MANUAL

CENTRIFUGAL FANS
(AMENDMENTS/SUPPLEMENTS TO API 560, Appendix E)

DEP 31.29.47.30-Gen.

January 1998
(DEP Circular 27/99 has been incorporated)

DESIGN AND ENGINEERING PRACTICE

PREFACE

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

Shell International Oil Products B.V. (SIOP)
and
Shell International Exploration and Production B.V. (SIEP)
and
Shell International Chemicals B.V. (SIC)

The Hague, The Netherlands,

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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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.

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PART I INTRODUCTION

1.1 SCOPE

This DEP specifies requirements and gives recommendations for centrifugal fans and blowers that develop less than 0.35 bar above atmospheric pressure and have a driver rating of more than 5 kW.

This DEP is based on API 560, second Edition, September 1995. Part II of this DEP amends, supplements and deletes various clauses/paragraphs of API 560, Appendix E. Clauses of API 560 which are not mentioned in this DEP shall remain applicable as written.

This DEP shall be used in conjunction with data/requisition sheet DEP 31.29.42.93-Gen.

1.2 DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS

Unless otherwise authorised by SIOP and SIEP, the distribution of this DEP is confined to companies forming part of the Royal Dutch/Shell Group or managed by a Group company, and to Contractors and Manufacturers/Suppliers nominated by them (i.e. the distribution code is "F", as described in DEP 00.00.05.05-Gen.).

This DEP is intended for use in oil refineries, chemical plants, gas plants and, where applicable, in exploration and production facilities and supply/marketing installations.

If national and/or local regulations exist in which some of the requirements may be more stringent than in this DEP, 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, environmental, economic and legal aspects. In all cases the Contractor shall inform the Principal of any deviation from the requirements of this DEP 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 DEP as closely as possible.

1.3 DEFINITIONS

1.3.1 General definitions

The **Contractor** is the party which carries out all or part of the design, engineering, procurement, construction, commissioning or management of a project, or operation or maintenance of a facility. The Principal may undertake all or part of the duties of the Contractor.

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

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 authorised to act for, and on behalf of, the Principal.

The word **shall** indicates a requirement.

The word **should** indicates a recommendation.

1.3.2 Specific definitions

Continuous operation
A service in which it is not expected that the compressor will have to be started/ stopped during normal plant operation.

Note: This definition is independent of the requirements for a service life of 20 years and for at least 5 years uninterrupted operation.

Essential service
A service in which failure of equipment renders a plant or process unit inoperable or reduces performance to a level unacceptable to the Principal.

Hydrogen service
All process conditions with a hydrogen partial pressure greater than 0.7 MPa (7 bar abs).

Intermittent operation
A service in which it is expected that the compressor will be started/ stopped at unspecified intervals, e.g.:

- automatic starts and stops at intervals by process operated controls;
- manual starts and stops at intervals by manual control for batch processes.

Note: This definition is independent of the requirements for a service life of 20 years and for at least 5 years uninterrupted operation.

Non-essential service
All services other than essential service and vital service.

Very toxic substances
Substances which produce serious harm to health as a result of a single or short term exposure. The following shall be considered very toxic:

- Levels of H_2S exceeding 1000 ppm mole (vol) in process streams;
- Other substances specified by the Principal to be very toxic

Vital service
A service in which failure of equipment causes an unsafe condition of the plant or installation resulting in jeopardy to life and/or major damage (e.g. fire, explosion).

1.4 ACTION ITEMS

A round bullet (•) in the margin next to a clause in API 560 appendix E indicates that a decision by the Principal is required. These decisions shall be indicated directly on the relevant data/requisition sheet where 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.

1.5 CROSS-REFERENCES

Where cross-references to other parts of this DEP are made, the referenced section number is shown in brackets. Other documents referenced by this DEP are listed in (Part III).

PART II AMENDMENTS/SUPPLEMENTS TO API 560, Appendix E

E.I GENERAL

E.1.1 SCOPE

add to this clause:

See also (Part I; 1.1).

E.1.2 DEFINITIONS OF TERMS

Add new terms to this clause:

E.1.2.12 *Trip speed for steam turbine drives* shall be approximately 110 percent of the maximum continuous speed.

E.1.2.13 *High temperature service*

High temperature service for fans and auxiliaries is a service with a fan inlet temperature greater than 200 °C. Fans in this service are called “high temperature fans”.

Add new clause:

E.1.4 CONFLICTING REQUIREMENTS

In the event of conflict between documents relating to the enquiry or purchase order, the following hierarchy of documents shall apply:

upper level: purchase order and variations thereto;

second level: data/requisition sheets and drawings;

third level: this DEP.

E.2 DESIGN

E.2.1 GENERAL

E.2.1.1 Add to this clause:

Fans shall not exceed the rating limits of the Manufacturer’s design.

In all respects, fans shall be within the range of the manufacturer's proven experience, and shall not use any prototype design or components. The Vendor shall list in the proposal all changes which are not proven in similar machines produced for the last 5 years or which have not acquired at least 16 000 hours operation. These changes are subject to the Principal's approval and proven alternatives may be requested.

E.2.1.4 Replace this clause by:

All electrical components and installations shall comply with applicable local regulations and be suitable for the area classification, gas grouping and temperature classes specified by the Principal on the data/requisition sheets.

E.2.1.10 Replace this clause by:

Unless otherwise specified on the data/requisition sheet the fan shall be of the overhung type.

Add new clause:

E.2.1.16 Noise Control

E.2.1.16.1 Limits

The Contractor shall comply with DEP 31.10.00.31-Gen., Noise Control, and thereby communicate to the Vendor the specified equipment noise limitations by using data sheet DEP 31.10.00.94-Gen., which forms part of the requisition. The Vendor is responsible for assuring that these equipment noise limitations have been specified.

E.2.1.16.2 Information to be submitted with the tender

The Vendor shall submit guaranteed sound power levels and sound pressure levels (including octave band spectrum) of the equipment, together with any other relevant information as requested on the data sheet, DEP 31.10.00.94-Gen. The Vendor shall indicate what special silencing measures, if any, are proposed in order to meet the specified levels.

In order to minimise the influence of factors, such as heavy piping loads, misalignment at operating conditions, improper supporting structure, mishandling during shipment and improper handling and assembly at site, the manufacturer shall review and comment on the purchaser's piping and foundation drawings. For high temperature fans the manufacturer's erection supervisor should be present for checking the initial cold alignment, and the piping/alignment at operating temperature.

E.2.2 FAN HOUSING

E.2.2.1 Add the following clauses:

E.2.2.1.1 Unstiffened flat surface areas of casing walls shall not exceed 0.25 m^2 each.

Fans with a casing mass of not greater than 150 kg shall have the casing connected to the bearing housing without additional supports.

Fans with a casing mass greater than 150 kg shall have the casing foot-mounted or centre line supported.

High temperature fans shall have the casing centre-line supported and guided to allow for thermal expansion without affecting the casing's centre-line position. In this case, due attention shall be paid to the connection of the casing to the seal housing to ensure that the seal housing will not be distorted due to forces induced by thermal expansion of the casing and/ or by piping or ducting forces. A flexible connection shall be provided

between the casing and the seal housing and a rigid connection shall be provided between the seal housing and the bearing bracket.

In tropical climates, the type of seal shall be selected to accommodate differences in thermal expansion between a foot-mounted casing and bearing pedestals.

E.2.2.1.2 High temperature fans shall be designed with a proven heat barrier between the fan casing and the bearing housing.

E.2.3 FAN HOUSING CONNECTIONS

E.2.3.1 Add to this clause:

The inlet and discharge connections shall be oriented as specified on the data/requisition sheet.

Flanges shall have a thickness of at least three times the casing wall thickness.

E.2.3.2 Delete this clause and replace by:

Casing drains shall be located at the lowest point of the casing and inlet bends. Drain connections shall have a nominal size of at least DN 25 and shall be flanged. Nominal sizes DN 45, DN 65, DN 90, DN 130, DN 180 and DN 230 shall not be used.

Add new clause:

E.2.3.3 Bolting

In pressure parts, tapped holes for bolting shall be kept to a minimum; studs should be used instead of cap screws.

Clearance shall be provided at bolting locations to permit the use of socket or box wrenches.

E.2.5 ROTATING ELEMENTS

E.2.5.1 Add to this clause:

Blade design shall be proposed by the Manufacturer for the approval of the Principal.

E2.5.3 Add to this clause:

Fan wheel materials shall be suitable for operation with the gas specified on the data/requisition sheet, considering corrosion, erosion and temperature (including temperature excursions).

E.2.5.5 Replace the third sentence of this clause by:

Cast or ductile iron hubs shall not be used.

Add to this clause:

For overhung types of fans, the impeller shall be mounted on the shaft with a hydraulic keyless taper fit to allow the impeller hub to be removed to replace or maintain bearings or sealing elements. Lock-nuts, if used, shall be self-locking (counter rotation thread) and positively located by means of lock screws or a lock plate. High temperature fan impellers should be located on the shaft by means of an end-plate fastened to the shaft and impeller by cap screws, rather than by using a keyed construction.

E.2.6 SHAFT SEALING OF FANS

E.2.6.1 Add to this clause:

Shaft seals shall be one of the following types, as specified on the data/requisition sheet.

a) Labyrinth. This type may include carbon ring packing in addition to the labyrinths, if approved by the Principal. If required, connections for an inert gas sealing system shall be supplied. Provision shall be made for measurement of the differential pressure between seal gas and process gas. The Vendor shall specify in the proposal the required seal gas flow and supply pressure.

b) Restrictive-ring. This type shall include rings (e.g. carbon) mounted in retainers or spacers. If required, inert gas sealing shall be supplied as for (a) above.

c) Non-contacting dry gas seals may be applied if approved by the principal.

E.2.6.2 Add to this clause:

……., except where non-contacting dry gas seals are applied.

Add new clause:

E.2.6.3 Shaft sleeves under seal rings shall be either hardened or hard-face overlayed.

E.2.7 CRITICAL SPEEDS/RESONANCES

E.2.7.1 Add to this clause:

For the complete fan-driver unit there shall be no torsional mode in the envelope between 10% below operating speed and 10% above trip speed. Similarly, there shall be no torsional mode in the envelope between 10% below (2 x operating speed) and 10% above (2 x trip speed).

Start up and shutdown shall not cause any damage as torsional critical speeds are passed.

E.2.8 VIBRATION AND BALANCING

E.2.8.1 Add to this clause:

The complete fan rotor assembly, including the coupling, shall be dynamically balanced. The residual unbalance shall not exceed the values according to ISO 1940/1 balancing quality grade G2.5. The result of the balancing shall be such that during shop testing of the fan unit, and actual operation on site under specified operating conditions, the vibration limits specified in clause E.2.8.3 of this DEP will not be exceeded.

E.2.8.3 Replace this clause by:

During the shop test of fans with rolling element bearings operating at any speed within the specified operating range, the maximum allowable unfiltered root mean square vibration velocity, shall not exceed 3 mm/s RMS, measured on the bearing bracket in any plane with an instrument conforming to ISO 2954.

During the shop test of fans with hydrodynamic radial bearings operating at any speed within the specified operating range, the maximum allowable unfiltered root mean square vibration velocity shall not exceed 3 mm/s RMS, measured on the bearing bracket in any plane with an instrument conforming to ISO 2954. If the fan is provided with non-contacting vibration probes (which shall comply with API Std 670), then the maximum allowable unfiltered double amplitude of shaft vibration (including shaft run-out*), shall not exceed the following values:

Speed (r/min)	**double amplitude of vibration (µm)**
Below 1000	80
1000 - 3600	80 000 / n where n = maximum continuous speed in r/min

NOTE: Shaft run-out is the total indicator reading in a radial direction when the shaft is rotated in its bearings. If the Manufacturer can demonstrate that 'electric' run out is present due to shaft material anomalies, the total mechanical and electrical run-out combined shall not exceed 10 µm. Electrical run-out can be deduced by slowly rolling the rotor in bearings or vee-blocks while measuring run-out with a proximity probe and a dial indicator at the same shaft location.

The manufacturer has to demonstrate during the shop test that fans equipped with non-contacting probes are free from bearing house resonance.

E.2.9 BEARINGS AND BEARING HOUSINGS

E.2.9.1 Replace this clause by:

Fans shall have horizontally-split, self-aligning hydrodynamic (sleeve) bearings and thrust bearings.

Alternatively, the following fans may have anti-friction bearings:

- fans with a driver power rating below 120 kW and which have an installed spare;
- fans in non-essential service.

E.2.9.3 Add to this clause:

Thrust collars for hydrodynamic bearings shall be replaceable unless otherwise specified, shall be installed with a substantial shrink fit to prevent fretting and shall be positively locked to prevent axial movement.

Maximum face runout of thrust faces shall be 13 µm total indicator reading. Split thrust collars shall not be used.

E.2.9.5 Add to this clause:

The shaft of high temperature fans shall be designed so that heat transmission from the process side to the shaft sealing and bearings is minimised. For this reason the Manufacturer may fit cooling disks. Unless unavoidable, inert gas should not be used for cooling.

E.2.9.6 Add to this clause:

High temperature fans shall have water-cooled bearing housings.

Oil coolers shall be designed for the maximum working pressure of the cooling liquid or 5 bar (ga), whichever is higher.

E.2.10 LUBRICATION

E.2. 10.1 Add to this clause:

A pressure lubrication system shall be furnished if specified on the data/requisition sheet or if recommended by the Vendor and approved by the Principal.

A circulation oil system shall be furnished to allow oil replenishment during normal operation for ring-oiled and splash-oiled bearings to achieve at least 3 years of uninterrupted operation.

E.2.10.3 Add to this clause:

As a minimum an external pressure lubrication system shall consist of a motor-driven oil pump with a suction strainer, a supply-and-return system, an oil cooler if required, an oil reservoir, a dual full-flow filter (nominal 25 µm or finer) and all the necessary controls and connections for instrumentation. The oil reservoir and piping shall be of austenitic stainless steel.

Shaft-driven lubricating oil pumps shall not be used, unless requested and/or approved by the Principal.

If both fan, driver and gearbox (if applicable) utilise a pressure lubrication system, a combined lubrication system shall be furnished. The Vendor shall confirm that all components are compatible for lubrication by the same lubricating oil.

Unless otherwise specified, the pressure lubrication system shall be the Manufacturer's standard.

Add new clause:

E.2.10.4 Transparent oil containers shall be of the glass type

E.2.11 MATERIALS

E.2.11.1 General

E.2.11.1.1 Replace this clause by:

Materials of construction shall be as specified on the data/requisition sheets. The

Manufacturer may suggest alternative materials. Material inspection certificates shall be in accordance with ISO 10474 type 3.1.B.

E.2.11.1.6 Add new clause:

NACE MR0175 shall apply for materials in contact with gas containing hydrogen sulphide.

E.2.11.3 Low temperature

Replace this clause by:

DEP 30.10.02.31-Gen. shall apply.

E.2.12 NAMEPLATES AND ROTATION ARROWS

E.2.12.2 Add to this clause:

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

The information on nameplates shall include the year of manufacture.

E.3 ACCESSORIES

E.3.1 DRIVERS

E.3.1.1 General

E.3.1.1.6 Add to this clause:

V-belt drive may be considered as an alternative (subject to the approval of the Principal) only if direct drive is not possible.

E.3.1.1.7 Replace this clause by:

Electric motor drivers shall comply with DEP 33.66.05.31-Gen. and requisition sheet DEP 33.66.05.93-Gen. The electric motor driver shall be capable of developing continuously at least 110% of the highest kW rating (including gear and coupling losses) required for any of the specified fan operating conditions and the requirements of E.3.1.1.2.

Add new clause:

E.3.1.1.10 Steam turbine drivers shall comply with DEP 31.29.60.30-Gen. or 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.

Steam turbine drivers shall be capable of continuously developing 110% of the power required for each of the Principal's specified operating conditions while operating at that corresponding speed under specified steam conditions.

If applicable, steam-turbine-driven equipment shall have gears integral with the turbine unless otherwise specified on the data/requisition sheet.

Add new clause:

E.3.1.1.11 Speed increasers and reducers shall be in accordance with DEP 31.29.00.32-Gen. and shall be sized for the maximum power and speed of the driver.

E.3.2 COUPLINGS AND GUARDS

Add new clause:

E.3.2.4 V-belt type drives if specified, shall be of the poly-V-belt type. They shall be antistatic and flame retardant

V-belt drives shall be furnished with belt guards.

Add new clause:

E.3.3.4 Base Plate

E.3.3.4.1 The fan and its driver shall have a common base plate unless otherwise specified.

E.3.3.4.2 The surfaces of the pads to accommodate the bearing housings and drivers shall be machined after welding. These pads shall be sized to allow the base plate level to be checked without having to remove the fan or driver. Mating faces of pedestals shall be machined after welding. Bearing houses shall be doweled after alignment

E.3.3.4.3 The base plate shall be provided with lifting lugs. During lifting, the beam deflection of the base plate shall be less than 1/1200 of the total length.

E.3.3.4.4 The bottom of the base plate between structural members shall be open. If installed on a concrete foundation, accessibility for grouting shall be provided under all load-bearing structural members. The base plate shall be provided with mounting pads for levelling purposes if specified.

E.3.3 CONTROLS AND INSTRUMENTATION

E.3.3.1 General

E.3.3.1.1 Replace this clause by:

Amended per Circular 27/99

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

E.3.4 PIPING AND APPURTENANCES

E.3.4.1 Inlet trash screens

Replace the words "(38 centimeters)" by "(38 mm)"

Delete the penultimate sentence.

Replace the last sentence by:

All construction materials for inlet trash screens and rain hoods shall be of stainless steel type AISI 316.

E.4 INSPECTION, TESTING AND PREPARATION FOR SHIPMENT

E.4.1 INSPECTION

E.4.1.1 Material inspection

Add to this clause:

Liquid penetrant examination shall be performed on all welds of items fabricated by welding.

Table E-2 Modify this table so that the maximum severity level of Type I defects (linear discontinuities) is “none permitted”

E.4.2 TESTING

Add to this clause:

E.4.2.1 General

If specified on the data/requisition sheet, the fan casing shall be pneumatically tested at a pressure of at least 10 mbar (ga), applying a detergent solution to the joint faces to detect air bubbles. Alternatively, a smoke bomb may be used if specified on the data/requisition sheet.

E.4.2.2 Mechanical running test

Add to this clause:

The following shall also apply for the mechanical running test and/or complete unit test:

1) The actual contract shaft seal(s) and bearings shall be used during the test.
2) If a pressure lubrication system is applied, oil pressure, viscosity and temperature during the test shall be within the ranges recommended in the Manufacturer's operating instructions for the specific fan under test. During a test run of 4 hours or more, oil temperature shall be kept at minimum and maximum values for at least one hour and vibration levels shall not exceed the values given by (2.8.3).
3) Sleeve bearings shall be visually inspected after the test.
4) If replacement or modification of bearings or seals or dismantling of the casing is required to replace or modify other parts to correct mechanical or performance deficiencies, the initial test will not be acceptable and the entire test procedure shall be repeated after such replacements or corrections have been completed.

Add new clause:

E.4.2.4 Overspeed test

For fans with variable speed drivers the fan rotor shall be subjected to an overspeed test of at least 110% of maximum continuous speed for 3 minutes. After the overspeed test each impeller shall be examined for cracks (using the liquid penetrant method), and for deformation or other defects. After this examination, fan rotors shall be rebalanced dynamically.

Add new clause:

E.4.2.5 Performance test

If a performance test is specified this shall be carried out in accordance with AMCA Publication 203 and the characteristic curves shall be provided. Corrections for site conditions shall be made if required.

If specified on the data requisition sheet, high temperature fans shall be performance tested at rated speed and flow at actual operating temperatures. The duration of this test shall be at least 8 hours.

NOTE: Model testing of fans shall not suffice for acceptance purposes unless approved by the Principal.

Add new clause:

E.4.2.6. Complete unit test

If specified on the data/requisition sheet, a complete unit test of the fan and its contract driver(s) and gearbox (if applicable), including contract couplings and clutches, shall be performed at the manufacturer's works. The duration of this test shall be at least 4 hours at maximum continuous speed. Vibration limits and bearing temperature limits shall be as for the mechanical running test (4.2.2) and shall be recorded at 20 minute intervals.

Add new clause:

E.4.2.7 Dimensional and visual check

Each fan shall be subjected to a dimensional check, for verification against approved drawings and Manufacturer's standards. The results shall be recorded. Dimensions to be checked shall include the following:

1) main dimensions;
2) concentricity and clearances between impeller and inlet;
3) base plate and holding down bolt hole dimensions;
4) size and position of inlet and outlet ducts;
5) coupling guard dimensions;
6) bore of half coupling to be delivered (if applicable);

The following shall be visually checked:

1) fan name plate for correct data;
2) presence of direction-of-rotation arrow;
3) inlet guide vanes, if fitted, for operation, correct direction of rotation and minimum/ maximum settings.

E.5 VENDOR'S DATA

E.5.2 DATA REQUIRED AFTER CONTRACT

5.2.5 Add to this clause:

The information to be furnished by the Vendor shall include the documents for control and instrumentation as specified in DEP 32.31.09.31-Gen.

PART III REFERENCES

In this DEP, reference is made to the following publications:

NOTE: Unless specifically designated by date, the latest edition of each publication shall be used, together with any amendments/supplements/revisions thereto.

SHELL STANDARDS

Index to DEP publications and standard specifications	DEP 00.00.05.05-Gen.
Metallic materials - prevention of brittle fracture	DEP 30.10.02.31-Gen.
Noise control	DEP 31.10.00.31-Gen.
Data/requisition sheet for equipment noise limitation	DEP 31.10.00.94-Gen.
Special purpose gear units for petroleum, chemical and gas industry services	DEP 31.29.00.32-Gen.
Data/requisition sheet for rotary-type compressors and fans	DEP 31.29.42.93-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 27/99

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 for electric motors	DEP 33.66.05.93-Gen.

AMERICAN STANDARDS

Field performance measurement of fan systems	AMCA Publication 203

Issued by:
AMCA (Air Movement and Control Association Inc.)
30 West University Drive
Arlington Heights
Illinois 60004-1893
USA

Fired Heaters for General Refinery Services	API 560 (September 1995)
Vibration, Axial position, and Bearing Temperature Monitoring Systems	API 670

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

Sulphide Stress Cracking Resistant Metallic Material for Oil Field Equipment	NACE MR0175

Issued by
National Association of Corrosion Engineers,
1440 South Creek, Houston
Texas 77084, USA

INTERNATIONAL STANDARDS

Balance quality requirements of rigid rotors - Part 1: Determination of permissible residual unbalance	ISO 1940-1
Requirements for instruments for measuring vibration severity	ISO 2954
Steel and steel products, inspection documents	ISO 10474

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(*Copies can also be obtained from national standards organizations*)