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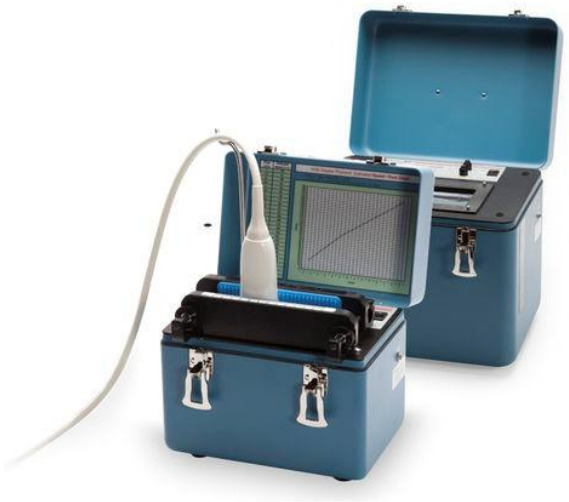
Instructions for Using the US-CT Multi-Mode Ultrasound Model Simulating Liver Biopsy

Overview

The liver biopsy phantom—a custom-made, multi-modal US-CT model—is filled with tissue-mimicking materials. It is designed for use in training demonstrations for ultrasound-guided puncture procedures and is capable of generating images under both ultrasound and X-CT modalities. A photograph of the phantom is shown in the accompanying figure.



Basic Structure

1. The shell is made of acrylic glass;
2. The internal net dimensions are 240mm (length) × 150mm (height) × 140mm (thickness);
3. The overall dimensions are 280mm (length) × 170mm (height) × 160mm (thickness);
4. It is equipped with uniform artificial tissue-like materials inside.
5. The overall weight is approximately 10 kilograms.

Technical Characteristics

Referencing the national standard GB10152—2009 and combining with the technical requirements for training demand ultrasonic body molds, the technical parameters of this body mold are as follows:

The internal material of TM (human-like material) has a sound velocity of: (1540 ± 10) m/s (23℃ ± 3℃)

The slope of background sound attenuation coefficient is no more than 0.10 dB/cm/MHz (23 ± 3℃)

The material of the left sound window: 70um thick polyester film material.

The size of the left sound window opening: 140mm * 150mm;

The body model is an overall cube structure. Its four sides are bonded together with plexiglass plates. The overall structure does not contain any metal materials. The structure is shown in Figure. The interior of the body model is composed of a transparent water-based gel as the background tissue imitation material and contains a translucent water-based gel structure in the shape of a liver. There are several dark cylindrical targets inside the translucent imitation liver, which are evenly distributed throughout the liver. The axial direction of the cylindrical targets is parallel to the thickness direction of the body model. The cylindrical targets are used for puncture identification. This target can produce image contrast with the surrounding tissue imitation material in both ultrasound and X-CT modes.

At the top of the body model, there is a 1.5mm thick semi-transparent silicone rubber film, which is held in place by the edge of the outer water channel frame. The outer water channel frame is made of plastic, and the four sides are fixed to the edge of the shell by hand-tightened screws. The silicone rubber film serves as an acoustic window and a puncture entry point, and also has the function of retaining the hydrogel liquid.