Installation and maintenance instructions

shaft seals

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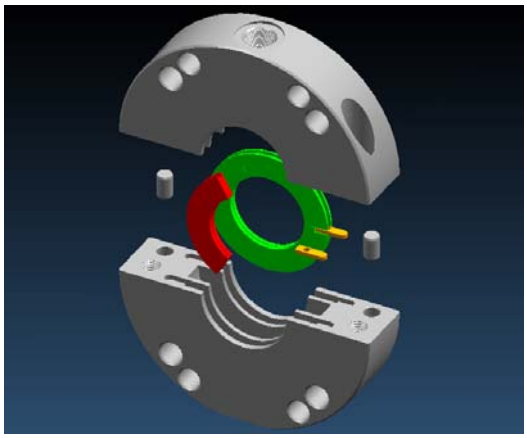

Vers.2, 2011

This installation and maintenance instructions are applicable for following seal types:

-Shaft seal with parted housing
Types: ADKS...)*
ADKF...
ADK...
ADS...

-Shaft seal with chamber housing
Type: AK...

)* example: ADKS140-50

AD: ABACUS Seal
K: short design
S: barrier gas port G1/2”
140: sealing diameter in mm
50: length in mm

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1. Brief descricption

1.1 Design and functional principle

The shaft seal AD200 and AK300 is a contactless working seal and is designed with a labyrinth gap.

Non-contact seals tight spaces of different pressure or the same pressure (as a protective seal), without contact between the shaft and housing. Through the gap of the seal, the medium flows from the space of higher pressure through several choke points to the space of lower pressure. Non-contact seals have thus always a degree of permeability. Non-contact seals are easily accessible to theoretical considerations and calculations, as the relationships to determine the leakage from the known equations of fluid dynamics and thermodynamics are derived.

The shaft seal AD200 and AK300 is a sealing system that is designed for sealing of rotating shafts with respect to stationary housing, eg a compressor to the shaft to the compressor housing (stator).

The shaft seal AD200 consists of a 2-parted housing and internally mounted seal rings. In the case of the shaft seal AK300 there is a chamber design with different chamber elements (modular principle). The number of seal rings can vary, in practice between 2 and max. 12 seal rings have proved successful. The 3-part seal rings which are hold by a spring are locked against rotation. Since there is no dynamic load by parts in the seal, no vibrations are generated by the shaft seal.

To achieve effective sealing, the use of a suitable barrier medium is essential. For this purpose, there is installed a barrier port (1 /2 " or 1/ 4 ") between the seal rings axially. As sealing medium there is N2 or any other suitable gas or air suitable. For certain clean or load-free operation, there is also the use of blocking fat possible.

Lubrication of the shaft seal is not necessary, because it is optimized for dry run.

1.2 Feature requirements

The proper function of the shaft seal is achieved only if the following conditions are met:

- Use of the shaft seal in accordance with the conditions for which it was selected
- Long-term use (monitoring) of barrier gas, specially with corrosive, toxic and environmentally- or noxius medium
- Axial and radial movement of the shaft work within the tolerances of the original brand
- The system bears the built-in seals is operated under the normal parameters (no severe vibration etc.)
- Formation of deposits on the surface of the shafts or sleeves by example crystallization, polymerisation is excluded.

If these functional requirements are not met, an increased leackage may occur or possibly shorten the working life of the seal or seal rings. To protect the shaft against running tracks of the sealing elements, a surface hardness of min. 300HB on the shaft or shaft sleeve is recommended.

1.3 Characteristics:

radial movability: 5mm (AD200)
2mm (AK300)

Size: D45…200mm (AD200)
D20…300mm (AK300)
Seal rings: PTFE compound mat. (max. 200°C) and carbon/graphite alloys (up to 500°C)

2. Safety guidelines

Read these instructions carefully. If the shaft seal is installed in accordance with the following instructions a smooth function over a long period of time could be expected.

For related shaft seal auxiliary equipment (air heaters etc.), separate instructions are available.

The operator must ensure that those personnel assigned handling, install and operate of the shaft seal and associated equipment is well acquainted with the design and operating requirements of such equipment.

Damage to any of the seal components and in particular the faces may cause (excessive) leakage in liquid or gas form. The degree of hazard depends on the sealed product and may have an effect on people and /or the environment. Components coming into contact with leakage must be corrosion resistant or suitably protected. Plant regulations concerning work safety, accident prevention and pollution must be strictly adhered to.

Improper handling of the shaft seal is in the subsequent operation a significant risk. Should be observed on the seal components during assembly of damage, they are replaced immediately

3. Actions before mounting the shaft seal

Before assembly, the seal components are checked. Make sure the counter surface to the seal is free from contamination and damage. Before mounting the contact surfaces are cleaned with a lint-free cloth to ensure a clean environment.

3.1 Required Tools and Parts:
- screwdriver and screws 1)
- liners (such as wood windows)
- Lint-free towels
- Flat sealing 1)
- Medium-and temperature-resistant sealing paste
- appropriate measuring tool
- appropriate cleaning agents to clean the butt joints (the joints are part of the assembly with a sealing paste is provided, which are renewed each time you open the shaft seal must)
- assembly drawings

3.2 Shaft seal unpack and place it on a lint-free flat surface on the plane surface.
Butt joints and screws apart the two halves carefully.
The sub-areas may not be tilted, otherwise the seals could be damaged.
3.3 Mounting all seals
3.4 The partial joints to be cleaned with a suitable detergent
3.5 All parts of the shaft seal ready set clearly on a clean surface.
3.6 check the shaft for the specifications.

4. installation of the shaft seal

4.1 Installation of shaft seal AD200

4.11 gasket 1) insert to the machine housing.
4.12 The lower housing half of the shaft seal to place under the shaft, liners
place between the machine housing and the lower housing half of the seal. Lower housing half with the
Mounting screws lightly. By means of the intermediate layers, a larger
Space for movement during assembly of the two halves met.
4.13 The sealing rings (Fig.4.1) are placed as in Fig. For this, the segments which energized the
Tension springs are kept in shape, keep on a support and carefully laid out the spring
solve. All parts (seal ring segments, spring and lock) put on a pad.
4.14 The mainspring of the first free slot for the sealing rings slide in the housing (Fig.4.2). Then
the spring to take the opposite side, insert the lock and close the spring.
4.15 The first segment of a ring seal between the spring and shaft insert. Gradually, the
other segments to insert. The lock must be attached to a particular segment.
4.16 The locks must be placed horizontally.
4.17 The sealing rings shall be positioned according to the direction of rotation as shown.
4.18 The contact surface of the upper half of the housing with appropriate seal coat paste 2) wafer-thin.
4.19 The upper half of the housing set up carefully on the lower half of the housing, while important to the
Eighth position of the seals.
4.20 liners removed, align the seal to the shaft and the mounting screws on the
Machine wall screw on cross
4.21 Existing connections for sealing gas or blocking fat plug. When operating with blocking fat, the
fat chambers should be filles with grease before.

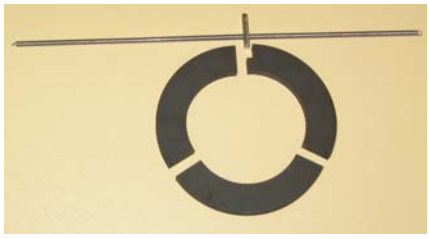


Fig. 4.1: seal ring AD200

Fig. 4.2: Seal ring AD200

Fig. 4.3: placing tension spring

4.2 Installation of shaft seal AK300

Before assembly the chamber parts should be mount on the shaft or shaft sleeve

4.21 The chamber parts are moved individually to the shaft / shaft sleeve.
The sealing rings are parted, but should be mounted as a complete part at this stage, following the instructions,
with the shaft / shaft sleeve are threaded. Are the seals now on the
Shaft / shaft sleeve, then made the further assembly of the seal to follow as in chapter 3.8.
If a separate sealing ring assembly may be necessary, then follow the instructions below.
4.22 The sealing rings are mounted as follows:
4.23 The sealing ring is present as in Fig.3.3. The tension spring is provided with a hook and an eyelet which together are the spring lock form.
4.24 Open the spring of the sealing ring and hold it with the segments on a clean base.

All sealing ring segments when opening the spring to hold on. The spring is under tension and the segments could leave unchecked.

4.25 Put the tension spring around the shaft / shaft sleeve insert and close the spring lock.
4.26 Lift the spring from the shaft / shaft sleeve, then first segment between the spring and the Insert shaft / shaft sleeve and insert the spring into the spring groove of the sealing ring.

The sealing ring segments must enclose the segment identification in accordance with this arrangement, the shaft / shaft sleeve.

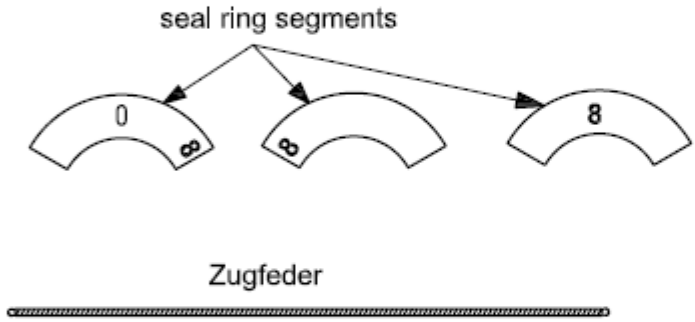
4.27 The other segments in compliance with the labeling mount as well.
Again, check that the sealing ring segments covered in the correct order of the Segment marking the shaft / shaft sleeve wrap.
4.28 Insert the seal ring axially on the shaft / shaft sleeve in the chamber housing
Note: The locking pin must engage in the locking groove of the sealing ring.
4.29 As described above, assemble all the existing seals.
4.30 complete seal unit to the machine back wall slide, align the shaft and with the site fixing screws and tighten evenly.
4.31 After connecting any existing extraction or purge gas lines, the shaft seal is operational.

Note: If the application is provided by a grease trap, the grease chambers are pre-filled with care. Fat not give up by force, otherwise they could damage the sealing rings.

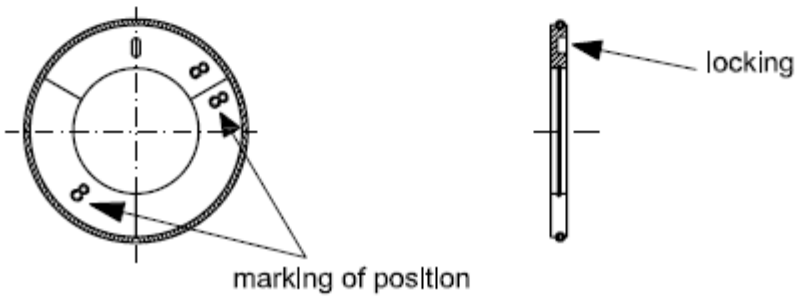
Seal ring structure

Fig.: 3-parted seal ring in chamber design AK300

parts in single position:
1. 3 seal ring segments
2. tensioning spring



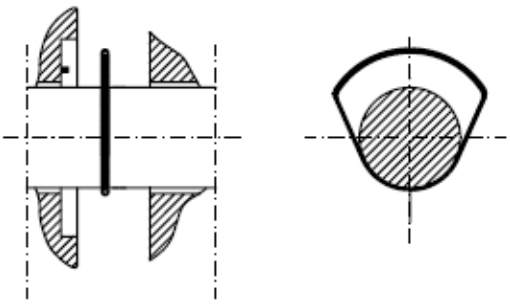
Part in mounted position:
3-tig. seal ring with tensioning spring around



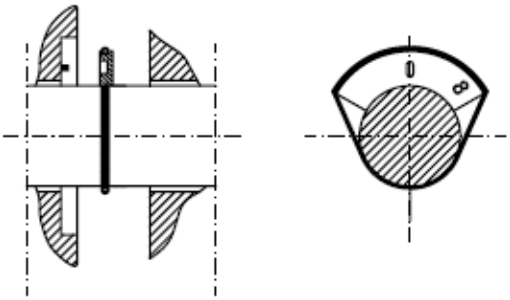
Seal ring mounting on a shaft

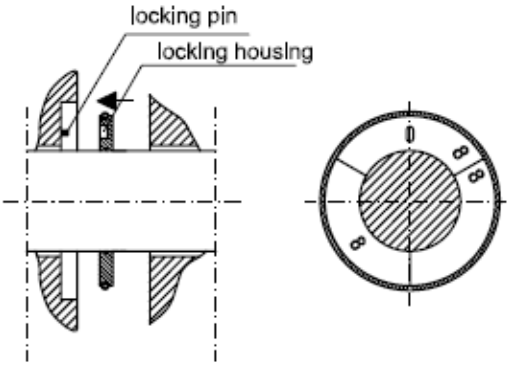
fig.: 3-parted seal ring AK300

1. tensioning spring on the shaft



2. Inserting segments of the seal ring





5. Dismantling of the shaft seal

The machine must be stopped first. Before the shaf tseal can be removed the machine has to wind down. All connections to be disconnected.

The barrier fluid must be relaxed if the machine is not under pressure. When removing the shaft seal, leakage of product is possible. Safety measures and protective clothing are to be considered in accordance with the applicable investment rules and comply. In the interval of the machine maintenance and in particular in case of damage the shaft seal must be dismantled, checked and cleaned. The exchange of seals is recommended.

Required Tools and Parts

•screwdriver, measuring tool
•liners (such as wood windows)
• Lint-free towels
• Medium-and temperature-resistant sealing paste
• Replacement/spare seal rings
• appropriate cleaning agents to clean the butt joints (the joints are provided with s fluid seal paste and must be sealed /provided with seal paste each time when the shaft seal is opened)
• assembly drawings

5.1 Dismantling of the shaft seal AD200

5.11 Proceed as follows: Loosen the mounting screws (not remove them), insert liner (between the lower housing half and machine wall), now fix the mounting screws at the bottom remove screws upper side, solve butt joints and screws
5.12 Now lift up the upper housing case carefully.
5.13 Lift the springs of the seal rings and then remove them.
5.14 Before further steps, all components to be checked.

5.2 Dismantling of the shaft seal AK300

5.21 Loosen the mounting screws and remove them.
5.22 The entire seal unit to be moves as far as possible axially until the running surface of the seal is visible, then remove seals.
5.23 All sealing components check up if any damage.
5.24 Before further steps, all components to be checked.

If the shaft / shaft sleeve is damaged, the entire seal must be removed. Shaft / shaft sleeve to be repaired or replaced and then the shaft seal to be mounted as described in Chapter 4 (installation the shaft seal)

6. General Informations

With regard to the representations and information contained in this installation and technical manual changes that are necessary to improve product performance, are reserved.

For damage or malfunction resulting from disregard to the instructions, ABACUS SEALS has no liability for consequences.

7. Transport, storage

The shaft seal and the associated accessories shall be transported in the unopened original shipping box and store. The location of the shaft seal and the associated accessories must be dry and dust free. Parts or complete shaft seals that are thrown during transport or were exposed to a strong shock may not be installed. Inspections by ABACUS SEALS or suitable and qualified staff will - before installation - highly recommended.

After a storage period of 3 years, the shaft seal should be reviewed about suitability. This is especially the sealing surfaces of the primary and secondary seals. Inspections by ABACUS SEALS is recommended.

In the case of conservation of the machine with built / built-in shaft seals, the preservative should not affect the function of the shaft seal, eg attack by not sticking to the sealing surfaces and the secondary seals.

8. Recommendation for operation

8.1 Pressure and temperature in the seal chamber and the sealing medium may not exceed the recommended maximum operating limits. Also, the shaft speed must work in the Operating limits which have do not exceed the seal. For seals which are used with buffer gas, the correct pressure of the buffer gas must be ensured. Due to low buffer gas pressure medium may escape, environmental pollution and increased wear or failure of the shaft seals is possible. For seals with vacuum or vent to the atmosphere there must be ensured that solid-free and no environmentally harmful substances are conveyed.The seal gas chamber can be used as a suction chamber. In this case, the pressure in the suction pabs. = not exceed 1 bar.

8.2 If not otherwise specified, the buffer gas pressure should at least be 0.1 bar above the pressure in the seal chamber. The seal must be necessarily subjected to pressure before the machine is started. In the same way, the pressure system will only discharge when the machine is completely isolated, is relieved and exhausted.

8.3 ABACUS SEALS can support based on information of the medium or product, seal size and art, properties of the seal gas and shaft speed information the leakage amounts which have to provide. Make sure that the purge gas or medium is clean and compatible with the Delivery medium or product.

8.4 The seal is designed so that it (at request and indicating operating parameters) against the / the listed in the product (s) (e) corrosion-resistant.

8.5 The grease locks are not used to lubricate the shaft seal, but only to increase the leaks. Using a grease seal the leakage or seal gas consumption of the shaft sea to be reduced by up to 90%. The grease must be medium-and temperature-resistant. For a several months of maintenance-free operation for grease dispensers are used.

Don´t use the seal materials with other materials than those specified in the request materials.
Consult ABACUS SEALS, if you are in doubt or if you use the seal for a different purpose than that for which it was designed for.

9. Maintenance

The maintenance of the facility as applicable, consists of the monitoring of pressure, temperature, leakage and consumption of barrier gas. Control/monitoring of buffer gas pressure and consumption is recommended. An increase in the values indicates worn seals. Is there a risk of dew point (acidification of the medium), we recommend a barrier gas heater for to use. The purge gas temperature should have approximately the operating temperature of the medium.

10. Spare parts, repair

This shaft seal is designed for reliable operation under appropriate conditions. But upon reaching the end of their normal life expectancy or to use outside of its constructive power limits are repairs or carry out an exchange of the sealing rings is necessary. This product is a precision seal. For the performance of the seal design and tolerances are crucial. Therefore spares which are only supplied by ABACUS SEALS to be used to repair this seal. These parts are available from ABACUS SEALS or the manufacturer of the machine. It is recommended to stock a set of seals to keep the downtime of the machine as low as possible. For damage caused by the use of spare parts and Accessories that have no liability or guarantee of ABACUS SEALS excluded.

Shaft seals can be repaired normally. If a repair is necessary, the seal is carefully dismounted in the machine.

Detoxify and clean the sealing unit, and send them to the company address.

The consignment must be accompanied by a signed attestation for decontamination. For each product, that has come in contact with the seal must be a material safety data sheets (MSDS) must be attached. The seal system is inspected and, if it is repaired, an estimate for restoring the original condition is presented. Following the adoption of the estimate, the sealing parts refurbished, tested and returned to the sender. The content of this brochure are product information and technical data in our view is correct, but only given for information purposes and therefore should not be interpreted with confidence in their accuracy as a confirmation or a guarantee of satisfactory results be. The information contained in this brochure is to be construed as a warranty on your product to more than contractually guaranteed or implied warranty as enclosed.

ABACUS SEALS can indeed formulate general guidelines for use, but do not give specific information about all possible applications. The ultimate responsibility for determining conformity of the selection, installation, operation and maintenance of the products must therefore accept the buyer / user. Since ABACUS SEALS execution of their products ever improved and brings up to date, the products listed in this brochure technical data, dimensions and specifications are subject to change without notice.

1) according to the contract, they must be procured locally/at site

2) suitable sealing paste for example: seal-s203

Additional operating instructions

Shaft seal applications in explosive environment acc. to ATEX (guideline 94/9/EG)

For applications in machines group II, category 2 G TX und 3 G TX

This additional instructions is supplementary to the existing standard installation and maintenance instructions for shaft seals acc. AD200, AK300, A1, so far as it is necessary for applications in explosive environment.
This instructions covers only the shaft seal, for all other components the relevant instructions are to be considered.

Attention!

Please read this instructions conscientiously, all hints to be consider carefully. If there are any questions, please contact the manufacturer. All works to be done by competent persons. In any case of use or installation of materials and spare parts which are not acc. the manufacturers specifications the conformity acc. 94/9/EG is not valid also guarantee expires.

Type of operation
The shaft seals is permitted for to use in intended applications as in this instructions. In any other case as acc. the manufacturers specifications the conformity acc. 94/9/EG is not valid also guarantee expires.

Attention!

It is not allowed to operate the shaft seal in deviating conditions and above the max. permissible pressure, temperature, medium, barrier gas as in the operating instructions.

Type of operation with barrier gas

Barrier gas serves for the inertisation and cooling of the seal and additionally prevents penetration of particles. Temperature increasing by friction of the seal rings is reduced.

Supply with barrier gas is to be guaranteed by the operator of the machine. It is recommended to use a pressure control device. The use of barrier grease is not permissible.

Expected life time of shaft seal

The life time of the seal rings depends from various conditions as

- Operating pressure max. 1,5 bar abs., barrier gas pressure max. 1,8 bar abs.
- temperature
- particle content in barrier gas (particle size: ≤10µm)
- surface quality of parts (see tb.1)
- Stop and go operation
- vibrations

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Due to the operating conditions the shaft seal has to be inspected regularly.

Protection with barrier gas

Shaft seals which are planned for operation with barrier gas are equipped with a G1/2“ barrier port. Barrier gas has to be supplied continuously with a suitable pressure by the operator. We recommend a barrier gas control system. It is important to regulate the pressure and not the flow quantity.

Category 2G

Measurement has to be near to the shaft seal housing and installed conformal to ATEX. A barrier gas control device acc. to FFR1, prEN13463-6 –SIL – EN61508 is to plan.
All connections to be technically tight.

Category 3G

Measurement has to be near to the shaft seal housing and installed conformal to ATEX. Barrier gas should be inspected continuously. If the operating pressure of the machine is not continuously a barrier gas contril device as in category 2 G is recommended also.

Nitrogen (N2) is preferred as barrier gas. Also other barrier gas may me acceptable, in this case it is necessary to have the manufacturers release.

Conditions for the barrier gas:

- In case of operating in vacuum, barrier gas prevents the penetration of oxygen into the explosive area
- Barrier gas to be **free of particles > 10 µm**. If it is not, a filter is recommended.

Use of temperature control

Optionally it is possible to use a temperature control in shaft seals. In this case the housing is made with a thread for the installation of temperature control (PT100).
In case of installation EN13456-6 and EN60079-14 to be consider. A metallic contact between measuring surface and Shaft seal housing must be ensured.

Range of temperature

The shaft seals are designed specially for the planned operating temperatures. An ambient temperature of 40°C is considered. If other higher temperatures are possible the manufacturer must be informed.

Additional heat up of the sealing housing must be excluded

- Protection against solar radiation and other heat sources
- Isolation and lacquer finish or any other surface treatment of the sealing housing is permitted
- Dust has to be cleaned from the housing regularly

Running surface of the seal rings

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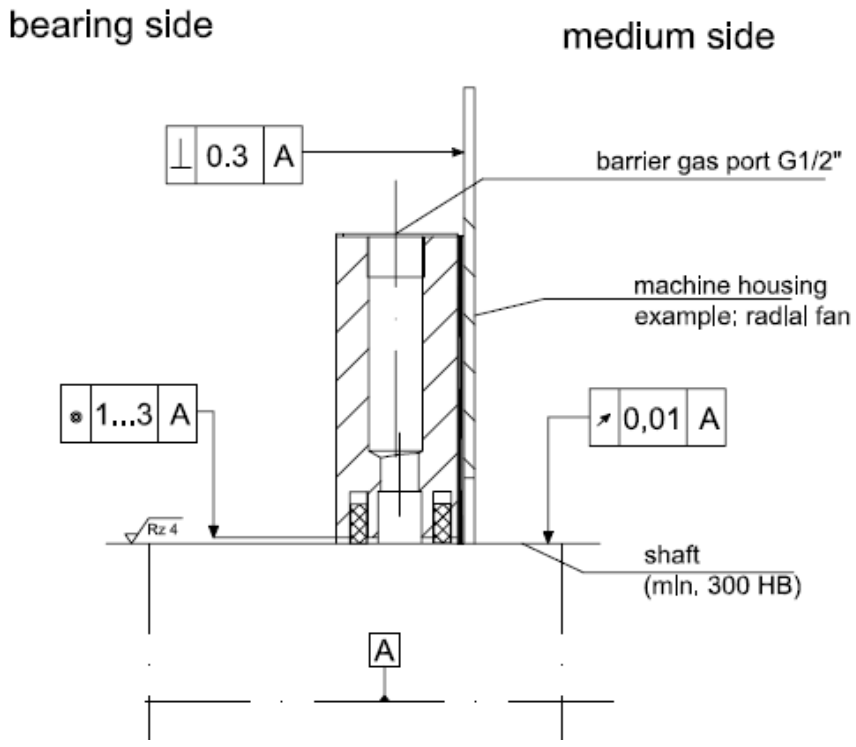
Acceptable tolerances between shaft seal and machine acc. tbl.1

shaft seal type	surface quality of running surface	concentricity of runnig surface	hardness of running surface	fitting in the area of shaft seal	deviation of the angle between housing and running surface	concentricity between housing and running surface
	max. Rz [µm]	max. [µm]	min. [HB]		max. (mm)	max. (mm)
AD200 Ex	0,8 / 4	10	300	h6	0,3	3
AKA300Ex	0,8 / 4	10	300	h6	0,3	1
A1Ex	0,8 / 4	10	300	H6	0,3	1

Tbl.1



Sketch Tbl. 1

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Shaft vibrations to be controlled and documented with ATEX conform device and components. High shaft vibrations may cause rise in temperature and excessive wear.

Storage, assembly disassembly, maintenance and disturbance treatment

1. Generally

-In case of any work at the shaft seal it is to guarantee that no explosive atmosphere is existing or may develop

-dust has to be cleaned from surfaces on the shaft seal housing and the near area

-EN1127-1, is to consider

The proceeding for the assembly, disassembly, repair is to be inferred from the standard operating and maintenance instructions to the series AD200 and/or AKA300.

Storage and transport of the rotary shaft seal:
Seal construction units do not vibrate, throw, push, or to fall leave. Store drying up to the assembly in the transportation packing and dust free. If defective parts or damages are recognizable, the rotary shaft seal is to be examined in an appropriate way, since this is otherwise useless. Defective seals or seal parts may not be inserted.

The manufacturer and also the operator of the equipment, into which the rotary shaft seal is built, must guarantee when assembling/repair that excluding original sealing rings are used. If defective parts or damages are recognizable, the rotary shaft seal is to be examined in an appropriate way, since this is otherwise useless. Defective seals or seal parts may not be inserted.

2. Preparation for the assembly

The seal parts are on damages to exchange deformations and outbreaks by transport or storage to examine if necessary. If defective parts or damages are recognizable, the rotary shaft seal is to be examined in an appropriate way, since this is otherwise useless. Defective seals or seal parts may not be inserted.

3. Assembly

When assembling of the secondary seals (by manufacturer of machine) is to be respected sufficiently metallic cross sections to the potential equalization between seal housings and equipment rear wall. The electrical resistance may not exceed1 GΩ . If this cannot be ensured it is to use a ground strap. Parting line and fixing bolts must be tightened with the torques specified in table 2. Liquid screw locking is permitted only if the potential equalization is guaranteed by ground straps. If defective parts or damages are recognizable, the rotary shaft seal is to be examined in an appropriate way, since this is otherwise useless. Defective seals or seal parts may not be inserted.

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Thread	M6	M8	M10	M12	M16
class of strength	A4-70	A4-70	A4-70	A4-70	A4-70
nut torque $M_{A\ dry}$	7 Nm	16Nm	31Nm	53Nm	129Nm

Table 2: torques

4. Disassembly

Safety references to work on the rotary shaft seal:
Before work on the rotary shaft seal (assembly, disassembly and repair)
-In case of any work at the shaft seal it is to guarantee that no explosive atmosphere is existing or may develop

-dust has to be cleaned from surfaces on the shaft seal housing and the near area

-EN1127-1, is to consider

The proceeding for the assembly, disassembly, repair is to be inferred from the standard operating manual to the series WD200 and/or WKA300.

5. Inspection

Additional the following points are to be particularly considered with regular inspections (intervals are from the operator to specify).

Examination of the barrier gas pressure (permissible values see technical documentation). Remove possibly existing dust deposits on the seal

With use of temperature sensors: Examination of the temperature in the seal (permissible values see technical documentation).

Temperature sensors for function, damage and strain relief of the cable run examine? Examine and if necessary clean possibly upstream filters depending upon solid content of the barrier gas for permeability

6. Maintenance and repair

The shaft seal components are to be examined for damages (tears, outbreaks, perceptible intake scoring) and if necessary exchange.

During repair of the shaft seal components must be achieved again in table 1 or the parameter indicated in the special design.

In principle sealing rings are to be exchanged with regularly taking place maintenance work (specified by the equipment manufacturer). The marking of the spare sealing rings must agree with the last revision conditions of the associated technical documentation. When operator changes the operating conditions (pressures, temperatures, wave/wave case diameter etc..) this is to be communicated to the manufacturer.

7. Disturbance treatment

In case of an incident, which was caused by the rotary shaft seal (e.g. check gas loss), as well as by exceeding of the values permissible for the rotary shaft seal (see technical documentation), to examine is the seal in each case

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to open (references in chapter 4 disassembly consider) and check. The components are to examine on damages (references see chapter 6 maintenance and repair). In particular the sealing rings are to examine on outbreaks flakings and inadmissibly high wear of the inside diameter.

8. Marking

The installed sealing rings are individually bored after the operating parameters. For replacement the ident No. is required or the order number is to be indicated, which are laid on for identification on the construction units.