

## Laminar piston rings

for pistons of internal combustion engines, compressors, pneumatic and hydraulic equipment, shock absorbers, etc.

## Laminar piston rings

for pistons of freeform and drop forging machine, hydraulic controls and presses



## Single laminar sealing rings

Single wound laminar rings for the sealing of grease lubricated roller and plain bearings.



## Single and/or double laminar sealing rings

Single and/or double laminar sealing rings are used to seal compensators at exhaust pipes for internal combustion engines, turbochargers and turbines. "FK5" rings are also used to seal bearing units for continuous casting plants.



## Double laminar sealing rings

Double wound laminar rings for the sealing of grease lubricated roller and plain bearings for special requirements and also for high rotational speeds.



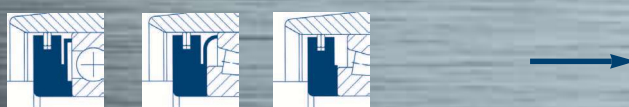
## Laminar retaining rings

Single and double wound laminar retaining rings. DMS double laminar retaining rings with centrifugal force retainer for high shaft speeds.



## Plastic laminar ring carrier seals

Plastic ring carriers with laminar sealing rings for the sealing of grease lubricated axle and machine bearings and conveyor belts.



Installation



Greasing



Questionnaire



Application examples



#### Application "FK3 AS" Outside clamping single rings (3 rings = 1 set)

Single wound laminar sealing rings "FK3 AS" are used as a grease seal for roller and plain bearings and they protect, if greased, against dust entry and ambient moisture. The combined ring sets "FK3 ASK" (additional sealing of the groove base diameter) optimize the sealing effect due to the increased labyrinth effect.

The "FK3 AS" or "FK3 ASK" assemblies are normally preferred over the "FK3 IS" or "FK3 ISK" assemblies due to their easier installation into the grooves. Depending on the applications or the technical requirements, the ring carriers can be manufactured from steel, cast iron, light alloy or plastics.

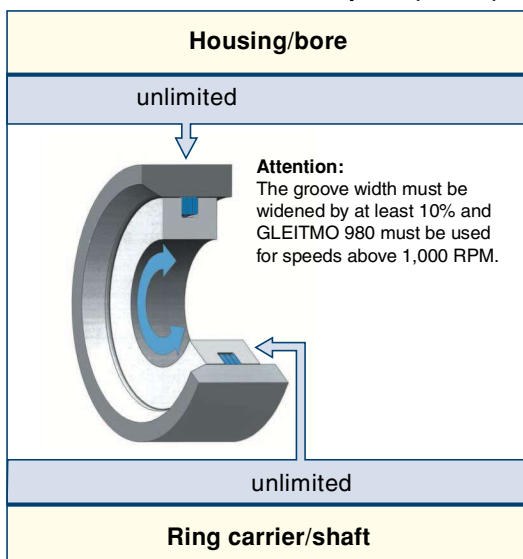
#### Ring materials

| Steel type         | Spring resistant up to | Hardness                 | Surface protection | Surface color          |
|--------------------|------------------------|--------------------------|--------------------|------------------------|
| C75S - DIN 1.0605  | max. +300°C            | on request <sup>1)</sup> | oiled              | variable <sup>2)</sup> |
| C60E - DIN 1.1221  | max. +300°C            | on request <sup>1)</sup> | oiled              | variable <sup>2)</sup> |
| 50CrV4- DIN 1.8159 | max. +400°C            | on request <sup>1)</sup> | oiled              | variable <sup>2)</sup> |
| CrNi - DIN 1.4310  | max. +450°C            | on request <sup>1)</sup> | bright and dry     | variable <sup>2)</sup> |

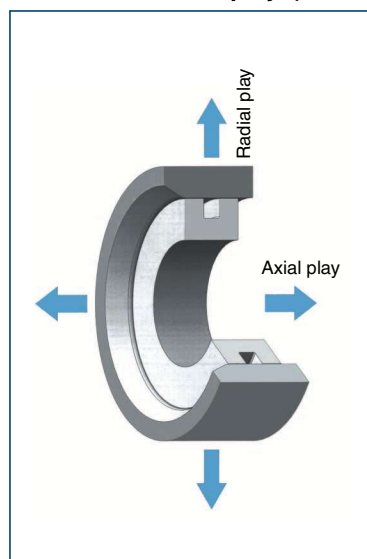
<sup>1)</sup> Variable depending on the thermal treatment type! Hardness values depending on ring cross section measured in Rockwell HRA or HRC.

<sup>2)</sup> The surface color can vary depending on the thermal treatment type: bright, light brown or blackened.

#### Permissible circumferential speed (in m/s)



#### Axial and/or radial play <sup>3)</sup>



#### FK3 AS ring set <sup>4)</sup>



#### Axial and/or radial play <sup>3)</sup>:

The groove width "A" must be widened by twice the play if play occurs in the area of the rings. The groove base diameter "D<sub>2</sub>" must be reduced by the radial play if radial play occurs. Damage to the rings and the surrounding components occurs if this is not adhered to. It is recommended to use the full groove width tolerances, especially in the case of thermal expansion.

#### Installation information:

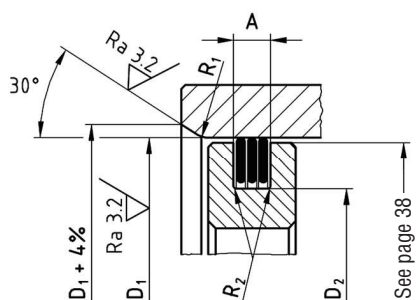
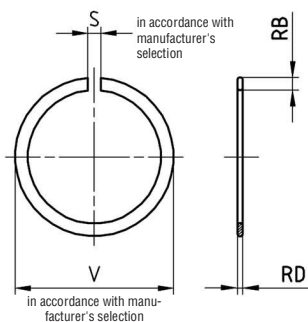
See pages 38 and 39.

#### Order information <sup>4)</sup>:

The ring diameter information must match the housing or bore diameter dimensions "D<sub>1</sub>" for all inquiries and/or orders. The rings can be ordered individually or in sets (1 set = 3 AS rings).

#### Run and installation tests:

Run and installation tests under operating conditions must be performed in each case before standard production of our laminar rings can begin to determine whether the desired sealing effects can be achieved.



| Nominal dimension      |           | Ring dimensions |           |      |           | Groove dimensions                        |           |     |           |                |                |
|------------------------|-----------|-----------------|-----------|------|-----------|------------------------------------------|-----------|-----|-----------|----------------|----------------|
| Bore<br>D <sub>1</sub> | Tolerance | RB              | Tolerance | RD   | Tolerance | D <sub>2</sub> =<br>D <sub>1</sub> minus | Tolerance | A   | Tolerance | R <sub>1</sub> | R <sub>2</sub> |
| 15 - 24.9              |           | 1.0             |           | 0.65 |           | - 2.6                                    |           | 2.2 |           |                |                |
| 25 - 29.9              |           | 1.2             |           | 0.65 |           | - 3.0                                    |           | 2.2 |           |                |                |
| 30 - 35.9              |           | 1.5             |           | 0.65 |           | - 3.6                                    |           | 2.2 |           |                |                |
| 36 - 42.9              |           | 1.8             |           | 0.65 |           | - 4.2                                    |           | 2.2 |           |                |                |
| 43 - 48.9              |           | 2.2             |           | 0.72 |           | - 5.0                                    |           | 2.4 |           |                |                |
| 49 - 51.9              |           | 2.4             |           | 0.72 |           | - 5.4                                    |           | 2.4 |           |                |                |
| 52 - 59.9              | H 6       | 2.6             | + 0.1     | 0.72 | + 0.04    | - 5.8                                    | + 0       | 2.4 | + 0.1     | min. 1         | 0.1            |
| 60 - 69.9              | H 7       | 2.8             | - 0.1     | 0.82 | - 0.02    | - 6.2                                    | - 0.2     | 2.7 | - 0       |                |                |
| 70 - 74.9              |           | 3.1             |           | 0.82 |           | - 6.8                                    |           | 2.7 |           |                |                |
| 75 - 79.9              |           | 3.3             |           | 0.82 |           | - 7.2                                    |           | 2.7 |           |                |                |
| 80 - 89.9              |           | 3.5             |           | 0.82 |           | - 7.6                                    |           | 2.7 |           |                |                |
| 90 - 99.9              |           | 3.8             |           | 0.82 |           | - 8.2                                    |           | 2.7 |           |                |                |
| 100 - 104.9            |           | 4.1             |           | 0.82 |           | - 8.8                                    |           | 2.7 |           |                |                |
| 105 - 109.9            |           | 4.3             |           | 0.98 |           | - 9.2                                    |           | 3.3 |           |                |                |
| 110 - 119.9            | H 7       | 4.6             | + 0.1     | 0.98 | + 0.05    | - 9.8                                    | + 0       | 3.3 | + 0.15    | min. 2         | 0.2            |
| 120 - 129.9            | H 8       | 5.0             | - 0.2     | 0.98 | - 0.03    | - 10.8                                   | - 0.25    | 3.3 | - 0       |                |                |
| 130 - 149.9            |           | 5.5             |           | 0.98 |           | - 11.8                                   |           | 3.3 |           |                |                |
| 150 - 170.9            |           | 6.0             |           | 1.0  |           | - 13.0                                   |           | 3.4 |           |                |                |
| 150 - 170.9            |           | *6.0            |           | 1.5  |           | - 13.0                                   |           | 5.1 |           |                |                |
| 171 - 199.9            |           | 7.0             |           | 1.0  |           | - 15.0                                   |           | 3.4 |           |                |                |
| 171 - 199.9            |           | *7.0            |           | 1.5  |           | - 15.0                                   |           | 5.1 |           |                |                |
| 200 - 259.9            | H 8       | 8.0             | + 0.15    | 1.2  | + 0.06    | - 18.0                                   | + 0       | 4.1 | + 0.2     | min. 3         | 0.3            |
| 200 - 259.9            | H 9       | *8.0            | - 0.3     | 1.5  | - 0.04    | - 18.0                                   | - 0.3     | 5.1 | - 0       |                |                |
| 260 - 319.9            |           | 9.0             |           | 1.5  |           | - 20.0                                   |           | 5.1 |           |                |                |
| 320 - 399.9            |           | 10.0            |           | 1.5  |           | - 22.0                                   |           | 5.2 |           |                |                |
| 400 - 439.9            |           | 11.0            |           | 1.5  |           | - 24.0                                   |           | 5.2 |           |                |                |
| 440 - 600.9            |           | 12.0            |           | 1.5  |           | - 26.0                                   |           | 5.2 |           |                |                |
| 440 - 600.9            |           | *12.0           |           | 2.5  |           | - 26.0                                   |           | 8.3 |           |                |                |
| 601 - 699.9            | H 9       | 14.0            | + 0.2     | 2.5  | + 0.07    | - 32.0                                   | + 0       | 8.3 | + 0.25    | min. 4         | 0.4            |
| 700 - 799.9            | H 10      | 16.0            | - 0.4     | 2.5  | - 0.05    | - 36.0                                   | - 0.4     | 8.3 | - 0       |                |                |
| 800 - 899.9            |           | 18.0            |           | 2.5  |           | - 40.0                                   |           | 8.3 |           |                |                |
| 900 - 999.9            |           | 20.0            |           | 2.5  |           | - 44.0                                   |           | 8.3 |           |                |                |
| 1000 - 1300            |           | 22.0            |           | 2.5  |           | - 48.0                                   |           | 8.4 |           |                |                |

All dimensions in mm

\*= reinforced ring design

Note: Please refer to the information on pages 2, 38, 39, 40 and 41 (questionnaire).

Please list exact bore or housing diameter "D<sub>1</sub> for all inquiries and orders!

# FK 3 ASK

## Single laminar sealing rings combined for bores



### Application "FK3 ASK" Outside clamping combined single rings (5 rings = 1 set)

Single wound laminar sealing rings "FK3 ASK" are used as a grease seal for roller and plain bearings and they protect, if greased, against dust entry and ambient moisture. Due to the increased labyrinth effect, the sealing effect is optimized by the additional sealing of the groove base diameter.

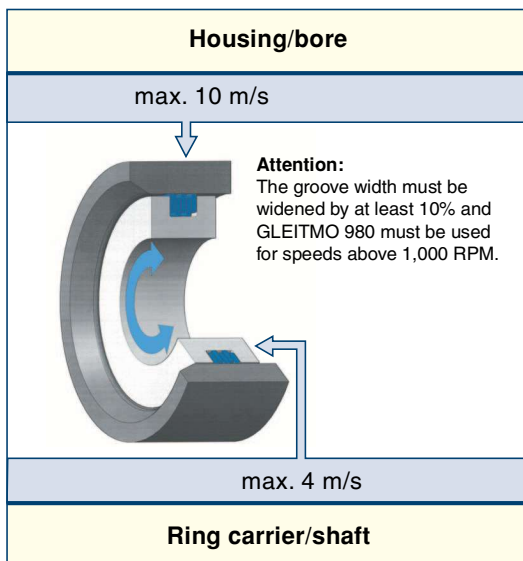
The "FK3 AS" or "FK3 ASK" assemblies are normally preferred over the "FK3 IS" or "FK3 ISK" assemblies due to their easier installation into the grooves. Depending on the applications or the technical requirements, the ring carriers can be manufactured from steel, cast iron, light alloy or plastics.

### Ring materials

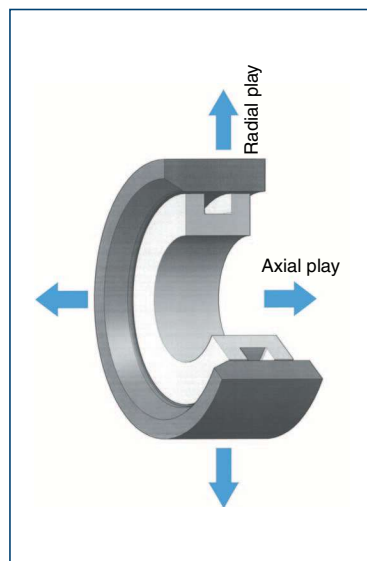
| Steel type         | Spring resistant up to | Hardness                 | Surface protection | Surface color          |
|--------------------|------------------------|--------------------------|--------------------|------------------------|
| C75S - DIN 1.0605  | max. +300°C            | on request <sup>1)</sup> | oiled              | variable <sup>2)</sup> |
| C60E - DIN 1.1221  | max. +300°C            | on request <sup>1)</sup> | oiled              | variable <sup>2)</sup> |
| 50CrV4- DIN 1.8159 | max. +400°C            | on request <sup>1)</sup> | oiled              | variable <sup>2)</sup> |
| CrNi - DIN 1.4310  | max. +450°C            | on request <sup>1)</sup> | bright and dry     | variable <sup>2)</sup> |

<sup>1)</sup> Variable depending on the thermal treatment type! Hardness values depending on ring cross section measured in Rockwell HRA or HRC.  
<sup>2)</sup> The surface color can vary depending on the thermal treatment type: bright, light brown or blackened.

### Permissible circumferential speed (in m/s)



### Axial and/or radial play <sup>3)</sup>



### FK3 ASK ring set <sup>4)</sup>



### Axial and/or radial play <sup>3)</sup>:

The groove width "A" must be widened by twice the play if play occurs in the area of the rings. The groove base diameter "D<sub>2</sub>" must be reduced by the radial play if radial play occurs. Damage to the rings and the surrounding components occurs if this is not adhered to. It is recommended to use the full groove width tolerances, especially in the case of thermal expansion.

### Installation information:

See pages 38 and 39.

### Order information <sup>4)</sup>:

The ring diameter information must match the housing or bore diameter dimensions "D<sub>1</sub>" for all inquiries and/or orders. The rings can be ordered individually or in sets (1 set = 3 AS rings + 2 IS rings).

### Run and installation tests:

Run and installation tests under operating conditions must be performed in each case before standard production of our laminar rings can begin to determine whether the desired sealing effects can be achieved.