Applications

The self-cleaning automatic KAF® Bernoulli® filter is a versatile self-cleaning, nearly maintenance-free filter for removal of particulate contaminants from highly polluted waters as well as process fluids e.g. from natural water sources (sea water, river water) and heating or cooling circuits and processes. It operates at a working pressure as low as 0.3 bar and is characterized by extremely low pressure loss, simple, space saving, robust design with high performance and low weight.

Characteristics

- Unique self cleaning function works from 0.1–25 bar
- Minimum working pressure 0.1 bar
- The filter can be integrated in the pipe system in any installation position
- Filtration rate ≥ 100 µ/micron – 10 mm
- Very low maintenance
- Low energy consumption
- Only few spare parts needed. Deliverable in SET’s for easy and regular preventative maintenance.

Approvals

3.1. Certificate, DGRL / TÜV, GL, LS, DNV, ABS, TR TF / TR CU Certificates (EAC), ASME U-Stamp, Lloyd’s Register Type Approval Certificate No. 16/20086

CE conformity evaluation according 2014/68/EU and marking according the directive.
Brief description

The KAF® Bernoulli® is a fully automatic self-cleaning filter and can be mounted vertically as well as horizontally. During operation the medium flows through the strainer insert from inside to outside and the dirt remains inside the strainer. The filter is equipped with a differential pressure monitoring system that automatically triggers the flushing process before any blockages in the filter strainer cause significant flow reductions. The flushing process can also take place after a predetermined time. Due to the specially shaped flushing disk the speed between the disk and strainer in the flushing process rises. The resulting local pressure drop causes an internal suction effect and the contaminant particles are removed from the strainer insert. Solid components are flushed out via the opened flush valve.

- Outlet flow is not interrupted in this process;
- the flushing volumes are low
- The pressure drop in the system is minimal

Notice:
The compatibility between medium and vessel or sealing material is the responsibility of the operator.
The design of the pressure vessel is based on a quasi-static operation (load cycle number ≤ 1000 according to AD 2000 Merkblatt S1, section 1.4). Max. Differential pressure inlet - outlet 1 bar.

Functional description of the cleaning process

The contaminated medium flows into the filter through the flange marked “inlet”. The contaminated medium flows through the filter insert from the inside to the outside and exits out of the flange marked “outlet” as cleaned medium. The flushing phase of the filter is either activated when the set differential pressure is attained, or the flushing phase is activated after a set time interval or by pressing the button. The flushing valve opens and larger contaminant particles are flushed out with the continuously flowing medium stream due to a pressure gradient. Subsequently the piston usually performs two strokes, thereby increasing the speed between the flushing disc and strainer wall. The contaminants are sucked off due to the resultant local pressure drop. The flushing time can be set by the controller according to the operating conditions, and flushing frequency depends on the level of contamination in the medium.

Operating instructions

The comprehensive instructions accompanying the filter must be followed!

The filter is installed in piping via flanges. Ensure that the standard version of the filter is installed vertically or horizontally in a mechanically stress-free manner without additional loads. The medium must flow in the direction specified on the housing. Incorrect installation can cause filter malfunctions. If the flush outlet pipe is installed with a gradient ensure that the inlet pressure of the filter is at least 0.3 bar higher than the counter pressure in the flush outlet pipe (pay attention to the loss through friction in pipes). Before using with another medium or other operation conditions than specified in the design, the resistance of the materials of the pressure-bearing parts and seals touched by the medium to be filtered must be checked by the customer; it may be necessary to consult with the manufacturer and to execute a conformity evaluation in accordance with PED EN 2014/68/EU (if there is a CE-marking requirement). The filter needs regularly maintenance (every 1–2 years). Please consider instructions delivered with the filter.
Filter dimensioning chart / Pressure loss diagram

At 200 µm filter fineness

Dimensioning example (0.2 mm filtration degree) / selection chart at 500 m³/h, the use of a DN 250 or DN 300 is recommended at 200 µm.
### Technical data and dimensions

#### Flanges in accordance with EN 1092-1 PN 10–16 or ANSI 16.5 150 lbs

<table>
<thead>
<tr>
<th>Material</th>
<th>D1</th>
<th>D2</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>Weight*</th>
<th>Flowrate ***</th>
<th>Example flushing volume / backflush (adjustable)</th>
<th>Flushing volume ****</th>
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</table>

* Dependent on design pressure, ** Rubber lined on request, *** Dependent on filtration degree **** EcoSense® is a processor controlled flush water management system. For EcoSense® control and functions the Em4 processor LCP has to be used.
## Technical data

### Filter insert / filtration degree
- **Standard**: Slot wedge wire 150–1.000 µm
  - Basket with perforated plate 1–10 mm
- **Special versions**: Others on request e.g. 100 µm

### Filter cover
- **Standard**: Cover with hex bolts + nuts
- **Special versions**: Basket with perforated plate 1–10 mm
- **Others on request**: e.g. 100 µm

### Venting device
- **Standard**: –
- **On request**: On request

### Drain device
- **Standard**: –
- **On request**: On request

### Connections
- **Standard**: Flange in accordance with EN 1092-1 11B PN 10/16
- **As specified by the customer**: e.g. ANSI, JIS

### Materials

#### Housing
- **Plastic**: GRP / FRP (polyester-based fiber-reinforced plastic)
- **Stainless steel / steel**: SS304 / SS316Ti, steel
- **Cast Iron**: GGG50 / EN-GJS-500-7 / ASTM-80-55-06
- **Special alloy steels**: (e.g. Duplex SS, Super Duplex SS)

#### Seals
- **Standard**: NBR
- **On request**: On request

#### Perforated plate / slotted hole strainer
- **Standard**: SS316Ti / SS316
- **Titanium, Hastelloy, Monel, Super Duplex, Uranus**

#### Flushing disk
- **Standard**: POM / GRP
- **Piston rod**: SS316L
- **Duplex, Super Duplex**

#### Differential pressure switch
- **Standard**: Ms chem. nickel-plated (Membrane)
- **Hastelloy, Monel (Membrane), Stainless steel**

#### Control
- **Standard**: Multi-function unit mounted (Crouzet Millenium III) / delivered separately
- **Crouzet Millenium en4 / Allen Bradley / Rockwell / Siemens, Exd**, Explosion-protected (ATEX)
- **230 V / 50 Hz / 1Ph**: On request
- **On request**: Protection class in Ex-compliant version (ATEX), Transmitter 4–20 mA, HART protocol, diaphragm seals

### Surface treatment, internal
- **Steel housing**: Chemonit 33 (rubberlining)
- **Cast Iron**: Chemonit 33 (rubberlining)
- **Stainless steel housing**: Pickled and passivated
- **GRP / FRP housing**: Chemical-resistant vinyl ester liner
- **Corrosion protection oil, Corrocoat, Polyglass, Epoxy coating**

### Surface treatment, external
- **Steel housing**: Epoxy in RAL 5010 blue
- **Cast Iron**: Epoxy in RAL 5010 blue
- **Stainless steel housing**: Pickled and passivated
- **GRP / FRP housing**: GRP outer color or through-colored in RAL 5015 blue
- **UV-resistant painting, customer specification**

### Range of application of the materials according to temperature
- **Steel / stainless steel housing / Cast Iron**: Temperature limits: In accordance with PED or AD2000 legislation –29 °C to 95 °C
- **Special version**: +120 °C
- **GRP housing**: Temperature limits: –70 °C to +60 °C
- **Special version**: +120 °C

### Design / Certification
- **Declaration of Conformity, 3.1 Material Certificates – Lloyds Register certified foundry acc. to DGRL 2014/68/EU for cast iron (GGG50/EN-GJS-500-7/ASTM 80-55-06)**
- **ASME-Code, ATEX, PED, NORSOK, DOSH, MOM, GOST, RTN, EN 13445**
KAF® spare part sets

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<tr>
<th>Set</th>
<th>Content</th>
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<tbody>
<tr>
<td>1</td>
<td>Insert, sealing (optional), set of bolts</td>
</tr>
<tr>
<td>2</td>
<td>Cover gasket</td>
</tr>
<tr>
<td>3</td>
<td>Piston rod to cover sealing</td>
</tr>
<tr>
<td>3A</td>
<td>Piston rod to cover sealing incl. Exhaust Air Disc</td>
</tr>
<tr>
<td>4</td>
<td>Pneumatic cylinder, restrictors, set of bolts</td>
</tr>
<tr>
<td>5</td>
<td>Set limit switches</td>
</tr>
<tr>
<td>6</td>
<td>Flange for pneumatic cylinder</td>
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<tr>
<td>7</td>
<td>Flushing disc, fixing nut, washer</td>
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<tr>
<td>8</td>
<td>Piston rod guide*</td>
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<tr>
<td>9</td>
<td>Complete solenoid valve unit</td>
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<tr>
<td>10</td>
<td>Differential pressure switch</td>
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<tr>
<td>11</td>
<td>Control unit/LCP with CPU</td>
</tr>
<tr>
<td>12</td>
<td>Flushing valve</td>
</tr>
<tr>
<td>13</td>
<td>Tubes, adapter fittings</td>
</tr>
<tr>
<td>14</td>
<td>Wearing parts set pneumatic cylinder (<em>air</em> repair package)</td>
</tr>
</tbody>
</table>

* as option for filter size ≥ DN 350; always mounted for filter size ≥ DN 500
Recommended spare part sets KAF®

For commissioning / continuous operation & strategical spares

- Please note this is only a general recommendation, which may have project related changes.
- Please ask for your detailed spare part quotation for your self-cleaning filter.
- After your definitions of spare packages, Krone will check if technical developments apply and always quote newest technical development.

- 2–4 weeks
- 4–8 weeks
- 10–16 weeks for special materials or versions

* Lead time depends on version, model and materials. Exact delivery time will be mentioned in quotation by Krone Filter Solutions.
** Dependent on filter operational stress/flush frequency depending on water quality.
*** If purchased together with 2–3 year operational spares the SET 2 and 3 can be reduced to 1 pcs.
**** Recommended number of strategical spare packages 30% of filter’s in operation/min. 1 package. If purchased with 4–7** years operational spares package can be reduced by those positions.

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<tr>
<th>Commissioning spares</th>
<th>2–3 years operation spares</th>
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<table>
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<th>4–7** years operational spares</th>
<th>2–3 years operation spares</th>
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<td>7</td>
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<td>4 (optional to SET 14)</td>
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<th>Stratagical spare package recommended purchase latest 1 year after START-UP****</th>
<th>2–3 years operation spares</th>
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www.krone-filter.com
14”/DN 350 Filter seawater cooling for use in Ex Zone 1

24”/DN 600 KAF® Filter – Bioethanol plant

3 x 15”/DN 400 KAF® Filter – desalination

24”/DN 600 KAF® Filter – Seawater cooling

14”/DN 350 Filter seawater cooling for use in Ex Zone 1

300 JIS/DN 300 ship seawater cooling for use in Ex Zone 1

200 JIS/DN 200 ship seawater cooling for use in Ex Zone 1
Type Approval Certificate

This is to certify that the undersigned product(s) has/have been tested with satisfactory results in accordance with the relevant requirements of the Lloyd’s Register Type Approval System.

This certificate is issued to:

PRODUCER
Krone Filter Solutions GmbH
Industriestrasse 19
28876 Oyten
Germany

DESCRIPTION
Single, duplex and self-cleaning automatic filter with several housing sizes and combinations made from standard materials spheroidal iron castings EN-GJS-500-7 (GGG 50)* or EN-GJS-400-15 (GGG 40), carbon steel optional rubber lined or stainless steel.

TYPES
KSF, KMF, KDF-K, KDF-V, KAF, KRF

APPLICATION
Filter depending on type for diesel oil, oil or water piping systems in ship and offshore installations classed or intended for Classification with Lloyd’s Register.

RATINGS

<table>
<thead>
<tr>
<th>Filter type:</th>
<th>Nominal pressures: [bar]</th>
<th>Size range:</th>
<th>Material:</th>
</tr>
</thead>
<tbody>
<tr>
<td>KSF</td>
<td>6, 10, 25</td>
<td>DN 15 – DN 600</td>
<td>Spheroidal iron casting</td>
</tr>
<tr>
<td>KMF</td>
<td>6, 10, 25</td>
<td>G ½” – 2 ½”</td>
<td>Spheroidal iron casting</td>
</tr>
<tr>
<td>KDF-K</td>
<td>6, 10, 25</td>
<td>DN 15 – DN 200</td>
<td>Spheroidal iron casting</td>
</tr>
<tr>
<td>KDF-V</td>
<td>6, 10, 25</td>
<td>DN 100 – DN 600</td>
<td>Spheroidal iron casting, carbon steel</td>
</tr>
<tr>
<td>KRF</td>
<td>6, 10</td>
<td>DN 32 – DN 400</td>
<td>Spheroidal iron casting, carbon steel</td>
</tr>
<tr>
<td>KAF</td>
<td>6, 10</td>
<td>DN 50 – DN 1000</td>
<td>Spheroidal iron casting, carbon or stainless steel</td>
</tr>
</tbody>
</table>

Certificate No. 16 / 20086
Issue Date 09 September 2016
Expiry Date 08 September 2021
Sheet 1 of 3

Lloyd’s Register EMEA
71 Fenchurch Street, London EC3M 4BS

Torsten Schröder
Hamburg Technical Support Office
Lloyd’s Register EMEA

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### RATINGS, cont.

<table>
<thead>
<tr>
<th>Material:</th>
<th>Temperature range:</th>
<th>For fluids**:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spheroidal cast iron</td>
<td>-10 up to +300°C</td>
<td>MDO, oil, water, seawater</td>
</tr>
<tr>
<td>Austenitic stainless steel:</td>
<td>-196 up to +300°C</td>
<td>MDO, oil, nitrogen</td>
</tr>
<tr>
<td>1.4571, 1.4401, 1.4404, 1.4408, 1.4539, 1.4301, 1.4541, SA240-304L, SA240-316Ti, SA240-321, SA240-316L, SA240-904L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Duplex stainless steel:</td>
<td>-40 up to +250°C</td>
<td>seawater</td>
</tr>
<tr>
<td>1.4462, 1.4463, UNS S31803</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Super duplex: 1.4410, UNS 32750</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carbon steel: St 50, P235GH, P245GH, P250GH, P265GH, SA516 Gr60, SA516 Gr70</td>
<td>-40 up to +100°C</td>
<td>MDO, oil, water, seawater</td>
</tr>
</tbody>
</table>

***) including fluids and mixture of similar evaluation class
Pressure reductions at elevated temperatures are to be considered.

**Media depending on type:**
- KAF, KRF: water, seawater
- KSF, KMF, KDF-K and KDF-V: MDO, oil, nitrogen, water, seawater

**OTHER CONDITIONS**
The manufacturer’s installation instructions are to be sought.

*) Not to be used for applications with expected significant chock or vibration loads.

**STANDARD**
Lloyd’s Register Rules and Regulations for the Classification of Ships, July 2016

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**Certificate No.** 16 / 20086

**Issue Date** 09 September 2016

**Expiry Date** 08 September 2021

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Hamburg Technical Support Office
Lloyd’s Register EMEA

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The Type Approval does not eliminate the need for normal inspection and survey procedures required by the Rules and Regulations.

If the specified standards are amended during the validity of this certificate, the product is to be re-approved prior to it being supplied to vessels to which the amended standards apply.

The Design Appraisal Document No. HTS/ENS 34963-16 and its supplementary Type Approval Terms and Conditions form part of this Certificate.

Certificate No. 16/20086

Issue Date 09 September 2016

Expiry Date 08 September 2021

Sheet 3 of 3

Lloyd’s Register EMEA
71 Fenchurch Street, London EC3M 4BS

Torsten Schröder
Hamburg Technical Support Office
Lloyd’s Register EMEA
THE LLOYD’S REGISTER’S TYPE APPROVAL SYSTEM, 2014
ISSUED TO: KRONE FILTER SOLUTIONS GMBH
FOR: SINGLE, DUPLEX AND AUTOMATIC FILTER
TYPES: KSF, KMF, KDF-K, KDF-V, KAF, KRF
TYPE APPROVAL CERTIFICATE NO. 16/20086

The undernoted documents have been reviewed for compliance with the requirements of the Lloyd’s Register’s Type Approval System Procedure TA14 and this Design Appraisal Document forms part of the Certificate.

APPROVAL DOCUMENTATION

- Application Form to LR Type Approval 26.11.2014
- Product Catalogue / general Data sheets 2014
   for types KSF, KMF, KDFK, KDFV, KDF and KRF
   KSF 2016
   KSF080.04.16.00.01, Rev. 0
   KSF080.04.16.01.01, Rev. 1
   KSF000.05.16.02.01, Rev. 0
   KMF LR Data sheet, Rev. 4
   KMFF000.03.05.16.00.01, Rev 0
   KMFF000.03.05.16.01.01, Rev 0
   KSFF000.03.05.16.02.01, Rev. 1
   KDFK LR Data sheet, Rev. 4
   KDFK080.06.05.10.00.01, Rev. 0
   KDFK080.04.05.10.01.02, Rev.2
   KSFF000.06.10.02.01, Rev. 0
   KDFV LR Data sheet, Rev. 2
   KDFV150.07.05.10.00.20, Rev 1
   KDFV150.07.05.10.01.20, Rev 1
   KDFV150.07.05.16.08.20, Rev 4
   KSFF000.07.05.10.02.01, Rev. 0

KMF

- KMF LR Data sheet, Rev. 4
- KMF000.03.05.16.00.01, Rev 0
- KMF000.03.05.16.01.01, Rev 0
- KSFF000.03.05.16.02.01, Rev. 1
- KDFK LR Data sheet, Rev. 4
- KDFK080.06.05.10.00.01, Rev. 0
- KDFK080.04.05.10.01.02, Rev.2
- KSFF000.06.10.02.01, Rev. 0
- KDFV LR Data sheet, Rev. 2
- KDFV150.07.05.10.00.20, Rev 1
- KDFV150.07.05.10.01.20, Rev 1
- KDFV150.07.05.16.08.20, Rev 4
- KSFF000.07.05.10.02.01, Rev. 0

KMF

- KMF GR3 incl. Parts list 22.11.2013
- Body KMF GR3 / GR1 ½” – G2” 22.11.2013
- KSFF Cover GR3 24.11.2011
- KDFK

- KDFK DN 80 PN10 incl. Parts list 24.02.2011
- KDFK Body GR4 DN80 PN10 JIS 10K 20.03.2014
- Cover GR6 31.03.2009
- KDFV

- KDFV GR7 DN150 incl. Parts list 12.07.2012
- KDFV Body GR7 DN150 27.04.2012
- KDFV Body Change Over GR7 DN150 12.07.2012
- Cover GR7 24.02.2011

FINAL ACCEPTANCE OF ACTUAL ITEM(S) DEPEND(S) ON SATISFACTORY SURVEY AND TESTING

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Form 6438MARREF (2016.05)
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Document no: HTS/ENS 34963-16  
Issue number 0  
Page 2 of 3

Date 09 September 2016

Please quote this reference number on all future communications HPC1461050/34963-16/TS

APPROVAL DOCUMENTATION, cont.

<table>
<thead>
<tr>
<th>KAF LR Data sheet, Rev. 0</th>
<th>KAF</th>
<th>KAF DN150 PN5 JIS B 2220 K5 FF incl. Parts list</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>KAF150.01.16.05.00.01, Rev. 0</td>
<td>KAF150.00.05.05.01.02, Rev. 0</td>
<td>Body KAF DN150 PN5</td>
<td>16.05.2014</td>
</tr>
<tr>
<td>KAF150.00.16.05.01.02, Rev. 0</td>
<td>KAF150.00.10.02.01, Rev. 0</td>
<td>Body KAF DN150 PN5 rubber lined incl. Parts list</td>
<td>16.05.2014</td>
</tr>
<tr>
<td>KAF150.00.16.10.02.01, Rev. 0</td>
<td>KAF150.00.16.10.02.01, Rev. 0</td>
<td>KAF Cover DN150 PN 19 / DNC-50 incl. Parts list</td>
<td>12.12.2013</td>
</tr>
<tr>
<td>KRF LR Data sheet, Rev. 4</td>
<td>KRF-BF</td>
<td>KAF Cover DN150 PN 19 / DNC-50 incl. Parts list</td>
<td>12.12.2013</td>
</tr>
</tbody>
</table>

TEST REPORTS

| HPC1461050/01 | LR Works Inspection including hydrostatic burst pressure tests at 100 bar for type KSF: DN 50, size 2; KSF: DN 80, size 4 and KSF: DN 100, size 8 | 14.12.2015 |
| HPC1461050/02 | hydrostatic burst pressure tests at 100 bar for type KMF: 2 ½” size 4; type KDF-K: DN 80, size 6 and KDF-K: DN 20, size 2 witnessed by LR Surveyor at Krone in Oyten | 17.12.2015 |
| HPC1461050/03 | hydrostatic burst pressure tests at 40 bar for type KAF: DN 200, PN 10 and at 64 bar for type KDF-V: DN 150, size 7, PN 16 witnessed by LR Surveyor at Krone in Oyten | 21.12.2015 |
| HPC1461050/04 | Visit of an existing installation with function test of KAF self-cleaning automatic filter at ‘Elbphilharmonie Hamburg’ | 11.01.2016 |

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E torsten.schroeder@lr.org

FINAL ACCEPTANCE OF ACTUAL ITEM(S) DEPEND(S) ON SATISFACTORY SURVEY AND TESTING

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Form 6438MARREF (2016.05)
**Supplementary Type Approval Terms and Conditions**

Type Approval certifies that a representative sample of the product(s) referred to herein has/have been found to meet the applicable design criteria for the use specified herein. It does not mean or imply approval for any other use, nor approval of any product(s) designed or manufactured otherwise than in strict conformity with the said representative sample.

Type Approval is based on the understanding that the manufacturer's recommendations and instructions and any relevant requirements of the Rules and Regulations are complied with.

Type Approval does not eliminate the need for normal inspection and survey procedures required by the Rules and Regulations.

Lloyd's Register EMEA reserves the right to cancel or withdraw this Type Approval Certificate in accordance with the LR Type Approval System Procedure.