

Centrifugal pumps for petroleum, petrochemical and natural gas industries

Centrifugal pumps for petroleum, petrochemical and
natural gas industries

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

Käesolev Eesti standard EVS-EN ISO 13709:2004 sisaldab Euroopa standardi EN ISO 13709:2003 ingliskeelset teksti. Käesolev dokument on jõustatud 20.02.2004 ja selle kohta on avaldatud teade Eesti standardiorganisatsiooni ametlikus väljaandes. Standard on kättesaadav Eesti standardiorganisatsioonist.	This Estonian standard EVS-EN ISO 13709:2004 consists of the English text of the European standard EN ISO 13709:2003. This document is endorsed on 20.02.2004 with the notification being published in the official publication of the Estonian national standardisation organisation. The standard is available from Estonian standardisation organisation.
--	---

Käsitlusala: 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.	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.
---	---

ICS 71.120.99, 75.180.20

Võtmesõnad:

EUROPEAN STANDARD

EN ISO 13709

NORME EUROPÉENNE

EUROPÄISCHE NORM

October 2003

ICS 71.120.99; 75.180.20

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)

Kreiselpumpen für den Einsatz in der Erdöl-,
petrochemische und Erdgasindustrie
(ISO 13709:2003)

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

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Management Centre or to any CEN member.

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.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and United Kingdom.



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

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

Contents

Page

Foreword	4
Introduction	5
1 Scope	6
2 Normative references	6
3 Terms and definitions	9
4 Classification and designation	14
4.1 General	14
4.2 Pump designations	15
4.3 Units and governing requirements	21
5 Basic design	21
5.1 General	21
5.2 Pump types	25
5.3 Pressure casings	26
5.4 Nozzles and pressure casing connections	28
5.5 External nozzle forces and moments	30
5.6 Rotors	36
5.7 Wear rings and running clearances	38
5.8 Mechanical shaft seals	39
5.9 Dynamics	42
5.10 Bearings and bearing housings	51
5.11 Lubrication	54
5.12 Materials	55
5.13 Nameplates and rotation arrows	60
6 Accessories	60
6.1 Drivers	60
6.2 Couplings and guards	63
6.3 Baseplates	64
6.4 Instrumentation	67
6.5 Piping and appurtenances	67
6.6 Special tools	68
7 Inspection, testing, and preparation for shipment	69
7.1 General	69
7.2 Inspection	69
7.3 Testing	71
7.4 Preparation for shipment	75
8 Specific pump types	76
8.1 Single-stage overhung pumps	76
8.2 Between-bearings pumps (types BB1 through BB5)	78
8.3 Vertically suspended pumps (types VS1 through VS7)	83
9 Vendor's data	89
9.1 General	89
9.2 Proposals	90
9.3 Contract data	93
Annex A (informative) Specific speed and suction-specific speed	95
Annex B (normative) Cooling water and lubrication system schematics	96
Annex C (normative) Hydraulic power recovery turbines	107

Annex D (normative) Standard baseplates	111
Annex E (informative) Inspector's checklist	113
Annex F (normative) Criteria for piping design	115
Annex G (informative) Materials class selection guidance	129
Annex H (normative) Materials and material specifications for pump parts	131
Annex I (normative) Lateral analysis	141
Annex J (normative) Determination of residual unbalance	147
Annex K (normative) Seal chamber runout illustrations	153
Annex L (informative) Vendor drawing and data requirements	154
Annex M (informative) Test data summary	163
Annex N (informative) Pump datasheets	167
Bibliography	186

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.

Endorsement notice

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

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.

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*

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⁾

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.