Chapter 6

Standards and approvals

1. European Standard EN 12756
2. Approvals

This chapter describes the standards, approvals and guidelines governing the use of mechanical shaft seals in industry.

1. European Standard EN 12756

Dimensions according to EN 12756

European Standard EN 12756 defines the principal dimensions for the installation of single and multiple mechanical shaft seals into pump housings.
The standard also describes the shaft seal designation and material codes to be used. This facilitates the exchange of shaft seal information between shaft seal suppliers and users.

Type designation

The type designation according to EN 12756 is based on this coding system for single shaft seals:

Example	N	U	012	S	O

Pos. 1: ***Assembly length:***
N = Normal
K = Short

Pos. 2: ***Balancing:***
U = Unbalanced
B = Balanced

Pos. 3: ***Nominal shaft diameter:***
The diameter in mm, indicated by a three-digit number

Pos. 4: ***Direction of rotation of the seal:***
R = Right-hand rotation (clockwise when viewed from the seat)
L = Left-hand rotation (counterclockwise when viewed from the seat)
S = Capability of rotation in either direction

Pos. 5: ***Retention against rotation of the seat***
0 = without retention
1 = with retention

Example of designation for a mechanical shaft seal with normal assembly length: **NU043S0.**
The code represents a shaft seal with normal assembly length, unbalanced, for a Ø43 shaft, capable of rotation in either direction, without retention against rotation of the seat.

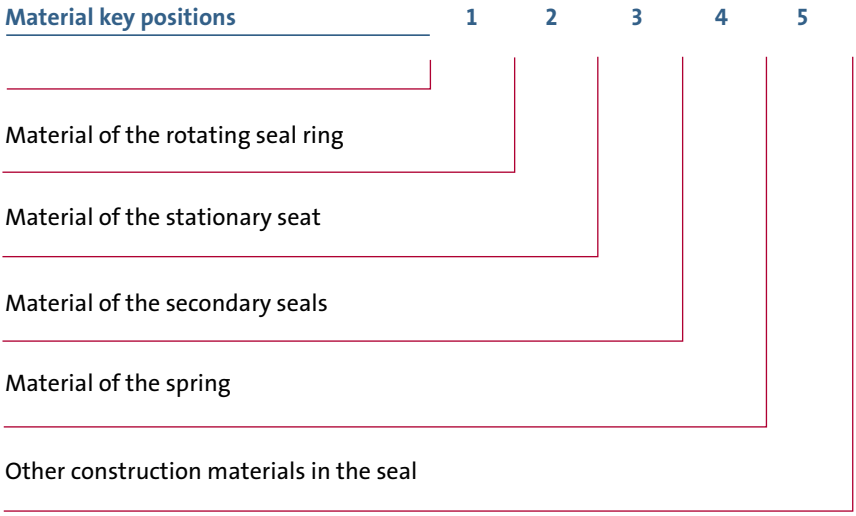
Comparable example for a mechanical shaft seal with short assembly length: **KU043S0.**

The EN 12756 specifies dimensions of the seat housing and a recommended maximum outside diameter of the rotating part.

Most seal manufacturers insert a type/product code in front of the seal designation.

In addition to the dimensions, EN 12756 also specifies the materials of the shaft seal components.

Material key according to EN 12756
The materials of the shaft seal components are indicated by means of code letters.
The code for single seals has five letters. In the following, only single seals will be described.



Example: EN12756-NU043S0-QQEGG

The code represents a shaft seal with normal assembly length, unbalanced, for a Ø43 shaft, capable of rotation in either direction, without retention against rotation of the seat, and with

1. rotating seal ring made of SiC
2. stationary seat made of SiC
3. secondary seals made of EPDM
4. spring made of CrNiMo steel
5. other shaft seal materials made of CrNiMo steel.

Many seal suppliers use this standard with some additions to describe the seals, but some also use their own codes.

Material key according to EN 12756, edition 2000

Position 1 and position 2	Position 3	Position 4 and position 5
Material for the rotating seal ring (1) and the stationary seat. (2)	Material for secondary seals.	Material for other construction materials in the seal.
Manufactured carbons A Carbon, metal-impregnated B Carbon, resin-impregnated C Other carbons **Metals** D Carbon steel E Cr steel F CrNi steel G CrNiMo steel H Metals with carbide coatings K Hard coatings, metallic M High-nickel alloy N Bronze P Grey cast iron R Alloyed grey cast iron S Cr-cast steel T Other materials **Carbides** U Tungsten carbide Q Silicon carbide J Other carbides **Metal oxides** V Aluminium oxide W Chromium oxide X Other metal oxides **Plastics** Y PTFE glass-fibre, reinforced Z Other plastics	**Elastomers** B Butyl rubber (IIR) E Ethylene-propylene rubber (EPDM) K Perfluoro rubber (FFKM) N Chloroprene rubber (CR) P Nitrile rubber (NBR) S Silicon rubber (MVQ) V Fluorocarbon rubber (FKM) X Other elastomers **Elastomers, sheathed** M Elastomers/ PTFE-sheated **Non-elastomers** G Graphite T PTFE Y Other non-elastomers **Various materials** U Various materials for flexible elements	D Carbon steel E Cr steel F CrNi steel G CrNiMo steel M High-nickel alloy N Bronze T Other materials

Numerous variants of the above materials can be seen in the literature of the various shaft seal manufacturers. **Note:** The same letter will be used in different positions.

2. Approvals

Specific approvals of shaft seals are sometimes required. Below you will find some examples.

Drinking water approvals and local approvals on a global scale

Materials which come into contact with drinking water during supply, treatment and distribution to the tap, may release substances into the water. This may have adverse effects on the general quality of the drinking water or pose a health risk to consumers.
Common to all drinking water approval schemes is therefore an assessment of the suitability of the materials for use with drinking water. The purpose is to prevent an unacceptable deterioration of the quality of the drinking water. The suitability of materials intended for use with drinking water can be determined by means of migration/leaching tests. The materials are tested independently or together in the assembled product.

The table below shows a number of important national approval bodies responsible for materials intended for use with drinking water.

Country	Name of scheme	Legal framework	Approval body/ institute	What is evaluated for leaching/ migration?	Mechanical testing of the complete product?
France	ACS (Attestation de conformité sanitaire). See [1]	Ministerial decree of 29 May 1997	Any one of four laboratories within France, authorised by the French Ministry of Health to perform and award ACS certification.	Either individual materials or a complete multiple material product can be awarded an ACS certificate	No
United Kingdom	WRAS / DWI BS 6920. See [2]	Water Supply (Water Fittings) Regulations 1999	Water Regulations Advisory Scheme/ Drinking Water Inspectorate	All non-metallic materials in contact with water in the product must pass British Standard 6920:2000, tested independently	Yes
Unites States	NSF 61. See [3]			Either individual materials or the complete product can be approved	No
Germany	DVGW UBA / KTW. See [4]			Individual materials/ components	No – not for pumps at this time

For further information, see [1] to [4].

Sanitary approvals
The use of pumps in hygienic and sanitary applications, such as plants for the pharmaceutical, food and biotechnology industries as well as sterile processes, is subject to higher design standards, in terms of cleanability and sterilisation, than the use of pumps in other applications.

The design, materials used and material surface finish are subject to a variety of national and international rules and regulations, guidelines and laws, such as:

- FDA (Food and Drug Administration) regulations
- EHEDG (European Hygienic Equipment Design Group) recommendations and certification
- 3A Sanitary Standards
- QHD (Qualified Hygienic Design) criteria.

FDA

The FDA (Food and Drug Administration) is a scientific, regulatory, public health agency within the United States Department of Health and Human Services.

FDA is responsible for the safety of the United State's foods, cosmetics, drugs, biologics, medical devices, and radiological products. It is one of the United States' oldest consumer protection agencies.

For further information, see FDA's homepage [5].

EHEDG

The EHEDG (European Hygienic Engineering & Design Group) was founded in 1989. The members of the organisation come from food industries, equipment manufacturers, research institutes and public health authorities. EHEDG is a non-profit organisation and has no legislative authority.
EHEDG develops guidelines and testing methods for the safe and hygienic processing of food.

Two EHEDG guidelines are important for assessing the hygienic design and cleaning of process equipment and components. See [6] and [7] from http://www.ehedg.org.

The guideline on Hygienic Equipment Design Criteria [6] describes the design criteria to be met for hygienic and aseptic process equipment. It gives guidance on how to construct food processing equipment and components so that it does not affect the bacteriological growth and quality of the food product in any adverse manner.

The guideline on in-place cleanability (CIP) of food processing equipment and components [7] describes a test procedure to indicate areas of poor hygienic design where food products and/or microbes can accumulate.
The degree of cleanliness is based on the removal of a bacteria-containing soil. The cleaning is performed using a mild detergent to leave some soil in the reference pipe. This facilitates cleanability comparisons between the test object and the reference pipe with a known surface roughness. If the test object has a cleanability equal to or better than the reference pipe, an EHEDG certificate can be issued.

As food safety does not end at the borders of Europe, the EHEDG actively promotes global harmonisation of guidelines and standards.

The EHEDG symbol is used by manufacturers to indicate compliance with the EHEDG criteria.

For further information, see EHEDG's homepage [8].

3-A Sanitary Standards

The 3-A Sanitary Standards, Inc. is the American counterpart of the European EHEDG.
The 3-A Sanitary Standards have no testing schemes. Consequently, only 3-A certificates of compliance can be issued. The US-based organisations NSF and 3-A have agreed to co-operate in the development of EHEDG Guidelines, and in turn EHEDG co-operates in the development of 3-A and NSF standards.

The 3-A symbol is used by manufacturers to indicate compliance with the 3-A Sanitary Standards

For further information, see the 3-A Sanitary Standards homepage [9].

QHD

QHD (Qualified Hygienic Design) is a testing system for the hygienic design and cleanability of components, machinery and plant for aseptic or sterile applications. The system is for self-certification under the German industry association, VDMA (Verband Deutscher Maschinen- und Anlagenbau e.V.). This ensures that all surfaces can be cleaned in place (CIP).

The manufacturer attests the relevant regulations for the designed product from the QHD manual.
Tests for good cleanability are carried out in a test laboratory either by the manufacturer himself or by independent approval bodies.

The QHD symbol is used by manufacturers to indicate compliance with the QHD criteria

For further information, see the VDMA homepage [10].

Other guidelines for use of mechanical shaft seals:

ATEX

ATEX is a French abbreviation for “ATmosphère EXplosible” (explosive atmosphere). ATEX is the name given to a set of European directives dealing with equipment intended for use in potentially explosive atmospheres.

ATEX certification is based on meeting the requirements of these two EU Directives:

1. **Directive 94/9/EC,** also known as ATEX 95 or the **ATEX Equipment Directive.** The directive applies to equipment and protective systems intended for use in potentially explosive atmospheres. The directive places responsibilities on the manufacturer of these products. The main responsibility of the manufacturer is to prevent the formation and ignition of explosive atmospheres.

2. **Directive 99/92/EC,** also known as ATEX 137 or the **ATEX Workplace Directive**. The directive sets out minimum requirements for improving the health and safety protection of workers potentially at risk from exposure to explosive atmosphere. This directive is concerned with the health and safety of workers with relation to potentially explosive atmospheres. It places responsibilities on the employer.

As previously described, mechanical shaft seals develop heat in the sealing gab during operation. The ATEX directives state whether special protections are required. Explosive atmospheres can be caused by flammable gases, mists or vapours or by combustible dusts, mixed with air. Areas with explosive atmospheres are classified into hazardous zones. The classification given to a particular zone, and its size and location, depends on the likelihood of an explosive atmosphere occurring and its persistence if it does.

Equipment is classified into categories, depending on the level of protection.

For further information, see [11].

API 682 and ISO 21049

API (American Petroleum Industry) is the only national trade association that represents all aspects of America’s oil and natural gas industry. The API 682 and ISO 21049 standards deal with mechanical shaft seals and systems around the seal used in the oil and gas industry.

For further information, see [12].

Summary
Different applications require different standards or approvals. The most important standard for mechanical shaft seals is EN 12756. In addition, approvals or guidelines for drinking water, food, cleaning or protection against explosion may be relevant.

Reference list

[1] http://www.sante.gouv.fr

[2] http://www.wras.co.uk

[3] http://www.nsf.org

[4] http://www.dvgw.de/104.html

[5] http://www.fda.gov

[6] The Hygienic Equipment Design Criteria, Document Guideline No. 8 (2004)

[7] A method for the assessment of in-place cleanability of food processing equipment, Document No. 2 (2000).

[8] http://www.ehedg.org

[9] http://www.3-a.org

[10] www.vdma.org

[11] www.ce-mark.com/atexdir.html

[12] Overview of API 682 and ISO 21049, Proceedings of the Twenty-First International Pump Users Symposium, Turbomachinery Laboratory, Texas A&M University, College Station, Texas, pp. 131-137, 2004