

Quality and Inspection Requirements of Piping Materials

Procedure

It is up to CONTEC - Authoring Subcommittee to provide guidance on the interpretation of the text of this Standard. The PETROBRAS Unit that uses this Standard is responsible for adopting and implementing its sections, subsections, and enumerations.

Technical Requirement: Prescription established as the most appropriate and to be strictly followed in accordance with this Standard. Any resolution not to follow it ("non-compliance" with this Standard) must have technical and managerial justifications and must be approved and documented by the PETROBRAS Unit that uses this Standard. It is characterized by imperative verbs.

Recommended Practice: Prescription that can be used under the conditions provided by this Standard, but which allows (and warns about) the possibility of an alternative (not specified in this Standard) that may be more suitable for a specific application. The adopted alternative must be approved and documented by the PETROBRAS Unit that uses this Standard. It is characterized by non-imperative verbs. It is indicated by the expression: **[Recommended Practice]**.

Copies of records of "non-compliances" with this Standard, which can contribute to its improvement, must be sent to CONTEC - Authoring Subcommittee.

Proposals for the revision of this Standard must be sent to CONTEC - Authoring Subcommittee, indicating their alphanumeric identification and revision, the section, subsection, and enumeration to be revised, the proposed wording, and the technical-economic justification. The proposals are evaluated during the process of amending this Standard.

"This Standard is the exclusive property of PETRÓLEO BRASILEIRO S.A. - PETROBRAS, for internal use within PETROBRAS and its corporate interests where the Common Corporate Rule (CCR) is deployed. It should be used by its suppliers of goods and services, affiliates, or similar entities in accordance with the conditions established in Bidding, Contract, Agreement, or similar documents. The use of this Standard by other companies/organizations/government entities and individuals is the sole responsibility of the users themselves."

CONTEC

Comissão de Normalização
Técnica

SC – 17

Piping

Presentation

PETROBRAS Technical Standards are developed by Working Groups (composed of expert Collaborative Technicians from the Company and its Subsidiaries), reviewed by the Company's Units and its Subsidiaries, approved by Authoring Subcommittees (composed of technicians from the same field representing the Company's Units and Subsidiaries), and endorsed by the Executive Core (consisting of representatives from the Company's Units and Subsidiaries). A PETROBRAS Technical Standard is subject to revision at any time by its Authoring Subcommittee and must be re-evaluated every 5 years for revalidation, revision, or cancellation. PETROBRAS Technical Standards are developed in accordance with the PETROBRAS Technical Standard N-1. For complete information on PETROBRAS Technical Standards, please refer to the PETROBRAS Technical Standards Catalog.

Foreword

This Standard is the English version (issued in 03/2023) of PETROBRAS N-215. 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 minimum quality requirements to be met when supplying piping materials for Petrobras and its shareholdings.

1.2 It applies to the following types of piping materials:

- Industrial Valves;
- Steel pipes;
- Fittings and nipples;
- Pipe flanges;
- Flange Stud bolts with Nuts;
- Flange gaskets.

1.3 Accessories or piping with components made of cast iron, bronze or aluminum alloys (except bronze-aluminum alloys), tin, and polymers, are subject to the requirements and tests of their respective manufacturing Standards.

1.4 This Standard's requirements apply to specification and piping materials supply processes started after its edition date.

1.5 The effective deadline for this Standard's implementation is 180 days after its publication. If the Petrobras unit applying this Standard understands that it is not possible to implement it within this timeframe, they must register an Implementation Plan within this period, defining the necessary actions and their respective deadlines.

1.6 The definition of the effective term for implementing this Standard's requirements, whenever it is referred in goods and services supply contracts, is an exclusive prerogative of Petrobras.

1.7 This Standard contains only Technical Requirements.

1.8 Materials without normative references (manufacturer standard) are not part of the scope of this Standard.

2 Normative References

The following listed documents are indispensable for the application of this document. Only the mentioned editions apply to dated references. For non-dated references, the most recent editions of the following documents apply.

NR-13 - Boilers, Pressure Vessels, Piping and Metallic Storage Tanks;

PETROBRAS N-76 - Piping Materials for Refining and Transportation Installations;

PETROBRAS N-133 - Welding;

PETROBRAS [N-1591](#) - Metals and Metal Alloys - Identification Through Magnet and Dot Testing;

PETROBRAS [N-1594](#) - Non-Destructive Test - Ultrasonic Testing in Welding;

ABNT [NBR 5426](#) - Planos de Amostragem e Procedimentos na Inspeção por Atributos;

ABNT [NBR 15693](#) - Ensaios Não Destrutivos - Teste por pontos - Identificação de Metais e Ligas Metálicas;

ABNT [NBR 15827](#) - Válvulas Industriais para Instalações de Exploração, Produção, Refino e Transporte de Produtos de Petróleo - Requisitos de Projeto e Ensaio de Protótipo;

ABNT [NBR 16137](#) - Ensaios Não Destrutivos - Identificação de Materiais por Teste por Pontos, Espectrometria por Fluorescência de Raios X e Espectrometria por Emissão Óptica;

ABNT [NBR 16278](#) - Inspeção de Fabricação - Qualificação e Certificação de Pessoas para o Setor de Petróleo e Gás;

ABNT [NBR ISO 9001](#) - Sistemas de Gestão da Qualidade Requisitos;

ABNT [NBR ISO 10497](#) - Ensaio de Válvulas - Requisitos de Ensaio de Fogo;

ABNT [NBR ISO/IEC 17020](#) - Avaliação da Conformidade - Requisitos para o Funcionamento de Diferentes Tipos de Organismos que Executam Inspeção;

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

ISO [898-1](#) - Mechanical Properties of Fasteners Made of Carbon Steel and Alloy Steel - Part 1: Bolts, Screws and Studs with Specified Property Classes - Coarse Thread and Fine Pitch Thread;

ISO [898-2](#) - Fasteners - Mechanical Properties of Fasteners Made of Carbon Steel and Alloy Steel - Part 2: Nuts with Specified Property Classes;

ISO [898-3](#) - Mechanical Properties of Fasteners Made of Carbon Steel and Alloy Steel - Part 3: Flat Washers with Specified Property Classes;

ISO [898-5](#) - Mechanical Properties of Fasteners Made of Carbon Steel and Alloy Steel - Part 5: Set Screws and Similar Threaded Fasteners with Specified Hardness Classes - Coarse Thread and Fine Pitch Thread;

ISO [898-7](#) - Mechanical Properties of Fasteners - Part 7: Torsional Test and Minimum Torques for Bolts And Screws With Nominal Diameters 1 Mm To 10 Mm;

ISO [3506-1](#) - Fasteners - Mechanical Properties of Corrosion-Resistant Stainless Steel Fasteners - Part 1: Bolts, Screws And Studs With Specified Grades And Property Classes;

ISO [3506-2](#) - Fasteners - Mechanical Properties of Corrosion-Resistant Stainless Steel Fasteners - Part 2: Nuts With Specified Grades And Property Classes;

ISO [4032](#) - Hexagon Regular Nuts (style 1) - Product Grades A and B;

ISO [6508-1](#) - Metallic Materials - Rockwell Hardness Test - Part 1: Test Method;

ISO [6508-2](#) - Metallic Materials - Rockwell Hardness Test - Part 2: Verification and Calibration of Testing Machines And Indenters;

ISO [6508-3](#) - Metallic Materials - Rockwell Hardness Test - Part 3: Calibration of Reference Blocks - Third Edition;

ISO [10474](#) - Steel and Steel Products - Inspection Documents;

ISO [15156-1](#) - Petroleum and natural gas industries - Materials for use in H₂S Containing Environments in Oil and Gas Production - Part 1: General Principles for Selection of Cracking-Resistant Materials;

ISO [15156-2](#) - Petroleum and natural gas industries - Materials for use in H₂S Containing Environments in Oil and Gas Production - Part 2: Cracking-resistant Carbon and Lowalloy Steels, and the use of Cast Irons;

ISO [15156-3](#) - Petroleum and natural gas industries - Materials for use in H₂S Containing Environments in Oil and Gas Production - Part 3: Cracking-resistant CRAs (Corrosion Resistant Alloys) and Other Alloys;

ISO [15848-1](#) - Industrial Valves - Measurement, Test and Qualification Procedures for Fugitive Emissions - Part 1: Classification System and Qualification Procedures for Type Testing Of Valves;

ISO [15848-2](#) - Industrial Valves - Measurement, Test and Qualification Procedures for Fugitive Emissions - Part 2: Production Acceptance Test of Valves;

ISO [17945](#) - Petroleum, Petrochemical and Natural Gas Industries - Metallic Materials Resistant to Sulfide Stress Cracking in Corrosive Petroleum Refining Environments;

ISO [27509](#) - Petroleum And Natural Gas Industries - Compact Flanged Connections With IX Seal Ring;

ASME [B16.5](#) - Pipe Flanges and Flanged Fittings NPS ½ Through NPS 24 Metric/Inch Standard;

ASME [B16.11](#) - Forged Fittings, Socket-welding and Threaded;

ASME [B16.20](#) - Metallic Gaskets for Pipe Flanges;

ASME [B16.47](#) - Large Diameter Steel Flanges NPS 26 Through NPS 60 metric/inch Standard;

ASME [BPVC - Sec. VIII - Div. 1](#) - Section VIII - Division 1 - Rules for Construction of Pressure Vessels;

ASME [BPVC - Sec. IX](#) - Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; And Welding, Brazing, And Fusing Operators - Welding, Brazing and Fusing Operators;

ASTM [A193/A193M](#) - Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications;

ASTM [A194/A194M](#) - Standard Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both;

ASTM [A234/A234M](#) - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service;

ASTM [A262](#) - Standard Practices for Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels;

ASTM [A307](#) - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength;

ASTM [A354](#) - Standard Specification for Quenched and Tempered Alloy Steel Bolts, Studs, and Other Externally Threaded Fasteners;

ASTM [A370](#) - Standard Test Methods and Definitions for Mechanical Testing of Steel Products;

ASTM [A437/A437M](#) - Standard Specification for Stainless and Alloy-Steel Turbine-Type Bolting Specially Heat Treated for High-Temperature Service;

ASTM [A453/A453M](#) - Standard Specification for High-Temperature Bolting, with Expansion Coefficients Comparable to Austenitic Stainless Steels;

ASTM [A540/A540M](#) - Standard Specification for Alloy-Steel Bolting for Special Applications;

ASTM [A563/A563M](#) - Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric);

ASTM [A923](#) - Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric);

ASTM [A960/A960M](#) - Standard Specification for Common Requirements for Wrought Steel Piping Fittings;

ASTM [A962/A962M](#) - Standard Specification for Common Requirements for Bolting Intended for Use at Any Temperature from Cryogenic to the Creep Range;

ASTM [A1014/A1014M](#) - Standard Specification for Precipitation-Hardening Bolting (UNS N07718) for High Temperature Service;

ASTM [E10](#) - Standard Test Method for Brinell Hardness of Metallic Materials;

ASTM [E18](#) - Standard Test Methods for Rockwell Hardness of Metallic Materials;

ASTM [E165/E165M](#) - Standard Practice for Liquid Penetrant Testing for General Industry;

ASTM [E562](#) - Standard Test Method for Determining Volume Fraction by Systematic Manual Point Count;

ASTM [F467](#) - Standard Specification for Nonferrous Nuts for General Use;

ASTM [F468](#) - Standard Specification for Nonferrous Bolts, Hex Cap Screws, Socket Head Cap Screws, and Studs for General Use;

ASTM [F593](#) - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs;

ASTM [F594](#) - Standard Specification for Stainless Steel Nuts;

ASTM [F836M](#) - Standard Specification for Style 1 Stainless Steel Metric Nuts (Metric);

ASTM [F3125/F3125M](#) - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength;

ASTM [G48](#) - Standard Test Methods for Pitting and Crevice Corrosion Resistance of Stainless Steels and Related Alloys by Use of Ferric Chloride Solution;

API [SPEC 6A](#) - Specification for Wellhead and Christmas Tree Equipment;

API [SPEC 6D](#) - Specification for Valves;

API [SPEC 17D](#) - Specification for Subsea Wellhead and Tree Equipment;

API [STD 607](#) - Fire Test for Quarter-turn Valves and Valves Equipped with Nonmetallic Seats;

API [STD 624](#) - Type Testing of Rising Stem Valves Equipped With Graphite Packing for Fugitive Emissions;

MSS [SP 6](#) - Standard Finishes for Contact Faces of Pipe Flanges and Connecting-End Flanges of Valves and Fittings;

MSS [SP 25](#) - Standard Marking System for Valves, Fittings, Flanges, and Unions;

MSS [SP 83](#) - Class 3000 and 6000 Pipe Unions, Socket Welding and Threaded (Carbon Steel, Alloy Steel, Stainless Steels, and Nickel Alloys);

MSS [SP 97](#) - Integrally Reinforced Forged Branch Outlet Fittings - Socket Welding, Threaded and Buttwelding Ends;

VDI [2440](#) - Emission Control - Mineral Oil Refineries;

3 Terms and Definitions

In addition to the terms and definitions present in the ABNT [NBR 16278](#), the following terms apply to this document:

3.1

Divergence Occurrence Report - COD

PETROBRAS internal procedure that formalizes the occurrence of non-compliance with the technical or contractual conditions established. Its purpose is to guide the Supplier or Manufacturer of products to make corrections, identify the root cause, and implement corrective actions in their Quality Management System, according to ISO [9001](#) requirements

3.2

Manufacturer

company responsible for manufacturing the asset according to the Contractual Instrument

3.3

Material Family

set of similar materials, which, due to their size, manufacturing process, and technology involved in their production, are manufactured and/or marketed by a specific group of Suppliers

3.4

Supplier

contracted company that will provide the asset to PETROBRAS according to the Contractual Instrument

3.5

Contract Manager

PETROBRAS employee responsible for all contractual matters with the Supplier

3.6

Supplier Quality Index - SQI

value between 0 and 100 % measuring Manufacturer/Supplier performance, set after a PETROBRAS quality audit. This index concerns the material family and the audited plant

3.7**Critical item**

Part of the supply scope, as defined by the Supplier, Project Standard or PETROBRAS specification, capable of causing interruption, environmental damage, harm to personnel and facility safety, or product shelf life reduction in the event of failure in its supply

3.8**Accreditation Body**

member and signatory of the "International Accreditation Forum" (IAF) and "International Laboratory Accreditation Cooperation" (ILAC), assigned in the country of origin with evaluating the local certification or inspection bodies' competence and impartiality in order to validate their services as trustworthy

3.9**Accredited Inspection Body - AIB**

third party company accredited for providing Inspection and Manufacturing services according to ABNT [NBR ISO 17020](#) Type A, in an activity scope compatible with the supplied good

3.10**Auditing Body**

PETROBRAS internal body assigned with performing inspection service and goods quality audits

3.11**Purchase Order**

document for the supply of assorted goods and services related with specified values, timeframes and conditions

3.12**Corrective Action Plan**

a plan prepared by the Supplier outlining the corrective actions related to the identification of the root cause of a non-conformity to be implemented in their Quality Management System

3.13**Monitoring Point - MP**

monitoring of continuous manufacturing process or Supplier/Manufacturer production cycle in instances in which summoning the Manufacturing Inspection manager is not necessary, although the forementioned Party may monitor it with the frequency deemed necessary to check its execution in accordance with the contractual procedures and requirements

3.14**Non-Conformity Report - NCR**

inspection record issued by the Supplier or Subsupplier's Quality System

3.15**Informative Report - IR or Non-Conformity Report - NCR**

inspection record issued by the Manufacturing Inspector to report any deviation from the contractual requirements provisioned for the manufacturing process. It must be issued for the rejection of intermediate inspection events

3.16**Material Requirement - MR**

PETROBRAS document describing the supply scope

3.17**General Quality Requirement for Goods**

document establishing the minimum quality requirements to be met in the direct or indirect supply of goods to PETROBRAS

3.18**Manufacturing Inspection Responsible - RIF**

party assigned with the Manufacturing Inspection, able to coordinate, plan and execute the manufacturing inspection. For Suppliers/Manufacturers required to contract an Inspection Body, the RIF is the contracted Inspection Body itself. For Suppliers/Manufacturers which are not required to contract an Inspection Body, the RIF position cannot be attributed to the party executing the manufacturing process

3.19**Inspection Service**

service executed by an independent Inspection Body in the execution of manufacturing Inspection activity

3.20**Subsupplier**

company chosen and qualified by the Supplier to supply goods or goods components and/or provide services

4 General

4.1 This Standard must be used in conjunction with the General Quality Requirement for Goods of PETROBRAS.

4.2 This Standard is divided in Annexes for each type of piping material:

- Annex A - Quality and Inspection Requirements for Industrial Valves
- Annex B - Quality and Inspection Requirements for Conduction Pipes
- Annex C - Quality and Inspection Requirements for Pipe Fittings, Flanges and Nipples
- Annex D - Quality and Inspection Requirements for Gaskets of Flanges
- Annex E - Quality and Inspection Requirements for Stud Bolts and Nuts of Flanges
- Annex F - PIT Templates
 - Model F.1 - Industrial Valves
 - Model F.2 - Control Valves
 - Model F.3 - Safety and Relief Valves
 - Model F.4 - Valve Accessories

5 Quality Inspection and Control Personnel Qualification and Certification

5.2 The manufacturing inspection must be performed by professionals qualified for the supplied product by the Manufacturing Inspection manager (RIF) or for certified inspectors from an Accredited Inspection Organ (OIA) in accordance to the contractual conditions.

5.2 The following activities related to inspection and quality control demand of services require certification of personal competences as per PETROBRAS [N-2941](#):

- a) welding inspection;
- b) Non-destructive testing inspection;
- c) Industrial painting inspection.

5.3 For materials released from third-party manufacturing inspection (OIA), the Supplier or Manufacturer must comply with the minimum quality guidelines described in the content of this Standard.

6 Procedure Qualifications

The welding, non-destructive tests and critical item painting must be approved by a certified professional.

7 Metrology

7.1 The test and measurement instruments used in the manufacturing inspection with a traceability requirement must be calibrated in accredited labs, according to ABNT [NBR ISO/IEC 17025](#) by an Accreditation Body belonging to ILAC, according to the scope of the performed calibration service.

7.1.1 The test and measurement instruments used in the control of manufacturing processes may be calibrated in the Suppliers/Manufacturers own labs, provided the calibration is made directly using a standard tracked in the country of origin's accreditation systems.

7.1.2 For instrument calibration in the conditions described in item 7.1.1, the following conditions must be met:

- a) Provision of specific instructions for performing each type of calibration;
- b) The equipment and instruments used must be in rooms with controlled temperature and moisture;
- c) The calibration must be made by professionals trained and capacitated according to a competence matrix (function map) provided by the supplier;
- d) The report (Calibration Certificate) must contain, phrased clearly, at least the following information:
 - i. Identification (traceability) of the calibrated instrument.
 - ii. Expected (reference) and found results.
 - iii. Calibration standard or equipment used.
 - iv. Indication of measurement uncertainties, including the error rate of the reference instrument.
 - v. Conclusion (approval / rejection);
 - vi. Signed of the assigned professional.
 - vii. Instrument calibration report expiry date.

7.1.3 The Supplier/Manufacturer must have a control systematic for the calibration instruments and provide criteria for instrument selection, considering the tolerance range to be measured in the resolution, as well as its use adequacy, based on the measurement uncertainty and its due application.

8 Control and Treatment of Non-Conformity

8.1 The supplier must control and address all non-conformities in its production line, according to its own procedures. Non-Conformity Reports (RNC), containing the defined dispositions and grounded technical reports must be documented.

8.2 The supplier must have a procedure to demonstrate corrective actions for issued RNCs and proving their effectiveness.

9 Inspection Record Control

The Supplier must have a procedure for issuance, control and archiving of records for Inspection and Testing activities (both internal and to their process and from their Subsuppliers) This procedure should allow for traceability within the Supplier's Quality Assurance system and throughout the product lifespan. The minimum record retention period for quality records should be five years.

10 Inspection and Testing Plan (PIT)

Unless specified differently in the Annexes, the minimum activities to be carried out by the Manufacturing Inspection Responsible are:

- a) Analysis and approval of the Inspection and Testing Plan;
- b) Verification of the conformity of manufacturing documents with contractual requirements;
- c) Verification of raw material certificates and quality records;
- d) Verification of labor, manufacturing methods and processes, controls, and intermediate tests;
- e) Witnessing of functional and/or performance tests, as relevant to manufacturing standards when applicable;
- f) Execution of visual inspection and witnessing of final dimensional examination;
- g) Verification of the data book;
- h) Issuance of Inspection Records;
- i) Verification of identification, preservation, and packaging according to contractual documents.

11 Determination of Product-Related Requirements

11.1 In addition to the requirements of ABNT [NBR ISO 9001](#):

- a) the Supplier must comply with the specific requirements of Technical Standards for each type of equipment of Annexes A to E, which must be mandatory applied throughout the manufacturing process and its quality control interventions;
- b) the Supplier must consider all requirements of the contract, as well as specified Standards, documents and instructions.

11.2 When not specified in the contract the Supplier must follow the hierarchy of normative documents in the following order:

- a) Material Requirements (MR), Technical Specifications (TS), Data Sheets (DS), Drawings (DE) and other documents from the Purchasing Company;
- b) this quality and inspection requirement;
- c) Technical Standards.

11.3 In case of conflict between requirements in contractual documents the stricter criterion prevails.