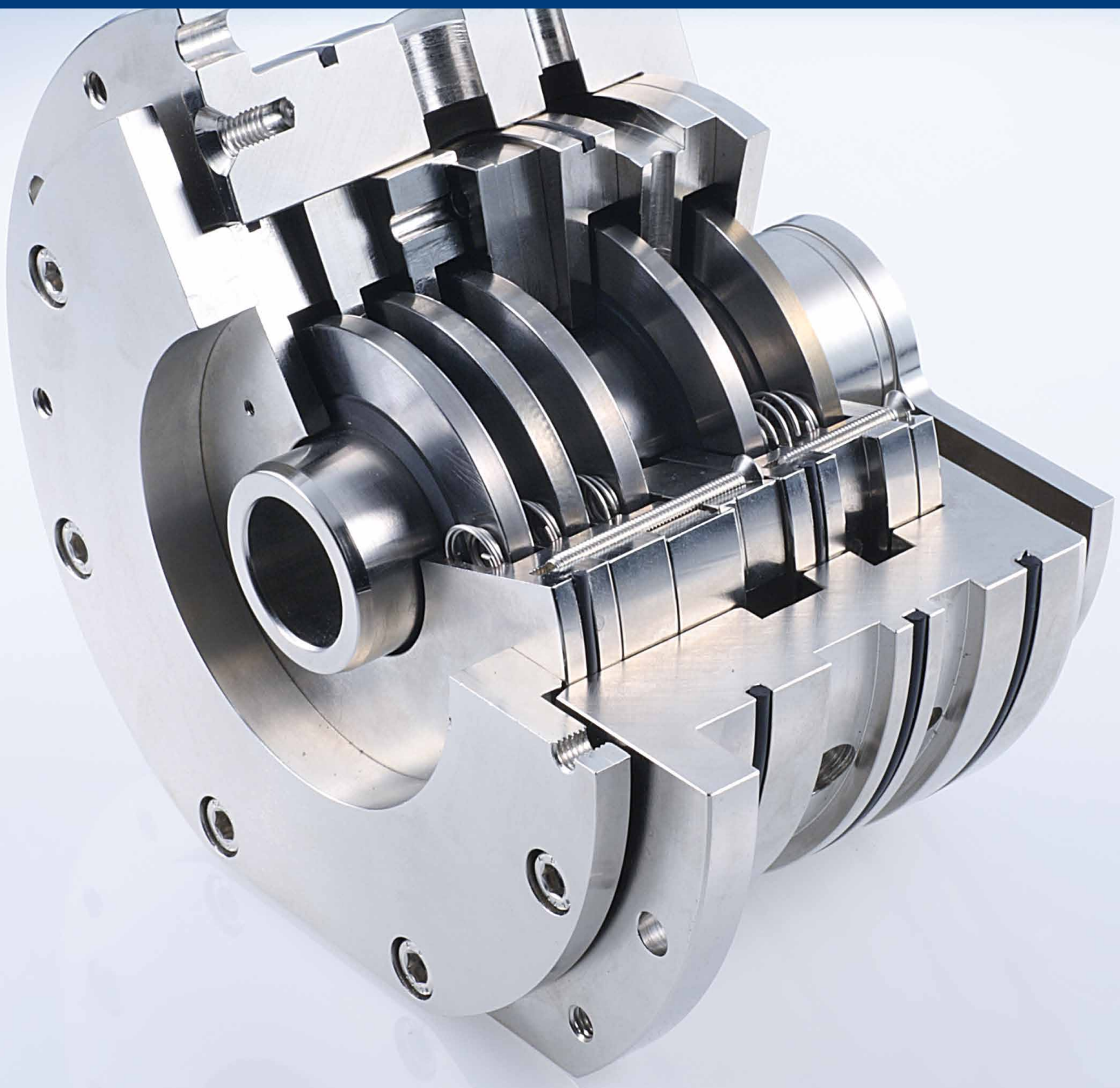
EagleBurgmann®
Rely on excellence

Espey carbon floating ring seals for turbo machines



Pioneering supplier of sealing systems

Customized sealing systems

EagleBurgmann Espey designs and manufactures seals and sealing systems for use in the oil and gas, chemical and petrochemical sectors, in power plant engineering, shipbuilding and in the industry in general.

Our seals offer reliable solutions for sealing a wide range of gases, gaseous mixtures, powders, vapour and water in machines and plants such as turbines, fans, compressors, centrifuges and mills. Among our customers are OEM's, operators and engineering companies from around the world.

In close consultation with our customers, we design seals and systems customized to suit individual applications and installations in a wide range of situations. In addition we provide extensive standard sealings to our customers.

EagleBurgmann Espey innovations are renowned for their added value. Wherever machines and systems require sealing, our products make a major contribution towards boosting performance, durability and efficiency.

Our professional advice and suggested solutions, underpinned by our versatile production facilities, aim to optimize the availability and economic potential of your plant. EagleBurgmann Espey has set itself the goal of significantly shortening delivery times and reliably increasing on-schedule delivery. To achieve these aims, our manufacturing facilities are fitted with the latest production monitoring systems.

EagleBurgmann Espey GmbH

The company was founded by Gustav Espey in Berlin 1888 as a factory for metal stuffing box packings.
With the oneset of industrialization, the company moved to the upcoming Ruhr region in 1927.
The company has been located on the Moers-Genend industrial estate since 2005 and currently employs nearly 100 staffs.

Today the company belongs to the EagleBurgmann Group. EagleBurgmann is an independent business group within the Freudenberg corporation; it manufactures, distributes mechanical seals, packings and static seals, as well as special products for a range of applications and branches of industry, and thus is one of the leading global companies in this field.

Freudenberg is a family-owned global corporation.
With its 14 business groups, the company is active in various sectors and markets.

Creativity, diversity and innovation are the cornerstones of its philosophy. Reliability and responsible conduct characterize the company's 160-year history.
Freudenberg focuses on partnership with its customers, on the long-term perspective, not to mention on financial stability and the excellence of its approx. 32,000 employees in 55 countries around the globe.

Content

Important note

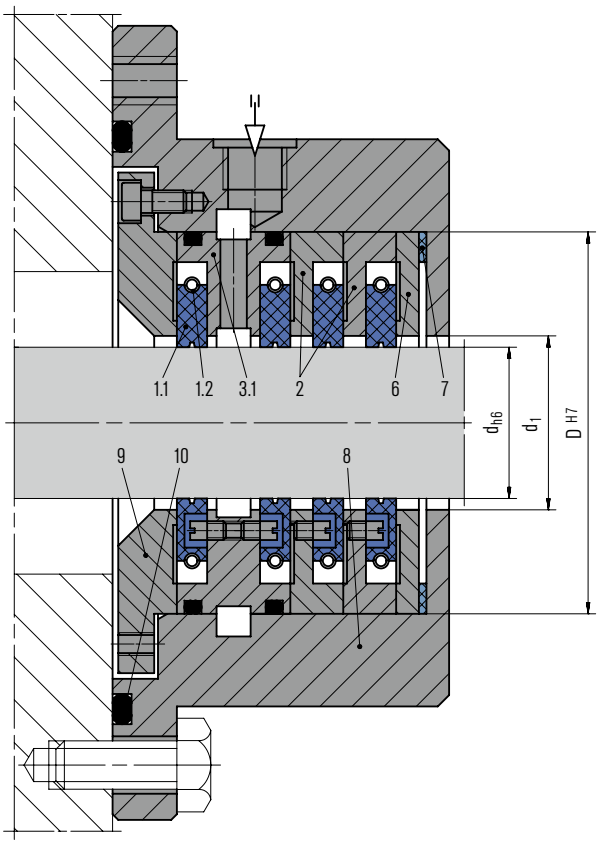
All the technical specifications are based on extensive tests and our many years of experience. However, the diversity of possible applications means that they can serve as guide values only.

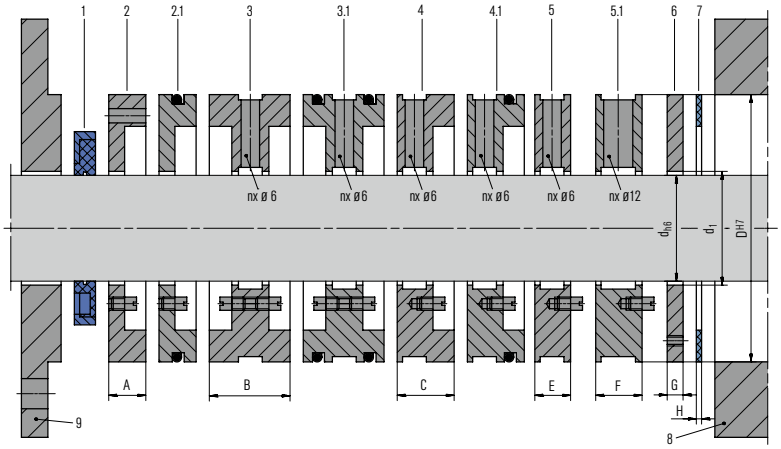
It should be noted that the extremal values of each operating parameter cannot be applied at the same time because of their interaction. Furthermore, the operating range of each specific product depends on the respective shaft diameter, materials used, mode of operation and on the medium to be sealed.

A guarantee can only be given in the individual case if the exact conditions of application are known and these are confirmed in a special agreement. When critical conditions of operation are involved, we recommend consulting with our specialist engineers.

Subject to change

1 Espey WKA250ND





Features

- Chamber seal (modular design – can be combined in any order), optional with housing and lid
- Multi-part seal rings, radially cut
- Very small operation gap – low leakage
- Dry running
- Self-adjusting seal rings
- Seal rings bear radial shaft movements
- Compensates axial shaft movements
- No sealing components mounted on the shaft and hence no additional shaft vibrations
- Seal rings running contact-free – sliding faces and machine consume no additional power
- Balanced seal ring inside chamber

Advantages

- High reliability
- Long-term operation time
- Maintainability
- Segmented seal rings for easy replacement

Operating range (see note on page 3)

Shaft diameter: d = 20 ... 300 mm (0.79" ... 11.81")
Operating pressure: p = vacuum ... 15 bar (218 PSI) abs.
Operating temperature: t = –120 °C ... +500 °C
(–184 °F ... +932 °F) for carbon,
max. 225 °C (437 °F) for PTFE compound
Sliding velocity: v_g = max. 240 m/s (787 ft/s) for carbon,
max. 40 m/s (131 ft/s) for PTFE compound
Radial play: 2.0 mm (0.08")
Axial movement: theoretically unlimited
Recommended wear guard: > 58 HB

Materials

Seal ring: Carbon, PTFE compound
Chamber and housing parts: 1.4021, 1.4571, Hastelloy™, Titan, Inconel™, others
Tension spring: 1.4571, Hastelloy™, Titan, Inconel™
Secondardy seal (elastomer): Fluorocarbon rubber (Viton™), Nitrile-butadiene-rubber (Perbunan™), Perfluorocarbon rubber (Kalrez™)
Secondary seal (gasket): Statotherm™-HT/HD, KSiL C 4400

Standards and approvals

- FDA

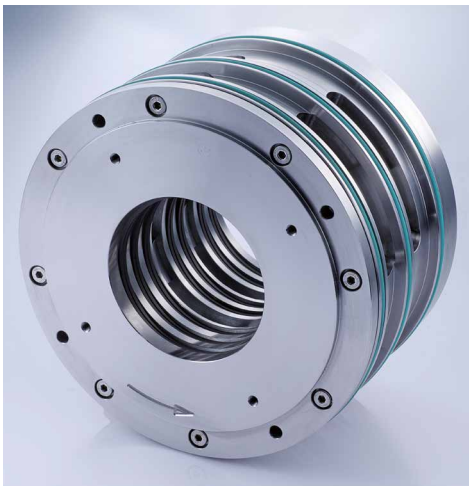
Item	Description	Variable for width
1.1	Seal ring	
1.2	Tension spring	
2	Chamber	A
2.1	Chamber with O-Ring	A
3	Barrier gas chamber	B
3.1	Barrier gas chamber with O-Rings	B
4	Lantern chamber	C
4.1	Lantern chamber with O-Ring	C
5	Lantern	E
6	End ring	G
7	Flat seal	H
8*	Housing	
9*	Lid	
10*	O-Ring Housing	

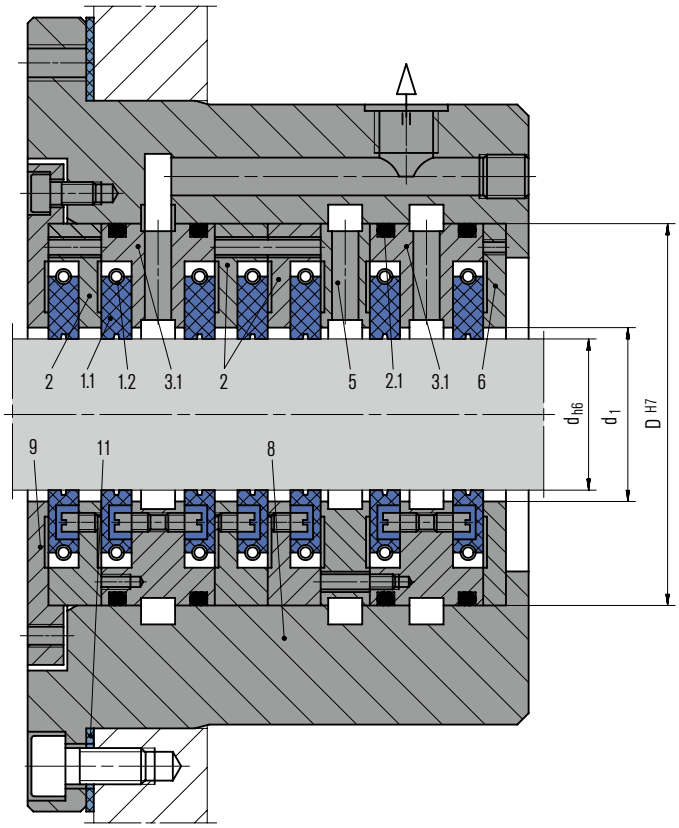
*On request

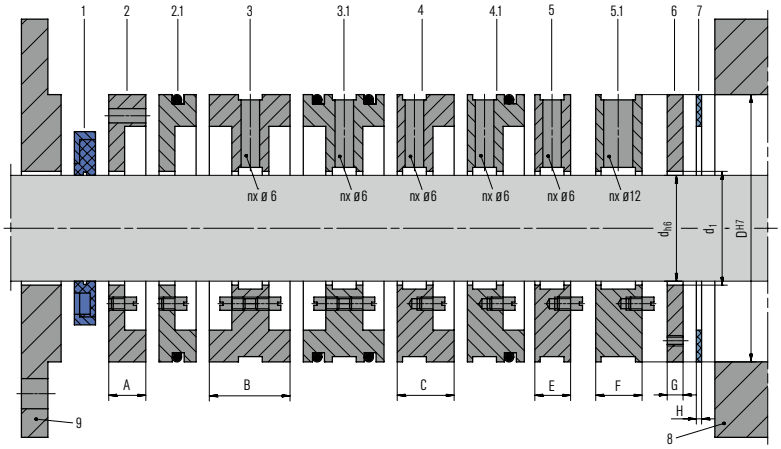
Recommended applications

- Oil and gas industry
- Refining technology
- Chemical industry
- Petrochemical industry
- Pulp and paper industry
- Metal production and processing
- Power plant technology
- Gases
- Fumes and exhaust, solids containing, flammable (ATEX), acid containing and toxic gases
- (Solids containing) steams/liquid mist
- Oil mist/penetrating oil
- Water
- Integral-gear compressors (one or multi-stage)
- Screw and chiller compressors
- Steam turbines
- Air regulating devices

Espey WKA400HD







Features

- Chamber seal (modular design – can be combined in any order), optional with housing and lid
- Very small operation gap – low leakage
- Multi-part seal rings, radially cut
- Dry running
- Self-adjusting seal rings
- Seal rings bear radial shaft movements
- Compensates axial shaft movements
- No sealing components mounted on the shaft and hence no additional shaft vibrations
- Seal rings running contact-free – sliding faces and machine consume no additional power
- Balanced seal ring inside chamber

Advantages

- High reliability
- Long-term operation time
- Maintainability
- Segmented seal rings for easy replacement

Operating range (see note on page 3)

Shaft diameter: d = 20 ... 300 mm (0.79" ... 11.81")
Operating pressure: p = vacuum ... 75 bar (1.088 PSI) abs.
Operating temperature: t = –120 °C ... +500 °C (–184 °F ... +932 °F)
Sliding velocity: v_g = max. 240 m/s (787 ft/s)
Radial play: 1.0 ... 2.0 mm (0.04" ... 0.08")
Axial movement: theoretically unlimited
Recommended wear guard: > 58 HRC

Materials

Seal ring: Carbon
Chamber and housing parts: 1.4021, 1.4571, Hastelloy™, Titan, Inconel™, others
Tension spring: 1.4571, Hastelloy™, Titan, Inconel™
Secondardy seal (elastomer): Fluorocarbon rubber (Viton™), Nitrile-butadiene-rubber (Perbunan™), Perfluorocarbon rubber (Kalrez™)
Secondary seal (gasket)::
Statotherm™-HT/HD, KSiL C 4400

Standards and approvals

- FDA

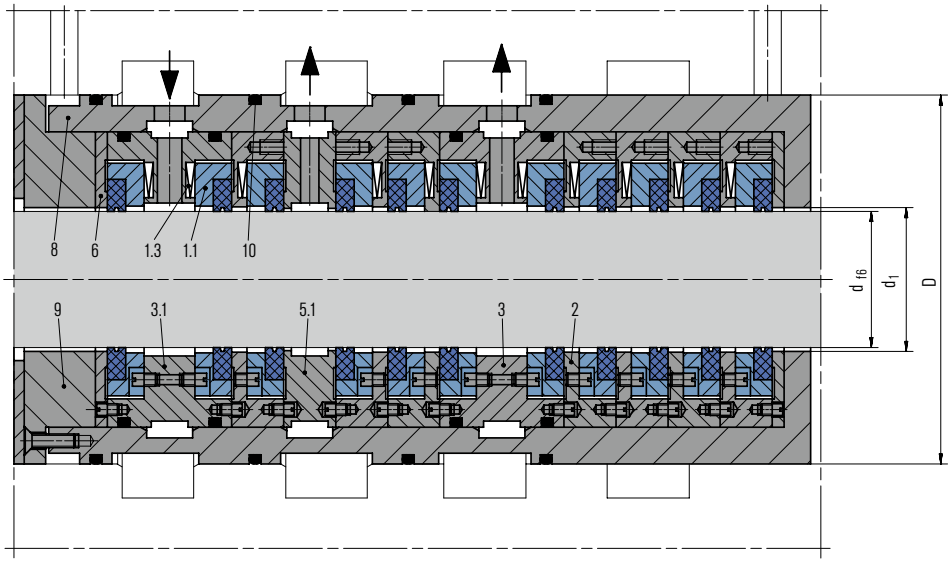
Item	Description	Variable for width
1.1	Seal ring	
1.2	Tension spring	
2	Chamber	A
2.1	Chamber with O-Ring	A
3	Barrier gas chamber	B
3.1	Barrier gas chamber with O-Rings	B
4	Lantern chamber	C
4.1	Lantern chamber with O-Ring	C
5	Lantern	E
6	End ring	G
7	Flat seal	H
8*	Housing	
9*	Lid	
11*	Flat seal housing	

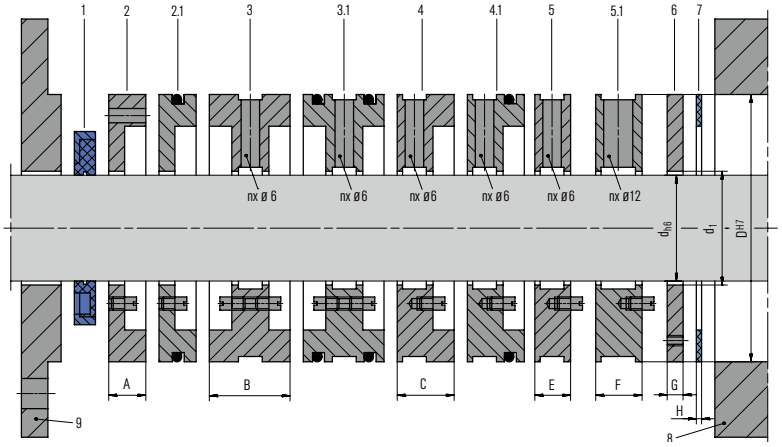
*On request

Recommended applications

- Oil and gas industry
- Refining technology
- Chemical industry
- Petrochemical industry
- Pulp and paper industry
- Metal production and processing
- Power plant technology
- Gases
- Fumes and exhaust, solids containing, flammable (ATEX), acid containing and toxic gases
- (Solids containing) steams/liquid mist
- Oil mist/penetrating oil
- Water
- Integral-gear compressors (one or multi-stage)
- Screw and chiller compressors
- Steam turbines
- Air regulating devices

1 Espey WKA700





Features

- Chamber seal (modular design – can be combined in any order), optional with housing and lid for screw compressors with one-part and horizontally split housing
- Very small operation gap – low leakage
- Dry running
- Seal rings bear radial shaft movements
- Compensates axial shaft movements
- No sealing components mounted on the shaft and hence no additional shaft vibrations
- Seal rings running contact-free – sliding faces and machine consume no additional power
- One-piece seal ring with titanium bandage
- Both side balanced seal ring inside chamber for short-term backpressure operation
- Seal ring axially spring-loaded – no swinging up at pressure-less machine operation

Advantages

- High reliability
- Long-term operation time
- Maintainability

Operating range (see note on page 3)

Shaft diameter: d = 50 ... 340 mm (1.79" ... 13.39")
Operating pressure: p = vacuum ... 65 bar (942.75 PSI) abs.
Operating temperature: t = −120 °C ... +225 °C (−184 °F ... +437 °F)
Sliding velocity: v_g = max. 240 m/s (787 ft/s)
Radial play: 1.0 mm (0.04")
Axial movement: theoretically unlimited
Recommended wear guard: > 58 HRC

Materials

Seal ring: Carbon with titanium bandage
Chamber and housing parts: 1.4021, 1.4571, 1.4313
Hastelloy™, Titan, Inconel™, others
Secondardy seal (elastomer): Fluorocarbon rubber (Viton™), Nitrile-butadiene-rubber (Perbunan™), Perfluorocarbon rubber (Kalrez™)
Secondary seal (gasket): Statotherm™-HT/HD, KSiL C 4400

Standards and approvals

- FDA

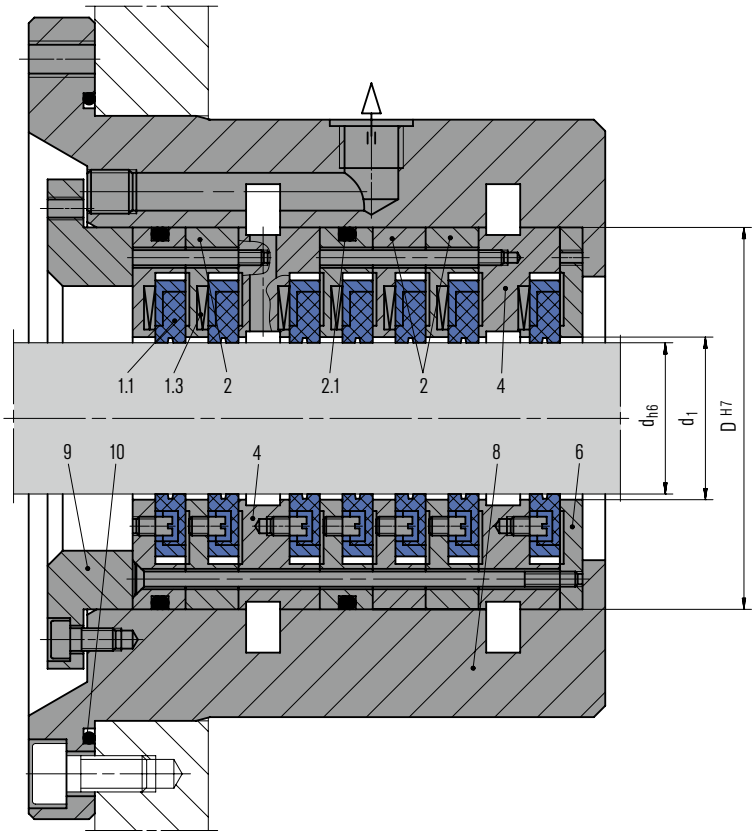
Item	Description	Variable for width
1.1	Seal ring	
1.3	Pressure spring	
2	Chamber	A
2.1	Chamber with O-Ring	A
3	Barrier gas chamber	B
3.1	Barrier gas chamber with O-Rings	B
4	Lantern chamber	C
4.1	Lantern chamber with O-Ring	C
5.1	Lantern breit	F
6	End ring	G
7	Flat seal	H
8*	Housing	
9*	Lid	
10*	O-Ring Housing	

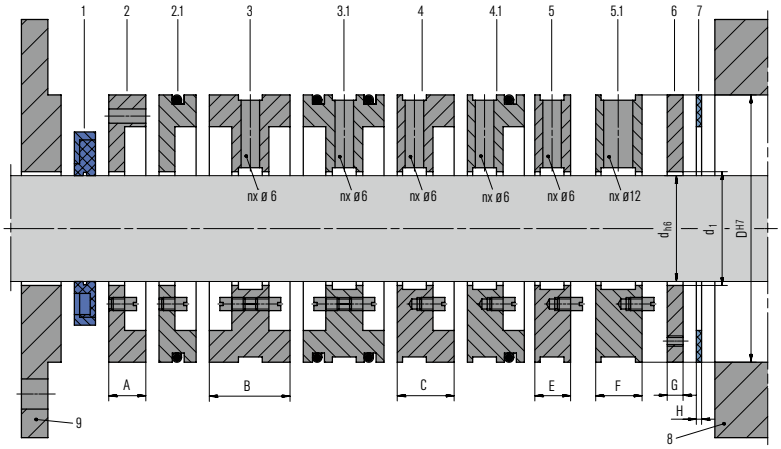
*On request

Recommended applications

- Oil and gas industry
- Refining technology
- Chemical industry
- Petrochemical industry
- Pulp and paper industry
- Metal production and processing
- Power plant technology
- Gases
- Fumes and exhaust, solids containing, acid containing and toxic gases
- (Solids containing) steams/liquid mist
- Oil mist/penetrating oil
- Water
- Screw compressors

Espey WKA802HD





Features

- Chamber seal (modular design – can be combined in any order), optional with housing and lid
- Very small operation gap – low leakage
- Dry running
- Seal rings bear radial shaft movements
- Compensates axial shaft movements
- No sealing components mounted on the shaft and hence no additional shaft vibrations
- Seal rings running contact-free – sliding faces and machine consume no additional power
- One-piece seal ring with titanium bandage
- Balanced seal ring inside chamber
- Seal ring axially spring-loaded – no swinging up at pressure-less machine operation

Advantages

- High reliability
- Long-term operation time
- Maintainability

Operating range (see note on page 3)

Shaft diameter: d = 20 ... 200 mm (0.79" ... 7.87")
Operating pressure:
p = vacuum ... 140 bar (2,031 PSI) abs.
Operating temperature: t = –120 °C ... +225 °C
(–184 °F ... +437 °F)
Sliding velocity: v_g = max. 240 m/s (787 ft/s)
Radial play: 1.0 mm (0.04")
Axial movement: theoretically unlimited
Recommended wear guard: > 58 HRC

Materials

Seal ring: Carbon with titanium bandage
Chamber and housing parts: 1.4021, 1.4571, Hastelloy™, Titan, Inconel™, others
Secondardy seal (elastomer): Fluorocarbon rubber (Viton™), Nitrile-butadiene-rubber (Perbunan™), Perfluorocarbon rubber (Kalrez™)
Secondary seal (gasket): Statotherm™-HT/HD, KSiL C 4400

Standards and approvals

- FDA

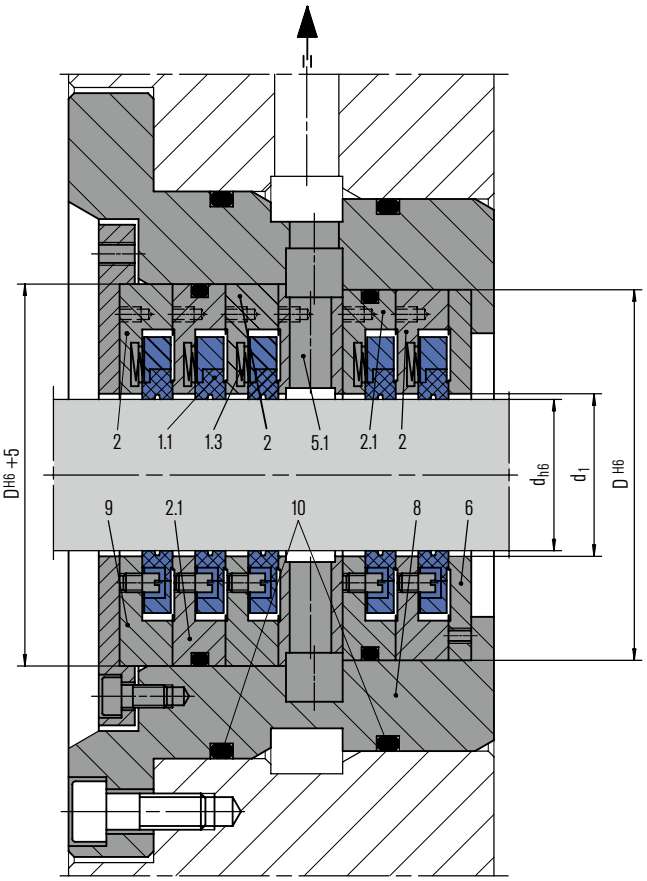
Item	Description	Variable for width
1.1	Seal ring	
1.3	Pressure spring	
2	Chamber	A
2.1	Chamber with O-Ring	A
3	Barrier gas chamber	B
3.1	Barrier gas chamber with O-Rings	B
4	Lantern chamber	C
4.1	Lantern chamber with O-Ring	C
5	Lantern schmal	E
5.1	Lantern breit	F
6	End ring	G
7	Flat seal	H
8*	Housing	
9*	Lid	
10*	O-Ring Housing	
11*	Flat seal housing	

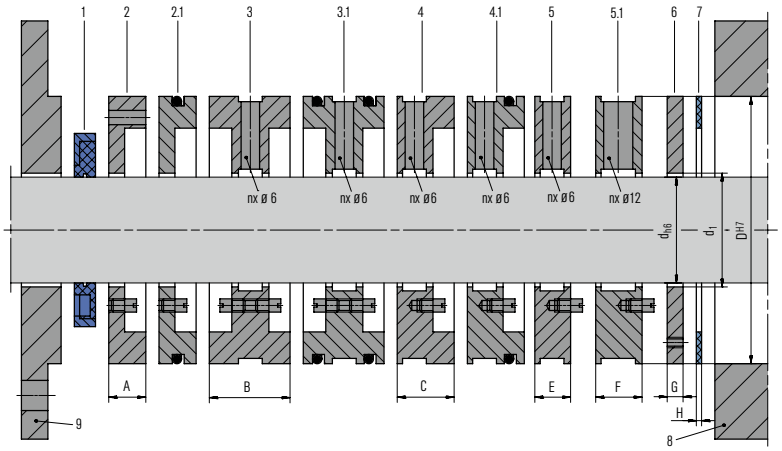
*On request

Recommended applications

- Oil and gas industry
- Refining technology
- Chemical industry
- Petrochemical industry
- Pulp and paper industry
- Metal production and processing
- Power plant technology
- Gases
- Fumes and exhaust, solids containing, acid containing and toxic gases
- (Solids containing) steams/liquid mist
- Oil mist/penetrating oil
- Water
- Integral-gear compressors (one or multi-stage)
- Screw and chiller compressors
- Steam turbines
- Air regulating devices

1 Espey WKA1100HP





Features

- Chamber seal (modular design – can be combined in any order), optional with housing and lid
- Very small operation gap – low leakage
- Dry running
- Seal rings bear radial shaft movements
- Compensates axial shaft movements
- No sealing components mounted on the shaft and hence no additional shaft vibrations
- Seal rings running contact-free – sliding faces and machine consume no additional power
- One-piece seal ring with titanium bandage
- Both side balanced seal ring inside chamber for short-term backpressure operation
- Seal ring axially spring-loaded – no swinging up at pressure-less machine operation

Advantages

- High reliability
- Long-term operation time
- Maintainability

Operating range (see note on page 3)

Shaft diameter: d = 20 ... 200 mm (0.79" ... 7.87")
Operating pressure:
p = vacuum ... 250 bar (3,626 PSI) abs.
Operating temperature: t = –120 °C ... +225 °C
(–184 °F ... +437 °F)
Sliding velocity: v_g = max. 240 m/s (787 ft/s)
Radial play: 1.0 mm (0.04")
Axial movement: theoretically unlimited
Recommended wear guard: > 58 HRC

Materials

Seal ring: Carbon with titanium bandage
Chamber and housing parts: 1.4021, 1.4571, Hastelloy™, Titan, Inconel™, others
Secondardy seal (elastomer): Fluorocarbon rubber (Viton™), Nitrile-butadiene-rubber (Perbunan™), Perfluorocarbon rubber (Kalrez™)
Secondary seal (gasket): Statotherm™-HT/HD, KSiL C 4400

Standards and approvals

- FDA

Item	Description	Variable for width
1.1	Seal ring	
1.3	Pressure spring	
2	Chamber	A
2.1	Chamber with O-Ring	A
3	Barrier gas chamber	B
3.1	Barrier gas chamber with O-Rings	B
4	Lantern chamber	C
4.1	Lantern chamber with O-Ring	C
5	Lantern schmal	E
5.1	Lantern breit	F
6	End ring	G
7	Flat seal	H
8*	Housing	
9*	Lid	
10*	O-Ring Housing	

*On request

Recommended applications

- Oil and gas industry
- Refining technology
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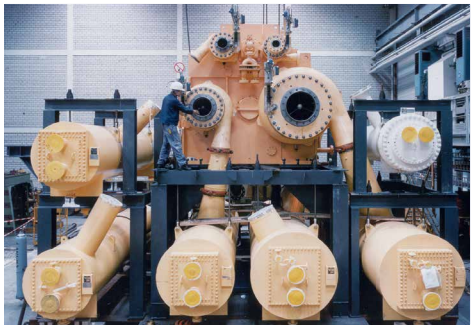
- Power plant technology
- Gases
- Fumes and exhaust, solids containing, acid containing and toxic gases
- (Solids containing) steams/liquid mist
- Oil mist/penetrating oil
- Water
- Integral-gear compressors (one or multi-stage)
- Screw and chiller compressors

Espey carbon floating ring seals for turbo machines

Espey chamber seals are applied in several turbo machines: integral gear, screw and chiller compressors, steam turbines and shut-off valves for power plants. Main industries are oil and gas, refining, chemical and petrochemical industry, power plants and plants for iron and steel production.
A further industry field with several references is carbon dioxide capture and storage (CCS) and enhanced oil recovery (EOR).

Espey chamber seals have a modular design, means the seals can be composed using standard parts to meet individual application requirements. Espey chamber seals work with a very small operation gap between shaft and seal ring – leading to very low leakage – are designed for dry-running and compensate radial and axial shaft deflections. Another advantage is that no sealing components which could generate additional shaft vibrations are actually fitted on the shaft. The seal rings are axially spring-loaded to prevent swinging up at pressure-less machine operation. Espey delivers chamber seals since several decades to worldwide notable compressor manufacturers.



Application

Espey WKA802HD as sealing for a multi-stage integral-gear compressor in the fertiliser production.

Photographs by courtesy of MAN Diesel & Turbo SE

Process description, problem and challenge

Urea is the worldwide leading nitrogen fertiliser. Urea is produced in high pressure synthesis from liquid ammonia and a gas-water mixture with 88.7 % carbon dioxide under high pressure and elevated temperatures in a synthesis tower. Thereby synthetic ammonia carbamate is produced which is finally obtained as white granules under supply of acid and heat. The high process pressures are generated by multi-stage radial integrally geared compressors.
The seal has to work as leakage protection of the high-compressed CO_2.

EagleBurgmann Espey solution

Espey developed the compact chamber seal Espey WKA802HD with barrier gas and leakage port and up to 8 seal rings for this radial integrally geared compressor designed by MAN Diesel & Turbo SE. The operation pressure of 140 bar (2,031 PSI), the temperature of 225 °C (437 °F) and revolutions up to 40,000 min^{-1} were the main design parameters. Each of the 8 stages was equipped with an individual Espey WKA802HD with different installation lengths, seal and outer diameters. The one-piece seal rings with titanium bandage were designed axially spring-loaded to avoid vibrations during start and spin-out phase. The seal solution has a high reliability and operates maintenance-free.

2 Case study: Espey WKA802 for sealing a CO_2 gear compressor

The fertilizer industry produces millions of tons of CO_2, which usually will be applied for EOR (enhanced oil recovery) or alternatively stored in underground geologic formations (CCS) to prevent the atmosphere gathering greenhouse gas. For the transportation to use in EOR the CO_2 has to be pre-compressed and dehydrated by means of a gear compressor. The American customer operating in the nitrogen fertilizer industry has chosen MAN Diesel & Turbo SE as their supplier for compressors - providing latest technology.

Process description

Nitrogen fertilizer production converts nitrogen from the atmosphere into urea, a form of nitrogen fertilizer. This process uses enormous amounts of heat and pressure to convert atmospheric nitrogen into a form usable for plants. The required heat and pressure is usually generated by natural gas, which gives off CO_2 when combusted. After combustion the CO_2 is separated, pre-compressed and dehydrated in a multi-stage gear compressor. From stage to stage the CO_2 gets more compressed and dryer, starting from 10.3 % water vapor in the first stage to 0 % in the last one. Thereby the medium' content of CO_2 increases, starting from nearly 90 % in the first stage to 100 % in the last one. The dry and pure CO_2 is fed into a pipeline to a high-pressure compressor for transportation to an EOR or CCS field.

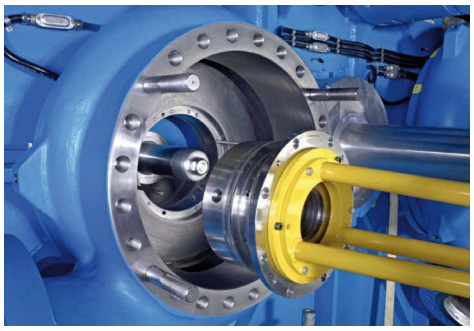
Problem and challenge

The gear compressor for serving this application includes 8 stages. Each stage requires an individual seal with the shortest possible installation length to avoid large overhangs and thereby vibrations. From stage 1 to stage 8 the shaft diameter decreases from 165 to 65 mm (6.50" to 2.56"), the revolutions increase from nearly 10,000 to 26,000 min^{-1} and the maximum operating pressure increases from 3 up to 109 bar (43.51 up to 1,580.91 PSI). The design temperature varies from 130 to 150 °C (266 to 302 °F). Ambient temperature moves between 4 and 38 °C (39.2 and 100.4 °F). Caused by the toxic and aggressive CO_2, all seals have to be designed with a barrier gas port for dry instrument air.

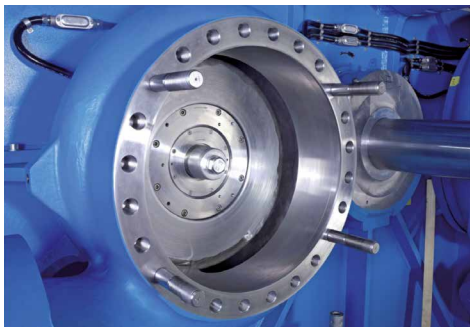
EagleBurgmann Espey solution

To fulfill the application requirement of no CO_2 and lowest barrier gas leakage to atmosphere with regard to revolutions, design temperature and operating pressure Espey designed the carbon floating ring seal Espey WKA802 with one-piece seal rings made of a carbon/titanium combination, barrier gas and recirculation ports. Espey WKA802 is based on a modular design, means that any seal parts can be combined in order to application requirements. The seal lengths vary from 145 mm (5.71") in stage 1 to 170 mm (6.69") in stage 8 to guarantee the required short installation length with view to long labyrinth seals. The seals guarantee a long-term operation time without maintenance.

Photos by courtesy of MAN Diesel & Turbo SE



Espey WKA802 during installation



Espey WKA802 installed in a gear compressor

Multi-stage gear compressor

Operating conditions

Application: multi-stage gear compressor
Seal type: Espey WKA802
Medium: water vapor, CO_2
Operation temperature: 130 ... 150 °C (266 ... 302 °F)
Pressure abs.: 3 ... 109 bar (43.51 ... 1,580.91 PSI)
Revolutions: 10,000 ... 26,000 min^{-1}
Shaft diameter: 65 ... 165 mm (2.56 ... 6.50")
Radial play: max. 0.01 mm (0.0004")
Barrier gas: dry instrument air

Quality and certificates

Quality management

The high standards we set ourselves not only drive us to produce innovative solutions, but are also reflected in the quality of our products. EagleBurgmann Espey maintains close relations to customers, suppliers and employees as a base for professional, trustful and efficient partnerships. We manufacture along the DIN EN ISO 9001:2008 to attain highest production standards to guarantee the high quality standards of our products and services. This is confirmed by successful operations stretching back over decades and many satisfied customers.

Health and safety management

At EagleBurgmann Espey occupational health and safety is of paramount importance. OHSAS 18001:1999 regulates the reduction of occupational accidents and improvement of employee working conditions.
DIN EN ISO 14001:2005 regulates environmentally-friendly business and human resources management at EagleBurgmann Espey, not to mention environmental awareness concerning the adherence to environmental legislation.

Maritime and naval licences

EagleBurgmann Espey has been awarded various licences for the Espey WDK-BHS bulkhead seal in both aluminium and stainless steel by maritime and naval organisations (including Lloyd's Register EMEA, Bureau Veritas, Russian Maritime Register of Shipping, Germanischer Lloyd and the ABS - American Bureau of Shipping).

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