SLOVENSKI STANDARD
SIST EN ISO 13709:2004

01-maj-2004

Centrifugal pumps for petroleum, petrochemical and natural gas industries (ISO 13709:2003)

Centrifugal pumps for petroleum, petrochemical and natural gas industries (ISO 13709:2003)

Kreiselpumpen für den Einsatz in der Erdöl-, schweren Chemie- und Gasindustrie (ISO 13709:2003)

Pompes centrifuges utilisées dans les industries du pétrole, de la pétrochimie et du gaz naturel (ISO 13709:2003)

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ICS:

23.080	Ļrpalke	Pumps
75.180.20	Predelovalna oprema	Processing equipment

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English version

Centrifugal pumps for petroleum, petrochemical and natural gas industries (ISO 13709:2003)

Pompes centrifuges utilisées dans les industries du pétrole, de la pétrochimie et du gaz naturel (ISO 13709:2003)

This European Standard was approved by CEN on 20 June 2003.

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: rue de Stassart, 36 B-1050 Brussels

Foreword

This document (EN ISO 13709:2003) has been prepared by Technical Committee ISO/TC 67 "Materials, equipment and offshore structures for petroleum and natural gas industries" in collaboration with Technical Committee CEN/TC 12 "Materials, equipment and offshore structures for petroleum and natural gas industries", the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by April 2004, and conflicting national standards shall be withdrawn at the latest by April 2004.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

NOTE FROM CMC The foreword is susceptible to be amended on reception of the German language version. The confirmed or amended foreword, and when appropriate, the normative annex ZA for the references to international publications with their relevant European publications will be circulated with the German version.

Endorsement notice

The text of ISO 13709:2003 has been approved by CEN as EN ISO 13709:2003 without any modifications.

INTERNATIONAL STANDARD

ISO 13709

First edition
2003-07-01

Centrifugal pumps for petroleum, petrochemical and natural gas industries

Pompes centrifuges pour les industries du pétrole, de la pétrochimie et du gaz naturel

Reference number
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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 13709 was prepared by Technical Committee ISO/TC 115, *Pumps*, Subcommittee SC 3, *Installation and special application*, in collaboration with Technical Committee ISO/TC 67, *Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries*, SC 6, *Processing equipment and systems*.

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.

A bullet (•) at the beginning of a clause or subclause indicates that either a decision is required or further information is to be provided by the purchaser. This information should be indicated on data sheets or stated in the enquiry or purchase order (see examples in Annex N).

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.

This International Standard is applicable to overhung pumps, between-bearings pumps and vertically-suspended pumps (see Table 1). Clause 8 provides requirements applicable to specific types of pump. All other clauses of this International Standard are applicable to all pump types. Illustrations are provided of the various specific pump types and the designations assigned to each specific type.

This International Standard is not applicable to sealless pumps.

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.

ISO 7-1, *Pipe threads where pressure-tight joints are made on the threads — Part 1: Dimensions, tolerances and designation*

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

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: Specification and verification of balance tolerances*

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), *Petroleum and natural gas industries — Lubrication, shaft-sealing and control-oil systems and auxiliaries*

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:—[1)], *Pumps — Shaft sealing systems for centrifugal and rotary pumps*

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

IEC 60079 (all parts), *Electrical apparatus for explosive gas atmosphere*

EN 287 (all parts), *Approval testing of welders — Fusion welding* [2)]

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* [3)]

AGMA 9000, *Flexible couplings — Potential unbalance classification* [4)]

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

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 petroleum, chemical and gas industry services*

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

ASME B15.1, *Safety standard for mechanical power transmission apparatus*

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1) To be published.

2) Comité Européen de Normalization, 36, rue de Stassart, B-1050 Brussels, Belgium.

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

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

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

ASME B16.1, *Cast iron pipe flanges and flanged fittings classes 25, 125 and 250*

ASME B16.5, *Pipe flanges and flanged fittings NPS 1/2 through NPS 24*

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

ASME B16.42, *Ductile iron pipe flanges and flanged fittings classes 150 and 300*

ASME B16.47, *Large diameter steel flanges NPS 26 through NPS 60*

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*

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

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

HI 1.3, *Centrifugal pumps — Horizontal baseplate design* [8)]

HI 1.6, *Centrifugal pump test*

HI 2.6, *Vertical pump test*

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 for evaluation of surface irregularities* [10)]

NACE MR0175, *Sulfide stress cracking resistant metallic materials for oilfield equipment item No. 21304* [11)]

NFPA 70, *National electrical code handbook* [12)]

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

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

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

8) Hydraulics 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.

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 pressurized dual (double) mechanical seals to completely isolate the pump process liquid from the environment

3.4
best efficiency point
BEP
flowrate at which a pump achieves its highest efficiency

3.5
buffer fluid
fluid, at a lower pressure than the process pressure being sealed, used as a lubricant or buffer between unpressurized dual (tandem) mechanical seals

3.6
critical speed
shaft rotational speed at which the rotor-bearing-support system is in a state of resonance

3.7
dry critical speed
rotor critical speed calculated assuming that there are no liquid effects, that the rotor is supported only at its bearings and that the bearings are of infinite stiffness

3.8
wet critical speed
rotor critical speed calculated considering the additional support and damping produced by the action of the pumped liquid within internal running clearances at the operating conditions and allowing for flexibility and damping within the bearings

3.9
datum elevation
elevation to which values of NPSH are referred

cf. **net positive suction head** (3.28)

3.10
double casing
type of pump construction in which the pressure casing is separate from the pumping elements contained in the casing

NOTE Examples of pumping elements include diffuser, diaphragms, bowls and volute inner casings.

3.11
drive train component
item of the equipment used in series to drive the pump

EXAMPLES Motor, gear, turbine, engine, fluid drive, clutch.

3.12
element
bundle
assembly of the rotor plus the internal stationary parts of a centrifugal pump

3.13
cartridge-type element
assembly of all the parts of the pump except for the casing

3.14
hydraulic power recovery turbine
turbomachine designed to recover power from a fluid stream

3.15
hydrodynamic bearing
bearing that uses the principles of hydrodynamic lubrication

3.16
maximum allowable speed
highest speed at which the manufacturer's design permits continuous operation

3.17
maximum allowable temperature
maximum continuous temperature for which the manufacturer has designed the pump (or any part to which the term is referred) when handling the specified fluid at the specified maximum operating pressure

3.18
maximum allowable working pressure
MAWP
maximum continuous pressure for which the manufacturer has designed the pump (or any part to which the term is referred) when handling the specified fluid at the specified maximum operating temperature

3.19
maximum continuous speed
highest rotational speed at which the pump, as built, is capable of continuous operation with the specified fluid at any of the specified operating conditions

3.20
maximum discharge pressure
maximum specified suction pressure plus the maximum differential pressure the pump with the furnished impeller is able to develop when operating at rated speed with fluid of the specified normal relative density (specific gravity)

3.21
maximum dynamic sealing pressure
highest pressure expected at the seals during any specified operating condition and during start-up and shut-down

3.22
maximum static sealing pressure
highest pressure, excluding pressures encountered during hydrostatic testing, to which the seals can be subjected while the pump is shut down

3.23
maximum suction pressure
highest suction pressure to which the pump is subjected during operation