TECHNICAL SPECIFICATION

PACKAGED, INTEGRALLY GEARED, CENTRIFUGAL PLANT AND INSTRUMENT AIR COMPRESSORS
(AMENDMENTS/SUPPLEMENTS TO API STANDARD 672)

DEP 31.29.40.33-Gen.

November 1983
(DEP Circulars 11/97 and 26/99 have been incorporated)

DESIGN AND ENGINEERING PRACTICE

USED BY

COMPANIES OF THE ROYAL DUTCH/SHELL GROUP

PREFACE

DEP (Design and Engineering Practice) publications reflect the views, at the time of publication, of:

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and other Service Companies.

They are based on the experience acquired during their involvement with the design, construction, operation and maintenance of processing units and facilities, and they are supplemented with the experience of Group Operating companies. Where appropriate they are based on, or reference is made to, national and international standards and codes of practice.

The objective is to set the recommended standard for good design and engineering practice applied by Group companies operating an oil refinery, gas handling installation, chemical plant, oil and gas production facility, or any other such facility, and thereby to achieve maximum technical and economic benefit from standardization.

The information set forth in these publications is provided to users for their consideration and decision to implement. This is of particular importance where DEPs may not cover every requirement or diversity of condition at each locality. The system of DEPs is expected to be sufficiently flexible to allow individual operating companies to adapt the information set forth in DEPs to their own environment and requirements.

When Contractors or Manufacturers/Suppliers use DEPs they shall be solely responsible for the quality of work and the attainment of the required design and engineering standards. In particular, for those requirements not specifically covered, the Principal will expect them to follow those design and engineering practices which will achieve the same level of integrity as reflected in the DEPs. If in doubt, the Contractor or Manufacturer/Supplier shall, without detracting from his own responsibility, consult the Principal or its technical advisor.

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1) Operating companies having a Service Agreement with SIOP, SIEP, SIC or other Service Company. The use of DEPs by these Operating companies is subject in all respects to the terms and conditions of the relevant Service Agreement.

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All administrative queries should be directed to the DEP Administrator in SIOP.

NOTE: In addition to DEP publications there are Standard Specifications and Draft DEPs for Development (DDDs). DDDs generally introduce new procedures or techniques that will probably need updating as further experience develops during their use. The above requirements for distribution and use of DEPs are also applicable to Standard Specifications and DDDs. Standard Specifications and DDDs will gradually be replaced by DEPs.

TABLE OF CONTENTS

PART I. INTRODUCTION

This specification contains the minimum technical requirements for packaged, integrally geared, centrifugal plant and instrument air compressors for use in oil refineries, chemical plants, gas plants and, where applicable, in exploration, production and new ventures.

This specification gives SIPM/SICM amendments and supplements to API Standard 672, First Edition, June 1979, `Packaged, Integrally Geared, Centrifugal Plant and Instrument Air Compressors for General Refinery Services'. It shall be used in conjunction with data/requisition sheet DEP 31.29.40.93-Gen.

As a rule the requirements of this specification shall be adhered to.

However, national and/or local regulations may exist in which some of the requirements are more stringent.

The contractor shall determine by careful scrutiny which of the requirements are the more stringent and which combination of requirements will be acceptable as regards safety, economic and legal aspects.

In all cases the contractor shall inform the principal of any deviation from the requirements of this specification which is considered to be necessary, in order to comply with national and/or local regulations. The principal may then negotiate with the authorities concerned with the object of obtaining agreement to follow this specification as closely as possible.

Unless otherwise authorized by SIPM, the distribution of this specification is confined to companies belonging to or managed by the Royal Dutch/Shell Group, and to contractors and manufacturers/suppliers nominated by them.

All publications referred to in this specification are listed in Part IV.

PART II. GENERAL INFORMATION

This specification is written in four parts of which Part the principal part, gives SIPM/SICM amendments and supplements to API Std 672, First Edition, June 1979.

Problems stemming from the publication of revisions or amendments to the above standard by the American Petroleum Institute in 1983 or subsequent years shall be referred to the principal.

Packaged, integrally geared, centrifugal plant and instrument air compressors shall conform to API Std 672 as amended/supplemented by this specification.

For ease of reference, the clause (or paragraph) numbering of API Std 672 has been used throughout Part III of this specification. Clauses (paragraphs) in API Std 672 not mentioned remain unaltered. Where cross references are made, the number of the section/sub-section/clause of this specification referred to is shown in brackets.

A bullet (•) in the margin against certain clauses (paragraphs) in API Std 672 indicates that a decision by the principal is required. These decisions shall be indicated directly on the relevant data/requisition sheet when provisions are made for them; otherwise they shall be indicated on the data/requisition sheet(s) under the heading `Additional Requirements' or stated in the purchase order.

DEFINITIONS

For the purpose of this specification, the following definitions shall hold:

Shall and **Should** -the word `shall' is to be understood as mandatory and the word `should' as strongly recommended to comply with the requirements of this specification.

The **Principal** is the party which initiates the project and ultimately pays for its design and construction.
The Principal* will generally specify the technical requirements. The Principal may also include an agent or consultant authorized to act for the Principal.

* For Group operating companies having a service agreement with SIPM or SICM, the term Principal shall be taken as referring to SIPM - MFEE/21.

The **Contractor** is the party which carries out all or part of the design, engineering, procurement, construction and commissioning for the project. The Principal may sometimes undertake all or part of the duties of the Contractor.

The **Purchaser** is the party which buys the packaged, integrally geared, centrifugal plant or instrument air compressor for its own use or as agent for the owner. The Purchaser may be either Principal or Contractor.

The **Manufacturer/Supplier** is the party which manufactures or supplies equipment and services to perform the duties specified by the Contractor.

The term **`Vendor'** is considered to be synonymous with the term Manufacturer/Supplier as defined above.

Pipe sizes: The international nomenclature - **Diameter Nominal** - written as DN 15, 25, 40, 50, etc., has been used for pipe sizes in this specification; the inch sizes have also been retained and are shown in brackets.

PART III AMENDMENTS/SUPPLEMENTS TO API STANDARD 672

SECTION 1 GENERAL

1.1 SCOPE

Delete this clause and insert:

This specification covers the minimum requirements for constant speed, packaged, integrally geared, centrifugal plant and instrument air compressors, including their drivers and auxiliaries.

1.3 CONFLICTING REQUIREMENTS

Delete this clause and replace by:

In the case of conflict between documents relating to the inquiry or purchase order, the following priority of documents shall apply:

- first priority :purchase order and variations thereto
- second priority :data/requisition sheets and drawings
- third priority :this specification.

1.4 DEFINITION OF TERMS

1.4.2 Delete this clause

1.4.12 Delete this clause

1.5 REFERENCED PUBLICATIONS

1.5.1 Delete from this clause:

API Std 615: `Sound Control of Mechanical Equipment for Refinery Services'.

Add to this clause:

SECTION 2 BASIC DESIGN

2.1 GENERAL

2.1.1 Add to this clause:

Compressor ratings shall not exceed the limits of the vendor's design but shall be well within the manufacturer's actual experience. Only equipment which has proven its reliability is acceptable.

2.1.2 Delete this clause and replace by:

Noise control

All equipment furnished shall be designed to minimize the generation of noise and shall not exceed the noise limits given in the supplementary clauses below.

2.1.2.1 General

All definitions, notations, measuring equipment, measuring procedures, test reporting, calculation methods and calculation procedures shall be in accordance with OCMA publication NWG-1

2.1.2.2 Noise limits

Unless otherwise specified, the following limits shall be met at any measuring location not less than 1 m from the equipment surface:

Sound Pressure Limit in dB re 20 µPa	
Compressor	87 dB (A)
Compressor + driver	90 dB (A)

If the equipment produces impulsive and/or narrow band noise, the above limits shall be taken 5 dB(A) lower, thus 82 dB(A) for compressor and 85 dB(A) for the compressor + driver.

Noise levels shall have an upper tolerance of + 0 dB.

The above requirements apply in the absence of reverberation and background noise from other sources, and for all operating conditions between minimum flow and rated flow.

In the event that more stringent limits apply, then these will be indicated on the data/requisition sheet DEP 31.10.00.94-Gen. which forms part of the requisition. In such cases, the equipment shall not exceed the sound power or sound pressure limit stated on the requisition.

2.1.2.3 Noise abatement

Where excessive noise from equipment cannot be eliminated by low noise design, corrective measures should, preferably, take the form of acoustic insulation for pipes, gearboxes, etc. Where noise hoods are proposed, prior approval of the principal shall be obtained regarding construction, materials and safety requirements.

Noise control measures shall cause no hindrance to operations nor any obstruction to routine maintenance activities.

2.1.2.4 Information to be submitted with the tender

The vendor shall state on data/requisition sheet DEP 31.10.00.94-Gen., as requested, either the sound pressure level not less than 1 m from the equipment surface in octave bands and in dB(A), or the maximum sound power level of the equipment (the total noise emitted) in octave bands and in dB(A).

The vendor shall also indicate what special silencing measures, if any, have been applied in

order to obtain these levels.

2.1.3 Delete this clause and replace by:

Cooling water systems shall be designed for the conditions specified in the data/requisition sheet, and in no case shall they be designed for a working pressure of less than 5 bar.

Provision shall be made for complete venting and draining.

2.1.5 Delete this clause and replace by:

All electrical components and installations shall be suitable for the area classification, gas grouping and temperature classes specified by the principal in the data/requisition sheets.

2.1.9 Delete this clause and replace by:

The combined performance of the compressor unit and its driver shall be the responsibility of the vendor. The combined unit shall perform substantially as well on its permanent foundation as it did on the manufacturer's test stand.

2.8 DYNAMICS

2.8.1 Critical speed

2.8.1.3 Delete this clause and replace by:

Actual critical speeds shall not encroach upon operating speed ranges at any of the specified loads (variation in load may affect bearing oil film stiffness and shift frequency of critical speeds).

At critical speeds the overall unfiltered peak-to-peak amplitude of vibration including run-out shall not exceed 1½ times the vibration limit given in (2.8.2) of this specification.

2.8.2 Vibration and balance

Delete this clause and replace by:

For the assembled machine operating at maximum continuous speed or at any other specified speed within the operating range, the overall unfiltered peak-to peak amplitude of vibration, including run-out*, in any plane measured on the shaft adjacent and relative to each radial bearing shall not exceed the following values:

Speed r/min	Permissible shaft vibration in µm
Below 3000	50
3000 - 15000	$\sqrt[10]{\frac{75000}{n}}$
Above 15000	$\frac{335000}{n}$

in which n = maximum continuous speed in revolutions per minute

At the trip speed of the driver, the vibration shall not exceed the above values plus 25%

* See sub-note (11) in API Std 672

2.11 MATERIALS

2.11.1 General

2.11.1.1 Add to this clause:

The material of construction for casings shall be steel or nodular cast iron.

2.11.2 Castings

2.11.2.3 Delete this clause and replace by:

Amended per Circular 11/97

Repair by welding

Weldable grades of castings may be repaired by welding subject to the following criteria:

1. Approval by the principal shall be obtained before any major* weld repair is carried out.

   * Refer to definition included after item 6.

2. All repairs shall meet the inspection requirements and acceptance standards for the original material.

   Castings subjected to a major repair shall be inspected by purchasers representative who shall be notified in accordance with paragraph 4.1.1 of API Std 672.

3. For steel castings the repair welding procedure and the repair welder's qualifications shall both be in accordance with ASTM A 488. Repair procedures are subject to approval by the principal.

4. The total quantity of weld metal deposited shall be less than 10% of the mass of the casting.

5. After weld repair, castings shall be suitably heat-treated if this is specified in the relevant material specification.

   A major* weld repair shall always be followed by a suitable heat treatment.

6. Details of all major weld repairs, and of the heat treatment where applicable, shall be recorded and reported to the principal.

   * The definition of a major weld repair is to be taken as either a removal of more than 50% of the wall thickness, or a length of more than 150 mm in one or more directions, or a total surface area of all repairs exceeding 20% of the total casting surface area

Repair by plugging

Cast gray iron or nodular iron may be repaired by plugging within the limits specified in ASTM A 278, ASTM A 536, or ASTM A 395 respectively. The drilled holes for plugs shall be carefully examined by dye penetrant to ensure removal of all defective material.

All necessary repairs not covered by ASTM shall be subject to approval by the principal.

Details of all repairs shall be recorded and reported to the principal, who shall be informed of the need for plugging before any repair is carried out.

2.11.2.4 Insert new clause:

Fully enclosed cored voids including voids closed by plugging are prohibited.

2.12 NAMEPLATES AND ARROWS

Add to this clause:

Unless otherwise specified, the text on nameplates shall be in the English language, and the data shall be in SI units.

The information on nameplates shall include the year of manufacture. Page 12

SECTION 3 ACCESSORIES

3.1 DRIVERS

3.1.4 Delete this clause and replace by:

Electric motor drivers shall comply with DEP 33.66.05.31-Gen. as specified on requisition sheet DEP 33.66.05.93-Gen.

The motor rating shall be at least 110% of the maximum unthrottled power - including coupling, shaft-driven oil pump, and gear losses - required for any of the specified compressor operating conditions.

3.1.7 Delete this clause and replace by:

Motors for auxiliary equipment shall comply with DEP 33.66.05.31-Gen.

3.1.8 Delete first sentence and replace by:

Steam turbine drivers shall conform to API Std 611 as amended/supplemented by DEP 31.29.60.30-Gen. or to API Std 612 as amended/supplemented by DEP 31.29.60.31-Gen. and data/requisition sheet DEP 31.29.61.95-Gen. or DEP 31.29.61.93-Gen., whichever is applicable.

3.4 CONTROLS AND INSTRUMENTATION

3.4.1 Add to this clause:

Amended per Circular 26/99

Instrumentation and connections for instruments shall be in accordance with DEP 32.31.09.31-Gen. and DEP 32.31.00.32-Gen.

3.4.4 Instrumentation

Insert new clause:

All instrumentation provided shall comply with DEP 32.31.09.31-Gen.

3.4.4.1 Thermometers

Delete this clause

3.4.4.2 Thermowells

Delete this clause

3.4.4.3 Pressure gages

Delete this clause

3.4.4.4 Delete this clause and replace by:

The instrumentation which shall be provided as a minimum shall be as specified in the data/requisition sheet.

3.4.5 Alarms and shutdowns

3.4.5.7 Delete this clause and replace by:

The alarms and shutdowns which shall be provided as a minimum shall be as specified in the data/requisition sheet.

Alarm and shutdown settings shall be indicated in the manufacturer's data.

3.4.7 Vibration and position detectors

3.4.7.1 Delete this clause and insert:

When specified in the data/requisition sheet, non-contacting vibration and axial-position transducers and, if so specified, the associated monitors, etc., shall be supplied, installed and calibrated in accordance with API Standard 670 as amended/supplemented by DEP 32.31.09.31-Gen.

3.4.7.2 Delete this clause

3.5 PIPING AND APPURTENANCES

3.5.3 Intercoolers and aftercoolers

3.5.3.1 Delete last two sentences of this clause and replace by:

The cooler materials shall be as specified in the data/requisition sheet.

SECTION 4 INSPECTION AND TESTING

4.1 GENERAL

4.1.2 Delete this clause and replace by:

The manufacturer shall provide the purchaser with assurance that materials of construction are in accordance with the purchase order.

The requirements for material certificates giving the chemical composition and the mechanical and test data for the materials used for the pressure-containing parts and for the main components of the compressor set out in the following supplementary clauses shall be adhered to.

4.1.2.1 The different types of certificate which shall be used by the manufacturer for verifying that the requirements of the specification and contract are met are distinguished below.

Type A

Certificates by which the manufacturer confirms that the product supplied corresponds to what was specified, on the basis of test results taken from the in-production testing of products of the same material and the same manufacturing method as the delivery concerned.

Type B

Certificates by which the manufacturer's inspector confirms that the product supplied corresponds to what was specified, on the basis of tests carried out on the delivery itself or on standards-specified test specimens related to the delivery.

The necessary testing shall have been carried out by a testing centre which is independent of production in the manufacturing works and which has the necessary facilities at its disposal. When the independence of the testing centre cannot be established, a Type C certificate shall be submitted.

Type C

Certificates as described under Type B with the additional requirement that the tests shall be witnessed by an independent inspector who shall be approved by the principal. Certificates shall be valid only when stamped and signed by this independent inspector.

4.1.2.2 All certificates shall contain the following information:

- name of manufacturer
- purchase order number and date
- manufacturer's order number
- identification number of certificate and its date of issue
- material specification (s)
- dimensions in SI units, unless otherwise specified or applicable
- material charge number, batch number or heat-lot number
- mechanical properties recorded from test results
- chemical composition recorded from results of chemical analyses
- NDT methods and results, where applicable
- heat treatment procedures, furnace charge number and heat treatment records, where applicable
- such supplementary or additional information as may be required.

Additionally, all Type C certificates shall state:

- name of the independent inspector who has witnessed the test(s)
- this independent inspector's identification symbol.

  Unless otherwise specified, the material concerned shall be stamped with an identical symbol using low-stress dies.

4.1.2.3 Material certificates in accordance with Type A are required for nodular cast iron pressure-containing parts.

4.1.2.4 As a minimum, material certificates in accordance with Type B are required for carbon or low-alloy steel pressure-containing parts, and for rotor shafts, gears and impellers.

4.1.2.5 If the manufacturer cannot comply with the material certification requirements of (4.1.2.3) and (4.1.2.4) of this specification, he shall include in his proposal a list detailing specifically each and every deviation.

4.1.3 Insert new clause:

Marking

4.1.3.1 Marking is required for component parts certified under material certificates Type B and Type C, see (4.1.2.1 and (4.1.2.4) of this specification.

Parts with a wall thickness in excess of 5 mm, except those items manufactured from austenitic stainless steel or from nickel alloys, shall be legibly marked by hard-die stamping on to a painted background, and at a point clearly visible later. Pipes should be marked at a point approximately 250 mm from one end.

Only low-stress stamps shall be used for hard-die stamping, and the stamps shall be round-nosed with a minimum radius of 0.25 mm.

For items manufactured from austenitic stainless steel or from nickel alloys, and for items with a wall thickness of 5 mm or less, the marking shall be applied by stencil using a water insoluble ink which contains no injurious substances such as metallic pigments, sulphur, sulphides or chlorides which could attack or harmfully affect the material.

4.1.3.2 The stamping/marking shall include:

- manufacturer's symbol; the stamp shall be identical to symbol on certificate*
- material and product identification
- charge or batch number
- heat treatment chart or furnace charge reference number, where applicable
- heat treatment symbol or code, where applicable
- NDT symbol or code, where applicable
- size and schedule
- hydrostatic test pressure in bar, where applicable.

* Where applicable, the third-party agency identification stamp or mark shall be identical to the stamp/mark on the certificate.

NOTE: Where the size of the fitting does not permit complete marking, the identification marks may be omitted in the reverse order presented above, or another form of identification may be used with the prior agreement of the principal.

4.2 INSPECTION

4.2.4 Delete this clause and replace by:

When radiography (of welds), magnetic particle inspection or dye-penetrant inspection is specified or required, or when ultrasonic inspection is specified or required, procedures and acceptance criteria shall be in accordance with (4.2.5) of this specification.

4.2.5 Castings

4.2.5.1 Delete this clause and replace by:

Casting surfaces, including steel castings for valves, flanges, fittings and other piping components, shall be examined visually by the manufacturer and shall be free of adhering sand, scale, cracks and hot tears.

Other surface discontinuities shall meet the visual acceptance standards specified in MSS SP-55.

Following visual inspection, and if specified, magnetic particle inspection shall be carried out on all surfaces after final machining.

Magnetic particle inspection method shall be in accordance with ASTM E 709.

Acceptability of defects shall be based on a comparison with the reference photographs given in ASTM E 125. For each type of defect, the degree of severity shall not exceed the limits in the following table:

Type	Degree
I	1
II	2
III	2
IV	1
V	1
VI	1

Irrespective of these generalized limits, it shall be the manufacturer's responsibility to review the design limits of all castings in the event that more stringent requirements are specified.

Dye-penetrant inspection shall be used only when magnetic particle inspection is not feasible.

Dye-penetrant inspection method shall be in accordance with ASTM E 165.

Acceptability of defects shall be based on a comparison with the reference photographs given in ASTM E 125. For each type of defect, the degree of severity shall not exceed the limits given in the table above.

4.2.5.2 Delete this clause and replace by:

When specified, full non-destructive inspection shall be carried out on all critical areas, such as abrupt changes in section, weld ends, at the junction of risers, gates or feeders to the casting, and areas of high stress. Prior to inspection, the purchaser and the manufacturer shall agree the critical areas and the type of non-destructive testing which shall be applied. Radiographic inspection shall be applied wherever possible.

Radiographic inspection procedure shall be in accordance with ASTM E 94.

The interpretation of radiographs shall be in accordance with ASTM E 186,

ASTM E 280 or ASTM E 446, whichever is applicable. For each type of defect, the degree of severity shall not exceed the limits in the following table:

Thickness mm	Gas and blow holes	Sand spots and inclusions	Internal shrinkage	Cracks and hot tears
			Types 1,2,3 and 4	
Below 25	2	2	2	Not allowed
25-50	3	3	2	Not allowed
51-114	3	3	2	Not allowed
Over 114	3	3	2	Not allowed

Ultrasonic inspection shall be used where radiography is not possible.

Ultrasonic inspection shall be in accordance with ASTM A 609. For each range of wall

thickness, the level of acceptance shall be in accordance with the following table:

Thickness mm	**Acceptance level**
Below 50	2
50-100	3
Over 100	4

4.2.5.4 Insert new clause:

The inspection requirements specified in (4.2.5.1) and (4.2.5.2) of this specification can be relaxed at the discretion of the principal if the manufacturer can establish proven good experience with the same casing material and the same casting technique. The principal and the manufacturer shall then agree the revised extent of the inspection.

4.2.6 Impellers

Delete this clause and replace by:

All accessible areas of welds on built-up impellers shall be inspected by dye-penetrant examination.

Cast impellers shall satisfy the manufacturer's spot radiographic examination prior to finish machining. Radiographs shall be taken at all critical points including areas of high stress.

After final machining, each impeller shall be subjected to an overspeed test of at least 115% of maximum continuous speed for a minimum period of 3 minutes.

Before and after the overspeed test, critical dimensions such as outside diameter and impeller eye diameter shall be measured. In principle, no dimensional change is permitted. Should any dimensional change occur, it shall be reported and acceptance shall be subject to the principal's approval.

After the overspeed test, impellers shall be checked for cracks and defects, then rebalanced.

4.3 TESTING

4.3.3 Mechanical running test

4.3.3.3 Add to this clause:

The test shall also verify that the location of critical speeds and the vibrations at critical speeds conform to the requirements of (2.8.1.3) of this specification.

4.3.3.7 Add new item to this clause:

6. Any mechanical defect which requires replacement or reconditioning of the parts concerned, such as rubbing in labyrinths.

4.4 PREPARATION FOR SHIPMENT

4.4.1 Add to this clause:

Preparation for shipment shall be in accordance with the requirements of the inquiry and of the purchase order(s), and the supplements appertaining thereto.

SECTION 6 VENDORS DATA

6.1 PROPOSALS

Delete item 1 and replace by:

1. Copies of the relevant data/requisition sheet(s) completed to the furthest extent practicable.

6.2 CONTRACT DATA

6.2.1 Drawings

6.2.1.1 Add to this clause:

The information shall include the documents for controls and instrumentation as specified in DEP 32.31.09.31-Gen.

PART IV REFERENCES

Amended per Circular 11/97

In this specification, reference is made to the following publications.

NOTE: The latest issue of each publication shall be used together with any amendments/supplements/revisions to such publications.

It is particularly important that the effect of revisions to international, national or other standards shall be considered when they are used in conjunction with DEPs, unless the standard referred to has been prescribed by date.

Data/requisition sheet for equipment noise limitation	DEP 31.10.00.94-Gen.
Data/requisition sheet for packaged, integrally geared, plant and instrument air compressors	DEP 31.29.40.93-Gen.
General-purpose steam turbines	DEP 31.29.60.30-Gen.
Special-purpose steam turbines	DEP 31.29.60.31-Gen.
Data/requisition sheet for special-purpose steam turbines	DEP 31.29.61.93-Gen.
Data/requisition sheet for general-purpose steam turbines	DEP 31.29.61.95-Gen.

Amended per Circular 26/99

Instruments for measurement and control	DEP 32.31.00.32-Gen.
Instrumentation for equipment packages	DEP 32.31.09.31-Gen.
Electric motors	DEP 33.66.05.31-Gen.
Requisition sheet for electric motors	DEP 33.66.05.93-Gen.

AMERICAN STANDARDS

General-Purpose Steam Turbines for Refinery Services	API Std 611 Second Edition, January 1982
Special-Purpose Steam Turbines for Refinery Services	API Std 612 Second Edition, June 1979
Noncontacting Vibration and Axial Position	API Std 670
Monitoring Systems	First Edition, 1976
Packaged, Integrally Geared, Centrifugal Plant and Instrument Air Compressors for General Refinery Services	API Std 672 First Edition, June 1979

Issued by
American Petroleum Institute,
Publication and Distribution Section,
2101 L Street Northwest,
Washington, DC 20037, USA

Gray Iron Castings for Pressure-Containing Parts for Temperatures up to 650°F (345)°C	ASTM A 278
Ferritic Ductile Iron Pressure- Retaining Castings for	ASTM A 395

use at Elevated Temperatures

Qualification of Procedures and Personnel for the Welding of Steel Castings	ASTM A 488
Ductile Iron Castings	ASTM A 536
Ultrasonic Examination of Carbon and Low-Alloy Steel Castings	ASTM A 609
Radiographic Testing	ASTM E 94
Magnetic Particle Indications on Ferrous Castings	ASTM E 125
Liquid Penetrant Inspection	ASTM E 165
Heavy-Walled (51 to 114 mm) Steel Castings	ASTM E 186
Heavy-Walled (114 to 305 mm) Steel Castings	ASTM E 280
Steel Castings up to 51 mm in Thickness	ASTM E 446
Magnetic Particle Examination	ASTM E 709

Issued by
American Society for Testing
and Materials,
1916 Race St., Philadelphia,
Pa. 19103, USA

Quality Standard for Steel Castings - Visual Method	MSS SP-55

Issued by
Manufacturers Standardization Society,
5203 Leesburg Pike, Suite 502,
Falls Church, Virginia 22041, USA

OIL COMPANIES MATERIALS ASSOCIATION

Noise Procedure Specification	OCMA publication NWG-1, Revision 2

Issued by
Heyden & Son Ltd
Hillview Gardens,
London NW4 2JQ,
England