



TECHNICAL REQUIREMENTS

MECHANICAL

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SHAFT SEALING SYSTEMS FOR CENTRIFUGAL AND ROTARY PUMPS

Document No. OL-TR-MRR-013

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1. SCOPE

- 1.1** The **API Standard 682 Fourth Edition May 2014**, “Pumps – Shaft Sealing Systems for Centrifugal and Rotary Pumps”, is an integral part of this job specification. The numbering of sections and paragraphs is the same as in API 682. The type of change e.g. addition, exception, modification or substitution is noted for each item.
- 1.2** Compliance with this standard does not relieve the manufacturer or the vendor of the responsibility for supplying equipment of proper design and construction and fully suitable for all the specified operating conditions.
- 1.3** Exceptions to this and other applicable standards shall be clearly stated in the vendor's proposals.
- 1.4** Vendor shall either submit a list of exceptions or a statement to the effect that its proposal is in full accordance with these standards. In this latter case the purchaser shall assume that the proposal includes the cost of the requirements of any of the applicable standards.
- 1.5** The vendor is responsible for ensuring that materials supplied by its sub-vendors comply with the requirements of these standards.

2. REFERENCES

2.1 General

For references see:

- Section 2 of API Std. 682-4.

The latest editions of the following publications are to be used with this Specification as applicable:

2.2 OL Specifications

| | |
|----------------------|---|
| OL-TR-GR-000 | <i>General Requirements</i> |
| OL-TR-GR-001 | <i>General. Noise Level</i> |
| OL-TR-CR-011 | <i>Civil. Corrosion Protection and Lining. Painting</i> |
| OL-TR-MR-000 | <i>Mechanical. General</i> |
| OL-TR-MRR-000 | <i>Mechanical. Machinery. General</i> |

2.3 Local, State, National Codes and Legislations

| | |
|--|---|
| Legislation of the Republic of Lithuanian | <i>Law on the Supervision of Potentially Dangerous Equipment No. I-1324 („Lietuvos Respublikos Potencialiai pavojingų įrenginių priežiūros įstatymas Nr. I-1324 (aktuali redakcija nuo 2011 -07-19)“)</i> |
| Legislation of the Republic of Lithuanian | <i>Law on Assessment of Conformity VIII-870 („Atitikties įvertinimo įstatymas VIII-870“)</i> |
| Legislation of the Republic of Lithuanian | <i>Technical Regulation on Pressure Equipment (Slėginių įrenginių techninis reglamentas)</i> |

**Legislation of the
Republic of Lithuanian**

*Technical Regulations for Equipment and Protection
Systems Used in Potentially Explosive Atmosphere
(„Įrangos ir apsaugos sistemų, naudojamų potencialiai
sprogioje aplinkoje, techninis reglamentas“)*

**STR 1, 2 (Legislation of
the Republic of
Lithuanian)**

Technical regalement's of construction

2.4 Others

Equipment shall comply also with the following:

2.4.1 Data sheet acc. to API Std. 682-4, Annex C (pages 128-129, SI units).

2.4.2 Pressure equipment, as defined in Pressure Equipment Directive (P.E.D.) 97/23/CE article 1, shall fully satisfy the P.E.D. essential safety requirements. In particular, design and construction shall be carried out by Manufacturer according to ASME or EN code, as amended under the supervision and approval of the nominated Notified Body, to fulfill P.E.D. requirements.

2.4.3 Equipment and Protection Systems intended for use in Potentially Explosive Atmospheres, shall be in full compliance with Directive 94/9/CE (ATEX) requirements.

NOTES:

- (1) Detailed information relevant to Area Classification, Group, Ignition Temperature etc., shall be as indicated on individual Material Requisition.*
- (2) Manufacturer shall affix the CE marking and shall prepare a declaration of conformity for the Equipment. Nomination of a Notified Body shall be made as needed.*

2.4.4 Compliance with European Directives includes all needed/requested CE nameplates, marking, declaration of conformity, operating instruction manuals etc.

3. TERMS AND DEFINITIONS

For terms and definitions see:

- Section 3 of API Std. 682-4.

4. REVISIONS TO API STANDARD 682

All headings contained herein correspond to paragraph numbering within API Std. 682-4 and reflect additions, substitutions, modifications, and deletions. All provisions not modified or deleted remain in force.

4.1 Modifications to Section 1: Scope

1.1 New Paragraph: Vendor Qualification

Seals and sealing systems rated over 34.5 bar(g) (500 psig), sealing liquids above 260°C (500°F) or below 0°C (32°F) or with a balance diameter equal to or greater than 100 mm (4") and all two seals regardless of service shall be supplied by vendors qualified by experience to manufacture the units proposed. To qualify, Vendor must have at least two seals of comparable tangential speed, pressure, temperature, and fluid properties. These seals must have been in service for at least one year and be performing satisfactorily.

1.2 New Paragraph: Alternative Designs

Where Vendor qualification requirement of Paragraph 1.1 prevents the application of the latest technology, Vendor shall submit to the purchaser an alternative proposal incorporating such features for review and approval by the OL's Engineer. The proposal shall specifically identify the undemonstrated features and state their advantages.

1.3 New Paragraph: Conflicting Requirements

The local laws and regulations and hierarchically the specific requirements stated in the purchase order and material requisition shall take precedence over this job specification. The vendor shall in any case notify the purchaser of any possible conflict for resolution.

4.2 Modifications to Section 4: Sealing Systems

4.1.4.1(2nd)-) Exception: Seal Categories, Types and Arrangements. Seal Arrangements

Balanced outer seals are preferred.

4.1.4.1(3rd)-) Exception: Seal Categories, Types and Arrangements. Seal Arrangements

Pressurized two seals which cannot be operated at rated barrier pressure with atmospheric pressure in the pump require approval by the OL's Engineer. Pressurized two seals using a gas or vapor as the barrier fluid are acceptable alternatives to liquid barrier designs and shall also meet the requirements of Paragraph above.

4.3 Modifications to Section 5: General

5.2 Clarification: Dimensions

Unless otherwise specified, data, drawings, hardware and equipment supplied to this standard shall use SI units, except pipe, pipe threading, and flanges to be based on U.S. standards.

4.4 Modifications to Section 6: Design Requirements

6.1.1.6 Clarification: Common Design Requirements (All Categories). General Information

Unless otherwise specified or agreed upon, the pump maximum allowable working pressure shall apply to the mechanical seal and associated ancillaries.

6.1.2.9 Addition: Common Design Requirements (All Categories). Seal Chamber and Gland Plate

Operation of a pressurized two seal (Arrangement 3) with rated barrier fluid pressure and ambient pressure in the pump shall be considered when determining stress levels.

6.1.2.14 Addition: Common Design Requirements (All Categories). Seal Chamber and Gland Plate

- e) Mechanical seal gland plates shall be furnished with a connection to permit measurement of seal chamber pressure during normal operation when a connection is not provided on the seal chamber directly. The seal chamber external vent if provided may be used for this purpose.
- f) When a pressure measurement port is provided in the gland it shall be directed to an area of the seal chamber and not the area used for distribution of flush fluid. When inclusion of this second port restricts the flow area for flush distribution or may otherwise negatively impact seal face cooling/flushing the design shall be submitted to Purchaser for review and approval of the OL's Engineer.

6.1.2.14 Exception: Common Design Requirements (All Categories). Seal Chamber and Gland Plate

Seal chamber conditions of pressure and temperature shall meet the seal vendor's requirements for satisfactory margin to vaporization with a minimum margin of 1.72 bar (25 psi). Where special provisions must be added to the pump or seal (such as floating throat bushings, coolers or hydropadded faces) to meet the required conditions the special provisions shall be submitted to Purchaser for review and approval of the OL's Engineer.

6.1.2.20.e) Addition: Common Design Requirements (All Categories). Seal Chamber and Gland Plate

For single seals with stationary flexible elements, the flush inlet arrangement shall be designed to avoid erosion of the stationary seal elements.

6.1.2.18 Addition: Common Design Requirements (All Categories). Seal Chamber and Gland Plate

Gland plates for Arrangement 1 seals shall be furnished with flush inlet, quench inlet and drain connections as a minimum.

6.1.2.20.b) Addition: Common Design Requirements (All Categories). Seal Chamber and Gland Plate

Unless specified otherwise, for vertical pumps utilizing any flush plan other than 02, 23, 53 or 54, the specified port for the inner seal shall be used to connect a plan 13 flush in addition to the specified flush. The orifice shall be sized to allow free removal of vapor without significantly affecting seal chamber pressure. When the port is used as the barrier/buffet fluid exit of a two seal, the orifice and valve shall be eliminated.

6.1.2.23 Addition: Common Design Requirements (All Categories). Seal Chamber and Gland Plate

- a) Floating bushings shall be carbon.
- b) Alternative secondary devices will be specified by Purchaser.
- c) Contacting (dry running) backup seals and non-contacting abeyant backup seals shall not be used for pumping temperatures above 350°F (176°C) unless a Plan 21, 23 or 32 cool flush is used to avoid coking and the need for steam quench.

6.1.3.16 New Paragraph: Common Design Requirements (All Categories). Cartridge Seal Sleeves

Mechanical seal sleeves shall be hardfaced with Colmonoy 6™ or equal, on surfaces under dynamic seal rings and close clearance floating throttle bushings.

6.1.6.1.4 New Paragraph: Common Design Requirements (All Categories). Materials. General

Sealing systems in any wet H2S service shall make use of materials in accordance with NACE MR0103 or NACE MR0175, as applicable.

6.1.6.1.5 New Paragraph: Common Design Requirements (All Categories). Materials. General

Asbestos and its compounds, or other carcinogenic fibers classified under any of the applicable Hazard Warning Directive shall not be used in any form.

6.1.6.2.3 Exception: Common Design Requirements (All Categories). Materials. Seal Faces

The mating ring shall be tungsten carbide when this is the vendor standard material (such as for designs utilizing a stationary flexible element and pumps operating above 3600 rpm). Use of a rotating mating ring made of silicon carbide for pusher seals and all seals operating above 3600 rpm shall be approved by the OL's Engineer.

6.1.6.2.4 Exception: Common Design Requirements (All Categories). Materials. Seal Faces

Alternate face materials will be specified.

6.1.6.5.4 Exception: Common Design Requirements (All Categories). Materials. Secondary Sealing Components

Secondary sealing element selection, e.g., elastomers and gaskets, shall be based on the maximum temperature specified.

6.1.6.10.4 New Point: Common Design Requirements (All Categories). Materials. Welding

- e) Wetted parts subject to welding shall be stress relieved, when presence of H₂S (including traces) is specified, to meet the yield strength and hardness requirements.

6.1.6.10.5.d) Addition: Common Design Requirements (All Categories). Materials. Welding

PWHT is required for all carbon and ferritic alloy steel pressure-containing components that are welded and/or weld repaired, when the weldment is exposed to a process containing wet H₂S. The PWHT procedure outlined in the ASME SEC VIII D1, Paragraphs UW-40, UW-49, UH-32, and UCS-56 shall be followed, except that the notes in Tables UHA-32 and UCS-56 to not apply. All welds, regardless of type or size, that are exposed to wet H₂S shall be PWHT at a minimum temperature of 620°C (1150°F). External attachments or seal welded threaded connections on P-1 Group 1 and 2 materials do not require PWHT.

6.2.1.2.1 Clarification: Design Requirements (Category-Specific). Category 1 Seals. Seal Chamber and Gland Plate (Category 1)

A distributed seal flush system shall be provided for Arrangement 1 and, when specified, for Arrangement 2 seals with rotating flexible elements.

6.2.2.2.1 Clarification: Design Requirements (Category-Specific). Category 2 Seals. Seal Chamber and Gland Plate (Category 2)

A distributed seal flush system shall be provided for Arrangement 1 and, when specified, for Arrangement 2 seals with rotating flexible elements.

4.5 Modifications to Section 7: Specific Seal Configurations

7.1.2.2 Modification: Arrangement 1 Seals. Seal Chamber and Gland Plate

Unless otherwise specified, a close-clearance (floating) carbon throttle bushing shall be provided for Category 1 or Category 2 seals in flammable or hazardous liquid applications.

7.2.1.4 Substitution: Arrangement 2 Seals. General

The recommended buffer fluid shall be specified on the data sheet by seal vendor.

4.6 Modifications to Section 8: Accessories

8.1.3 Addition: Auxiliary Piping Systems

The proposed auxiliary piping layout, including type and orientation of battery limit connections shall be subject to purchaser approval. All battery limit connections shall be flanged.

4.7 Modifications to Section 9: Instrumentations

9.1.2 Substitution: General

Unless otherwise specified, controls and instrumentation shall be designed for outdoor installation and shall meet the requirements of IP 65 as detailed in IEC 60529 (NEMA 4, Publication 250) for mechanical protection and, when applicable, the pertinent section of IEC 60079 for protection against explosive atmosphere.

9.4.2 Exception: Pressure Gauges

Pressure indicators for use on unpressurized dual seal reservoirs shall meet the requirements of Paragraph 9.4.2 except the maximum reading on the gauge shall permit the high pressure alarm (when supplied) reading to be approximately 3/4 of full scale. In order to comply with the MAWP of the reservoir, the gauge shall be certified to have a burst or rupture pressure above the reservoir MAWP or a liquid filled isolation diaphragm having a burst pressure at least 1.5 time the reservoir MAWP shall be installed between the reservoir and the gauge.

9.5.3.1 Addition: Switches. Level Switches

Unless otherwise specified, capacitance type level switches shall be used.

9.6.1 Addition: Level Indicators

All materials for level indicators shall be compatible with the barrier/buffer fluid and the pump and flush fluids.

9.7.1 Addition: Flow Instruments. Flow Indicators

Materials for flow indicators shall be compatible with the buffer/barrier fluid and the pump and flush fluid and shall have pressure and temperature rating at least equal to the pump casing.

9.8.3 Clarification: Relief Valves

Thermal relief valves shall be provided for components that may be blocked-in by isolation valves. Vendor shall mark THERM outside the relief valve symbol on the schematic.

4.8 Modifications to Section 10: Inspection, Testing and Preparation for Shipment

10.1.1 Clarification: General

The extent of inspection and testing participation, as well as the advance notice, are defined in the equipment data sheets.

10.1.5 Modification: General

The vendor shall provide, at an early stage of the contract, a quality control plan listing the proposed program of inspection and testing, for purchaser review and agreement, on the items to be witnessed or observed and the hold points.

10.1.8 New Paragraph: General

Inspection shall include suborders, materials, welding, heat treatment, repairs, non-destructive testing, dimensional check, approval of test data and certification, final inspection prior to shipment and, when applicable, verification of the statutory certification, such as European Community Directives and associated "CE" marks, etc.

10.2.4 New Paragraph: Inspection

Hardness of parts, welds, and heat-affected zones shall be verified on H2S service.

10.4.1 Modification: Preparation for Shipment

Preparation for shipment shall be in accordance with the requirements stated in the purchase documents.

10.4.3 Modification: Preparation for Shipment

The painting of all exterior surfaces shall be suitable for the specified environment. The paint, preparation, and painting procedure shall be approved by purchaser and shall include both primer and finish coat.

4.9 New Section 12: Guarantee and Warranty

12.1 New Paragraph: Guarantee and Warranty

Vendor shall be responsible for the commercial and engineering coordination, supply, delivery and satisfactory operation of the complete sealing unit, including any other auxiliary equipment in vendor's scope of supply.

12.2 New Paragraph: Guarantee and Warranty

Vendor shall be responsible for parts supplied by its sub suppliers.

12.3 New Paragraph: Guarantee and Warranty

Unless exceptions are recorded in vendor proposal, it shall be understood that the vendor agrees to the guarantees and warranties specified below:

12.3.1 New Paragraph: Guarantee and Warranty. Mechanical

Unless otherwise specified in the purchase order, all equipment and component parts shall be warranted by the vendor against defective materials, design and workmanship for one year after being placed in service or 18 months after date of delivery whichever is the earliest.

12.3.2 New Paragraph: Guarantee and Warranty. Performance

The equipment shall be guaranteed for satisfactory performance at the operating conditions specified in the data sheet.

12.3.3 New Paragraph: Guarantee and Warranty. Make-Good

If any performance deficiency or defect occurs during the guarantee and warranty period, the vendor shall make all necessary alterations, repairs and replacement at the conditions defined in the purchase documents.

4.10 Modifications to Annex G: Standard Flush Plans and Auxiliary Hardware

Figure G.12: Addition: Standard Seal Flush Plan 23

Valved vent and valved drain connections shall be provided in the upper and lower side of flush harness.

Figure G.14: Addition: Standard Seal Flush Plan 32

Vendor's scope of supply shall also include block and check valves, Y-strainer and flow indicator (rotameter).

Figure G.17: Addition: Standard Seal Flush Plan 52

Vapor vent line shall also include check and CSO block valves. A valved drain shall be provided in the lower side of the harness.

High-level alarm (LAH) shall be supplied when pump leakage into barrier system would not activate the PSH, such as in aqueous solutions or low seal chamber pressure applications.

Figure G.18: Addition: Standard Seal Flush Plan 53A

The external barrier gas supply connection shall also include a pressure control valve, CSO block and check valves, and a 3 mm restriction orifice. A valved drain shall be provided in the lower side of the harness.

A relief valve is required when gas source pressure exceeds reservoir MAWP, or due to local codes.

Figure G.19: Addition: Standard Seal Flush Plan 53B

The sealant make-up connection shall include Y-strainer, a 3 mm restriction orifice and block and check valves. A valved drain shall be provided in the lower side of the harness.

A relief valve is required when gas source pressure exceeds accumulator MAWP, or due to local codes.

Figure G.20: Addition: Standard Seal Flush Plan 53C

The sealant make-up connection shall include Y-strainer, a 3 mm restriction orifice and block and check valves. A valved drain shall be provided in the lower side of the harness.

Figure G.21: Addition: Standard Seal Flush Plan 54

Vendor scope of supply shall include Y-strainer, flow indicator (rotameter), control and check valves, pressure indicator, pressure switch, a 3 mm restriction orifice, and block valves.

Figure G.24: Clarification: Standard Seal Flush Plan 62

Vendor scope of supply shall include block and check valves and a drain drip nipple.

Figure G.30: Clarification: Standard Seal Flush Plan 72

Vendor scope of supply shall include block and check valves.

Figure G.31: Clarification: Standard Seal Flush Plan 74

Vendor scope of supply shall include block and check valves.

Figure G.32: Clarification: Standard Seal Flush Plan 75

The level switch shall be provided. Vendor scope of supply shall include a check valve installed upstream the block valve.

Figure G.33: Addition: Standard Seal Flush Plan 76

Vendor scope of supply shall include a check valve installed upstream the block valve.