Air Tables Are Not Always Needed for Vibration Isolation

Anthony G. Moss, Auburn University

Most of the time an air table is not needed for vibration isolation of electrophysiological equipment and microscopes. In fact, an air table can be a liability in that it is likely to pick up air-borne vibrations. This is especially likely if you have a solid enclosure, as is often used for the construction of Faraday cages used in electrophysiological investigations of vision research. Sound propagation can be particularly annoying, especially at the lower frequencies. Such important details are often forgotten in discussions of this topic.

A good damping table will help reduce the resonances, but still often can't overcome the difficulty posed by sound. One of the best solutions is proper placement of the entire rig: on the slab in the basement in a quiet place with no heavy vibrations from nearby heating, ventilating, and air-conditioning (HVAC) and other equipment. If needed, pour an additional slab of concrete, and place the instrument on this.

Mount the table stable to the floor with some sort of vibration damping. This could include felt pads (in some cases gluing them down as with heavy shop machinery), or of course, the table can be directly bolted down. Bolting and/or gluing is probably not needed if the setup is very heavy. As a graduate student, I found putting the feet in several inches of beach sand to be very effective at providing stable, quiet support.

Use a vibration-damping table top – this is very important. I've used sand-filled and shot-filled table tops, and our current table (provided by Bio-Rad with the CLSM) is a honeycomb table. All work well, but I think that the best I have seen is the annealed steel, lead-shot table I have under my current electrophysiology rig. Mass (my table is >400 pounds) seems to be one of the most important features of this type of table. The Newport catalog is particularly useful for the selection of such table tops. Of course, to hold such a massive table top, a complete steel air table may be needed after all! It probably won't need to be pressurized, unless you have vibration in the floor. If you must levitate the table, it may be surprising that dry nitrogen need not necessarily be used. Often, the house air system can be used, just be sure it meets the minimal pressure requirements.

If you don't have access to an air table and your load isn't particularly heavy (perhaps only 100 to 250 pounds), partially inflated bicycle or boat trailer inner tubes can be very useful. They have the great advantage of being very inexpensive; the down side is that you cannot easily reach the inner-tube when the system is loaded up. To remedy this, remove the valves from the innertubes, and attach high-pressure hosing to the valve stem (use teflon tape to seal the connection) and extend the valve position out where you can reach the tube with a bicycle pump. This way the plate and microscope, *etc.* can be balanced after loading.

Bike tubes can work well, but they do deflate, pop, rot and in general aren't as simple to use as might be thought. A better, more effective and lower maintenance alternative is silicon elastomer shock absorbers (Edmund Scientific silicone elastomer hemispheres: "Sorbothane vibration mounts, Cat. No. H35264"), which are simply placed under the antivibration plate, either on a bench or preferably a stand-alone table. (I have no affiliation with Edmund Scientific; just a satisfied user.) These items do have an upper limit of weight, and overloading results in them cracking and splitting wide open. They do not have to be balanced out, however, are very stable, and are not prone to aging.

Some investigators laud the merits of tennis balls. Needless to say, they have to be stopped from rolling! To prevent a migrating rig, drill holes in a 2 x 4 inch or similar wooden board. These holes should be approximately 3/4 inch less than the full diameter of a ball. Loosely insert the balls and place the table on top. I personally have not found tennis balls to be helpful for my work, but I do know that they are popular with many workers. Squash and racket balls are also useful. Squash balls are the best of these three from my observation, although they are a bit small and tend to compress easily.

Keep in mind that while mass is the simplest way to reduce vibration, it also affects the vibration frequencies passed. If an isolation table is used on an isolation slab, it is important to make sure that they each pass different frequencies of vibration. In general, try to use components that inherently resonate at different frequencies, to prevent propagation of sounds in the setup.

Also, please bear in mind that each setup is unique. Your solution will probably not be the same as your colleague's down the hall, unless you are doing exactly the same type of work with the same instrumentation. ■

A Note to the Editor:

In the April 1999 issue of this publication, in the Microscopy 101 section, Tina Corvalho wrote about an image handling problem she had encountered in her micrographs and how she was able to detect the cause and solve the problem using a publication called "A Guide to Scanning Microscope Observation" which she thought might be a JEOL publication. It is indeed a JEOL publication that we have had available for a long time and it has been updated fairly recently. It is available on our website in either HTML or PDF formats by going to http://jeol.com and clicking the download button. The print version is available by contacting either myself (978-536-2270) or any local JEOL sales representative.

- - - Steve Hamilton, JEOL USA