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Making Contact With Your Tubes

WITHIN HIGH-END AUDIO it's a well known and much-discussed fact that metal-to-metal electrical contacts significantly degrade the purity of signals passing through them.

Numerous types of contact base-materials plated with a variety of precious metals abound, while the use of contact cleaners and enhancers is virtual standard procedure even though the results are often less than ideal.

Seemingly overlooked in this quest for sonically acceptable contacts is the one made by the average tube to its socket. While sockets themselves can be problematic, it's hard-oxide coated tube pins that create the most audible-offense.

There are basically two types of pin configurations in present use:

- The octal style, where hollow, tin-plated pins are molded into a plastic base. Connection is made to the various elements within the tube by inserting the soft wires that exit the glass bulb of the tube itself into the hollow pins within the base and soldering them where they exit. This construction makes possible an acceptable electrical connection to the tube socket.
- A style used on the 7- to 9-pin miniature and the 12-pin compactron (6LF6) types, consisting of hard leads (pins) molded directly into the glass base of the tube. While various molding techniques are in use, all involve heating the glass to a plastic temperature with the pins held in place by a positioning jig.[1, 2] The glass is then pressure-die formed around the pins to form the base upon which the electrical structure of the tube is ultimately mounted. This done, the glass envelope is fitted over the whole assembly and fused to the base.

In this second case, a consequence of the various glass-working operations is that the pins become coated with a very hard oxide that is far from an ideal electrical interfacing surface. Consequently, in the better grades of tubes the pins are subjected to various cleaning and plating operations, the two most common platings being tin and gold.

The sonic improvement that results from the removal of these oxides is truly startling and well worth the time and effort required. At PEARL we consider such treatment to be absolutely essential and will not direct evaluative or developmental effort towards any gear that uses uncleaned tubes.

Most audiophiles using tube equipment have experimented—intentionally or not—with various brands of tubes, seeking to find the types that are most pleasing to the ear. Comparisons using tubes with oxidized pins are almost always misleading, and some very good-sounding tubes, with oxidized pins, can be wrongly condemned as poor performers.

There are several safe cleaning methods that can be used, but before proceeding it must be stressed that at no time should excessive force be applied to the pins. This can cause slow leaks and ultimate loss of vacuum which leads, of course, to failure.

ACID CLEANING

A 15% to 20% (by volume) solution of hydrochloric acid will remove the oxide in about one hour. However, there are a number of safety measures that must be strictly observed when working with any acid. When making up dilute solutions, always pour *ACID INTO WATER* and never water into acid. Heat is often released when an acid combines with water, and if water is poured into acid, the heat generated is concentrated around the water and can cause it to boil, spewing acid over everyone and everything in the vicinity! Always wear a full face shield, as acid splashes are no one's idea of a good time.

Pour about ⅜″ (10mm) of diluted acid into:

- a rectangular, flat-bottomed glass baking dish, if you are cleaning production quantities
- a wide-mouth canning jar or chemistry-lab beaker, if only a few tubes are to be done.

Stand the tubes in the acid until the pins look distinctly grey. Hydrochloric acid smells terrible, and its vapor is extremely unpleasant to inhale, so this job is best done outdoors or in a laboratory fume hood. As no significant quantity of gas is liberated by

this process, a loosely fitting lid can be used over the acid container if outdoors treatment is unsuitable. However, the fumes will often cause the branding ink on the tube to come off when the tubes are rinsed.

When finished, wash the tubes off in hot tapwater for about thirty seconds each, always allowing time for them to cool before proceeding with subsequent steps. Following this, any residual acid should be neutralized—easily done using a solution of baking soda (bicarbonate, not baking powder). Dissolve about a teaspoonful in 8 oz. of tapwater, and let the tubes stand in this solution for 3 to 5 minutes. Follow this procedure with another hot water rinse, and the tube pins are ready for the tinning procedure.

Stand the rinsed tubes on a piece of paper towel.

Mechanical Cleaning

The elbow-grease method:

The simplest of these methods is to get a roll of air-duct sealing tape, available from any self-respecting hardware store, and use it to hold the tube to some work surface while the pins are sanded clean.

The procedure is to lay down a short length of tape right at the edge of the table top, place the tube on it such that the pins hang out over the edge, and fix the tube in place with another piece of tape. Simply cut a few ½″ (12mm) wide strips of fine (360 grit) wet-or-dry sandpaper to use *shoeshine-wise* on the individual pins until, once again, they look distinctly grey.

Blast-cleaning methods:

If you have access to a cabinet-type glass-bead cleaning machine, you can clean tube pins with remarkable ease. The procedure is to wrap the glass envelope with a double layer of masking tape, leaving the pins exposed. Be sure to pinch the tape together over the exhaust tip, and don't attempt to do 6LF6's unless you cover the exhaust tip with a piece of rubber hose. This is done because the gloves used in such machines effectively prevent fine manual manipulation of anything small, and the likelihood of dropping a tube is high. As well, the force of even a momentary misdirection of the hand-held blast nozzle can blow the tubes around inside the machine.

Such machines normally operate at about 80psi, and this must be reduced to about 25psi by means of the same air-pressure regulator used to reduce the shop pressure to the usual 80psi level. Failure to do this can result in a hole being blown in the envelope during the blasting procedure.

Most glass beaders use a media-recirculating system to re-use the beads rather than throwing them away after one pass through the machine. If the machine is a re-circulating and not a dead-loss type, empty out the media storage cavity in the reclaim cyclone, pour in a fresh charge of beads, and run the machine until fresh beads issue from the nozzle The use of recycled, and hence broken, beads produces a rough finish on the pins that is not desirable. Using only fresh beads, the finish will be a gently undulating surface with no sharp discontinuities.

If production quantities of tubes are to be cleaned, an old abrasive-blast spark plug cleaning machine can be readily modified. Please call us for details.

Plating

From an electronics supply house buy a bottle of the electroless tin-plating solution used for tinning the copper traces on printed-circuit boards. This solution does not require power supplies or any of the other paraphernalia of conventional electroplating.

Simply pour a ⅜″ (10mm) depth into another glass container like the one used for cleaning, stand the tubes in it for about five minutes, and you have tin-plated tube pins!

Rinse, neutralize, and rinse the tubes as before; dry them thoroughly, first by hand with paper towel, and finally in a warm place for an hour. When toweling the tubes dry, be careful to wipe clean the glass area on the bottom of the tube inside the pin circle. It is possible that some chemical residues may still cling to the glass, which can cause undesirable interelectrode leakage.

If you want to go the last bit towards getting the glass really clean, a mild solution of Joy (only *Joy*, Madge!) and a *soft* toothbrush can be used to scrub the pin area. *Do not* use a hard bristle brush for this, as you can crack the glass envelope through the surprisingly great force applied to the pins while scrubbing. Follow the soap and water scrub with a distilled or de-ionized water rinse.

The reason for using Joy is because it leaves behind a trace residue that is so minute as to rival that of the high-performance detergents used in hyper-critical cleaning situations, such as those in chemistry labs where washed glassware must be absolutely clean and contaminant-free.[3]

Unless you are thoroughly familiar with soldering heat-sensitive assemblies, do not attempt to solder to the tube pins, as the heat can cause the seals to fail, with vacuum loss and ultimate failure.

An Interesting Experiment

As an aside, it is both interesting and informative to listen to the sound of a batch of tubes during

the various stages of the process outlined above. Each tube should be used in the same position in the equipment and should be labeled with a piece of masking tape, as the acid cleaning can remove inks from the glass. The difference from oxidized to acid-cleaned pins is more dramatic than that from cleaned to tinned pins, although we find the improvement to be just as worthwhile. We'd appreciate your comments regarding your findings.

While clean contacts are certainly desirable, many cleaners—particularly those that are designed to enhance contacts—leave behind unwanted residues that can cause problems. This is particularly true if such products are used on vacuum tube pins because the heat involved will often degrade the coating created by the enhancer resulting in diminished sound quality.

Overall, we have found the best approach to be absolutely bare, metal-to-metal contact.[3] To achieve this, use a solvent such as lacquer thinner, acetone, or toluene applied to a pipe cleaner to clean the contacts in question. These are quite powerful chemicals and can dissolve some types of the plastics used as insulators in RCA and tonearm connectors so use white pipe cleaners and check to be sure that the dirty-looking crud you remove from your connectors is actually dirt and not dissolved plastic.

We further suggest that low-level (e.g. phono) contacts be cleaned before every serious listening session.[3] It is truly amazing how fast these contacts deteriorate and how much this can upset the balance of a finely tuned system.

To date we have not found a contact cleaner/enhancer that is a better performer than simple, scrupulously clean bare-metal contact. This is by no means to say that such a product does not exist—simply that we haven't found it as yet. The best approach to this issue is to do your own listening experiments.

Some readers may wonder why we don't suggest a method of gold- or silver-plating contacts. The reasons are twofold: the plating procedure is much more complex and expensive than the electroless-tin method; and finally, humble tin plating is, in fact, very good-sounding.

UPDATE 1

Recent observations indicate that electroless-tin plating may not be as chemically stable in the long term as conventional bright-tin electroplating. It appears that electroless tin will oxidize much more readily in humid environments. While this presents no real problem, it may mean that tubes so plated may have to be acid stripped and re-plated every so often.

UPDATE 2

Possibly the simplest method of all to deoxidize tube pins is to scrape them clean with a small pen knife. Although your knife should be fairly sharp, no great amount of force is required. If you are willing to re-do the procedure once in awhile, the tin plating procedure can be foregone.

REFERENCES

1 Glass Bases for Radio Valves. Rowe, M.A., *Electronic Engineering,* August 1944.

2 The Technique of Glass Manipulation. Percival, G.A., *Electronic Engineering,* April 1944.

3 Thanks to Ed Logan of Logan Labs, Altamonte Springs, Florida, for these and many other useful tips.