Capítulo 13 – Elementos de Máquinas

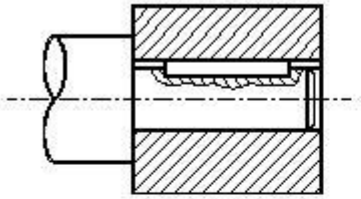
OBJECTIVOS

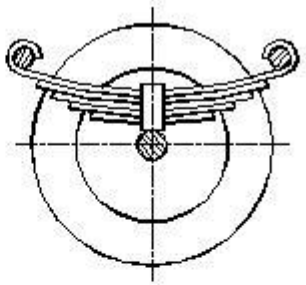
- Compreender a representação de elementos normalizados;
- Representar, cotar e referenciar elementos de máquinas;
- Distinguir e compreender formas de ligação;
- Distinguir os elementos normalizados na representação de conjunto num desenho.

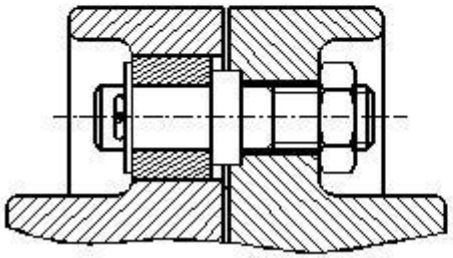
Silva, Ribeiro, Dias, Sousa

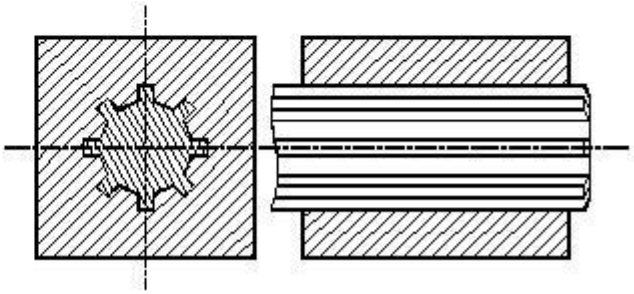
PROCESSOS DE LIGAÇÃO

- Permanentes
  - -directas
  - -indirectas
- desmontáveis



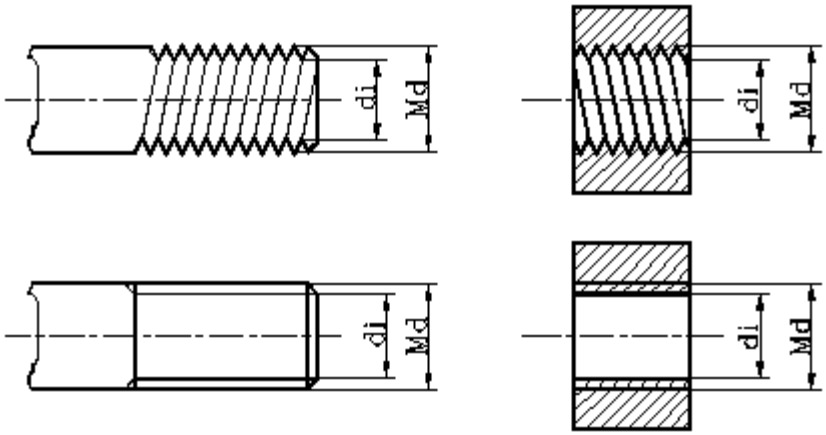


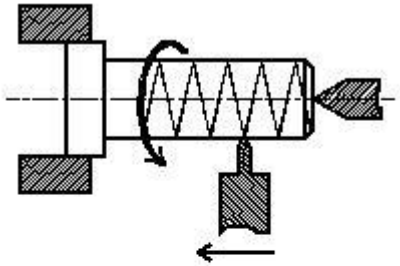




ROSCAS

- Geometria
- Profundidade
- Passo





REDONDA

TRAPEZOIDAL

rosca para madeira

rosca autoroscante

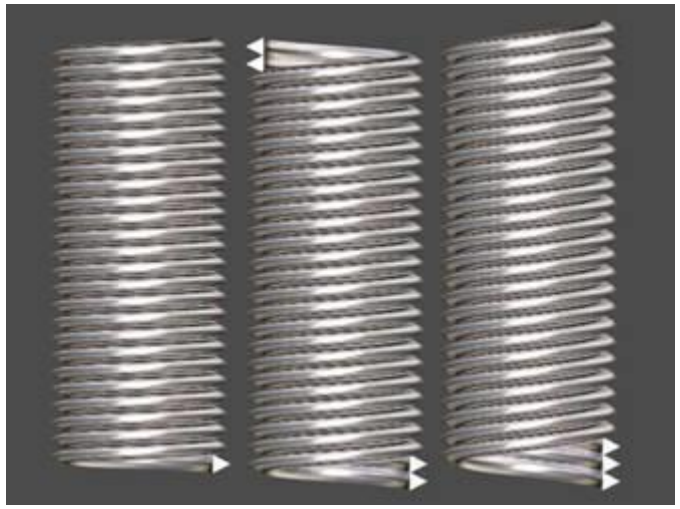
RECTANGULAR

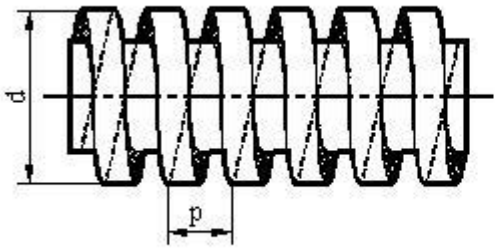
DENTE DE SERRA

rosca cilíndrica

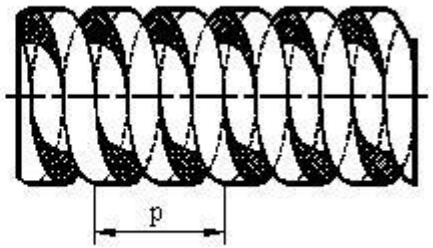
rosca cónica

- Rosca simples
- Rosca múltipla





Rosca simples



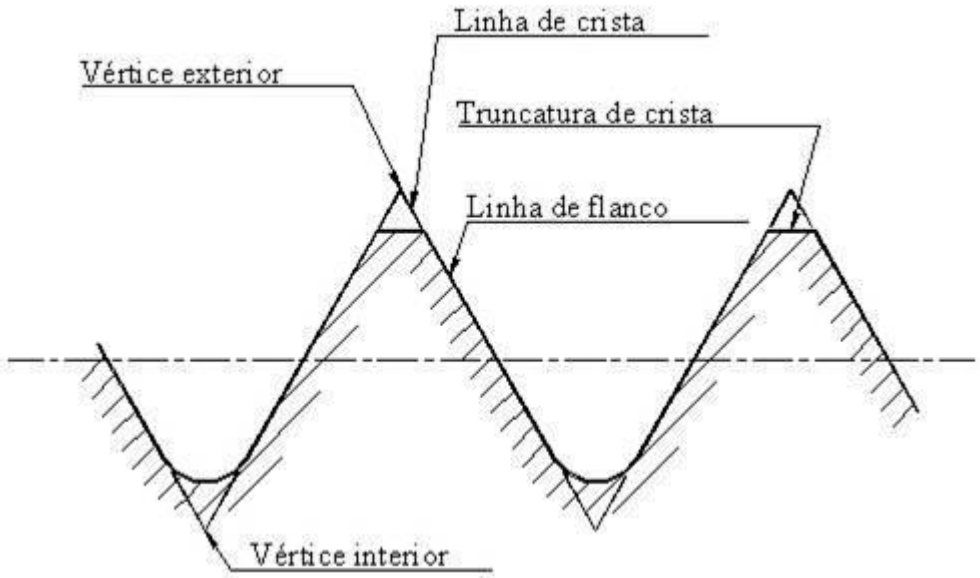
Rosca dupla (2 entradas)

- Perfil triangular

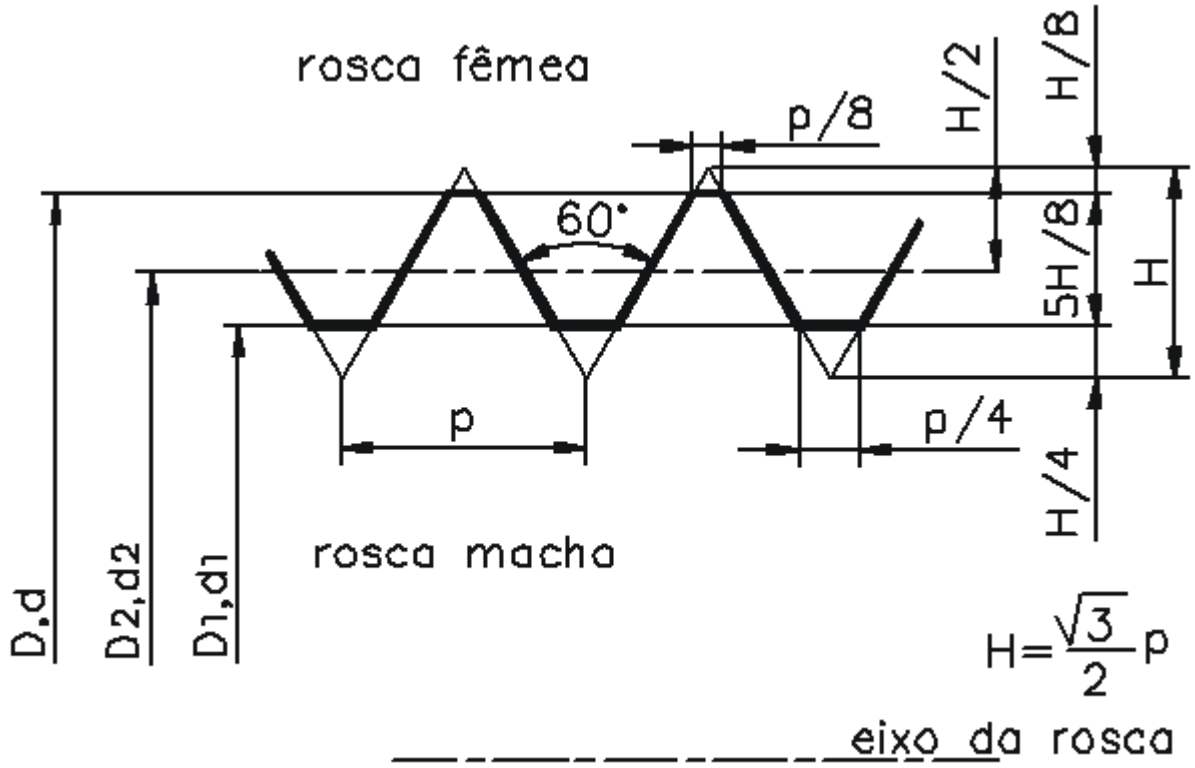
  -Flanco

  -Crista

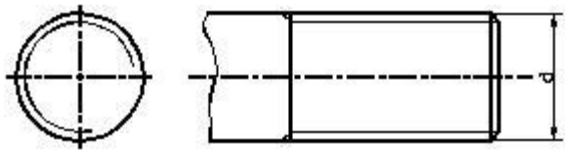
  -Cava



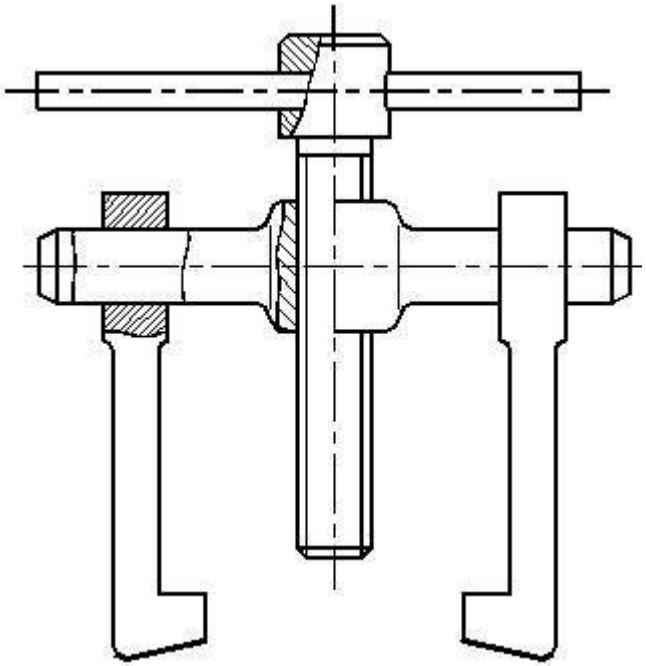
Elementos dimensionais de uma rosca triangular



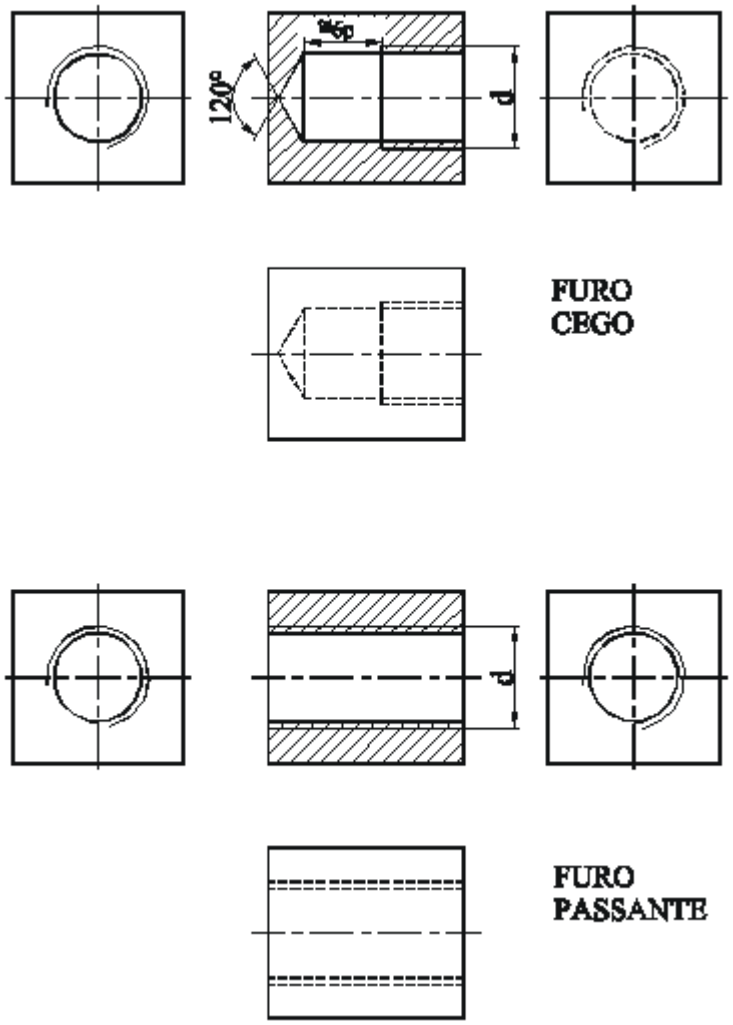
Representação de roscas



Conjunto de peças roscadas

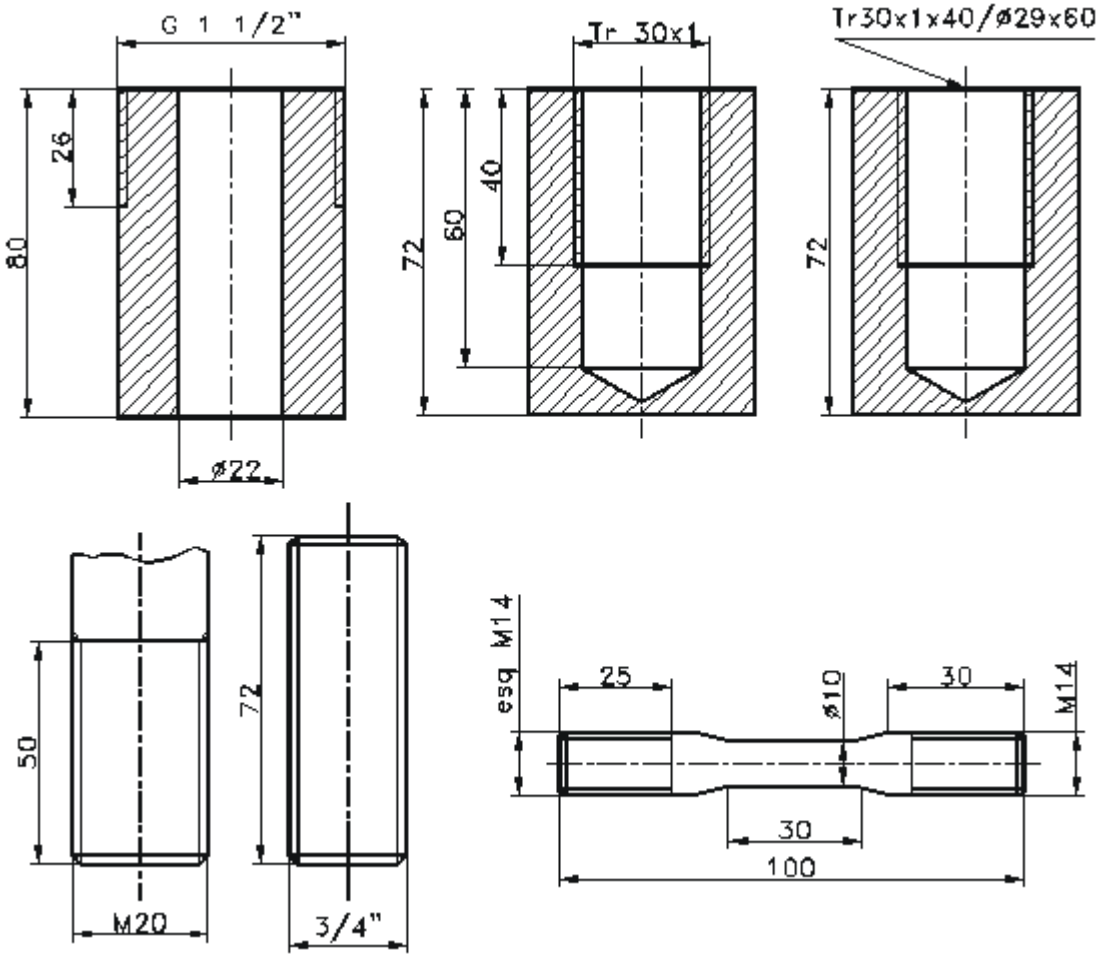


Furos

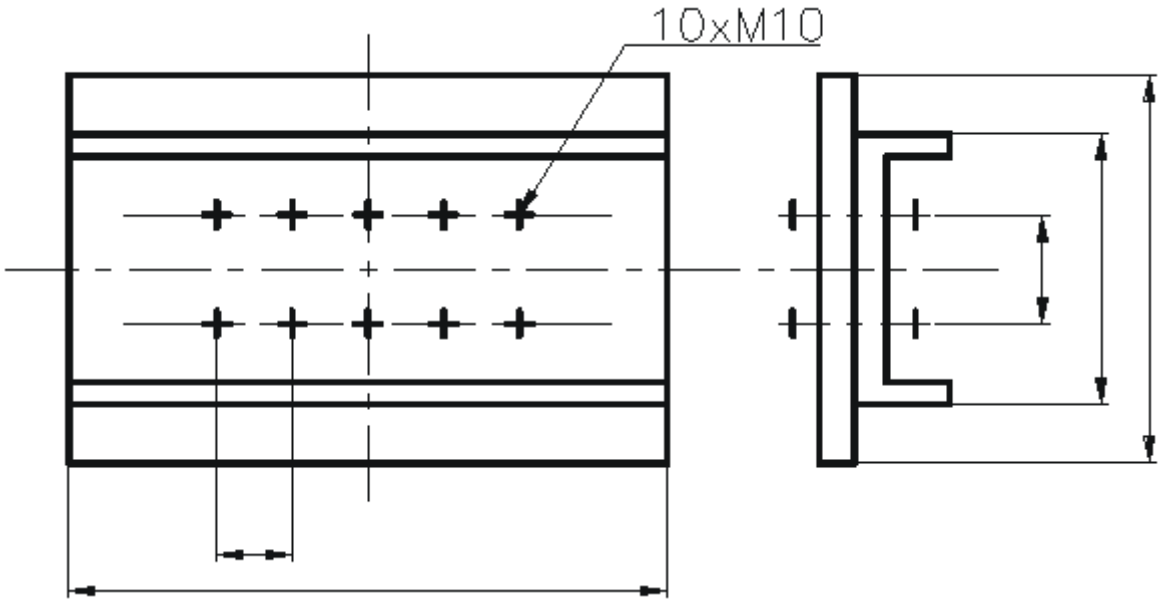


Cotagem de Roscas

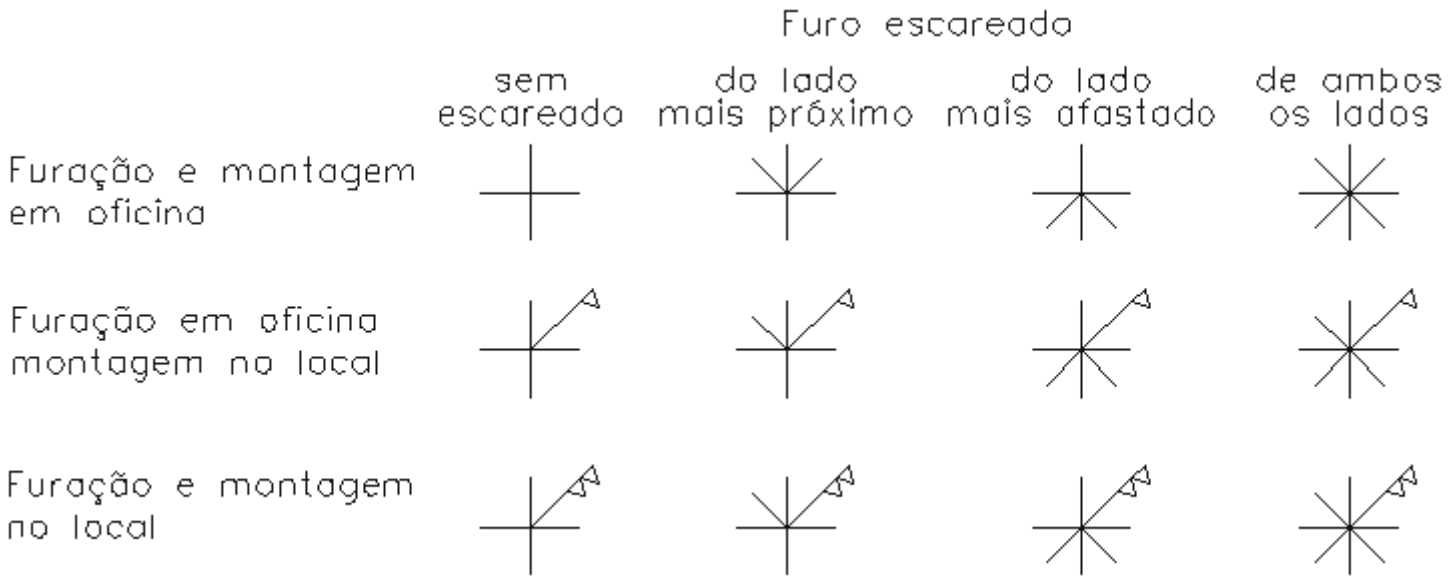
- **ISO** (métrica) (M)
- *Whitworth*
- Gás (G)
- Rectangular (R)
- Trapezoidal (Tr)
- Dente de serra (S)
- Redonda (Rd)



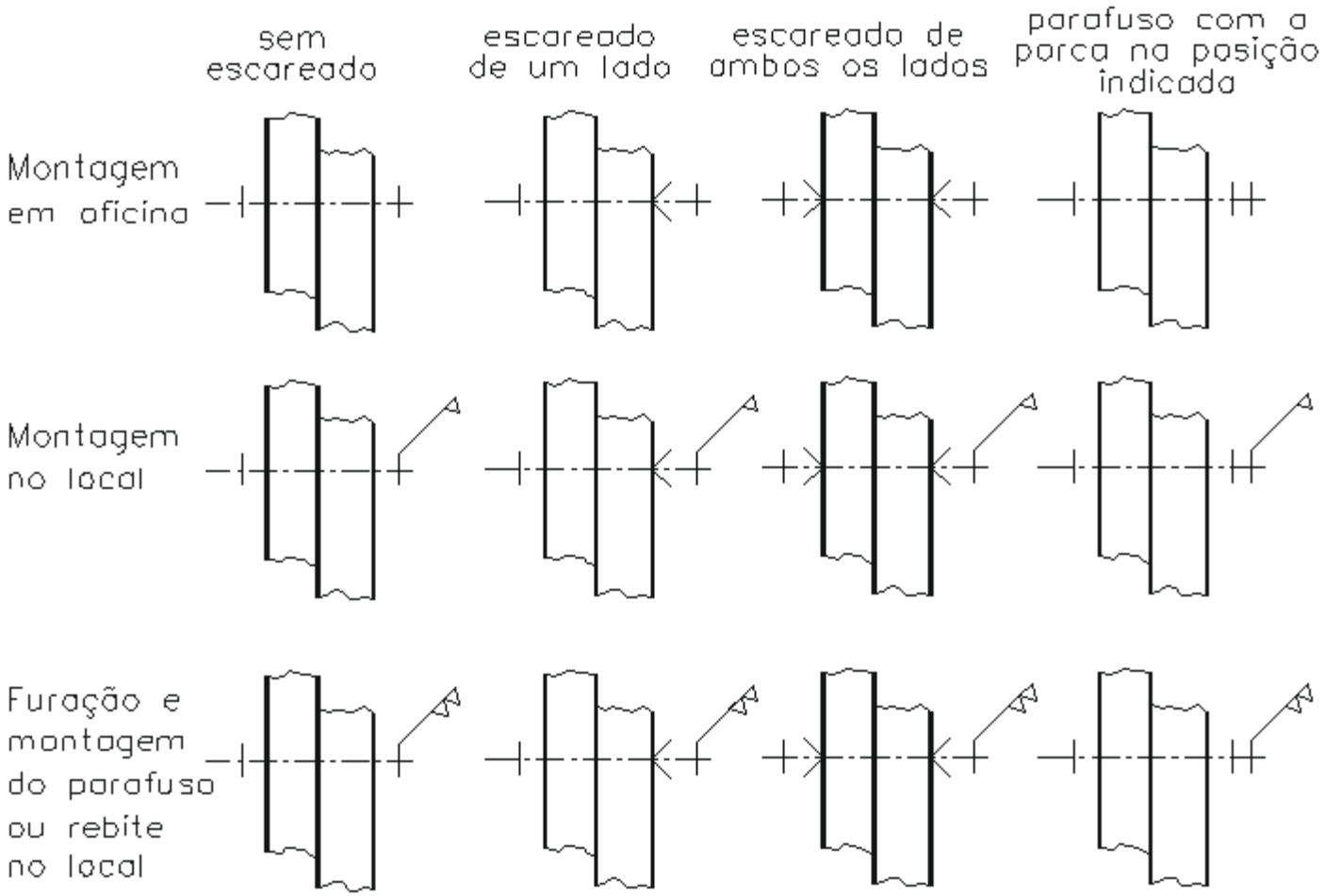
Representação de furações



Representação simbólica de furos



Representação simbólica de furos e ligações

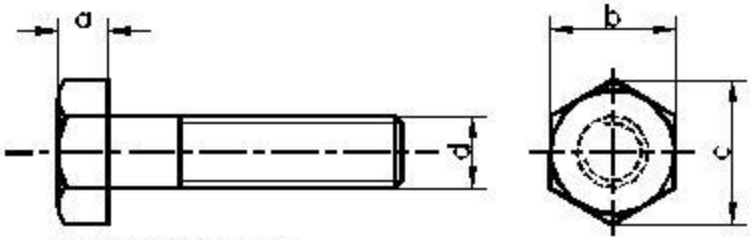


Parafusos

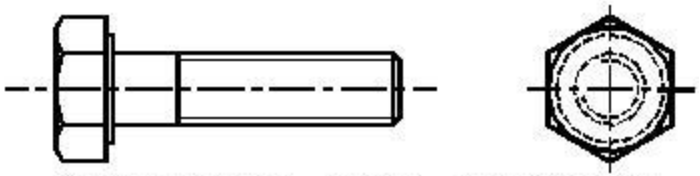
- Forma da Cabeça (ISO1891)
  - Prismática,
  - Fenda,
  - Caixa,
  - outros
- Haste ou Espiga (ISO4753)

Cabeças de Parafusos

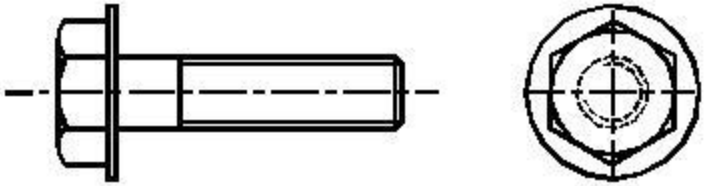
Prismática



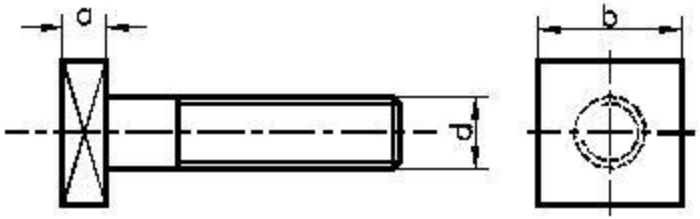
SEXTAVADA



SEXTAVADA COM ALMOFADA

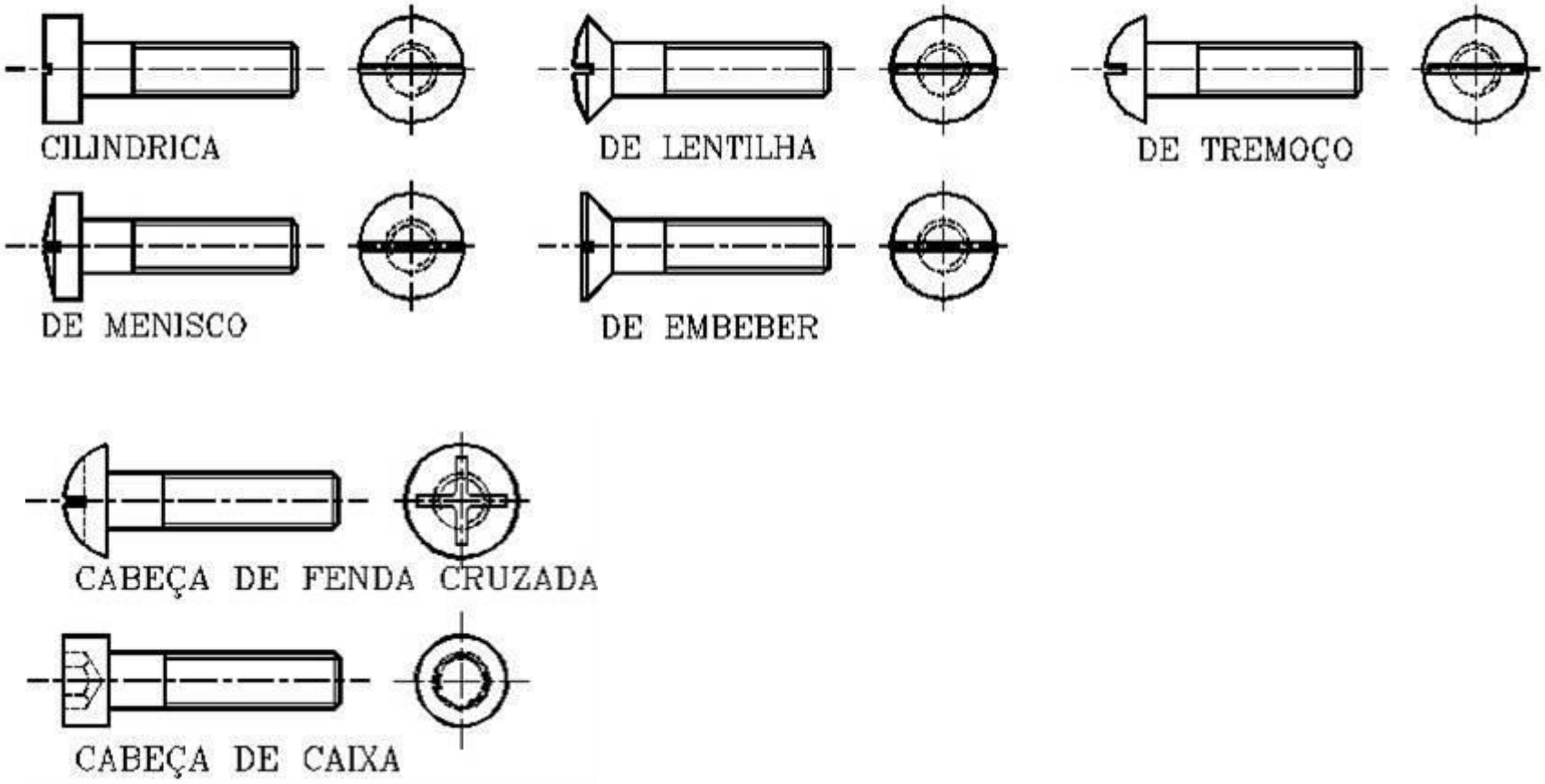


SEXTAVADA COM VERDUGO

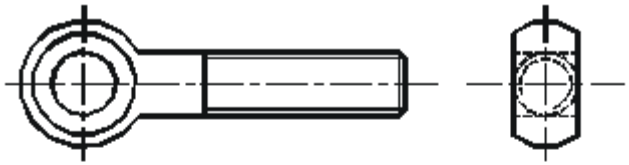


QUADRADA

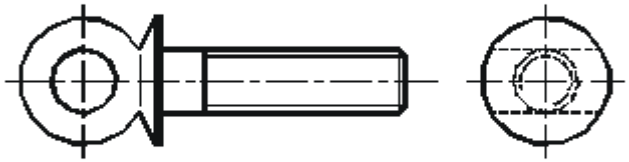
Fenda


CILINDRICA
DE LENTILHA
DE TREMOÇO
DE MENISCO
DE EMBEBER
CABEÇA DE FENDA CRUZADA
CABEÇA DE CAIXA

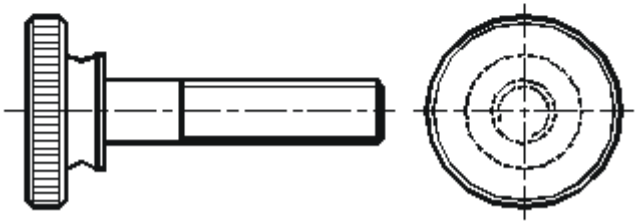
outros tipos



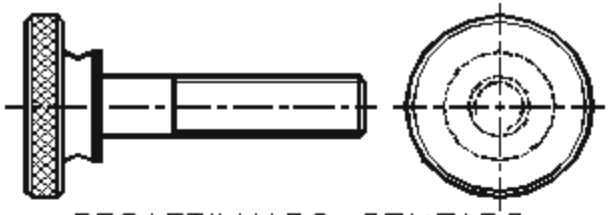
DE OLHAL



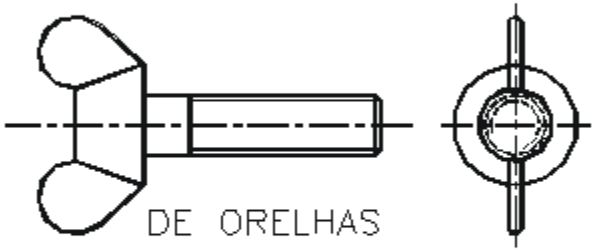
DE BOLA



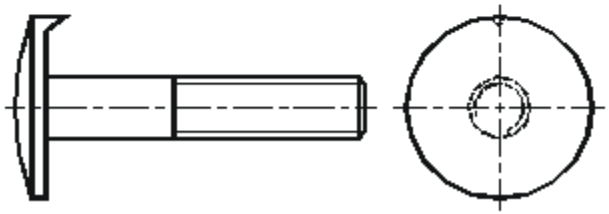
RECARTILHADO RECTO



RECARTILHADO CRUZADO

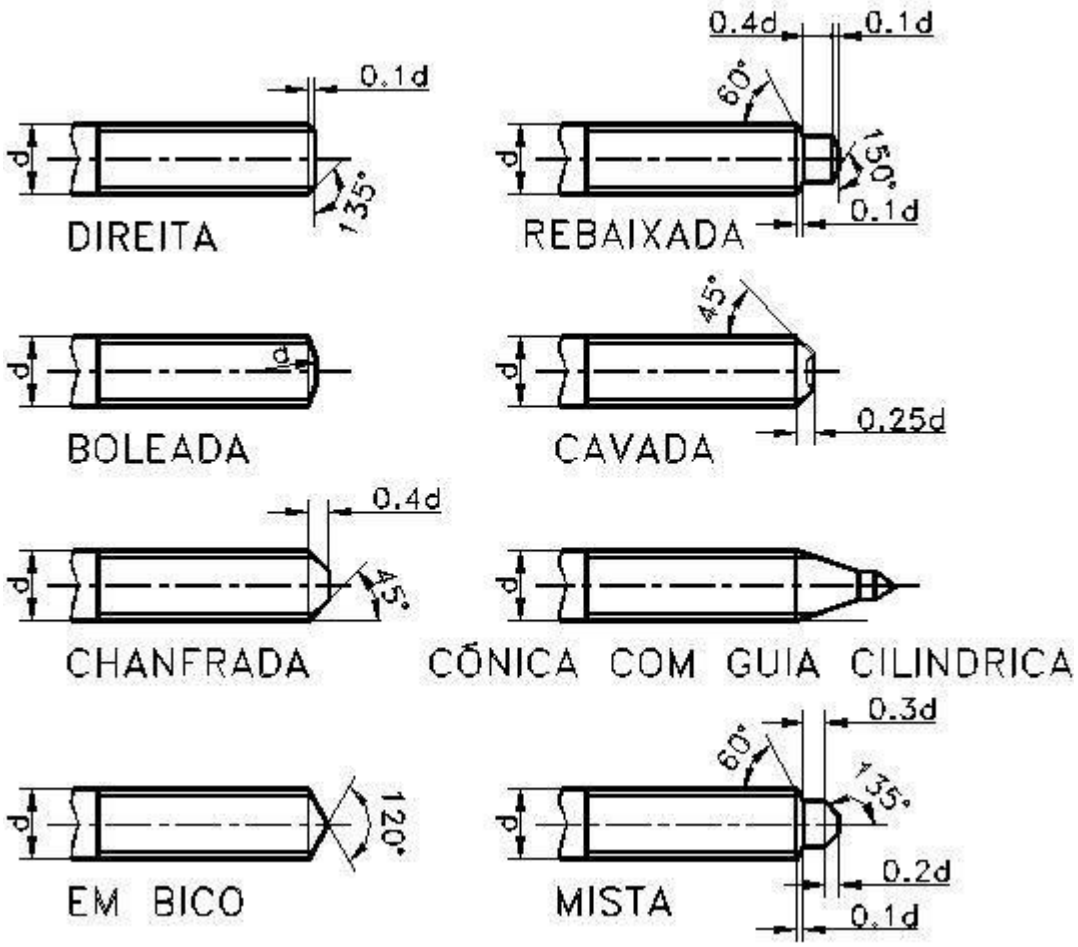


DE ORELHAS

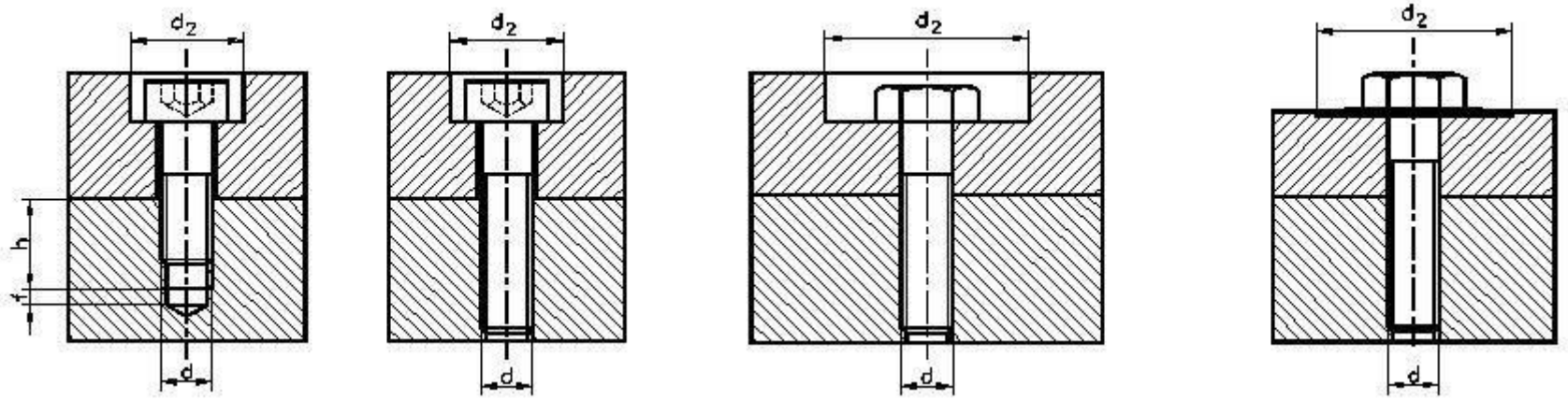


ABAULADA COM PATILHA

Espiga

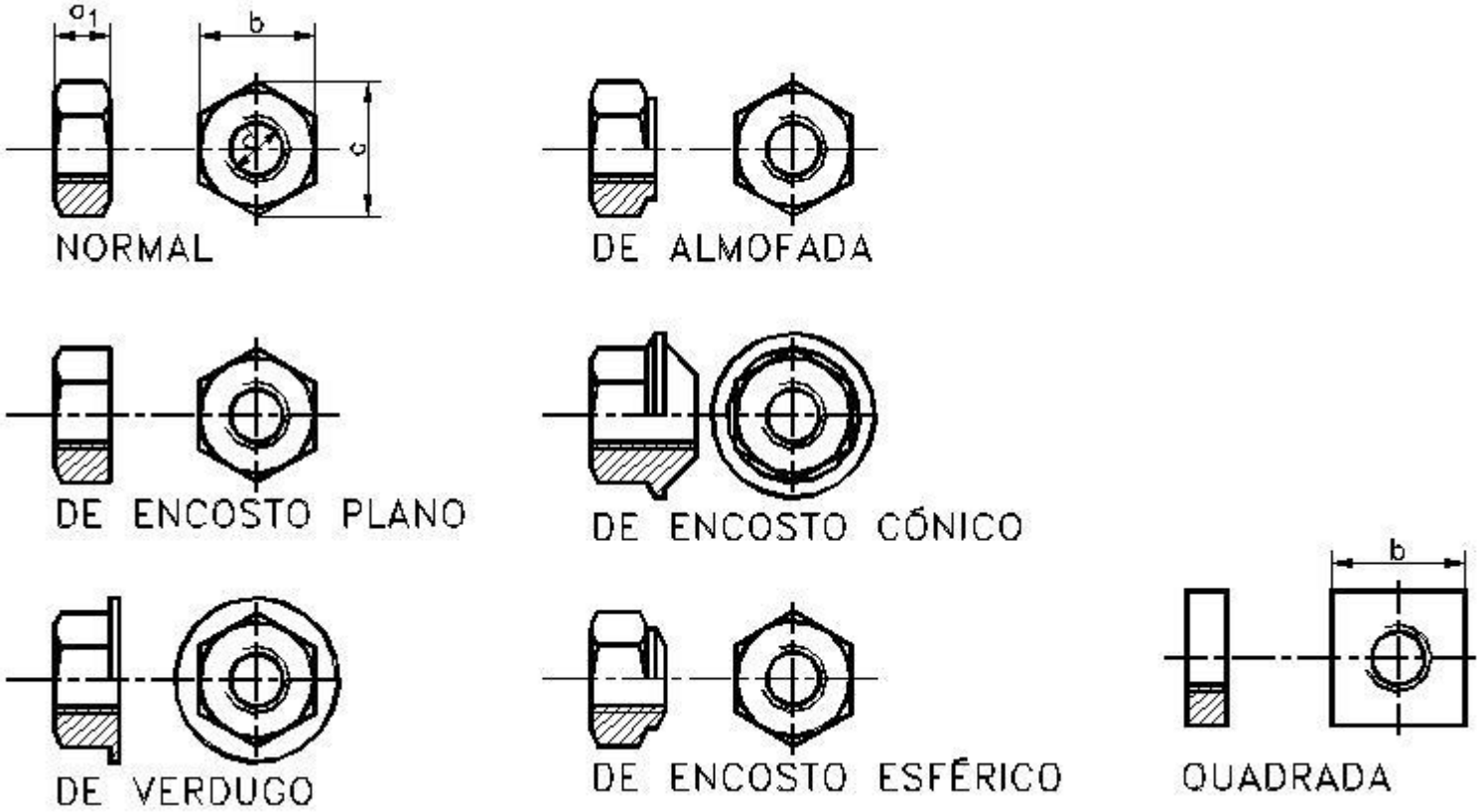

0.1d
d
135°
DIREITA
0.4d
0.1d
60°
150°
0.1d
REBAIXADA
d
BOLEADA
45°
0.25d
CAVADA
0.4d
45°
CHANFRADA
CÕNICA COM GUIA CILINDRICA
120°
EM BICO
0.3d
60°
135°
0.2d
0.1d
MISTA

Caixa



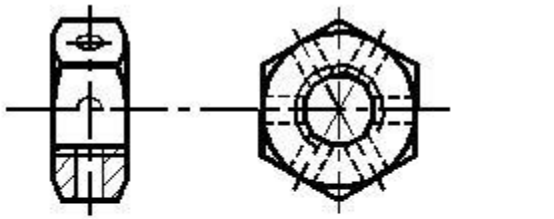
Porcas

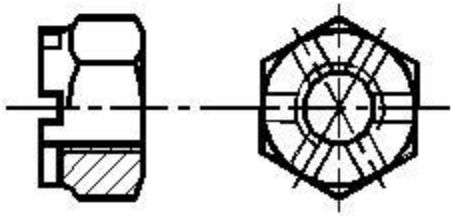
Prismáticas para aperto com chave

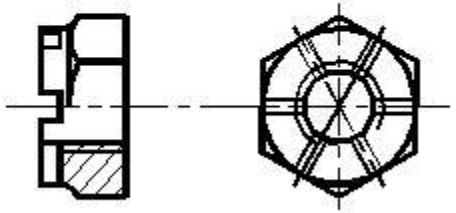


ELEMENTOS DE MÁQUINAS

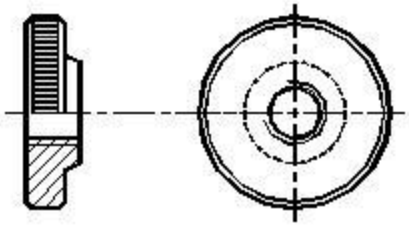
Para imobilização

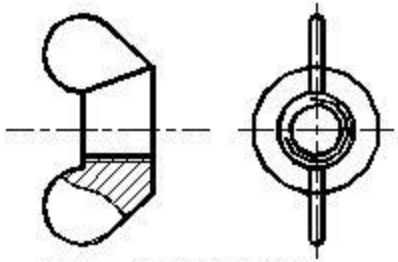

COM FUROS PARA TROÇO

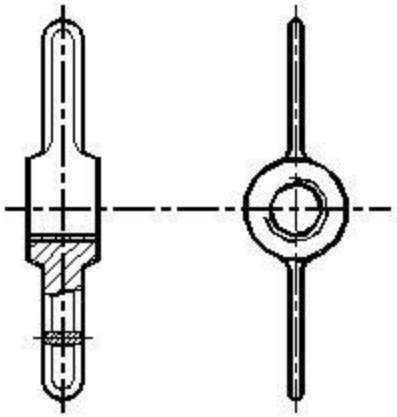

DE CASTELO

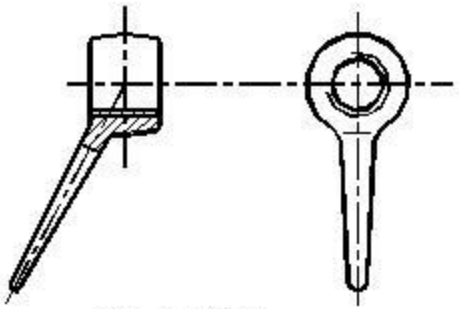

SERRADA

Para apertar à mão

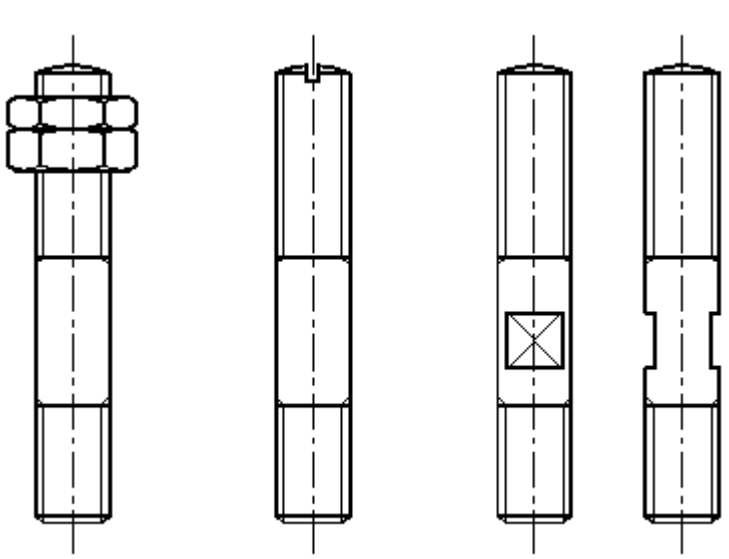

RECARTILHADA

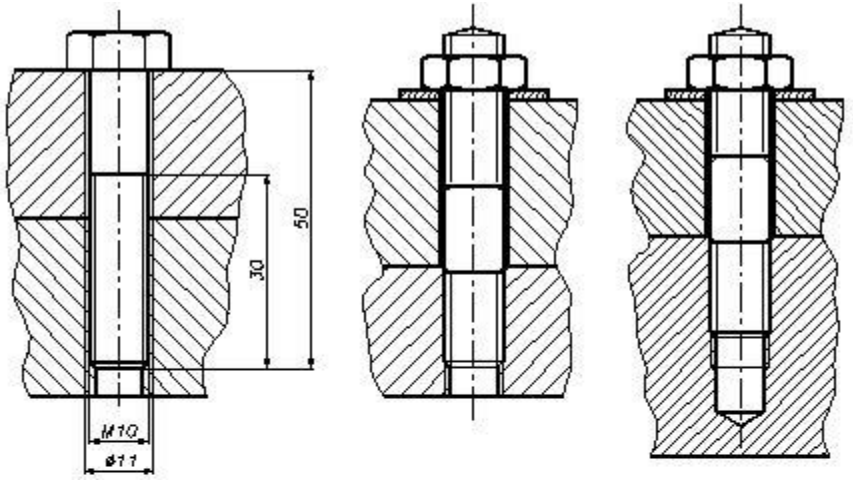

DE ORELHAS

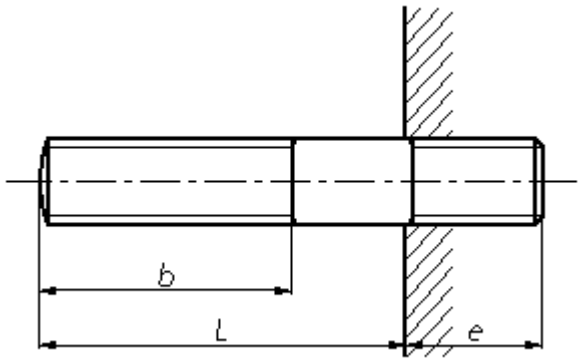

DE MANÍPULO

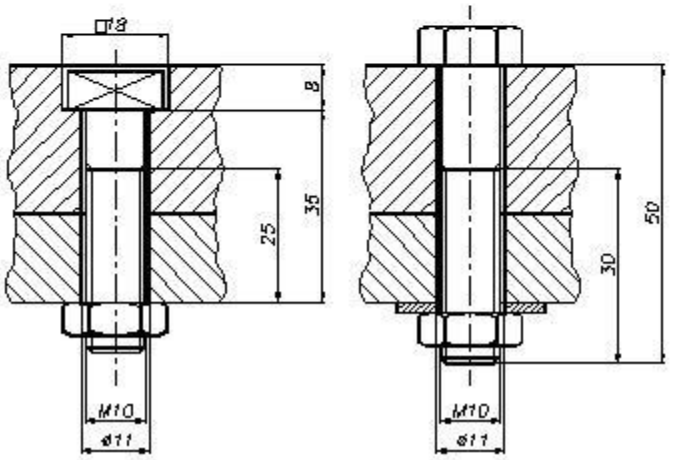

DE RABO

Pernos - haste cilíndrica roscada
em ambas as extremidades

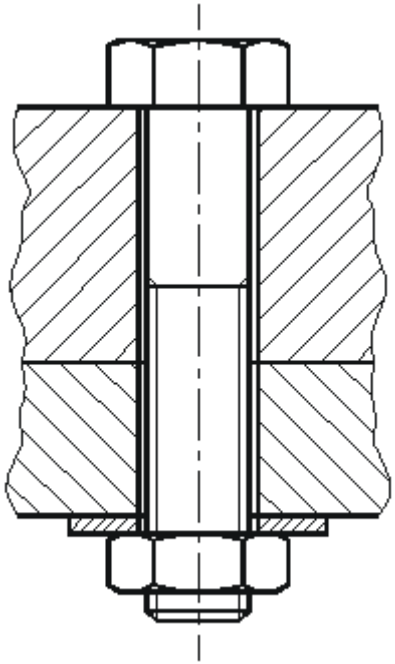


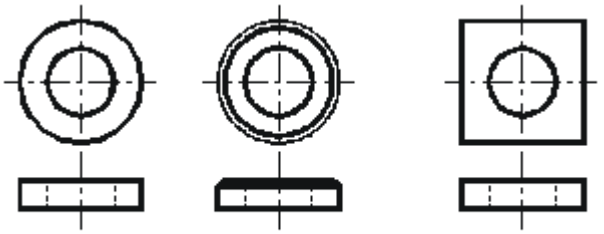




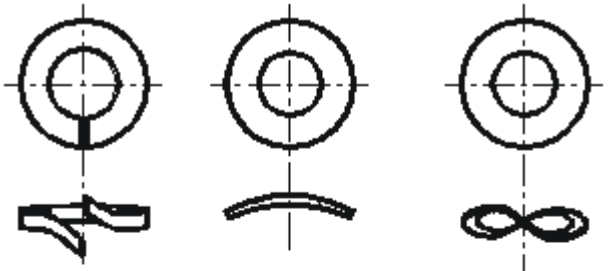


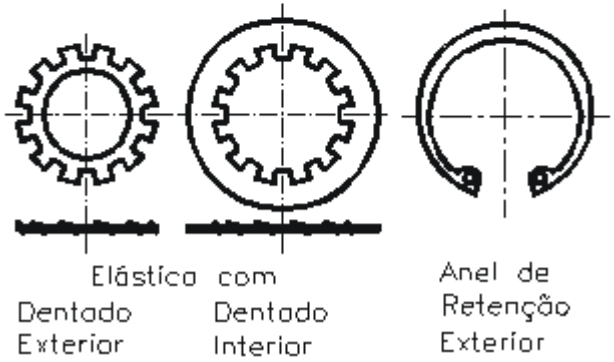
Anilhas

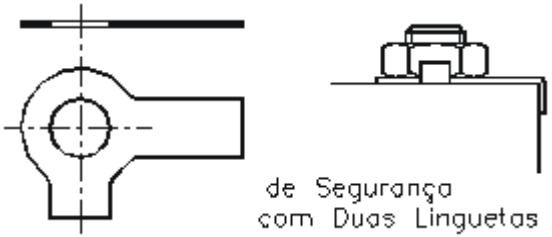



Plana
Plana Chanfrada
Quadrada

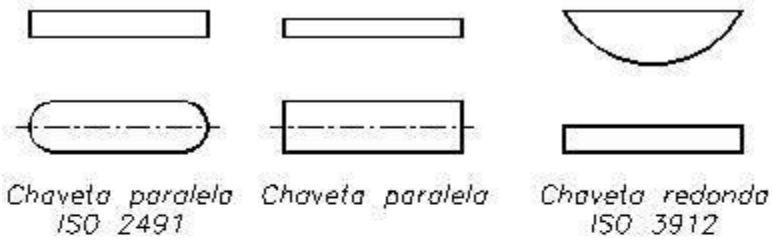

Plana com
Furo Quadrado
Quadrada em Cunha
(para perfis U e I)

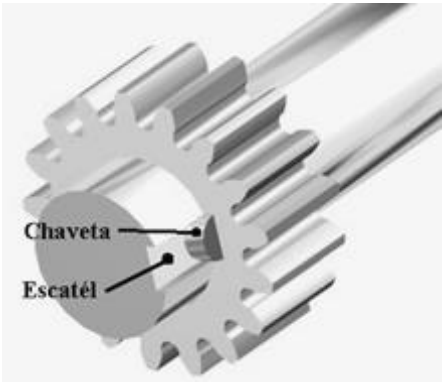

Helicoidal
de Pressão
Elástica
Curvada
Elástica
Ondulada

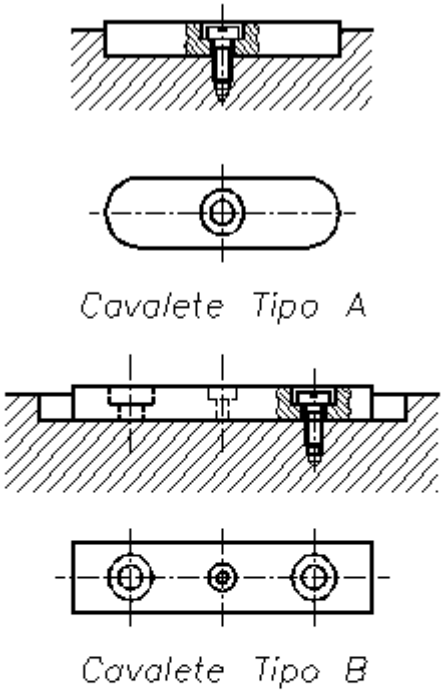

Elástica com
Dentado
Exterior
Dentado
Interior
Anel de
Retenção
Exterior

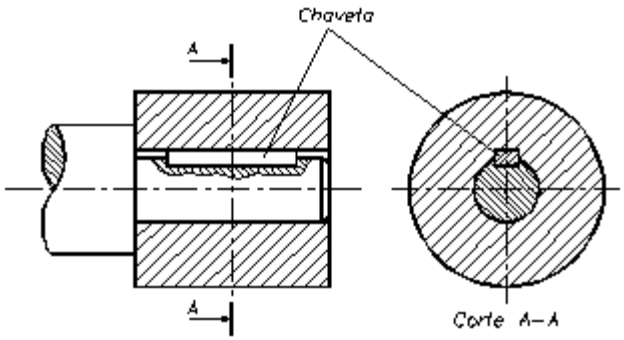

de Segurança
com Duas Linguetas

Chavetas e Cavaletes

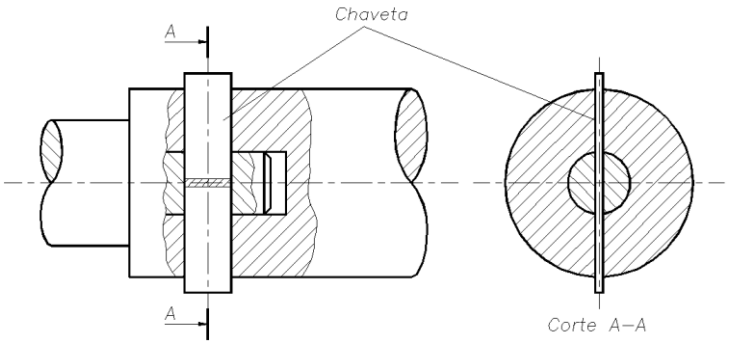






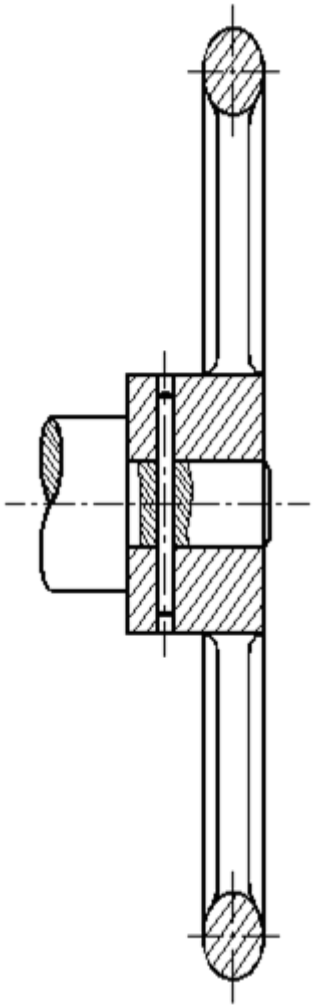


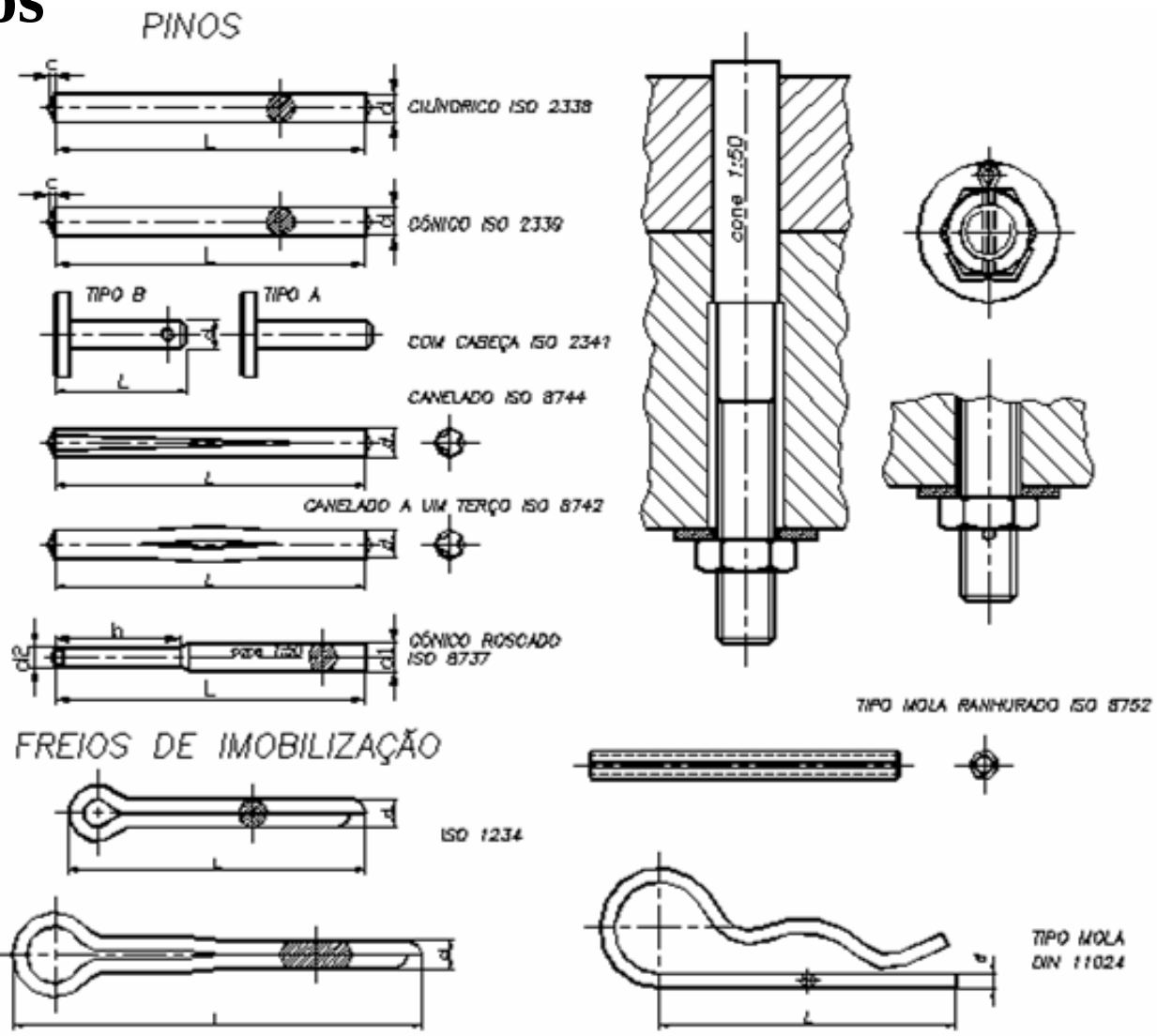
longitudinais



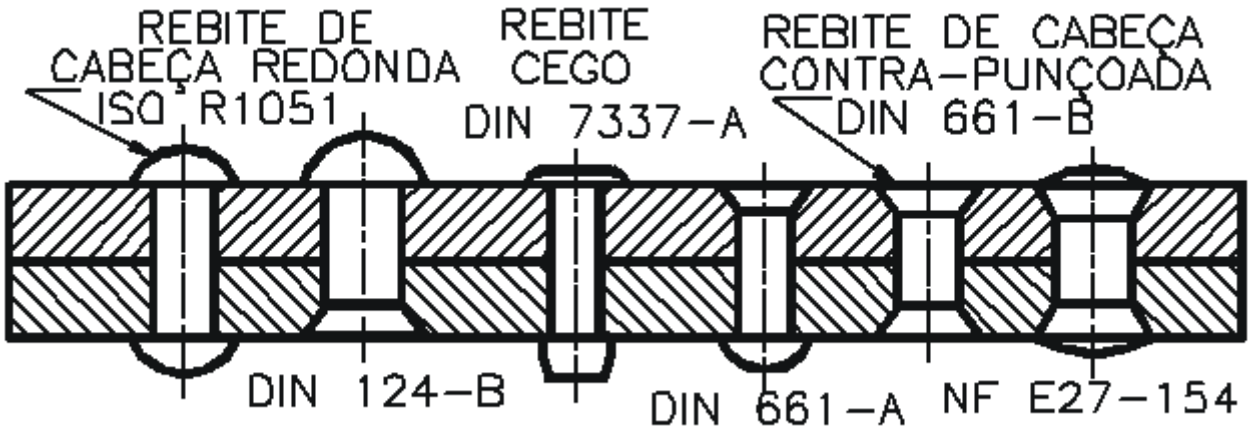
transversais

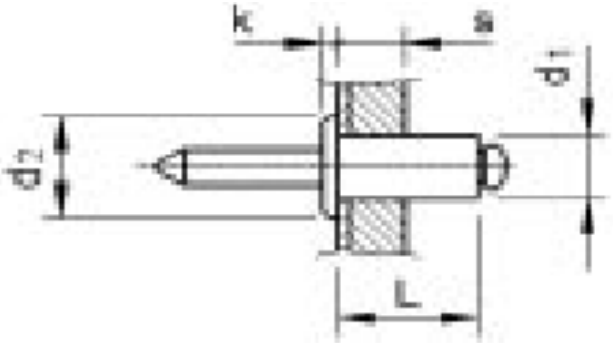
Cavilhas e Troços

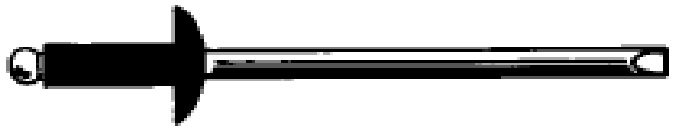




Rebites

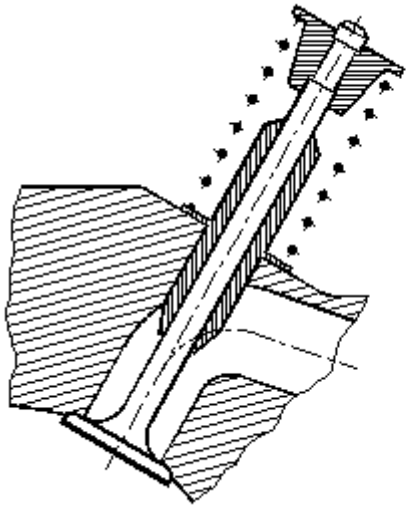

REBITE DE CABEÇA REDONDA ISO R1051
REBITE CEGO DIN 7337-A
REBITE DE CABEÇA CONTRA-PUNÇOADA DIN 661-B
DIN 124-B
DIN 661-A
NF E27-154

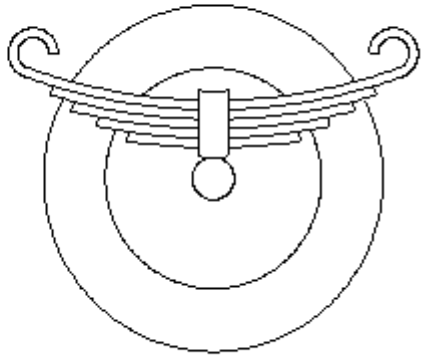

k
s
d1
d2
L

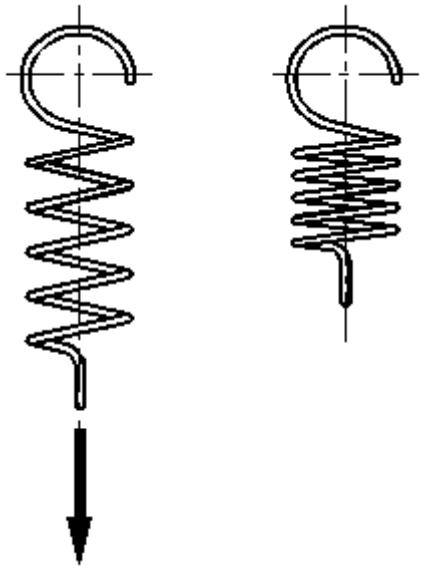


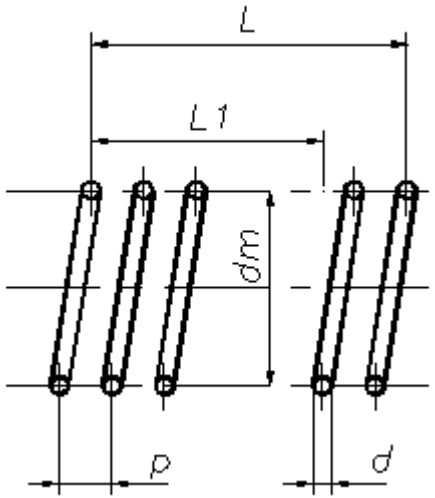
Molas

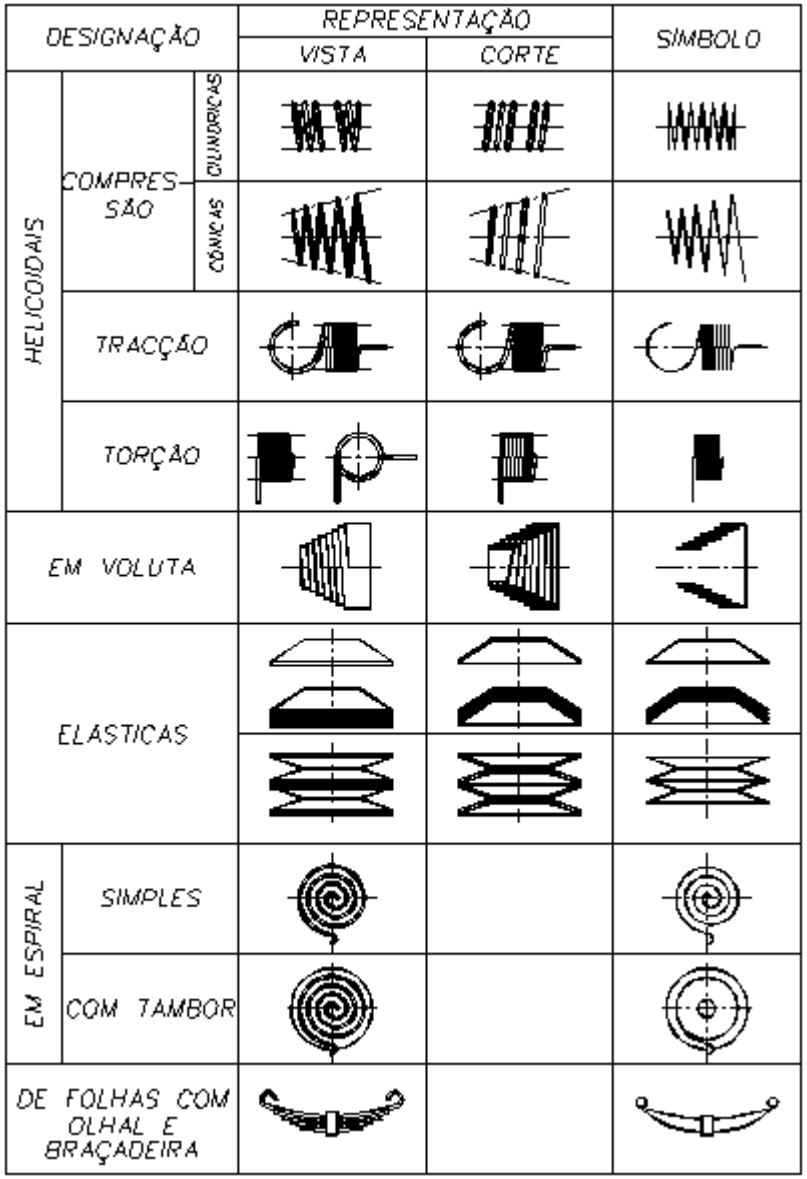
- Helicoidal
- Voluta
- Anilhas Elásticas
- Espiral
- Folha ou Lâminas







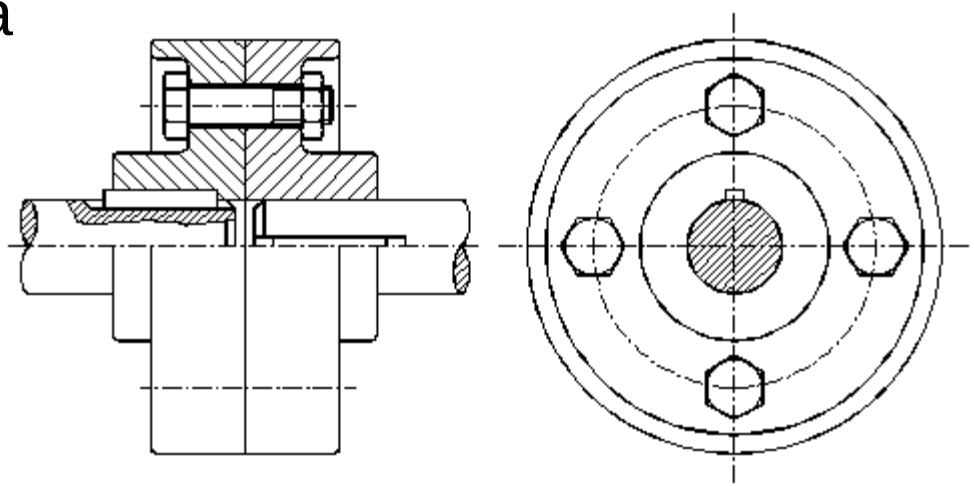




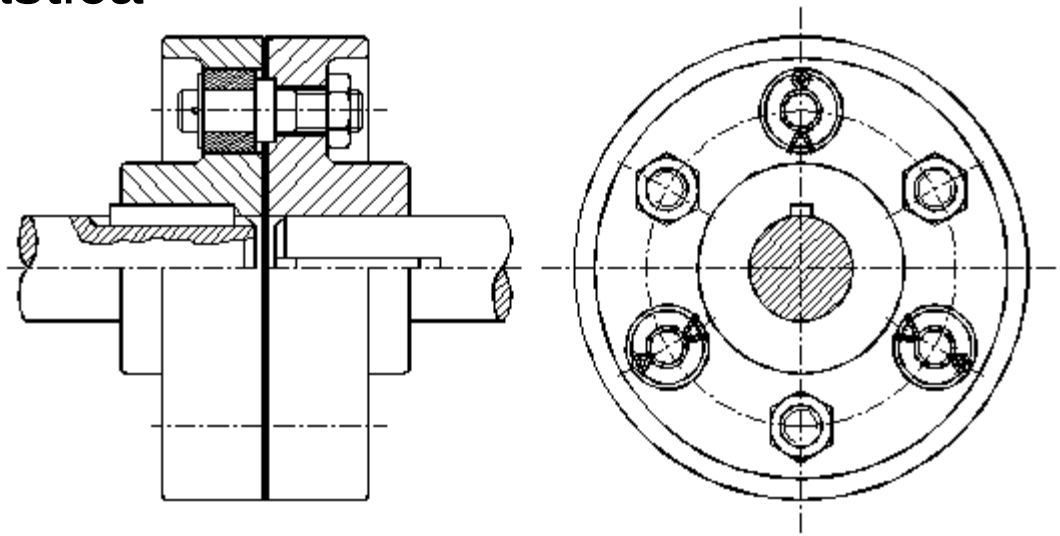
Representação de Molas (ISO 2162)

Uniões de Veios

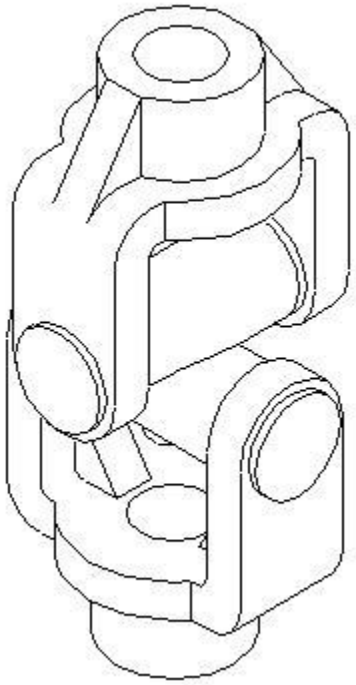
Fixa

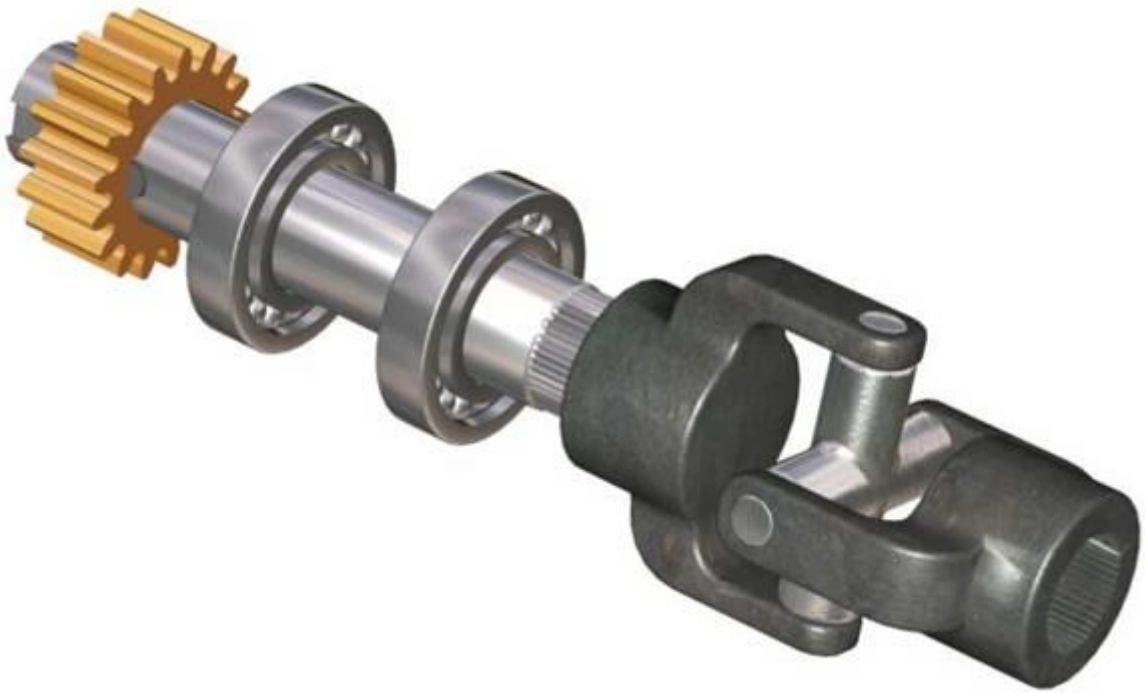


Elástica

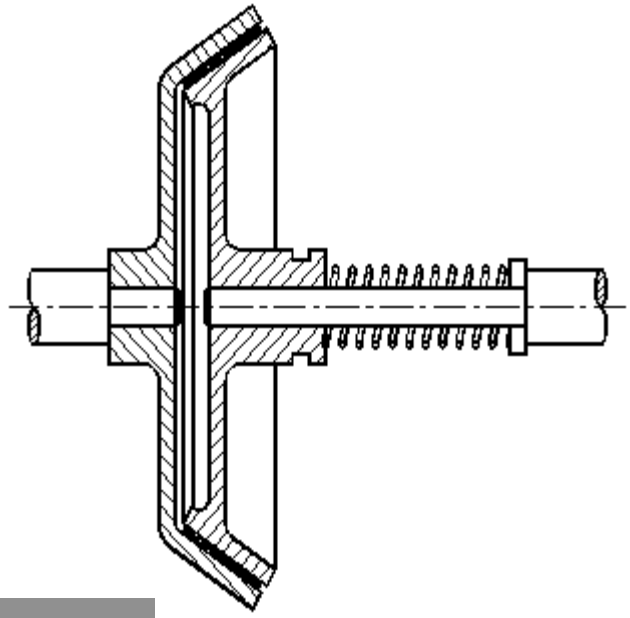


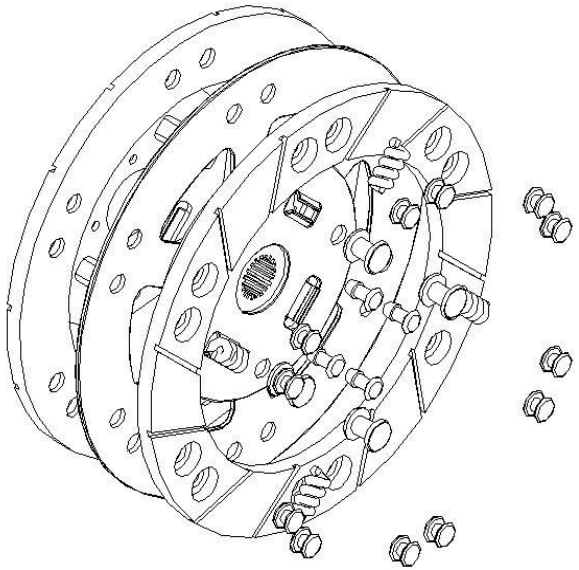
Cardan

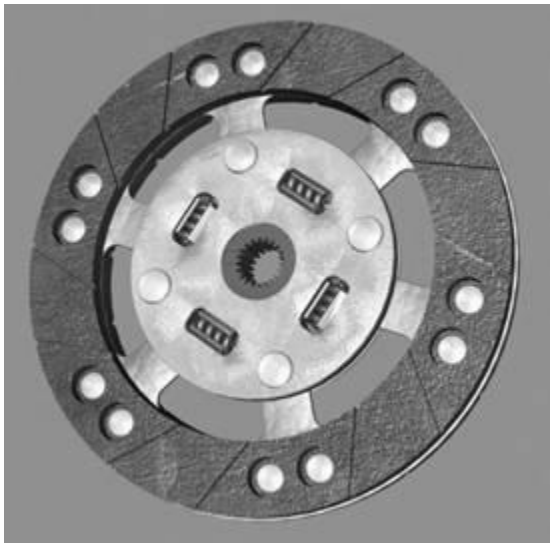




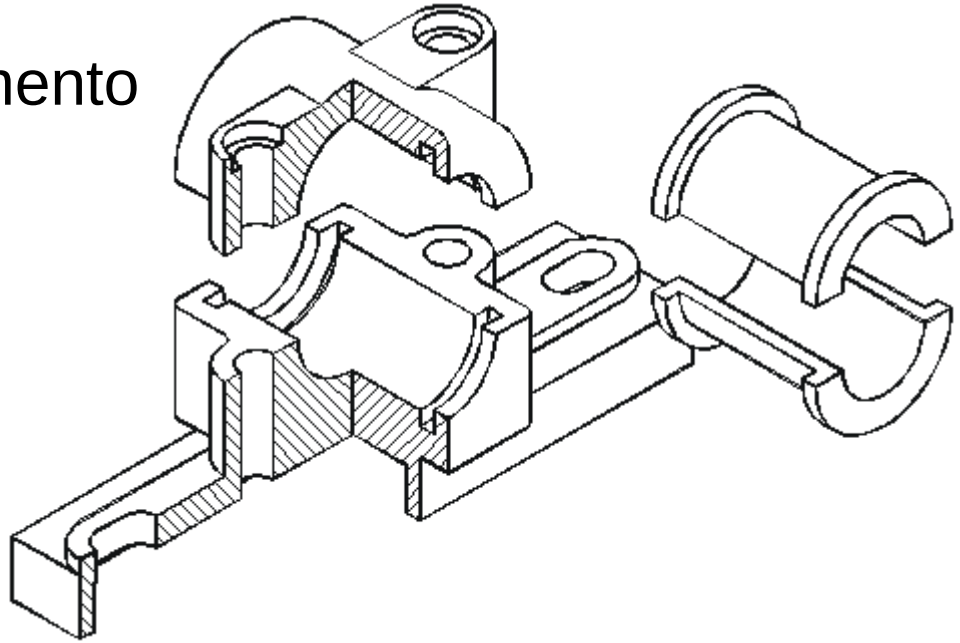
Embraiagens

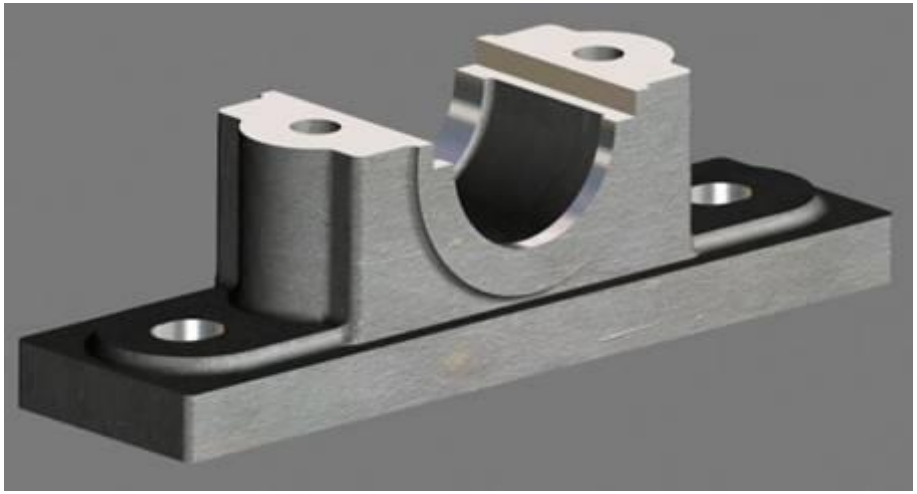




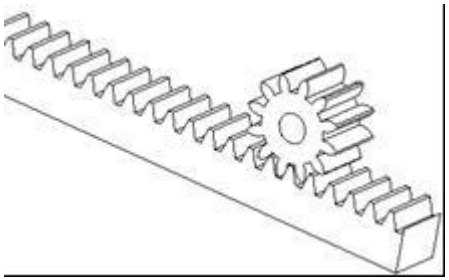


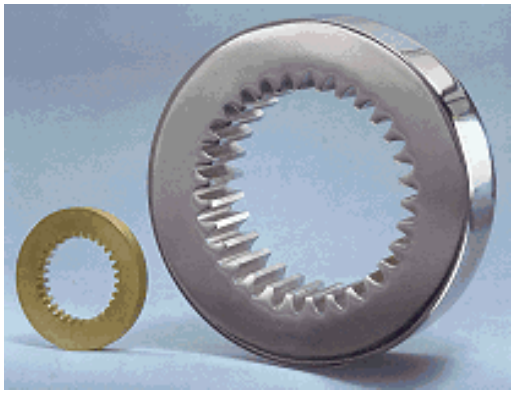
Chumaceira de escorregamento



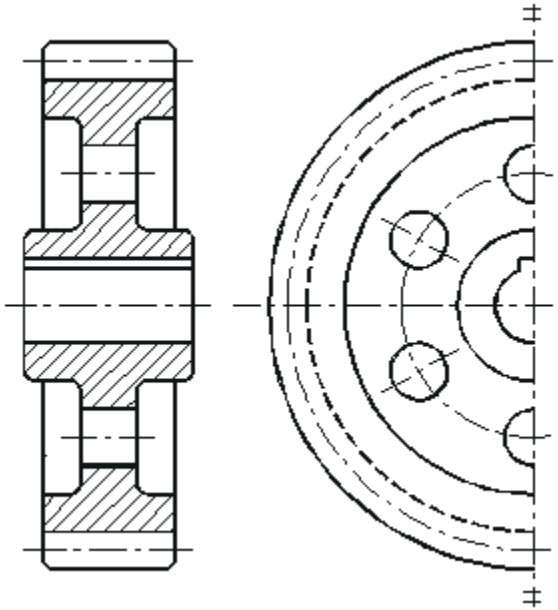


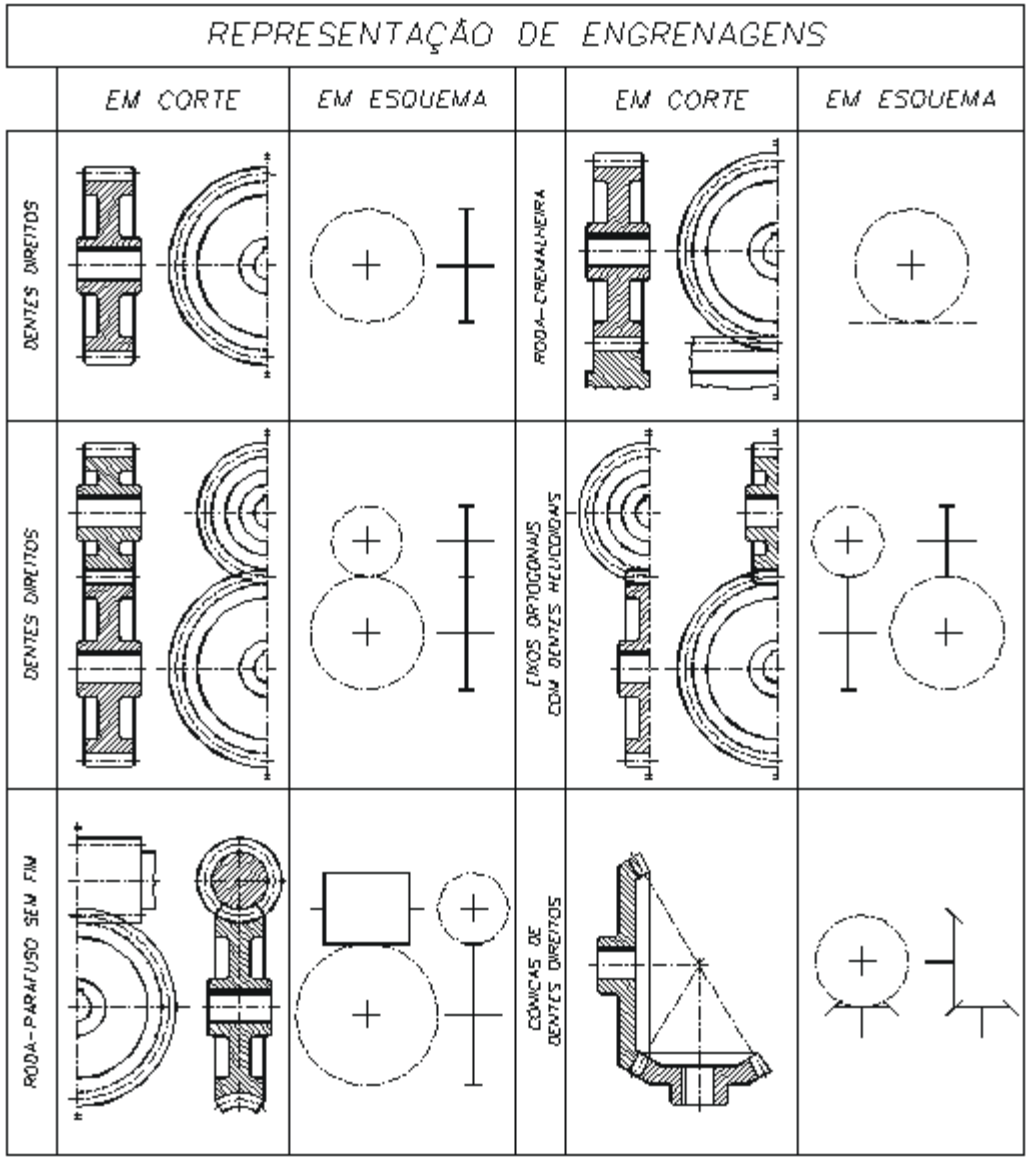
Engrenagens



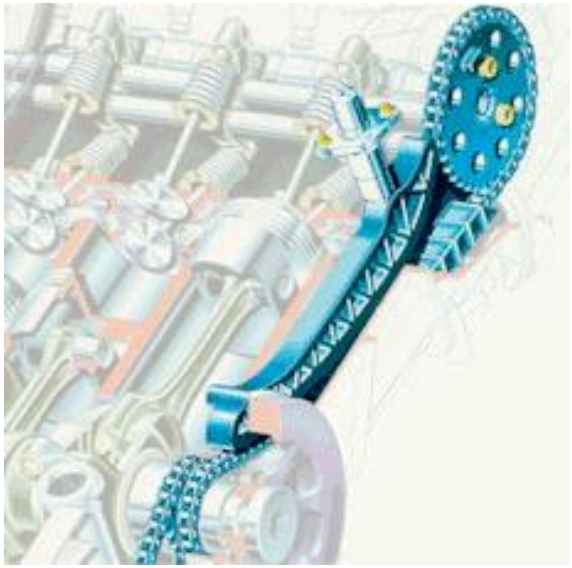


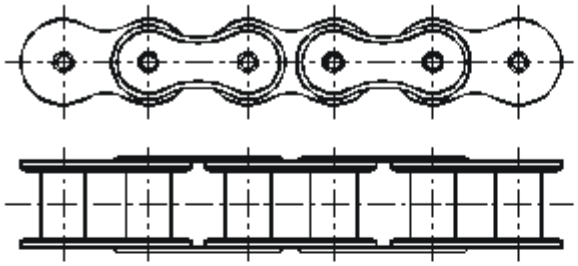
Representação de Engrenagens

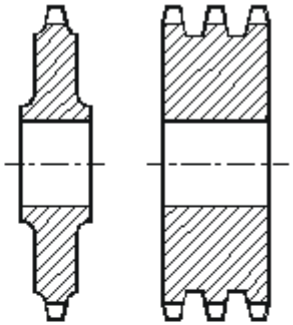


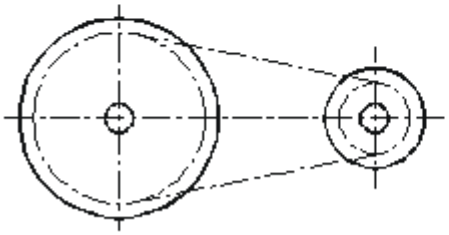


Transmissão por correntes

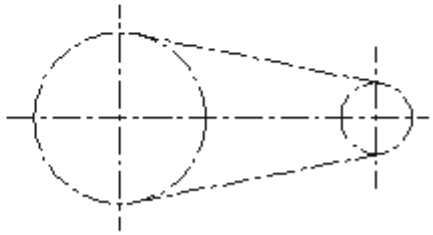






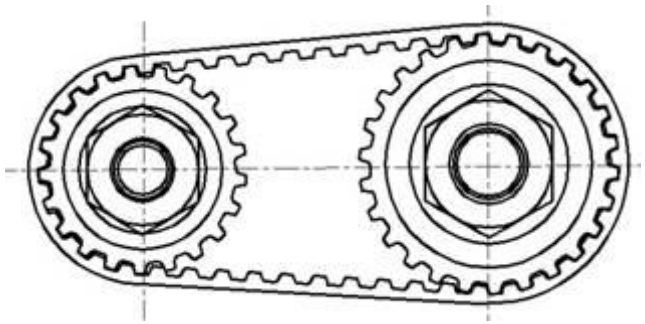


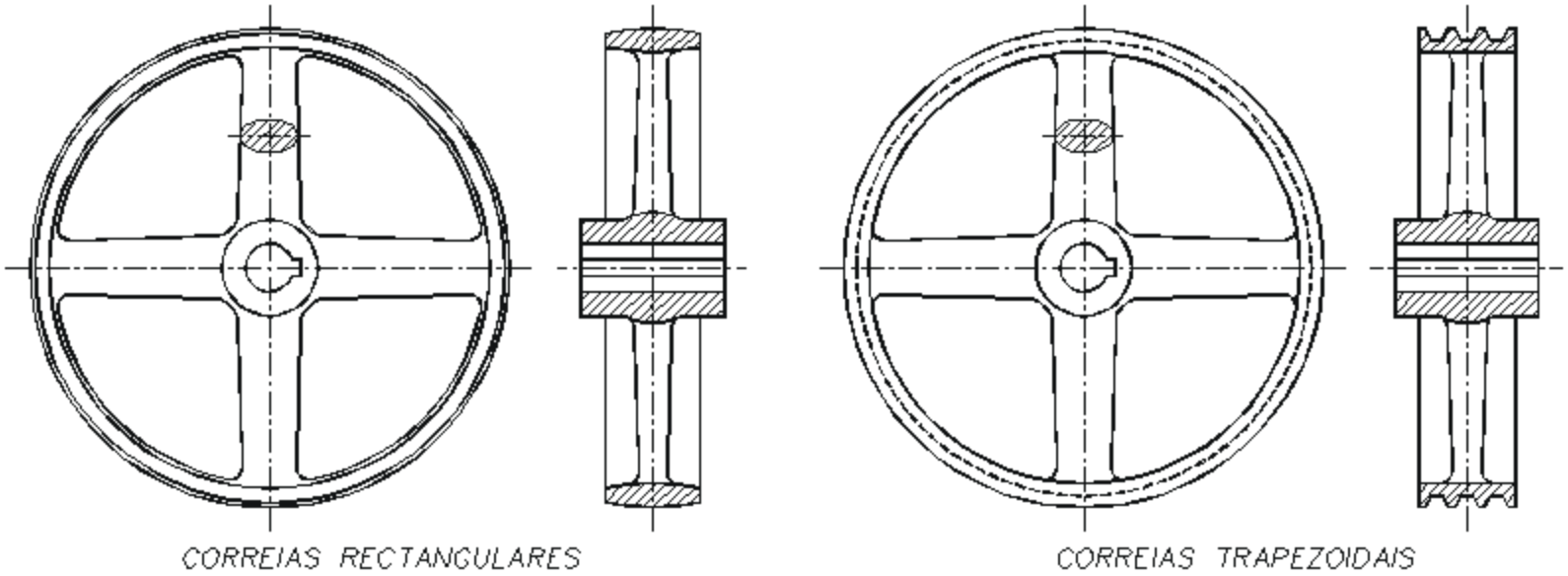
REPRESENTAÇÃO SIMPLIFICADA



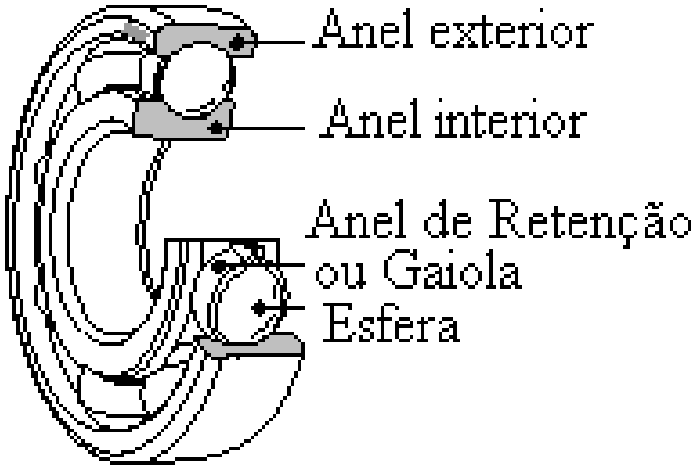
REPRESENTAÇÃO ESQUEMÁTICA

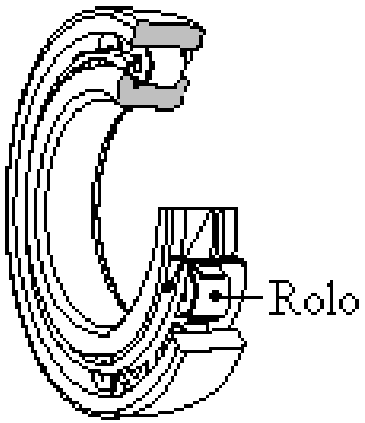
Transmissão por correias dentadas

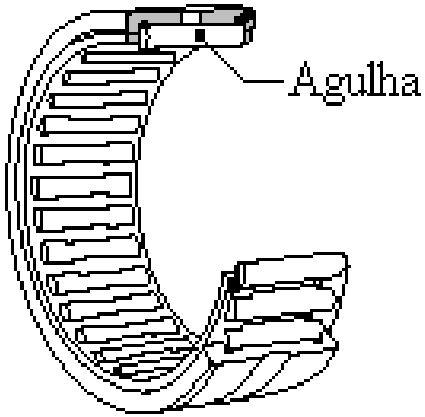


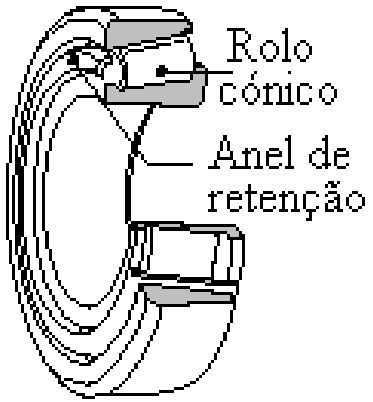


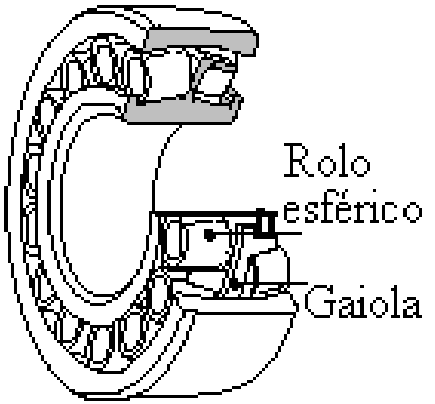
Rolamentos


Anel exterior
Anel interior
Anel de Retenção
ou Gaiola
Esfera

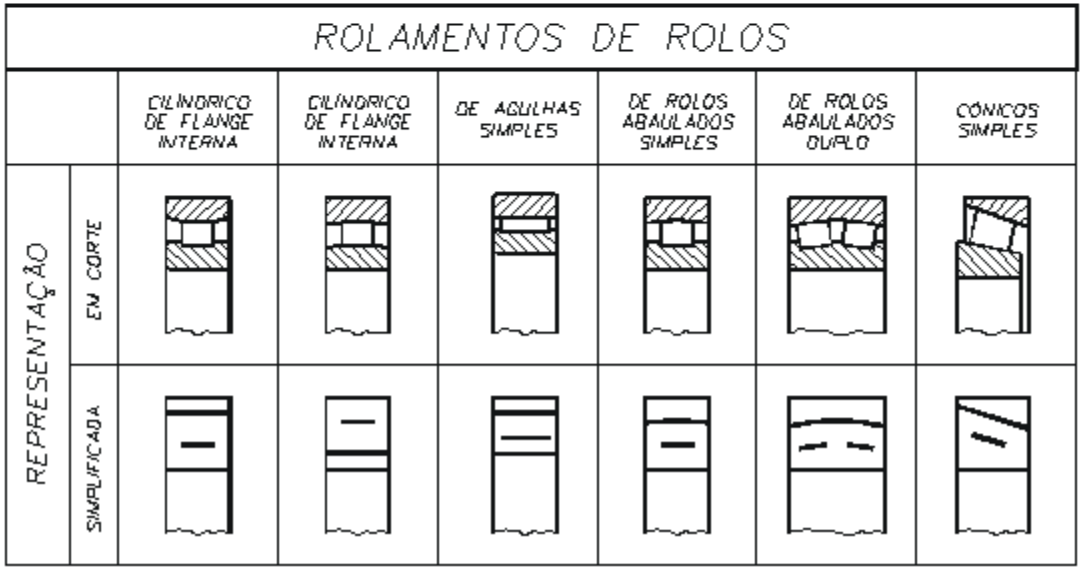

Rolo


Agulha


Rolo
cónico
Anel de
retenção

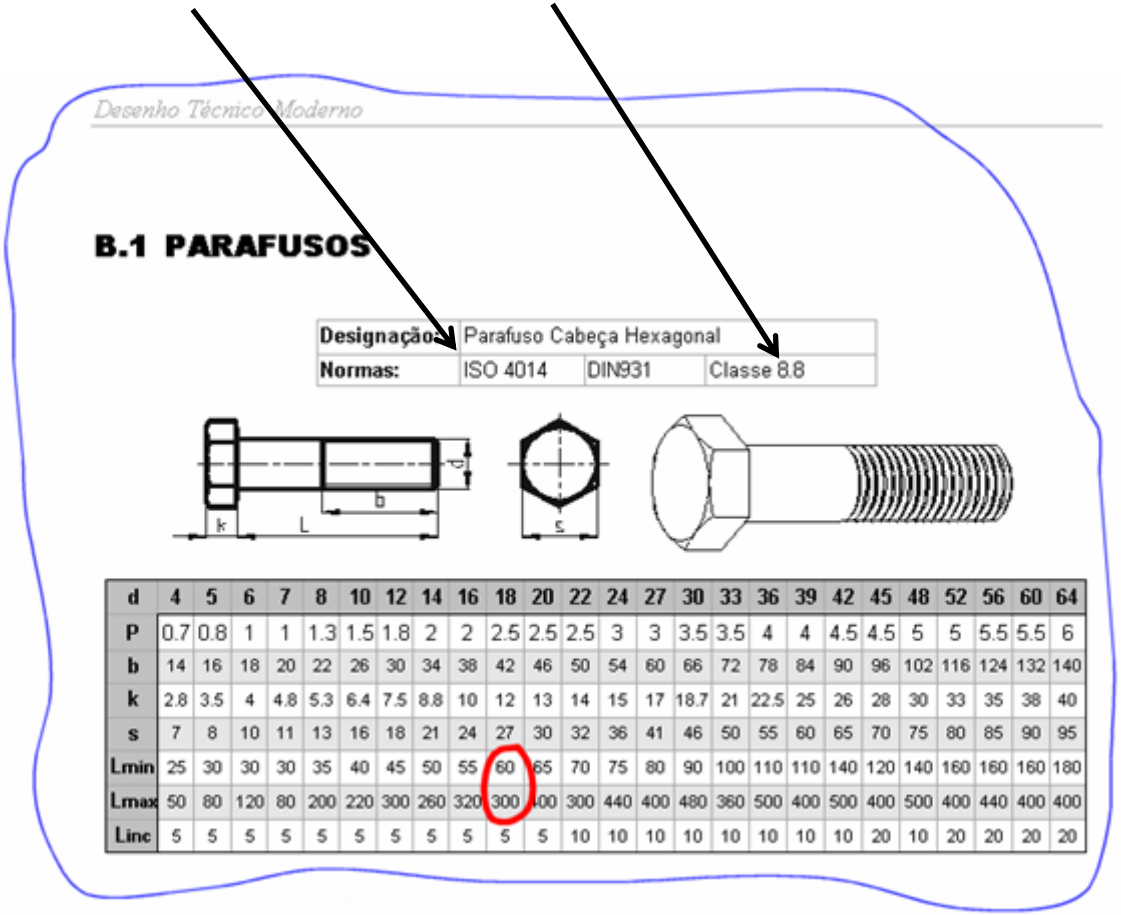

Rolo
esférico
Gaiola

Representação de Rolamentos



Especificação de componentes (ver Anexo B)

Parafuso Cabeça Hexagonal ISO4014 - M18x80 8.8



Desenho Técnico Moderno

B.1 PARAFUSOS

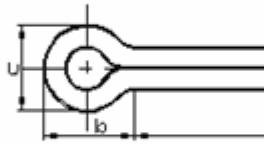
Designação:	Parafuso Cabeça Hexagonal		
Normas:	ISO 4014	DIN931	Classe 8.8

d	4	5	6	7	8	10	12	14	16	18	20	22	24	27	30	33	36	39	42	45	48	52	56	60	64
P	0.7	0.8	1	1	1.3	1.5	1.8	2	2	2.5	2.5	2.5	3	3	3.5	3.5	4	4	4.5	4.5	5	5	5.5	5.5	6
b	14	16	18	20	22	26	30	34	38	42	46	50	54	60	66	72	78	84	90	96	102	116	124	132	140
k	2.8	3.5	4	4.8	5.3	6.4	7.5	8.8	10	12	13	14	15	17	18.7	21	22.5	25	26	28	30	33	35	38	40
s	7	8	10	11	13	16	18	21	24	27	30	32	36	41	46	50	55	60	65	70	75	80	85	90	95
Lmin	25	30	30	30	35	40	45	50	55	60	65	70	75	80	90	100	110	110	140	120	140	160	160	160	180
Lmax	50	80	120	80	200	220	300	260	320	300	400	300	440	400	480	360	500	400	500	400	500	400	440	400	400
Linc	5	5	5	5	5	5	5	5	5	5	5	10	10	10	10	10	10	10	10	20	10	20	20	20	20

Freio de Imobilização ISO1234 - 4x20

B.3 FREIOS

Designação:	Freios de Imobilização–dxL		
Normas:	ISO 1234	DIN 94	Em Aço



d(norm.)	1	1,6	2	2,5	3,2	3,5	4	4,5	5	6,3	7	8	10	13
d(max.)	0,9	1,4	1,8	2,3	2,9	3,2	3,7	4,2	4,6	5,9	6,5	7,5	9,5	12,4
d1(min.)	0,8	1,3	1,7	2,1	2,7	3	3,5	4	4,4	5,7	6,7	7,3	9,3	12,1
a(max.)	1,6	2,5	2,5	2,5	3,2	3,5	4	4	4	4	4,7	4	6,3	6,3
b	3	3,2	4	5	6,4	7	8	8,5	10	12,6	12,3	16	20	25
c(min.)	1,6	2,4	3,2	4	5,1	6,1	6,5	7,6	8	10,3	12,45	13,1	16,6	21,7
c(max.)	1,8	2,8	3,6	4,6	5,8	6,8	7,4	8,2	9,2	11,8	12,5	15	19	24,8
Lmin	10	10	16	16	16	20	20	50	25	25	63	40	63	63
Lmax	50	50	63	63	63	80	80	63	100	100	80	125	160	160
Linc	2-5	2-5	4-5	4-5	4-5	5	5	-						