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

NIOEC SP

NIOEC SPECIFICATION FOR RECIPROCATING PROCESS COMPRESSORS FOR GENERAL REFINERY SERVICES

FIRST EDITION

JANUARY, 2006

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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 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

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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

To satisfy the requirements of this NIOEC Specification, API 618 with the modification as specified herein after shall be strictly followed.

The following annotations, as specified hereunder, have been used at the bottom right hand side of each clause or paragraph to indicate the type of change made to the equivalent clause or paragraph of API.

Substitution: The clause in API shall be deleted and replaced by the new clause in this Standard.

Addition: The new clause with the new number shall be added to the relevant section of API.

Modification: Part of the clause or paragraph in API shall be modified and/or the new description

1. SCOPE

- 1.1 NIOEC Specifications cover the general requirements for detailed engineering, procurements, testing inspection & construction of refinery/ oil plant, distribution depots, pump stations and pipelines.
- 1.2 This Specification covers the general requirements for reciprocating compressors to be purchased for NIOEC installations.
- 1.3 Process requirements and specific additional mechanical requirements together with driving equipment operating conditions are contained in the detail compressor Specification data sheets.

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 NIOEC and the Vendor/Contractor.

API (AMERICAN PETROLEUM INSTITUTE)

API 618 " Position Displacement pump-Reciprocating.", Fourth edition ,1995

ASME (THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS)

Boiler and Pressure Vessel Code, Section VIII, Div 1

SAE (SOCIETY OF AUTOMOTIVE ENGINEERS)

TEMA (TUBULAR EXCHANGER MANUFACTURERS ASSOCIATION)

NIOEC (NIOEC SPECIFICATION)

[NIOEC-SP-00-10](#) "NIOEC Specification for units"

[NIOEC-SP-46-00](#) "NIOEC Specification for Pumps Drivers and Auxiliary Equipments"

[NIOEC-SP-46-02](#) "NIOEC Specification for General Purpose Steam Turbines"

[NIOEC-SP-46-06](#) "NIOEC Specification for Special Purpose Steam Turbines"

[NIOEC-SP-47-10](#) "NIOEC Specification for Noise Control and Vibration"

[NIOEC-SP-60-02](#) "NIOEC Specification for Low Voltage Induction Motors"

[NIOEC-SP-60-20](#) "NIOEC Specification for Medium and High Voltage Induction Motors"

[NIOEC-SP-60-00](#) "NIOEC Specification for Electrical Design Criteria"

3. UNITS

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

4. DEFINITION & TERMINOLOGY

Employer: National Iranian Oil Engineering and Construction Company (NIOEC).

Contractor: The person, firm, Company or consortium whose tender has been accepted by the Employer or legal successors in title to such person.

Purchaser: National Iranian Oil Engineering & Construction Company in cases where this Specification is part of a direct purchase by National Iranian Oil Engineering & Construction

Company: In cases where this Specification is part of Contract Documents, "Purchaser" means the Contractor.

Vendor: The manufacturer's from which the equipment is to be purchased.

5. MODIFICATION TO API 618

The reciprocating compressors shall be furnished in accordance with API Standard 618, with the following additions, and modifications:

1.1.1 (Addition)

The compressor, driver, auxiliary equipment, piping, and appurtenances shall be furnished in strict accordance with the purchase order, including the proposal and specifications, unless specific written approval of changes is obtained from the purchaser. The vendor shall bring any know conflicting requirements to the attention of the purchaser for a decision.

1.4.38 (Addition)

Allowable rod loading is the limiting force that a manufacturer will permit on the compressor piston rod, the crosshead assembly, the connecting rod, and the crankshaft under any conditions of continuous operation.

1.4.39 (Addition)

Actual rod loading is the force developed due to differential pressure across the piston differential areas plus the inertia of the reciprocating parts transmitted through the piston rod.

2.1.2 (Modification)

For sound pressure level refer to NIOEC-SP-46-00 and NIOEC-SP-47-10.

2.1.5 (Addition)

Compressors, drivers, auxiliary equipment, piping, and appurtenances shall also be designed and constructed for continuous full-load duty at the specified operating conditions for at least three years of service.

Under all conditions of operation, the compressor, driver, and all accessories shall run safely to trip speed and or cylinder relief valve setting.

2.1.6 & 2.19 (Modification)

Compressors, drivers, auxiliary equipment, piping, and appurtenances shall be accessible for rapid and easy maintenance particularly regarding the packing and valves. It is recognized that this is a design criterion and that continuous operation for this period of time involves factor beyond the vendor s control.

2.1.7 (Modification)

All electrical components and installation shall meet the requirements of NIOEC-SP-60-00.

2.1.10 (Modification)

The compressor vendor shall assume full responsibility for the engineering coordination of the compressor and drive train. (See Paragraph 2.5 for a discussion of vibration and critical speeds)

2.1.12 (Substitution)

The capacity at the normal operating point certified by the manufacturer is to have no negative tolerance. The compressor vendor shall submit the design tolerance between the compressor s rated capacity and the required capacity. This tolerance should not be more than 3%

2.1.14 (Modification)

The compressor and all its auxiliaries shall be suitable for outdoor installation exposed to dusty and refinery atmosphere. Refer to the specification sheets for ambient conditions and electrical area classification, etc.

2.1.20 (Addition)

The proposal and operating instructions shall state maximum and minimum conditions for each cylinder, i.e., as limited by pressure, temperature, rod load, etc. including part-load conditions, which can possibly result in operation which would shorten the life of the

machine. Specified protective devices shall be furnished by the compressor manufacturer as shown on the specification sheets.

Compressor and drive train shall also be capable to operate continuously in any condition of loading or unloading that can be achieved with the capacity control system provided when operating at rated suction conditions.

2.2 Allowable Speeds (Modification)

Average piston speed shall not exceed 900 ft/min. for lubricated compressors or 3.5m/s. for non-lubricated compressors and for compressors handling saturated hydrocarbon gases.

Vendor's recommended speed is acceptable unless otherwise shown on the specification sheets.

For special high pressure services these maximum speeds should be considerably lower, based on the manufacturer's experience.

2.3.1 (Modification)

The actual discharge temperature shall not exceed 150°C for lubricated compressors or 135°C for non-lubricated compressors both at full load and part load operation. When handling gases with high hydrogen content the discharge temperature should not exceed 135°C

2.3.2 (Modification)

The high discharge temperature trip signal, which will shut down the unit, shall be set at 20°C above the maximum operating discharge temperature. Each cylinder shall have its own dedicated temperature measuring point for this purpose, which shall be located as close as possible to the cylinder discharge valve.

2.4.5 (Modification)

The compressor shall be capable handling momentary excursions of operation up to 15 percent above the maximum allowable continuous combined rod-load and maximum allowable continuous gas load ratings.

2.4.6 (Addition)

Predicted combined rod-loading for specified normal and worst case condition (i.e. at relief valve set pressure of part-load) shall be submitted at the time of proposal.

The actual rod loading, calculated on the basis of cylinder relieving pressure plus 10 percent accumulation and considering part-load operation, if applicable, shall not exceed the vendor's maximum allowable rod-load for the compressor.

The configuration and weights of the piston, rod, crosshead, and connecting rod shall be designed to assure load reversal on the crosshead pin at all operating conditions (including all capacity control steps) specified on the specification sheets. Vendor's proposal shall include data to verify that the above requirements are met.

2.5.1 (Modification)

The compressor vendor shall assume full responsibility for the performance of necessary torsional studies and the elimination of any lateral or torsional vibrations that may hinder the

operation of the complete unit within the specified operating range in any specified loading step. The vendor shall state the speeds (from dead stop up to or down from trip speed or synchronous speed) at which all critical speeds occur.

2.5.2 (Modification)

Belt-driven units are not acceptable for geared units, vendor shall perform a torsional analysis of the compressor gear driver arrangement and shall ensure that no operating condition is within 20% of a torsional critical speed. The vendor shall furnish a copy of this analysis and related data to purchaser for review.

2.6.1.1 (Modification)

The actual maximum allowable working pressure of the cylinders selected shall be stated in the data sheets and on the cylinders nameplates.

2.6.1.2 (Modification)

Only horizontal cylinders are acceptable, which shall have top suction and bottom discharge, top discharge is not allowed. Compressors shall be provided with pairs of cylinders (balanced opposed type) for those having more than 2 cylinders. Extra long studs with double nuts are required on all bottom discharge connections.

2.6.1.5 (Modification)

Studs holes shall be counter bored (chamfered)

2.6.2.1 (Modification)

All required compressor cylinder supports shall be supplied with the compressors. Cylinder supports shall be independent of the piping.

2.6.2.3 (Modification)

Cylinder liners shall have a minimum thickness of ½ inch.

Cylinder liners shall extend the full length of the cylinder, and shall be pinned or doweled from outside to prevent possible rotation.

2.6.2.5 (Modification)

Cylinder liners shall be honed to 10 micro-inches RMS finish maximum for non-lubricated service.

2.6.2.14 & 2.6.3.5.4 (Addition)

Water jackets shall be hydrostatically tested at 1.5 times the design pressure. It shall be good for a minimum of 75 psig operating pressure. Drains shall be provided at the lowest points.

2.6.3.2 (Modification)

Air cooled cylinders are not acceptable.