KKS

Ultrasonic technology & Surface refinement

Ultrasonic technology

Swiss Quality

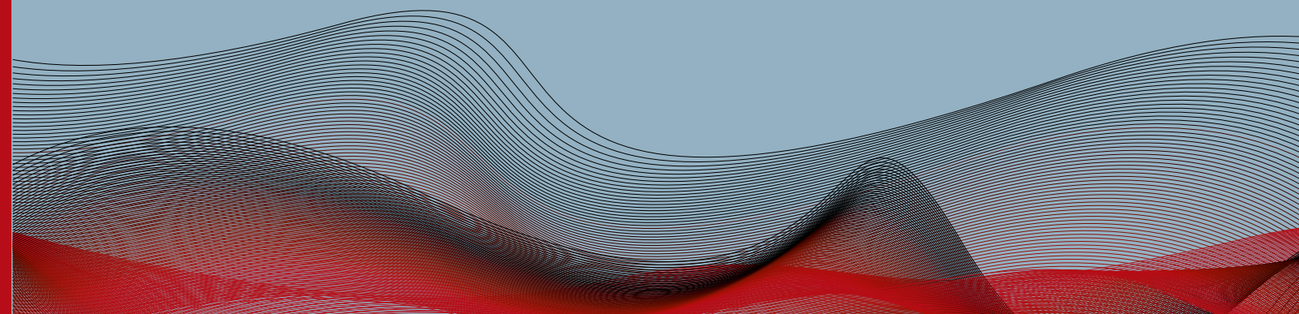
Further information at:
www.kks-ultraschall.ch

Purity as vision

Purity is in the life-blood of Switzerland. Since 1982 an epicentre for ultrasound-based cleaning has been established here in the form of KKS. It is motivation and the power to innovate that move us. Along with technical knowledge and control of our actions. Above all it is our ability to perceive vibrations. This means: we listen to our customers. We address their needs and explore their applications. We consider it our mission to create technologically leading solutions for ultrasound-based cleaning and surface finishing processes for our customers. In this way we provide greater performance, cost-effectiveness and flexibility. And we create significant added value for our customers. Together with you we want to be successful as an internationally renowned specialist in these niche markets and to make an effective contribution to further development.

KKS markets a complete range of ultrasonic components as individual items and spare parts. We also use these components in our ultrasonic systems, both in standard systems and in customer-specific systems and guarantee the best quality with them. Leading businesses from a very wide range of industries have chosen us as their technology partner due to the quality of our systems, as well as their durability and excellent performance. The KKS SINGLE, DUAL and MIX frequency technologies, combined with our cleaning solutions, make ultrasonic cleaning an efficient and at the same time environmentally sound method, capable of cleaning products of all types.

We provide a small insight in the world of purity on the following pages. If you should have any questions about our products and services, we will be pleased to be of assistance at any time.



Purity through ultrasound

Purest cost-effectiveness

Our customers have been able to rely on the familiar characteristics of KKS systems such as

- Maximum performance
- Reliability
- Durability
- Cost-effectiveness

for decades – the result of our uncompromising quality awareness.

Ultrasound-based cleaning is a very effective and gentle process for intensively cleaning materials of all types, as well as finely structured, porous, open-pored surfaces and very complex geometries, in a very short time, without additional manual effort and without damage. The range of applications extends from the smallest components for microelectronics and optics, through medical implants, to bulky parts for the automotive industry.

Ultrasound and ultrasonic cleaning – a varied and broad spectrum of applications

- Medical technology/pharmaceutical industry
- Precision mechanics/watch industry
- Vacuum technology
- Coating technology
- Mould cleaning
- Water treatment
- Aerospace industry
- Food industry
- Optics
- Electronics

The unique action of ultrasound is based on the physical phenomenon of cavitation. In liquid media sonic waves of more than 1 W/cm^2 generate microscopically small, low-pressure bubbles (cavitation bubbles) that implode immediately. This process, which preferably occurs at boundaries between the liquid and the item to be cleaned, generates high pressures and large amounts of turbulence, and releases enormous amounts of energy. The surface of items to be cleaned is intensively purified by the resulting “jets” as well as by suction and pressure pulses.

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Purity through research

Purest flexibility
All KKS ultrasonic equipment can be provided with SINGLE, DUAL or MIX frequency technology to fit needs and requirements.

SINGLE: 27 / 30 / 40 / 60 / 80 / 100 kHz
DUAL/MIX: 27 & 80 kHz / 30 & 60 kHz / 40 & 100 kHz

Purest performance
KKS generators, designed for industrial use with powers of up to 2000 watts, feature maximum performance with minimal space requirements.

Scientific basis of ultrasonic cleaning

Sound
Definition: propagation of very low pressure and density fluctuations in an elastic medium (gas, liquid, solid body).

Properties: physically the term “sound” covers all signals that human or animal hearing can perceive and acquire acoustically. Sound is a mechanical wave and is therefore bound to a transmission medium in which it propagates by means of pressure and density fluctuations. It can propagate in gases, liquids and solid bodies with entirely different velocities that are also affected by the temperature and the external pressure. In gases and liquids sound propagates by means of longitudinal waves, in solid bodies transverse waves also occur.

Unit: sound is categorised into frequencies that are given in the unit Hertz [Hz]. One Hertz corresponds to one vibration per second (1/s).

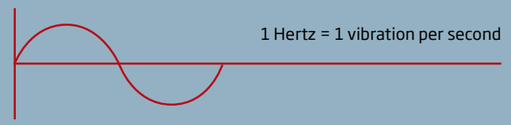
Ultrasound
Definition: sonic waves in the frequency range from 20 kHz up to 1 GHz, that is above the human hearing range.

Properties: ultrasonic waves are generated with significantly more energy, i.e. “louder” than audible sound. Depending on the characteristics of an obstacle, ultrasonic waves are either reflected, absorbed or scattered by it or pass through it (transmission). As with other waves, the effects of refraction, diffraction and interference also occur. In ultrasonic technology we roughly differentiate between:

- Small signal applications (material testing, medical technology, diagnosis) with powers below 1 W/cm² and frequencies above 100 kHz
- High power sonic applications in ultrasonic cleaning with powers above 1 W/cm² and frequencies mostly below 100 kHz

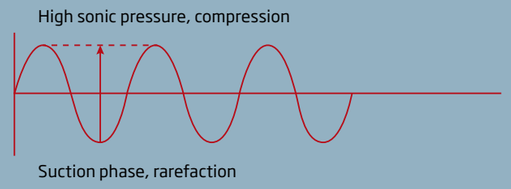
A differentiation is made between the following frequency ranges in acoustics:

0 Hz	to	20 Hz	Infrasound
16 Hz	to	20 kHz	Audible sound
20 kHz	to	1 GHz	Ultrasound
	From	1 GHz	Hypersound



Ultrasound in liquids
Liquids are held together by cohesive forces that act between the individual atoms and molecules within a substance and in this way define the tensile strength of a liquid. The alternating sonic pressure causes continuous density and pressure changes in the medium (“compression” and “expansion”). In the “suction phase” of the vibration there is relative low pressure (expansion). The liquid can tear due to the formation of a bubble-shaped void (a “transient vacuum”), however the liquid at the boundary of the void evaporates immediately and the bubble is filled with vapour from the liquid. In the “compression phase” the vapour condenses again. In this way an oscillating vapour phase (cavitation bubble) is produced. Even at an ultrasonic intensity from approx. 1 W/cm² the tensile forces are greater than the binding forces of a liquid, which are approx. 1000 N/cm². Due to contaminants (insoluble particles of dust, traces of gas – so-called cavitation nuclei) liquids mostly tear already at approx. 10 N/cm² and cause the cavitation effect to occur.

Compression/expansion



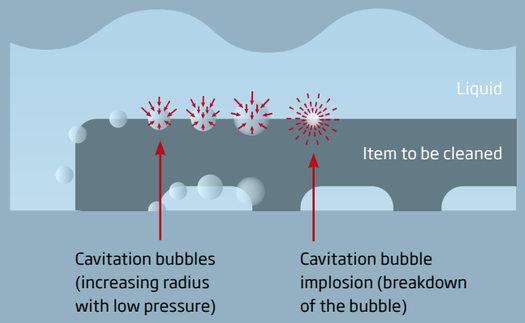
In the ideal case the oscillating cavitation bubbles are therefore filled with pure liquid vapour. However, in reality there are also gas bubbles in the liquid. These are always created when filling the cleaningtanks for example. Gas bubbles impair the behaviour of the cavitation bubbles, the cleaning liquid must therefore be degassed prior to use.

Cavitation effect

During the low pressure phase of the sonic field, the radius of the cavitation bubble increases over a few vibration cycles. During this process each bubble absorbs a large amount of energy from the sonic field. If enough ultrasonic energy is applied, the cavitation bubble can no longer oscillate stably, at the start of the next compression phase it suddenly collapses within nanoseconds (“transient cavitation”) and emits all of its energy back to the surrounding liquid. During this process shock waves, heavy turbulence and large flows are produced that are a thousand times more powerful than the primary ultrasonic field. It is these phenomena that cause dirt particles to detach from a surface. Cavitation implosions primarily occur at the boundaries between the liquid and the item to be cleaned. In other words, precisely where cleaning is required.
This physical process can however have negative consequences: for example ship’s propellers, water turbines and parts of pumps are attacked by cavitation.

In general there are three levels of cleaning

Primary cleaning Low frequency	27 kHz	High implosion forces
Fine cleaning Medium frequency	40 kHz	Medium implosion forces
Ultra-fine cleaning High frequency	80 kHz	Low implosion forces



Purest technology

KKS provides technologically leading solutions for every application area.

Technology	Meaning
SINGLE frequency	The generator operates at one frequency.
DUAL frequency	The generator can be operated at two frequencies, either of which can be selected for cleaning.
MIX frequency	If two transducers with two generators are installed in an ultrasonic tank, it is possible to clean items in the relevant bath using both frequencies simultaneously.

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Cleaning with ultrasound

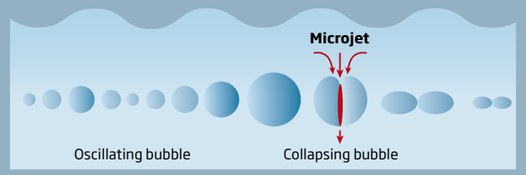
Cavitation and microjets

Cavitation is the primary cause of the cleaning action. If a cavitation bubble collapses at a phase boundary, a directional liquid flow (“microjet illustration”) is produced that impacts the item to be cleaned with a velocity of around 400 km/h. Local pressure peaks of up to 1000 bar and temperatures up to 5500 °C also occur. The dirt particles are detached by the microjet and emulsified in the cleaning liquid. Acoustic microflows caused by the oscillation and the collapse of the cavitation bubbles in turn promote the transport of the detached dirt away from the surface of the item. Even very small and difficult to access areas (porous or open-pored structures, drilled holes, undercuts etc.) are therefore reached without problems. The cavitation effect is dependent on parameters such as the external pressure, the temperature, the viscosity of the liquid, the ultrasonic frequency and the ultrasonic power.

Acoustic effects on contaminated surfaces

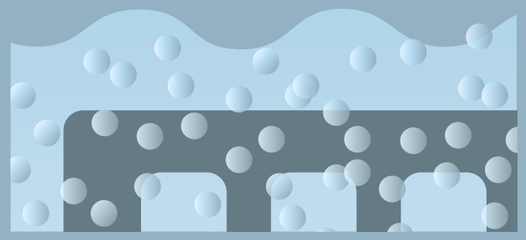
“Acoustic flow” “Stable cavitation” “Transient cavitation” → Erosion/detachment

Collapsing bubble near to a boundary with microjet

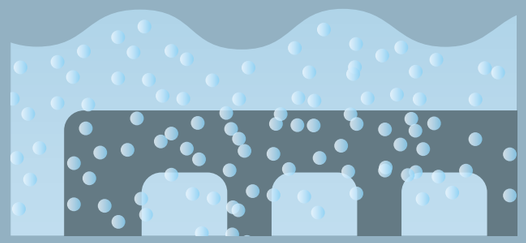


Sonic frequency

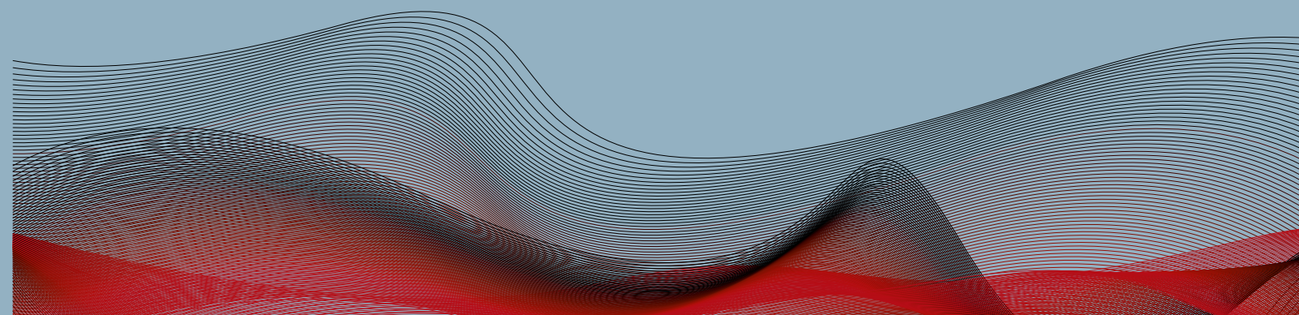
The sonic frequency plays an important role: at low frequencies large cavitation bubbles are produced that produce shock waves with high power as they implode. At high frequencies on the other hand the radius of the bubbles is smaller and the implosion forces are therefore lower. For this reason tenaciously adhering dirt is most effectively removed at low ultrasonic frequencies. However, cavitation damage may be caused to the surfaces of delicate materials. Higher ultrasonic frequencies can also prove effective, as the flow velocities are higher. As a result, particularly small, less firmly adhering particles are effectively removed.



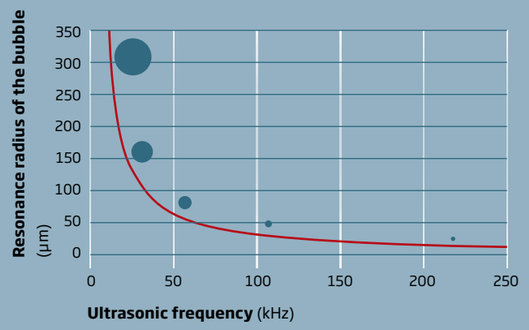
Low frequencies for heavy contamination.



High frequencies for small bores and delicate structures.



The resonance radius of cavitation bubbles as a function of the sonic frequency

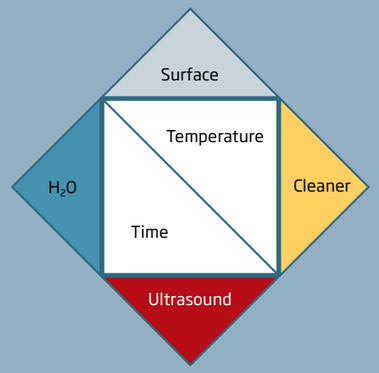


Other cleaning factors

For effective ultrasonic cleaning a series of other parameters must be considered. The correct selection of the duration of the cleaning, temperature, chemical composition of the cleaning medium and quality of the rinsing water are essential for a good cleaning result.

The nature of the item to be cleaned and its surface properties are as important in ultrasonic cleaning as for other cleaning methods. Other factors are also crucial:

- **Ultrasound-specific:** Usage of suitable baskets, whereby the tank must not be overloaded with too many items to minimise the absorption of the ultrasound.
- **Cleaning liquid:** Usage of surface tension reducing chemical additives to ensure optimal transmission of the ultrasonic energy.
- **Temperature:** 40 °C to 90 °C is normal for aqueous alkaline, neutral or acidic solutions. Each cleaning liquid has its optimal temperature for transmission of the sound and cavitation. With increasing temperature the viscosity and density decrease and the vapour pressure increases.



Purest process

KKS focuses and demonstrates its competences in three clearly defined fields of activity:

- Development and production of ultrasonic components and power generators
- High technology ultrasonic cleaning systems
- Optimised ultrasonic cleaning media for every application

We apply all competences on a daily basis as a service at our in-house surface centre.

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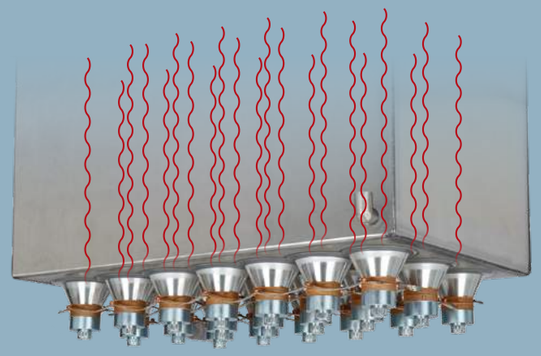
Components of ultrasonic cleaning

Generation of ultrasound

The principle of ultrasonic cleaning is based on the application of high-energy sonic waves to a liquid cleaning medium which entirely encloses the item to be cleaned. The ultrasound is generated by an ultrasonic transducer, controlled by a **generator** that converts the mains voltage into the appropriate ultrasonic frequency and output voltage.

An **ultrasonic transducer** contains a varying number of transducer elements connected in parallel depending on the power. This group of elements converts the electrical oscillations generated by the generator into mechanical vibrations via piezo-ceramic discs.

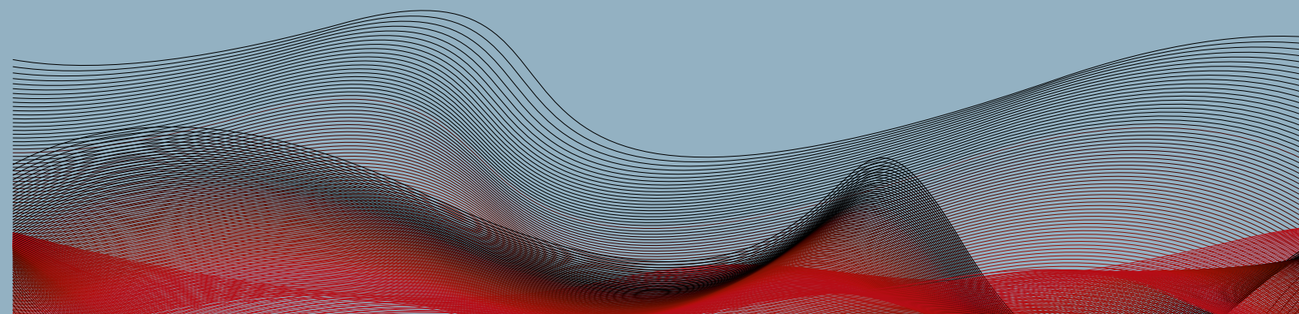
The vibrations are transmitted to a **stainless steel membrane** via coupling pieces. The liquid medium in the cleaning tank is put into oscillation by the deflection of the surface of the membrane; as a result a homogeneous sonic field is produced.



Purest components

KKS high-performance ultrasonic components for aqueous cleaning feature a series of outstanding characteristics:

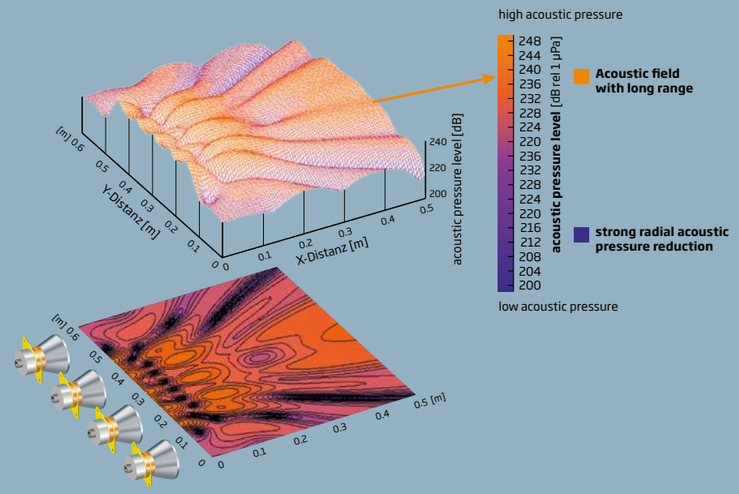
- Compact and powerful – individual ultrasonic modules up to 2000 watts
- Maximum availability – protected against short circuits and no-load operation
- Best cleaning results – automatic frequency modulation, frequency optimisation and power stabilisation
- Adaptable – different ultrasonic frequencies for SINGLE, DUAL or MIX applications
- Communicative – via the “AnyBus” control module it is relatively easy to integrate KKS generators in control systems



Ultrasonic transducer designs

Ultrasonic transducer designs can be divided into two main categories:

- Surface transducers with directional emission
- Rod/tube transducers with omnidirectional emission.



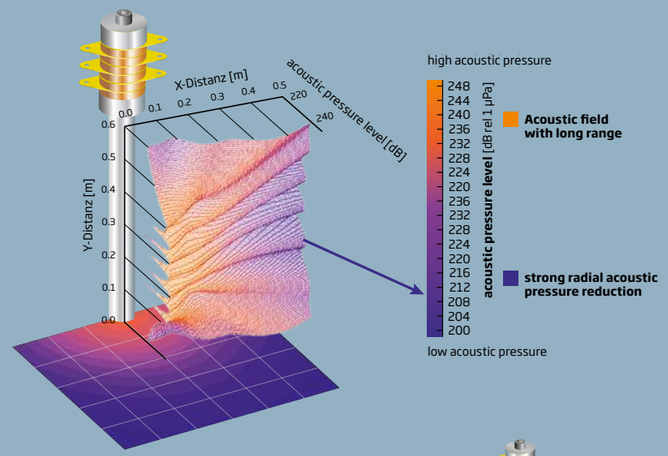
Surface transducers have a near field characteristic with a large homogeneous range.

Surface transducer

High ultrasonic energy is output over a plane surface of maximum size in a tank. Directional emission is produced.

Advantages

- DUAL frequencies (27 & 80 kHz / 30 & 60 kHz / 40 & 100 kHz)
- Optimal homogeneous sonic field in the cleaning tank
- Very good price-performance ratio
- Best cleaning quality



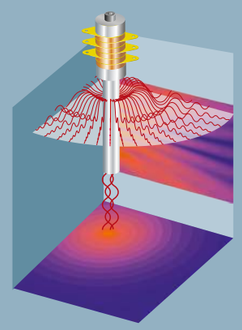
Tube transducers emit with a significant radial reduction in the sonic pressure in disc-shaped layers.

Advantages

- Little space required for installation
- Targeted sonic treatment of bores

Disadvantages

- Higher power losses on the generation of the vibration in the ultrasonic transducer
- Undesirable omnidirectional emission (tank damage)
- Emission not homogeneous, with dead spots
- only frequencies up to approx. 40 kHz possible



On tube or rod sonic transducers, a longitudinal vibration is produced first on the single-piece rod, or on the single-piece tube and is radiated radially over 360° in the form of a transverse component. This "vibration deflection" causes additional losses and results in uneven emission of the ultrasonic energy along the length of the rod.

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Cleaning agents

As water is only of limited suitability for ultrasonic cleaning, in general it is recommended to use cleaning agents (cleaning liquids with chemical additives, in particular surface active substances). These agents must be specially developed to ensure an optimal cleaning result. For ultrasonic cleaning the selection of the cleaning agent is as important as the design of the necessary ultrasonic equipment (generators, transducers, operating frequency etc.). Decisive factor is how the dirt or the medium that binds the dirt can be solved or chemically cracked. During this process the items to be cleaned must be attacked as little as possible. Furthermore, the material of which the items to be cleaned are made and the history of the contamination are crucial for the selection of the cleaning liquid. In general trial cleaning in advance in specially equipped laboratories at cleaning specialists is to be recommended. During this process other process steps such as drying, rinsing etc. are checked.

Industrial component cleaning

For industrial component cleaning in the metalworking industry or surface treatment, two types of ultrasonic cleaners are normally used:

Aqueous bath

- Alkaline, pH value = 8 - 14
  Widely used and economical. These media have not only have a good cleaning action, they are also largely degradable, i.e. non-polluting. They are particularly suitable for the removal of oils and greases.
- Neutral bath, pH value = 7
- Acidic bath, pH value = 1 - 6
  These agents, based on inorganic or organic acids, are particularly suitable for scale removal, rust removal and the removal of oxide layers on metals. Oils and greases of non-animal origin can also be removed.

Solvent systems

Solvent systems remove grease very well, however they can often only be used for clearly defined contamination and under very specific technical conditions.

The advantages of ultrasonic cleaning

- Pore-deep clean surfaces without scratching, brushing or scraping – also on porous or open-pored structures, complex geometry, small gaps or blind holes in the item to be cleaned
- Short cleaning times from a few seconds to minutes
- Straightforward and quick to apply
- Can be used for practically all types of contamination and materials
- Prevention of tedious and expensive manual work – the cleaning becomes a successful experience
- Significantly fewer chemicals additives are required than for many conventional cleaning processes
- The cleaning process can be automated and provides reproducible results

Purest reliability

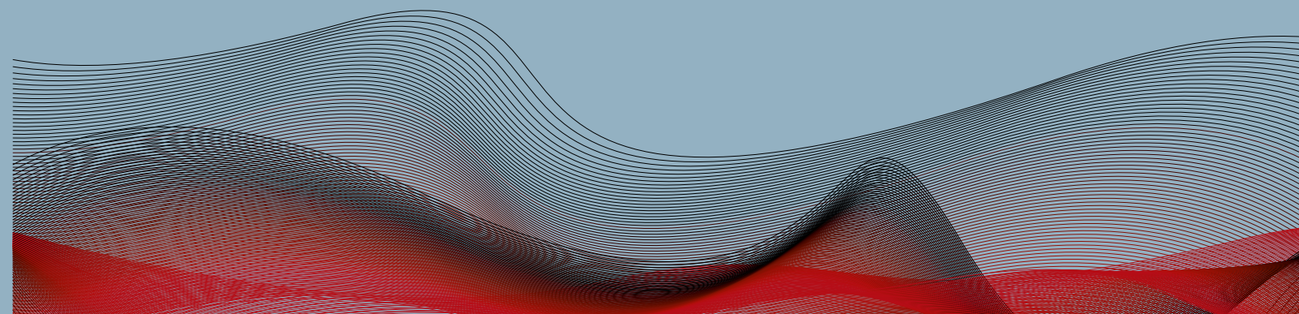
KKS ultrasonic transducers are guarantors for durability and performance:

- Space-saving installation
- Maximum power output
- DUPLEX stainless steel to minimise the cavitation erosion

Purest selection

As a complete solution provider KKS supplies everything for ultrasonic cleaning from a single source:

- Ultrasonic cleaning media
- Ultrasonic components
- Ultrasonic cleaning systems



General information on the usage of ultrasonic cleaning baths

- The bath or tank is filled with cleaning agent (pay attention to level and displacement volume of large volume parts!) and if necessary, heated to operating temperature.
- The chemical cleaning additive is added.
- The ultrasound is switched on and set to maximum power (preferably pulsed ultrasound or high ultrasonic frequency) to “degas the cleaning liquid”. The process takes between a few minutes and 30 minutes, depending on the ultrasonic power installed and the temperature.

Degassing the cleaning liquid
Larger quantities of air or other gases are always dissolved or suspended as insoluble bubbles in “new, cold liquids”. At the start of the application of the ultrasound these bubbles initially coagulate (gas cavitation) and can be seen to rise.
A large part of the ultrasonic energy is consumed during this degassing process, the cleaning action on the object is significantly reduced.
The addition of surfactant agents to aqueous solutions accelerates the degassing process. Many cleaning additives already contain surfactant agents.
The degassing is clearly visible and can be checked accordingly. This process must be repeated on the same liquid only after a longer period without use (day) or after intensive mixing (pump-filter unit) with the tank surface open.

Part cleaning
The parts to be cleaned are held directly into the bath or suspended via a fixture such that they are fully immersed. During this process a minimum distance of approx. 5 – 10 cm from the surfaces emitting ultrasound is to be maintained. In particular, the following need to be considered:

- As far as possible do not place small parts in layers on top of each other. Parts with large surface areas (lenses, printed circuit boards) mostly need to be arranged parallel to the direction of the sound.
- Position parts in racks individually and as far a possible according to their surfaces.

The cleaning time is between a few seconds and several minutes, depending on the contamination and the chemical dissolving properties of the cleaning liquid. With older or dried soiling, as can arise above all during maintenance work, the treatment times may be longer. In such cases, e.g. prior “soaking” in the bath may be useful. The cleaning result is significantly improved by movement of the parts in the bath, e.g. by means of an integrated oscillation device or by manually moving the parts (avoidance of the effect of standing ultrasonic waves), because in this way the removal of layers already detached is improved. On the removal of the items to be cleaned from a bath that is not continuously maintained, residues of the bath liquid or even detached particles of dirt may remain adhering to the surfaces of the parts. For this reason the items to be cleaned should be subsequently rinsed.

General information on cleaning
Despite the “comprehensive distribution” of the ultrasound throughout the entire tank volume, an accumulation of several small parts or even large parts can cause a shadow effect.
This means the ultrasonic intensity present at the part itself is not sufficient to trigger cavitation at the surface. The part is not clean enough.
Direct contact with the surface emitting the sound, in particular with base sound, will result in inadequate cleaning performance and will damage the ultrasonic transducer!

Bath maintenance
After each cleaning cycle and after an extended period without use, the liquid should be replaced and the tank cleaned. Any residue must be removed.

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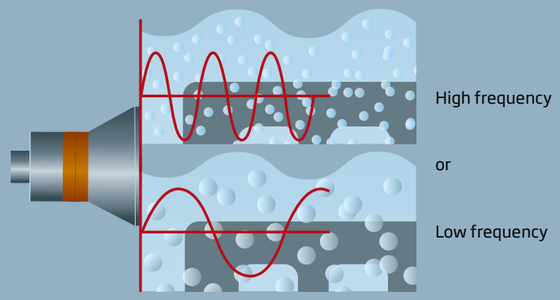
“After sales service”
KKS provides competent advice and support during all project phases. Individual customer services are provided simultaneously.
KKS customers receive quick, punctual delivery in the areas of planning, installation and customer service for their equipment and systems. In addition, flexible, individual services tailored to the customer’s needs ensure sustainable high system availability and customer satisfaction.

DUAL or MIX frequency ultrasonic technology

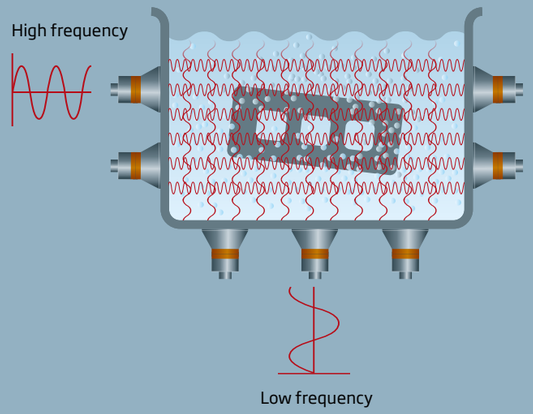
By means of sequential or simultaneous sonic treatment with two matched frequencies, e.g. 27 kHz and 80 kHz, excellent cleaning results can be achieved in relatively short process times.

DUAL ultrasonic technology
Time and again the DUAL or MIX frequency technology proves itself to be one of the most efficient and effective ultrasonic cleaning processes. Comparisons and trials have produced entirely new findings: the combination of primary and fine cleaning in the same process increases flexibility and it is possible to achieve excellent cleaning results not obtained previously. At low frequencies fewer but as a result larger cavitation bubbles with higher implosion energy are formed with DUAL or MIX frequency technology. The complex layers of dirt are broken up and the surface structure is enlarged. At high frequencies many more, albeit smaller cavitation bubbles with lower implosion force form. The smaller cavitation bubbles ensure that even porous surfaces, open-pored structures as well as very small bores and delicate structures are freed from contamination. Thanks to the DUAL frequency ultrasonic systems, primary and very fine cleaning can be undertaken in the same tank.

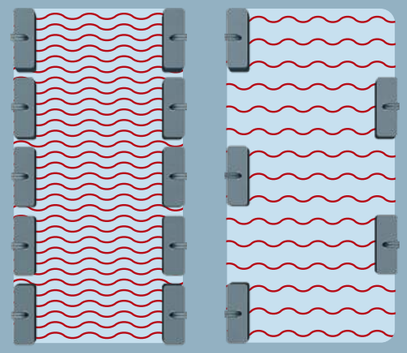
KKS dual frequency ultrasonic systems
We develop and manufacture these systems with high quality.
- For the highest possible efficiency
- Individually adapted dimensions
- Ultrasonic membranes with thicknesses of 2/3/5 mm
- Membrane material DUPLEX stainless steel



The MIX frequency tank
Here the transducer elements on the side wall of the ultrasonic batch vibrate with a different frequency to those on the tank base. By means of simultaneous sonic treatment with two matched frequencies, e.g. 27/80 kHz, 30/60 kHz and 40/100 kHz, excellent cleaning results not achieved in the past can be obtained.



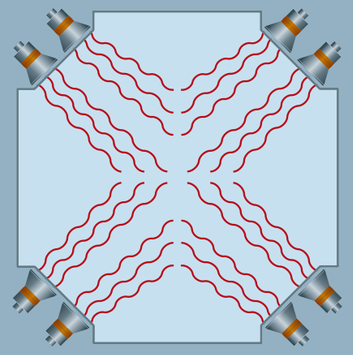
Installation examples for immersible transducers and transducers bonded directly onto the tank
Whether immersible transducers are used or ultrasonic transducers fitted directly onto the tank depends on the size of the bath and its use.



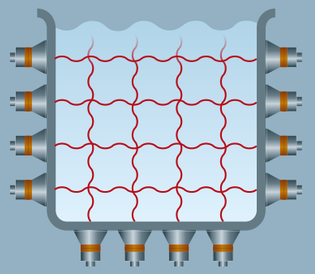
Full and partial equipment of the tanks

Full equipment
Advantage: maximum performance due to full configuration
Disadvantage: high procurement cost

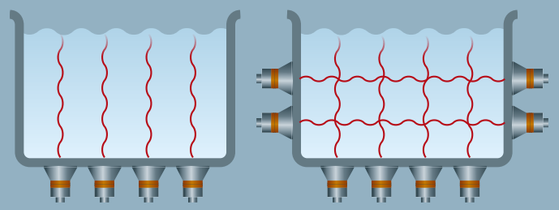
Partial equipment
Advantages: it is possible to retrofit to the empty positions without problems; half the procurement costs
Disadvantage: lower performance



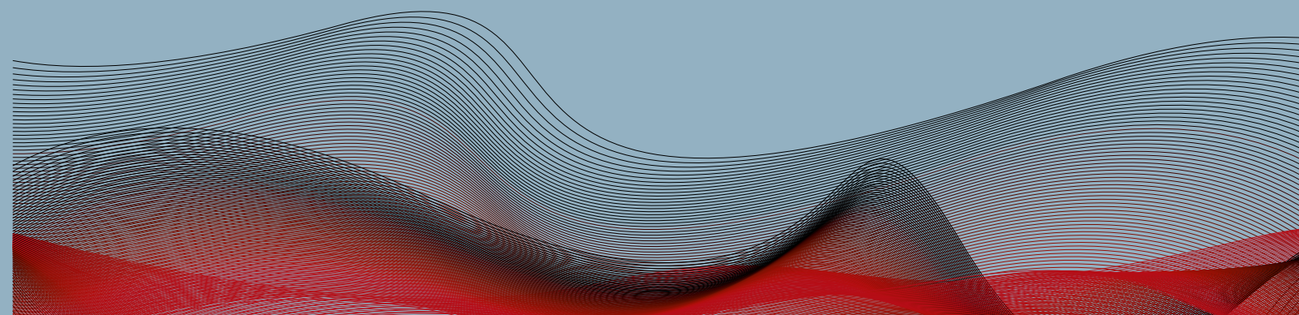
Installation example for corner transducers
These special transducers are used on special systems, 1-chamber systems or where little space must be exploited optimally. They are suitable for use in vacuums.



Customer-specific designs
Like the systems, the power and size of the immersible transducers are of customer-specific design. Tank with a full side configuration can also be fitted with immersible transducers on the base of the tank. All immersible transducers can be supplied with 2/3/5 mm membranes. The immersible transducers are manufactured from cavitation-resistant, highly acid and corrosion-resistant stainless steel 1.4462 (DUPLEX-stainless-steel).



Installation examples with transducers bonded directly onto the tank (very fine cleaning)
For bath volumes below 100 litres, transducer elements are usually bonded directly to the sheet metal of the tank, usually only on the base of the tank. If higher performance is required, transducers can also be bonded to the side walls.



Purity using technology: KKS ultrasonic systems

Purest technology
KKS provides technologically leading solutions for every application area.

Technology	Meaning
SINGLE frequency	The ultrasonic device operates with one single frequency.
DUAL frequency	The generator can be operated at two frequencies, either of which can be selected for cleaning
MIX frequency	If two ultrasonic sources with two generators are installed in an ultrasonic bath, it is possible to clean items in the relevant bath using both frequencies simultaneously

High-performance ultrasonic transducers

KKS ultrasonic transducers feature extreme durability, reliability and constant power output. They comprise two piezo-ceramic discs that are mechanically pre-stressed via two metal end pieces. The nominal power of a transducer at all frequencies is generally 50 watts.

27 / 80 kHz

30 / 60 kHz

40 / 100 kHz

The domain of KKS ultrasonic technology is in particular cleaning tasks that require several ultrasonic frequencies. The powerful KKS ultrasonic transducers, together with our ultrasonic generators, make it possible to equip ultrasonic systems with SINGLE, DUAL and MIX frequency technology.

Standard frequency pairs:
- 27 and 80 kHz
- 30 and 60 kHz
- 40 and 100 kHz

Low frequencies of 27, 30 or 40 kHz
- Primary cleaning
- Produce few, albeit larger cavitation bubbles with high implosion energy
- Remove stubborn contamination

High frequencies of 60, 80 or 100 kHz
- Fine cleaning
- Produce a large number of, albeit smaller cavitation bubbles with a lower implosion energy
- Remove layers of contaminastion in the smallest bores and delicate structures or porous surfaces
- Gentle on surfaces

Advantages of MIX frequency technology:
Simultaneous treatment with several matched ultrasonic frequencies in the same cleaning bath ensures pore-deep, gentle cleaning of complex parts in a short time.

- The different ultrasonic frequencies can be used simultaneously or separately
- Combination of high cleaning energy and deep action
- Gentle, pore-deep cleaning

KKS

High performance ultrasonic generators

KKS FT-TM generator

FT-TM: the bench-top model with all options
The generator FT-TM is designed for industrial use with powers up to 2000 watts. Of particularly compact design, it leaves nothing to be desired thanks to its very high efficiency and flexibility. All functions can be controlled both manually and also integrated into a control system.

Dimensions	400 × 150 × 91 mm
Ideal application	Single and multiple chamber cleaning systems
Ultrasonic power	50 – 2000 W
Power regulation	10 – 100 %
Ultrasonic frequencies	SINGLE: 27 / 30 / 40 / 60 / 80 / 100 kHz DUAL: 27 & 80 / 30 & 60 / 40 & 100 kHz
Microprocessor controller	✓
Degas function	✓
Automatic frequency optimisation	✓
Automatic power stabilisation	✓
Analogue interface	✓
AnyBus interface	–
Fault messages	✓
19" module carrier	–

KKS FT-MG generator

FT-MG: the uncompromising module generator
The modular design of the generator FT-MG opens up a large number of possibilities that will meet any requirement. The individual generator modules can be conveniently installed from the front in a module housing or in a 19"/4 U FT rack. The following plug-ins are available:

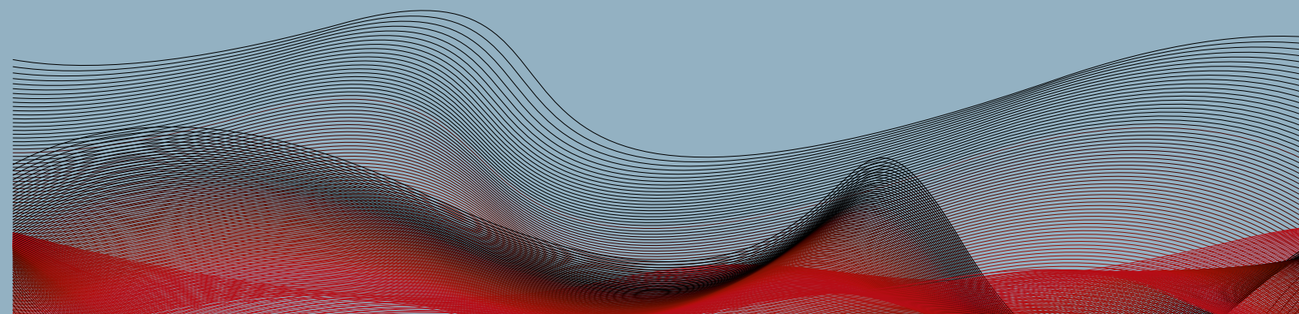
- 4 ultrasonic power modules, each up to 2000 watts
- 1 control module for manual operation or
- 1 AnyBus control module for the integration of the generators in control and monitoring systems
- Mixed configurations with modules with different frequencies and powers possible

Dimensions	–
Ideal application	Multiple chamber cleaning systems, automatic cleaning systems
Ultrasonic power	50 – 8000 W; max. 8000 watts per module housing or 19"/4 U FT module carrier
Power regulation	10 – 100 %
Ultrasonic frequencies	SINGLE: 27 / 30 / 40 / 60 / 80 / 100 kHz DUAL: 27 & 80 / 30 & 60 / 40 & 100 kHz
Microprocessor controller	✓
Degas function	✓
Automatic frequency optimisation	✓
Automatic power stabilisation	✓
Analogue interface	✓
AnyBus interface	✓
Fault messages	✓
19" module carrier	✓

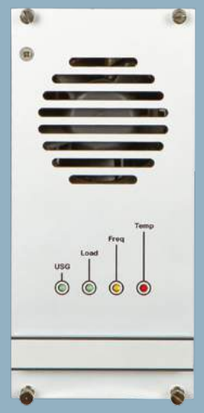
Purest highlights
The KKS ultrasonic generator technology combines an entire series of convincing arguments:

- Compact and powerful – ultrasonic modules up to 2000 watts
- Maximum availability – protected against short circuits and no-load operation
- Best cleaning results – automatic frequency modulation, frequency optimisation and power stabilisation

KKS



FT-MG: the components



Ultrasonic power modules
Microprocessor-controlled high-power modules with all available frequencies for SINGLE, DUAL or MIX applications. Can be installed from the front in a module housing or in a 19”/4 U FT rack.

Control module for straightforward manual operation
Control module for control and regulation of the ultrasonic parameters for all power modules in a module generator.

AnyBus control module – flexible integration into superordinate control and monitoring systems
The AnyBus control module permits the straightforward integration of generators via a very wide range of BUS systems such as PROFIBUS, PROFINET, Device NET, EtherCAT etc. It is possible to individually control up to 4 module generators with a total of 16 power modules.

High-performance ultrasonic transducer systems

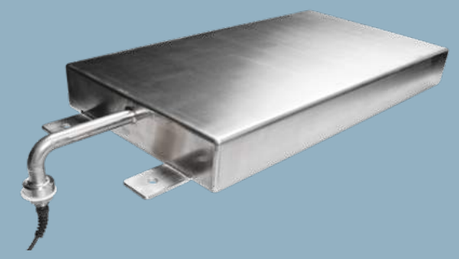
As the element for the transfer of the ultrasonic waves to the cleaning liquid, ultrasonic transducers or ultrasonic systems have a crucial impact on the effectiveness and reliability of an ultrasonic cleaning system. One of KKS’ core competences is the development and manufacture of such customer-specific ultrasonic systems of any size and performance class. During this process the strictest quality standards are applied. Whenever possible we use DUPLEX stainless steel for our transducer systems; this steel has very high resistance to cavitation erosion. Our products are guarantors for durability and maximum power output.

DUAL frequency technology
Each of the transducer elements installed in our ultrasonic systems can generate at least two frequencies. This feature has the advantage that both primary cleaning and fine cleaning can be undertaken in the same ultrasonic tank. If at least two sources of ultrasonic systems are installed in the same ultrasonic tank, the cleaning process can be further optimised using MIX frequency technology and in this way the process time shortened.

Immersible transducers – robust and flexible
Our immersible transducers feature a robust design, high efficiency, directional radiation emission as well as numerous installation options. They are mostly installed in large ultrasonic tanks with high powers. It is possible to upgrade cleaning tanks without major modifications.

Immersible transducer for bolt fastening through the wall of the ultrasonic tank

Immersible transducer with hooks for hanging it into the ultrasonic tank



Immersible transducer with fastening straps for fixing to a suspended unit in an ultrasonic tank

KKS

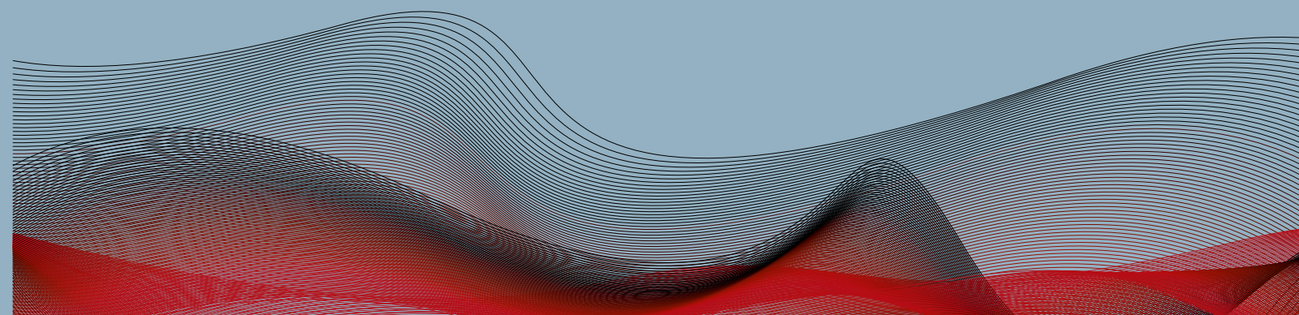
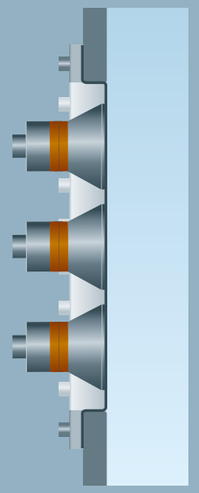


Plate transducers - space-saving and highly efficient

Our plate transducers are robust and efficient ultrasonic devices that are fitted to a flat or angled stainless steel membrane. They are mostly space-savingly flange-mounted in an appropriate break-out in the cleaning tank using welded and press-fit frames. The tank volume is not reduced by the installation of the transducers. Plate transducers are therefore suitable both for original equipment and also for upgrading existing tanks.



Installation view of a plate type transducer with contoured membrane

Ultrasonic plate transducer with press-on mounting frame

Installation example of a tank with plate type transducers – exetrior view

Installation example of a tank with plate type transducers – interior view

Ultrasonic tank equipped with transducer-elements on the tank bottom and a longitudinal side

Longlife ultrasonic transducers - maximum power density and service life

Our longlife transducer systems feature an extremely robust design. The 5-mm thick ultrasonic membrane and the 3-mm thick housing are exclusively manufactured from DUPLEX stainless steel and feature above-average service lives.

The longlife systems are preferably used for the following requirements:

- Very high power density (watts/membrane surface area)
- Little installation space
- Deposition of abrasive contamination into the cleaning tank
- High mechanical requirements
- Usage in vacuums

The longlife systems are available in different geometric versions:

- Rectangular, as immersible transducers
- Triangular, as immersible corner transducers

Longlife corner transducer

Customer-specific designs - quick and without complications

We listen to our customers, address their needs and explore their applications to develop technologically leading solutions. Customer-specific designs for ultrasonic equipment, the manufacture of complete ultrasonic tanks as well as the configuration of tanks, transducer plates, reactors or other assemblies form part of our service that is regularly received by many of our customers.

We are also your partner – we would be pleased to assist you in the planning and design of your specific ultrasonic applications.

Further information at: www.kks-ultraschall.ch

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