

CONTECComissão de Normalização
Técnica**SC-27**

Non-Destructive Testing

Non-Destructive Testing - Thermography

1st Amendment

This is the 1st amendment to PETROBRAS N-2370 REV. D, and it is used to alter the text of the Standard in the part(s) indicated below:

NOTE 1 The new(s) page(s) with the performed amendment(s) is (are) placed in its corresponding position(s).

NOTE 2 The amended pages, indicated the date of the amendment, are placed at the end of this standard, in chronological order, and shall not be used.

CONTENTS OF THE 1st AMENDMENT - 09/2013

- Section 2:

Exclusion of the ABNT NBR 7552:2004.

Inclusion of the ABNT [NBR NM 327:2011](#).

- Section 3:

The replacement of the ABNT NBR 7552:2004 of the ABNT [NBR NM 327:2011](#).

Penetrant Materials

Specification

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.

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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.

Foreword

This Standard is the English version (issued in 04/2012) of PETROBRAS N-2370 REV. D 02/2011. 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 specifies the minimum requirements for the manufacturing and acceptance of penetrant materials.

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

1.3 This Standard contains only Technical Requirements.

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.

PETROBRAS [N-1596](#) - Non-Destructive Testing - Penetrant Testing;

ABNT [NBR 14725-4:2009](#) - Produtos Químicos - Informações sobre Segurança, Saúde e Meio Ambiente Parte 4: Ficha de Informações de Segurança de Produtos Químicos (FISPQ);

ABNT [NBR NM 327:2011](#) - Ensaios Não Destrutivos - Líquidos Penetrantes – Terminologia;

ISO [3452-2:2006](#) - Non-Destructive Testing - Penetrant Testing - Part 2: Testing of Penetrant Materials;

ISO [3452-3:1998](#) - Non-Destructive Testing - Penetrant Testing - Part 3: Reference Test Blocks;

ISO [12706:2009](#) - Non-Destructive Testing - Penetrant Testing - Vocabulary;

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

ASTM [D 93:2010](#) - Standard Test Methods for Flash Point by Pensky-Martens Closed Tester;

ASTM [D 445:2010](#) - Standard Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and Calculation of Dynamic Viscosity);

SAE [AMS 2644 E:2006](#) - Inspection Material, Penetrant.

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 Standard applies the terms and definitions of ABNT [NBR NM 327:2011](#), ISO [12706:2009](#) and ASME [BPVC Sec. V:2010](#).

4 General conditions

4.1 The package label shall be necessarily contain the information shown in Table 1.

Table 1 - Package Labels

Info	Penetrant	Remover	Emulsifier	Developer	Solvent
Batch number	x	x	x	x	x
Date of manufacture	x	x	x	x	x
Expiration date	x	x	x	x	x
Product code	x	x	x	x	x
Applicable standards	x	x	x	x	x
Safety and toxicity instruction	x	x		x	x
Type of penetrant as to lighting and removal	x				
Type of emulsifier			x		
Emulsification time			x		
Type of developer				x	
Minimum content in grams of the product without propellant	x	x	x	x	x
Instructions for use of the product	x	x	x	x	x
Storage conditions	x	x	x	x	x
Flammability characteristics	x	x	x	x	x
Propellant used	x	x	x	x	x
Product manufacturer	x	x	x	x	x
Basic composition	x	x	x	x	x
Application temperature	x	x	x	x	x
Restrictions for use regarding contaminants	x	x	x	x	x
Sensitivity level	x				

4.2 Purchasing Unit

4.2.1 Products Purchased for Use in Brazil

Upon the purchase of penetrant materials shall be provided the Material Safety Data Sheet, in according to ABNT [NBR 14725-4:2009](#), as well as the Chemical Analysis Certification of the products.

4.2.2 Products Purchased for Use Abroad

Upon the purchase of penetrant materials shall be provided the Material Safety Data Sheet (MSDS), in according to the local regulations, as well as the Chemical Analysis Certification of the products.

5 Specific Conditions

5.1 General Properties

5.1.1 Flash Point Test

Except for aerosol products that use hydrocarbons as a propellant, the minimum flash point must be 93 °C, for lipophilic penetrants and emulsifiers, this should be determined according to ASTM [D 93:2010](#).

5.1.2 Toxicity

Toxicity characteristics should be properly specified on the product label, as well as safety and first aid measures, according to 4.2.

5.1.3 Corrosive Properties

Penetrant materials should be tested and evaluated according to ISO [3452-2:2006](#) or SAE [AMS 2644 E: 2006](#).

5.1.4 Contaminants

For penetrant materials used in nickel-based alloy, austenitic stainless steels, duplex, superduplex or titanium tests, the contaminant content (sulphur, chlorine and fluorine) should be determined and evaluated according to ASME [BPVC Sec. V:2010](#) Article 6 Mandatory Appendix II Items 641 and II 642 or according to ISO [3452-2:2006](#).

5.1.5 Viscosity

Viscosity should be determined by the manufacturer for batch acceptance, in compliance with ISO [3452-2:2006](#) and according to the method set forth in ASTM [D 445:2010](#) at a temperature of 38 °C ± 3 °C.

5.1.6 Storage Stability

The penetrant materials should comply with SAE [AMS 2644 E:2006](#).

5.1.7 Sensitivity Test

The penetrant materials should be sensitive to the detection of discontinuities equal or greater than that presented by the photographic standard or the reference sample.

5.1.7.1 Sensitivity must be determined for the set of penetrant materials, with testing in Type 1 comparison block, described in ISO [3452-3:1998](#), and the sensitivity level must be classified in accordance with Table 2. The minimum sensitivity levels required by PETROBRAS standard should be Type I Level 2 and Type II Level 2.

Table 2 - Classification of Sensitivity Levels

Family of Fluorescent products (type I)	
High Sensitivity - Level 2	100 % detection of indications for the 10 µm standard.
Family of Colored products (type II)	
High Sensitivity - Level 2	100 % detection of indications for the 30 µm standard.
Ultra high sensitivity - Level 3	100 % detection of indications for the 20 µm standard.

5.1.7.2 To determine the sensitivity, a batch sample must be applied to one part of the comparator block and the result must be compared to that from another part of the block, using a reference sample. The result is acceptable when showing sensitivity equal or higher than the reference sample.

5.1.7.3 If no reference sample is available, a photographic standard with the same sensitivity or higher should be used, and this should be compared with results obtained for the batch tested. The result is acceptable when the number of indications is equal or higher than that of the photographic standard.

5.1.7.4 Penetrant materials should meet the required sensitivity level in temperature ranges specified by the manufacturer.

5.1.7.5 During the sensitivity test, the comparison block and all penetrant materials specified should have their temperatures brought to that specified by the test procedure. For temperatures above 40 °C, only the comparison block should be brought to the specified temperature.

5.1.8 Penetrant Materials Removal Test

The penetrant materials removal tests should comply with [AMS 2644 E:2006](#).

5.1.9 Redispersibility Test

The developers redispersion tests should comply with SAE [AMS 2644 E:2006](#).

5.2 Specific Properties

5.2.1 Penetrants

5.2.1.1 Wetting Test

The penetrant should be able to wet the surface and the film formed should not retract or form droplets after 10 minutes when applied to the surface of a Type 1 standard, as per ISO [3452-3:1998](#).

5.2.1.2 Fluorescent Brightness Test

The fluorescent penetrant shall be tested and assessed according to ISO [3452-2:2006](#) or SAE [AMS 2644 E: 2006](#). Fluorescent penetrants should have a 90 % minimal brightness, corresponding to Level 3 of Sensitivity, when compared to the reference penetrant FP-4PE.

5.2.2 Emulsifiers

The emulsifier's color shall be substantially different from the penetrant color with which it is used, both when viewed under white light and under ultraviolet light.

5.2.3 Developers

Developers should meet the requirements specified in ISO [3452-2:2006](#) or SAE [AMS 2644 E:2006](#).

6 Acceptance and Non-Acceptance

6.1 All certificates for successful tests specified in the Standard should be provided upon the delivery of the penetrant materials.

6.2 The batch shall be considered accepted if all the specified tests meet the requirements of this Standard.

INDEX OF REVISIONS	
REV. A and B	
There is no index of revisions.	
REV. C	
Affected Parts	Description of Alteration
1.2	Revised
2	Revised
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6.2.1	Revised
6.2.2	Revised
6.2.3	Revised
6.2.4	Revised
6.2.5	Revised
7.3	Include
REV. D	
Affected Parts	Description of Alteration
All	Revised

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