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Non-destructive testing — Pulsed eddy current testing of ferromagnetic metallic components

Essais non destructifs — Contrôle par courants de Foucault pulsés de composants métalliques ferromagnétiques

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 135, *Non-destructive testing*, Subcommittee SC 4, *Eddy current methods*.

Non-destructive testing — Pulsed eddy current testing of ferromagnetic metallic components

1 Scope

This document specifies the pulsed eddy current (PEC) testing technique used to perform thickness measurement on ferromagnetic metallic components with or without the presence of coating, insulation and weather sheeting.

This document applies to the testing of in-service components made of carbon steel and low-alloy steel in the temperature of –100 °C to 500 °C (temperature measured at metal surface). The range of wall thickness of components is from 3 mm to 65 mm and the range of thickness of coatings is from 0 mm to 200 mm. The tested components also include piping of diameter not less than 50 mm.

The technique described in this document is sensitive to the geometry of the component and applying the technique to components outside of its scope will result in unpredictable inaccuracy. This document does not apply to the testing of crack defects and local metal loss caused by pitting.

This document does not establish evaluation criteria. The evaluation criteria shall be specified by the contractual agreement between parties.

2 Normative references

The following documents are referred to in text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 15548-3, *Non-destructive testing — Equipment for eddy current examination — Part 3: System characteristics and verification*

ISO 16809, *Non-destructive testing — Ultrasonic thickness measurement*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 12718 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1
coating
material which covers the surface of a tested component in the forms of adhesive, adsorbed layer, bundle, twine or inlay, etc. such as paint, plastic, asphalt, rock-wool, foam, metal mesh, cement, carbon (glass) fibre, marine organism, etc.

Note 1 to entry: For the purpose of this document, the word coating is used to describe any protective or insulative layer on the component to be tested.

3.2
cover
sheet metal protective layer on the outside of the coating

3.3
excitation pulse duration
time needed for the energy to travel through the actual thickness of the component

Note 1 to entry: It needs to be long enough to penetrate the full thickness

3.4
decay rate
rate of change in electromagnetic field measured by the receiver sensor after the transmitter has been switched off

Note 1 to entry: For example, the bending point of one of the typical measurement methods (see Figure 1).

3.5
bending point
point where the received signal decay rate changes from linear to exponential

3.6
characteristic time
time measured between the end of the excitation pulse and the bending point

Note 1 to entry: Its value is proportional to the magnetic permeability, electrical conductivity and the thickness squared.

3.7
pulse repetition frequency
prf
number of pulses generated per second, expressed in Hertz (Hz)

4 General principles

4.1 Principles of PEC testing

According to ISO 12718, pulsed eddy currents are eddy currents generated by a pulsed electromagnetic field.

Similar to sinusoidal eddy currents, induced pulsed eddy currents are modified by any local variation in the material properties.

The pulse is characterized by its duration (T), which enables to generate induced currents with a very high intensity.

The time interval between two measurements is linked to the material thickness.