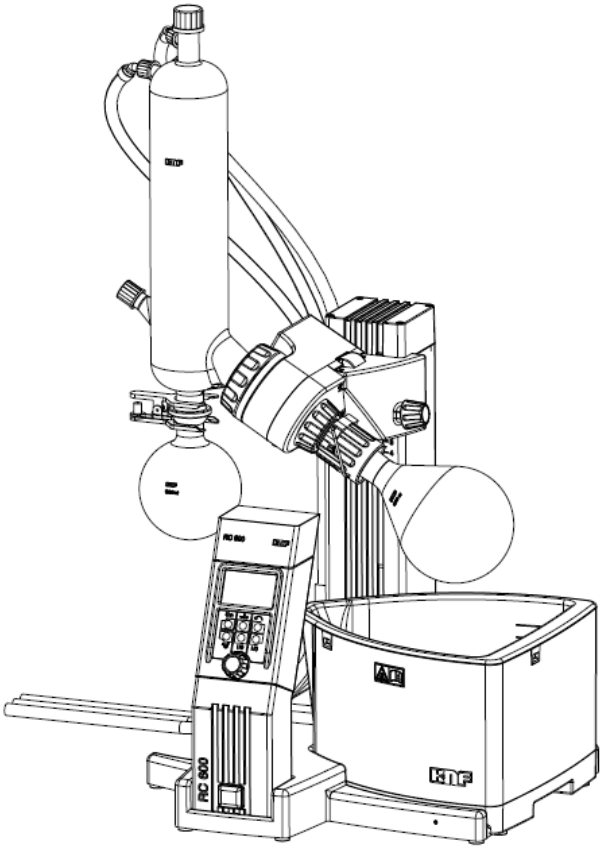
Rotary evaporator

RC600

Operating instructions



Before operating the rotary evaporator and the accessories, please read the operating instructions on the web site (www.knf.com/downloads) and pay attention to the safety precautions!

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Contents **Page**

1 General information

1.1 Information about the instructions

Contents

The operating instructions contain important information on how to use the rotary evaporator In order to ensure safe working and proper functioning it is essential to observe all the specified safety precautions.

Storage location

These operating instructions are part of the product, and must be stored in its immediate vicinity in a location accessible to personnel at all times.

Passing on

These operating instructions are part of the product, and must be passed on to the next owner if the device is resold.

Illustrations in the instructions

Illustrations in these operating instructions may or may not be to scale.

The illustrations may differ slightly from the actual product.

1.2 Warnings

Warnings in the operating instructions are identified with the danger symbol, keywords and colours. These provide an indication of the extent of the danger.

DANGER

Indicates a dangerous situation which will lead directly to death or serious injury if it is not avoided.

WARNING

Indicates a dangerous situation which may lead to death or serious injury if it is not avoided.

CAUTION

Indicates a dangerous situation which may lead to moderate or minor injuries if it is not avoided.

NOTE

Indicates a situation which may cause damage to property if it is not avoided.

1.3 Symbols

The following symbols appear in the operating instructions, on labels on the device, and on its packaging:

⚠ WARNING

Risk of injuries and property damage caused by illegible labels

The labelling on the device may become illegible with time.

- ➢ Maintain labels on the device in a legible condition.
- ➢ Replace any illegible labels.

The following symbols in the operating instructions and on the device and its packaging indicate environmental protection considerations:

Recycling

Not to be disposed of in household waste

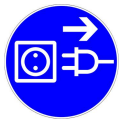
The following symbols in safety precautions and on the device indicate the nature of the danger:

General warning sign

Warning about electrical danger

Warning about low temperature/frost

Warning about hot surface



This symbol calls for disconnection from the mains.

1.4 Disclaimer of liability

In preparing the contents of these operating instructions, account has been taken of applicable regulations and the state of the art.

The manufacturer can accept no liability for any damage or malfunctions caused by failure to follow the operating instructions.

The manufacturer can accept no liability for any damage or malfunctions caused by modification or conversion of the device or improper handling.

The manufacturer can accept no liability for any damage or malfunctions caused by the use of non-approved spare parts and accessories.

1.5 Manufacturer's address

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www.knf.com

1.6 Year of manufacture

The year of manufacture is shown on the device's type plate.

1.7 Other applicable documents

The documents listed must also be taken into consideration.

- Chemical resistance list (www.knf.com/downloads)
- Sales documents
- GTCs

1.8 Copyright

1.9 Warranty conditions

The applicable warranty conditions are set out in the General Terms and Conditions of Business and the sales documents.

2 Use

2.1 Intended use

The RC 600 rotary evaporator is designed for use in chemical, pharmaceutical and biological laboratories. It is intended solely to separate solutions (distillation, drying, recovery, extraction, etc.).

Make sure that the installation location is dry and the rotary evaporator is protected against water in the form of rain, spray, splashes and drips.

The rotary evaporator may be used exclusively in indoor areas.

The rotary evaporator may be used only under a fume hood or with the properly installed protective cover (accessory).

Owner's responsibility

Operating parameters and conditions

Only install and operate the rotary evaporator under the operating parameters and conditions described in Chapter 4. Technical data.

Protect the rotary evaporator from moisture.

Use under a fume hood

Ensure that no hazardous materials can enter the surrounding environment (including heating and cooling media), even in the event of glass breakage, leaks, or loss of cooling.

Ensure that no hazardous materials/reactions can be produced through contact of processed solutions and solvents with the heating and cooling media or the ambient air. It may be necessary to operate the unit only under a suitable fume hood.

Whenever the rotary evaporator is operated outside a suitable fume hood (after eliminating these sources of danger), the protective cover must be used (refer to Chapter 12.2 Accessories (see also Chapter 6), p.50).

Requirements for processed substances

Before using a substance, investigate its compatibility with the materials used in the seals and hoses.

Before using a substance, investigate whether it can be evaporated without risk.

Chilled condenser

Make sure the hoses for gas and coolant are correctly assigned on the chilled condenser.

Adequately cool the chilled condenser at all times.

Accessories

Laboratory equipment and supplemental components attached to the rotary evaporator must meet the specifications provided in Chapter 4.

2.2 Improper use

The rotary evaporator may not be used in potentially explosive atmospheres.

The rotary evaporator may not be used in a corrosive environment.

The heating bath of the rotary evaporator may not be used to warm food. It serves exclusively to add heat to the evaporation flask.

Never apply excess pressure to the rotary evaporator's vacuum connection.

The lift drive may not be blocked or put under load.

3 Safety

The rotary evaporator is constructed according to generally recognised rules of technology and in accordance with pertinent occupational safety and accident prevention regulations. Nevertheless, potential dangers during use can result in injuries to the user or others, or in damage to the rotary evaporator or other property.

Use the rotary evaporator only in a technically flawless condition, in accordance with its intended use, with awareness of safety and potential hazards, and in observance of the operating instructions.

Personnel

Ensure that only trained and instructed personnel or specially trained laboratory personnel work on the rotary evaporator. This applies also to assembly, connection and servicing work.

Make sure that the personnel has read and understood the operating instructions, and in particular the "Safety" chapter.

Working in a safety-conscious manner

Ensure adherence to all pertinent accident prevention and safety regulations when working on and operating the rotary evaporator. The protective clothing required for safety in the laboratory must be worn, i.e. protective glasses, gloves, etc.

Handling dangerous media

Safety regulations for handling initial substances and those that are produced in the process must be observed. This applies equally to the heating and cooling media.

Handling flammable media

Be aware that the rotary evaporator is not designed to be explosion-proof.

Ensure that the distillation residue is not explosive.

Make sure that the temperature of the medium is always sufficiently below its ignition temperature in order to avoid ignition or explosion. This also applies to unusual operating situations.

Consider any external sources of energy, such as sources of radiation, that could additionally heat the medium.

In case of doubt, consult KNF customer service.

Proper handling of the initial and resulting substances / heating and cooling media must be ensured.

Manufacturer regulations must be observed when disposing of the heating and cooling media. Be aware that the heating and cooling media may become contaminated.

Ventilating the rotary evaporator

When ventilating the rotary evaporator with air or inert gas, be sure to prevent formation of reactive or explosive media. The maximum permissible operating pressure of the chilled condenser is 0.1 bar rel.

Vaporization delay

Ensure that the evaporation flask rotates throughout the entire heating phase (even during submersion/lifting) in order to avoid heating only one side of the evaporation flask or experiencing a vaporization delay.

Ensure that the evaporation flask is immersed or raised only at a low speed. Increase speed only to the extent that no heating medium is ejected from the heating bath.

Environmental protection

All replacement parts should be properly stored and disposed of in accordance with the applicable environmental protection regulations. Ensure adherence to the pertinent national and international regulations. This especially applies to parts contaminated with toxic substances.

Standards

The rotary evaporator meets the safety stipulations of Directive 2004/108/EC for electromagnetic compatibility, Directive 2006/42/EC for machines, and Directive 2011/65/EU (RoHS2). The following harmonised standards are fulfilled:

- DIN EN 61010-1
- DIN EN 61010-2-010
- DIN EN 61326-1

The rotary evaporator complies with the following according to IEC 664:

- Overvoltage category II
- Contamination level 2

Customer service and repairs

All repairs to the rotary evaporator must be carried out by the responsible KNF Customer Service team.

Housing parts with live parts may be opened by trained personnel only.

Use only genuine parts from KNF for servicing work.

Glass breakage

Take special care with glass parts.

Carry out a visual inspection on glass parts before each use. Do not use any damaged parts.

Hazardous fumes

Ensure that fumes are extracted from a fume hood.

Do not evaporate unknown fluids. Ensure the unit is tight.

High internal pressure

Ensure that the pressures in the system remain within the prescribed range.

Hot surfaces and fluids

Do not touch hot surfaces or liquids. Wait until the liquids and surfaces have cooled down sufficiently after switching off the unit..

Rotating parts

Do not wear loose clothing or jewelry, such as scarves, ties, bracelets or necklaces.

4 Technical data

4.1 Rotary evaporator

Materials for parts in contact with the medium		
Glass parts	Borosilicate glass	
Vapour tube seal	PTFE compound	
Refilling valve's fitting*	PP	
Fitting seal	Silicon	
Plug seals	PTFE-coated	
Coolant line materials		
Fittings on condenser	PP	
Fitting seal	Silicon	
Vacuum line materials		
Fitting on condenser	PP	
Pneumatic data		
Max. permissible operating pressure [bar rel]	0.1	
Electrical data		
Nominal voltage [V]	See type label	
Frequency [Hz]	50-60	
Heating power [W]	1300	
Total power [W]	max. 1500	
Total operating current [A]	See type label	
Fuse [A]	2 x 8A delayed 2 x 16A delayed	at 220-240V at 100-127V
Protection class	IP20	
Heating bath		
Empty weight [kg]	1.85	
Volume [ml]	5000	
Fill volume [ml]	4000	
Heating temperature [°C]	20 - 180	
Pull-out length [mm]	70	
Coolant supply (chilled condenser)		
Permissible pressure [bar rel]	3	
Permissible temperature	- 15°C to + 20°C	
Cooled surface [cm^2]	1230	

Tab. 1 (1st part) ** Accessory*

Evaporation flask parameters	
Evaporation flask size	50 - 3000 ml
Speed [rpm]	25 - 280
Vertical travel [mm]	150
Lifting speed [mm/s]	approx. 38
Angle of inclination [°]	12 - 45
General	
Total weight [kg]	9.1
Dimensions W x D x H [mm]: - without glass set (footprint) - with glass set (approx.)	 431 x 447 x 464 487 x 447 x 823
Vacuum, coolant, and refilling connections	GL14
Maximum permissible ambient relative humidity	80 % for temperatures up to 31°C, decreasing linearly to 50% at 40°C
Maximum altitude of installation [m above sea level]	2000
Safety functions	
Drive motor protection	Electronic overcurrent protection
Protection against overheating of heating bath	Thermal circuit breaker (manual reset) Electronic temperature limit Electronic cut-out if insufficient water
Protection during power failure	Evaporation flask automatically lifted from the heating bath
Protection against glass breakage	Digitally-adjustable stop
Monitoring of protective cover (accessory)	Hall effect sensor

Tab. 1 (2nd part)

4.2 Equipment delivered with RC 600

- Rotary evaporator
- Glass set, comprising:
  - Vapour tube
  - Chilled condenser
  - Collecting flask, 1000 ml
  - Bracket for collection flask
  - Evaporation flask, 1000 ml
- Heating bath
- Set of hose fittings
  - 1x Hose fitting ID8 (vacuum)
  - 2x Hose fittings ID8 (coolant)
  - 2x Hose clamps ID8
- Protective cover (optional)
- Refilling valve (optional)
- Power cable
- Operating instructions
- Abbreviated instructions
- Table of solvents
- CD with digital operating instructions

5 Components and functions

5.1 Components of the rotary evaporator

1 Power switch
2 Terminal
3 Collection flask (coated)
4 Flask clamp for **3**
5 Refilling connection
6 Chilled condenser
7 Tension nut for chilled condenser
8 Flask mechanism
9 Tension nut for vapour tube
10 Flask nut
11 Tower
12 Rotary knob for pivot angle
13 Evaporation flask
14 Heating bath

15 Vacuum line
16 Coolant line
17 Coolant line
18 Rotary knob for pivot angle
19 USB connection
20 Fuses
21 Mains plug connection

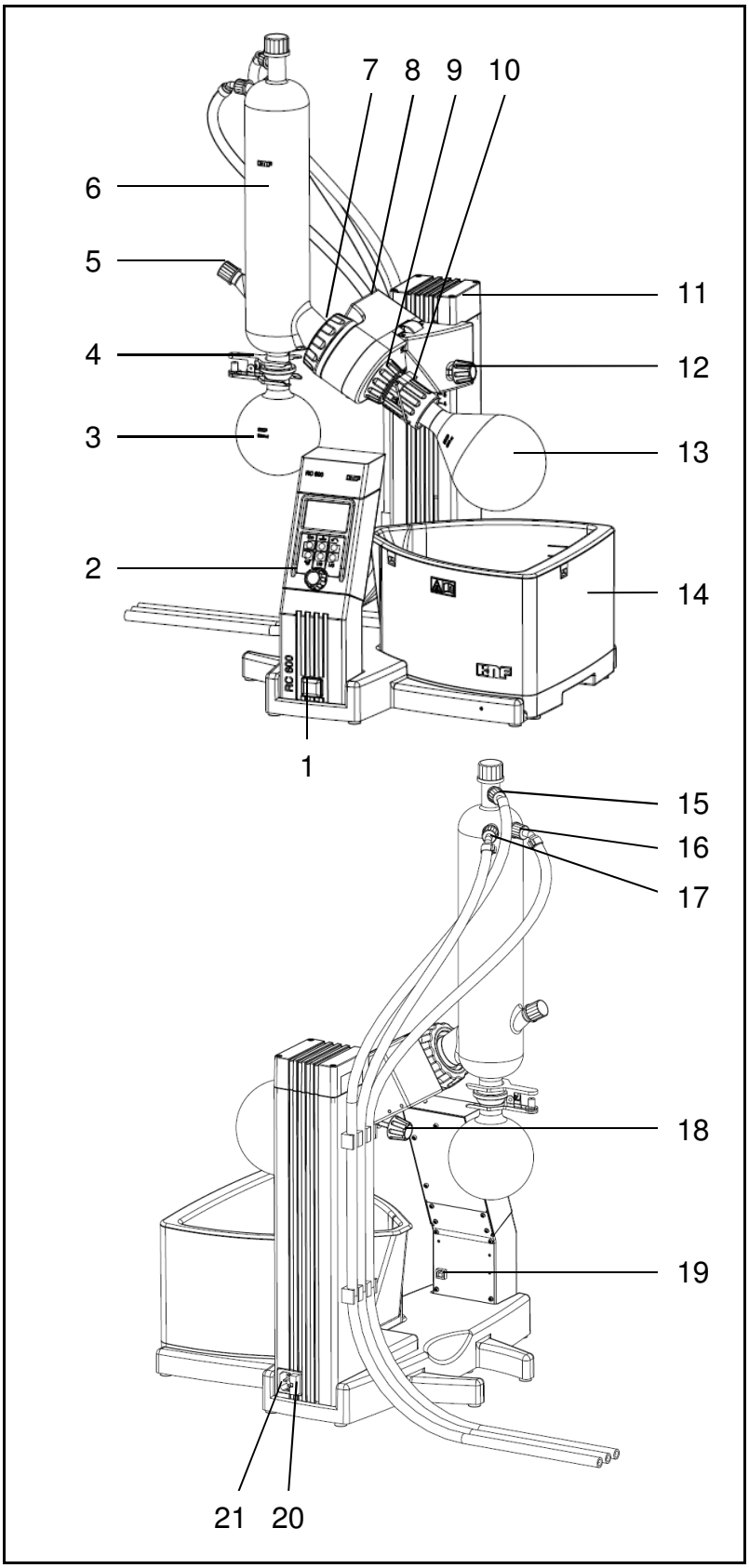


Fig. 1: Rotary evaporator RC 600

The RC 600 rotary evaporator is designed for distillation and evaporation of solutions. The rotary evaporator is operated via the terminal (Fig. 1/**2**, p. 15).

The solution that is to be evaporated is located in the evaporation flask (**13**). The solution is evaporated through a suitable combination of temperature and vacuum. The evaporation flask is immersed into the heating bath (**14**), in which a heating liquid is located, typically water or a suitable oil. The drive (**8**) continually rotates the evaporation flask in the heating bath. Once the solvent begins to evaporate, it rises through the vapour tube and into the chilled condenser (**6**), which is continually cooled with cooling water or another cooling medium. Here the vapour is cooled to the point where it condenses and collects (again in liquid form) in the collection flask (**3**).

The chilled condenser and collection flask have a transparent coating that protects them against implosion.

A protective cover (accessory) is placed onto the heating bath to protect the evaporation flask from implosion and to protect against spray.

5.2 Rotary evaporator functions

- **Evaporation flask**
  Use the rotary knobs (Fig. 1/**12+18**) to adjust the evaporation flask's angle of inclination. Together with the ability to move the evaporation flask up and down and to displace the heating bath, the rotary evaporator may be adapted to various shapes and sizes of evaporation flasks.
  The drive (**8**) rotates the evaporation flask, thereby achieving a high rate of evaporation:
  - A more homogeneous distribution of temperature is achieved both in the heating bath and in the evaporation flask (optimisation of temperature control and heat transfer).
  - The moistened surface inside the evaporation flask is enlarged (increases heat transfer and the boiling surface).
  - Formation of a concentration gradient in the solution is avoided.

  Additional advantages of rotation include:
  - The risk of boiling delay is reduced
  - No localized overheating, no crust formation

  The terminal (2) is used to switch the rotation of the evaporation flask on or off and to select the desired speed (see Chapter *8, Operating the rotary evaporator*).
  In the event of a power failure the evaporation flask is automatically lifted from the heating bath.
- **Heating bath**
  Use the rotary evaporator's heating bath (**14**) to achieve and maintain the temperature for optimum distillation according to requirements.
  The heating bath may be pulled out on guide rails in

order to permit the use of a wide range of evaporation flask sizes (see section *Evaporation flasks*).
The specially shaped pouring lip makes it easier to empty the heating bath.

5.3 Terminal

Assembly

1 Rotary knob for:
- Entering setpoints:
  - o Heating temperature
  - o Rotation
  - o Fine adjustment of immersion depth

2 Button to lower lift
3 Button to raise lift
4 Button for rotation on/off
5 Display
6 Button for heating bath selection
7 Button for exchange flask function
8 Button for heating bath on/off

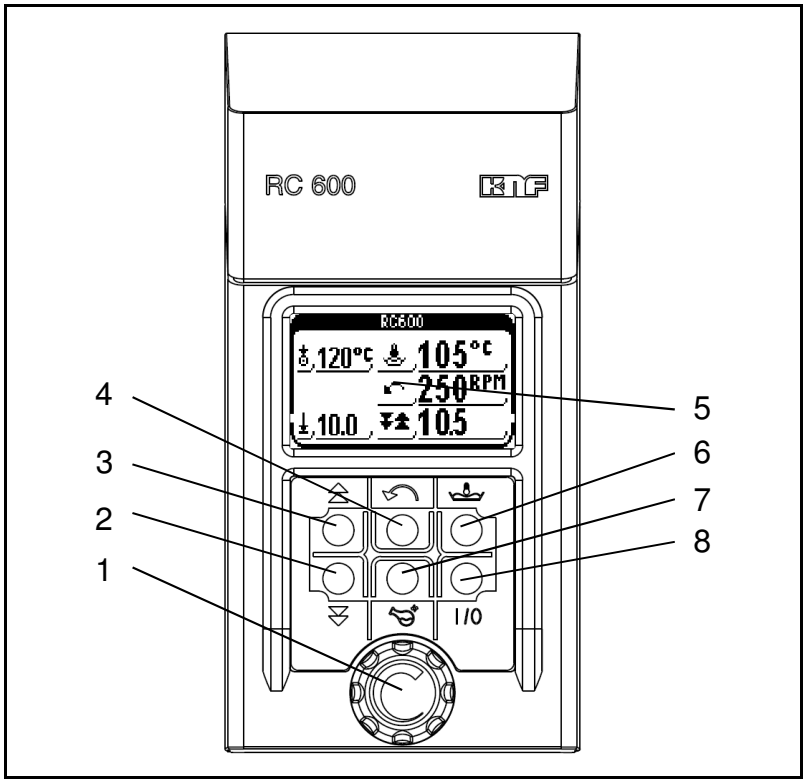


Fig. 2: Terminal RC 600

Function

The terminal is used to set the process parameters with which the RC 600 rotary evaporator works.

Settings are adjusted via the terminal's membrane buttons (Fig. 2/**2+3+4+6+7+8**) or with the rotary knob (**1**).

The speed, heating bath setpoint and actual temperature, the lift position and the value of the digital end stop are shown on the display (5).

5.4 USB connection

The USB Connection (Fig. 1/19) is used for technical service and software update. The current software version is displayed shortly once the RC600 is turned on. Consult with your KNF provider for the latest software version.

6 Setup and connection

Connect the rotary evaporator only under the operating parameters and conditions described in Chapter 4 Technical data (pages 12 + 13).

Observe all information about the device's intended use and safety precautions (see Chapter 2 and 3, page 8ff).

⚠ WARNING

Risk of personal injury from poisoning or explosion and damage to the rotary evaporator.

Hazardous gases and vapours may be produced during distillation.

- Gas drawn out of the rotary evaporator must be safely diverted.

6.1 Installation

Shipment

The rotary evaporator may be carried only by the components marked grey in Fig. 3. Carrying the rotary evaporator by any point other than the indicated points may result in damage to the unit.

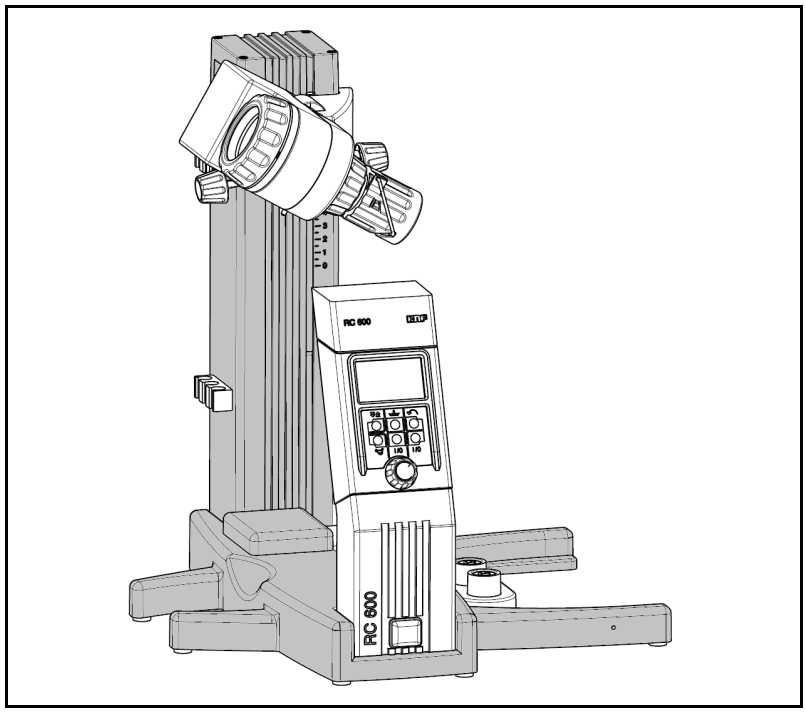


Fig. 3: Carrying the rotary evaporator

Before setting up the rotary evaporator, allow it to reach ambient temperature at the location where it will be used.

Installation location

Make sure that the installation location is dry and the rotary evaporator is protected against water in the form of rain, spray, splashes and drips.

Choose a safe location (flat, stable surface) for the rotary evaporator.

Protect the rotary evaporator from dust.

Protect the rotary evaporator from vibration and impact.

Connected components

Attach to the rotary evaporator only components that are designed for the rotary evaporator's pneumatic data and/or coolant-supply parameters (see Chapter 4 Technical data).

Installing the heating bath

Place the included heating bath (Fig. 1/**14**, p. 15) onto the base connector.
Once in place, the heating bath can be shifted along the axis of rotation (for maximum pull-out length, see Chapter 4 Technical data).

Installing the chilled condenser

NOTE
When installing glass parts, allow sufficient space above the rotary evaporator because the glass structure may exceed the dimensions of the rotary evaporator itself.

The chilled condenser (Fig. 1/**6**, page 15) is delivered uninstalled. Install as follows:

1. Loosen tension nut (**7**) for chilled condenser until the chilled condenser can be inserted.
2. Insert chilled condenser (**6**).
3. Retighten tension nut (**7**) for chilled condenser.

NOTE
To finish tightening the tension nut, grasp the chilled condenser with your other hand and use it as a lever (see Fig. 4).

- - - - Tighten tension nut
——— Use chilled condenser to aid in fully tightening the tension nut

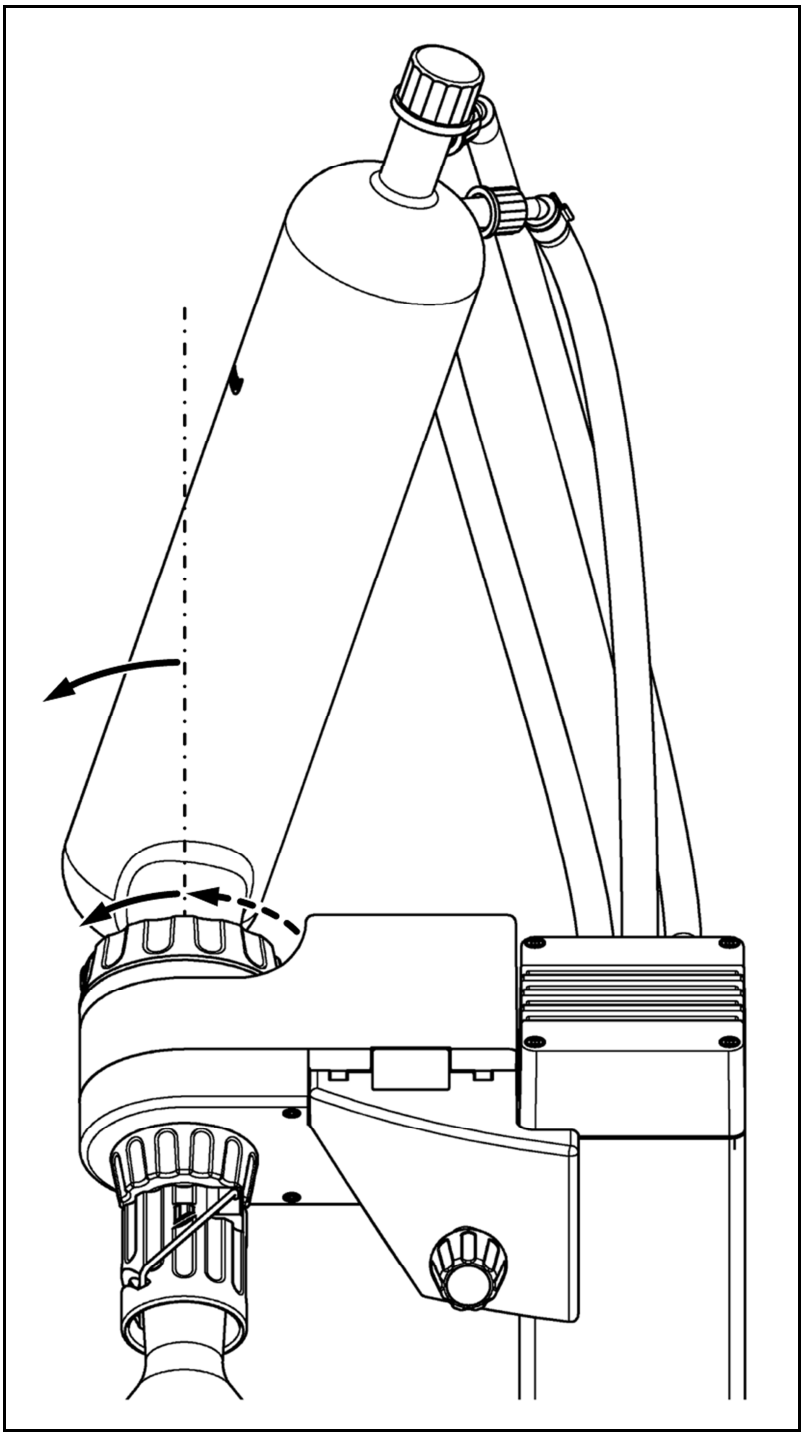


Fig. 4: Fully tightening the tension nut

4. Attach coolant hoses (Fig. 5/**2** and **3**) to the condenser or fill the dry ice condenser with dry ice.

⚠ WARNING

Extreme cold may cause personal injury

There is a risk of serious local freezing when handling dry ice.

➢ Observe the manufacturer's hazard notices.

NOTE

When installing the hoses, make sure that they are sufficiently long for the entire stroke distance.

1 Vacuum - black
2 Coolant inlet - blue
3 Coolant outlet - red

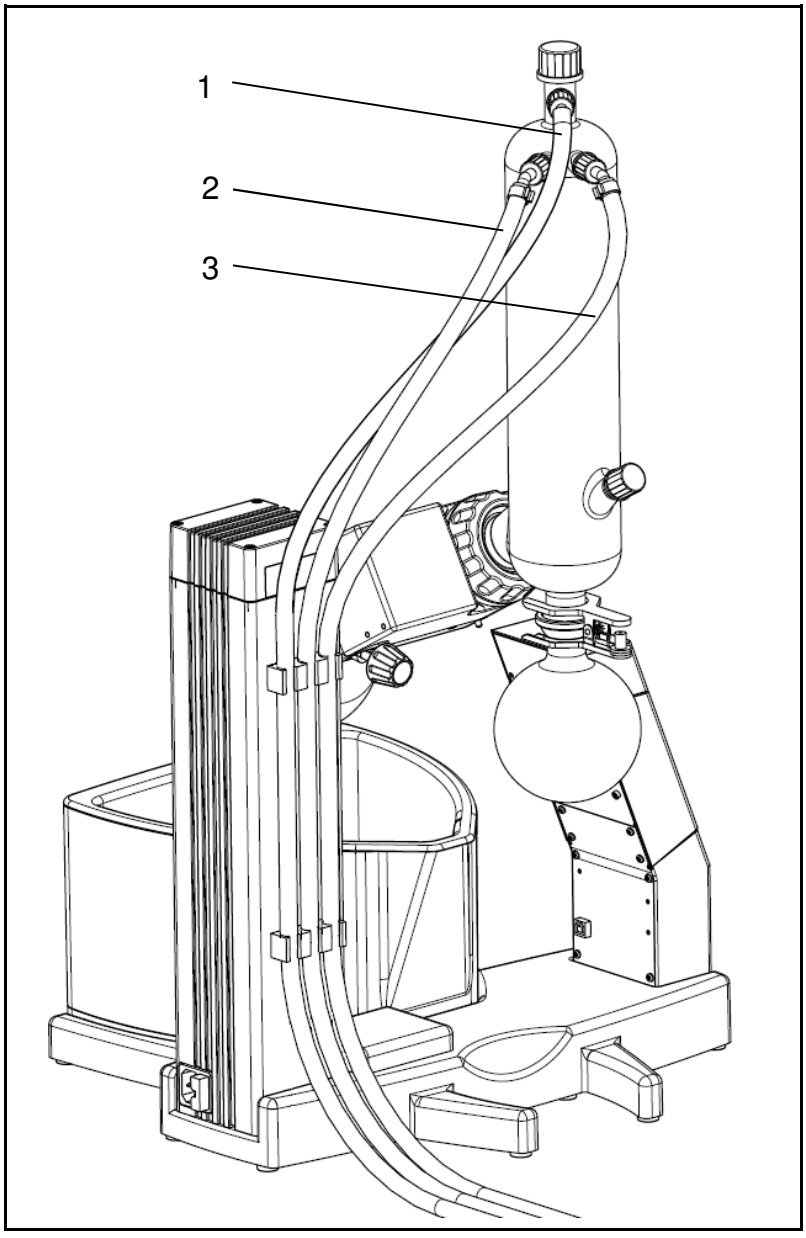


Fig. 5: Attaching lines for coolant and vacuum

The chilled condenser is now fastened to the rotary evaporator.

NOTE

In order to ensure a proper seal, retighten the tension nut once more while under vacuum.

Removing the chilled condenser

Requirements:

- Loosen hoses
- Remove collection flask (see below)

1. Loosen tension nut (**7**) until the chilled condenser can be pulled out.

NOTE

When loosening the tension nut, grasp the chilled condenser with your other hand and use it as a lever (refer to Fig. 4).

2. Remove chilled condenser (**6**).

Installing the collection flask

Install the separate collection flask (Fig. 1/**3**, page 15) using the included flask clamp (Fig. 1/**4**, page 15).

Remove collection flask and empty if necessary

Requirements:

- Rotary evaporator must be ventilated

WARNING

Personal injury by poisoning

When opening the process space, such as when removing the flasks, residual solvent vapours may escape to the surrounding atmosphere.

➢ Extract any solvent vapours (e.g. under a fume hood)

WARNING

Personal injury by hazardous materials

The distillate in the collection flask may be a hazardous material.

➢ Observe all safety regulations and disposal requirements for the distillate!

Loosen the flask clip (Fig. 1/**4**, page 15) and remove the collection flask (Fig. 1/**3**, page 15). Empty the collection flask if necessary.

Installing the evaporation flask

Install the included evaporation flask (Fig. 1/**13**, page 15):

⚠ WARNING

Risk of injury from glass splinters, chemical reactions (solvent with heating medium), solvent, and hot liquids.

The evaporation flask may slide down during installation and become damaged (glass breakage).

➢ When tightening the flask nut, make sure the fastening clip is not lifted.

1. Loosen flask nut (**10**) by about 2-3 revolutions.
2. Slide evaporation flask (**13**) onto the tapered adapter. The flask nut's (**10**) fastening clip must audibly engage. If it does not, further loosen the flask nut and slide the evaporation flask back into place.

NOTE

The wire clip now securely holds the evaporation flask in place.

3. Tighten evaporation flask via vacuum or by lightly tightening the flask nut (**10**).
4. Adjust the angle and heating bath position to the size of the evaporation flask.
5. When working outside the fume hood, use the protective cover (see Chapter 11, *Spare parts and accessories*).

The evaporation flask is now installed and secure.

Removing the evaporation flask

Requirements:

- Completely lift out the evaporation flask and allow it to cool sufficiently.
- Stop rotation
- Rotary evaporator must be ventilated

⚠ WARNING

Personal injury by poisoning

When opening the process space, such as when removing the flasks, residual solvent vapours may escape to the surrounding atmosphere.

➢ Extract any vapours (e.g. under a fume hood).

⚠ WARNING

Personal injury by hazardous materials

The content of the evaporation flask may be a hazardous material. Additionally, mixing with the heating medium may produce hazardous materials.

- ➢ Observe all safety regulations and disposal requirements for the solvent!

1. If present, open or lift off the protective cover (see Chapter 11, *Spare parts and accessories*).

NOTE

If the protective cover is opened and the listed requirements are not fulfilled, an acoustic warning will sound.

2. If the flask nut (**10**) is tightened, loosen it.

⚠ WARNING

Risk of burns from hot media.

If the flask nut is rotated too far out, there is a risk that the evaporation flask could fall into the heating bath.

- ➢ Make sure that the flask nut is loosened by no more than three revolutions.

NOTE

If the evaporation flask is securely in place, the flask nut can be used to assist in removal.

NOTE

The fastening clip prevents the evaporation flask from sliding out.

3. Grasp the evaporation flask and lift up the fastening clip.

⚠ WARNING

Risk of burns from hot surfaces.

Skin contact with the hot evaporation flask may result in burns.

- ➢ Allow evaporation flask to cool
- ➢ Grasp evaporation flask at the cooler neck

4. Pull off evaporation flask

Adjust the angle of the evaporator flask

Set the evaporator flask's angle of inclination via the rotary knobs (**12** and **18**).

Adjusting the immersion depth of the evaporator flask

⚠ WARNING

Risk of injury from glass splinters, chemical reactions (solvent with heating medium), solvent, and hot liquids.

Evaporation flask and flask nut may collide with the wall or base of the heating bath during lowering and become damaged (glass breakage).

- ➢ Always monitor lowering of the evaporation flask. (If necessary, adjust the heating bath position, inclination, and immersion depth to the size of the evaporation flask).

Adjust the immersion depth of the evaporation flask using the terminal (see Chapter 8, *Operating the rotary evaporator*).

NOTE

In the event of power failure, in the interest of safety, the evaporation flask will automatically lift out of the heating bath to its upper endpoint.

Installing and using the refilling valve (accessory)

If needed, install the refilling valve (see Chapter 11, *Spare parts and accessories*) (see Fig. 6):

1 PTFE hose
2 Refilling valve
3 Drip washer

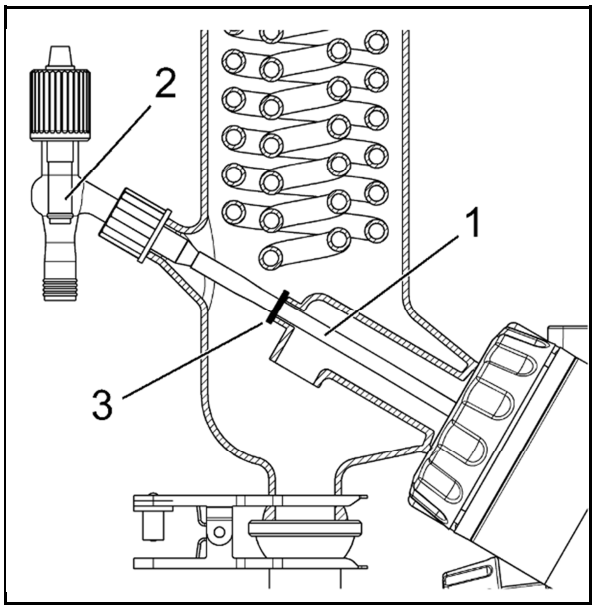


Fig. 6: Position of drip washer

1. Slide the PTFE tube (**1**) onto the refilling valve's (**2**) corresponding glass fitting.
2. Slide the drip washer (**3**) onto the PTFE tube (**1**).
3. Insert the PTFE tube (**1**) through the chilled condenser and into the evaporation flask.

   Ideally, the drip washer (**3**) will rest on the insertion tube (see Fig. 6).
4. Position the refilling valve (**2**) and securely tighten the union nut. The refilling valve is now installed.

Installing protective cover (accessory)

NOTE

If the rotary evaporator is not operated under a fume hood (heating temperature no more than 90°C), then installation of the protective cover on the heating bath is mandatory for protection against implosion (airborne glass splinters and liquid) and hot spray water!

NOTE

The protective cover may be used only with heating bath temperatures up to 90°C. When temperatures are higher, the evaporator must be used without the protective cover and under a fume hood!

NOTE

The protective cover is not included in delivery and must be ordered separately (see Chapter 11, *Spare parts and accessories*).

NOTE

Do not carry the heating bath by the protective cover!

1. Place the protective cover (Fig. 7/**1**) on the heating bath (**2**).
2. Fasten the protective cover (**1**) to the heating bath:
   To do this, tighten the three knurled screws (**3**).

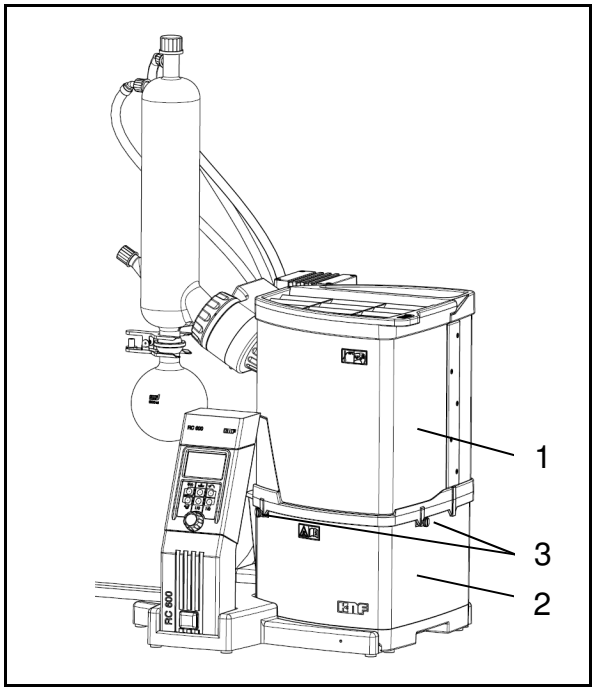


Fig. 7: Protective cover closed

The walls of the protective cover are transparent, permitting observation of events inside the evaporator flask. It also has a flap (Fig. 8/**1**) that permits rapid access to the evaporator flask.

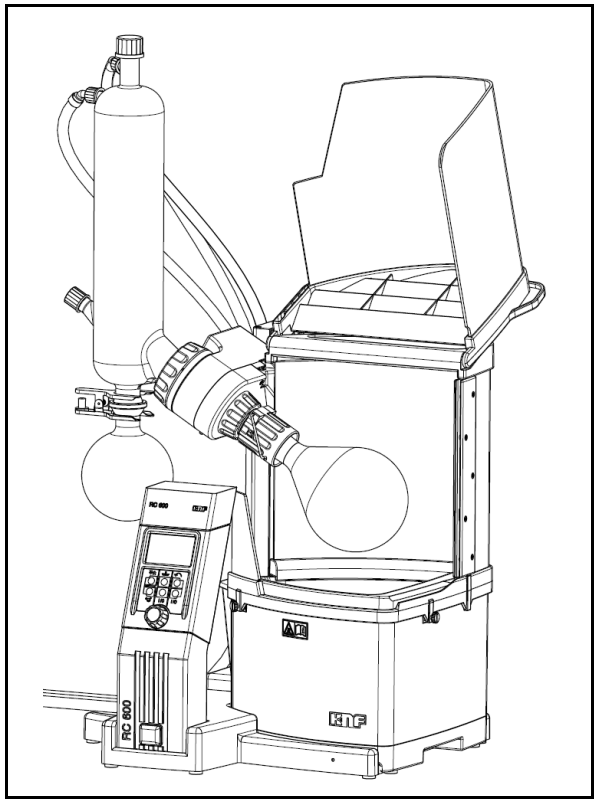


Fig. 8: Protective cover open

The protective cover and flap are monitored electronically. Using the terminal, you can select how the rotary evaporator will react when the protective cover is removed or the flap opened during operation (see Chapter 8.1).

NOTE
When working without the protective cover (under fume hood), electronic monitoring of the protective cover must be deactivated at the terminal (see Chapter 8.1.2).

6.2 Connections

1. Connect the suction side of the vacuum pump to the vacuum connection (Fig. 5/**1**, page 21).

NOTE

Use a vacuum hose for this purpose.

NOTE

Safely divert gas emissions (from the pump) so no gases escape into the ambient air.

2. Attach coolant feed and return lines to the chilled condenser (Fig. 5/**2+3**, p. 21, connections exchangeable).

NOTE

If the rotary evaporator is cooled with a dry ice condenser, additional coolant is not required.

⚠ WARNING

Risk of rupturing from excess pressure

If the discharge line is blocked, the permitted operating pressure of the chilled condenser may be exceeded.

➢ Block only the inlet of the coolant line

3. If necessary for safety reasons, connect an inert gas feed line in order to ventilate the glass parts.
4. Insert the power cable plug into a properly installed earthed socket.

7 Operation

7.1 Initial start-up

Before switching on the rotary evaporator, check the following points:

Prerequisites for start-up
▪ All hoses attached properly ▪ Specifications of the power supply correspond with the data on the rotary evaporator's type plate ▪ Coolant connection on the chilled condenser is operational ▪ The rotary evaporator is at room temperature ▪ User ensures that the lift drive can move freely and without obstruction ▪ User ensures that the hoses on the condenser are long enough for the entire stroke

Tab. 1

Operate the rotary evaporator only under the operating parameters and conditions described in Chapter 4 Technical data (pages 12 + 13).

Make sure the rotary evaporator is used properly (see Chapter 2.1, page 8).

Make sure that the rotary evaporator cannot be misused (see Chapter 2.2, page 9).

Observe the safety precautions (see Chapter 3, page 10+11).

⚠ WARNING

Inadequate cooling may result in personal injury and damage to the rotary evaporator.

If cooling is inadequate, there will be a danger of the vacuum pump system sucking solvent vapours from the chilled condenser.

➢ Make sure that no solvent can enter the ambient atmosphere in the event of a cooling failure.

NOTE

In order for the chilled condenser to recover solvent from the rising gas, it must be cooled with a coolant.

Inspecting and emptying the collection flask

Check the fill level of condensate in the collection flask (Fig. 1/**3**, page 15) at suitable intervals. Empty the collection flask if necessary.

Shifting heating bath

The position of the heating bath must be adapted to the size and inclination of the evaporation flask.

Filling heating bath

⚠ WARNING

Risk of burns from hot media.

Hot vapours may be produced when filling the heating bath.

- ➢ Ensure that the heating bath temperature is always lower than the boiling temperature of the medium.
  Note that if the water level is low, the actual temperature of the heating coil may be significantly higher than the indicated temperature.

⚠ WARNING

Risk of burns from hot media.

When lowering the evaporation flask into the heating bath, the heating bath may overflow if the fill volume is too high.

- ➢ When filling the heating bath, consider how the evaporation flask will displace the heating medium in the bath.
- ➢ Oil can expand strongly under heat, use accordingly less.

⚠ WARNING

Risk of burns from hot media.

Hot media may be spilled when sliding or carrying the heating bath.

- ➢ Make sure that the heating bath is sufficiently cooled before sliding or carrying.

⚠ WARNING

Personal injury by poisoning

Risk of poisoning through inhaling oil vapours.

- ➢ Use under a suitable fume hood

NOTE

The heating bath contains a scale that indicates the maximum fill volume based on the size of the selected evaporation flask.

To more accurately estimate the proper filling volume, the evaporation flask may be lowered into the heating bath before filling (see Chapter 8, *Operating the rotary evaporator*).

NOTE

Do not use de-ionised or distilled water

Fill heating bath with heating medium.

⚠ WARNING

Risk of burns from hot surfaces.

If the heating bath is not sufficiently filled, the base of the bath in particular may overheat.

- ➢ Ensure that the heating bath contains sufficient heating medium at all times and that it does not run dry through evaporation during operation.

NOTE

If there is insufficient fluid in the heating bath (dry start or runs dry), it switches off automatically and an error message is displayed (see Chapter 10).

The temperature of the heating coil is limited in two ways (electronically and electromechanically).

Refilling evaporation flask

⚠ WARNING

Risk of personal injury from poisoning or explosion

Hazardous mixtures may be produced when refilling the evaporation flask.

- ➢ Ensure that this does not result in a hazardous situation.

Using the refilling valve, the evaporation flask may be refilled under vacuum during operation, as follows:

1. Connect the refilling valve to the additional medium.
2. Open the refilling valve.

The additional medium will be drawn into the evaporation flask.

Switching on the rotary evaporator

Switch on the rotary evaporator at the power switch (see Fig. 1/**1,** page 15).

NOTE

For information about operating the rotary evaporator, refer to Chapter 8, page 33.

7.2 Shutdown

- ➢ Stop the current process.
- ➢ Ventilate rotary evaporator

⚠WARNING

Risk of personal injury from poisoning or explosion and damage to the rotary evaporator.

Ventilation of the rotary evaporator may result in poisonous or explosive mixtures.

- ➢ If necessary, ventilate the rotary evaporator with inert gas.

- ➢ Switch off rotary evaporator at the power switch (Fig. 1/**1,** page 15).

⚠WARNING

Risk of burns from hot media.

Skin contact with hot surfaces and medium may occur when emptying the heating bath and evaporation flask.

- ➢ Allow heating bath and evaporation flask to cool completely.

- ➢ Empty heating bath

⚠WARNING

Personal injury by hazardous materials

The media located in the evaporation and collection flasks may be hazardous materials.

- ➢ Observe all safety regulations and disposal requirements for the media!

⚠WARNING

Personal injury by poisoning

When opening the process space, such as when removing the flasks, residual solvent vapour may enter the surrounding atmosphere.

- ➢ Extract any solvent vapours (e.g. under fume hood).

- ➢ Empty evaporation and collection flasks.
- ➢ Stop the feed of coolant, separate any coolant connections.
- ➢ Separate vacuum connection, if present.

8 Operating the rotary evaporator

8.1 Terminal

8.1.1 General functions and displays

1 Rotary knob for:
- Entering setpoints:
  - o Heating temperature
  - o Rotation
  - o Fine adjustment of immersion depth

2 Button to lower lift
3 Button to raise lift
4 Button for rotation on/off
5 Display
6 Button for heating bath selection
7 Button for exchange flask function
8 Button for heating bath on/off

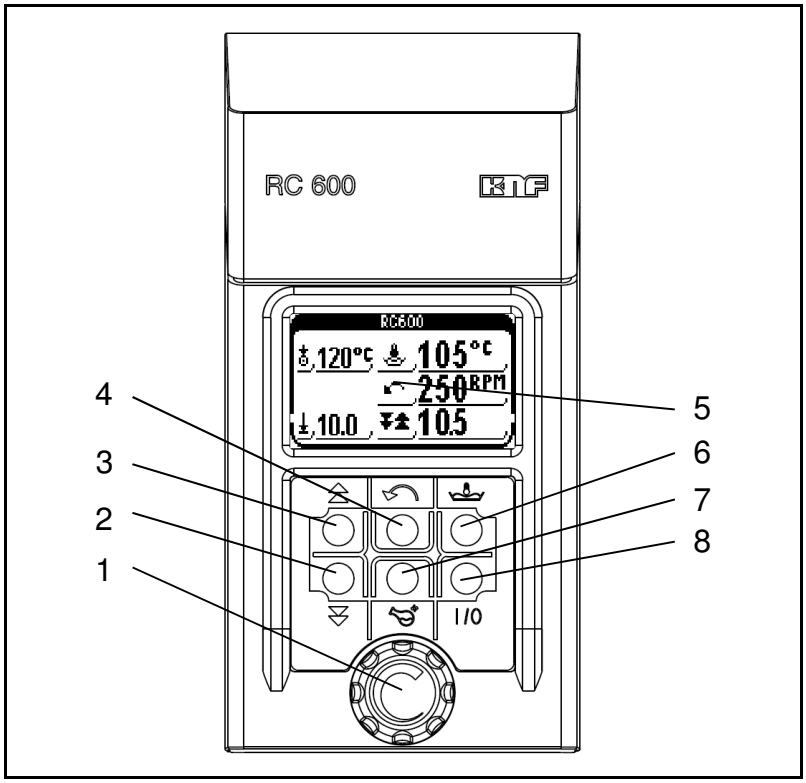


Fig. 9: Terminal

The rotary evaporator is operated via the terminal with the aid of:

- the rotary knob (Fig. 9/**1**) and
- the membrane buttons (Fig. 9/ **2+3+4+6+7+8**).

The **rotary knob** has the following functions:

- Rotate the knob:
- Entering setpoints:
  - Speed of evaporator flask
  - Fine adjustment of immersion depth
  - Temperature of heating bath

Content of the **display**:

- Displays setpoint and actual temperature (Fig. 10/ **2**+**4**, page 34);
- Displays the height of the digital end stop and the evaporator flask (Fig. 10/ **7**+**10**)
- Displays the speed of the evaporator flask (Fig. 10/ **12**)
- Display Oil mode (Fig. 10/ 13)

Displays

1 Heating bath status display
2 Heating bath setpoint
3 Selection icon for heating bath
4 Actual value of heating bath
5 Unit of temperature
6 Icon for digital end point
7 Set digital end point
8 Selection icon / status display for speed
9 Selection icon for lift
10 Lift position
11 Unit of speed
12 Speed
13 Oil mode (since SW Version 6.00)

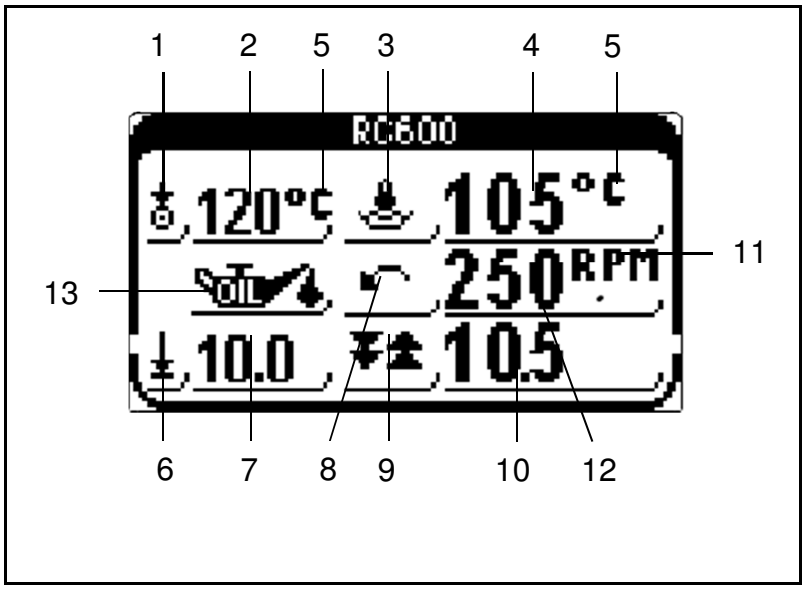


Fig. 10: Displays on the screen

The **membrane keyboard** has the following functions:

- Operating keys (Fig. 11) with the functions:

Switch heating bath on and off (**6**)

Heating bath selection (**3**)

Switch rotation on and off (**2**)

Lift selection through short press of the buttons (**1**/**4**)

Raise lift (**1**)

Lower lift (**4**)

Exchange flask function (**5**)

Menus, fields, and buttons

1 Button to raise lift
2 Button for rotation on/off
3 Button for heating bath selection
4 Button to lower lift
5 Button for exchange flask function
6 Button for heating bath on/off or activate Oil mode (since SW Version 6.00)

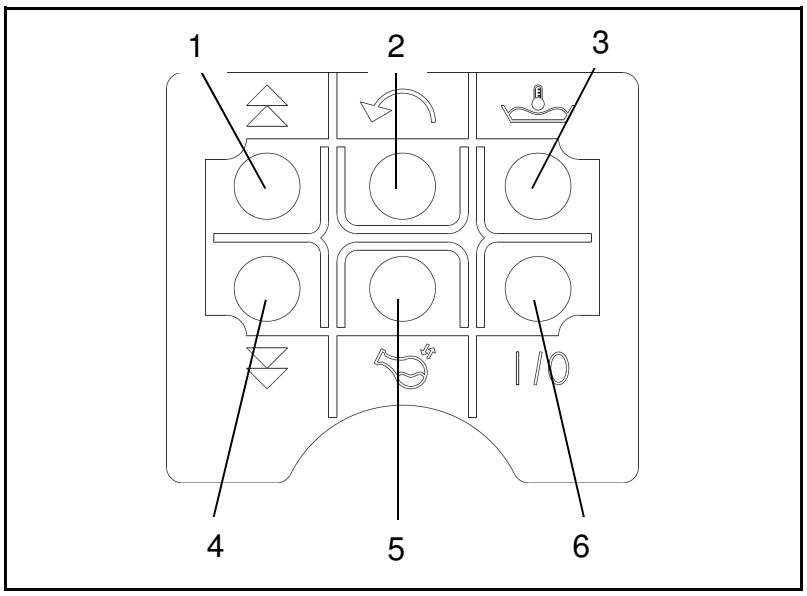


Fig. 11: Buttons on the membrane keyboard

8.1.2 Operation

Base settings

When the rotary evaporator is switched on, a start screen is displayed for 2-5 seconds with the logo and version number of the firmware.

a) Activate/deactivate electronic monitoring of the protective cover

If the rotary evaporator is not operated under a suitable fume hood, the protective cover (accessory) must be used (see Chapter 6.1) and electronic monitoring must be switched on.

The various safety settings can be changed by pressing the buttons simultaneously (Fig. 11/**2+3**).

- After 3 seconds, a single sound indicates that the EMERGENCY STOP function is inactive. When the rotary evaporator is running with the cover open, a continuous acoustic warning will be heard.
- After 6 seconds, you will hear two acoustic signals in quick succession. They indicate that the EMERGENCY STOP function is active. If the cover is opened during operation, the evaporator flask is automatically raised from the heating bath and rotation stops.
- After 9 seconds, you will hear three acoustic signals in quick succession. This deactivates the electronic monitoring of the protective cover

b) To change the unit of temperature, press button 3 (Fig. 11/**3**) for 5 seconds. This is confirmed with an acoustic signal.

c) To change the heating fluid (Oil mode since SW Version 6.00), press button 6 (Fig. 11/**6**) for 4 seconds. This is confirmed with an acoustic signal and with an icon on the display (Fig. 10/ 13).

Switch heating bath and rotation of evaporation flask on and off.

Use the button (Fig.11/**6**) to switch the heating bath on and press it again to switch it off.

Rotation of the evaporator flask is activated and deactivated via the button (**2**).

NOTE
When the heating bath or rotation of the evaporation flask is switched on, the corresponding icon will flash (Fig. 10/**1**+**8**).

Entering setpoints

The following setpoints may be selected through the membrane keyboard:

*Input field **	*Function*	*Setpoint range*
1 - 4 (+ Rotary knob)	Immersion depth	0…12.9
2 + Rotary knob	Speed [rpm]	25…280
3 + Rotary knob	Heating bath temperature - [°C] - [°F] - [K]	 20…180 68…356 293…453

*Tab. 2 * according to Fig. 11*

- Press input field for the desired setpoint.

NOTE

The selected input field will be highlighted on the display with a black background.

- Use the rotary knob to adjust the setpoint.
- After 2 seconds, the display returns to the starting state.

NOTE

The speed is selected in the starting state.

Changing the immersion depth

⚠ WARNING

Risk of burns from hot media

When the evaporation flask is being immersed in the heating bath, heating medium may spray out of the bath if the rotation speed is too fast.

➢ Before immersing the evaporation flask in the heating bath, reduce the rotation speed.

The immersion depth can be raised via button 1(see Fig. 11/**1**) or lowered via button 4 (see Fig. 11/**4**).

- Press button 1 or 4 (see Fig. 11/**1+4**) and then turn rotary knob 1 (see Fig. 9/**1**) to finely adjust the lift.
- Hold button 5 (see Fig. 11/**5**) for 5 seconds to apply the current position of the evaporation flask. The flask cannot pass the stored position. Press the button again for 5 seconds to delete the stored position.

Exchange flask function

⚠ WARNING

Risk of injury from glass splinters, chemical reactions (solvent with heating medium), solvent, and hot liquids.

When using the "Exchange flask" button, any changes to the size or shape of the evaporation flask may cause the flask to collide with the heating bath tank or other parts.

- ➢ The heating bath position, angle and immersion depth must not be changed while the evaporating flask is being exchanged.
- ➢ Replace only with a flask with the same size and shape.

- When you press the Exchange flask function button (Fig. 11/**5**) the flask moves to its top position. Rotation is stopped.
- Change the evaporation flask.
- When you press the Exchange flask function button (5) again, the evaporator flask returns to the stored position and rotation is started again.

8.2 Change the evaporation flask

See Chapter 6.1 for information on installing and removing the evaporation flask.

NOTE

It may be necessary to coordinate the angle of inclination, heating bath position, and immersion depth (lower stop position).

9 Servicing

If you have any questions about servicing, call your KNF technical adviser (see last page for contact telephone number).

9.1 Servicing schedule

Component	Servicing interval
Rotary evaporator	Inspect regularly for external damage or leaks
Heating bath medium	Inspect regularly for contamination of the heating medium

Tab. 3

9.2 Cleaning

NOTE

When cleaning, make sure that no liquids enter the inside of the housing.

⚠ WARNING

Personal injury by hazardous materials

After operation, the components of the rotary evaporator may be contaminated with aggressive materials.

- ➢ Always wear protective clothing (protective glasses, gloves, etc.) as required for workplace safety in a laboratory.

9.2.1 Cleaning the rotary evaporator

Clean the outside of the rotary evaporator only with a moist cloth. Do not use flammable cleaning agents.

9.2.2 Cleaning glass parts

Requirements

- Glass parts adequately cooled
- Rotary evaporator must be ventilated
- For chilled condenser only:
  - Remove any coolant that is present
  - Chilled coil or dry ice condenser is at room temperature

Collection flask

1. Remove collection flask (see Ch. 6.1)
2. Dispose of contents in collection flask according to local regulations.
3. Rinse collection flask with suitable cleaning agent.
4. Re-install collection flask (see Ch. 6.1)

Evaporation flask

1. Remove evaporation flask (see Ch. 6.1).
2. Dispose of contents in evaporation flask according to local regulations.
3. Rinse evaporation flask with suitable cleaning agent.
4. Re-install evaporation flask (see Ch. 6.1).

Chilled condenser

1. Remove chilled condenser (see Ch. 6.1).
2. Rinse chilled condenser with suitable cleaning agent.
3. Re-install chilled condenser (see Ch. 6.1).

Vapour tube

1. Remove vapour tube (see Ch. 9.3).
2. Rinse vapour tube with suitable cleaning agent.
3. Re-install vapour tube (see Ch. 9.3)

9.2.3 Clean seal

1. Remove seal (see Ch. 9.4.)
2. Clean seal with suitable cleaning agent.
3. If necessary, clean seal receiver with suitable cleaning agent.
4. If necessary, clean vapour tube (see Ch. 9.2.2).
5. Re-install seal (see Ch. 9.4)

9.2.4 Clean heating bath

⚠ WARNING

Personal injury and heating bath damage by short circuit.

In case that Water gets into the heating bath case, there is danger of a short circuit.

- ➢ Do not immerse the heating bath in water or overflow it with water.
- ➢ Wipe the heating bath clean.

Requirements

- Heater must be shut off
- Heating bath adequately cooled
- Evaporation flask in upper stop position
- Protective cover removed (if present)

1. Remove heating bath
2. Dispose of contents of heating bath according to local regulations.
3. Clean heating bath with suitable cleaning agent.
4. Re-install heating bath

9.2.5 Cleaning protective cover (accessory)

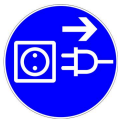
Rinse protective cover with clear water; clean with a soft cloth.

NOTE

Synthetic glass scratches easily and is sensitive to solvents.

9.3 Changing vapour tube

Requirements



- Rotary evaporator disconnected from mains power and de-energised
- Heating bath empty
- Evaporation flask removed (see Ch. 6.1).
- Rotary evaporator free of hazardous materials
- Rotary evaporator must be ventilated
- Protective cover removed (if present)

⚠ WARNING

Dangerous substances in the rotary evaporator can cause a health hazard

Depending on the distilled solvent, caustic burns or poisoning are possible.

➢ Wear protective clothing if necessary, e.g. protective gloves.

⚠ CAUTION

Danger of burns from hot parts

Glass parts and the heating bath may be hot even after the rotary evaporator has been shut off.

➢ Allow the rotary evaporator to cool off after operation.

1. Screw off flask nut (Fig. 12/**1**).

NOTE

With the other hand, hold the vapour tube's tension nut (**3**).

2. Loosen the vapour tube's tension nut (**3**) until the vapour tube (**2**) can be pulled out.

NOTE

While doing this, press and hold the block for the rotation drive (**4**).

3. Pull out the vapour tube (**2**).
4. Insert the new vapour tube (**2**) until it engages.

NOTE

If you have difficulty finding the engagement point, slightly tighten the tension nut after inserting the vapour tube.

NOTE

Finding the engagement point may also be easier when the condenser is removed (see Ch. 6.1).

5. Lightly tighten the vapour tube's tension nut (**3**).

NOTE

While doing this, press and hold the block for the rotation drive (**4**).

6. Screw on the flask nut (**1**).

NOTE

With the other hand, hold the vapour tube's tension nut (**3**).

1 Flask nut
2 Vapour tube
3 Vapour tube's tension nut
4 Catch for the rotation drive

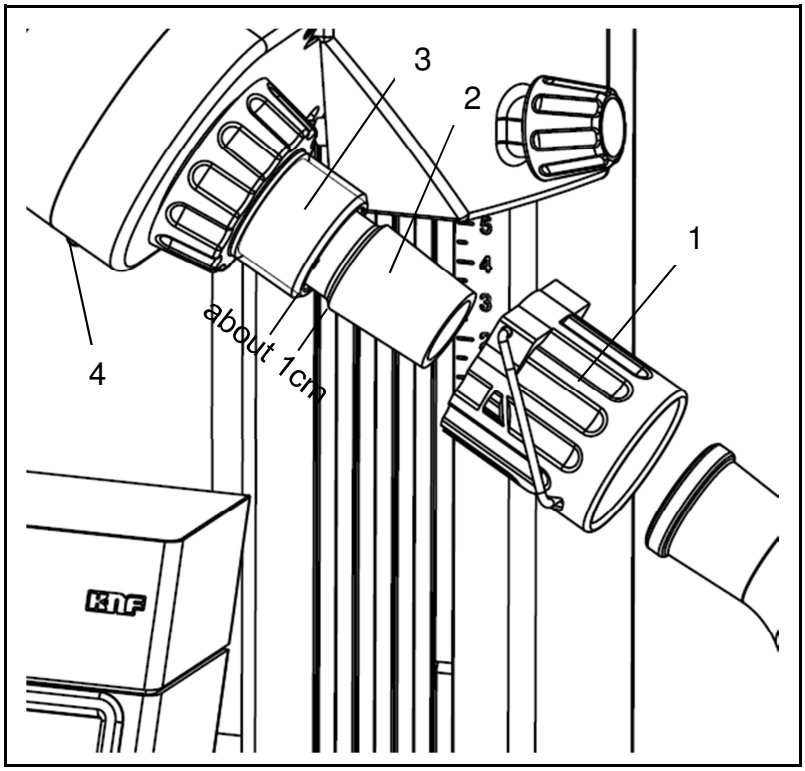


Fig. 12: Changing vapour tube

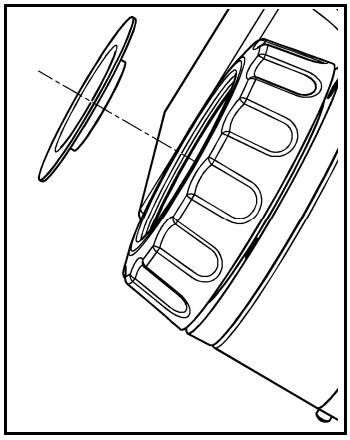


Fig. 13: Aligning the seal

9.4 Changing seal

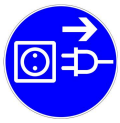
1. Remove chilled condenser (see Ch. 6.1).
2. Remove vapour tube (see Ch. 9.3).
3. Remove old seal (see Fig. 13).
4. Re-install vapour tube (see Ch. 9.3).
5. Slide the new seal (see Ch. 12.1 "Spare parts") onto the vapour tube.

NOTE
The lip of the seal must be aligned inward (see Fig. 13).

6. Install vapour tube (see Ch. 9.3).
7. Install chilled condenser (see Ch. 6.1).
8. Properly dispose of old seal.

9.5 Changing fuses

Requirements



- Rotary evaporator disconnected from mains power and de-energised
- Heating bath empty
- Rotary evaporator free of hazardous materials

⚠ CAUTION

Danger of burns from hot parts

Glass parts and the heating bath may be hot even after the rotary evaporator has been shut off.

➢ Allow the rotary evaporator to cool off after operation.

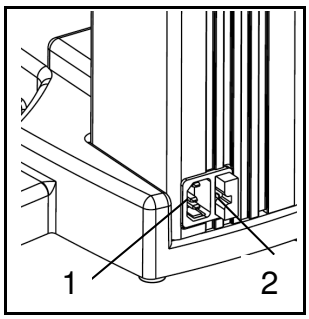


Fig. 14: Changing fuses (200-240V)

a) 220-240 Volt units

1. Loosen cover (Fig. 14/**1**) and remove (Fig. 14/**2**).
2. Replace blown fuses (Fuse specification, see Chapter 4, page 12).
3. Replace cover (Fig. 14//1).

b) 100-127 Volt units

■ DANGER

Risk of electric shock, danger of death

Separate the rotary evaporator from the power supply before working on the rotary evaporator.

➢ Make sure that the pump is de-energised.

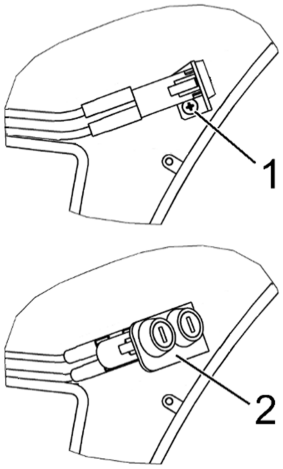


Fig. 15: Changing fuses (100-127V)

1. Unscrew the eight rubber feet (Fig. 15/ 1) and carefully remove the bottom plate under the rotary evaporator.
2. Remove screw (Fig. 15/ 1) and pull the fuse holder out .
3. Open the cover of the fuse holder with a screwdriver (Fig. 15/ 2), remove the damaged fuse and replace it with a new one (fuse specifications on chapter 4, page 12).
4. Close fuse holder (Fig. 15/2) and reinstall it (Fig. 15/ 1).
5. Place the bottom plate carefully in position and fixate it by screwing the rubber feet on.

10 Troubleshooting

DANGER

Risk of electric shock, danger of death

Separate the rotary evaporator from the power supply before working on the rotary evaporator.

➢ Make sure that the pump is de-energised.

- Rotary evaporator generally: see Tab. 4.
- Terminal generally: see Tab. 5.
- Error message in display: see Tab. 6.

Rotary evaporator generally		
Error	**Possible cause**	**Remedy**
The rotary evaporator is switched on, but the power switch does not illuminate.	Power cable not plugged in.	Plug the rotary evaporator's mains power cable into a properly installed grounded socket.
	No voltage in the mains.	Check the room's fuses.
	Power cable's internal fuse is burned out.	Use a suitably-sized power cable (see rotary evaporator's type label for power consumption). Replace power cable's fuse if necessary.
	Fuses in rotary evaporator are blown.	4. Identify and eliminate cause of overload. 5. Change the rotary evaporator's mains fuses (see Ch. 9.5, page 43).
The desired vacuum is not reached.	The attached vacuum device is inadequate.	Attach an adequate vacuum device.
	Leaks in the hose connections at the tower and chilled condenser.	Check hoses and fittings; tighten or replace as necessary.
	Sealing caps on chilled condenser have leaks.	Check the caps' internal seals; retighten / replace as necessary.
	The refilling valve (accessory) is not fully closed.	Close the refilling valve. Securely tighten the refilling valve's through cap. Check the cap's seal if necessary.
	The rotary drive's seal is worn.	Replace seal (see Ch. 9.4.).
	The vapour tube's sealing surface is damaged.	Replace vapour tube (see Ch. 9.3).
	Solvent evaporating in collecting flask	Empty collecting flask

The rotary drive does not reach the selected speed or does not move.	Flask drive blocked by foreign parts.	Remove foreign parts.
	The wrong speed setpoint has been selected.	Correct the setpoint (see Ch. 8.1.2, page 35).
	Condensate residue is adhered to the seal.	Clean seal (see Ch. 9.2.3, page 38).
Evaporation flask cannot be lowered / raised.	Evaporation flask or flask nut collide with the heating bath.	Lift evaporation flask (see Ch. 8.1.2, page 36) or reposition heating bath. Observe Chapter 6.1 (page 18) when re-immersing evaporation flask.
	Foreign parts / objects are blocking lift drive.	Remove foreign parts / objects.
	Setpoint for immersion depth is reached.	Change the evaporation flask's immersion depth (see Ch. 8.1.2, page 36).
Heating bath does not heat.	Heating bath is not switched on (symbol in display not flashing).	Switch on heating bath (see Ch. 8.1.2, page 35).
	Not enough heating medium in heating bath (error message, see Table **Fehler! Verweisquelle konnte nicht gefunden werden.**).	Replenish heating medium (see Ch. 7.1, page 30).
	Heating bath has no electrical contact.	Make sure heating bath sits properly on rotary evaporator. Make sure no foreign parts are underneath heating bath.
	Thermal circuit breaker has triggered.	Reset circuit breaker (see Fig. 16).
Condensate in separators / vacuum system's secondary condensers.	Cooling capacity inadequate for the volume of vapour (chilled condenser backs up with liquid).	Ensure that the chilled condenser is supplied with sufficient cooling medium (observe volume and temperature, Ch. 2.1). Adapt vapour volume to available cooling capacity.
Inside of chilled condenser is fogged up to the vacuum connection.		

Tab. 4: General troubleshooting

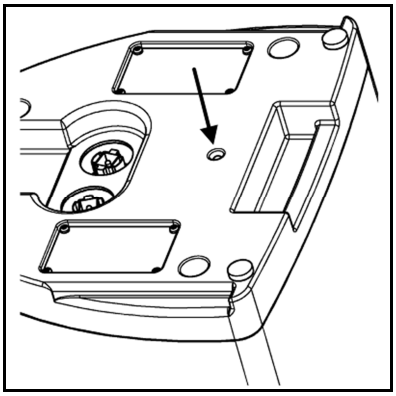


Fig. 16: Resetting the heating bath's circuit breaker

Resetting the heating bath's thermal circuit breaker

If an error occurs and the temperature of the heating bath exceeds 240°C the circuit breaker will automatically switch off the heating bath. The circuit breaker must then be reset manually, as follows:

1. Allow heating bath to cool
2. Empty heating bath
3. Determine cause of error and remove

NOTE

If you are unable to determine the cause of the error, call your KNF technical adviser (see last page for telephone number).

4. Reset circuit breaker

NOTE

Use a pointed object such as a pencil or a pointed tool to press the button on the underside of the heating bath (see arrow in Fig. 16).

Terminal		
Error	**Possible cause**	**Remedy**
Temperature display shows implausible values.	Temperature unit was changed.	➔ Select the desired temperature unit.

Tab. 5: Terminal troubleshooting

Error message in the display with simultaneous acoustic warning		
Error message	Meaning	Possible cause
E01	Temperature sensor defective or temperature difference between the two temperature sensors too high	No Heating bath or it is not properly placed on the contacts.
E02	Heating bath has run dry	Heating bath is empty or oil has been heated below 100 °C without selecting Oil mode (Oil mode since SW Version 6.00).
E04	Heating coil defective	Circuit breaker below hating bath has not been reset (see Fig. 16).
E05	Flask rotation mechanism blocked	Catch for the rotation drive is blocked (Fig. 12/ **4**)
E08	Display defect (with an intermittent acoustic warning)	Internal cause.
E09	Heating bath temperature sensor defective	Internal cause.
E10	Flask drive defective	Internal cause.

Tab. 6: Error message

Fault persists

If you are still unable to diagnose the problem, please send the rotary evaporator to KNF customer service (see address on last page).

1. Clean rotary evaporator, heating bath, and any parts that come into contact with the medium (see Chapter 9.2, page 38ff).
2. Send the rotary evaporator, together with completed Declaration of No Objection and Decontamination (Chapter 14, page 53), to KNF stating the nature of the distilled medium.

11 Solvent library

Solvent	Formula	Molar mass [g/mol]	Evaporation enthalpy [J/g]	Boiling point at 1013mbar [°C]	Density [g/cm^3]	Vakuum benötigt für Siedepunkt von 40°C
Aceton	CH_3H_6O	58.1	553	56	0.790	556
Acetonitril	C_2H_3N	41.1	833	82	0.786	230
n-pentanol	$C_5H_{12}O$	88.1	595	37	0.814	11
Benzol	C_6H_6	78.1	5448	80	0.877	236
n-butanol	$C_4H_{10}O$	74.1	620	118	0.810	25
tert-butanol	$C_4H_{10}O$	74.1	590	82	0.789	130
2-Butanon	C_4H_8O	72.1	473	80	0.805	243
Chlorbenzol	C_6H_5Cl	112.6	377	132	1.106	36
Chloroform	$CHCl_3$	119.4	264	62	1.483	474
Cyclohexan	C_6H_{12}	84.0	389	81	0.779	235
Diethylether	$C_4H_{10}O$	74.0	389	35	0.714	850
1,2-Dichlorethan	$C_2H_4Cl_2$	99.0	335	84	1.235	210
cis-1,2-Dichlorethan	$C_2H_2Cl_2$	97.0	322	60	1.284	479
trans-1,2-Dichlorethan	$C_2H_2Cl_2$	97.0	314	48	1.257	751
Diisopropylether	$C_6H_{14}O$	102.0	318	68	0.724	375
Dioxan	$C_4H_8O_2$	88.1	406	101	1.034	107
dimethylformamide (DMF)	C_3H_7NO	73.1	-	153	0.949	11
Essigsäure	$C_2H_4O_2$	60.0	695	118	1.049	44
Ethanol	C_2H_6O	46.0	879	79	0.789	175
Ethylacetat	$C_4H_8O_2$	88.1	394	77	0.900	240
Heptan	C_7H_{16}	100.2	373	98	0.684	120
Hexan	C_6H_{14}	86.2	368	69	0.660	360
Isopropanol	C_3H_8O	60.1	699	82	0.786	137
Isopentanol	$C_5H_{12}O$	88.1	595	129	0.809	14
Methylethylketon (Butanon)	C_4H_8O	72.1	473	80	0.805	243
Methanol	CH_4O	60.1	787	97	0.804	67
Dichlormethan	CH_2Cl_2	84.9	373	40	1.327	850
Pentan	C_5H_{12}	72.1	473	80	0.805	243
n-propanol	C_3H_8O	60.1	787	97	0.804	67
Pentachlorethan	C_2HCl_5	202.3	201	162	1.680	13
1,1,2,2,-tetrachlorethan	$C_2H_2Cl_4$	167.9	247	146	1.595	20
tetrachlormethan	CCl_4	153.8	226	77	1.594	271
1,1,1-	$C_2H_3Cl_3$	133.4	251	74	1.339	300

Solvent	Formula	Molar mass [g/mol]	Evaporation enthalpy [J/g]	Boiling point at 1013mbar [°C]	Density [g/cm^3]	Vakuum benötigt für Siedepunkt von 40°C
trichlormethan						
Tetrachlorethen	C_2Cl_4	165.8	234	121	1.623	53
THF (tetrahydrofuran)	C_4H_8O	72.1	-	67	0.889	374
Tuelene	C_7H_8	92.2	427	111	0.867	77
Trichlorethan	C_2HCl_3	131.3	264	87	1.464	183
Wasser	H_2O	18.0	2261	100	1.000	72
Xylole	C_8H_{10}	106.2	389	-	-	25
o-xylole	C_8H_{10}	106.2	-	144	0.880	-
m-xylole	C_8H_{10}	106.2	-	139	0.864	-
p-xylole	C_8H_{10}	106.2	-	138	0.861	-

Tab. 7: Solvent library

12 Spare parts and accessories

12.1 Spare parts

Spare part	Order No.
Seal	113046
Mains cable D	026363
Mains cable CH	027523
Mains cable UK	129326
Mains cable USA/JP	127875
Norprene® hose ID6 (sold by the metre*)	055535
Hose fitting ID6 with cap GL14	301092
Hose clamp ID6	127329
Collection flask 500 ml (coated)	128158
Collection flask 1000 ml (coated)	113939
Flask clamp collection flask	025968
Evaporation flask 1000 ml NS29/32	128159
Evaporation flask 1000 ml NS24/40	128893
Vapour tube NS29/32	126059
Vapour tube NS24/40	128762
Flask nut NS29/32	126056
Flask nut NS24/40	128781
Mains fuses - 240 V, 50/60Hz: T 8 (2x) - 115 V, 50/60Hz: T 15 (2x) NOTE: Observe Chapter 9.5 when changing fuses.	 136067 136309

*Tab. 8: * Indicate desired length in whole metres.*

12.2 Accessories (see also Chapter 6)

Accessories	Order No.
Protective cover for heating bath NOTE: Always activate the protection function when using the protective cover outside of a suitable fume hood (see Chapter 8.1.2).	127204
Refilling valve	300639
Insulation for cooling hoses (375 mm)	301270
Norprene® hose ID10 (sold by meter*)	028187
Hose fitting ID10 with cap GL14	301198

*Tab. 9: * Indicate desired length in whole metres.*

12.3 Glass product

Glass product		Order No.
Collection flask (coated)	100 ml	300557
	250 ml	300558
	500 ml	128158
	1000 ml	113939
	2000 ml	113938
Evaporation flask NS29/32	50 ml	113079
	100 ml	113080
	250 ml	113081
	500 ml	113082
	1000 ml	128159
	2000 ml	113083
	3000 ml	113084
Evaporation flask NS24/40	50 ml	300561
	100 ml	300562
	250 ml	300563
	500 ml	300564
	1000 ml	128893
	2000 ml	300565
	3000 ml	300566
Powder flask NS29/32	500 ml	300588
	1000 ml	300589
	2000 ml	300590
Powder flask NS24/40	500 ml	300591
	1000 ml	300592
	2000 ml	300593
Vapor tube with foam brake	NS29/32	302144
	NS24/40	302145
Foam brake	NS29/32	301114
	NS24/40	301115

Tab. 10: Glass products

13 Returns

Pumps and systems used in laboratories and process-based industries are exposed to a wide variety of conditions. This means that the components contacting transferred media could become contaminated by toxic, radioactive, or otherwise hazardous substances.

For this reason, customers who send any pumps or systems back to KNF must submit a Declaration of No Objection and Decontamination in order to avoid a hazardous situation for KNF employees. This Declaration of No Objection and Decontamination provides information about, for example:

- physiological safety
- whether medium-contacting parts have been cleaned
- whether decontamination was completed
- media that have been transferred or used

and must declare physiological safety. To ensure worker safety, work may not be started on pumps or systems without a signed Declaration of No Objection and Decontamination.

For optimal processing of a return, a copy of this declaration should be sent in advance via e-mail, regular mail, or fax to KNF Customer Service (refer to final page for address). In order to avoid endangering employees who open the shipment's packaging, despite any residual hazards, the original version of the Declaration of No Objection and Decontamination must accompany the delivery receipt on the outside of the packaging.

The form for the Declaration of No Objection and Decontamination is included with these operating instructions and may also be downloaded from the KNF website.

The customer must specify the device type(s) and serial number(s) in the Declaration of No Objection and Decontamination in order to provide for the unambiguous assignment of the Declaration to the device that is sent to KNF.

In addition to the customer's declaration of physiological safety, information about operating conditions and the customer's application are also of importance to ensure that the return shipment is handled appropriately. Therefore, the Declaration of No Objection and Decontamination requests this information as well.

14 Declaration of No Objection and Decontamination

Form Rev. 00 / downloaded www.knf.com

Health and safety clearance and decontamination form

This declaration must be present and complete (the original must accompany the shipment's delivery receipt) before the returned device can be examined.

Device type: .....

Serial number(s): .....

.....

.....

Reason for returning the device (please describe in detail):

(The device(s) was(were) in operation ☐ yes ☐ no)

.....

.....

.....

.....

.....

We confirm that the above device(s)

☐ has(have) pumped exclusively **physiologically unobjectionable** media and that it(they) are free of hazardous materials and any materials that are harmful to health.

The device(s) was(were) cleaned ☐ yes ☐ no

☐ has(have) pumped media of the following category(categories) which are not physiologically unobjectionable and that cleaning of the device(s) (potentially only media-contacting parts) is required.

Name, chemical formula, Material Safety Data Sheet

☐ aggressive .....

☐ biological .....

☐ radioactive .....

☐ toxic .....

☐ other .....

The device(s) was(were) decontaminated and work can proceed without special measures ☐ yes

Method / proof: .....

.....

The device(s) was(were) not decontaminated and special measures are required before starting work ☐ yes

Measures: .....

.....

Legally binding declaration

We herewith affirm that the information provided in this form is correct and complete. Shipment of the devices and components is in compliance with statutory regulations.

.....	.....	.....	.....	.....
Company (stamp)	Date	Name	Authorized signature	Position

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