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INSTALLATION AND OPERATION MANUAL

T-SERIES ULTRASONIC CLEANING TANKS

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CAUTION: *Failure to install the equipment properly and follow operations listed in this manual may result in equipment damage and/or injury.*

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**CAUTION: READ BEFORE USING THE EQUIPMENT.**

Failure to respect all of the warnings in this manual could lead to severe and/or fatal electrical shock.

DO NOT – operate the unit without proper electrical grounding.

DO NOT – use adapter plug or cut off ground terminal of plug.

DO NOT – perform maintenance on the equipment without unplugging power cord and disconnecting transducers.



CAUTION: *Ignoring any of the warnings in this manual could result in personal injury and/or property damage.*

ALWAYS – Consult published safety regulations and manufacturer's data sheet. Inform operating personnel of toxicity.

ALWAYS – Use proper eye protection, gloves, and protective clothing when using equipment.

DO NOT – Use flammable solvents in the equipment.

DO NOT – Operate the equipment with solvent in a water based cleaning solution. A solvent layer underneath the water may super-heat and expel cleaning solution from the tank when the ultrasonics are first applied.

DO NOT – Allow cleaning solution to come in contact with the human body. Use a rack, basket, or tongs to insert or remove parts from the solution. Remove harmful vapor/fumes from work area.

DO NOT – Place tank on a flammable or combustible surface.



CAUTION: *Ignoring any of the warnings in this manual could result in equipment and/or parts damage.*

ALWAYS – Fill a heated tank to proper working height to minimize burnout or de-bonding.

USE ONLY – Cleaning solutions that are compatible with parts to be cleaned.

DO NOT – Use strong corrosive liquids such as strong acids or powerful caustics directly in the cleaning tank. Stainless steel is attacked by some agents and the ultrasonics will accelerate corrosive action.

DO NOT – Boil the cleaning solution. Boiling may overheat and damage the transducers.

DO NOT – Drop or place items to be cleaned directly on the bottom of the tank.

DO NOT – Energize the equipment while the tank is empty.

**PRUDENCE: LIRE AVANT D'UTILISER L'APPAREIL.**

Le non-respect de tous les avertissements dans ce manuel pourrait causer des chocs électriques graves et/ou fatal.

NE PAS – Utiliser l'appareil sans mise à la terre électrique appropriée.

NE PAS – Utiliser d'adaptateur ou de couper la borne de prise de terre.

NE PAS – Effectuer la maintenance sur l'équipement sans débrancher le cordon d'alimentation et de débrancher les transducteurs.

**PRUDENCE: *Ignorer tout les avertissements dans ce manuel pourrait de provoquer des blessures et/ou des propriété dommages.***

TOUJOURS – Consulter les règlements de sécurité publiés et la fiche technique du fabricant. Informer le personnel d'exploitation de la toxicité.

TOUJOURS – Utiliser une protection oculaire appropriée, des gants et des vêtements de protection lors de l'utilisation du matériel.

NE PAS – Utiliser de solvants inflammables dans l'équipement.

NE PAS – Faire fonctionner l'équipement avec un solvant dans une solution de nettoyage à base d'eau. Une couche de solvant au-dessous de l'eau peut super chaleur et d'expulser la solution de nettoyage à partir du réservoir lorsque les ultrasons sont tout d'abord appliqués.

NE PAS – Laisser la solution de nettoyage à venir en contact avec le corps humain. Utilisez un rack, panier, ou des pinces pour insérer ou retirer des parties de la solution. Retirer nuisibles vapeurs / fumées de la zone de travail.

NE PAS – Placer le réservoir sur une surface inflammable ou combustible.



PRUDENCE: *Ignorer toute les avertissements dans ce manuel pourrait causer des équipements et/ou des pièces dommage*

TOUJOURS – Remplir un réservoir chauffé à la hauteur de travail adéquate pour minimiser l'épuisement professionnel ou décollement de chauffe.

UTILISATION SEULEMENT – Nettoyage solutions qui sont compatibles avec les pièces à nettoyer.

NE PAS – Utiliser de solides liquides corrosifs tels que des acides forts ou caustiques puissants directement dans le réservoir de nettoyage. L'acier inoxydable est attaqué par certains agents et les ultrasons va accélérer l'action corrosive.

NE PAS – Faire bouillir la solution de nettoyage. Ébullition peut surchauffer et endommager les transducteurs.

NE PAS – Articles de chute ou de placer à nettoyer directement sur le fond de la cuve

NE PAS – Dynamiser l'équipement alors que le réservoir est vide.

In recent years, ultrasonic energy has been harnessed to perform many tasks including cleaning for industry. "Ultrasonic cleaning" is actually ultrasonic scrubbing. The process uses the cavitation of shock waves to create a scrubbing action on any part introduced into a cleaning chamber.

An ultrasonic cleaning system consists of an electronic generator utilizing 60 cycles of alternating current and transforming it into a higher frequency (HF) alternating current in the ultrasonic range. The generator is coupled to one or several transducers in the cleaning chamber. The HF electrical energy from the generator output is converted into mechanical energy inside the transducer elements. An ultrasonic transducer is a device that expands and contracts when fed HF alternating current. The expansion-contraction frequency of the transducer element corresponds to the alternating HF from the generator output current. The transducers are fastened to the chamber and transfer ultrasonic motion to the tank walls and the liquid.

A sound wave in liquid has high pressure ahead and low pressure behind it. As the sound wave passes, the pressure can reach a value below the liquid cohesive forces. This produces numerous small empty cavities in the liquid. Some of these small cavities, or micro-bubbles, enter into resonance with the frequency of the sound. They start to wildly oscillate and finally collapse, releasing strong shock waves. In a high-intensity cavitation field, bubbles implode millions of times per minute releasing powerful shock waves. The waves impinge against any submerged object in the liquid. Cavitation shock waves are the tools behind the scrubbing action observed in ultrasonic cleaners.

Although many frequencies are produced in an ultrasonic cleaning tank, there is a basic frequency corresponding to the fundamental resonance between the generator and the transducer. The most common fundamental frequency for ultrasonic cleaning falls between 20kHz and 60kHz. Frequencies below 20kHz may be more efficient cleaners due to lower frequencies creating greater scrubbing effects. The problem with frequencies below 20kHz are the annoying audible subharmonics. Frequencies above 50kHz are generally used for cleaning small objects and orifices. Due to shorter wave lengths, frequencies above 50kHz enable better penetration of acoustic energy in small openings and crevices. Higher frequencies, above 100kHz, have greater wave penetration. The issue with frequencies above 100kHz is the small resonant cavitation bubbles release far less energy at collapse time.

Upper harmonics and subharmonics of the transducer main emission are always present. In poorly designed cleaners, subharmonics in the audible range can create environmental noise. Below are physical and chemical factors that influence the intensity of ultrasonic cavitation in liquids:

TEMPERATURE

Increasing the temperature increases the cavitation intensity until it reaches a maximum and then decreases. For water, maximum cavitation is observed between 115°F and 140°F.

NATURE OF LIQUID

Water and aqueous solutions deliver more cavitation energy than organic solvents at equal acoustic energy density.

SURFACE TENSION

Liquids with a high surface tension (IE: water) deliver more cavitation energy than low surface tension solutions (IE: organic solvents). Adding traces of soap to cavitating water could momentarily kill the cavitation energy more than low surface tension solutions.

VISCOSITY

If everything else is equal, it is more difficult to cavitate high viscosity liquids or solutions.

VAPOR PRESSURE

Chemicals and liquids with high vapor pressure (IE: at room temperature) are more difficult to cavitate than low vapor pressure liquids (IE: mercury).

HYDROSTATIC-PRESSURE

It is easier to cavitate a liquid when reducing the hydrostatic pressure above the liquid surface. Reversely, an increase in gas pressure (pressurization) can momentarily decrease the cavitation intensity.

DISSOLVED GASES

The threshold of cavitation in a liquid depends upon the small traces of dust or dissolved gases always present. More energy is needed to cavitate degassed than aerated water. Ultrasonics first degas (noiseless large air bubbles come to the liquid surface) then produce small cavitation bubbles oscillating in resonance before collapse (energy releasing phase called vaporous cavitation).

EXPOSURE TIME TO ULTRASOUND

Some transducers are driven to produce short pulsed ultrasonic emissions. Measurements with pulses of varying length revealed a time delay between the application of ultrasonic power and the onset of cavitation. The longer a liquid is exposed to intense sound, the lower the threshold pressure at which cavitation occurs.

For the best ultrasonic cavitation, an appropriate chemical is needed. Chemicals can range from standard alkaline to a sophisticated surface active compound. Sonic Systems, Inc. has developed a number of such chemical additives.

The selection of cleaning liquids is generally determined by the kind of soil to be removed and the material to be cleaned. The cleaning solution used should act on the soil without attacking the part to be cleaned. Physical and chemical properties of a cleaning solution are important because the liquid transmitting the energy from the transducers also participates in the cleaning process.

The cleaning solution aids in cleaning in two ways:

1. Mechanical action (cavitation).
2. Solvent action, physical wetting or chemical attack on surface soil.

Recommendations for the most satisfactory solution in a particular ultrasonic application cannot safely be made without considering the specific soil to be removed, the type of metal or material to be cleaned, and the subsequent processing of the part following the cleaning stage. Other important considerations in selecting a cleaning solution include fire and health hazards, cost, and availability.

In selecting a specific ultrasonic cleaning solution, it is frequently quickest to begin with a solution that has proved most satisfactory without ultrasonics. Generally, ultrasonics increase the cleaning effectiveness of the solution permitting a faster and more thorough cleaning.

The following suggestions aid the user in maximizing the ultrasonic cleaning capabilities of the unit.

DEGASSING

Degassing is the removal of air trapped in the cleaning solution. Air trapped in the solution reduces the effectiveness of ultrasonics. Air may become trapped by adding/removing a work load, turbulating the solution such as a filtration system or adding liquid to the tank. Degassing is accomplished by running the ultrasonics, heating the liquid or by letting the solution remain static.

CHEMISTRY/SOAP

The right chemistry can greatly increase the effectiveness of ultrasonic cleaning. Especially helpful, are surfactants that reduce the surface tension of the solution. A reduction in surface tension allows for better ultrasonic cavitation. The reduced surface tension gives better wet-ability of the parts. The increased wet-ability allows dirt to become trapped in the cleaning solution. Due to their chemical properties, some enzymatic detergents are much harder to create cavitation and require a longer degas time. Enzymatics have low amounts of wetting agents that trap air in the solution. In addition, enzymatics are typically recommended for use in low temperatures not conducive for cavitation. If using an enzymatic soap, the minimum amount specified on the label should be used and the degas time should be increased to at least five minutes. Actual degas time will depend on chemistry/soap being used.

TEMPERATURE

The most effective temperature range for ultrasonic cleaning is between 115° F and 140° F. For correct temperature selection of your specific solution, please refer to the cleaning solution manufacturer's recommendation.



WARNING: Before adding chemicals to the cleaning tanks, consult the special safety instructions located in SECTION 1 of this manual.

A T-Series tank is one or more banks of transducers integrated into the bottom of welded stainless steel stand alone tank. The tank is connected to a generator with coax cables. Sonic Systems offers these tanks in a variety of sizes. The part numbers for tanks breaks down into the first letter being a “T” for T-Series. The next placeholder becomes the number of transducer banks. The next placeholder becomes the nominal width of the tank in increments of 4 inches. The next placeholder becomes the nominal length of the tank in increments of 4 inches. The part number is then followed by a dash and then the tank height in inches. The part number is then followed by a dash and then the operational frequency in kHz. A sample part number would be T234-12-27. The breakdown of the sample serial number is a T-Series tank, containing two transducer banks, a nominal width of 12 inches, a nominal length of 16 inches, a nominal depth of 12 inches and an operational frequency of 27 kHz. Custom sizes can also be designated as T2XX-27. This could be the same tank configuration, only there is no sizing designated. It is also possible for a custom tank to be designated a unique model number.

Operating Temperature	0 – 45°C Ambient 10 to 90% humidity, non-condensing
Power Requirements	Power supplied by ultrasonic generator(s)
Operational Frequency	27 or 40kHz nominal frequency depending on model
Nema Rating	Nema 1, IP10

Each system is identified by serial number on tag the back panel of the unit. Both the model number and the serial number are required in any correspondence with the company.

POWER REQUIREMENTS

The transducer banks of the ultrasonic cleaning tank are solely powered by Sonic Systems ultrasonic generators. Failure to do this could present injury to personnel or damage to equipment.

MECHANICAL CHECK

The system you have received was thoroughly tested before shipment. It has been protected as completely as possible from the rigors of transportation. However, since it is impossible to insure complete absence of in transit damage, a thorough inspection of the unit should be made prior to use.

1. Before unpacking or uncrating, check the external conditions of the carton or crate and note any signs of rough handling.
2. After removing the unit from its pack, inspect the external surfaces for dents, cuts, breakage and other signs of damage. Check all external fittings to see that they have not loosened.

****NOTIFY THE CARRIER AND THE MANUFACTURER IMMEDIATELY OF ANY DAMAGE.***

3. If damage to the shipping carton is evident, request the carrier be present when the generator is unpacked.
4. Check the equipment for damage and inspect the cabinet and panel for dents and scratches.

CLAIM FOR DAMAGE

If the 2700/4000 Series is mechanically damaged or fails to meet specification upon receipt, notify SSI or our representative immediately. Retain the shipping carton and packing material for the carrier's inspection as well as for subsequent use in returning the unit if necessary.

PACKAGING FOR RESHIPMENT

1. Whenever possible, use the original shipping carton and packing material for reshipment.
2. If the original packing material is not available, wrap the instrument in heavy paper or plastic.
3. Use a strong shipping container. If a cardboard carton is used, it should be at least 200 lbs. test material.
4. Use shock absorbing material around all sides of the instrument to provide a firm cushion and to prevent movement inside the container. Allow for a minimum of two inches between the instrument and the container wall on each side.
5. Protect the unit by means of cardboard spacers inserted between the system and the shipping carton. Make sure the instrument cannot move in the container during shipment.
6. Seal the carton with a good grade of shipping tape.
7. Mark the container: ***FRAGILE, ELECTRONIC INSTRUMENT.***

MOVEMENT OF CLEANING TANK

Never transport a cleaning tank while it contains liquid. Completely drain tank before moving. Ultrasonic cleaning tanks can be quite heavy. It is recommended to transport the tank into the working position using the original shipping package and transporting with a pallet jack or forklift to the working location. Once in position, the tank may be slid from the shipping package. When lifting a cleaning tank it is recommended to support the tank from the bottom or from tank flanges (if equipped).

It is always necessary to match the generator to the load in order to achieve maximum efficiency and the most desirable system operation. SSI always matches the generator to the load at the factory for optimal unit efficiency. To ensure correct set-up, follow the "CONNECTION AND OPERATION" instructions furnished with the associated generator. Further information on transducer matching or available transducers can be obtained by contacting **SONIC SYSTEMS, INC. ENGINEERING DEPARTMENT**.



WARNING: *Ensure the generator is located in an area where cleaning solution from the tank can not splash onto it.*

CONNECTION TO GENERATOR

Sonic Systems transducers must be used only with Sonic Systems generators. The generators are connected to the transducers via a coaxial cable. The coaxial cable has a connector on the generator end and is either hardwired or has a connector on the transducer end. Systems with multiple coaxial cables are numbered and then hooked up to their respective terminals on the generator and the transducer.



WARNING: *Failure to use the generators in any manner other than specified can result in injury to personnel or damage to the equipment*

UTILITY HOOKUPS

All Sonic Systems cleaning tanks come equipped with a drain fitting. If the unit is not equipped with an optional drain valve, add one at this time and connect it to a drain line. Standard drain line size is 3/4" NPT stainless steel female pipe thread. Some units are equipped with an optional 1/2" NPT stainless steel female fill port. If your unit has the optional fill port, tie the port to a water source.

CONNECTION TO MAINS POWER

Always check voltage and ampere rating of heaters and/or filtration system before connecting to a receptacle or hard wiring. A higher voltage and/or amperes than rated can cause an electrical fire if not properly installed. If there are questions on installation, electrical information is available through Sonic Systems, Inc. Engineering Department.

Before cleaning commences, the tank must be filled with a water/detergent solution. The solution requires degassing for maximum cleaning efficiency. To do this the operator should proceed as follows:

1. Fill the tank to the desired level.
2. Add a detergent to the water.
3. Turn the generator switch on.
4. Run the tank for 5 to 10 minutes to degas the water for maximum cleaning efficiency.

Upon completion of the above fill and degassing operation, the unit is ready for normal use. All that is required is to immerse the rack or basket load of ware in the tank, and turn the generator switch on.

When the detergent solution becomes heavily contaminated, drain the tank and refill with a clean solution. Drain the tank at the end of the cycle. Draining the tank consists of merely opening of the drain valve. Residue may be rinsed from the bottom by rinsing off with warm water.

Sonic Systems cleaning tanks are available with many options. Below are listings for some of the available options.

STRIP HEATER

The heaters are located inside the tank wrap. Set the thermostat to the desired temperature and turn on the main power switch. The unit now heats the liquid and maintains the set temperature.

IMMERSION HEATER

The heater is located on the back side of the tank. The heater thermostat is located inside the heater housing. On the bottom of the housing is the electrical cord to be plugged into a wall receptacle. Set the thermostat to the desired temperature. The unit heats the liquid and maintains the set temperature.

FILTRATION SYSTEM

The filtration system consists of a pump, a 10" filter housing, and a pressure gauge. Replace filters with only the same size and type as marked on the filter housing. The pressure gauge is an indicator when the filter element needs replacement. When the pressure rises 5 psi above normal operating pressure, the element should be replaced. To operate the system, plug the electrical cord located on the switch housing in the front of the tank into a wall receptacle or hard wire into a disconnect. To operate the filtration system, turn "ON" the pump switch.



WARNING: As with ultrasonic operation, heater and filtration options require a certain liquid level be maintained in order to prevent injury to personnel or damage to the equipment.



CAUTION: *Disconnect power cord before servicing. All parts of the circuit present shock hazards while power cord is connected.*

MAINTENANCE

The SSI Ultra-braze is a lead zirconate composite (sandwich) transducer assembly. It is ruggedly designed and constructed to provide high energy conversion and reliable performance. The assembly consists of a nose piece nickel-brazed to the tank bottom, a coupler disc (center electrode), bolt and insulators, and a compression block. In normal use, the transducer will never require service.

TANK BOTTOM EROSION

The radiating surface of the tank, although made of heavy gauge, heavy quality stainless steel, eventually becomes somewhat pitted due to the ultrasonic action. This is normal in high power ultrasonic equipment and no cause for concern.

TANK RUSTING

The tanks are fabricated with stainless steel and are resistant to rust. When iron work is processed through the tank and free iron makes direct contact with the tank walls or bottom over a period of time, spots of rust may be induced on the stainless surface. If this should become a problem, rust may be removed and the surface passivated by the following technique:

1. Clean any oil film from the surface.
2. Add a 1/3 solution of commercial grade nitric acid.
3. Let set for approximately 20 minutes.

SYMPTOMS	PROBABLE CAUSE	RECOMMENDATIONS
<p>No ultrasonic power</p>	<ol style="list-style-type: none"> 1. Problem with generator. 2. Faulty coax cable. 3. Problem with transducers. 	<ol style="list-style-type: none"> 1. Check generator. 2. Check cable for open or short circuit. 3. Check transducers for open or short circuit.
<p>Reduced cleaning power</p>	<ol style="list-style-type: none"> 1. Improper cleaning solution. 2. Solution not degassed. 3. Solution not up to temperature. 4. Parts basket is not proper design. 5. Improper loading of parts. 	<ol style="list-style-type: none"> 1. Use recommended cleaning solutions. 2. Run ultrasonics to help degas solution. 3. Operate cleaning solution between 120 – 140°F. 4. Restrictive access baskets or plastic baskets can reduce the cavitation field. Use a large open weave basket for optimal performance. 5. Improper orientation or stacking of parts can lead to a reduced ultrasonic field.

The following are general safety procedures not related to any specific procedures and therefore do not appear elsewhere in this publication. These are recommended precautions personnel must understand and apply during many phases of operation and maintenance of the system.

SAFETY PRECAUTIONS

Before attempting to operate the ultrasonic cleaning console, the technician must be familiar with the procedures specified in this manual. The system checkout shall be completed and the following precautions shall be observed while operating this equipment:

1. Any servicing, adjustment, maintenance, or repair of this system must be performed only by qualified and authorized personnel.
2. Do not attempt to service any electrical equipment while the power is on or while the unit is in operation.
3. Ensure that all electrical equipment is secured and connected properly.

RESUSCITATION

Personnel working with or near high voltages should be familiar with modern methods of resuscitation. Information about resuscitation can be obtained from the Bureau of Medicine and Surgery.

SERVICING

Any servicing, adjustment, maintenance, or repair of the ultrasonic cleaning console electronics must be performed by qualified personnel.



WARNING: Ultrasonic transducers inside the system may remain charged even when system is removed from the generator.



Use of the cleaning tank other than as specified can result in injury to personnel or damage to the equipment.

ORDER REPLACEMENT PARTS

To obtain replacement parts, address order or inquiry to SONIC SYSTEMS, INC., or its authorized service facility.

FACTORY CONTACT



SERVICE EXT: 116

SALES EXT: 110

WEBSITE: www.sonicssystemsinc.com

The website contains links to email addresses for sales, service and technical support.