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

NIOEC SP

NIOEC SPECIFICATION FOR BASIC DESIGN PACKAGE

SECOND EDITION

DEC., 2009

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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 ongoing 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 Department of NIOEC for evaluation and consideration.

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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.

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0. INTRODUCTION

This Specification indicates the minimum requirements of the basic design package including check points to be considered by the basic designer and process engineers for assurance of fulfillment of NIOEC's requirements at the stage of basic design for the implementation of process plant projects.

1. SCOPE

This Specification which is mainly prepared in accordance with the requirements of part I of IPS-E-PR-150 with some modifications, defines the Company's minimum requirements for the basic design package which is to be prepared by the basic design Contractor, concerning the format of the package and contents.

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.

IPS (IRANIAN PETROLEUM STANDARDS)

IPS-E-PR-150	"Engineering Standard for Basic Design Package & Recommended Practice for Feasibility Studies"
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NIOEC-SP (NIOEC SPECIFICATIONS)

NIOEC-SP-00-10	"NIOEC Specification for Units"
NIOEC-SP-00-11	"NIOEC Specification for Site Conditions"
NIOEC-SP-00-50	"NIOEC Specification for Process and Mechanics Design Criteria"
NIOEC-SP-00-52	"NIOEC Specification for Process Flow Diagram"
NIOEC-SP-00-54	"NIOEC Specification for Basic Engineering Design Data"
NIOEC-SP-00-55	"NIOEC Specification for Piping & Instrumentation Diagrams (P&IDs)"
NIOEC-SP-00-58	"NIOEC Specification for Start-Up Sequence & General Commissioning Procedures"
NIOEC-SP-00-59	"NIOEC Specification for Plant Operating Manuals"
NIOEC-SP-00-62	"NIOEC Specification for Numbering System"
NIOEC-SP-45-03	"NIOEC Specification for Fired Heaters"

3. SYMBOLS AND ABBREVIATIONS

Symbols and abbreviations referred to in this Standard are as follows:

<u>SYMBOL/ABBREVIATION</u>	<u>DESCRIPTION</u>
APC	Advanced Process Control
API	American Petroleum Institute
BEDD	Basic Engineering Design Data

BOD₅	The 5 Day Biological Oxygen Demand at 20°C
COD	The Total Chemical Oxygen Demand
DCS	Distributed Control System
HVAC&R	Heating, Ventilation, Air Conditioning Cooling & Refrigeration
NPSH	Net Positive Suction Head
PFD	Process Flow Diagram
P&ID_s	Piping & Instrumentation Diagrams

4. UNITS

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

5. FORMAT

5.1 Covers and Size

The basic design package shall be presented in the form of a book of one or more volumes, the format of which shall essentially conform to the requirements stipulated in this Standard. The following format shall be applied for the basic design package within the variation in the standard.

1) Size of covers

230 mm × 300 mm (bound on the 300 mm side)

2) Size and type of back covers

70 mm maximum thickness and integral with covers

3) Color of covers and back covers

Blue-steel, without window

4) Color of title in covers and back covers

Golden

5) Form of title character

Block letters

6) Printing of character

Silk screen process

5.2 Titles

The basic design package shall be called:

"Basic Design Package"

The titles shall include:

1) Country's name

2) Company's name and emblem

- 3) Refinery/plant name or location
- 4) Project designation
- 5) Plant/Unit name and number
- 6) Volume number, if more than one volume
- 7) Date of issue
- 8) Contractor's name and mark
- 9) Licensor's name and mark, (if any).

The typical arrangement of titles for the front and bottom are shown Appendices B.1 and B.2 respectively.

6. CONTENTS OF BASIC DESIGN PACKAGE

The basic design package shall be sufficiently comprehensive to allow a third-party Contractor to carry out the detail design engineering, procurement/supply of equipment and shall comprise of technical data and information as required.

The contents shall essentially consist of the following items. If required, deletions, additions and/or modifications may be applied in accordance with the scope of the project upon Company's approval. The contents listed in Appendix A.1 shall be prepared as common for all Units, whereas, the contents required as per Appendix A.2 shall be prepared for each Unit separately and independent of the other Units.

6.1 Common for All Units

The documents listed in Appendix A.1 contain the items which are common for all Units throughout the complex/refinery.

This common information shall be provided in an individual package apart from the contents shown in Appendix A.1.

However, this information can be combined in the same volume containing the individual items for each Unit if only basic design of one Unit is required. The contents of each document shall be as described below:

6.1.1 General design data

6.1.1.1 General information

This shall include the following items where required for whole refinery/complex:

- Numbering system (as per [NIOEC-SP-00-62](#)),
- Units of measurement (as per [NIOEC-SP-00-10](#)),
- Site Conditions (as per [NIOEC-SP-00-11](#)),
- Basis of design including Units design and normal capacities,
- Specifications and properties of the refinery feed, raw materials and products for winter/summer cases wherever required,
- Refinery battery limit conditions for various incoming / outgoing streams,
- Test methods and procedures,
- General legends and symbols for PFD, P&ID, electrical, HVAC, civil and structure drawings. A common and unanimous legends and symbols in accordance with NIOEC Standard Drawings shall be used,
- Standard drawings, (to be used unanimously in accordance with NIOEC Standard

- Drawings),
- Standards and Codes for design,
- Health and safety measures and precautions,
- Set of design calculations (this information shall be prepared in a separate volume and be attached to the basic design package);
- Material selection philosophy,
- Main equipment design criteria (for vessels, reactors, towers, storage tanks, heat exchangers, air coolers, coolers and condensers, boilers, heaters, pumps, compressors, control valves, piping, etc.) as provided by the Employer in [NIOEC-SP-00-50](#) and completed by the Basic Engineering Designer/Licensors,
- Driver's selection philosophy,
- Control philosophy,
- Product loading, storage and dispatch philosophy,
- Other miscellaneous general requirements.

6.1.1.2 Basic engineering design data (BEDD)

This shall provide the necessary basic information required for the basic design of the facilities and shall contain the following information:

- Standards and codes for design,
- Utility operating and design conditions (Note 1),
- Site condition information (Note 1),
- Regulations concerning environmental pollution (air, water disposal, noise, etc.),
- Equipment including instrumentation and electrical general design information,
- Other requirements such as general design information for buildings, insulation, painting, fire proofing, etc.

Note (1):

For utility information (operating and design conditions) and site condition required data, reference should be made to [NIOEC-SP-00-54](#) "Basic Engineering Design Data (BEDD)".

6.1.1.3 Refinery/Complex material balance

This shall provide the overall feed and products material balance in the refinery/complex. The data shall also be shown on the refinery/complex block flow diagram which shall be prepared by the Basic Designer.

6.1.1.4 Utility summary tables

The maximum estimated utility requirements in summer and winter cases shall be tabulated for whole complex/refinery.

The utility services to be considered are electric power, steam, condensate, boiler feed water, potable (drinking) water, fire water, plant (service) water, raw water, cooling water, sea water, fuel gas, fuel oil, natural gas, instrument and plant air, inert gas, nitrogen, etc. Special requirements such as purging nitrogen, plant air for regeneration and decoking, etc. shall be provided. For typical utility summary tables, reference should be made to [NIOEC-SP-00-59](#), "Plant Operating Manuals".

6.1.1.5 Flare load summary tables

Gas and liquid flow rates, operating conditions and applicable physical properties of all streams to be routed to the flare or blow down systems shall be tabulated for each failure and each safety relief valve. The load summary tables shall include all causes of emergency failures throughout the integrated Refinery. Additionally, for flare unit, process flow diagrams indicating molecular mass (weight), density, pressure, temperature and phase for the various nodes shall be provided.

The table shall be provided and completed typically as shown in [NIOEC-SP-00-59](#).

6.1.1.6 Effluent summary tables

All gaseous and liquid effluents showing quantities and qualities of impurities which are object of control (sulfur, phenol, oil, BOD₅, COD, etc.) shall be tabulated to facilitate determining the environmental impact of the project.

6.1.1.7 Winterizing & heat conservation and insulation data

Design basis for winterizing and heat conservation including fluid maintaining temperature for winterizing/heat conservation shall be provided. Insulation philosophy for selection of hot insulation, personnel safety, cold insulation and other purposes shall also be presented.

6.1.1.8 Health, Safety and Environmental Aspects:

The following requirements shall be provided:

Recommendations for fire-fighting facilities required for process units, tank-farm and all offsite facilities areas while providing the flow rates of water/foam, cooling systems, deluge valve requirements and identification of the areas which require it, shall be provided. Also provision of fire water storage tank, diesel engine pump and the relevant facilities and control system, etc. shall be considered. Any fire-fighting facilities should be reviewed to be integrated with the existing fire-fighting facilities.

- a) Specifications, fire rating and identification of areas for fire proofing of steel structure and equipment.
- b) Recommendation for fire-fighting facilities required for process Unit(s) and storage areas including rate of water/foam required, cooling system, deluge valve requirements and identification of the areas which require it.
- c) Recommendation for fire fighting facilities as well as provision of blast proof walls and/or roof for control room.
- d) Recommendations for handling/storage of various chemicals, catalysts, hazardous materials etc.
- e) Number and location of safety showers, eye washes, fire hydrants, etc.
- f) Proposed methods of fire-fighting for different types of fires.
- g) Any other specific safety requirement.
- h) All general and specific requirements of the safety features such as the recommendations for handling and storage of various chemicals, catalysts, etc. shall be provided. Upon the Employer's request, the Basic Engineering Designer/Licensors shall participate in the safety HAZOP Study during the implementation of Detail Design Engineering stage. As far as fire fighting facilities are concerned following points shall be considered as minimum requirement:

6.1.1.9 Resins, chemicals, solvents and catalysts

- a) The following information shall be prepared for each catalyst, packing and solid absorbent employed in the process:
- service;
 - name or designation;
 - acceptable suppliers;
 - volume required;
 - density;
 - pellet or grain size and shape;
 - design life;
 - regeneration characteristics.
- b) The following information shall be provided for all resins, chemicals, additives, solvents and inhibitors employed in the process:
- name or designation;
 - initial fill quantity;
 - annual consumption;
 - physical properties;
 - loading, unloading and make up procedures;
 - shelf life (if any);
 - any specific warehousing requirement.

6.1.1.10 Hazardous area classification

It shall indicate the sources of hazards and the extent of hazardous areas, providing area classifications for the selection of electrical equipment.

6.1.1.11 Licensor's proprietary items

Sufficient process design data such as heat and material balance tables, required calculations and mechanical design data, equipment capacities and duties, specifications data, drawings, engineering details shall be supplied so as to perform detail design and procure the items from Licensor's approved manufacturers.

Licensor's standard engineering specifications and drawings for the detailed design of the specific Unit shall be provided. The Licensor shall supply these specifications and drawings as applicable to particular sections of the Unit. The specifications and drawings shall cover details or practices not given in the engineering procedures and specifications supplied by the Company.

6.1.2 Project specifications

Basic design package shall include preparation all project specifications, standard drawings applicable to the various parts of the project. The project standards/specifications shall be provided to define the project basic requirements for basic design and engineering, Vendor selection, procurement, manufacturing, inspection and installation of the equipment and materials in accordance with NIOEC Specifications. Project Specifications shall be prepared by addition of one addendum to NIOEC Specifications.

For the Licensed Units, the specific project specifications (where needed) shall be provided by the Licensor together with the process design specifications.

Where required, specifications provided by the Licensor shall be adhered to the project specifications by the Basic Engineering Designer.

project specifications shall cover but not be limited to the following:

- fired heaters, including steam boilers, waste heat boilers, incinerators and all kinds of furnaces;
- storage tanks, including all types of tanks, spheres, sumps and basins;
- vessels, including all types of the vessels, towers, reactors, separators, and fractionators. The specifications for the internal parts of the vessels and towers such as trays, packings, distributors, etc. shall also be included in this section;
- heat exchangers, including all types of the heat transfer equipment such as process to process heat exchangers, coolers, double pipe heat exchangers, reboilers, chillers, plate type heat exchangers, condensers, air coolers, etc.;
- machinery, including all types of compressors, turbines, blowers and pumps (e.g., rotary, reciprocating, centrifugal, etc.);

- electrical, including all electric motors, cables, switches, transformers, generators, lighting, telecommunication, etc.;
- instrument, including Distributed Control System (DCS), and all instrumentation systems and equipment such as alarms and shut-down systems, analyzers, transmitters, differential pressure elements, thermometers, thermocouples, level gages, pressure gages, control valves, measuring devices, cables, computer, etc.;
- piping, including piping material, classification, lay-out, fittings, valves, etc.;
- insulation, including project required insulation thickness tables and general specifications;
- painting;
- civil, including specifications for concrete, paving, stairs, platforms, structures, buildings, site preparations, rough grading, foundations, etc.
- HVAC&R, including air conditioning and refrigeration general specifications and basic design data (e.g., room temperature, humidity, etc.);
- miscellaneous, including all project specifications for package equipment, welding , buildings, safety, noise, etc. not included in the above mentioned specifications.

6.1.3 Project Specifications and Standard Drawings

The project specifications and standard drawings necessary from a Basic Process Design standpoint shall be included in the Basic Engineering Design Package.

6.1.4 Manuals

Basic engineering designer should prepare the following preliminary manuals. Each manual shall be provided in an individual bound volume apart from the basic design package.

6.1.4.1 Operating manual

The operating manual shall include and outline of start-up, shut-down and alternative operations. It shall also indicate emergency procedures covering utility failures and major operating upsets. In addition, all safety procedures, catalyst regeneration instructions and process descriptions in the all operation modes shall be included. For further information on the contents of operating manual, reference should be made to [NIOEC-SP-00-59](#), "Plant Operating Manuals". This operating manual shall be reviewed and revised/completed at the

stage of detail design phase by Detail Designer.

6.1.4.2 Laboratory manual (if required by the Company)

The laboratory manual shall include the following:

a) Laboratory equipment:- equipment list;

- basic specifications.

b) Laboratory building:

- building plot plan;
- equipment location diagram;
- utility distribution diagram.

c) Analytical method for:

- raw materials;
- chemicals;
- process control;
- products;
- catalysts;
- water impurities.

d) Instructions for sample taking and its frequency.

6.1.4.3 Maintenance manuals (if required by the Company)

Maintenance manuals shall include:

- particular emphasis on preventive maintenance;
- maintenance instructions for each equipment, including specific types of lubricant/grease required;
- periodicity of major shutdowns for regular overhaul / maintenance;
- any other special maintenance procedure.

6.1.4.4 Test run procedure manual

The manual shall include details of performance test runs and other aspects of commissioning such as:

- operating data to be recorded by the Company in the log book;
- sampling method;
- analytical methods;
- methods of calculations;
- interpretation and measuring of parameters during the test;
- methods of taking operating data;
- methods of evaluating the Unit performance.

For further information, reference should be made to [NIOEC-SP-00-58](#), "Start-Up Sequence & General Commissioning Procedures".