

CONTECComissão de Normalização
Técnica**SC-08**

Fired Heaters

Design and Fabrication of Furnace**2nd Amendment**

This is the 2nd Amendment to PETROBRAS N-1671 REV. F, incorporated the 1st amendment and it is used to alter the text of the Standard in the part(s) indicated below:

NOTE 1 The news pages with the performed amendments are placed in its corresponding positions.

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 - 04/2014**- Section 2:**

Exclusion of ABNT NBR 10700 and NBR 10701.

Inclusion of BSI [BS EN 15259](#).**- Subsection 7.2:**

Alteration of the text.

CONTENTS OF THE 2nd AMENDMENT - 04/2015**- Section 2:**

Exclusion of ISO 13705.

Exclusion of Note.

- Subsection 3.1:

Alteration of the text.

- Subsection 6.2:

Alteration of the text.

Design and Fabrication of Furnace

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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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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SC - 08

Fired Heaters

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Foreword

This Standard is the English version (issued in 10/2012) of PETROBRAS N-1671 REV. F 07/2012. 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 defines the required conditions for design, materials, fabrication, inspection, testing, and preparation for shipment of tubular furnace subject to flames and auxiliary equipment generally used in refinery services.

1.2 The descriptions and terminology of the tubular furnace subject to flames are given by ABNT [NBR 10778](#).

1.3 This Standard applies to procedures initiated as of their editing date.

1.4 This Standard contains Technical Requirements and Recommended Practices.

2 Normative References

The documents listed below are essential to the application of this document. For dated references, only the mentioned editions shall be applied. For non-dated references, the newest mentioned editions are applied.

ABNT [NBR 6123](#) - Forças Devidas ao Vento em Edificações;

ABNT [NBR 10778](#) - Forno Tubular Sujeito à Chama;

ABNT [NBR ISO 2768-1](#) - Tolerâncias Gerais - Parte 1: Tolerâncias para Dimensões Lineares e Angulares sem Indicação de Tolerância Individual;

API [STD 560](#) - Fired Heaters for General Refinery Service;

API [STD 614](#) - Lubrication, Shaft-Sealing and Oil-Control Systems and Auxiliaries;

API [STD 670](#) - Machinery Protection Systems;

API [STD 673:2002](#) - Centrifugal Fans for Petroleum, Chemical and Gas for Industry Services;

ASME [STS-1](#) - Steel Stacks;

BSI [BS EN 15259](#) - Air Quality - Measurement Of Stationary Source Emissions - Requirements For Measurement Sections And Sites And For The Measurement Objective, Plan And Report.

NOTE 1 CANCELLED - AMENDMENT - 04/2015.

NOTE 2 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 Design and Fabrication Standard

3.1 The design and fabrication of the furnace shall follow the API [STD 560](#), supplemented and/or modified by this Standard.

3.2 For the linear and angular tolerances with no direct indication in the project documents, the ABNT [NBR ISO 2768-1](#) shall be followed.

4 Design Requirements

4.1 Thermal Design

4.1.1 It is recommended that distributors/collectors (manifolds) from furnaces with multi-pass, in single phase flow, are dimensioned for a maximum difference between the flow rates less than 10%. **[Recommended Practice]**

4.1.2 It is not recommended to use distributors where the flow is biphasic. **[Recommended Practice]**

4.2 Mechanical Design

4.2.1 The structures and their components shall be designed for all load conditions expected during transport, assembly, operation, and maintenance. This includes support to equipment, machinery and scaffolding, outside and inside the furnace.

4.2.2 The furnaces that will have pig decoking shall have sufficient space and facilities for the installation of the pig launchers in the input and output nozzles of the coil.

4.2.3 For reformer furnaces, the elements Al, Ti, Zn (including galvanized components), Pb and Cd shall not be used in components, accessories, coatings or painting located above the arch.

5 Tubes

5.1 To austenitic stainless steel coils, only 18 Cr-8 Ni or 25 Cr - 20 Ni stainless steel pins or fins shall be used.

5.2 The stainless steels type 321 and 347 shall be provided on solubilized and stabilized condition.

5.3 The circumferential joints of tubes shall be positioned in order to not interfere with the supports and guides upon thermal expansion.

6 Tube Supports

6.1 The calculated deflection of the tube, due to the long term creep rate, shall be, at most, equal to a nominal diameter for maximum design condition.

6.2 For materials not listed on graphs of allowable stresses from API [STD 560](#), the designer shall specify the source (manufacturer) adopted when determining the allowable stress of tube supports.

6.3 ASTM A 217 Gr. C5 material shall not be used.

6.4 In vertical coils top supported on radiant section, welded guides at lower curves shall not be used.

6.5 The convection tube supports shall be checked for the condition of coil hydrostatic test. In this condition, the calculated stresses shall not exceed 90% of material yield stress.

6.6 The use of detachable parts of the tube supports shall be avoided. Otherwise, the connection pins shall be locked with welded washers.

6.7 End tube supports welded to metal structure of the convection module shall not be used.

7 Stacks, Ceilings, Ducts and Breeching

7.1 The mechanical design of the stack shall be in accordance with ASME [STS-1](#), and the minimum wind loads shall be in accordance with ABNT [NBR 6123](#).

7.2 Provision shall be made for platforms, sampling nozzles, and other facilities according to the BSI [BS EN 15259](#).

7.3 Cylindrical furnaces with helical tubes shall have radiant section arch fully detachable, in order to allow full replacement of the coil.

7.4 In vertical cylindrical furnaces, the door on the ceiling for removal of tubes shall be large enough to allow removing of at least one 'hook' - a group formed by two welded tubes and one return bend.

8 Pressure Relief Doors

8.1 Pressure relief doors shall be provided with a minimum area calculated by the following expression:

$$A = 5,1 \times 10^{-7} \times M \times \sqrt{T_g + 273}$$

Where:

A is the total area of the door (m²);

M is the maximum flowrate of combustion gases (kg/h);

T_g is the gas temperature at the door location (°C).

NOTE Design basis:

a) opening pressure = 1245 Pa (127 mm of water column);

b) pressure loss through the door = 2.8 x velocity head;

c) maximum door area does not exceed 0.4 m². **[Recommended Practice]**