PETROBRAS

N-2315	REV. D	ENGLISH	04 / 2011

Performance of Non-Destructive Test - Ultrasound in Steel Forgings

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.

CONTEC
Comissão de Normalização Técnica

SC - 27
Non-Destructive Tests

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.

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Foreword

This Standard is the English version (issued in 08/2012) of PETROBRAS N-2315 REV. D 04/2011. 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 applies to required conditions for the performance of non-destructive test with ultrasound in steel forgings.

1.2 This Standard applies to procedures started as from the date of its edition.

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.

INMETRO VIM:2008 - Vocabulário Internacional de Metrologia (First Brazilian Edition of VIM 2008);

ABNT NBR ISO/IEC 17024:2004 - Avaliação de Conformidade – Requisitos Gerais para Organismos que Realizam Certificação de Pessoas;

ABNT NBR ISO/IEC 17025:2005 - Requisitos Gerais para a Competência de Laboratórios de Ensaio e Calibração;

ABNT NBR NM ISO 9712:2007- Ensaio Não Destrutivo - Qualificação e Certificação de Pessoal;

ISO 9712:2005 - Non-Destructive Testing - Qualification and Certification of Personnel;

ISO/IEC 17024:2003 - Conformity Assessment - General Requirements for Bodies Operating Certification of Persons;

ASME BPVC Sec. V: 2010 - Section V - Nondestructive Examination;

ASTM A388/A388M:2010 - Standard Practice for Ultrasonic Examination of Heavy Steel Forging;

BSI BS EN 10228-3:1998 - Non-Destructive Testing of Steel Forgings - Part 3: Ultrasonic Testing of Ferritic or Martensitic Steel Forgings;

CEN EN 473:2008 - Qualification and Certification of Nondestructive Testing Personnel - General Principles;

DNV-OS-F101:2007 - 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 effects of this document, the INMETRO VIM:2008 terms and definitions apply, as well as the following:

3.1
addition
insertion of a new paragraph or insertion of text within a paragraph

3.2
change
replacement of a paragraph or a partial change within it

3.3
deletion
exclusion of a paragraph or any part of it

3.4
base standard
design, manufacturing, construction and assembly standards related to the inspected equipment and supplementary standards mentioned by these

4 General conditions

4.1 The ultrasound test should be performed as recommended in the Base Standards in its specifications regarding design, manufacturing, construction and assembly for the inspected equipment, except for changes, additions and deletions mentioned in the specific conditions.

4.2 In cases where a base standard mentioned in Section 2 is not mentioned in Section 5 of the specific terms, the base standard should be applied in its entirety to the ultrasound non-destructive testing related items.

4.3 All standards concerning the project, manufacturing, construction and assembly should be supplemented by 5.1 and 5.2, for additional requirements specified therein for the ultrasound testing.

5 Specific Conditions

5.1 Qualification of Personnel

5.1.1 For services executed in Brazil, training and certification of personnel for the ultrasound testing procedure should be done by the Sistema Brasileiro de Qualificação e Certificação de Pessoal em Ensaios Não Destrutivos - ABENDI, according to ABNT NBR NM ISO 9712:2007.

5.1.2 For services performed abroad, qualification and certification should be according to 5.1.1. or by independent entities in other countries, with certification by national entities in these countries in strict compliance with ISO/IEC 17024:2003, and operating in accordance with ISO 9712:2006 or with other standards from normalization entities, as long as they comply with CEN EN 473:2008.

NOTE Self-certification systems, such as "Nondestructive Personnel Qualification and Certification ASNT SNT-TC-1A" for Level 1, 2 or 3 Instructors, in which the certification methodology is established or applied by the employer according to his own criteria, are not allowed by PETROBRAS, even if mentioned in base standards of this document.

5.2 Procedure Qualification

5.2.1 The procedure must be qualified and certified by Level 3 Inspector.

5.2.2 Objective evidence of procedure quality should be kept to allow their verification by PETROBRAS at any time, when requested.

5.2.3 The procedure qualification shall be done in accordance with the standard set out for the project, manufacturing, construction and assembly.

NOTE When the system for the procedure qualification is not specified in the project, manufacturing, construction and assembly standards, such qualification shall be done in specimens typical of the inspection to be done, with identical characteristics and in sufficient amount to, during the qualification process, demonstrate that the test is repeatable, there is measurement accuracy and detection probability, compatible with the inspection and criteria adopted in the assessment of discontinuities.

5.2.4 The procedure qualification shall be done before the services and shall include, at a minimum, items set forth in Table 1. Whenever a variable is changed, a procedure revision shall be issued. If the variable is essential, the procedure must be qualified again.

Table 1 - Procedure Requirements

Requirements	Essential variable	Non essential variable
Purpose	x	
Reference standards	x	
Personnel qualification requirements		x
Material and settings, including size and thickness range	x	
Sketches with dimensional details		x
Tool (manufacturer and model)	x	
Heads: type, manufacturer, model, dimensions, angle, frequency, length of nearby field and thickness to use;	x	
Computerized data acquisition system, including computer software and its version, when applicable	x	
Description of the scanning system (manual or mechanized), as applicable	x	
Method and frequency for instrument adjustments		x
Technique to be used (example: direct contact method, pulse-echo method, immersion)	x	
Adjustment technique	x	
Instrument sensitivity adjustment	x	
Surface conditions and preparation technique		x
Couplant		x
Scanning technique	x	
Discontinuities dimensioning method	x	
Criteria for registration and acceptance of discontinuities		x
Results registration system		x
Report form for presentation of results		x

5.2.5 At the recording of the results, it shall be issued a report containing, at minimum:

a) name of the issuer (PETROBRAS agency or company performing the service);
b) numerical identification;
c) number and revision of the procedure;
d) identification of the part (type and dimensions);
e) specification of material part;
f) identification, including serial number, of the instruments and cylinder heads used;
g) computerized system for data acquisition, including software and its version, when applicable;
h) scan instrument, when used;
i) record identification of instrument calibration;
j) temperature of the tested part;
k) couplant used;
l) surface where the test was performed;
m) identification of the reference block, when applicable;
n) sensitivity adjustment method;
o) test duration;
p) superficial finishing of the inspected area;
q) sound attenuation of the material, when applicable;
r) register of results, including the response level (range) in relation to the adopted reference, the depth and the dimensions of the discontinuities and/or areas with loss of background echo;
s) standards, including edition/revision, and/or reference values for interpretation of the results;
t) sketch of the part showing the examined area, the discontinuities and/or areas with signal loss;
u) opinion indicating acceptance, rejection or recommendation for complementary examination;
v) place and date:
w) identification, signature and level of the responsible inspector.

5.3 Measuring System Calibration

5.3.1 The measurement system devices requiring periodical calibration are the ultrasound device, the head and standard blocks.

5.3.2 The periodicity of calibration of the ultrasound equipment shall not be greater than 24 months.

NOTE 1 The calibration certificates are issued by accredited laboratories, in accordance with ABNT NBR ISO/IEC 17025:2005. In case there is no accredited laboratory for the magnitude of calibration, laboratories with standards referenced to Rede Brasileira de Calibração (RBC) or with a nationally or internationally accredited metrological system can be used.

NOTE 2 Any repair or service in the measurement system requires a recalibration, notwithstanding the programmed interval already set.

5.4 Acceptance Criteria for Discontinuities

The acceptance criterion should be established by the forged project specification. When not determined by the design specification, the acceptance criterion should be that specified in ASTM A388/A388M:2010.

5.5 Change, Addition and Deletion of DNV OS-F101:2007, APPENDIX D

5.5.1 Item D206 - "Reference blocks for straight beam testing - Supplementary Requirement S1 of ASTM A388 shall apply, but with the Following additional requirements" - Deletion

5.5.2 Item D207 - “Reference blocks for angle beam testing - The reference notches shall be rectangular OD and ID notches with a depth of” - Deletion

5.6 Change, Addition and Deletion of ASTM A388/A388M:2010

5.6.1 Item 10 - Recording - Addition

If the size of the actual discontinuity is smaller than the profile of the sonic beam (6dB), the 6dB drop technique is not suitable for dimensioning purposes. The surface area measured will be overestimated and will not represent the actual size of the indication. A guide to rate whether the indications are larger or smaller than the beam profile in the 6 dB drop technique is given in BSI BS EN 10228-3:1998, part 13.

5.6.2 Item 12 - Quality Levels - Addition

For inspection of forged duplex stainless steels, follow the recommendations given in DNV OS-F101:2007 - App.D - D 300 - "Ultrasonic and liquid penetrant testing of duplex stainless steel forgings".

5.7 Change, Addition and Deletion of ASME BPVC Sec. V:2010

When the ASME BPVC Sec. V:2010 refers to ASTM A388/A388M:2010, Item 5.6 of this Standard applies.

INDEX OF REVISIONS	
REV. A and B	
There is no index of revisions.	
REV. C	
Affected Parts	**Description of Alteration**
All	Revised
REV. D	
Affected Parts	**Description of Alteration**
All	Revised