



Operating Manual

SONOREX SUPER

High-performance ultrasonic baths



Applies to:

RK 31, RK 31 H, RK 52, RK 52 H

RK 100, RK 100 H, RK 102 H, RK 103 H, RK 106

RK 156, RK 156 BH

RK 170 H

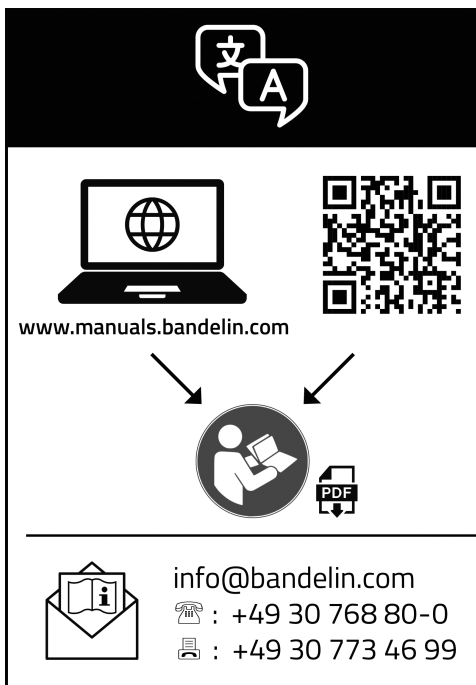
RK 255, RK 255 H

RK 510, RK 510 H, RK 512 H

RK 514, RK 514 H, RK 514 BH

RK 1028, RK 1028 H, RK 1028 C, RK 1028 CH

RK 1040, RK 1050, RK 1050 CH



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BANDELIN *electronic* GmbH & Co. KG, Heinrichstr. 3-4, 12207 Berlin, Germany
Phone: +49 30 76880-0, Fax: +49 30 7734699, info@bandelin.com

Certified in accordance with ISO 9001 and ISO 13485

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1 About this operating manual

These instructions for use contain necessary and useful information on how to operate the ultrasound bath safely and efficiently.

- Read these instructions for use before using the ultrasound bath.
- Pay special attention to chapter **2 Safety**.
- If you pass this ultrasound bath on to others, please enclose these instructions for use.
- Contact your specialist dealer or BANDELIN if any of your questions are not answered in these instructions for use. Information on service can be found in chapter **6.4 Repair**.

Illustrations are provided as examples and are not to scale.

2 Safety

2.1 Use of the ultrasound bath

The following applications are possible with the ultrasound bath:

- Ultrasonic cleaning of objects of various shapes, types and sizes,
- Homogenising, emulsifying,
- Rapid degassing of liquids,
- Sonochemical applications, e.g. for radical production or improved material transport,
- Sample preparation for analysis.

A solution of water and a special ultrasound preparation is used as the sonication fluid. Information on the sonication fluid can be found in chapter **5.2 Sonication fluid**.

Objects to be treated may not be placed on the bottom of the oscillating tank. They must be placed in the sonication fluid in an insert basket or another suitable container. An overview of suitable accessories can be found in chapter **10 Accessories**.

In the case of stains, discolouration, rust, etc., a deep cleaning can be performed using special detergents and indirect sonication.

Do not operate the ultrasound bath while unattended.

2.2 To be used in the medical sector

The medical purpose of the ultrasound bath is to clean instruments. Ultrasonic cleaning takes place in the context of further steps needed for the reprocessing of medical ultrasound baths. In doing so, observe the hygiene requirements according to the applicable regulations. The ultrasound bath is a Class I medical ultrasound bath pursuant to Regulation (EU) 2017/745.

EMDN nomenclature: V0799

Indications/areas of application

Medical instruments can be cleaned in the ultrasound bath as part of manual processing, and before or after automated reprocessing.

The information supplied by the instrument manufacturer specifies whether the instruments are suited for ultrasonic cleaning.

Contraindications/exclusions

- Lenses, camera systems, light cables, mirrors, or objects made of or containing elastic materials (e.g. catheters, respiratory system functional parts, flexible endoscopes) are not suitable for sonication, or are only suitable under certain conditions. The specifications of the respective manufacturer provide information on suitability for ultrasonic cleaning.
- The ultrasound bath is not suitable for cleaning or disinfecting contact lenses.
- The direct sonication of flammable liquids is not permitted.

Possible side effects/restrictions

- Ultrasound does not disinfect. However, processes such as chemical disinfection may be accelerated in the ultrasound bath.
- Cavitation erosion can cause surfaces to be mechanically corroded and their coatings to dissolve.

User group

The ultrasound bath may be used by persons who have been qualified and trained for their work, e.g. the reprocessing of instruments.

Pregnancy is not a contraindication for using the ultrasound bath.

Serious incidents must be reported to
BANDELIN electronic GmbH & Co. KG and to the competent authorities.

2.3 Prevention of cross-contamination and infection

If the ultrasound bath is used in the medical field, regularly clean and disinfect the surfaces of the device with a surface disinfectant that has at least bactericidal, yeasticidal and limited virucidal properties, in order to avoid cross-contamination. Process accessories such as holders, carriers or baskets in a cleaning and disinfection device.

At higher temperatures, vapours and aerosols that are contaminated with introduced impurities may escape from the ultrasound bath. This can lead to infections and disease. When cleaning medical instruments, avoid bath temperatures above 40 °C. If necessary, use a lid, suction device or protective equipment.

2.4 Keep out of reach of children

Children cannot identify hazards posed by the ultrasound bath. Therefore, keep the ultrasound bath out of the reach of children.

2.5 Danger of electric shock

The ultrasound bath is an electrical device. Failure to follow safety rules can result in a life-threatening electric shock.

- Protect the ultrasound bath from moisture and wetness. Keep the surface and controls clean and dry.
- Only transport the ultrasound bath in empty condition.
- Only drain the ultrasound bath when it is switched off.
- Do not spray or expose the ultrasound bath to splashing water.
- Always disconnect the ultrasound bath from the mains before cleaning or maintenance.
- Only connect the ultrasound bath to a power outlet with a grounded socket.
- If you notice a defect in the ultrasound bath, disconnect the mains plug immediately. Do not connect a defective ultrasound bath to the mains.

- Repairs should only be carried out by the manufacturer. See chapter **6.4 Repair**.
- Position the ultrasound bath so that it is easy to unplug the mains connection at any time and without difficulty.

2.6 Harmful to health due to ultrasound noise

The ultrasound noise typical of the process can be perceived as very unpleasant. Remaining within a radius of 2 m for an extended period of time may cause damage to health.

- Wear suitable hearing protection.
- Use a lid to reduce noise. The ultrasound bath can also be used in a sound proof box.

2.7 Hazards due to high temperature

The ultrasound bath, the sonication fluid and the sonication objects can become hot during operation. Contact with these products may cause burns. The temperature can be set at up to 80 °C.

Ultrasound energy warms up the sonication fluid even without additional heating. Prolonged ultrasound operation can lead to very high temperatures. In an ultrasound bath with heating, the set temperature can be significantly exceeded by the energy of the ultrasound.

- Observe the treatment times recommended by the manufacturer of the ultrasound preparation. Do not leave the ultrasound switched on for longer than necessary.
- Do not reach into the sonication fluid with your hand. Remove sonication objects with the insert basket or forceps.
- Allow the sonication objects to cool before touching them.
- Lifting from the handles can cause the hands to touch the edge of the oscillating tank, which can be very hot. After operation, allow the ultrasound bath to cool down before lifting it for emptying.

Non-aqueous fluids can heat up many times faster than water. A possible flashpoint can be reached or exceeded after a very short sonication time. In the case of high-boiling liquids, the bath tem-

perature can rise to over 120 °C due to the energy input of the ultrasound. This can lead to fires and severe burns.

- Do not use combustible, explosive, non-aqueous liquids (e.g. petrol, solvents) or mixtures with combustible liquids (e.g. alcoholic solutions) directly in the stainless steel oscillating tank.
- Small quantities of flammable liquids in sample containers can be sonicated indirectly. Before sonication of flammable liquids, familiarise yourself with the necessary safety measures and applicable regulations for handling these liquids.

2.8 Danger due to ultrasound

The strong ultrasound in the ultrasound bath destroys cell structures. If a body part is immersed in the sonication fluid during operation, this can lead not just to skin damage, but also to internal tissue damage. On fingers, the periosteum can become damaged.

- Do not touch the sonication fluid during operation.
- Never sonicate living beings.

2.9 Danger due to preparations used

Preparations used in the ultrasound bath may be toxic or corrosive. They can irritate the eyes, skin and mucous membranes. Vapours and aerosols can also be dangerous.

- Wear gloves and safety goggles when handling hazardous preparations.
- Do not ingest the preparations and do not allow them to come into contact with the eyes or skin. Do not lean over the ultrasound bath, in order to avoid vapours from coming into contact with the eyes or from being inhaled.
- Place a lid on the ultrasound bath during operation. In case of dangerous vapours, use a suction device.
- Observe the information on the label and in the safety data sheet of the preparation.
- Keep the preparations away from children and untrained persons.

2.10 Disposing of sonication fluid

Dispose of the sonication fluid according to the information provided by the manufacturer of the ultrasound agents used. The recommended ultrasound agents from the TICKOPUR, TICKOMED and STAMMOPUR product ranges from DR. H. STAMM GmbH are biodegradable according to the articles of Regulation (EC) no. 648/2004 (Detergents Regulation). If necessary, the sonication fluid needs to be neutralised before disposal.

During cleaning, water-polluting substances, e.g. oils or heavy-metal compounds, can contaminate the sonication fluid depending on the type of soiling. If the limit value for these substances is exceeded, the sonication fluid must be reprocessed or disposed of as special waste.

Observe the local waste water regulations.

2.11 Erosion of the oscillating tank

The surface of the oscillating tank is subject to erosion. How quickly this erosion takes place depends on the use of the ultrasound bath. The erosion leads to leakage in the oscillating tank. Bath liquid can thus penetrate into the interior of the ultrasound bath. Moisture on electrical components can cause an electric shock or fire.

- Stop using the ultrasound bath if you notice a leak. Disconnect the mains plug immediately. Empty the oscillating tank.

You can extend the lifespan of the oscillating tank by observing the following instructions:

- Replace sonication fluid that is visibly contaminated by particles.
- Only use demineralised water (DI water) with an ultrasound-compatible preparation.
- Do not use chemicals that contain or release chloride ions in the oscillating tank. This is the case with some disinfectants, household cleaners and dishwashing detergents. Chloride ions will corrode stainless steel.
- Only use the ultrasound bath with accessories that are suitable for the device and the objects to be treated, e.g. a basket. Do not place any objects to be treated directly on the bottom of the oscillating tank. An overview of suitable accessories can be found in chapter **10 Accessories**.

2.12 Preventing damage to the ultrasound bath

- Only use aggressive preparations in inset beakers or insert tubs. When working with aggressive preparations, avoid splashing in the contact liquid or on the stainless steel surface. Immediately replace contaminated sonication fluid. Clean surfaces and wipe them dry.
- If strongly acidic preparations are used, the ball of the ball valve can become corroded. The ball valve will leak. If the use of a strongly acidic detergent cannot be avoided, use a stainless steel ball valve.
- Do not operate the ultrasound bath without sonication fluid in the oscillating tank. Make especially sure that the heating is switched off when the oscillating tank is empty. The fill level must always be at or slightly above the filling level mark.

2.13 Disturbance of wireless communication

The ultrasound bath may interfere with other wireless communication ultrasound baths in the immediate vicinity, such as:

- mobile phones,
- WLAN devices,
- Bluetooth devices.

If interference occurs with the operation of a wireless device, move it further away from the ultrasound bath.

The ultrasound bath meets the requirements for class B devices according to EN 55011.

2.14 Safety stickers on the ultrasound bath

- Observe all safety labels on the ultrasound bath.
- Keep the safety stickers in legible condition. Do not remove them. Replace them if they are no longer legible. To do so, please contact our Customer Service. See chapter **6.4 Repair**.

3 Design and function

3.1 Structure

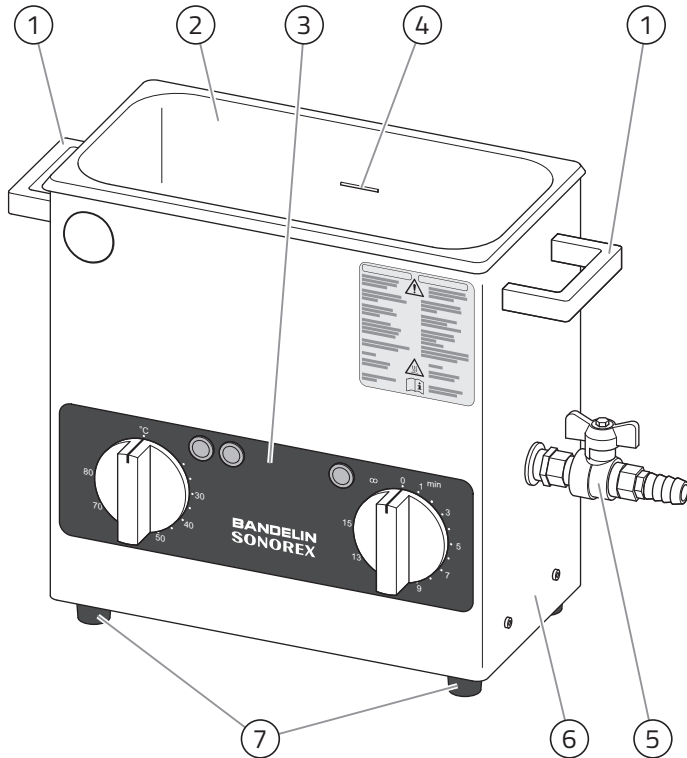


Fig. 1 Overview of the ultrasound bath

- 1 Handles (depending on model)
- 2 Oscillating tank
- 3 Control panel
- 4 Filling level mark
- 5 Drain with ball valve (depending on model)
- 6 Housing
- 7 Feet of the ultrasound bath

3.2 Control panel

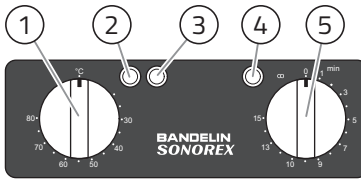


Fig. 2 Operating elements for all ultrasound baths with heating except RK 31 H

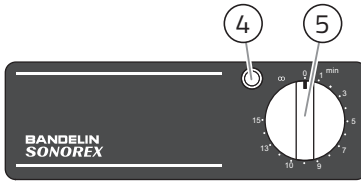


Fig. 3 Operating elements for all ultrasound baths without heating:
RK 31, RK 52, RK 100, RK 106, RK 156, RK 255, RK 510, RK 514, RK 1028,
RK 1028 C, RK 1040, RK 1050

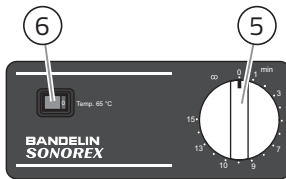


Fig. 4 Operating elements for type RK 31 H

- 1 Turning knob to adjust the heating temperature
- 2 White indicator light,
 - When lit up on model RK 52 H: heating turned on
 - When lit up on models RK 100 H ... RK 1050 CH: heating regulation active
- 3 Yellow indicator light,
When lit up on models RK 100 H ... RK 1050 CH: heating turned on
- 4 Green indicator light,
When lit up: ultrasound turned on
- 5 Turning knob to set the ultrasound duration
- 6 Toggle switch to switch the heating on/off

3.3 Function

The ultrasound bath uses cavitation triggered by low-frequency ultrasound. Piezoelectric oscillating systems are located on the underside of the oscillating tank. The ultrasound generates strong pressure fluctuations in the sonication fluid. Cavitation bubbles are formed at the pressure minima. At higher ambient pressure around the bubbles, they collapse very quickly. This results in strong local microcurrents on the surfaces of the objects being treated. This removes dirt from the surface of the objects. Dirt particles are removed and fresh sonication fluid flows in.

SONOREX ultrasound baths use SweepTec®, a technology in which the ultrasonic frequency often fluctuates around the value of the operating frequency. The optimal operating frequency depends on the load, filling level, temperature and type of sonication fluid. The operating frequency can deviate significantly from the nominal frequency. SweepTec® creates an especially homogeneous ultrasonic field in the bath volume for consistently optimal results.

4 Preparation for operation

4.1 Installation site requirements

The installation location of the ultrasound bath must meet the following conditions:

- The installation surface must be horizontal, firm and dry.
- The load-bearing capacity must be sufficient for the ultrasound bath with the sonication fluid. For weight and work content, see chapter **8.1 Technical data**.
- Adequate ventilation must be ensured. The air supply under the bottom of the unit may not be obstructed. If a sound proof box is used, it must also ensure sufficient ventilation.
- A water connection should be available nearby to fill the ultrasound bath. A basin must be available to drain or pour out the sonication fluid.

4.2 Assembling the ball valve

Applies to ultrasound baths from RK 102 H.

Fit the supplied ball valve, the hose grommet and the hose as described in the assembly instructions included with the ball valve.

4.3 Conduct a function test

Requirement

- The ultrasound bath has adapted to the climatic conditions at the installation site for at least 24 hours.

Procedure

1. Make sure that the ultrasound bath is switched off. The turning knob to set the ultrasound duration must be set to "0". If present, the turning knob to set the heating temperature must be set to "°C", or the toggle switch must be in the left position ("0").
2. Plug the power cord of the ultrasound bath into a socket with earthing contact.

3. Briefly switch on the ultrasound. To do this, turn the knob to the right for the ultrasound duration, and turn it back to "0" after 1 to 2 seconds.

Results

» A distinct sound can be heard when the ultrasound is turned on.

If there is no sound, contact Service.

A foil test should be carried out before first use. This serves to document the effect of the ultrasound. See chapter **6.3 Performing the foil test**.

4.4 Rinsing out the oscillating tank

Thoroughly rinse the ultrasound bath's oscillating tank with water before first use.

In order to protect the surface during transport and storage, the ultrasound bath is covered with an oily preservative. Before the ultrasound bath is put into service, this preservative must be removed with a suitable cleaning agent.

5 Operation

5.1 Direct and indirect sonication

Objects can be sonicated directly or indirectly in the ultrasound bath.

Direct sonication is the standard procedure. The objects to be treated are introduced in the oscillating tank with suitable accessories, e.g. a basket. There they have direct contact with the sonication fluid.

Indirect sonication is used in the following cases:

- Sonication of sample fluids,
- Use of chemically aggressive or flammable liquids,
- Use of demineralised water without additives,
- Removal of chemically aggressive contamination,
- Removal of stains, discolouration and rust using acidic preparations.

The objects or liquids to be sonicated are introduced in the contact liquid in an inset beaker, for transfer of the ultrasound in the oscillating tank. The contact liquid in the oscillating tank must contain a surfactant preparation.

For suitable accessories for direct and indirect sonication, see chapter **10 Accessories**.

5.2 Sonication fluid

A solution made from water and a special ultrasound agent is used as the sonication fluid. Drinking water or demineralised water can be used for the water.

Water without any additives is unsuitable for sonication. Use of demineralised water without an ultrasound agent leads to increased erosion of the ultrasonic oscillating tank.

The ultrasound agent used must foster cavitation and be biodegradable, easy to dispose of, material-compatible and long-lasting. BANDELIN recommends ultrasound agents from the TICKOPUR, TICKOMED and STAMMOPUR product ranges from DR. H. STAMM GmbH.

- Telephone advice: +49 30 76880-280
- Internet: www.dr-stamm.de

Observe the information on dosing provided by the ultrasound agent manufacturer. Please refer to the dosing table for the required quantities of ultrasound agent and water. See chapter **9 Dosing table**.

You can calculate the quantities yourself in the same way as the following example:

10 l ready to use solution, 2.5%:

$$\frac{10 \text{ l} \times 2,5 \%}{100 \%} = 0,25 \text{ l agent}$$

$$10 \text{ l} - 0,25 \text{ l} = 9,75 \text{ l water}$$

5.3 Sonication time

NOTICE**Risk of damage to the goods to be treated**

Excessively long sonication can damage the surface of the goods to be treated.

- Select a short sonication time where possible.

The ideal sonication time depends on several factors:

- Type and concentration of agent
- Working temperature of sonication fluid
- Type of soiling
- Type of goods to be treated, in particular materials

Note the information on the recommended sonication time from the agent manufacturer. To begin with, select as short a sonication time as possible to protect the objects to be sonicated and the ultrasonic oscillating tank. Check the result. Lengthen the sonication time if the result is not sufficient.

5.4 Pour in sonication fluid

⚠ CAUTION

Risk of scalding

- Do not fill the oscillating tank with hot water.
- Maximum filling temperature: 50 °C.

NOTICE

Damage caused by condensation in the ultrasound bath

At high humidity, condensation forms inside the ultrasound bath when cold water is added.

- Do not fill the oscillating tank with cold water at high humidity.

NOTICE

If using a powder preparation, do not add it directly to the oscillating tank.

- Mix a powder preparation in another container before adding it to the oscillating tank.
- Add the preparation to the oscillating tank only when it is completely dissolved.

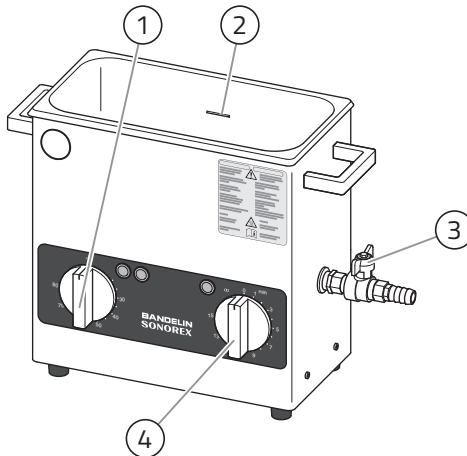


Fig. 5 Fill oscillating tank

- 1 Turning knob to adjust the heating temperature
- 2 Filling level mark

- 3 Drain with ball valve (depending on model)
- 4 Turning knob to set the ultrasound duration

Requirements

- For ultrasound baths with an outlet, the ball valve must be closed.
- The ultrasound and heating must be turned off.

Procedure

1. Fill $\frac{1}{3}$ of the oscillating tank with water.
2. Dose the preparation into the oscillating tank. See chapter **9 Dosing table**.
3. Fill with water up to the filling level mark; avoid foam formation when doing so. For indirect sonication, take into account displacement through insert containers.

Results

- » The ultrasound bath is ready to be switched on.

5.5 Switching the sonication on and off

Requirements

- The oscillating tank is filled.
- The mains plug is plugged into a socket with earthing contact.

Procedure

1. If there is a lid, place it on the ultrasound bath.
2. Rotate the turning knob for the ultrasound duration to the desired sonication time or to the ∞ symbol for continuous operation.
 - » The ultrasound is switched on. The sound from the ultrasound can be heard.
 - » The green indicator light is lit.
 - » If the turning knob is not set to ∞ , it will slowly move counter-clockwise, indicating the remaining sonication time. As soon as it is set to "0", the ultrasound switches off.
3. To switch off the sonication, rotate the turning knob to "0" for the ultrasound duration.
 - » The green indicator light goes out.



Information

- You can turn the knob in both directions.
- You can extend, shorten or switch off the sonication at any time.
- The timer only works if mains voltage is present. Without mains voltage, the locking of the turning knob can hardly be felt.

5.6 Switching the heating on and off

Concerns the following ultrasound baths:

- RK 31 H,
- RK 52 H,
- RK 100 H, RK 102 H, RK 103 H, RK 156 BH, RK 170 H, RK 255 H, RK 510 H, RK 512 H, RK 514 H, RK 514 BH, RK 1028 H, RK 1028 CH, RK 1050 CH



WARNING

Risk of scalding

During heating, vapour bubbles can rise explosively under certain conditions (boiling delay).

- Stir the sonication fluid now and then during heating or switch on the ultrasound.

Heated sonication fluid intensifies the effect of the ultrasound. Experience has shown that the best results are obtained with a temperature of 50 to 60 °C. This can reduce the sonication time. At higher temperatures, the effect of the ultrasound decreases again.

Do not heat sonication fluid for reprocessing medical instruments above 45 °C.

Ultrasound also warms up the sonication fluid. During continuous operation, especially when the oscillating tank is covered, the temperature of the sonication fluid may rise above the set value. Therefore, check the temperature when treating temperature-sensitive objects.

- Observe the specifications of the preparation manufacturer to achieve the optimal temperature.

- Preheating during the degassing of the sonication fluid is optimal. See chapter **5.7 Degassing sonication fluid**.
- To preheat, remove the basket or other accessories from the oscillating tank. Cover the oscillating tank with the lid, if available.



Information

The heater is equipped with overtemperature protection. If there is no heating function, disconnect the ultrasound bath from the mains and allow it to cool down to below 50 °C before putting it back into operation.

RK 31 H

Switch on the heating using the toggle switch.

- The switch lights up when the heating is on, even if the target temperature has been reached.
- The temperature control is permanently set at 65 °C.

RK 52 H

Turn on the heating by turning the knob to the desired temperature.

- The indicator light is lit.
- When the target temperature is reached, the indicator light goes out.

RK 100 H, RK 102 H, RK 103 H, RK 156 BH, RK 170 H, RK 255 H, RK 510 H, RK 512 H, RK 514 H, RK 514 BH, RK 1028 H, RK 1028 CH, RK 1050 CH

Turn on the heating by turning the knob to the desired temperature.

- The yellow and white indicator lights are lit.
- When the target temperature is reached, the yellow indicator light goes out.

5.7 Degassing sonication fluid

Sonation fluid that has been freshly filled or left in the ultrasonic oscillating tank must be degassed before use. Degassing the sonication fluid increases the effect of the ultrasound.

- Cover the ultrasonic oscillating tank with the lid if available.
- Switch the ultrasound on for degassing. The degassing time is:
 - Volume of sonication fluid up to 10 litres:
10 minutes
 - Volume of sonication fluid over 10 litres:
30 minutes



Information

The ultrasound noise becomes quieter during degassing. This means that the ultrasonic effect is increasing.

5.8 Adding goods to be treated

To achieve good results, observe the following information when inserting goods to be treated:

- Each time before sonication, check whether the sonication fluid is contaminated. If there is visible contamination, replace the sonication fluid.
- The sonication fluid must be degassed. See chapter **5.7 Degassing sonication fluid**.
- The sonication fluid must be preheated to the required working temperature before you add objects.
- Use suitable accessories, e.g. a basket. Do not place any objects directly on the bottom of the ultrasonic oscillating tank. Use a studded silicone mat for sensitive objects. See chapter **10 Accessories**.
- Insert objects so they are distributed. Do not stack them. Sensitive objects may not touch other objects.
- The ultrasound must be switched off while objects are being inserted.
- Check the filling level. The goods to be treated must be completely submerged in the fluid. Inset beakers for indirect sonication need to be submerged at least 2 cm in the sonication fluid.
- Remove air bubbles from cavities. Rotate the objects accordingly. Remove air bubbles under inset beakers. The ultrasound

only works where the fluid is in contact with the goods to be treated or the inset beaker.

- Position the side with greater soiling so it is facing downwards. Insert objects with joints (e.g. scissors or tongs) in open condition so that the whole surface is optimally reached by the sonication fluid.

5.9 Remove treated objects

WARNING

Risk of burns

The sonication fluid, objects to be treated, the surface of the ultrasound bath and accessories may be very hot.

- Do not touch the surface of the ultrasound bath or accessories such as the lid. Do not reach into the sonication fluid.
- Allow the sonication objects to cool before touching them.

Switch off the ultrasound before removing the sonication objects.

Do not remove sonication objects by hand. Carefully remove e.g. the insert basket with the sonication objects and place it on a level surface.

Rinse sonication objects with clean water.

Do not leave sonication objects in the sonication fluid for too long. This can damage the objects.

5.10 Empty the oscillating tank

WARNING

Danger of electric shock

- Disconnect the mains plug before lifting the ultrasound bath.
- Do not place the ultrasound bath in a sink for emptying.
- Make sure that no liquid can get into the housing.

CAUTION

Hot sonication fluid and oscillating tank

There is a risk of burns when lifting the ultrasound bath to empty it.

- Allow the ultrasound bath to cool down before lifting it.

Contamination on the bottom of the oscillating tank reduces the ultrasonic output. Empty and clean the oscillating tank if the sonication fluid is visibly contaminated.

Also, observe the specifications of the manufacturer of the preparation regarding the service life of the sonication fluid.

Replace used sonication fluid completely. Do not freshen the fluid by topping it up.

Procedure

1. Switch off the ultrasound. If present, switch off the heating. If you need to move the ultrasound bath to empty it, disconnect the mains plug.
2. If the ultrasound bath has an outlet, open the ball valve. If the ultrasound bath has no outlet, carefully pour out the oscillating tank contents over the corner.
3. Rinse the oscillating tank thoroughly.
4. Wipe the ultrasound bath dry with a soft cloth.
5. If necessary, disinfect the ultrasound bath with a suitable surface disinfectant.

5.11 Troubleshooting a malfunction

Error	Possible causes	Troubleshooting
Insufficient ultrasound effect, loud noises	▪ Sonication fluid contains gases. ▪ There are too many sonication objects in the oscillating tank.	▪ Degas the sonication fluid. See chapter 5.7 Degassing sonication fluid. ▪ Reduce the number of objects to be treated.
Uneven noises (wobbling)	▪ Inadequate fill level in the oscillating tank.	▪ Slightly change the fill level of the sonication fluid in the oscillating tank. In doing so, observe the minimum fill level and correct dosing of the preparation. ▪ Reposition the objects to be treated.
Heating is not working	▪ The heater has switched off due to overtemperature. ▪ The heating is defective.	▪ Disconnect the ultrasound bath from the mains and allow it to cool down to below 50 °C before putting it back into operation. ▪ Have the ultrasound bath repaired.

6 Maintenance

6.1 Cleaning and maintaining the ultrasound bath

Cleaning the housing

- Wipe the housing with a damp cloth. Wipe dry with a soft cloth.
- Do not use abrasive cleaning agents, only care products without scouring additives.
- If necessary, disinfect the housing with a suitable surface disinfectant.

Care of the oscillating tank

Impurities in the oscillating tank accelerate the tank's wear, can lead to corrosion and reduce the ultrasound effect. Therefore, please observe the following instructions:

- Rinse the oscillating tank thoroughly with water after each use. Wipe dry with a soft cloth.
- Clean edges and remove residues with a stainless steel care product without abrasive additives.
- Do not use steel wool, scrapers or shavers to clean the oscillating tank.
- Metal parts and rust particles in the oscillating tank cause corrosion. Therefore, do not leave any metal parts in the oscillating tank. If rust stains are visible, remove them immediately with a soft cloth and a stainless steel cleaning product without abrasive additives.

6.2 Tests

<i>NOTICE</i>

Damage to the ultrasound bath

- Perform tests only on a filled ultrasound bath.
-

If one of the tests does not produce the desired result, contact Service. See chapter **6.4 Repair**.

Check indicator lights

Check the operation of the indicator lights.

All devices:

- Briefly switch on the ultrasound.
 - The green indicator light is lit as long as the ultrasound is switched on.

RK 31 H:

- Briefly switch on the heating using the toggle switch.
 - The indicator light in the toggle switch is lit as long as the heating is switched on.

RK 52 H:

- Briefly switch on the heating with the turning knob to above 30 °C.
 - The white indicator light remains lit as long as the heating is switched on.

RK 100 H, RK 102 H, RK 103 H, RK 156 BH, RK 170 H, RK 255 H, RK 510 H, RK 512 H RK 514 H, RK 514 BH, RK 1028 H, RK 1028 CH, RK 1050 CH:

- Briefly switch on the heating with the turning knob to above 30 °C.
 - The white and yellow indicator lights are lit as long as the heating is switched on.

Check the ultrasonic and heating power

The power can be checked with a wattmeter between the mains plug of the ultrasound bath and the power outlet.

Procedure

1. Fill the oscillating tank with water.
2. Switch the ultrasound and, if present, the heating on and off, one after the other. Read the power.
3. Compare the readings with the technical data. See chapter **8.1 Technical data**.

The measured values may deviate by a maximum of $\pm 20\%$ from the values in the technical data.

Checking the ultrasound effect

Check the effect of the ultrasound upon putting into service and at regular intervals. A check every 3 months is recommended. See chapter **6.3 Performing the foil test**.

6.3 Performing the foil test

Before the first use and at regular intervals, e.g. every 3 months, a foil test should be conducted. This serves to ensure the consistent effect of the ultrasound. The frequency with which these tests are carried out is your responsibility.

The foil test is a simple procedure to demonstrate the intensity and distribution of cavitation in an ultrasonic bath. It involves stretching aluminium foil over a foil test frame. This frame will be perforated or destroyed to a certain degree by cavitation, depending on the sonication time.

In order to compare the results, it is **important for the conditions of the foil test to always remain the same**:

- Filling the oscillating tank to the filling level mark,
- Temperature of the sonication fluid,
- Degassing time,
- Frame positioning,
- Foil type (brand, thickness),
- Sonication time,
- Type and concentration of the ultrasound preparation.

Fluid for the foil test

In order to obtain a sufficiently strong cavitation effect, the foil test also requires the surface tension of the water used to be reduced using surfactant preparations.

We recommend the following ultrasound preparations:

- TICKOPUR R 33,
- TICKOPUR R 30,
- TICKOPUR TR 7,
- TICKOMED 1,
- STAMMOPUR R,
- STAMMOPUR DR 8.

If none of these products are available, a neutral or mildly alkaline product that does not destroy aluminium may be used. The product must be approved by the manufacturer for use in ultrasonic baths.

Test results and documentation

Assuming constant test conditions, the test result is evaluated based on the perforated surfaces of the foils. The perforated surfaces of all foils should have approximately the same reach and distribution – they are never identical. Consistency of process validations, e.g. for the treatment of medical devices, can only be ensured through regular foil tests.

To document the test results, you can download a documentation template here:

<https://bandelin.com/folientest/>

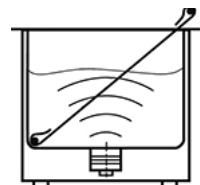
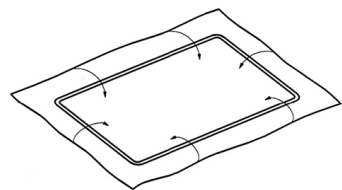
Here you will also find an application video.



Foils can also be archived if done in a suitable manner (scanning, photos, etc.). This allows foils to be compared at any time.

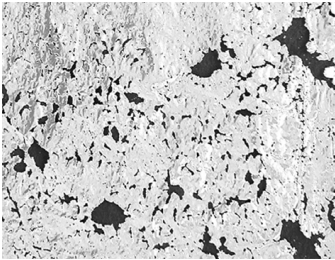
Conducting the foil test

1. Fill the oscillating tank to the filling level mark with water and a suitable ultrasound preparation, in the concentration specified by the manufacturer.
2. Degas the sonication fluid.
See chapter 5.7 **Degassing sonication fluid.**
3. Stretch aluminium foil (household foil, 10 µm to 25 µm thick) over the foil test frame.
Depending on the tank size, it is possible that the frame will protrude outside the tank. Covering the part of the foil test frame that is covered by the sonication fluid will be enough.
4. Place the covered foil test frame diagonally in the centre of the oscillating tank. Fasten it if necessary.
5. Switch on the ultrasound. Sonicate the foil for at least one minute until visible perfora-



tions or holes are produced. With sturdier foils (thicker or coated ones), the sonication time may be up to 3 minutes.

6. Switch off the ultrasound. Remove the foil test frame. Remove the aluminium foil from the foil test frame and allow it to dry.
7. The foil must be perforated, see image. Else, we recommend having the device checked by the Service department at BANDELIN electronic GmbH & Co. KG: See chapter **6.4 Repair**.
8. Archive the foil with the test date and serial number of the ultrasonic bath. The foil test document template can also be completed and archived.
9. Rinse the oscillating tank thoroughly to remove any detached foil particles.



You can order suitable foil test frames from BANDELIN electronic GmbH & Co. KG. The foil test frames are configured for a wide range of tank dimensions. Aluminium foil is additionally required to perform the test as it is not included in the delivery.

Type	Order no.	For
FT 1	3190	RK 31/H, RK 52/H
FT 4	3074	RK 100/H, RK 102 H, RK 103, RK 106, RK 255/H
FT 6	3222	RK 156/BH
FT 14	3084	RK 510/H, RK 512 H, RK 514/H/BH
FT 40	3094	RK 170 H, RK 1028/H/C/CH, RK 1040
FT 45	3204	RK 1050/CH

6.4 Repair



WARNING

Health risk due to contaminated ultrasound bath

- Decontaminate the ultrasound bath before shipping if it has come into contact with hazardous substances.

If the ultrasound bath needs to be repaired, send it to the manufacturer.

Clean the ultrasound bath before shipping it.

Decontaminate the ultrasound bath if it has come into contact with toxic, corrosive, radioactive or biologically hazardous substances. Also clean and decontaminate any accessories that you send in.

Download the "Certificate of Decontamination" form here:

<https://www.bandelin.com/downloads>

Fill out the form and attach it to the outside of the packaging so that it is clearly visible. Acceptance will be refused without a completed form.

Send the ultrasound bath to the following address:

BANDELIN electronic GmbH & Co. KG

Heinrichstr. 3–4
12207 Berlin
Germany

+49 30 76880-13
service@bandelin.com



7 Disposal

WARNING

Health risk due to contaminated ultrasonic bath

- Decontaminate the ultrasonic bath before disposal if it has come into contact with hazardous substances.
- Also decontaminate accessories before disposal.

Dispose of the ultrasonic bath properly as electronic waste if it can no longer be used. Do not dispose of the ultrasonic bath with household waste. Observe the locally applicable regulations for the disposal of electronic waste.



The vibrating elements contain sintered ceramics made of lead titanium zirconium oxide.

- EC No. 235-727-4
- CAS No. 12626-81-2

This use is authorised in accordance with RoHS Directive 2011/65/EU, Annex III, exception 7c. I.

Dispose of accessories as metal scrap or plastic waste depending on the materials used.

8 Device information

8.1 Technical data

Electrical data

Mains supply	230 V~ (± 10 %) 50/60 Hz
Protection class	I
Degree of protection	IP 32
Ultrasonic frequency	35 kHz

Type	Ultrasonic peak power/ultra-sonic nominal power	Heating power	Current consumption (230 V)	Current consumption (115 V)
	[W]	[W]	[A]	[A]
RK 31	160/40	–	0.2	0.4
RK 31 H	160/40	70	0.5	1.0
RK 52	240/60	–	0.3	0.6
RK 52 H	240/60	140	0.9	1.8
RK 100	320/80	–	0.4	0.7
RK 100 H	320/80	140	1.0	2.0
RK 102 H	480/120	140	1.2	2.3
RK 103 H	560/140	200	1.5	3.0
RK 106	480/120	–	0.6	1.1
RK 156	640/160	–	0.7	1.4
RK 156 BH	860/215	600	3.6	7.1
RK 170 H	1520/380	1600	8.7	17.3

Type	Ultrasonic peak power/ultra-sonic nominal power	Heating power	Current consumption (230 V)	Current consumption (115 V)
	[W]	[W]	[A]	[A]
RK 255	640/160	–	0.7	1.4
RK 255 H	640/160	280	2.0	3.9
RK 510	640/160	–	0.7	1.4
RK 510 H	640/160	400	2.5	4.9
RK 512 H	860/215	400	2.7	5.4
RK 514	860/215	–	1.0	1.9
RK 514 H	860/215	600	3.6	7.1
RK 514 BH	860/215	600	3.6	7.1
RK 1028	1200/300	–	1.4	2.7
RK 1028 C	2000/500	–	2.2	–
RK 1028 H	1200/300	1300	7.0	14.0
RK 1028 CH	1200/300	1450	7.7	15.3
RK 1040	1520/380	–	1.7	3.4
RK 1050	2400/600	–	2.7	5.3
RK 1050 CH	2400/600	1950	11.1	17.9

Dimensions and weights

Type	Internal dimensions, oscillating tank (L × W × H)	Work contents	Connection for ball valve (outlet)	Weight
	[mm]	[l]		[kg]
RK 31	190 × 85 × 60	0.6	–	2.2
RK 31 H	190 × 85 × 60	0.6	–	2.3
RK 52	150 × 140 × 100	1.2	–	2.4
RK 52 H	150 × 140 × 100	1.2	–	2.6
RK 100	240 × 140 × 100	2.0	–	3.2
RK 100 H	240 × 140 × 100	2.0	–	3.4
RK 102 H	240 × 140 × 100	2.0	G ¼	4.1
RK 103 H	240 × 140 × 150	2.5	G ¼	4.3
RK 106	Ø 240 × 130	4.0	G ¼	5.2
RK 156	500 × 140 × 100	4.0	G ¼	6.0
RK 156 BH	500 × 140 × 150	6.0	G ¼	7.3
RK 170 H	1000 × 200 × 200	26.0	G ½	26.2
RK 255	300 × 150 × 150	3.8	G ¼	4.8
RK 255 H	300 × 150 × 150	3.8	G ¼	5.0
RK 510	300 × 240 × 150	6.6	G ½	7.2
RK 510 H	300 × 240 × 150	6.6	G ½	7.4
RK 512 H	300 × 240 × 200	8.7	G ½	8.3
RK 514	325 × 300 × 150	9.0	G ½	8.8
RK 514 H	325 × 300 × 150	9.0	G ½	8.8
RK 514 BH	325 × 300 × 200	12.5	G ½	9.8

Type	Internal dimensions, oscillating tank (L x W x H)	Work contents	Connection for ball valve (outlet)	Weight
	[mm]	[l]		[kg]
RK 1028	500 x 300 x 200	19.0	G ½	14.0
RK 1028 C	500 x 300 x 300	30.0	G ½	24.5
RK 1028 H	500 x 300 x 200	19.0	G ½	14.7
RK 1028 CH	500 x 300 x 300	30.0	G ½	23.4
RK 1040	Ø 500 x 195	28.0	G ½	19.4
RK 1050	600 x 500 x 200	41.0	G ½	30.0
RK 1050 CH	600 x 500 x 300	60.0	G ½	36.0

8.2 Ambient conditions

Overvoltage category:	II
Degree of contamination:	2
Permissible ambient temperature:	5 - 40 °C
Permissible relative humidity up to 31 °C:	80 % (non-condensing)
Permissible relative humidity up to 40 °C:	50 % (non-condensing)
Altitude	< 2000 m above sea level
For indoor operation only	

8.3 CE conformity

The ultrasound bath is a medical ultrasound bath and meets the CE marking criteria of the European Union:

- 2017/745/EU – MDR
- 2014/35/EU – Low Voltage Directive
- 2014/30/EU – EMC Directive
- 2011/65/EU RoHS Directive

A declaration of conformity can be requested from the manufacturer by providing the serial number.

9 Dosing table

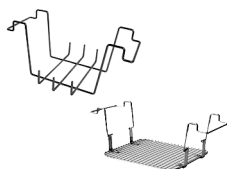
Type	Operating volume	Dosage Water + agent				
	[l]	1 %	2 %	3 %	5 %	10 %
RK 31, RK 31 H	0.6	590 ml + 10 ml	585 ml + 15 ml	580 ml + 40 ml	570 ml + 30 ml	540 ml + 60 ml
RK 52, RK 52 H	1.2	1.1 l + 15 ml	1.1 l + 25 ml	1.1 l + 40 ml	1.1 l + 60 ml	1.0 l + 120 ml
RK 100, RK 100 H, RK 102 H	2.0	1.9 l + 20 ml	1.9 l + 40 ml	1.9 l + 60 ml	1.9 l + 100 ml	1.8 l + 200 ml
RK 103 H	2.7	2.6 l + 30 ml	2.6 l + 55 ml	2.6 l + 85 ml	2.5 l + 140 ml	2.4 l + 270 ml
RK 106, RK 156	4.0	3.9 l + 40 ml	3.9 l + 80 ml	3.8 l + 120 ml	3.8 l + 200 ml	3.6 l + 400 ml
RK 156 BH	6.0	5.9 l + 60 ml	5.8 l + 120 ml	5.8 l + 180 ml	5.7 l + 300 ml	5.4 l + 600 ml
RK 170 H	26.0	25.7 l + 260 ml	25.4 l + 520 ml	25.2 l + 780 ml	24.7 l + 1.3 l	23.4 l + 2.6 l
RK 255, RK 255 H	3.8	3.7 l + 40 ml	3.7 l + 80 ml	3.6 l + 120 ml	3.6 l + 190 ml	3.4 l + 380 ml
RK 510, RK 510 H	6.6	6.5 l + 70 ml	6.4 l + 140 ml	6.4 l + 200 ml	6.2 l + 330 ml	5.9 l + 660 ml
RK 512 H	8.7	8.6 l + 90 ml	8.5 l + 180 ml	8.4 l + 270 ml	8.2 l + 440 ml	7.8 l + 870 ml
RK 514, RK 514 H	9.0	8.9 l + 90 ml	8.8 l + 180 ml	8.7 l + 270 ml	8.5 l + 450 ml	8.1 l + 900 ml
RK 514 BH	12.5	12.3 l + 130 ml	12.2 l + 250 ml	12.1 l + 380 ml	11.8 l + 630 ml	11.2 l + 1.3 l

Type	Operat- ing vol- ume	Dosage Water + agent				
	[l]	1 %	2 %	3 %	5 %	10 %
RK 1028, RK 1028 H	19.0	18.8 l + 190 ml	18.6 l + 380 ml	18.4 l + 570 ml	18.0 l + 950 ml	17.1 l + 1.9 l
RK 1028 C, RK 1028 CH	30.0	29.7 l + 300 ml	29.4 l + 600 ml	29.1 l + 900 ml	28.5 l + 1.5 l	27.0 l + 3.0 l
RK 1040	28.0	27.7 l + 280 ml	27.4 l + 560 ml	27.1 l + 840 ml	26.6 l + 1.4 l	25.2 l + 2.8 l
RK 1050	41.0	40.5 l + 410 ml	40.1 l + 820 ml	39.7 l + 1.3 l	38.9 l + 2.1 l	36.9 l + 4.1 l
RK 1050 CH	60.0	59.4 l + 600 ml	58.8 l + 1.2 l	58.2 l + 1.8 l	57.0 l + 3.0 l	54.0 l + 6.0 l

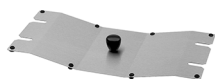
10 Accessories


Insert basket K ...,

made of stainless steel, screen mesh.
 Protects goods to be treated and avoids damage to the tank bottom. Optimum transfer of the ultrasound.


Utensil holder GH ...,

made of stainless steel, mesh size 12 x 12 mm.
 For large individual parts.
 GH 1 for glass flasks up to 105 mm diameter.


Lid D ...,

made of stainless steel.
 For use with inserted basket.
 Protects against contamination from outside. Condensation water is guided into the ultrasonic oscillating tank. Reduces noise.


Inset basket K ... EM,

made of stainless steel.
 An alternative to DIN insert trays in the medical field. Basket holder KT required.


Basket holder KT ..., made of stainless steel.

For inset baskets K...EM or DIN insert trays in the medical field.


Lid D ... T,

made of stainless steel.
 For use with inset baskets without handles (K ... EM).


Insert tub KW ...,

made of plastic, with lid.
 For use of chemicals that attack the stainless steel tank. Note temperature and chemical resistance of PE (KW 3 ... KW 5) and PP (from KW 10-0).

Type	Insert bas- ket	Utensil holder	Lid D ...	Inset basket	Basket holder	Lid D ... T	Insert tub
RK 31 /H	K 08	–	D 08	–	–	–	–
RK 52 /H	K 1 C	GH 1	D 52	–	–	D 1 T	–
RK 100 /H, RK 102 H	K 3 C	GH 1	D 100	–	–	D 3 T	KW 3
RK 103 H	K 3 CL	–	D 100	–	–	D 3 T	KW 3
RK 106	K 6	–	D 6	–	–	–	–
RK 156	K 6 L	–	D 156	–	–	–	–
RK 156 BH	K 6 BL	–	D 156	–	–	–	–
RK 170 H	K 7	–	D 170	–	–	–	–
RK 255 /H	K 5 C	–	D 255	–	–	D 5 T	KW 5
RK 510 /H	K 10	GH 10	D 510	–	–	D 10 T	KW 10-0
RK 512 H	K 10 B	–	D 510	–	–	D 10 T	–
RK 514 /H	K 14	–	D 514	K 14 EM	KT 14	D 14 T	KW 14
RK 514 BH	K 14 B	–	D 514	–	–	D 14 T	KW 14 B
RK 1028 /H	K 28	GH 28	D 1028	K 29 EM	KT 30	D 28 T	KW 28-0
RK 1028 C	K 28 C	–	D 1028 C	–	–	–	KW 28-0
RK 1028 CH	K 28 C	–	D 1028 C	–	–	–	KW 28-0
RK 1040	K 40	–	D 40	–	–	–	–
RK 1050	K 50	–	D 1050 C	–	–	–	KW 50-0
RK 1050 CH	K 50 C	–	D 1050 C	–	–	–	KW 50 B-0



Inset baskets KD ..., PD ...,
sieve cloth.

Suitable for inset beakers, for cleaning small parts.

KD 0: Stainless steel, interior Ø 75 mm;

PD 04: Plastic, interior Ø 60 mm.



Inset beakers

SD ... (glass), EB ... (stainless steel), KB ..., PD ... (plastic).

For indirect cleaning of small parts, suitable for positioning lid and beaker holder Ø 87 mm. With ring and lid.

KB 04, SD 04 and SD 05 Ø 76 mm, without lid.

SD 09 without lid.



Positioning lid DE ...,

made of stainless steel.

To hang inset beakers. Positioning for optimum utilisation of ultrasound energy.



Beaker holder ES ...,

made of stainless steel.

To hold 4 inset beakers in larger ultrasound baths. Positioning for optimum utilisation of ultrasound energy.



Impression tray holder LT 102,

made of stainless steel.

For cleaning of impression trays.



Inset basket PK ... C and K ... P,

made of plastic, perforated.

For gentle cleaning of sensitive surfaces, e.g. instruments such as probes, syringes, stoppers.



Injection nozzle holder ED ...,

made of stainless steel.

To hang in the oscillating tank. Holds injection nozzles of diverse sizes.



Cassette holder KAH ...,

made of stainless steel.

To hang in the oscillating tank. Holder for up to three cassette levels.

Type	Inset basket	Insert beaker	Position- ing lid/ beaker holder	Impres- sion tray holder	Insert basket	Injection nozzle mount	Cassette holder
RK 31 /H	PD 04	KB 04, SD 05	DE 08	–	–	–	–
RK 52 /H	KD 0, PD 04	SD 06, SD 09, PD 06, EB 05	DE 52	–	PK 1 C	ED 0	–
RK 100 /H, RK 102 H	KD 0, PD 04	SD 06, SD 09, PD 06, EB 05	DE 100	LT 102	PK 2 C	ED 9	–
RK 103 H	KD 0, PD 04	SD 06, SD 09, PD 06, EB 05	DE 100	–	PK 3 C	–	–
RK 106	KD 0, PD 04	SD 06, SD 09, PD 06, EB 05	DE 6	–	–	–	–
RK 156	KD 0, PD 04	SD 06, SD 09, PD 06, EB 05	DE 156	–	–	–	–
RK 156 BH	KD 0, PD 04	SD 06, SD 09, PD 06, EB 05	DE 156	–	–	–	–
RK 170 H	–	–	–	–	–	–	–
RK 255 /H	KD 0, PD 04	SD 06, SD 09, PD 06, EB 05	DE 255	–	K 5 P	–	–
RK 510 /H	KD 0, PD 04	SD 06, SD 09, PD 06, EB 05	DE 510	–	–	ED 9	–
RK 512 H	KD 0, PD 04	SD 06, SD 09, PD 06, EB 05	DE 510	–	–	–	–
RK 514 /H	KD 0, PD 04	SD 06, SD 09, PD 06, EB 05	DE 514	–	–	–	KAH 14.3
RK 514 BH	KD 0, PD 04	SD 06, SD 09, PD 06, EB 05	DE 514	–	–	ED 14	–
RK 1028 /H	KD 0, PD 04	SD 06, SD 09, PD 06, EB 05	ES 4	–	–	–	–
RK 1028 C	KD 0, PD 04	SD 06, SD 09, PD 06, EB 05	ES 4	–	–	–	–
RK 1028 CH	KD 0, PD 04	SD 06, SD 09, PD 06, EB 05	ES 4	–	–	–	–
RK 1040	–	–	–	–	–	–	–
RK 1050	KD 0, PD 04	SD 06, SD 09, PD 06, EB 05	ES 4	–	–	–	–
RK 1050 CH	KD 0, PD 04	SD 06, SD 09, PD 06, EB 05	ES 4	–	–	–	–


Mounting brackets EK ...,

made of stainless steel, for laboratory flasks.

Prevents flasks floating to the surface. For screwing into insert baskets and utensil holders.

EK 10 – 10 ml, max. diameter 31 mm

EK 25 – 25 ml, max. diameter 42 mm

EK 50 – 50 ml, max. diameter 52 mm

EK 100 – 100 ml, max. diameter 65 mm

EK 250 – 250 ml, max. diameter 85 mm


Handle adapter GV ...,

made of stainless steel.

For insert baskets and utensil holders.


Test tube holder RG ...,

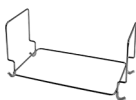
made of stainless steel.

For simultaneous sonication of 6 test tubes up to 25 mm diameter and 8 test tubes up to 16 mm diameter. Can also be used as a test tube stand. Content of test tubes remains visible.


Tableting punch holder TH ...,

made of stainless steel.

For holding tableting punches with different diameters.


Sieve holder SH 7,

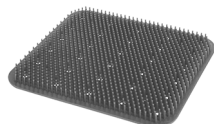
made of stainless steel.

For single sieve cleaning.


Sieve holder SH 28 C,

made of stainless steel.

For the simultaneous and gentle cleaning of up to 5 analysis sieves with 200 mm diameter.


Studded silicone mat SM ...

For contact-free storage of highly sensitive instruments. Fastening in basket prevents instruments from floating to the surface and being damaged. Ultrasound permeable.


Fixation clamps FE 12

Set with 2 large and 5 small plastic clamps for safely securing the flexible endoscope accessories in the basket. Prevents damage to biopsy forceps and instruments.

Type	Mounting brackets for laboratory flasks	Handle adapter	Test tube holder	Tableting punch holder	Sieve holder	Stud-ded sili-cone mat	Fixation clamps
RK 31 /H	–	–	–	–	–	–	–
RK 52 /H	EK 10, EK 25, EK 50, EK 100, EK 250	GV 3	RG 2	–	–	–	–
RK 100 /H, RK 102 H	EK 10, EK 25, EK 50, EK 100, EK 250	GV 3	RG 2	–	–	SM 3	–
RK 103 H	EK 10, EK 25, EK 50, EK 100, EK 250	GV 3	RG 2	–	–	–	–
RK 106	EK 10, EK 25, EK 50, EK 100, EK 250	–	–	–	SH 7	–	–
RK 156	EK 10, EK 25, EK 50, EK 100, EK 250	GV 3	–	–	–	SM 6	FE 12
RK 156 BH	EK 10, EK 25, EK 50, EK 100, EK 250	GV 3	–	–	–	SM 6	FE 12
RK 170 H	–	–	–	–	–	–	FE 12
RK 255 /H	EK 10, EK 25, EK 50, EK 100, EK 250	GV 3	–	–	–	SM 5	FE 12
RK 510 /H	EK 10, EK 25, EK 50, EK 100, EK 250	GV 10	–	–	–	–	–
RK 512 H	EK 10, EK 25, EK 50, EK 100, EK 250	GV 10	–	–	–	–	–
RK 514 /H	EK 10, EK 25, EK 50, EK 100, EK 250	GV 10	–	TH 14 B	–	SM 14	FE 12
RK 514 BH	EK 10, EK 25, EK 50, EK 100, EK 250	GV 10	–	TH 14 B-S 22 TH 14 B-S 28	–	–	–
RK 1028 /H	EK 10, EK 25, EK 50, EK 100, EK 250	GV 10	–	TH 28-S 22 TH 28-S 28	–	SM 29	FE 12
RK 1028 C	EK 10, EK 25, EK 50, EK 100, EK 250	GV 10	–	–	SH 28 C	–	–
RK 1028 CH	EK 10, EK 25, EK 50, EK 100, EK 250	GV 10	–	TH 28 C TH 28 C-S 22 TH 28 C-S 28	SH 28 C	–	–
RK 1040	–	–	–	–	–	–	–
RK 1050	–	–	–	–	–	–	–
RK 1050 CH	–	–	–	–	–	–	–

BANDELIN

Ultraschall seit 1955

BANDELIN *electronic* GmbH & Co. KG

Heinrichstr. 3–4
12207 Berlin
Germany

Phone: +49 30 76880-0
Fax: +49 30 7734699

info@bandelin.com
www.bandelin.com