

Guidance on the use of plain washers











Table 21 | Guidance on the use of plain washers with screws and nuts

Washer	Hardness washer	min. 100 HV	min. 200 HV	min. 300 HV
Screw	Property class	≤ 6.8	yes	yes
		8.8	no	yes
		9.8	no	yes
		10.9	no	yes
		12.9	no	no
Nut	Property class	≤ 6	yes	yes
		8	no	yes
		9	no	yes
		10	no	yes
		12	no	no
Case-hardened thread rolling screws		yes	yes	yes
Stainless steel bolts, screws and nuts		—	yes	—

Shearing forces for different pins

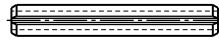


Table 29

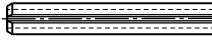
				Force F in Newton (N)												Diameter									
Material	Permitted Shearing force T to in N/mm²	Standard		0,6	0,8	1	1,2	1,5	2	2,5	3	3,5	4	4,5	5	6	8	10	12	13	14	16	18	20	
95 Mn Pb 28 K Free cutting steel 1.0718	<Ø 10~400 Ø 10-16~360 >Ø 16~320	CP ISO 2338 DIN 7		110	220	350	500	800	1400	2100	3050		5050		8250	11400	20250	31600	45000	49000	62000	78000		110000	
		KP turned ISO 2339 DIN 1																							
		Grooved pin DIN 1470/1471/ 1472/1473/1474/ 1475																							
St 60-2K 1.0060	<Ø 5~560 Ø 5-10~520 >Ø 10~490	KP grinded ISO 2339 DIN 1				440		990	1750	2750	3950		7030		10200	14700	26100	40820	55370						
		DIN 258 GKP													10200	14700	26100	40820	55370			98500		153800	
		DIN 7977 GKP													10200	14700	26100	40820	55370			98500		153800	
		DIN 7978 KPIG														14700	26100	40820	55370			98500		153800	
		Hardened steel HRC 58-62	~1500	DIN 6325 CPK						2650	4710	7360	10600		18840		29400	42400	75300	117700	169500		230800	301500	
Stainless 1.4305		CP ISO 2338 DIN 7		See resp. material (9 5 Mn Pb 28K)																					
		KP ISO 2339 DIN 1																							

Spring pins acc. to ISO 8752

Up to 8 mm



From 10 mm



Material: Spring steel hardened and tempered to 420-560 HV.

Table 212

Nominal diameter mm	1	1,5	2	2,5	3	3,5	4	4,5	5	6	8	10	12	13	14	16	18	20
Shear force double lap joint min. kN	0,7	1,58	2,82	4,38	6,32	9,06	11,24	15,36	17,54	26,04	42,76	70,16	104,1	115,1	144,7	171	222,5	280,6

Spiral pins, medium duty acc. to ISO 8750



Material: Spring steel hardened and tempered to 420-545 HV.

Table 213

Nominal diameter mm	0,8	1	1,2	1,5	2	2,5	3	3,5	4	5	6	8	10	12	14	16	20
Shear force double lap joint min. kN	0,4	0,6	0,9	1,45	2,5	3,9	5,5	7,5	9,6	15	22	39	62	89	120	155	250

Spiral pins, heavy duty acc. to ISO 8748



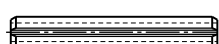
Material: Spring steel hardened and tempered to 420-545 HV.

Table 214

Nominal diameter mm	1,5	2	2,5	3	3,5	4	5	6	8	10	12	14	16	20
Shear force double lap joint min. kN	1,9	3,5	5,5	7,6	10	13,5	20	30	53	84	120	165	210	340

Spring pins, light duty acc. to ISO 13337

Up to 8 mm



From 10 mm

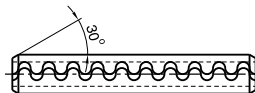


Material: Spring steel hardened and tempered to 420-560 HV.

Table 215

Nominal diameter mm	2	2,5	3	3,5	4	4,5	5	6	8	10	12	13	14	16	18	20
Shear force double lap joint min. kN	1,5	2,4	3,5	4,6	8,0	8,8	10,4	18	24	40	48	66	84	98	126	158

Connex type S



Material: Spring steel acc. to AISI 6150, hardened to 42-50 HRC.

Table 216

Nominal diameter mm	1	1,5	2	2,5	3	4	5	6	8	10	12	14	15	16	18	20
Shear force double lap joint min. kN	0,7	1,58	2,82	4,38	6,32	10,6	17,54	26,06	42,76	70,16	104,1	144,7	157,7	171	222,5	280,6

