

Description: Operating manual for BT-BURGMANN mechanical seals

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**REVISION TABLE**

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REV.	DATE	SEE FOR EMISSION	DESCRIPTION / MODIFICATION	STARTING DATE	APPROVED
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## 1. OBJECT AND APPLICATION FIELD

This Technical Specification is the operating manual for assembly, operating condition and maintenance of BT-BURGMANN mechanical seals.

To ensure optimum seal performance and to avoid any inconvenience or malfunction, please carefully READ and OBSERVE the following operating instructions. In the event of any doubt, please contact BT-BURGMANN.

This procedure is valid for all BT-BURGMANN mechanical seals, listed as follow:

- AR / AR3
- RN / RN3 / RN6
- FN / FN3
- FH / FHC / FH6
- PN / PNL
- PNT
- A2
- A3
- RN.NU / RN3.NU / RN6.NU
- RN.NB / RN3.NB
- FN.NU / FN.KU
- FH.NU / FH.KU
- C5.KU / C56.KU
- C5.KB / C56.KB
- C5E / C53E

## 2. SAFETY

Any person being involved in assembly, disassembly, start-up, operation and maintenance of the BT-BURGMANN mechanical seals must have read and understood this operating manual and in particular the safety notes. We recommend the user to have this confirmed in writing.

BT-BURGMANN mechanical seals are manufactured on a high quality level (the Company has attained the quality system certification UNI EN ISO 9001:08) and they keep a high working reliability.

Although, if the mechanical seals are not operated within their intended purpose or handled inexpertly by untrained personnel, they may cause risks.

The user has to check what effects a failure of the mechanical seal might have and what safety measures have to be taken to prevent personal injury or damage to the environment.

The pump has to be put up in such a way that seal leakage can be led off.

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The pump has to be disposed properly to avoid any injury caused by spurting product in the event of a seal failure.

BT-BURGMANN mechanical seals must be operated, maintained or repaired by authorized, trained and instructed personnel only.

In principle, any work to be done on the mechanical seal is permitted when the seal is neither operating nor pressurized.

The responsibilities for the respective jobs to be done have to be determined clearly and observed in order to prevent unclear competencies from the point of safety.

Apart from the notes given in this manual, the general regulations for worker's protection and for the prevention of accidents have to be observed.

Unauthorised modifications or alterations which affect the operational safety of the mechanical seal are not permitted.

### 3. MANUFACTURER

BT TENUTE MECCANICHE ROTANTI S.p.A.

Via Leonardo da Vinci n.9

36057 Arcugnano – Vicenza (Italy)

### 4. DISTRIBUTOR

BT BURGMANN S.p.A.

Via A. Meucci n.58

36057 Arcugnano – Vicenza (Italy)

### 5. EUROPEAN DIRECTIVES

Directive 2006/42/EC "Machine Directive": Mechanical seals are machinery elements, i.e. they do therefore not come under the range of application of the Machinery Directive.

Directive 94/9/EC "ATEX Directive": It should be noted that the standard BT-Burgmann mechanical seals are not made for applications in potentially explosive atmospheres.

For any specific request, please contact the technical department BT-Burgmann.

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**6. OPERATING LIMITS**

The operating limits for BT-Burgmann mechanical seals are indicated in the catalogue.

Operating conditions: Shaft diameter  $d_1$  [mm]  
 Pressure to be sealed  $p_{max}$  [bar]  
 Temperature of medium  $t$  [°C]  
 Sliding velocity  $v$  [m/s]

Seal type	Diameter $d_1$	Pressure $p_{max}$ (*)	Temperature $t$ (**)	Speed $v$ (*)
<b>AR - AR3</b>	6 ÷ 60	6	-20 ÷ +140	10
<b>RN - RN3 - RN6</b>	8 ÷ 110	10	-70 ÷ +200	20
<b>FN - FN3</b>	10 ÷ 40	10	-20 ÷ +180	20
<b>FH - FHC - FH6</b>	10 ÷ 100	10	-70 ÷ +200	20
<b>PN - PNL</b>	8 ÷ 40	12	-20 ÷ +120	10
<b>PNT</b>	1/2" ÷ 3/4"	12	-20 ÷ +120	10
<b>A2</b>	1/2" ÷ 3/4"	4	-20 ÷ +90	10
<b>A3</b>	14 ÷ 16	12	-20 ÷ +120	10
<b>RN.NU - RN3.NU - RN6.NU</b>	10 ÷ 100	10	-70 ÷ +200	20
<b>RN.NB - RN3.NB</b>	10 ÷ 100	40	-20 ÷ +180	20
<b>FN.NU - FN.KU</b>	10 ÷ 40	10	-20 ÷ +180	20
<b>FH.NU - FH.KU</b>	10 ÷ 100	10	-70 ÷ +200	20
<b>C5.KU - C56.KU</b>	20 ÷ 100	10	-70 ÷ +200	20
<b>C5.KB - C56.KB</b>	20 ÷ 100	40	-70 ÷ +200	20
<b>C5E - C53E</b>	20 ÷ 80	12	-20 ÷ +180	15

(\*) The operating limits change in accordance with the materials of the sliding faces and directly depend on the PV factor.

(\*\*) The temperature range depends from the elastomer used in the secondary seal elements.

Operation exceeding the max operating limits are not allowed

Higher loads (pressure, temperature, speed) can increase wear or lead to damage sliding faces or elastomers. This could result in a seal shorter life time and in the risk of a sudden seal failure, dangerous for people and environment.

If the seal should be operated under different conditions than those indicated, consultation with the BT-BURGMANN technical department is recommended.

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## 7. TEMPERATURE LIMITS FOR ELASTOMERS

The following table shows the allowed temperature range, in Celsius degree, for conventional o-ring (elastomers and non-elastomers):

<i>Elastomers</i>	(*)	<i>Temperature [°C]</i>	<i>Notes</i>
<b>Nitrile butadiene rubber (NBR)</b>	<b>P</b>	- 20 ÷ + 90	
<b>Chloroprene rubber (CR)</b>	<b>C</b>	- 30 ÷ + 120	
<b>Ethylene propylene (EPDM)</b>	<b>E</b>	- 40 ÷ + 140	not resistant to mineral oils and greases
<b>Silicone rubber (VMQ)</b>	<b>S</b>	- 50 ÷ + 200	
<b>Fluorocarbon rubber (FKM)</b>	<b>V</b>	- 20 ÷ + 200	in hot water at max 120°C
<b>Butyl rubber</b>	<b>B</b>	- 40 ÷ + 140	not resistant to mineral oils and greases
<b>Perfluorocarbon rubber (FFKM)</b>	<b>K</b>	+ 270	possible swelling in fluoride solvents
<b>PTFE</b>	<b>T</b>	- 200 ÷ + 250	

(\*) material designation according EN12756:2000

## 8. WORKING CONDITIONS

The mechanical seal should be constantly wetted by liquid media.

It is important to avoid a dry running of the seal.

The media to be sealed should not damage the mechanical seal neither chemically (corrosion, embrittlement) nor physically (erosion, abrasion).

The seals also fit to be used as multiple mechanical seals in tandem arrangement together with a quench supply or as double mechanical seals together with a barrier fluid system.

In case of double opposite mechanical seal assembly, we recommend to use a barrier fluid suitable with the circulating product, at a pressure of 1,5 ÷ 2 bar higher than the fluid to be sealed.

## 9. EMISSIONS (LEAKAGES)

A mechanical seal is a dynamic seal that cannot be free of leakage due to physical and technical reasons.

Seal design, manufacture tolerances, operating conditions, quality of the machine, etc. mainly define the leakage value. In fact, compared to other dynamic sealing systems, there is the presence of a small leakage.

A possibly increased leakage during start-up will decrease to a normal quantity after the running-in period of the sliding faces.

The leakage can be liquid or gaseous, depending on the aggressiveness of the medium to be sealed.

Medium may splash out if the seal fails.

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Personal injury may be prevented by the user providing for splash protection and wearing safety glasses.

User has to take care for proper disposal of the leakage.

Leakage of mechanical seal at outboard side has to be drained and disposed properly.

Components which may get in contact with the leakage have to be corrosion-resistant or have to be properly protected.

**10. TRASPORT**

If not specified differently by contract, the BT-BURGMANN standard packing is used which is suitable for dry transport by truck, train or plane.

The warning indications and notes on the packing must be observed.

Notes for incoming inspection:

- Check packaging for visible damage
- Open packaging carefully. Do not damage or lose parts supplied
- Check if consignment is complete (delivery note)
- Inform the supplier immediately if parts are damaged or missing

**11. STORAGE<sup>1</sup>**

These instructions apply to all BT-BURGMANN mechanical seals which have been supplied and stored in their undamaged original packaging as well as to seals which have been installed in a component of a plant (e.g. pump, compressor, agitator, etc.), but have not been put into operation yet.

A preservation of the BT-BURGMANN mechanical seals is not necessary. Do not use anticorrosive.

Sliding materials and elastomers are subject to material-specific and time based alterations (distortion, ageing) which might reduce the full efficiency of the seals.

This may be avoided by observing the storage instruction.

Damages caused by improper storage may not be claimed on the BT-BURGMANN company with reference to their warranty.

Store the mechanical seals in their original packing, lying on a flat surface.

Indications for storage of mechanical seals:

- constantly tempered (relative air humidity below 70%; optimal temperature should be around 25°C; storage temperature must be in the range of -30°C / 50°C)
- dust-free
- moderately ventilated

<sup>1</sup> For storage of elastomers parts, following International Norm ISO 8331:2007

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Protect the seal from:

- direct exposure to heat sources (sun, heating)
- ultraviolet light (arc welding, halogen or fluorescent lamps, sunlight)
- risk of embrittlement or swelling of elastomeric materials
- direct contact with chemical agents (never put EPDM elastomers in contact with mineral oil and grease)
- Ozone potential sources (high voltages sources, electric motors, etc)

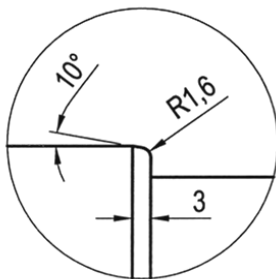
Check the mechanical seal:

- after a storage period of approximately 2-3 years
- in case of a damage of the packing
- after a shock on the mechanical seal (e.g. by dropping down the packed seal)

## 12. PRELIMINARIES TO ASSEMBLY

Preliminary controls at the machine:

- All connecting surfaces free from burrs and sharp edges
- Radiused transitions
- Chamfered edges (it is preferable a cone of 2mm x 30° or in accordance with EN 12756:2000, according to the following figure):



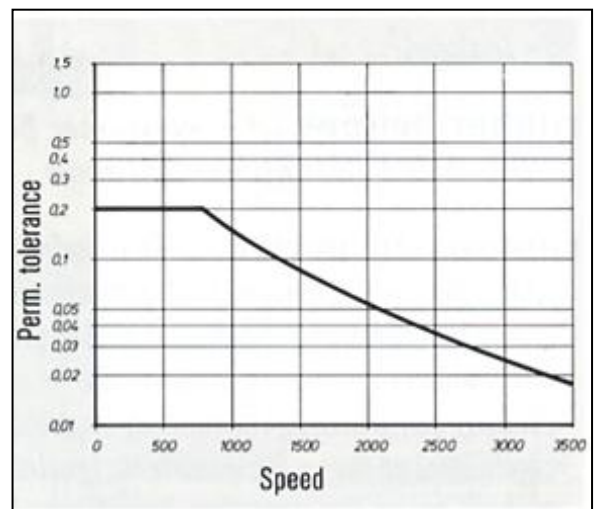
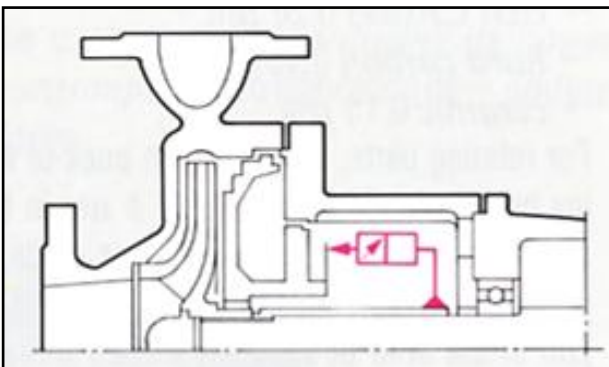
- Ensure that quotes and tolerances of the shaft and seat diameters are strictly observed (refer to BT catalogue or to BT-BURGMANN technical dept. specific drawings).
- Provide a shoulder or stop device for the seal driver to take up the axial forces
- To fit at the assembly quote our BT-PN and BT-PNL mechanical seals, with back ring, in case of lock with seeger ring, it is suggested to insert a 2-3 mm spacer ring (e.g. a washer) between the seeger and the back ring to avoid a deformation of the back ring itself.

**Description: Operating manual for BT-BURGMANN mechanical seals**Shaft and seat finished surfaces:

- for bellows mechanical seals (BT series AR, PN, PNL, PNT and A3) shaft finishing must have a roughness Ra from 0,6  $\mu\text{m}$  to 1  $\mu\text{m}$
- for o-ring mechanical seals (BT series RN, FN, FH and C5) shaft finishing must have a roughness Ra from 0,4  $\mu\text{m}$  to 0,6  $\mu\text{m}$
- for PTFE wedge mechanical seals (BT series RN6, FH6 and C56) shaft finishing must have a roughness Ra  $\leq 0,2 \mu\text{m}$
- the seat surface must have a roughness Ra  $\leq 2,5 \mu\text{m}$  in case of stationary seats with elastomers, and a roughness Ra  $\leq 1,6 \mu\text{m}$  in case of stationary seats with PTFE.

Check at the machine:

- damage of connecting surfaces to the mechanical seals
- matching dimensions, rectangularity and concentricity to the shaft axis
- concentricity accuracy of the shaft, according to ISO 5199:2002
  - diameters up to 50 mm: max 0,05 mm
  - diameters 50  $\div$  100 mm: max 0,08 mm
  - diameters exceeding 100 mm: max 0,1 mm
- Axial run-out: it is the axial oscillation of the seal surface measured on a single complete shaft rotation. The run-out tolerances depend on the shaft rotation speed. Exceeding the above values, the seal life decreases and fluid leakages can occur.

*Run-out and tolerances*

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### 13. UTILITIES AND TOOLS

For an easy seal assembly, the following utilities and tools are suggested:

- Ethyl alcohol
- Water and detergent (water and soap solution at 2%)
- Pusher tools
- Mounting sleeves or cones

### 14. ASSEMBLY

The BT-BURGMANN mechanical seals are precision components requiring special attention during assembly. The seal should remain packed until the assembly, operations have to be done in dust-free surroundings. Cleanliness must be as well observed for the different pump components, as chips and blasting traces can damage irreparably the seal.

Should any seeger seats, locks for keys or sharp edged seats be present on the shaft, the use of pushers or mounting sleeves is required, thus avoiding to compromise the secondary seals integrity (cuts on bellows or o-rings).

For installation the assembly drawing of the mechanical seal (working length and the related dimensions) has to be available.

At this point:

- Unpack the seal and check seal face, seat and elastomer bellows for possible damages.
- Ensure that the sliding faces are perfectly clean from greases, oils and any dirty (possible leakage).
- Preferably mount the seal dry by the use of pushers.

In case of difficult assembly, to reduce the seal friction, sprinkle the seat or the shaft with ethyl alcohol (or water + 2% detergent) ensuring the sliding faces remain dry and clean.

Oil or grease as assembly agent has to be avoided absolutely.

- For BT-BURGMANN bellow seals (series BT-AR, BT-PN, BT-PNL, BT-PNT and BT-A3) push the rotating seal unit (bellows) with a slow clockwise turn onto the shaft until the bellows shoulder is settled on the shaft. Keep the shaft wet if the distance to slide the seal is rather long.
- Do not use any lubricant on the seal surfaces.  
Seal surfaces must be absolutely clean and dry.
- Never assembly the seal out of the installation tolerances suggested by BT-BURGMANN catalogue or drawing, ensure that the seal is perfectly settled on its stop.

Do never force during installation.

Absolutely avoid the seal is having impacts or shocks.

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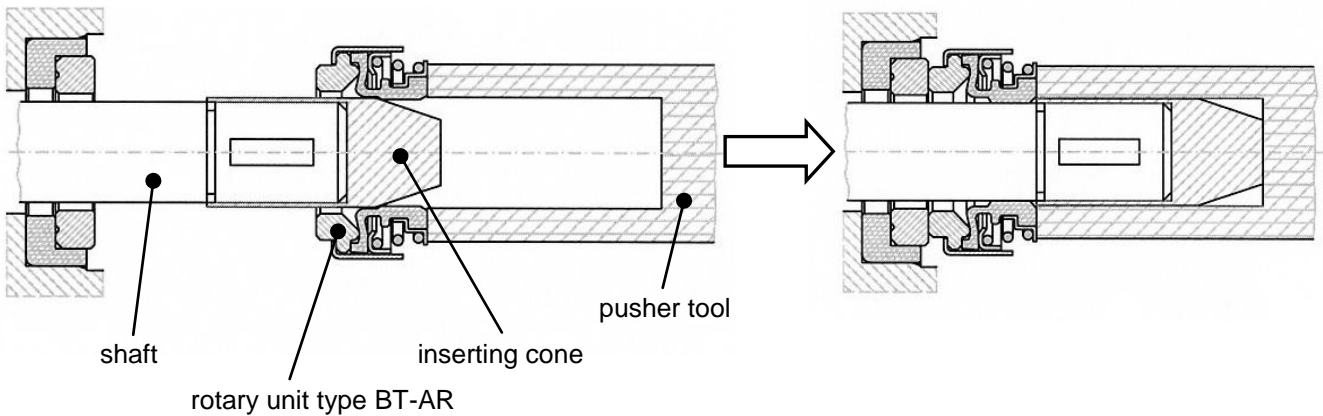
If by accident the seal drops to the ground, its integrity must be verified and eventually replace the seal with a new one.

**Never put EPDM elastomers in contact with mineral oils or greases.**

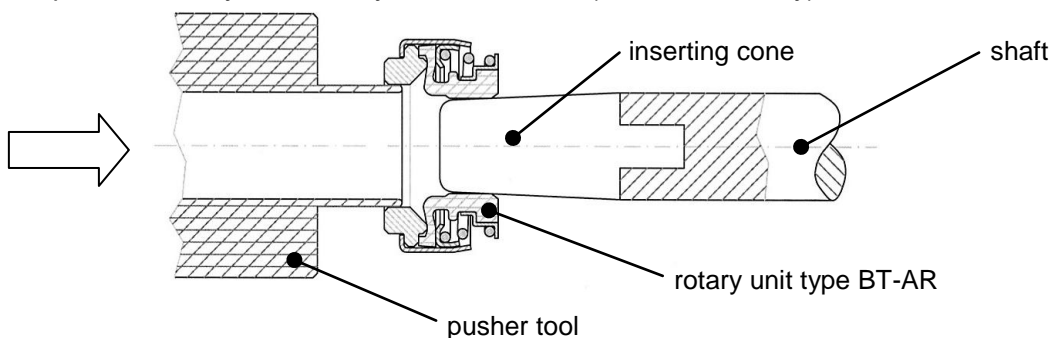
For any problem or anomaly, please contact our technical department for the proper explanations and information.

Following the above instructions helps to avoid damages to the sealing system and subsequent leakage.

- *Example of assembly of the rotary unit BT-AR seal (straight assembly)*

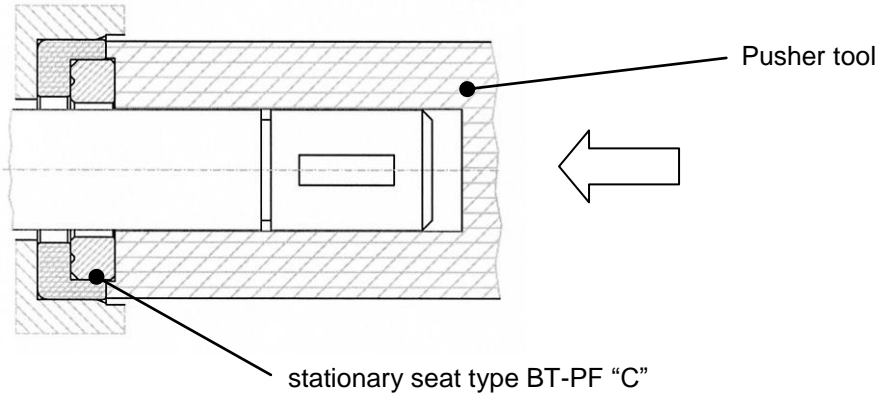


- *Example of assembly of the rotary unit BT-AR seal (reverse assembly)*



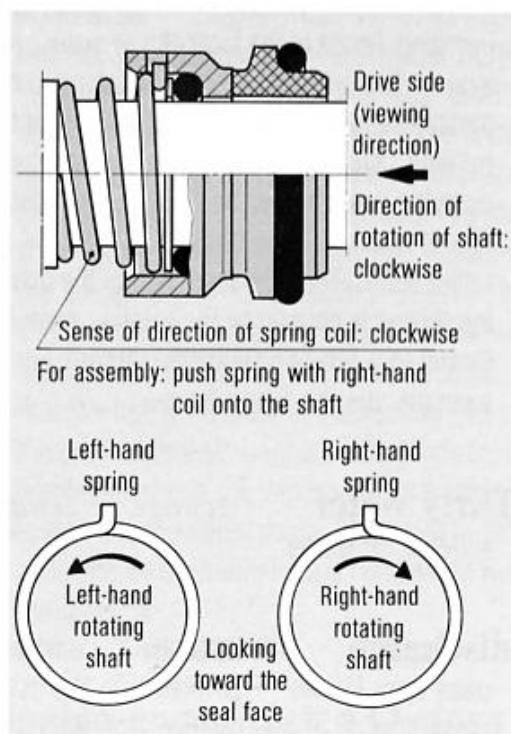
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- *Example of assembly of a stationary "C" shaped seat*

**15. DIRECTION OF ROTATION**

The BT-BURGMANN mechanical seals types AR, PN, PNL, PNT, A2, A3 and C5 have independent rotation direction and could be assembled on machines having both clockwise or anticlockwise direction of shaft rotation.

The BT-BURGMANN mechanical seals types RN, FN, and FH, driven by a conical spring, have dependent direction of rotation, therefore it must be ensured that, looking toward the seal face, the shaft direction of rotation and the winding direction of the conical spring (left-hand or right-hand thread) must be the same.



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## 16. START UP

Flood pump and seal cavity (stuffing box) with media and vent thoroughly.

To prevent damage to the sliding faces from dry running, the buffer space must be carefully vented.

Now the seal is ready for operation.

The mechanical seal has constantly to be wetted by the product in its liquid form, especially when the pump is started or stopped.

The pump design has to be done to take this need into consideration (e.g. heating of the product).

Never start the machine in dry conditions (dry running) to avoid irreparable damages of the sliding faces.

If the operation limit values and the instructions given in this manual are observed, a trouble-free operation of the mechanical seal can be expected.

## 17. WORKERS PROTECTION

BT-BURGMANN's mechanical seals are seldom used for sealing hazardous substances (chemical, medical substances, etc.). If that were the case, the valid regulations for handling hazardous substances have to be observed by all means.

Media may splash out if the seal fails.

Personal injury may be prevented by the user, providing for splash protection and wearing safety goggles, etc., as well as take care for proper disposal of the leakage.

## 18. TROUBLES DURING OPERATION

In case of failure due to high leakage the amount of leakage should be observed.

Changes of the operating conditions have possibly to be recorded.

In case of hazardous substances leakage from the mechanical seal, the machine must be shut down for safety reasons.

A continuous, flowing leakage indicates that the seal is damaged and must be replaced.

## 19. MAINTENANCE

The correctly operated mechanical seal needs no maintenance.

Wear parts, however, have to be replaced if necessary (e.g. o-ring parts).

An inspection of the mechanical seal should be carried out during a revision of the machine.

If the mechanical seal is disassembled during a revision of the plant it should be replaced by a new one.

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## 20. REPAIR

In case of seal failure, it should be replaced by a new one.

It's recommended to store a complete seal for a quick replacement, as spare parts.

If repair has to be done on site, it should be carried out in a clean room, preferably by trained personnel.

## 21. SEAL REMOVAL

- Shut down the pump in duly procedure, let it cool down and depressurize it.
- Drain the pump if necessary.
- Secure the pump against inadvertent start.
- Observe the safety notes.

In principle, any work to be done on the mechanical seal is allowed only when the seal is neither operating nor pressurized. We recommend to follow the regulations for preventing accidents valid in your Country.

If the seal have been in operation with hazardous substances the regulations for handling hazardous substances must be followed.

In case of doubt the necessary information has to be obtained before starting repair.

The order of disassembly to remove the mechanical seal out of the pump depends on the design of the pump and has to be determined by the pump manufacturer.

The disassembly (removal) of the seal is carried out in the reverse sequence as described for assembly (set up).

## 22. DISPOSAL INSTRUCTION

Usually, the BT-BURGMANN mechanical seals can be easily disposed after a thorough cleaning.

- Metal parts (steels, non-ferrous heavy metal) divided into the different groups belongs to scrap metal waste.
- Secondary seals materials (elastomers, PTFE) belong to special waste. Some of them, divided into the different groups, can be recycled.

**Attention:** material containing fluorine (e.g. Viton o-rings, PTFE) must not be burnt.

- Ceramic materials (synthetic carbons ceramics, carbides) can be separated from their housing materials and disposed as common waste.

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### 23. TECHNICAL ASSISTANCE AND INFORMATION

For information or enquiries (technical information, prices, orders, etc.) please contact us at the following address: BT-BURGMANN S.p.A.

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web site [www.btburgmann.com](http://www.btburgmann.com)

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