

***VARIOMAG***<sup>™</sup>  
**Magnetic Stirrer**  
**MOBIL DIRECT**

**Operating Manual**  
50108697 Issue 02.2007



Analyze • Detect • Measure • Control<sup>™</sup>

**Thermo**  
SCIENTIFIC

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## Contents

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Contents	Page
1 User considerations	4
<b>1.1 Correct use</b>	4
<b>1.2 Incorrect use</b>	4
<b>1.3 Pictographs</b>	4
2 Safety considerations	5
3 Equipment description	7
4 Function	8
5 Startup procedure	9
6 Stirring operation	10
<b>6.1 Stirring vessels</b>	10
<b>6.2 Magnetic stirring bars</b>	10
<b>6.3 Recommended rotation speed ranges</b>	13
<b>6.4 Stirring</b>	13
6.4.1 Tips on stirring	14
7 Maintenance and cleaning	15
8 Errors	16
9 Technical specifications	18
10 Warranty	20

# 1 User considerations

## 1.1 Correct use

The magnetic stirring system MOBIL DIRECT is designed for stirring liquids in a laboratory or production environment. It is fitted with one stirring point. The system can be employed for chemical, microbiological, biotechnical, pharmaceutical, or medical purposes.

It is suited to operation in the following areas:

- On the laboratory bench
- In fume cupboards
- In standard or gas incubators with or without humidifier
- In refrigerators
- Below round-bottomed flasks
- With mounted bath
- In laminar flow equipment
- In safety laboratories and sterile rooms

## 1.2 Incorrect use

The MOBIL DIRECT magnetic stirring system must not be operated in hazardous locations.

The magnetic stirring drive must not be exposed to temperature shock.

The magnetic stirring system must not be operated in a water bath.

Do not stir flammable liquids with a low boiling point.

## 1.3 Pictographs

You will find the following pictographs in this operating manual:



### **DANGER!**

This sign refers to dangerous voltages.



### **DANGER!**

This sign refers to hazardous situations. Hazards to human life are indicated by the word "LIFE HAZARD".



### **CAUTION!**

This sign indicates danger to equipment and machinery.



### **INFORMATION**

This sign indicates easier working practices.

◆ Indicates an operating step.

⇒ Indicates alternatives.

## 2 Safety considerations

**For your own safety, you should observe the following safety warning signs.**

The safety warnings indicate a possible source of danger.

At the same time, they contain information on how correct action can avert danger. You will always find warning signs attached to points of possible danger.



**DANGER!**

**Magnetism.**

**Magnetic or metallic parts (e.g. data carriers, pacemakers, watches) can be affected by magnetic fields.**

**Keep such parts away from the magnetic stirrer and the magnetic stirring bar.**



**DANGER!**

**Supply voltage and supply frequency must be within the range specified for the power supply unit. The power supply unit must only be connected to an earthed socket.**



**CAUTION!**

**Operating conditions:**

**Magnetic stirrer: -10 to +56 °C at max. 100 % RH**

**Power supply: +5 to +40 °C at max. 80 % RH**

**See technical specifications.**

**The magnetic stirrer must not be operated in a water bath.**

**The power supply unit must not be run in humid rooms, or set up in water splash zones.**



**CAUTION!**

**The equipment must not be operated in hazardous locations.**



**CAUTION!**

**The magnetic stirrer must be switched off before connecting or pulling the connector. To do so, set the rotation speed control to OFF.**



**CAUTION!**

**Do not place large or heavy stirring vessels directly on top of the magnetic stirrer.**

**Do not exceed the maximum load.**



**CAUTION!**

Do not place hot stirring vessels directly on top of the magnetic stirrer. Maximum surface temperature of the magnetic stirrer: 56 °C. When higher medium temperatures are involved, you should provide for suitable insulation between the magnetic stirrer and the stirring vessel.



**CAUTION!**

Large stirring bars spinning out of control may break the stirring vessel. Danger of broken glass. Immediately turn off the stirring bar spinning out of control by setting the rotation speed control to OFF.



**CAUTION!**

Do not use cleaning agents that attack and corrode the stainless steel surface of the magnetic stirrer.



**CAUTION!**

In case of repair, the equipment must only be opened by an authorised service agent.



**CAUTION!**

Do not allow AlNiCo5 type magnetic stirring bars to remain in an alternating magnetic field if they cannot rotate freely. Do not subject the magnetic stirring bar to a strong inverse magnetic field. This may cause the bar to become demagnetised.



**INFORMATION**

The length of the magnetic stirring bar (2) must be smaller than the diameter of the magnetic coupling (technical specification).



**INFORMATION**

There is a strong magnetic bond between the MOBIL DIRECT magnetic stirrer and the stirring bar. The distance between the surface of the magnetic stirrer and the stirring bar should be no less than 10 mm. If the walls of the stirring vessel are very thin, place a non-magnetic plate between the magnetic stirrer and the stirring vessel.

## 3 Equipment description

Figure 1 shows the components together with their position numbers.

The MOBIL DIRECT magnetic stirring drive consists of a powerful magnetic stirrer with a separate power supply unit. It features one stirring point. The secondary power cord connects the magnetic stirrer to the power supply unit that supplies it with power. The power supply unit is connected to electrical mains using the primary power cord. That the power supply is separate ensures completely safe operation, because the magnetic stirrer only contains safe low voltage. Following a power failure, the magnetic stirring system will turn on again automatically.

You can turn the magnetic stirrer on and select the stirring speed with the rotation speed control. Following a soft start, the magnetic stirrer will rotate at the selected speed.

The magnetic drive is fitted into the polished stainless steel housing of the MOBIL DIRECT magnetic stirrer. It is equipped with very strong magnets\*. The magnetic field is produced by a high-powered hermetically sealed disc armature. The space around the drive is filled with synthetic resin and closed off inside the housing in a watertight manner.

If the magnetic stirring system is mechanically overloaded, the speed is automatically reduced. In this way, the permissible rated power is not exceeded. If the drive system or the standing surface becomes hotter than 75 °C, the magnetic stirrer is switched off.

Stirring vessel and magnetic stirring bar do not fall within the scope of delivery.

\*) Powerful rare-earth permanent magnets.

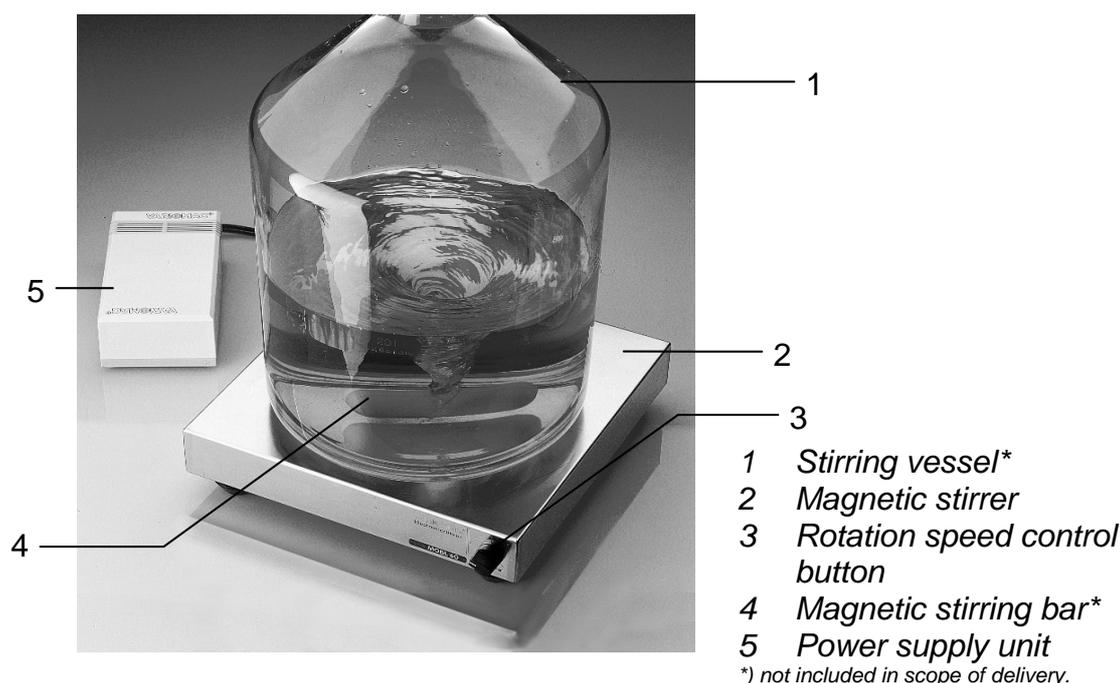


Figure 1: MOBIL DIRECT with power supply unit

## 4 Function

The MOBIL DIRECT magnetic stirring system is used for chemical, microbiological, biotechnical, pharmaceutical, or medical purposes. It has been designed especially for large stirring volumes.

You can stir liquids in various shapes of vessel (e.g. Erlenmeyer flasks, storage flasks). As the rotation speed can be adjusted variably, liquids can be moved gently or mixed vigorously.

The stirring vessel contains a magnetic stirring bar. When the stirring vessel is placed on the stirring point, a rotating magnetic field will move the magnetic stirring bar.

You can turn the magnetic stirrer on and select the stirring speed with the rotation speed control. Following a soft start, the magnetic stirrer will stir at the selected speed.

If the rotation speed control is turned to OFF during operation, the stirring bar is subjected to rapid braking action. This is how you can quickly stop a stirring bar spinning out of control.

## 5 Startup procedure

**DANGER!**

Supply voltage and supply frequency must be within the range specified for the power supply unit. The power supply unit must only be connected to an earthed socket.

**DANGER!**

Magnetism. Magnetic or metallic parts (e.g. data carriers, pacemakers, watches) can be affected by magnetic fields. Keep such parts away from the magnetic stirrer and the magnetic stirring bar.

**CAUTION!**

The equipment must not be operated in hazardous locations.

**CAUTION!**

Operating conditions:

Magnetic stirrer: -10 to +56 °C at max. 100 % RH

Power supply: +5 to +40 °C at max. 80 % RH

See Technical Specifications.

The magnetic stirrer must not be operated in a water bath.

The power supply unit must not be run in humid rooms, or set up in water splash zones.

**CAUTION!**

The magnetic stirrer must be switched off before connecting or pulling the connector. To do so, set the rotation speed control to OFF.

- ◆ Set the rotation speed control to OFF.
- ◆ Connect the secondary power cord of the power supply unit to the connector on the back of the magnetic stirrer.
- ◆ Plug the mains plug into a properly installed mains outlet.
- ◆ If an absolutely sterile environment is required, the power supply unit should be located outside the sterile zone.
- ◆ When working in humid rooms or a corrosive environment: locate the power supply unit in a dry, non-corrosive environment.

## 6 Stirring operation

### 6.1 Stirring vessels

You should use stirring vessels that are circular in shape, and made of glass, nonmagnetic metal, or plastic. They should have the same wall thickness throughout. Flat-bottomed glass vessels (not concave) and smooth surfaces improve the running quality of the magnetic stirring bar.

When stirring larger volumes of liquid, you should use stirring vessels having a relatively small diameter and a thin bottom.



#### CAUTION!

Do not place large or heavy stirring vessels directly on top of the magnetic stirrer.  
Do not exceed the maximum load.

### 6.2 Magnetic stirring bars

Thermo recommends the following magnetic stirring bars:

Type	Dimensions (mm)	Material	Order No.
KOMET 90	( $\varnothing$ x L) 24 x 90	SmCo	50087902
Twin magnetic stirring bar	(L x W x H) 90 x 81 x 30 Stirring bars: KOMET 90	SmCo	50087868
Magnetic stirring bar with bearing	( $\varnothing$ x H) 146 x 48 Stirring bar: KOMET 90	SmCo	50087869

Table 1: Suitable magnetic stirring bars



#### INFORMATION

The length of the magnetic stirring bar must be smaller than the diameter of the magnetic coupling (technical specification).

Thermo has developed a new magnetic stirring bar **KOMET 90** (Figure 2). It contains a high-quality super-strong samarium-cobalt magnet. KOMET 90 shows a strong magnetic force. The stronger attraction to the magnetic alternating field provides the stirring bar with very efficient stirring properties. Even if there are greater distances (e.g. in high measuring cylinders) the stirring force will be maintained. The stability of the stirring bar will not be impaired if the vessel has a curved bottom. The strong magnetic coupling in samarium-cobalt magnets will also increase friction. The standard design of the KOMET magnetic stirring bar is therefore unsuitable for

## 6 Stirring operation

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stirring liquids containing particulate matter (such as mud) or for stirring in vessels with a rough interior surface. Some of the KOMET stirring bars were specially fitted with a wear-resistant glide ring for use under excruciating circumstances, such as when stirring vessels feature rough plastic or stainless-steel bottoms or if the media to be stirred contain solids (Figure 3).

Any risk of demagnetisation by external magnetic fields is completely eliminated. All KOMET series stirring bars can be readily recognized by their two conical ends.

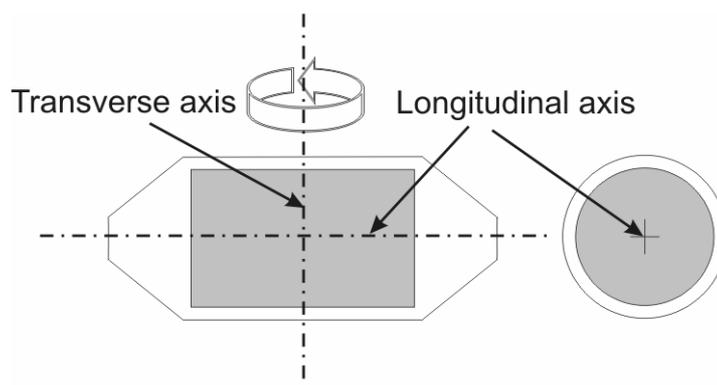


Figure 2: Stirring bar **KOMET 90** (Order No. 50087902).  
Side view (left) and cross-section through central portion (right).

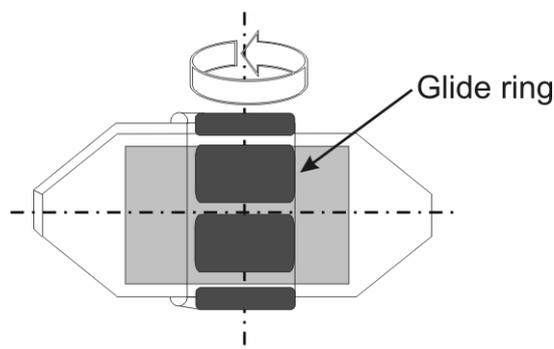
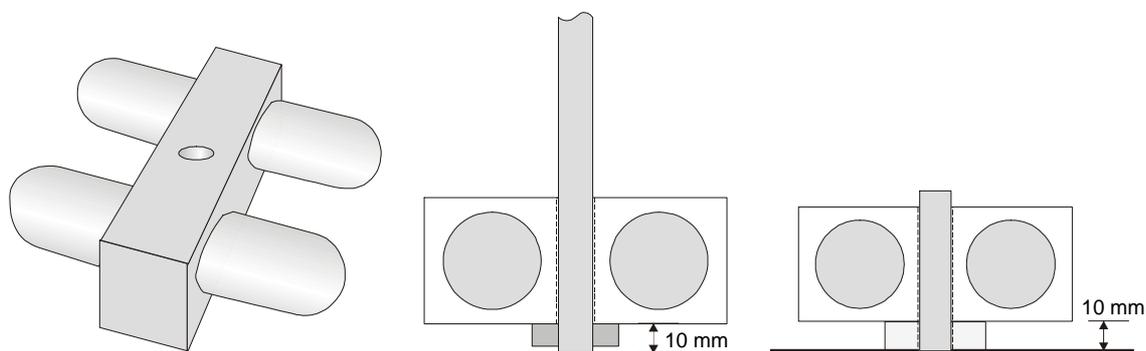


Figure 3: **KOMET** stirring bar with glide ring

If you are working with stirring vessels having rough plastic or stainless steel surfaces, you should use a twin magnetic stirring bar (suspension not included in scope of delivery). It is equipped with two magnetic stirring bars KOMET 90. The stirring bar is suspended from the top into the stirring vessel and kept away from the bottom (Figure 4). Alternatively, it can be fixed at the bottom of the stirring vessel with the aid of a centring device (centring device not included in scope of delivery).

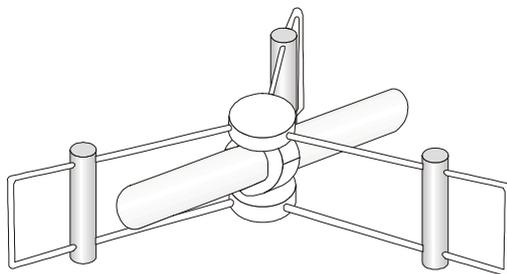
## 6 Stirring operation

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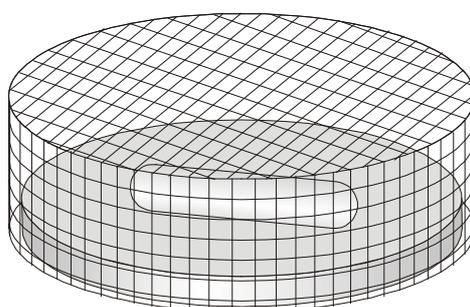
*Figure 4: Twin magnetic stirring bar (left, Order No. 50087868).  
Cross-section through stirring bar suspended from top (centre), or fixed at the bottom of the stirring vessel (right).*

In addition, a magnetic stirring bar incorporating a bearing can be supplied as an accessory item (Figure 5). It can be kept in place safely inside the stirring vessel. Only use this stirring bar at lower or medium rotation speed.



*Figure 5: Magnetic stirring bar with bearing (Order No. 50087869)*

To improve the slide characteristics of the magnetic stirring bar, you can place a stirring disc into the stirring vessel (Figure 6). It consists of a flat glass or PTFE disc and a screen. The latter prevents the magnetic stirring bar from escaping in a sideways direction. When using the stirring disc, take care to note that it will not rotate of its own accord. Affix it to the bottom of the vessel, for example.



*Figure 6: Stirring disc with screen*

### 6.3 Recommended rotation speed ranges

We recommend the following rotation speed ranges for various applications:

Application	Speed range (rpm)
Microbiological and biotechnical applications:	
Aeration of bacteria cultures	200 - 350
Growth of bacteria cultures	300 - 450
Dissolving nutrient media, intense aeration of bacteria cultures	350 - 500
Routine laboratory work:	
Prevent accretion of suspended matter	150 - 250
Titration	250 - 400
Dissolving solids	350 - 700
Improved heat transmission	300 - 600
Chemical reactions	100 - 1000

Table 2: Recommended rotation speed ranges

### 6.4 Stirring



#### CAUTION!

Do not place hot stirring vessels directly on top of the magnetic stirrer. Maximum magnetic stirrer surface temperature: 56 °C. When higher medium temperatures are involved, you should provide for suitable insulation between the magnetic stirrer and the stirring vessel.



#### CAUTION

There is a strong magnetic bond between the MOBIL DIRECT magnetic stirrer and the stirring bar. The distance between the surface of the magnetic stirrer and the stirring bar should be no less than 10 mm. If the walls of the stirring vessel are very thin, place a non-magnetic plate between the magnetic stirrer and the stirring vessel.

- ◆ Fill the stirring vessel only to a level where the stirring motion will not cause it to spill over.
- ◆ Set the rotation speed control to OFF.
- ◆ Insert a stirring bar into the stirring vessel.
- ◆ If required, place a non-magnetic plate between the magnetic stirrer and the stirring vessel.
- ◆ Centre the stirring vessel on the marked stirring point.
- ◆ Turn rotation speed control button in a clockwise direction and set to a low speed. The magnetic stirring bar moves to the centre of rotation.

- ◆ Set the desired rotation speed with the rotation speed control button.

Following a soft start, the magnetic stirring bar will rotate at the selected speed.



### CAUTION!

**Large stirring bars spinning out of control may break the stirring vessel. Danger of broken glass. Immediately turn off the stirring bar spinning out of control by setting the rotation speed control to OFF.**

You can stop the stirring bar within 2 seconds by setting the rotation speed control to OFF.

### 6.4.1 Tips on stirring

⇒ **If the stirring bar cannot be centred, repeatedly wanders off-centre, or migrates between the poles:**

- The magnetic retention force is too low.
  - The base of the stirring vessel is concave or too thick.
  - The distance between magnetic stirrer and stirring vessel is too big.
  - The size of the stirring bar used is unsuitable.
- 
- ◆ Move the stirring vessel a little back and forth and recentre it on the stirring point.
  - ◆ Reduce the rotation speed with the rotation speed control button, or
  - ◆ use a suitable magnetic stirring bar (see Table 1), or
  - ◆ use a smaller stirring vessel with a thin-walled, flat base, or
  - ◆ reduce the filling level in the stirring vessel.

⇒ **If the stirring action is too weak:**

- ◆ Use a longer magnetic stirring bar or a stirring vessel with a smaller diameter.
- ◆ Reduce the distance between stirring vessel and magnetic stirrer.

⇒ **If you want to interrupt the stirring process rapidly:**

- ◆ Set the rotation speed control to OFF.

The magnetic stirring bar will be brought to a rapid stop (within 2 seconds).

⇒ **If you want to stop stirring:**

- ◆ Slowly set the rotation speed control to OFF.

## 7 Maintenance and cleaning



### CAUTION!

**Do not use cleaning agents that attack and corrode the stainless steel surface of the magnetic stirrer.**

The equipment does not require maintenance.

Clean the surfaces of the magnetic stirrer at regular intervals.

For this purpose you can use

- Water containing a surfactant detergent additive
- Isopropanol
  
- ◆ Set the rotation speed control to OFF.
- ◆ Unplug the mains plug.
- ◆ Clean the surfaces of the magnetic stirrer.

Where the surface of the magnetic stirrer has become severely soiled, you may clean it using a water jet or a disinfectant solution.



### CAUTION!

**In case of repair, the equipment must only be opened by an authorised service agent.**

In case of necessity to repair the equipment, it should be returned to an authorized servicing agent. The equipment must be clean and free from harmful substances.

To avoid transport damages during the shipment, please send the equipment correctly packed in the original packing.

**Please always enclose the filled out return delivery note.**

If necessary ask for the return delivery note at Thermo (address: see inside of the cover sheet).

When ordering spares, please state equipment type and serial number.

You can obtain further technical documents (e.g. circuit diagrams, board data) for your engineers by contacting the address on the inside of the cover sheet.

## 8 Errors

- **The magnetic stirring bar is not rotating:**

There is too much friction between the magnetic stirring bar and the bottom of the vessel:

- ◆ Use a magnetic stirring bar with a suspension arrangement, a bearing, or with a stirring disc, or
- ◆ use a smaller magnetic stirring bar, or
- ◆ increase the distance between magnetic stirring bar and magnetic stirrer. For example, place a glass plate or a non-magnetic metal plate between the magnetic stirrer and the stirring vessel. The distance should be at least 10 mm.

Or the viscosity of the medium is too high:

- ◆ Use a smaller magnetic stirring bar.

Or the sediment is too thick:

- ◆ Add the sediment slowly and in small amounts.

- **Rotation of the magnetic stirring bar is always uneven:**

It is unavoidable that magnetic stirring bars will age with time, for example through sterilization, use at excessive temperatures, or mechanical stress (such as when you drop it). This may adversely affect the stirring bar's magnetic properties.



### CAUTION!

**Do not allow AINiCo5 type magnetic stirring bars to remain in an alternating magnetic field if they cannot rotate freely. Do not subject it to a strong inverse magnetic field. This may cause the bar to become demagnetised.**

- ◆ Remove and replace the magnetic stirring bar with a new one.

or

- ◆ Use the KOMET series of super-strong magnetic stirring bars offered by THERMO (see Chapter 6.2).

- **The area below the magnetic stirrer heats up excessively:**

Under unfavourable installation conditions and maximum power output, the temperature of the standing surface may be approx. 10 to 30 °C above the ambient temperature.

If the resulting heat transfer to the stirring vessel is to be prevented, you should take the following steps:

- ◆ Operate the magnetic stirrer in the lower speed range.
- ◆ Ensure that the magnetic stirrer site is well ventilated.

- ◆ Place an insulating plate approximately 10 mm thick between the stirring vessel and the stirring point area.
- **The magnetic stirrer does not attain the selected speed:**

The power supply unit has been operated above its power limit.

  - ◆ Reduce the rotation speed with the rotation speed control button.
- **The magnetic stirrer turns itself off:**

The magnetic drive has heated to a temperature above 75 °C. The overheating protection has turned off the stirring drive.

  - ◆ Allow the magnetic stirrer to cool.
  - ◆ Reduce the power demand on the stirring drive (reduced speed, lower stirring volumes, lower friction, larger distance between the magnetic stirrer and the stirring vessel).
  - ◆ If you are stirring hot liquids:

Place an insulating plate between the magnetic stirrer and the stirring vessel.

## 9 Technical specifications

<b>Magnetic stirrer</b>		<b>MOBIL DIRECT</b>
Order No.: without power supply		50088121
Order No.: incl. power supply	option DE option US option GB option JP option AU	50088128 50088131 50100547 50088129 on request
Stirring points		1
Stirring volume	L	1 – 150
Stirring power	W	40
Rotation speed range	rpm	100 - 1000
Max. momentum (shaft)	Ncm	50
Direction		Clockwise
Startup time	s	60
Magnetic coupling Ø	mm	110
Dimensions (W x D x H)	mm	330 x 330 x 80
Weight	kg	16
Max. load	N	800
Housing		Stainless steel, polished
Excess temperature protector	°C	75
Operating voltage	VAC	24
Protection* of the stirrer		IP 65 (acc. to DIN 40050)
Permissible operating conditions		-10 °C to +56 °C at 10 % to 100 % relative humidity 500 to 1060 hPa barometric pressure
Permissible storage conditions		-40 °C to +70 °C, at max.80 % relative humidity, 500 to 1060 hPa barometric pressure

\*) The jack located at the back of the magnetic stirrer is not protected.

***Subject to technical alterations***

## 9 Technical specifications

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<b>Benchtop power supply unit</b>		
Order No.:	option DE option US option GB option JP option AU	50087979 50087982 50100544 50087981 50087980
Input voltage/Frequency	VAC/Hz	DE: 230/50-60 US: 115/50-60 GB: 230/50-60 JP: 100/50-60 AU: 240/50-60
Output voltage	VAC	24
Protection		IP 20 (acc, to DIN 40050)
Mark of conformity		GS, VDE, protection class II
Cable lengths		prim. 1,80 / sec.: 1,80
Permissible operating conditions		+10 °C to +40 °C at 30 % to 75 % relative humidity 700 to 1060 hPa barometric pressure
Permissible storage conditions		-40 °C to +70 °C, at max.80 % relative humidity, 500 to 1060 hPa barometric pressure

***Subject to technical alterations***

## 10 Warranty

VARIOMAG magnetic stirrers have a modular construction and offer the greatest possible degree of trouble-free operation, thanks to their maintenance-free stirring and magnetic drives.

If despite our strict quality controls a system component should ever fail to work perfectly, it can be repaired or replaced by our after-sales service with no difficulty. Please retain your invoice, which will be needed when presenting any warranty claims.

**Two years full warranty on all system components!**