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

NIOEC SP

NIOEC SPECIFICATION FOR PROCESS DESIGN OF COOLING WATER CIRCUITS

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 on going 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 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 and Engineering Director of NIOEC for evaluation and approval.

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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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INTRODUCTION

To satisfy the requirements of this NIOEC Specification, Iranian Petroleum Standard IPS-E-PR-400 (Revised on Dec. 2013) with the modifications as specified herein after shall be strictly followed.

Articles 1 and 2 of this document replace entirely the related articles in the referenced IPS Standard.

1. SCOPE

This NIOEC Specification covers:

- Cooling Water Circuits for Internal Combustion Engines.
- Cooling Water Circuits for Reciprocating Compressors.
- Cooling Water Circuits for Intercooling and Aftercooling Facilities.

Deviations from this specification will only be permitted on obtaining written approval from NIOEC.

Resolution on cases not explicitly stipulated in this Specification, or on cases where conflicts may arise among the requirements of the referenced IPS and the international standards, shall be made through written consent and approval of NIOEC.

2. REFERENCES

The following standards, codes, and specifications, 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 610	"Centrifugal Pumps for Petroleum, Petrochemical and Natural Gas Industries", 11 th . Ed., September 2010 Clause 6, "Basic Design".
API Standard 618	"Reciprocating Compressors for Petroleum, Chemical, and Gas Industry Services". Fifth Edition, December 2007, "Intercoolers and After coolers".
API Standard 619	"Rotary-Type Positive Displacement Compressors For Petroleum, Chemical, And Natural Gas Industry Services ",, Fifth Edition, December 2010"Intercoolers and Aftercoolers".
API Standard 660	"Shell-and-Tube Heat Exchangers ",.Eighth Edition, August 2007
API Standard 661	"Air-Cooled Heat Exchangers For General Refinery Services ",.Sixth Edition, February 2006.
API Standard 680	"Packaged Reciprocating Plant and Instrument Air Compressors for General Refinery Services", 1st. Ed., October 1987, Clause 3.2.5.

ASME (AMERICAN SOCIETY FOR MECHANICAL ENGINEERS)

ASME Code, Section VIII, Division 1 Part 2, Appendix A.

IPS (IRANIAN PETROLEUM STANDARDS)

IPS-E-PR-400 "Engineering Standard for Process Design of Cooling Water Circuits"

NIOEC SP (NIOEC SPECIFICATIONS)

NIOEC-SP-00-10 "NIOEC Specification for Units"
 NIOEC-SP-41-01 "NIOEC Specification for Storage Tanks Field Erected"
 NIOEC-SP-41-03 "NIOEC Specification for pressure vessels"
 NIOEC-SP-44-01 "NIOEC Specification for Shell and Tube Heat Exchangers"
 NIOEC-SP-40-01 "NIOEC Specification for Rotary Machinery"
 NIOEC-SP-41-02 "NIOEC Specification for Large Welded Low Pressure Storage Tanks"
 NIOEC-SP-41-06 "NIOEC Specification for Aviation Turbine Fuel Storage Tanks"
 NIOEC-SP-41-07 "NIOEC Specification for Pressure Storage Spheres (LPG)"

TEMA (TUBULAR EXCHANGER MANUFACTURERS ASSOCIATION, INC)

TEMA Class R Heat Exchangers

2.1. EQUIVALENT TO IPS STANDARDS

Substitute the following IPS Standards as referred to throughout IPS-E-PR-400 for the relevant NIOEC's Specifications as follows:

<u>IPS Standard</u>	<u>Relevant NIOEC Specification</u>
IPS-E-GN-100	NIOEC-SP-00-10
IPS-G-ME-100	NIOEC-SP-41-01
IPS-G-ME-110	NIOEC-SP-41-06
IPS-G-ME-120	NIOEC-SP-41-02
IPS-C-ME-130	NIOEC-SP-41-07
IPS-E-ME-130	NIOEC-SP-41-07
IPS-G-ME-220	NIOEC-SP-44-01
IPS-E-PM-100	NIOEC-SP-40-01

3. UNITS

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

4. ADDENDUM TO IPS-E-PR-400

This addendum revises the below listed articles of the referenced standard as follows:

3.13 Maximum Allowable Working Pressure (MAWP): (Substitution)

The maximum continuous gauge pressure for which the manufacturer has designed the equipment (or any part to which the term is referred) when handling the specified fluid at the specified maximum operating temperature.

3.19 Rated Discharge Temperature: (Substitution)

The highest predicted operating temperature resulting from any specified operating condition.

5. UNITS (Deletion)

6.2.2.2

a) (Modification)

Atmospheric thermosyphon coolant systems (see Figure B.1, Plan B) may be supplied when cylinders are not required to operate fully unloaded for extended periods of time and either (a) the expected maximum discharge temperature is 100°C (210°F) or (b) the adiabatic gas temperature rise is less than 85K (150°F).

By mutual agreement between the purchaser and the vendor and approval by company, a pressurized thermosyphon system may be used. The pressurized system may only be used where the expected maximum gas discharge temperature is not to exceed 105°C (220°F). In such cases, the system shall be supplied with a thermal relief valve set at a gauge pressure of 1.7 bar (25 psig) maximum.

6.2.2.2

b) (Modification)

Static-filled coolant systems may be supplied where cylinders are not required to operate fully unloaded for extended periods of time, the expected maximum discharge temperature is less than 90°C (190°F), and the adiabatic gas temperature rise (difference between suction temperature and discharge temperature based on isentropic compression) is less than 85K (150°F). (See Fig. B.1 Plan A).

6.2.4.4.3 (Addition)

If specified, the vendor shall supply a closed liquid cooling system. If specified, and for all sour or toxic gas services, this system shall be separate from the cylinder jacket cooling system. See Figure C.1 of Appendix “C” for additional details on self-contained cooling systems for cylinder pressure packing.

Note: The inlet packing case coolant temperature should not exceed 35°C (95°F). Packing efficiency increases with low coolant temperature.

6.2.5.2 (Substitution)

The cylinder cooling system provided shall be adequate to prevent gas condensation. Coolant inlet temperatures shall be maintained at least 6 K (12 °F) above the inlet gas temperature (and at least 10 K (20 °F) above the inlet gas temperature for wet and saturated gas). These limits do not apply to “bone dry” gases. The coolant system shall be such that the above requirements are satisfied under all operating and transient conditions including start-up from cold.

Note 1: Lower inlet coolant temperatures can cause condensation of gas constituents, which can be detrimental to the life of cylinder valves, piston rings and packing.

Note 2: When the purchaser cannot supply coolant with adequate inlet temperature, a closed jacket cooling system or an inline heater as shown in Figure B.1, Plan C, should be considered.

Note 3: For most applications the inlet gas temperature is considered to be equal to the dew point. In applications where it is known that the gas dew point is substantially below the gas

inlet temperature and remains that way at all times during operation, a lower coolant inlet temperature may be considered as long as condensation is avoided.

6.2.5.5 (Substitution)

When possible, coolant exit temperatures should not be higher than 17K (30°F) above gas inlet temperature.

Note: Excessively high coolant exit temperatures can result in loss of capacity and efficiency.

6.2.5.10 (Addition)

Cooling water rate and velocity shall be provided by the Vendor to prevent fouling of cylinder jacket system.

6.2.5.11 (Addition)

The arrangement of the cooling jackets shall be such that failure of a gasket or other seal does not result in leakage of coolant into the cylinder or gas into the cooling system. When cooling of cylinder heads is provided, separate non-interconnecting jackets are required for cylinder bodies and cylinder heads.

6.2.5.12 (Addition)

A heating unit shall be provided as part of the self-contained closed jacket system for use during cold weather operation and for bringing the system up to temperature before start-up.

6.2.6.1 (Modification)

Unless otherwise specified by the Company, the Vendor shall supply a closed cooling water piping system for all equipment mounted on the compressor package. The piping shall be arranged to provide a single inlet connection and a single outlet connection for each water circuit operating at different inlet temperature levels and shall include a coolant control valve and a flow indicator as noted in 6.2.6.9 Series-type circuits shall have the necessary valved bypasses to provide temperature control. (See Figs. A.1, C.1, & E.1 of Appendices "A", "C", & "E" as the case may be).

6.2.6.9 (Modification)

Both, cooling water inlet and outlet lines to each compressor cylinder shall be provided with a isolation valve. A globe valve with union shall be provided on the main outlet line from each cylinder. A sight glass flow and temperature indicator shall be installed in the outlet line from each cylinder.

Note: Where more than one cooling water inlet and outlet point exist on a cylinder, one sight glass flow indicator and regulating globe valve shall be provided for each outlet point on each cylinder.

6.2.6.13 (Addition)

Where a thermosyphon or a static cooling system is provided, the vendor shall furnish piping with a drain valve at its lowest point and an expansion tank (complete with fill-and-vent connections and level indication) sized to prevent overflow of coolant (see Figure B.1, Plans A and B).

ENGINEERING STANDARD

FOR

PROCESS DESIGN OF COOLING WATER CIRCUITS

ORIGINAL EDITION

JULY 1994

This standard specification is reviewed and updated by the relevant technical committee on Feb. 1999(1), Oct. 2004(2) and Dec. 2013(3). The approved modifications are included in the present issue of IPS.

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