SHEAR DOWEL HED

Expansion joint dowelling in concrete structural elements

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Expansion joint dowelling in concrete structural elements

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SHEAR DOWEL HED

THE PRODUCT
Due to the use of these HED type shear dowels, dowelling applications on expansion joints can be solved simply and reliably even where there are varying shear forces. It guarantees a displacement of the structural element in the longitudinal axis of the rod up to a joint width of 40 mm. The shear dowels are available in steel grade S 355 galvanized or in stainless steel with material number 1.4571 / 1.4362 (corrosion-protection class 3). All types are available with a special fire protection sleeve for classification according to F90.

FEATURES
▪ Prevents component displacement in the area of the joint
▪ Simple, precise-fit assembly using shear dowel sleeves on the shuttering. A rip-proof film protects the sleeve from ingress of concrete
▪ There is no requirement to drill through the shuttering or supplementary drilling of the concrete

APPLICATION AREA
Single type HED shear dowels are used wherever shear forces are to be transferred through structural joints, e.g. expansion joints between concrete slabs, in floors and walls, for joints between supports and walls or between balconies and floors.
TYPES AND DIMENSIONS

TYPES

SHEAR DOWEL HED-S + GS SLEEVES
- Motion in the longitudinal direction
- Transmission of transverse forces vertically and parallel to the joint
- Sliding sleeve and dowel made of stainless steel

SHEAR DOWEL HED-S + GSQ SLEEVES
- Motion in the longitudinal and transverse direction
- Transmission of transverse forces vertically to the joint
- Sliding sleeve and dowel made of stainless steel

SHEAR DOWEL HED-S + GK SLEEVES
- Motion in the longitudinal direction
- Transmission of transverse forces vertically and parallel to the joint
- Sliding sleeve made of plastic, dowel made of S 355 galvanized or stainless steel

SHEAR DOWEL HED-P
- Motion in the longitudinal direction
- Transmission of transverse forces vertically and parallel to the joint
- With plasticized spring element
- Dowel made of S 355 galvanized or stainless steel

DIMENSIONS

<table>
<thead>
<tr>
<th>Dowel type</th>
<th>Dowel element</th>
<th>Sleeves GS, GK</th>
<th>Sleeves GSQ</th>
<th>Max transverse displacement y [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>HED-S</td>
<td>Dowel Ø [mm]</td>
<td>Sleeve length l_u [mm]</td>
<td>Nail plate B/H [mm]</td>
<td>Sleeve length l_H [mm]</td>
</tr>
<tr>
<td>20</td>
<td>20</td>
<td>160</td>
<td>70/70</td>
<td>180</td>
</tr>
<tr>
<td>22</td>
<td>22</td>
<td>160</td>
<td>70/70</td>
<td>180</td>
</tr>
<tr>
<td>25</td>
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<td>160</td>
<td>70/70</td>
<td>180</td>
</tr>
<tr>
<td>30</td>
<td>30</td>
<td>185</td>
<td>80/80</td>
<td>205</td>
</tr>
</tbody>
</table>
**SHEAR DOWEL HED**

**MEASUREMENTS**

**REINFORCED CONCRETE**

The decisive resistance for dimensioning is the lesser value of the steel bearing capacity and concrete bearing capacity:

\[ V_{Rd} = \min (V_{Rd,S}; V_{Rd,C}) \]

The decisive resistance for the concrete bearing capacity is the lesser value of the verifications of concrete edge break and punching shear:

\[ V_{Rd,C} = \min (V_{Rd,ce}; V_{Rd,ct}) \]

- \( V_{Rd,S} \): Dimensioning resistance of the steel bearing capacity taking into account the friction forces \( (f_\mu = 0,9) \)
- \( V_{Rd,C} \): Dimensioning resistance of the concrete bearing capacity
- \( V_{Rd,ce} \): Dimensioning resistance of the concrete edge break according to the expert opinion of Prof. Eligehausen 2004
- \( V_{Rd,ct} \): Dimensioning resistance to punching shear in accordance with EC2

**Dimensioning Resistances: Steel Bearing Capacity**

\[ V_{Rd,S} = f_\mu \times 1,25 \times (f_y / \gamma_{MS}) \times W / (z + \varnothing/2) \]

**Dimensioning Resistances: Concrete Bearing Capacity**

- \( f_\mu \): 0,9 reduction factor for friction
- \( f_y \): Yield point dowel [N/mm²]
- \( z \): Joint width [mm]
- \( \varnothing \): Dowel diameter [mm]
- \( W \): Moment of resistance [mm³]
- \( \gamma_{MS} \): Material safety factor for steel
# MEASUREMENTS

## DIMENSIONING RESISTANCES FOR CONCRETE AND STEEL BEARING CAPACITY IN REINFORCED CONCRETE

<table>
<thead>
<tr>
<th>Dowel type</th>
<th>Dimensioning resistances for steel bearing capacity $V_{rd,S}$ [kN] taking the friction for the joint width into account</th>
<th>Component thickness $h$ [mm]</th>
<th>Rated resistances concrete load capacity* $V_{rd,C}$ [kN] for C20/25</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$z = 0$-$10$ mm $z = 11$-$20$ mm $z = 21$-$30$ mm $z = 31$-$40$ mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>14.3 9.5 7.1 5.7</td>
<td>$\geq 160$ $\geq 180$</td>
<td>13.7 14.3**</td>
</tr>
<tr>
<td>22</td>
<td>18.1 12.2 9.3 7.4</td>
<td>$\geq 180$ $\geq 200$ $\geq 220$ $\geq 240$</td>
<td>14.2 15.8 17.2 18.0 18.1**</td>
</tr>
<tr>
<td>25</td>
<td>24.8 17.1 13.1 10.6</td>
<td>$\geq 180$ $\geq 200$ $\geq 220$ $\geq 240$ $\geq 260$</td>
<td>20.5 22.4 23.6 24.6 24.8**</td>
</tr>
<tr>
<td>30</td>
<td>38.5 27.5 21.4 17.5</td>
<td>$\geq 220$ $\geq 240$ $\geq 260$ $\geq 300$ $\geq 320$</td>
<td>29.2 31.5 33.7 35.8 38.0 38.5**</td>
</tr>
</tbody>
</table>

* taking on-site reinforcement into account
** for these values the dimensioning resistance of the steel bearing capacity is reached taking the friction forces ($f_\mu = 0.9$) into account

## ON-SITE REINFORCEMENT AND MINIMUM SPACINGS

![Diagram showing on-site reinforcement and minimum spacings](image)

<table>
<thead>
<tr>
<th>Dowel type</th>
<th>Required dowel spacing $e_{min}$ [mm]</th>
<th>Distance from edge $a_i$ [mm]</th>
<th>Construction element thickness $h_{min}$ [mm]</th>
<th>Stirrup spacing $I_c$ [mm]</th>
<th>On-site reinforcement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>310</td>
<td>155</td>
<td>160</td>
<td>60</td>
<td>2 Ø 10</td>
</tr>
<tr>
<td>22</td>
<td>350</td>
<td>175</td>
<td>160</td>
<td>60</td>
<td>2 Ø 10</td>
</tr>
<tr>
<td>25</td>
<td>410</td>
<td>205</td>
<td>180</td>
<td>70</td>
<td>2 Ø 12</td>
</tr>
<tr>
<td>30</td>
<td>560</td>
<td>280</td>
<td>220</td>
<td>90</td>
<td>2 Ø 14</td>
</tr>
</tbody>
</table>

$e_{min}$ minimum spacing between axes of single dowels
$a_i$ minimum distance from edge
$h_{min}$ minimum construction element thickness
$I_c$ Spacing of the first splice stirrup on the dowel
$A_{sx}$ Splice stirrup
$A_{sy}$ Longitudinal reinforcement
MEASUREMENTS

NON-REINFORCED CONCRETE

The determination of the dimensioning resistances $V_{Rd}$ of the shear dowels HED for the steel and concrete bearing capacity according to Booklet 346, DafStb as follows:

**STEEL BEARING CAPACITY**

$$V_{Rd,S} = f_{\mu} \times 1.25 \times \left( f_{yk} / \gamma_{MS} \right) \times W / (z + \theta/2)$$

**CONCRETE BEARING CAPACITY**

$$V_{Rd,C} = 0.4 \times f_{yk} \times \theta^{0.1} / (333 + 12.2 \times z)$$

$$0.4 = (\alpha \times \gamma_{MW}) / 3$$

with:

- $f_{\mu}$: 0.9 reduction factor for friction
- $f_{yk}$: Yield point Dowel [N/mm²]
- $f_{ck}$: Characteristic cylinder compressive strength of the concrete [N/mm²]
- $z$: Joint width [mm]
- $\theta$: Dowel diameter [mm]
- $W$: Moment of resistance [mm³]
- $\gamma_{MS}$: Material safety factor for steel
- $\alpha$: 0.85 (in consideration with longterm effects on the compressive strength of concrete)
- $\gamma_{MW}$: 1,425 (average between permanent, $\gamma_{q} = 1.35$ and varying, $\gamma_{q} = 1.5$ impacts)

**DIMENSIONING RESISTANCES IN NON-REINFORCED CONCRETE**

<table>
<thead>
<tr>
<th>Dowel type</th>
<th>Concrete quality</th>
<th>Dowel Ø [mm]</th>
<th>Min. construction element thickness $h_{\text{min}}$ [mm]</th>
<th>Dimensioning resistances [kN] taking the resistance of the joint width into account</th>
</tr>
</thead>
<tbody>
<tr>
<td>HED-S</td>
<td>≥ C 20/25</td>
<td>20</td>
<td>320</td>
<td>$z = 0-10$ mm: 9.5, $z = 11-20$ mm: 7.1, $z = 21-30$ mm: 5.7, $z = 31-40$ mm: 4.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>22</td>
<td>350</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>25</td>
<td>400</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>30</td>
<td>480</td>
<td></td>
</tr>
<tr>
<td>HED-P</td>
<td>20</td>
<td>20</td>
<td>320</td>
<td></td>
</tr>
<tr>
<td></td>
<td>22</td>
<td>22</td>
<td>350</td>
<td></td>
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<tr>
<td></td>
<td>30</td>
<td>30</td>
<td>480</td>
<td></td>
</tr>
</tbody>
</table>

An edge spacing of $a_{s} \geq 8 \theta$ and a dowel spacing of $e \geq 16 \theta$ referred to the dowel axis must be maintained in all directions.
If there are technical fire protection requirements on the construction elements according to DIN 4102 Part 2, the shear dowels must be installed with fire protection sleeves. In order to meet the classification F90 the unprotected dowel must be fitted with a fire protection sleeve in the joint. In the event of a fire, the fire protection sleeve foams and completely fills the joint.

### Joint insulation on site

- Fire protection sleeve

### DIMENSIONS OF THE FIRE PROTECTION SLEEVES TYPE BRM & BRMQ

<table>
<thead>
<tr>
<th>Type</th>
<th>Dowel</th>
<th>Sleeve</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ø [mm]</td>
<td>b [mm]</td>
</tr>
<tr>
<td>BRM 20</td>
<td>20</td>
<td>122</td>
</tr>
<tr>
<td>BRM 22</td>
<td>22</td>
<td>122</td>
</tr>
<tr>
<td>BRM 25</td>
<td>25</td>
<td>122</td>
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<tr>
<td>BRM 30</td>
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<td>122</td>
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<tr>
<td>BRMQ 20</td>
<td>20</td>
<td>152</td>
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<tr>
<td>BRMQ 22</td>
<td>22</td>
<td>152</td>
</tr>
<tr>
<td>BRMQ 25</td>
<td>25</td>
<td>152</td>
</tr>
<tr>
<td>BRMQ 30</td>
<td>30</td>
<td>152</td>
</tr>
</tbody>
</table>

Ordering example: BRM-25-20 for shear dowel HED 25 Nominal joint 20 mm
INSTALLATION INSTRUCTIONS SHEAR DOWEL HED-S + GK/GS SHEAR DOWEL SLEEVE*

- Nail the sleeve on to the shuttering
- Do NOT remove protective sticker
- Arrange the reinforcement in accordance with the reinforcement plan
- Concrete in the first section
- Strip the shuttering
- Remove protective sticker
- Apply the joint material
- Cut an aperture in the joint material
- Attach the fire protection sleeve
- Push the dowel into the sleeve
- Arrange the reinforcement in accordance with the reinforcement plan
- Concrete in the second section

* Fitting with GSQ sleeve has to be effected correspondingly. It should be ensured that the GSQ sleeve is fit horizontally.
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