



LAB Online Exhibition



Operation Manual



knowledge



Action movie

Table of Contents

1	Scope of delivery	2
2	Safety	3
2.1	Symbols	3
2.2	Requirements for the User	3
2.3	Proper Use	3
2.4	Improper Use	4
2.5	General Risks	4
2.6	Safety Measures	4
3	Function	6
3.1	Functional Principle	6
4	Installation	7
4.1	Placement	7
4.2	Unpacking	7
4.3	Connection to Power Supply	7
4.4	Hose connection	8
5	Operation	9
5.1	Operator's controls	9
5.2	Keyboard	9
5.3	General	10
5.4	Kjeldahl digestion process	11
5.5	Operation of the K-437	12
5.6	Service Menu	13
5.7	Error messages	14
6	Maintenance	15
6.1	General	15
6.2	Upkeep	15
6.3	Seals	16
6.4	Power Supply Fuse	16
6.5	Customer Service	16
7	Taking out of operation	17
7.1	Storage/Transport	17
7.2	Disposal	17
8	Spare parts	18
8.1	Spare parts	18
9	Appendix	19
9.1	Technical Data	19
9.2	Materials Used	19
9.3	Declaration of conformity	20



Please read these operating instructions carefully before using the **BÜCHI** Digest System **K-437**. Keep these instructions in the proximity of the apparatus so that you can consult them immediately whenever necessary.

The apparatus should not be connected to the power supply and turned on until all of the necessary preparations have been completed.

Chapter 2 contains important safety instructions. Read them carefully; they are essential for the safe operation of the apparatus.

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Figure 1: Overview of K-437

1 Scope of delivery

Description	Order No.
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Versions of the equipment:

K-437	230 V	50/60 Hz	38584
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Table 1: Versions of the equipment

Standard accessories:

1 Exhaust unit, complete	38561
1 Rack, 20 spaces	38621
5 Digestion tubes, set of 4	37377
1 EPDM hose, 1.5 m, 8 mm	26275
1 Mains cable of the following types:	
Type CH	10021
Type Schuko	10029
Type GB	17833
Type AUS	17834
Type USA	33756
1 Operating instructions in one of the following languages:	
German	96760
English	96761
French	96762
Italian	96763
Spanish	96764
1 Packaging	35161

Table 2: Standard accessories

Optional accessories:

Water jet pump made of plastic	02913
Sealing cover	17396
PTFE seal for suction tube, set of 20 tubes	38623
Retaining plate	38559
Stands for racks, 20 spaces	38639
Suction tube with condensate brake	38640
Kjeldahl tablets (Hg/Se-free), 250 tablets	28765
Scrubber B-414 with condenser, 230 V	37882
Connecting cable to scrubber B-414	14738
Digestion tubes, set of 4	37377

Table 3: Optional accessories

2 Safety

The apparatus is manufactured according to state-of-the-art technology and recognized safety regulations. Nevertheless, using this apparatus can lead to certain risks and dangers:

- If the apparatus is used by inadequately trained personnel.
- If the apparatus is not used according to these instructions.

2.1 Symbols

**Stop**

Information about risks which can lead to extensive property damage or to serious or life-threatening personal injury.

**Warning**

Information about risks which can lead to personal injury or to property damage.

**Reference**

Information which refers to technical requirements. Failure to heed these requirements can lead to malfunctions, inefficiency, and production losses.

**Warning**

Surface temperature exceeds 60°C.

2.2 Requirements for the User

The apparatus may be used only by laboratory personnel or other persons who due to their training or professional experience are capable of recognizing possible dangers which might arise from the use of the apparatus.

2.3 Proper Use

The apparatus was designed and built for laboratory use. Its proper use is the heating of concentrated sulfuric acid for oxidation of organic sample components.

2.4 Improper Use

Any use of the apparatus other than that given above or any use of the apparatus which is not in accordance with the technical data shall be regarded as a misuse. The operator bears the sole responsibility for any and all damage which may result from such misuse.

In particular, the following uses of the apparatus are prohibited:

- Use of the apparatus in rooms which require ex-protected apparatus.
- Preparing samples which can explode or ignite due to a blow, friction, heat, or sparks.

2.5 General Risks

In general, risks can arise from:

- Hot sulfuric acid
- Flammable gases or solvent vapors in the immediate vicinity of the apparatus
- Damaged glass equipment
- Placing the apparatus too close to the wall (see Chapter 4.1, Placement)
- Burns caused by touching hot glass parts.



The removal of covers using standard tools is prohibited except for authorized maintenance personnel. The apparatus must not be started up glass equipment is damaged.



The apparatus must not be started up glass equipment is damaged.



In order to avoid injuries to the hands and fingers, during the lifting action the machine may not be manipulated.

After operation the machine can still have temperatures up to 60°C, this is indicated by the blinking "HEAT" LED.



Touching any parts of the apparatus carrying electrical current can result in fatal injury!



2.6 Safety Measures

It is recommended that the apparatus be operated only under a ventilation hood.

Protective clothing such as **goggles, gloves, and laboratory coats** must be worn during operation of the apparatus. These operating instructions must be regarded as an integral part of the Digestion System K-437 and be available at all times to operating personnel at the place of operation of the apparatus. This also applies to instructions in other languages, which may be ordered separately.

Modifications

Modifications of the apparatus or of spare parts or accessories as well as the use of spare parts or accessories other than those mentioned in these operating instructions is allowed only with the prior written permission of BÜCHI Labortechnik AG.

Responsibility of the Operator

The operator is responsible for the instruction of his personnel. Copies of these operating instructions in various languages can be ordered for this purpose.

The operator shall inform the manufacturer without delay of any safety-related events which might occur during operation of the apparatus.

If safe operation of the apparatus no longer appears possible, the apparatus must be shut down and secured against unintentional operation.



It must be assumed that safe operation is no longer possible

- if there is visible damage to the apparatus;
- if the apparatus is no longer functioning;
- following a long period of storage under unfavorable conditions;
- following transport under difficult conditions.

The apparatus must not be operated with flammable substances.

If it becomes necessary to involve Büchi Service, safety and environmental protection considerations require that dangerous substances (e.g., according to EU Regulations L 360, 1976/79, or VBG 16) on or in the apparatus must be indicated and declared.

3 Function

The K-437 digestion system is suitable for digestion processes with concentrated boiling sulphuric acid. The digesting parameters are listed in the Büchi applications.

3.1 Functional Principle

① Rack with digestion tubes	38621
② Heating block	
③ Exhaust unit	38561
④ Hose for water jet pump or to scrubber B-414	26275
⑤ Lift	

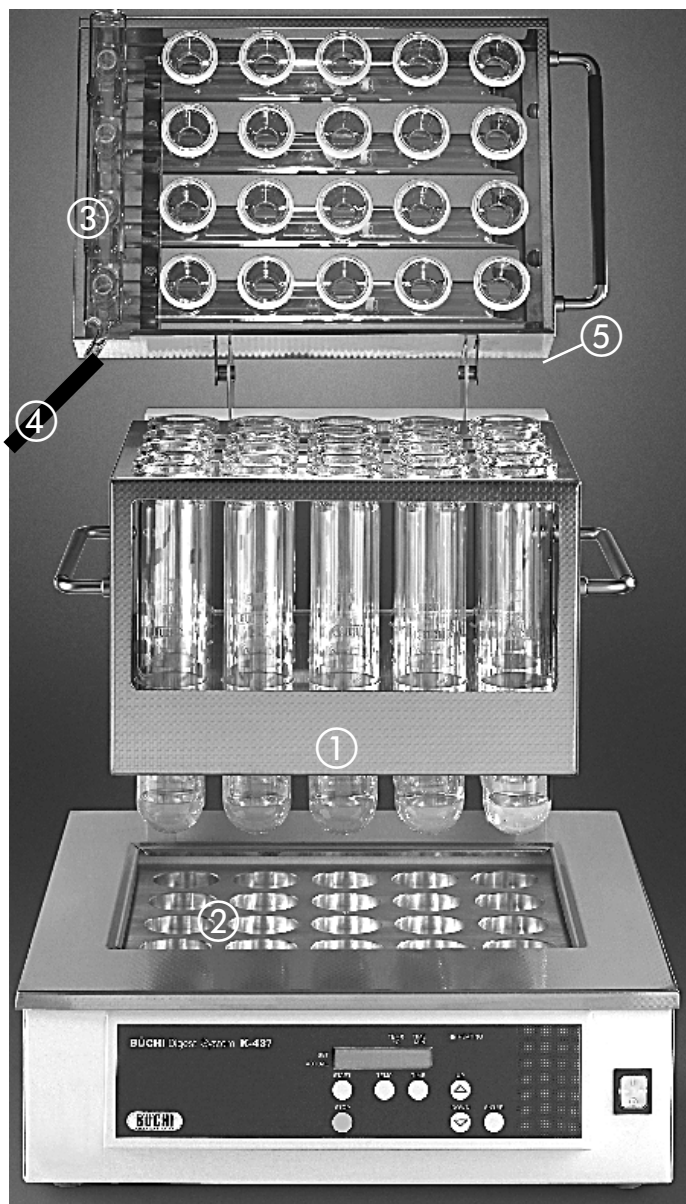


Figure 2: Functional Principle of the K-437

4 Installation

4.1 Placement

The apparatus must be set up on a stable, clean, and level surface.

For safety reasons, the lateral clearance of the machine as well as the clearance between the back side of the machine and the wall or between other objects in the vicinity must be at least 5 cm. in each case.

4.2 Unpacking



Keep the original packaging for the event of a later transport.

If the packaging has been damaged, check the apparatus carefully for glass breakage or damage to the casing.



At least two people must be engaged in the manual transport of the machine due to its heavy weight. Watch position of fingers when putting machine down!

Ensure that the voltage of the power outlet corresponds to the voltage given on the apparatus plate. Always connect the apparatus to a grounded outlet. This will avoid risks due to internal defects.

4.3 Connection to Power Supply

Before the K-437 is turned on for the first time, ensure that the power supply voltage corresponds to the voltage given on the apparatus plate.

Then connect the apparatus to the power supply with the apparatus cable.

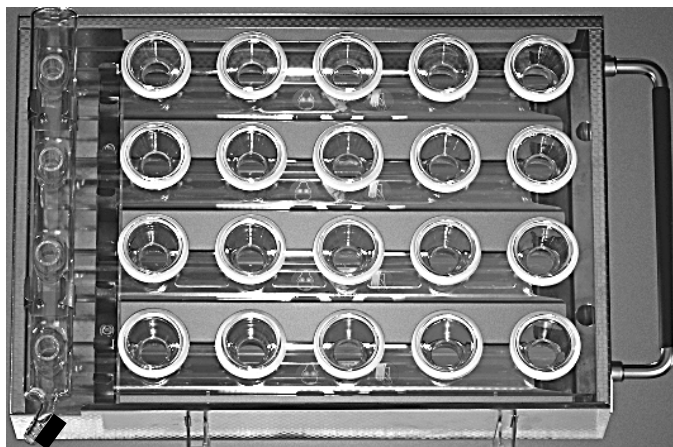


Figure 3: Hose connection, enlarged view

4.4 Hose connection

Fit the EPDM hose to scrubber B-414 or the water jet pump to exhaust the digestion gases. Please ensure here that the hose connections are as short as possible.

When working with a water jet pump, poisonous and caustic gases can escape into the environment if the suction output is not sufficient.



Regarding usage of the Büchi Scrubber B-414, one must ensure that the scrubber is located on the left next to the hydrolysis device. Otherwise the sample tubes cool off too much due to the stream of air from the pump built into the Büchi Scrubber B-414.

If a scrubber is used without condensation step, the condensation that accrues must be caught by means of a Woulff bottle between the hydrolysis unit and the scrubber.



The BÜCHI Scrubber B-414 (230 V) can be connected directly on the K-437 using a connecting cable. However, care must be taken to ensure that the voltage of the scrubber is the same as the voltage for the K-437.

5 Operation



Figure 4: Controls, front

5.1 Operator's controls

- ① Main switch
- ② Indicator light for heating



Figure 5: Controls, back

- ③ Mains supply with fuse
- ④ Mains socket for scrubber B-414

5.2 Keyboard

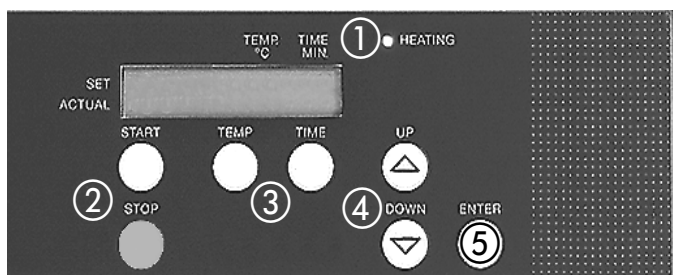


Figure 6: Keyboard

- ① Indicator light for heating
- ② Start / Stop
- ③ Temp / Time
- ④ Arrow keys
- ⑤ Enter

5.3 General

It is important that the condensation zone of the sulphuric acid does not rise too high in the digestion tube (maximum of 5 cm below the rim of the tube).

Normally 18 - 20 ml of H_2SO_4 is used for a weighed portion 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.

To vaporize larger amounts of water (> 10 ml), it is advisable to use boiling stones (not glass beads) as this will prevent boiling delays. If the distillation temperature is too high, it is likely to cause substantial boiling delays. The starting temperature should not be greater than 250°C.



Hot, caustic sulfuric acid is used for the operation of this apparatus.

For this reason, protective goggles must be worn at all times when using this apparatus or working in its immediate proximity. Close unused connections with plug caps (Art. No. 17396).

It is absolutely essential that the seals on the suction pipes be properly installed and fit the glass evenly!

To vaporize larger amounts of water (> 10 ml), it is advisable to use boiling stones (not glass beads) as this will prevent boiling delays. If the distillation temperature is too high, it is likely to cause substantial boiling delays. The starting temperature should not be greater than 250°C.

The digestion time depends on the substance to be digested and information on this can be found in the Büchi applications. If no Büchi application is available, the digestion time must be ascertained by means of experiments. (Once the solution has become clear, continue to boil the solution for approximately a further 30 minutes.) Once the samples have cooled off, the digestion tube can be connected directly to a Büchi distillation unit for distillation.

Due to different contact surfaces between the hydrolysis tubes and the heating block, not all 20 samples boil simultaneously. However, as long as it is ensured that the hydrolysis time and hydrolysis temperatures are sufficient, the differing speeds of boiling have no influence on the results.



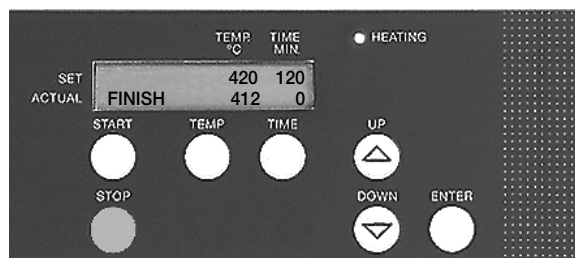
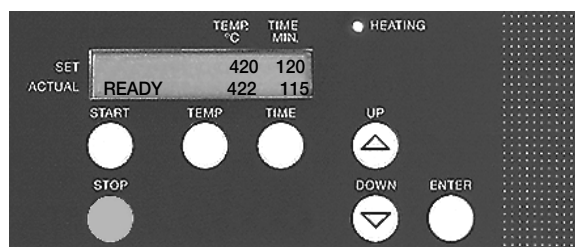
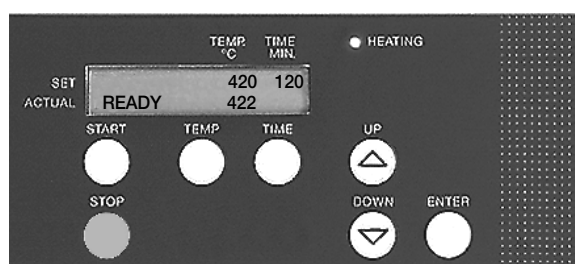
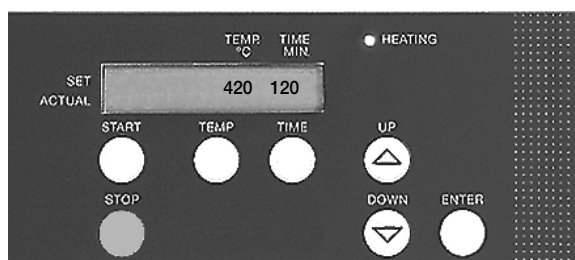
If the digested samples are allowed to cool for a long period of time, the sample will occasionally solidify.

Before it can be distilled, the sample must be liquefied again:

- by carefully adding a small quantity of distilled water, or
- by slightly warming it in the Digestion Unit.

5.4 Kjeldahl digestion process

- Switch on the unit and preheat to the required temperature.
- Place the digestion tubes in the rack.
- Pour the samples and reagents into the digestion tubes. It is essential to wear protective goggles.
- Fit sealing covers (Order No. 17396) over any vacant rack positions.
- Fit the sample rack into the fixture provided.
- Mount the suction unit, with the seals fitted, onto the digestion tubes.
- If the digestion temperature has been reached (READY appears on the display), fit the sample rack, with the suction unit fitted, into the heating block and press the START button. (The connected scrubber will start automatically.)
- Start up the scrubber or water jet pump before gases can develop.
- Once the digestion process is complete, fit the sample rack in the cooling position, with the suction unit fitted, so that it can cool off.
- Once cooling has been completed, press the STOP button to end the digestion process. (The connected scrubber will switch off.)
- The blinking LED "Heat" indicates that the machine is still hot and is being cooled by the ventilator. After hydrolysis is finished the machine should remain connected to power for an additional 30 minutes. In this way the machine is further cooled and thus the service life of the built-in display is extended.
- Repeat the procedure for subsequent digestion processes.



5.5 Operation of the K-437

1. Switching on the K-437

Press the main switch. (Light in switch illuminates green.)
The temperature and digestion time last selected are shown in the display.

2. Editing parameters

Inputs can be changed by pressing the TEMP or TIME buttons. Enter the required temperature or time by pressing the arrow keys (▲) or (▼) and confirm by pressing ENTER. If "0 Min." is entered for the time, the timer will be switched off and the operator must monitor the digestion time.

3. Starting digestion

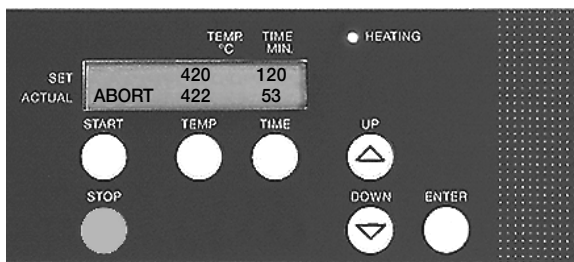
Press the START button to start the heating phase. The "READY" indicator on the display shows that the set digestion temperature has been reached. The samples can now be positioned in the digestion block and the suction module is fitted. The timer is started by pressing the START button again and the remaining digestion time is indicated in the form of a countdown of the figures on the display. If the scrubber is connected to the K-437, it is started at the same time as the START button is pressed. If this is not the case, the water jet pump must be started manually.

4. Editing the digestion parameters

during digestion
The inputs can be changed by pressing the TEMP or TIME buttons. Press ENTER to confirm the changes.

5. End of digestion

The heating is switched off at the end of the set digestion time and an alarm sounds to make the operator aware that the digestion procedure has ended. The scrubber continues to operate until the cooling time has ended (see item 7) or until the STOP button is pressed. If "0" is entered for the digestion time, no alarm will sound and the heating will not be switched off. The operator will monitor the digestion time and, when the procedure has been completed, will switch the heating off by pressing the STOP button. The scrubber continues to operate until the STOP button is pressed for a second time. (Do not forget to cool off the samples - see item 7.)



6. Interrupting the digestion

Digestion can be interrupted at any time by pressing the STOP button. In this case, the heating switches itself off but the scrubber will continue to operate until the STOP button is pressed for a second time. (Do not forget to cool off the samples - see item 7.)

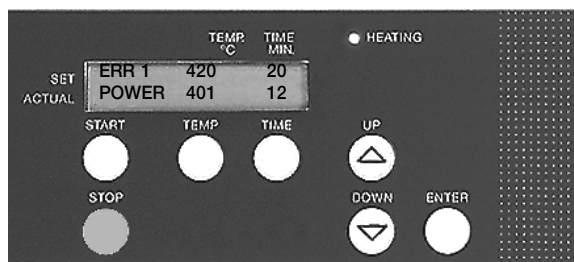
7. Cooling off the digested samples

Both the sample rack and the fitted suction module are moved into the cooling position. (The scrubber or the water jet pump will still continue to operate.) After the cooling phase, the scrubber is switched off by pressing the STOP button.

8. Removing the sample rack

Swivel back the suction module and remove the sample rack with the cooled samples.

After the hydrolysis has ended the machine should remain connected to power for an additional 30 minutes. In this way the machine is further cooled via a built-in ventilator and thus the service life of the built-in display is extended.

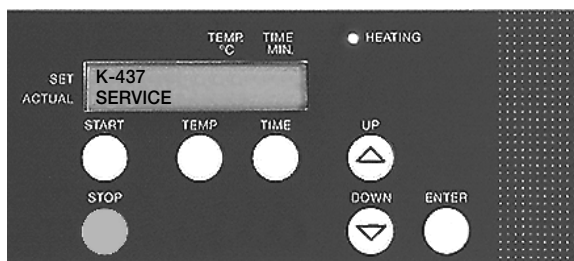


9. Switching off the K-437

Press the main switch. (Light in the switch will go out.)

10. Power failure

The digestion process is interrupted if a power failure occurs. The heating switches itself off.



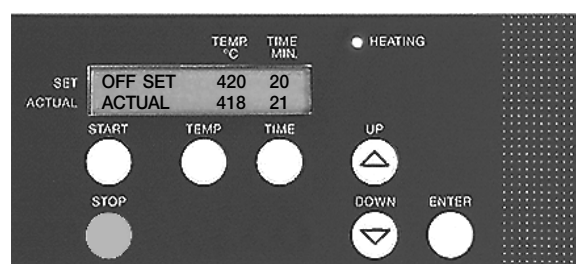
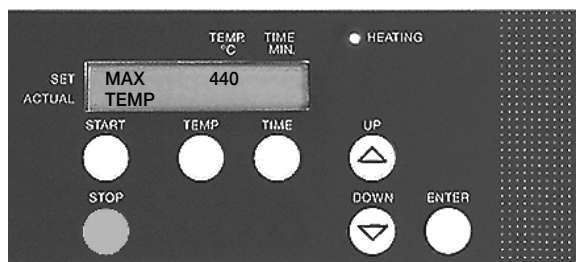
5.6 Service Menu

1. Accessing the service menu

Press the STOP button for approx. 3 seconds. The service menu will be displayed. In each case, use the STOP button to move to the next submenu.

2. Contrast

The contrast is corrected by using the arrow keys or by (v).



3. Maximum temperature

For reasons of safety, the maximum temperature ex works is limited to 420°C. If a lower or higher digestion temperature is required, this can be changed here within a range of between 100°C minimum and 450°C maximum.



Warning

Digestion temperatures of over 420°C may result in a loss of nitrogen. If digestion times exceed 180 minutes, the rise in the temperature at the rack may result in the seals being damaged.

4. Temperature calibration

If the actual temperature measured is different from the specified temperature, use the arrow keys (▲) or (▼) to correct this.

5.7 Error messages

ERR 1 Power

The hydrolysis process is interrupted through an interruption of power.

The heat is turned off.

If the interruption of power is remedied, the error message can be deleted from the display by pressing "STOP".

ERR 2 Temperatures

The current heating block temperature exceeds the programmed temperature by more than 10°C.

The hydrolysis is automatically stopped and the heat switched off.

ERR 3

Due to a blocked or defective ventilator the internal temperature of the machine exceeds 60°C. The machine must be switched off as fast as possible. Please contact Büchi Service.

6 Maintenance

6.1 General

The housing of the Digestion Unit K-437 is made of metal and covered with an acid-resistant coating.



To avoid damage to this coating, any acid drops should be wiped away with a damp cloth. Avoid any scratching of the coating whatsoever!

6.2 Upkeep

Daily care:

- Check glass components for damage.
- Clean housing components with a damp cloth.

The glass components are clean.

Cleaning the digestion tubes

If individual digestion tubes are not washed correctly in the laboratory washing machine, the inside of the tubes may be scratched. Digestion tubes which have sustained such damage may break during digestion. An optional retaining plate (No. 38559) is available which will allow the digestion tubes together with the sample rack to be washed in the laboratory washing machine. This procedure will prevent the tubes from being damaged.

Procedure

- Mount the retaining plate on the rack at the points provided.
- Position with rack in the laboratory washing machine with the openings on the tubes pointing downwards.
- Remove the retaining plate after washing. The digestion tubes are ready for the next time they are used.

Cleaning the exhaust unit

The exhaust unit can be cleaned under running water or in the laboratory washing machine.

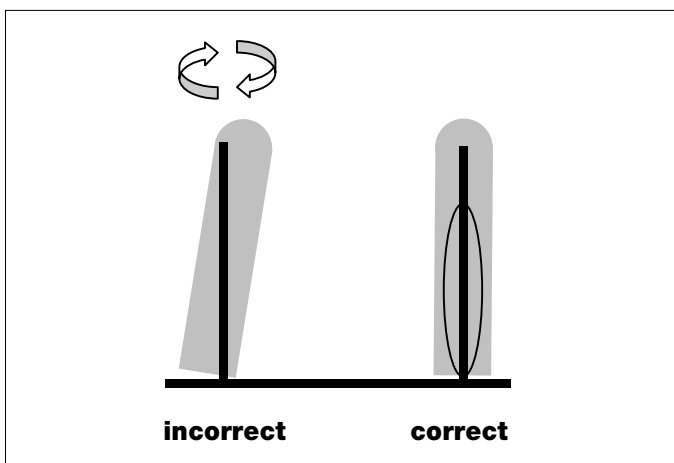


Figure 7: Cleaning the digestion tubes

6.3 Seals

The seals are expendable material and must be replaced if they are damaged or no longer seal properly.

Inspection and Maintenance Requirements

Observe all guidelines which aim at maintaining the apparatus in operable condition. This includes regular cleaning and inspection for possible damage.

The operator shall carefully check the apparatus for proper operation following every repair.

6.4 Power Supply Fuse

Proceed as follows to change the fuse:

- Pull out the power supply cable
- Remove the fuse holder
- Replace the fuse with a new fuse of the same values:
 - 230V: T 10A L 250V
- Replace the fuse holder

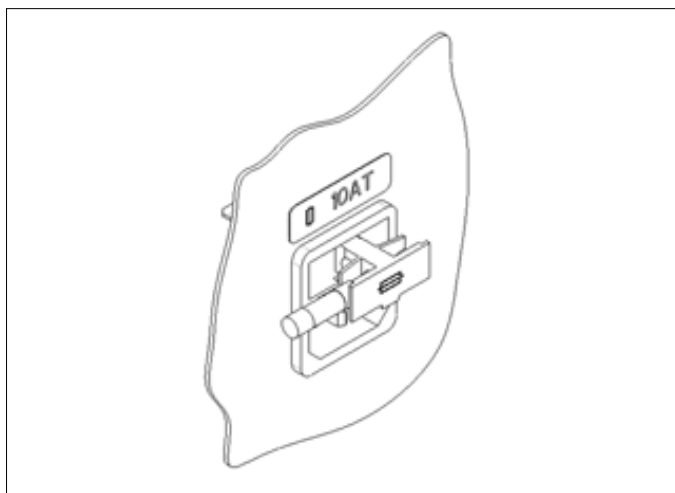


Figure 8: Apparatus plug, built-in

6.5 Customer Service

Work on or in the apparatus may be carried out only by authorized service personnel. These are people with sound technical vocational training and knowledge of the risks which result when safety measures are disregarded. BÜCHI customer service offices have service manuals specific to the various apparatus; these manuals can be obtained only by authorized personnel.

The addresses of the official BÜCHI customer service offices are listed on the last cover page of these operating instructions. If malfunctions arise or if you have technical questions or problems in operating the apparatus, please consult these offices.

BÜCHI's customer service provides the following services:

- Spare parts service
- Repair service
- Maintenance service
- Technical consulting

7 Taking out of operation



Any dangerous substances must be removed and the apparatus must be cleaned thoroughly. This avoids any risk that persons could be injured by contact with dangerous substances.

7.1 Storage/Transport

After it has been cleaned, return the apparatus to the original packaging for storage and transport.

7.2 Disposal

Chapter 9, Appendix, Table 6 contains a list of the materials used in the manufacture of the most important parts of the apparatus so that it can be disposed of in accordance with environmental regulations. This ensures that the various parts can be separated and recycled properly. Dispose of electronic components in accordance with the applicable regulations. Please observe the valid regional and local statutes in disposing of the apparatus.

8 Spare parts

Only original accessories and spare parts from BÜCHI guarantee that the apparatus will function properly and safely. Spare parts and accessories from other manufacturers may be used only with the express permission of the manufacturer. The above-mentioned spare parts may be used in assembling or dismantling the apparatus only as described in Chapter 6 of these operating instructions. It is forbidden to allow third parties to view or possess this manual; production of the apparatus based on this manual is forbidden.

8.1 Spare parts



Figure 9: Spare parts K-437

No.	Description	Order No.
①	PTFE seal, set of 20 seals	38623
②	Suction tube	38527
③	Vapour collection tube	38530
④	Digestion tube, set of 4 tubes	37377
	Rack, 20 spaces, complete	38621
⑤	Sealing cover	17396
⑥	EPDM hose, 1.5 m, 8 mm	26275
	Fuse, set of 10 fuses	16952

Table 4: Spare parts

9 Appendix

9.1 Technical Data

Measurements (width x height x depth)	435 x 527 x 776 mm
Voltage	230 V, 50/60 Hz
Connected value	2200 Watt
Power input	10 Ampère
Weight (net) (incl. 20 digestion tubes)	35 kg
Overvoltage category	II
Pollution degree	2
Ambient temperature	5 – 40°C
Humidity	< 90 %
Temperature range	50 C° to 420 C° (450°C)
Temperature drift	+/- 5°C

Table 5: Technical data

9.2 Materials used

Part	Material	Material code
Housing	Sheet steel DC01 + EVZ	DIN17162
Coating	Polyester/epoxy	PEP 31
Heating block	Aluminium AlMgSi 1	DIN 3.2315
Insulation	Thermal Ceramiks 800	X-607
Rack	Sheet steel, stainless	1.4301
Glass components	Borosilicate 3.3	DIN/ISO 3585
Hose	Ethylene/propylene terpolymer rubber	EPDM

Table 6: Materials used

9.3 Declaration of confirmity

We **Büchi** Labortechnik AG
Postfach, CH-9230 Flawil
Switzerland

do hereby declare on our responsibility that the product:

BÜCHI Digest System **K-437**

which is the object of this certification, is in accordance with the following norms:

EN 292-1:1991

Safe operation of machines; basic terminology; methodology

EN 292-2:1991

Safe operation of machines; technical rules and specifications

EN 60335-1:1988 (~IEC 335-1 VDE 0700-1 SEV 1054-1)

Safety regulations for household appliances

EN 55011:1991/B (~VDE 0875/B VDE 0871/B)

Limits and measuring procedures for radio interference by industrial, scientific, and medical high-frequency apparatus

EN 50081-1:1992

Electromagnetic compatibility – technical basic norm for interference broadcast in residential zones, business zones, and small industry

EN 61000-3-2: 1995/1996

Limits for harmonic current emissions

EN 61000-3-3: 1995

Limitation of voltage fluctuations and flicker

In accordance with the regulations of the EU guidelines
89/392/EWG machine guidelines

Flawil, 08.01.01

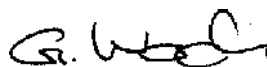
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