



**International
Standard**

ISO 15783

**Seal-less rotodynamic pumps —
Class II — Specification**

*Pompes rotodynamiques sans dispositif d'étanchéité d'arbre —
Classe II — Spécifications*

**Second edition
2026-05**

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 115, *Pumps*, Subcommittee SC 1, *Dimensions and technical specifications of pumps*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 197, *Pumps*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 15783:2002), which has been technically revised. It also incorporates the Amendment ISO 15783:2002/Amd.1:2008.

The main changes are as follows:

- Normative references were extensively revised. Some references have been updated.
- Liquid properties were added in [4.2.1](#).
- Definition of rigid support added in Note of [Table 1](#).
- [Annex F](#) was extensively revised. Hastelloy alloy was also added to [Table F.1](#).
- [4.13.1](#) and [4.13.3](#) were added to [Annex G](#);
- Bibliography was extensively revised.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document is the first of a series dealing with technical specifications for seal-less pumps; they correspond to two classes of technical specifications, Classes I and II, of which Class I is the more severe requirements.

Where a decision may be required by the purchaser, or agreement is required between the purchaser and manufacturer/supplier, the relevant text is highlighted with • and is listed in [Annex G](#).

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Seal-less rotodynamic pumps — Class II — Specification

1 Scope

This document specifies the requirements for seal-less rotodynamic pumps that are driven with permanent magnet coupling (magnet drive pumps) or with canned motor, and which are mainly used in chemical processes, water treatment and petrochemical industries. Their use can be dictated by space, noise, environment or safety regulations.

Seal-less pumps are pumps where an inner rotor is completely contained in a pressure vessel holding the pumped fluid. The pressure vessel or primary containment device is sealed by static seals such as gaskets or O-rings.

Pumps normally conform to recognized standard specifications (e.g. ISO 5199, explosion protection, electromagnetic compatibility), except where special requirements are specified herein.

This document includes design features concerned with installation, maintenance and operational safety of the pumps, and defines those items to be agreed upon between the purchaser and manufacturer/supplier.

Where conformity to this document has been requested and calls for a specific design feature, alternative designs can be offered providing that they satisfy the intent of this document and they are described in detail. Pumps which do not conform with all requirements of this document can also be offered providing that the deviations are fully identified and described.

Whenever documents include contradictory requirements, they are applied in the following sequence of priority:

- a) purchase order (or inquiry, if no order placed), see [Annexes C](#) and [D](#);
- b) data sheet (see [Annex A](#)) or technical sheet or specification;
- c) this document;
- d) other standards.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 76, *Rolling bearings — Static load ratings*

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

ISO 3744, *Acoustics — Determination of sound power levels and sound energy levels of noise sources using sound pressure — Engineering methods for an essentially free field over a reflecting plane*

ISO 3746, *Acoustics — Determination of sound power levels and sound energy levels of noise sources using sound pressure — Survey method using an enveloping measurement surface over a reflecting plane*

ISO 5199, *Technical specifications for centrifugal pumps — Class II*

ISO 7005-1, *Pipe flanges — Part 1: Steel flanges for industrial and general service piping systems*

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

ISO 7005-3, *Metallic flanges — Part 3: Copper alloy and composite flanges*

ISO 9906, *Rotodynamic pumps — Hydraulic performance acceptance tests — Grades 1, 2 and 3*

ISO 25178-601, *Geometrical product specifications (GPS) — Surface texture: Areal — Part 601: Design and characteristics of contact (stylus) instruments*

IEC 60034 (all parts), *Rotating electrical machines*

EN 12162, *Liquid pumps — Safety requirements — Procedure for hydrostatic testing*

3 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1

magnetic drive pump

MDP

pump in which the shaft power of the drive is transferred to the impeller of the pump by means of a permanent magnetic field, which passes through a containment barrier (shell) to an inner rotor having permanent magnets or an induction device

3.2

canned motor pump

CMP

pump in which the stator of an electric motor is separated from the rotor by a sealed containment barrier (liner)

Note 1 to entry: The rotor runs in the liquid being pumped or in another liquid.

Note 2 to entry: The shaft power is transmitted by means of an electromagnetic field.

3.3

seal-less rotodynamic pump

pump design in which the impeller shaft also carries the rotor of either a canned induction motor or a synchronous or an asynchronous magnetic drive

Note 1 to entry: The design does not use a dynamic shaft seal as a primary containment device. Static seals are the means used for containing the fluid.

3.3.1

hydraulic end

end of the pump which transfers mechanical energy into the liquid being pumped

3.3.2

lubrication

flow necessary in a magnetic drive in the area between the inner magnet and the containment shell, or in a canned motor between the rotor and the sleeve, for dissipation of the heat due to inherent Eddy current losses in metallic containment shells and frictional heat generation from bearings, and for lubrication

Note 1 to entry: Internal pump bearings are lubricated and cooled by the pumped fluid or an external, compatible flushing fluid.

3.3.3

close coupled

<MDP> coupling arrangement in which the motor is supplied with a flange adapter which mounts directly onto the casing or body of the pump and in which the outer magnet ring is mounted onto the motor shaft

3.3.4

air gap

<MDP> radial distance between the inner diameter (ID) of the outer magnet assembly and the outer diameter (OD) of the containment shell

3.4

break-out torque

torque load applied to the drive shaft with the rotor locked at the point at which magnetic decoupling occurs

3.5

magnetic coupling

device which transmits torque through the use of magnet(s) attached to the drive and driven shafts

3.6

inner magnet ring

rows of magnets operating within the containment shell, driven by the *outer magnet ring* (3.7)

Note 1 to entry: The inner magnet ring is mounted on the same rotating element as the pump impeller.

3.7

outer magnet ring

rows of permanent magnets securely fixed to a carrier, evenly spaced to provide a uniform magnetic field

Note 1 to entry: outer magnet ring, while rotating, transmits power through a containment shell, driving the inner magnet ring or torque ring.

3.8

Eddy currents

electrical currents generated in a conductive material when strong magnetic fields are rotated around it

3.8.1

Eddy current loss

power loss resulting from *Eddy currents* (3.8)

Note 1 to entry: The energy in these Eddy currents is normally dissipated as heat due to the electrical resistance of the material.

3.8.2

decouple

failure of a synchronous *magnetic coupling* (3.5) to rotate synchronously, or the stall condition of an eddy current drive

3.9

Containment

3.9.1

sheath

thin-walled hermetically sealed enclosure fitted to the inner rotor enclosing the *inner magnet ring* (3.6) (MDP) or rotor laminations (CMP)

Note 1 to entry: See [Figures 1](#) and [2](#).

**3.9.2
shell**

hermetically sealed enclosure fitted within the total-gap between the inner *magnet ring* (3.6) and the *outer magnet ring* (3.7) of an MDP and which provides for the primary containment of the pumped liquid

Note 1 to entry: See [Figure 2](#).

**3.9.3
liner**

hermetically sealed enclosure fitted to the ID of the stator assembly of a CMP and providing for the primary containment of the pumped liquid

Note 1 to entry: See [Figure 1](#).

**3.9.4
secondary containment**

backup pressure-containing system using static seals only to contain leakage in the event of failure of the primary containment by *shell* (3.9.2) or by *liner* (3.9.3), and including provisions to indicate a failure of the containment shell or liner

**3.9.5
drive shaft**

<MDP> outer shaft of the magnetic drive coupling

**3.9.6
secondary control**

minimization of release of pumped liquid in the event of failure of the containment *shell* (3.9.2) or stator liner

4 Design

4.1 General

4.1.1 Characteristic curve

The characteristic curve shall indicate the permitted operating range of the pump. Pumps should have a stable characteristic curve. In addition, the characteristic curves for the smallest and largest impeller diameters shall also be shown.

Minimum and maximum continuous stable flows at which the pump can operate without exceeding the noise, vibration and temperature limits imposed by this document shall clearly be stated by the manufacturer/supplier.

4.1.2 Net Positive Suction Head (NPSH)

•The NPSH required (NPSHR) shall be based on cold water testing as determined by testing in accordance with ISO 9906 unless otherwise agreed.

The manufacturer/supplier shall make available a typical curve as a function of flow for water. NPSHR curves shall be based upon a head drop of 3 % (NPSH3).

Correction factors for hydrocarbons shall not be applied to the NPSHR curves.

Pumps shall be selected such that the minimum NPSH available (NPSHA) in the installation exceeds the NPSHR of the pump by at least the specified safety margin. This safety margin shall be not less than 0,5 m, but the manufacturer/supplier may specify a significantly higher margin depending on factors including the following:

- size, type, specific speed, hydraulic geometry or design of the pump;
- operating speed or inlet velocity;

- the pumped liquid and temperature;
- the cavitation erosion resistance of the construction materials.

4.1.3 Outdoor installation

The pumps shall be suitable for outdoor installation under normal ambient conditions.

•Local regulations or extraordinary ambient conditions, such as high or low temperatures, corrosive environment, sandstorms, for which the pump is required to be suitable should be specified by the purchaser.

4.2 Prime movers

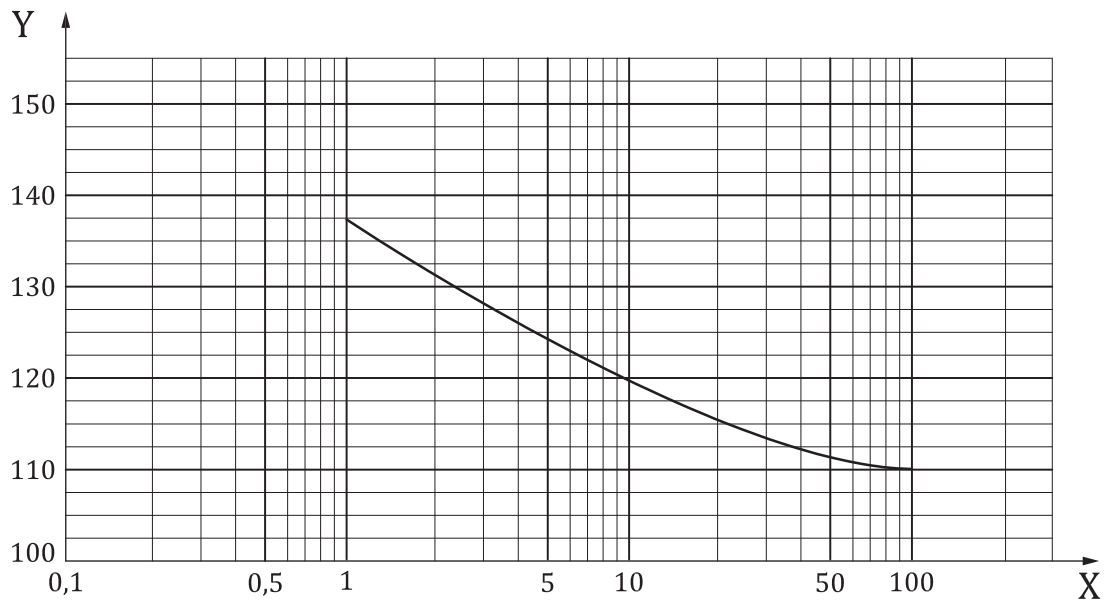
4.2.1 General

The following shall be considered when determining the power/speed requirements of the pump.

- a) The application and method of operation of the pump. For example, in an installation intended for parallel operation, the possible performance range with only one pump in operation, taking into account the system characteristic.
- b) The position of the operating point on the pump characteristic curve.
- c) The circulation flow for lubrication of bearings and removal of heat losses (especially for pumps with low rates of flow).
- d) Properties of the pumped liquid (viscosity, solids content, density, specific heat, vapour pressure).
- e) Power loss, including slip loss through transmission (only magnet drive pumps).
- f) Atmospheric conditions at the pump site.
- g) Starting method of the pump:
 - if a pump (e.g., a stand-by pump) is started automatically then consideration shall be given to whether the pump may start against a closed valve, or whether the pump may start against an open valve or be pumping into an empty pipeline; i.e. operates within a pumping system in which the pump pressure is provided only for pipeline friction losses.
- h) For variable speed arrangements the minimum continuous speed shall be indicated by the manufacturer/supplier to ensure proper cooling and lubrication of the bearings.

Prime movers required as drivers for seal-less pumps covered by this document shall have power output ratings at least equal to the percentage of rated power input given in [Figure 1](#), this value never being less than 1 kW.

Where it appears that this will lead to unnecessary oversizing of the driver, an alternative proposal shall be submitted for the purchaser's approval.



Key

- X pump power input at rated conditions, kW
- Y prime mover output, percentage of pump power input at rated conditions, %

Figure 1 — Prime mover output, percentage of pump power input at rated conditions

4.2.2 Magnetic drive pumps

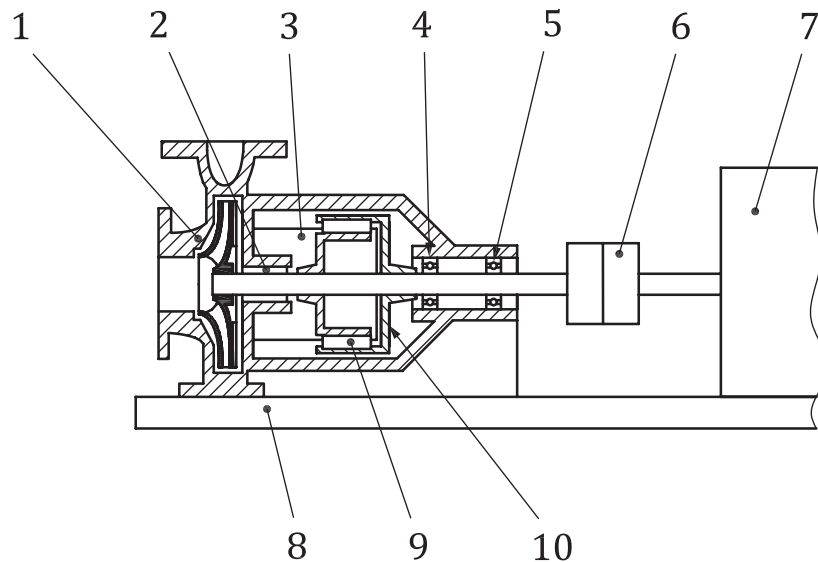
When determining the permanent magnetic drive to be used, the following points shall be taken into consideration in addition to the points a) to h) listed under [4.2.1](#).

- a) The magnetic drive shall be selected for the allowed operating range with the selected impeller diameter at operating temperature and taking into consideration the characteristics of the liquid to be pumped.
 - If the density of the liquid of the normal operation is below 1 000 kg/m³ special agreements between the manufacturer/supplier and purchaser for testing and cleaning shall be made.
- b) Heat generated by Eddy current losses, power losses in the shell, power losses in the bearings and power losses due to liquid circulation shall be removed by pumped liquid or by supply of external cooling fluid.
- c) The magnetic material temperature shall be maintained at or below rated values for the material used. Magnetic materials should not be subject to irreversible losses.
- d) The irreversible magnetic losses at operating temperatures of the magnetic drive shall be considered.

Fluids containing magnetically attracted particles should be avoided unless such particles can be effectively removed.

Special arrangements may be provided to avoid formation of ice in air gaps when pumping cold liquids.

The magnetic drive shall be designed in such a manner that start-up will not cause the magnet assemblies to decouple, see [Figure 2](#).

**Key**

| | |
|----|---------------------------|
| 1 | hydraulic end |
| 2 | bearing |
| 3 | shell |
| 4 | bearing housing |
| 5 | rolling bearing |
| 6 | coupling |
| 7 | prime mover |
| 8 | baseplate |
| 9 | sheath: inner magnet ring |
| 10 | outer magnet ring |

Figure 2 — Example of a magnetic drive pump (MDP)

4.2.3 Canned motor pumps

Canned motors are generally cooled by circulation of pumped liquid or by the use of coolant liquid to remove heat generated by the containment liner, Eddy current losses, motor electrical losses and mechanical losses. Stator winding temperatures shall be maintained at or below values established for the grade of insulation used, see [Figure 3](#).

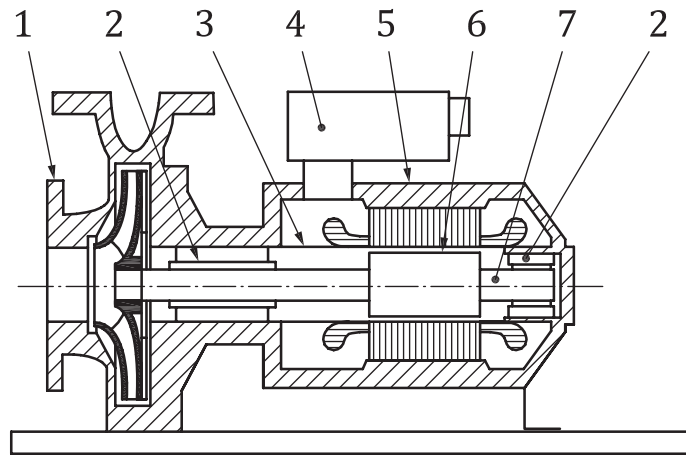
When rating a canned motor, the conditions listed below shall be taken into consideration in addition to points a) to h) listed under [4.2.1](#):

- power losses within the canned rotor;
- power losses in the bearings;
- power losses due to liquid circulation;
- explosion protection requirements.

Manufacturers/suppliers shall specify external cooling requirements when required.

Stand-by units may require special arrangements for flushing and/or heating to prevent the settling out of solids, or the formation of ice, or solidification or too low viscosity of the liquid to be pumped.

•The details of such arrangements should be agreed upon between the purchaser and manufacturer/supplier.

**Key**

| | |
|---|-----------------|
| 1 | hydraulic end |
| 2 | bearing |
| 3 | liner |
| 4 | terminal box |
| 5 | stator assembly |
| 6 | rotor sheath |
| 7 | rotor |

Figure 3 — Example of a canned motor pump (CMP)

4.3 Critical speed, balancing and vibrations

4.3.1 Critical speed

The critical speed shall be calculated with liquid.

•For some pump types (e.g., vertical line shaft and horizontal multistage), the first critical speed may be below the operating speed when agreed between the purchaser and manufacturer/supplier.

Particular attention shall be paid to the critical speed when the pump is to be driven at variable speed.

4.3.2 Balancing and vibration

4.3.2.1 General

All major rotating components shall be balanced.

4.3.2.2 Horizontal pumps

Unfiltered vibration shall not exceed the vibration severity limits as given in [Table 1](#) when measured on the manufacturer's/supplier's test facilities¹⁾. These values are measured radially at the bearing housing at a single operating point at rated speed ($\pm 5\%$) and rated flow ($\pm 5\%$) when operating without cavitation.

The manufacturer/supplier shall determine the grade of balancing required in order to achieve acceptable vibration levels within the limits specified in this document.

NOTE This can normally be achieved by balancing in accordance with a minimum of class G6.3 of ISO 21940-11.

1) For in situ acceptance limits refer to ISO 20816-3.

Table 1 — Maximum allowable unfiltered vibration values in millimetres per second

| Pump arrangement | Pump type and criterion | |
|--|-------------------------|---------------------|
| | Canned motor pump | Magnetic drive pump |
| Pump with rigid support centre-line height ≤225 mm | 2,3 | 3,0 |
| Pump with rigid support centre-line height >225 mm | 3,0 | 4,5 |
| Pump with flexible support | 3,0 | 4,5 |
| NOTE 1 The values of vibration velocity filtered for rotating frequency and blade passing frequency can be expected to be lower than given in the table. | | |
| NOTE 2 A rigid support is one where the lowest natural frequency of the combined machine and support system in the direction of measurement is at least 25 % higher than the rotational frequency. Any other support is considered flexible. | | |

4.3.2.3 Vertical pumps

Vibration readings shall be taken on the top flange of the driver mounting on vertical pumps with rigid couplings and near to the top pump bearing on vertical pumps with flexible couplings.

Vibration limits for both rolling and sleeve bearing pumps shall not exceed the vibration severity limits as given in [Table 1](#) during shop test at rated speed ($\pm 5\%$) and rated flow ($\pm 5\%$) operating without cavitation²⁾.

4.4 Pressure-containing parts

4.4.1 Primary containment

Containment of the pumped liquid shall be by means able to withstand the stresses derived from the maximum allowable working pressure and any dynamic effects of operation. The wetted materials shall be compatible with each other and the pumped liquid, and shall be dimensioned to give an adequate working life.

It is recognized that several effective methods are suitable for the design of pressure-containing parts. These may be based upon recognized national codes or upon other proven methods. To satisfy the acceptance criteria, each design method shall

- be a written procedure,
- recognize limits of material stresses,
- incorporate a checking stage, and
- have been proven empirically or experimentally.

4.4.2 Secondary containment

Where containment of any leakage is considered to be desirable, the pump shall be provided with a secondary containment.

The secondary containment shall be designed to allow installation of a sensor by the purchaser to indicate change in status and either to shut-down the pump or to warn that attention and rectification is required. The secondary containment shall sustain this condition when exposed to the pumped liquid for a minimum of 48 h. It shall be capable of containment under the maximum allowable working pressure, temperature and any dynamic effects from operation.

2) For in situ acceptance limits refer to ISO 20816-3.