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

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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.

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

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.

Any quality oriented manufacturer of retaining rings should assess the most appropriate production technology for its specific range of products.

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.

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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 \( (l_1 - l_2) \) of the strip blanked ring (where usually \( l_1 > l_2 \)). To reduce the chamfer effect of the strip blanked ring, an alternative groove shape should be considered, thus increasing tooling costs for end users.

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.

**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.

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

**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.**

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