Bore Clamp
Block-type eccentric, for bore diameter 6.6 to 13.8 mm, double acting, max. operating pressure 250 bar

Application
The patented bore clamp is particularly suitable for positioning and clamping of workpieces with bore holes from diameter 6.6 to 13.8 mm in the support face.

The workpiece is directly put onto the bore clamp, so that the remaining surfaces are free for 5-sided machining.

Due to its small and eccentric design the bore clamp can be placed very close to the workpiece contour.

The variants with centring and compensation can compensate side loads.

According to the load additional clamping forces can be necessary, since the axial clamping force is relatively small (see page 3).

Description
In the body of the bore clamp a double-acting hydraulic cylinder is mounted. By screwing in the clamping screw the piston actuates via a dowel pin a drive pin that is eccentrically arranged at the edge of the housing.

The clamping ring is centred on a taper sleeve and hold by the head of the clamping screw.

The clamping screw is secured by means of a thread coating against loosening.

Penetration of liquids and swarf is avoided by the connection of positive air pressure protection.

Important notes
If liquids or swarf can penetrate, e.g. due to an open clamping bore, positive air pressure protection must be continuously switched on. In addition, the hardened support surface and the clamping ring should be blast cleaned before every clamping process.

Clamping ring and clamping screws are wear parts and should be exchanged after approx. 10,000 actuations (see page 3).

The axial pulling force is non-positively transmitted, since the exterior diameter of the clamping ring is not profiled. Therefore the clamping bores should not be tapered.

Advantages
- Axial clamping in simple and smooth bore holes
- Low bore depths
- 5-sided machining possible
- 3 different clamping inserts
  “With centring”
  “Without centring”
- Additional centring elements are not required
- Compensation of side loads (with centring and compensation)
- Repetitive accuracy 0.003 mm (with centring and compensation)
- Compact eccentric design
- Hardened support surface
- Pneumatic seat check
- Connection for positive air pressure protection
- Oil supply alternatively via pipe thread or drilled channels

Function

Centring function
- Bore clamp with centring
  Type 4319-X1
  Fixed centring cone
- Bore clamp with compensation
  Type 4319-X2
  Centring cone in one axial direction
  ± 0.2 mm movable
- Bore clamp without centring
  Type 4319-X3
  Centring cone in all directions
  ± 0.25 mm movable

Operating conditions and other data see data sheet A 0.100.

Connecting possibilities

Pipe thread

Drilled channels

Applications
- Centre and clamp in 1 bore hole
- Centre and clamp in 2 bore holes
- Centre and clamp in more than 2 bore holes

Centring function

Clamping screw

Piston

Drive pin

Dowel pin

Clamping ring

Taper sleeve

Pneumatic seat check

Applications
Dimensions
Technical data

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<tbody>
<tr>
<td>4319-X1</td>
<td>With centring</td>
<td>6.6 - 6.8</td>
<td>6.6</td>
<td>9</td>
<td>11</td>
<td>13.5</td>
<td>see clamping force diagram page 3</td>
<td>see clamping force diagram page 3</td>
<td>see clamping force diagram page 3</td>
<td>250</td>
<td>50</td>
<td>0.2</td>
<td>25</td>
<td>67.5</td>
<td>59</td>
<td>12(10)</td>
<td>7.3</td>
<td>7.5</td>
<td>1.65</td>
<td>4319-21A-066</td>
<td>4319-21A-090</td>
<td>4319-31A-110</td>
<td>4319-31A-135</td>
<td>3610-158</td>
</tr>
<tr>
<td>4319-X2</td>
<td>With compensation (direction adjustable)</td>
<td>9.0 - 9.2</td>
<td>9.0</td>
<td>11</td>
<td>13.5</td>
<td>13.5</td>
<td>see clamping force diagram page 3</td>
<td>see clamping force diagram page 3</td>
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<td>4319-X3</td>
<td>Without centring</td>
<td>11.0 - 11.3</td>
<td>11.0</td>
<td>11</td>
<td>13.5</td>
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<td></td>
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<td>13.5 - 13.8</td>
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*) Forces at the clamping point and important notes see page 3
**) Cannot compensate side loads (see explanation page 3)
Clamping force
Clamping bore hole + Spare parts

Forces at the clamping point

\[ F_z \] Pulling force of the clamping screw see chart page 2
\[ F_w \] Radial expansion force of the clamping ring see chart page 2
\[ F_H \] Axial clamping force (support force) see clamping force diagram
\[ F_R \] Axial retention force \[ \Rightarrow \] workpiece fitting force see displacement force diagram
\[ F_Q \] Side load \[ \Rightarrow \] workpiece displacement force see displacement force diagram

Effective clamping force \[ F_{\text{sp}} \]

The pulling force of the clamping screw acts onto the clamping ring, that will be expanded on the clamping taper and moves approx. 0.2-1 mm downwards. As soon as the clamping ring gets in contact with the bore hole diameter a pull-down effect onto the support surface of the bore clamp results due to the sliding friction. The axial clamping force also depends on the friction coefficient \( \mu \).

**Axial retention force \( F_R \)**

The clamping ring contacts the bore diameter with the expansion force \( F_w \). The axial clamping force also depends on the friction coefficient \( \mu \). The axial retention force is a little bit higher with “soft” materials (Al) than the clamping force \( F_{\text{sp}} \). However when planning the system the values indicated in the clamping force diagram should not be exceeded for safety reasons.

**Side load \( F_Q \)**

Bore clamps with centring
- compensate side loads from all directions.

Bore clamps with compensation
- compensate only side loads square to the compensation direction.

Bore clamps without centring
- do not compensate side loads.

The displacement force diagram shows the displacement of the workpiece in mm in case of side loads per bore clamp.

### Spares

**Clamping range \( \varnothing \) dsp [mm]**

<table>
<thead>
<tr>
<th>Clamping range</th>
<th>( \varnothing ) dsp [mm]</th>
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<tr>
<td>Min. clamping ring ( \varnothing ) ( *) ) [mm]</td>
<td>6.5 8.9 10.9 13.4</td>
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<tr>
<td>Max. clamping ring ( \varnothing ) ( **) ) [mm]</td>
<td>6.9 9.3 11.4 13.9</td>
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<tr>
<td>Min. bore depth ( \varnothing ) [mm]</td>
<td>8 9 10 11.5</td>
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</table>

**Part no. (spare part)**

| Clamping ring | 3548-815 3548-633 3548-634 3548-639 |
| Clamping ring + clamping screw | 0354-245 0354-246 0354-247 0354-248 |
| Adjusting sleeve | 3410-1193 3410-1194 3410-1195 3410-1196 |

\( *) \) New condition \( **) \) Max. diameter of adjusting sleeve

### Adjust clamping ring

New bore clamps are adjusted to the ordered clamping range. (Do not adjust the clamping screw).

1. Hydraulically move the bore clamp to clamping position.
2. Put the clamping ring onto the clamping taper. Pay attention to the correct position of the taper angle! (see drawing above).
3. Screw in the clamping screw just before getting in contact with the clamping ring.
4. Screw in the adjusting sleeve.
5. Screw in the clamping screw until the clamping ring contacts the interior diameter of the adjusting sleeve. Tighten the clamping screw only slightly! (The thread is secured against loosening by means of the Tuflok coating).
6. Move the bore clamp to the unclamping position and remove the adjusting sleeve.
7. Screw in the clamping screw just before getting in contact with the clamping ring.
8. Put the adjusting sleeve back on the bore clamp.
9. Screw in the clamping screw until the clamping ring contacts the interior diameter of the adjusting sleeve. Tighten the clamping screw only slightly!
10. Move the bore clamp to the unclamping position and remove the adjusting sleeve.

**Measuring conditions**

**Material** C45+C

Wet machining

**Operating pressure [bar]**

- **Min.** 100 150 200 250
- **Max.** 350 500 720

**Material testing**

- C35
- C60
- C45+C

**Table of forces**

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<td>C45+C</td>
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<td>4319-3XA-135 max. 100 280 475 625</td>
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Important!

In case of hardened workpieces and in very smooth and greased clamping bore holes, the clamping force can be close to zero. Remedy: Provide additional clamping elements, as e.g. swing clamps.