Centrifugal Pumps for Petroleum, Petrochemical and Natural Gas Industries

API STANDARD 610
NINTH EDITION, JANUARY 2003

This Standard is Technically Equivalent to the
ISO Final Draft International Standard 13709

Proposed National Adoption

American
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Helping You
Get The Job
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Downstream Segment

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Contents

Page

Foreword

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Introduction

This International Standard was developed from API Standard 610, 8th edition, 1995, with the intent that the 9th edition of API 610 will be the same as this International Standard.

Users of this International Standard should be aware that further or differing requirements may be needed for individual applications. This International Standard is not intended to inhibit a vendor from offering, or the purchaser from accepting alternative equipment or engineering solutions for the individual application. This may be particularly appropriate where there is innovative or developing technology. Where an alternative is offered, the vendor should identify any variations from this International Standard and provide details.

Annex A specifies calculations for specific speed and suction specific speed.

Annex B contains schematic drawings of cooling water and lubrication systems.

Annex C specifies requirements for hydraulic power recovery turbines.

Annex D specifies requirements for standard baseplates.

Annex E contains an inspector's checklist.

Annex F specifies criteria for piping design.

Annex G give guidance on material class selection.

Annex H specifies requirements and gives guidance on materials selection.

Annex I specifies requirements for lateral analysis.

Annex J specifies requirements for determining residual unbalance.

Annex K contains seal chamber runout illustrations.

Annex L contains forms which may be used to indicate vendor drawing and data requirements.

Annex M contains forms which may be used to record test data.

Annex N contains data sheets which purchasers are encouraged to use.

This International Standard requires the purchaser to specify certain details and features.

A bullet (•) at the beginning of a paragraph indicates that either a decision or further information is required. Further information should be shown on the data sheets (see example in Annex N) or stated in the quotation request and purchase order.

In this International Standard, where practical, US Customary units are included in brackets for information.

Centrifugal pumps for petroleum, petrochemical and natural gas industries

1 Scope

This International Standard specifies requirements for centrifugal pumps, including pumps running in reverse as hydraulic power recovery turbines, for use in petroleum, petrochemical, and gas industry process services. It does not cover sealless pumps. This International Standard is applicable to overhung pumps, between-bearings pumps, and vertically-suspended pumps (see Table 1). Clause 8 applies to specific types of pumps. All other clauses of this International Standard apply to all pump types. The figures in 4.1 show the various specific pump types and the designations assigned to each specific type.

Table 1 — Pump classification type identification

Centrifugal pumps	Overhung	Flexibly-coupled	Horizontal	Foot-mounted	OH1
				Centreline-supported	OH2
			Vertical in-line with bearing bracket		OH3
		Rigidly-coupled	Vertical in-line		OH4
		Close-coupled	Vertical in-line		OH5
			High-speed integrally-geared		OH6
	Between-bearings	1- and 2-stage	Axially-split		BB1
			Radially-split		BB2
		Multistage	Axially-split		BB3
			Radially-split	Single-casing	BB4
				Double-casing	BB5
	Vertically- suspended	Single-casing	Discharge through column	Diffuser	VS1
				Volute	VS2
				Axial-flow	VS3
			Separate discharge	Line-shaft	VS4
				Cantilever	VS5
		Double-casing	Diffuser		VS6
			Volute		VS7

NOTE Figures of the various types are given in 4.1.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60034,*Rotating electrical machines — Part 1: Rating and performance.*

IEC 60079, *Electrical apparatus for explosive gas atmosphere.*

ISO 7, *Pipe threads where pressure-tight joints are made on the threads.*

ISO 228-1, *Pipe threads where pressure-tight joints are not made on the threads — Part 1: Designation, dimensions and tolerances.*

ISO 261, *ISO general-purpose metric screw threads — General plan.*

ISO 262, *ISO general-purpose metric screw threads — Selected sizes for screws, bolts, and nuts.*

ISO 281, *Rolling bearings — Dynamic load ratings and rating life.*

ISO 286 (all parts), *ISO system of limits and fits*.

ISO 724, *ISO general-purpose metric screw threads — Basic dimensions.*

ISO 965 (all parts), *ISO general-purpose metric screw threads — Tolerances.*

ISO 1940-1, *Mechanical vibration — Balance quality requirements of rigid rotors — Part 1: Determination of permissible residual unbalance.*

ISO 4200, *Plain end steel tubes, welded and seamless—General tables of dimensions and masses per unit length.*

ISO 5753, *Rolling bearings — Radial internal clearance.*

ISO 7005-1, *Metallic flanges — Part 1: Steel flanges*.

ISO 7005-2, *Metallic flanges — Part 2: Cast iron flanges.*

ISO 8501 (all parts), *Preparation of steel substrates before application of paints and related products – Visual assessment of surface cleanliness.*

ISO 9906, *Rotodynamic pumps — Hydraulic performance acceptance tests — Grades 1 and 2.*

ISO 10436, *Petroleum and natural gas industries — General-purpose steam turbines for refinery service*.

ISO 10438 (all parts), *Lubrication, shaft-sealing and control — Oil systems for special-purpose applications.*

ISO 10441, *Petroleum and natural gas industries-flexible couplings for mechanical power transmission — Special purpose applications.*

ISO 11342, *Mechanical Vibration — Methods and Criteria for the Mechanical Balancing of Flexible Rotors*

ISO 14691, *Petroleum and natural gas industries — Flexible couplings for mechanical power transmission — General purpose applications.*

ISO 15649, *Petroleum and natural gas industries — Piping.*

ISO 21049, *Pumps — Shaft sealing systems for centrifugal and rotary pumps.*

EN 287, *Approval testing of welders — Fusion welding.*[1)]

EN 288, *Specification and approval of welding procedures for metallic materials*

EN 13445 (all parts), *Unfired pressure vessels.*

ABMA 7, *Shaft and housing fits for metric radial ball and roller bearings.*[2)]

AGMA 9000, *Flexible couplings — Potential unbalance classification.*[3)]

AGMA 9002, *Bores and keyways for flexible couplings (inch series).*

API 5L, *Specification for line pipe.*[4)]

API 541, *Form-wound squirrel-cage induction motors — 250 horsepower and larger.*

API 611, *General purpose steam turbines for refinery service.*

API 670, *Noncontacting vibration and axial position monitoring system* .

API 671, *Special-purpose couplings for refinery service*.

API 677, *General-purpose gear units for refinery service*

API RP 500, *Classification of locations for electrical installations at petroleum facilities*.

API RP 686, *Machinery installation and installation design.*

ASME B1.1, *Unified inch screw threads, UN and UNR thread form.*[5)]

ASME B15.1, *Mechanical power transmission apparatus.*

ASME B16.1, *Cast iron pipe flanges and flanged fittings.*

ASME B16.5, *Pipe flanges and flanged fittings (steel).*

ASME B16.11, *Forged steel fittings, socket-welding and threaded.*

ASME B16.42, *Ductile iron pipe flanges & flanged fittings.*

ASME B16.47, *Large diameter steel flanges.*

ASME B17.1, *Keys and keyseats.*

ASME *Boiler and pressure vessel code*, *Section V, "Nondestructive examination"*

ASME *Boiler and pressure vessel code*, *Section VIII, "Pressure vessels"*

ASME *Boiler and pressure vessel code*, *Section IX, "Welding and brazing qualifications"* .

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1) Comité Européen de Normalisation, 36, rue de Stassart, B-1050 Brussels, Belgium

2) American Bearing Manufacturers Association, 2025 M Street, NW, Suite 800, Washington, DC 20036, USA

3) American Gear Manufacturers' Association, 1500 King Street, Suite 201, Alexandria, VA 22314, USA.

4) American Petroleum Institute, 1220 L Street NW, Washington, DC 20005-4070, USA

5) American Society of Mechanical Engineers, Three Park Avenue, New York, NY 10016-5990, USA

AWS D1.1, *Structural welding code — Steel.*[6)]

DIN 910, *Heavy-duty hexagon head screw plugs*.[7)]

HI 1.3, *Centrifugal pumps — Design and application*[8)]

HI1.6, *Centrifugal pump — Tests*

HI2.6, *Vertical pump — Tests*

IEEE 841, *Standard for petroleum and chemical industry — Severe duty totally enclosed fan-cooled (TEFC) squirrel cage induction motors — Up to and including 370 kW (500 hp).*[9)]

MSS-SP-55, *Quality standard for steel castings for valves, flanges and fittings and other piping components — Visual method.*[10)]

NACE MR0175, *Sulfide stress cracking resistant metallic materials for oilfield equipment.*[11)]

NFPA 70, *National Electrical Code.*[12)]

SSPC SP 6, *Surface Preparation Specification.*[13)]

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
axially-split
split with the principal joint parallel to the shaft centreline

3.2
barrel pump
horizontal pump of the double-casing type

3.3
barrier fluid
fluid, at a higher pressure than the process pressure being sealed, introduced between pressurised dual (double) mechanical seals to completely isolate the pump process liquid from the environment

6) American Welding Society, 550 North LeJeune Road, Miami, FL 33136, USA

7) Deutsches Institut fur Normung, Burggrafenstrasse 6, Berlin, Germany D-10787

8) Hydraulic Institute, 9 Sylvan Way, Parsippany NJ, 07054, USA

9) Institute of Electrical & Electronics Engineers, 445 Hoes Lane, Piscataway, NJ 08855-1331

10) Manufacturers Standardization Society of The Valve and Fittings Industry Inc., 127 Park Street N.E., Vienna, VA 22180-4602, USA

11) National Association of Corrosion Engineers, 1440 South Creek Drive, Houston, TX 77084-4906, USA

12) National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02269-9101, USA

13) Society for Protective Coatings, 40 24th Street, 6th Floor, Pittsburgh, PA 15222-4643, USA