

Article:

Shackles

Subject:

Bearing surface of Green Pin®

Sling shackles

Date:

28-10-2015

Ref:

PI-08-04 EN

Note: Main dimensions, general info and warnings can be found in our latest catalogue

The optimal conditions for a sling not only depend on the D/d ratio, they are also influenced by the ratio between the width of the shackle crown versus the radius in the shackle crown.

The bending efficiency of the steel wire rope or textile sling depends on below points:

D/d ratio (bending efficiency)

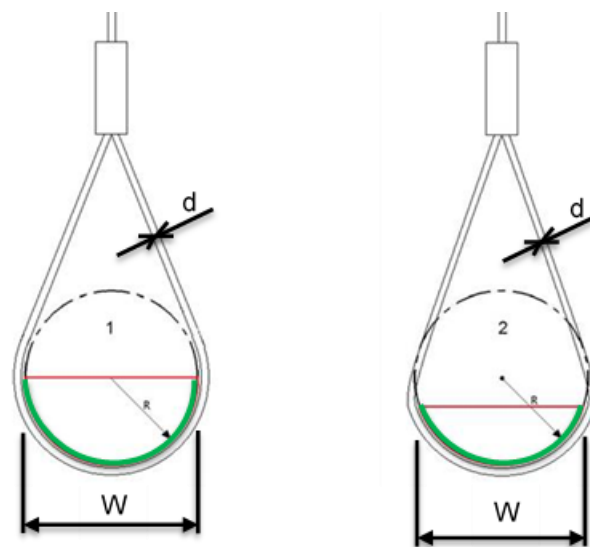
$D = W$ = width of the top of the crown of the shackle body, d = diameter of the sling, see picture 1. When a wire rope or textile sling is bent around a sling shackle there is a loss of strength due to this bending action. To determine by how much the WLL of a sling must be reduced in order to guarantee its safety factor the D/d ratio can be used. When the D/d ratio becomes smaller this loss of strength becomes greater and the rope becomes less efficient. For the shackle no reduction is required.

Bearing surface

The total length of the surface where the shackle body and the sling make full contact.

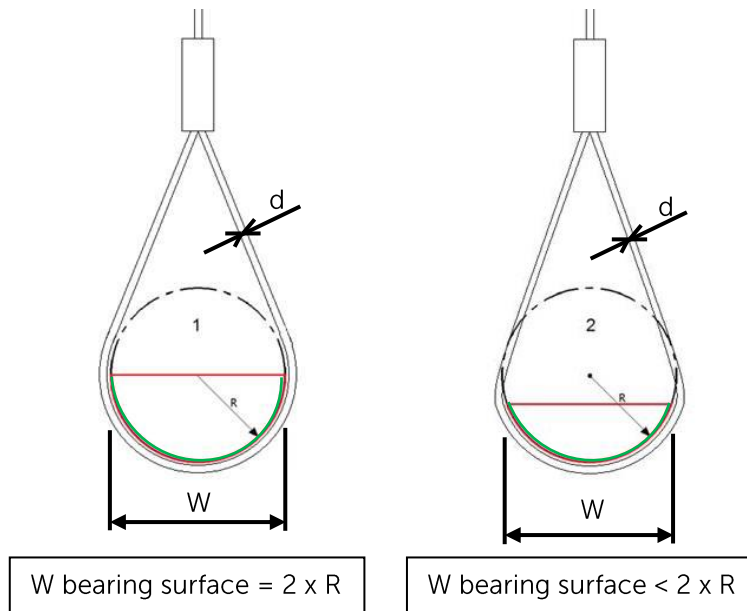
Ratio between W and R

If the W (width of the top of the crown) of the shackle body is less than two times the radius of the crown of the shackle body, the sling does not lay smoothly against the entire bearing surface. This may cause unwanted nicks in the wire rope, as shown in picture 2. This will reduce the lifetime of the sling.



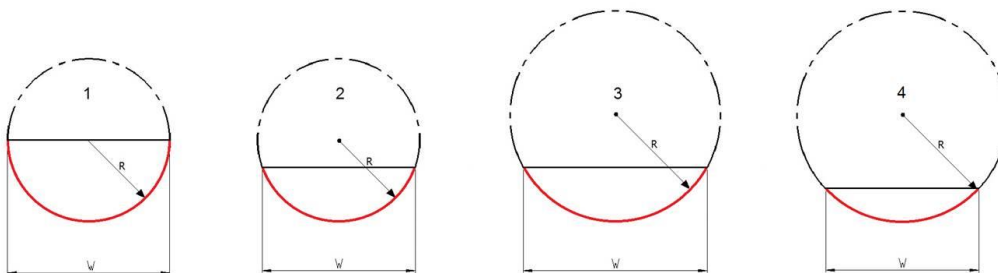
 = Bearing surface

If the width of the bearing surface is less than two times the radius of the bearing surface, the wire rope does not lay smoothly against the entire bearing surface. This may cause unwanted nicks in the wire rope, as shown in picture 2.



To explain the ratio between the radius of the bearing surface and the width of the crown see below diagrams:

- Situation 1 = W : R = 2 : 1
- Situation 2 = W : R = 1.8 : 1
- Situation 3 = W : R = 1.75 : 1
- Situation 4 = W : R = 1.4 : 1



- If you compare situation 1 and 2 you see that with the same radius (r) the bearing length (red line) decreases when the width (w) decreases.
- If you compare situation 3 and 4 you see that with the same radius (r) the bearing length (red line) decreases when the width (w) decreases.
- If you compare situation 2 and 4, you see that with the same width (w) but a larger radius (r), the bearing length (red line) is smaller in situation 4.
- If you compare situation 2 and 4, you see that this 'sharp edge' is sharper when ratio between the width and radius decreases.

These illustrations demonstrate that the optimal situation with the longest bearing surface is reached only when the width of the shackle crown is two times the radius of the bearing surface. In other words: the D/d ratio does not improve by only increasing the radius of the bearing surface; the width must also be adjusted to create the optimal $W = 2 \times R$ situation.

All Green Pin® P-6033 sling shackles are close to the optimal value. See table 1.

| Green Pin® P-6033 Sling shackles | | | |
|----------------------------------|-------|--------|----------------|
| WLL | Width | Radius | Ratio |
| t | mm | mm | Width : Radius |
| 7 | 41 | 21 | 1,95 |
| 12.5 | 54 | 27 | 2,00 |
| 18 | 64 | 38 | 1,68 |
| 30 | 79 | 45 | 1,76 |
| 40 | 97 | 53 | 1,83 |
| 55 | 100 | 55 | 1,82 |
| 75 | 120 | 64 | 1,88 |
| 125 | 150 | 80 | 1,88 |
| 150 | 170 | 88 | 1,93 |
| 200 | 205 | 110 | 1,86 |
| 250 | 240 | 126 | 1,90 |
| 300 | 265 | 140 | 1,89 |
| 400 | 320 | 160 | 2,00 |
| 500 | 339 | 170 | 1,99 |
| 600 | 370 | 190 | 1,95 |
| 700 | 400 | 200 | 2,00 |
| 800 | 420 | 215 | 1,95 |
| 900 | 440 | 220 | 2,00 |
| 1000 | 460 | 230 | 2,00 |
| 1250 | 530 | 260 | 2,00 |
| 1550 | 560 | 280 | 2,00 |

(Ratio value 2 is optimal)