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NATIONAL STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

GB/T 31211.1-2024

Non-destructive testing - Ultrasonic guided wave testing - Part 1: General principles

无损检测 超声导波检测 第1部分：总则

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Foreword

This document is in accordance with the provisions of GB/T 1:1-2020 "Guidelines for standardization work Part 1: Structure and drafting rules for standardization documents" Drafting: This document is part 1 of GB/T 31211 Non-destructive testing - ultrasonic guided wave testing: GB/T 31211 has been published for the following part:

--- Part 1: General;

--- Part 2: Magnetostriction method: This document replaces GB/T 31211-2014 "General principles for non-destructive testing of ultrasonic guided waves": Compared with GB/T 31211-2014, except for structural In addition to adjustments and editorial changes, the main technical changes are as follows:

a) Some terms and definitions have been changed (see Chapter 3, Chapter 3 of the:2014 edition);

b) The detection principle has been changed (see 4:1, Chapter 4 of the:2014 edition);

c) Added ultrasonic guided wave testing technology classification (see 4:2);

d) The advantages, characteristics and limitations of ultrasonic guided wave testing have been deleted (see Chapter 4 of the:2014 edition);

e) The safety requirements have been changed (see Chapter 5, Chapter 5 of the:2014 edition);

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f) The general testing process specifications have been changed (see Chapter 7, 7:1 of the:2014 edition);

g) The detection instrument system has been changed (see 8:1, 8:1 of the:2014 edition);

h) The ultrasonic guided wave sensor has been changed (see 8:2, 8:3 of the:2014 edition);

i) Added the detector function classification (see 8:3:1);

j) The test specimen has been changed (see 8:4, 8:7 of the:2014 edition);

k) The maintenance and verification of testing equipment has been modified (see 8:5, 8:8 of the:2014 edition);

1 Scope

China's national general principles standard for ultrasonic guided wave testing, and the current edition of the general part of GB/T 31211, replacing GB/T 31211-2014. It specifies the detection principle, the safety requirements, the personnel qualification, the general testing procedure, the detection system, the testing procedure, the evaluation and handling of results, and the test records and reports for ultrasonic guided wave examination. Guided wave testing is a different proposition from conventional ultrasonic testing, and the difference is what makes it valuable. Conventional ultrasonics sends a short pulse into the thickness of a component and examines the small volume beneath the probe, so inspecting a pipeline means inspecting it point by point. Guided wave testing launches a wave that travels along the component - guided by its own walls, using the whole wall thickness as a waveguide - so a single transducer ring placed at one accessible position examines tens of metres of pipe in both directions, including buried, insulated, clamped or elevated lengths that cannot be reached at all. That capability comes with a physics that has to be respected: guided waves are dispersive, meaning the wave speed depends on frequency, and several modes propagate at once, so the same defect produces different signals at different frequencies and in different modes. Selecting the mode and the frequency is therefore an examination decision rather than an instrument setting, and the 2024 revision adds a clause specifically on that selection. It also adds a classification of guided wave testing techniques and of detector functions, adds comparative testing, and revises the detection principle, the instrument system, the transducers, the reference specimens and the equipment maintenance and verification. Issued and in force from 25 April 2024.

This document describes the use of various ultrasonic guided waves such as magnetostrictive, piezoelectric ultrasonic, electromagnetic ultrasonic, laser ultrasonic, etc: to detect the components under test: Use method: This document is applicable to elastic solid structural parts with regular cross-sectional geometric shapes such as tubes, bars, plates, wires (including ropes and cables), profiles, etc: Ultrasonic guided wave testing:

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2 Normative references

The contents of the following documents constitute the essential clauses of this document through normative references in this document: For referenced documents without a date, only the version corresponding to that date applies to this document; for referenced documents without a date, the latest version (including all amendments) applies to This document:

GB/T 9445 Qualification and certification of non-destructive testing personnel GB/T 12604:

3 Terms and definitions

The terms and definitions defined in GB/T 12604:1 and GB/T 20737 and the following apply to this document: 3:

1 Waveguide A structure that directs ultrasound waves of a specific frequency:

Note: For example, thin bars, tubes or thin plates: When the wall thickness is close to the wavelength, the longitudinal and transverse waves are affected by the boundary conditions and do not propagate in the original mode: It is spread in a specific form: 3:

2 Ultrasonic guided wave Ultrasonic waves propagating along the surface or inside of a waveguide (3:1) structure in a specific waveguide mode (3:6): 3:

3 Dispersion The phenomenon that wave speed changes with frequency: 3:

4 Dispersive equation The relationship between wave velocity and frequency is reflected by the equations that satisfy the special solutions of elastic dynamics according to specific boundary conditions: 3:

5 Dispersion curve dispersioncurve The curve of the relationship between wave velocity and frequency obtained by solving the dispersion equation (3:4):

Note: The abscissa of the dispersion curve represents the frequency-thickness product, frequency, wavelength or wave number, and the ordinate represents the group velocity or phase velocity:

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