

Prestressing Basics

Tensile and compressive stresses

Mechanical stresses can be divided into compressive and tensile stresses, meaning that material is either pushed together or pulled apart. For ductile materials, compressive and tensile stress limits are usually the same. Hard and brittle materials, however, can usually take much higher compressive than tensile stresses. Moreover, tensile stresses are critical in parts with repeated loading, where even tensile stress under the material's static limit leads to accumulating damage. That way, tensile stresses often cause premature fatigue failure of parts with repeated loading.

Improved service life by prestressing

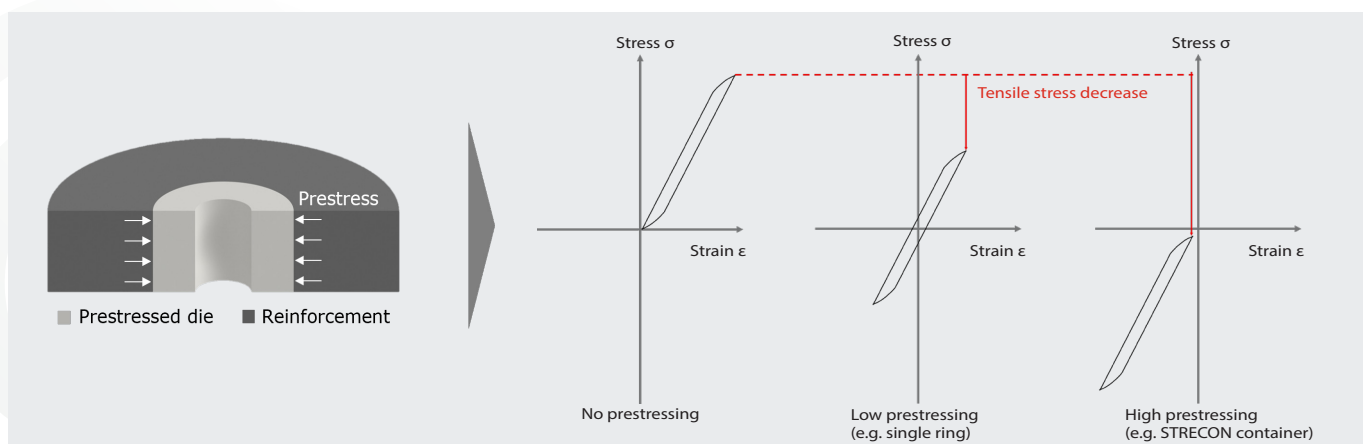
Prestressing is used to shift the mechanical loading of technical parts from a tensile stress state to a compressive one in order to increase part strength and service life. A constant compressive prestress is applied, so that the part is under compressive stress when not additionally loaded. When adding cyclic stresses, the stress increases and moves towards a tensile stress. If enough prestress is applied, tensile stresses can be prevented completely (see figure). This is very beneficial for the service life of the component, which in some cases can be increased several times by prestressing.

Practical prestressing of ring-shaped parts

Prestressing is especially useful for ring-shaped parts under high inner pressure, such as dies for forging or high-pressure synthesis. To achieve prestressing of such parts, they are pressed into a reinforcement ring. The inner diameter of the reinforcement is slightly smaller than the outer diameter of the die. The resulting overlap is called interference fit and leads to a radial pressure acting from the reinforcement onto the die, creating the compressive prestress.

Limits of prestressing

In theory, it is desirable to have as high a compressive prestress as possible. In practice, however, the compressive strength of the die and the tensile strength of the reinforcement limit the applicable prestress. Single or double rings are normally used as reinforcement systems, and the limiting factor for the achievable prestress is usually the yield stress of the reinforcement rings. STRECON containers have a much higher strength than conventional reinforcement rings and therefore enhance the limits of prestressing towards higher compressive stresses. Read more about the [stripwinding technology](#) and the [STRECON container concept](#) in other tech notes.



The STRECON container allows for higher prestressing of the forging die than normal compression rings