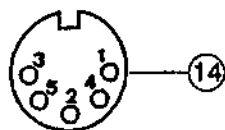
14 = 5-pin diode plug, 180° angle (Order No. 087-0648)

15 = 6-pin diode plug, 270° angle (Order No. 087-1336)

16 = 5-pin diode plug, 270° angle (Order No. 087-1955)



Socket 1



5.1 External temperature presetting (14)

(Presetting device, programmer, computer interface)

Connection at socket 1:

Pin 2 Reference potential "Neutral"

Pin 5 Voltage input $U_{\text{Actual}} 0^{\circ}\text{C} = 0,00\text{V}; 10\text{mV}/^{\circ}\text{C}$

When using:

Switch 5 to "On" (depressed),

Switch 28 to "intern"

5.2 External Pt100-Control Sensor (14)

To be connected to socket 1:

Pin 1+3 Pt100 Sensor

When using:

Switch 5 to "Off" (not depressed),

Switch 28 to "extern"

The external sensor has to be **balanced** as the length of the cable influences measuring results.

- 1 Connect external control sensor and insert into the middle of the bath.

In the internal control mode a fixed temperature is to be preset with the digital switches 4. Switch 5 on "Off" (not depressed) and switch 28 to "intern".

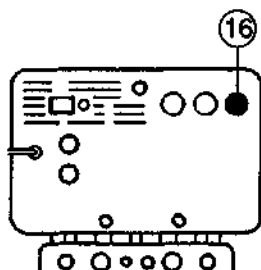
- 2 As soon as constant temperature conditions have been reached, switch 28 is set to "extern". The temperature displayed will change. Adjust the potentiometer 12 until the temperature value previously shown in the internal control mode is reached again.

Electrical Connections

In case the external temperature presetting and the external control sensor are to be used simultaneously an additional cable is required (V-Cable, HAAKE Order No. 222-1186).

In this mode:

Switch 5 to "On" (depressed), Switch 28 to "extern"



5.3 Remote Monitoring (16) at Socket 2

Pin 2 Safety circuit input (5-12V at 10mA min.)

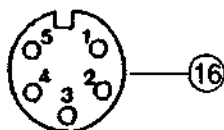
Pin 3 Reference potential "Neutral" (Safety Circuit)

Pin 4 Floating potential (open in case of alarm)

Pin 2 + 3 = Input from external alarm devices

Pin 3 + 4 = Output to external alarm devices

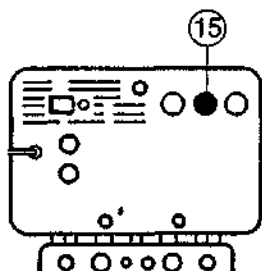
Socket 2



5.4 Socket for Temperature Recorder (16) at Socket 2

Pin 1 Reference potential "Neutral" (Meas. Circuit)

Pin 5 Recorder output U_{Actual} $0^{\circ}\text{C} = 0,00\text{V}$; $10\text{mV}/^{\circ}\text{C}$



Socket 4



5.5 Connection for Refrigerated Units (15) at Socket 4

This socket is predominantly used when the F3 is combined with a HAAKE refrigerated unit (e. g. as F3-C, F3-CH, F3-K F3-Q).

Pin 1 -12V for including the refrigerated unit within the safety circuit

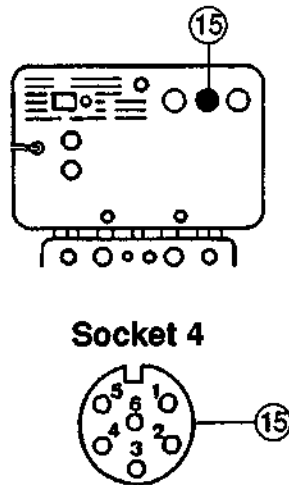
Pin 2 Reference potential "Neutral"

Pin 3+4 Limitation of the presetting ability by a resistor integrated within the refrigerated unit*

If a F3 is to be combined with a refrigerated unit a suitable connection cable is supplied.

* The integrated resistor limits the temperature setting of the F3 to the max. allowable value of the particular refrigerated bath. Should you wish a different limitation, we will gladly inform you.

Electrical Connections



5.6 Additional heating via auxiliary controlling device ZS1 (Optional accessory) at Socket 4

Should the heating demand for your particular application be higher than 1000 or 2000 W, there is a possibility for controlling an additional heater which is connected to a suitable controlling device (e.g. ZS1) which receives its control signals from socket 4.

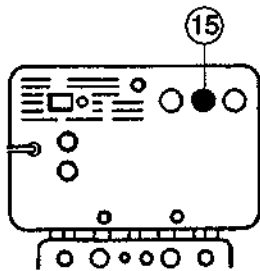
- Pin 2 "Neutral" and 6: Pulse package control in accordance with the ANTIDRIFT procedure *or* . . .
- Pin 2 "Neutral" and 5: On/Off control (Flip-flop control)

The input resistor of the circuit must have a size of at least 1 K Ω . It is recommended to use an opto-coupler for achieving galvanic separation. This is the case when a ZS1 is used.

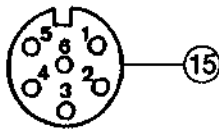
The ZS1 is supplied with a suitable cable. If the refrigerated unit and the controlling device are used together, it is necessary to use a special cable.

(V-Cable HAAKE Order No. 222-1186)

Electrical Connections

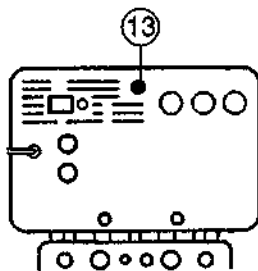


Socket 4



5.7 Controlled Cooling (15) at Socket 4

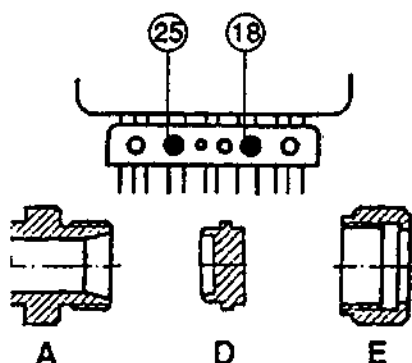
Quite often there are special applications which require controlling the cooling elements in a push-pull arrangement with the heating elements (e.g. via solenoid valves). In this case the procedure described in point 5.6 also applies, however with one exception: The controlling device must allow a reversal of the switching poles. The ZS1 is suitable for this purpose.



5.8 External Reset of the Safety Circuit

Using the jack socket 13 a push-button (switch) can be connected which allows to effect a Reset after a malfunction. (Provided the cause for the malfunction has been corrected before.)

Connecting the Hoses



6. Connecting the Hoses

Hoses are used to connect the pump with an external vessel. If objects are to be temperature controlled in the internal bath only, the pump nozzles **A** (18 and 25) can be closed with a plug piece **D** attached with a coupling nut **E**. However, in order to achieve better temperature accuracy, it is recommended to connect the two nozzles with a short hose.

General recommendations concerning the max. allowable length of hoses cannot be given. It all depends largely on the size, form and material of the external vessel to be temperature controlled as heat dissipation and the circulating capacity have a decisive influence.

It should be understood that the length of a hose and its diameter can hamper the circulating capacity and thus the temperature accuracy. Whenever possible, the decision should be made in favor of the wider hose diameter, and the vessel to be temperature controlled should be placed as close as possible to the F3 and its internal bath (hose lengths beyond 5 meters are unsuitable).

- ! **High operating temperatures will lead to high temperatures on the hose surface and even more so at the metal nozzles. Avoid touching them!**
- ! **Hoses must not be folded or bent!
A wide radius should be used if turns have to be made!**
- ! **Hoses might become brittle after prolonged use or they may get very soft. They should therefore be checked regularly and exchanged if necessary!**

6.1 Plastic Hoses

It must be ensured that the hoses selected are fully suitable for the particular application, i.e. that they will not split, crack or become disengaged from their nozzles.

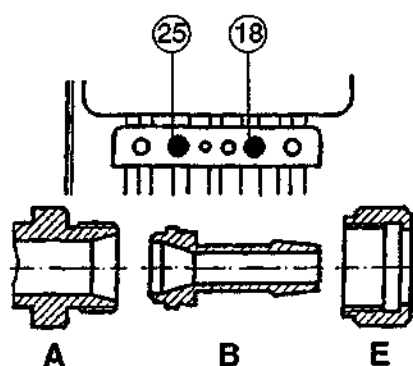
- ! **All hose connections have to be secured with hose clamps!**

Connecting the Hoses

If not arranged otherwise, HAAKE supplies Perbunan hoses together with its circulators. They have proven their versatility in a temperature range between - 30 and + 100°C. Perbunan is resistant against water, alcohol and most oils.

Hoses for other thermal liquids and temperature ranges can be supplied by HAAKE:

Hose Material:	Allowable Temperature Range:	Remarks:
PVC	10 to 60°C	For water only!
Viton	- 60 to 200°C	
Silicone	- 30 to 220°C	Not for silicone oil!
Metal	-100 to 350°C	See 6.2



The hose fittings **B** supplied (8 or 12 mm Ø depending on the hoses to be connected) are attached to the pump nozzle **A** with the coupling nut **E**.

6.2 HAAKE Metal Hoses

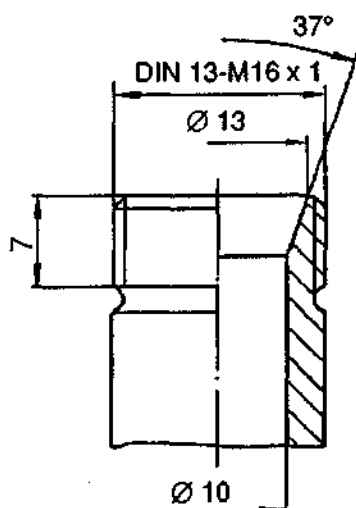
The HAAKE metal hoses - insulated stainless steel - provide a high degree of safety and are suitable for both high and low temperatures.

Metal hoses are attached directly to the nozzle **A**, gaskets are not required.

! The hoses must not be kinked or subjected to mechanical strain!

These hoses are available in lengths of 0.5, 1.0 and 1.5 meters from HAAKE. Couplings for connecting two hoses are also available should other lengths be required for a particular application.

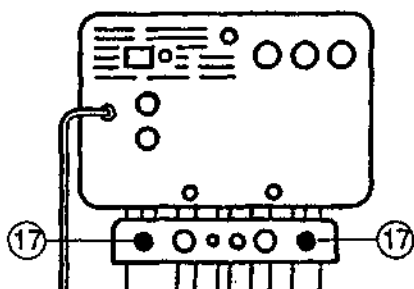
The smallest opening for metal hoses is 10 mm. The metal hoses are provided with coupling nuts (M16 x 1, DIN 12 879, part 2) at either end. The counter piece for attaching them is illustrated to the left.



Connecting the Hoses

6.3 Tap Water Cooling

Applicable only for units without built-in cooling units!



6.3.1 Tap Water Connection

Using the built-in cooling coil, the lowest attainable operating temperature is about 2 to 3°C above the given tap water temperature.

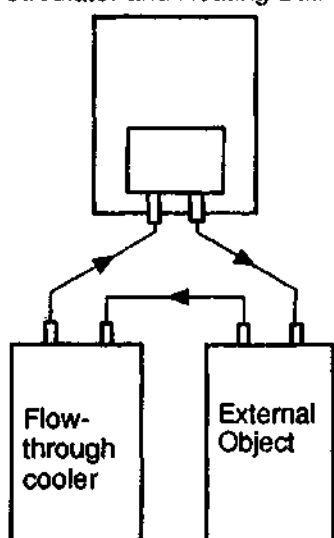
- 1 Use hoses with 8 mm interior Ø and connect to 17. The direction of the flow can be freely selected. It must be taken care that at one side the water can run out into a wash basin or sewer system.

Pressure fluctuations of the public water supply may hamper the temperature accuracy. For proper results the water pressure should be stable or measures should be taken to keep it stable.

The min. pressure should not be below 1 bar.

- 2 The amount of flow should be set to a min. value. At first the full flow should be used so that the unit can reach its operating temperature, then, using the water cock or a hose clamp, the amount of flow should be reduced until the heating (yellow light) and idle periods are about equal.

Circulator and Heating Bath



6.4 External Cooling Units

With immersion and flow-through coolers from HAAKE the thermal liquid can be cooled down considerably below 0°C and the F3 can be rendered independent from tap water.

For F3-S and F3-M a flow-through cooler is to be used. This cooler is hooked up into the return flow line of the external vessel and from there to the F3 (s. Fig.).

For F3 with bath bridges H42 or H41 immersion coolers have proven the best choice.

The opening for the immersion cooler is already provided in the bridges.

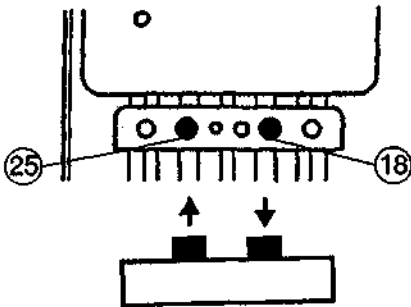
Please ask for the HAAKE Data Sheet "Immersion and Flow-through Coolers"!

Connecting the Hoses

6.5 Pressure and Suction Pump

6.5.1 Temperature controlling an object in an internal bath:

Close pressure port (18) and suction port (25) with the closing pieces and coupling nuts or, better still, connect the two nozzles with a short hose.

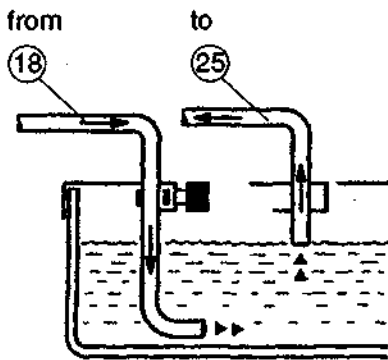


6.5.2 Connection of external closed systems

Instruments with a pressure-tight temperature jacket or coil or a heat exchanger (user).

Connection: From the pressure port (18) to the external user and then back to the suction port (25).

In this arrangement the external system may well be placed higher than the F3 Temp. System. Provided there are no leaks, the liquid from the upper system will not flow down when the unit is turned off.



6.5.3 Connection of external open baths:

Connection: From the pressure port (18) to the external bath and then back to the suction port (25).

With a hose support (optional accessory) which is employed for baths with a wall thickness up to 26 mm, both the pressure and suction hose are securely held. With a clamp in the pressure hose the amount of the circulating liquid is balanced with that of the amount floating back. It is recommended to use a hose with 8 mm interior-Ø as pressure hose and one with 12 mm interior-Ø as suction hose.

The end of the pressure hose in the bath vessel should be placed in a position where an optimum circulation within the bath is achieved.

The liquid level of the external bath can be adjusted with the end of the suction hose.

The external user and the F3 Temp. Unit have to be arranged so that they have the same liquid level in order to prevent draining by siphoning action. In case the application requires that both systems have to be situated at different levels, the two hose lines have to be closed prior to turning off the F3 Temp. Unit.



When a safety element causes a shut off, the siphoning of one of the vessels cannot be prevented.

7. Filling with Thermal Liquid

The selection of the proper bath liquid (thermal liquid) influences the capacity of a temperature control unit decisively. The technical data with special emphasis on the temperature accuracy were established with water and/or alcohol i.e. with low viscous liquids (in accordance with DIN 58 966). The temperature accuracy will decrease as the viscosity of the thermal liquid increases. It is difficult to arrive at valid statements which can be applied as a general rule as the length of the hoses, the volume and the material of the connected systems have a great influence on this accuracy.

The heating up and the cooling down time of a system to be temperature controlled can be influenced by the bath liquid too. Alcohol and oil, for instance reduce these times by half when compared to water.

7.1 Recommended Bath Liquids

5 to 80°C

Distilled Water

- Normal tap water leads to calcareous deposits on all flat surfaces coming into contact with the water necessitating frequent cleaning with suitable solvents.
- Water, of course, can be employed up to 95°C, however, above 80°C the amount of water vaporizing reaches an amount which could harm the unit's electronics and surroundings. Apart from these annoying effects the liquid level has to be constantly replenished.

–10 to 80°C

In applications below 5°C the water has to be mixed with anti-freeze. In doing so, the amount of antifreeze added should cover a temperature range 10°C lower than the operating temperature of the particular application. This will prevent the water from gelling (freezing) in the area of the evaporating coil which is the coldest part of the compressor's cooling circuit.

An excess of antifreeze reduces the temperature accuracy.

–40 to 150°C

HAAKE SIL180

... is especially suitable in combination with the HAAKE units F3-CH and F3-K as the total temperature range can be covered with one liquid.

It is a silicone oil which has a creeping tendency so that the bath surface has to be cleaned now and then.

Filling

–60 to 50°C

for F3-Q

Alcohol, like methanol, ethanol or isopropanol does not harm the F3-Q unit. However, we warn against using these liquids. All alcohols have a flash point below the average room temperature. They can easily ignite and pose a great risk for the surrounding instrumentation and personnel. This is the reason why many operating regulations flatly prohibit the use of alcohol for this purpose.

Within the range to –60°C we recommend:

HAAKE SIL100

Stable bath liquid over a prolonged period with creeping tendency (see SIL 180).

Within the range to –50°C:

HAAKE Synth60

Synthetic thermal liquid with hygroscopic properties. Water contents precipitate on the evaporator coil and thus hamper efficient temperature exchange. The water contents can evaporate by working occasionally with temperatures of 50°C for a couple of hours.

higher than 80°C

According to the table of suitable liquids (see next page) there are several liquids to choose from. Please adhere to the information given in this table!

MIN ... : Mineral oil is inexpensive, it can, however, cause annoying smells.

Synth ... : Synthetic thermal liquid with a medium life span (some months) and little smell annoyance.

SIL ... : Silicone oil with a very long life span (> 1 year) and negligible smell.

! Important !

It is absolutely mandatory that the overtemperature cut-off point is set lower than the flash point for the thermal liquid selected. (See Chapter 10.1 and table on the following page).

Filling

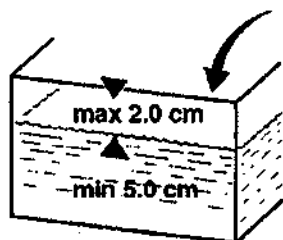
Table of HAAKE Bath Liquids						
Bath Liquid	Temperature Range °C	Flash Point °C	Boiling Point °C	Freezing Point °C	Color	Reacts with:
Sil 100	-75 / 60	65	200	-95	transparent colorless	Silicone
Sil 180	-40 / 160	170	300	-100	transparent colorless	Silicone
Sil 300	80 / 270	280	–	-35	transparent colorless	Silicone
Synth 20 (Methylcyclohexane)	-120 / 20 ¹⁾	-4 ¹⁾	98	-140	transparent ²⁾ colorless	Light metals Zinc
Synth 60	-50 / 60	65	187	-70	transparent colorless	Rubber Silicone
Synth 210	-10 / 200	205	330	-65	transparent yellow	Copper, Aluminum Bronze
Synth 260	50 / 265	270	–	-37	transparent ²⁾ colorless	Copper, Aluminum Bronze
Min 110	10 / 110	115	–	-30	transparent colorless	neutral
Min 200	20 / 195	200	–	-12	transparent colorless	neutral
Min 260	80 / 250	260	–	-18	yellow/violet opalescent	neutral

1) Safety measures must be observed 2) Water soluble

Leaflets on the Safety Precautions according DIN 90 200 for all bath liquids are available. Please send us your request!

Additional hints on suitable thermal liquids are contained in our technical leaflet "HAAKE Bath Liquids". Please send us your request. The above table is an extract.

Filling



7.2 Filling with Thermal Liquid

Filling level of the interior bath:

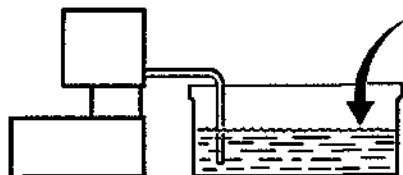
max. up to 2.0 cm below the deck plate,

min. up to 5.0 cm below the deck plate.

When working with water or water mixed with antifreeze:
the filling level should be 2 cm below the deck plate.

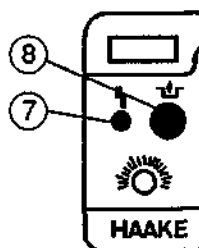
When working with oil below room temperature:
The instructions for water apply.

When working with oil above 80°C:
Keep level somewhat lower. Oil expands when being heated. Rule of thumb: 10% volume increase per 100°C heat increase.



External systems included within the circulating pump circuit and/or open additional baths have to be filled with the same thermal liquid in order to avoid too much of the liquid being drawn from the internal bath. The bath level should be checked when the preset temperature has been reached!

Quite often closed external systems cannot be prefilled as suggested. In this case the internal bath of the unit has to be filled to the max. level. After starting the unit, the pump will feed the necessary liquid to the external system. Should the demand be higher than the volume difference between the high and low level, the low liquid level sensor will be activated.



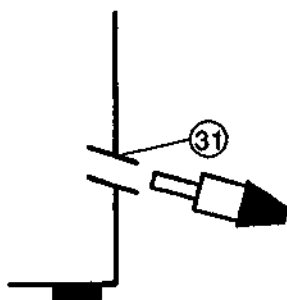
In this case:

- 1 Replenish the liquid,
- 2 Press Reset key 8:
⇒ The unit runs again and commences filling the external system.
- 3 Repeat this action if necessary.

☞ The malfunction is optically indicated → light 7 illuminates and a chirping sound warns acoustically.

8. Draining the Bath

The internal bath is drained at nozzle 31 .



- 1 Place a suitable container underneath the nozzle.
Caution: The liquid will drain out in a slight arc!
- 2 Unscrew closing plug until it becomes disengaged from the threads. A pin prevents the liquid from running out right away.
- 3 Pull plug (pin) out in a sudden motion. The liquid starts running out.
- 4 Possible residues can also be removed by tilting the unit slightly.

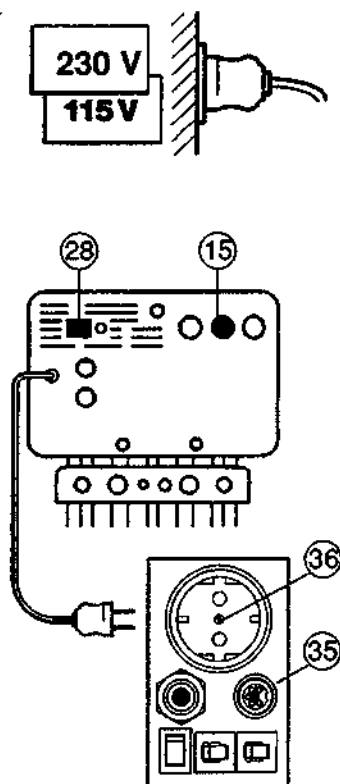
! Hot thermal liquid should not be drained! When certain conditions make draining necessary, please act safety conscious: Wear protective clothing and protective gloves!

Operating

9. Operating

9.1 Connection to the Mains

Connect unit only to a mains receptacle with a protective ground. Prior to the actual connection, compare local mains with the information on the nameplate. Voltage deviations of +/- 10% are allowed. The receptacle must be fused to carry the total electrical demand of the unit.



9.1.1 F3-C, F3-CH, F3-K and F3-Q only

- 1 Connect mains plug of the temp. control unit F3 with the receptacle 36 at the rear of the refrigerated unit.
- 2 Connect control cable with socket 15 (4) of the temp. control unit and socket 35 of the cooling unit.
- 3 Put selector switch 28 to "intern".
- 4 Put selector switch 5 to "Off" (not depressed).

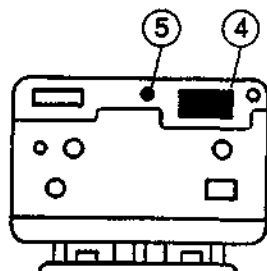
9.1.2 F3-V only

- 1 Connect mains plug of the temp. control unit F3 with the receptacle 36 at the rear of the refrigerated unit.

☞ The cooling unit V is not integrated within the safety circuit of the F3. Only the F3 is switched off in case of malfunctions. The heat transfer liquid with the refrigerated bath is cooled down to approx. -10°C.
Please ensure suitable heat transfer liquid is used!

9.2 Checking the Liquid Circuit

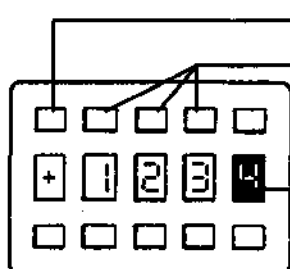
Prior to starting the unit, confirm that the pressure and suction port are either connected with a short hose or closed with the plugs provided for this purpose and also, in case an external liquid circuit is installed, make sure that the hoses are connected properly and secured against becoming disengaged from the nozzle or from the vessel itself. (Refer to 6.5).



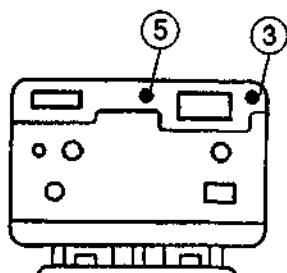
9.3 Setting the Temperature

The temperature setting mode can be selected with a small pressure switch 5 (PG):

- a) "intern" (not depressed)) =
Setting by means of the built-in digital switch 4

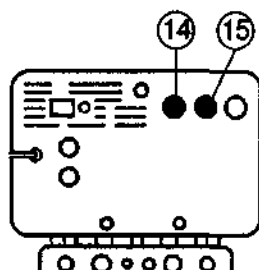


- select the appropriate math. sign (+/-)
- use these digits for the full degree
 - upper keys are lowering the figures
 - lower keys are increasing the figures
- use this field for setting $1/10$ s of a full degree



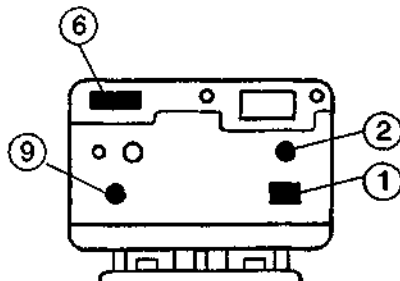
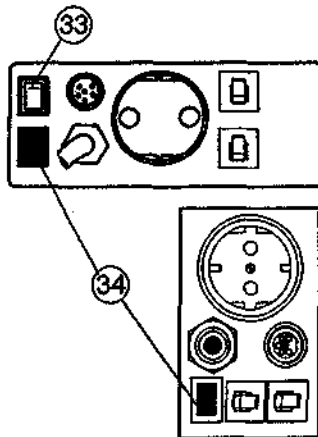
Small corrections can be made later - with the unit running - using the potentiometer 3. Changes made with 3 can be noticed at the digital display. When using 3 you should bear in mind that the unit will require some time to react to your settings.

- b) "extern" (depressed) =
this allows external settings (programmer, computer etc.) which are connected at socket 14 (1). Separate instructions pertaining to HAAKE auxiliary devices are included. Others have to be in compliance with the conditions stipulated in Chapter 5.1.



- ☞ Should the pressure switch 5 be on "extern" (depressed) and a suitable programmer is not connected at 14 (1) the unit will "read" this as a temperature value of 0°C, i.e. the heater will not be actuated with temperatures above 0°C, however, if the actual temperature is < 0°C, the bath is heated to 0°C.

Operating



9.4 Starting the Unit

Set Excess Temperature Limiter 9 clearly above the operating temperature you want to use for your application.

9.4.1 F3-C, F3-CH, F3-K and F3-V only:

- 1 Actuate main switch 34 of the cooling unit.
The cooling fan always operates whether the compressor is running or not.

In the case of the F3-CH also actuate switch 33 (for details refer to 11.3).

9.4.2 All combinations of units:

- 1 Press switch 1 of the temp. control unit. This leads to:
 - ⇒ Control light of 1 lights up green.
 - ⇒ Digital display 6 indicates the actual bath temperature.
 - ⇒ Pump motor runs → the bath liquid is circulated.

The compressor usually starts with a small jerk. At operating temperatures above 45°C there is normally no cooling action required. In this case the cooling unit should be switched off at 34.

If the actual bath temperature is lower than the set temperature:

- ⇒ the heater control light 2 lights up yellow, the heater is on.
- ⇒ during the heating up phase 2 is constantly on.
- ⇒ in the control phase 2 flashes.

When the bath temperature is lower than the set temperature:

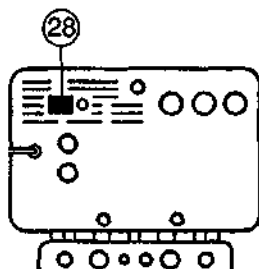
- ⇒ 2 does not light → the heater is off.

When the temperature display flashes the set temperature exceeds the allowed operating temperature of the temp. control unit combination:

- 2 Adjust to allowed temperature setting.

☞ If, after starting the unit, the alarm circuit is actuated: Refer to Chapter 10.

Operating

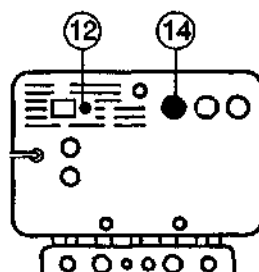


9.5 Control Modes

At the rear of the unit there is a small switch 28 which allows selection of two control modes.

9.5.1 Switch position "INT"

This is the position for normal operation. Display and control are actuated using the integrated Pt100 sensor. The operating temperature in the internal bath coincides with the temperature set at the digital switch and shown on the display (within a minor \pm tolerance).



9.5.2 Switch position "EXT"

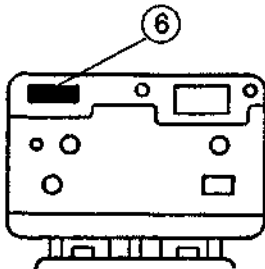
In this switch position an external Pt100 sensor situated somewhere in the external liquid circuit is used for control and display. It is connected with the F3 via 14 (1). This control mode should be used when certain operating conditions (long hoses, considerable influencing factors etc.) will cause substantial deviations between the temperature of the bath vessel and the external circuit.

Cable lengths and display fluctuations caused by them may be compensated with potentiometer 12 in two ways:

- 1) The external temperature is measured once and the discrepancy corrected with the potentiometer 12.
- 2) Refer to Chapter 5.2

! If in this control mode, heater action is required, please adhere to item 10.1.3.

More information regarding this topic is contained in the HAAKE brochure "External Temperature Control" which is available on request.



9.6 Display of the actual temperature

The bath temperature adjacent to the built-in digital thermometer is displayed at 6. Depending on the position of switch 28 this reflects the actual temperature of the built-in Pt100 sensor in position 'INT' and is also the temperature of the external Pt100 sensor when this switch is set at 'EXT'. (Please refer to Chapter 8.5)

A temp. control unit ensures that a temperature level is attained and kept with a good temperature constancy (small control deviation). A temp. control unit is never to be regarded as a temperature measuring instrument. Absolute temperatures have to be measured and verified with a certified measurement instrument or with a calibrated external thermometer.

In doing so it has to be noted that, owing to heat losses, or due to thermal loads there might be small reading deviations.

You should, therefore, take your measurements at a position important for your particular application. If you mark down the temperature of the display you will notice that, providing the thermal load and ambient remains unchanged, you will always have the same absolute temperature at this place of measurement. The temperature is reproducible.

☞ A temp. control unit is not a measurement instrument as stipulated in ISO-DIN 9004 / IEC 29004.

- ! **Operation at higher temperatures:**
All metal surfaces and hose connections get warm or hot!
Please be careful.
Wear protective gloves and goggles when taking the lid off the bath vessel.
Do not move the unit under these conditions!

10. Safety

The safety features offer protection in case of so-called "individual errors" i.e. it must be assumed that two non-related errors do not happen *simultaneously* (this concept is also the basis for all safety standards). Such errors are for instance:

Error in the temperature controller

⇒ Overtemperature ⇒ fire hazard

Leak in the liquid circuit

⇒ Low liquid level ⇒ fire hazard

Pump blocked

⇒ Motor overheating ⇒ fire hazard

Also:

Improperly set excess temperature limiter

⇒ fire hazard

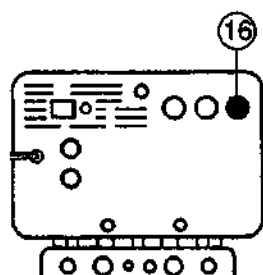
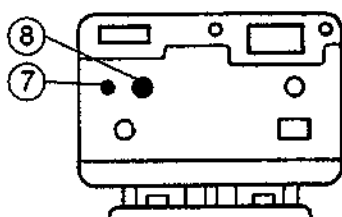
When one of the safety elements is triggered:

- an acoustic signal is emitted
- the malfunction indicator 7 lights
- the safety relevant components of the unit (pump, heater, compressor and fan) are switched off **permanently** i. e. the safety circuit transfers the unit to a safe state.

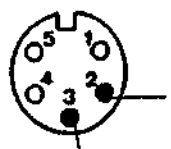


The cause for the malfunction however has to be found and corrected.

When this has been done, the unit can be cleared again by pressing key 8 (RESET function).



Socket 2



Depending on the application, it can also happen that the substances or samples to be temperature controlled are damaged or destroyed. In order to take measures early enough to prevent serious damage, there is the possibility of transmitting the alarm signal to a monitoring center (refer to Chapter 10.2).

Units with these safety features are categorized into the safety class 2 according to DIN 12 879 and may be operated unsupervised.

The safety circuit may also be externally triggered (by a safety element) if this should be necessary due to certain dangers of a particular application. These safety elements may be temperature sensors, flow sensors, liquid level sensors, smoke sensors etc.

The safety circuit is triggered when the pins 2 (+) and 3 (neutral) of socket 16 (2) receive a positive DC voltage (refer to Chapter 5.3).

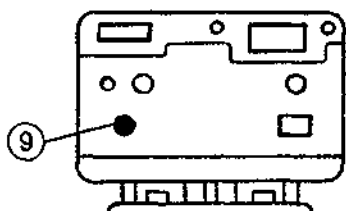


10.1 Excess Temperature Limiter

It protects against dangers stemming from uncontrolled heating of the bath liquid which might be caused if the set value is exceeded.

The excess temperature limiter 9 is used for setting a fixed cut-off temperature.

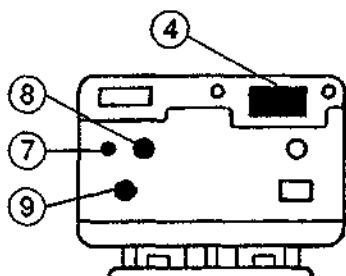
! Effective protection can only be expected when the cut-off point is carefully selected and set.



Basically there are two protective aims:

- Protection against ignition of the bath liquid.
The cut-off point must be sufficiently (approx. 5-10°C) below the flash point of the bath liquid used.
- Additional protection of the object to be temperature controlled,
e.g. a biological sample. The cut-off point must be placed as close as possible to the desired temperature value.

The excess temperature limiter 9 is adjusted by means of a slotted screw with a rough scale of temperature values marked around it. This scale, of course, can only serve as an approximate setting means for this cut-off point. However, the cut-off point can be determined quite exactly if the following procedure is adhered to:



10.1.1 Setting the Excess Temperature Limiter

If for instance a bath liquid has a flash point of 60°C, the unit should cut off after reaching 55°C at the latest. This can be achieved with the help of a controlled test.

With the digital switch 4 the operating temperature is set to exactly 55°C. As soon as this temperature is indicated on the display, the excess temperature limiter 9 is turned backwards very slowly (to the left) until the unit is cut off (acoustic signal, red malfunction light 7 is on). Set operating temperature on the actual value (< 55°C) and wait until the bath liquid has cooled down somewhat. After clearing (resetting) the unit with switch 8 it can be used for temperatures below 55°C. As soon as 55°C is reached, it is safely switched off.

If the unit is to cut off at an approximate value only, the excess temperature limiter 9 is turned somewhat in the other direction (to the right) after the cut-off value has been reached. Then the unit can be reset as instructed above.

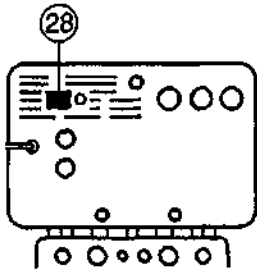
10.1.2 Testing the cut-off point

Set operating temperature and watch the digital display. The value indicated when the alarm goes off is the real cut-off temperature.

10.1.3 Special safety precautions when using an external Pt100 sensor:



When an external Pt100 control sensor is used, there is consequently a temperature difference between the internal bath and the external system. This is a desired effect. This difference is between $1/10$ and some full degrees provided the combination of the units corresponds with the planned application. This difference must then be considered when selecting the cut-off point.



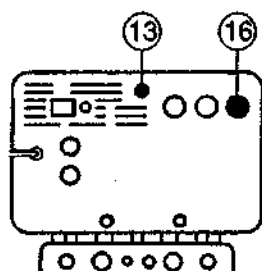
In the heating-up phase when using the external control mode (switch 28 on "extern") this temperature difference might be quite considerable. In order to avoid that the over-temperature sensor is triggered, it should be verified that ...

- the flash point of the bath liquid is higher than the max. temperature reached in the internal bath and ...
- that the excess temperature limiter is set according to this condition.

After the entire temp. control system is balanced for the application, the cut-off point has to be reduced accordingly.

This procedure can often not be adopted. A good way to overcome such difficulties is heating-up with the internal control mode (switch 28 on "intern") and then changing to external control (switch 28 on "extern") when the internal and external bath have reached about the same temperature.

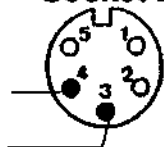
Safety



Socket 2



Socket 2



10.2 Monitoring Functions

The operating state of the temp. control unit F3 can be monitored by a monitoring station or by a laboratory computer via socket 16 (2):

a. Temperature

The display value of the digital thermometer 6 corresponds to an analog voltage which is fed to the pins 5 and 1 (neutral) of socket 16 (2). The following conditions apply:

$$0^{\circ}\text{C} = 0,00 \text{ V } (+/- 2\text{mV}); \text{ potential gradient } 10,0 \text{ mV}/^{\circ}\text{C}$$

This voltage could, for instance, be recorded by a printer, displayed by an instrument or used for monitoring purposes.

b. Safety Circuit

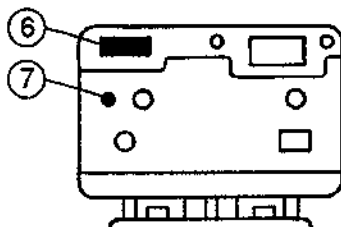
If no malfunction is present, pins 3 and 4 are short circuited (floating potential). As soon as the safety circuit is activated this closed connection is open.

It is also possible to effect an external Reset of the unit: The 3.5 mm jack plug socket 13 can be used for hooking up a contact transmitter.

10.3 Malfunction Indicators (As a memory refresher):

The acoustic signal (chirping sound) together with the malfunction display 7 could mean:

1. The liquid level of the bath is too low.
2. The temperature of the bath has reached the overtemperature cut-off point.
3. A highly viscous liquid poses too big a load for the pump or a foreign object is blocking the pump propeller.
In both cases a thermal sensor in the motor windings shuts off the unit before actual damage is done.



Cooling

11. Cooling (F3-C, F3-CH, F3-K, F3-Q and F3-V only)

The cooling bath enables low temperatures of the temp. control unit F3 or allows the quick cooling down of a warm bath to a lower temperature level.

Operating Temperature Range:

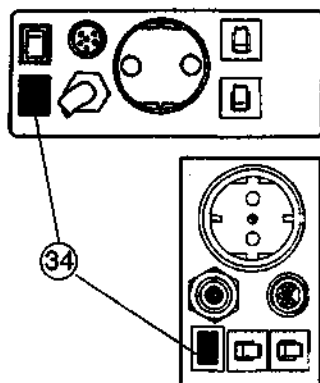
F3-C: From -20° to 150°C

F3-CH: From -30° to 150°C

F3-K: From -40° to 150°C

F3-Q: From -60° to 50°C

F3-V: From -5° to 150°C



11.1 F3-C, F3-CH, F3-K and F3-V only

Constant cooling at operating temperatures above approx. 100°C is not allowed! This would cause excess pressure and temperature in the cooling circuit which, in turn, would trigger the excess temperature protection switch (KLIXON) and as a result the compressor would be switched off. As soon as the temperature in the compressor circuit would be down to normal again, the KLIXON would switch on the compressor again. This cyclic switching of the compressor would be harmful, shortening its life span considerably. Under such conditions the cooling bath should be switched off at 34.

Starting the cooling unit at 34 even under operating temperatures around 150°C is allowed for the purpose of a quick cooling down of the bath.

11.2 Cryostat F3-Q only

The cryostat is controlled completely by the F3 and it is not necessary to start it separately. Temperature control is achieved by controlled heating against constant cooling.

Cooling


11.3 Automatic fan action (F3-CH only)


In order to keep the level of the emitted noise low, the refrigerated bath CH is equipped with an automatic fan. At ambient temperatures of $> 30^{\circ}\text{C}$ or at high thermal loads the fan speed is automatically increased. This, in turn, causes the velocity of flow to increase (to be noticed as a louder flow noise of the passing air), this however prevents inadmissible pressure conditions in the cooling circuit.

Especially during temperature controlling tasks around 20°C , short temperature fluctuations in the bath may be experienced.

In this case the automatic fan action can be turned off at switch 33.



 = OFF

 = ON

! The temperature of CH housing can get relatively high during low fan speed. Again, if this poses a problem, the automatic fan action can be turned off at switch 33!

Maintenance

12. Maintenance

The stainless steel surfaces of the bath vessel and of the housing may after some time show spots and become tarnished. Normal stainless steel cleaners as they are used in the kitchen can be used.

 **Do not use scouring powder!**

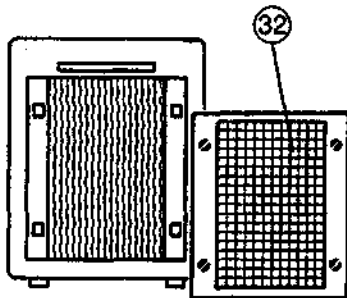
The bath vessel must be kept clean. Substances containing acid or basic substances and metal shavings should be removed quickly as they could be harmful to the surfaces causing corrosion.

12.1 Cleaning the fins (liquefier) of the compressor:

In order to maintain the cooling capacity of the unit, cleaning has to be done two to four times per year, depending on the grade of soiling.

F3-C, F3-K, F3-Q and F3-V only:

- 1 Clean the fins thoroughly with compressed air.
If extremely soiled → remove the outer housing of the cooling unit (to be done by trained personnel).



F3-CH only:

- 1 Remove ventilation grid 32, turn screws 90° and take off.
- 2 Clean fins with a brush.
- 3 Position grid and press in screws (no turning required).

12.2 Discarding the unit:

Sometime in the future the life span of the cooling unit will end.

Therefore:

- !** This units may contain ozone destroying CFCs i.e. the unit may only be discarded by authorized personnel.

Accessories

13. Accessories

For the completion or extension of your unit, HAAKE offers a broad accessory program.

Here are some articles from our "Accessories Brochure":

13.1 Hoses and Insulation

- Silicone hoses
- Viton hoses
- Metal hoses
- Foam rubber insulation

13.2 Bath (Thermal) Liquids (refer to page 22)

- Silicone oils
- Synthetic thermal liquids
- Mineral oils

13.3 External Programmers

- Programmers
- Computer-Interfaces

13.4 Additional Coolers

- Immersion Coolers
- Flow-through Coolers

13.5 Bridges and Bath Vessels

- H42 for HAAKE vessels
- H41 for baths up to a width of 800 mm
- Bath vessel
 - W13 (stainless steel)
 - W15 (stainless steel)
 - W19 (stainless steel)
 - W26 (stainless steel)

13.6 Bath Covers

- Plastic lid for HAAKE bath vessels (suitable up to 60°C)
- Metal lid for HAAKE bath vessels
- Allplas balls (suitable for water only)

Technical Specifications

14. Technical Specifications (DIN 58966)

		Temp. Contr. Unit F3 assembled to bridge	Circulator Unit	
			F3-S	F3-M
Operating Temp. Range	°C	45 to 250	45 to 250	45 to 250
Extended Temp. Range (with additional cooling)	°C	-100 to 250	-100 to 250	-100 to 250
Cooling Coil		integrated	integrated	integrated
Temp. Control Accuracy	°C	+/-0.01	+/-0.01	+/-0.01
Pressure Pump: Press.max.	mbar	210	210	210
Flow max.	mbar	16	16	16
Suction Pump: Suct. max.	l/min	170	170	170
Flow max.	l/min	14	14	14
Heater Capacity	W	2000	1000	2000
Temp. Setting Mode		digital	digital	digital
Temperature Display		digital/LED	digital/LED	digital/LED
Temp. Controlling Mode		ANTIDRIFT	ANTIDRIFT	ANTIDRIFT
Mode Switch (internal/external control)		yes	yes	yes
Temp. Control Sensor		Pt100	Pt100	Pt100
Excess Temp. Limiter	°C	20 to 250	20 to 250	20 to 250
Low Liquid Level Limiter xed		Trigger point fixed	Trigger point fixed	Trigger pt. fi-
Safety Class (DIN12879)		2	2	2
Spray Water Prot.(DIN40050)		IP 30	IP 30	IP 30
Connection Sockets for:				
- external Control Sensor		yes	yes	yes
- external Programmer		yes	yes	yes
- Contr. Cable f. Cooling Unit		yes	yes	yes
- Monitoring		yes	yes	yes
- external Release/Reset		yes	yes	yes
Dimensions: WxLxH	mm	-	190x285x320	220x370x320
Bath Opening/Depth	mm	-	125x100/150	140x150x150
Immersion Depth	mm	150	-	-
Volume	l	-	2-3	3,5-4,5
RFI Suppression (VDE0875)	N	N	N	
Submerged parts:			Stainless steel, 18/8	
Weight	kg	5	7	9
Mains Connection	V/Hz	220±10%/50-60	220±10%/50-60	220±10%/50-60
Total Wattage	VA	2100	1100	2100
Ambient Temp. Range	°C	10-40	10-40	10-40

Technical Specifications

		Refrigerated circulator	Open-bath circulators	
		F3-V	F3-W13	F3-W19
Operating Temp. Range	°C	-5 to 150	35 to 250	30 to 250
Extended Temp. Range (with additional cooling)	°C	-	-100 to 250	-100 to 250
Cooling Coil		integrated	integrated	integrated
Temp. Control Accuracy	°C	+/-0.02	+/-0.01	+/-0.01
Pressure Pump: Press. max.	mbar	210	210	210
Flow max.	mbar	16	16	16
Suction Pump: Suct. max.	l/min	170	170	170
Flow max.	l/min	14	14	14
Heater Capacity	W	2000	2000	2000
Temp. Setting Mode		digital	digital	digital
Temperature Display		digital/LED	digital/LED	digital/LED
Temp. Controlling Mode		ANTIDRIFT	ANTIDRIFT	ANTIDRIFT
Mode Switch (internal/external control)		yes	yes	yes
Temp. Control Sensor		Pt100	Pt100	Pt100
Excess Temp. Limiter	°C	20 to 250	20 to 250	20 to 250
Low Liquid Level Limiter		Trigger point fixed	Trigger point fixed	Trigger pt. fixed
Safety Class (DIN12879)		2	2	2
Spray Water Prot.(DIN40050)		IP 30	IP 30	IP 30
Connection Sockets for:				
- external Control Sensor		yes	yes	yes
- external Programmer		yes	yes	yes
- Contr. Cable f. Cooling Unit		yes	yes	yes
- Monitoring		yes	yes	yes
- external Release/Reset		yes	yes	yes
Dimensions: WxLxH	mm	535x335x375	335x360x325	335x535x325
Bath Opening/Depth	mm	300x175	300x175	300x175
Immersion depth	mm	200	150	150
Volume	l	12 - 17	7 - 12	10 - 19
RFI Suppression (VDE0875)	N	N	N	N
Submerged parts:		Stainless steel, 18/8		
Weight	kg	29	12,4	13,8
Mains Connection	V/Hz	220±10%/50*	230±10%/50-60	230±10%/50-60
Total Wattage	VA	2450	2100	2100
Ambient Temp. Range	°C	10-40	10-40	10-40

*) 220 V/60 Hz available on request

Technical Specifications

		F3-C	F3-CH
Operating Temp. Range	°C	-20 to 150	-30 to 150
Extended Temp. Range	°C	-	-
Temp. Setting Mode		digital	digital
Temperature Display		digital/LED	digital/LED
Resolution of Display	°C	0.1	0.1
Temp. Control Accuracy	°C	+/- 0.02	+/- 0.02
Contr. Sensor		Pt 100	Pt 100
Temp. Controlling Mode		ANTIDRIFT	ANTIDRIFT
Heater Capacity	W	1000	2000
Cooling Coil integrated		-	-
Pump Capacity			
Pressure Pump Press. max.	mbar	210	210
Flow max.	l/min.	16	16
Suction Pump Suct. max.	mbar	170	170
Flow max.	l/min.	14	14
Cooling Capacity (-10)/20°C	W	(7)/200	(130)/380
Low Liquid Level Limiter		trigger point fixed	trigger point fixed
Excess Liquid Level Protection		-	-
Excess Temp. Prot./Cut-off point	°C	20 to 150	20 to 150
Spray Water Prot. (DIN40050)		IP 30	IP 30
Safety Class (DIN 12879)		2	2
External Temp. Presetting	V/°C	0,01	0,01
Connect f. addit. Pt100 Sensor		-	-
Connect. f. Temp. Recorder	V/°C	0,01	0,01
Bath Opening/Depth	mm	140x150/150	140x150/150
Volume	l	4.5	4.5
Dimensions (WxLxH)	mm	495x400x380	220x430x405
Submerged parts:		Stainless steel 18/8	
Weight	kg	29.5	29.5
Total Wattage	VA	1250	2250
Mains Connection	V/Hz	220 ±10% / 50	
RFI Suppression (VDE 0875)		N	N
Ambient Temperature	°C	10 to 40	10 to 40

Technical Specifications

		F3-K	F3-Q
Operating Temp. Range	°C	-40 to 150	-60 to 50
Temp. Setting Mode		digital	digital
Temperature Display		digital/LED	digital/LED
Resolution of Display	°C	0.1	0.1
Temp. Control Accuracy	°C	+/- 0.02	+/- 0.05
Temp. Controlling Mode		ANTIDRIFT	ANTIDRIFT
Control Sensor		Pt 100	Pt 100
Heater Capacity	W	2000	1000
Cooling Capacity (-40)/-10/20°C)	W	270/380	(120)/200/250
Number of Compressors		1	2
Compressor Cooling		Air	Air
Pump Capacity			
Pressure Pump Press. max.	mbar	210	210
Flow max.	l/min.	16	16
Suction Pump Suct. max.	mbar	170	170
Flow max.	l/min.	14	14
Low Liquid Level Limiter		trigger point fixed	trigger point fixed
Excess Temp. Prot./Cut-off point	°C	20 to 150	variable
Spray Water Prot. (DIN40050)		IP 30	IP 30
Safety Class (DIN 12879)	2	2	2
External Temp. Presetting	V/°C	0.01	0.01
Connection for Temp. Recorder	V/°C	0.01	0.01
Bath Opening/Depth	mm	295x190/150	140x150/150
Volume	l	12	4
Dimensions (WxLxH)	mm	400x400x660	400x400x615
Submerged parts:		Stainless steel 18/8	Stainless steel 18/8
Weight	kg	45	66 / 64
Total Wattage	VA	2300	1900
Mains Connection	V/Hz	220 ±10% / 50	
RFI Suppression (VDE 0875)		N	N
Ambient Temperature	°C	10 to 40	10 to 40

