NATIONAL STANDARD OF THE

PEOPLE'S REPUBLIC OF CHINA

GB/T 11344-2021

Non-destructive testing - Ultrasonic thickness measurement

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1 Scope

This Standard specifies the ultrasonic thickness measurement through the ultrasonic pulse-echo contact method.

This Standard is applicable to the ultrasonic thickness measurement of metal and non-metal materials.

2 Normative References

The contents of the following documents constitute the indispensable clauses of this document through the normative references. In terms of references with a specified date, only versions with a specified date are applicable to this document. In terms of references without a specified date, the latest version (including all the modifications)

is applicable to this document.

GB/T 9445 Non-destructive Testing - Qualification and Certification of NDT Personnel (GB/T 9445-2015, ISO 9712.2012, IDT)

GB/T 12604.1 Non-destructive Testing - Terminology - Ultrasonic Testing (GB/T 12604.1-2020, ISO 5577.2017, MOD)

GB/T 20737 Non-destructive Testing - General Terms and Definitions (GB/T 20737-2006, ISO/TS 18173.2005, IDT)

GB/T 36439 Non-destructive Testing - Certification and Qualification of Aerospace Non-destructive Testing Personnel

3 Terms and Definitions

The terms and definitions defined in GB/T 12604.1 and GB/T 20737 are applicable to this document.

4.1 By measuring the time for the ultrasonic signals transmitted by the probe to pass

through the measured material for one, two or multiple times, the thickness of the measured material is determined.

4.2 The sound velocity of the measured material is a function of the physical properties

of the material. In terms of a given material, it is usually assumed that the sound velocity of the material is a constant.

4.3 Ultrasonic thickness measurement can be achieved through the following four

methods shown in Figure 1.

5.1.1 The instruments shall be able to easily adjust and display the thickness value

within the measurement range. The time baseline adjustment function has different names on different instruments, for example, range, scan, material calibration or sound velocity.

5.1.2 The digital direct-reading ultrasonic thickness gauge converts the sound path

time between the initial pulse and the first echo, or multiple echoes into a meter indication or digital display. This type of instruments are used for the thickness measurement of the product within a specific material and thickness range, and directly digitally display the thickness.

5.2.1 Ultrasonic thickness measurement shall adopt dual-element or single-element

longitudinal-wave probes.

5.3.1 Ultrasonic thickness measurement satisfies the acoustic coupling between the

probe and the material by applying fluid or gel. The coupling agent shall have good sound permeability and have no adverse effects on the tested materials, equipment and operating personnel.

5.4 Calibration Blocks

The sound velocity and thickness of the calibration blocks shall be already-known, and identical or similar to the material of the tested product. The calibration blocks can be in a set or a step. The thickness of the blocks should cover the thickness range of the tested product.

6.1.1 The surface of the tested product shall be clean and flat, and free of loose surface

or non-sticky coatings. The measurement contact area shall be not less than 2 times the diameter of the probe. Poor contact may cause the loss of acoustic energy and changes in signal and sound beam propagation paths.

6.2.1.2 In accordance with the material, geometrical shape and thickness of the tested

product, as well as the requirements for measurement accuracy, appropriate instruments and measurement methods shall be selected. See Appendix C and

6.2.2.1 When the pulse echo method is adopted for measurement (Method 1, Method

2 and Method 3), see Appendix C (Figure C.1 and Figure C.2).

6.2.3.1 In-service measurement is mainly applied to the residual thickness

measurement of corroded and abrasive products. It is recommended to use dual-element probe; the measurement of low reflection echo area may appropriately increase the gain.

6.2.3.2 When measuring many data points with location information, instruments with

data recording function should be used.

6.3.1 Broadband probes excite a shorter pulse than narrowband probes and have a

better resolution. They are generally used for the thickness measurement of coatings or thin plates. When measuring high-attenuation materials, the broadband probes can obtain more stable echoes.

6.3.4 When measuring products with a relatively small thickness, the delay block probe

and Method 2 or Method 3 may be used for the measurement. When the acoustic impedance of the delay block material is relatively low, for example, plastic delay block being placed on the metal for measurement, the interface echo may generate a phase shift, which shall be corrected to obtain accurate measurement results. Some thickness gauges have the function of automatic correction.

6.3.5 When the surface temperature of the material is relatively high, and the delay

block is used as a thermal barrier, the delay block shall be able to withstand the temperature of the tested product.

6.3.6 In accordance with different thicknesses and materials, the frequency range of

the probes may be between 100 kHz for the measurement of high-attenuation materials and 50 MHz for the measurement of thin metals sheets.

6.4.3.1 When the temperature is higher than 60 °C, high-temperature probe shall be

used, and the coupling agent shall satisfy the requirements for use at the testing temperature.

6.4.3.2 When using ultrasonic flaw detector with A-scan display, the instrument should

have a screen-locking function to facilitate the testing personnel's evaluation of the response signal. The contact time of the probe shall be limited to the shortest time

6.4.4.1 When measuring in hazardous environment, the current laws and regulations