# Cone Clamping Elements RLK 402

## for very high bending moments

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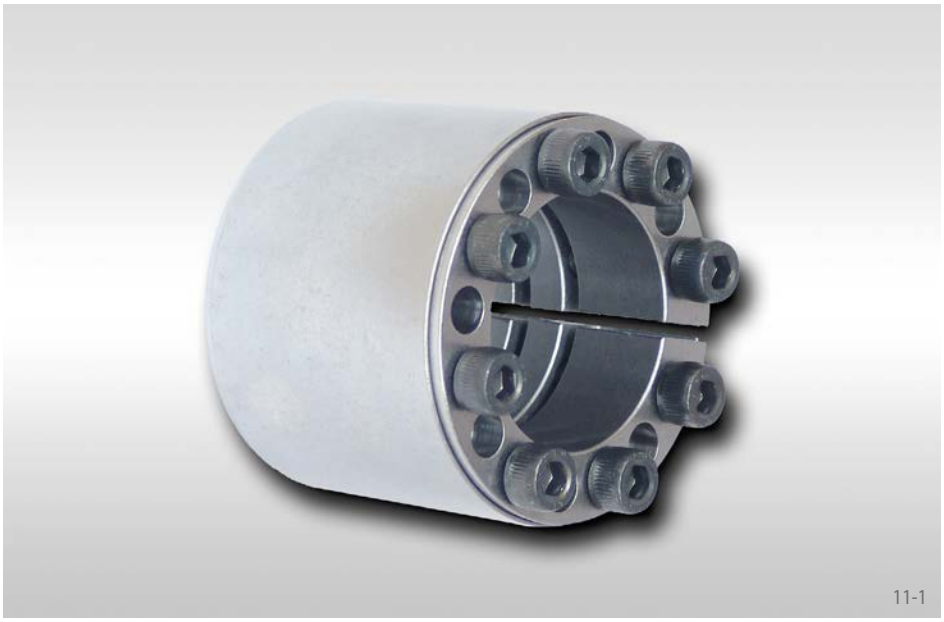
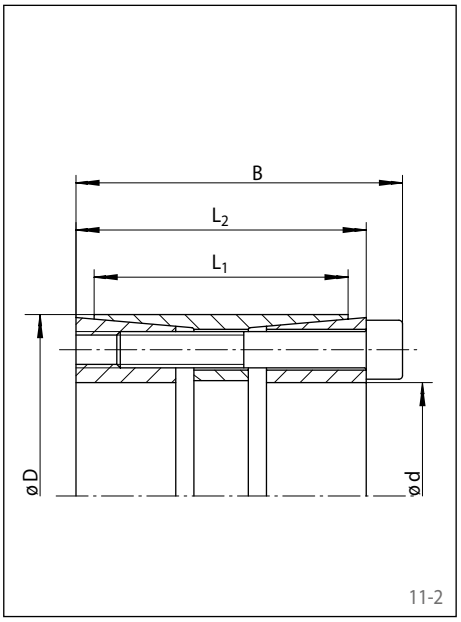


11-1




11-2

| Dimensions | | | | | Technical Data | | | | | | | | | | | | | Article number |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Size | | | | | Transmissible torque or axial force | | Bending moments | | Contact pressure at | | Pressure at $M_b$ max | | Clamping screws | | | | Weight | |
| | | | | | | | | | Shaft | Hub | Shaft | Hub | Tightening torque | Number | Size | Length | | |
| d | D | B | L1 | L2 | M | F | $M_b$ max | $M_t$ res at $M_b$ max | $P_W$ | $P_N$ | $P_W$ | $P_N$ | $M_S$ | | | | | |
| mm | mm | mm | mm | mm | Nm | kN | | | N/mm² | N/mm² | N/mm² | N/mm² | Nm | | | mm | kg | |
| 70 | 110 | 86 | 70 | 76 | 11450 | 327 | 5150 | 10220 | 207 | 131 | 227 | 145 | 83 | 10 | M10 | 60 | 2,9 | 4205-070201-000000 |
| 75 | 115 | 86 | 70 | 76 | 12270 | 327 | 5520 | 10950 | 193 | 126 | 214 | 139 | 83 | 10 | M10 | 60 | 3,1 | 4205-075201-000000 |
| 80 | 120 | 86 | 70 | 76 | 15700 | 393 | 7070 | 14020 | 217 | 145 | 246 | 164 | 83 | 12 | M10 | 60 | 3,3 | 4205-080201-000000 |
| 85 | 125 | 86 | 70 | 76 | 16680 | 393 | 7510 | 14900 | 204 | 139 | 234 | 159 | 83 | 12 | M10 | 60 | 3,4 | 4205-085201-000000 |
| 90 | 130 | 86 | 70 | 76 | 17660 | 393 | 7950 | 15770 | 193 | 133 | 222 | 154 | 83 | 12 | M10 | 60 | 3,5 | 4205-090201-000000 |
| 95 | 135 | 86 | 70 | 76 | 18650 | 393 | 8390 | 16650 | 183 | 129 | 212 | 149 | 83 | 12 | M10 | 60 | 3,7 | 4205-095201-000000 |
| 100 | 145 | 110 | 92 | 98 | 28590 | 572 | 10290 | 26670 | 190 | 131 | 210 | 145 | 144 | 12 | M12 | 80 | 5,6 | 4205-100201-000000 |
| 110 | 155 | 110 | 92 | 98 | 31450 | 572 | 11320 | 29340 | 172 | 122 | 192 | 136 | 144 | 12 | M12 | 80 | 6,1 | 4205-110201-000000 |
| 120 | 165 | 110 | 92 | 98 | 40030 | 667 | 14410 | 37340 | 184 | 134 | 208 | 151 | 144 | 14 | M12 | 80 | 6,6 | 4205-120201-000000 |
| 130 | 180 | 128 | 108 | 114 | 50980 | 784 | 18350 | 47560 | 170 | 123 | 190 | 137 | 229 | 12 | M14 | 90 | 9,5 | 4205-130201-000000 |
| 140 | 190 | 128 | 108 | 114 | 64050 | 915 | 23060 | 59760 | 184 | 136 | 208 | 153 | 229 | 14 | M14 | 90 | 10,0 | 4205-140201-000000 |
| 150 | 200 | 128 | 108 | 114 | 78430 | 1046 | 28230 | 73170 | 197 | 148 | 223 | 167 | 229 | 16 | M14 | 90 | 10,6 | 4205-150201-000000 |
| 160 | 210 | 128 | 108 | 114 | 83660 | 1046 | 30120 | 78050 | 184 | 141 | 211 | 161 | 229 | 16 | M14 | 90 | 11,2 | 4205-160201-000000 |
| 170 | 225 | 162 | 136 | 146 | 106510 | 1253 | 38340 | 99370 | 166 | 125 | 186 | 140 | 354 | 14 | M16 | 110 | 16,8 | 4205-170201-000000 |
| 180 | 235 | 162 | 136 | 146 | 128890 | 1432 | 46400 | 120240 | 179 | 137 | 202 | 154 | 354 | 16 | M16 | 110 | 17,6 | 4205-180201-000000 |
| 190 | 250 | 162 | 136 | 146 | 136050 | 1432 | 48980 | 126920 | 167 | 127 | 189 | 144 | 354 | 16 | M16 | 110 | 20,3 | 4205-190201-000000 |
| 200 | 260 | 162 | 136 | 146 | 143210 | 1432 | 51550 | 133600 | 158 | 122 | 181 | 139 | 354 | 16 | M16 | 110 | 21,3 | 4205-200201-000000 |
| 220 | 285 | 162 | 136 | 146 | 196910 | 1790 | 70890 | 183710 | 180 | 139 | 208 | 161 | 354 | 20 | M16 | 110 | 24,9 | 4205-220201-000000 |
| 240 | 305 | 162 | 136 | 146 | 236290 | 1969 | 85100 | 220450 | 181 | 143 | 213 | 167 | 354 | 22 | M16 | 110 | 26,9 | 4205-240201-000000 |
| 260 | 325 | 162 | 136 | 146 | 255980 | 1969 | 92200 | 238820 | 167 | 134 | 199 | 159 | 354 | 22 | M16 | 110 | 28,7 | 4205-260201-000000 |
| 280 | 355 | 197 | 165 | 177 | 350500 | 2504 | 126200 | 327000 | 164 | 129 | 191 | 150 | 692 | 18 | M20 | 130 | 43,4 | 4205-280201-000000 |
| 300 | 375 | 197 | 165 | 177 | 417260 | 2782 | 150200 | 389280 | 170 | 136 | 200 | 160 | 692 | 20 | M20 | 130 | 46,0 | 4205-300201-000000 |

The technical data provided are based on theoretical calculations and the specified screw tightening torques.

# Hub design

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Hub arrangement

For Cone Clamping Elements with a fixed backstop point, the hub must be positioned as shown in figure 14-1.

For Cone Clamping Elements without a fixed backstop point, the hub must be positioned as shown in figure 14-2. In this case, it is assumed for practical purposes that the screw heads of the Cone Clamping Element are flush with the hub on one side

Required hub width

The hub width $N_A$ used in the application must not be smaller than the load-bearing hub width $L_1$.

Required hub outer diameter

The hub outer diameter $K_A$ used in the application must not be smaller than the required hub outer diameter $K_{min}$. The required hub outer diameter $K_{min}$ can be calculated approximately using the hub width $N_A$ used in the application and the corresponding yield strength $R_e$ of the hub material as follows:

$$K_{min} = 1{,}2 \cdot D \cdot \frac{H - 1{,}25}{H - 3}$$

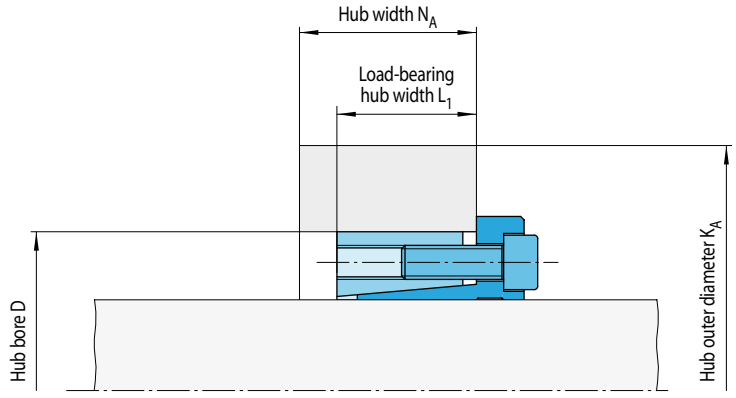
$$\text{with } H = \left( \frac{R_e}{1{,}27 \cdot P_N} \cdot \frac{N_A}{L_T} \right)^2$$

Required yield strength of the hub material

For a given hub width $N_A$ and a given hub outside diameter $K_A$, the yield strength $R_e$ of the hub material must be greater than the equivalent stress $\sigma_v$ in the hub.

$$\sigma_v = 1{,}27 \cdot P_N \cdot \frac{L_T}{N_A} \cdot \sqrt{\frac{3 + C_N^4}{1 - C_N^2}}$$

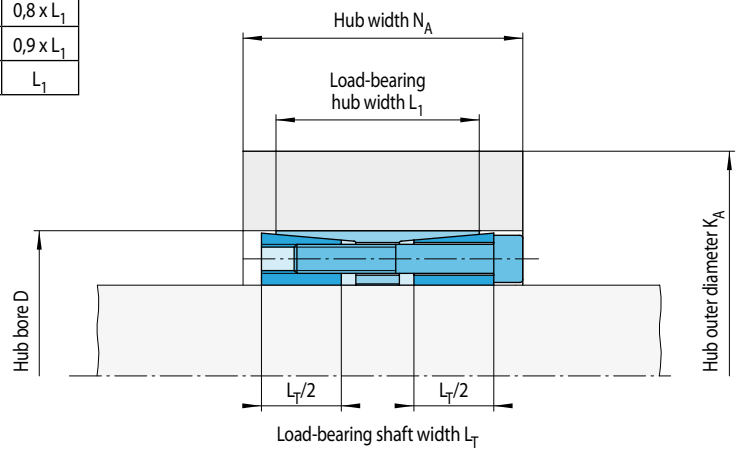
$$\text{with } C_N = \frac{D}{K_A}$$




**Hub arrangement for Cone Clamping Elements with a fixed backstop point (shown here as RLK 136 TC)**

14-1

| Series | $L_T$ |
|---|---|
| RLK 402 | 0,8 x $L_1$ |
| RLK 404 | 0,9 x $L_1$ |
| other | $L_1$ |




**Hub arrangement for Cone Clamping Elements without a fixed backstop point (shown here as RLK 402)**

14-2

## Formula symbols

$C_N$ = Auxiliary value without unit

D = Hub bore according to table [mm]

H = Auxiliary value without unit

$K_A$ = Hub outer diameter used in the application [mm]

$K_{min}$ = Required hub outer diameter according to calculation [mm]

$L_1$ = Load-bearing axial hub width according to table [mm]

$L_T$ = Load-bearing shaft width [mm]

$N_A$ = Hub width used in the application [mm]

$P_N$ = Contact pressure at the hub according to table [N/mm²]

$R_e$ = Hub material yield strength [N/mm²]

$\sigma_v$ = Equivalent stress in the hub [N/mm²]

# Torques and axial forces

## Clamping screw tightening torque

The tightening torque $M_S$ listed in the tables must be achieved during assembly and must not be exceeded by more than 10%. If the indicated tightening torque $M_S$ is not achieved, the transmissible torque or axial force, as well as the contact pressures at the shaft and at the hub will be proportionally reduced compared to the values listed in the tables for M or F as well as for $P_W$ and $P_N$. When the indicated tightening torque $M_S$ is undercut by more than 30%, please contact us.

## Simultaneous transmission of torque and axial force

The transmissible torques M which are shown in the tables apply for axial forces F = 0 kN and conversely, the indicated axial forces F apply to torques M = 0 Nm. If torque and axial force are to be transmitted simultaneously, the transmissible torque and the transmissible axial force are reduced compared to the values listed in the tables for M and F.

For a given axial force $F_A$, the reduced torque $M_{red}$ is calculated as:

$$M_{red} = \sqrt{M^2 - (F_A \cdot \frac{d}{2})^2}$$

For a given torque $M_A$, the reduced axial force $F_{red}$ is calculated as:

$$F_{red} = \frac{2}{d} \sqrt{M^2 - M_A{}^2}$$

## Design of shaft and hub

The transmissible torques or axial forces listed are subject to the following tolerances, surface characteristics and material requirements. Please contact us in the case of deviations.

Tolerances

- h8 for shaft diameter d
- H8 for hub bore D

Surfaces

Average surface roughness at the contact surfaces between the shaft and the hub bore: $R_z$ = 10 … 25 µm.

Materials

The following apply to the shaft and the hub:

- E-module ≥ 170 kN/mm²

## Installation

Please request our installation and operating instructions Cone Clamping Elements.

## Formula symbols

| | | |
|---|---|---|
| d | = | Shaft diameter according to table [mm] |
| F | = | Transmissible axial force according to table [kN] |
| $F_A$ | = | Maximum actual application axial force [kN] |
| $F_{red}$ | = | Reduced axial force [kN] |
| M | = | Transmissible torque according to table [Nm] |
| $M_A$ | = | Maximum actual application torque [Nm] |
| $M_{red}$ | = | Reduced torque [Nm] |
| $M_S$ | = | Screw tightening torque according to table [Nm] |
| $P_N$ | = | Contact pressure at the hub according to table [N/mm²] |
| $P_W$ | = | Contact pressure at the shaft according to table [N/mm²] |