SLOVENSKI STANDARD
SIST EN ISO 9906:2000

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Rotodynamic pumps - Hydraulic performance acceptance tests - Grades 1 and 2 (ISO 9906:1999)

Rotodynamic pumps - Hydraulic performance acceptance tests - Grades 1 and 2 (ISO 9906:1999)

Kreiselpumpen - Hydraulische Abnahmeprüfung Klassen 1 und 2 (ISO 9906:1999)

Pompes rotodynamiques - Essais de fonctionnement hydraulique pour la réception - Niveaux 1 et 2 (ISO 9906:1999)

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English version

Rotodynamic pumps - Hydraulic performance acceptance tests - Grades 1 and 2 (ISO 9906:1999)

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This European Standard was approved by CEN on 20 August 1999.

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, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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

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Foreword

This document (ISO 9906:1999) has been prepared by Technical Committee ISO/TC 115 "Pumps" in collaboration with Technical Committee CEN/TC 197 "Pumps", 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of an identical text or by endorsement, at the latest by June 2000, and conflicting national standards shall be withdrawn at the latest by June 2000.

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, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Endorsement notice

The text of the International Standard ISO 9906:1999 has been approved by CEN as a European Standard without any modifications.

NOTE Normative references to International Standards are listed in annex ZA (normative).

Annex ZA
(normative)

Normative references to international publications with their relevant European publications

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

NOTE Where an International Publication has been modified by common modifications, indicated by (mod.), the relevant EN/HD applies.

Publication	Year	Title	EN	Year
ISO 5167-1	1991	Measurement of fluid flow by means of pressure differential devices - Part 1: Orifice plates, nozzles and Venturi tubes	EN ISO 5167-1	1995
ISO 5198	1998	Centrifugal, mixed flow and axial pumps - Code for hydraulic performance tests - Precision class	EN ISO 5198	1987
ISO 8316	1987	Measurement of liquid flow in closed conduits - Method by collection of the liquid in a volumetric tank	EN ISO 8316	1995
ISO 9104	1991	Measurement of fluid flow in closed conduits - Methods of evaluating the performance of electromagnetic flow-meters for liquids	EN 29104	1993

INTERNATIONAL STANDARD

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Rotodynamic pumps — Hydraulic performance acceptance tests — Grades 1 and 2

Pompes rotodynamiques — Essais de fonctionnement hydraulique pour la réception — Niveaux 1 et 2

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Contents

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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 3.

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.

International Standard ISO 9906 was prepared by Technical Committee ISO/TC 115, *Pumps*, Subcommittee SC 2, *Methods of measuring and testing*.

This first edition of ISO 9906 cancels and replaces ISO 2548:1975 and ISO 3555:1977, which have been combined and technically revised (see Introduction).

Annexes A, B and C form a normative part of this International Standard. Annexes D to K are for information only.

Introduction

This International Standard combines and replaces the former acceptance test standards ISO 3555:1977 (corresponding to grade 1 of this International Standard) and ISO 2548:1975 (corresponding to grade 2 of this International Standard), but there is an important change in the verification of guarantees, because the uncertainty of measurement must not influence the acceptability of a pump and the tolerances are due to constructional differences only.

New tolerance factors have been introduced to ensure as far as possible that a pump which was acceptable under the previous International Standards (ISO 2548 and/or ISO 3555) would also be acceptable under this International Standard.

Contrary to this International Standard, ISO 5198 is not to be understood as an acceptance test code. It gives guidance for measurements of very high accuracy and for the thermodynamic method for direct measurement of efficiencies, but it does not recommend verification of guarantees.

Terms used in this International Standard such as “guarantee” or “acceptance” should be understood in a technical but not in a legal sense. The term “guarantee” therefore specifies values for checking purposes determined in the contract, but does not say anything about the rights or duties arising, if these values are not reached or fulfilled. The term “acceptance” does not have any legal meaning here, either. Therefore, an acceptance test carried out successfully alone does not represent an “acceptance” in the legal sense.

Rotodynamic pumps — Hydraulic performance acceptance tests — Grades 1 and 2

1 Scope

This International Standard specifies hydraulic performance tests for acceptance of rotodynamic pumps (centrifugal, mixed flow and axial pumps, hereinafter simply designated as “pumps”). It is applicable to pumps of any size and to any pumped liquids behaving as clean cold water (such as defined in 5.4.5.2). It is neither concerned with the structural details of the pump nor with the mechanical properties of their components.

This International Standard contains two grades of accuracy of measurement: grade 1 for higher accuracy, and grade 2 for lower accuracy. These grades include different values for tolerance factors, for allowable fluctuations and uncertainties of measurement.

For pumps produced in series with selection made from typical performance curves and for pumps a with power input of less than 10 kW, see annex A for higher tolerance factors.

This International Standard is applicable both to a pump itself without any fittings and to a combination of a pump associated with all or part of its upstream and/or downstream fittings.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 1438-1, *Water flow measurement in open channels using weirs and Venturi flumes — Part 1: Thin-plate weirs.*

ISO 2186, *Fluid flow in closed conduits — Connections for pressure signal transmissions between primary and secondary elements.*

ISO 3354, *Measurement of clean water flow in closed conduits — Velocity-area method using, current-meters in full conduits and under regular flow conditions.*

ISO 3966, *Measurement of fluid flow in closed conduits — Velocity area method using Pitot static tubes.*

ISO 4373, *Measurement of liquid flow in open channels — Water-level measuring devices.*

ISO 5167-1, *Measurement of fluid flow by means of pressure differential devices — Part 1: Orifice plates, nozzles and Venturi tubes inserted in circular cross-section conduits running full.*

ISO 5198, *Centrifugal, mixed flow and axial pumps — Code for hydraulic performance tests — Precision grade.*

ISO 7194, *Measurement of fluid flow in closed conduits — Velocity-area methods of flow measurement in swirling or asymmetric flow conditions in circular ducts by means of current-meters or Pitot-static tubes.*

ISO 8316, *Measurement of liquid flow in closed conduits — Method by collection of the liquid in a volumetric tank.*

ISO 9104, *Measurement of liquid flow in closed conduits — Methods of evaluating the performance of electro-magnetic flow-meters for liquids.*

IEC 60034-2, *Recommendations for rotating electrical machinery (excluding machines for traction vehicles) — Part 2: Determination of efficiency of rotating electrical machinery.*

IEC 60051, *Recommendations for direct acting electrical measuring instruments and their accessories.*

3 Terms, definitions and symbols

For the purposes of this International Standard, the following terms, definitions and symbols apply.

NOTE 1 The definitions, particularly those given for head and net positive suction head (NPSH), may not be appropriate for general use in hydrodynamics, and are for the purposes of this International Standard only. Some terms in current use but not strictly necessary for the use of this International Standard are not defined.

NOTE 2 Table 1 gives an alphabetical list of symbols used, and Table 2 gives a list of subscripts. In this International Standard all formulae are given in coherent SI units. For conversion of other units to SI units, see annex D.

NOTE 3 In order to avoid any error of interpretation, it is deemed desirable to reproduce the definitions of quantities and units as given in ISO 31 and to supplement these definitions by some specific information on their use in this International Standard.

3.1
angular velocity
number of radians of a shaft per unit time

$$\omega = 2\pi n$$

3.2
speed of rotation
number of rotations per unit time

3.3
density
mass per unit volume

3.4
pressure
force per unit area

NOTE In this International Standard all pressures are gauge pressures, i.e. measured with respect to the atmospheric pressure, except for atmospheric pressure and the vapour pressure which are absolute pressures.

3.5
power
energy transferred per unit time

3.6
Reynolds number

$$Re = \frac{UD}{v}$$

3.7
mass flow rate
external mass flow rate of the pump, i.e. the rate of flow discharged into the pipe from the outlet branch of the pump

NOTE 1 The following losses or abstractions are inherent to the pump:

a) discharge necessary for hydraulic balancing of axial thrust;

b) cooling of bearings of the pump itself;

c) liquid seal to the packing.

NOTE 2 Leakage from the fittings, internal leakage, etc., are not to be reckoned in the rate of flow. On the contrary, all derived flows for other purposes, such as

— cooling of the motor bearings;

— cooling of a gear box (bearings, oil cooler), etc.

are to be reckoned in the rate of flow.

NOTE 3 Whether and how these flows are to be taken into account depends on the location of their derivation and of the section of flow-measurement, respectively.

3.8
volume flow rate
outlet volume flow rate has the following value:

$$Q = \frac{q}{\rho}$$

NOTE In this International Standard the symbol Q may also designate the volume flow rate in any given section. It is the quotient of the mass flow rate in this section and the density. (The section may be designated by subscripts.)

3.9
mean velocity
mean axial velocity of flow equal to the volume flow rate divided by the pipe cross section area

$$U = \frac{Q}{A}$$

NOTE Attention is drawn to the fact that in this case Q may vary for different reasons across the circuit.

3.10
local velocity
velocity of flow at any point

3.11
head
energy per unit mass of fluid, divided by acceleration due to gravity, g

3.12
reference plane
any horizontal plane used as a datum for height measurement

NOTE For practical reasons it is preferable not to specify an imaginary reference plane.

3.13
height above reference plane
height of the considered point above the reference plane

NOTE Its value is:

— positive, if the considered point is above the reference plane;

— negative, if the considered point is below the reference plane.

See Figures 3 and 4.