

Non-Destructive Testing - Magnetic Particles

Procedure

This Standard replaces and cancels its previous revision.

The CONTEC - Authoring Subcommittee provides guidance on the interpretation of this Standard when questions arise regarding its contents. The Department of PETROBRAS that uses this Standard is responsible for adopting and applying the sections, subsections and enumerates thereof.

Technical Requirement: A provision established as the most adequate and which shall be used strictly in accordance with this Standard. If a decision is taken not to follow the requirement ("non-conformity" to this Standard) it shall be based on well-founded economic and management reasons, and be approved and registered by the Department of PETROBRAS that uses this Standard. It is characterized by imperative nature.

Recommended Practice: A provision that may be adopted under the conditions of this Standard, but which admits (and draws attention to) the possibility of there being a more adequate alternative (not written in this Standard) to the particular application. The alternative adopted shall be approved and registered by the Department of PETROBRAS that uses this Standard. It is characterized by verbs of a nonmandatory nature. It is indicated by the expression: **[Recommended Practice]**.

Copies of the registered "non-conformities" to this Standard that may contribute to the improvement thereof shall be submitted to the CONTEC - Authoring Subcommittee.

Proposed revisions to this Standard shall be submitted to the CONTEC - Authoring Subcommittee, indicating the alphanumeric identification and revision of the Standard, the section, subsection and enumerate to be revised, the proposed text, and technical/economic justification for revision. The proposals are evaluated during the work for alteration of this Standard.

"This Standard is exclusive property of Petróleo Brasileiro S. A. - PETROBRAS, internal application and PETROBRAS Subsidiaries and shall be used by its suppliers of goods and services under contracts or similar under the conditions established in Bidding, Contract, Agreement or similar.

The use of this Standard by other companies / organizations / government agencies and individuals is the sole responsibility of the users.."

Introduction

PETROBRAS Technical Standards are prepared by Working Groups - WG (consisting specialized of Technical Collaborators from Company and its Subsidiaries), are commented by Company Units and its Subsidiaries, are approved by the Authoring Subcommittees - SCs (consisting of technicians from the same specialty, representing the various Company Units and its Subsidiaries), and ratified by the Executive Nucleus (consisting of representatives of the Company Units and its Subsidiaries). A PETROBRAS Technical Standard is subject to revision at any time by its Authoring Subcommittee and shall be reviewed every 5 years to be revalidated, revised or cancelled. PETROBRAS Technical Standards are prepared in accordance with PETROBRAS Technical Standard [N-1](#). For complete information about PETROBRAS Technical Standards see PETROBRAS Technical Standards Catalog.

CONTEC
Comissão de Normalização
Técnica

SC - 27
Non-Destructive Testing

Foreword

This Standard is the English version (issued in 11/2013) of PETROBRAS N-1598 REV. G 09/2013. In case of doubt, the Portuguese version, which is the valid document for all intents and purposes, shall be used.

1 Scope

1.1 This Standard establishes the conditions to be followed for non-destructive testing by means of magnetic particles, complementing national and foreign standards.

1.2 This Standard applies to procedures started as of its date of issuance.

1.3 This Standard contains Technical Requirements and Recommended Practices.

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 applies.

INMETRO [VIM 2012](#) - Vocabulário Internacional de Metrologia – Conceitos Fundamentais e Gerais e Termos Associados;

ABNT [NBR 16030:2012](#) - Ensaios Não Destrutivos - Partículas Magnéticas - Detecção de Descontinuidades;

ABNT [NBR ISO IEC 17025:2005](#) - Requisitos Gerais para a Competência de Laboratórios de Ensaio e Calibração;

ABNT [NBR NM 328:2011](#) - Ensaios Não Destrutivos - Partículas Magnéticas - Terminologia;

ABNT [NBR NM ISO 9712](#) - Ensaio Não Destrutivos - Qualificação e Certificação de Pessoal;

ISO [17638:2003](#) - Non-Destructive Testing of Welds - Magnetic Particle Testing;

ISO/IEC [17024:2012](#) - Conformity Assessment - General Requirements for Bodies Operating Certification of Persons;

ASME [BPVC - Section V:2010](#) - Nondestructive Examination;

ASTM [E709:2008](#) - Standard Guide for Magnetic Particle Testing;

ASTM [E1444/E1444M:2012](#) - Standard Practice for Magnetic Particle Testing;

DNV-OS-[F101:2012](#) - Submarine Pipeline Systems.

NOTE For documents referred in this Standard and for which only the Portuguese version is available, the PETROBRAS department that uses this Standard should be consulted for any information required for the specific application.

3 Terms and Definitions

For the purposes of this document, the following terms and definitions apply. For the purposes of this document, the terms and definitions of ABNT [NBR NM 328:2011](#), INMETRO [VIM:2012](#) and those below are applicable.

3.1**addition**

addition of a new paragraph or of a text to a paragraph

3.2**alteration**

replacement of an entire paragraph or alteration of part of it

3.3**suppression**

deletion of the paragraph or of part of it

3.4**base standard**

assembly, construction, manufacturing and design standards relating to the inspected equipment item, and complementary standards mentioned by them

4 General Conditions

4.1 The magnetic particles testing shall be performed as recommended in design, manufacture, construction and assembly specifications or standards relating to the inspected equipment item, except for any changes, additions and deletions mentioned under specific conditions.

4.2 For the base standards in Section 2 regarding personnel qualification and procedure, it is necessary to add 5.1 and 5.2 of this Standard, in order to complement them about the requirements specified therein for magnetic particles testing.

5 Specific Conditions**5.1 Personnel Qualification**

5.1.1 For services performed in Brazil, the personnel qualification and certification for non-destructive testing shall be made using the “Sistema Nacional de Qualificação e Certificação de Pessoal em Ensaios Não Destrutivos” by the “Associação Brasileira de Ensaios Não Destrutivos e Inspeção” (ABENDI), according to ABNT [NBR NM ISO 9712](#).

5.1.2 For services performed abroad, qualification and certification shall be made as established in 5.1.1 or by independent international entities, accredited by national bodies in their respective countries, which fully meet the requirements of ISO IEC [17024:2012](#), and that fully complies with ISO 9712:2012.

NOTE Self-certification systems, such as Nondestructive Personnel Qualification and Certification ASNT SNT-TC-1A for inspectors for Levels 1, 2 or 3, in which the certification method is established or enforced by the employer itself, according to its criteria, are not accepted by PETROBRAS, even if they are mentioned in the base standards of this Standard.

5.2 Procedure Qualification

5.2.1 The procedure shall be qualified and certified by a Level 3 inspector.

5.2.2 Objective evidences of the qualification procedure shall be kept, in order to allow its check by PETROBRAS at any time, when requested.

5.2.3 The qualification procedure shall be performed by running tests on parts with natural or artificial discontinuities. The procedure is considered qualified when discontinuities are detected in the whole area provided for testing, for each position of magnetization source.

5.2.4 When the procedure provides for the use of contrast paint, tests shall be performed with and without the contrast paint. The contrast paint testing shall be performed with the maximum film thickness provided for in the procedure. The results shall be compared and they will be deemed as approved if the result with contrast paint is equal to or better than the one obtained without the paint layer.

5.2.5 The qualification procedure shall be performed in accordance with design, fabrication, construction and assembly standards.

NOTE When the procedure qualification methodology is not specified in design, manufacture, construction and assembly standards, the qualification shall be performed in representative test specimens of the inspection to be executed, with similar characteristics and in sufficient quantity so that, in the qualification process, it may be shown that the test has repeatability, measurement uncertainty, and detection probability characteristics consistent with the inspection and the criteria used in the evaluation of discontinuities.

5.2.6 When magnetic flux lines cannot be crossed, even with the use of an additional magnetization technique, it shall be clearly defined in the procedure objective.

5.2.7 The inspection procedure shall have an outline, detailing the overlapping scheme and the testing sequence, according to the shape, dimensions and details of the part to be tested.

5.2.8 The qualification procedure shall be performed before the services are executed, and the qualified procedure shall include, at least, the items described in Table 1. Whenever any of the variables is changed, a revision of the procedure shall be issued. If the variable is essential, the procedure shall be re-qualified.

Table 1 - Variables of Written Procedure

Requirements	Essential variable	Non essential variable
Identification and preparation date		X
Objective		X
Reference standards	X	
Material, shape or type of part, dimensions, test extent and details of the part to be tested	X	
Test performing step, within the production process, where applicable		X
Apparatus (including lighting equipment), mentioning manufacturer and model	X	
Check of test conditions, periodicity and records, when applicable		X