INTERNATIONAL STANDARD

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Non-destructive testing — Equipment for eddy current examination —

Part 3: System characteristics and verification

Essais non destructifs — Appareillage pour examen par courants de Foucault —

Partie 3: Caractéristiques du système et vérifications

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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 15548-3 was prepared by European Committee for Standardization (CEN) Technical Committee CEN/TC 138, *Non-destructive testing*, in collaboration with ISO Technical Committee TC 135, *Non-destructive testing*, Subcommittee SC 4, *Eddy current methods*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

ISO 15548 consists of the following parts, under the general title *Non-destructive testing — Equipment for eddy current examination*:

— *Part 1: Instrument characteristics and verification*

— *Part 2: Probe characteristics and verification*

— *Part 3: System characteristics and verification*

Non-destructive testing — Equipment for eddy current examination —

Part 3:
System characteristics and verification

1 Scope

This part of ISO 15548 identifies the functional characteristics of a general-purpose eddy current system and provides methods for their measurement and verification.

The evaluation of these characteristics permits a well-defined description and comparability of an eddy current equipment.

By careful choice of the characteristics, a consistent and effective eddy current examination system can be designed for a specific application.

Where accessories are used, these are characterised using the principles of this part of ISO 15548.

This part of ISO 15548 does not give the extent of verification nor acceptance criteria for the characteristics. These are given in the application documents.

2 Normative references

The following referenced documents are indispensable for the application 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 12718, *Non-destructive testing — Eddy current testing — Terminology*

3 Terms and definitions

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

4 System characteristics

4.1 General characteristics

The system is designed to examine a defined product or perform a defined measurement; the eddy current techniques implemented shall be specified. A system comprises the instrument, interconnecting elements (e.g. cable and slip rings), probe arrangement, mechanical arrangement, accessories and reference pieces.

The general characteristics of a system include the following:

a) **Physical characteristics**:

- throughput speed;
- scanning path;
- mechanical arrangement and settings and their interaction with the product to be tested.

b) **Calibration-related characteristics**:

- response to a reference block;
- correlation of response with inferred parameters: coating thickness, crack depth, etc.

c) **Functional characteristics**:

- instrument and accessory settings accessible on knobs or displays;
- balance and origin of complex plane display;
- dynamic range of test system in amplitude and phase.

4.2 Accessories

These are functional units that may be integrated into, or added to, the basic instrument, which have not been identified in the foregoing text, for example, lift-off compensation system, marking system, magnetic saturation unit, demagnetizing arrangements, data acquisition and analysis software.

The function of these units shall be described and their characteristics shall be stated.

Where an accessory influences the test result, it shall undergo a specific verification in accordance with a written procedure.

5 Verification

5.1 General

For a consistent and effective eddy current examination, it is necessary to verify that the performance of the component parts of the eddy current test system is maintained within acceptable limits.

The physical condition of the reference pieces shall be verified to be within acceptable limits before being used to verify the system or probes.

The measuring equipment used for verification shall be in a known state of calibration.

For a better understanding, the verification procedure is identically described in all three parts of ISO 15548.

5.2 Levels of verification

There are three levels of verification. Each level defines the time intervals between verification and the complexity of the verification.

It is understood that initial type testing has already been done by the manufacturer or under his control.

a) **Level 1: Global functional check**

A verification is performed at regular intervals of time on the eddy current test system, using reference blocks to verify that the performance is within specified limits.

The verification is usually performed at the examination location.

The time interval and the reference pieces are defined in the verification procedure.

b) **Level 2: Detailed functional check and calibration**

A verification on an extended time scale is performed to ensure the stability of selected characteristics of the eddy current instrument, probe, accessories and reference blocks.

c) **Level 3: Characterisation**

A verification is performed on the eddy current instrument, probe accessories and reference blocks to assess conformity with the characteristics supplied by the manufacturer.

The organization requiring the verification shall specify the characteristics to be verified.

The main features of verification are shown in Table 1.

Table 1 — Verification procedure

Level	Object	Typical time period	Instruments	Responsible entity
1 Global functional check	Stability of system performance	Frequently, e.g. hourly, daily	Reference blocks	User
2 Detailed functional check and calibration	Stability of selected characteristics of the instrument, probes and accessories	Less frequently but at least annually and after repair	Calibrated measuring instruments, reference blocks	User
3 Characterisation	All characteristics of the instrument, probes and accessories	Once (on release) and when required	Calibrated laboratory measuring instruments and reference blocks	Manufacturer, user

5.3 Verification procedure

The characteristics to be verified are dependent on the application. The essential characteristics and the level of verification shall be specified in a verification procedure.

The examination procedure for the application shall refer to the verification procedure. This can restrict the number of characteristics to be verified for a defined application.

Sufficient data on the characteristics featured in an instrument, probe and reference block shall be provided, in order that verification may be performed within the scope of this part of ISO 15548.

5.4 Corrective actions

Level 1: When the performance is not within the specified limits, a decision shall be made concerning the product examined since the previous successful verification. Corrective actions shall be made to bring the performance within the acceptable limits.

Level 2: When the deviation of the characteristic is greater than the acceptable limits specified by the manufacturer or in the application document, a decision shall be made concerning the instrument, the probe or the accessory being verified.

Level 3: When the characteristic is out of the acceptable range specified by the manufacturer or by the application document, a decision shall be made concerning the instrument, the probe or the accessory being verified.

6 Implementation of the functional verification

The functional verification of the system cannot be limited to the verification of the elements of the system, taken separately. It shall be carried out on the system considered as a global entity.

The implementation of the functional verification of a system is specific to each application, and requires a procedure to be defined in the application document and stating at least:

— periodicity of the verification;

— conditions triggering a verification: e.g. replacement of one of the elements of the system.

This implementation includes the following steps:

— setting and/or calibration of the system for the verification;

— assessment of the acceptable limits of performance;

— verification of specified items: at least signal-to-noise ratio for reference signals, phase and amplitude response on reference blocks, stability of balance;

— measurement method for each item.

If the results of the measurements indicate that the performance is out of the acceptable limits, this shall be reported and corrective actions shall be made to bring the performance within the acceptable limits.

These actions could be:

— recalibration of the system;

— level 2 or level 3 verification for one or more elements of the system.

All of the product examined since the previous successful verification is considered as not examined and the decision made concerning this product shall be reported e.g. re-examination or use of another non-destructive testing (NDT) method.