

Operating manual for EAGLEBURGMANN BT mechanical seals

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REVISION TABLE

		DATE FIRST EMISSION	EMISSION / CHECKED	APPROVED	
		09/03/2005	<i>Alessandro Bedin</i>	<i>Alessandro Bedin</i>	
REV.	DATE	SEE FOR EMISSION	DESCRIPTION / MODIFICATION	STARTING DATE	APPROVED
1	11/01/2010	<i>Federico Zugno</i>	New emission technical specification (PRT 02/2010)	11/01/2010	<i>Alessandro Bedin</i>
2	17/02/2014	<i>Federico Zugno</i>	Update technical specification (PRT 20/2014)	17/02/2014	<i>Alessandro Bedin</i>
3	27/01/2017	<i>F. Zugno / A.Bedin</i>	Revision chapters 1, 2, 4, 5, 6, 23	27/1/2017	<i>Alessandro Bedin</i>
4	10/11/2017	<i>Cristian Cavedon</i>	Revision of chapters 1, 4, 5. Addition of chapter 24.	10/11/2017	<i>Alessandro Bedin</i>

EagleBurgmann® EagleBurgmann BT S.p.A. Arcugnano (Vicenza) - Italy	TECHNICAL SPECIFICATION	S004		
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1. OBJECT AND APPLICATION FIELD

This Technical Specification is the operating manual for assembly, operating condition and maintenance of EagleBurgmann BT 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 EagleBurgmann BT. This procedure is valid for all BT mechanical seals, listed as follow:

Rubber bellows seals, independent rotation direction, type

- AR / AR3
- PN / PNL
- PNT
- A2
- A3
- ARP

Pusher seals with conical spring, dependent on rotating direction, type

- RN / RN3 / RN4 / RN6
- FN / FN.NU / FN.KU
- FH / FHC / FH6 / FH.NU / FH.KU
- RN.NU / RN3.NU / RN4.NU / RN6.NU / RN.KU / RN3.KU / RN4.KU / RN6.KU
- RN.NB / RN3.NB / RN.KB / RN3.KB
- FH.NB / FH.KB

Pusher seals, multi-springs, independent rotation direction, type

- C5.KU / C56.KU
- C5.KB / C56.KB
- C5E / C53E
- C7 / C73 / C7.KU / C73.KU
- C8 / C8.KU

2. SAFETY

Any person being involved in assembly, disassembly, start-up, operation and maintenance of the EagleBurgmann BT 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.

The EagleBurgmann BT mechanical seals are manufactured on a high quality level (the Company has obtained the quality system certification UNI EN ISO 9001) and they keep a high working reliability.

Nevertheless, mechanical seals may generate risks if they are not used within their intended purpose or handled inexpertly by untrained personnel.

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The user has to check what effects a failure of the mechanical seal might have on the plant/process where it is working, on environment, safety and health of people, by considering that an eventual breaking of the mechanical seal leads to the contact between the two usually parted environments.

The user has to define which safety measures have to be applied to prevent personal injury or damage to the environment.

The pump has to be set up so that product of seal leakage can be easily led off.

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

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

In principle, any work required on the mechanical seal is permitted only 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.

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

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3. MANUFACTURER AND DISTRIBUTOR

EagleBurgmann BT S.p.A.
 Via Antonio Meucci, 58
 36057 Arcugnano – Vicenza (Italy)

4. EUROPEAN DIRECTIVES

Directive 2006/42/EC, so called "Machine Directive": Mechanical seals are not under the range of application of the Machinery Directive.

Directive 2014/34/EU, so called "ATEX Directive": EagleBurgmann BT mechanical seals can be used in some ATEX applications. If the user needs this requirement, please contact our offices to check if the working parameters are included in the range of application of our products.

Directive 98/83/EC, concerning the quality of water for human consumption: EagleBurgmann BT mechanical seals may be used for these applications, if specific combinations of materials are applied (cf chapter 24 of this document). In this case, the user should contact our offices to verify the compatibility of materials with legislative requirements.

Regulation (EC) No 1935 of 2004, on materials and articles intended to get in contact with food: mechanical seals produced by EagleBurgmann BT have not been tested for such applications. If the user considers the application of a seal in these conditions, it would better to contact EagleBurgmann BT for appropriate check.

Operating manual for EAGLEBURGMANN BT mechanical seals**5. OPERATING LIMITS**

Operating limits for EagleBurgmann BT mechanical seals are specified in the catalogue.

Operating conditions: Shaft diameter d_1 [mm]
 Working pressure p_1 [bar]
 Media temperature t [°C]
 Sliding velocity v [m/s]

Seal type	Diameter d_1	Pressure p_1 (*)	Temperature t (**)	Velocity v (*)
AR – AR3	6 ÷ 70	6	-20 ÷ +120	10
RN - RN3 – RN4 – RN6	8 ÷ 110	12	-35 ÷ +180	15
FN – FN.NU – FN.KU	10 ÷ 40	12 (16)	-35 ÷ +180	15
FH – FHC - FH6 – FH.NU – FH.KU	10 ÷ 100	12 (16)	-35 ÷ +180	15
FH.NB – FH.KB	16 ÷ 70	25	-35 ÷ +180	15
PN - PNL	8 ÷ 40	12	-20 ÷ +120	10
PNT	1/2" ÷ 3/4"	12	-20 ÷ +120	10
A2	1/2" ÷ 3/4"	4	-20 ÷ +90	10
A3	14 ÷ 16	12	-20 ÷ +120	10
ARP	20 ÷ 40	6	-20 ÷ +90	10
RN.NU – RN3.NU - RN4.NU – RN6.NU	10 ÷ 100	12	-35 ÷ +180	15
RN.KU – RN3.KU - RN4.NU – RN6.KU	10 ÷ 100	12	-35 ÷ +180	15
RN.NB – RN3.NB – RN.KB – RN3.KB	10 ÷ 100	25	-35 ÷ +180	15
C5.KU – C56.KU	20 ÷ 100	12 (16)	-35 ÷ +180	20
C5.KB – C56.KB	18 ÷ 100	25 (40)	-35 ÷ +180	20
C5E – C53E	20 ÷ 80	12	-35 ÷ +180	15
C7 – C73 – C7.KU – C73.KU	16 ÷ 100	12 (16)	-35 ÷ +180	20
C8 – C8.KU	16 ÷ 100	12 (16)	-35 ÷ +180	20

(*) 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.

Operations exceeding the max operating limits are not allowed.

Higher loads (pressure, temperature, speed) can increase wear or damage sliding faces or elastomers.

This could result in a seal shorter lifetime and in the risk of a sudden seal failure, dangerous for people and environment.

If the mechanical seal has to operate under different conditions than those indicated, consultation with our offices is recommended.

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6. 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>(*)</i>	<i>Temperature [°C]</i>	<i>Notes</i>
Nitrile butadiene rubber (NBR)	P	- 20 ÷ + 90	
Chloroprene rubber (CR)	C	- 30 ÷ + 120	
Ethylene propylene (EPDM)	E	- 40 ÷ + 140	not resistant to mineral oils and greases
Silicone rubber (VMQ)	S	- 50 ÷ + 200	
Fluorocarbon rubber (FKM)	V	- 20 ÷ + 200	in hot water max +90°C
Butyl rubber	B	- 40 ÷ + 110	not resistant to mineral oils and greases
Perfluorocarbon rubber (FFKM)	K	-5 ÷ + 270	possible swelling in fluoride solvents
PTFE	T	- 200 ÷ + 250	

(*) material designation according EN12756

7. WORKING CONDITIONS

During operation, the mechanical seal should be constantly wetted by liquid media. It is important to avoid the dry running of the seal.

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

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.

8. 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, a mechanical seal has a smaller 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.

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.

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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.

9. TRASPORT

If not specified differently by contract, the EagleBurgmann BT standard packing will be used, as it 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

10. STORAGE¹

These instructions apply to all EagleBurgmann BT 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 EagleBurgmann BT 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 EagleBurgmann BT with reference to their warranty.

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

Indications for storage environment 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

¹ For storage of elastomers parts, following International Norm ISO 2230

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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)

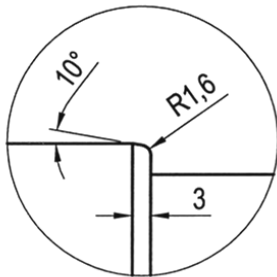
Check the mechanical seal:

- 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)

11. PRELIMINARIES TO ASSEMBLY

Preliminary controls at the machine:

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



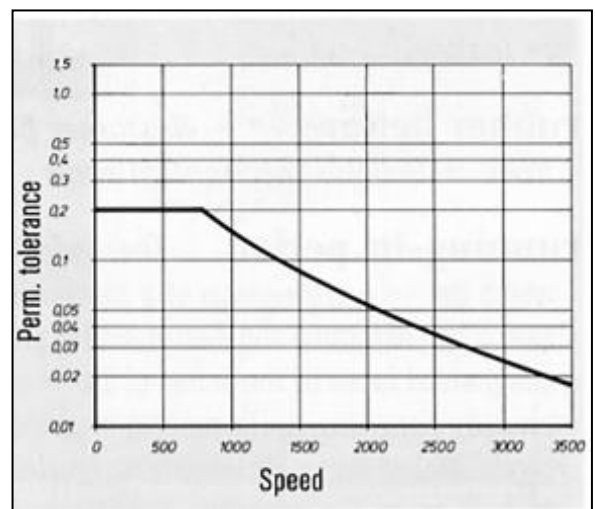
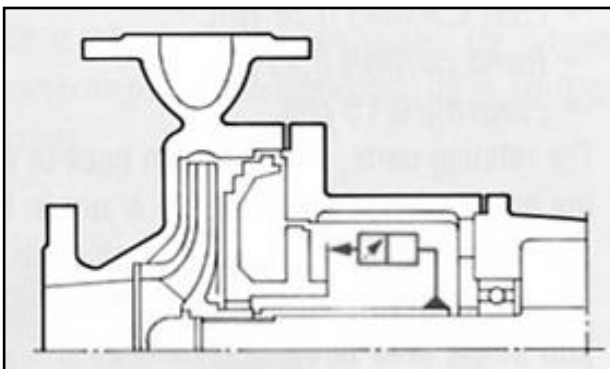
- Ensure that quotes and tolerances of the shaft and seat diameters are strictly observed (refer to EagleBurgmann BT catalogue or to EagleBurgmann BT technical dept. specific drawings).
- Provide a shoulder or stop device for the seal driver to take up the axial forces
- To fit at the assembly quote our BT-PN and BT-PNL mechanical seals, with back ring, in case of locking 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.

Operating manual for EAGLEBURGMANN BT mechanical sealsShaft 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 μm to 1 μm
- for o-ring mechanical seals (BT series RN, FN, FH and C5) shaft finishing must have a roughness Ra from 0,4 μm to 0,6 μm
- 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
 - diameters up to 50 mm: max 0,05 mm
 - diameters 50 ÷ 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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12. 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

13. ASSEMBLY

The EagleBurgmann BT 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. Cleanness 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 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 EagleBurgmann BT 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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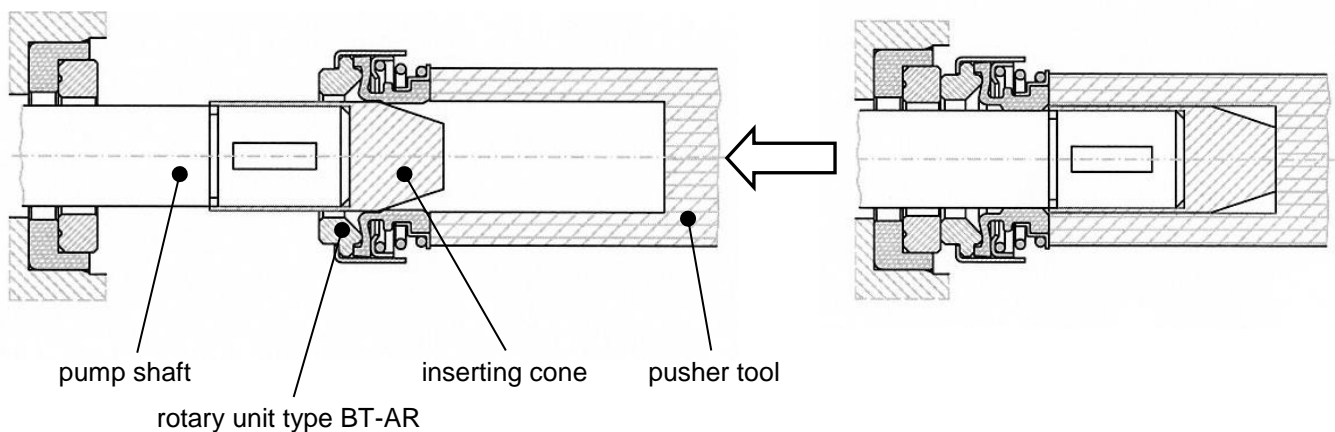
If by accident the seal drops to the ground, its integrity must be verified and the user should, eventually, replace the seal with a new one.

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

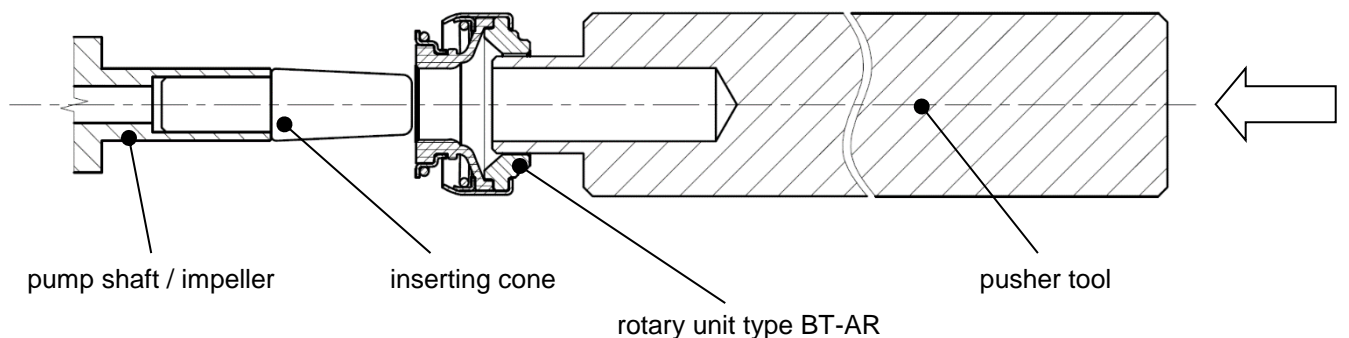
For any problem or anomaly, please contact our technical department for the proper explanations and information.

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)*

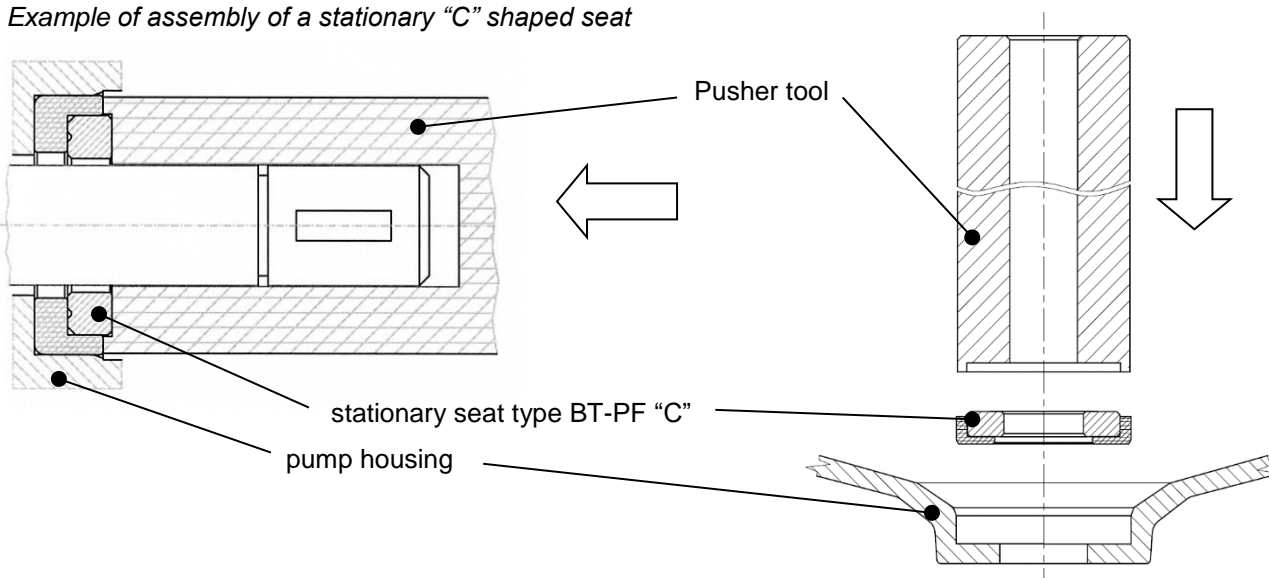


- *Example of assembly of the rotary unit BT-AR seal (reverse assembly)*



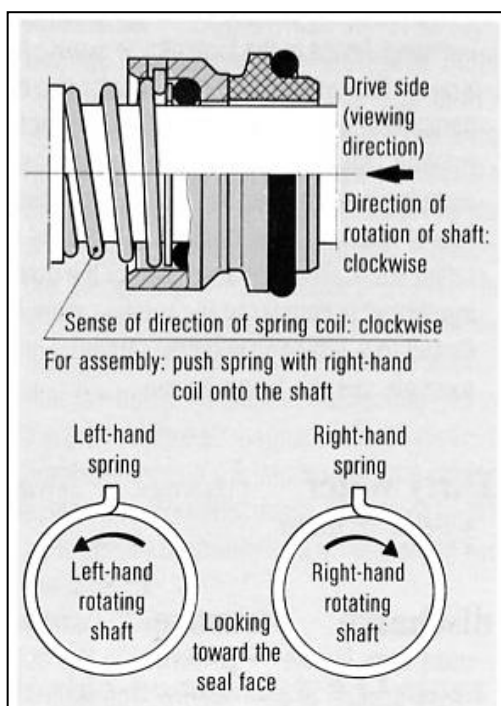
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- Example of assembly of a stationary "C" shaped seat



14. DIRECTION OF ROTATION

The EagleBurgmann BT mechanical seals types AR, PN, PNL, PNT, A2, A3 and C5 have independent rotation direction. They can be assembled on machines having clockwise or counterclockwise direction of shaft rotation. The EagleBurgmann BT 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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15. START UP

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

To prevent damage of 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.

16. WORKERS PROTECTION

The EagleBurgmann BT mechanical seals are seldom used for sealing hazardous substances (chemical, medical substances, etc.). If this is 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.

17. 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.

18. 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 every 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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19. 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.

20. 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 have to be carried out in the reverse sequence as described for assembly (set up).

21. DISPOSAL INSTRUCTION

Usually, the EagleBurgmann BT 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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22. TECHNICAL ASSISTANCE AND INFORMATION

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

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36057 Arcugnano – Vicenza (Italy)

Tel. 0444-288.977

Fax 0444-288.971 / 0444-288.693

e-mail: info@eagleburgmannbt.com

web site: www.eagleburgmannbt.com

23. COPYRIGHT

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EagleBurgmann BT S.p.A. reserves the right to carry out technical modifications which might become necessary to improve our products but are not mentioned in this manual yet.

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24. COMPLIANCE CERTIFICATE TO D.M. 174/04 (ITALIAN LEGISLATION ON DRINKING WATER)

Having regard to the current Italian Legislation:

D.M. n.174 of 6 April 2004

“Materials and objects used in fixed plants for the collection, treatment, supply and distribution of water intended for human consumption”

and the following linked laws:

D.M. 21 March 1973

“Hygienic regulation on packaging, containers and tools intended to come into contact with alimentary substances or with substances for personal care.”

D.M. 4 April 1985

“Regulation on ceramic objects intended to come into contact with alimentary products.”

Council Directive 98/83/EC of 3 November 1998

on the quality of water intended for human consumption

D. leg. n.31 of 2 February 2001

“Transposition of Council Directive 98/83/17 of 3 Nov 1998 on the quality of water intended for human consumption.”

As required under Art 2, comma 3 of D.M. 174/04, **EagleBurgmann BT S.p.A.** –Via Meucci 58, Arcugnano (Vi), Italy – declares that articles commercialized, and belonging to the following classes of product, fit the contact with water intended for human consumption and conform to the applicable regulations.

Arcugnano, 10th Nov. 2017

EagleBurgmann BT S.p.A.

The General Manager

Antonio Maria Costa

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Operating manual for EAGLEBURGMANN BT mechanical seals				

Classes of product fitting for contact with water intended for human consumption, according to D.M. 174/04

EagleBurgmann BT S.p.A. Single Pusher type Mechanical Seals	BT – FN / FN.NU / FN.KU
	BT – RN / RN.NU / RN.NB
	BT – FH / FHC /FH.KU / FH.NB / FH.KB
	BT – C7 / C7.KU
	BT – C8 / C8.KU
EagleBurgmann BT S.p.A. Rubber Bellow Mechanical Seals	BT – AR
	BT – PN / PNL
	BT - PNT
	BT – A2
	BT – A3