

Steam Fire-Tube Boiler

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.

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CONTEC

Comissão de Normalização
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SC - 22

Utility Equipment

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 05/2012) of PETROBRAS N-2309 REV. C 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 sets out the conditions required for supplying of stationary, automatic, compact, steam fire-tube boiler, as well as its auxiliary equipment for PETROBRAS onshore facilities, such as: refineries, terminals, production plants, power plants and thermal power plants.

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

Norma Regulamentadora nº 13 ([NR-13](#)) - Caldeiras e Vasos de Pressão;

Norma Regulamentadora nº 26 ([NR-26](#)) - Sinalização de Segurança;

PETROBRAS [N-2](#) - Anticorrosive Coating of Industrial Equipment;

PETROBRAS [N-76](#) - Materiais de Tubulação para Instalações de Refino e Transporte;

PETROBRAS [N-133](#) - Welding;

PETROBRAS [N-313](#) - Electrical Induction Motor;

PETROBRAS [N-314](#) - Paineis de Baixa Tensão Centro de Controle de Motores;

PETROBRAS [N-442](#) - Pintura Externa de Tubulações em Instalações Terrestres;

PETROBRAS [N-906](#) - Bombas Centrífugas para Serviços Médios;

PETROBRAS [N-1219](#) - Cores;

PETROBRAS [N-1550](#) - Pintura de Estrutura Metálica;

PETROBRAS [N-1618](#) - Material para Isolamento Térmico;

PETROBRAS [N-1735](#) - Pintura de Máquinas, Equipamentos Elétricos e Instrumentos;

PETROBRAS [N-2250](#) - Caldeira Flamotubular - Folha de Dados;

ABNT [NBR 11096](#) - Caldeiras Estacionárias Aquotubulares e Flamotubulares a Vapor - Terminologia;

ABNT [NBR 12177-1](#) - Caldeiras Estacionárias a Vapor - Inspeção de Segurança - Parte 1: Caldeiras Flamotubulares;

ABNT [NBR 12313](#) - Sistema de Combustão - Controle e Segurança para Utilização de Gases Combustíveis em Processos de Baixa e Alta Temperatura;

ASME [BPVC Sec I](#) - Boiler and Pressure Vessel Code - Section I - Rules for Construction of Power Boilers;

ASTM [A 36/A36M](#) - Standard Specification for Carbon Structural Steel;

ASTM [A 178/A178M](#) - Standard Specification for Electric-Resistance-Welded Carbon Steel and Carbon-Manganese Steel Boiler and Superheater Tubes;

ASTM [A 192/A192M](#) - Standard Specification for Seamless Carbon Steel Boiler Tubes for High-Pressure Service;

ASTM [A 283/A283M](#) - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates;

ASTM [A 285/A285M](#) - Standard Specification for Pressure Vessel Plates, Carbon Steel, Low- and Intermediate-Tensile Strength;

DIN [EN 10220](#) - Seamless and Welded Steel Tubes - Dimensions and Masses per Unit Length.

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 purposes of this document terms and definitions of ABNT [NBR 11096](#) are applied.

4 General Description

4.1 Every boiler shall form a compact unit, preferably supported on a single suitable metal structure, such as skid-mounted, where all auxiliary equipment included in the scope of supply shall be arranged as well. This unit shall be supplied in full and factory-assembled.

4.2 The boilers shall be automatic, cylindrical, horizontal, and ready for the operation, by making only connections to electricity, fuel, water, drain, steam, stack and interconnections of the electrical panel and fan.

4.3 In general the boilers shall be provided with the following systems:

- a) body:
 - side;
 - combustion chamber;
 - mirror;
 - pipes;
 - insulation;
 - refractory;
- b) start-up system;
- c) combustion systems;
- d) safety and control systems;
- e) water supply systems;
- f) emergency systems;
- g) electrical control systems;
- h) forced draft systems;
- i) exhaust gas systems (ducts and stacks)
- j) fittings;
- k) optional equipment.

5 Project

5.1 General

5.1.1 The equipment shall be designed and manufactured in accordance with the standards and codes in Section 2 in force on the date of issuance of this Standard or afterwards.

5.1.2 The electric drives shall be drip and splash proof, and additional classifications shall be considered in the case of specific use of the equipment.

5.1.3 Emissions from boilers shall meet the applicable law restrictions in force at the municipal, state and federal levels.

5.1.4 The boilers shall be designed and built for continuous operation. The fire safety system shall meet ABNT [NBR 12313](#).

5.1.5 The automatic control range of steam production shall be at least from 33% to 100%.

5.1.6 Boilers shall be equipped with peep hole and inspection and cleaning access.

5.1.7 The boilers shall have a minimum refractory to minimize the number of maintenance. Use preferably wet-back boiler.

5.1.8 Components

Auxiliary equipment, instruments, valves, accessories and material essential to the operation of the boiler shall be requested from suppliers qualified by PETROBRAS.

5.1.9 The manufacturer shall inform the thermal efficiency of the boiler with the method of evaluation.

5.1.10 The manufacturer shall inform the total energy consumption for each boiler operating at maximum steam output, as well as the power consumption of draft fans, water pump, fuel pump, heaters and other loads part of the scope of supply for fire-tube boiler.

5.1.11 The Regulatory Standard no. 13 ([NR-13](#)), related to boiler design, shall be met in full. When the fuel to be used is a gas, combustion and fire safety systems shall comply with ABNT [NBR 12313](#).