

SONOPULS Ultrasonic Homogenizers

HD 2070 – HD 2200

**Please observe detailed operating instructions
containing safety instructions!**

Attention:

- Before starting, check the fixing of the probe to the standard or booster horn, if necessary tighten it.
- Avoid any contact of the vessels with the oscillating probe, otherwise probe or vessels could be damaged.
- Do not touch any oscillating part (standard or booster horn and probes) during the process.
- Switch off the unit before removing or fixing the probes, standard or booster horns.
- Use only spanners 10, 15, 17 or 22, sickle spanner 40/42 and sickle spanner 40/42, long, for fixing / removing from probes, standard or booster horns.
- Noise protection - use a sound-proof box or wear hearing protectors.
- Do not use combustible solvents in open vessels because the operational safety of the homogenizer can not be guaranteed. Do not place the homogenizer into a sound-proof box because solvent fumes could not escape!

⇒

- ① For fixing of probes (e. g. flat tips, microtips or tapered tips) use only tools listed in the operating instructions. Do not use pliers or other tools.

Please observe:

- Fitting surfaces must be clean.
 - Tighten probes well.
 - Handle probes with care - they are sensitive precision items.
- ② Place the ultrasonic converter into the opening of the sound-proof box or fit the black housing into the clamp of the stainless steel stand. Connect the ultrasonic converter to the HF-generator.
- ③ Connect the HF-generator to a grounded safety socket 230 V~ or 115 V~, 50/60 Hz depending on type (observe mains voltage selector).
- ④ - Turn "POWER" - turner to left stop.
- Press the mains switch (green pilot lamp lights up), after 3 seconds the unit is ready to start, LED-display lights up.
 - operating mode:
 - a) Countdown operation - enter required settings by means of +/- key and mode-key and confirm
 - b) Continuous operation - enter required settings by means of +/- key and mode-key and confirm
 - c) To change between countdown- and continuous operation press reset-key.
 - d) "CYCLE" operation - applicable for both, continuous or countdown operation by means of +/- key and mode-key and confirm
 - On / Off – either with Start/Stop-key, with push button on top of the converter or foot switch.
 - After immersing the probe into the liquid set "POWER"-tuner clockwise at the required value.

Important:

Respect output limits of different probes (see separate product information of probes).

Manufacturer:

BANDELIN
www.bandelin.com
info@bandelin.com

60 years of experience in ultrasound

Certification
EN ISO 9001 / 12.2000 • EN ISO 13485:2003 + AC:2007

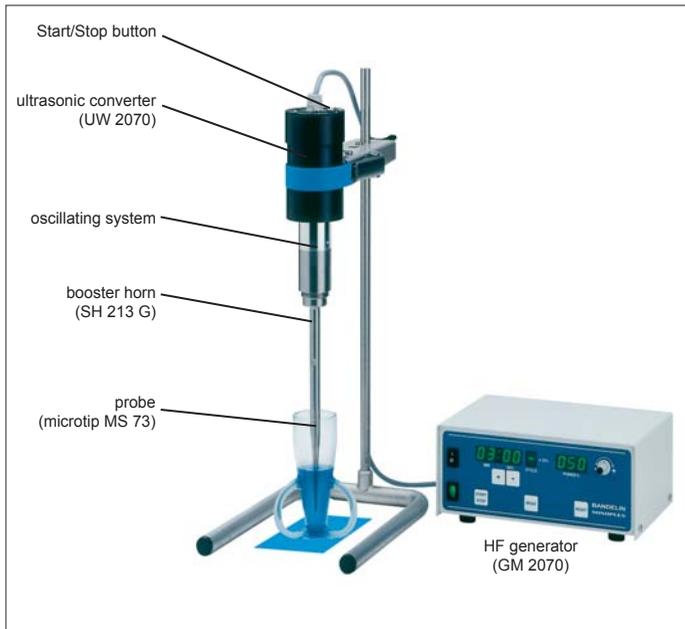
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SONOPULS Ultrasonic homogenizers

HD 2070
HD 2200

Volumes: 1 ml - 500 ml
Volumes: 2 ml - 1000 ml

(115 V or 230 V)



Cleaning unit, accessories and cleaning agents have strictly to be used according to the instruction manual or the corresponding product information.

Keep cleaning unit and cleaning agents away from children and from persons not instructed for correct use by means of these instructions.

In case of improper use, the manufacturer does not take any responsibility for safety and proper functioning. Unauthorized changes/modifications will additionally cause expiration of the C E-conformity.

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Product information SONOPULS accessories

1 Safety instructions – to be strictly observed!



General

- Units and accessories have to be strictly used according to the instruction manual and/or the corresponding product information.
- Application of the unit or parts of it on human or animals is not permitted/allowed.
- The unit may only be operated and used by authorized personnel.
- Children and all persons not instructed for correct operation of units and accessories must not get in contact with the unit.
- In case of improper use, the manufacturer does not assume any responsibility for safety and proper functioning. In case of unauthorized modification of the unit the C €-conformity will expire.
- Before connection, check for local mains supply.
(For safety reasons the switch-able generator is delivered in default position 230 V. Adjust the voltage selector if necessary, see chapter 3.2.)
- The hygiene leads according to chapter 7 of this operating instructions have to be strictly observed.
- Fix the ultrasonic converter only at the black housing with a suitable clamp, e. g. the one of the stainless steel stand HG 5.
- Never twist the black housing of the ultrasonic converter towards the aluminium cylinder (oscillating system). This way, the oscillating and the electrical connections will be damaged.
- Do not use combustible solvents in open vessels because the operational safety of the homogenizer is not guaranteed. It must be ensured a safe extractor hood of inflammable steams. In case of using sound proof boxes steams cannot escape.
- The operating instructions with safety instructions have to remain always with the unit and are to be strictly followed.
- When transferring the unit to another user the safety instructions must be handed over.

Damages and defects

- After the packing has been removed, check the HF generator and ultrasonic converter for any damage which might have occurred during transport. If damage due to transport has been discovered, do not connect the HF generator to the mains supply, but report the damage immediately and in writing to the carrier and to your supplier. Save the original packing.
- In case of defects disconnect the mains supply immediately.
- The unit may only be repaired by authorized personnel or by the manufacturer.
- Use only **SONOPULS** original parts or parts of the same quality for replacement!
- Exchange defective mains cable completely.

Operation

- Connect the HF generator to a grounded safety socket only.
Fuse protection 10 A (mains fuse).
- Do not plug or unplug any connections (e. g. ultrasonic converter, foot switch) when the unit is switched on.
- Never connect power or voltage supplies of any type to the signal inputs and outputs.
- The signal lines of foot switch, temperature sensor etc. must not exceed a length of 3 m.
- Always check the firm fitting of the probe to the standard or booster horn before starting operation (see chapter 4.3.1).
- Keep the HF generator and operating elements clean and dry.
- Observe the environmental conditions (chapter 3.1).
- Protect the unit against corrosive influences.

- Being medicine products, special precautionary measures regarding the electromagnetic compatibility (EMC) have to be observed with the homogenizers HD 2070 and HD 2200 (see chapter 3.1 of the manufacturer declaration). In particular, the HF generator must not be placed directly beside other devices or stacked with other devices. If such an operation is necessary nevertheless because of the process, the device should be observed during operation in order to examine and keep the intended, trouble-free operation in this configuration.
- During operation of the homogenizers HD 2070 and HD 2200, operation of portable and mobile HF communication devices in direct proximity to these units should be avoided, since the function mode as well as the intended, trouble-free operation may be affected.
- Use only appropriate tools for fixing and removing (see appendix 3).
- **Do not** touch oscillating parts (e. g. standard or booster horns, probes, oscillating system) when equipment is in operation! This could be harmful to your health.
- Avoid any contact of the vessels with the oscillating probe, otherwise probe or vessels could be damaged.
- Before fixing or removing (see chapter 4.3.1 and 4.4) standard or booster horns or accessories switch off the unit and separate the ultrasonic converter from the HF generator.
- Sonication of liquids causes noise. Suitable accessories like a sound-proof box reduce the noise considerably. If the equipment is being operated without a sound-proof box, wear hearing protectors.
- Do not allow the unit to run without supervision.
- Attention danger of splash!
When processing small samples and when immersing the oscillating probe into the sample, ensure that there is no aerosoling.



2 Purpose and principle of operation

Purpose

Ultrasonic homogenizers produce a high-power ultrasound with high amplitudes. The oscillations are transmitted and amplified down along the length of the horn and the probe into the aqueous sample to be treated. Ultrasonic homogenizers are used in laboratories, hospitals and industrial research to solve various tasks in sample preparation, quality control, scientific experiments as well as in analysis or pilot or short production runs.

Application examples:

- Cell disruption for paternity test
- Cell disruption (extraction of micro-organisms, tissue cells)
- Homogenization of liquids
- Emulsification of liquids difficult to mix
- Dispersing of agglomerates
- Acceleration of chemical reactions
- Degassing of liquids
- Sample preparation in environmental analyses (sewage analyses, soil samples)
- Sonochemistry

Ultrasonic homogenizers are also used for in-vitro-diagnostics operations in laboratories to obtain detailed in-sight in ultrasonic treatment of organic material. Therefore the homogenizers are classified as medical device in compliance to the directive for in-vitro-diagnostics 98/79/EG.

Principle of operation

The HF generator converts the received power (power frequencies of 50 or 60 Hz) into high-frequency power at a frequency of 20 kHz. The ultrasonic converter connected to the HF generator transforms the high-frequency power from the HF generator to ultrasound, converting it to a form of mechanical energy. This is achieved through an efficient and robust PZT ultrasonic transducer system. Hence, the tip of the probe also vibrates at a frequency of 20 kHz and transfers these vibrations with high power density to the sonicated sample. The amplitude of vibrations is held constant regardless of the loads on the probe by feeding back signals from the ultrasonic converter (AMPLICHRON® circuit), if the permissible maximum power is not exceeded. Thus, a reproducibility of process parameters is ensured for process validation.

Standard or booster horns with probes (microtips, tapered tips or titanium flat tips) are mounted on the ultrasonic converter. These serve as mechanical transformers and amplify the amplitude of the ultrasonic vibrations at the tip by a large factor.

3 HF-generators GM 2070 / GM 2200

3.1 Technical data

| Generator | GM 2070 | GM 2200 | GM 2070-U | GM 2200-U |
|---------------------------|--------------------|---------|------------------------------|-----------|
| HF-output | 70 W | 200 W | 70 W | 200 W |
| HF-frequency | 20 kHz | 20 kHz | 20 kHz | 20 kHz |
| Mains supply | 230 V~, 50/60 Hz | | 115 V~ oder 230 V~, 50/60 Hz | |
| Weight | 2,5 kg | | 5,5 kg | |
| Dimensions (l × w × h) | 257 × 180 × 115 mm | | 255 × 272 × 115 mm | |

| | |
|---------------------------------------------------------|-----------------------------------------------|
| Cable length: | 2 m |
| Ultrasonic frequency: | 20 kHz ± 500 Hz |
| Time setting range: | 00:01 – 99:59 [mm:ss] or continuous operation |
| Ultrasonic operating mode: | pulsing or continuous |
| Amplitude setting range: | 10 – 100 in 1% increments |
| Operating elements: | Power turner, keypad buttons |
| Remote control (ON/OFF): foot switch TS 8 (optional) | buttons on ultrasound converter, |
| Degree of protection: | IP 42 |

Place HF-generator GM 2070 or GM 2200 on a stable and dry surface and connect it to a grounded safety socket 230 V~ or 115 V~, 50/60 Hz.

Before connecting to the mains socket check mains voltage. Set voltage selector to the appropriate value (units GM 2070-U and GM 2200-U).

- constant amplitude provided by AMPLICHRON® system.
- simple operation by foil keys, power tuner and push button.
- integrated digital timer to set process time.
- Start - Stop - also possible by optional remote control (foot switch) or push button on top of the ultrasonic converter
- “POWER” ⇒ amplitude setting displayed in %
- “CYCLE” ⇒ indicates pulsed mode; it is divided in active and passive intervals (10 digits are possible)

| pulsed cycle | active interval (sec) | passive interval (sec) |
|--------------|-----------------------|------------------------|
| 1 | 0,1 | 0,9 |
| 2 | 0,2 | 0,8 |
| 3 | 0,3 | 0,7 |
| 4 | 0,4 | 0,6 |
| 5 | 0,5 | 0,5 |
| 6 | 0,6 | 0,4 |
| 7 | 0,7 | 0,3 |
| 8 | 0,8 | 0,2 |
| 9 | 0,9 | 0,1 |
| - | 1 | 0 |

Environmental conditions in accordance with EN 61 010-1 (IEC 1010-1)

Degree of soiling: 2 according to 60664-1:11.02
 Excess voltage category: II
 permissible relative humidity up to 31 °C: 80 %
 permissible relative humidity up to 40 °C: 50 %
 permissible temperature of surroundings: 5 up to 40 °C
 must not be exposed to dew

Information for the use as a medical product

Designation: Ultrasonic homogenizer
 UMDNS-nomenclature (ECRI): 17-125
 Purposes: homogenizing, emulsifying, cell disruption and suspending

Medical device compliant to the directive for in-vitro diagnostics Directive 98/79/EEC: device according to product category 5

Type, model, serial number, year of manufacture: see label at the generator

Information according to DIN EN 60601-1 / VDE 0750 Teil 1 / IEC 601-1:

Protection class: I
Protection type (B, BF, CF): n. a.

e-procurement

e-cl@ss:
Class of HD units: 32-08-02-02
Class of HD accessories: 32-08-92-03

SONOPULS ultrasonic homogenizers are RFI-proofed and marked C E .

Limits according to EN 55011, EN 61000-6-1/08.2002, EN 60601-1-2 and EN 61326-1.

References to EMC

The HD 2070 and HD 2200 homogenizers are intended for operation in one of the following electromagnetic environments. Users must ensure that the devices are operated according to the conditions specified below.

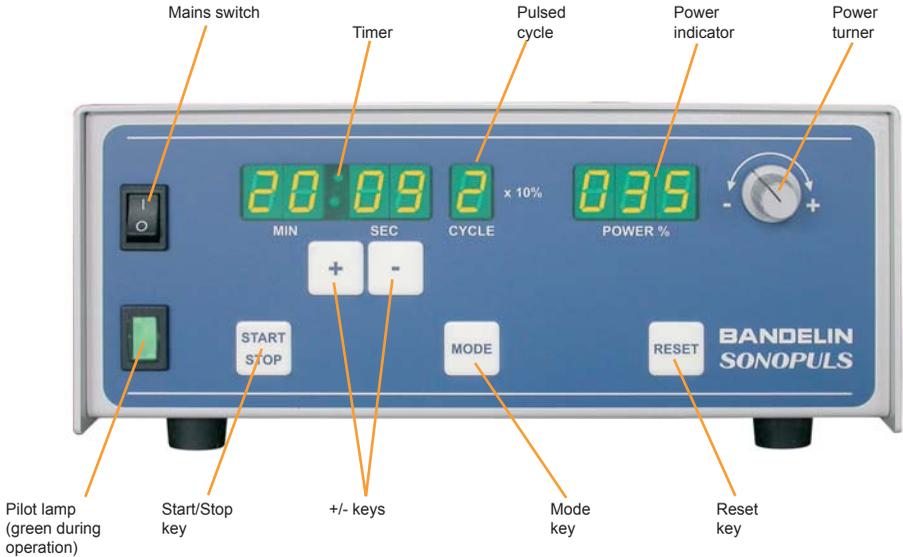
| Guidelines and manufacturer's declaration – electromagnetic emissions | | |
|-----------------------------------------------------------------------|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Emission tests | Conformity | Electromagnetic environment – guidelines |
| HF (high-frequency) emissions according to CISPR 11 | Group 1 | The HD 2070 and HD 2200 homogenizers only use HF energy for the internal functioning of the equipment itself. The HF emissions are therefore very low and are not likely to cause any interference in nearby electronic equipment. |
| HF emissions according to CISPR 11 | Class B | The HD 2070 and HD 2200 homogenizers are suitable for use in all environments other than: a) domestic environments and b) environments directly connected to a low-voltage power supply network that supplies domestic buildings. |
| Harmonics emissions according to IEC 61000-3-2 | Class A | |
| Voltage fluctuations and flicker emissions according to IEC 61000-3-3 | Concurs | |

| Guidelines and manufacturer's declaration – electromagnetic immunity | | | |
|---------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Immunity test | IEC 60601 test level | Compliance level | Electromagnetic environment – guidelines |
| Electrostatic discharge (ESD) according to IEC 61000-4-2 | ±6kV contact discharge ±8kV air discharge | ±6kV contact discharge ±8kV air discharge | Floors should be made of wood, concrete or ceramic tiles. If floors are covered with synthetic material, the relative humidity needs to be at least 30%. |
| Rapid transient electrical disturbances/bursts according to IEC 61000-4-4 | ±2kV for power supply lines ±1kV for input/output lines | ±2kV for power supply lines ±1kV for input/output lines | The power supply should meet the quality levels required by typical commercial or hospital environments. |
| Voltage surges according to IEC 61000-4-5 | ±1kV normal mode voltage ±2kV common mode voltage | ±1kV normal mode voltage ±2kV common mode voltage | The power supply should meet the quality levels required by typical commercial or hospital environments. |
| Voltage drops, temporary interruptions and fluctuations in the power supply according to IEC 61000-4-11 | <5% U_T (>95% drop in U_T for 1/2 cycle) 40% U_T (60% drop in U_T for 5 cycles) 70% U_T (30% drop in U_T for 25 cycles) <5% U_T (>95% drop in U_T for 5 sec) | <5% U_T (>95% drop in U_T for 1/2 cycle) 40% U_T (60% drop in U_T for 5 cycles) 70% U_T (30% drop in U_T for 25 cycles) <5% U_T (>95% drop in U_T for 5 sec) | The power supply should meet the quality levels required by typical commercial or hospital environments. If users require the HD 2070 and HD 2200 homogenizers to run continuously regardless of power fluctuations, we recommend using an uninterruptible power supply. |
| Magnetic field that occurs with a power supply of 50/60Hz according to IEC 61000-4-8 | 3A/m | 3A/m | The electromagnetic fields should correspond to the typical values found in commercial and hospital environments. |

Note: U_T is the mains AC voltage prior to application of the test level.

3.2 Display, operating elements and connection

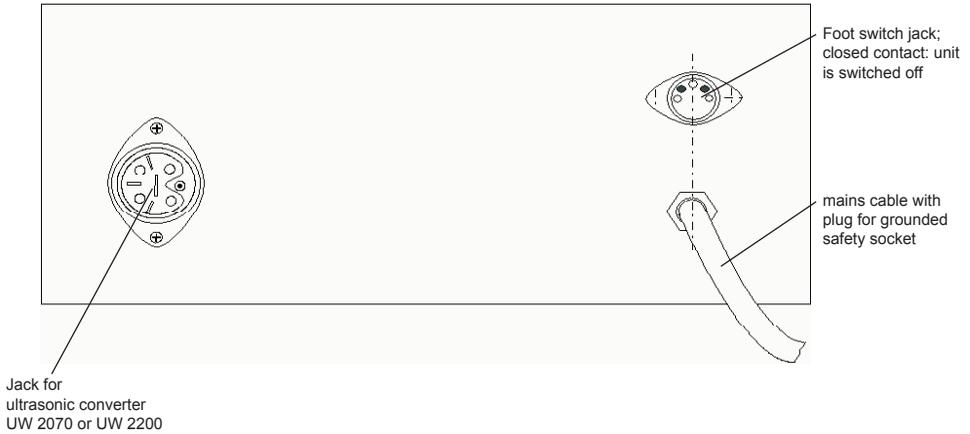
Front



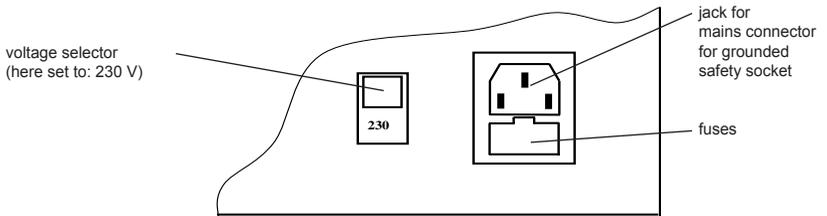
- Mains switch ON / OFF.
- Pilot lamp operating indicator (green).
- START/STOP start or stop of stored program.
- MODE selection of time - (minutes, seconds) and pulsed cycle - and after selection for storing countdown or continuous operation.
- +/- Push: the indicated value can be increased or reduced in intervals of 1 digit. Continuous pressing (>2 sec): enables fast run;
- RESET program interruption. Change between countdown and continuous operation.
- POWER-tuner to set the amplitude (10 - 100 %) during operation.

Back side

GM 2070 and GM 2200



GM 2070-U and GM 2200-U



- Push button on top of the ultrasonic converter: start or stop of stored program
⇒ see front page.
- Remote foot switch optional: start or stop of stored program.

3.3 Advantages of the generator

- environment-friendly due to a very low stand-by current consumption.
- start - stop - function can either be operated by remote foot switch (optional) or push button on top of the ultrasonic converter.
- storage of pulsation and time.
- bright digital display for time, pulsation and amplitude.
- timer check by simultaneous pressing of "+" and "-" keys (see chapter 5.5).
- easy time and pulsation adjustment, fast run.
- the last setting is stored even after mains failure.
- automatic check and error displaying of converter / generator connection (see chapter 5.5).

4 Ultrasonic converters UW 2070 / UW 2200

4.1 Technical data

| | |
|-----------------------------------------|---------------|
| PZT oscillating systems: | ✓ |
| Start/stop button: | ✓ |
| Fail-safe against continuous operation: | ✓ |
| Frequency: | 20 kHz |
| Weight: | 1,2 kg |
| Dimensions: | Ø 70 × 120 mm |
| Degree of protection: | IP 20 |

Environmental conditions see chapter 3.1.

4.2 Fixing the ultrasonic converter

- Connect the plug of the ultrasonic converter into the HF jack at the generator back side and tighten it with the threaded ring.
- Put the ultrasonic converter into the ring holder of the sound-proof box LS 4 or LS 8 or fix the black housing into the clamp of the stainless steel holder, e. g. stainless steel support stand HG 5.
- Connect the ultrasonic converter UW 2070 or UW 2200 to the HF generator GM 2070 or GM 2200.
- Do not touch the contact pins of the plug in order to avoid possible electrical charging and discharging of the piezo-elements caused by temperature changes.
- Do not cover the ventilation openings of the ultrasonic converter's housing.
- Keep the ultrasonic converter dry and clean, prevent any liquid from penetrating into the converter.
- On delivery, the standard horn SH 70 G is fixed tightly to the ultrasonic converter UW 2070 or the booster horn SH 213 G to UW 2200.
- Other booster horns can be mounted, please see chapter 4.4.

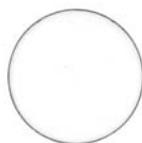
4.3 Range of probes

For detailed information about individual probes see separate product information.

| HD 2070 | | | | | | | | | |
|---------------------------------------------|----------------------|----------------------|----------------------|---------------------|---------------------|---------------------|------------------------|---------------------------|---------------------------|
| Probe | MS 72 | MS 73 | KE 76 | TT 13 | VS 70 T | TT 13 FZ | GS 6 GS 6 L 6 mm | GS 13 GS 13 L 13 mm | GS 18 GS 18 L 19 mm |
| Ø (diameter) | 2 mm | 3 mm | 6 mm | 13 mm | 13 mm | 13 mm | | | |
| Connection to standard horns | SH 70 G, (FZ 5 G) | | | | | FZ 5 G | SH 70 GQ | | |
| Volume range | 1 ml - 25 ml | 2 ml - 50 ml | 5 ml - 100 ml | 10 ml - 200 ml | 10 ml - 200 ml | - | 2 ml - 100 ml | 25 ml - 200 ml | 25 ml - 500 ml |
| Amplitude | 253 µm _{ss} | 212 µm _{ss} | 165 µm _{ss} | 78 µm _{ss} | 80 µm _{ss} | 78 µm _{ss} | 13 µm _{ss} | 13 µm _{ss} | 13 µm _{ss} |
| Maximum admissible amplitude setting | <u>97 %</u> | 100 % | 100 % | 100 % | 100 % | 100 % | <u>35 %</u> | <u>40 %</u> | <u>40 %</u> |

| HD 2200 | | | | | | | | | | |
|---------------------------------------------|----------------------------|----------------------|----------------------|----------------------|----------------------|----------------------|---------------------|---------------------|---------------------|---------------------|
| Probe | MS 72 | MS 73 | KE 76 | TT 13 | VS 70 T | TT 13 FZ | TT 19 | VS 190 T | TT 25 | VS 200 T |
| Ø (diameter) | 2 mm | 3 mm | 6 mm | 13 mm | 13 mm | 13 mm | 19 mm | 19 mm | 25 mm | 25 mm |
| Connection to standard horns | SH 213, SH 213 G, (FZ 7 G) | | | | | FZ 7 G | SH 219 G | | SH 225 G | |
| Volume range | 2 ml - 30 ml | 5 ml - 90 ml | 10 ml - 350 ml | 20 ml - 900 ml | 20 ml - 900 ml | - | 25 ml - 900 ml | 25 ml - 900 ml | 30 ml - 1000 ml | 30 ml - 1000 ml |
| Amplitude | 282 µm _{ss} | 302 µm _{ss} | 249 µm _{ss} | 149 µm _{ss} | 153 µm _{ss} | 149 µm _{ss} | 73 µm _{ss} | 73 µm _{ss} | 48 µm _{ss} | 46 µm _{ss} |
| Maximum admissible amplitude setting | <u>52 %</u> | <u>65 %</u> | <u>72 %</u> | 100 % | 100 % | 100 % | 100 % | 100 % | 100 % | 100 % |

All probes are subject to natural wear and tear, which leads to erosion on the ultrasound emitting surface and to a reduction of their performance. If probes are used frequently, a quantity of spare probes should be kept in stock. Typical samples of erosion at titanium flat tip TT 13:



New titanium flat tip.



Erosion still admissible, flat tip can be polished.



Cavities are beginning to form. Grinding necessary.



Limits of erosion exceeded. New tip necessary.

The surfaces emitting ultrasound can repeatedly be grinded or re-polished very thoroughly. If the material has been reduced by approx. 1 mm due to erosion or grinding, the probe is out of tune and cannot be used any longer.

Working up the sound radiating surface:

A work up can be made with a grinding machine with a fine-grained grinding wheel or manually with a diamond-coated file. Suitable abrasives are for example:

- fine grinding disc, PUR-bonded, grain size 150
- fine grinding disc, caoutchouc-bonded, grain size 120
- grinding disc PNK, corundum, grain size 180 ... 280
- diamond-coated file, D 181 or D 251

4.3.1 Fixing and removal of probes

Probes

- are screwed onto the standard or booster horn,
- transmit the ultrasound into the medium to be processed,
- are made of high-grade titanium alloy.

Attention! Probes are shock-sensitive.

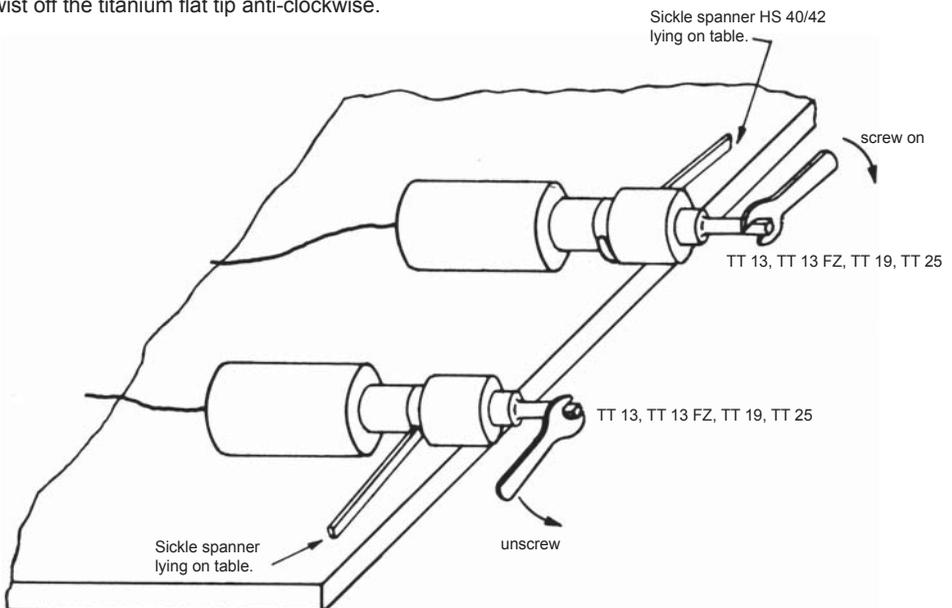
Before fixing the probes the unit must be switched off and the ultrasonic converter must be separated from the HF generator.

4.3.1.1 Fixing and removal of flat tips

Screw titanium flat tip into the female thread of the standard or booster horn.

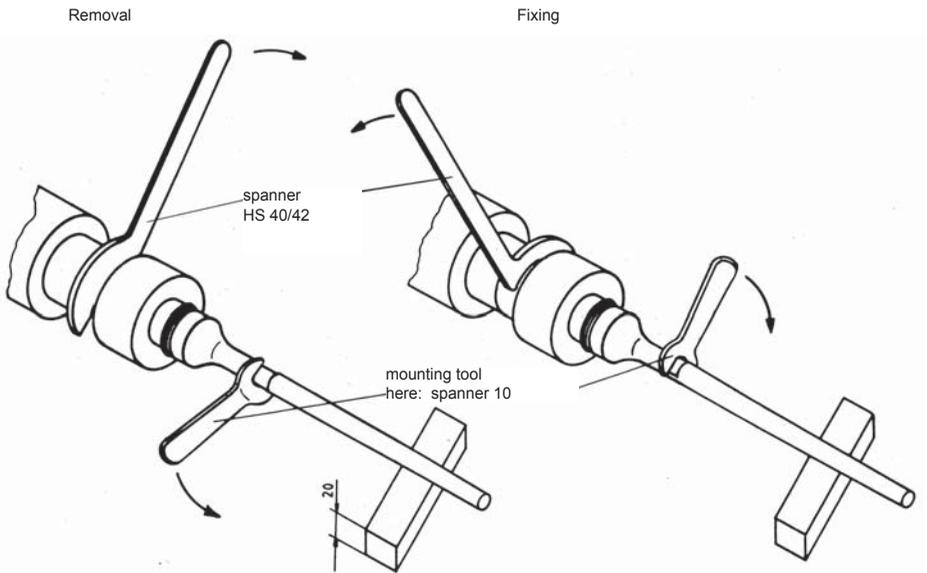
- Titanium flat tips
 - TT 13 is mounted to the standard horn SH 70 G (HD 2070) or to the booster horn SH 213 G (HD 2200).
 - TT 13 FZ is mounted to the flow-through standard horn FZ 5 G (HD 2070) or to the flow-through booster horn FZ 7 G (HD 2200).
 - TT 19 is mounted to the booster horn SH 219 G on HD 2200.
 - TT 25 is mounted to the booster horn SH 225 G on HD 2200.

- ① Wipe carefully the mating surfaces of the standard or booster horn and the titanium flat tip ⇒ make sure that these surfaces are clean.
- ② Screw in the titanium flat tip manually.
- ③ Use spanner - 10 for TT 13 and TT 13 FZ, 15 for TT 19, 22 for TT 25.
- ④ Hold the standard or booster horn with the sickle spanner HS 40/42 and turn the titanium flat tip clockwise, pull hard.
- ⑤ Twist off the titanium flat tip anti-clockwise.



4.3.1.2 Fixing and removal of microtips and tapered tips, long probes and silica glass probes

- Microtips and tapered tips (MS 72, MS 73, KE 76), long probes (VS 70 /T, VS 200 /T) and silica glass probes (GS ... /L)
 - MS 72, MS 73, KE 76 are screwed onto the standard horn SH 70 G (HD 2070).
 - GS ... /L are screwed onto the booster horn SH 70 GQ (HD 2070).
 - MS 72, MS 73, KE 76, VS 70 /T are screwed onto the standard horn SH 213 G (HD 2200).
 - VS 190 T is screwed onto the standard horn SH 219 G (HD 2200).
 - VS 200 /T are screwed onto the standard horn SH 225 G (HD 2200).
- ① Wipe carefully the mating surfaces of the horn and the tip (MS 72, MS 73 or KE 76) ⇒ make sure that surfaces are clean.
 - ② Screw the tip into the horn manually.
 - ③ Place the tip onto a pad, approximately 20 mm thick, to prevent it from being bent.
 - ④ Hold the horn tightly at the fixing holes by using the sickle spanner HS 40/42. Tighten the tip with the proper tool, see picture.
 - ⑤ To remove the tip, twist the spanner in reverse direction.



4.4 Fixing and removal of standard and booster horns

Standard or booster horns

- are screwed onto the ultrasonic converter,
- are made of high grade titanium alloy,
- transmit the oscillations to the probe,
- boost the amplitude due to their special construction.

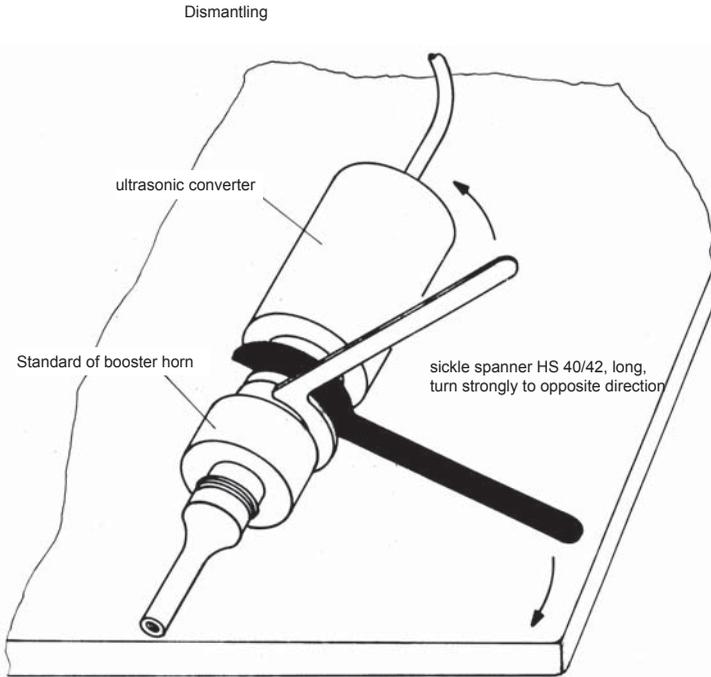
Upon delivery, standard horn SH 70 G is fixed to ultrasonic converter UW 2070, booster horn SH 213 G to ultrasonic converter UW 2200.

Before fixing other horns the unit must be switched off and the ultrasonic converter must be separated from the HF generator.

At first dismantle the standard or booster horn SH 70 G or SH 213 G from ultrasonic converter UW 2070 or UW 2200. Place the ultrasonic converter on a solid plate (non-slippery).

Dismantling

Attach a sickle spanner to the ultrasonic converter and another one to the standard or booster horn, picture 6. To remove the horn, press one sickle spanner downwards, and the other one upwards. When ordering extra horns, the sickle spanner is included.



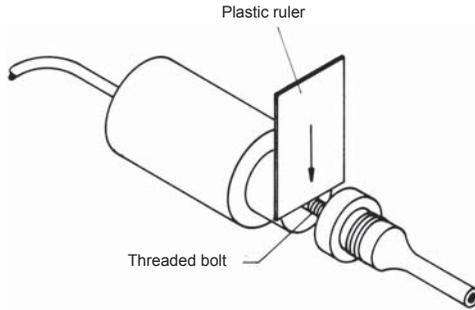
Mounting

Clean threads and mating faces are necessary for successful operation.

Clean all mating faces, studs and threaded holes with alcohol and lint-free cloth.

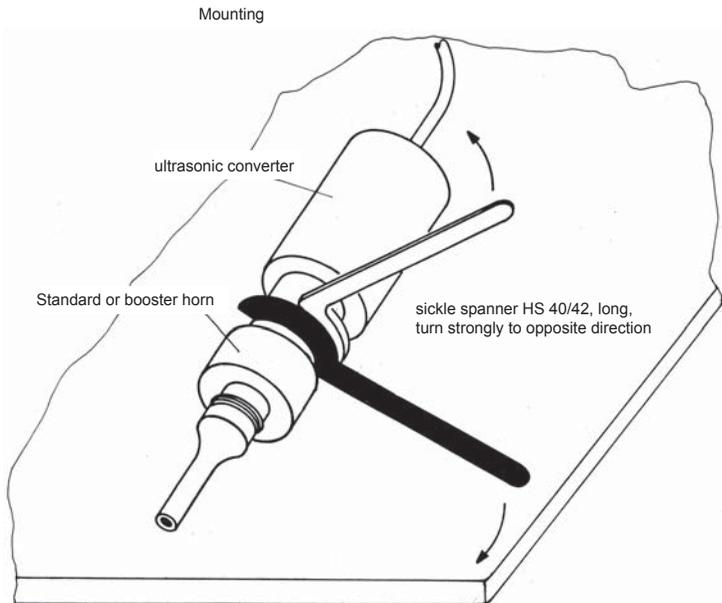
Screw the stud of the standard or booster horn into the threading of the ultrasonic converter up to approx. 2/3 of its length.

In order to avoid screwing in the stud more than 2/3, place a plastic ruler or similar onto the thread and press it slightly down.



Screw the horn on to the threaded bolt, take the ruler out and fix the horn manually.

Then use both long sickle spanners to fix it tightly to the converter.



For detailed information about individual standard or booster horns see separate product information.

The following standard or booster horns can be connected to the ultrasonic converter:

| Homogenizer | HD 2070 | HD 2200 |
|---------------------------------------------------|---------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|
| Ultrasonic converter | UW 2070 | UW 2200 |
| Standard supply: standard or booster horn | standard horn SH 70 G | booster horn SH 213 G |
| Special accessories (to be ordered separately) | diamond probe horn DH 13 G Flow-thru standard horn FZ 5 G Special standard horn SH 70 GQ | booster horns SH 219 G SH 225 G diamond probe horn DH 13 G Flow-thru standard horn FZ 7 G |

5 Starting and application

5.1 Getting set for operation

- After the packing has been removed, check HF generator and ultrasonic converter for any damage which might have occurred during transport. If damage due to transport has been discovered, do not take the HF generator in operation, but report the damage immediately and in writing to the carrier and to your supplier. Save the original packing.
- Check completeness of all components by means of the delivery note. Irregularities must be communicated to the supplier in writing immediately.

5.2 Installation and operating recommendations

- Before connecting the power, compare the available power with the mains voltage on the generator base or label and only connect the appropriate type to a grounded safety socket.
230 V~ 50/60 Hz alternatively 115 V~ 50/60 Hz
- Place the HF generator on a solid, even and dry base.
- Do not place the HF generator closely to other electrical or electronic devices and do not stack it with such devices.
- Place the ultrasonic converter safely and proper into the support.
- Do not touch the processing vessel with the vibrating probe – probes and vessels can be damaged.
- Do not use bent probes (⇒ instable operation, power loss).
- **The recommended immersion depth for probes is 10 to 20 mm**, in order to avoid sucking and/or mixing air into the sample. If air mixing is required, the probe should be immersed a few millimeters only.
When working with larger depths and/or when sonicating samples of high viscosities the energy of the probe is considerably absorbed. Consecutively, the set amplitude (power) might be reached, especially if the settings have been exceeded 50 %. In such case the generator cannot supply the necessary power.
- Micro and tapered tips should only be inserted max. 20 mm into the liquid.
- To produce emulsions, the probe should be inserted to the height of the separation plane between the liquids being mixed.
- Do not use combustible solvents in open reaction vessels because they may endanger the homogenizer's operation.
- For shut-off disconnect the unit from mains (pull mains plug).

5.3 Operation modes

The unit can work in two modes: **countdown and continuous operation**

In **countdown operation** you can set the time and the pulsed cycle. After starting the generator either by START/STOP-key, push button on top of the ultrasonic converter or foot switch, the countdown mode (cycle in seconds) - proceeds until zero with automatic switch-off.

The maximum time setting is 99 min and 59 sec. (The unit refuses time setting 00:00).

In **continuous operation** the ultrasound can be set to continuous or pulsed operation (see table page 6, below). When reaching the maximum time of 99 min and 59 sec, it continues starting again at 00:00.

Detailed information is scheduled in „Working in continuous operation“ and „Working in countdown operation“.

5.4 Power - amplitude setting

The range of the amplitude setting is 10 ... 100 %, adjustable in 1 %-steps. Before pressing the START-key, set „POWER“ knob to left stop. Having started the unit, set the power tuner to the required value. It is always displayed and constantly regulated. Due to changes in processed liquid medium, caused by sonication, the actual display can vary up to 5 digits during operation.

5.5 Test routines

Operating functions can be tested immediately:

- | | |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test of display | press the keys „+“ and „-“ simultaneously. All display-segments light up from 0 to 9, then the last stored settings are displayed. |
| Test of connection | If the ultrasonic converter has not been tightened strong enough to the generator, power indicator will not display any value after 1 second - the generator switches off. Fix tightly the converter, restart the unit by START/STOP. |

5.6 Working in countdown operation

| | Action | Display | Remark |
|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | <p>Switch on generator Set "POWER" turner to left stop. Press mains switch - Display lights up after 3 seconds.</p> | <p>MIN/SEC: last setting CYCLE: last setting ("." = max.) POWER: 000 %</p> <p>The green pilot lamp lights up.</p> <p style="text-align: center;">Start —————▶ point 5</p> | <p>When switching on the generator the previously used operation is always active. Required change to continuous operation be pressing RESET-key possible. Once the generator has been started, program changes or other commands except power tuning are not possible!</p> |
| 2 | <p>Setting Selection of time (sec, min) and pulsed cycle by pressing MODE-key step-by-step. Set time or/and pulse interval by +/- keys. If the keys are pressed longer than 2 sec, the fast run begins!</p> | <p>MIN/SEC: last setting CYCLE: last setting ("." = max.) POWER: 000 %</p> <p style="text-align: center;">Start —————▶ point 5</p> | <p>Start possible without entering a new program - actual storing.</p> <p>In case of no setting within 10 sec. display is fluctuating - The setting modus will be inactivated. No storage possible. Display returns to the last setting.</p> |
| 3 | <p>End of programming (storing) Use the MODE-key until display remains in fluctuating.</p> | <p>MIN/SEC: new setting CYCLE: new setting POWER: 000 %</p> <p style="text-align: center;">Start —————▶ point 5</p> | <p>The programme is stored.</p> <p>During operation power is to be set or modified.</p> |
| 4 | <p>Programming without storing Do not confirm settings by the MODE-key.</p> | <p>MIN/SEC: new setting CYCLE: new setting POWER: 000 %</p> <p style="text-align: center;">Start —————▶ point 5</p> | <p>Start possible without setting a new program - actual storing when starting within 10 sec.</p> <p>Use the RESET-key for a new setting.</p> |
| 5 | <p>Starting up Use the START/STOP key at the generator, on top of the converter or the foot switch.</p> | <p>MIN/SEC: counts down CYCLE: new setting POWER: %, actual</p> | <p>In case of no power indication, the ultrasonic converter is not well connected ⇒ converter must be connected before starting any program.</p> |
| 6 | <p>Interruption Press the START/STOP-key at the generator, the push button on top of the converter or the foot switch.</p> | <p>MIN/SEC: remaining time CYCLE: new setting POWER: 000 %</p> <p>During interruption the colon in the min/sec indicator is fluctuating.</p> | <p>New settings can be made or current operation can be continued. - actual storing</p> |
| 7 | <p>Continuing Press the START/STOP-key at the generator, on top of the converter or the foot switch.</p> | <p>MIN/SEC: counts down CYCLE: new setting POWER: %, actual</p> | <p>The pulsed mode is being kept. End of countdown shows 00 : 00. After a short time display returns to previously stored programme.</p> |

| | Action | Display | Remark |
|----|---------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 8 | Break-off Press the RESET-key. | MIN/SEC: last setting CYCLE: last setting POWER: 000 % | The current program can be interrupted at any time by pressing RESET. The last setting will automatically be displayed. When pressing the RESET-key a second time after interruption, the generator switches over to continuous operation. |
| 9 | Switch over to continuous operation after generator stop Press RESET-key, once | MIN/SEC: 00 min 00 sec CYCLE: last setting POWER: 000 % | |
| 10 | Activate stored programme Press RESET-key, once. | MIN/SEC: stored value CYCLE: stored value POWER: 000 % | 1st pressing: the stored program is indicated in continuous mode. 2nd pressing: the stored program is indicated in countdown mode. |
| 11 | Switch off generator Turn power tuner to the left stop. Press the "mains switch". | Display extinguishes. Pilot lamp extinguishes. The programme, previously set, is being kept. | A break of 10 sec has to be made before restarting the generator. The stored countdown operation is being kept. |

Attention ! Refer the maximum admissible amplitude setting of the probes see chapter 4. 3.

5.7 Working in continuous operation

| | Action | Display | Remark |
|---|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | <p><u>Switch on generator</u> Set „POWER“ tuner to left stop. Press “mains switch“ - Display lights up after 3 seconds.</p> | <p>MIN/SEC: last setting CYCLE: last setting (“.” = max.) POWER: 000 %</p> <p>The green pilot lamp lights up.</p> | <p>When switching on the generator, always the last used operation is active. Required change to continuous operation by pressing RESET-key possible.</p> |
| 2 | <p><u>Starting up</u> Use the START/STOP key at the generator, on top of the converter or the foot switch.</p> | <p>MIN/SEC: counting forward CYCLE: current value POWER: %, actual</p> | <p>Power tuning is to be set or modified during operation. When reaching the maximum time of 99 min and 59 sec, it recontinues at zero. Once the generator has been started, program changes or other commands except power tuning are not possible!</p> |
| 3 | <p><u>Interruption</u> Press the START/STOP-key at the generator, the push button on top of the converter or the foot switch.</p> | <p>MIN/SEC: run off time CYCLE: setting value POWER: 000 %</p> <p>During interruption the colon in the min/sec indicator is fluctuating.</p> | <p>New settings can be made or current operation can be continued. - actual storing.</p> |
| 4 | <p><u>Continuing</u> Press the START/STOP-key at the generator, on top of the converter or the foot switch.</p> | <p>MIN/SEC: counting forward CYCLE: value set POWER: %, actual</p> | |
| 5 | <p><u>Break off</u> Press RESET-key.</p> | <p>MIN/SEC: 00 min 00 sec CYCLE: value set POWER: 000 %</p> | <p>A restart or change over to countdown operation by pressing the RESET-key is possible.</p> |
| 6 | <p><u>Switch over to countdown operation</u> After the break off, press RESET-key once.</p> | <p>MIN/SEC: last stored value CYCLE: last stored value POWER: 000 %</p> | <p>If another time as 00:00 is indicated, continuous operation is switched off. The setting 00:00 is not possible in continuous mode and will not be indicated, either.</p> |
| 7 | <p><u>Switch off generator</u> Turn power tuner to the left stop. Press the mains switch.</p> | <p>Display extinguishes. Pilot lamp extinguishes.</p> <p>The programme, previously set, is being kept.</p> | <p>A break of 10 sec has to be made before restarting the generator. The stored continuous operation is being kept.</p> |

Attention ! Refer the maximum admissible amplitude setting of the probes see chapter 4. 3.

6 Remote control / monitoring

There are several methods of remotely controlling and operating the unit. Thus, you can choose the optimum solution for your application.

1. Manual remote control using button (see title page) on the ultrasonic converter.
Functions: Ultrasonic output ON / OFF
2. Remote control using foot switch TS 8.
The foot switch can be connected to the remote control socket.
Functions: Ultrasonic output ON / OFF

7 Treatment of contaminated parts at the ultrasonic converter, vessels and accessories in medical range

During the operation of ultrasonic homogenizers oscillating parts, vessels or other accessories like laboratory stands and tools can be contaminated by micro-organisms or toxic substances and cross infection might be the result. A thorough disinfection and cleaning after each operation is necessary. In case of improper or irregular disinfection and cleaning micro-biological or toxic contamination is possible, caused by settlement of micro-organisms, especially at the joint between titanium flat tip and booster horn, or at the radiating faces of the probes (see chapter 4.3 wear and tear). Therefore, all oscillating parts like standard horns, booster horns, microtips, tapered tips or titanium flat tips, vessels and other accessories must be cleaned and disinfected after every treatment. The parts must be detached, if necessary.

In case of toxic contamination, the respective national rules and conditions must be strictly respected.

According to the hygienic plan, the user must carry out regular disinfection and cleaning with a surface disinfecting agent certified by VAH, or another efficiently classified agent.

Lead: Further instructions and regulations valid with the user/operator must be observed.

8 Available accessories

Standard delivery:

HD 2070: GM 2070, UW 2070, SH 70 G and MS 73

HD 2200: GM 2200, UW 2200, SH 213 G and TT 13

BANDELIN offers a wide range of accessories for many applications.

The connection of various accessories to homogenizers HD 2070 and HD 2200 is shown in appendix 1 to 2.

Use only the spanners for mounting / dismantling as pictured in appendix 3.

9 Maintenance and repair

SONOPULS Homogenizers are maintenance-free.

When supplying them, the devices have been calibrated with us. A calibration is only necessary in case of repairs. The calibration shall be carried out only by the manufacturer.

The only wear-out can occur on the radiating area of the probes caused by cavitation erosion. Worn out or defective probes can be replaced by the user in accordance with these operating instructions according to chapter 4.2 to 4.4.

For a trouble-free operation, homogenizers should not be used in places of

- high humidity,
- high temperatures,
- corrosive influences (e. g. chemical processes) and
- intensive dust.

Appendix 4 gives information on possible malfunction, causes and remedies.

If the user is unable to carry out the troubleshooting, the ultrasonic homogenizer must be returned to the customer service of the supplier or manufacturer.

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If service is required, please contact your supplier.

Manufacturer:

BANDELIN

www.bandelin.com
info@bandelin.com

60 years of experience in ultrasound

Certification

EN ISO 9001 / 12.2000 • EN ISO 13485:2003 + AC:2007

Subject to technical alterations.

BANDELIN electronic GmbH & Co. KG

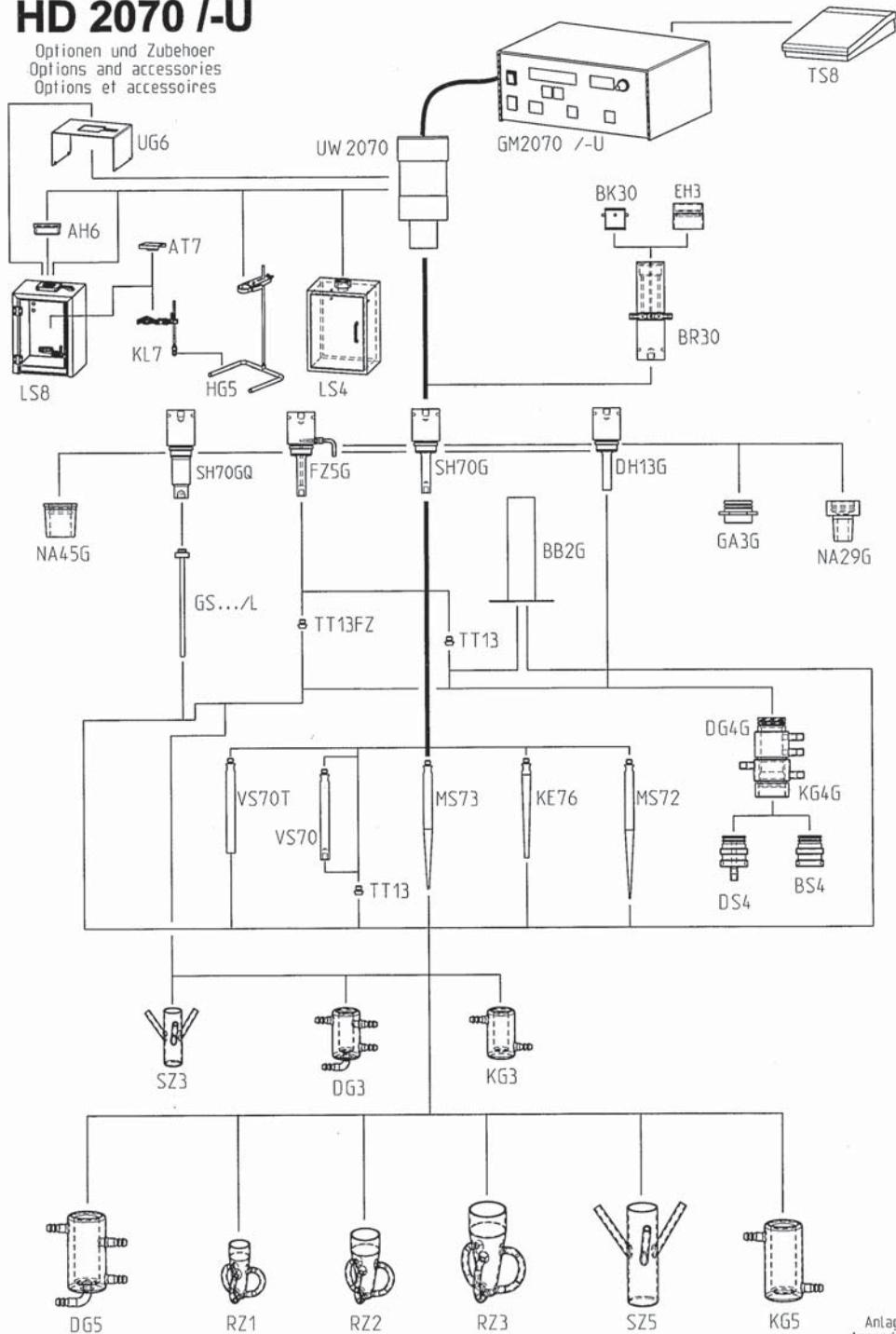
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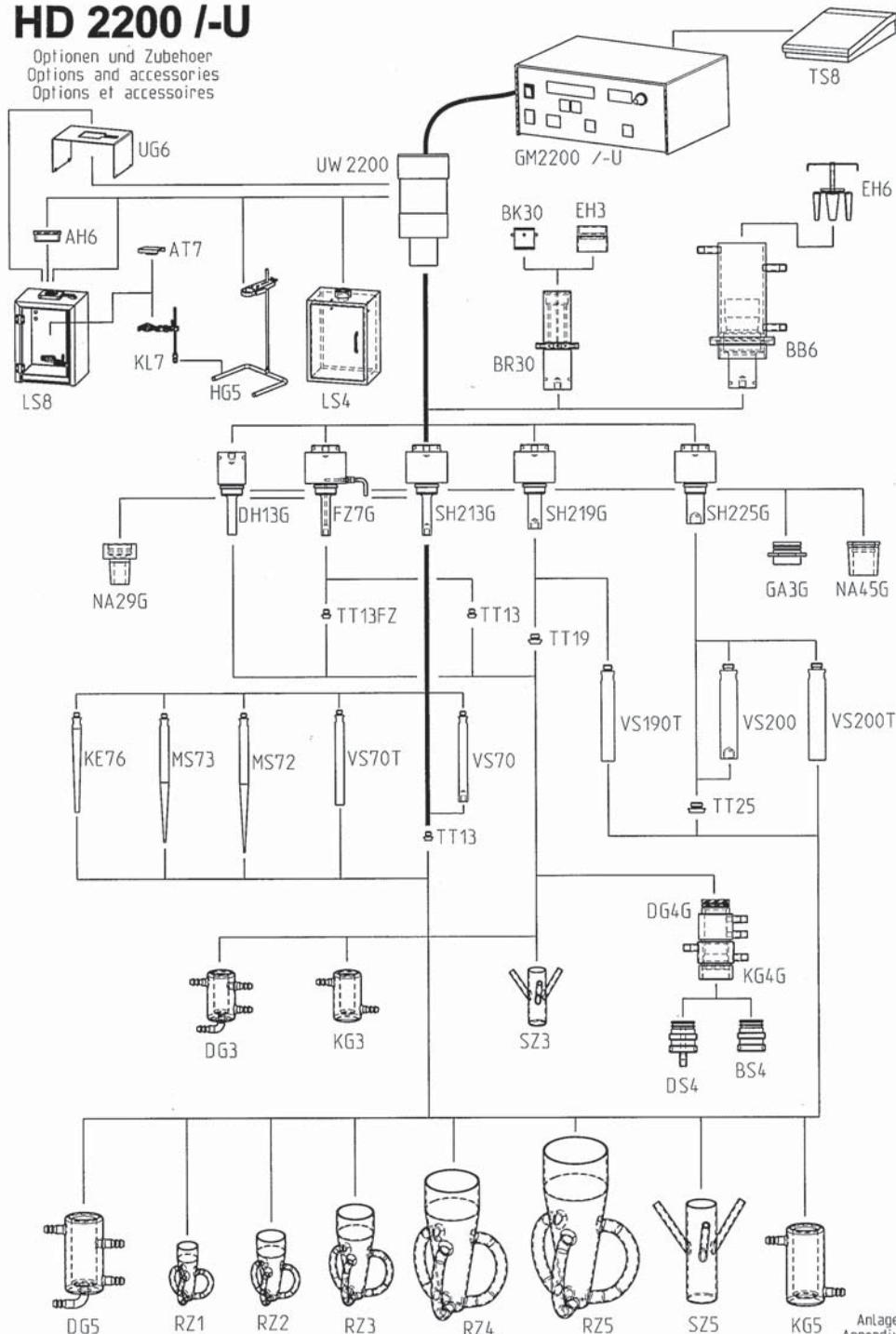
HD 2070 /-U

Optionen und Zubehör
Options and accessories
Options et accessoires



HD 2200 /-U

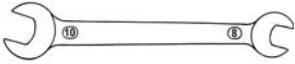
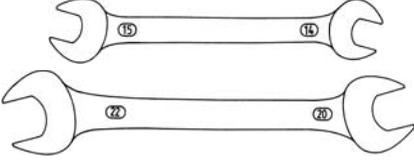
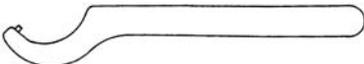
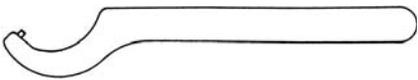
Optionen und Zubehör
Options and accessories
Options et accessoires



Spanners for mounting and dismantling

Probes and standard or booster horns are extremely sensitive parts, they must be mounted or dismantled with utmost care.

Use only the following spanners:

| Spanner type | Application |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Spanner SW 10</p>  <p>Is part of delivery.</p> | <p>For mounting / dismantling of MS 72, MS 73, KE 76, TT 13 and TT 13 FZ ⇒ chapter 4.3.1, as well as probe extender VS 70</p> |
| <p>Spanners</p>  <p>Not supplied by BANDELIN.</p> | <p>For mounting / dismantling of titanium flat tips TT 19 and TT 25. spanner 15 for TT 19 spanner 17 for VS 190 T spanner 22 for TT 25 ⇒ chapter 4.3.1 as well as probe extender VS 200</p> |
| <p>Sickle spanner HS 20/22</p>  <p>Part of delivery of each silica glass probe.</p> | <p>For mounting / dismantling of silica glass probes: GS 6 /L GS 13 /L GS 18 /L ⇒ chapter 4.3.1.</p> |
| <p>Sickle spanner HS 40/42</p>  <p>Part of delivery of the homogenizer.</p> | <p>For mounting / dismantling of probes (Serves to hold the horn) ⇒ chapter 4</p> |
| <p>Sickle spanner HS 40/42, long</p>  <p>2 pieces belong to a delivery of each optionally ordered standard or booster horn.</p> | <p>For mounting / dismantling standard or booster horn to the ultrasonic converter ⇒ chapter 4.4</p> |

Maintenance and troubleshooting

Repairs must be carried out by skilled personal only!

Please inform us about disfunctions in writing – use the enclosed questionnaire.

Important information

- Before repairing, switch off the unit!
- Replace defective parts only by original **SONOPULS** parts.
- Please ensure correct fixing of ultrasonic converter and horn, as well as horn and probe. Faulty functions are frequently caused by insufficient mechanical coupling between these parts. Please note detailed descriptions in the main part (point 4)



Never twist the black housing of the ultrasonic converter towards the aluminium cylinder (oscillating system). This way, the oscillating and the electrical connections will be damaged.

Error analysis

Error analysis for HD 2070-U or HD 2200-U

| Fault | Probable causes | Remedy |
|------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| Unit cannot be switched on? green pilot lamp does not light? | Wrong position of voltage selector at the generator ? (severe operating fault) Mains supply 115 V but switch position at 230 V? Mains supply 230 V but switch position at 115 V? | - Change the switch position to 115 V at the rear of the generator. - ⇒ return the homogenizer to the manufacturer, because of severe damage. |

Error analysis for HD 2070, HD 2200, HD 2070-U or HD 2200-U

| Fault | Probable causes | Remedy |
|------------------------------------------------------------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| Unit cannot be switched on? green pilot lamp does not light? | No mains power Loose or defective mains cable? Defective central fuse? | - Check plug-and-socket connection. - Check cable for conductivity, or exchange mains connector, if necessary. - Change central fuse. |
| No time display? | Defective micro controller? | - After test failure, see chapter 5.5 ⇒ return the homogenizer to the manufacturer |

Error analysis for HD 2070 or HD 2200

| Fault | Probable causes | Remedy |
|-------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| No power indication? does the green pilot lamp light | HF-cable of ultrasonic converter is not connected | <ul style="list-style-type: none"> - Plug in the HF-cable to ultrasonic converter, see chapter 3.2. - Check the cavitation erosion on the radiating surface of the tip / probe. If the erosion is too strong, replace the tip / probe, see chapter 4.3 |
| Little or no ultrasonic power? | Loose horn or tip? Defective standard or booster horn or probe? Check the cavitation erosion on the tip / probe - see chapter 4.6. low? cavities are beginning to form? strong? Liquid between horn and probe? The threaded bolt on the standard or booster horn and / or on the micro- or tapered tip has a crack? Defective threaded fastener at tip? | <ul style="list-style-type: none"> - Dismantle the parts with the included tools, clean the surfaces and screw it tightly together, see chapter 4. - Check horn, probe and threaded bolt for cracks; dismantle and exchange them, if necessary. ⇒ Make sure that their surfaces are clean and plane, see chapter 4. - Polish the irradiating surface. - Face or grind the irradiating surface (max. 1 mm). - Replace the tip / probe. - Remove probe, clean threads and mating faces, dry them, check for plane surfaces and remount the probe, see chapter 4. - Dismantle parts, check threads and mating faces, dry them, check for plane surfaces and remount the probe, see chapter 4. - Change the tip, see chapter 4.3.1. |
| Unusual high temperature near the joint ultrasonic converter – standard or booster horn or standard or booster horn – probe? | Oscillating parts (standard or booster horn and probe) are not tightened sufficiently? Mating faces of the oscillating parts are contaminated? | <ul style="list-style-type: none"> - Dismantle corresponding parts, clean the surfaces and fix them tightly, see chapter 4. |
| HF-generator is not working in pulse mode, or is operating continuously in pulse mode „CYCLE“? | Defective micro controller? | <ul style="list-style-type: none"> - After test failure, see chapter 5.5 ⇒ return the homogenizer to the manufacturer |

If a faulty function cannot be eliminated according to this schedule, please contact your dealer, always quoting model and serial number of both, the converter and the generator.