

DESENHO TÉCNICO MECÂNICO I

AULA 8 - ELEMENTOS DE MÁQUINA (UNIÃO E FIXAÇÃO)



Notas de Aulas v.2015

DESENHO DE CONJUNTO E DE DETALHE

DEFINIÇÕES

Conjuntos Mecânicos

Peças justapostas para efetuar uma função

Composição (folhas)

Desenho de conjunto

Desenho de componentes



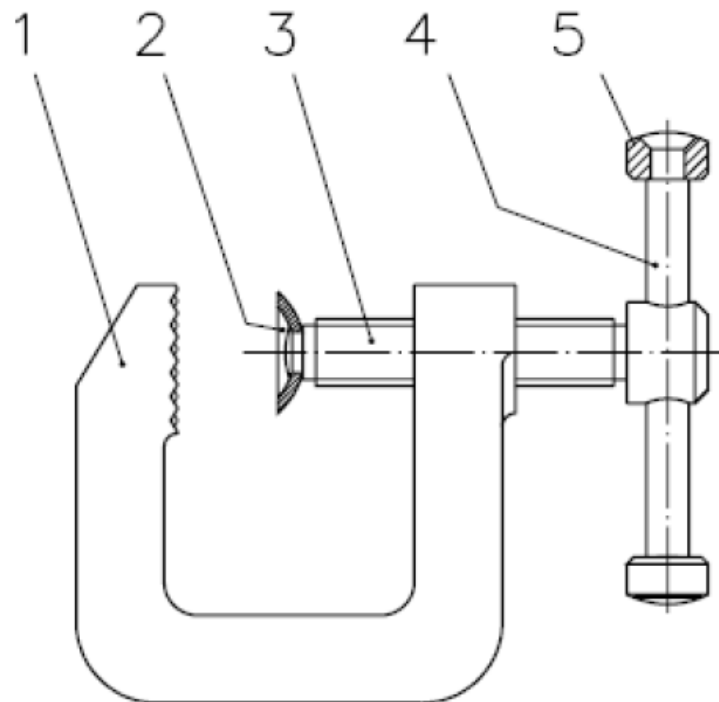
Exemplo de Uso

(fixação de madeiras para furação, colagem, etc)



Exemplo de Conjunto Mecânico
(GRAMPO FIXO)

Desenho em Explosão
(Não usado para fabricação)



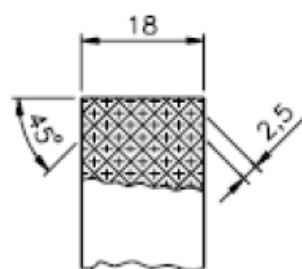
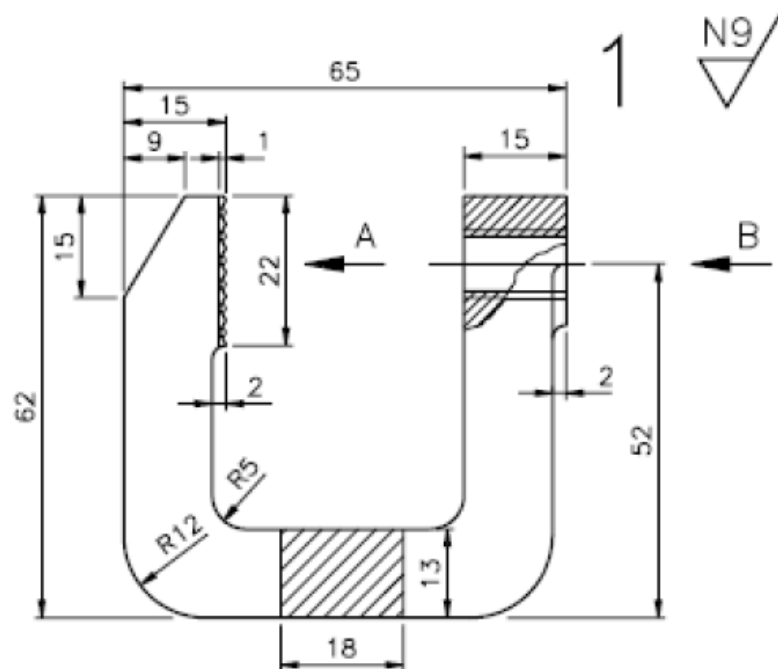
5	Cabeça	Des.nº 1.5	2	Aço ABNT 1010/20 tref. Ø12,7 x 20
4	Manípulo	Des.nº 1.4	1	Aço ABNT 1010/20 tref. Ø6,35 x 80
3	Parafuso	Des.nº 1.3	1	Aço ABNT 1010/20 tref. Ø 16 x 70
2	Encosto móvel	Des.nº 1.2	1	Aço ABNT 1010/20 # 16 Ø25
1	Corpo	Des.nº 1.1	1	Aço ABNT 1010/20 = 19 x 63,5 x 66

Peca	Denominação e observações	Quant.	Material e dimensões													
<table border="1"> <tr> <td rowspan="4"> SENAI São Paulo </td> <td>Titulo:</td> <td>GRAMPO FIXO (CONJUNTO)</td> <td>  Escala: 1:1 </td> </tr> <tr> <td>Aluno:</td> <td></td> <td>Unidade mm</td> </tr> <tr> <td>Professor:</td> <td></td> <td>Data: / /</td> </tr> <tr> <td></td> <td>C.F.P.:</td> <td>Turma:</td> </tr> </table>				SENAI São Paulo	Titulo:	GRAMPO FIXO (CONJUNTO)	 Escala: 1:1	Aluno:		Unidade mm	Professor:		Data: / /		C.F.P.:	Turma:
SENAI São Paulo	Titulo:	GRAMPO FIXO (CONJUNTO)	 Escala: 1:1													
	Aluno:		Unidade mm													
	Professor:		Data: / /													
		C.F.P.:	Turma:													
			Des.nº : 1													

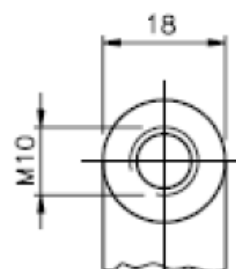
Formato A5 (148,5 x 210mm)

FOLHA 1

DESENHO DE CONJUNTO



Visto de A



Visto de B

Afastamento geral $\pm 0,1$

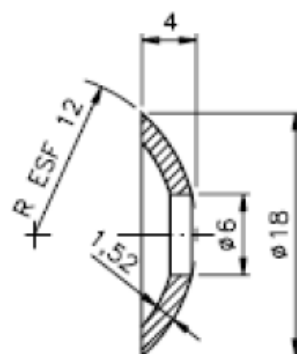
1	Corpo	1	Aço ABNT 1010/20 $\square 19 \times 63,5 \times 66$
Peça	Denominação e observações	Quant.	Material e dimensões
Título: GRAMPO FIXO (COMPONENTE) Aluno: Professor:		Unidade: mm Data: / / C.F.P.:	
SENAI São Paulo		Escala: 1:1 Turma: Des.º: 1.1	

Formato A5 (148,5 x 210mm)

FOLHA 1.1

DESENHO DE COMPONENTE

2 ✓



Afastamento geral $\pm 0,1$

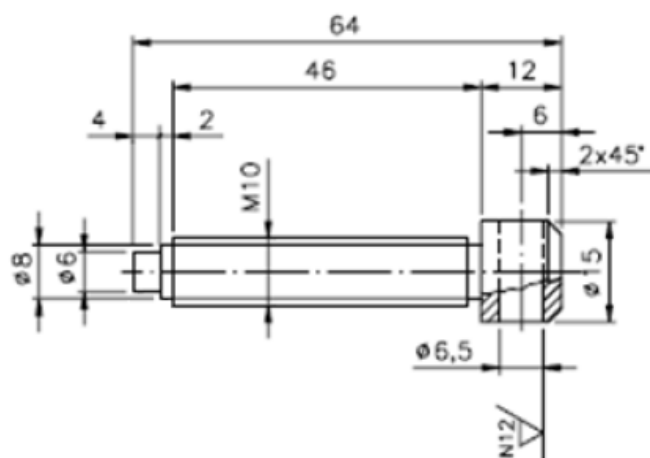
2	Encosto móvel	1	Aço ABNT 1010/20 - # 16 Ø 25
Peça	Denominação e observações	Quant.	Material e dimensões
SENAI São Paulo		Título: GRAMPO FIXO (COMPONENTE)	Escala: 2:1 Unidade mm Data: / / Turma: C.F.P.: Des.nº: 1.2

Formato A3 (148,5 x 210mm)

FOLHA 1.2

DESENHO DE COMPONENTE

3 ∇ N9/ (∇ N12/)



Afastamento geral $\pm 0,1$

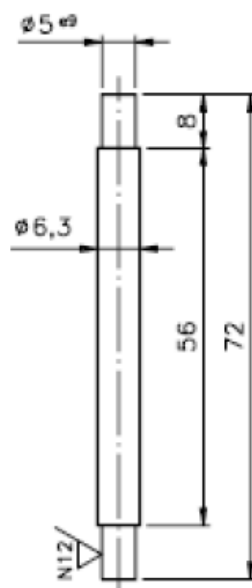
3	Parafuso	1	Aço ABNT 1010/20 - tref. $\phi 16 \times 70$													
Piço	Denominação e observações	Quant.	Material e dimensões													
<table border="1"> <tr> <td rowspan="4"> SENAI São Paulo </td> <td>Título:</td> <td>GRAMPO FIXO (COMPONENTE)</td> <td>  Escala: 1:1 </td> </tr> <tr> <td>Aluno:</td> <td></td> <td>Unidade mm</td> </tr> <tr> <td>Professor:</td> <td></td> <td>Data: / / Turma:</td> </tr> <tr> <td></td> <td>C.F.P.:</td> <td>Des. nº : 1.3</td> </tr> </table>				SENAI São Paulo	Título:	GRAMPO FIXO (COMPONENTE)	 Escala: 1:1	Aluno:		Unidade mm	Professor:		Data: / / Turma:		C.F.P.:	Des. nº : 1.3
SENAI São Paulo	Título:	GRAMPO FIXO (COMPONENTE)	 Escala: 1:1													
	Aluno:		Unidade mm													
	Professor:		Data: / / Turma:													
		C.F.P.:	Des. nº : 1.3													

Formato A5 (148,5 x 210mm)

FOLHA 1.3

DESENHO DE COMPONENTE

4 ✓ (N12/)



Afastamento geral $\pm 0,1$

4	Manípulo	1	Aço ABNT 1010/20 tref. ø6,35 x 80
Peca	Denominação e observações	Quant.	Material e dimensões

SENAI

São Paulo

Título: GRAMPO FIXO
(COMPONENTE)

Aluno:

Professor:



Unidade mm

Data: / /

C.F.P.

Escala:

1:1

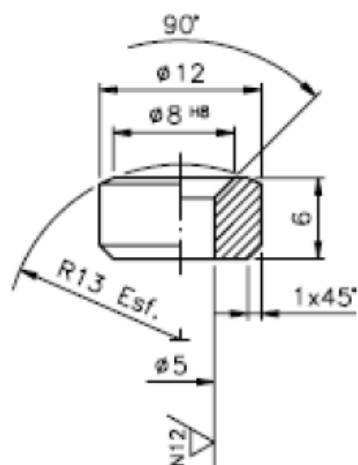
Turma:

Des. nº: 1.4

FOLHA 1.4

DESENHO DE COMPONENTE

5 $\nabla^{N9/}$ ($\nabla^{N12/}$)



Afastamento geral $\pm 0,1$

5	Cabeça	2	Aço ABNT 1010/20 tref. $\phi 12,7 \times 20$
Peça	Denominação e observações	Quant.	Material e dimensões
 São Paulo	Título:	GRAMPO FIXO (COMPONENTE)	
	Aluno:	Data: / /	
	Professor:	C.F.P.:	
		Des.ne: 1.5	

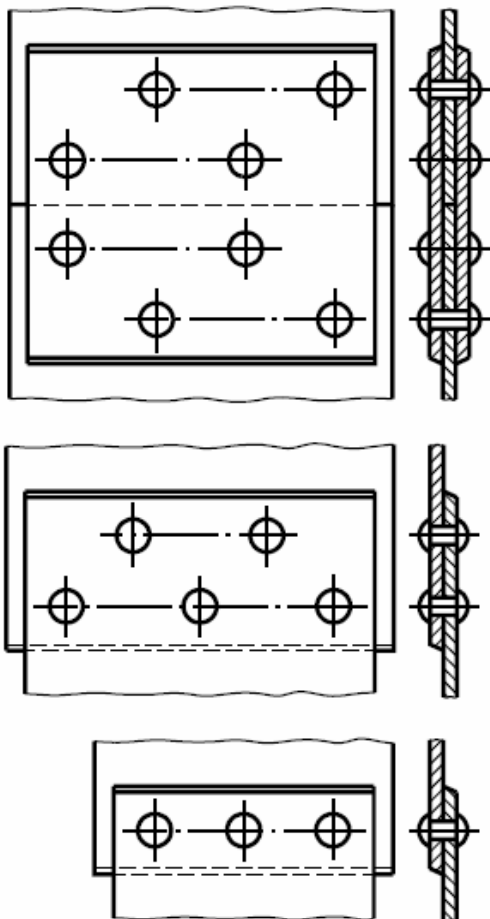
Formato A5 (148,5 x 210mm)

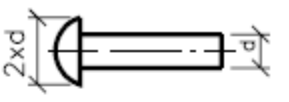
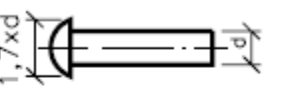
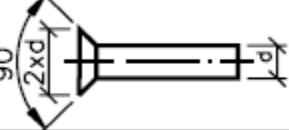
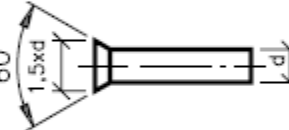
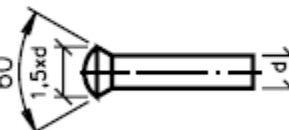
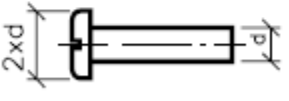
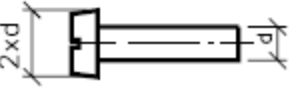
FOLHA 1.5

DESENHO DE COMPONENTE

ELEMENTOS DE FIXAÇÃO

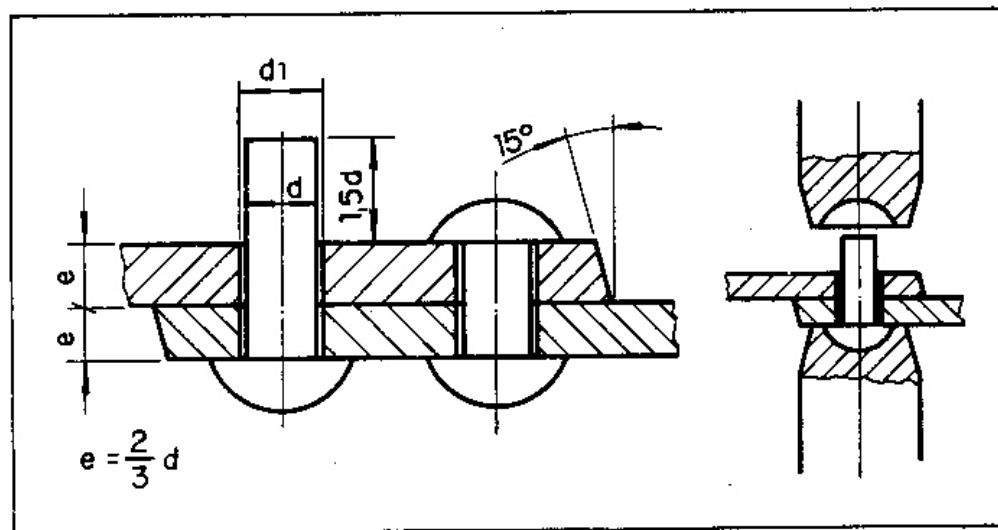
REBITES



	Cabeça redonda larga
	Cabeça redonda estreita
	Cabeça escareada chata larga
	Cabeça escareada chata estreita
	Cabeça escareada com calota
	Cabeça tipo panela
	Cabeça cilíndrica

ELEMENTOS DE FIXAÇÃO

REBITES



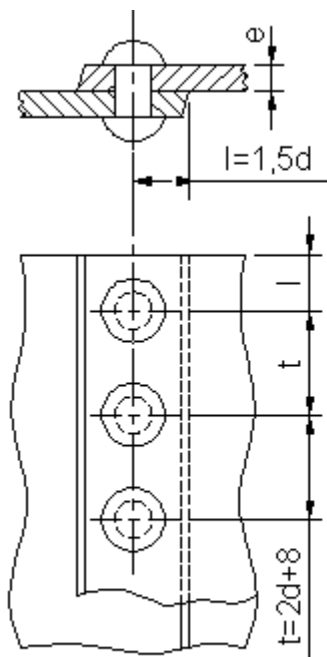


ELEMENTOS DE FIXAÇÃO

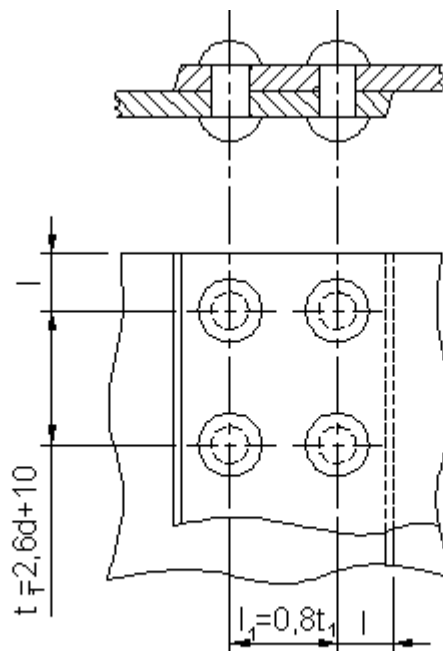
REBITES

Costuras:

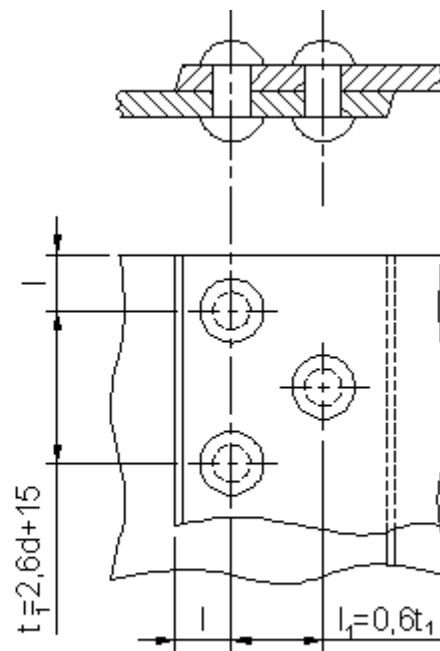
- a) simples;
- b) dupla;
- c) em zigue-zague.



Costura simples



Costura dupla

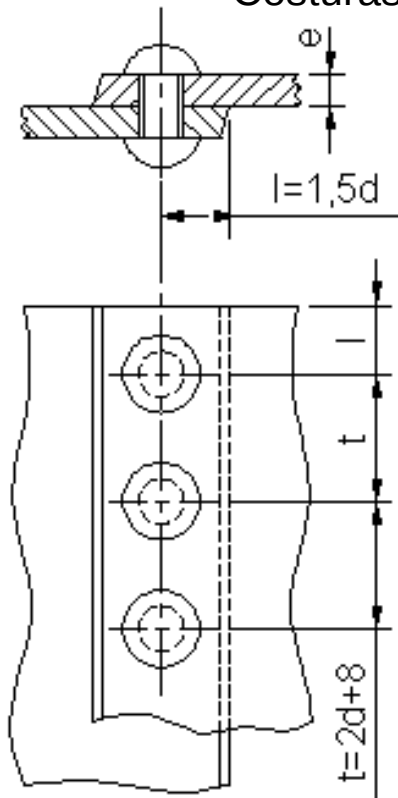


Costura em zigue-zague

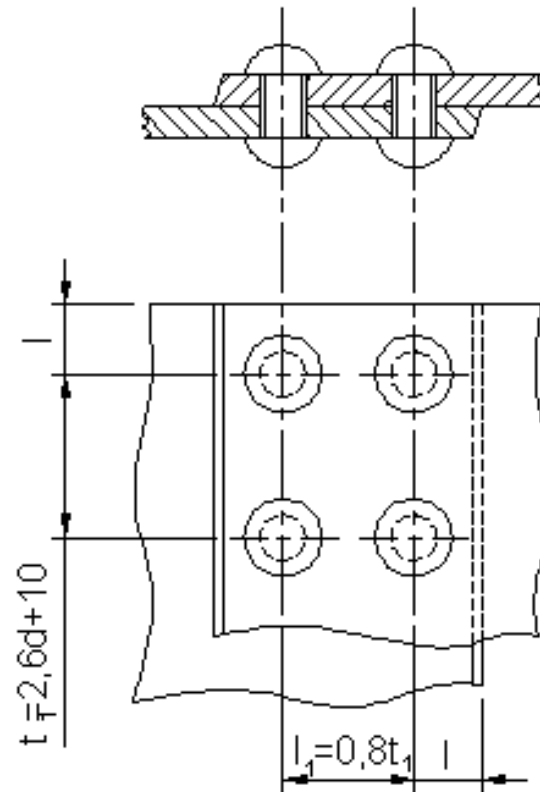
ELEMENTOS DE FIXAÇÃO

REBITES

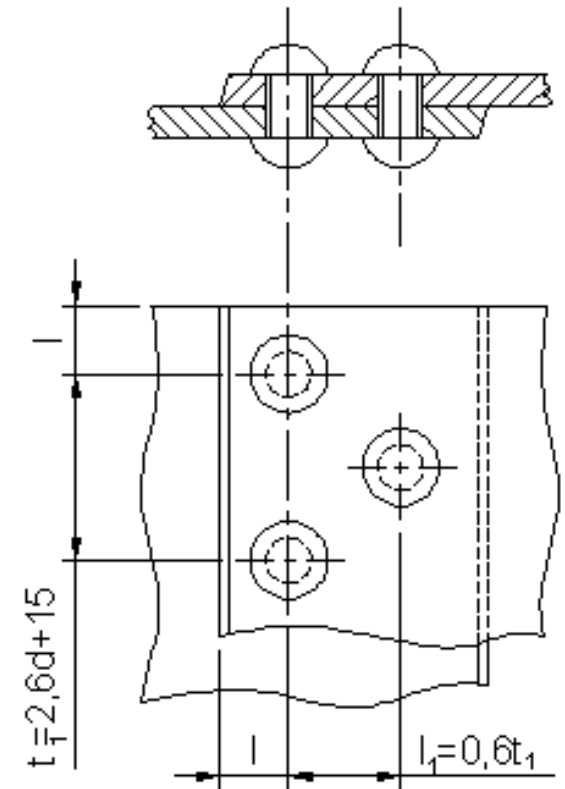
Costuras



Costura simples



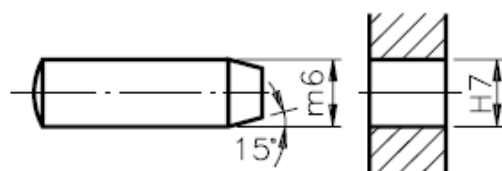
Costura dupla



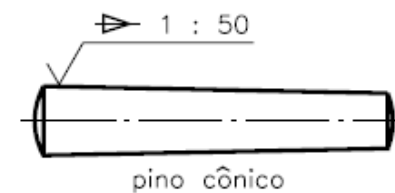
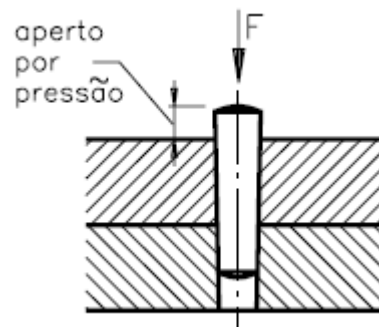
Costura em zigue-zague

ELEMENTOS DE FIXAÇÃO

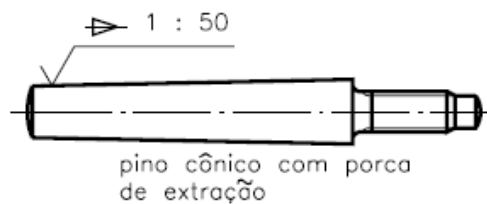
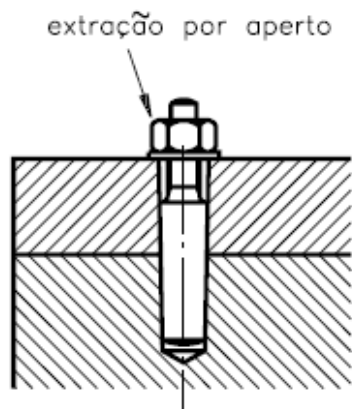
PINOS



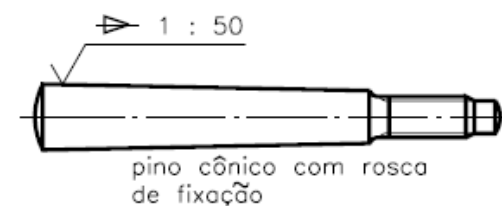
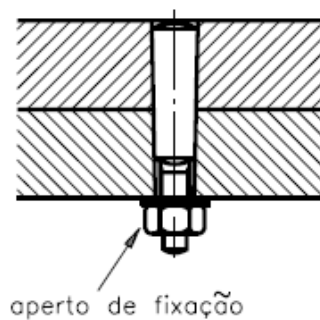
pino de ajuste



pino cônico

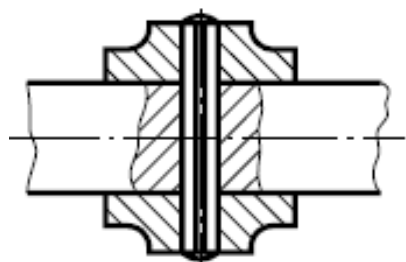
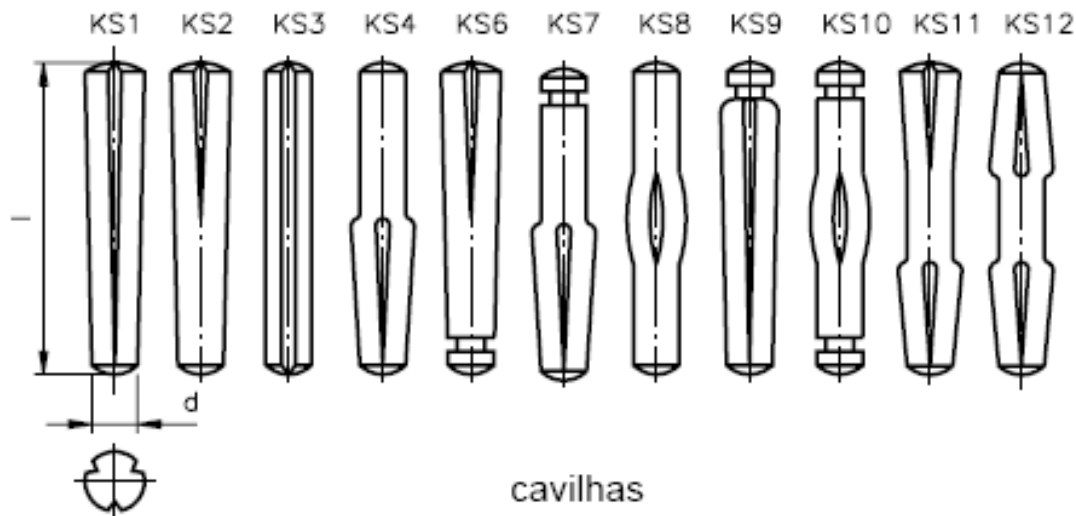


pino cônico com porca de extração



pino cônico com rosca de fixação

ELEMENTOS DE FIXAÇÃO CAVILHAS



fixação com cavilhas

TIPO	NORMA	UTILIZAÇÃO
KS 1	DIN 1471	Fixação e junção.
KS 2	DIN 1472	Ajustagem e articulação.
KS 3	DIN 1473	Fixação e junção em casos de aplicação de forças variáveis e simétricas, bordas de peças de ferro fundido.
KS 4	DIN 1474	Encosto e ajustagem.
KS 6 e 7	—	Ajustagem e fixação de molas e correntes.
KS 9	—	Utilizado nos casos em que se tem necessidade de puxar a cavilha do furo.
KS 10	—	Fixação bilateral de molas de tração ou de eixos de roletes.
KS 8	DIN 1475	Articulação de peças.
KS 11 e 12	—	Fixação de eixos de roletes e manivelas.
KN 4	DIN 1476	Fixação de blindagens, chapas e dobradiças sobre metal
KN 5	DIN 1477	
KN 7	—	Eixo de articulação de barras de estruturas, tramelas, ganchos, roletes e polias.



ELEMENTOS DE FIXAÇÃO

CUPILHAS

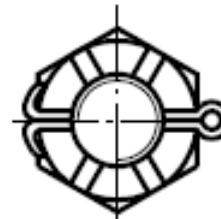
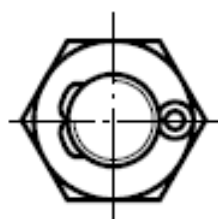
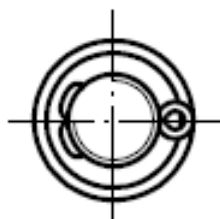
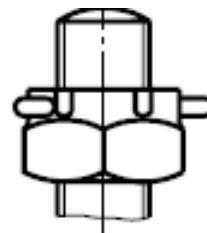
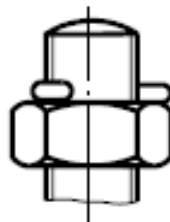
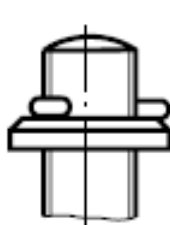
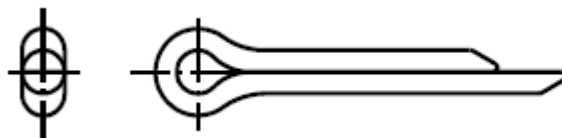
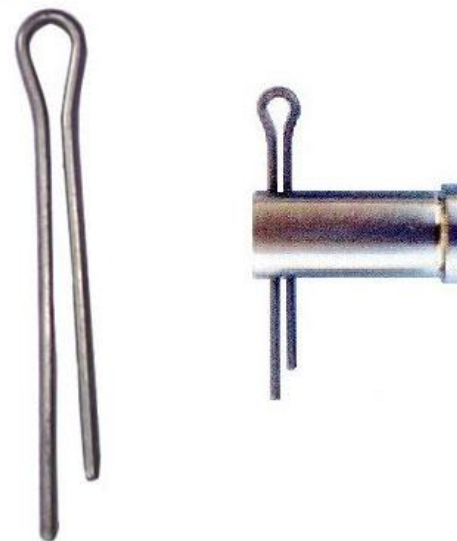
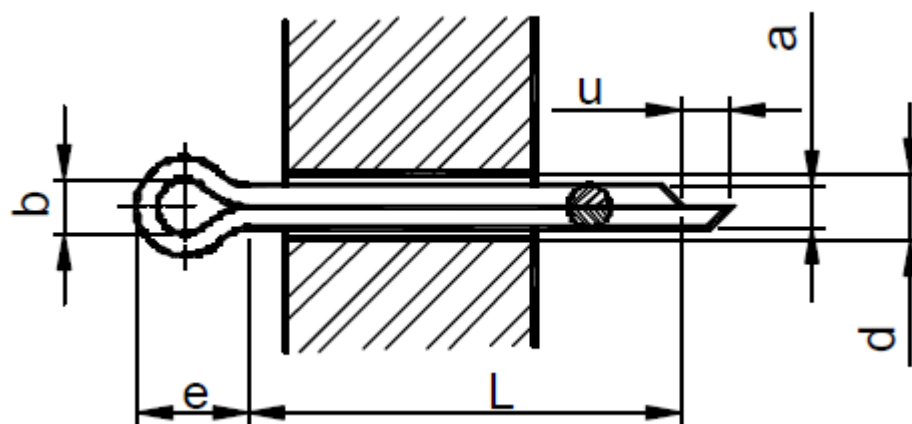


FOTO ILUSTRATIVA



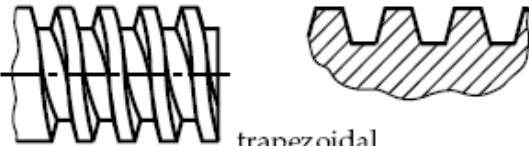
Indicação para designação		Diâmetro real do contra-pino a	Diâmetro da Rosca métrica em função do diâmetro do contra-pino	u	b	e
Diâmetro nominal do contra-pino d	Comprimento L					
0,6	de 4 a 8	0,5	M1,2	1	1,25	2,1
0,8	5 a 12	0,7	M3	1	1,4	2,3
1	5 a 15	0,9	M4	1	1,5	2,5
1,5	8 a 30	1,3	M5 e M6	2	2	3,3
2	10 a 40	1,8	M8 a M10	2	2,3	4
3	15 a 60	2,7	M12 a M14	2	3	5
4	20 a 70	3,7	M16 a M20	3	4,1	7,2
5	28 a 80	4,7	M24	3	4,7	8,2
6	35 a 90	5,7	M30 a M36	3	5,7	10,2
8	45 a 140	7,7	M42 a M48	3	7,7	13,5
10	60 a 170	9,7	M56 a M80	4	9,7	17
13	100 a 240	12,6	> M80	4	12,7	23

Especificação: dxL
Contra pino : $\phi 4 \times 50$

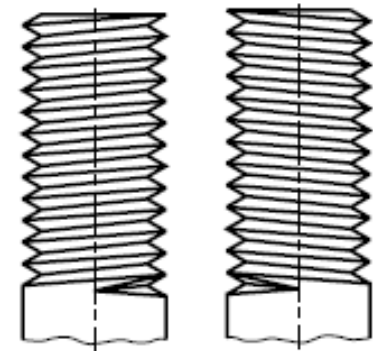


ELEMENTOS DE FIXAÇÃO

PARAFUSOS

TIPOS DE ROSCAS (PERFIS) PERFIL DE FILETE	APLICAÇÃO
 triangular	Parafusos e porcas de fixação na união de peças. Ex.: Fixação da roda do carro.
 trapezoidal	Parafusos que transmitem movimento suave e uniforme. Ex.: Fusos de máquinas.
 redondo	Parafusos de grandes diâmetros sujeitos a grandes esforços. Ex.: Equipamentos ferroviários.
 quadrado	Parafusos que sofrem grandes esforços e choques. Ex.: Prensas e morsas.
 rosca dente-de-serra	Parafusos que exercem grande esforço num só sentido Ex.: Macacos de catraca

Sentido de direção da rosca



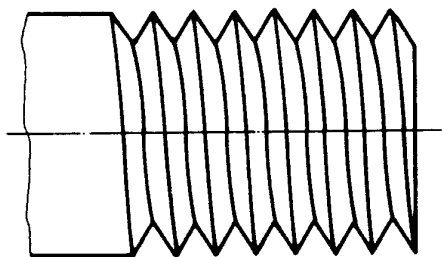
direita

esquerda

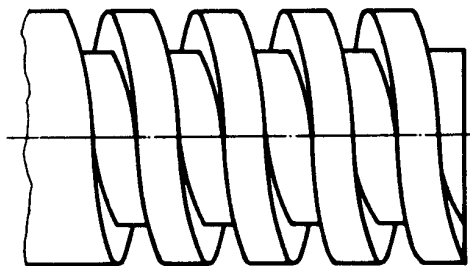
ELEMENTOS DE FIXAÇÃO – tipos de representação

PARAFUSOS

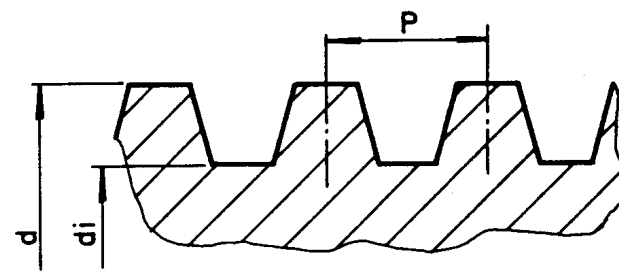
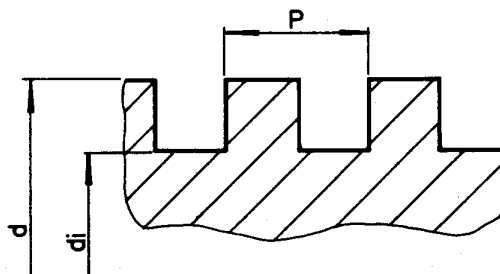
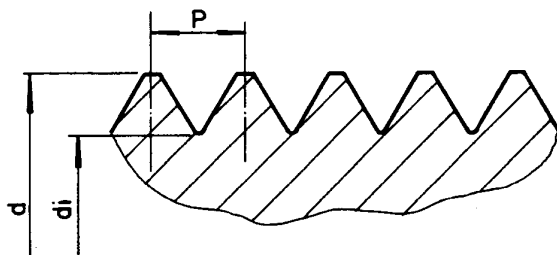
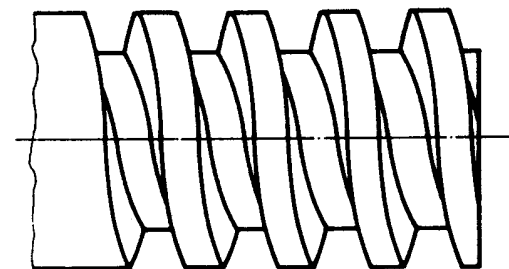
Rosca triangular



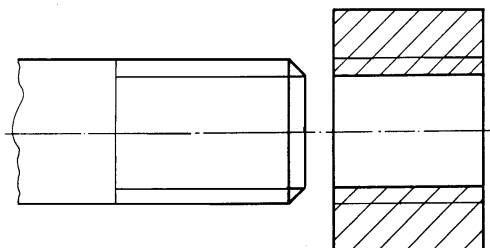
Rosca quadrada



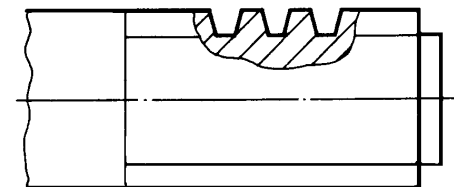
Rosca trapezoidal



Rosca com perfil triangular



Rosca com perfil especial

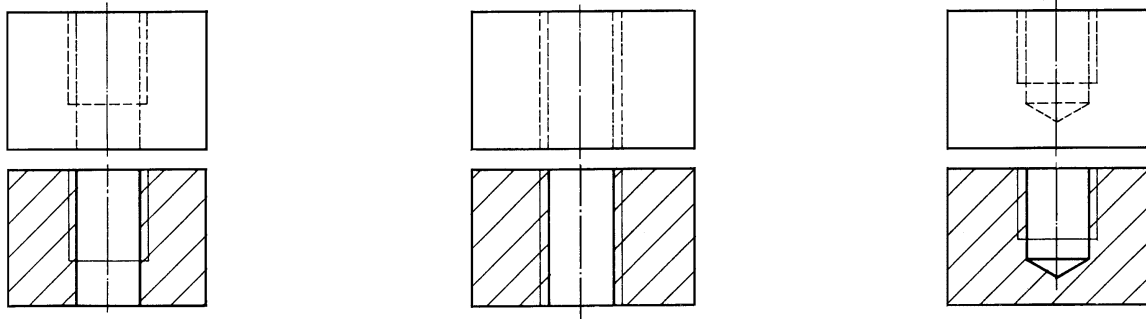




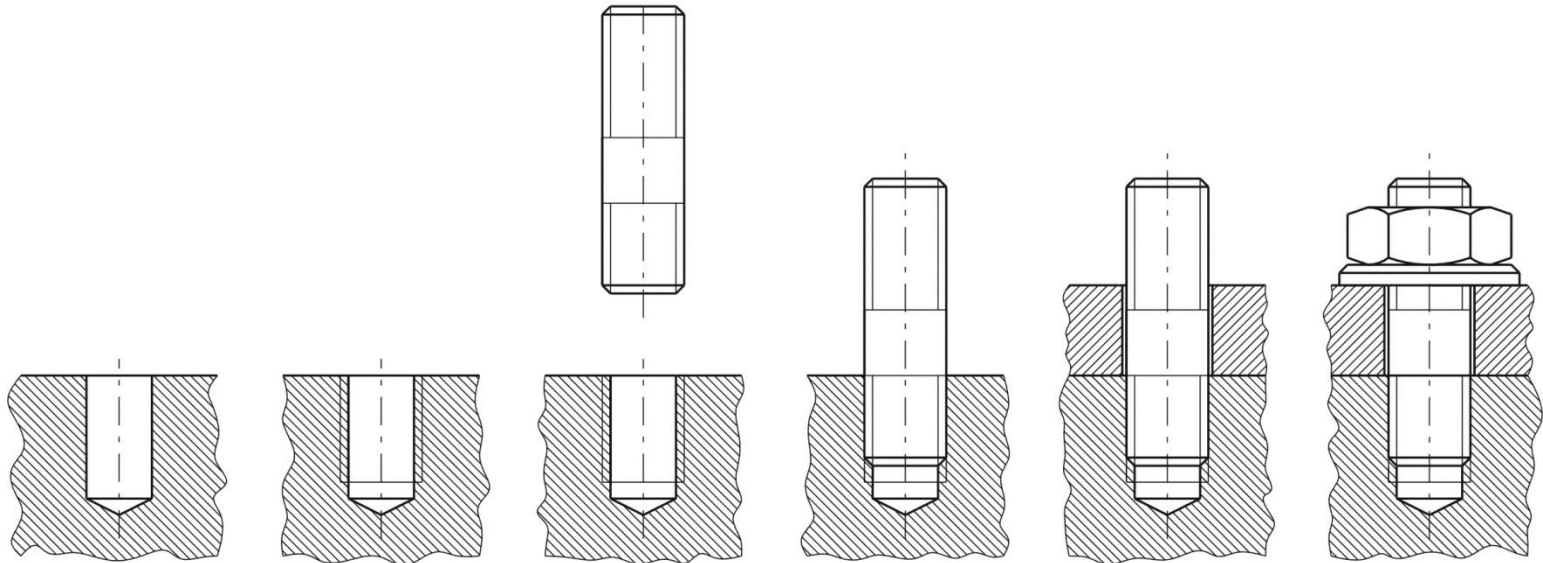
ELEMENTOS DE FIXAÇÃO

PARAFUSOS

- Representação convencional de furos roscados (em corte, a região da rosca é hachurada).



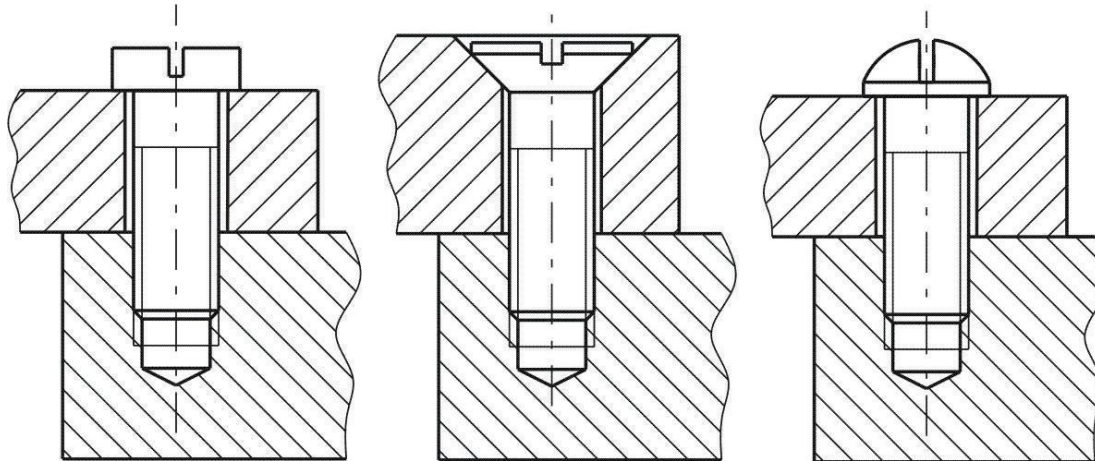
- Fabricação de furo roscado e união por prisioneiro, arruela e porca.



ELEMENTOS DE FIXAÇÃO

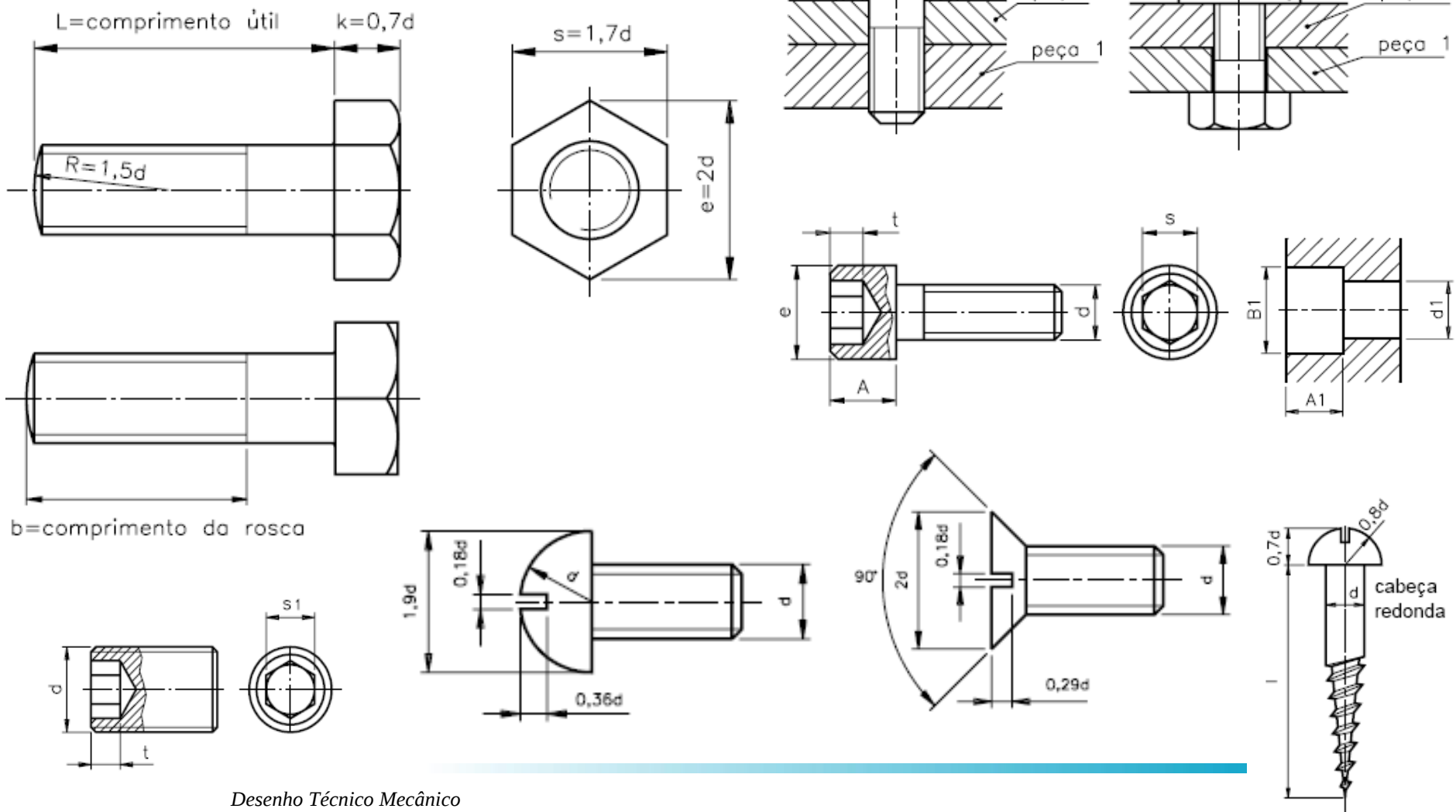
PARAFUSOS

- União de duas chapas por parafusos:



ELEMENTOS DE FIXAÇÃO

PARAFUSOS



ELEMENTOS DE FIXAÇÃO

PARAFUSOS

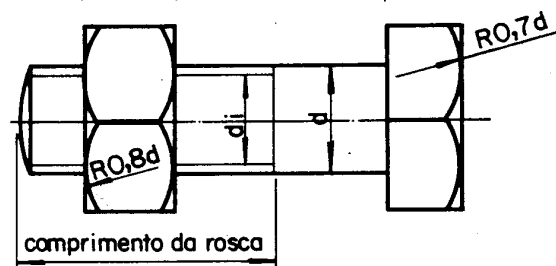
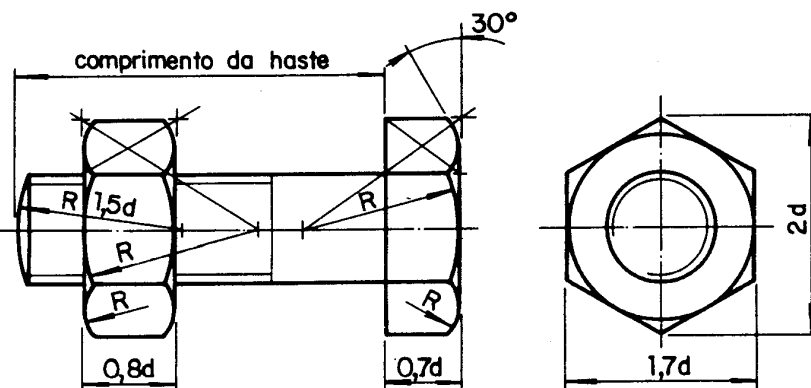
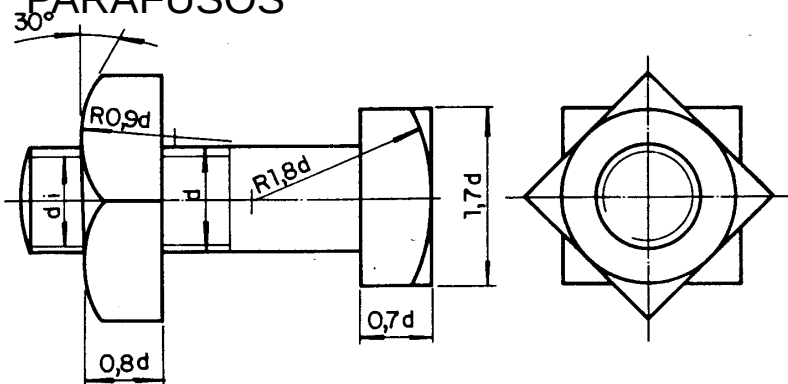


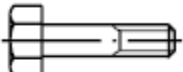
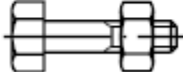
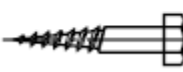
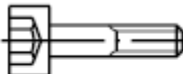
TABELA DE ROSCAS

ROSCA MÉTRICA (M) Perfil triangular - ISO NB 97			ROSCA WHITWORTH Normal				ROSCA WHITWORTH GÁS Para canos (RC) NB 202 - ABNT			
d Diam.	di Núcleo	P Passo	d Poleg.	d mm	di Núcleo	Nº de fios/1"	d Poleg.	d mm	di Núcleo	Nº de fios/1"
4	3,141	0,7	1/8"	3,17	2,36	40	1/8"	9,73	8,57	28
6	4,773	1	5/32"	3,96	2,95	32	1/4"	13,15	11,44	19
8	6,466	1,25	3/16"	4,76	3,40	24	3/8"	16,63	14,95	19
10	8,160	1,5	7/32"	5,55	4,20	20	1/2"	20,95	18,63	14
12	9,833	1,75	1/4"	6,35	4,72	20	5/8"	22,91	20,58	14
14	11,546	2	5/16"	7,93	6,13	18	3/4"	26,44	24,11	14
16	13,546	2	3/8"	9,52	7,49	16	7/8"	30,20	27,87	14
18	14,933	2,5	1/2"	12,70	9,99	12	1"	33,25	30,29	11
20	16,933	2,5	9/16"	14,28	11,57	12	1 1/4"	41,91	38,95	11
22	18,933	2,5	5/8"	15,87	12,91	11	1 1/2"	47,80	44,84	11
24	20,319	3	11/16"	17,46	14,50	11	1 3/4"	53,74	50,79	11
30	25,706	3,5	3/4"	19,05	16,79	10	2"	59,61	56,65	11
36	31,093	4	13/16"	20,63	17,38	10	2 1/4"	65,71	62,75	11
42	36,479	4,5	7/8"	22,22	18,61	9	2 1/2"	75,18	72,23	11
48	41,866	5	15/16"	23,81	20,19	9	2 3/4"	81,53	78,58	11
56	49,252	5,5	1"	25,40	21,33	8	3"	87,88	84,93	11
60	53,252	5,5	1 1/8"	28,57	23,92	7	3 1/4"	93,98	91,02	11
64	56,639	6	1 1/4"	31,75	27,10	7	3 1/2"	100,33	97,37	11



ELEMENTOS DE FIXAÇÃO

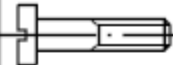
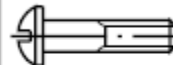
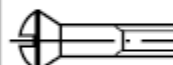
PARAFUSOS

	parafuso sextavado			parafuso sextavado com rosca total
	parafuso sextavado com porca			parafuso auto-atarraxante de cabeça sextavada
	parafuso de cabeça cilíndrica com sextavado interno			
	parafuso de cabeça quadrada			



ELEMENTOS DE FIXAÇÃO

PARAFUSOS

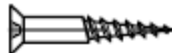
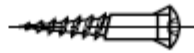
	parafuso de cabeça cilíndrica com fenda			parafuso de cabeça redonda com fenda
	parafuso de cabeça cilíndrica abaulada com fenda			parafuso de cabeça escareada com fenda
	parafuso de cabeça escareada abaulada com fenda			parafuso sem cabeça com fenda
	parafuso para madeira de cabeça escareada com fenda			parafuso sem cabeça com rosca total e fenda
	parafuso tipo prego de cabeça escareada			



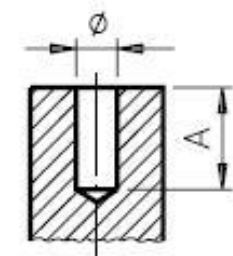


ELEMENTOS DE FIXAÇÃO

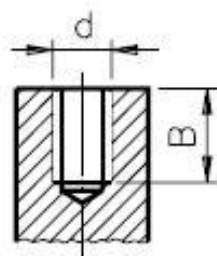
PARAFUSOS

	parafuso de cabeça panela com fenda cruzada			parafuso de cabeça escareada com fenda cruzada
	parafuso de cabeça redonda com fenda cruzada			parafuso de cabeça escareada abaulada com fenda cruzada
	parafuso para madeira de cabeça escareada com fenda cruzada			parafuso para madeira de cabeça escareada abaulada com fenda cruzada
	prisioneiro			
	parafuso de cabeça recartilhada			
	parafuso borboleta			

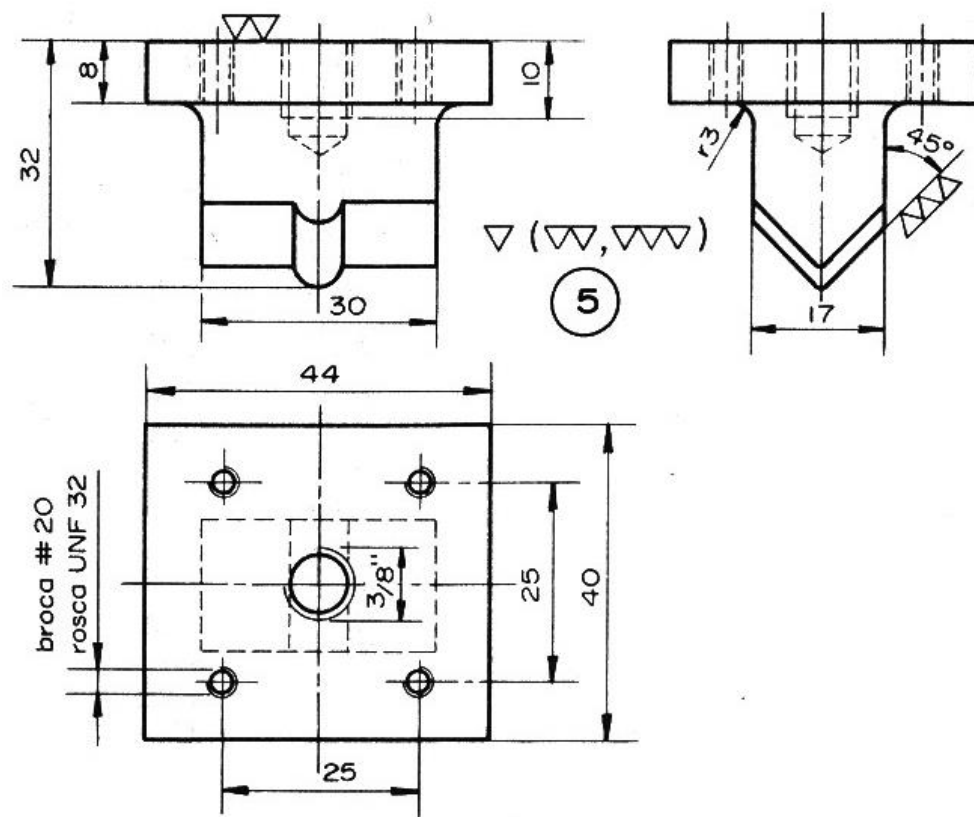
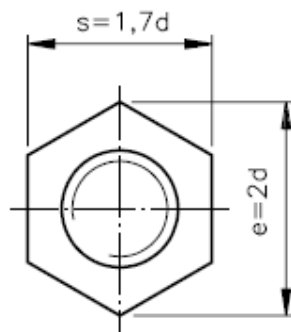
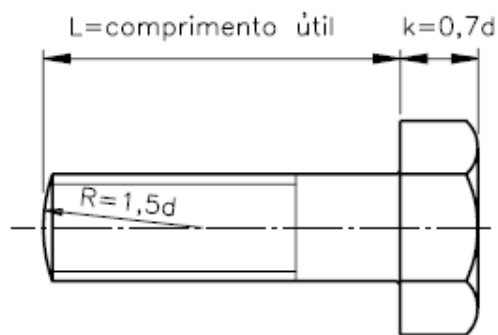
ELEMENTOS DE FIXAÇÃO PARAFUSOS



furo broqueado



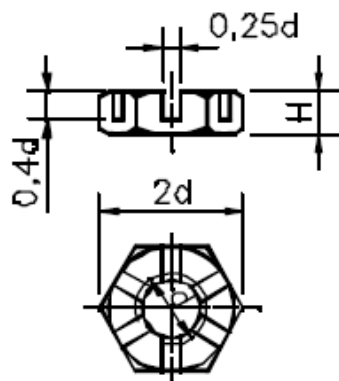
furo roscado



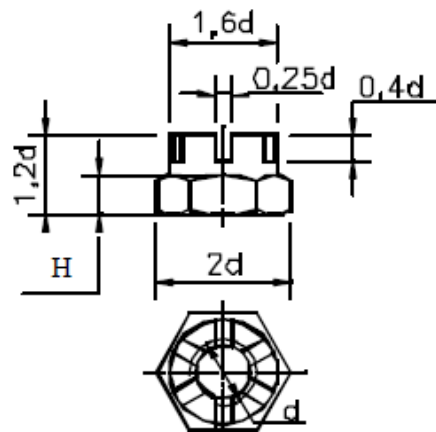
ELEMENTOS DE FIXAÇÃO

PORCAS

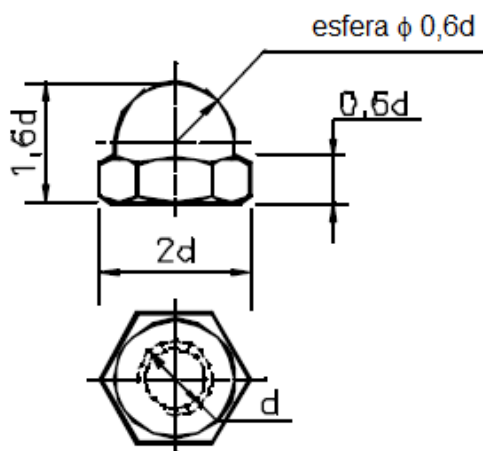
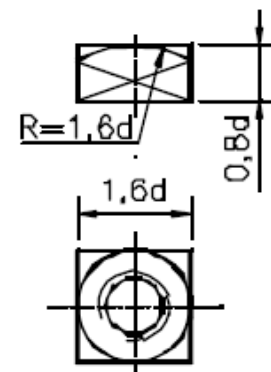
sext. c/ entalhes radiais



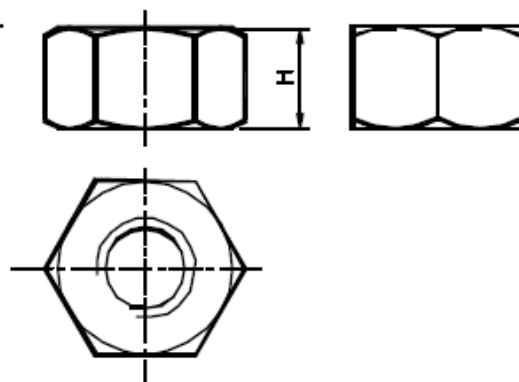
Porca Castelo



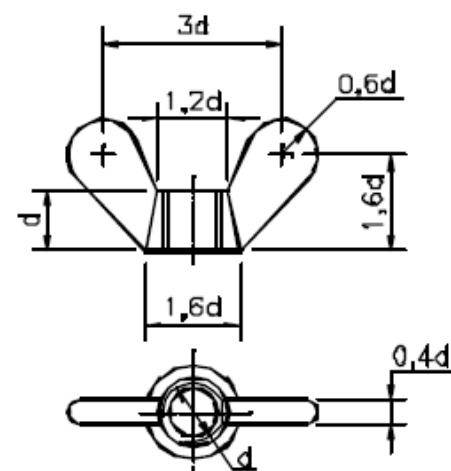
Quadrada



Porca esférica



Porca sextavada

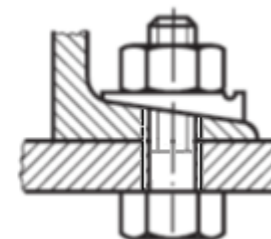
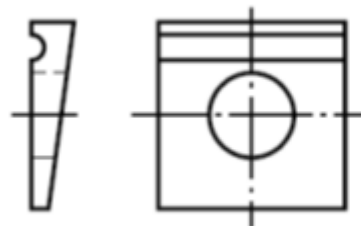
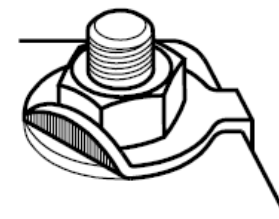
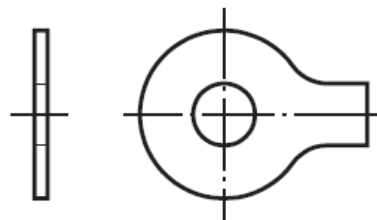
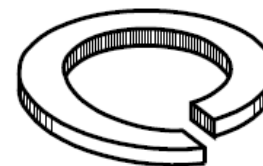
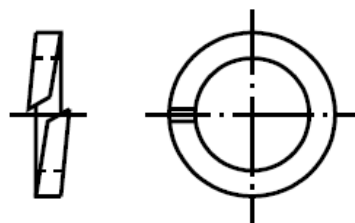
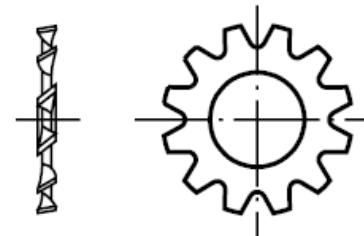
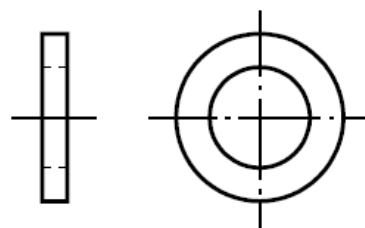
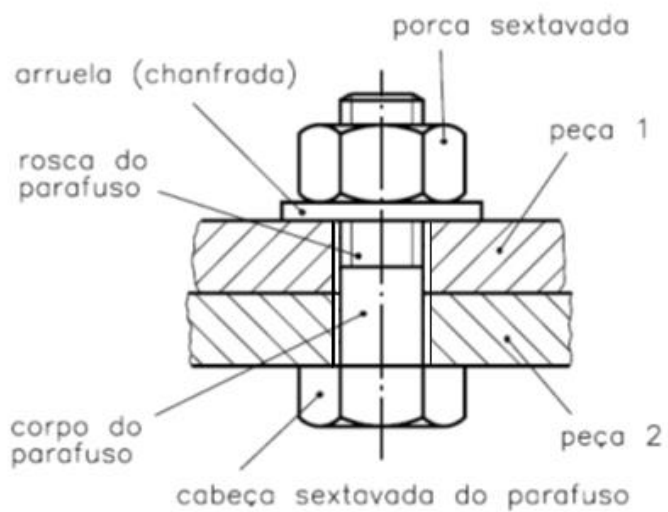


Porca borboleta



ELEMENTOS DE FIXAÇÃO

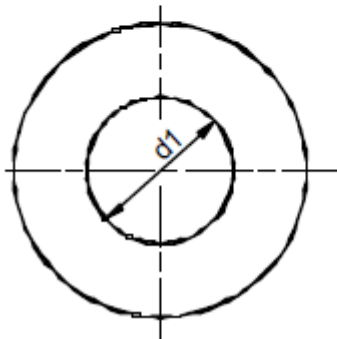
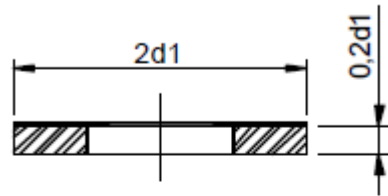
ARRUELAS



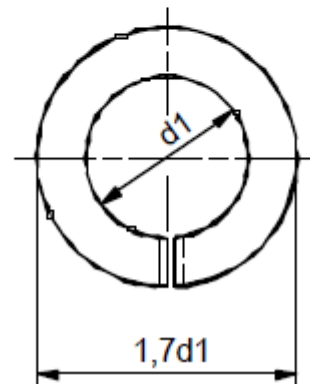
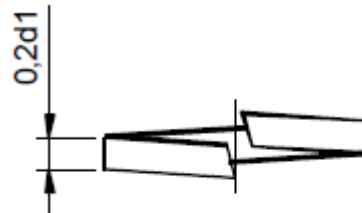
ELEMENTOS DE FIXAÇÃO

ARRUELAS

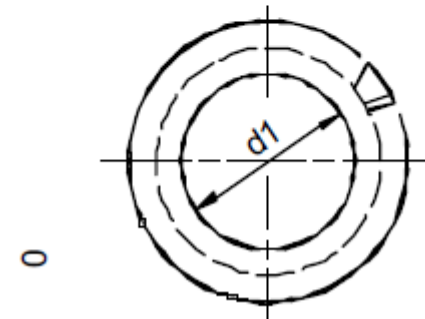
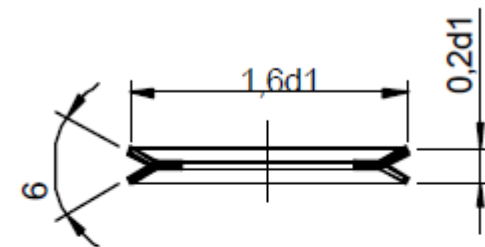
Arruela lisa



Arruela de pressão

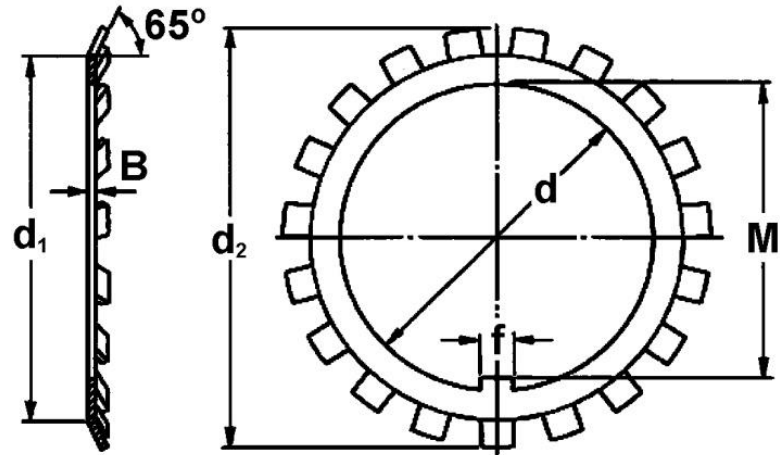
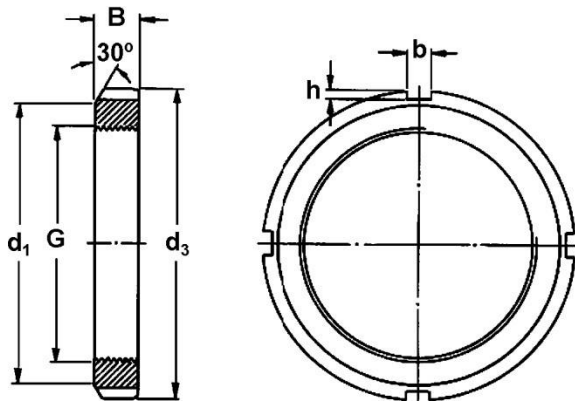


Arruela denteada

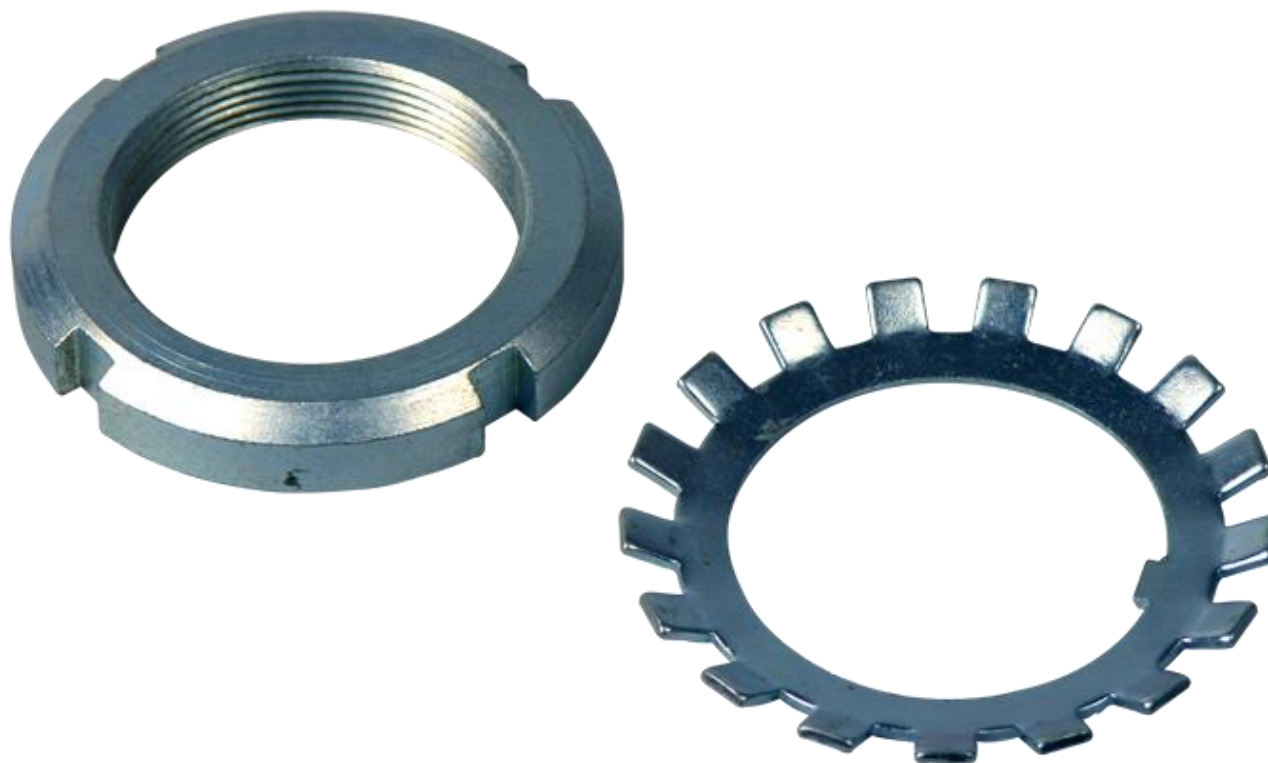


ELEMENTOS DE FIXAÇÃO

Porca de fixação e arruela de trava

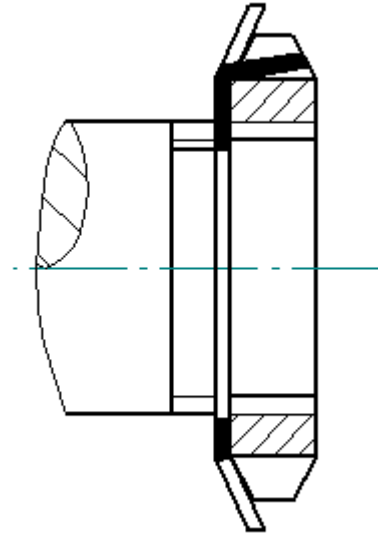






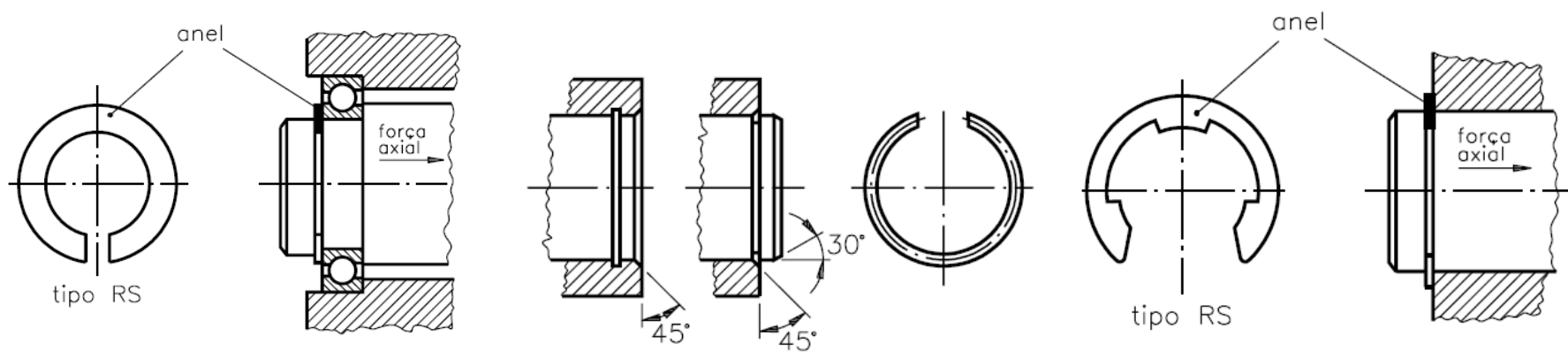
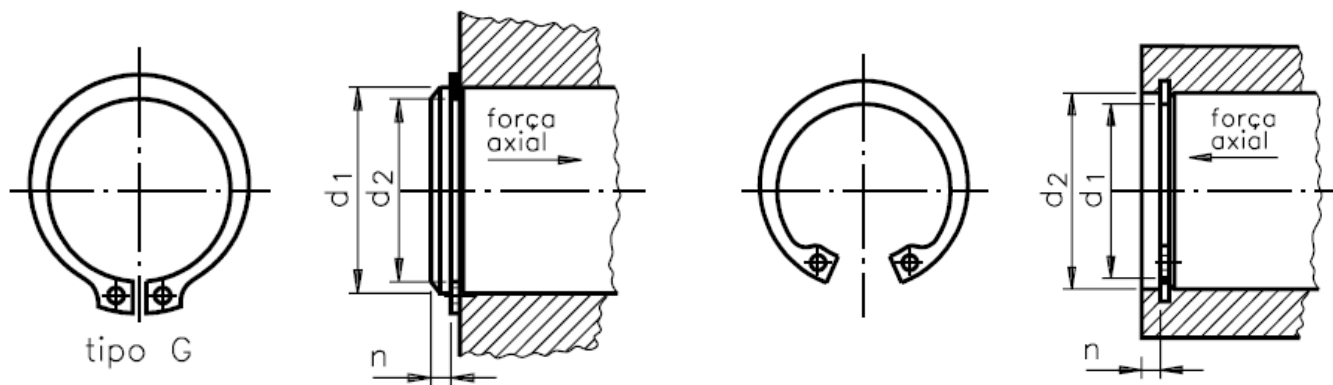
ELEMENTOS DE FIXAÇÃO

Porca de fixação e arruela de trava

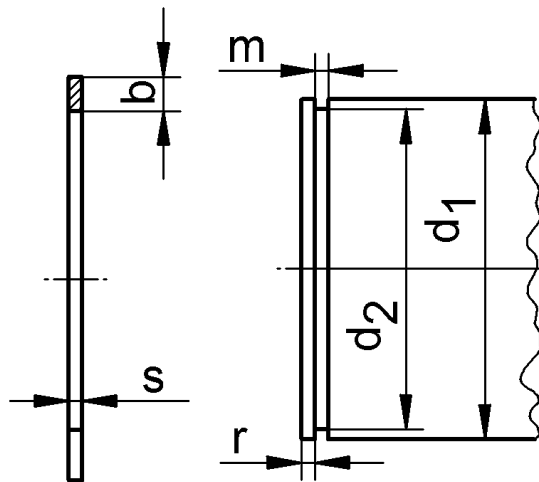
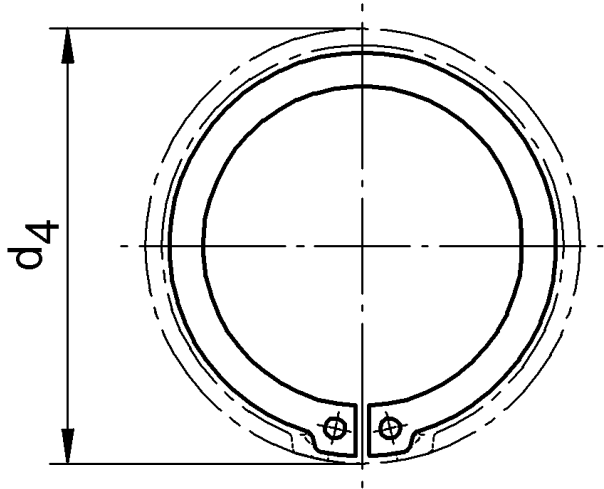


ELEMENTOS DE FIXAÇÃO

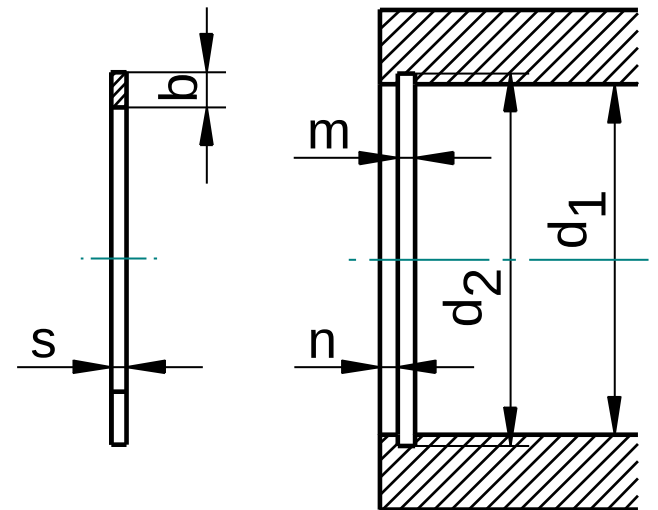
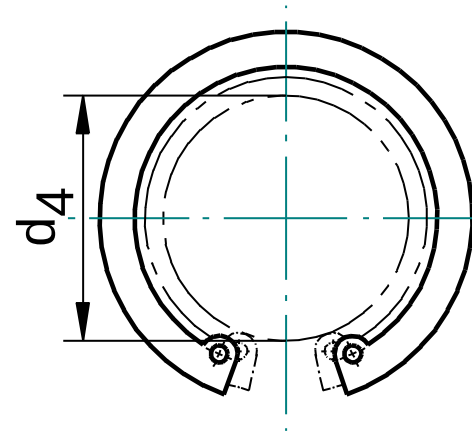
ANÉIS ELÁSTICOS



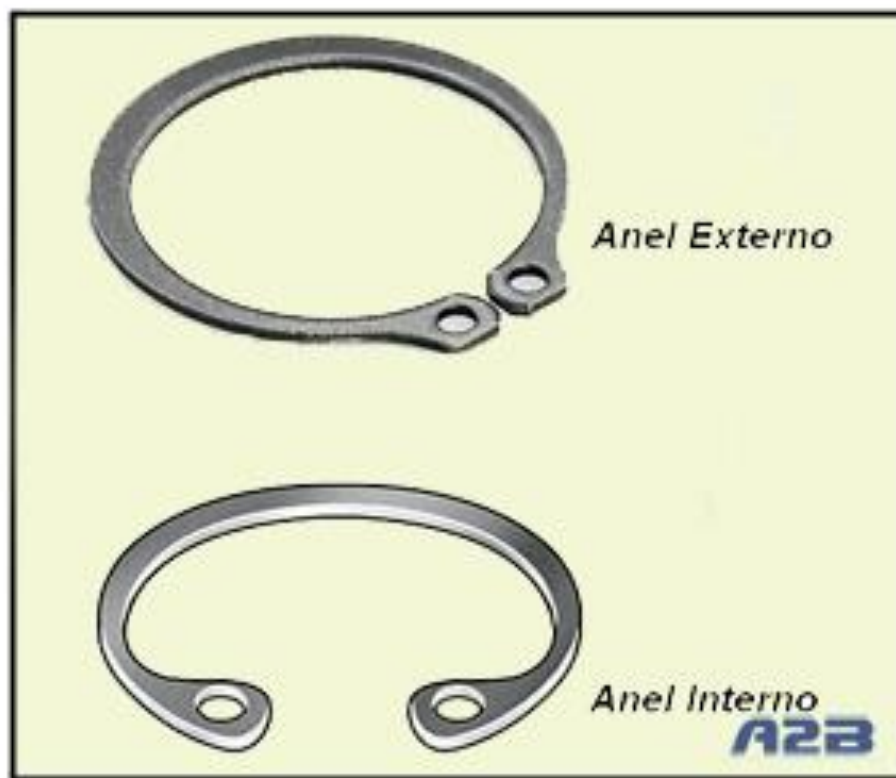
Anéis elásticos - Eixos



Anéis elásticos - Furos







ELEMENTOS DE FIXAÇÃO

ANÉIS ELÁSTICOS

ANEL ELÁSTICO PARA EIXOS									TIPO DAe						
Anel sem pressão para $d_1 = 4 \div 9$ Medidas em mm									$n = \frac{d_1 - d_2}{2} \cdot 3$						
d_1	s	d_3	$\sim a$	$\sim b$	d_5	d_2	m	d_1	s	d_3	$\sim a$	$\sim b$	d_5	d_2	m
	hll						min		hll						min
4	0,40	3,7	1,8	0,7	1,0	3,3	0,50	34	1,50	31,5	5,3	4,0	2,5	32,3	1,60
5	0,60	4,7	2,2	1,1	1,0	4,3	0,70	35	1,50	32,2	5,4	4,0	2,5	33,0	1,80
6	0,70	5,6	2,6	1,3	1,2	5,7	0,80	36	1,75	33,2	5,4	4,0	2,5	34,0	1,85
7	0,80	6,5	2,8	1,3	1,2	6,7	0,90	37	1,75	34,2	5,5	4,0	2,5	35,0	1,85
8	0,80	7,4	2,8	1,5	1,2	7,8	0,90	38	1,75	35,2	5,6	4,5	2,5	36,0	1,85
9	1,00	8,4	3,0	1,7	1,3	8,6	1,10	39	1,75	36,0	5,7	4,5	2,5	37,0	1,85
10	1,00	9,3	3,0	1,8	1,5	9,6	1,10	40	1,75	36,5	5,8	4,5	2,5	37,5	1,85
11	1,00	10,2	3,1	1,9	1,5	10,5	1,10	42	1,75	38,5	6,2	4,5	2,5	39,5	1,85
12	1,00	11,0	3,2	2,2	1,7	11,5	1,10	44	1,75	40,5	6,3	4,5	2,5	41,5	1,85
13	1,00	11,9	3,3	2,2	1,7	12,4	1,10	45	1,75	41,5	6,3	4,8	2,5	42,5	1,85
14	1,00	12,9	3,4	2,2	1,7	13,4	1,10	46	1,75	42,5	6,3	4,8	2,5	43,5	1,85
15	1,00	13,3	3,5	2,2	1,7	14,3	1,10	47	1,75	43,5	6,4	4,8	2,5	44,5	1,85
16	1,00	14,7	3,6	2,2	1,7	15,2	1,10	48	1,75	44,5	6,5	4,8	2,5	45,5	1,85

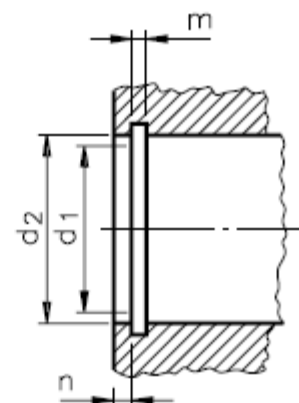
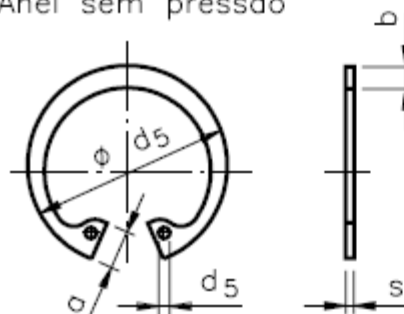
ELEMENTOS DE FIXAÇÃO

ANÉIS ELÁSTICOS

ANEL ELÁSTICO PARA FUROS

TIPO DAi

Anel sem pressão



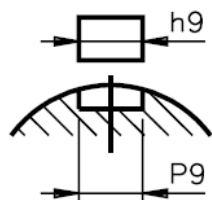
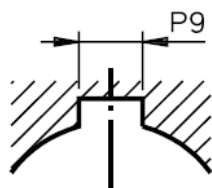
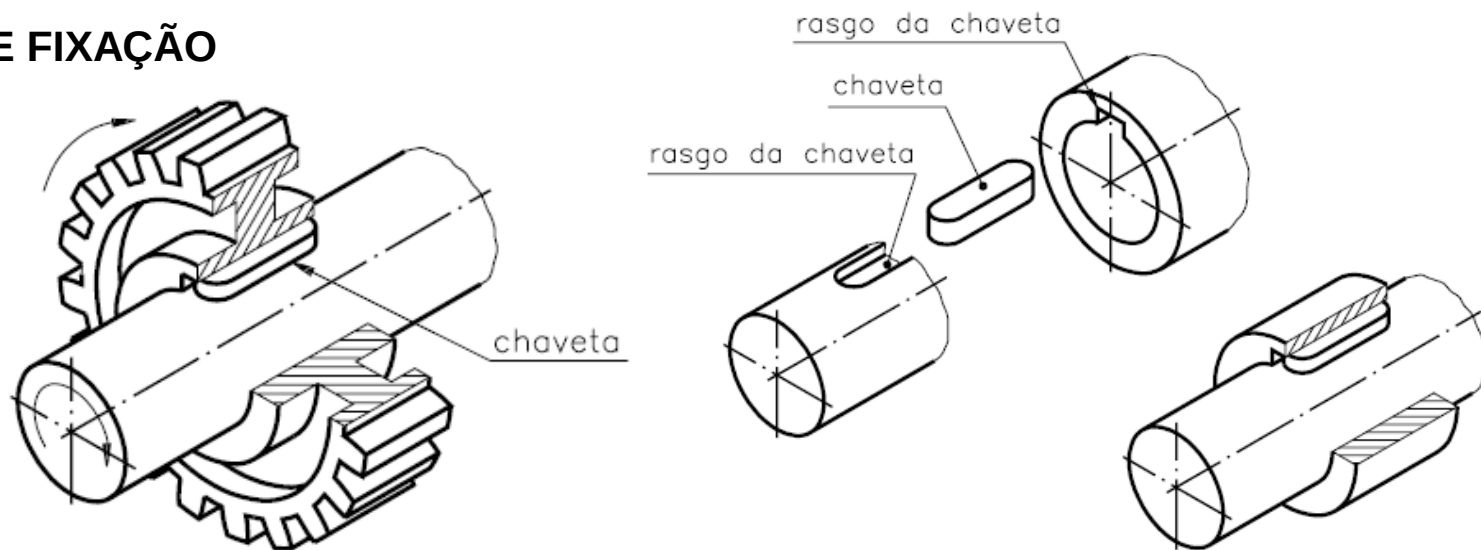
Medidas em mm

$$n = \frac{d2 - d1}{2} \cdot 3$$

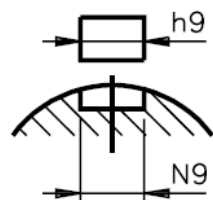
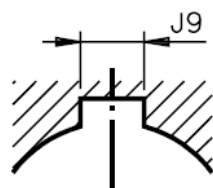
d ₁	s	d ₃	-a	-b	d ₅	d ₂	m	d ₁	s	d ₃	-a	-b	d ₅	d ₂	m
	hll						min		hll						min
9,5	1,00	10,30	3,00	1,60	1,50	9,90	1,10	38	1,50	40,80	5,30	4,00	2,50	40,00	1,60
10	1,00	10,80	3,10	1,60	1,50	10,40	1,10	39	1,50	42,00	5,50	4,00	2,50	41,00	1,60
10,5	1,00	11,30	3,10	1,60	1,50	10,90	1,10	40	1,75	43,50	5,70	4,00	2,50	42,50	1,85
11	1,00	11,80	3,20	1,60	1,50	11,40	1,10	41	1,75	44,50	5,70	4,00	2,50	43,50	1,85
12	1,00	13,00	3,30	2,00	1,70	12,50	1,10	42	1,75	45,50	5,80	4,00	2,50	44,50	1,85
13	1,00	14,10	3,50	2,00	1,70	13,60	1,10	43	1,75	46,50	5,80	4,50	2,50	45,50	1,85
14	1,00	15,10	3,60	2,00	1,70	14,60	1,10	44	1,75	47,50	5,90	4,50	2,50	46,50	1,85
15	1,00	16,20	3,60	2,00	1,70	15,70	1,10	45	1,75	48,50	5,90	4,50	2,50	47,50	1,85
16	1,00	17,30	3,70	2,00	1,70	16,80	1,10	46	1,75	49,50	6,00	4,50	2,50	48,50	1,85

ELEMENTOS DE FIXAÇÃO

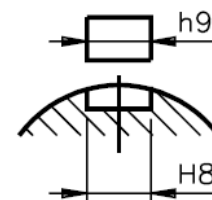
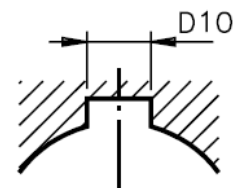
CHAVETAS



ajuste forçado
(montagens fixas)



deslizante justo
(montagens justas)

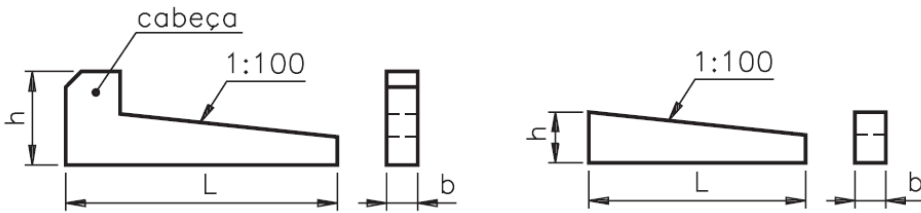


deslizante livre
(peças móveis)

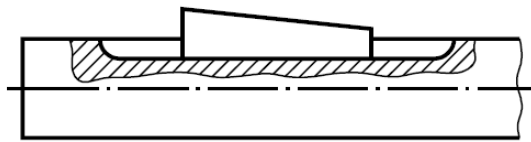
ELEMENTOS DE FIXAÇÃO

CHAVETAS

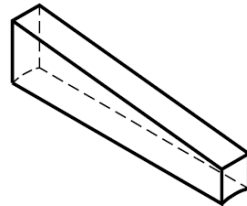
Cunha



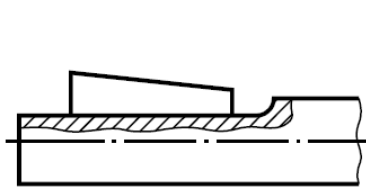
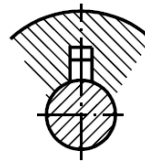
Longitudinais



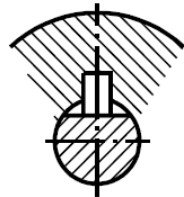
Encaixadas



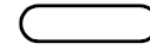
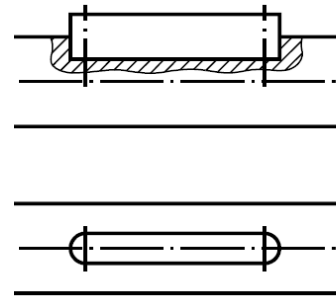
Meia-cana



Plana



Paralelas



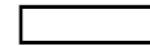
A



C



E



B

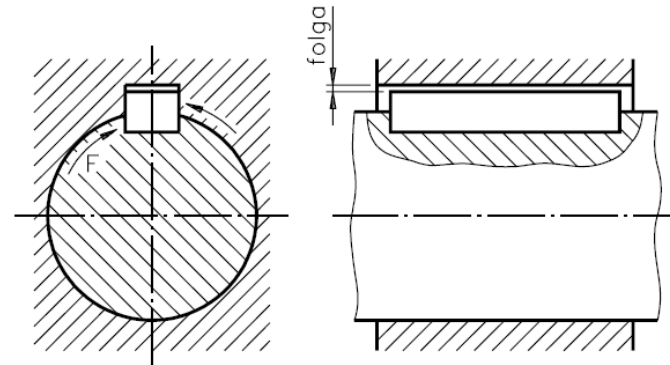


D

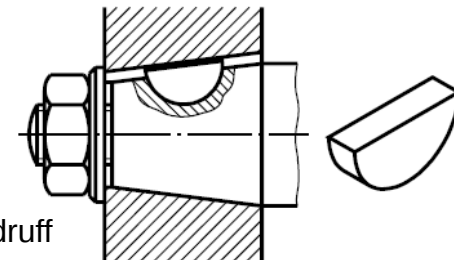


F

Embutidas



Meia-Lua

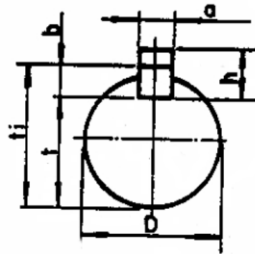
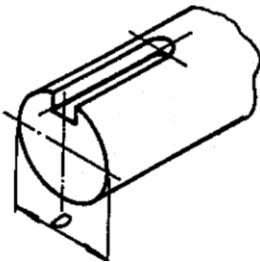
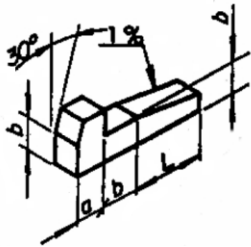


Woodruff

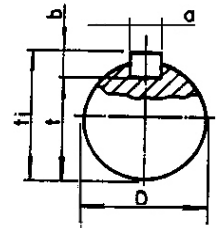
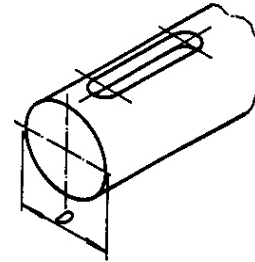
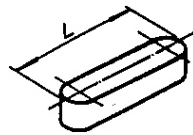
ELEMENTOS DE FIXAÇÃO – tipos

CHAVETAS

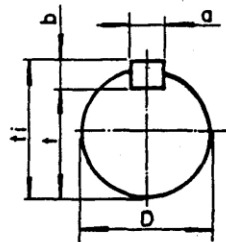
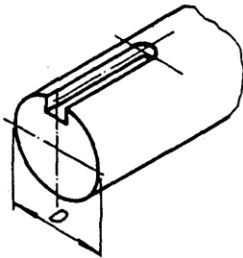
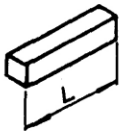
Chaveta de cabeça



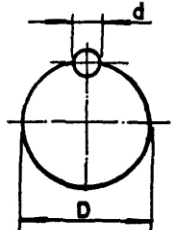
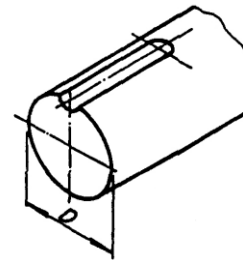
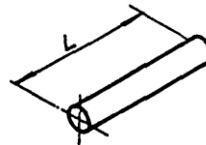
Chaveta embutida



Chaveta plana



Chaveta redonda

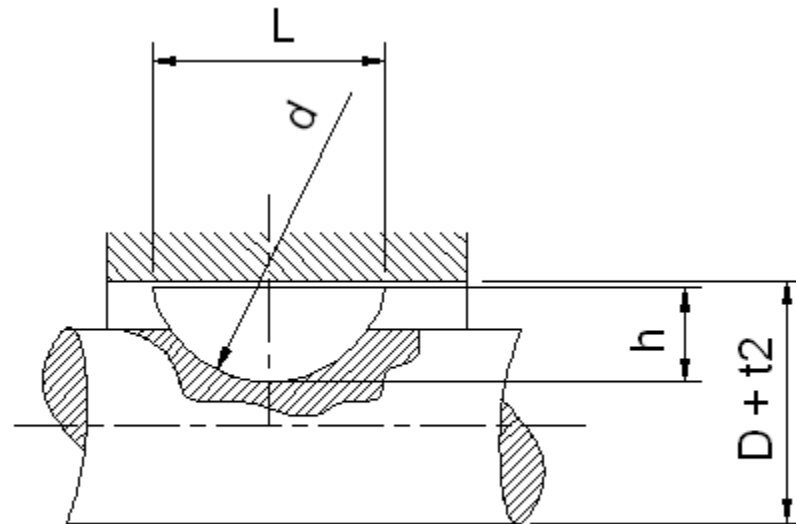
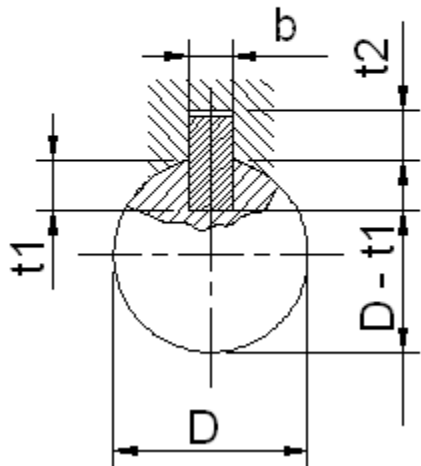
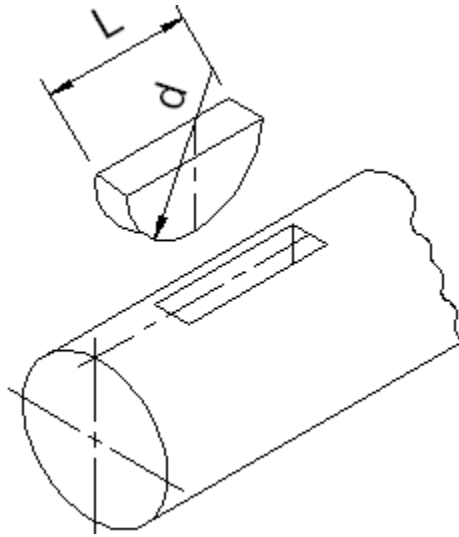


ELEMENTOS DE FIXAÇÃO – tipos

CHAVETAS

TABELA DE PROPORÇÕES						
Diâmetro do eixo (D)	a	b	h	t	ti	d
13 - 17	5	5	8	D - 3	D + 2	7,5
18 - 22	6	6	9	D - 3,5	D + 2,5	8,5
23 - 30	8	7	10	D - 4	D + 3	10,0
31 – 38	10	8	12	D - 5	D + 3	11,5
39 – 34	12	8	12	D - 5	D + 3	13,0
45 – 50	14	9	14	D - 5,5	D + 3,5	13,5
51 – 58	16	10	15	D - 6	D + 4	14,5
59 – 68	18	11	16	D - 7	D + 4	16,0
69 -78	20	12	19	D - 7,5	D + 4,5	17,0
Obs.: O comprimento L é calculado em até duas vezes o diâmetro do eixo						

Chaveta Woodruff



Chaveta Woodruff

Diâmetro do eixo D	Largura e altura b x h	Rasgo		L	d
		t ₁	t ₂		
de 3 a 4	1 x 1,4	1	0,5	3,82	4
>4 a 6	1,5 x 2,5	2	0,7	6,76	7
>6 a 8	2 x 2,6	1,8	0,9	6,76	7
	2 x 3,7	2,9	0,9	9,66	10
>9 a 10	2,5 x 3,7	2,9	0,9	9,66	10
	3 x 3,7	2,5	1,3	9,66	10
	3 x 5	3,8	1,3	12,65	13
	3 x 6,5	5,3	1,3	15,72	16
>10 a 12	4 x 5	3,5	1,6	12,65	13
	4 x 6,5	5	1,6	15,72	16
	4 x 7,5	6	1,6	18,57	19
>12 a 17	5 x 6,5	4,5	2,1	15,72	16
	5 x 7,5	5,5	2,1	18,57	19
	5 x 9	7	2,1	21,63	22

Diâmetro do eixo D	Largura e altura b x h	Rasgo		L	d
		t ₁	t ₂		
>17 a 22	6 x 7,5	5,1	2,5	18,57	19
	6 x 9	6,6	2,5	21,63	22
	6 x 10	7,6	2,5	24,49	25
	6 x 11	8,6	2,5	27,35	28
>22 a 30	8 x 9	6,2	2,9	21,63	22
	8 x 11	8,2	2,9	27,35	28
	8 x 13	10,2	2,9	31,43	32
>30 a 38	10 x 11	7,8	3,3	27,35	28
	10 x 13	9,8	3,3	31,43	32
	10 x 16	12,8	3,3	43,08	45

Exercício 1: Faça o desenho do conjunto e dos componentes do suporte de manivela.

Peça 1 – Base – material: ferro fundido

Peça 2 – Cabo – material: aço 1020

Peça 3 – Eixo – material: aço 1020

Peça 4 – Parafuso – cabeça sextavada – M29 x 110mm

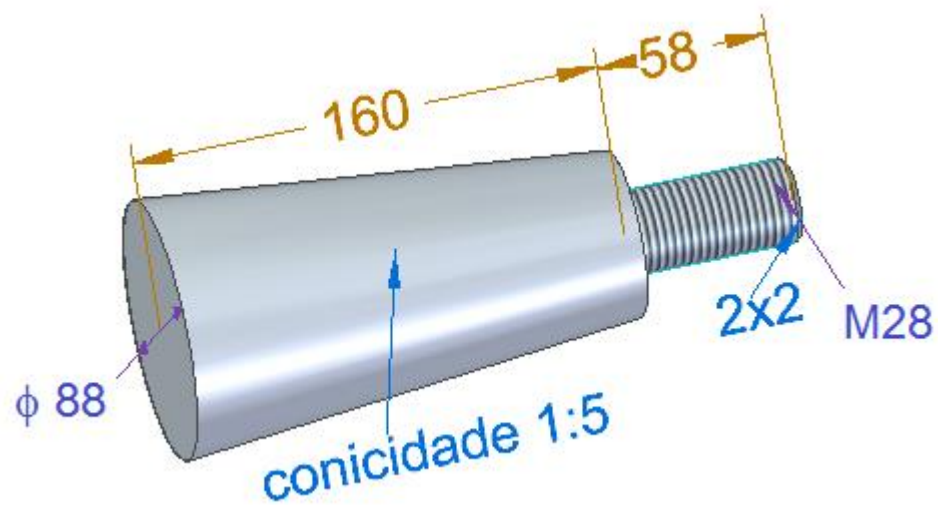
Peça 5 – Chaveta - ver dimensões para o eixo de $\phi 100\text{mm}$.

Ajuste do furo da base com o eixo: H7j6

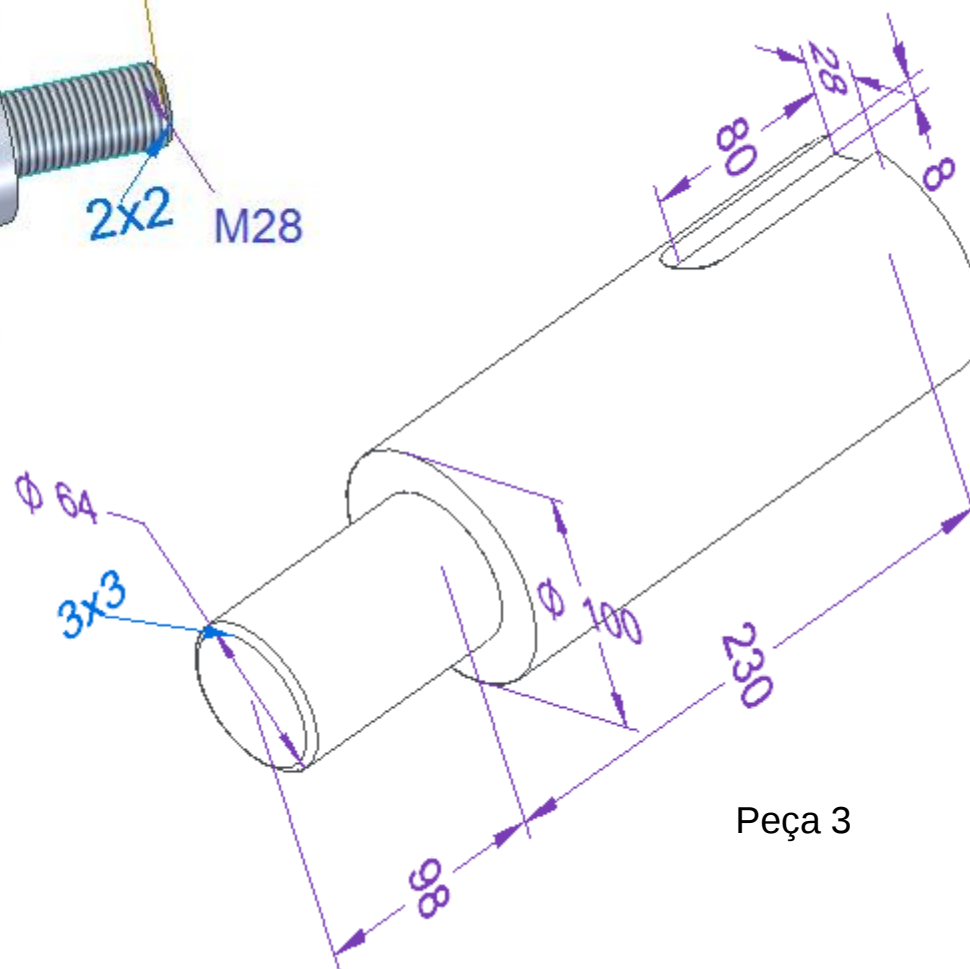
Ajuste da chaveta com o rasgo N9h9

Furo $\phi 64\text{ mm}$ na peça 1 – Ra $1,6\text{ }\mu\text{m}$

Ponta eixo $\phi 64\text{ mm}$ na peça 3 – Ra $1,6\text{ }\mu\text{m}$

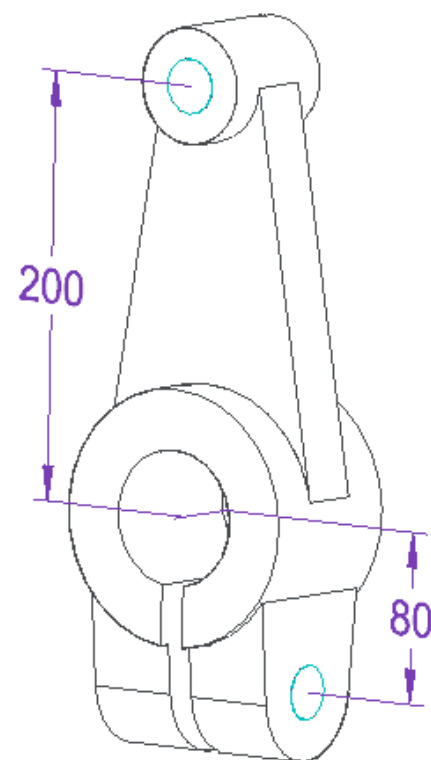
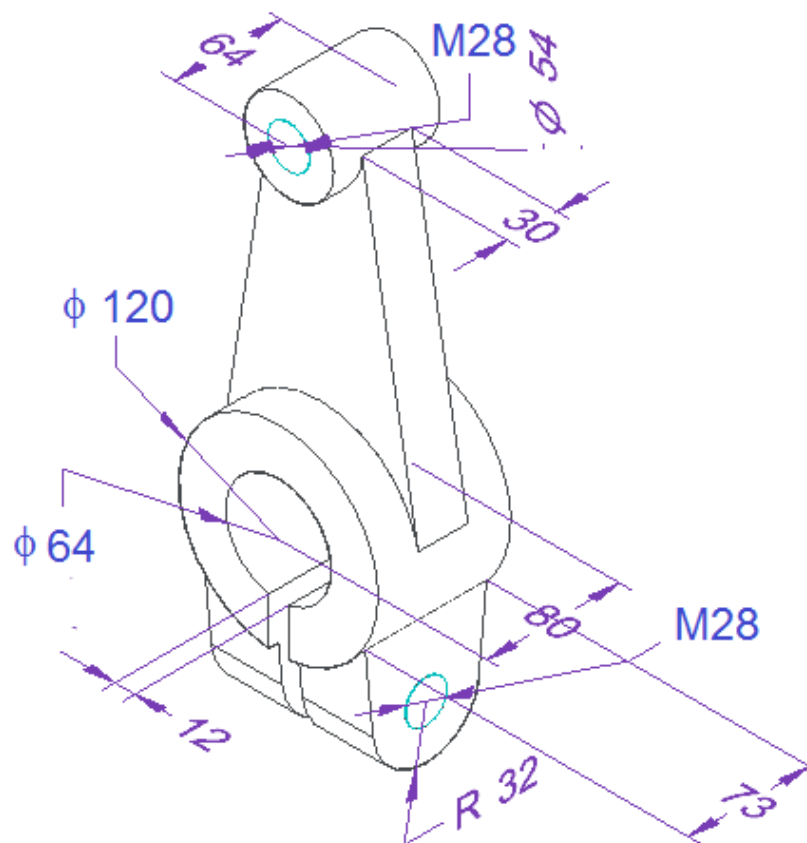


Peça 1



Peça 3

Peça 2



REFERÊNCIAS

Gordo, N.; Ferreira, J. **Elementos de Máquina**, Escola SENAI-SP.