

NIOEC-SP-45-02(0)							
DOCUMENT CODE							NO. OF PAGES: 33
PLAN/PRJ/SUB	UNIT	PHASE	DISCIPLINE	DOCUMENT TYPE	SERIAL NO.	REV. NO.	DATE
NIOEC	000	EG	ME	SP	4502	A0	JULY, 2005



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

NIOEC SP

NIOEC SPECIFICATION FOR FIELD ERECTED WATER TUBE BOILERS

FIRST EDITION

JULY, 2005

THIS STANDARD IS THE PROPERTY OF NATIONAL IRANIAN OIL ENGINEERING & CONSTRUCTION COMPANY. IT IS CONFIDENTIAL AND ALL RIGHTS RESERVED TO THE OWNER. NEITHER WHOLE NOR ANY PART OF THIS DOCUMENT MAY BE DISCLOSED TO ANY THIRD PARTY, REPRODUCED, STORED IN ANY RETRIEVAL SYSTEM OR TRANSMITTED IN ANY FORM OR BY ANY MEANS WITHOUT THE PRIOR WRITTEN CONSENT OF THE NATIONAL IRANIAN OIL ENGINEERING & CONSTRUCTION COMPANY

IN THE NAME OF GOD**FOREWORD**

By their very nature, technical standard 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 standard 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 standard 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 on going projects.

In response to the initiative of the Design Division of the Engineering and Construction 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 Division of the Engineering and Construction 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 complied.

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 Deputy of the Engineering and Construction Director of NIOEC for evaluation and consideration.

S. R. KASAEIZADEH


EXECUTIVE DIRECTOR

REVISION INDEX

REV. PAGE	1	2	3	4	5	REV. PAGE	1	2	3	4	5	REV. PAGE	1	2	3	4	5	REV. PAGE	1	2	3	4	5
1						26						51						76					
2						27						52						77					
3						28						53						78					
4						29						54						79					
5						30						55						80					
6						31						56						81					
7						32						57						82					
8						33						58						83					
9						34						59						84					
10						35						60						85					
11						36						61						86					
12						37						62						87					
13						38						63						88					
14						39						64						89					
15						40						65						90					
16						41						66						91					
17						42						67						92					
18						43						68						93					
19						44						69						94					
20						45						70						95					
21						46						71						96					
22						47						72						97					
23						48						73						98					
24						49						74						99					
25						50						75						100					

NOTES:

- 1) THIS SHEET IS A RECORD OF ALL REVISIONS TO THIS SPECIFICATION.
- 2) REMARKS RELATED TO EACH REVISION SHOW A BRIEF DESCRIPTION. THESE REMARKS SHALL BE INTERPRETED IN CONJUNCTION WITH THE REVISED TEXT MARKED BY REVISION NUMBERS.
- 3) WHEN APPROVED EACH REVISION SHALL BE CONSIDERED AS A PART OF THE ORIGINAL DOCUMENT.
- 4) NUMBER OF PAGES EXCLUDES THIS SHEET AND THE COVER SHEET.

5					
4					
3					
2					
1					
0	JULY, 2005	K.FARROKHI	M.H.ZAKER	M.R.FARZAM	M.A.A.SAJEDI
REV.	DATE	PREPARED	CHECKED	APPROVED	AUTHORIZED

<u>CONTENTS:</u>	<u>PAGE NO.</u>
1. SCOPE	2
2. REFERENCES	2
3. UNITS	3
4. DEFINITIONS & TERMOINOLOGY	3
5. SUPPLY	4
6. DESIGN DATA	6
7. STRUCTURAL DESIGN	8
8. MATERIALS	8
9. DESIGN	8
10. PERFORMANCE CONDITIONS	19
11. GUARANTEE	20
12. PREDICTED PERFORMANCE CONDITIONS	20
13. PREPARATION FOR SHIPMENT	20
14. INFORMATION REQUIRED WITH QUOTATION	21
15. DRAWINGS AND DATA REQUIRED	22
16. FABRICATION	22
 APPENDICES	
DATA SHEETS	26

1. SCOPE

1.1 This specification covers the requirements for the supply of field erected water tube boilers with accessories, design, fabrication, inspection, performance conditions, preparation for shipment, and information required with quotations.

2. REFERENCES

Throughout this Specification the following dated and undated standards/codes are referred to. These referenced documents shall, to the extent specified herein, form a part of this Specification.

For undated references, the latest edition of the referenced document (including any supplements and amendments) applies. For dated references, the edition cited applies. The applicability of changes in dated references that occur after the cited date shall mutually be agreed upon by the Company and the Vendor/Contractor.

The following codes and standards shall be applied as relevant in addition to the requirements of this Job Specification.

API (AMERICAN PETROLEUM INSTITUTE)

API 613 “Special Purpose Gear Units for Petroleum, Chemical, and Gas Industry Services” Forth Edition June, 1995

ASME (AMERICAN SOCIETY OF MECHANICAL ENGINEERS)

Boiler and pressure vessel code edition 2002.

ASME Code Sec. I

ASME Code Sec. II

ASME Code Sec. VIII

ASME Code Sec. IX

ASME STANDARD

B 16.5 “Steel Pipe Flanges and Flanged Fitting” Edition 1996

B 31.3 “Petroleum Process Piping” Edition 2002

AISC (AMERICANS INSTITUTE OF STEEL CONSTRUCTION)

Edition 1989

AGMA (AMERICAN GEAR MANUFACTURERS ASSOCIATION)

420.04 “Standard Practice for Helical and Herringbone Gear Speed Reducers and Increasers”

421.06 “Standard Practice for High Speed Helical and Herringbone Gear Units”

NEMA (NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION)

SM-23 “Mechanical Drive Steam Turbines” Edition 1985

AWS (AMERICAN WELDING SOCIETY)

D1.1 Edition

NIOEC-SP (NIOEC SPECIFICATIONS)

NIOEC-SP-00-01	“NIOEC Specification for Civil Design Criteria”
NIOEC-SP-00-11	“NIOEC Specification for Site Conditions”
NIOEC-SP-00-10	“NIOEC Specification for Units”
NIOEC-SP-20-01	“NIOEC Specification for Structural Steel Fabrication”
NIOEC-SP-41-03	“NIOEC Specification for Pressure Vessels”
NIOEC-SP-43-14	“NIOEC Specification for Centrifugal Fan”
NIOEC-SP-45-07	“NIOEC Specification for Refractory Linings”
NIOEC-SP-46-02	“NIOEC Specification for General Purpose steam Turbines”
NIOEC-SP-47-10	“NIOEC Specification for Permissible Noise Level”
NIOEC-SP-50-04 ,07,08	“NIOEC Specification for Piping”
NIOEC-SP-60-02	“NIOEC Specification for Squirrel Cage Induction Motors”
NIOEC-SP-60-07	“NIOEC Specification for Aircraft Warning Lights”
NIOEC-SP-80-01	“NIOEC Specification for Insulation”
NIOEC-SP-80-02	“NIOEC Specification for Painting”
Data Sheet for	“Water Tube Boiler”
Data Sheet for	“General Purpose Steam Turbine”

The official code symbol stamp per the applicable code will not be required, unless otherwise specified.

3. UNITS

International system of units (SI) shall be used in accordance with NIOEC-SP-00-10, unless otherwise specified in NIOEC-SP-00-50 “Design Criteria”.

4. DEFINITIONS & TERMINOLOGY

4.1 “Employer” means: “National Iranian Oil Engineering & Construction Company”.
(NIOEC)

4.2 “Purchaser” means: “National Iranian Oil Engineering & Construction Company”. When quoted in this Specification as per of a direct Purchaser order by NIOEC and “Contractor” where this Specification is part of contract documents.

4.3 “Vendor” means: The manufacturer from which the equipment is to be purchased.

5. SUPPLY

5.1 Complete self-supporting boiler for outdoor installation including boiler drums, tubes, drum supports, internals drum and header connections, waterwall tubes, waterwall headers and drum, waterwall circulator tubes, stack, duct and structural steel.

5.2 Complete superheater assembly including inlet and outlet headers, center outlet, connecting tubes between boiler drum and saturated steam header and necessary support for headers and elements.

5.3 Burner assembly consisting of steam atomized burners, pilot assemblies, and air register for the combustion of fuel oil, gas and gasoline.

5.4 Forced draft fan requirements will be specified on the boiler Data Sheet.

5.5 Soot blowers with electrical accessories, pipes, valves, pipe hangers and guides and fittings. Soot blowers are not initially required for the boilers fueled with only refinery fuel gas, but space for future installation of soot blowers, water washing or steam lancing doors shall be provided.

5.6 All ductwork between forced draft fan and boiler and burner windboxes.

5.7 Boiler valves and accessories including safety valves, blow-off valves, drum vent valve, chemical feed valve, continuous blowdown valves, steam gauges, water gauge stop valves, water gauge drain valves, steam gauge line stop valves, water gauges, and superheater valves.

5.8 A sealing air system shall be provided from the F.D. fan discharge duct for the observation ports soot blowers etc.

On pressurized boiler, observation doors shall have a view glass and shall be furnished with:

a) Aspirating air of sufficient pressure to prevent flue gases from blowing out when the door is open. Each door should be fitted with inter lock.

b) Seal air to minimize flue gas leakage and prevent fogging of the view glass when the door is closed.

5.9 Outdoor setting, insulation, Refractories and 14 gauge, or 2mm. min. ribbed outer casing shall be provided with necessary seals, expansion joints, door lining, to complete the setting.

5.10 Miscellaneous roof steel, buckstays and lower header supports.

5.11 Vendor shall furnish ladders, platforms, stairways, stack and ducting from expansion joint. After flue gas outlet damper to stack.

- 5.12 The Vendor shall furnish one (1) complete set of pneumatic tube rollers, two (2) complete sets of spare rolls for each size tube, and three (3) sets of spare gaskets.
- 5.13 Fluegas outlet damper at boiler outlet.
- 5.14 Instrumentation, including feedwater regulator, flame failure devices, three element control system, alarms, recorders, instrument panels, etc. Boiler instrumentation shall be included in the specified Data Sheets.
- 5.15 Concrete foundation design information and all relevant drawings only.
- 5.16 All anchor bolts for major foundations.
- 5.17 Feedwater pipings to steam drums as per flow diagram.
- 5.18 Steam pipings per flow diagram.
- 5.19 Piping to all burners.
- 5.20 Chemical injection, continuous and intermittent blowdown pipings.
- 5.21 Desuperheater complete with injection facility, at superheater outlet.
- 5.22 Where data presented on Data Sheets conflict with the requirement of this specification, the individual Data Sheet shall govern.
- 5.23 Field erection, Vendor must however supply erection schedule and details.
- 5.24 Economizer and static air preheater are required.
- 5.25 Maximum degree of shop fabrication commensurate with shipping limitations is preferred.
- 5.26 The Vendor shall furnish the following valves and accessories, all per ASME Codes, details of which will be specified on the Data Sheets.

Boiler Valves & Accessories

Safety Valve
Blow-Off Valve (Tandem)
Drum Vent Valve
Chemical Feed Stop Valve
Chemical Feed Check Valve
Cont. Blowdown Micrometer Valve
Cont. Blowdown Line Stop Valve
Steam Gauge
Water Gauge Stop Valve
Water Gauge Drain
Steam Gauge Line Stop Valve
Water Gauge
Feed Water Stop and Check Valve

Double valves in series should be used for blow down facilities, upper drum venting, sample connection (boiler water, saturated and superheated steam)

Water Wall Valves

Drain - As required

Drain connections (lower drum, water walls, superheater)

Two 1" I.D-lbs. ASI R.F Flanged openings for the installation of the thermowells.

Location:

a: Burner air inlet

b: Bailer outlet

Superheater Valves

Safety

Drain-Inlet Header

Drain-Outlet Header

Steam sampling connection from

Inlet header

Vent

Non-return and stop valves on superheater outlet. Non-return valve means combined stop/check valve.

Superheater outlet safety valves to be furnished and set at 47.2 barg (685 psig) according to ASME Sec.I PG-71.

- 5.27 Sample collector for checking of boiler TDS shall be provided with sample cooler and pressure reducing device.

6. DESIGN DATA

- 6.1 The maximum heat flux density at any localized "hot spots" shall not exceed 300 kW/m^2 ($95,000 \text{ Btu/ft}^2\text{h}$). The boiler designer shall present with his proposal the predicted furnace heat flux distribution along the length and height of the furnace at MCR and state the maximum and average heat flux and the furnace flue-gas exit temperature.

Note:

The heat flux density is the quantity of heat passing through unit surface area in unit time and is expressed as kW/m^2 ($\text{Btu} / \text{ft}^2\text{h}$). The surface area shall be that of the flat projected area of exposed tubes and exposed extended surface, integral with the tube. Refractory covered surfaces shall not be included.

- 6.2 The furnace width shall enable sufficient spacing of burners to ensure burner flame discrimination by individual viewing heads and also to make certain that there is no flame impingement on the side walls. The furnace depth shall be sufficient to ensure that burner flames do not impinge on the rear wall or penetrate the screen tube arrangement.

The depth of furnace shall not be so disproportionate to the width that a significant volume of furnace is not occupied by the flame, thereby making the total projected surface area not truly reckonable for the radiant heat rate calculations.

6.3 Vendor's guarantee of boiler performance shall be based on specified ambient conditions at plant site as per NIOEC-SP-00-09 "Site Conditions".
Ease of operation, inspection, maintenance, repair and cleaning are of major concern in design and arrangement of boiler.

6.4 Boiler and ancillaries shall be capable of continuous 24 hours a day operation between a 26 month statutory shut down period.

6.5 Boilers shall be designed for the following operating conditions:

6.5.1 Guaranteed net steam capacity, each boiler at superheater outlet excluding all blowdown per paragraph 5.3.12 heat losses and all steam used for boiler auxiliaries such as fans, soot blowers, burners, etc. as specified on data sheet.

6.5.2 Overdesign capacity for four hours continuous operation with an interval of not less than 20 hours between periods Vendor to specify (Minimum acceptable 15%).

6.5.3 Guaranteed turn down ratio Vendor to specify.

6.5.4 Minimum thermal efficiency when firing gas Job Specification to specify.

6.5.5 The steam temperature at desuperheater outlet shall be controlled between 371°C and 397°C through the operating range 40% to 100% load. And the steam temperature at esuperheater outlet shall be guaranteed $397 \pm 3^\circ\text{C}$ at 100% (MCR).

6.5.6 Guaranteed operation superheater outlet pressure, and Specified on Data Sheet.

6.5.7 Feedwater inlet temperature Specified on Data Sheet.

6.5.8 Steam drums shall be equipped internally with steam separators and scrubbers to ensure that the carry-over of total solids from the boiler water shall not exceed the following:

1 ppm up to 65 bar

5 ppm from 65 bar up to 135 bar

The boiler manufacturer shall state the maximum total dissolved solids (TDS) in the boiler water at which the required steam quality can be obtained.

6.5.9 Heat release per cubic foot of furnace volume when firing Specified fuels. Vendor to specify.

6.5.10 Superheater, drums and boiler tube system maximum design pressure Vendor to specify, but a minimum of 3 bar (50 psi) above operating pressure is required.

6.5.11 Steam drum and boiler tube system maximum design temperature. Superheater design temperature per code. Design temperature specified on Data Sheet.

6.5.12 Total continuous and intermitted blowdowns will be no more than 5% of steam generated. Vendor to specify capacity at 100% rating.

6.5.13 Steam for Fan Drivers Specified on Data sheet.

6.5.14 Exhaust Steam from Fan Drivers Specified on Data Sheet.

6.5.15 Stack temperature. Vendor to Specify.

6.5.16 Boiler feedwater and chemical injection Specified on Data Sheet.

6.5.17 Boiler dynamically shall be able to maintain a constant steam pressure for any load change occurring within a 3 minute interval between 30% and 100% of maximum continuous rating (MCR) or vice versa.

7. STRUCTURAL DESIGN

7.1 Earthquake load shall be in accordance with civil design criteria NIOEC-SP-00-01 (Clause 2.10).

7.2 Wind load shall be in accordance with chapter 16 of U.B.C as following:

7.2.1 Basic wind speed and exposure coefficient as site NIOEC-SP-00-11 (Cylindrical surfaces shall be taken as 60% of the loads of the flat surfaces).

7.2.2 Design wind pressure shall be in accordance with the chapter 16 of U.B.C. Volume 2 Division III.

7.3 Boiler setting design shall consider the possibility of oscillation at critical wind and flue gas velocities.

8. MATERIALS

Materials and construction for all pressure parts shall be as specified in the relevant ASME Boiler and Pressure Vessel Codes.

Refractories shall be in accordance with the ASTM relevant codes. Other materials of construction shall be as a minimum equal to the following:

	ASTM
Columns, beams and other structural shapes	Carbon Steel ASTM A 36
Steel Plate Enclosure	Carbon Steel ASTM A-283 Gr.C.
Bolts and Nuts	Carbon Steel ASTM A-307

Vendor may quote on other equivalent materials, but all substitutions shall be subject to written approval by the Purchaser.

Vendor must state details of materials he proposes to use for tubes, headers, steam drum.

9. DESIGN

9.1 Mechanical Design

A detailed welding procedure shall be submitted to the purchaser for approval before commencing fabrication. Facilities shall be provided for acid cleaning of the boiler with particular reference to the supply of adequate connections.