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Sound with a frequency above the limit of audibility is called ultrasonic. Ultrasonic inspection provides a sensitive method of nondestructive testing in most materials: metallic, nonmetallic, magnetic or nonmagnetic. It permits the detection of small flaws with only single surface accessibility and is capable of estimating location and size of the defect. The effective result of an ultrasonic test is heavily dependent on subject surface condition, grain size and direction and acoustic impedance. Ultrasonic inspection operates on the principle of transmitted and reflected sound wave. Sound has a constant velocity in a given substance; therefore, a change in the acoustical impedance of the material causes a change in the sound velocity at that point producing an echo. The distance of the acoustical impedance can be determined if the velocity of the sound in the test material and the time taken for the sound to reach and return from the flaw is known.

Ultrasonic inspection is usually performed with reflection technique. This technique is most widely used in aircraft maintenance inspection.

In reflection mode the transducer performs both the sending and the receiving of the pulsed waves as the sound is reflected back to the device. Reflected ultrasound comes from an obstacle such as the back wall of the object or from an imperfection within the object. The diagnostic machine displays these results in three different ways: A-scan display, B-scan, C-scan.

The advantages of Ultrasonic testing are:

- 1) high penetrating power which allows the detection of flaws deep in the part;
- 2) high sensitivity, permitting the detection of extremely small flaws;
- 3) non hazardous to operations or to nearby personnel and has no effect on equipment and materials in the vicinity;
- 4) results are immediate. Therefore on the spot decisions can be made.

The disadvantages are:

- 1) manual operation requires careful attention of experienced technicians;
- 2) parts which are rough, irregular in shape, very small or thin, or not homogeneous are difficult to inspect;
- 3) surface must be prepared by cleaning and removing loose scale, paint, etc;
- 4) couplants are needed to provide effective transfer of ultrasonic wave energy between transducers and inspected parts.

In conclusion, in spite of numerous disadvantages the Ultrasonic testing is considered to be the most effective method for detection of internal cracks.