SONOPULS
Standard and booster horns for the HD 5000 and HD 4000 series

Standard and booster horns are made of a titanium alloy (TiAl6V4) in various shapes and sizes. They transmit the vibrations from the ultrasonic converter to the probe and increase the amplitude. The corresponding horn is firmly bolted to the ultrasonic converter. All standard and booster horns are equipped with a fixed threaded pin. This enables quick and easy assembly to the ultrasonic converter using the corresponding tool without any additional aids. Horns labelled SH are suitable for connecting probes of different diameters, horns labelled TH have a fixed working tip. The external thread enables the tight connection of vessels with standard ground joint NS 29/32 or 45/40 using standard ground joint adapters NA. Reaction vessels with a DN 20 flange can be mounted tightly using the FA flange adapter.

Horns for interchangeable probes

SH standard and booster horns offer the option of connecting probes with different diameters.

	Standard horns	Booster horns	
Type	SH 100 G	SH 200 G	SH 400 G
For UW	100 / 5100	200 / 5200	400
Code No.	3731	3732	3734

Horns with fixed working tip

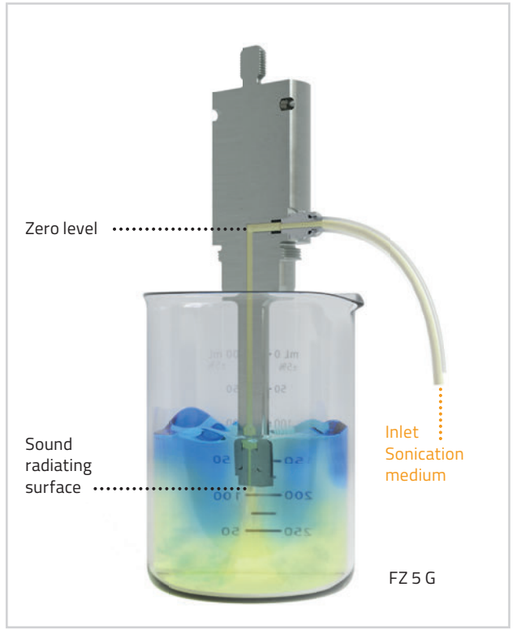
When sonicating samples in screw-on flow-through cells, e.g. DG 4 G, only the flat tip, but not a long probe, can be used as the probe. If the sonication medium is a suspension, the medium can penetrate the titanium disc flat tip/horn screw connection - regardless of how tight the connection is. This leads to an overload of the generator and thus to device failure. To prevent the medium from penetrating, we recommend horns with a fixed working tip.

	Standard horns	Booster horns	
Type	TH 100 G	TH 200 G	TH 400 G
For UW	100 / 5100	200 / 5200	400
Code No.	3968	3969	3970

Flow-through horns FZ

The premixed media are fed into the vibration-free zero plane of the flow-through horn and downwards through the internal channel to the sound-emitting surface. In the titanium disc, the media are exposed to the ultrasonic effect and fed into the sample vessel via the opening in the titanium disc (Ø 1.5 mm).

	Flow-through horn	Flow-through booster horn
Type	FZ 5 G	FZ 7 G
For UW	100 / 5100	200 / 5200
Code No.	490	452



Combination of two media with the flow-through sonication vessel DG and the flow-through horn FZ

A flow-through horn FZ is used instead of a standard or booster horn. The first medium is fed into the sonication chamber via the inflow of the flow -through cell DG 4 G, the second medium via the inflow of the flow-through horn FZ. This medium enters the sonication chamber of the DG via the opening in the sound-emitting surface of the flat tip. Both media can thus be mixed well.

The degree of sonication is determined by the amplitude displayed at the ultrasonic generator and the flow rate of the pump. The flow-through vessel DG is equipped with a cooling jacket, e.g. to prevent excessive heating if the medium remains in the sonication chamber for a longer period of time.

Sleeve adapter NA

Vessels with the standard ground joints NS 29/32 or NS 45/40 are often used for chemical reactions in laboratories.
They are screwed onto the external threads of standard, booster or flow-through horns and inserted into a vessel with standard ground joint.

Sealing ring
Material: EPDM
Hardness: 70 Shore A

Type	NA 29 G	NA 45 G
For	▪ NS 29 / 32 ▪ SH 100 G / SH 200 G ▪ TH 100 G / TH 200 G ▪ FZ 5 G / FZ 7 G with probes, Ø max. 13 mm	▪ NS 45 / 40 ▪ SH 100 G / SH 200 G / SH 400 G ▪ TH 100 G / TH 200 G / TH 400 G ▪ FZ 5 G / FZ 7 G with probes, Ø max. 25 mm
Material	PTFE	PTFE
Code No.	540	487

Flange adapter FA 3 G

With the FA 3 G flange adapter, reaction vessels with a DN 20 flange can be mounted on standard or booster horns with an external thread and connected probes of Ø 2–25 mm. Vibration-free coupling is ensured by the flat sealing flange, the sealing ring encloses the standard or booster horn.
The probe must only be immersed about 1.5-2 cm into the medium to be sonicated. The energy loss is considerable if it is immersed too deeply.

Sealing ring
Material: EPDM
Hardness: 70 Shore A

Type	FA 3 G
For	SH 100 G / SH 200 G / SH 400 G
Compatible with	Probe, Ø 2–25 mm
Material	stainless steel 1.4571
Mounting holes	4 pcs. M 10 (DIN 2573)
Code No.	474

Selection and use of probes

The probes are thermostable, autoclavable and resistant to almost all corrosive media. They are made from a titanium alloy (TiAl6V4 / 3.7165).

The choice of probe depends on several factors: the desired power density, the sonication volume, the shape and size of the sonication vessel, the amplitude and the temperaturesensitivity of the sample. It should be noted that the radiation surface is only located at the probe tip and not at the sides. Depending on the application and process requirements, one or more factors may be decisive for the selection of the probe.

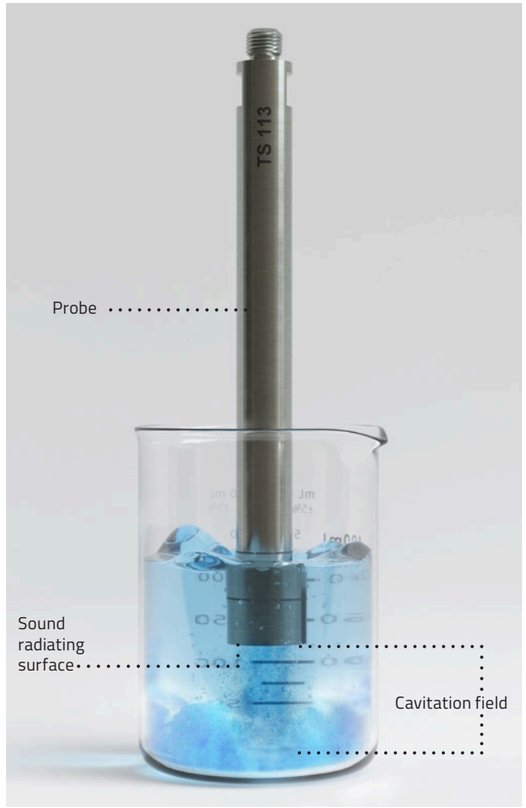
An approximate sample volume range is recommended for each probe. This is only a guide value. The volume to be sonicated is application specific. For example, the 13 mm probe, mounted on the UW 200, can be used for around 20-900 ml. Depending on the size and shape of the sonication vessel, it may be difficult to sonicate a 20 ml volume with the 13 mm probe; a micro tip may be a better option. The size and shape of the sample vessel is therefore another factor when selecting a probe.

Probes with a small radiation surface are recommended for sonication of samples in small, slim vessels, never for samples larger than 50 ml. These probes work with high intensity and are therefore designed for a short sonication time. Probes with a small radiation surface (also known as micro tips) in particular generate a very high level of heat in small volumes. In the case of temperature-sensitive samples, work should be carried out in pulsed mode or the sample should also be cooled.

Larger volumes require a larger probe radiation surface. For example, a 38 mm probe is more suitable for sonicating a 1 litre sample volume than a 25 mm probe.

The use of sample containers with a conical base increases the possible immersion depth and thus reduces the risk of splashing. Indirect sonication is another way of processing very small volumes. Compared to direct sonication, the power density decreases here. However, a very high power density is required to break down yeast cells, for example.

The sound distribution corresponds to a series of "hemispherical shells", whereby these increase in radius with increasing distance from the sound-emitting surface. At the same time, the power density decreases.



The smaller the diameter of the probe tip, the higher the power density [W/cm²] or cavitation strength with the same electrical power consumption!

The cavitation process is associated with erosive material removal from the tip of the probe. After some operating time, this is visible as a "crater landscape" on the sound-emitting surface of the probe. The higher the amplitude, the higher the material removal and the shorter the life time. This means that the smaller the diameter of the emitting surface, the shorter the life time at the same power. Assuming continuous sonication (100 % amplitude, without pulsation), the life time of a probe with a small radiating surface is limited to approx. six hours. The use of a probe with a suitable radiation surface not only reduces the process duration, but also increases the life time of the probe. However, most applications are in the seconds or minutes range. In some cases, the erosion that occurs during direct sonication is undesirable as it always mixes with the sonication medium (e.g. in sample preparation for metal analysis or similar). To avoid erosion, see "Indirect sonication".

Basic probe shapes and their application features

The design of the probe determines the amplification factor of the amplitude and thus, in conjunction with the power provided by the ultrasonic generator, the energy input into the medium. At constant electrical power, the sound intensity transmitted into the medium therefore increases in inverse proportion to the emitting surface of the probe. This means that probes with the smallest emitting surfaces transmit the greater power per surface area [W/mm²] through high amplitudes, depending on the electrical power consumption of the ultrasonic generator.

Micro tip
Stepped design,
Use for processing small volumes in reaction cups or centrifuge tubes

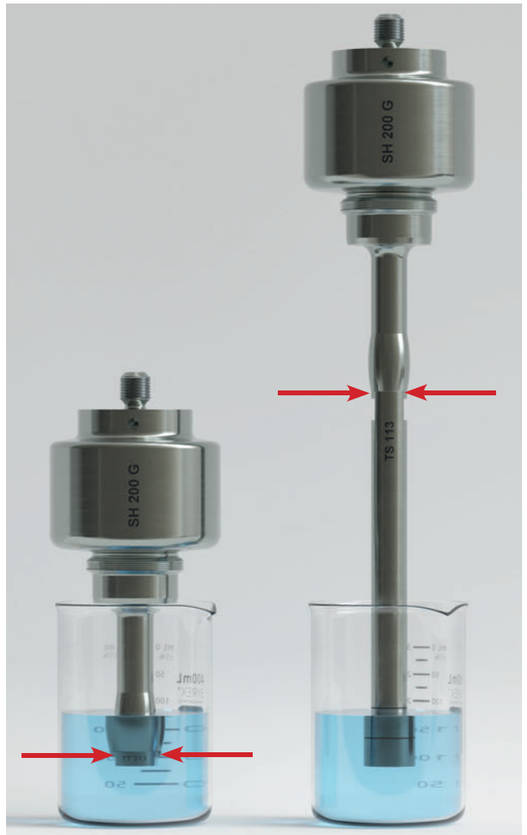
Cone-shaped probe
Conical design, used for processing medium volumes in small beakers, cooling vessels, flow-through vessels or rosettes cells made of glass

Cylindrical probe
Rod shape, used for processing larger volumes in beakers, cooling vessels, flow-through vessels or rosette cells made of glass

Stepped probe
Wide range for small to large volumes from ml quantities to 3 litres in beakers, cooling vessels, flow-through vessels or rosette cells

flat tip vs. probe

The use of a flat tip enables the "sound-emitting surface" to be replaced cost-effectively if the homogeniser is used intensively and frequently. However, when using the flat tip, the screw connection of the flat tip/horn must be immersed into the sonication liquid. If the assembly is not sufficiently tight, very fine particles from the sample liquid can enter the gap and damage the mating surfaces of the system. This will cause the device to malfunction. When using long probes, on the other hand, the penetration of sample material into the screw connection can be ruled out. The use of a flat tip instead of a long probe should therefore be considered taking into account the sample material and the expected usage intensity.



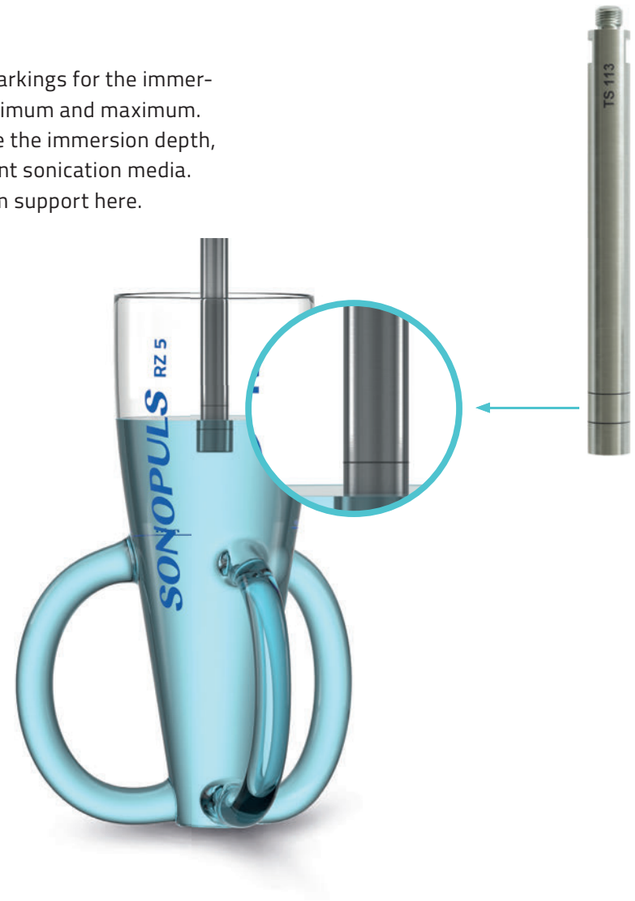
Screw connection horn/titanium disc and horn/probe, cylindrical

Fixed threaded pin on the probes

All probes are equipped with a fixed threaded pin. This enables quick and easy installation on the standard or booster horn using the tool supplied.

Marking immersion depth

Cylindrical probes have two markings for the immersion depth: recommended minimum and maximum. It is often difficult to recognise the immersion depth, especially with non-transparent sonication media. The markings provide optimum support here.



Cavitation erosion test ASTM G32-92

Used for the standard test method according to ASTM G32-16 to determine the cavitation erosion on the sound-emitting surface of a test specimen (= test probe).

Test probe TS ASTM G32
Code No. 37461

The standard conditions for the test probe specified by the standard are complied with:

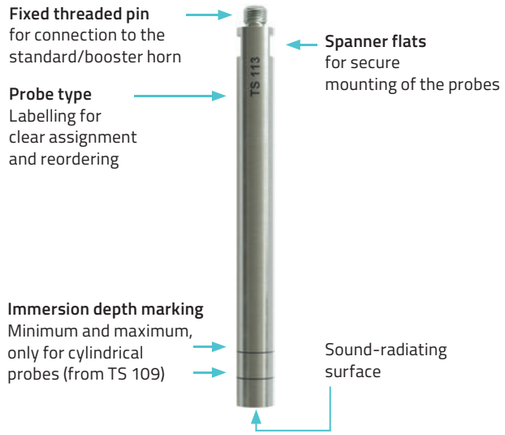
	Specification of the ASTM G32-92 standard	Test probe TS ASTM G32 for HD 4200 / 5200
Frequency [kHz]	20 ± 0.5	✓
Sound emitting surface Diameter [mm]	15.9 ± 0.,05	✓
Amplitude (peak-peak) [µm]	50 ± 5 %	✓

SONOPULS

Probes for the HD 5000 and HD 4000 series

Probes are wearing parts. High power densities occur on the sound-emitting surface. This leads to material erosion (= cavitation erosion) even on this high-strength titanium alloy and therefore limits the life time of the probe. It is therefore recommended to order two to three replacement probes when purchasing the device. The probes are matched to the corresponding working frequency.

The length specifications(*) may vary slightly due to material tolerances in the titanium alloy.



Type	TS 102	TS 103	TS 104	TS 106	TS 109	TT 213	TS 113	TS 216	TS 219	TS 225
Code No.	3740	3741	3742	3743	3744	3750	3745	3746	3747	3748
Diameter [mm]	2	3	4,5	6	9	13	13	16	19	25
Length ca. [mm]	157	147	133	128	126	5	130	137	145	153
Standard horn for HD 4100/HD 5100	SH 100 G	SH 100 G	SH 100 G	SH 100 G	SH 100 G	SH 100 G	SH 100 G	-	-	-
Booster horn for HD 4200 / HD 5200	-	SH 200 G	SH 200 G	SH 200 G	SH 200 G	SH 200 G	SH 200 G	SH 200 G	SH 200 G	SH 200 G
Amplitude HD 4050 / 5050 HD 4100 / 5100 HD 4200 / 5200 (peak-peak) [µm]	135 260 -	105 245 320	90 190 265	75 160 230	65 135 200	- 80 140	- 80 140	- - 105	- - 80	- - 50
Volumes HD 4050 / HD 5050 [ml]	0.5–20	1–25	3–50	5–75	10–100	-	-	-	-	-
Volumes HD 4100 / HD 5100 [ml]	2–25	3–50	5–75	10–100	15–150	20–200	20–200	-	-	-
Volumes HD 4200 / HD 5200 [ml]	-	5–90	5–100	10–350	10–500	20–900	20–900	25–900	25–900	30–1,000

Type	TS 413	TS 416	TS 419	TS 425	TS 425 L	TS 432	TS 438
Code No.	3752	3753	3754	3755	3759	3756	3757
Diameter [mm]	13	16	19	25	25	32	38
Length ca. [mm]	139	132	129	130	254	136	144
Booster horn for HD 4400 [mm]	SH 400 G	SH 400 G	SH 400 G	SH 400 G	SH 400 G	SH 400 G	SH 400 G
Amplitude HD 4400 (peak-peak) [µm]	260	180	130	75	75	50	40
Volume HD 4400 [ml]	100–750	250–1,000	250–1,500	500–2,000	500–2,000	500–2,500	500–3,000

Probe extension

The probe extension is used to extend the working length and to bridge distances in high vessels and is mounted between the standard/booster horn and the cylindrical probe or flat tip. Conical probes or micro tips must not be connected.

- **Probe extension TS 113 V between standard horn SH 100 G / SH 200 G and horn TS 113 or TT 213**
- **Probe extension TS 425 V between booster horn SH 400 G and probe TS 425**
- **Probe extension VS 20 between UW 5020 and MS 1.5 / 2.0 / 2.5**

Type	VS 20	TS 113 V	TS 425 V
For HD	5020	4100/4200 5100/5200	4400
Code No.	3655	3666	3667

Micro tips

Due to the different designs of the probes, different amplitude amplifications can be transferred to the respective sample to be sonicated, depending on the requirements and field of application. Due to the high power input via the relatively small radiation surface of the probe, high power densities can be achieved in the liquid media. The micro tips are mainly used for sonication of very small sample quantities, e.g. complex cell disruption in biology.

Type	MS 1.5	MS 2.0	MS 2.5
Code No.	3639	3654	3652
Diameter [mm]	1,5	2,0	2,5
Length ca. [mm]	64	59	55
Amplitude HD 5020 (tip-tip) [µm]	70	75	80
Volume HD 5020 [ml]	0,1-10	0,25-20	0,5-25

SONOPULS

Vessels for direct sonication

During direct sonication, the probe is immersed in the sample to be sonicated. The advantage of this method is the very high energy input compared to indirect sonication. Information on selecting the appropriate vessels for your application can be found in chapter 3.

All glass vessels are made of borosilicate glass. The material has very good chemical and temperature resistance and is therefore very suitable for laboratory use. Cleaning and/or disinfection can be carried out with appropriate agents in an ultrasonic bath or washer-disinfector. The glass can be autoclaved.

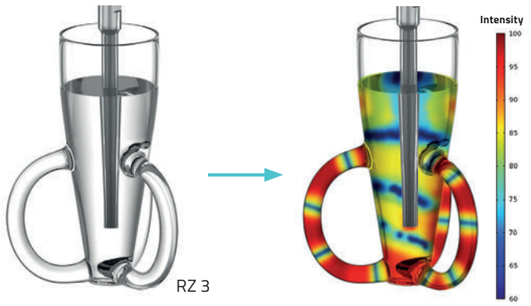
Rosette cells RZ

The rosette cells allow uniform and intensive sonication of liquid media. Due to the sound pressure, the sample is pressed against the bottom of the vessel and thus through the three side arms and can circulate well. This results in continuous mixing of the medium. When the rosette cells are placed in an ice bath, the contents are effectively cooled due to the enlarged glass surface and good circulation.

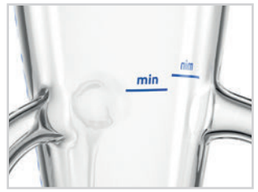
Type	RZ 1	RZ 2	RZ 3	RZ 4	RZ 5
For dia. of samples [mm]	2–3	2–6	3–13	13–25	19–25
For HD	4050/4100 4200/ 5050/5100/ 5200		4100 4200 5100 5200	4200 4400 5200	4400
Min. volume [ml]	20	30	60	260	430
Max. volume [ml]	25	50	100	410	660
Dia. internal [mm]	27	40	50	75	90
Depth [mm]	80	95	130	200	240
Code No.	3606	3607	522	3256	483

RZ 1 RZ 2 RZ 3 RZ 4 RZ 5

Intensity distribution
(Distance between probe tip
and vessel bottom = 3 cm)
Source: Berlin University of Applied Sciences (BHT)



RZ 3



Marking of the minimum fill level

Vessels for direct sonication with cooling

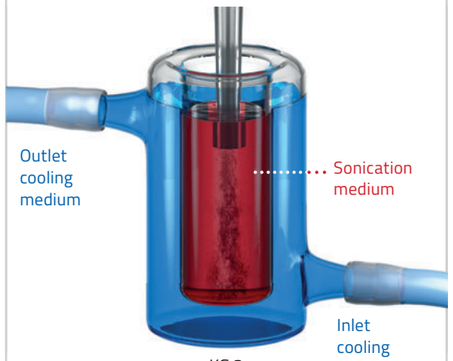
Cooling vessels KG

During sonication, mechanical energy is converted into heat (due to internal friction in the liquid), resulting in a more or less high heating of the samples. Cooling of the medium may therefore be necessary for temperature-sensitive samples.
The sample vessels can be placed in an ice bath, for example. However, the immersion depth of the probe is not visible. A better alternative is the KG cooling vessels with cooling jacket for connection to an external cooler. This enables controlled temperature control during sonication.

Type	KG 3	KG 5
For dia. of probes [mm]	2–13	13–25
For HD	4050/4100 4200/ 5050/5100/ 5200	4200/5200
Max. volume [ml]	20	90
Dia. internal [mm]	20	35
Depth [mm]	55	95
Cooling jacket	✓	✓
Code No.	536	481

KG 3 KG 5

The cooling medium is pumped through the cooling jacket in a circuit using a thermostat.
This allows a quick response to a temperature increase.



KG 3

SONOPULS
Flow-through vessels for direct sonication

Flow-through cells are used for the continuous processing of large batches of low-viscosity solutions. They are well suited for dispersing, emulsifying, mixing or homogenising.

Using a pump, the liquid is pumped from below against the sound-emitting surface of the probe, passes directly through the cavitation field and leaves the chamber via the outlet. A pump must be provided by the user.

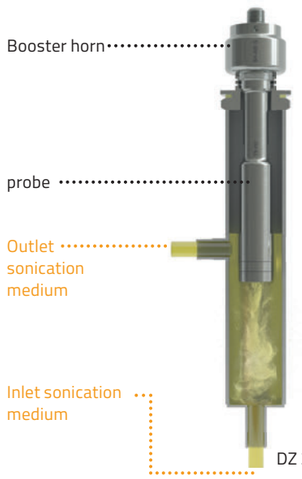
If intensive sonication is required, batches can also be routed through the system several times. The sonication level depends on the set amplitude and the flow rate.

Flow cell DZ 300 E

Material: Stainless steel 1.4404
The connection is made directly to the external thread of the booster horn. The DZ 300 E is particularly suitable for emulsifying, mixing or homogenising. The flow cell is tightly sealed when screwed onto the booster horn. This prevents air from entering.

Type	**DZ 300 E***
For HD	4400
Compatible with	SH 400 G
Max. through-flowrate [l/h]	130
Max. pressure [bar]	4
Code No.	3822

*cannot be used with TS 438



Continuous sonication of larger volumes.
The sample is pumped into the flow cell via the inlet at the bottom, passes through the cavitation field and exits via the outlet. The sample can be sonicated several times. The degree of sonication is determined by both the amplitude and the flow rate.

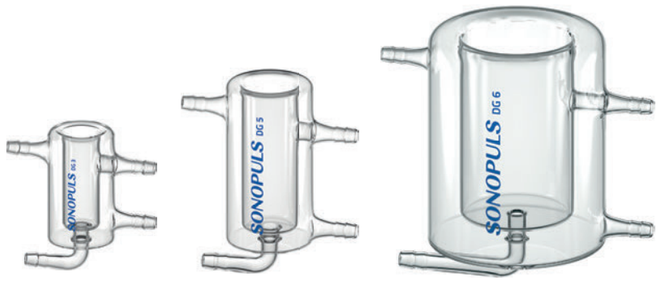
SONOPULS

Flow-through vessels for direct sonication with cooling

DG flow-through vessels

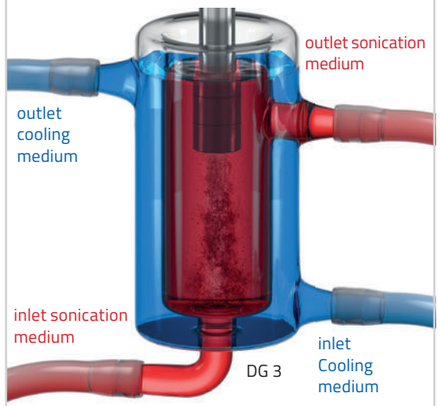
With cooling jacket. Continuous sonication of samples with a flow rate of up to 30 l/h is possible.
The cooling jacket allows the temperature to be controlled by liquid coolant during sonication.

Type	DG 3	DG 5	DG 6
For dia. of probe [mm]	2–13	13–25	25–38
For HD	4050/4100 4200/ 5050/5100/ 5200		4200 4400 5200
Max. flow-through rate [l/h]	5.6	30	30
Dia. internal [mm]	20	35	71
Depth [mm]	55	100	120
Cooling jacket	✓	✓	✓
Code No.	538	482	3819

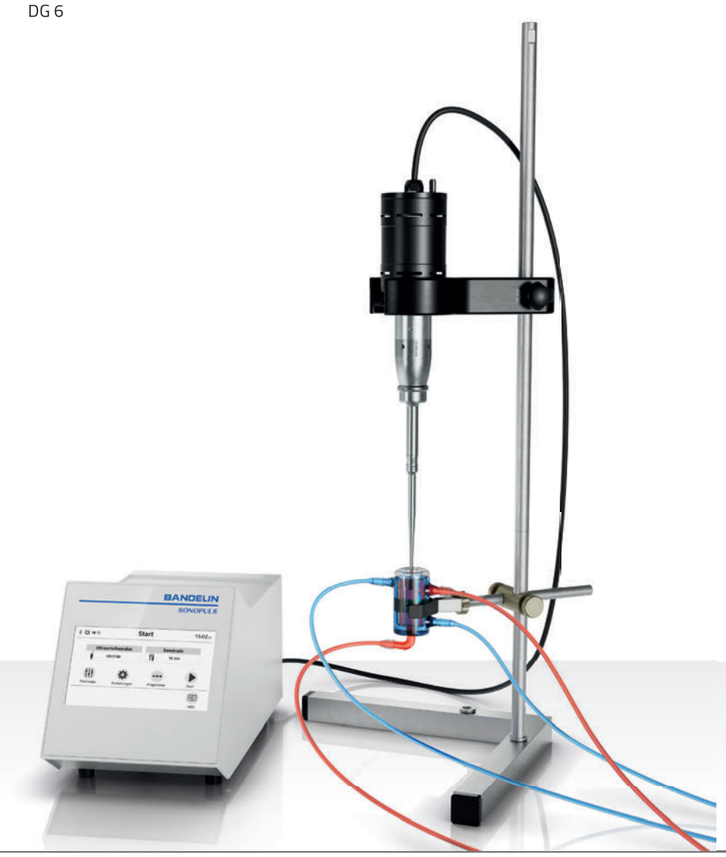


DG 3 DG 5 DG 6

The cooling medium is pumped through the cooling jacket in a circuit with the aid of a thermostat. This enables a quick response to a temperature increase. The sonication medium is channelled directly against the sound-emitting surface of the horn.



DG 3



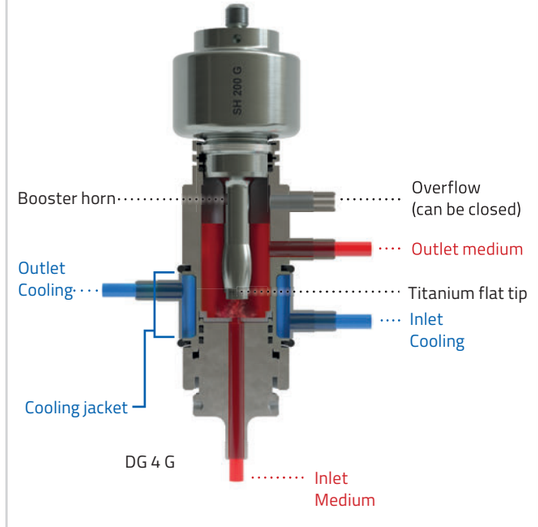
Flow-through PA vessel DG 4 G

Material: Stainless steel 1.4301
The connection is made directly to the external thread of the standard or booster horn. The DG 4 G is particularly well suited for emulsifying, mixing or homogenising. The sonication vessel is "hermetically sealed" when screwed onto the horn (the overflow is also sealed).
This prevents air from entering.
Infectious substances can also be sonicated.
The sample liquid is fed directly into the cavitation field from below via the inlet, sonicated and discharged via the outlet. An external 2-channel pump must be provided. The sonication level is controlled via the amplitude setting on the generator and the flow rate.
The medium can also be sonicated in a circuit to intensify the process. The integrated cooling jacket is used to regulate the sample temperature. An external cooler must be provided by the customer.

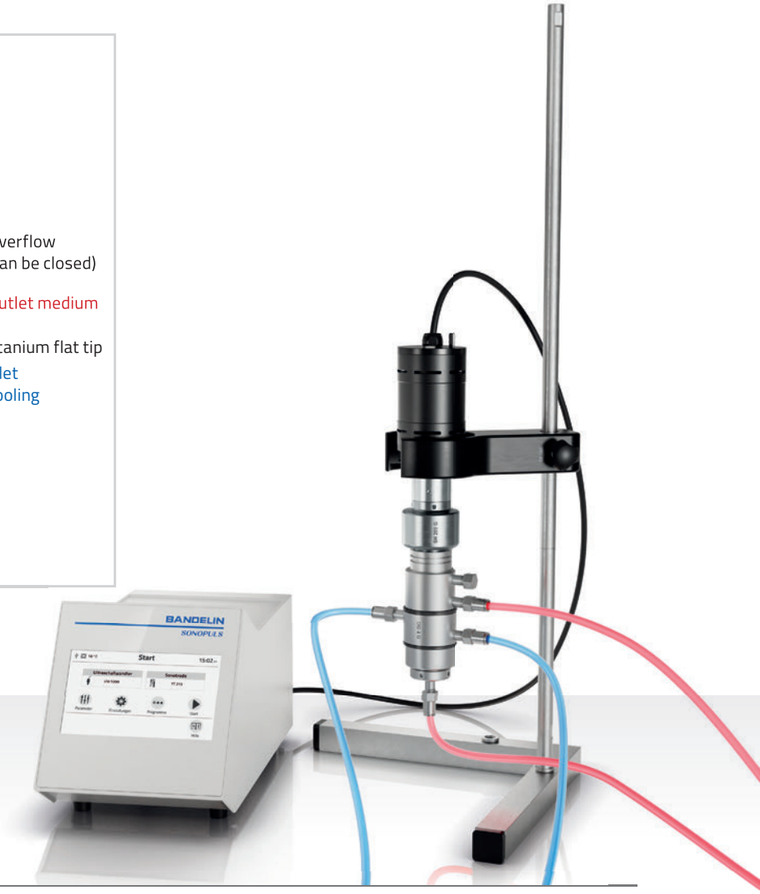
DG 4 G

Type	DG 4 G
For HD	4100 / 4200 / 5100 / 5200
Compatible with	SH 100/200 G with TT 213/TH 100/200 G
Max. flow-through rate [l/h]	50
Max. pressure [bar]	2
Cooling jacket	✓
Code No.	3608

Bottom view DG 4 G, Baffle plate with hole



DG 4 G



SONOPULS
Vessels for indirect sonication

Indirect sonication prevents direct contact between the probe and the sample. The function corresponds to a small, high-intensity ultrasonic bath. The ultrasonic power is transferred into the sample vessels via the contact liquid, titanium particles from the probe are excluded. Indirect sonication is used in particular for the sonication of very small sample quantities: foaming or sample loss are excluded.
The method is well suited for sonicating pathogenic samples - cross-contamination is ruled out. Cooling of the samples is also possible. We recommend connecting the external chiller LABOCOOL LC 200.

It is important that the fill level always remains constant and that the reaction vessels do not float. Otherwise, sonication results could be impaired. The cover plate of the sample holder prevents floating. Adding ice chips is also a way of cooling, but does not ensure a constant temperature. If ice chips are used, they must be located on the sides of the reaction vessels. Below the reaction vessels, they can have a negative influence on the result. The power density [W/l] introduced is approx. 150 times higher than in a "normal" ultrasonic bath, but lower than with direct sonication using a probe.

TR 110 disc resonator

Material: Titanium TiAl6V4 (3.7165)
Equipped with a fixed threaded pin. For quick and easy installation with the specified tool.
The TR 110 disc resonator enables an indirect Intensive sonication of the smallest sample quantities, e.g. bacteria, in up to 14 closed sample vials (reaction cups). The uniform sound field guarantees reproducible results in all vials. Indirect sonication prevents both contamination of the samples by the probe ablation and cross-contamination. The ultrasonic power is transferred to the respective reaction cups via a contact liquid. In addition, the disc resonator has inlet and outlet connections so that the samples can be tempered via the reservoir. For stationary operation, inlets and outlets can be short-circuited using a hose bend.
In cooling mode, inlets and outlets must be connected to a peristaltic pump with a low flow rate or a cooling circuit via suitable hoses.

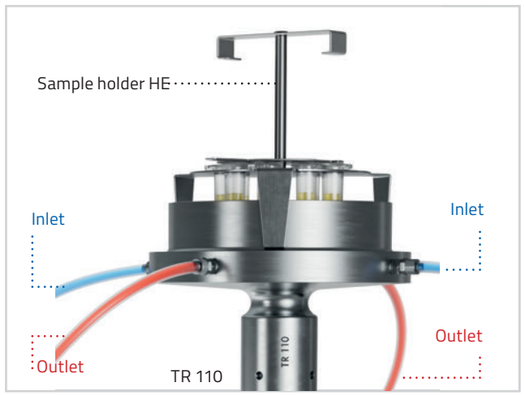
Type	Code No.	For HD	Inner diameter [mm]	Depth [mm]	Capacity [ml]	Connection type for the hoses	Power density [W/l]
TR 110	3902	4200 / 5200	110	25	190 (stationär)	M5 thread	790

Holders for every size of reaction vessel

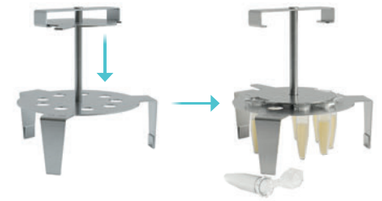
Material: Stainless steel 1.4301
The various sample holders can hold up to 14 reaction cups. Depending on the vessel size, you can choose between four different holders. They are positioned on the edge of the cup booster using a curved handle.

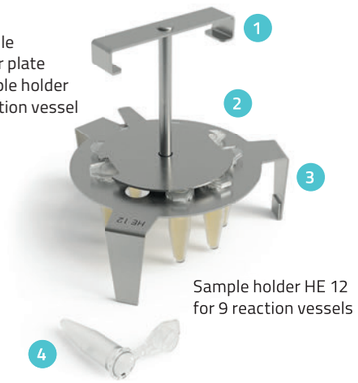

Sample holders HE 6, HE 12, HE 13 and HE 17

Type	Code No.	For	Hole diameter [mm]	Number of holes
HE 6	3903	PCR-Tubes	6	14
HE 12	3904	Reaction cups 0.5/1.5/2.0 ml	11.5	9
HE 13	3905	Polystyrene tubes, long, with/without screw cap 5 ml	13	9
HE 17	3906	5 ml tube	17	9



The reaction cups must be immersed in the contact liquid in the reservoir of the disc resonator. The cover plate prevents the reaction cups from floating during operation.


Cover plate prevents floating



Sample holder HE 12 for 9 reaction vessels

SONOPULS

Vessels for indirect sonication

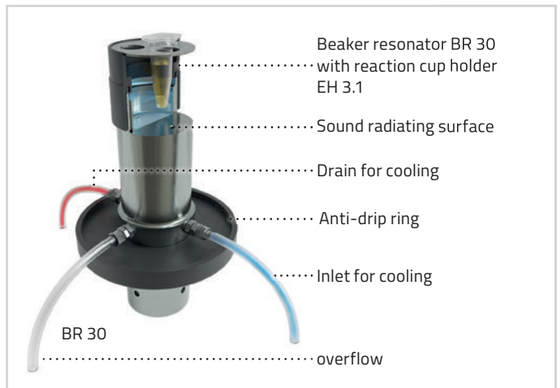
Cup booster BR 30

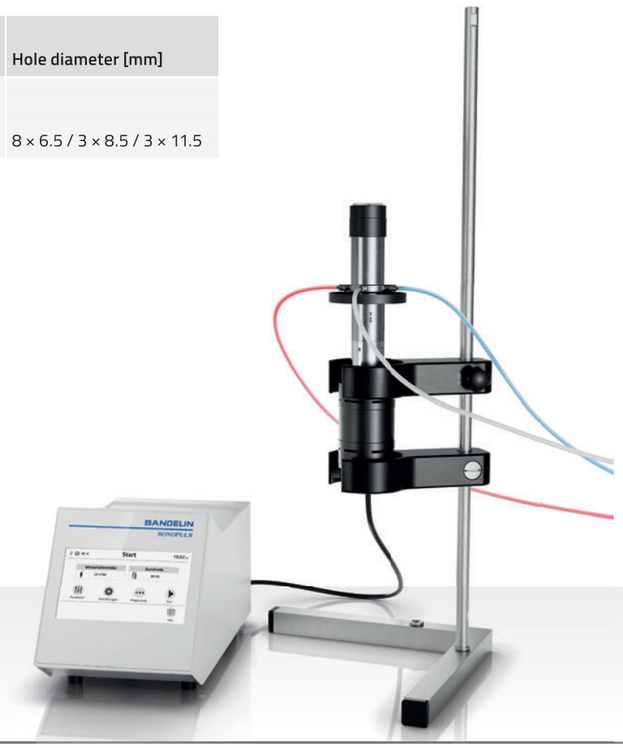
Material: Titanium TiAl6V4 (3.7165)
The Cup booster is designed for intensive, indirect sonication of the smallest sample quantities, e.g. bacteria in closed sample vessels (microtubes). The samples are placed into the BR 30 with the reaction cup holder EH 3.1. In addition, the Cup booster possesses inlet, outlet, and overflow connections so that the samples can be tempered by the reservoir. In stationary operation, the inlet and outlet can be shorted with the help of a hose bend. In cooling mode, the inlet and outlet are to be connected through suitable hoses to a hose pump with a low output. The beaker resonator is mounted directly on the ultrasonic converter. It is equipped with a fixed threaded pin for easy mounting. Quick and easy assembly with the specified tool is guaranteed.

Cup booster BR 30 and reaction cup holder EH 3.1

Type	Code No.	For HD	Inner diameter [mm]	Depth [mm]	Capacity [ml]	Connection type for the hoses	Power density [W/l]
BR 30	7510	4100 / 4200 / 5100 / 5200	32	15	12	3 hose screw connections with cap nut and sealing ring	12,500

Type	Code No.	For	Material	Hole diameter [mm]
EH 3.1	7527	3 × 1 ml or 2 ml reaction cups 3 × 0.5 ml reaction cups 8 × 0.2 ml PCR-Cups	Stainless steel and POM	8 × 6.5 / 3 × 8.5 / 3 × 11.5





Cup horn BB 6

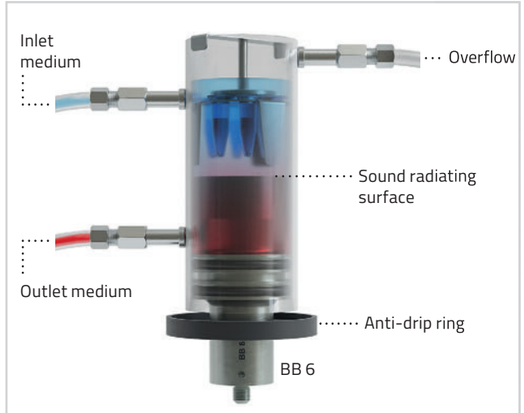
Material: Titanium TiAl6V4 (3.7165) / Makrolon
The cup horn is designed for indirect sonication of the smallest sample quantities, e.g. bacteria, in closed sample vessels (microtubes). The samples are placed in the BB 6 with the EH 6 microtube holder.
In addition, the cup horn possesses inlet, outlet, and overflow connections so that the samples can be tempered.
For stationary operation, the inlet and outlet can be closed using the accompanying screw caps.
It is equipped with a fixed threaded pin for easy mounting.
Quick, easy and direct installation on the ultrasonic converter is possible with the specified tool.

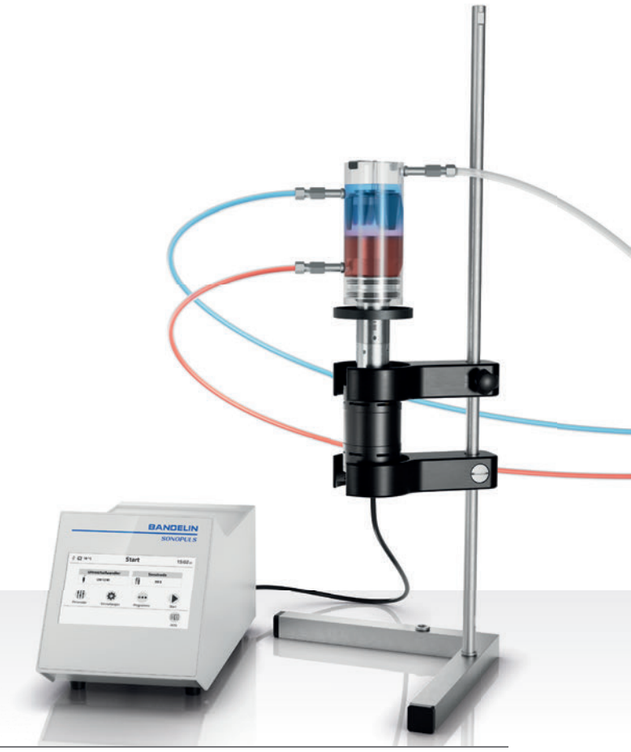
For temperature-controlled application with the *new recirculating chiller* **LABOCOOL** LC 200 suitable.

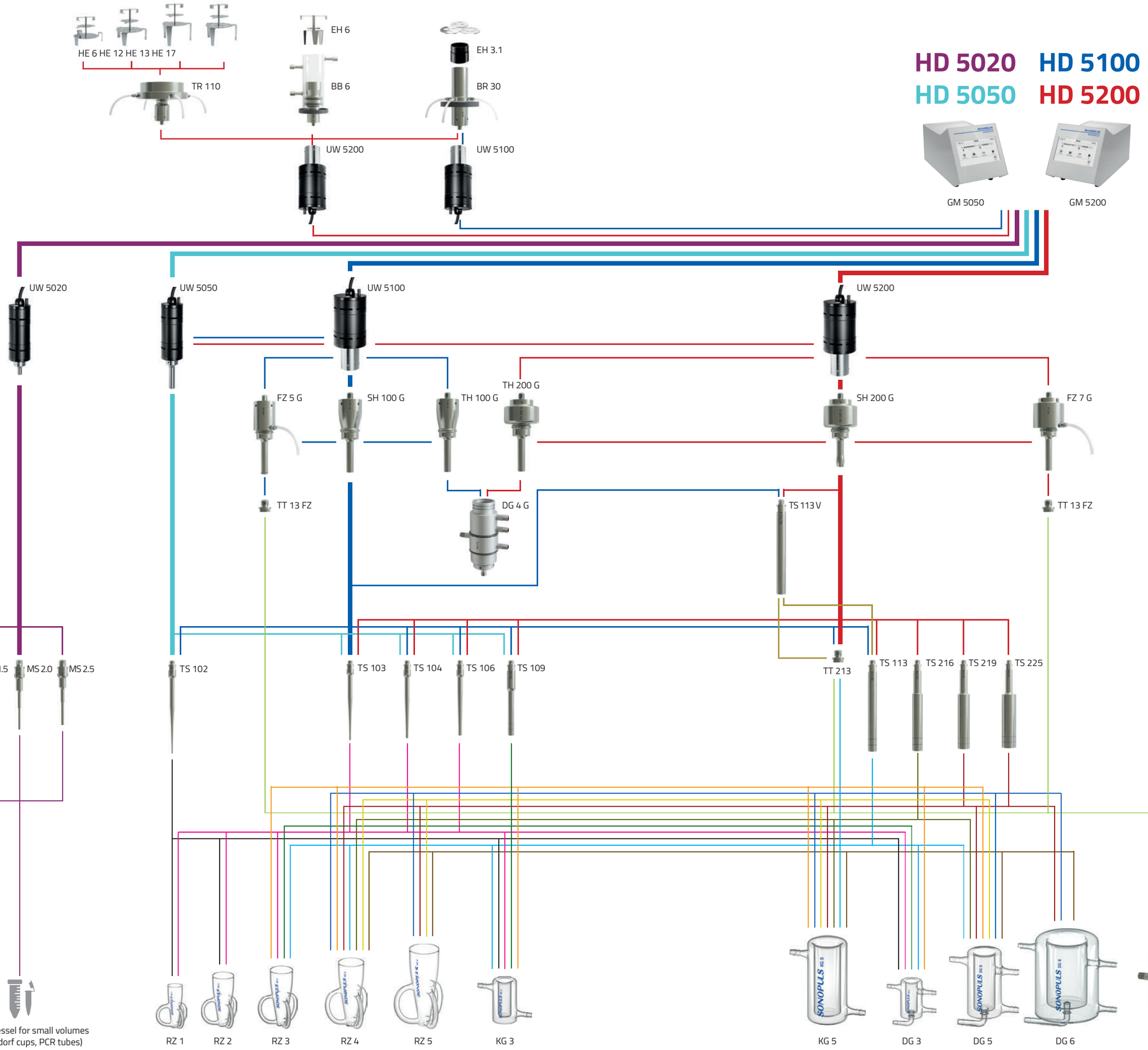
Cup horn BB 6 and reaction cup holder EH 6

Type	Code No.	For HD	Inner diameter [mm]	Depth [mm]	Reservoir-volumen [ml]	Connection type for the hoses	Power density [W/l]
BB 6	3605	4200 / 5200	64	167	200	Hose fittings 5 × 3 mm	750

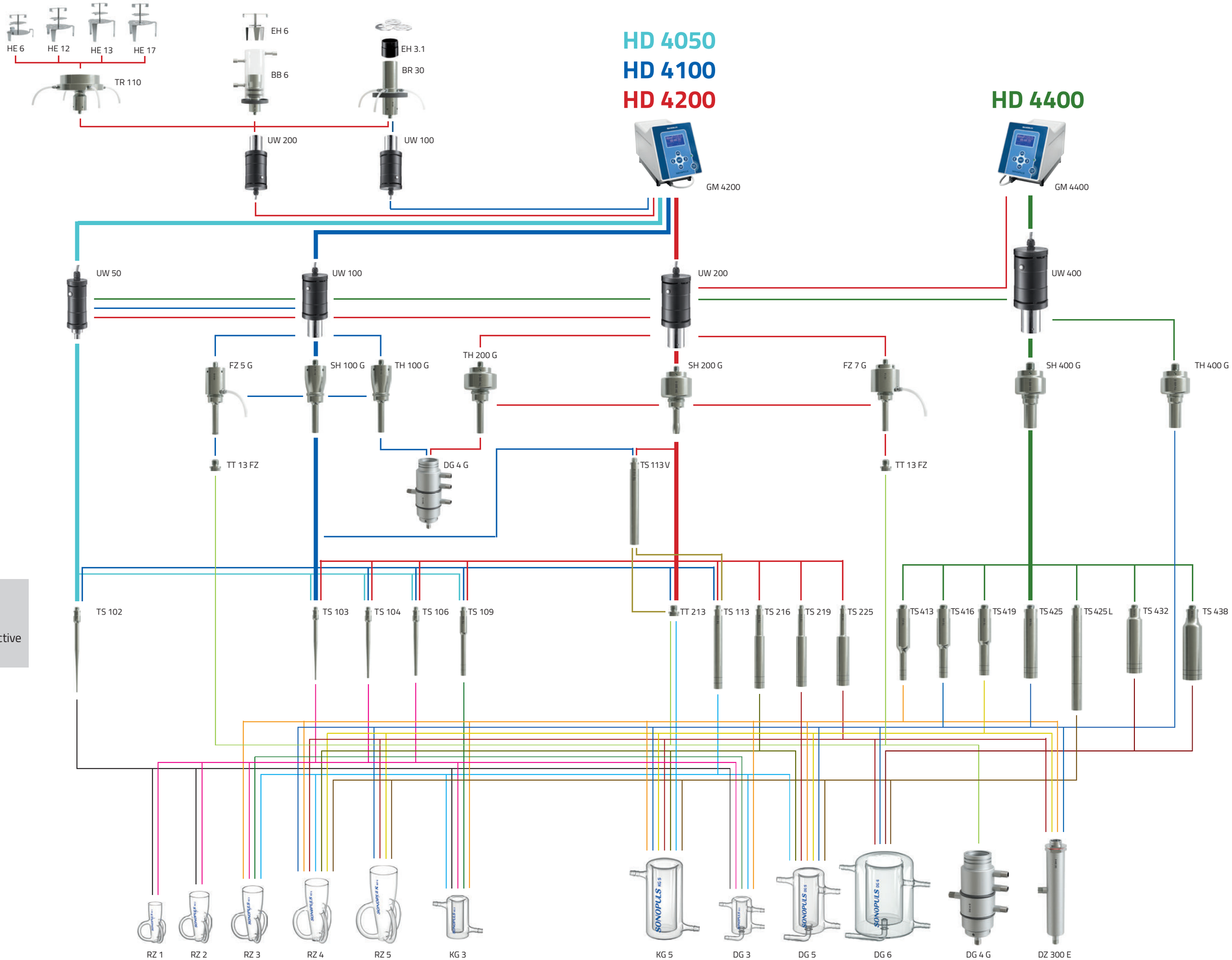
Type	Code No.	For	Material	Hole diameter [mm]
EH 6	7503	6 × 1.5 / 2 ml	Stainless steel	11.5







The thick lines represent the respective SONOPULS sets.



The thick lines represent the respective SONOPULS sets.

Stand, Sound proof box, Recirculating chiller, Temperature sensors and Foot switch

With the standard set, BANDELIN already supplies a ready-to-use device. A comprehensive range of accessories is available for customised adaptations to the applications.

The most practical and popular accessories for the most common applications are presented in more detail below.

Possible accessories:

Stand HG 40

Sound proof box LS 40

Temperature sensors TM 50 and TM 5000

Foot switch TS 8

Recirculating chiller LABOCOOL LC 200

Stand HG 40

Material: Stainless steel 1.4301 and POM
The HG 40 offers a firm stand and flexible handling for adjusting the holder for the ultrasonic converter with probe. The positioning of the sonication vessel can be significantly facilitated by an additional holder with support table. Sufficient free movement for the user is guaranteed.

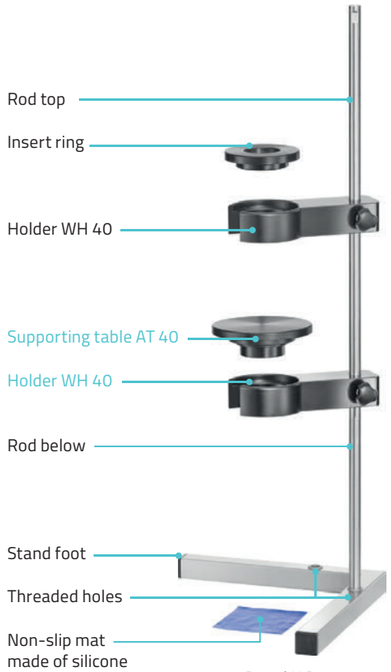
Scope of delivery:

- Holder WH 40
- Insert ring
- Non-slip mat made of silicone

Optional accessories:

- Second holder WH 40
- Supporting table AT 40

Type	HG 40	WH 40	AT 40
For HD	2070.2 / 2200.2 / 3100 / 3200 / 3400 4050 / 4100 / 4200 / 4400 / 5020 / 5050 / 5100 / 5200		
Code No.	3681	3900	3901



Stand HG 40

One holding frame, suitable for all SONOPULS ultrasonic converters

All ultrasonic converters from the 5000 series and the 4000, 3000 and 2000 series can be inserted into the holding-frame.
For the ultrasonic converters UW 5020, 5050 and UW 50, the supplied retaining ring is required.

Insert ring

Ultrasonic converter UW 5200

Ultrasonic converter UW 5050

HD 3100 with HG 40

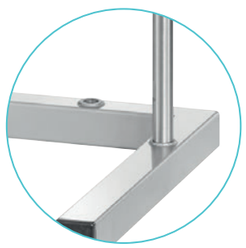
HD 2200.2 with HG 40

HD 4200 mit HG 40

HD 5100 with HG 40

Flexible mounting/installation

The stand rod can be positioned on the left or right side of the stand base.
The Outlet medium is in two parts and is screwed together using a thread. If both parts are assembled, this results in a total length of 816 mm. With just one rod, the stand is 548 mm high. The rod has a standard diameter of 16 mm. Commercially available clamps can also be attached to it, e.g. to fix laboratory vessels with a round base to.



The WH 40 holder for the ultrasonic converter is height-adjustable and can be swivelled.

Flexible: application options for direct and indirect sonication

The stand can be used flexibly for direct and indirect sonication. The scope of delivery includes a silicone non-slip mat, which prevents possible slipping of the sonication vessel during direct sonication. However, a second WH 40 holder is required for fixing the ultrasonic converter for indirect sonication.

Direct sonication

Indirect sonication

1 Possible applications with supporting table

Optionally, a second WH 40 holder can be used in combination with an AT 40 supporting table. This allows the vessels placed on it to be moved directly to the probe and their immersion depth to be easily regulated.

Direct sonication with supporting table

2 Use of two ultrasonic converters

A second WH 40 holder can be used to attach another ultrasonic converter at the same time, for example. Variable positioning of the sonication vessel is made possible with an additional WH 40 holder and the AT 40 supporting table.

Sonication of two samples on one stand

3 Convenient placement in the sound proof box

The HG 40 stand is designed so that it can be placed in the LS 40 sound proof box. Easy sample handling is ensured.

The door opening angle of the LS 40 sound proof box is 180° and the interior has sufficient space for direct and indirect applications.

Take a look at our video.

Sound proof box LS 40

Cavitation produces very unpleasant noises for the user and other people in the vicinity.
To reduce the noise level, it is recommended to use a sound proof box.

The housing, splash guard, drip tray and perforated plate are made of stainless steel (1.4301).

- Noise reduction by approx. 30 dB-AU
- LED interior lighting and acrylic glass for process viewing
- Removeable drip tray; made of stainless steel, easy to clean
- Splash guard, stainless steel insert inside easy to wipe clean
- Closable bushing at the rear side to accomodate lines and hoses for cooling or circulation systems or to connect a temperature sensor
- Ventilation system for reducing a process-related formation of moisture
- Door opening angle 180° for easy sample handling

Type	Code No.	Description	For HD
LS 40	36821	Sound proof box (noise reduction by 30 dB-AU) + 230 V EU plug CEE 7/7	2070.2 / 2200.2 3100 / 3200 3400 / 4050 4100 / 4200 4400 / 5020 5050 / 5100 5200
	36822	Sound proof box (noise reduction by 30 dB-AU) + 230 V-CH plug SEV 1011: T12	
	36823	Sound proof box (noise reduction by 30 dB-AU) + 230 V GB plug BS 1363	
	36824	Sound proof box (noise reduction by 30 dB-AU) + 115 V-US plug NEMA 5-15	

The LS 40 sound proof box can be used with the stand HG 40 or alternatively a suitable laboratory stand.

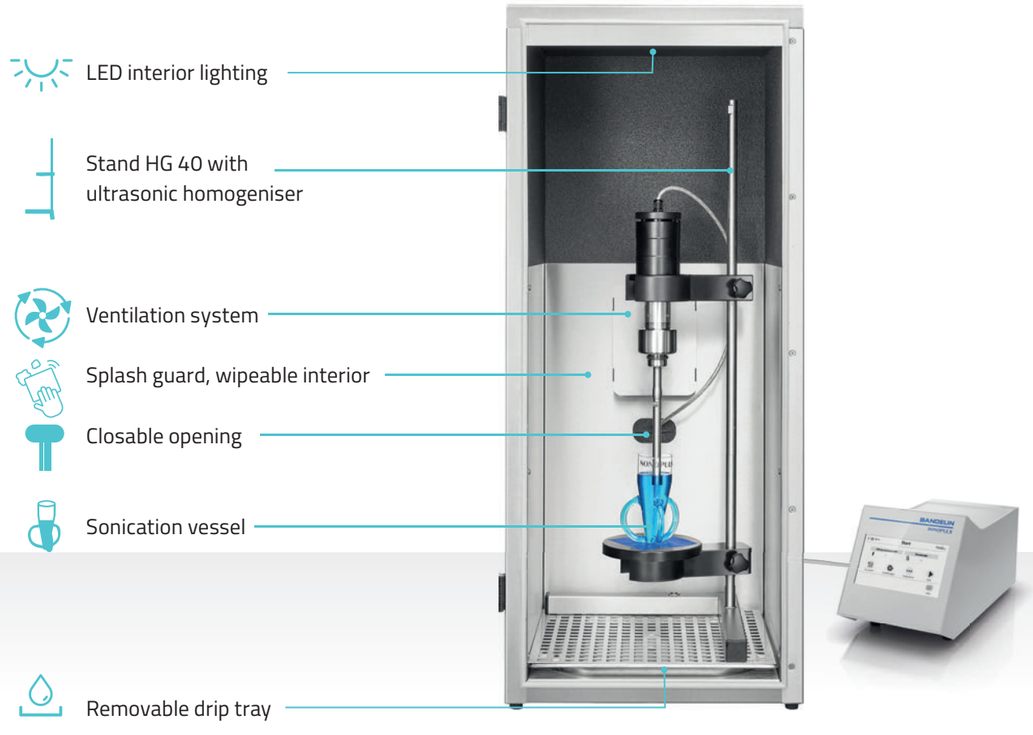
For direct and indirect sonication

The stand HG 40 can be flexibly positioned in the LS 40 sound proof box to provide direct or indirect sonication.

Direct sonication
Sound proof box LS 40, stand HG 40 with holder WH 40, ultrasonic converter UW 200, booster horn SH 200 G, horn TS 113 and rosette cell RZ 3

Direct sonication
Sound proof box LS 40, stand HG 40 with two holders WH 40 and support table AT 40, ultrasonic converter UW 200, booster horn SH 200 G, probe TS 113 and rosette cell RZ 3

Indirect sonication
Sound proof box LS 40, stand HG 40 with two holders WH 40, ultrasonic converter UW 200 and cup horn BB 6 with reaction cup holder EH 6



Temperature sensor TM

By connecting the temperature sensor either to the ultrasonic generator (series HD 4000) or to the ultrasonic converter (series HD 5000), temperature detection is activated and user-defined temperature monitoring is possible during the sonication process.

Sample temperatures in the range from -10 to 120 °C can be measured.

High temperatures must not be allowed to enter the ultrasonic converter (max. 80 °C). Long-term exposure to high temperatures must be avoided!

Type	TM 50	TM 5000
For HD	4050 / 4100 / 4200 4400	5020 / 5050 / 5100 5200
Diameter of the measuring tip [mm]	1.9	2
Sensor length [mm]	100	150
Code No.	3733	3763

TM 50 TM 5000

Foot switch TS

Instead of the "START/STOP" button on the ultrasonic generator, the device can also be operated using the foot switch. With 3 m connection cable.

Type	TS 8
For HD	4050 / 4100 / 4200 / 4400
Code No.	513

LABOCOOL LC 200
Recirculating chiller

LABOCOOL LC 200 is used for either removal of process heat or effective cooling of samples during sonication with the SONOPULS ultrasonic homogeniser. Compared to conventional recirculating chillers, LABOCOOOL LC 200 is characterised by a closed water circuit without an equalization tank. Thus, a constant water level is achieved in the processing vessel and overflowing is excluded.
Due to the natural refrigerant R-290, LABOCOOL LC 200 is particularly efficient and climate-friendly.

For constant media temperature in the ultrasonic bath: ***LABOCOOL*** **LC 400**

Applications with cooling

The sonication of biological samples reduces the processing time for sample preparation for following analysis and enables reproducible results. The high ultrasonic power applied generates frictional heat, which warms-up the sonication liquid in a short time. In order to protect samples from excessive heat input, many applications require an external cooling system. LABOCOOL LC 200 provides a ready-to-connect complete solution which enables a cooling of samples at the push of a button.

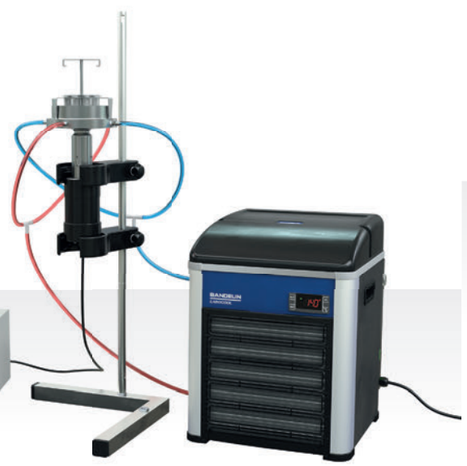
Use for applications with the cup horn BB 6

LABOCOOL LC 200 is connected to BB 6 cup horn using the supplied tubes. BB 6 can also be placed into the sound proof box.

Use in applications with the cup booster TR 110

An outstanding feature of TR 110 is the most efficient cooling system using two cooling water inlets and two outlets. These are easily connected to LABOCOOL LC 200 by supplied accessories. When using in the sound proof box, LC 200 can be placed next to the sound proof box.

LABOCOOL LC 200 with HD 5200 and BB 6



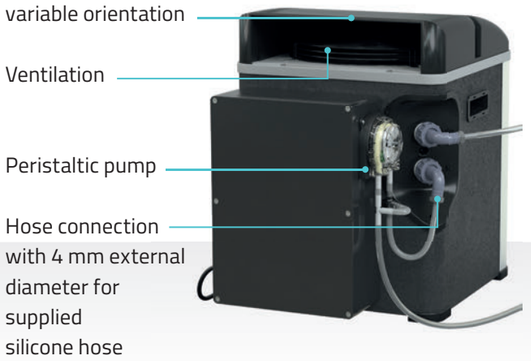
LABOCOOL LC 200 with HD 5200 and TR 110

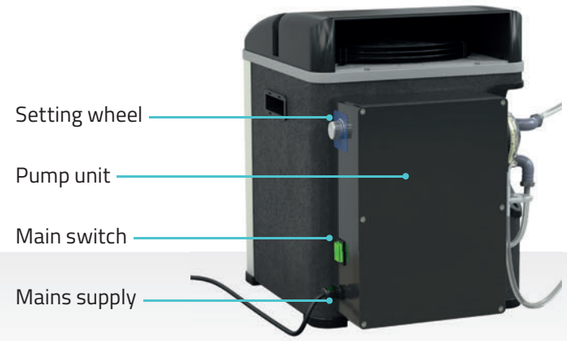
Front side

The display on the front shows the status of the cooling function and the water temperature in the device. The desired water temperature can be set within a range of 5-30 °C using the buttons on the side.

Back side

The pump unit and the main switch are located at the rear of the appliance. The volume flow of the self-priming peristaltic pump can be varied by means of an adjusting knob.





Type	Code No.	For HD series	External dimensions l × w × h [mm]	Cooling power [W]	Refrige-rant	Refrigerant quantity [g]	Pump type	Pump power [W]	max. flow-rate [l/h]
LC 200	3855	4200 / 5200	415 × 320 × 420	200	R-290	90	Peristaltic pump	10	36