API 682 4th edition
Category 2/3
Configurations

Mechanical seals

Piping plans

Seal supply systems

Configuration

3NC-FB
**EagleBurgmann mechanical seals applicable for this configuration**

<table>
<thead>
<tr>
<th>Seal type A</th>
<th>Seal type B</th>
<th>Seal type C</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Balanced pusher seals)</td>
<td>(Metal bellows seals with O-Rings)</td>
<td>(Metal bellows seals with flexible graphite)</td>
</tr>
</tbody>
</table>

**Engineered seals**

Beyond API specifications, EagleBurgmann offers a comprehensive range of engineered seals tailored to customer’s specification. Please inquire.

**API piping plans applicable for 3NC-FB configuration**

**Process side**

- **Plan 01**
  - Integral (internal) recirculation from the pump discharge to the seal chamber.

- **Plan 02**
  - Dead-ended seal chamber with no recirculation of flushed fluid. Flush connections plugged.

- **Plan 11 (12)**
  - Recirculation from the pump discharge through a flow control orifice to a cyclone separator delivering clean fluid to the seal chamber. The solids are delivered to the pump suction line.

- **Plan 21 (22)**
  - Recirculation from pump discharge through a flow control orifice and cooler (in Plan 22 through a strainer, a flow control orifice, and a cooler) into the seal chamber.

- **Plan 31**
  - Recirculation from the pump discharge through a cyclone separator delivering the clean fluid to the seal chamber. The solids are delivered to the pump suction line.

- **Plan 32**
  - Injection of clean fluid into the seal chamber from an external source.

**Between seals**

- **Plan 21 (22)**
  - Recirculation from pump discharge through a flow control orifice and cooler (in Plan 22 through a strainer, a flow control orifice, and a cooler) into the seal chamber.

- **Plan 31**
  - Recirculation from the pump discharge through a cyclone separator delivering the clean fluid to the seal chamber. The solids are delivered to the pump suction line.

- **Plan 32**
  - Injection of clean fluid into the seal chamber from an external source.

**EagleBurgmann seal supply systems and components**

<table>
<thead>
<tr>
<th>Plans</th>
<th>Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>21 (22)</td>
<td>WEF6 Water cooler, WEL6 Air cooler, SPF6 Temperature indicator</td>
</tr>
<tr>
<td>31</td>
<td>ZKG6 Cyclone separator</td>
</tr>
<tr>
<td>41</td>
<td>WEF6 Water cooler, WEL6 Air cooler, SPF6 Temperature indicator, ZKG6 Cyclone separator</td>
</tr>
<tr>
<td>32</td>
<td>SPX6 Flush unit</td>
</tr>
<tr>
<td>74</td>
<td>GSS6001 Gas supply system</td>
</tr>
<tr>
<td>99</td>
<td>Engineered to customer’s specifications</td>
</tr>
</tbody>
</table>

**The API experts**

EagleBurgmann is one of the leading international system providers of sealing technology. For more than 20 years we have been actively contributing our expertise to developing and implementing the API 682 standard for the selection and application of seals and supply systems in centrifugal and rotary pumps.

**Solutions for more safety and productivity**

The new 4th edition of API 682 is in line with the latest achievements and current developments. EagleBurgmann offers the widest portfolio of seals and seal supply systems acc. to API 682 4th edition, and consequently has the optimum product for each API-compliant requirement: technically mature, practical solutions that provide significantly greater safety and process reliability in refining technology, petrochemical, oil & gas and chemical industries.

**API 682 4th edition**

**Category 2 and 3**

**Configuration 3NC-FB (Non Contacting – Face-to-Back)**

**EagleBurgmann seal supply systems and components**

<table>
<thead>
<tr>
<th>Plans</th>
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</tr>
</tbody>
</table>

**Engineered piping plans applicable for 3NC-FB configuration**

**Process side**

- **Plan 01**
  - Integral (internal) recirculation from the pump discharge to the seal chamber.

- **Plan 02**
  - Dead-ended seal chamber with no recirculation of flushed fluid. Flush connections plugged.

- **Plan 11 (12)**
  - Recirculation from the pump discharge through a flow control orifice to a cyclone separator delivering clean fluid to the seal chamber. The solids are delivered to the pump suction line.

- **Plan 21 (22)**
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  - Recirculation from the pump discharge through a cyclone separator delivering the clean fluid to the seal chamber. The solids are delivered to the pump suction line.

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  - Injection of clean fluid into the seal chamber from an external source.

**Between seals**

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</table>

**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 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.
Features
- API 682 Category 2 and 3, Type A, Arrangement 3 seal
- Dual seal in face-to-back arrangement
- Gas-lubricated
- Balanced
- Cartridge unit
- Independent of direction of rotation
- Stationary springs
- Contact free operation, no friction

Advantages
- Universally applicable both for retrofits or original equipment
- Efficient stock keeping due to standardized components
- Extended selection of materials
- Metal parts also in special materials available

Recommended applications
- Refining technology
- Petrochemical industry
- Oil and gas industry
- Gases and liquids
- Media which require high purity
- Environmental harmful media
- API 610/ISO 13709 pumps
- Process pumps

Operating range (see note on page 3)
- Shaft diameter: \( d = 20 \ldots 110 \text{ mm (0.79” \ldots 4.33”) } \)
- Pressure: \( p_1 = 42 \text{ bar (609 PSI)} \)
- Temperature: \( t = -20 \degree C \ldots +176 \degree C (-4 \degree F \ldots +350 \degree F) \)
- Sliding velocity: \( v_g = 4 \ldots 23 \text{ m/s (13 \ldots 76 ft/s)} \)
- Axial movement: \( \pm 1.0 \text{ mm} \)

Materials
- Seal ring (product side): Silicon carbide Q19, SSiC (Q1)
- Seal ring (atmospheric side): Blister resistant carbon, Silicon carbide SSiC (Q1), Q19
- Mating rings: Silicon carbide SSiC (Q1), RBSiC (Q2)
- Secondary seals: EPDM (E), NBR (P), FKM (V), FFKM (K)
- Springs: Hastelloy® C-4 (M)* and C-276 (M5)
- Metal parts: CrNiMo steel 316 (G) or equivalent, optional materials on request.
  * EagleBurgmann standard

Recommended piping plans
- Process side: 01, 02, 03, 11, 12, 21, 22, 31, 32, 34
- Between seals: 74
**Features**
- API 682 Category 2 and 3, Type A, Arrangement 3 seal
- Dual seal in face-to-back arrangement
- Gas-lubricated
- Balanced
- Cartridge unit
- Stationary multiple springs
- Independent of direction of rotation
- Solid seal faces

**Advantages**
- Non-contacting stationary spring unit design
- No process fluid penetration into the seal faces, no leakage to the atmospheric side
- Applicable to slurry fluid
- Applicable inboard seal design for reverse and positive pressure
- Low power consumption

**Recommended applications**
- Chemical industry
- Petrochemical industry
- Oil and gas industry
- Refining technology
- Gases and liquids
- Hazardous media
- Environmental harmful media
- Monomer
- API 610/ISO 13709 pumps
- Process pumps

**Operating range (see note on page 3)**
- Shaft diameter: $d_1 = 20 \ldots 110$ mm ($0.79'' \ldots 4.33''$)
- Pressure: $p =$ vacuum $\ldots 16$ bar (232 PSI)
- Temperature: $t = -40 ^\circ C \ldots +160 ^\circ C ( -40 ^\circ F \ldots +320 ^\circ F)$
- Sliding velocity: $v_g = 23 \text{ m/s} (75 \text{ ft/s})$

**Materials**
- Seal rings: Silicon carbide SSiC (Q1), High density carbon graphite
- Mating rings: Silicon carbide SSiC (Q1)
- Secondary seals: FKM (V)
- Springs: Hastelloy® C-276 (M5)
- Metal parts: CrNiMo steel 316 (G)

**Recommended piping plans**
- Process side: 01, 02, 03, 11, 12, 21, 22, 31, 32, 41
- Between seals: 74

**Item**
- 1, 8 Seal ring
- 2, 7, 9, 14, 16, 17, 24, 25 Thrust ring
- 3, 10 Spring
- 4, 11 Mating ring
- 5, 12 Pin
- 6, 13, 21, 27, 30 Seal sleeve
- 15 Labyrinth
- 18 Adapter sleeve
- 19 Gland plate
- 20, 26 Adapter
- 22 Retaining ring
- 23 HSH cap screw
- 28, 33 Drive collar
- 29 Set screw
- 31 Setting device
- GBO Gas barrier OUT
- GBI Gas barrier IN
GSS6001 Gas supply system

Features
- Safe operation thanks to incorporated pressure regulator with upstream filter
- System mounted on a plate
- Easy wall or rack mounting

Advantages
- Coalescing filter with integrated sight-glass for monitoring liquid level to ensure safe operation even in case of poor gas quality.
- Rigid base frame for easy rack mounting.
- Wide range of flow monitoring to ensure utmost reliability of mechanical seals.

Recommended applications
- Refining technology
- Oil and gas industry
- Petrochemical industry
- Chemical industry
- Power plant technology

Functional description
Buffered, gas-lubricated mechanical seals may only be used in conjunction with adequately pressurized gas (e.g. from a closed circular nitrogen pipeline provided by the operator). For Plan 74 systems the barrier gas pressure level ($p_3$) must always be higher than the pressure level ($p_1$) of the sealed product, whatever the operational state of the machine. The minimum pressure overlay level ($\Delta p$) is specified for the individual seal types.

Main GSS functions:
- Filtering of the buffer and flushing gas
- Pressure monitoring and regulation
- Flow monitoring

Typical tasks for the GSS:
- Barrier gas supply for dual seals
- Gas supply for tandem seals

Notes
Design, calculation and production acc. to ASME VIII, Div. 1.
3rd party inspection and other certificates on request.

Installation

Product variants
<table>
<thead>
<tr>
<th>Designation</th>
<th>GSS6001A4M001-D0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure Equipment Directive</td>
<td>ASME</td>
</tr>
<tr>
<td>Allowable pressure</td>
<td>40 bar (580 PSI)</td>
</tr>
<tr>
<td>Allowable temperature</td>
<td>$-20 ^\circ C$ ... $+50 ^\circ C$ ($-4 ^\circ F$ ... $+122 ^\circ F$)</td>
</tr>
<tr>
<td>Metal parts</td>
<td>316L</td>
</tr>
<tr>
<td>Process connections</td>
<td>Flange 1/2&quot;, 600 lbs</td>
</tr>
</tbody>
</table>

Other versions on request.

1) Design data, permissible working values depend on the actual conditions of service.
Features
Heat exchangers of the WEF6000-A4 range are used to cool process/barrier fluids in seal supply circuits. WEF6000-A4 heat exchangers are fully compliant with API 682 4th edition regulations. The process/barrier medium is directed through the tube, and the cooling medium is directed through the shell.

Venting and draining of the process/barrier medium side as well as the cooling water side is ensured. In addition, the heat exchangers can also be combined with a temperature instrument in the supply line to the mechanical seal (optional in accordance with API 682 4th edition).

Advantages
- Operating limits up to 45 bar/260 °C (653 PSI/500 °F) (tube side): suitable for a wide range of demanding operating conditions.
- Cooling water side and process side can be completely vented and drained.
- Seamless pipes on process side
- Special design without welding inside the cooler
- Higher cooling water velocity due to innovative cooler design
- Stainless steel 316L: high resistance to corrosive media

Recommended applications
- Refining technology
- Oil and gas industry
- Petrochemical industry
- Chemical industry
- Power plant technology

Notes
Design and production in accordance with EU Pressure Equipment Directive PED 97/23 EC. Design, calculation and production acc. to ASME VIII, Div. 1 (cooler not subject to ASME stamp requirements, piping <6”)

Cleaning: Process/barrier medium side and cooling water side: flush with a suitable solvent.

Product variants

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>From mechanical seal</td>
</tr>
<tr>
<td>B</td>
<td>To mechanical seal</td>
</tr>
<tr>
<td>C</td>
<td>Cooling water IN</td>
</tr>
<tr>
<td>D</td>
<td>Cooling water OUT</td>
</tr>
<tr>
<td>E</td>
<td>Vent</td>
</tr>
<tr>
<td>F</td>
<td>Drain</td>
</tr>
</tbody>
</table>

Other versions on request.

1) Design data, permissible working values depend on the actual conditions of service.
2) Guidelines with buffer/barrier fluid water 60 °C (140 °F) – cooling water 20 °C (68 °F).
3) Guidelines with buffer/barrier fluid oil 60 °C (140 °F) – cooling water 20 °C (68 °F).
Features

Heat exchangers of the WEL6000-A4 range (shown here: WEL6002-A4) are used to cool process/barrier fluids in seal supply circuits. The heat exchangers are made of helical, laserwelded finned tubes. The cooling medium is ambient air. It is important, therefore, for WEL heat exchangers to be installed in well ventilated places indoors or, ideally, outdoors. There is a choice of three different basic versions of the WEL6000-A4 range as well as supplied fully assembled together with valves, base frame and other system components.

Advantages

- Operating limits up to 44 bar/260 ºC (638 PSI/500 ºF) (tube side): suitable for a wide range of demanding operating conditions.
- Can be completely vented and drained
- Seamless pipes
- Stainless steel 316L: high resistance to corrosive media

Recommended applications

- Refining technology
- Oil and gas industry
- Petrochemical industry
- Chemical industry
- Power plant technology

Product variants

<table>
<thead>
<tr>
<th>Designation</th>
<th>WEL6001-A4A001-D0</th>
<th>WEL6002-A4A001-D0</th>
<th>WEL6003-A4A001-D0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of heat exchanger</td>
<td>ASME</td>
<td>PED</td>
<td>ASME</td>
</tr>
<tr>
<td>Number of finned tubes</td>
<td>1</td>
<td>2 finned tubes switched in parallel</td>
<td>2 finned tubes switched in parallel and doubled length</td>
</tr>
<tr>
<td>Connections</td>
<td>Flange 3/4&quot;, 600 lbs</td>
<td>Flange 3/4&quot;, 600 lbs</td>
<td>Flange 3/4&quot;, 600 lbs</td>
</tr>
<tr>
<td>Drain/vent connection</td>
<td>Flange 1/2&quot;, 600 lbs</td>
<td>Flange 1/2&quot;, 600 lbs</td>
<td>Flange 1/2&quot;, 600 lbs</td>
</tr>
<tr>
<td>Allowable pressure (tube side)</td>
<td>44 bar (638 PSI)</td>
<td>44 bar (638 PSI)</td>
<td>44 bar (638 PSI)</td>
</tr>
<tr>
<td>Allowable temperature process/barrier medium side (tube side)</td>
<td>-29 ºC ... +260 ºC</td>
<td>-29 ºC ... +260 ºC</td>
<td>-29 ºC ... +260 ºC</td>
</tr>
<tr>
<td>Cooling capacity (kW)</td>
<td>1.5</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Cooling capacity (kW)</td>
<td>1.2</td>
<td>1.5</td>
<td>2</td>
</tr>
<tr>
<td>Volume (l)</td>
<td>1.2</td>
<td>2.4</td>
<td>4.8</td>
</tr>
<tr>
<td>Metal parts</td>
<td>316L</td>
<td>316L</td>
<td>316L</td>
</tr>
</tbody>
</table>

Notes

- Design and production in accordance with EU Pressure Equipment Directive PED 97/23 EC.
- Design, calculation and production acc. to ASME VIII, Div. 1 (cooler not subject to ASME stamp requirements, piping <6")
- Seamless pipes
- Stainless steel 316L: high resistance to corrosive media
- Design data, permissible working values depend on the actual conditions of service.
- Guidelines with barrier fluid/double barrier water 60 ºC (140 ºF) – ambient temperature 20 ºC (68 ºF); moved air at min. 0.7 m/s (2.3 ft/s); product flow rate 8 l/min.
- Guidelines with barrier fluid/double barrier fluid oil 60 ºC (140 ºF) – ambient temperature 20 ºC (68 ºF); moved air at min. 0.7 m/s (2.3 ft/s); product flow rate 8 l/min.
- Version with screwed connection G1/2" available as an option.
Features
The measuring unit of the SPT6000-A4 range is used to visually monitor the operating temperature.

The measuring unit consists of a bi-metallic temperature gauge (NG100) with protective sleeve installed in a measuring block incl. drain connection.

Advantages
- Operating limits up to 45 bar/260 °C (653 PSI/500 °F) (design parameters)
- Temperature indicating range up to 200 °C (392 °F)
- Wetted parts: Stainless steel 316L for high resistance to corrosive media

Recommended applications
- Refining technology
- Oil and gas industry
- Petrochemical industry
- Chemical industry
- Power plant technology

Product variants

<table>
<thead>
<tr>
<th></th>
<th>SPT6000-A4</th>
<th>SPT6000-A4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Designation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connections – process</td>
<td>Flange 3/4&quot;, 600 lbs</td>
<td>Flange 3/4&quot;, 600 lbs</td>
</tr>
<tr>
<td>Connections – drain</td>
<td>G 1/2&quot;</td>
<td>G 1/2&quot;</td>
</tr>
<tr>
<td>Allowable pressure</td>
<td>45 bar (653 PSI)</td>
<td>45 bar (653 PSI)</td>
</tr>
<tr>
<td>Temperature range</td>
<td>0 °C ... +120 °C (32 °F ... +248 °F)</td>
<td>0 °C ... +200 °C (32 °F ... +392 °F)</td>
</tr>
<tr>
<td>Wetted parts 316L</td>
<td>316L</td>
<td></td>
</tr>
</tbody>
</table>

Other versions on request.
1) Design data, permissible working values depend on the actual conditions of service.
**Features**

The ZY6000-A4 range is available in three versions:

- **ZYA6000-A4**: Cyclone separator for high flow rates and high pressures.
- **ZYB6000-A4**: Cyclone separator for high flow rates and high pressures; 100 % X-ray capability.
- **ZYC6000-A4**: Cast version, block-type design with integral flanges.

**Advantages**

- Contamination is automatically conveyed to the suction nozzle of the pump: maintenance-free mode of operation for guaranteed reliability
- High filtration efficiency
- Wide range of products for the optimum solution for every application
- ZYA6000-A4 and ZYB6000-A4: available for operating pressures of up to 200 bar (2,900 PSI)
- ZYC6000-A4 in block-type design with integrated flange connections: low space requirements because of compact design

**Functional description**

Cyclone separators of the ZY6000-A4 range are used to clean mainly aqueous liquids containing contamination such as dirt and solids (e.g., in circulation systems of sewage, sludge or pipeline pumps).

The best possible filtration efficiency is achieved when the specific weight of the solids is much higher than that of the carrier liquid and when the differential pressure is as large as possible within the permissible pressure range (min. 1.7 bar (24.7 PSI) in accordance with API 682). The viscosity of the medium is a factor that also needs to be taken into account.

### Product variants

<table>
<thead>
<tr>
<th>Designation</th>
<th>ZYA6000</th>
<th>ZYB6000</th>
<th>ZYC6000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Features</td>
<td>Standard</td>
<td>100 % X-ray capability</td>
<td>Cast version</td>
</tr>
<tr>
<td>Allowable pressure a)</td>
<td>60 bar (870 PSI)</td>
<td>60 bar (870 PSI)</td>
<td>60 bar (870 PSI)</td>
</tr>
<tr>
<td>Temperature range</td>
<td>-29 °C ... +150 °C (-20 °F ... +302 °F)</td>
<td>-29 °C ... +150 °C (-20 °F ... +302 °F)</td>
<td>-29 °C ... +150 °C (-20 °F ... +302 °F)</td>
</tr>
<tr>
<td>O-Ring b)</td>
<td>Viton®</td>
<td>Viton®</td>
<td>Viton®</td>
</tr>
<tr>
<td>Wetted parts</td>
<td>316L</td>
<td>316L</td>
<td>316L</td>
</tr>
</tbody>
</table>

Other versions on request.

a) Max. permissible working values depend on version.
b) Other materials on request, e.g. FKM, EPDM.
**Features**

The EagleBurgmann flush unit of the SPX6000-A4 range consists of a manifold with integrated inline filter supplied together with a needle valve and pressure gauge. Optional available with temperature gauge and/or flow indicator. The unit is used to control the flushing of a mechanical seal.

**Advantages**

- Compact design due to integral filter
- Modular concept – optimal monitoring equipment available

**Recommended applications**

- Refining technology
- Oil and gas industry
- Petrochemical industry
- Chemical industry
- Power plant technology

**Functional description**

The SPX6000-A4 flush unit continuously supplies flushing media from an external source to the mechanical seal. This plan is almost always used in combination with a throat bushing which serve as a throttle device to maintain a higher pressure in the stuffing box to isolate the pumped product from the seal chamber.

**Product variants**

<table>
<thead>
<tr>
<th>Designation</th>
<th>SPX6000-A4</th>
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<tbody>
<tr>
<td>Allowable pressure(^1)</td>
<td>44 bar (638 PSI)</td>
</tr>
<tr>
<td>Allowable temperature(^1)</td>
<td>(-20 °C … +120 °C) ((-4 °F … +248 °F))</td>
</tr>
<tr>
<td>Process connections</td>
<td>(\frac{1}{2})&quot; NPT</td>
</tr>
<tr>
<td>Metal parts</td>
<td>316L</td>
</tr>
</tbody>
</table>

Other versions on request.

\(^{1}\) Design data, permissible working values depend on the actual conditions of service.
EagleBurgmann is one of the internationally leading companies for industrial sealing technology. Our products are used everywhere where safety and reliability are important: in the oil and gas industry, refining technology, the petrochemical, chemical and pharmaceutical industries, food processing, power, water, mining, pulp & paper, aerospace and many other spheres. Every day, more than 6,000 employees contribute their ideas, solutions and commitment towards ensuring that customers all over the world can rely on our seals. Our modular TotalSealCare service underlines our strong customer orientation and offers tailor-made services for every application.