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NATIONAL IRANIAN OIL REFINING & DISTRIBUTION COMPANY
NATIONAL IRANIAN OIL ENGINEERING
& CONSTRUCTION COMPANY

NIOEC SP

NIOEC SPECIFICATION FOR FIRED HEATERS

FIRST EDITION
JULY, 2005

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IN THE NAME OF GOD**FOREWORD**

By their very nature, technical Specifications are continuously subject to modifications and revisions. To strengthen their merit and usefulness, continuous improvements, addendum, deletion of disparate information and consequently provision of updated revisions are to be made in order to ascertain that such Specifications meet the current requirements, inclusive of Iranian Petroleum Standards (IPS) and the recognized and acceptable national and international Standards, as well as the optimal codes and practices based on the accumulated in-house know-how and plant knowledge and experiences.

However, in reality, due to several reasons, not to mention the complexity of the matter, the ultimate goal of continuous direct embedment of the required changes on the relevant Specifications may be far reaching. Therefore, in the interim periods between the officially issued revisions, the required changes will appear in other documents related to the engineering and design work of the ongoing projects.

In response to the initiative of the Design and Engineering Directorate, and considering that the task of the execution of several important and mega projects for the realization of the new oil refineries, pipelines and oil terminals as well as improvements of the existing facilities, has been assigned to NIOEC, it was decided to update the NIOEC Specifications and to issue new official revisions.

The Design and Engineering Directorate was itself entrusted to carry out this important task, and as such by forming several special technical committees, working in close co-operation and cohesion and sharing their expertise and knowledge, the updated and revised NIOEC Specifications were successfully prepared and compiled.

These Specifications are intended to be used for Oil Refineries, Distribution Depots, Oil Terminals, Pipelines and Pump Stations within NIOEC's projects, and have been proven to be of high value for such purposes. It must however be appreciated that these Specifications represent the minimum requirements and should in no way be interpreted as a restriction on the use of better procedures, engineering and design practices or materials.

We encourage and highly appreciate the users and other clear sighted and experts to send their comments on the Specifications to the Design and Engineering Director of NIOEC for evaluation and approval.

REVISION INDEX

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NOTES:

- 1) THIS SHEET IS A RECORD OF ALL REVISIONS TO THIS SPECIFICATION.
- 2) WHEN APPROVED EACH REVISION SHALL BE CONSIDERED AS A PART OF THE ORIGINAL DOCUMENT.
- 3) NUMBER OF PAGES EXCLUDES THIS SHEET AND THE COVER SHEET.

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1. SCOPE

- 1.1.** This Specification describes the general requirements for supplying horizontal and vertical direct-fired heaters (called “furnaces” for brevity). The requirements outlined herein are supplementary to the specifications listed on the individual fired heater Data Sheets.
- 1.2.** This Specification covers, All structural steel, Refractories, Burners, Tubes, Fittings and, Hangers, Stacks and Breaching, Dampers, Stair ways, Ladders and Platforms, Roofs, Tube rollers and other special tools.
- 1.3.** Deviations from this specification will only be permitted on obtaining written approval from NIOEC.
- 1.4.** Resolution on cases not explicitly stipulated in this Specification, or on cases where conflicts may arise among the requirements of the referenced/relevant IPS and the international standards, shall be made through written consent and approval of NIOEC.

2. REFERENCES

The following standards, codes, and specification, to the extent specified hereinafter, shall constitute a part of this NIOEC Specification. Latest edition of the undated referenced documents and the cited edition of the dated references shall apply. The applicability of changes made to the dated references, after the cited date shall be mutually agreed upon between NIOEC and the Vendor/Contractor.

API (AMERICAN PETROLEUM INSTITUTE)

API STANDARD 560	“Fired Heaters for General Refinery Service”
API STANDARD 530	“Calculation of Heater-Tube Thickness in Petroleum Refineries”

ASME (AMERICAN SOCIETY OF MECHANICAL ENGINEERS)

ASME code Sec. I	“Rules for Construction of Power Boilers”
ASME Code Sec. II	“Materials”
ASME code Sec. VIII Div.1	“Rules for Construction of Pressure Vessels
ASME code Sec. IX	“Welding, Brazing, and Fusing Qualifications”
ASME code B16.5	“Steel Pipe Flanges and Flanged Fittings”
ASME code B31.3	“Chemical Plant and Petroleum Refinery Piping”

ASTM (AMERICAN SOCIETY FOR TESTING AND MATERIALS)

ASTM Specification D-396-61T

NIOEC-SD (NIOEC STANDARD DRAWINGS)

NIOEC-SD-1002	“Fire Proofing Details for Steel Structures”
NIOEC-SD-2003	“Industrial Platform & Stairs Typical Details”

NIOEC-SP (NIOEC SPECIFICATIONS)

NIOEC-SP-00-01	“NIOEC Specification for Civil Design Criteria”
NIOEC-SP-45-07	“NIOEC Specification for Refractory Linings”
NIOEC-SP-45-04	“NIOEC Specification for Steam Methan Reformer Furnace”
NIOEC-SP-45-14	“NIOEC Specification for Refractory Linings Procedure for Fired Heaters”
NIOEC-SP-20-01	“NIOEC Specification for Structural Steel Fabrication”
NIOEC-SP-70-01	“NIOEC Specification for Instrumentation”
NIOEC-SP-80-02	“NIOEC Specification for Painting”
NIOEC-SP-47-10	“NIOEC Specification for NOISE”
NIOEC-SP-00-50	“NIOEC Specification for Design Criteria for Process & Mechanic”
NIOEC-SP-10-01	“NIOEC Specification for Concrete Foundations”
NIOEC-SP-60-07	“NIOEC Specification for Lighting”
NIOEC-SP-50-01 to 50-18	“NIOEC Specification for Piping”
NIOEC-SP-00-10	“NIOEC Specification for Units”
NIOEC-SP-40-03	“NIOEC Specification for Spare Parts Requirements
NIOEC-SP-50-18	“NIOEC Specification for Piping Material Purchase Valves”

NIOEC- SIP (NIOEC SHOP INSPECTION PROCEDURE)

NIOEC-SIP-43-03	“NIOEC Shop Inspection Procedure for fired Process Heaters”
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3. UNITS

International system of units (SI) shall be used in accordance with NIOEC-SP-00-10, unless otherwise specified.

4. GENERAL

- 4.1.** The design, fabrication, test & inspection of fired heaters shall conform to API560&API 530.
- 4.2.** The official code stamp as per the applicable code will not be required, unless otherwise specified.
- 4.3.** Approval of Vendors drawings shall not relieve the Vendor from responsibility in performance of the equipment specified herein.

5. DESIGN**5.1. Thermal Design****5.1.1. General**

- 5.1.1.1.** Calculated and guaranteed actual efficiencies shall be as shown on the Data Sheets and shall be based on design duty, pressure drop, fuel lower heating value and excess air as per NIOEC-SP-00-50.

- 5.1.1.2.** The average radiant heat flux specified on the Data Sheets is defined as the quotient of total heat absorbed by the radiant tubes divided by the total outside circumferential tube area inside the firebox, including any fitting inside the firebox. The rows of convection tubes exposed to direct radiant shall be considered as being in the radiant section and the maximum radiant heat absorption rate shall apply to these tubes, irrespective of whether extended surface elements are used or not.
- 5.1.1.3.** The maximum radiant heat flux density is defined as the maximum heat rate to any portion of any radiant tube. The rate shall be calculated for the front 60° of the tube surface. This density is not to be considered an operating average flux density for any given length of tube surface.
- 5.1.2.** Process design conditions are shown on the individual Fired Heater Data Sheets.
- 5.1.3.** Vendor shall specify the amount of excess air and stack temperature when operating at the guaranteed efficiency.
- 5.1.4.** For determination of minimum firing distances API560 (Min. clearance for forced draft and induced draft operation) shall be followed.

6. MECHANICAL DESIGN

All furnaces of the same type shall be designed as far as practical to use the maximum of interchangeable parts (heater tubes, tube headers, supports, etc.). Thus, an inventory of spare parts will be kept to a minimum.

Mechanical details shall be designed, fabricated and tested in accordance with the applicable codes and standards, latest edition.

6.1. Materials

Materials shall conform to API560. For refractory materials NIOEC-SP-45-07 shall be followed. Equivalent materials shall be approved by Client.

6.2. Furnace Layout and tube Arrangement

- 6.2.1.** More than one roof exit or stack shall be provided for effective convection tube lengths exceeding 40 feet (12 meters).
- 6.2.2.** The maximum allowable inside film temperature for any process service as defined in Data Sheet shall not be exceeded in the radiant, shield, or convection sections anywhere in the specified coil.
- 6.2.3.** The maximum rate of heat flux at any point in the convection section shall not exceed the maximum rate occurring at any point in the radiant section.
- 6.2.4.** Minimum clear distance between refractory setting and tube centerline in the radiant section shall be 1.5 nominal tube diameters, with a clearance of not less than 100 millimeters. For horizontal radiant tubes, the minimum clearance from floor refractory to tube outside diameter shall be not less than 300 mm (12 in).
- 6.2.5.** Radiant heating section tubes shall be single row and minimum center to center distance of adjacent tubes shall be two nominal pipe diameters.