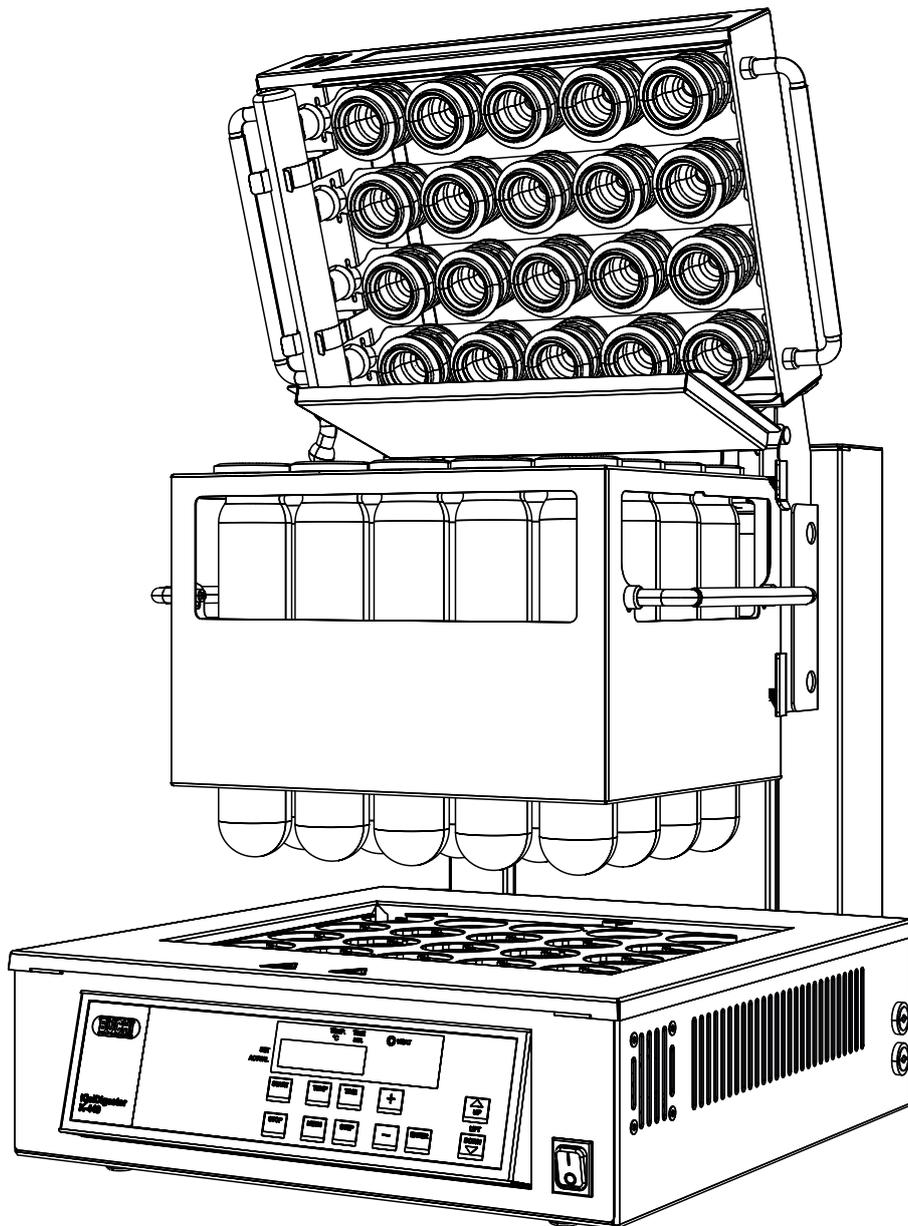




# KjelDigester K-446 / K-449

## Operation Manual



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BUCHI reserves the right to make changes to the manual as deemed necessary in the light of experience; especially in respect to structure, illustrations and technical detail.

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## 1 General

This manual describes the Kjeldigester K-446 and K-449 and provides all information required for its safe operation and to maintain it in good working order.

It is addressed to laboratory personnel in particular.

### 1.1 About this manual

Read this manual carefully before installing and running the device. Note the safety precautions in chapter 2 in particular. Store the manual in the immediate vicinity of the device, so that it can be consulted at any time.

#### 1.1.1 Structure of the manual

The operation manual consists of 11 chapters which cover all information relevant to the operator of the device.

Chapter	Meaning
1 General	Gives a general overview about the manual and device. It also gives a brief information on how to use this manual and other general information.
2 Safety	Describes the safety concept of the device and contains general rules of behavior and warnings from hazards concerning the use of the product.
3 Technical data	Introduces the reader to the device specifications. It contains technical data, requirements and performance data.
4 Description of function	Explains the basic principle of the device, shows how it is structured and gives a functional description of the assemblies.
5 Installation	Describes how the device is installed and gives instructions on initial startup.
6 Operation	Gives examples of typical device applications and instructions on how to operate the device properly and safely.
7 Maintenance	Gives instructions on all maintenance work to be performed in order to keep the device in good working condition.
8 Troubleshooting	Helps to resume operation after a minor problem has occurred. It lists possible occurrences, their probable cause and suggests how to remedy the problem. Explains checks for troubleshooting and maintenance.
9 Taking out of operation	Instructs how to store and dispose the device. It also instructs users for the reuse after a storage period.
10 Spare parts	Lists spare parts, accessories, and options including their ordering information.
11 Appendix	Additional documents regarding requirements.

## 1.1.2 Additional user information

### Page number

The page number in the footer contains the current chapter (e.g. **1** – 12) and the page number (e.g. 1 – **12**).

### Cross-references

Cross-References consist at least the chapter and the page number (1 – 12).

### NOTE

Paragraphs starting with NOTE transport helpful information for working with the device/software. NOTE's are not related to any kind of hazard or damage.

## 1.1.3 Available languages

This operation manual is available in the following languages:

Language	Order number
English	11593546
German	11593547
French	11593548
Italian	11593549
Spanish	11593550
Chinese	11593551
Japanese	11593552

## 1.1.4 Reference documents

### Scrubber K-415

Language	Order number
English	11593505
German	11593506
French	11593507
Italian	11593508
Spanish	11593509
Chinese	11593510
Japanese	11593511

## 1.1.5 Abbreviations

EPDM	Ethylene propylene diene monomer
FCC	Federal Communications Commission
TKN	Total Kjeldahl nitrogen
METH	Method

MSDS	Material safety data sheets
No	Number
Pcs	Pieces
PTFE	Polytetrafluoroethylene
Qty	Quantity

## 1.2 About the Kjeldigester K-446/K-449

### 1.2.1 General information

No technical modifications may be made to the device without the prior written agreement of BÜCHI. Unauthorized modifications may affect the system safety or result in accidents.

### 1.2.2 Type plate

Type plate is located on the right side of the Kjeldigester.

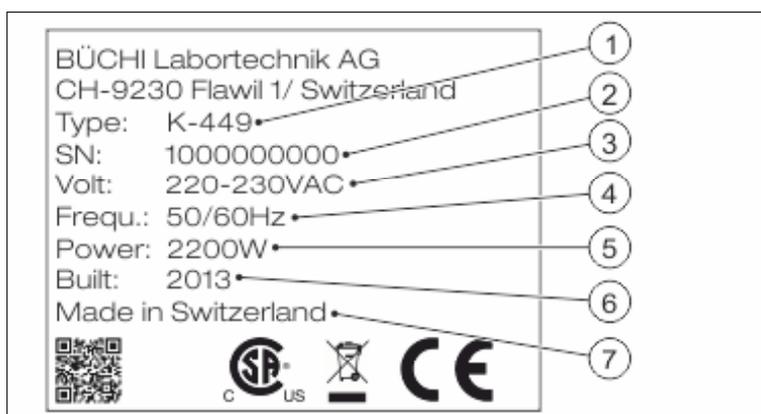


Fig. 1.1 Key of type plate (example)

- |                              |                          |
|------------------------------|--------------------------|
| ① Device name                | ⑤ Maximum power rating   |
| ② Serial number              | ⑥ Year of manufacture    |
| ③ Input voltage range        | ⑦ Country of manufacture |
| ④ Frequency of input voltage |                          |

### 1.3 Scope of delivery

Description	Qty	Order number
KjelDigester	1	–
· K-446 with standard suction module	–	1154461000
· K-446 suction module with condensate trap	–	1154462000
· K-449 with standard suction module	–	1154491000
· K-449 suction module with condensate trap	–	1154492000
Drip tray holder	1	11059804
Drip tray	1	11059031
Sample tube, 300 mL (4 pcs.)	5	037377
Rack	1	11059831
Hose 1.5 m, 8 mm	1	11056005
Hose connector S19	1	11057159
Clamp S19	1	11057149
Power supply cable	1	–
· Type CH	–	010010
· Type Schuko	–	010016
· Type GB	–	017835
· Type USA	–	033763
· Type AUS	–	017836

## 2 Safety

The safety of the user and personnel can only be ensured if the safety instructions and the safety related warnings in the individual chapters are strictly observed and followed. Therefore, the manual must always be available to all persons performing tasks described herein.

### 2.1 User qualifications

Before using the Kjeldigester the operation manual must be read and understood.

The device may only be used by laboratory personnel and other persons who on account of training or professional experience have an overview of the dangers which can develop when operating the device.

### 2.2 Proper use

The Kjeldigester has been designed and built for laboratories. It serves for the heating of concentrated  $H_2SO_4$  for the oxidation of organic sample components.

### 2.3 Safety warnings

#### 2.3.1 Warning explanation

DANGER, WARNING, CAUTION and NOTICE are standardized signal words for identifying levels of hazard seriousness of risks related to personal injury and property damage. All signal words, which are related to personal injury are accompanied by the general safety sign.

For the safety it is important to read and fully understand the table with the different signal words and their definitions.

Sign	Signal word	Definition	Risk level
	<b>DANGER</b>	Indicates a hazardous situation which, if not avoided, will result in death or serious injury.	★★★★
	<b>WARNING</b>	Indicates a hazardous situation which, if not avoided, may result in serious injury or death.	★★★☆☆
	<b>CAUTION</b>	Indicates a hazardous situation which, if not avoided, may result in minor or moderate injury.	★★☆☆☆
	<b>NOTICE</b>	Indicates possible material damage, but no practices related to personal injury.	☆☆☆☆

Supplementary safety information symbols may be placed in a rectangular panel on the left to the signal word and the supplementary text.

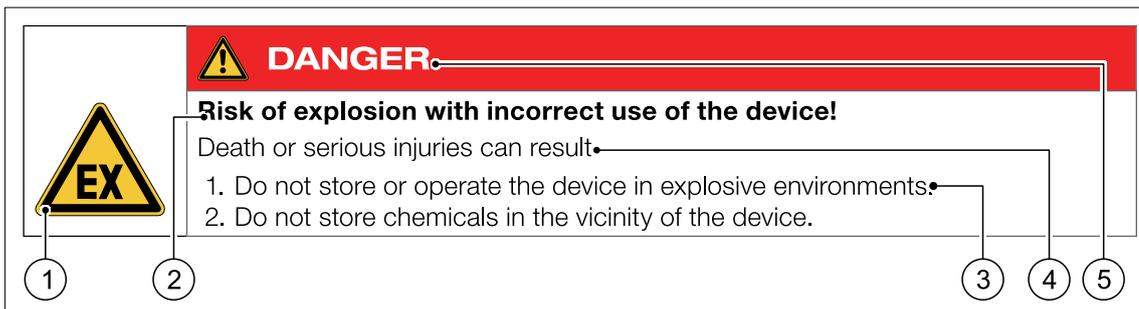


Fig. 2.1 Example of warning

- ① Safety symbol
- ② Source of danger
- ③ Instruction to avoid danger
- ④ Result of danger if not avoided
- ⑤ Warning title

### 2.3.2 Symbols

The reference list incorporates safety symbols and their meaning. The symbols can occur in this operation manual or on the device.

#### Warning safety symbols

Symbol	Meaning	Symbol	Meaning
	General warning		Corrosive hazard
	Electrical hazard		Flammable
	Biohazard		Explosive environment
	Broken glass		Inhalation harmful
	Device damage		Hot surface
	Hand bruising		Magnet

**Mandatory safety symbols**

Symbol	Meaning	Symbol	Meaning
	Wear protective goggles		Wear protective clothes
	Wear protective gloves		Heavy load, lift with assistance

**2.4 General safety rules****2.4.1 Responsibility of the operator**

The head of the laboratory is responsible for training his personnel.

The operator shall inform the manufacturer without delay of any safety-related incidents which might occur during operation of the device or its accessories.

Issues can be reported to the e-mail address: [quality@buchicom](mailto:quality@buchicom).

Legal regulations, such as local, state and federal laws applying to the device or its accessories must be strictly followed.

**2.4.2 Duty of maintenance and care**

The operator is responsible for the proper condition of the device. This includes maintenance, service and repair jobs that are performed on schedule by authorized personnel only.

**2.4.3 Spare parts to be used**

Use only genuine BUCHI consumables and spare parts for maintenance to assure good system performance, reliability and safety. Any modifications of spare parts or assemblies are only allowed with the prior written permission of BUCHI.

**2.4.4 Modifications**

Modifications to the device are only permitted after prior consultation and with the written approval of BUCHI. Modifications and upgrades shall only be carried out by an authorized BUCHI technical engineer. BUCHI will decline any claim resulting from unauthorized modifications.

## 2.5 Product safety

The device is designed and built in accordance with current state-of-the-art technology. Nevertheless, risks to users, property, and the environment can arise when the device is used carelessly or improperly.

BUCHI has identified the following residual dangers emanating from the device:

- The device is operated by insufficiently trained personnel.
- The device is not operated according to its proper use.
- Appropriate warnings in this manual serve to make the user alert to these residual dangers.

### 2.5.1 General hazards

The following safety messages show hazards of general kind which may occur when handling the device. The user shall observe all listed counter measures in order to achieve and maintain the lowest possible level of hazard.

Additional warning messages can be found whenever actions and situations described in this manual are related to situational hazards.

	<p> <b>DANGER</b></p> <p><b>Risk of explosion with incorrect use of the device!</b> Death or serious injuries can result.</p> <ol style="list-style-type: none"><li>1. Do not store or operate the device in explosive environments.</li><li>2. Do not store chemicals in the vicinity of the device.</li><li>3. Operate the device in a fume hood with sufficient ventilation to directly withdraw fumes.</li><li>4. Use the user protection shield when working with H<sub>2</sub>O<sub>2</sub> or larger amounts of water (&gt;10 mL).</li><li>5. Follow the safety notes in the application notes.</li></ol>
	<p> <b>WARNING</b></p> <p><b>Risk of burns from flammable fumes!</b> Serious injuries or death can result.</p> <ol style="list-style-type: none"><li>1. Remove all sources of flammable fumes.</li><li>2. Do not store flammable chemicals in the vicinity of the device.</li></ol>

	<p><b>WARNING</b></p> <p><b>Risk of chemical burns from hot acid or peroxide fumes!</b>          Serious injuries or death can result.</p> <ol style="list-style-type: none"> <li>1. Do not operate the system with faulty parts.</li> <li>2. Check device setup for proper sealing before use.</li> <li>3. Do not inhale process fumes.</li> <li>4. Operate the device inside an active fume hood.</li> <li>5. Use a Scrubber or water jet pump to neutralize exhaust fumes.</li> <li>6. Do not move the device or parts of it during digestion.</li> <li>7. Always wear the personnel protective equipment.</li> </ol>
	<p><b>CAUTION</b></p> <p><b>Risk of hot machine parts and glassware!</b>          Minor or moderate burns can result.</p> <ol style="list-style-type: none"> <li>1. Do not touch hot parts or surfaces.</li> <li>2. Let the system and inserted glassware cool down safely.</li> <li>3. Do not move the device or parts of it when hot.</li> </ol>
	<p><b>NOTICE</b></p> <p><b>Risk of spilled liquids or mechanical shocks.</b>          Liquids leaking into the housing or mechanical shocks can damage the device.</p> <ol style="list-style-type: none"> <li>1. Do not spill liquids over the device or its components</li> <li>2. Do not move the device when it is loaded with sample liquid</li> <li>3. Do not drop the device or its components</li> <li>4. Keep external vibrations away from the device</li> <li>5. Safely attach the device to the bench in earthquake prone regions</li> <li>6. For H<sub>2</sub>O<sub>2</sub> or TKN applications, do not operate the device without the user protection shield installed.</li> </ol>

## 2.5.2 Specific hazard

### H<sub>2</sub>O<sub>2</sub> or TKN digestion

Using H<sub>2</sub>O<sub>2</sub> or TKN for the digestion makes it mandatory to perform the following steps to keep the work place as safe as possible.

 	 <b>WARNING</b>
	<p><b>Risk of explosion and chemical burns!</b>          Serious injuries or death can result.</p> <ol style="list-style-type: none"> <li>1. Wear the personal protective equipment.</li> <li>2. Make sure all components are in proper working condition.</li> <li>3. Operate the device inside an active fume hood.</li> <li>4. Follow the safety instructions in the application notes.</li> </ol>

1. Use the user protection shield at any time during sample preparation and during digestion (both H<sub>2</sub>O<sub>2</sub> and TKN).
  - User protection shield, installation, (5–32).
2. Use a suitable dosing device with tube to safely dose H<sub>2</sub>O<sub>2</sub>.
3. Preparation and digestion needs to be done within an active fume hood.

### 2.5.3 Personal protective equipment

Always wear personal protective equipment such as protective eye goggles, protective clothing and gloves. The personal protective equipment must meet all requirements of all MSDS for the chemicals used.

### 2.5.4 Built-in safety elements and measures

#### Glassware

All original BUCHI glass parts are made of high temperature, chemical resistant borosilicate glass and optimal match the heating block.

#### Heating block

The heating block is equipped with a safety overtemperature switch. In case of a temperature above 500 °C the heating block will be switched off and the Kjeldigester starts a continuous beeping sound.

#### Fume removal

Acid fumes generated during digestion accumulate in the suction module.

The fumes must be safely withdrawn from the suction module via a EPDM hose to a Scrubber (e.g. Scrubber K-415) or via water jet pump into a sink with sufficient suction flow.

#### Lift (K-449)

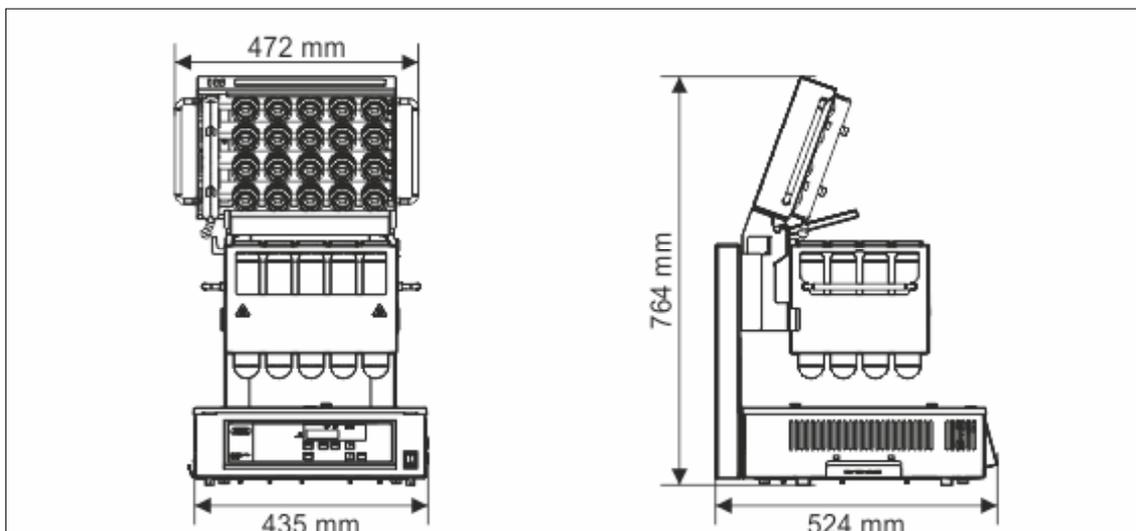
The Kjeldigester K-449 is equipped with a rechargeable battery. In case of a power failure the lift moves up automatically.

Before the lift starts moving down automatically a beeping sound informs the operator.

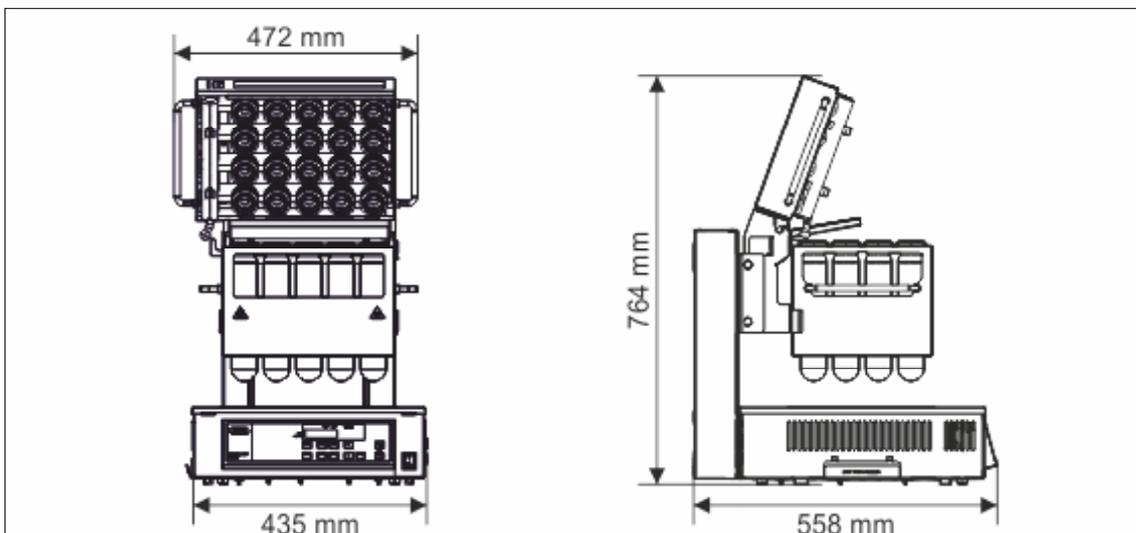
### 3 Technical data

#### 3.1 Device dimensions

##### 3.1.1 K-446



##### 3.1.2 K-449



#### 3.2 General technical data

Description	K-446	K-449
Weight, total	30 kg	37.3 kg
Weight, w/o accessory	18.5 kg	25.8 kg
Approval	UL/CSA, CE	UL/CSA,CE
Pollution degree	2	2
Overvoltage category	II	II
Clearance to wall	5 cm	5 cm

Description	K-446	K-449
Display	2 row LCD display	2 row LCD display
Resolution temperature display	1 °C	1 °C
Temperature range	30–450 °C	30–450 °C
Average temperature stability	±1 °C	±1 °C
Absolute temperature accuracy	±7 °C at 420 °C	±7 °C at 420 °C

### 3.2.1 Electrical system

Description	K-446	K-449
Input voltage	220–240 V ±10 %	220–240 V ±10 %
Frequency	50–60 Hz	50–60 Hz
Power consumption max.	2300 W	2300 W
Output current, Scrubber	0.7 A	0.7 A
Fuse	2× T10 A/L250 V	2× T10 A/L250 V

### 3.2.2 Environmental conditions

Description	K-446	K-449
Temperature	5–40 °C	5–40 °C
Altitude above sea level max.	2000 m	2000 m
Humidity	Maximum relative humidity 80 % for temperatures up to 31 °C, decreasing linearly to 50 % relative humidity at 40 °C	
Use	For indoor use only	

## 4 Description of function

### 4.1 Purpose and design

The KjelDigester is suitable for digestion processes with concentrated boiling  $H_2SO_4$  and a catalyst. The digestion parameters are listed in the BUCHI Application Notes.

### 4.2 KjelDigester overview

#### 4.2.1 Front and side view

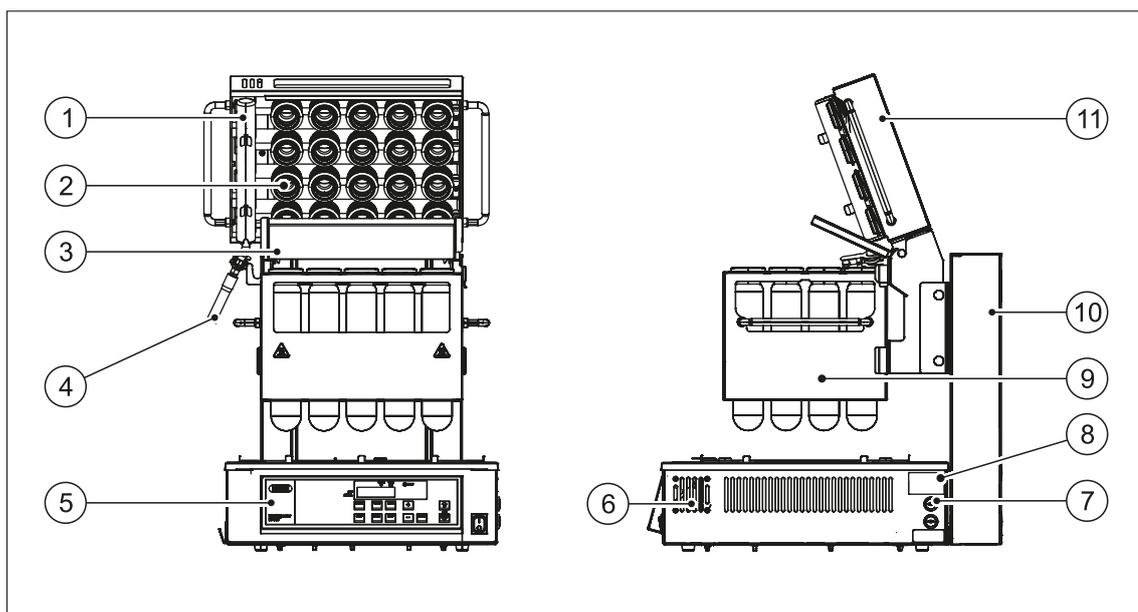


Fig. 4.1 KjelDigester front and side view

- |                           |                                     |
|---------------------------|-------------------------------------|
| ① Fume collection tube    | ⑦ Fuse 10 A/250 V                   |
| ② Suction tube            | ⑧ Type plate                        |
| ③ Drip tray               | ⑨ Rack                              |
| ④ Suction hose            | ⑩ Lift (K-449 only)/bracket (K-446) |
| ⑤ Control panel, (4–22)   | ⑪ Suction module                    |
| ⑥ Cooling fan, electronic |                                     |

### 4.2.2 Rear view

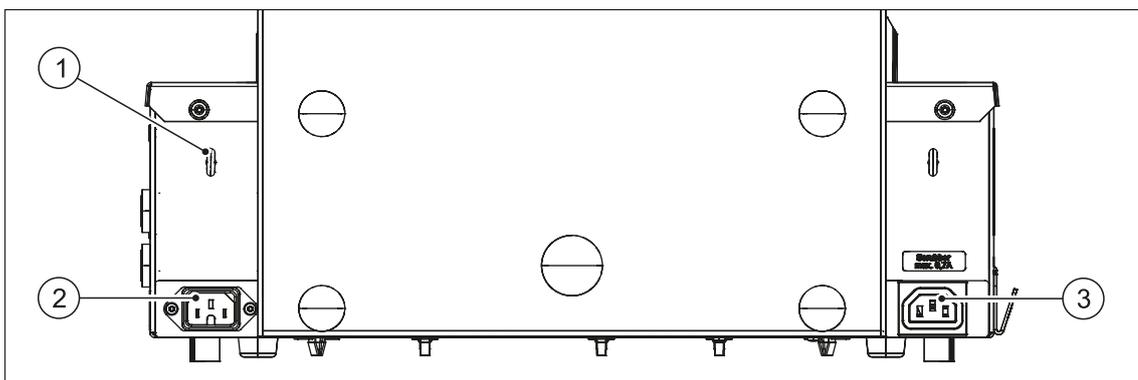


Fig. 4.2 KjeldDigester rear view

- ① Eye bolt
- ② Power supply KjeldDigester
- ③ Interface Scrubber

### 4.2.3 Top-side view

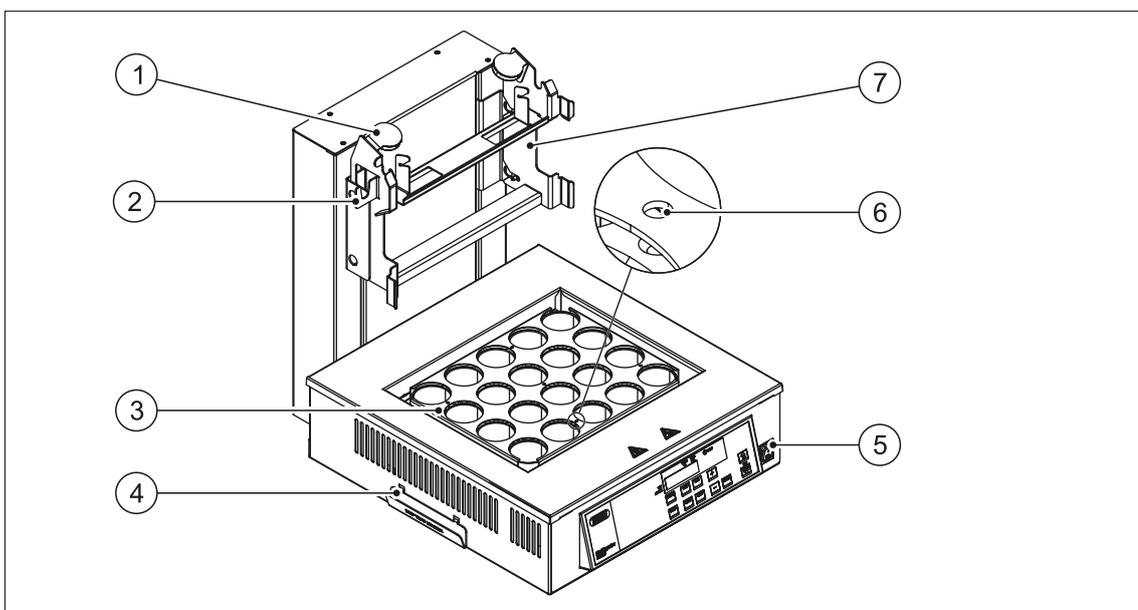


Fig. 4.3 Heating block components

- ① Magnet
- ② Scrubber hose bracket
- ③ Heating block cover
- ④ Drip tray holder
- ⑤ Main switch
- ⑥ Measuring point for external temp. sensor
- ⑦ Rack support

### 4.3 Function

The KjeldDigester is used to convert organic bound nitrogen (e.g. in proteins) in a sample into ammonium sulfate. During the digestion process, acid fumes and reaction gases may emerge and are handled by the Scrubber. The Scrubber is connected to the KjeldDigester for neutralizing acid fumes and adsorbing unpleasant odors.

#### 4.3.1 Digestion process

The aluminum heating block ④ generates high temperatures of up to 450 °C in order to heat the sample ③ up to 370 °C (boiling point). The sample is digested in constantly boiling  $H_2SO_4$ . Hot acid fumes rise into the condensation zone ②, condense and rinse back down to the sample creating a constant reflux. Residual fumes which escape the condensation zone via the acid fume outlet ① are highly corrosive and must be withdrawn and efficiently neutralized (e.g. with the Scrubber K-415).

The condensation should not take place inside the safety zone ⑩ in order to avoid shortening the lifetime of the sealings. In case the condensation is too close to the suction module (e.g. due to very high temperature settings or if too much catalyst was used) losses of nitrogen through creating  $N_2$  are possible and the samples can dry out.

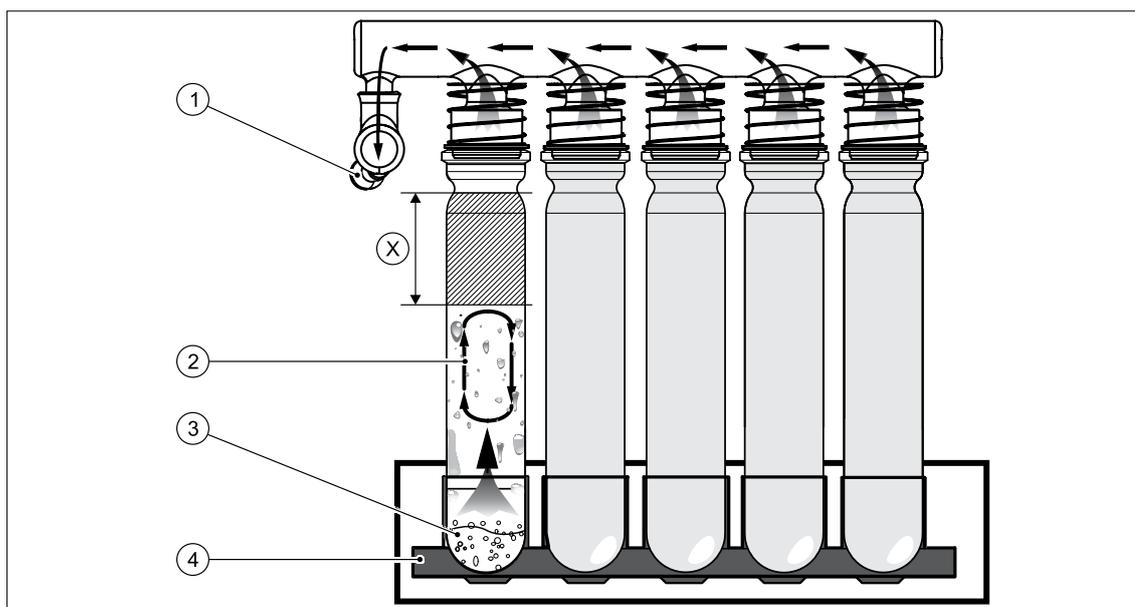


Fig. 4.4 Function of the KjeldDigester

- |                     |                            |
|---------------------|----------------------------|
| ⑩ Safety zone       | ③ Boiling/digestion sample |
| ① Acid fume outlet  | ④ Heating block            |
| ② Condensation zone |                            |

## 4.4 Control panel

### 4.4.1 Control panel display

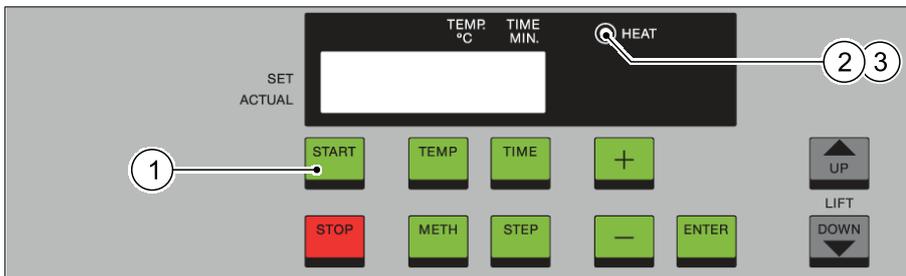


Fig. 4.5 K-449 Display

- ① Display, (4-22)
- ② LED heating block (on/off), (4-22)
- ③ LED heating block (flashing), (4-22)

#### Display

Shows various informations such as set and actual temperatures, heating and cooling time.

#### LED heating block (on/off)

On: The heating block is heating.

Off: The heating block is turned off and the temperature is below 60 °C.

#### LED heating block (flashing)

The heating block is not heating but the temperature is above 60 °C.

### 4.4.2 Control panel buttons

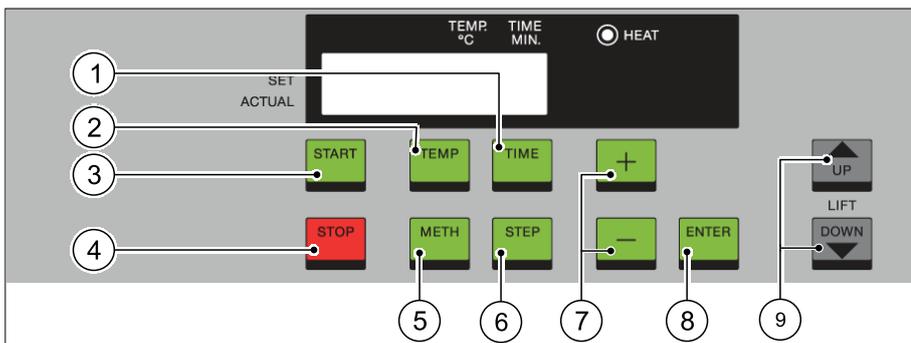


Fig. 4.6 KjelDigester K-449 control panel

- ① Time, (4-23)
- ② Temperature, (4-23)
- ③ Start, (4-23)
- ④ Stop, (4-23)
- ⑤ Method, (4-23)
- ⑥ Step, (4-23)
- ⑦ Increase/decrease value [+/-]
- ⑧ Enter
- ⑨ Lift up/down, (4-23)

**Time**

**Range** 0–999 minutes

Activates the heating time value for an adjustment.

**Temperature**

**Range** 30–450 °C

Activates the heating temperature of the heating block for an adjustment.

**Start**

Starts a digestion process.

**Stop**

- Stops a digestion process.
- Enables access to the settings menu.
- Stops the Scrubber.

**Method (K-449 only)**

**Range** 0–9 methods

Up to 9 methods can be programmed. Each method contains 4 adjustable steps. In each step, the temperature and time can be set. Also the cool down time can be adjusted.

## NOTE

*The first step is also used as the preheat function.*

Method number 0 is reserved for the manual mode on the K-449. No steps can be programmed.

**Step (K-449 only)**

Allows to navigate forward within a method during editing.

**Lift up/down (K-449 only)**

Allows to move the rack up and down at any time.

**4.4.3 Scrubber control (K-449 only)**

5.5.6 Adjust the Scrubber control (K-449 only), (5–31).

**Range** 0–255 minutes

The Scrubber can be controlled via the KjelDigester. E.g. can the Scrubber be controlled intermitted for 1 minute on, for 1 minute off.

## NOTE

*An altered value will also be active during the cooling time in the automatic mode.*

BUCHI recommends to leave this setting by default (on 0 min., off 0 min.) unless a adjustment becomes necessary due to a special application.

#### 4.5 Rack, cooling and heating position

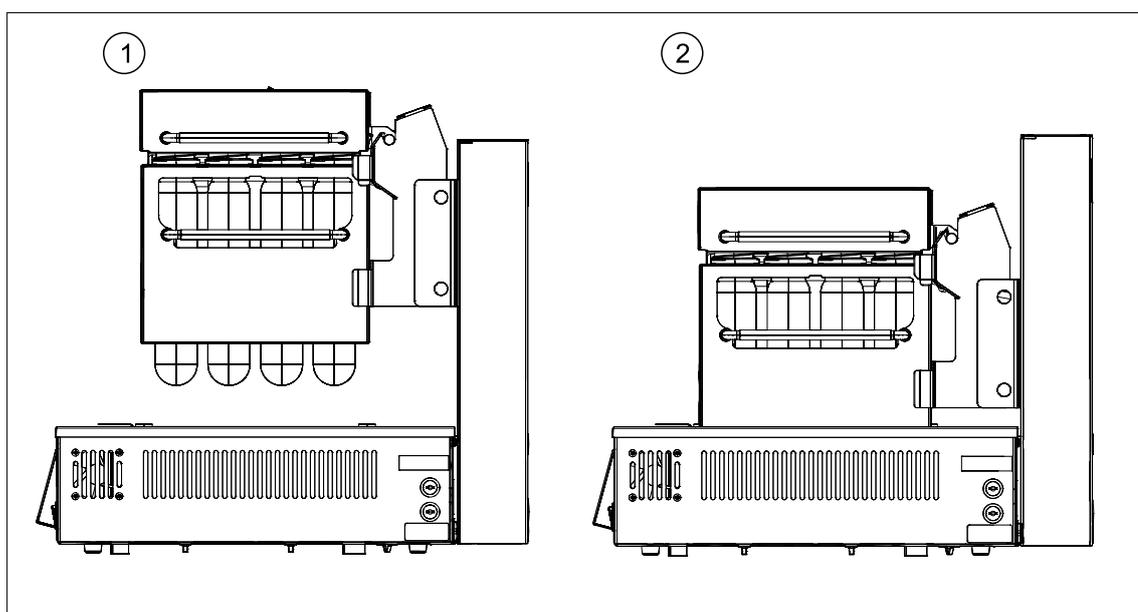


Fig. 4.7 Cooling and heating position of the samples

① Rack in cooling position

② Rack in heating position

In the cooling position the rack hangs over the heating block, the samples are not heated. In the heating position the samples are lowered into the heating block for digestion.

For the KjeldDigester K-446, the rack is moved between the two positions by hand, for the K-449 via the automatic lift.

#### 4.6 Functionality comparison K-446/K-449

Function	K-446	K-449
Scrubber control (on/off)	•	•
Temperature adjustment during digestion (method 0)	•	•
Overtemperature switch	•	•
Lift for rack (up/down)	–	•
Programmable methods	–	•
Backup battery for cooling and lift (power loss)	–	•
Delayed start time	–	•

## 5 Installation

### 5.1 Unpacking

	 <b>DANGER</b>
	<p><b>Risk pacemaker malfunction!</b> Death or serious injuries can result.</p> <ol style="list-style-type: none"> <li>1. Keep a distance of at least 15 cm between a pacemaker and the magnets of the rack support.</li> </ol>

	 <b>CAUTION</b>
	<p><b>Risk of injuries due to weight of the device!</b> Minor or moderate injuries can result.</p> <ol style="list-style-type: none"> <li>1. Call a second person to lift the device.</li> <li>2. Do not lift the device alone.</li> </ol>

1. Unpack the device.

	 <b>CAUTION</b>
	<p><b>Risk of cuts from damaged glass parts!</b> Minor or moderate cuts can result.</p> <ol style="list-style-type: none"> <li>1. Handle glass parts with care.</li> <li>2. Check all glass parts for damage before installation.</li> <li>3. Do not use any damaged parts.</li> <li>4. Do not touch cracks or bits of broken glass with bare hands.</li> </ol>

2. Check the device for any damage caused during the transportation.
3. Report damage to the responsible transportation company.
4. Keep the original packaging for future transportation.
5. Check all glass parts for damage.
  - 8.4.2 Glass parts, check, (8–58).

### 5.2 Preparation for assembly

1. Place the device in a fume hood.
  - It is recommended that the fume hood complies with the norm DIN EN 14175-2.
  - Keep around the device a free space of at least 5 cm.
2. If using a Scrubber, place it on the left side of the Kjeldigester.

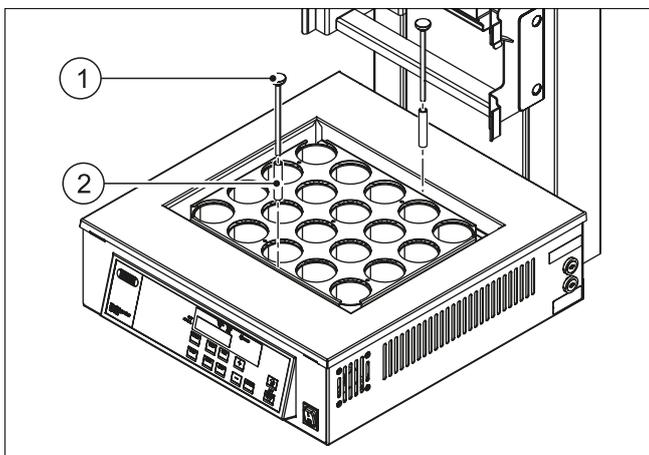
#### NOTE

*Keep the Scrubber suction hose as short and straight as possible. It prevents cooling air of the Scrubber blowing towards the heating block of the Kjeldigester.*

3. Remove the transport lock, (5–26).

### 5.3 Transport lock, removal

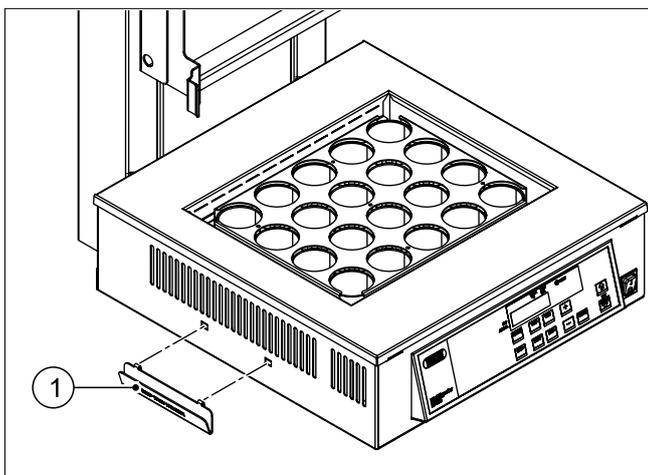
1. Remove the 2 screws ① and spacers ② from the heating block.
2. Keep the removed parts for future transportation.



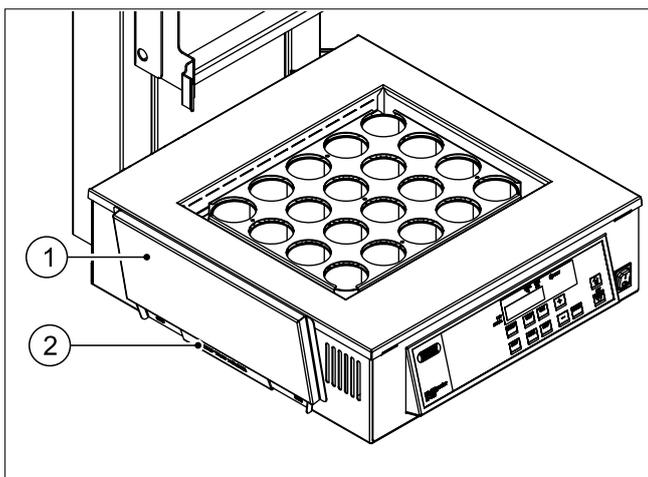
### 5.4 Device assembly

#### 5.4.1 Drip tray, installation

1. Install the drip tray holder ① at the two holes on the left side of the device.



- Place the drip tray ① in the drip tray holder ②.

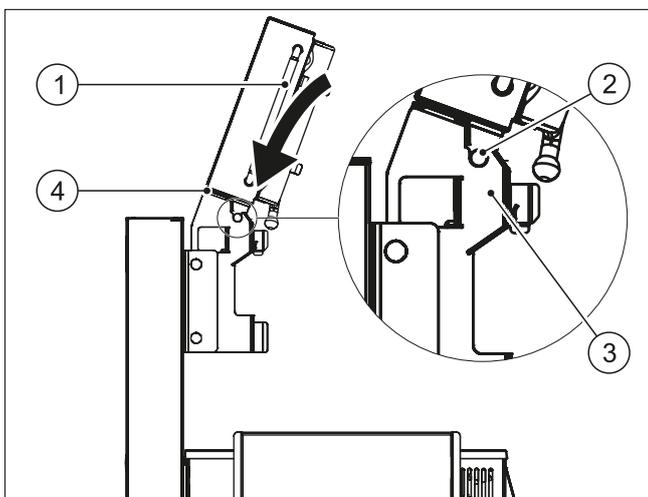


#### 5.4.2 Suction module, installation

- Hold the suction module on both handles ① and place it on the rack support ③.  
· Make sure both hinge bolts ② are located in the notches of the rack support.

##### NOTE

*The magnets ④ on the rack support will hold the suction module in the open position.*



#### 5.4.3 Scrubber/water jet pump, connection

##### Preliminary tasks

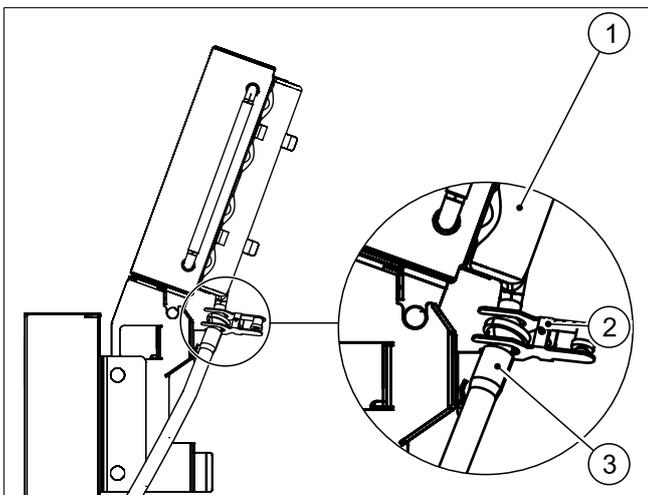
- Place the Scrubber next to the Kjeldigester on the left side.

## Tasks

	 <b>WARNING</b>
	<p><b>Risk of acid or toxic fume inhalation.</b>          Serious injuries or death can result.</p> <ol style="list-style-type: none"> <li>1. Always run the Scrubber or water jet pump during the digestion process.</li> <li>2. Operate the Scrubber and Kjeldigester only in a fume hood.</li> <li>3. Close the fume hood door as far as possible.</li> </ol>

	 <b>NOTICE</b>
	<p><b>Risk of wrong power input on the Scrubber.</b>          Wrong input voltage of the Scrubber can damage electronic components.</p> <ol style="list-style-type: none"> <li>1. Do only connect a Scrubber with 230 V input to the Kjeldigester. Output voltage of the Kjeldigester is 240 V only.</li> </ol>

1. Connect the Scrubber connection cable on the rear of the Kjeldigester.
2. Connect the hose ③ with the ball joint hose connector to the fume collection tube ①.
3. Secure the connection with the catchpot clip ②.
4. Shorten the other end of the hose ③ to keep the hose as short and straight as possible.
5. Connect the hose ③ to a Scrubber or water jet pump.



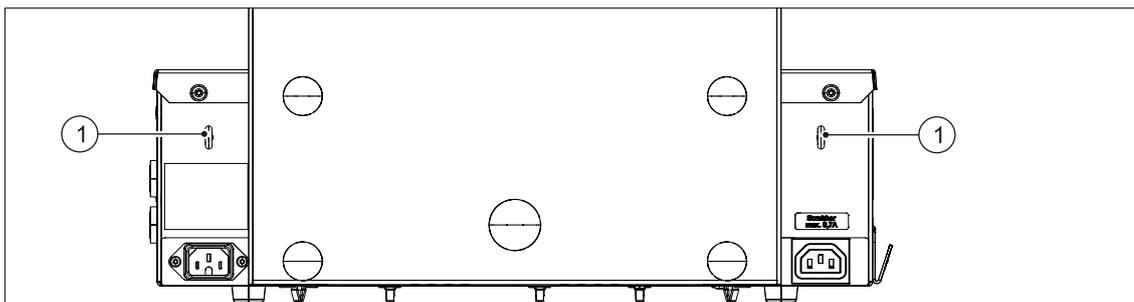
## Follow-on tasks

1. Depending on the configuration continue with following step:
  - Install the condensate bottle (5–33).

#### 5.4.4 Device fixation (earthquake)

	 <b>NOTICE</b>
	<p><b>Risk of device damage from earthquakes.</b> An unsecured device can be damaged in earthquake prone regions.</p> <ol style="list-style-type: none"> <li>1. Use the eye bolts on the rear of the device for fixation.</li> </ol>

1. Tie down the device on the 2 eye bolts ① on the rear of the device.
  - Eye bolt M4×10



#### 5.4.5 Electrical connection

	 <b>NOTICE</b>
	<p><b>Risk of electrical damage.</b> The device can be damaged by the wrong power supply and input voltage.</p> <ol style="list-style-type: none"> <li>1. The external power supply must meet the voltage given on the type plate.</li> </ol>

1. Connect the external power supply cable to the device on the rear side.
  - Make sure the device complies with the local voltage range before connecting.
  - The external power supply must be equipped with a ground connection.
  - Use a plug-in location which allows to disconnect the device at any time.

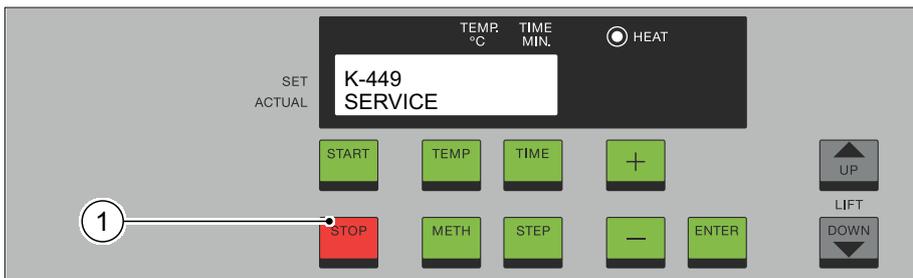
##### NOTE

*The allowed voltage range for the device can be checked on the type plate.*

### 5.5 Settings

#### 5.5.1 Accessing the settings menu

1. Press ① [STOP] for 3 seconds.
  - The settings menu appears.
2. Press ① [STOP] to switch through the settings menu.
  - Contrast, (5–30).
  - Maximum temperature, (5–30).
  - Temperature calibration, (5–31).
  - Clock, (5–31).
  - Scrubber control, (5–31).



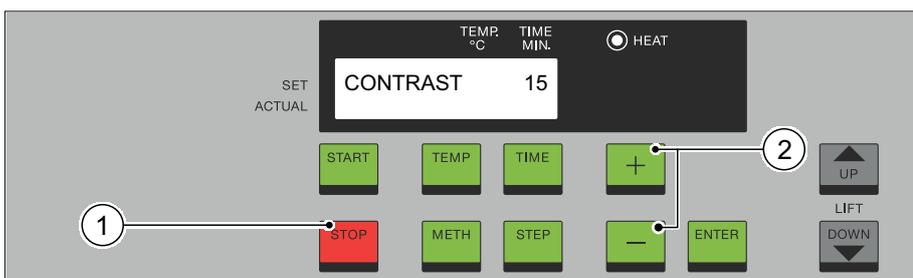
## 5.5.2 Adjust the contrast

### Preliminary tasks

1. 5.5.1 Accessing the settings menu, (5–29).

### Tasks

1. Press ① [STOP].  
· The contrast menu appears.
2. Set the contrast to the desired value by pressing ② [+/-].
3. Press ③ [ENTER] to confirm the new value.



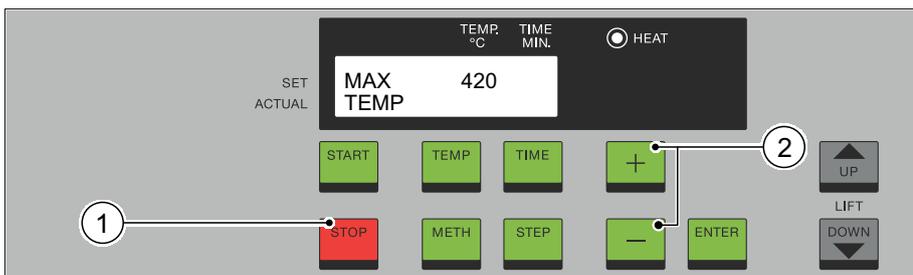
## 5.5.3 Adjust the maximum temperature

### Preliminary tasks

1. 5.5.1 Accessing the settings menu, (5–29).

### Tasks

1. Press ① [STOP] until the maximum temperature menu appears.  
NOTE  
*Temperatures above 420 °C can cause a loss of nitrogen or dried out samples.*
2. Set the maximum temperature to the desired value by pressing ② [+/-].  
· Range 30–450 °C.
3. Press ③ [ENTER] to confirm the new value.



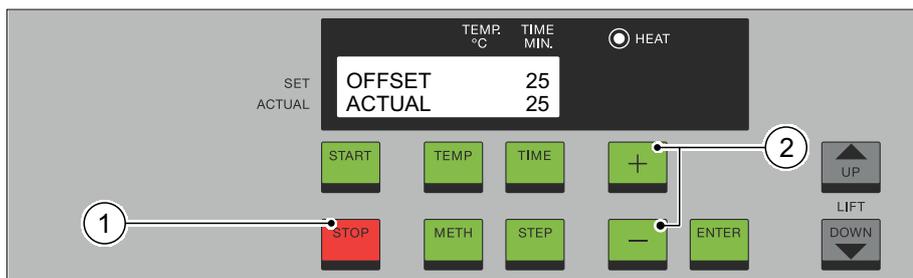
## 5.5.4 Adjust the temperature offset

### Preliminary tasks

1. 5.5.1 Accessing the settings menu, (5–29).

### Tasks

1. Press ① [STOP] until the offset menu appears.
2. Set the temperature offset to the desired value by pressing ② [+/-].  
· The offset value can be measured with an additional temperature sensor.
3. Press ③ [ENTER] to confirm the new value.



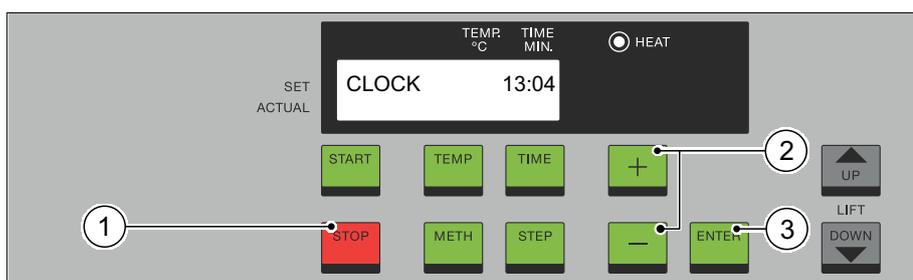
## 5.5.5 Set the clock (K-449 only)

### Preliminary tasks

1. 5.5.1 Accessing the settings menu, (5–29).

### Tasks

1. Press ① [STOP] until the clock menu appears.
2. Adjust the hours by pressing ② [+/-].
3. Press ③ [ENTER] to confirm the new value.
4. Adjust the minutes by pressing ② [+/-].
5. Press ③ [ENTER] to confirm the new value.



## 5.5.6 Adjust the Scrubber control (K-449 only)

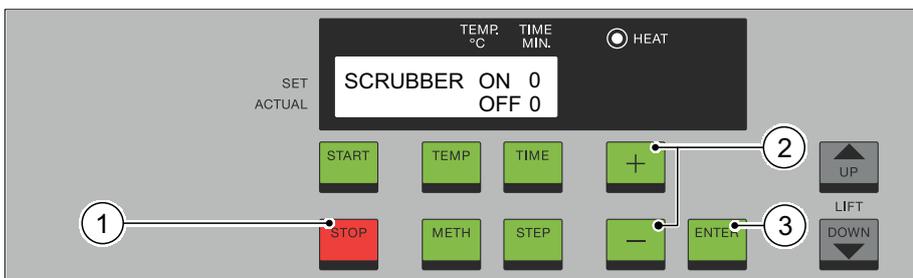
### Preliminary tasks

1. 5.5.1 Accessing the settings menu, (5–29).

## Tasks

	 <b>WARNING</b>
	<p><b>Risk of acid or toxic fume inhalation with a wrong setting of the Scrubber control.</b></p> <p>Serious injuries or death can result.</p> <ol style="list-style-type: none"> <li>1. Make sure the Scrubber is removing fumes during the complete digestion process.</li> </ol>

1. Press ① [STOP] until the Scrubber control menu appears.
2. Adjust the interval time for switching on the Scrubber by pressing ② [+/-].  
· Range 0–255 minutes.
3. Press ③ [ENTER] to confirm the new value.
4. Adjust the interval time for switching off the Scrubber by pressing ② [+/-].  
· Range 0–255 minutes.
5. Press ① [STOP].  
· The default menu appears.

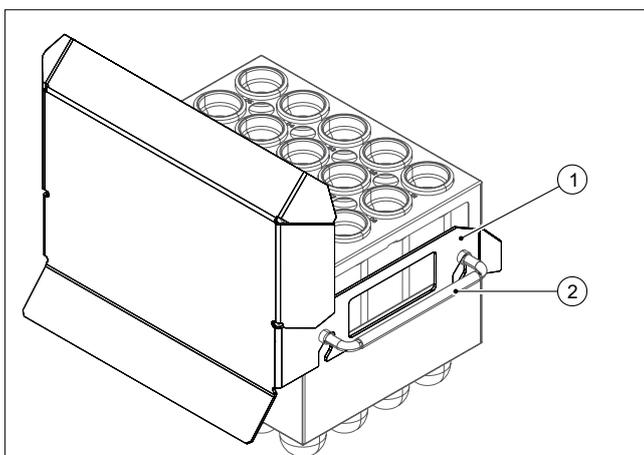


## 5.6 User protection shield, installation

### NOTE

Install the user protection shield when working with  $H_2O_2$  or larger amounts of water (>10 mL).

1. Install the user protection shield ① on the rack handles ②.
- 11057889 User protection shield



## 5.7 Condensate bottle, installation



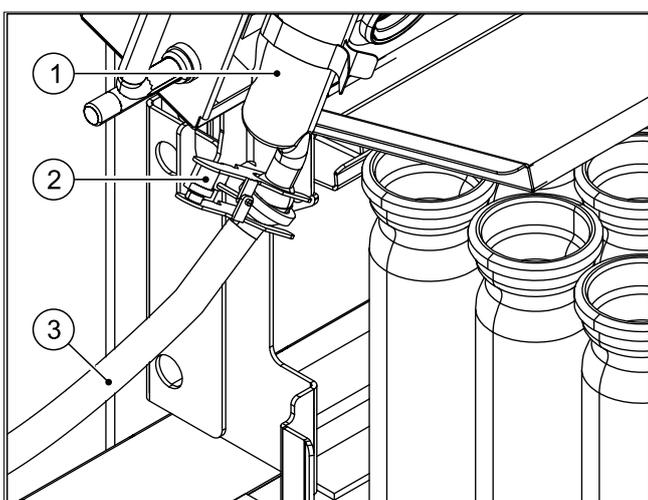
### CAUTION

#### Risk of acid or peroxide fume inhalation!

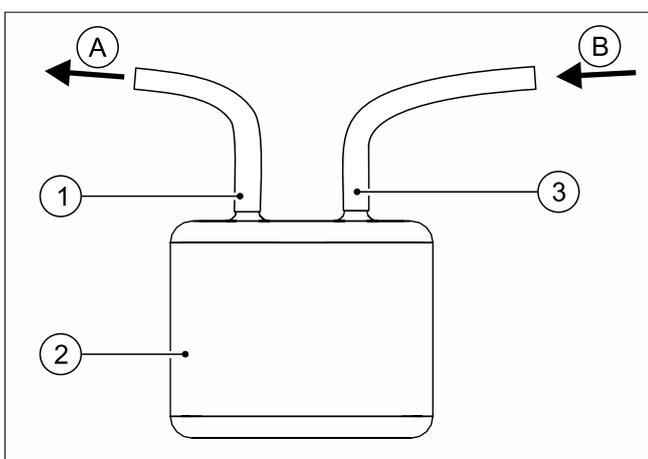
Minor or moderate chemical burns of the airways.

1. Keep the suction hoses between the Kjeldigester and Scrubber as straight as possible to prevent liquid blocking the hoses.
2. Make sure the condensate bottle is placed lower than the suction module.
3. Operate and maintain the Scrubber according to its operation manual.
4. Make sure the hoses are not damaged.

1. Connect the hose ③ with the hose connector to the fume collection tube ①.
2. Secure the connection with the catchpot clip ②.

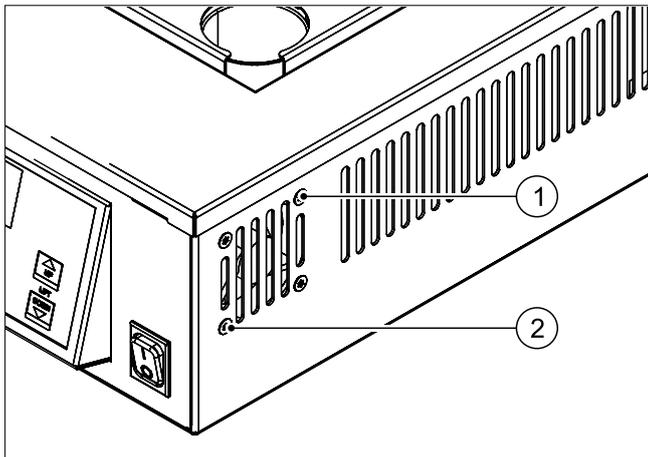


3. Connect the hose ③ coming from the Kjeldigester ② to the condensate bottle ②.  
· 025100 Condensate bottle
4. Connect the hose ① from the Scrubber ① to the condensate bottle.
5. Close the 2 remaining connections of the condensate bottle with 2 plugs.



### 5.8 Air supply hose, installation

1. Remove the 2 TORX-screws ②.
2. Position the air supply hose ① on the housing of KjeldDigester and tighten the 2 TORX-screws.  
· 040079 Air supply hose
3. Guide the hose inlet to the outside of the fume hood to provide fresh air to the electronic components.



## 6 Operation

  	 <b>WARNING</b>
	<p><b>Risk of poisoning from contact with or ingestion of harmful substances and fumes at use!</b></p> <p>Serious injuries or death can result.</p>
	<ol style="list-style-type: none"> <li>1. Before operation, check the device for correct assembling.</li> <li>2. Before operation inspect sealing, springs glass parts and hoses for good condition and tightness.</li> <li>3. Exchange worn out or defective parts.</li> <li>4. Withdraw released fumes and gaseous substances by a Scrubber or water jet pump.</li> <li>5. Dispose condensate in tubings and glassware safely after use.</li> <li>6. Do not inhale digestion fumes.</li> </ol>

	 <b>CAUTION</b>
	<p><b>Risk of cuts from broken glass and sharp metal parts!</b></p> <p>Minor or moderate cuts can result.</p>
	<ol style="list-style-type: none"> <li>1. Handle glass parts with care.</li> <li>2. Visually inspect every glass part before mounting.</li> <li>3. Wear protective gloves when touching cracks or bits of broken glass.</li> </ol>

### 6.1 General application information

Typically 15–20 mL of  $H_2SO_4$  is used for a sample amount of approx. 1 g of organic material. For weighed portions over and above this, approx. 3–5 mL of  $H_2SO_4$  (5–10 mL for greases and mineral oils) must be used additionally for each additional gram of organic material.

   	 <b>WARNING</b>
	<p><b>Risk of burns from corrosives!</b></p> <p>Serious injuries or death can result.</p>
	<ol style="list-style-type: none"> <li>1. Observe all MSDS of the used chemicals.</li> <li>2. Handle corrosives in well ventilated environments only.</li> <li>3. Always wear protective goggles.</li> <li>4. Always wear protective gloves.</li> <li>5. Always wear protective clothes.</li> <li>6. Do not use damaged glassware.</li> </ol>

	 <b>NOTICE</b>
	<p><b>Risk of material damage due to wrong handling.</b> Improper handling of device components can cause a device damage.</p> <ol style="list-style-type: none"> <li>1. Do not use cold water to cool down hot sample tubes after digestion.</li> <li>2. Make sure that the rack containing the sample tubes is placed in and removed from the digestion block with reasonable care.</li> <li>3. Make sure that the rack is properly adjusted at the lift of the K-449, to make the tubes smoothly slight into the openings of the digestion block.</li> <li>4. Use digestion rods instead of use glass beads.</li> </ol>

To vaporize larger amounts of water (10–200 mL), use digestion rods as this will prevent boiling delays for optimal user protection from possible splashes due to boiling delays. Always use the user protection shield installed at the rack.

The digestion time and profile depends on the substance to be digested. Information on this can be found in the BUCHI Application Notes. If no BUCHI application is available, the digestion method must be ascertained by means of experiments. If the solution has become clear, continue to boil the solution for about 30 minutes. Once the samples have cooled off, the sample tube can be connected directly to a BUCHI distillation unit or the KjelSampler for distillation.

Due to different heat transfer and air flows between the sample tubes and the heating block, not all 20 samples boil simultaneously. However, as long as it is ensured that the digestion time and digestion temperatures are sufficient, the different boiling times have no influence on the results.

If the digested samples are allowed to cool down for a long period of time, the samples might solidify occasionally.

In this case, the sample must be liquefied again before it can be distilled:

- by adding very carefully a small quantity of distilled water
- by slightly warming it up in the KjelDigester

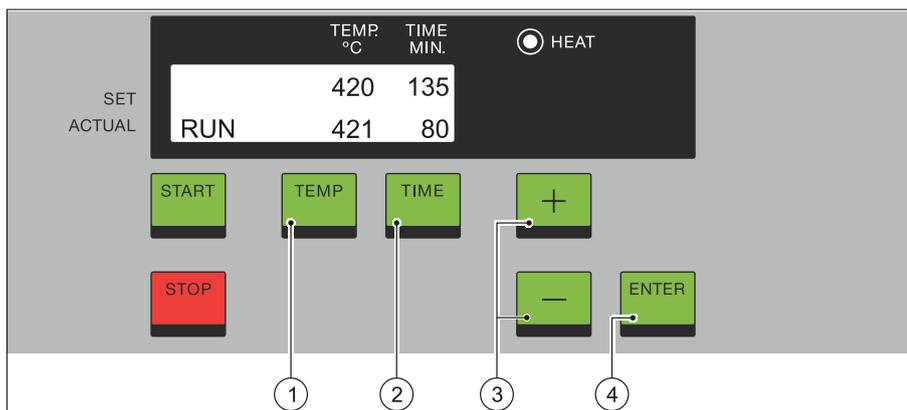
## 6.2 Start a digestion

1. For the K-446:
  - 6.7.1 Digestion process, (6–39).
2. For the K-449:
  - 6.8.1 Digestion process, manual mode, (6–40).
  - 6.8.2 Digestion process, automatic mode, (6–41).

## 6.3 Set parameters for manual digestion

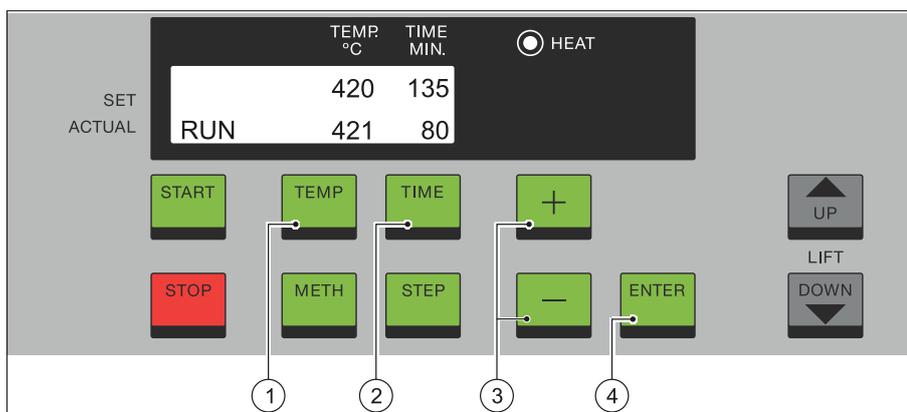
### 6.3.1 K-446

1. Press ① [TEMP] and adjust the temperature by pressing ③ [+/-].
1. Press ④ [ENTER] to confirm the new value.
2. Press ② [TIME] and adjust the time by pressing ③ [+/-].
3. Press ④ [ENTER] to confirm the new value.



### 6.3.2 K-449

1. Press Method [METH] and select method number 0 by pressing ③ [+/-], press ④ [ENTER] to confirm.
2. Method number 0 is used for a manual digestion or to heat the device without lift movement.
3. Press ① [TEMP] and adjust the temperature by pressing ③ [+/-].
4. Press ④ [ENTER] to confirm the new value.
5. Press ② [TIME] and adjust the time by pressing ③ [+/-].
6. Press ④ [ENTER] to confirm the new value.

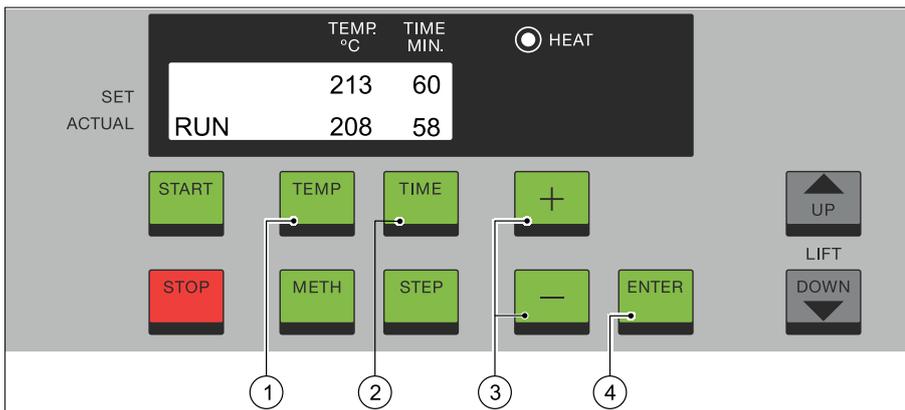


## 6.4 Editing parameters during a digestion

### NOTE

Parameters on the K-449 cannot be changed during a digestion in the automatic mode (METH 1–9).

1. Press ① [TEMP] and adjust the temperature by pressing ③ [+/-].
2. Press ④ [ENTER] to confirm the new value.
3. Press ② [TIME] and adjust the time by pressing ③ [+/-].
4. Press ④ [ENTER] to confirm the new value.



### 6.5 Abort a digestion

1. Press stop [STOP] at any time during the digestion to abort a process.

#### NOTE

*The Scrubber continues to run until the stop [STOP] button is pressed again.*

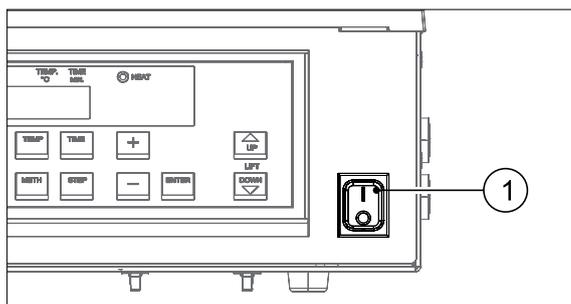
	<p><b>CAUTION</b></p>
	<p><b>Risk of burns from hot rack handles!</b> Minor or moderate burns can result.</p> <ol style="list-style-type: none"> <li>1. Wear protective gloves when lifting the rack. Rack handles can exceed temperatures of 70 °C.</li> </ol>

2. On the K-446:
  - Lift the rack and suction module out of the heating block into the cooling position.
3. On the K-449:
  - The rack moves automatically out of the heating block into the cooling position.

### 6.6 Switch off the Kjeldigester

	<p><b>NOTICE</b></p>
	<p><b>Insufficient cooling of the device.</b> Switching off the device without cooling down can damage electrical components.</p> <ol style="list-style-type: none"> <li>1. Do not switch off the device when the heating block is warmer than 60 °C.</li> </ol>

1. Tilt up the suction module.
2. Insert the drip tray.
3. Remove the rack.
4. Let the Kjeldigester cool down.
  - The heating block is cooled down if the LED [HEAT] goes off.
5. Switch off the main switch ①.



## 6.7 KjelDigester K-446

### 6.7.1 Digestion process

#### Preliminary tasks

1. Turn on the main switch.
2. Set the desired temperature and time.
  - 6.3 Set parameters for manual digestion, (6–36)
3. Press the start [START] button.
  - The preheating of the heating block starts.
  - When the set temperature is reached ready [READY] appears on the display.

#### Tasks

1. Place the sample tubes into the rack.
2. Pour the samples and reagents into the sample tubes.
3. Use glass caps for any unoccupied positions to close the suction circuit.
4. Fit the sample rack into the cooling position.
5. Remove the drip tray.
6. Tilt down the suction module onto the sample tubes.
7. Check if all the sealings of the suction module are fitting the sample tubes.
8. Place the rack and suction module into the heating position.

	<p><b>! WARNING</b></p>
	<p><b>Risk of acid or toxic fume inhalation.</b>          Serious injuries or death can result.</p> <ol style="list-style-type: none"> <li>1. Always run the Scrubber or water jet pump during the digestion process.</li> <li>2. Operate the Scrubber and KjelDigester only in a fume hood.</li> <li>3. Close the fume hood door as far as possible.</li> </ol>

9. Press the start [START] button on the control panel.
  - The Scrubber starts (if connected).
10. Start the Scrubber (if not connected) or the water jet pump.

	 <b>CAUTION</b>
	<p><b>Risk of burns from hot rack handles!</b>          Minor or moderate burns can result.</p> <ol style="list-style-type: none"> <li>1. Wear protective gloves when lifting the rack. Rack handles can exceed temperatures of 70 °C.</li> </ol>

11. Place the rack in the cooling position when the digestion is finished.
  - A beep sound is audible for 10 seconds to inform the user about the finished digestion.
  - The message [FINISH] appears on the display.
12. Wait until the samples are cooled down.
  - The LED [HEAT] flashes until the temperature of the heating block is below 60 °C.
13. Tilt up the suction module when no more fumes are escaping from the sample tubes.
14. Place the drip tray between the suction module and the samples.
15. Switch off the Scrubber (if connected) by pressing the stop [STOP] button.

## 6.8 KjeldDigester K-449

### 6.8.1 Digestion process, manual mode

#### Preliminary tasks

1. Turn on the main switch.
2. Select the method number 0.
3. Set the desired temperature and time.
  - 6.3 Set parameters for manual digestion, (6–36)
4. Press the start [START] button.
  - The preheating of the heating block starts.
  - When the set temperature is reached ready [READY] appears on the display.

#### Tasks

1. Place the sample tubes into the rack.
2. Pour the samples and reagents into the sample tubes.
3. Use glass caps for any unoccupied positions to close the suction circuit.
4. Fit the sample rack into the cooling position.
5. Remove the drip tray.
6. Tilt down the suction module onto the sample tubes.
7. Check if all the sealings of the suction module are fitting the sample tubes.

	 <b>WARNING</b>
	<p><b>Risk of acid or toxic fume inhalation.</b>          Serious injuries or death can result.</p> <ol style="list-style-type: none"> <li>1. Always run the Scrubber or water jet pump during the digestion process.</li> <li>2. Operate the Scrubber and KjeldDigester only in a fume hood.</li> <li>3. Close the fume hood door as far as possible.</li> </ol>

8. Press the start button.
  - The rack lowers automatically into the heating block.
  - The Scrubber starts (if connected).
9. Start the Scrubber (if not connected) or the water jet pump.
10. After the digestion process the rack will move automatically into cooling position.
  - The message [FINISH] appears on the display.
  - A beep sound is audible for 10 seconds to inform the user about the finished digestion.
11. Wait until the samples are cooled down.
  - The LED [HEAT] flashes until the temperature of the heating block is below 60 °C.
12. Tilt up the suction module when no more fumes are escaping from the sample tubes.
13. Place the drip tray between the suction module and the samples.
14. Switch off the Scrubber by pressing the stop [STOP] button.

## 6.8.2 Digestion process, automatic mode

### Preliminary tasks

1. Turn on the main switch.
2. Select or setup a method (Method 1 – 9).
  - 6.8.6 Select a method, (6–44).
  - 6.8.4 Set parameters for an automatic digestion, (6–43).
3. Press the start [START] button.
  - The start time setting appears.
4. Press the start [START] button.
  - The block is heated to the set temperature of step 1.
  - The rack will lower automatically into the heating block when the temperature of step 1 is reached.
  - The Scrubber starts (if connected).

### Tasks

1. Place the sample tubes into the rack.
2. Pour the samples and reagents into the sample tubes.
3. Use glass caps for any unoccupied positions to close the suction circuit.
4. Fit the sample rack into the cooling position.
5. Remove the drip tray.
6. Tilt down the suction module onto the sample tubes.
7. Check if all the sealings of the suction module are fitting the sample tubes.

	 <b>WARNING</b>
	<p><b>Risk of acid or toxic fume inhalation.</b>          Serious injuries or death can result.</p> <ol style="list-style-type: none"> <li>1. Always run the Scrubber or water jet pump during the digestion process.</li> <li>2. Operate the Scrubber and Kjeldigester only in a fume hood.</li> <li>3. Close the fume hood door as far as possible.</li> </ol>

8. Start the Scrubber (if not connected) or the water jet pump.
  - The device beeps 3 times before the lift starts moving down into heating position.

#### Follow-on tasks

1. After the digestion process the rack will move automatically into the cooling position.
  - The LED [HEAT] flashes until the temperature of the heating block is below 60 °C.
  - The Scrubber keeps running until the cooling time is completed as defined in the method.
2. Tilt up the suction module.
3. Place the drip tray between the suction module and the samples.
4. Press the start [START] button to repeat the same method or press stop [STOP] to select another method.

### 6.8.3 Digestion process, delayed start

#### Preliminary tasks

1. Connect the Scrubber to the K-449.
2. 5.5.5 Set the clock (K-449 only), (5–31).
3. 6.8.6 Select a method, (6–44).
4. 6.8.7 Set up a delayed start time, (6–44).

#### Tasks

1. Press the start [START] button.
  - 6.8.7 Set up a delayed start time, (6–44).
2. Place the sample tubes into the rack.
3. Pour the samples and reagents into the sample tubes.
4. Use glass caps for any unoccupied positions to close the suction circuit.
5. Fit the sample rack into the cooling position.
6. Remove the drip tray.
7. Tilt down the suction module onto the sample tubes.
8. Check if all the sealings of the suction module are fitting the sample tubes.

	 <b>WARNING</b>
	<p><b>Risk of acid or toxic fume inhalation.</b>          Serious injuries or death can result.</p> <ol style="list-style-type: none"> <li>1. Always run the Scrubber during the digestion process.</li> <li>2. Operate the Scrubber and Kjeldigester only in a fume hood.</li> <li>3. Close the fume hood door as far as possible.</li> </ol>

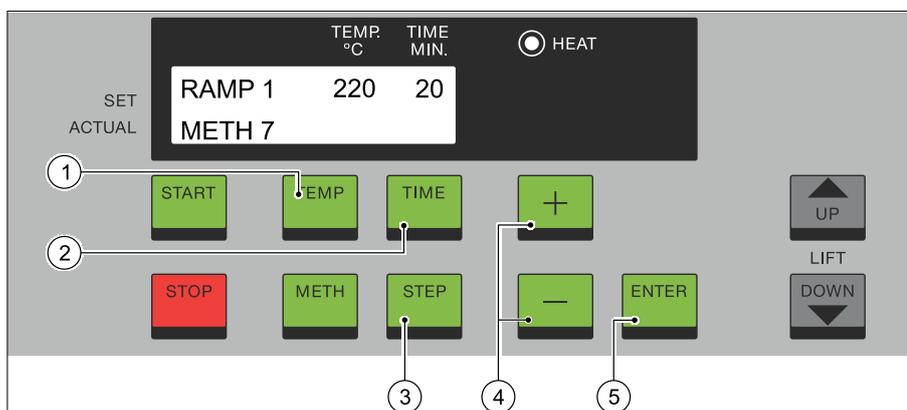
9. Make sure the Scrubber main switch is on and the cooling water is working.

### 6.8.4 Set parameters for an automatic digestion

1. Press Method [METH].
2. Select a method number between 1 and 9.  
· 6.8.6 Select a method, (6–44).
3. Press ③ [STEP].  
· The text [STARTTIME] on the display appears.
4. Set a delayed start time if required or press ③ [STEP] to continue.  
· 6.8.7 Set up a delayed start time, (6–44).
5. Press ① [TEMP] and adjust the temperature by pressing ④ [+/-].
6. Press ⑤ [ENTER] to confirm the new value.
7. Press ② [TIME] and adjust the time by pressing ④ [+/-].
8. Press ⑤ [ENTER] to confirm the new value.
9. Press ③ [STEP].
10. Repeat the steps 5 – 9.

#### NOTE

*If not all of the 4 steps are required, set the time to zero on the remaining steps.*

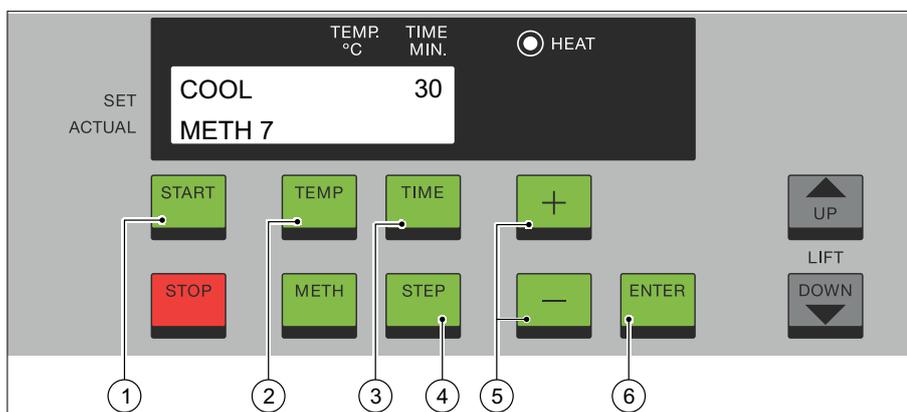


11. Press ① [TIME] and adjust the cooling time to keep the Scrubber running after the digestion is finished by pressing ③ [+/-].

#### NOTE

*Set up a time amount big enough that no more fumes are evading from the sample tubes when the Scrubber stops. BUCHI recommends a starting value of 30 minutes.*

12. Press ④ [ENTER] to confirm the new value.
13. Press ② [STEP].



### 6.8.5 Edit a method

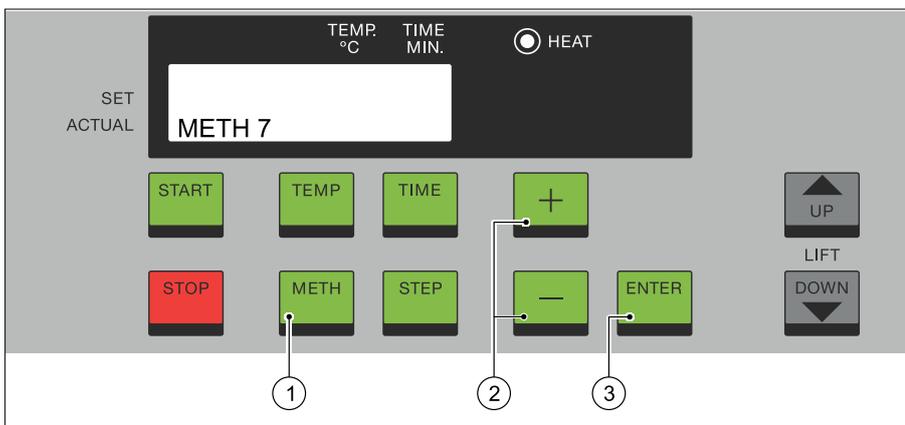
1. Edit a method according to the next step:
  - 6.8.4 Set parameters for an automatic digestion, (6–43).

### 6.8.6 Select a method

1. Press ① [METH].
  - The method number flashes.
2. Select the desired method number by pressing ② [+/-].
3. Press ③ [ENTER] to confirm the method.

#### NOTE

*Method number 0 is reserved for the manual mode.*

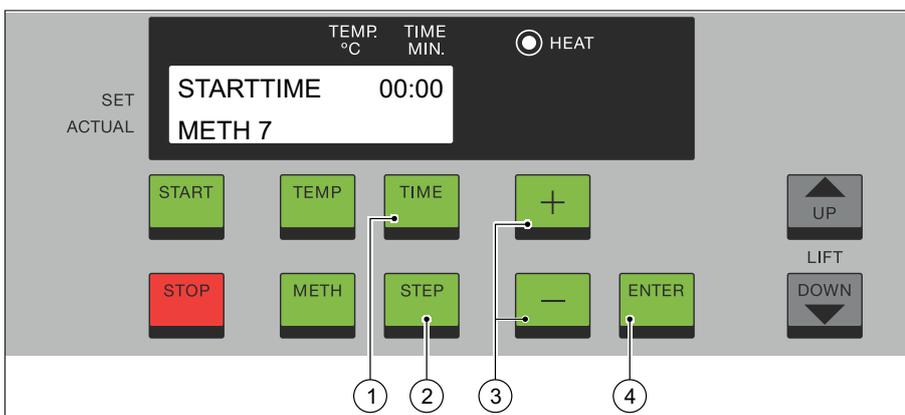


### 6.8.7 Set up a delayed start time

1. Select the desired method.
2. Press ② [STEP].
  - The text [STARTTIME] on the display appears.
3. Press ① [TIME] and adjust the hour by pressing ③ [+/-].
4. Press ④ [ENTER] to confirm the new value.
5. Adjust the minutes by pressing ③ [+/-].
6. Press ④ [ENTER] to confirm the new value.

#### NOTE

*Make sure that the internal clock is set properly for an accurate work of the delayed start time.*



### 6.8.8 Moving the lift up or down



#### **WARNING**

#### **Risk of hand bruising and burns due to the moving lift!**

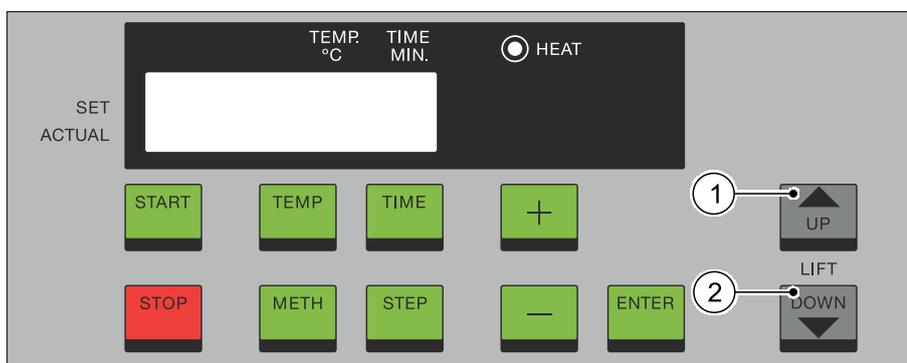
Serious injuries or death can result.

1. Do not reach between the heating block and rack during the lift movement.
2. Do not touch the device during the lift operation.

1. Move the lift up or down by pressing ① or ② [UP/DOWN].
  - The lift moves automatically in the automatic mode.

#### NOTE

*The lift can be moved manually at any time.*





## 7 Maintenance

All maintenance and repair work described in this manual can be carried out by the operator. All other tasks must be carried out by trained service personnel. Therefore contact the BUCHI customer service or the sales representative.

Use only genuine BUCHI consumables and spare parts for maintenance to assure good device performance, reliability and safety. Any modifications of spare parts or assemblies are only allowed with the prior written permission of BUCHI.

### 7.1 Maintenance plan

#### 7.1.1 Maintenance as required/after use

No Task

1.	Clean the suction module	(7-49)
2.	Check the sealings and springs	(8-57)
3.	Check the glass parts: · Suction tubes and fume collection tube · Check the sample tubes · Hose connector on the fume collection tube	(8-58)
4.	Clean the sample tubes	(7-49)
5.	Clean the drip tray	
6.	Clean the heating block holes with a wire brush	

#### 7.1.2 Daily maintenance

No Task

1.	Clean the suction module	(7-49)
2.	Clean the Kjeldigester	(7-48)
3.	Check the glass parts: · Suction tubes and fume collection tube · Check the sample tubes · Hose connector on the fume collection tube	(8-58)

#### 7.1.3 Maintenance every week

No Task

1.	Clean the rack	
2.	Clean the magnets of the rack support with a damp cloth	
3.	Clean the catchpot clip.	
4.	Clean the Scrubber hose	(7-49)

### 7.1.4 Maintenance every year or after every 1000 digestion cycles

No Task

- |   |        |
|---|--------|
| 1. Check the rechargeable battery                         | (8–58) |
| 2. Replace the sealings and springs of the suction module | (7–50) |

### 7.1.5 Maintenance every 3 years

No Task

- |                                     |        |
|-------------------------------------|--------|
| 1. Replace the rechargeable battery | (7–52) |
|-------------------------------------|--------|

## 7.2 Cleaning

### 7.2.1 KjeldDigester, cleaning

	 <b>NOTICE</b>
	<p><b>Risk of liquids leaking into the housing or electrical components!</b> Device damage by liquids and detergents and corrosion through chemicals.</p> <ol style="list-style-type: none"> <li>1. Let the device cool down before cleaning.</li> <li>2. Do not spill liquids over the device, wipe off any liquids instantly.</li> <li>3. Use a pipette to remove remaining liquid.</li> <li>4. Use ethanol or soapy water as detergent only.</li> </ol>

#### Preliminary tasks

1. Let the heating block cool down (<60 °C).
2. Switch off the main switch.

	 <b>WARNING</b>
	<p><b>Risk of electric shock or burns from electric current during cleaning!</b> Serious injuries or death can result.</p> <ol style="list-style-type: none"> <li>1. Switch off the device.</li> <li>2. Disconnect the power supply cable from the device.</li> <li>3. Wait until the device is completely dry before reusing.</li> </ol>

3. Disconnect the power supply cable of the device.

#### Tasks

1. Clean the drip tray with water and store it in the drip tray holder.
2. Clean the device surfaces and covers with a damp cloth to remove acid splashes.
  - Remove the heating block cover for cleaning.
3. Clean the heating block cover.
4. Clean all spaces, e.g. between heating block and housing.
  - In case of a strong contaminant of the heating block use the wire brush and drilling machine.
5. Put back the cover onto the heating block.

### 7.2.2 Scrubber hose, cleaning

1. Disconnect the Scrubber hose on the both ends (Scrubber and Kjeldigester).
2. Carry the hose with both openings showing upwards to prevent liquid to leak out.
3. Flush hose with hot water.
  - Use ethanol as a detergent for major contaminants.
4. Reconnect the hose on the Scrubber and Kjeldigester.

### 7.2.3 Suction module sealing and spring, cleaning

#### Preliminary tasks

1. Remove the suction module (7–54).

#### Tasks

1. Put the suction module upside down in to a washing bath.
2. Clean the sealings and springs with water and a brush.
  - Use ethanol or soapy water as detergent for major contaminants.
3. Clean the suction tubes and the fume collection tube with detergent and a brush.
4. Flush the suction tubes and the fume collection tube with water.
5. Dry the sealings with a soft cloth.

#### NOTE

*The complete suction module can also be cleaned in a laboratory dishwasher.*

6. In case of a strong contaminant disassemble the suction module and clean the parts in a ultrasonic bath.

#### Follow-on tasks

1. Check the glass parts (8–58).

### 7.2.4 Sample tube, cleaning

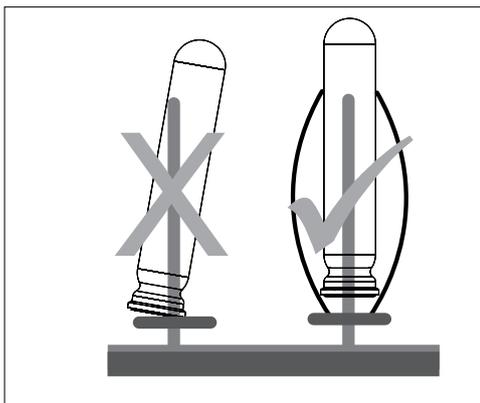
	 <b>NOTICE</b>
	<p><b>Risk of sample tube damage.</b> Sample tubes can break due to mechanical or temperature shocks.</p> <ol style="list-style-type: none"> <li>1. Do not cool down sample tubes with cold water.</li> <li>2. Do not place hot sample tubes and the rack on a cold surface.</li> </ol>

#### Single tube

1. Place the sample tubes into the dish washer.
2. Make sure the sample tubes are properly mounted in the dishwasher to prevent any damage.

#### NOTE

*Sample tubes with scratches or chips can break during a digestion.*

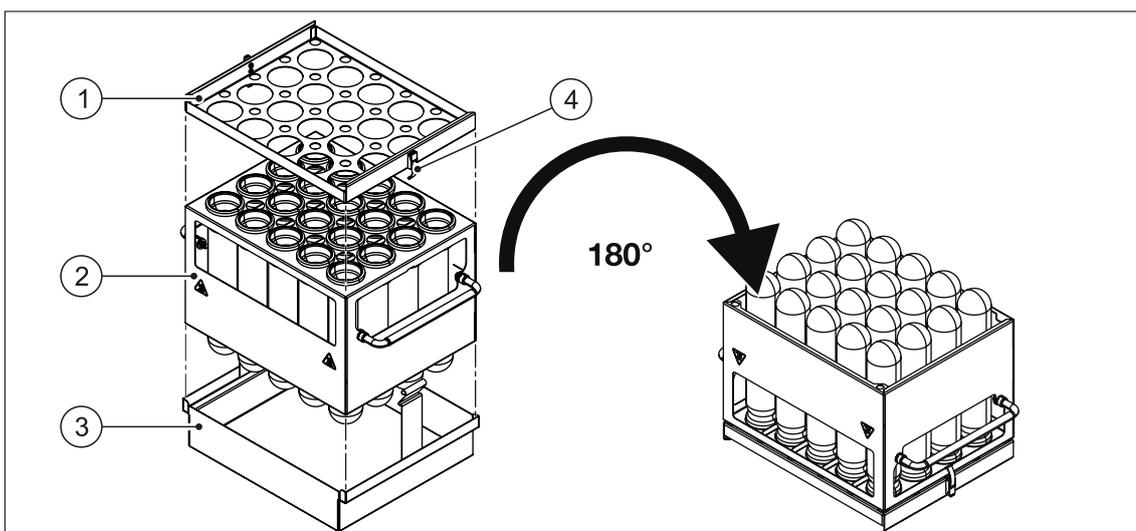


### Tubes and rack

#### NOTE

To clean the tubes and rack together in the dishwasher additional accessories are required.

1. Place the sample tubes and rack ② on the rack stand ③.
2. Install the retaining plate ① and lock it with the 2 latches ④ to secure the sample tubes.
3. Turn the rack upside down and place it in the dishwasher.



### Follow-on tasks

1. Check the glass parts (8–58).

## 7.3 Suction module sealing and spring ,replacement

### Preliminary tasks

1. Remove the suction module (7–54).

## Tasks

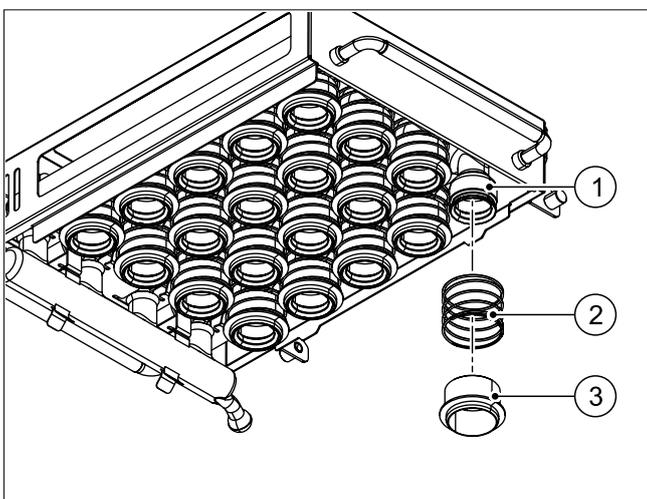
	 <b>NOTICE</b>
	<p><b>Risk of sealing damage by sharp objects.</b></p> <p>The sealings can be damaged by the use of sharp objects.</p> <ol style="list-style-type: none"> <li>1. Do not bring sealings in contact with sharp objects.</li> <li>2. Use ethanol or soapy water as detergent only.</li> <li>3. Do not lubricate sealings.</li> </ol>

1. Hold back the suction tube ① and pull down the sealing ③ by hand.

### NOTE

*Replacing the sealing under running, warm water will ease the removal.*

2. Remove the spring ②.

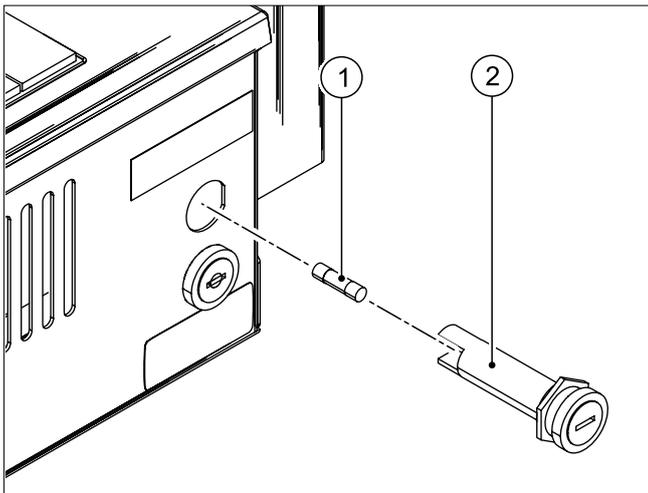


3. Install the spring and sealing in reverse order.

## 7.4 Fuse power supply, replacement

	 <b>WARNING</b>
	<p><b>Risk of electric shock with connected power supply cable!</b></p> <p>Serious injuries or death can result.</p> <ol style="list-style-type: none"> <li>1. Switch off the device</li> <li>2. Disconnect the power supply cable from the device.</li> </ol>

1. Switch off the main switch.
2. Disconnect the power supply cable from the device.
3. Unscrew the fuse carrier ②.
  - Make sure the O-ring on the fuse carrier is not damaged.
4. Replace the defective fuse ①.
5. Screw in the fuse carrier.
6. Connect the power supply cable.



7. If the fuse brakes repeatedly contact the customer support.
  - 8.1 Customer service, (8-55).

## 7.5 Rechargeable battery (K-449 only), replacement

### Required tools:

- TORX screw driver T10

### Preliminary tasks

1. Remove the drip tray and store it on the drip tray holder on the left side of the device.
2. Remove the suction module (7-54).

### Tasks

1. Make sure the lift is in the cooling position.

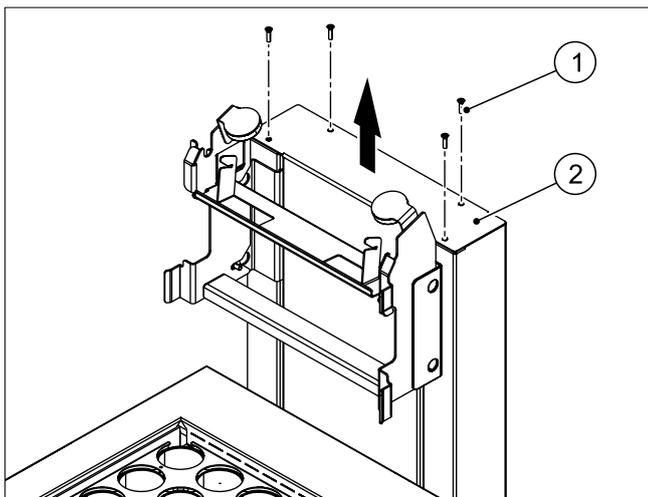
	 <b>WARNING</b>
	<p><b>Risk of electric shock with connected power supply cable!</b>          Serious injuries or death can result.</p> <ol style="list-style-type: none"> <li>1. Switch off the device.</li> <li>2. Disconnect the power supply cable from the device.</li> </ol>

2. Switch off the device.
3. Disconnect the power supply cable from the device.
4. Remove the 4 TORX screws ① of the lift cover.

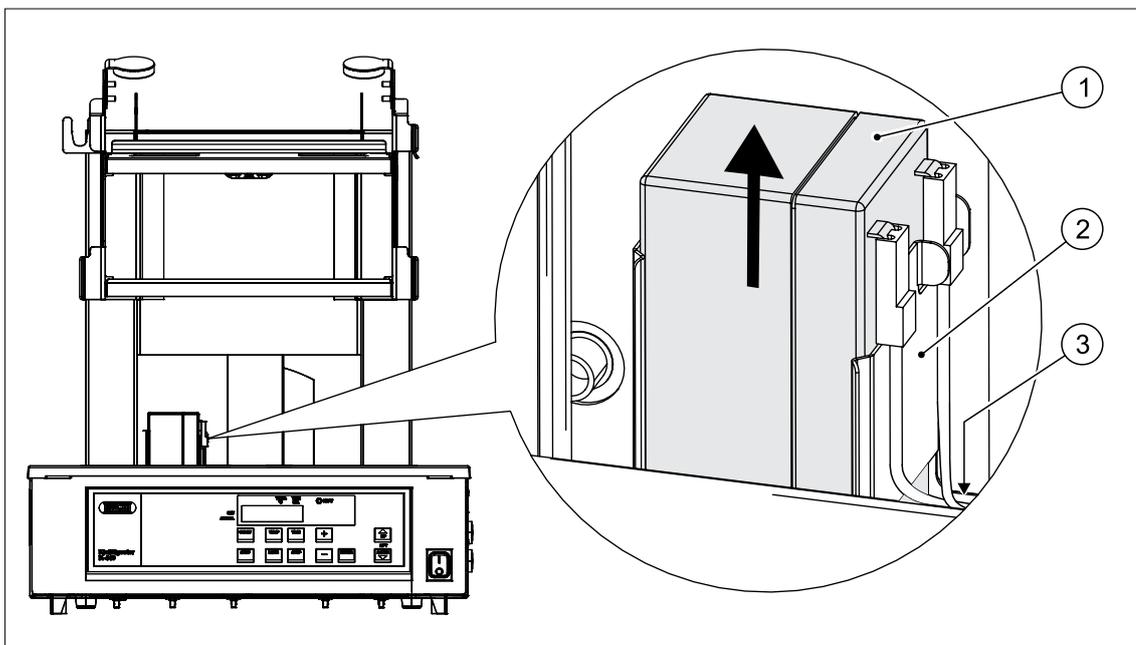
#### *Required tools*

TORX screw driver T10

5. Slide out the lift cover ②.



6. Move the battery ① upwards out of the bracket ②.
7. Disconnect the electrical plug ③ of the battery cable.



8. Install the new battery.
9. Assemble in reverse order.

#### Follow-on tasks

1. Check the rechargeable battery (8–58).

## 7.6 Suction module, removal

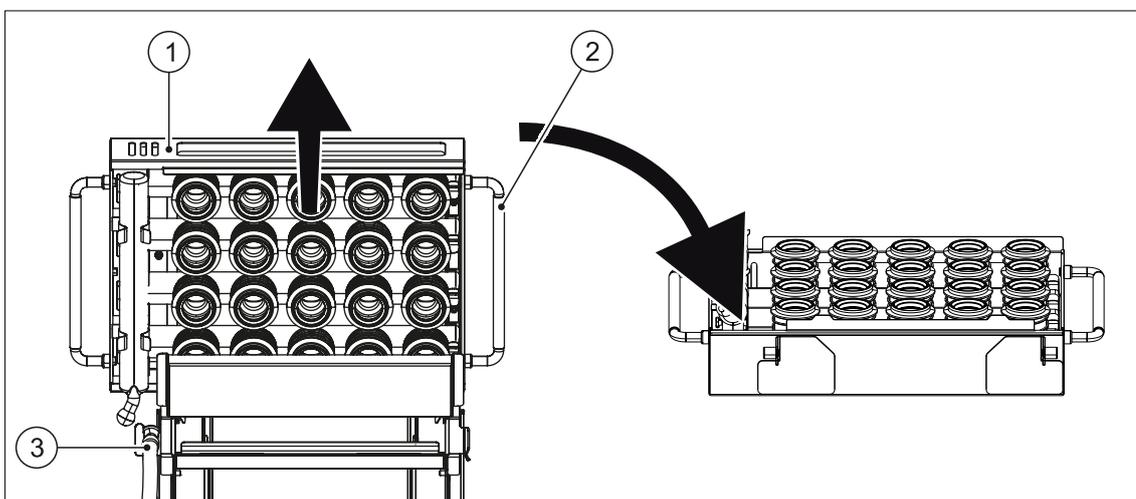
1. Disconnect the Scrubber hose ③ from the fume collection tube and store it the bracket left of the device.
2. Hold the suction module ① on both handles ② and lift it up and to the rear.

### NOTE

*The magnets on rack support will hold the suction module back until the force of the magnetic field is overcome by lifting up.*

	<b>CAUTION</b>
	<b>Risk of chemical burns from acid!</b> Minor or moderate cuts can result. <ol style="list-style-type: none"><li>1. Wear the personal protective equipment.</li></ol>

3. Store and carry the suction module upside down to prevent acid drops pour out of the suction module.



## 8 Troubleshooting

### 8.1 Customer service

Only authorized service personnel are allowed to perform repair work on the device which is not described in this manual. Authorization requires a comprehensive technical training and knowledge of possible dangers which might arise when working at the device. Such training and knowledge can only be provided by BUCHI.

The customer service and support offers the following support:

- Spare part delivery
- Repairs
- Technical advice

Addresses of official BUCHI customer service offices can be found on the BUCHI website.

[www.buchi.com](http://www.buchi.com)

### 8.2 Error messages on the display

The troubleshooting table lists possible malfunctions and errors of the device. The operator is enabled to correct some of those problems or errors. For this, appropriate corrective measures are listed in the column "Corrective measure".

Malfunction	Possible cause	Corrective measure
ERR 1 POWER	Power supply interrupted. The heat is turned off automatically.	Restart. Delete the error message from the display by pressing [STOP].
ERR 2 TEMP	The current heating block temperature exceeds 500 °C (constant beeping sound).	Switch off the main switch. Restart. Delete the error message from the display by pressing [STOP].
ERR 3 SHUT OFF MAINS	Due to a blocked or defective fan the internal temperature of the device exceeds 60 °C.	Switch off the device and contact the BUCHI customer service.
PT 1000 ERROR	Temperature sensor short or circuit interrupted.	Switch off the device and contact the BUCHI customer service.

## 8.3 Faults

### 8.3.1 Broken sample tube during digestion



#### WARNING

##### Risk of burns from corrosives!

Serious injuries or death can result.

1. Observe all MSDS of the used chemicals.
2. Handle corrosives in well ventilated environments only.
3. Wear the personnel protective equipment.



#### WARNING

##### Risk of acid or toxic fume inhalation!

Serious injuries or death can result.

1. Run a Scrubber or water jet pump during a digestion and cool down time.
2. Close the fume hood as far as possible.

1. Abort the digestion by pressing the stop [STOP] button on the control panel.
2. Close the fume hood completely.
3. Wait until the heating block is cooled down.
4. Switch off the Scrubber.
5. Tilt up the suction module and place the drip tray underneath.
6. Remove the rack.
7. Remove residual bits of glass with a long forceps.
8. Remove the heating block cover and wash it.
9. Remove liquid from the heating block with a pipet.

#### NOTE

*If liquid is flown into the insulation frame jack up the device (2 cm) on one side and collect the liquid on the other side.*

10. Clean the heating block with the use of a long forceps and paper towel.

#### NOTE

*Use distilled water to remove residues.*

11. Clean the surface below and around the Kjeldigester.



#### NOTICE

##### Risk of sample tube damage.

The sample tubes can brake due to residues in the heating block holes.

1. Remove all residues (e.g. liquid, glass or crystals) from the heating block holes before reusing the device.

12. Make sure that no residues (e.g. liquid, glass or crystals) are left in the heating block holes.
13. Reinstall the heating block cover.

**Follow-on tasks**

1. Clean the KjeldDigester (7–48).
2. Check the glassware (8–58).

**8.3.2 Power supply failure [ERR 1] during a digestion**

	 <b>CAUTION</b>
	<p><b>Risk of acid or toxic fume inhalation!</b>          Minor or moderate chemical burns of the airways.</p> <ol style="list-style-type: none"> <li>1. Close the door of the fume hood as far as possible.</li> <li>2. Leave the room.</li> </ol>

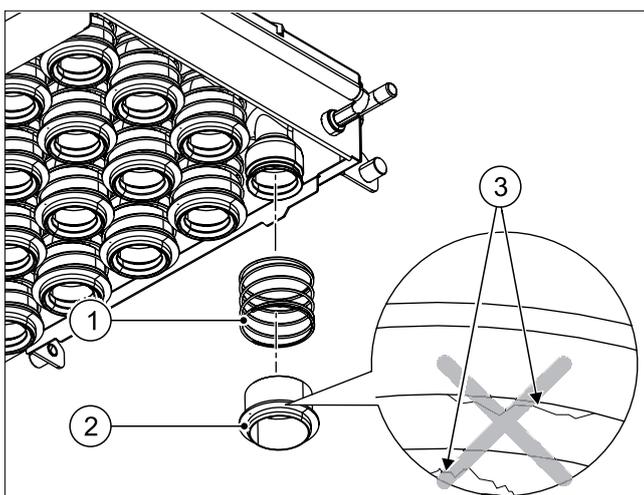
1. Close the door of the fume hood as far as possible.
2. Leave the room and secure it until no fumes are left.
3. Try to reestablish the power supply so that the fume will be aspirated.
4. Restart the digestion.

**8.3.3 Sample tubes jam in the heating block (K-449 only)**

1. Perform a glass part check (8–58).
2. Contact the BUCHI customer service to align the rack support and heating block.

**8.4 Checks****8.4.1 Suction module sealing and spring, check**

1. Check all sealings ② and springs ① on the suction module.
  - No damaged spots ③ on the sealings.
  - No broken springs.



### Results

Sealings and springs show no damage:

- The sealings and springs are O.K.

Sealings and springs are damaged or show wear:

- Replace the sealings and springs (7–50).

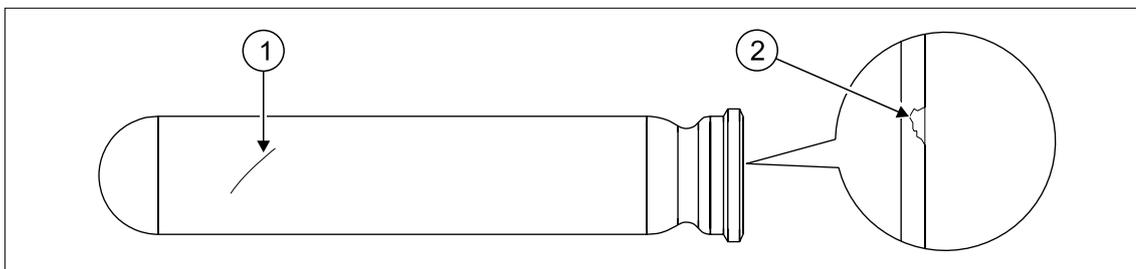
### 8.4.2 Glass parts, check

1. Check all glass parts for scratches ① or chips ②:

- Sample tubes
- Suction tubes
- Fume collection tube
- Hose connector

#### NOTE

*Sample tubes with scratches or chips can break during a digestion.*



### Results

Glass parts show no damage:

- The glass parts are O.K.

Glass parts have scratches or chips:

- Replace faulty glass parts.

### 8.4.3 Rechargeable battery (K-449 only), check

#### NOTE

*This check can be done before a regular digestion.*

1. Prepare the sample tubes and the rack for a digestion.
2. Place the filled rack into cooling position.
3. Turn on the main switch.
4. Move the lift to the heating position by pressing the down button on the control panel.
5. Disconnect the power supply cable from the device.

**Results**

The lift moves completely up to the cooling position:

- The battery is O.K.

The lift does not completely move up to the cooling position:

- Replace the rechargeable battery (7–52).

**Follow-on tasks**

1. After restarting the device press [STOP] to clear the error message [ERR 1].



## 9 Taking out of operation

	 <b>CAUTION</b>
	<b>Risk of injuries due to weight of the device!</b> Minor or moderate injuries can result. <ol style="list-style-type: none"><li>1. Call a second person to lift the device.</li><li>2. Do not lift the device alone.</li></ol>

### 9.1 Transport

#### Preliminary tasks

1. Prepare the original packaging.
2. Make sure the device is free of any liquids and residues.
  - 7.2.1 KjeldDigester, cleaning, (7–48).

#### Tasks

1. Install the transport lock in reverse order according to:
  - 5.3 Transport lock, removal, (5–26).
2. Disassemble the device in reverse order according to:
  - 5.4 Device assembly, (5–26).
3. Put all relevant documentation e.g. operation manual into the packaging.

### 9.2 Taking out of operation

1. Make sure the device is free of any liquids and residues
  - 7.2.1 KjeldDigester, cleaning, (7–48).
2. Disassemble the device in reverse order.
  - 5.4 Device assembly, (5–26).
3. For disposal of liquids and consumables such as catalyst or acid, see MSDS of these chemicals.
4. Follow the valid regional and local laws concerning a disposal. For help, please contact the local authorities.
  - 9.3 Materials used, (9–62).

**9.3 Materials used**

Part	Material
Magnet	Neodymium
Coating	Polyester/epoxy
Lift guide	Polyethylene
Heating block	Aluminum AlMgSi 1
Sealing (suction module)	PTFE
Spring (suction module)	Stainless spring steel
Insulation	Superwool blanket 607 (SiO <sub>2</sub> /CaO/MgO)
Housing, Rack	Sheet steel, stainless (1.4301/1.4016)
Glass components	Borosilicate 3.3
Hose	Ethylene/propylene terpolymer rubber

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## 10 Spare parts

### 10.1 General information

Always state the part number and product description when ordering spare parts.

Use only genuine BUCHI consumables and spare parts for maintenance to assure good system performance, reliability and safety. Any modifications of spare parts or assemblies are only allowed with the prior written permission of BUCHI.

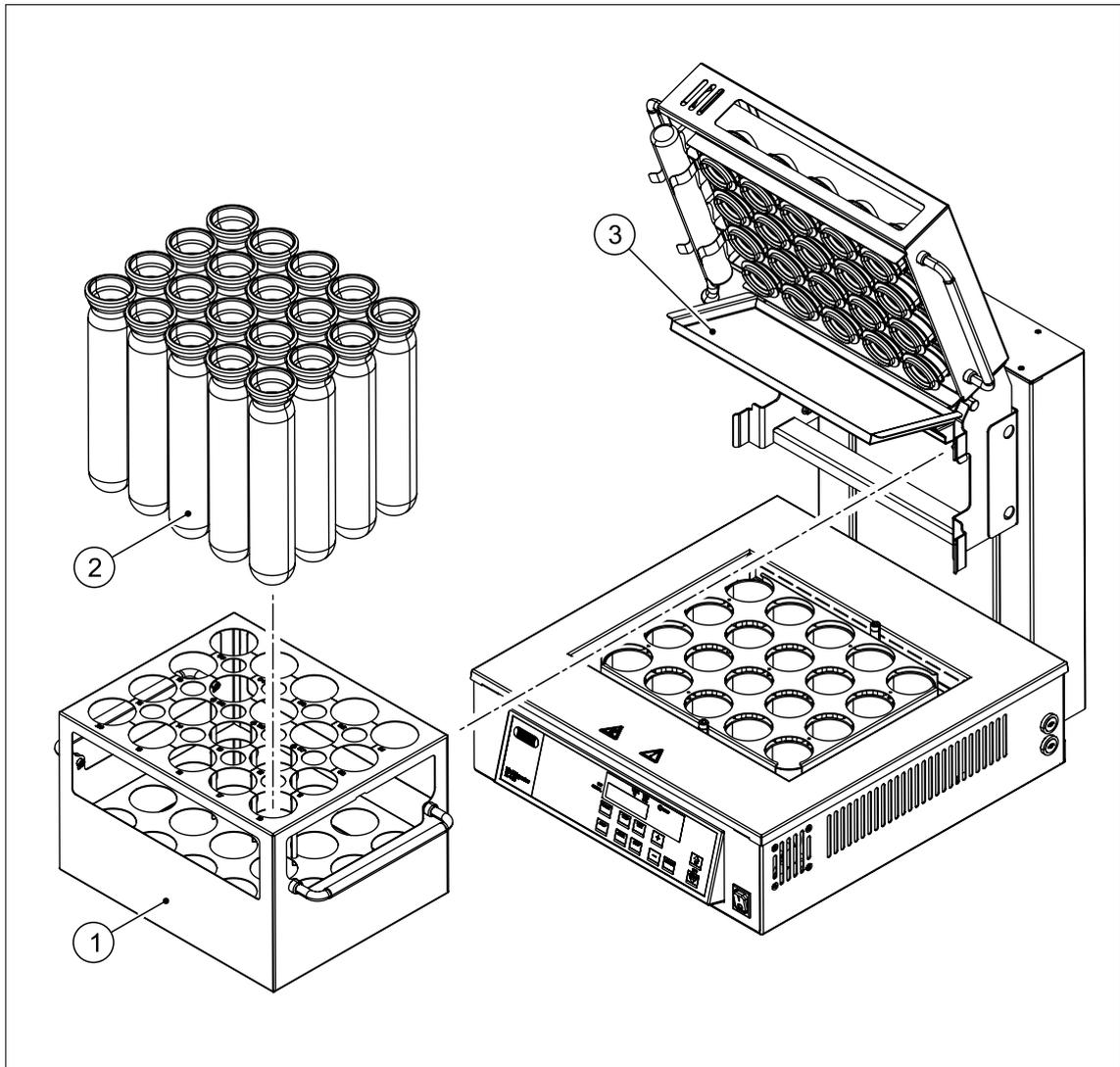
Description:

- Shows the nomenclature of item.
- Shows technical information e.g. diameter, length, weight.

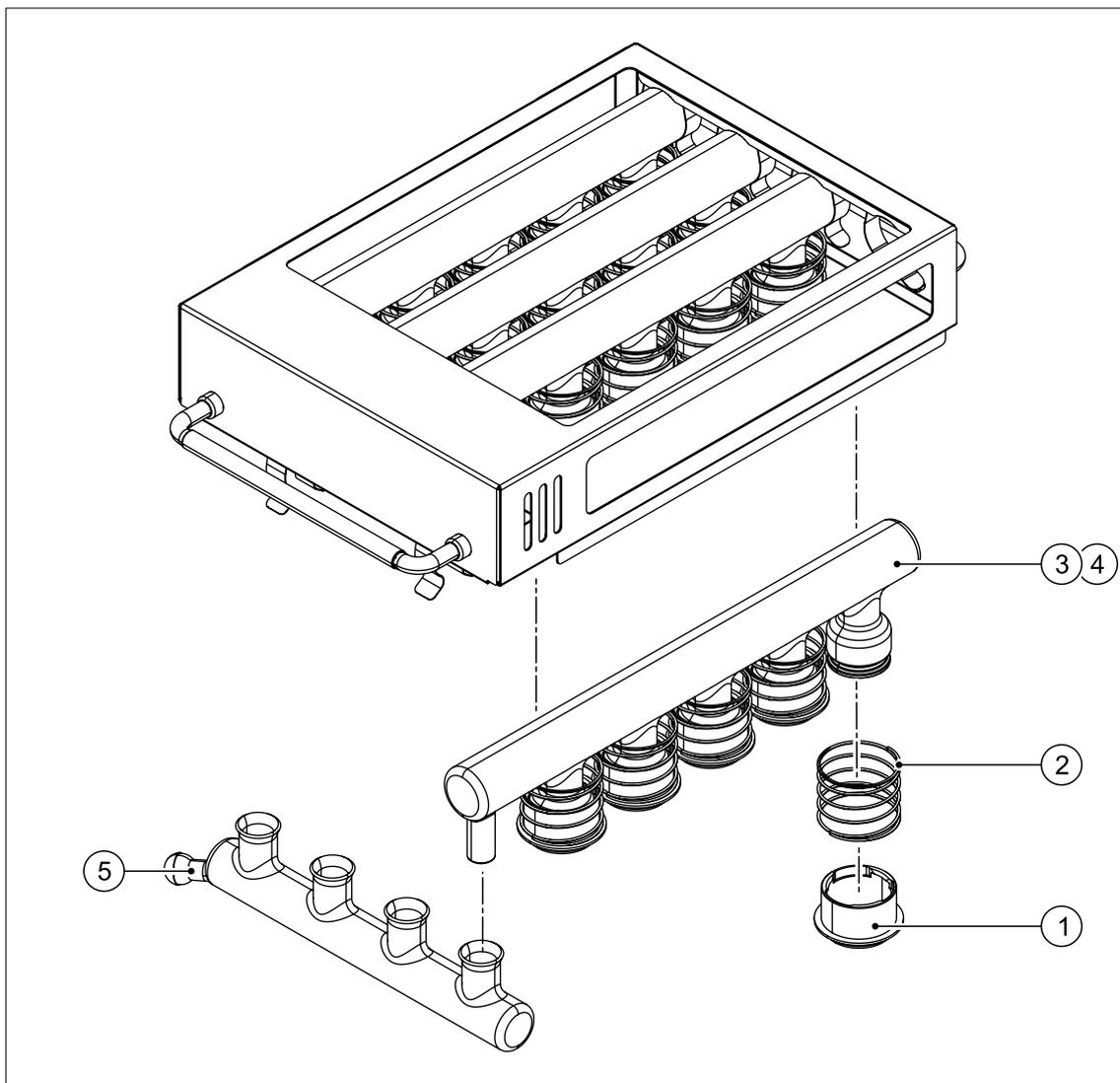
Quantity (Qty):

- Shows the quantity of items included.

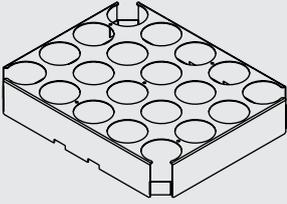
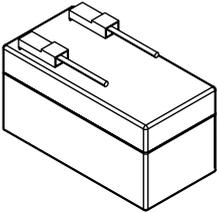
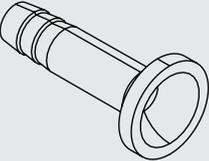
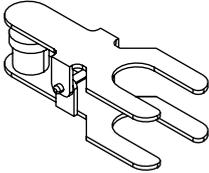
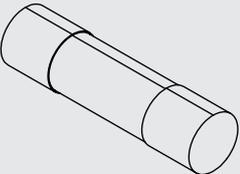
## 10.2 Spare parts KjeldDigester K-446/K-449



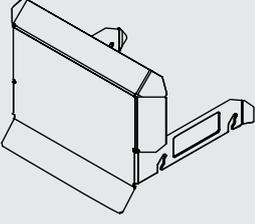
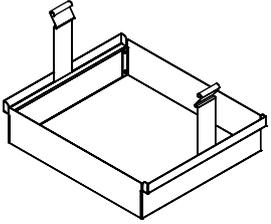
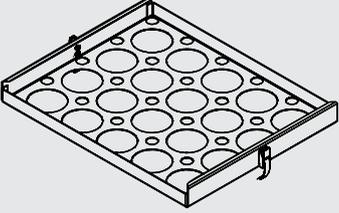
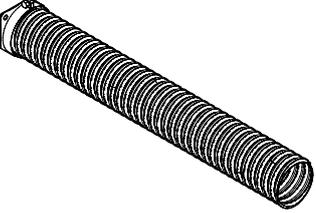
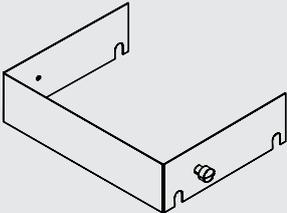
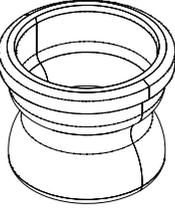
Position	Description	Qty	Order number
①	Rack	1	11059831
②	Sample tube, 300 mL	4	037377
③	Sample tube, 300 mL	20	11059690
④	Drip tray	1	11059031
⑤	Drip tray holder	1	11059804

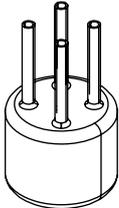
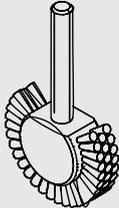


Position	Description	Qty	Order number
①	Sealing PTFE	10	11059764
②	Spring	10	11059765
③	Suction tube, standard	1	11058651
④	Suction tube with condensate trap	1	11058827
⑤	Fume collection tube	1	11058825

Picture	Description	Qty	Order number
	Heating block cover	1	11058793
	Rechargeable battery (including connection cable)	1	11059102
	Hose connector	1	11057159
	Catchpot clip	1	11057149
	Fuse 10 A	10	016952
	Power supply cable	1	–
	· Type CH	–	010010
	· Type Schuko	–	010016
	· Type GB	–	017835
	· Type USA	–	033763
	· Type AUS	–	017836
	Hose EPDM 8/1500 mm	1	11056005

### 10.3 Optional accessories

Picture	Description	Qty	Order number
	User protection shield	1	11057889
	Rack stand	1	11058659
	Retaining plate, for dishwasher	1	038559
	Air supply	1	040079
	Heat insulation cover	1	040052
	Glass cap	4	040049

Picture	Description	Qty	Order number
	Digestion rod	10	043087
	Condensate bottle	1	025100
	Wire brush	1	043929
	Connecting cable to Scrubber	1	030973
	IQ/OQ set (en)	1	11059762
	Repeating OQ (en)	1	11059763
	Scrubber K-415 (TripleScrub <sup>ECO</sup> )	1	114152331
	Water jet pump made of plastic	1	002913

### 10.3.1 Kjeldahl Tablets

Description	Qty	Order number
Titanium (3.71 g) 3.500 g K <sub>2</sub> SO <sub>4</sub> , 0.105 g CuSO <sub>4</sub> × 5 H <sub>2</sub> O, 0.105 g TiO <sub>2</sub>	1000	11057980
Missouri (5.00 g) 4.980 g K <sub>2</sub> SO <sub>4</sub> , 0.020 g CuSO <sub>4</sub> × 5 H <sub>2</sub> O	1000	11057982
ECO (4.00 g) 3.998 g K <sub>2</sub> SO <sub>4</sub> , 0.002 g CuSO <sub>4</sub> × 5 H <sub>2</sub> O	1000	11057983
Titanium Micro (1.59 g) 1.500 g K <sub>2</sub> SO <sub>4</sub> , 0.045 g CuSO <sub>4</sub> × 5 H <sub>2</sub> O, 0.045 g TiO <sub>2</sub>	1000	11057981
Copper Micro 1.500 g K <sub>2</sub> SO <sub>4</sub> , 0.150 g CuSO <sub>4</sub> × 5 H <sub>2</sub> O	1000	11057985
Antifoam (1.00 g) 0.970 g Na <sub>2</sub> SO <sub>4</sub> , 0.030 g silicone antifoam)	1000	11057984

## 11 Appendix

### 11.1 FCC requirements (for USA and Canada)

#### English:

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to both Part 15 of the FCC Rules and the radio interference regulations of the Canadian Department of Communications. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment.

This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

#### Français:

Cet appareil a été testé et s'est avéré conforme aux limites prévues pour les appareils numériques de classe A et à la partie 15 des réglementations FCC ainsi qu'à la réglementation des interférences radio du Canadian Department of Communications. Ces limites sont destinées à fournir une protection adéquate contre les interférences néfastes lorsque l'appareil est utilisé dans un environnement commercial.

Cet appareil génère, utilise et peut irradier une énergie à fréquence radioélectrique, il est en outre susceptible d'engendrer des interférences avec les communications radio, s'il n'est pas installé et utilisé conformément aux instructions du mode d'emploi. L'utilisation de cet appareil dans les zones résidentielles peut causer des interférences néfastes, auquel cas l'exploitant sera amené à prendre les dispositions utiles pour palier aux interférences à ses propres frais.

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