



Cutting, Preparation, and Testing of Samples for the *ACUPRO* Impedance Tube



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Introduction

Sample Cutting and Preparation

The following slides will familiarize you with the cutting and preparation of different kinds of samples for the *ACUPRO* impedance tube. Effective sample preparation is a skill that, once developed, will insure accurate and repeatable results using the *ACUPRO* impedance tube.



Types of Materials

Sample Cutting and Preparation

Most materials used for noise control may be classified as:

1. “Soft” materials used as sound absorbers
 - Open-cell foams and fiber materials
 - Underlayments (“shoddies”)
2. “Semi-rigid” materials used as barriers
 - Rubber
 - Stiff closed-cell foams
3. “Hard” materials used in construction
 - Wood and wood products
 - Gypsum

The terms “soft”, “semi-rigid” and “hard” will be used in the following slides to designate these general classes of materials.

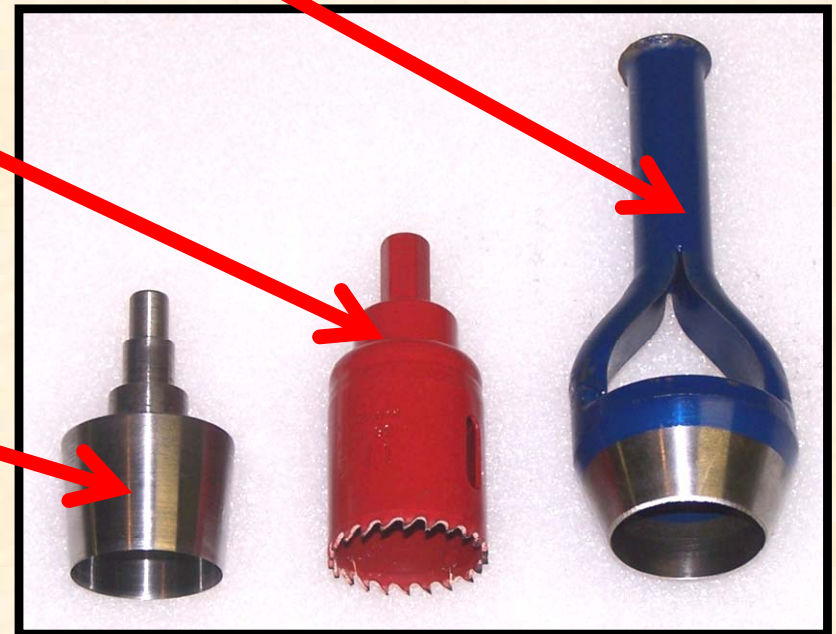
Tools for Cutting Materials*

Sample Cutting and Preparation

Cutter (punch) for “semi-rigid” materials

Cutter for “hard” materials

Cutter for “soft” materials (supplied with all ACUPRO systems)



* These three cutters are available from Spectronics, Inc.

Cutting and Preparation of “Soft” Samples

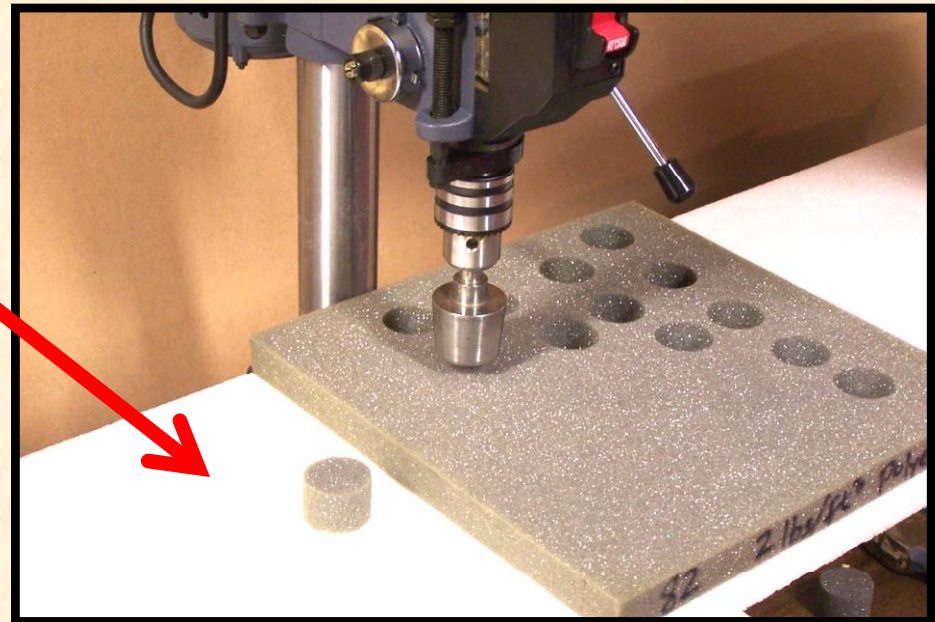
Sample Cutting and Preparation

- Use Spectronics “soft” cutter **ONLY** for cutting soft foams and similar soft materials. **Use of this cutter on other materials will damage the cutter.**
- Attach the Spectronics “soft” cutter in a drill press or similar machine (see photo below).
- Place a layer of material (such as Styrofoam or several layers of cardboard) under the soft material to be cut in order to protect the cutter.



“Soft” cutter

Styrofoam or
cardboard to
protect cutter



Cutting and Preparation of “Soft” Samples

Sample Cutting and Preparation

- IMPORTANT: wear eye and hand protection at all times.
- Set machine for slow speed (approximately 200 rpm) operation.
- Start machine and lower cutter slowly until it contacts material. Continue lowering cutter slowly through the material - **do not force!**
- If cutter will not cut or tears soft material, it is likely dull. Place cutter in a lathe and sharpen.
- When cutter passes through the material turn off the machine and remove sample from cutter.
- Check sample to see that it is not deformed. Cut another sample if necessary.
- Soft samples should require no additional preparation.



Insertion of “Soft” Samples in Sample Holder

Sample Cutting and Preparation

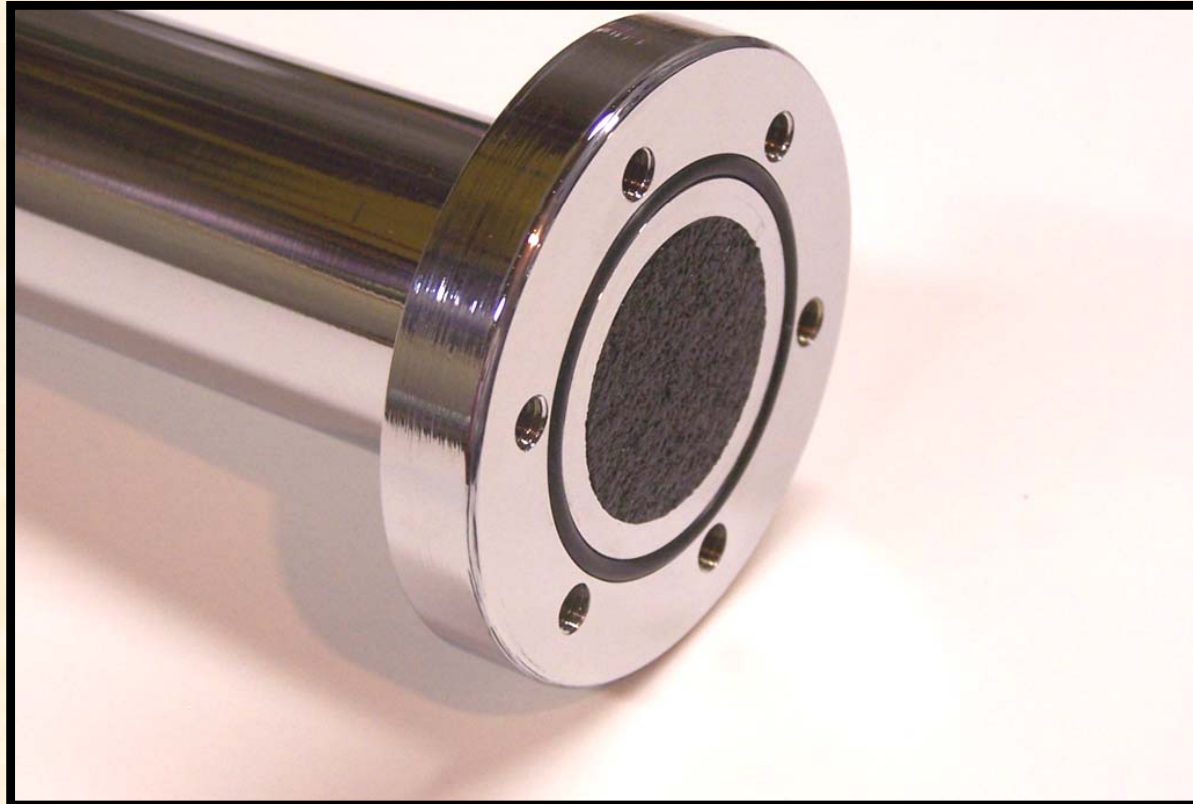
- Using a measuring device, set the depth of the piston in the sample holder equal to the thickness of the soft sample.
- Insert the soft sample into sample holder being careful not to compress the sample. Use a small tool to relieve compression.



Insertion of “Soft” Samples in Sample Holder

Sample Cutting and Preparation

- When inserted properly, the flat surface of the soft sample should be flush with the sample holder flange.



Cutting and Preparing “Semi-Rigid” Samples

Sample Cutting and Preparation

- The “semi-rigid” cutter (punch) may be used to cut stiff materials such as closed cell foams and rubber materials used as noise barriers. **Do not use Spectronics “soft” cutter for these materials.**
- To cut a “semi-rigid” sample, lay material to be cut on top of a wood panel.
- IMPORTANT: wear eye and hand protection at all times.
- Holding the cutter securely with one hand, strike the end of the cutter with a hammer. Several hits may be necessary.



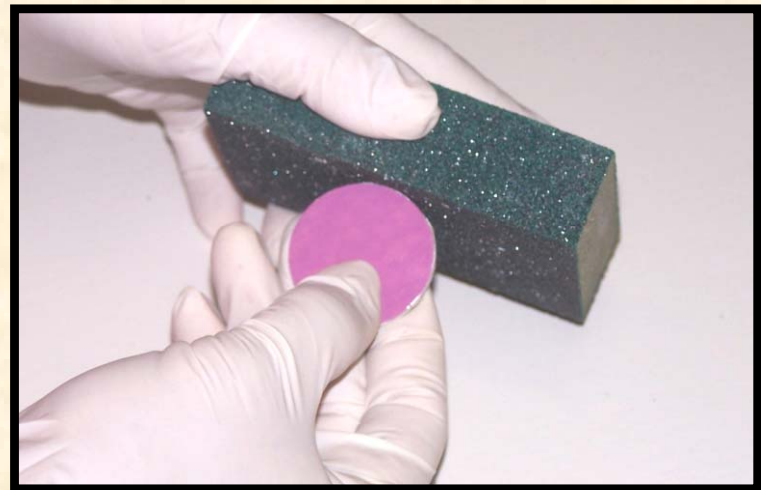
“Semi-rigid” cutter (punch)



Cutting and Preparing “Semi-Rigid” Samples

Sample Cutting and Preparation

- Depending on the material, the sample may need additional preparation before inserting it into the sample holder (or TL tube). Use “sand paper” or a file to carefully smooth the edges of the sample.
- If sample is too large, it will deform when inserted into the sample holder or TL tube. Repeat smoothing procedure along edges of sample until sample fits into the sample holder or TL tube without deforming.
- When inserted into the sample holder or TL tube properly, the sample should fit the circumference. Use petroleum jelly or similar material as required to seal around the circumference between the sample and the tube.



Cutting and Preparation of “Hard” Samples

Sample Cutting and Preparation

IMPORTANT: Please Read

- Hard samples such as wood and other building materials may be tested using the *ACUPRO* system to determine the material’s sound transmission loss (TL).
- At this time there is no ISO standard for TL testing in impedance tubes. Impedance tube TL testing is limited to establishing the *relative* TL of samples only.
- The measured TL is limited to a maximum of about 20 dB; for samples with higher TL, the results may not be accurate due to limited acoustic output of the JBL compression driver. Generally, this will be the case if, for example, the material is wood having a thickness greater than about 10 - 15 mm.
- **IMPORTANT:** do **NOT** increase the voltage to the JBL compression driver over approximately 3 V rms in an effort to measure the TL of materials having a TL greater than approximately 20 dB as this may damage the driver.

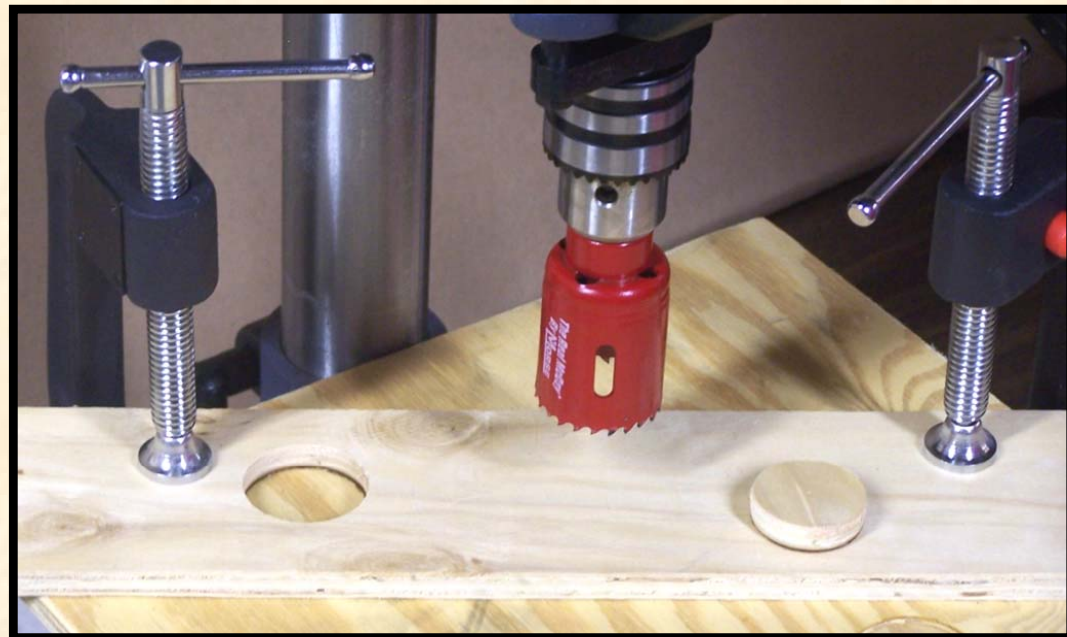
Cutting and Preparation of “Hard” Samples

Sample Cutting and Preparation

- Attach the Spectronics “toothed” cutter in a drill press or similar machine (see photo below).
- Place a wood panel below the material from which the sample is to be cut and clamp both panel and material securely.



Toothed Cutter



Cutting and Preparation of “Hard” Samples

Sample Cutting and Preparation

- **IMPORTANT:** wear eye and hand protection at all times.
- Set machine for slow speed operation (approximately 200 rpm).
- Start machine and lower cutter slowly until it contacts material.
- When cutter passes through the material, turn off the machine and remove sample from cutter.



Preparing and Inserting the Hard Sample

Sample Cutting and Preparation

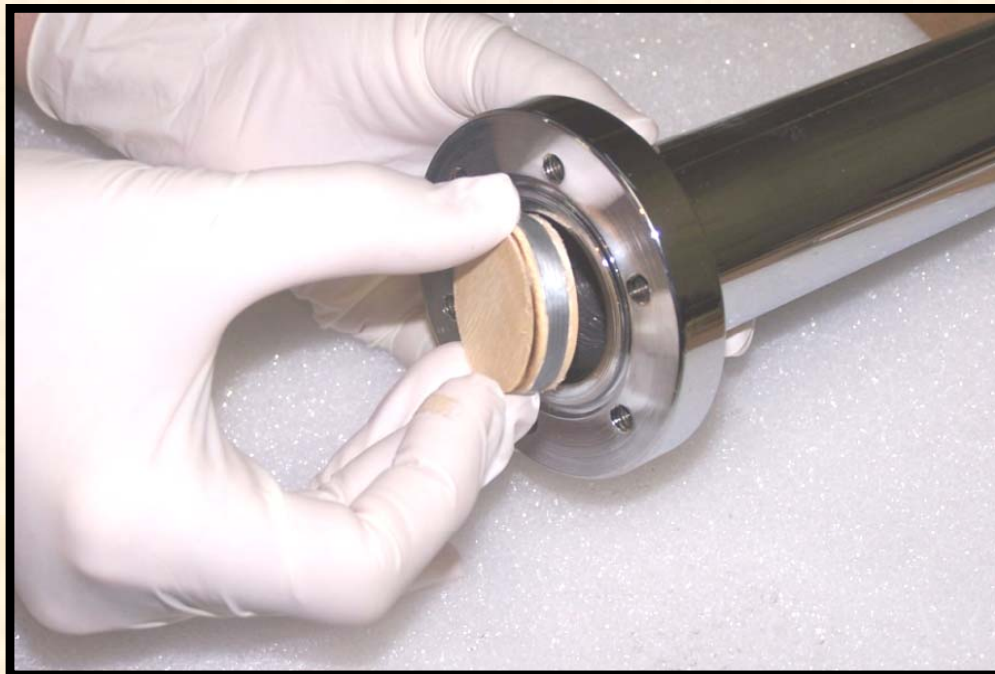
- Depending on the material, the sample cut using the toothed cutter may be approximately 0.5 to 1 mm smaller than the TL tube. **Do not attempt to test a sample that does not fit properly (too tight or too loose) inside the TL tube - the TL results will not be correct.**
- Cut a thin strip of heavy adhesive tape and wrap the strip of tape around the circumference of the sample once or twice depending on the thickness of the tape. The goal is to take up most of the clearance with the tape but leaving a small clearance.



Preparing and Inserting the Hard Sample

Sample Cutting and Preparation

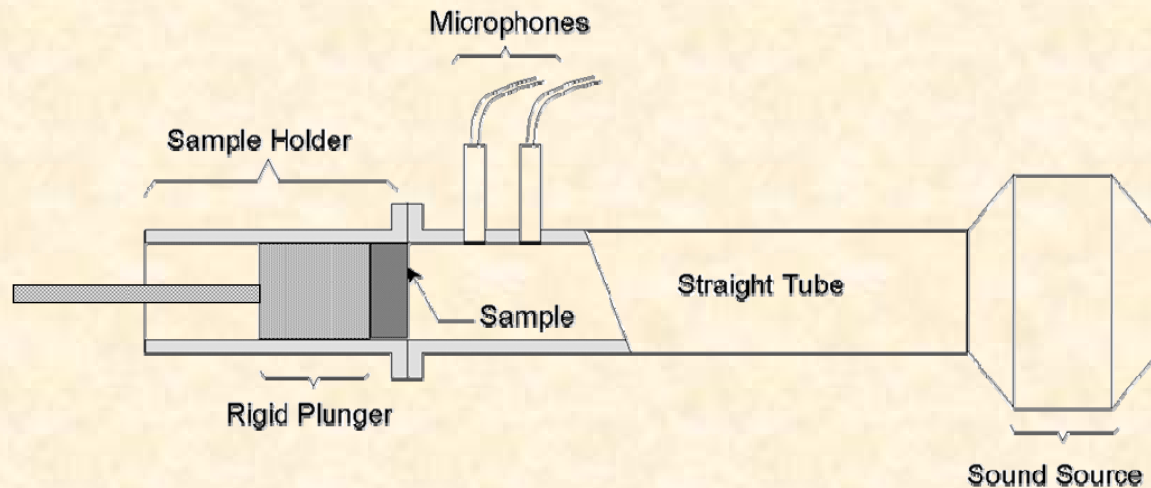
Insert the sample into the TL tube; if the sample is loose, add more tape to the circumference of the sample. When sample fits with a slight clearance inside the tube seal the remaining space with petroleum jelly. This will prevent sound leakage around the sample.



Two-Microphone Standards

Sample Cutting and Preparation

1. ISO 10534-2, *Acoustics-Determination of sound absorption coefficient and impedance in impedance tubes - Part 2: Transfer-function method.*
2. ASTM E1050-98, *Standard Test Method for Impedance and Absorption of Acoustical Material Using a Tube, Two Microphones and a Digital Frequency Analysis System.*



Thank you !



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