

## Maintenance Do's - Don'ts and other Notes For Your Ultrasonic Cleaner

By Ken Kotoski

I would first like to clarify how an ultrasonic cleaner works. The ultrasonic produces ultrasound waves. Ultrasound is not audible. The ultrasound waves are very high frequency waves that are transmitted into the solution and are responsible for "tearing" apart the dirt and grime. The statement that tiny air bubbles are responsible for cleaning is not accurate. Actually, air and gas in the liquid hinders any cleaning. You may notice after placing fresh tap water into an ultrasonic that a lot of air will be forced out of the water right away. As all of the air is removed, the ultrasonic will clean better.

- 1) Anything you put into the ultrasonic that is not a rigid solid (for example plastic or rubber) will greatly reduce the cleaning ability. That is why glass beakers and steel trays and baskets are used. They pass the ultrasonic wave right on through without impeding them. Wire mesh baskets are not as good as solid pans or beakers. The mesh actually breaks the waves up into smaller waves and these smaller waves are weaker and don't clean as well as if a solid bottom pan or beaker were used.
- 2) Don't drop anything heavy on the bottom of the tank. The transducers are ceramic crystals that are fragile. They can be broken or cracked if this happens. Other ways crystals get broken include running the cleaner with little or no solution in the tank. In addition, when changing the solution be sure the old solution has cooled down before replacing it. When an ultrasonic has been running the transducers get hot and if they are suddenly cooled it can crack them. The transducers can also be broken if a 'heavy' object is placed directly on the tank bottom. If the unit is turned on and run with a heavy object resting on the bottom the transducers will overheat and crack.
- 3) I understand that equipment upkeep is time consuming, but it is essential to the overall longevity of your equipment. As with all equipment regular service and/or care needs to be done. An ultrasonic should be wiped down with a water-moistened cloth each day to remove the soap that has been splashed and dripped. Most soaps are caustic and if left on the unit will start to eat away the metal parts. In addition, if they are allowed to build up they can eventually get to the circuit board and cause short circuits because the soaps take a very long time to dry and some won't dry at all.

**VERY IMPORTANT:** When cleaning the unit DO NOT ever put it under water (running or otherwise). The ultrasonics are not sealed and when water gets inside, it will get to the circuit and will not dry out very quickly so a short can occur.

The lack of wiping the unit down daily is the cause of the majority of ultrasonics failing. This is an ongoing problem that happens over time, not right away.

- 4) When running the cleaner be sure the liquid is at the proper level. If using a heated unit the liquid should not be less than 1" below the rim of the tank. The heating elements are placed on the side of the tanks and on smaller units (less than 1 gal.) the heating elements normally are about 1" down from the rim. The heating elements are designed to produce a significant amount of heat for their size and without the solution covering them they will burn out. If using an unheated unit the same liquid level is suggested, however it is not as critical. The level could go down an inch or so before you endanger the transducers unless it is a pint size unit.
- 5) The type of solution you use can cause problems for your ultrasonic. Water with a very little amount of soap is the recommended solution. Unless you have specifically purchased a unit from the manufacturer that is made for ammonia or other degreasers do not use them. The ultrasonics that are sold in the jewelry and dental industries are not made for it and when placing ammonia in one, the cleaner will change it into a mild acid. This acid will eat the tank.
- 6) When adding soap to the water in the tank it is better to have too little than too much. The first and most important job of the soap is to reduce surface tension so the water will degas. Remember, any trapped gas in the solution will hinder the ultrasonics ability to work at top efficiency. After

degassing, the soap will have some ability to help clean, however, too much will reduce the overall effectiveness of the ultrasonic activity. The ultrasonic action uses the molecules in the solution to clean or tear the dirt off the item by stretching them and then collapsing them rapidly, so any trapped gases will act as a cushion and will not allow the ultrasonic to work as well as it should. Too much soap will act as a damper on the ultrasonic waves.

Think of it this way. If you took a hammer to a rubber ball what happens? The hammer will slightly collapse the ball and the hammer will be bounced off of it but the majority of the force will be absorbed by the ball. The ball in this case is gas in the solution and the hammer is the ultrasonic waves.

All soaps for any purpose have as one of the very first ingredients a wetting agent. This allows the water to become wetter and reduce surface tension. In our use this allows the gasses to be expelled quickly.

Try this experiment: Empty your cleaner. Rinse it and place fresh tap water in it. Turn it on. You will see some of the gasses come to the surface. If you let it run for several hours the majority of the remaining gasses will come out. But instead place a drop or two of soap in the water while it is running. Within a few minutes you will see a large amount of gas coming out. The gas is released because the surface tension has been reduced. If you were to try and clean a part without the use of soap you would find it takes a very long time. This is because of high surface tension. And you don't want your pieces to be in an ultrasonic for long.

- 7) When running your cleaner don't let anything rest on the bottom. If metal is placed on the bottom of the tank the vibration will eventually rub a hole in the tank.

The last thing you want to replace on an ultrasonic is the tank. The reason is that you can't just replace the tank. The transducers have to be replaced as well - they cannot be salvaged.

Baskets that sits on the bottom of the tank rather than being suspended should not be used. Anything that sits on the bottom of the tank will reduce the ultrasonic activity and it decreases the ability of the transducers to move the tank bottom. This will overheat the transducers, which leads to broken transducers. The best way to clean parts is to suspend them.

- 8) Plastic will absorb the ultrasonic waves, and should not be used as a container to hold parts in the ultrasonic. The only good containers are beakers (pyrex or metal), metal baskets and metal trays. I don't recommend glass jars because they are not made to withstand the ultrasound and I wouldn't want anyone to be cut by a glass container that shattered. Pyrex beakers are okay because they are made to withstand many stresses. Any container has to be 'rigid' so that it will not absorb the waves and instead allow the waves to pass right through. This means you shouldn't use plastic or rubber items.

Another method is to suspend a piece from a wire or rack hung across the sides of the ultrasonic. Ideally, nothing should set on the bottom of the tank. The best containers are those that are suspended from the rim of the ultrasonic. Special beaker plates are made for suspending them. Trays and baskets are also made that suspend from the rim of the ultrasonic. You will always maintain the quality and efficiency of your ultrasonics cleaning when the transducers are allowed to move the tank bottom freely.

- 9) Always make sure the ground prong on the plug is in good shape. Don't remove it. It needs to be there for safety. If your outlet doesn't accept a 3 prong plug change the outlet and make sure it is grounded.
- 10) When placing or removing items from the sonic be sure it is turned off or your hands are insulated from the items. If the item is metal and doesn't have a rubber coating on the handles use rubber gloves.

- 11) Don't ever put your hand into a sonic that is running. The chance of electrocution is small but can still happen. The ultrasound that is created by the unit is not the same as that which is used in the medical field. This ultrasound is designed to be destructive and over time will destroy the bones in your hands.

The tank being metal will wear out with use on all units. When the transducers are working the electrical pulses force them to physically change shape. This shape changing is what creates the ultrasound. This motion is transmitted to and through the tank.

Imagine taking a piece of sterling flat stock that is 1/2 hard and bending it back and forth many times. What happens? There will be a line where the metal gets progressively weaker until it breaks. Just before breaking it will have developed very tiny holes in that weak area. This is the exact same thing that is happening to your sonic tank. All of the smaller sonics use tanks that have been drawn down. So the weakest and thinnest points are the corners. These are the places normally that will form tiny holes first.

Some cleaners operate at frequencies that will cause the tank to deteriorate where the transducers are mounted. The more aggressive the cleaner is, the faster these holes will be created. One manufacturer claims that in their unit if metal filings are left on the bottom of the tank this too will increase the speed of tank deterioration. This mfg. makes one of the most aggressive ultrasonic cleaners on the market.

If diamonds are left on the bottom of the tank they will eat a hole in the tank very quickly. So be sure stones are set tightly before placing in the cleaner and if any do happen to fall out be sure to remove them promptly.

Usually the faster a cleaner cleans the faster it will self destruct. All ultrasonic cleaners are not created equal and all will destroy themselves eventually. They all can be repaired like new.

When purchasing a new unit there are trade offs. How fast do you need your items cleaned vs. How long do you want your cleaner to last before needing to be repaired. The manufacturers are all very competitive and are making advancements everyday to improve the effectiveness of their brands.

In my opinion some brands are better than others in general. Again if you need to clean fast and have a high volume of cleaning to do you will want a very aggressive cleaner. Therefore it will self destruct sooner. If you have the finances maybe several cleaners that will live longer and clean slower are a better choice, or a much larger unit that cleans slower would work.

Purchasing an ultrasonic cleaner is probably one of the more difficult buying decisions to make. I have seen and repaired most of the brands on the market and I have some very strong opinions as to which are made best and made to last and clean the best. Because ultrasonic cleaners have so many variables built into them one thing you will find among all that use them is a lack of agreement as to which is the best.

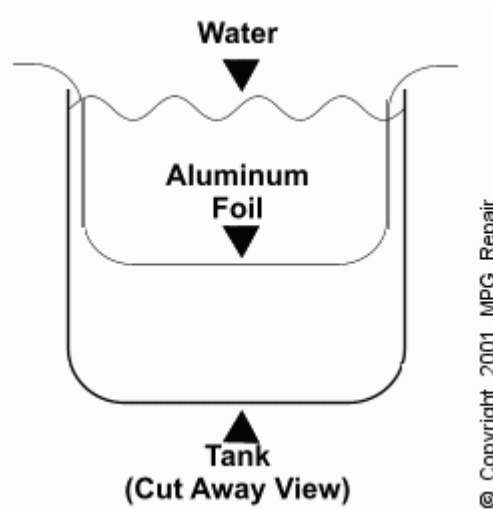
The worst thing to influence your decision on a purchase is price. Price is not how to determine the quality of an ultrasonic. The most expensive units are so because of various reasons some have nothing to do with how the cleaners work. For instance a brand made in Germany is more expensive for several reasons. One of these is duties and shipping that have to be paid. Obviously these factors have nothing to do with how good the unit is. On the other hand a very cheap brand may be 'cheap' for several reasons like the 'company' is some guy building the units in his garage and if you need warranty work done you will either not be able to get it or will take forever.

Talking about warranty brings up one other item. Most cleaners come with some kind of warranty. The best have a 10 year warranty on the tank and transducer. If they have less there is a reason.

When buying a new unit be sure to do the industry standard foil test and save it. Then down the road when you feel the sonic isn't working as well as it should do the test again and compare the foils. If the second has less pitting and holes, then the unit should be sent in for service.

The foil test:

- 1) Fill the tank with water and soap solution, allow to de-gas.
- 2) Take a piece of regular aluminum foil slightly larger in one direction than the tank.
- 3) Suspend the foil in the middle of the tank by hanging it over the ends of the tank. Be sure the foil in the tank is horizontal or as close as possible.



- 4) Turn the unit on for 1 minute.
- 5) Shut the unit off.
- 6) Observe the pattern of pits and holes in the foil.

A new sonic should have a fairly even pattern of holes and pits. Most of the foil should be covered with these. Save this piece for comparison to later tests.

Where the holes in the foil are, is the strongest and most consistent action. The pits are less action and if there are spots that were unaffected there is no action.

I would always suggest repairing a piece of equipment rather than buying a new unit. It will always save you money. I believe it is in your best interest to buy new equipment only when yours can't be repaired economically or when a new piece of equipment does something that your current one does not do or the new one does it better.

Ken Kotoski is owner of MPG Repair. He has over ten years experience in maintaining and repairing equipment in the industry. He has also had experience in running a production shop where numerous processes were being used including stamping, forming, casting, fabricating and others. His experience with the use, operation and repair of tools and equipment includes small items like handpieces to large equipment such as hydrogen ovens and presses. He has worked on nearly every piece of equipment in the industry and has used it in manufacturing. This unique knowledge combines the functionality of equipment and the needs of production. He is always available to answer questions and help with technical problems.

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