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How different blanking technologies may influence the final performance of the retaining ring

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Any quality oriented manufacturer of retaining rings should assess the most appropriate production technology for its specific range of products.
Steel strip blanking versus steel wire blanking is a prime example as it could influence the final performance of the retaining ring.
It is evident that small sizes can't be blanked from wire. The question is what about larger sizes, where both technologies can be applied?

After several tests and thanks to its long experience in the industry, BENERI SpA concludes that retaining rings blanked from wire are more efficient as well as providing cost savings to end users.

Cross sections of retaining rings produced with different metal cutting processes

Each production technology generates a specific cross section of the retaining ring, as shown in Figure 1. Both sheared edges of the retaining ring produced by **strip blanking** feature a deformed zone (die-roll), a cut zone (burnish) and a fractured zone (fracture). This is due to the **plastic deformation of the material** as a result of blanking.

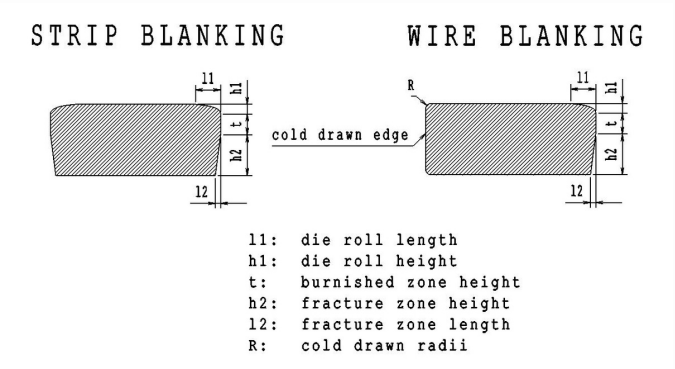

Figure 1: Each production technology generates a specific cross section of the retaining ring

On the other hand, the retaining ring obtained by wire is affected by blanking deformation on one side only – the opposite edge is in fact obtained through cold drawn process.
The chamfer on the upper side of the ring (l1 – h1), due to the 'die roll' effect, is not easy to define and should be measured piece by piece.
The chamfer on the upper side of the ring (l1 – h1), due to the 'die roll' effect, is not easy to define and should be measured piece by piece. The chamfer (l2), due to the fracture of the material, is a consequence of the die clearance of the tool – a function of thickness and mechanical features of the material.

How the retaining ring sits into the groove

In order to transmit large axial forces, **the groove should be shaped so that the retaining ring fills it as completely as possible and the axially loaded area of the groove should be at its maximum**.
On this basis, there is a difference in how retaining rings fill the most widely designed type of groove, depending on which kind of blanking technology has been applied during the production process.
Figure 2 shows how both cross sections sit into the groove. On the left, the groove is in contact with a sheared edged profile (ring made by strip); on the right, the groove is in contact with a cold drawn profile (ring made by wire).
The blanked side of the retaining ring made by strip does not fill the most common type of groove at best.

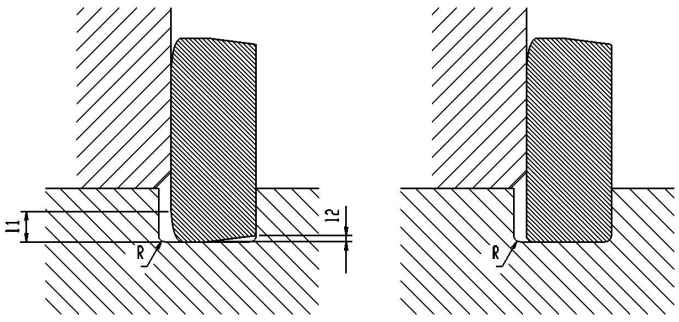

Figure 2: How both cross sections sit into the groove

In the contact area, the ring has a rounded corner, a sharped cornered side and a rough finished blanked surface, which does not fully envelope the bottom of the groove, meaning possible wear during operation. The loaded area between ring and groove is subject to chamfers (l1 – l2) that reduce contact area and axial load.
Instead, **the cold drawn side of the retaining ring made by wire fully fills the most widely and designed type of groove.**
In the contact area, the ring has just a small radius on the corner and a perfect flat cold drawn surface to fully envelope the bottom of the groove, avoiding possible wear during operation. The loaded area between ring and groove is maximised in order to guarantee the highest axial load in service conditions.

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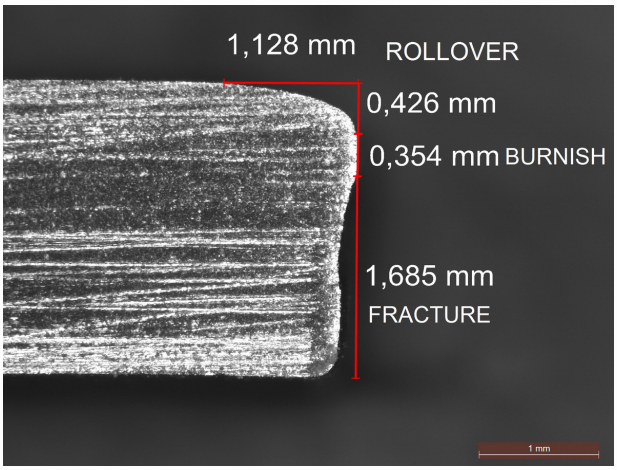
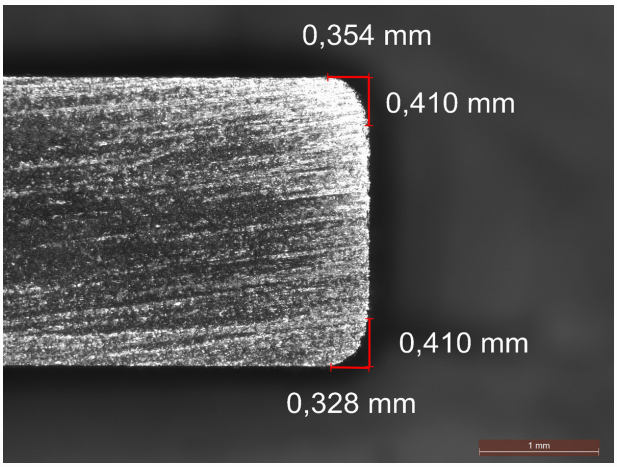
As seen in Figure 1 and in Figure 2, the radius of the wire blanked ring is smaller than the chamfers (l1 – l2) of the strip blanked ring (where usually l1 > l2). To reduce the chamfer effect of the strip blanked ring, an alternative groove shape should be considered, thus increasing tooling costs for end users.



DIN 472mm 80 (zoom: 25X) - Cross section profile: Blanked surface in contact with the groove



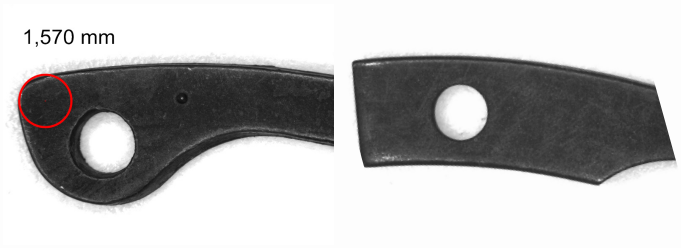
DIN 472mm 80 (zoom: 25X) – Cross section profile: cold-drawned surface in contact with the groove

Oriented sitting

In order to reduce the chamfer effect as much as possible, the strip blanked ring should be seated into the groove with the sharp cornered side facing the loaded side of the groove. However:

1. Even the sharp cornered side will give a corner distance because of the die clearance and the surface condition of the cutting tool;
2. Remember that the corner distance on the upper side (roll over), even if larger than the lower side, will not be fully effective. The question of when the roll-over distance became dangerous is open...

The considerations above are not relevant for wire blanked retaining rings, since upper and lower side of its cross section have the same radii obtained by the cold drawn process and are not affected by blanking. This is why **wire cut rings don't need any specific orientation in the groove**.



On the left: detail of the lug of a retaining ring blanked by steel strip(zoom: 6.3X). Radius of 1.57mm on the external side of the ring.

On the right: detail of the lug of a retaining ring cut by wire (zoom: 6.3X). Sharp-edged shape on the external side of the ring.

Lug shape under stress conditions

The radius on the external side of the lugs of retaining rings made by steel strip may cause the leak of the ring from its groove in case of high static load. Instead, **the lugs of retaining rings by wire are sharp edged. This feature provides the ring with higher load bearing capacity under high stress conditions**, avoiding its possible leakage from the groove.

There are several manufacturers of retaining rings. However, only few of them are able to provide a wide range of retaining rings made by trapezoidal steel wire. The reason that wire blanking technology is more difficult to achieve is that it requires high-tech and expensive machinery and a profound experience and know-how in the world of retaining rings.

BENERI is proud to be one of the very few companies throughout the world with the expertise to implement this technology, offering the widest range of retaining rings blanked from steel wire.

The chart below shows BENER's complete line of retaining rings that are made from wire.

FULL RANGE OF BENERI RETAINING RINGS MADE BY WIRE		
	EXTERNAL RETAINING RING	INTERNAL RETAINNG RING
Metric	DIN 471 - ∅ from mm 28	DIN 472 - ∅ from mm 34
Inch	2100-5100 - ∅ from size 112	2000-5000 - ∅ from size 131

This is how BENERI stands out from any other worldwide retaining rings supplier.