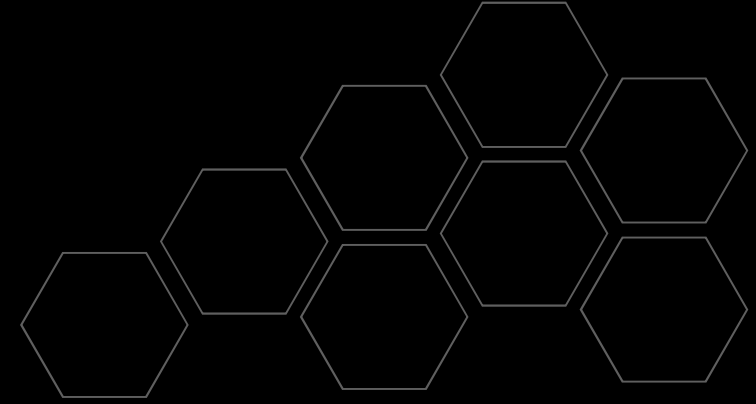
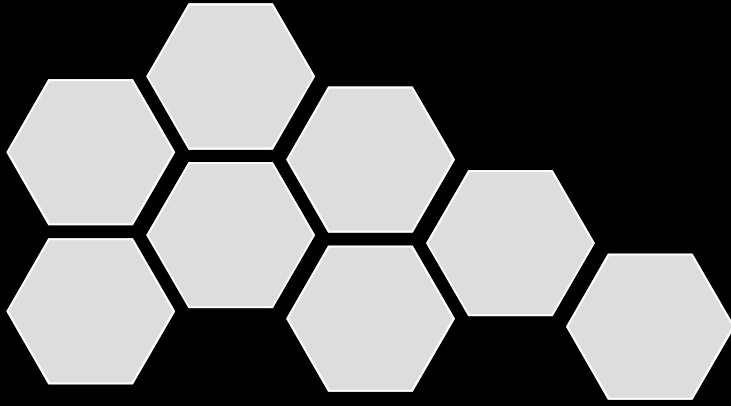
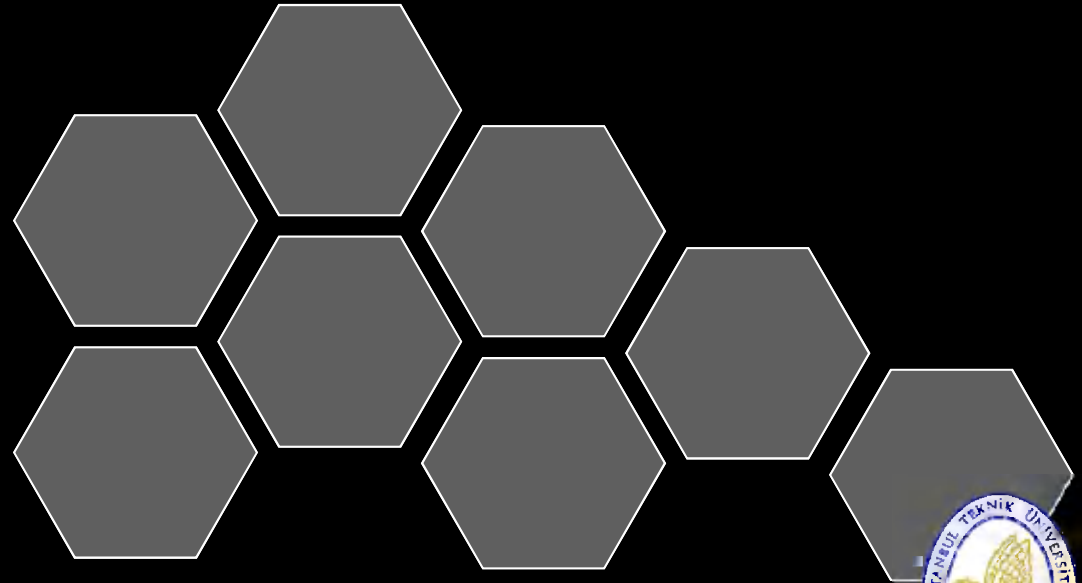
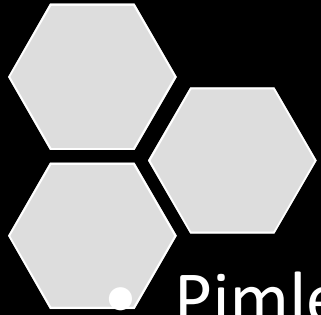




Pimler ve Pernolar

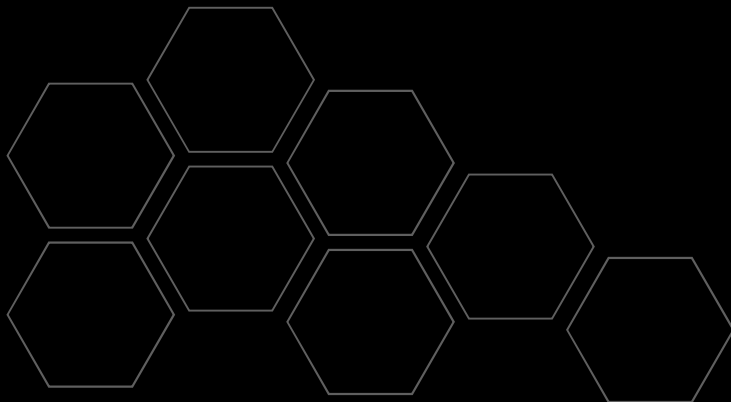
Vedat Temiz





Genel Bilgiler

- Pimler tespit, mafsallama ve merkezleme amacı ile kullanılan genellikle silindirik makina elemanlarıdır.
- **Uygulamaları**
 - Mafsal bağlantıları
 - Yayların tespiti
 - Mil-göbek bağlantılarında
 - Kapakların merkezlenmesinde

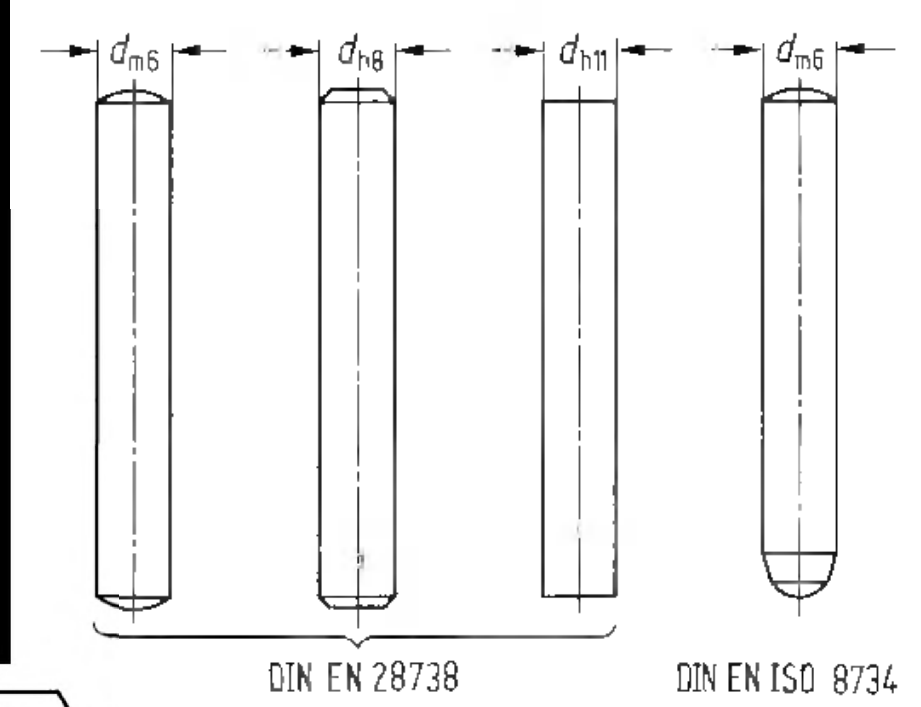
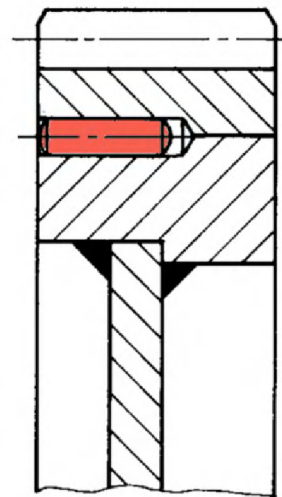
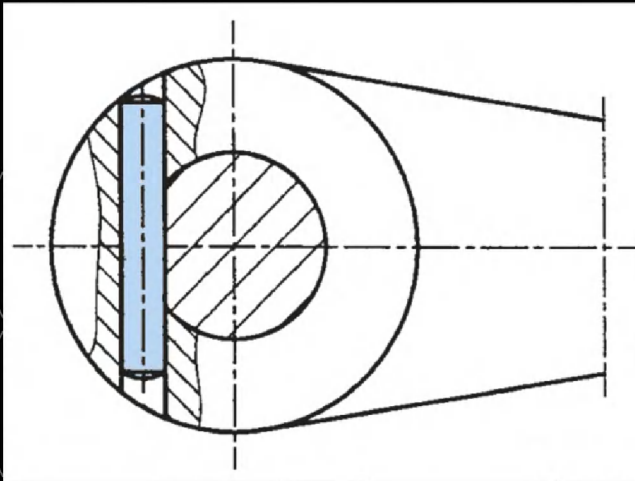
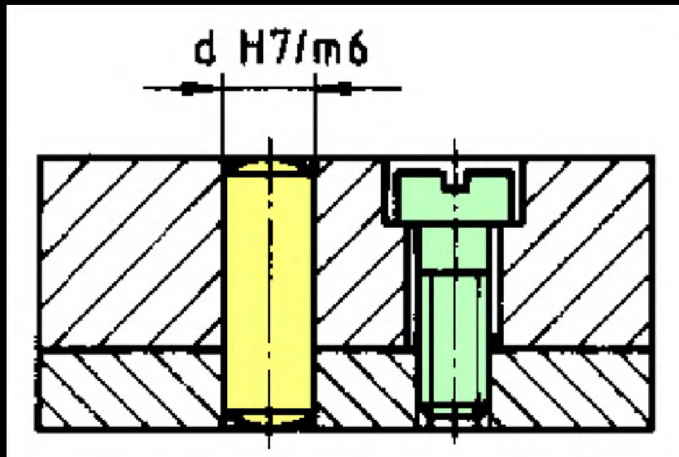




Pim çeşitleri

Silindirik pimler

Montaj durumuna göre serbest veya sıkı geçme olabilirler.



Pim çeşitleri

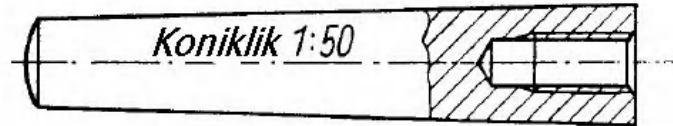
Konik pimler



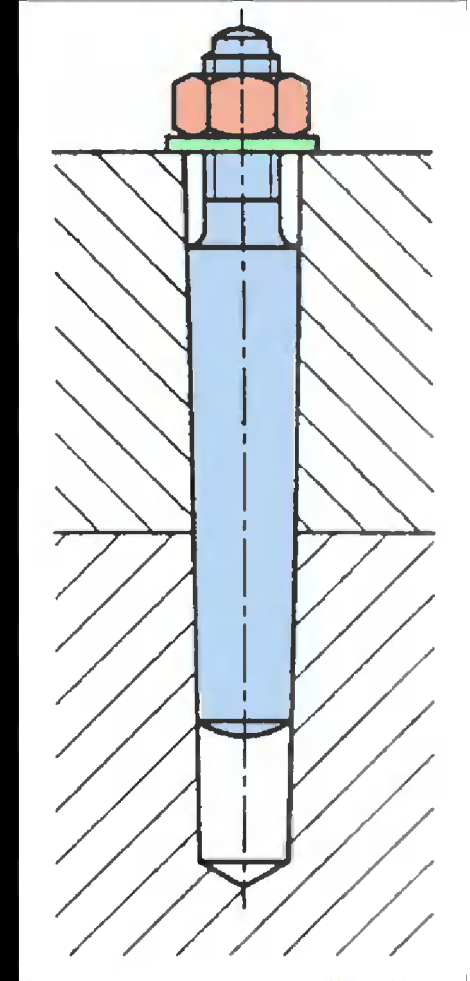
DINEN 22339

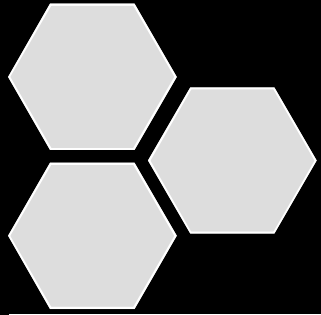


DINEN 28737



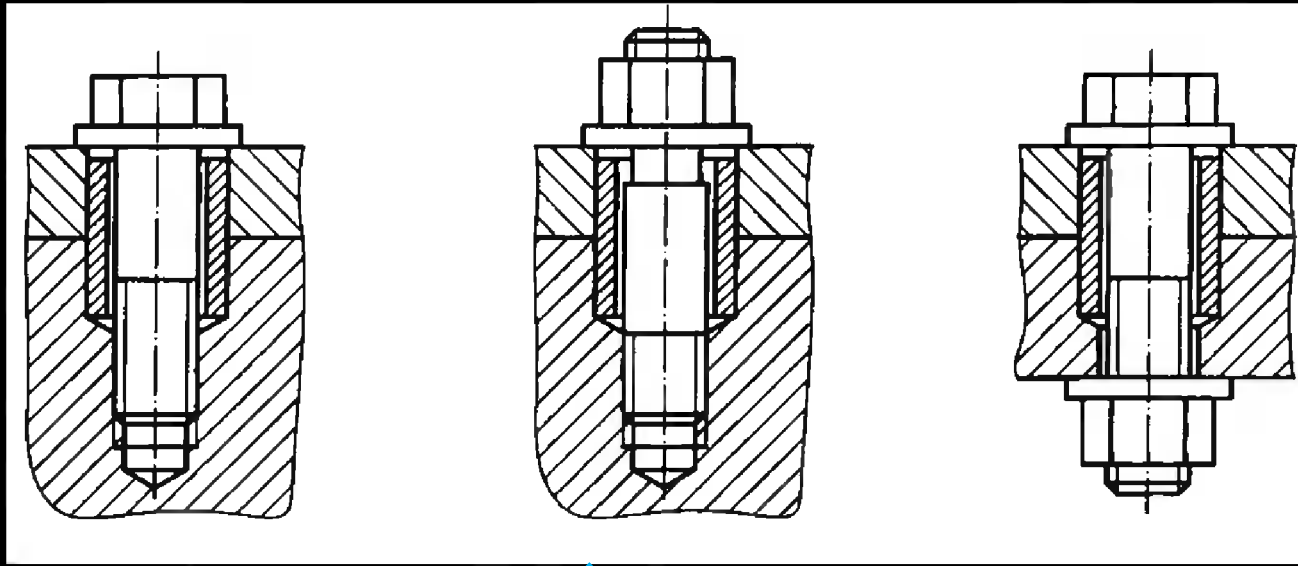
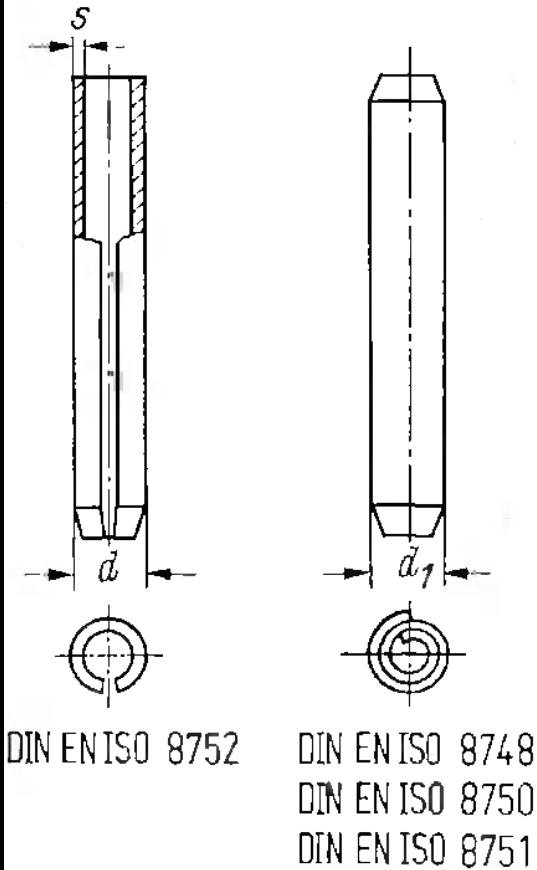
DINEN 28736





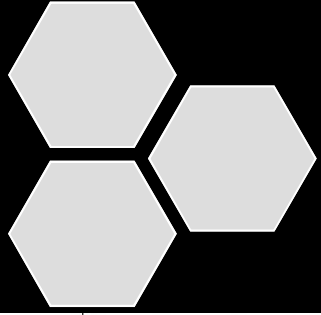
Pim çeşitleri

İçi boş ve spiral pimler



İçi boş pimle yapılmış, kesmeye maruz
civata bağlantıları.



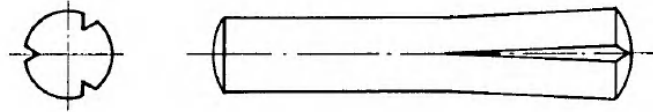


Pim çeşitleri

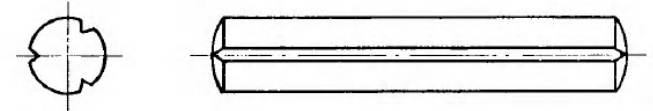
Çentikli pimler



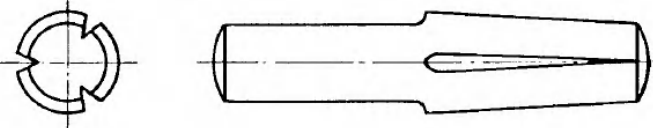
DINEN 28744



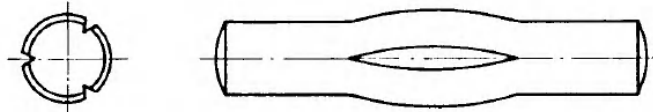
DINEN 28745



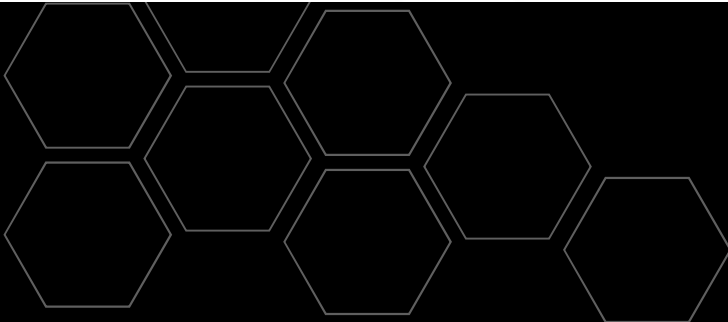
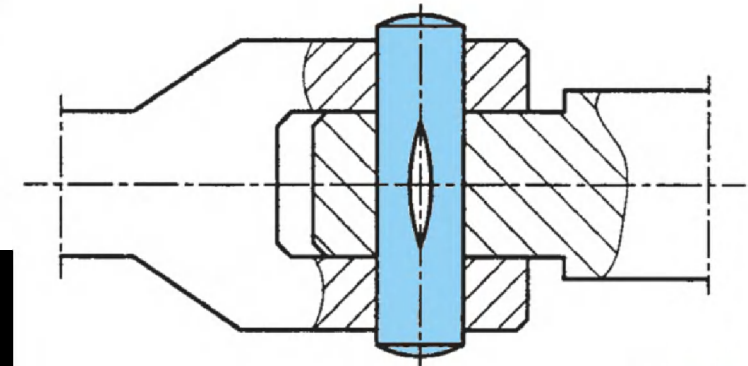
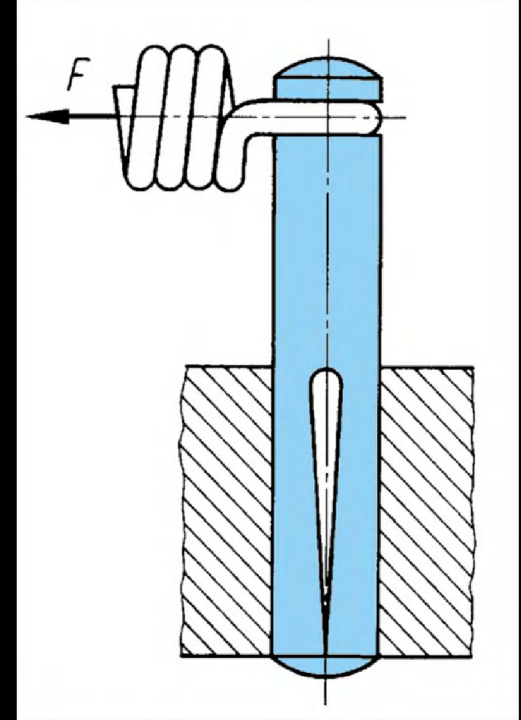
DINEN 28740



DINEN 28741

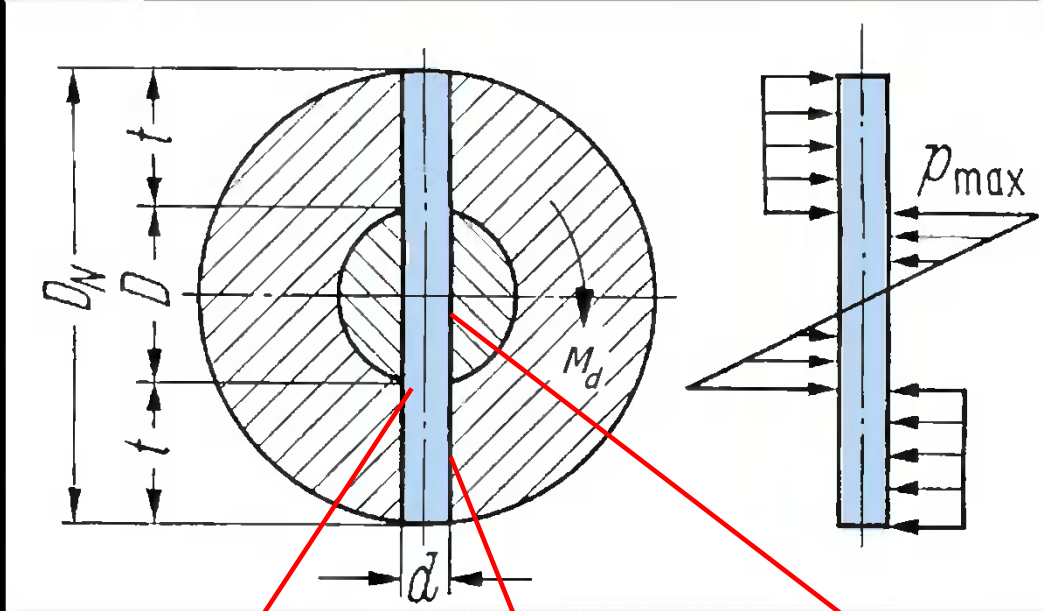


DINEN 28742



Hesap esasları

Radyal pimler



Tavsiye edilen değerler:

$$d/D = 0,2 \dots 0,3$$

Çelik göbek için $D_N/D \approx 2$

Dökme demir göbek için $D_N/D \approx 2,5$

Ara yüzeye etkiyen
teğetsel kuvvet

$$F_t = \frac{M_d}{D}$$

Pim kesiti

$$A_p = \frac{\pi \cdot d^2}{4}$$

$$\tau_p = \frac{F_t}{A_p}$$

Pimin
kesilmesi

$$p_G = \frac{M_d}{t \cdot d \cdot (D + t)}$$

Göbeğin ezilmesi

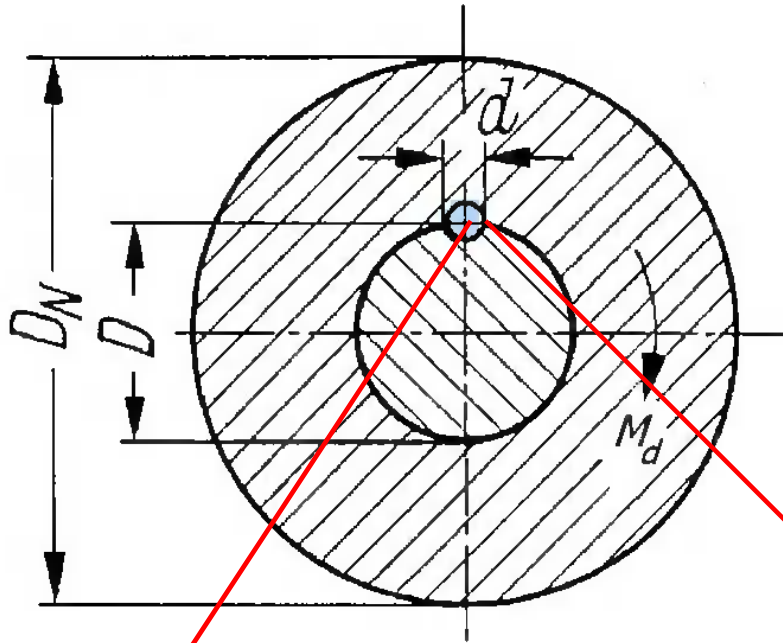
$$p_{Mmaks} = \frac{6 \cdot M_d}{d \cdot D^2}$$

Pimin ezilmesi



Hesap esasları

Eksenel pimler



Tavsiye edilen değerler:

$$d/D = 0,13 \dots 0,2$$

$$\text{Pimin eksenel uzunluğu: } l = (1 \dots 1,5) \cdot D$$

Ara yüzeye etkiyen
teğetsel kuvvet

$$F_t = \frac{M_d}{D/2}$$

Pimin projeksiyon
alanı

$$A_p = d \cdot l$$

$$\tau_p = \frac{F_t}{A_p}$$

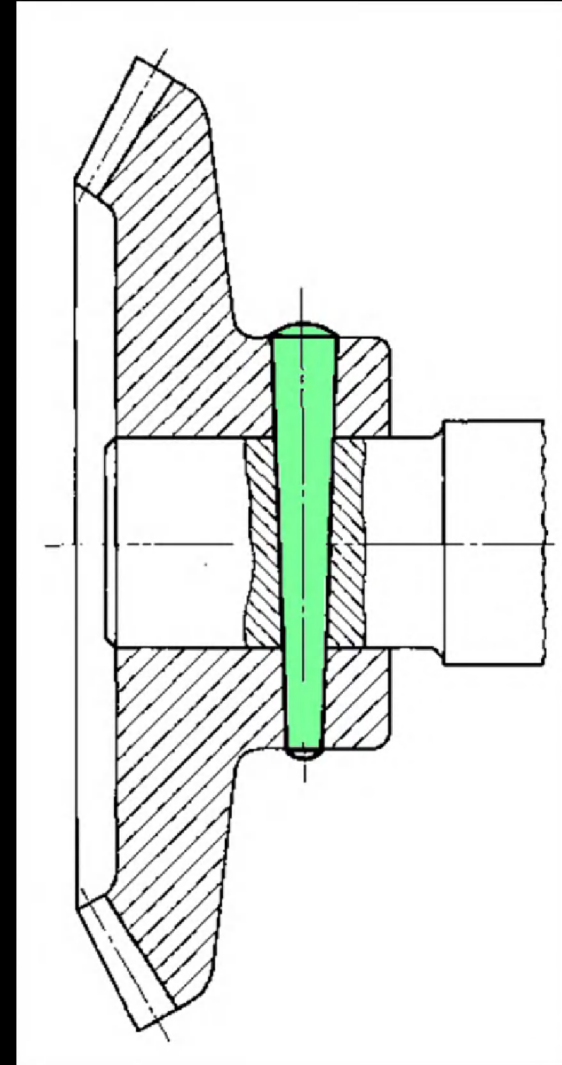
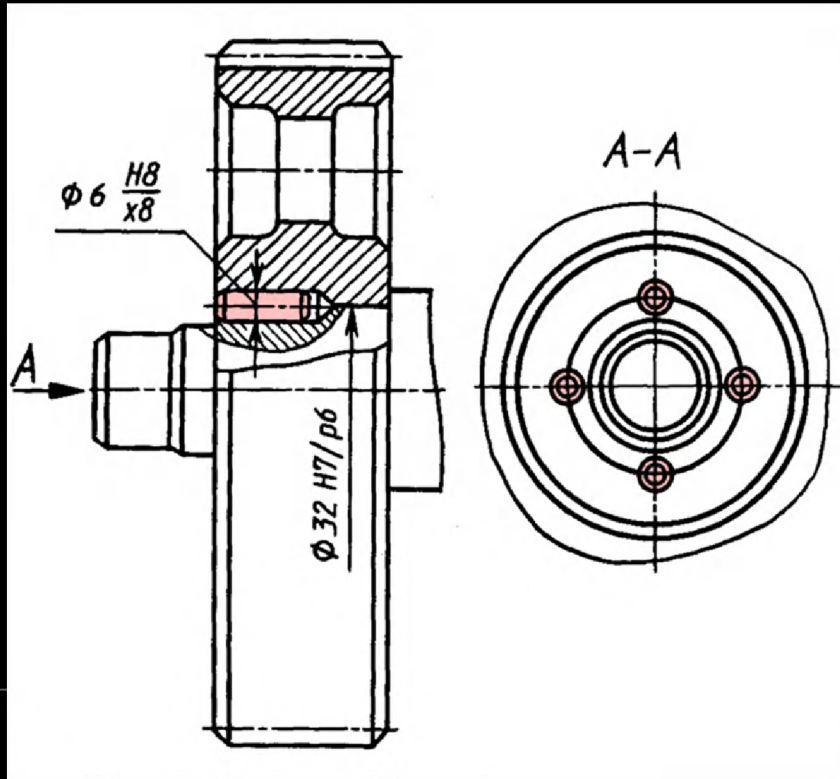
Pimin
kesilmesi

$$p_{G,M} = \frac{4 \cdot M_d}{l \cdot d \cdot D}$$

Pim ve göbeğin ezilmesi

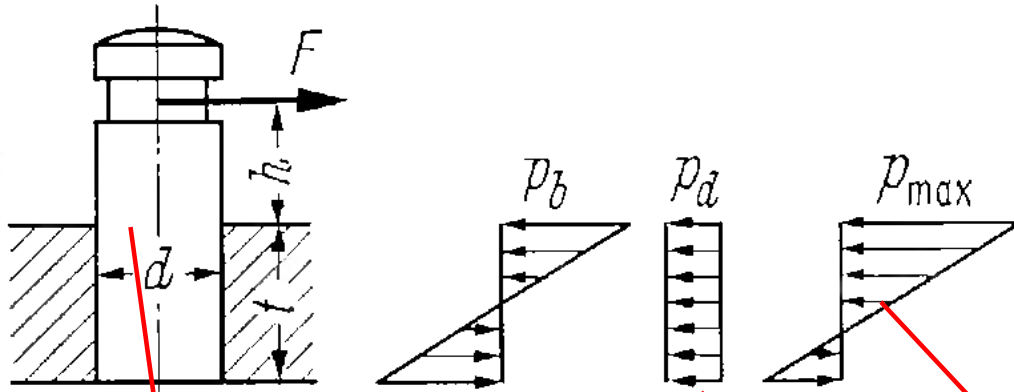


Eksenel ve radyal pimle yapılmış mil- göbek bağlantıları



Hesap esasları

Eksenel pimler



Tavsiye edilen değerler:
 $t/d = 4 \dots 5$

Eğilme momenti $\rightarrow M_e = F \cdot h$

Mukavemet momenti $\rightarrow W_e = \frac{d \cdot t^2}{6}$

$$\tau_p = \frac{4 \cdot F}{\pi \cdot d^2}$$

Pimin
kesilmesi

$$p_e = \frac{F \cdot (h + t/2) \cdot 6}{d \cdot t^2}$$

Eğilme momentinden
dolayı pimin ezilmesi

$$p_p = \frac{F}{d \cdot t}$$

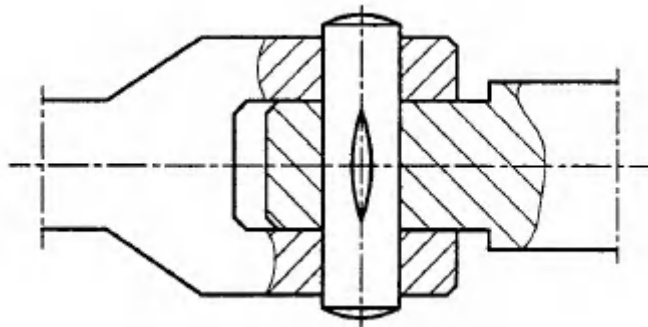
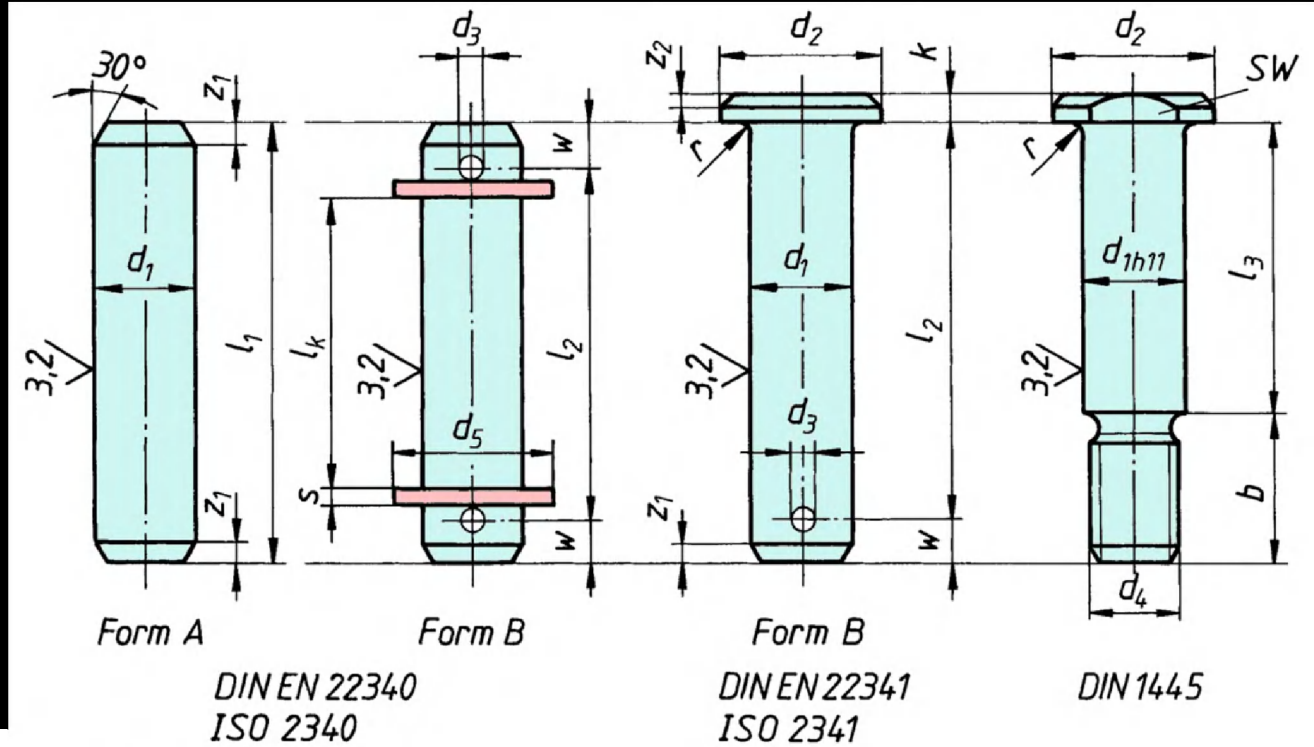
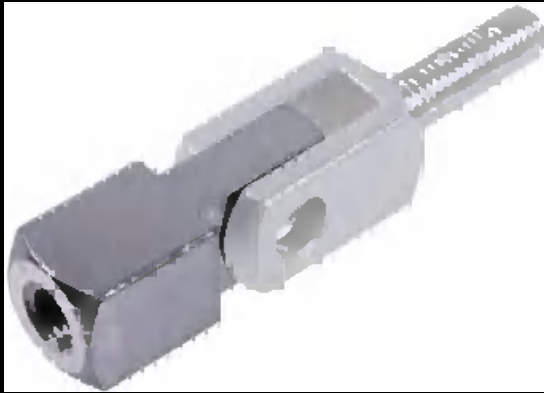
Pimin
ezilmesi

$$p_{maks} = p_e + p_p = \frac{F \cdot (4 + 6 \cdot h/t)}{d \cdot t}$$



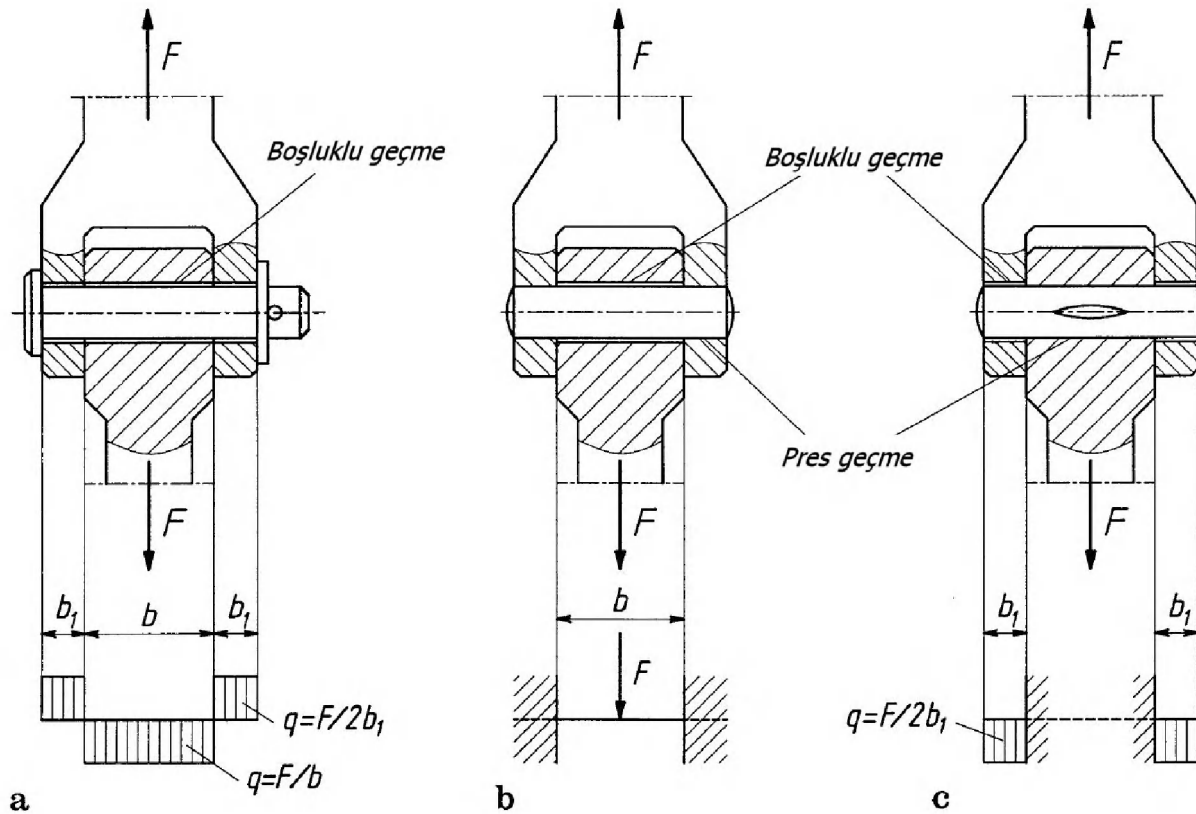
Pernolar

- Mafsallama amacı ile kullanılan silindirik makina elemanlarıdır.



Pernolar

Hesap esasları



Pernonun eğilmesi

$$\sigma_{ep} = \frac{M_{emaks}}{W_e}$$

Pernonun kesilmesi

$$\tau_p = \frac{F}{2 \cdot \frac{\pi \cdot d^2}{4}}$$

Göbekteki ezilme

$$p_G = \frac{F}{2 \cdot b_1 \cdot d}$$

Pernodaki ezilme

$$p_P = \frac{F}{b \cdot d}$$

Makina Elemanları I

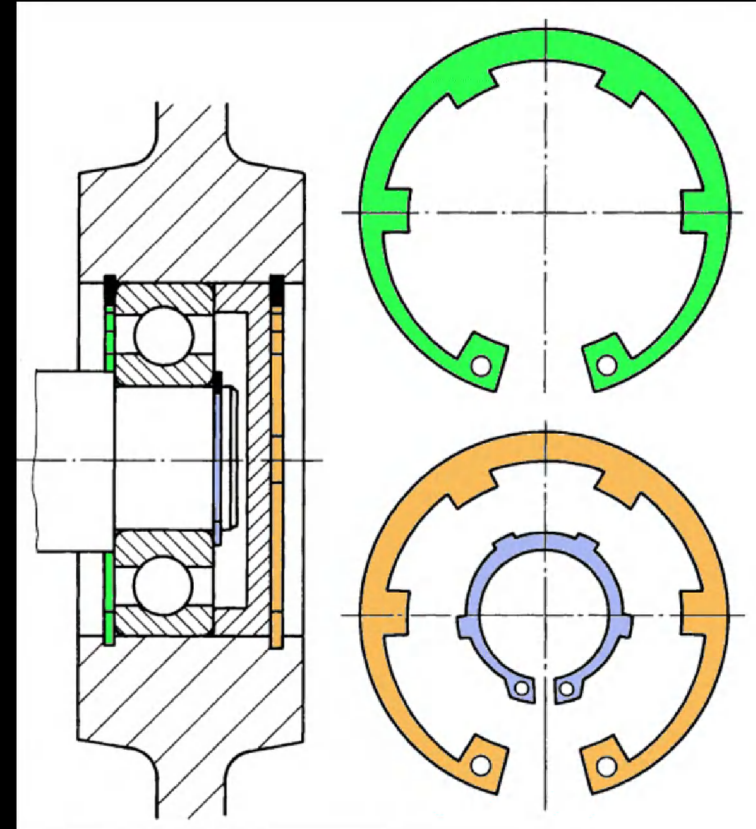
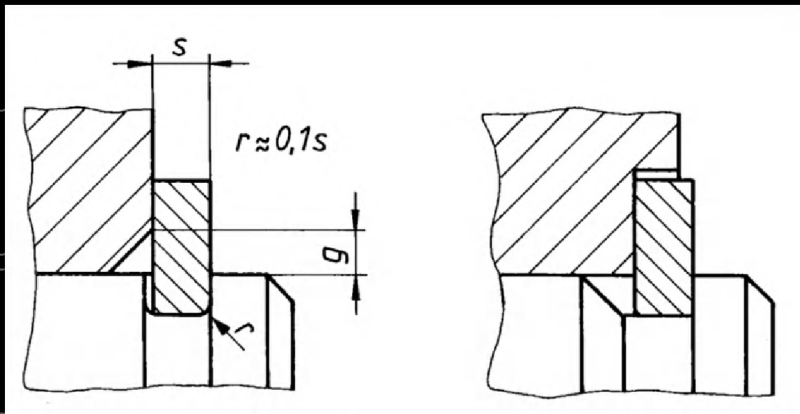
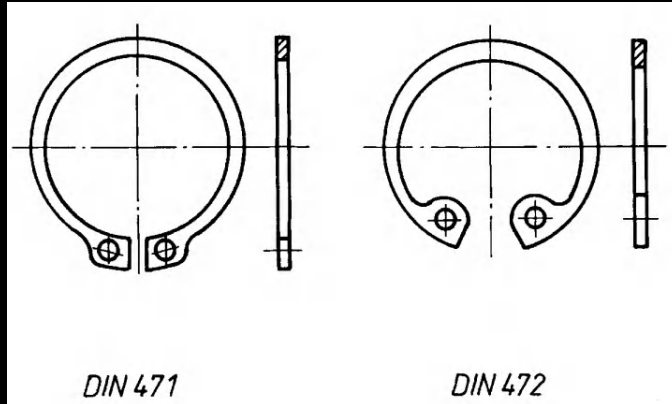




Pernolar

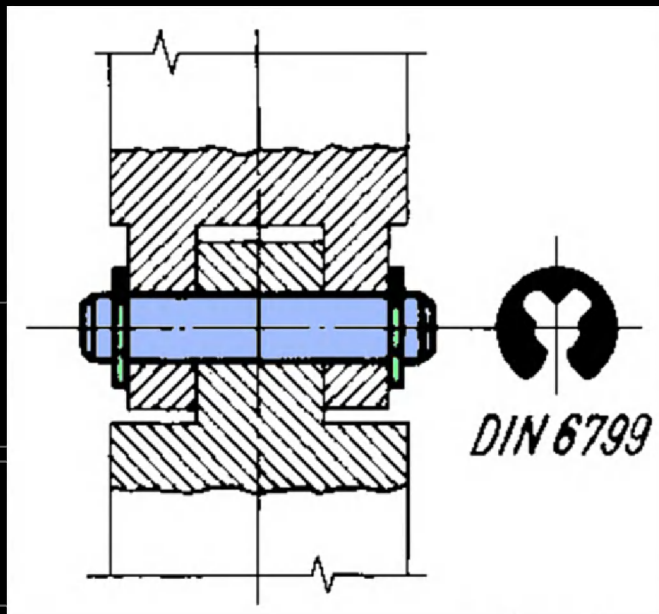
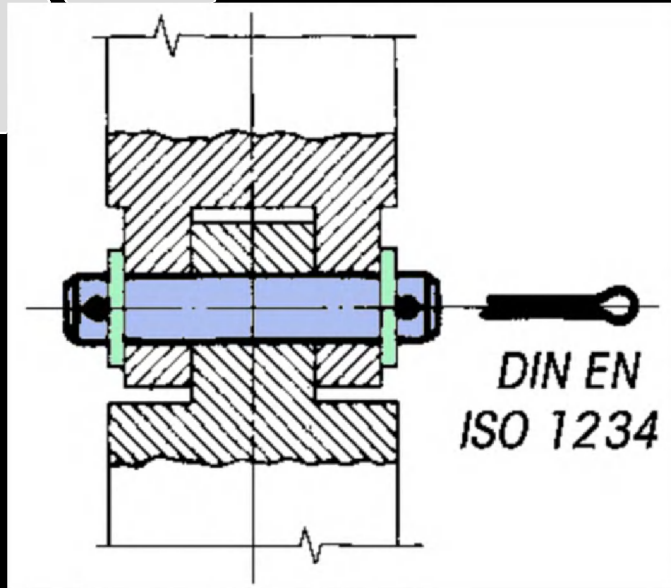
Eksenel tespit

Seeger halkaları (Yaylı segmanlar): Sadece pernolarda değil, pek çok makine elemanının (rulmanlı yatak, dişli çark, kavrama göbeği vb.) mil veya yuva içinde aksinel yönde tespiti için kullanılırlar. Seeger halkaları standart elemanlardır. Montaj için açılacak yuvanın boyutları da standart ölçülerde olmak zorundadır.



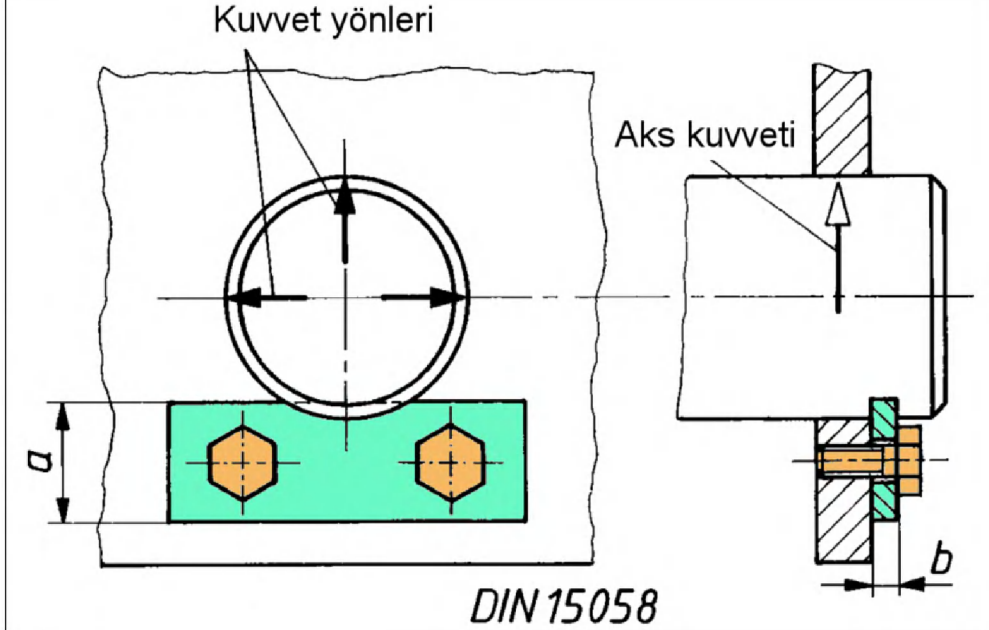
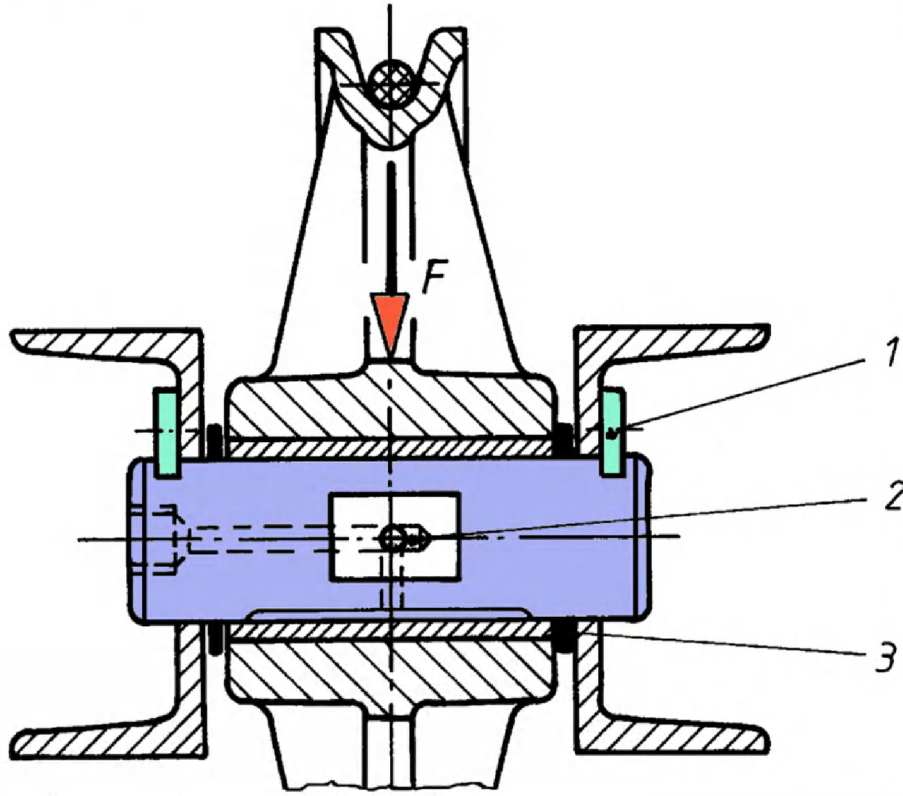
Pernolar

Eksenel tespit



Pernolar

Eksenel tespit



1. Dayama laması
2. Yağlama kanalı
3. Eksenel tespit bileziği