Instructions for Use

BANDELIN
Ultraschall seit 1955

SONOREX DIGIPLUS

High-performance ultrasonic baths

Valid for:

DL 102 H, DL 156 BH, DL 255 H,
DL 510 H, DL 512 H, DL 514 BH, DL 1028 H

1586-005 GB/2021-03

BANDELIN *electronic* GmbH & Co. KG, Heinrichstraße 3–4, Germany, 12207 Berlin,

Tel.: +49-30-768 80 - 0, Fax: +49-30-773 46 99, info@bandelin.com

General

The equipment, the accessories and the preparations are to be used in accordance with the operating instructions and/or the product information.

The instructions are part of the scope of delivery and are to be stored in the vicinity of the device for later reference. This also applies if possession of the device is transferred elsewhere.

Before the device is put into operation, these Instructions for Use are to be read carefully and completely in order for the user to become familiarised with all functions.

The warnings and safety precautions (Section 1.5) are always to be heeded during use.

The manufacturer will not assume any responsibility for the device's safety or functional ability in the event of improper handling or usage contrary to the intended purpose. In the event of unauthorised alterations/modifications, both the warranty claim and the CE conformity will expire.

If Service is required, please contact the specialist dealer in charge or the manufacturer.

Symbols used:

Symbol	Significance	Explanation
	Danger	Identifies information that could signify a risk to life and limb, especially through electric shock, if not observed.
	Caution	Identifies information that is to be observed and adhered to without fail, to prevent damage to the device and danger to the user. When device parts are labelled with this symbol, reference must be made to the documentation.
	Warning	Warning of hot surface.
	Important	Identifies information that is important for execution.
	Note	Identifies information provided for explanatory purposes.
	Do not grip inside	For health reasons, touching the oscillating fluid is prohibited.
	Wear ear protectors	For health reasons, standing for long periods of time in the vicinity of the device without ear protectors is prohibited.
➢	Operating sequence instructions	Identifies instructions that are to be followed in the described sequence.

BANDELIN electronic GmbH & Co. KG • Heinrichstraße 3-4 • 12207 Berlin • Deutschland • info@bandelin.com

Contents

Informative appendices

1 Product description

Ultrasonic bath of type SONOREX DIGIPLUS DL... .
The exact type specification and serial number are found on the type plate, on the rear side of the ultrasonic bath.

Product features:

- Stainless steel oscillating tank (1) with transducers, ultrasound frequency 35 kHz
- Digital timer for 1, 2, 3, 4, 5, 10, 15, 30 min and continuous operation (2)
- Digital power setting from 20% to 100% in 10% increments (3).
- Digital heating setting from 20°C to 80°C in 5°C increments (4).
- Filling level mark for safe filling (5)
- Compact, easy-to-clean stainless steel housing (6)
- Rubber feet for safe positioning (7)
- Outlet with ball valve (8) for easy draining of the bath fluid and handles (9)

SONOREX DIGIPLUS DL 102 H

1.1 Mode of operation

SONOREX ultrasonic baths use the effect of cavitation. Under their oscillating tank bottoms they contain piezoelectric transducers, the energy of which is transferred to the bath liquid with ultrasound frequency as mechanical oscillations. As a result, microscopically small bubbles are continuously formed in the bath liquid, which release energy upon imploding and generate local microcurrents. This process is called cavitation. During the cleaning process, it causes contamination to be regularly "blasted" from the hard surfaces of the objects being treated. At the same time, dirt particles are removed and fresh bath liquid flows in. During sonochemical processes, cavitation may have a catalytic effect, e.g. with the production of stable emulsions or the rapid degasification of fluids with a high gas content.

SONOREX ultrasonic baths are efficiently supported by SweepTec® automatic frequency control. SweepTec® immediately balances load-dependent working point fluctuations to the optimal working point using fast frequency modulation. This produces an especially homogeneous and uniform ultrasound field in the bath for constantly reproducible results.

BANDELIN electronic GmbH & Co. KG • Heinrichstraße 3-4 • 12207 Berlin • Deutschland • info@bandelin.com

1.2 Purpose

General use

SONOREX ultrasonic baths are intended for the sonication of aqueous fluids. They work on the basis of low-frequency ultrasound and can be used in versatile ways. Their main application is gentle and intensive cleaning of objects of diverse shapes, types and sizes. Alternatively, chemical processes can be favourably supported and accelerated in an ultrasonic bath, e.g. when preparing or treating samples.

Sonication is always carried out in connection with a suitable preparation that is added to the bath liquid. In order to use the device as intended, a basket or another inset beaker, into which objects are placed during sonication, is also required. Only in this manner is the optimum diffusion of the ultrasound guaranteed.

The ultrasonic bath is operated from the front. The operation is usually carried out on a table.

1.3 CE conformity

The units satisfy the CE marking criteria in the European Union:

- "Low-voltage directive"
- "Electromagnetic compatibility" directive
- RoHS Directive

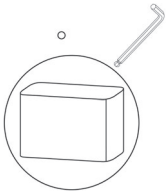
in their currently valid versions.

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

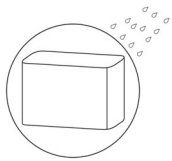
1.4 Technical data

SONOREX ultrasonic baths are interference-suppressed and CE marked.
Safety: EN 61010-1,
EMC: EN 61326-1

Mains supply:	230 V~ (± 10%) 50/60 Hz, (115 V upon request), mains cable length 2 m
Protection class:	Class I
Frequency	35 kHz
Oscillating tank:	Stainless steel
Serial number (SN):	See type plate
Degree of protection:	IP 33 according to DIN 60529
Altitude:	up to 2000 m above sea level



Protected against access by instruments to dangerous components, protected against solid foreign bodies with a diameter of 2.5 mm or larger



Protected from splashes up to 60° from its vertical axis

Bath type	Order No.	Interior dimensions (L × W × D)	Operating volume	Outlet (valve)	Ultrasonic peak power/* / Ultrasonic nominal output	Weight (net)	Heating capacity	Current consumption (230 V)	Current consumption (115 V)
		mm	l		W / W	kg	W	A	A
DL 102 H	7180	240 × 140 × 100	2.0	G ¼	400 / 100	4.3	140	1.2	2.3
DL 156 BH	7181	500 × 140 × 150	6.0	G ¼	720 / 180	7.3	600	3.6	7.1
DL 255 H	7182	300 × 150 × 150	3.8	G ¼	560 / 140	5.3	280	2.0	3.9
DL 510 H	7183	300 × 240 × 150	6.6	G ½	560 / 140	7.6	400	2.5	4.9
DL 512 H	7184	300 × 240 × 200	8.7	G ½	720 / 180	8.0	400	2.7	5.4
DL 514 BH	7185	325 × 300 × 200	12.5	G ½	720 / 180	9.8	600	3.6	7.1
DL 1028 H	7186	500 × 300 × 200	19.0	G ½	1020 / 255	14.7	1300	7.0	14.0

/* In order to improve the effect, the ultrasound is modulated, whereby a 4-fold utrasonic nominal output value is obtained as ultrasonic peak power, in connection with SweepTec.

Environmental conditions pursuant to EN 61 010-1

Overvoltage category:	II
Degree of contamination:	2
Permissible ambient temperature:	5 to 40°C
Permissible relative humidity up to 31°C:	80%
Permissible relative humidity up to 40°C:	50%

No condensation allowed.
Only for indoor operation.

BANDELIN electronic GmbH & Co. KG • Heinrichstraße 3-4 • 12207 Berlin • Deutschland • info@bandelin.com

1.4.1 Electromagnetic ambient conditions (EMC)

The device was tested to DIN EN 61326-1 for electromagnetic compatibility (EMC) and complies with the requirements for class B devices according to EN 55011.
It is suitable for use in facilities and areas which are directly connected to a public low-voltage supply network, e.g. medical laboratory facilities.

1.5 Warnings and safety precautions

General

- Keep the ultrasonic bath out of the reach of children and persons who have not been instructed in its operation by reference to these instructions.
- We will not offer a guarantee for damages to the ultrasonic bath or oscillating tank, or to the objects to be treated, as a result of use of inadequate disinfection agents or detergents.
- Keep the surface of the ultrasonic bath and operating elements clean and dry.
- Do not expose the ultrasonic bath to corroding influences.
- Move the ultrasonic bath only when it is empty.
- Empty the ultrasonic bath only while turned off.
- Ultrasonic baths adhere to prescribed EMC limit values, such that it can be assumed that the electromagnetic radiation emanating from the units is harmless to humans. A binding statement for wearers of implants can only be made at the place of work and together with the implant manufacturer. In case of doubt, information regarding the allowable electromagnetic exposure level is to be obtained from the implant manufacturer.

Operation

- Observe ambient and set-up conditions, see Section 1.4.
- Only plug in the ultrasonic bath to an outlet with a grounded socket.
- Do not operate the ultrasonic bath without fluids.
- Do not stand or lay any objects on the tank bottom, accessories must be used, see Section 7.

- Do not immerse any parts of the body (e.g. hands, feet) or living beings (animals or plants) into the tank; in particular, do not immerse them in the ultrasonic fluid during ultrasound operation. Danger: Ultrasound has a cell-destroying effect.

- In the event of continuous activity within a 2 m radius, adequate hearing protection must be worn. Danger: Hearing disturbances during operation when not wearing hearing protection - the typical ultrasound cavitation noise can be very uncomfortable.
- When preheating the bath liquid, stir at least every 15 min. or switch on the ultrasound. Danger: Scalding due to delayed boiling.
- Do not leave the ultrasonic bath unattended while in operation.

Damage

- If damage to the ultrasonic bath is detected, do not connect the ultrasonic bath to the mains.
- In the event of defects, disconnect the mains plug immediately.
- Repairs are only to be conducted by authorised skilled personnel or by the manufacturer.
- Defective parts may only be replaced with original SONOREX parts.

BANDELIN electronic GmbH & Co. KG • Heinrichstraße 3-4 • 12207 Berlin • Deutschland • info@bandelin.com

2 Preparation

Carefully unpack the ultrasonic bath and accessories and inspect them for completeness or possible transportation damages. If any damages or defects are found, these are to be immediately notified in writing to the transportation company and to the supplier.
Before startup, the ultrasonic bath is to be left to stand at its operating location for 2 hours so that it may adapt to the ambient conditions.

2.1 Scope of delivery

1 Ultrasonic bath – see delivery note

1 Ball valve (brass, galvanized) with hose, packaged separately with sealing tape and assembly instructions

1 Instruction manual

Additional accessories according to order – see delivery note

2.2 Set-up / assembly

- Place the ultrasonic bath atop a firm, level and dry surface. In doing so,
  - observe the maximum weight of the ultrasonic bath, including fluid. For net weight, see technical data, Section 1.4.
  - do not block the air supply below the ultrasonic bath.
  - guard against moisture and wetness - risk of electric shock.
- Mount the ball valve, hose socket and hose, which are included in the delivery, pursuant to the enclosed assembly instructions.

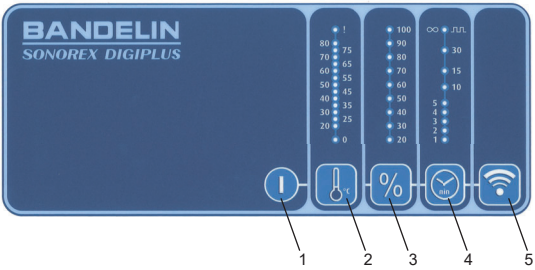
2.3 Start-up

- Thoroughly rinse the ultrasonic bath's oscillating tank with water before its first use.
  Note:
  In order to protect the surface during transport and storage, all outer surfaces (and also the inner walls of the oscillating tank) are covered with an oily preservative. This should be removed with a suitable cleanser before first use, see chapter 5.
- Connect the ultrasonic bath up to the power supply (grounded socket).
- Conduct function test - switch on ultrasonic bath, briefly switch on and turn off the ultrasound (maximum of 1 to 2 seconds), a hissing noise should be heard. Then switch the device off again.
- It is recommended that a foil test be conducted as part of quality assurance prior to the first use.
  This test is to be saved for later comparison, see appendix for information.
- If applicable, hang accessories in the ultrasonic bath and place lid on top.

3 Operation

3.1 Operating elements

The ultrasound, the power and the heating system are operated from the front:



1 Ultrasonic bath ON/OFF button
2 Temperature setting button with temperature scale above
3 Power setting button with output scale above
4 Time setting button with time scale above
5 Start/Stop button – Ultrasound

3.1.1 Ultrasound

With the ultrasonic bath turned on – ON/OFF button – the ultrasound output is turned on with the Start/Stop button after the time is set.

Timed operation:

- Setting via pressing buttons
  → Time 1, 2, 3, 4, 5, 10, 15 or 30 minutes
  - LED for the set time lights up yellow.
  - Following pressing of the Start/Stop button, a running light displays the remaining time optically.
  - Once the time expires, the ultrasonic output is stopped automatically.
- Premature pressing of the Start/Stop button ends the ultrasound output.

Continuous operation:

•Setting via pressing buttons
→ LED ∞ lights up
  - After pressing the Start/Stop button, the top (green) LED is continuously lit and LEDs flashing every second (downward-directed running light) signal ultrasound activity.
  - The ultrasonic bath does not turn off automatically: press the Start/Stop button to switch it off.

Notes

- For safety reasons, the ultrasound bath is turned off automatically if no button is pressed for more than 12 hours.
- While turned off, the ultrasonic bath may remain connected to the mains. It can be disconnected from the mains by pulling the mains plug.

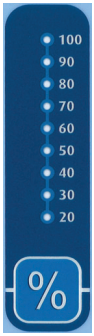
BANDELIN electronic GmbH & Co. KG • Heinrichstraße 3-4 • 12207 Berlin • Deutschland • info@bandelin.com

3.1.2 Power

The power is controlled by the power setting button.

When the ultrasonic bath is switched on, the LED "100" lights up.

- Set the required power by pressing the buttons
  → Power range 20-100%
  - The set power goes up or down with every button pressed
    For example.: Power is set to 100%
    Next button presses = 90 - 80 - 70 - 60...
    When the 20% setting is reached, the scale starts rising again
    30 - 20 - 30 - 40 - 50... (in other words: up, down, up...)



Notes:

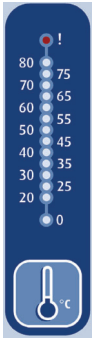
- The last selected power setting is saved when the unit is switched off and used again when it is switched back on again.
- The power should be set to 100% for foil tests and degassing the bath fluid.

3.1.3 Heating

The heating is controlled by the temperature setting button.

When the ultrasonic bath is switched on for the first time, the green LED "0" lights up.

- Set the required temperature by pressing the buttons
  → Temperature range 20-80°C.
  - Set temperature = yellow illuminated LED.
  - Actual temperature = yellow flashing LED.
    It flashes
    slowly above the set temperature (= heating is off) and
    rapidly (= heating is on) above it.
  - Once the set temperature is reached, only
    the corresponding LED lights up.
    The LED "!" flashes red if the temperature
    exceeds 80 °C.
  - Switching off the heating manually:
    Keep the temperature setting button depressed for more than 2 seconds.
    The green LED "0" lights up.



Notes:

- The heating system works independently from the ultrasound.
- The last selected temperature is not saved.
  Once the ultrasonic bath is switched off (ON/OFF), the temperature "0" is set.
- The heating will automatically turn on every time that the bath temperature drops below the set temperature.
- The temperature scale display is accurate to ± 2.5 °C.
  The red LED is triggered at around 80 °C + 5K.
- The heat automatically switches off to protect the ultrasonic bath from overheating.
  The ultrasonic bath will need to cool down sufficiently (water temperature around 50 °C) and be disconnected from the mains power briefly before it can be used again.

Avoid retardation of boiling:

If a temperature is set, the ultrasonic bath attempts to reach the selected temperature immediately. When heating (without the ultrasound switched on), the ultrasound is automatically switched on for 3 seconds per minute to agitate the liquid and consequently avoid retardation of boiling.

- This function is always active at temperatures > 60 °C and cannot be switched off!
- The function can be switched off for temperatures < 60 °C. It must be reactivated again every time the unit is switched on. Activating the function:
  By pressing the temperature setting button when you switch the unit on (ON/OFF).

3.2 Special functions

Degas (⎍⎍ – in the time scale area)

- The DEGAS function is used to degas the unit before the treatment. The required time can be set with the time setting button if desired. Then keep the Start/Stop button depressed for at least 2 seconds.
  The system can be stopped prematurely by pressing the Start/Stop button.
  During the degassing, the top green LED (⎍⎍) also flashes until the time expires.
- Switching between ultrasound – degas: If the Start/Stop button is kept depressed for a long time when ultrasound is running, the ultrasound is firstly switched off and then after approx. 2 seconds the Degas function is reactivated.

Locking continuous operation (∞ – in the time scale range)

To avoid accidentally turning on the continuous operation, the continuous operation can be deactivated:

- ➢ Pull the power plug out.
- ➢ Press the time setting button, hold it depressed and insert the mains plug at the same time. The yellow LED "1 min" lights up in confirmation.

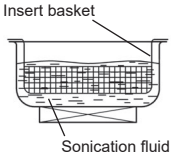
The function can be reactivated in the same way. The green LED continuous operation (∞) lights up in confirmation.

BANDELIN electronic GmbH & Co. KG • Heinrichstraße 3-4 • 12207 Berlin • Deutschland • info@bandelin.com

4 Use

Direct sonication

Normally, sonication takes place **directly** in the oscillating tank. For this purpose, the objects to be treated are placed in a basket and hung inside the oscillating tank which is filled with sonication fluid.

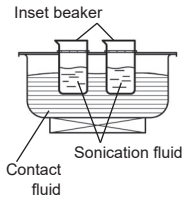


Indirect sonication

Indirect sonication in inset beakers is to be conducted for special applications or to protect the stainless steel oscillating tank in the case of:

- Sonication of sample fluids.
- Use of chemically aggressive fluids (e.g. using acids as cleaning agents).
- Removal of chemically aggressive soiling (e.g. cleaning of developing machine racks).
- Removal of abrasive contamination (e.g. polishing pastes, quartz, sand).

For indirect sonication, a contact liquid (water + surfactants) must be filled in between the inset beaker and the oscillating tank.



4.1 Instructions for use

Instructions – filling

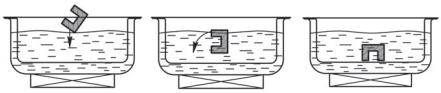
- Verify that the ball valve is closed.
- Ultrasound and heating must be turned off.
- Do not fill oscillating tank with hot water. Maximum filling temperature: 50°C.
- Water of at least drinking quality must be used to fill the oscillating tank.
- Water without additives is not suited for sonication. BANDELIN recommends the TICKOPUR or STAMMOPUR preparations.
- Only use distilled or deionised water without additives in inset beakers or insert tubs.
- The fill level must always be at or slightly above the filling level mark.
  A low fill level will damage the ultrasonic bath!
- Do not use any combustible, explosive, non-aqueous liquids or azeotropic mixtures directly in the stainless steel oscillating tank (e.g. benzine, solvents). Furthermore, chemicals that contain or that separate chloride ions (some disinfectants, household cleaners, and dish detergents), may not be used directly in the stainless steel tank.
- When working with aggressive preparations in inset beakers or insert tubs: Prevent the contact liquid or stainless steel surfaces from being sprayed. If necessary, replace the contact liquid, clean the surfaces and wipe dry.
- When using strongly acidic preparations, the hard chromium plating of the ball valve may become corroded and the ball valve start to leak.
  If the use of a strongly acidic cleaning agent cannot be avoided, the use of a stainless steel ball valve is recommended.
- When using preparations, the safety instructions included in the product leaflets are to be fundamentally adhered to.
- Replace used sonication fluids, do not refresh by adding fluids.

BANDELIN electronic GmbH & Co. KG • Heinrichstraße 3-4 • 12207 Berlin • Deutschland • info@bandelin.com

Notes - Inserting objects

- Fully remove air bubbles from cavities (e.g. blind holes).

  Indirect sonication
  Remove any air bubbles from underneath the vessels.



Notes - Temperature and heating

- Warmed-up fluids intensify the ultrasound effect. Experience has shown that the best results are obtained with a bath temperature of 50 to 60 °C. With high temperatures, however, the effect of the ultrasound cavitation decreases again [/1].
- In order to save time during use, the bath fluid may be preheated during degassing.
- Ultrasound energy warms up the sonication fluid (even without additional heating).
  - In case of continuous sonication and/or covering the oscillating tank, the fluid temperature will increase, even rising above the value set on the thermostat. For this reason, check the temperature when treating temperature-sensitive components.
  - Non-aqueous fluids can heat up many times faster than water. A possible flashpoint can be reached and/or exceeded after a very short sonication time. In the case of high-boiling liquids (with and without a flashpoint), the bath temperature can increase to >120 °C due to the energy input of the ultrasound. This leads to irreparable damage to the ultrasonic bath.
- For an optimum bath temperature, observe the specifications of the specimen manufacturer!
- To protect the electronic components inside the ultrasonic bath, the ultrasound output is reduced upon reaching a critical temperature in order to inhibit a further increase in the interior temperature.
- The fluid in the oscillating tank must not exceed a maximum operating temperature of 100°C.

/1 MILLNER, R.: Wissenspeicher Ultraschalltechnik, Fachbuchverlag publishing house, Leipzig 1987

BANDELIN electronic GmbH & Co. KG • Heinrichstraße 3-4 • 12207 Berlin • Deutschland • info@bandelin.com

4.2 General use

Step 1: Fill oscillating tank

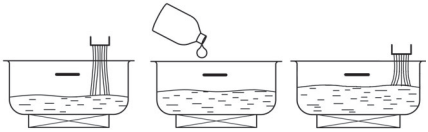
The oscillating tank is filled with water and a suitable preparation to reduce the surface tension, see Section 7.2.

Direct sonication

- Fill 1/3 of oscillating tank with water.
- Add dosed preparation to the oscillating tank. See appendix for dosage information.
- Fill carefully up to the filling level mark, avoid as much as possible the formation of foam.

Indirect sonication

When using aggressive acidic liquids (e.g., sulfuric acid, hydrochloric acid), we recommend using alkaline contact liquid such as 5% TICKOPUR R 33.



- Fill 1/3 of oscillating tank with water.
- Surfactant.
- Fill carefully, avoid as much as possible the formation of foam.
  The oscillating tank must be filled depending on the inset beaker since inset beakers displace the contact liquid.

Step 2: Degassing the fluid

Freshly-filled bath fluid or fluid that has remained in the oscillating tank for a longer period of time must be degassed prior to use. See also Section 4.3.1.

- Remove basket and other accessories from the oscillating tank.
- Place lid on top.
- Set the power to 100%, see Section 3.1.2.
- For degassing, set the time and start the ultrasound (Press START/STOP button for 2 sec), see Sections 3.1.1 and 3.2.
  - up to 10 litres bath volume: 10 min
  - more than 10 litres bath volume: 30 min
- Turn on the ultrasonic bath.

Time need to be extended with acidic cleaning solutions.

Step 3: Preheat fluid

In ultrasonic baths with built-in heating, the fluid may be preheated independently of the ultrasound. This increases the ultrasound effect, especially when removing fats, oils and polishing paste residue, and shortens the duration of the subsequent ultrasound.

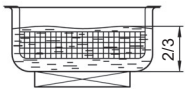
- Remove basket and other accessories from the oscillating tank.
- Place lid on top.
- Set the desired temperature, see Section 3.1.3. The ultrasonic bath begins heating immediately.
- For an even warming of fluids, stir the fluids or switch on the ultrasound for a few minutes now and then, otherwise there will be delayed boiling - risk of scalding!

Step 4: Insert objects to be treated

Before every sonication it is necessary to check whether the sonication fluid needs to be cleaned or replaced.

Direct sonication

Oscillating tank with inset basket



- ➢ Hang the insert basket with the goods to be treated, or place the basket holder in the oscillating tank. Place the inset basket on the basket holder.
- ➢ Check that the objects to be treated are fully covered with fluid.
- ➢ With every object inserted, the fill level is to be controlled.

Indirect sonication

Oscillating tank with positioning lid and inset beakers

- ➢ Place the positioning lid atop the oscillating tank and hang the inset beakers from the positioning lid, or hang the insert tub directly in the oscillating tank.
- ➢ Immersion depth for inset beakers is min. 2 cm.
- ➢ Control the fill level (contact liquid).

For cleaning tasks

Place the objects to be cleaned in the appropriate accessories, in doing so please note:

- Evenly distribute parts, do not stack them.
- An overloading of the basket or inset beaker reduces the ultrasound effect (the ultrasound is absorbed).
- Place the more heavily soiled side facing downward.
- Parts with joints are to be fully opened before placing inside.
- Delicate parts are not to come into contact with one another - for positioning, use special accessories such as silicone knob mats if necessary, see Section 7.
- Due to the design, the ultrasound effect is weaker on the outlet side. Heavily contaminated objects should not be placed in the basket over the outlet.

For indirect sonication of fluids

Fill sample vessel(s), in doing so please note:

- It is possible to treat multiple sample vessels with different fluids at the same time.
- When treating small quantities of combustible fluids in sample vessels, the country-specific guidelines/regulations that are currently in effect are to be observed.

Step 5: Ultrasound - Operation

Fundamentally, the sonication time is to be as short as possible in order to protect the objects to be treated and the oscillating tank.
In the case of stubborn residue, conduct sonication for a longer time if necessary.

- ➢ Place lid on top.
- ➢ Set the power accordingly as necessary, see Section 3.1.2.
- ➢ Set the required sonication period and start the ultrasound, see Section 3.1.1.

Step 6: Removing treated objects

After sonication, the objects are to be removed from the ultrasonic bath. Allowing them to remain any longer in the bath fluid may damage them.

- Switch off the ultrasound.
- Remove the basket or inset beaker from the tank and set down atop a level surface.

Caution

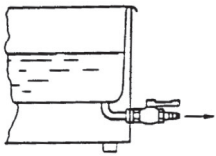
Depending upon the set temperature or the duration of sonication, the baskets and objects may be hot!

- After the cleaning processes, rinse the treated objects with water of at least drinking quality. Visually review the sonication results.
- Before the next sonication, verify the service life (see Section 4.3.2) of the bath fluid. Heed the specifications of the preparation manufacturer. If necessary, empty the oscillating tank.

Step 7: Empty the oscillating tank.

Layers of contamination on the tank bottom reduce the ultrasonic output.
The oscillating tank is to be emptied after a long period of use or sonication of heavily soiled objects, see Section 4.3.2.

- Switching off the ultrasonic bath (ON/OFF button).
- Pull the power plug.
- Do not place the ultrasonic bath in the sink.
- Empty the oscillating tank by setting the ball valve handle in the discharge direction.



- After emptying the oscillating tank, thoroughly rinse it. Then dry with a soft cloth.
  For further care instructions, see Section 5.

BANDELIN electronic GmbH & Co. KG • Heinrichstraße 3-4 • 12207 Berlin • Deutschland • info@bandelin.com

4.3 Further information

4.3.1 Degassing

Degassing the sonication fluid increases the ultrasound effect.
Freshly filled-in fluid or fluid that has remained in the oscillating tank for a longer period of time must be degassed prior to use. Gases released in the fluid (e.g. oxygen) are reduced through degassing and the ultrasound effect is thus significantly improved.

The cavitation noise changes during degassing, loud degassing noises disappear at the end of the degassing process, the ultrasonic bath appears to work more quietly.
A lower noise level, however, does not mean a reduction in ultrasonic power. It rather means the end of the degassing process and an improvement in the ultrasound effect.

4.3.2 Disposal of sonication fluids

The working solution is disposed of pursuant to the specifications in the product leaflet and the label supplied by the manufacturer of the preparations employed. All aqueous preparations made by DR H. STAMM GmbH are prepared pursuant to the regulations of the German Washing and Cleansing Agents Act, are biodegradable and as working solutions may be disposed of in the wastewater. Strongly acidic and strongly alkaline fluids are to be previously neutralised pursuant to technical data sheet specifications. The manufacturer's specifications for the respective preparations should be observed.
During cleaning, materials hazardous to water such as oils, heavy metal compounds, etc., depending on the type of contamination, may enter the working solution. If the limit values are exceeded, the working solution must be reconditioned (removal of contaminants) or be disposed of as toxic waste.
Disinfection and cleaning agents that become contaminated when used are considered "waste material" pursuant to the German Waste Act (AbfG) and may not be taken back by the manufacturer. In other countries, the relevant supplementary/divergent national regulations should be taken into account.
In every case, the statutory provisions and regulations of municipal wastewater plants must be adhered to. Information is provided by municipal wastewater plants as well as by environmental agencies.

BANDELIN electronic GmbH & Co. KG • Heinrichstraße 3-4 • 12207 Berlin • Deutschland • info@bandelin.com

5 Cleaning and maintenance of the ultrasonic bath

To achieve an optimum lifespan for the ultrasonic bath, cleaning and maintenance are to be conducted regularly.

CAUTION!

Disconnect the ultrasonic bath from the mains before cleaning / maintenance.

Do not rinse or immerse the ultrasonic bath in water and do not expose it to splash water.

5.1 Cleaning and care

Oscillating tank

The oscillating tank of an ultrasonic bath is a part subject to wear.
It is continuously exposed to cavitation during ultrasound operation. Dirt particles remaining in the tank abrade and damage the tank surface due to the movement of the fluid, therefore

- Rinse the oscillating tank with water thoroughly and frequently and dry using a soft cloth.
- Regularly remove residue from the edges of the oscillating tank using a commercial stainless steel cleaning product without any abrasive additives.
- Do not use steel wool, scrapers or graters for cleaning / maintenance.
- Metal particles that remain on the stainless steel surface as well as rust particles from the water pipe system penetrate the passive protective layer of the stainless steel. The stainless steel is "activated" in this process and it begins to rust. The extraneous rust produces localised corrosion of the stainless steel. For this reason, remove metal parts such as screws, filings, etc., from the oscillating tank, and immediately remove rust stains using a soft cloth and a commercial stainless steel cleaning product without abrasive additives.

Housing

- Do not use any abrasive cleaners, only commercial care products without abrasive additives.
- Housing is to be wiped off only from the outside, use a suitable surface disinfectant if needed. Afterwards, allow to dry off or wipe dry.

5.2 Warehousing / storing

During long periods of non-use, the ultrasonic bath is to be stored in a cool, dry location. The lid should be placed on top in order to protect the oscillating tank from outside contamination.

6 Maintenance and repair

6.1 Maintenance

SONOREX ultrasonic baths require no maintenance.
For purposes of regular control, the following functional checks may be carried out.

6.2 Functional checks

Checking control lights

A test routine can be started for an internal function check:
The ultrasonic bath must be switched off for this. When the Start/Stop button is kept held down, the ultrasonic bath is switched on with the ON/OFF button.
All LEDs light up after each other for 1/3 second. The last set values are then displayed.
The test is then successfully completed.
If there are any deviations, the ultrasonic bath must be sent in for checking/repairs.

Checking the ultrasound and/or heating

The functioning can be checked using a standard wattmeter. It is to be inserted between the ultrasonic bath's power plug and the power outlet.

- Fill the oscillating tank with fluid, see Section 4.2.
- For testing purposes, only the ultrasound (power set to 100%) or only the heating system are to be switched on. Next, the value displayed is to be compared with the corresponding value in the technical data (Section 1.4) (tolerances ± 20%).

Checking the ultrasound effect

- For monitoring, we recommend the performance of a foil test.
  A suitable frame for the foil test can be requested from the manufacturer. Customary aluminium foil is used to conduct the test. Next, a comparison is made with previously-generated foils.
  For more detailed information, please see the appendix.
- A measurement procedure is described in DIN SPEC 40170:2013-11 (Measurement and evaluation of cavitation noise).

6.3 Error analysis

SONOREX ultrasonic baths are robustly constructed and designed for a high level of reliability. Nevertheless, the possibility of a malfunction due to a defective component can never be fully discounted.
The following overview of possible sources of error should serve as an aid for error detection and elimination.

- Ultrasonic bath oscillates weakly, unevenly or noise is too loud:
  - Has fluid been properly degassed? ⇒ Treat for 15 min.
  - Is it overloaded with objects to be treated? ⇒ Remove a few parts.
  - Uneven noises (wobbling) ⇒ No error - slightly adjust the filling level of the fluid.
- Heating system defective?
  The ultrasonic bath can be readily operated without heating.
- Slight erosion visible on the bottom of the bath? ⇒ Natural wear. Ultrasonic bath OK.

Any malfunctions are to be communicated in writing to the manufacturer.

BANDELIN electronic GmbH & Co. KG • Heinrichstraße 3-4 • 12207 Berlin • Deutschland • info@bandelin.com

6.4 Repairs and service

CAUTION!

Repair work may only be carried out by authorised, qualified personnel or by the manufacturer. The manufacturer assumes no liability for unauthorised interventions on the ultrasonic bath!

If errors or defects are ascertained as a result of the functional check, and if it is impossible to rectify such errors, the ultrasonic bath may no longer be used. In such a case, please contact the supplier or the manufacturer:

BANDELIN electronic GmbH & Co. KG
Heinrichstraße 3-4
12207 Berlin

Repair service:
Tel.: +49 30 768 80-13
Fax: +49 30 768 802 00 13

E-mail:
info@bandelin.com

In the case of returns, the general terms and conditions for delivery and payment of BANDELIN electronic GmbH & Co. KG shall apply.
In addition, the ultrasonic bath is to be cleaned and decontaminated (if necessary), see the following section.

Decontamination certificate

If the ultrasonic bath is sent back to the manufacturer for repairs (with accessories, if applicable), the form "Certificate of Decontamination" is to be filled out and affixed to the packaging on the outside, in a visible spot.
If this form has not been filled out, we reserve the right to refuse receipt of the package in order to protect our employees.

The form can be downloaded from the Internet as a PDF file:
www.bandelin.com - Download ...

7 Accessories

The proper accessories facilitate use of the ultrasound and also protect the oscillating tank and objects to be treated.

BANDELIN offers a broad range of accessories, see appendix.
Additional information may be obtained from our supplier, our sales representative or from our website.

No-obligation telephone consultation:
+49 30 768 80-0

Website:
www.bandelin.com

7.1 Required accessories

Required accessories are e.g. baskets, basket holders, positioning lids with inset beakers, etc. For more detailed information, please see the appendix.

Do not stand or lay any objects directly on the tank bottom.
Exceptions to this rule are special baskets and basket holders (e.g., K 6 and SH 7) that have been designed by BANDELIN in such a manner that they do not lie in the cavitation field and do not damage the tank bottom.

7.2 Preparations

Special preparations that are suitable for use with ultrasound, i.e. cavitation-conducive, biodegradable, easily disposable, gentle to the material and long-lasting, are required for use with ultrasound.

BANDELIN recommends the TICKOPUR or STAMMOPUR concentrates by DR. H. STAMM GmbH, which have been especially developed for ultrasound use and which optimally utilise the ultrasound.
Additional information may be obtained from our supplier, our sales representatives or from our website.

No-obligation telephone consultation:
+49 30 768 80-280

Website:
www.dr-stamm.de

IMPORTANT!

- When using preparations, the safety instructions on the label and in the respective product leaflets must be adhered to.
- Keep the preparations out of the reach of children and also of persons who have not been instructed in their use by reference to the product information.
- Do not ingest or inhale the preparations and do not allow them to come into contact with the eyes or skin.
- Preparations in powder form may only be used fully dissolved.

8 Taking the unit out of service

The device must be disposed of appropriately, not with household waste.

Disposal must be conducted in accordance with the Waste, Electrical and Electronic Equipment Directive 2012/19/EU.
Any supplementary/deviating regulations must be observed.

- The device must be decontaminated before disposal. It can then be disposed of as electronic waste. If decontamination is incomplete / cannot be correctly performed, a material safety data sheet for the liquids used must be affixed to each device.
- Metal accessories such as the lid or basket should be decontaminated and disposed of as metal waste.
- Plastic accessories such as insert baskets, silicone knob mats or lids must be decontaminated and disposed of.
- The packing is recyclable.

A Dosing table

The dosing table can be requested free of charge in DIN A4 format, or may be downloaded from the Internet as a PDF file.

http://www.bandelin.com/dosier.htm

Bath type	Fill quantity	Dosage	Dosage	Dosage	Dosage	Dosage
		1%	2%	3%	5%	10%
DL 102 H	2.0 l	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**
DL 156 BH	6.0 l	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**
DL 255 H	3.8 l	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**
DL 510 H	6.6 l	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**
DL 512 H	8.7 l	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**
DL 514 BH	12.5 l	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**
DL 1028 H	19.0 l	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**

/Number in standard print: Water Number in **bold** print: Preparation Numbers have been rounded.

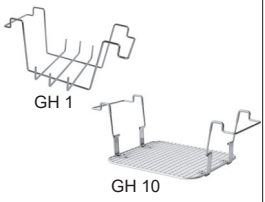
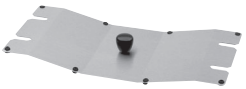
If a sample vessel was used, the dosage can be calculated as follows:
Example:

- 10 litres ready-made solution
- 2.5 % dosing of the preparation

$$\frac{10\ \text{l} \times 2.5\%}{100\%} = 0.25\ \text{l preparation}$$

10 l – 0.25 l = 9.75 l water

B Accessories

	**Insert basket K ...**, made of stainless steel, sieve cloth. Protects objects to be cleaned and prevents damage to the tank bottom. Optimum ultrasound transmission.
	**Utensil holder GH ...**, made of stainless steel, mesh size 12 x 12 mm, for larger components. GH 1 for flasks up to Ø 105 mm.
	**Lid D ...**, made of stainless steel, for use with inserted basket. Protects from exterior contamination. Condensation water is discharged in the oscillating tank. Sound-absorbing
	**Inset basket K ... EM**, made of stainless steel, an alternative to DIN sieve trays in the medical field. KT basket holder required.
	**Basket holder KT ...**, made of stainless steel, for inset baskets K...EM or DIN sieve trays in the medical field.
	**Lid D ... T**, made of stainless steel. These lids are especially for the use of inset baskets without brackets (K ... EM).
	**Insert tub KW ...**, made of plastic, with lid. For use of chemicals that would corrode the stainless steel tank. Observe temperature and chemical resistance of PE (KW 3 ... KW 5) and PP (as of KW 10-0).

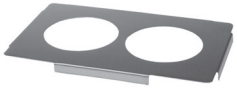
Accessories / Devices	Insert basket	Utensil holder	Lid D ...	Insert basket	Basket holder	Lid D ... T	Insert tub
DL 102 H	K 3 C	GH 1	D 100	-	-	D 3 T	KW 3
DL 156 BH	K 6 BL	-	D 156	-	-	-	-
DL 255 H	K 5 C	-	D 255	-	-	D 5 T	KW 5
DL 510 H	K 10	GH 10	D 510	-	-	D 10 T	KW 10-0
DL 512 H	K 10 B	GH 10 B	D 510	-	-	D 10 T	-
DL 514 BH	K 14 B	GH 14 B	D 514	-	-	D 14 T	KW 14 B
DL 1028 H	K 28	GH 28	D 1028	K 29 EM	KT 30	D 28 T	KW 28-0

KD 0 PD 04

Inset baskets KD ..., PD ...,
Sieve cloth.
Compatible with inset beakers. Cleaning of small parts.
KD 0 Stainless steel Ø interior 75 mm
PD 04 Plastic Ø interior 60 mm

SD 06 EB 05 PD 06

Inset beakers
SD ... (glass), **EB ...** (stainless steel), **PD ...** (plastic)
for indirect cleaning of small parts, compatible with 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,
for suspending inset beakers. Positioning for optimum utilisation of ultrasound energy.

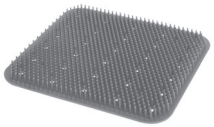
Beaker holder ES ...,
made of stainless steel,
to hold 4 inset beakers in larger ultrasonic baths. Positioning for optimum utilisation of ultrasound energy.

Impression tray holder LT 102,
made of stainless steel,
for cleaning of impression trays.

Insert basket PK ... C and K … P,
made of plastic, perforated,
for gentle cleaning of sensitive surfaces, e.g. instruments such as probes, syringes, stoppers, etc.

Nozzle receptacles ED ...,
made of stainless steel,
for suspending in the oscillating tank. Receipt of nozzles of diverse sizes.

Accessories / Devices	Insert basket	Inset beaker	Positioning lid / beaker holders	Impression tray holder	Insert basket	Nozzle receptacle
DL 102 H	KD 0, PD 04	SD 06, SD 09, PD 06, EB 05	DE 100	LT 102	PK 2 C	ED 9
DL 156 BH	KD 0, PD 04	SD 06, SD 09, PD 06, EB 05	DE 156	-	-	-
DL 255 H	KD 0, PD 04	SD 06, SD 09, PD 06, EB 05	DE 255	-	K 5 P	-
DL 510 H	KD 0, PD 04	SD 06, SD 09, PD 06, EB 05	DE 510	-	-	ED 9
DL 512 H	KD 0, PD 04	SD 06, SD 09, PD 06, EB 05	DE 510	-	-	-
DL 514 BH	KD 0, PD 04	SD 06, SD 09, PD 06, EB 05	DE 514	-	-	ED 14
DL 1028 H	KD 0, PD 04	SD 06, SD 09, PD 06, EB 05	ES 4		-	

	**Holding clamps EK ...**, made of stainless steel, for laboratory flasks. Prevent them from buoying upwards. To be screwed into insert baskets and utensil holders. EK 10 – 10 ml – max. Ø 31 mm EK 25 – 25 ml – max. Ø 42 mm EK 50 – 50 ml – max. Ø 52 mm EK 100 – 100 ml – max. Ø 65 mm EK 250 – 250 ml – max. Ø 85 mm
	**Handle adjustment GV ...**, made of stainless steel, for insert baskets and utensil holders
	**Test tube holder RG ...**, made of stainless steel. For the simultaneous sonication of 6 test tubes of up to Ø 25 mm and 8 test tubes of up to Ø 16 mm. May also be used as a test tube stand. The test tube contents remain visible.
	**Tabletting punch holder TH ...**, made of stainless steel. Holds tabletting punches of diverse diameters.
	**Silicone knob mat SM ...**, For the contact-free positioning of highly-sensitive instruments. Fastening inside the basket prevents the instruments from buoying upwards and being damaged. Permeable for ultrasound purposes.
	**Fixation clamps FE 12,** Set of 2 large and 5 small plastic clamps for the safe fixation of flexible endoscope accessories to the basket. Prevents damage to biopsy forceps and instruments

Accessories / Devices	Holding clamps for laboratory flasks	Handle adjustment	Test tube holder	Tabletting punch holder	Silicone knob mat	Fixation clamps
DL 102 H	EK 10, EK 25, EK 50, EK 100, EK 250	GV 3	RG 2	-	SM 3	-
DL 156 BH	EK 10, EK 25, EK 50, EK 100, EK 250	GV 3	-	-	SM 6	FE 12
DL 255 H	EK 10, EK 25, EK 50, EK 100, EK 250	GV 3	-	-	SM 5	FE 12
DL 510 H	EK 10, EK 25, EK 50, EK 100, EK 250	GV 10	-	-	-	-
DL 512 H	EK 10, EK 25, EK 50, EK 100, EK 250	GV 10	-	-	-	-
DL 514 BH	EK 10, EK 25, EK 50, EK 100, EK 250	GV 10		TH 14 B-S 22 TH 14 B-S 28	-	-
DL 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

Information

Foil test

Function testing of an ultrasonic bath

A foil test[1] is recommended for testing ultrasonic baths. This should be conducted upon initial startup and at regular intervals thereafter (e.g. every 3 months). The frequency of testing is the responsibility of the user.
The foil test is a simple procedure for demonstrating the intensity and distribution of cavitation in an ultrasonic bath. It involves stretching aluminium foil over a foil testing frame, which will be perforated or destroyed to a certain degree by cavitation, depending on sonication time.

For purposes of reproducibility, it is **important that the test conditions remain constant**:

- Filling the oscillation tank to the filling level mark
- Temperature of the sonication fluid
- Degassing time
- Positioning of frame
- Foil type (brand, thickness)
- Sonication time
- Type and concentration of ultrasonic agent

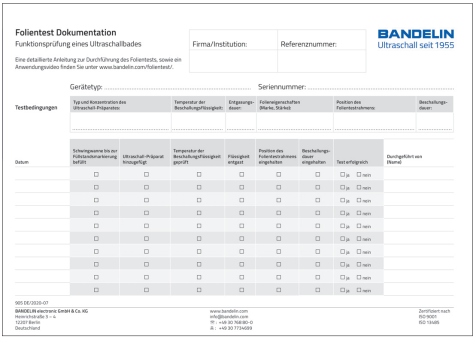
Fluid for the foil test:
In order to obtain a sufficiently strong cavitation effect, the foil test also requires the surface tension of the water used to be reduced using surfactant preparations.
We recommend the following ultrasonic agents:

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 determined from the perforated surface of the foils.
The perforated areas of all foils should have approximately the same extent and distribution – the results are never identical.
Consistency of process validation, e.g. for treatment of medical devices, can only be ensured by regular foil tests.

As documentation of the test results, the following document templates can be used.
A PDF for downloading and a usage video are available at http://bandelin.com/folientest/.



Folientest Dokumentation
Funktionsprüfung eines Ultraschallbades

Eine detaillierte Anleitung zur Durchführung des Folientests, sowie ein Anwendungsvideo finden Sie unter www.bandelin.com/folientest/.

Firma/Institution:	Referenznummer:

BANDELIN
Ultraschall seit 1955

Gerätetyp: .... Seriennummer: ....

Testbedingungen

Typ und Konzentration des Ultraschall-Präparates:	Temperatur der Beschallungsflüssigkeit:	Entgasungs-dauer:	Folieneigenschaften (Marke, Stärke):	Position des Folientestrahmens:	Beschallungs-dauer:
....	....	....	....	....	....

Datum	Schwingwanne bis zur Füllstandsmarkierung befüllt	Ultraschall-Präparat hinzugefügt	Temperatur der Beschallungsflüssigkeit geprüft	Flüssigkeit entgast	Position des Folientestrahmens eingehalten	Beschallungs-dauer eingehalten	Test erfolgreich	Durchgeführt von (Name)
	☐	☐	☐	☐	☐	☐	☐ ja ☐ nein	
	☐	☐	☐	☐	☐	☐	☐ ja ☐ nein	
	☐	☐	☐	☐	☐	☐	☐ ja ☐ nein	
	☐	☐	☐	☐	☐	☐	☐ ja ☐ nein	
	☐	☐	☐	☐	☐	☐	☐ ja ☐ nein	
	☐	☐	☐	☐	☐	☐	☐ ja ☐ nein	
	☐	☐	☐	☐	☐	☐	☐ ja ☐ nein	
	☐	☐	☐	☐	☐	☐	☐ ja ☐ nein	
	☐	☐	☐	☐	☐	☐	☐ ja ☐ nein	
	☐	☐	☐	☐	☐	☐	☐ ja ☐ nein	

905 DE/2020-07

BANDELIN electronic GmbH & Co. KG
Heinrichstraße 3 – 4
12207 Berlin
Deutschland

www.bandelin.com
info@bandelin.com
☎: +49 30 768 80-0
Fax: +49 30 7734699

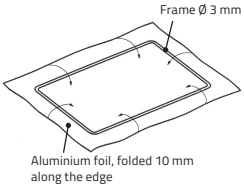
Zertifiziert nach
ISO 9001
ISO 13485

Foils can also be suitably archived (scanning, photos, etc.).
This allows the foils to be compared at any time.

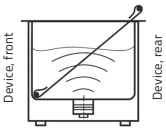
1 Investigations on test procedures for ultrasonic cleaners. IEC/TR 60886 (1987-03)

Conducting the foil test

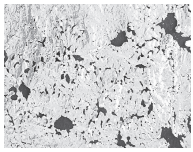
1. Fill oscillating tank to the filling level mark with water and an appropriate ultrasonic agent, in the concentration specified by the manufacturer.
2. Degas the liquid (see user instructions)
3. Stretch aluminium foil (household foil, 10 µm to 25 µm thick) over the foil testing frame.
   Depending on the tank size, it is possible that the frame will protrude outside the tank.
   It is sufficient to cover the submerged portion of the frame with foil.



4. With the ultrasound switched off, position or fix the foil-wrapped frame at an angle across the middle of the oscillating tank (see video).



5. Switch on the ultrasound and sonicate the foil for at least one minute until visible perforations 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, take the foil out and let it dry.
7. The foil must be perforated, see photo. Otherwise, we recommend having the device checked by the service department at BANDELIN electronic GmbH & Co. KG.



8. Archiving of foil with test date and serial number of the ultrasonic bath. The foil test document template can also be completed and archived.
9. After the test, the oscillating tank must be thoroughly rinsed out to remove any loose foil particles.

Type	Order no.	for
FT 1	3190	DT 31/H, DT 52/H RK 31/H, RK 52/H
FT 4	3074	DL 102 H, DL 255 H, DT 100/H, DT 102H/H-RC, DT 103, DT 106, DT 255/H/H-RC, RK 100/H, RK 102 H, RK 103, RK 106, RK 255/H
FT 6	3222	DL 156 BH, DT 156/BH, RK 156/BH
FT 14	3084	DL 510 H, DL 512 H, DL 514 BH, DT 510/H/H-RC, DT 512 H, DT 514H/BH/BH-RC, DT 510 F, RK 510/H, RK 512 H, RK 514/H/BH, ZE 514/...DT
FT 36	3673	DT 1028 F, ZE 1031/1032/...DT
FT 37	3674	DT 1058 M, ZE 1058/1059/...DT
FT 38	3672	MC 1001/E
FT 40	3094	DL 1028 H, DT 1028/H/CH, RK 170 H, RK 1028/H/C/CH, RK 1040
FT 42	3224	TRISON (TE 3000)
FT 45	3204	DT 1050 CH, RK 1050/CH

Suitable foil testing frames can be ordered from BANDELIN electronic GmbH & Co. KG.
The foil testing frames are suitable for a wide range of tank dimensions. Aluminium foil is also required for conducting the test, but this is not included in the delivery.

BANDELIN electronic GmbH & Co. KG
Heinrichstraße 3–4
12207 Berlin
Deutschland

www.bandelin.com
info@bandelin.com
☏ + 49 30 768 80 - 0
🖷 + 49 30 773 46 99

Zertifiziert nach
ISO 9001
ISO 13485

Note:

The user instructions in this and other languages, as well as further information, can be found in the enclosed CD.