SLOVENSKI STANDARD
SIST EN 13275:2001

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Kriogene posode - Črpalke za kriogeno področje

Cryogenic vessels - Pumps for cryogenic service

Kryo-Behälter - Pumpen für den Kryo-Betrieb

Récipients cryogéniques - Pompes pour service cryogénique

Ta slovenski standard je istoveten z: **EN 13275:2000**

ICS:

23.020.40	Proti mrazu odporne posode (kriogenske posode)	Cryogenic vessels
23.080	Črpalke	Pumps

SIST EN 13275:2001 **en**

EUROPEAN STANDARD
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English version

Cryogenic vessels - Pumps for cryogenic service

Récipients cryogéniques - Pompes pour service cryogénique

Kryo-Behälter - Pumpen für kryo-Betrieb

This European Standard was approved by CEN on 9 April 2000.

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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 Central Secretariat has the same status as the official versions.

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

Central Secretariat: rue de Stassart, 36 B-1050 Brussels

Contents

Foreword

This European Standard has been prepared by Technical Committee CEN/TC 268 "Cryogenic vessels", 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of an identical text or by endorsement, at the latest by November 2000, and conflicting national standards shall be withdrawn at the latest November 2000.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.

1 Scope

This standard specifies the minimum requirements for the design, manufacture and testing of pumps for cryogenic service (i.e. for cryogenic fluids, see EN 1251-1).

This standard covers centrifugal pumps. However the principles may be applied to other types of pumps (e.g. reciprocating).

This standard also gives guidance on the design of installations (see annex A).

It does not specify requirements on operation or maintenance.

2 Normative references

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.

EN 809:1998, *Pumps and pump units for liquids – Common safety requirements.*

EN 1251-1:2000, *Cryogenic vessels - Transportable vacuum insulated of not more than 1000 litres volume – Part 1 : Fundamental requirements*

EN 1252-1:1998, *Cryogenic vessels - Materials - Part 1: Toughness requirements for temperatures below -80 °C.*

prEN 1252-2, *Cryogenic vessels - Materials - Part 2: Toughness requirements for temperatures between - 80 °C and - 20 °C.*

EN 1333:1996, *Pipework components - Definition and selection of PN.*

EN 1797:2000, *Cryogenic vessels - Gas/material compatibility.*

EN 12300:1998, *Cryogenic vessels - Cleanliness.*

EN ISO 5198:1998, *Centrifugal, mixed flow and axial pumps - Code for hydraulic performance test – Precision class (ISO 5198:1987).*

EN ISO 6708:1995, *Pipework components - Definition and selection of DN (nominal size) (ISO 6708:1995).*

EN ISO 9908:1997, *Technical specification for centrifugal pumps - Class III (ISO 9908:1993).*

ISO 5199:1986, *Technical specification for centrifugal pumps - Class II.*

ISO 9906:1999, *Rotodynamic pumps - Hydraulic performance acceptance tests - Grades 1 and 2.*

3 Terms and definitions

For the purposes of this European Standard, the following definitions apply :

3.1
nominal size (DN)
[EN ISO 6708:1995]

3.2
nominal pressure (PN)
[EN 1333:1996]

NOTE PN is equal to PS as defined in the directive 97/23/CE.

3.3
specified minimum temperature
the lowest temperature for which the pump is specified

3.4
duty point
a performance point defined by pressure or head and volume or mass flowrate

3.5
net positive suction head (NPSH)
[Table 1 in EN ISO 5198:1998 or ISO 9906:1999]

4 Requirements for pump

4.1 General

It is a requirement of this standard that a cryogenic pump shall first comply with appropriate EN standards e.g. EN 809. In the event of conflict, the requirements of this standard shall take priority over the general standards.

4.2 Materials

4.2.1 General

Materials of construction shall be selected taking into consideration that cryogenic pumps operate at low temperature, often in a damp environment, and at times with liquid oxygen, or with flammable fluids.

The minimum requirements given in 4.2.2, 4.2.3 and 4.2.4 shall apply.

4.2.2 Mechanical properties at low temperature

Metallic materials which are under stress at low temperature and which exhibit a ductile/brittle transition (such as ferritic steels) shall have minimum impact test values in accordance with EN 1252-1 or prEN 1252-2 as appropriate.

Metallic materials which can be shown to have no ductile/brittle transition do not require impact testing.

Non-metallic materials are generally used only for seal or heat barrier materials. If such materials are to be used for structural parts, stress levels and material impact values shall be shown to be acceptable for the intended use.

4.2.3 Corrosion resistance

Materials should be resistant to, or protected from, atmospheric corrosion. Where this is not achievable, a suitable corrosion allowance shall be considered.

4.2.4 Oxygen compatibility

If the specified minimum temperature is equal to or less than the boiling point of air or the pump is intended for oxygen service, the materials which are, or are likely to come, in contact with oxygen or oxygen enriched air, shall be oxygen compatible in accordance with EN 1797.

Consideration of the requirements for oxygen compatibility should be made when the pump is employed for oxidising cryogenic fluids , e.g. nitrous oxide.

Materials should be selected that minimise the potential of an ignition and inhibit sustained combustion.

These material properties are :

— high ignition temperature ;

— high thermal conductivity ;

— low heat of combustion.

A table of materials found through testing and operating experience to be particularly suitable for centrifugal cryogenic pumps in oxygen service, is included as annex B. Materials other than those identified in annex B may be used but their selection shall be justified by specific testing or long term experience in this application.

For (any) parts of the pump which are, or are likely to come, in contact with oxygen and which could be exposed to energy sources such as friction, aluminium or aluminium alloy shall not be used. The use of aluminium or aluminium alloy for any other parts shall only be adopted after careful consideration.

Stainless steel shall not be used for exposed thin components. Exceptions allowable are the seal bellows, trapped shims or gaskets and screw locking devices of stationary parts where knowledge of past satisfactory performance is available, however suitable alternative method e.g. Monel, Inconel should be considered.

NOTE Tin bronze has been found to be most suitable for the main "wetted" pump components. The most common aluminium bronzes, which contain typically between 6 % and 11 % aluminium have relatively high heats of combustion and if combustion occurs are practically impossible to extinguish in an oxygen environment.

4.3 Design

4.3.1 Pressure containing parts

The high pressure side of the pump shall be designed to withstand at least the nominal delivery pressure. The low pressure side shall be designed to withstand at least the nominal inlet pressure.

4.3.2 Performance

The pump design and installation shall meet the performance requirements specified on a data sheet (or similar document). An example of a data sheet can be found in ISO 5199 and ISO 9908.

4.3.3 Clearances

Clearances between moving and stationary parts within the pump shall be as large as practical, consistent with good hydraulic performance and sealing. Material selection for components should take into account the often large differences in expansion coefficients to ensure satisfactory clearances and interferences at the operating temperatures and during cooldown.

4.3.4 Rubbing prevention

The consequences of bearing failure or the consumption of wearing parts shall be considered, particularly in pumps designed for liquid oxygen duty.

4.3.5 Fastenings

All internal fasteners shall be secured to prevent them loosening in service. (e.g., friction nuts, tab washers).

Consideration shall be given to more adequately securing items which might normally be held in place by an interference fit only, (e.g. wear rings). These components can cool down more quickly than others and become temporarily loose.

4.3.6 Warm bearings

Rolling elements bearings designed to run warm, shall be located or protected such that freezing of the lubricating grease or oil is avoided. The effect of ice build up over a period shall be considered. This may result in overcooling of the bearing and may allow shaft seal leakage to be forced directly into the driver bearing. Motor bearing heaters may be considered for cold standby pumps.

4.3.7 Cold bearings

For bearings designed to run cold, lubricated by the cryogenic fluid, the use of materials and design arrangements that can safely withstand short term dry running shall be considered.

4.3.8 Bearing lubrication

For direct coupled cryogenic pumps, grease and oils shall be suitable for all oxidising and predictable offset conditions. The lubricants should typically be suitable down to – 40 °C.

Sealed bearings are preferred. Where bearing re-greasing in situ is required grease drain plugs should be provided to reduce the risk of accumulations of grease within the motor housing.

Liquid oxygen pumps shall be constructed so that possible oxygen leakage cannot contact any hydrocarbon lubricant. Where this cannot be prevented with certainty, the use of oxygen compatible lubricants meeting the requirement of EN 1797, shall be considered. It should be noted, however, that such oxygen compatible lubricants are less able to protect the bearing against corrosion, generally reduce the ability of the bearing to withstand load and speed, and may have some adverse reaction with some material combinations.

4.3.9 Shaft seals

Shaft seals will probably be either mechanical rubbing face or labyrinth type. Both have a high possibility of leakage.

The design of the mechanical seal shall prevent metal to metal rubbing between the seal carrier and the rotating seal ring when the soft face material wears out.

For pumps in oxygen service a protective sleeve shall be fitted between the bellows of any mechanical seal and the shaft.

Labyrinth shaft seals need to be treated as systems, engineered for the particular application. Injected gas may be an inert gas or oxygen.

Leakage detection devices should be considered, e.g. low temperature trip.

A slinger or other deflection device shall be used to prevent direct impingement of shaft seal leakage on the driver bearing.

4.3.10 Purging

A tapping for a dry inert gas purge may be used to :

a) prevent the ingress of moisture (and possibly ice build-up) within the seal area ;

b) prevent the ingress of moisture into areas using oxygen compatible lubricants ;

c) provide a barrier between oxygen compatible and non oxygen compatible parts of a pump (e.g. cold end and mechanical drive).

4.3.11 Particle prevention

Appropriate devices such as a filter shall be used if there is a risk of contamination in service.