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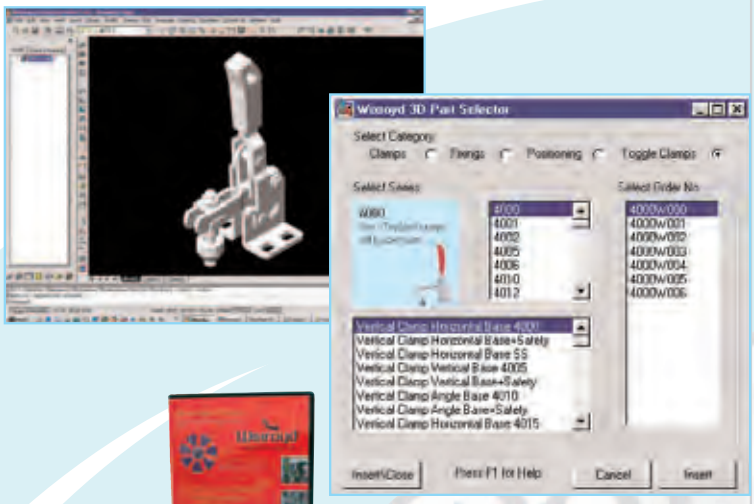

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General Tolerances DIN ISO 2768

DIN ISO 2768 PART 1

Table 1. Limit deviations for linear sizes with the exception of cut-off edges - values in mm
(for radius of curvature and chamfer heights, please refer to table 2)

Tolerance Class		Limit deviations for ranges of nominal sizes							
Symbol	Designation	from 0,5[1] to 3	over 3 to 6	over 6 to 30	over 30 to 120	over 120 to 400	over 400 to 1000	over 1000 to 2000	over 2000 to 4000
f	fine	±0,05	±0,05	±0,1	±0,15	±0,2	±0,3	±0,5	-
m	medium	±0,1	±0,1	±0,2	±0,3	±0,5	±0,8	±1,2	±2
c	coarse	±0,2	±0,3	±0,5	±0,8	±1,2	±2	±3	±4
v	very coarse	-	±0,5	±1	±1,5	±2,5	±4	±6	±8

[1] For nominal sizes below 0,5mm, the limit deviations are to be indicated directly on the relevant nominal size(s).

Table 2. Limit deviations for cut-off edges values in mm (radius of curvature and chamfer heights)

Tolerance Class		Limit deviations for ranges of nominal sizes		
Symbol	Designation	from 0,5[1] to 3	over 3 to 6	over 6
f	fine	±0,2	±0,5	±1
m	medium			
c	coarse	±0,4	±1	±2
v	very coarse			

[1] For nominal sizes below 0,5mm, the limit deviations are to be indicated directly on the relevant nominal size(s).

DIN ISO 2768 PART 1

Table 3. Limit deviations for angular dimensions.

Tolerance Class		Limit deviations for linear ranges, expressed in mm, for the shorter leg of the relevant angle				
Symbol	Designation	up to 10	over 10 to 50	over 50 to 120	over 120 to 400	over 400
f	fine	±1°	±0°30′	±0°20′	±0°10′	±0°5′
m	medium					
c	coarse	±1°30′	±1°	±0°30′	±0°15′	±0°10′
v	very coarse	±3°	±2°	±1°	±0°30′	±0°20′

DIN ISO 2768 PART 2

Table 1. General tolerances for straightness and eveness - values in mm

Tolerance Class	General tolerances for straightness and eveness for ranges of nominal sizes					
	up to 10	over 10 to 30	over 30 to 100	over 100 to 300	over 300 to 1000	over 1000 to 3000
H	0,02	0,05	0,1	0,2	0,3	0,4
K	0,05	0,1	0,2	0,4	0,6	0,8
L	0,1	0,2	0,4	0,8	1,2	1,6

Table 2. General tolerances for perpendicularity - values in mm

Tolerance Class	Perpendicularity tolerances for ranges of nominal sizes for the shorter leg of the angle			
	up to 100	over 100 to 300	over 300 to 1000	over 1000 to 3000
H	0,2	0,3	0,4	0,5
K	0,4	0,6	0,8	1
L	0,6	1	1,5	2

Table 3. General tolerances for symmetry - values in mm

Tolerance Class	Symmetry tolerances for ranges of nominal sizes			
	up to 100	over 100 to 300	over 300 to 1000	over 1000 to 3000
H	0,5	0,5	0,5	0,5
K	0,6	0,6	0,8	1,0
L	0,6	1,0	1,5	2,0

ISO Tolerances for holes (ISO 286-2) DIN 7154

Tolerance Zone	Limiting deviation	Nominal sizes in mm over 3 incl.6	6 10	10 18	18 30	30 40	40 50	50 65	65 80	80 100	100 120	120 140	140 160	160 180	180 200	200 225	225 250	250 280	280 315	315 355	355 400	400 450	450 500	500 560	560 630	630 710	710 800	800 900	900 1000
		deviation in µm																											
E6	upper	+28	+34	+43	+53	+66		+79		+94		+110				+129		+142		+161		+175		+189		+210		+226	
	lower	+20	+25	+32	+40	+50		+60		+72		+85				+100		+110		+125		+135		+145		+160		+170	
E7	upper	+32	+40	+50	+61	+75		+90		+107		+125				+146		+162		+182		+198		+215		+240		+260	
	lower	+20	+25	+32	+40	+50		+60		+72		+85				+100		+110		+125		+135		+145		+160		+170	
E11	upper	+95	+115	+142	+170	+210		+250		+292		+335				+390		+430		+485		+535		+585		+660		+730	
	lower	+20	+25	+32	+40	+50		+60		+72		+85				+100		+110		+125		+135		+145		+160		+170	
E12	upper	+140	+175	+212	+250	+300		+360		+422		+485				+560		+630		+695		+765		+845		+960		+1070	
	lower	+20	+25	+32	+40	+50		+60		+72		+85				+100		+110		+125		+135		+145		+160		+170	
E13	upper	+200	+245	+302	+370	+440		+520		+612		+715				+820		+920		+1015		+1105		+1245		+1410		+1570	
	lower	+20	+25	+32	+40	+50		+60		+72		+85				+100		+110		+125		+135		+145		+160		+170	
F6	upper	+18	+22	+27	+33	+41		+49		+58		+68				+79		+88		+98		+108		+120		+130		+142	
	lower	+10	+13	+16	+20	+25		+30		+36		+43				+50		+56		+62		+68		+76		+80		+86	
F7	upper	+22	+28	+34	+41	+50		+60		+71		+83				+96		+108		+119		+131		+146		+160		+176	
	lower	+10	+13	+16	+20	+25		+30		+36		+43				+50		+56		+62		+68		+76		+80		+86	
F8	upper	+28	+35	+43	+53	+64		+76		+90		+106				+122		+137		+151		+165		+186		+205		+226	
	lower	+10	+13	+16	+20	+25		+30		+36		+43				+50		+56		+62		+68		+76		+80		+86	
G6	upper	+12	+14	+17	+20	+25		+29		+34		+39				+44		+49		+54		+60		+66		+74		+82	
	lower	+4	+5	+6	+7	+9		+10		+12		+14				+15		+17		+18		+20		+22		+24		+26	
G7	upper	+16	+20	+24	+28	+34		+40		+47		+54				+61		+69		+75		+83		+92		+104		+116	
	lower	+4	+5	+6	+7	+9		+10		+12		+14				+15		+17		+18		+20		+22		+24		+26	
G8	upper	+22	+27	+33	+40	+48		+56		+66		+77				+87		+98		+107		+117		+132		+149		+166	
	lower	+4	+5	+6	+7	+9		+10		+12		+14				+15		+17		+18		+20		+22		+24		+26	
H6	upper	+8	+9	+11	+13	+16		+19		+22		+25				+29		+32		+36		+40		+44		+50		+56	
	lower	0	0	0	0	0		0		0		0				0		0		0		0		0		0		0	
H7	upper	+12	+15	+18	+21	+25		+30		+35		+40				+46		+52		+57		+63		+70		+80		+90	
	lower	0	0	0	0	0		0		0		0				0		0		0		0		0		0		0	
H8	upper	+18	+22	+27	+33	+39		+46		+54		+63				+72		+81		+89		+97		+110		+125		+140	
	lower	0	0	0	0	0		0		0		0				0		0		0		0		0		0		0	
H9	upper	+30	+36	+43	+52	+62		+74		+87		+100				+115		+130		+140		+155		+175		+200		+230	
	lower	0	0	0	0	0		0		0		0				0		0		0		0		0		0		0	
H10	upper	+48	+58	+70	+84	+100		+120		+140		+160				+185		+210		+230		+250		+280		+320		+360	
	lower	0	0	0	0	0		0		0		0				0		0		0		0		0		0		0	
H11	upper	+75	+90	+110	+130	+160		+190		+220		+250				+290		+320		+360		+400		+440		+500		+560	
	lower	0	0	0	0	0		0		0		0				0		0		0		0		0		0		0	
J6	upper	+5	+5	+6	+8	+10		+13		+16		+18				+22		+25		+29		+33		-		-		-	
	lower	-3	-4	-5	-5	-6		-6		-6		-7				-7		-7		-7		-7							
J7	upper	+6	+8	+10	+12	+14		+18		+22		+26				+30		+36		+39		+43		-		-		-	
	lower	-6	-7	-8	-9	-11		-12		-13		-14				-16		-16		-18		-20							
J8	upper	+10	+12	+15	+20	+24		+28		+34		+41				+47		+55		+60		+66		-		-		-	
	lower	-8	-10	-12	-13	-15		-18		-20		-22				-25		-26		-29		-31							
JS6	upper	+4	+4,5	+5,5	+6,5	+8		+9,5		+11		+12,5				+14,5		+16		+18		+20		+22		+25		+28	
	lower	-4	-4,5	-5,5	-6,5	-8		-9,5		-11		-12,5				-14,5		-16		-18		-20		-22		-25		-28	
JS7	upper	+6	+7,5	+9	+10,5	+12,5		+15		+17,5		+20				+23		+26		+28,5		+31,5		+35		+40		+45	
	lower	-6	-7,5	-9	-10,5	-12,5		-15		-17,5		-20				-23		-26		-28,5		-31,5		-35		-40		-45	
JS8	upper	+9	+11	+13,5	+16,5	+19,5		+23		+27		+31,5				+36		+40,5		+44,5		+48,5		+55		+62,5		+70	
	lower	-9	-11	-13,5	-16,5	-19,5		-23		-27		-31,5				-36		-40,5		-44,5		-48,5		-55		-62,5		-70	
K6	upper	+2	+2	+2	+2	+3		+4		+4		+4				+5		+5		+7		+8		0		0		0	
	lower	-6	-7	-9	-11	-13		-15		-18		-21				-24		-27		-29		-32		-44		-50		-56	
K7	upper	+3	+5	+6	+6	+7		+9		+10		+12				+13		+16		+17		+18		+0		+0		+0	
	lower	-9	-10	-12	-15	-18		-21		-25		-28				-33		-36		-40		-45		-70		-80		-90	
K8	upper	+5	+6	+8	+10	+12		+14		+16		+20				+22		+25		+28		+29		+0		+0		+0	
	lower	-13	-16	-19	-23	-27		-32		-38		-43				-50		-56		-61		-68		-110		-125		-140	
M6	upper	-1	-3	-4	-4	-4		-5		-6		-8				-8		-9		-10		-10		-26		-30		-34	
	lower	-9	-12	-15	-17	-20		-24		-28		-33				-37		-41		-46		-50		-70		-80		-90	
M7	upper	0	0	0	0	0		0		0		0				0		0		0		0		-26		-30		-34	
	lower	-12	-15	-18	-21	-25		-30		-35		-40				-46		-52		-57		-63		-96		-110		-124	
M8	upper	+2	+1	+2	+4	+5		+5		+6		+8				+9		+9		+11		+11		-26		-30		-34	
	lower	-16	-21	-25	-29	-34		-41		-48		-55				-63		-72		-78		-86		-136		-155		-174	
N6	upper	-5	-7	-9	-11	-12		-14		-16		-20				-22		-25		-26		-27		-44		-50		-56	
	lower	-13	-16	-20	-24	-28		-33		-38		-45				-51		-57		-62		-67		-88		-100		-112	
N7	upper	-4	-4	-5	-7	-8		-9		-10		-12				-14		-14		-16		-17		-44		-50		-56	
	lower	-16	-19	-23	-28	-33		-39		-45		-52				-60		-66		-73		-80		-114		-130		-146	
N8	upper	-2	-3	-3	-3	-3		-4		-4		-4				-5		-5		-5		-6		-44		-50		-56	
	lower	-20	-25	-30	-36	-42		-50		-58		-67				-77		-86		-94		-103		-154		-175		-196	
P6	upper	-9	-12	-15	-18	-21		-26		-30		-36				-41		-47		-51		-55		-78		-88		-100	
	lower	-17	-21	-26	-31	-37		-45		-52		-61				-70		-79		-87		-95		-122		-138		-156	
P7	upper	-8	-9	-11	-14	-17		-21		-24		-28				-33		-36		-41		-45		-78		-88		-100	
	lower	-20	-24	-29	-35	-42		-51		-59		-68				-79		-88		-98		-108		-148		-168		-190	
P8	upper	-12	-15	-18	-22	-26		-32		-37		-43				-50		-56		-62		-68		-78		-88		-100	
	lower	-30	-37	-45	-55	-65		-78		-91		-106				-122		-137		-151		-165		-188		-213		-240	
R6	upper	-12	-16	-20	-24	-29	-35	-37	-44	-47	-56	-58	-61	-68	-71	-75	-85	-89	-97	-103	-113	-119	-150	-155	-175	-185	-210	-220	
	lower	-20	-25	-31	-37	-45	-54	-56	-66	-69	-81	-83	-86	-97	-100	-104	-117	-121	-133	-139	-153	-159	-194	-199	-225	-235	-266	-276	
R7	upper	-11	-13	-16	-20	-25	-30	-32	-38	-41	-48	-50	-53	-60	-63	-67	-74	-78	-87	-93	-103	-109	-150	-155	-175	-185	-210	-220	
	lower	-23	-28	-34	-41	-50	-60	-62	-73	-76	-88	-90	-93	-106	-109	-113	-126	-130	-144	-150	-166	-172	-220	-225	-225	-265	-300	-310	

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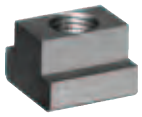
ISO Tolerances for shafts (ISO 286-2) DIN 7155

Tolerance Zone	Limiting deviation	Nominal sizes in mm over 3 incl.6	6 10	10 18	18 30	30 40	40 50	50 65	65 80	80 100	100 120	120 140	140 160	160 180	180 200	200 225	225 250	250 280	280 315	315 355	355 400	400 450	450 500
		deviation in µm																					
a12	upper	-270	-280	-290	+300	-310	-320	-340	-360	-380	-410	-460	-520	-580	-660	-740	-820	-920	-1050	-1200	-1350	-1500	-1650
	lower	-390	-430	-470	-510	-560	-570	-640	-660	-730	-760	-860	-920	-980	-1120	-1200	-1280	-1440	-15770	-1770	-1920	-2130	-2280
a13	upper	-270	-280	-290	-300	-310	-320	-340	-360	-380	-410	-460	-520	-580	-660	-740	-820	-920	-1050	-1200	-1350	-1500	-1650
	lower	-450	-500	-560	-630	-700	-710	-800	-820	-920	-950	-1090	-1150	-1210	-1380	-1460	-1540	-1730	-1860	-2090	-2240	-2470	-2620
c13	upper	-70	-80	-95	-110	-120	-130	-140	-150	-170	-180	-200	-210	-230	-240	-260	-280	-300	-330	-360	-400	-440	-480
	lower	-250	-300	-365	-440	-510	-520	-600	-610	-710	-720	-830	-840	-860	-960	-980	-1000	-1110	-1140	-1250	-1290	-1410	-1450
d6	upper	-30	-40	-50	-65	-80		-100		-120			-145			-170		-190		-210		-230	
	lower	-38	-49	-61	-78	-96		-119		-142			-170			-199		-222		-246		-270	
e6	upper	-20	-25	-32	-40	-50		-60		-72			-85			-100		-110		-125		-135	
	lower	-28	-34	+3	-53	-66		-79		-94			-110			-129		-142		-161		-175	
e13	upper	-20	-25	-32	-40	-50		-60		-72			-85			-100		-110		-125		-135	
	lower	-200	-245	-302	-370	-440		-520		-612			-715			-820		-920		-1015		-1105	
f5	upper	-10	-13	-16	-20	-25		-30		-36			-43			-50		-56		-62		-68	
	lower	-15	-19	-24	-29	-36		-43		-51			-61			-70		-79		-87		-95	
f6	upper	-10	-13	-16	-20	-25		-30		-36			-43			-50		-56		-62		-68	
	lower	-18	-22	-27	-33	-41		-49		-58			-68			-79		-88		-98		-108	
f7	upper	-10	-13	-16	-20	-25		-30		-36			-43			-50		-56		-62		-68	
	lower	-22	-28	-34	-41	-50		-60		-71			-83			-96		-108		-119		-131	
g5	upper	-4	-5	-6	-7	-9		-10		-12			-14			-15		-17		-18		-20	
	lower	-9	-11	-14	-16	-20		-23		-27			-32			-35		-40		-43		-47	
g6	upper	-4	-5	-6	-7	-9		-10		-12			-14			-15		-17		-18		-20	
	lower	-12	-14	-17	-20	-25		-29		-34			-39			-44		-49		-54		-60	
g7	upper	-4	-5	-6	-7	-9		-10		-12			-14			-15		-17		-18		-20	
	lower	-16	-20	-24	-28	-34		-40		-47			-54			-61		-69		-75		-83	
h4	upper	0	0	0	0	0		0		0			0			0		0		0		0	
	lower	-4	-4	-5	-6	-7		-8		-10			-12			-14		-16		-18		-20	
h5	upper	0	0	0	0	0		0		0			0			0		0		0		0	
	lower	-5	-6	-8	-9	-11		-13		-15			-18			-20		-23		-25		-27	
h6	upper	0	0	0	0	0		0		0			0			0		0		0		0	
	lower	-8	-9	-11	-13	-16		-19		-22			-25			-29		-32		-36		-40	
h7	upper	0	0	0	0	0		0		0			0			0		0		0		0	
	lower	-12	-15	-18	-21	-25		-30		-35			-40			-46		-52		-57		-63	
h8	upper	0	0	0	0	0		0		0			0			0		0		0		0	
	lower	-18	-22	-27	-33	-39		-46		-54			-63			-72		-81		-89		-97	
h10	upper	0	0	0	0	0		0		0			0			0		0		0		0	
	lower	-48	-58	-70	-84	-100		-120		-140			-160			-185		-210		-230		-250	
h11	upper	0	0	0	0	0		0		0			0			0		0		0		0	
	lower	-75	-90	-110	-130	-160		-190		-220			-250			-290		-320		-360		-400	
h12	upper	0	0	0	0	0		0		0			0			0		0		0		0	
	lower	-120	-150	-180	-210	-250		-300		-350			-400			-460		-520		-570		-630	
j5	upper	+3	+4	+5	+5	+6		+6		+6			+7			+7		+7		+7		+7	
	lower	-2	-2	-3	-4	-5		-7		-9			-11			-13		-16		-18		-20	
j6	upper	+6	+7	+8	+9	+11		+12		+13			+14			+16		+16		+18		+20	
	lower	-2	-2	-3	-4	-5		-7		-9			-11			-13		-16		-18		-20	
j7	upper	+8	+10	+12	+13	+15		+18		+20			+22			+25		+26		+29		+31	
	lower	-4	-5	-6	-8	-10		-12		-15			-18			-21		-26		-28		-32	
js5	upper	+2,5	+3	+4	+4,5	+5,5		+6,5		+7,5			+9			+10		+11,5		+12,5		+13,5	
	lower	-2,5	-3	-4	-4,5	-5,5		-6,5		-7,5			-9			-10		-11,5		-12,5		-13,5	
js6	upper	+4	+4,5	+5,5	+6,5	+8		+9,5		+11			+12,5			+14,5		+16		+18		+20	
	lower	-4	-4,5	-5,5	-6,5	-8		-9,5		-11			-12,5			-14,5		-16		-18		-20	
js7	upper	+6	+7,5	+9	+10,5	+12,5		+15		+17,5			+20			+23		+26		+28,5		+31,5	
	lower	-6	-7,5	-9	-10,5	-12,5		-15		-17,5			-20			-23		-26		-28,5		-31,5	
k5	upper	+6	+7	+9	+11	+13		+15		+18			+21			+24		+27		+29		+32	
	lower	+1	+1	+1	+2	+2		+2		+3			+3			+4		+4		+4		+5	
k6	upper	+9	+10	+12	+15	+18		+21		+25			+28			+33		+36		+40		+45	
	lower	+1	+1	+1	+2	+2		+2		+3			+3			+4		+4		+4		+5	
k7	upper	+13	+16	+19	+23	+27		+32		+38			+43			+50		+56		+61		+68	
	lower	+1	+1	+1	+2	+2		+2		+3			+3			+4		+4		+4		+5	
m5	upper	+9	+12	+15	+17	+20		+24		+28			+33			+37		+43		+46		+50	
	lower	+4	+6	+7	+8	+9		+11		+13			+15			+17		+20		+21		+23	
m6	upper	+12	+15	+18	+21	+25		+30		+35			+40			+46		+52		+57		+63	
	lower	+4	+6	+7	+8	+9		+11		+13			+15			+17		+20		+21		+23	
m7	upper	+16	+21	+25	+29	+34		+41		+48			+55			+63		+72		+78		+86	
	lower	+4	+6	+7	+8	+9		+11		+13			+15			+17		+20		+21		+23	
n5	upper	+13	+16	+20	+24	+28		+33		+38			+45			+51		+57		+62		+67	
	lower	+8	+10	+12	+15	+17		+20		+23			+27			+31		+34		+37		+40	
n6	upper	+16	+19	+23	+28	+33		+39		+45			+52			+60		+66		+73		+80	
	lower	+8	+10	+12	+15	+17		+20		+23			+27			+31		+34		+37		+40	
n7	upper	+20	+25	+30	+36	+42		+50		+58			+67			+77		+86		+94		+103	
	lower	+8	+10	+12	+15	+17		+20		+23			+27			+31		+34		+37		+40	
p5	upper	+17	+21	+26	+31	+37		+45		+52			+61			+70		+79		+87		+95	
	lower	+12	+15	+18	+22	+26		+32		+37			+43			+50		+56		+62		+68	
p6	upper	+20	+24	+29	+35	+42		+51		+59			+68			+79		+88		+98		+108	
	lower	+12	+15	+18	+22	+26		+32		+37			+43			+50		+56		+62		+68	
r6	upper	+23	+28	+34	+41	+50	+60	+62	+73	+76	+88	+90	+93	+106	+109	+113	+126	+130	+144	+150	+166	+172	
	lower	+15	+19	+23	+28	+34	+41	+43	+51	+54	+63	+65	+68	+77	+80	+84	+94	+98	+108	+114	+126	+132	

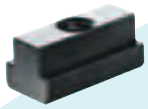
Tightening movements/strengths for screwed joints

Tightening moments / strengths for screwed joints

2400 T-nuts DIN 508



2410 T-nuts extended



2412 T-nuts rhombus

2430/2 Fixture nuts DIN 6330

2440/2 Collar Nuts DIN 6331

2462 Swivel Nuts

2460 Extension Nuts

2510-2550 Spherical Washers Conical Seats DIN 6319

2100 T-bolts DIN 787

2110 Studs, DIN 6379

1882 Swing bolts, DIN 444

Thread		Strength	M6	M8	M10	M12	M14	M16	M18	M20	M22	M24	M27	M30	M36	M42	M48
Pitch	mm	class	1	1,25	1,50	1,75	2	2	2,50	2,50	2,50	3	3	3,50	4	4,50	5
Nuts:																	
Hardness, DIN 6330/6331	HRC	10								22 - 32							
Test Force (A_S-S_P) DinISO 898, part 2	kN	10	20,9	38,1	60	88	121	165	203	260	321	374	486	595	866	-	-
Screws:																	
Hardness	HRC	8,8				22 - 32							23 - 34				
		10,9								32 - 39							
		12,9								39 - 44							
Tightening values:																	
Specified failing load (A_S-R_M)	kN	8,8	16	29	46	67	92	125	159	203	252	293	381	466	678	930	1222
		10,9	21	38	60	88	120	163	200	255	315	367	477	583	850	1165	1531
		12,9	24	45	71	103	140	192	234	299	370	431	560	684	997	1367	1797
Permissable load on screws max. 80% of yield point	kN	8,8	10	19	30	43	59	80	101	129	160	186	242	296	431	591	777
		10,9	14	27	43	63	86	118	144	184	228	265	345	421	614	843	1107
		12,9	17	32	51	74	101	138	169	215	266	310	404	493	719	986	1296
Test Force (AS-SP) acc. to DIN ISO 898 part 1	kN	8,8	12	21	34	49	67	91	115	147	182	212	275	337	490	672	882
		10,9	17	30	48	70	96	130	159	203	252	293	381	466	678	930	1222
		12,9	20	35	56	82	112	152	186	238	294	342	445	544	792	1087	1428
Permissable prestressing force with 90% utilisation of yield point and friction μ = 0,14	kN	8,8	9	17	26	38	53	73	91	117	146	168	221	269	394	542	714
		10,9	13	25	38	55	77	107	130	167	208	240	315	384	561	773	1018
		12,9	15	29	44	65	91	125	152	196	243	281	369	449	657	904	1191
Required tightening moment for permissable prestressing force and friction μ = 0,14	Nm	8,8	10	25	46	82	130	206	284	407	542	698	1021	1355	2372	3802	5730
		10,9	14	36	67	120	191	302	405	580	772	994	1455	1930	3378	5415	8162
		12,9	17	43	79	141	223	354	474	679	903	1163	1703	2258	3953	6337	9571
Required lever length to obtain the permissable prestressing force with normal manual force	mm	8,8	30	65	125	215	330	490	650	870	1100	1350	-	-	-	-	-
		10,9	42	90	175	300	450	700	920	1200	1560	-	-	-	-	-	-
		12,9	51	110	210	360	550	830	1100	1470	1860	-	-	-	-	-	-
Possible torque with normal ring spanner and torsional force.	Nm	-	60	80	90	100	110	125	140	150	170	185	225	240	300	330	410
*Prestressing force resulting thereof	kN	-	54	53	48	45	43	43	43	42	42	43	45	43	45	46	50
*When applying this prestressing force, there is a danger of...		8,8	breaking hazard		yeilding hazard		danger of loosening of clamped parts on application of operational forces										
		10,9															
		12,9															

A_S = nominal load cross section im mm² / S_P = test load in N/ mm² / R_M = minimum tensile strength in N/mm² / μ = coefficient of friction

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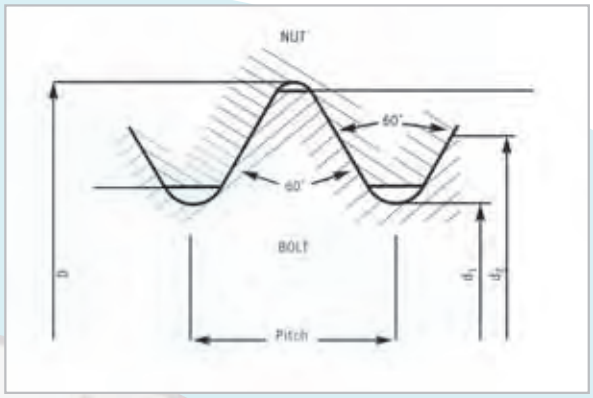
Table of screw threads



ISO Metric Fine Threads (mm)

O. DIA. (D)	Core (d1)	Pitch (P)	Depth	Flat	Effec. (d2)	Tapp'g Drill	Clearance Drill
8	6,773	1,00	0,6134	0,125	7,35	7,00	9,00
10	8,467	1,25	0,7668	0,156	9,18	8,75	11,00
12	10,467	1,25	0,7668	0,156	11,18	10,75	13,5
16	14,160	1,50	0,920	0,187	15,025	14,50	17,5
20	18,160	1,50	0,920	0,187	19,025	18,50	21,5
24	21,546	2,00	1,226	0,250	22,70	22,00	25,5
30	27,546	2,00	1,226	0,250	28,70	28,00	31,5
36	32,319	3,00	1,841	0,375	34,05	32,75	38,0
42	38,265	3,00	1,841	0,375	40,05	38,75	44,0
48	44,28	3,00	1,841	0,375	46,05	44,75	51,0
56	51,093	4,00	2,455	0,500	53,40	51,75	59,0
64	59,065	4,00	2,455	0,500	61,40	59,75	67,00

British Standard Pipe Threads (inch)

Size	O. DIA. (D)	Core (d1)	Pitch (P)	Depth	Radius	Effec. (d2)	Threads per inch	Cl'ance Drill
D	0,383	0,337	0,0357	0,0229	0,0049	0,3601	28	13/32
B	0,158	0,451	0,0526	0,0335	0,0072	0,4845	19	17/32
E	0,656	0,589	0,0526	0,0335	0,0072	0,6225	19	11/16
A	0,825	0,734	0,0714	0,0457	0,0098	0,7793	14	27/32
F	0,902	0,811	0,0714	0,0457	0,0098	0,8563	14	15/16
C	1,041	0,95	0,0714	0,0457	0,0098	0,9953	14	1 1/6
G	1,189	1,098	0,0714	0,0457	0,0098	1,1433	14	1 7/32
1	1,309	1,193	0,0909	0,0582	0,0125	1,2508	11	1 3/8
1B	1,65	1,534	0,0909	0,0582	0,0125	1,5918	11	1 11/16
1A	1,882	1,766	0,0909	0,0582	0,0125	1,8238	11	1 29/32
1C	2,116	2	0,0909	0,0582	0,0125	2,0578	11	2 5/32
2	2,347	2,231	0,0909	0,0582	0,0125	2,2888	11	2 3/8

ISO Metric Coarse Threads (mm)

O. DIA. (D)	Core (d1)	Pitch (P)	Depth	Flat	Effec. (d2)	Tapp'g Drill	Clearance Drill
1,6	1,1706	0,35	0,2147	0,04375	1,373	1,25	1,65
1,8	1,3706	0,35	0,2147	0,04375	1,573	1,45	1,85
2	1,5092	0,40	0,2454	0,05000	1,740	1,60	2,05
2,2	1,6480	0,45	0,2760	0,05625	1,908	1,75	2,25
2,5	1,9480	0,45	0,2760	0,05625	2,208	2,05	2,60
3	2,3866	0,50	0,3067	0,06250	2,675	2,50	3,10
3,5	2,7638	0,60	0,3681	0,07500	3,110	2,90	3,60
4	3,1412	0,70	0,4294	0,08750	3,545	3,30	4,10
4,5	3,5798	0,75	0,4601	0,09375	4,013	3,80	4,60
5	4,0184	0,80	0,4908	0,10000	4,480	4,20	5,10
6	4,7732	1,00	0,6134	0,12500	5,350	5,00	6,10
7	5,7732	1,00	0,6134	0,12500	6,350	6,00	7,20
8	6,4664	1,25	0,7668	0,15625	7,188	6,80	8,20
10	8,1596	1,50	0,9202	0,18750	9,026	8,50	10,20
12	9,8530	1,75	1,0735	0,21875	10,863	10,20	12,20
14	11,5462	2,00	1,2269	0,25000	12,701	12,00	14,25
16	13,5462	2,00	1,2269	0,25000	14,701	14,00	16,25
18	14,9328	2,50	1,5336	0,31250	16,376	15,50	18,25
20	16,9328	2,50	1,5336	0,31250	18,376	17,50	20,25
22	18,9328	2,50	1,5336	0,31250	20,376	19,50	22,25
24	20,3194	3,00	1,8403	0,37500	22,051	21,00	24,25
27	23,3194	3,00	1,8403	0,37500	25,051	24,00	27,25
30	25,7060	3,50	2,1470	0,43750	27,727	26,50	30,50
33	28,7060	3,50	2,1470	0,43750	30,727	29,50	33,50
36	31,0924	4,00	2,4538	0,50000	33,402	32,00	36,50
39	34,0924	4,00	2,4538	0,50000	36,402	35,00	39,50
42	36,4790	4,50	2,7605	0,56250	39,077	37,50	42,50
45	39,4790	4,50	2,7605	0,56250	42,077	40,50	45,50
48	41,8646	5,00	3,0672	0,62500	44,752	43,00	48,75
52	45,8646	5,00	3,0672	0,62500	48,752	47,00	52,75
56	49,2522	5,50	3,3739	0,68750	52,428	50,50	56,75
60	53,2522	5,50	3,3739	0,68750	56,428	54,50	60,75
64	56,6388	6,00	3,6806	0,75000	60,103	58,00	64,75
68	60,6388	6,00	3,6806	0,75000	64,103	62,00	68,75

Conversion Tables

TEMPERATURE CONVERSIONS

To convert from:	To:	Substitute in Formula:
Degrees Celcius	Degrees Fahrenheit	(°C x 9/ 5) +32
Degrees Celcius	Kelvin	(°C + 273,16)
Degrees Fahrenheit	Degrees Celcius	(°F-32) x 5/ 9
Degrees Fahrenheit	Degrees Rankin	(°F + 459,69)

TORQUE CONVERSIONS

To obtain: Muliply Number of:	Newton Metres	Kilogram Force Metres	Foot Pounds	Inch Pounds
Newton Metres	1	0,1020	0,7376	8,651
Kilogram Force Metres	9,807	1	7,233	86,80
Foot Pounds	1,356	0,1383	1	12,00
Inch Pounds	0,1130	0,01152	0,08333	1

FORCE CONVERSIONS

To obtain: Multiply Number of:	Kilonewtons	Kilogram Force	Pound Force	Poundals
Kilonewtons	1	102,0	224,8	7233
Kilogramme Force	0,009807	1	2,205	70,93
Pound Force	0,004448	0,4536	1	32,17
Poundals	0,0001383	0,01410	0,03108	1

DENSITY CONVERSIONS

To obtain: Multiply	Grams per Millilitre	Kilograms per Cubic Metre	Pounds per Cubic Foot	Pounds per Cubic Inch
Grams per Millimetre	1	1000	62,43	0,03613
Kilograms per Cubic Metre	0,001000	1	0,06243	0,00003613
Kilograms per Cubic Foot	0,01602	16,02	1	0,0005787
Pounds per Cubic Inch	27,68	27,680	1728	1

LENGTH CONVERSIONS

To obtain: Multiply Number of:	Metres	Inches	Feet	Millimetres	Miles	Kilometers
Metres	1	39,37	3,2808	1000	0,0006214	0,001
Inches	0,0254	1	0,0833	25,4	0,00001578	0,0000254
Feet	0,3048	12	1	304,8	0,0001894	0,0003048
Millimetres	0,001	0,03937	0,0032808	1	0,0000006214	0,000001
Miles	1609,35	63,360	5,286	1,609,350	1	1,60935
Kilometres	1,000	39,370	3280,83	1,000,000	0,62137	1

VOLUME CONVERSIONS

To obtain: Multiply number of:	Cubic Decimetres (litres)	Cubic Inches	Cubic Feet	US Quart	US Gallon	Imperial Gallon	US Barrel (Petroleum)
Cubic Decimetres (l)	1	61,0234	0,03531	1,05668	0,264178	0,220083	0,00629
Cubic Inches	0,01639	1	5,787x10-4	0,1732	0,004329	0,003606	0,000103
Cubic Feet	28,317	1728	1	29,9221	7,48055	6,22888	0,1781
US Quart	0,94636	57,75	0,03342	1	0,25	0,2062	0,00595
US Gallon	3,78543	231	0,13368	4	1	0,833	0,02381
Imperial Gallon	4,54374	277,274	0,16054	4,80128	1,20032	1	0,02877
US Barrel (Petroleum)	158,98	9702	5,6146	168	42	34,973	1

PRESSURE CONVERSIONS

To obtain: Multiply Number of:	Pounds per Square Inch	Inches of Water Column	Feet of Water Column	Inches of Mercury	Ounces per Square Inch	Bar	Millibar mBar	Kilopascals kPa	Kilograms per Square centimetre
Pounds per Square Inch	1	27,68	2,307	2,036	16	0,06895	68,95	6,895	0,0703
Inches of Water Column	0,0361	1	0,8333	0,7355	0,5776	0,002491	2,491	0,2491	0,00254
Feet of Water Column	0,4336	12	1	0,8826	6,936	0,02989	29,89	2,989	0,0305
Inches of Mercury	0,4911	13,60	1,133	1	7,858	0,03386	33,86	3,386	0,03453
Ounces per Square Inch	0,9625	1,73	0,144	0,127	1	0,00431	4,309	0,4309	0,0044
Bar	14,50	401,5	33,45	29,53	232	1	1000	100	1,020
Millibar mBar	0,0145	0,4015	0,03345	0,02953	0,232	0,001	1	0,100	0,00102
Kilopascals kPa	0,1450	4015	0,3345	0,2953	2,32	0,01	10	1	0,0102
Kilograms per Square centimetre	14,22	393,7	32,81	28,96	227,5	0,9807	980,7	98,07	1

VOLUMETRIC RATE OF FLOW CONVERSIONS

To obtain: Multiply Number of:	Litres per Second	Litres per minute	Cubic Metres per hour	Cubic feet per hour	Gallons per minute	Imperial Gallons per minute	US Gallons per min	US Barrels per day (24US Gal)
Litres per Second	1	60	3,600	127,1	21,19	13,20	15,85	543,4
Litres per minute	0,1667	1	0,06000	2,119	0,03532	0,2200	0,2642	9,057
Cubic Metres per hour	0,2778	16,67	1	35,31	0,5886	3,666	4,403	150,9
Cubic feet per hour	0,007865	0,4719	0,02832	1	0,01667	0,1038	0,1247	4,275
Gallons per minute	0,4719	28,32	1,6999	60,00	1	6,229	7,481	256,5
Imperial Gallons per min	0,07577	4,546	0,2727	9,633	0,1606	1	1,201	41,17
US Gallons per min	0,06309	3,785	0,2271	8,021	0,1337	0,8327	1	34,29
US Barrels per day (24US Gal)	0,001840	0,1104	0,006624	0,2339	0,003899	0,02428	0,02917	1

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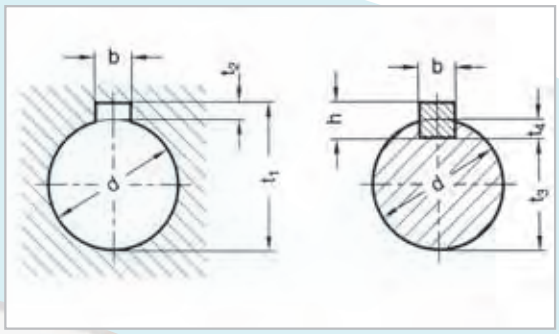
KEYWAYS TO DIN 6885 - SHEET 1



d	b P9/JS9 Hole	b P9/N9 Shaft	h	t1 = d+t2	t2	t3 = d-t4	t4
7	2	2	2	8	1+0,1	5,8	1,2+0,1
8	2	2	2	9	1	6,8	1,2
9	3	3	3	10,4	1,4	7,2	1,8
10	3	3	3	11,4	1,4	8,2	1,8
11	4	4	4	12,8	1,8	8,5	2,5
12	4	4	4	13,8	1,8	9,5	2,5
13	5	5	5	15,3	2,3	10	3
14	5	5	5	16,3	2,3	11	3
15	5	5	5	17,3	2,3	12	3
16	5	5	5	18,3	2,3	13	3
17	5	5	5	19,3	2,3	14	3
18	6	6	6	20,8	2,8	14,5	3,5
20	6	6	6	22,8	2,8	16,5	3,5
22	6	6	6	24,8	2,8	18,5	3,5
24	8	8	7	27,3	3,3+0,2	20	4+0,2
25	8	8	7	28,3	3,3	21	4
26	8	8	7	29,3	3,3	22	4
28	8	8	7	31,3	3,3	24	4
30	8	8	7	33,3	3,3	26	4
32	10	10	8	35,3	3,3	27	5
34	10	10	8	37,3	3,3	29	5
35	10	10	8	38,3	3,3	30	5
36	10	10	8	39,3	3,3	31	5
38	10	10	8	41,3	3,3	33	5
40	12	12	8	43,3	3,3	35	5
42	12	12	8	45,3	3,3	37	5
44	12	12	8	47,3	3,3	39	5

COMMONLY ACCEPTED SYMBOLS AND ABBREVIATIONS USED ON ENGINEERING DRAWINGS ARE

Term	Abbreviation or symbols	Term	Abbreviation or symbol
Across flats	AF	Number	No
Assembly	ASSY	Pattern number	PATT NO.
British Standard	BS	Pitch circle diameter	PCD
Centres	CRS	Radius (in a note)	RAD
Centre Line on a view	C	Radius (preceding a diameter)	R *
Centre Line in a note	CL	Reference	REF
Centre of gravity	CG	Required	REQD
Chamfered, Chamfer (in a note)	CHAM	Right hand	RH
Cheese head	CH HD	Round head	RD HD
Countersink	CSK	Screw (or screwed)	SCR
Countersunk head	CSK HD	Sheet	SH
Counterbore	CBORE	Sketch	SK
Cylinder or cylindrical	CYL	Specification	SPEC
Diameter (in a note)	DIA	Spherical	SPHERE
Diameter (preceding a dimension)	Ø *	Spherical diameter (only preceding a dimension)	SØ*
Dimension	DIM.	Spherical radius (only preceding a dimension)	SR*
Drawing	DRG		
Equally spaced	EQUI SP	Spotface	SFACE
External	EXT	Square (in a note)	SQ
Figure	FIG.	Square (preceding a dimension)	□ * or ☒
Full indicated movement	FIM		
Hexagon	HEX	Standard	STD
Hexagon head	HEX HD	Taper, on diameter or width	⟶ * (orientated to direction of taper)
Insulated or insulation	INSUL	Thread	THD
Internal	INT	Thick	THK
Left Hand	LH	Tolerance	TOL
Long	LG	Typical or typically	TYP
Machine	MC	Undercut	UCUT
Material	MATL	Volume	VOL
Maximum	MAX	Weight	WT
Maximum material condition	MMC		
Minimum	MIN		
Not to scale (A dimension not to scale underlined)	NTS	*These symbols are recognised internationally	

Related Steel Specifications

Carbon Steel

Steel	BS 970 1991	BS 970 1983	BS 970 1955 En	AISI/SAE	WERK-STOFF	KURZ-NAME
040A04	040A04	040A04	2A, 2A/1, 2B	1006	1,0313	D 8-2
040A10	040A10	040A10	2A	1010	1,0301	Ck 10
040A12	040A12	030A12	2A, 2A/1, 2B	1012		
040A15		040A15		1015	1,0401	C 15
040A22			2C, 2D	1023	1,0402	C 22
045A10	045A10	045A10		1010	1,0301	C 10
045M10	045M10	045M10	32A	1010	1,0301	C 10
050A20			2C, 2D	1020		
055M15	055M15	055M15	2	1016	1,0402	C 22
060A32		060A32		1035	1,1180	Cm 35
060A40		060A40		1040	1,1186	Ck 40
060A45		060A45		1045	1,1191	Ck 45
060A47		060A47		1045	1,1191	Ck 45
060A57		060A57		1055	1,0535	C 55
060A62	060A62	060A62	43D	1060	1,0601	C 60
060A67	060A67	060A67		1064		
060A72	060A72	060A72				
060A78	060A78	060A78				
060A81	060A81	060A81		1080		
060A96			44, 44B			
070A72			42	1070		
070A78			42			
070M20	070M20	070M20	3B	1020	1,0402	C 22
070M26		070M26		1026		
070M55	070M55	070M55	9	1055	1,0535	C 55
080A15	080A15	080A15	3B	1016	1,1141	C 15
080A20	080A20			1021		
080A30	080A30	080A30	5B	1030		
080A32		080A32	5C	1035	1,1180	Cm 35
080A35		080A35	8A	1035	1,1180	Cm 35
080A37		070A37	8B	1035		
080A40		080A40	8C	1040	1,1186	Ck 40
080A42	080A42	080A42	8D	1042		
080A47	080A47	080A47	43B	1046	1,1730	C 45
080A52		080A52	43C	1053		
080A57		080A57		1055	1,05335	C 55
080A67	080A67	080A67	43E	1065		C 67
080H36		080H36		1035		
080H41		080H41		1039		
080H46		080H46		1046		
080M15	080M15	080M15	32C	1016	1,1141	C 15
080M30	080M30	080M30	6	1030	1,1178	Ck 30
080M36		080M36		1035		
080M40	080M40	080M40	8	1040	1,1186	Ck 40
080M46		080M46		1045	1,1191	Ck 45
080M50	080M50	080M50	43A	1049		

Carbon and Carbon Manganese Freecutting Steels

210A15	210A15	210A15		1117		
210M15	210M15	210M15	32M	1117	1,0723	15 S 20
212A37		212A37	8BM			
212A42	212A42	212A42	8DM	1139	1,0727	45 S 20
212M36		212M36	8M	1140	1,0726	35 S 20
214A15	214A15	214A15		1118		
214M15	214M15	214M15	202	1118		
216M28		216M28		1132		
216M36	216M36	216M36	15AM	1137		
216M44		216M44				
220M07		220M07	1A	1113	1,0711	9 S 20
225M36		225M36				
226M44	226M44	226M44	8M	1144	1,0727	45 S 20
230M07	230M07	230M07	1A	1213	1,0715	9 SMn 28
230M07Pb	230M07Pb	230M07Pb	1A Pb	12L14	1,0718	9 SMnPb 28

Stainless and Heat Resisting Steels

Steel	BS 970 1991	BS 970 1983	BS 970 1955 En	AISI/SAE	WERK-STOFF	KURZ-NAME
302S31	302S31	302S31		302		
303S31	303S31	303S31	58M	303	1,4305	X10 CrNis 18 9
303S42	303S42	303S42	58AM	303Se	1,4305	X10 CrNis 18 9
304S11	304S11	304S11		304L	1,4306	X2 CrNi 19 11
304S15	304S15	304S15	58E	304	1,4301	X5 CrNi 18 10
304S31	304S31	304S31		304	1,4301	X5 CrNi 18 10
310S31	310S31	310S31		310	1,4845	X12 CrNi 25 21
316S11	316S11	316S11		316L	1,4404	X2 CrNiMo 17 13 2
316S13	316S13	316S13		316L	1,4435	X2 CrNiMo 18 14 3
316S31	316S31	316S31		316	1,4401	X5 CrNiMo 17 12 2
316S33	316S33	316S33		316	1,4436	X5 CrNiMO 17 13 2
320S31	320S31	320S31		316Ti	1,4571	X6 CrNiMoTi 17 12 2
321S31	321S31	321S31		321	1,4541	X6 CrNiTi 18 10
325S31	325S31	325S31				
326S36			58JM	316Se		
347S31	347S31	347S31		347	1,4550	X6 CrNiNb 18 10
403S17	403S17	403S17		403	1,4000	X6 Cr 13
410S21	410S21	410S21	56A	410S	1,4006	X10 Cr 13
416S21	416S21	416S21	56AM	416	1,4005	X12 Cr S 13
416S29	416S29	416S29	56BM			
416S37	416S37	416S37	56CM			
416S41	416S41	416S41	56AM	416Se		
420S29	420S29	420S29	56B	420	1,4021	X20 Cr 13
420S37	420S37	420S37	56C			
430S17	430S17	430S17		430	1,4016	X6 Cr 17
431S29	431S29	431S29	57	431	1,4057	X20 CrNi 17 2
441S49			57	431Se		

Alloy Steels

Steel	BS 970 1991	BS 970 1983	BS 970 1955 En	AISI/SAE	WERK-STOFF	KURZ-NAME
523H15	523H15	523H15		5015	1,7012	13 Cr 2
523M15	523M15	523M15		5015	1,7015	15 Cr 3
527A17	527A17	527A17		5115		
527A60			48	5160	1,7176	55 Cr 3
527H17	527H17	527H17		5115		
527H60				5160	1,7176	55 Cr 3
527M17	527M17	527M17		5115		
530A30		530A30	18A	5130	1,7030	28 Cr 4
530A32		530A32	18B	5130	1,7033	34 Cr 4
530A36		530A36	18C	5132	1,7034	37 Cr 4
530A40		530A40	18D	5140	1,7035	41 Cr 4
530H32		530H32		5130	1,7033	34 Cr 4
530H36		530H36		5132	1,7034	37 Cr 4
530H40		530H40		5140	1,7035	41 Cr 4
530M40	530M40	530M40	18	5140	1,7035	41 Cr 4
534A99		534A99	31	52100	1,3505	100 Cr 6
590A15	590A15	590A15			1,7131	16 Mn Cr 5
590H17	590H17	590H17			1,7131	16 Mn Cr 5
590M17	590M17	590M17			1,7131	16 Mn Cr 5
605A32		605A32	16B			
605A37		605A37	16C			
605H32		605H32				
605H37		605H37				
605M36	605M36	605M36	16			
606M36	606M36	606M36	16M			
635A14	635A14	635A14				
635H15	635H15	635H15				
635M15	635M15	635M115	351			
637A16	637A16	637A16				
637H17	637H17	637H17				
637M17	637M17	637M17	352			
655H13	655H13	655H13		3415	1,5752	14 NiCr 14
655M13	655M13	655M13	36	3415	1,5752	14 NiCr 14
665H17	665H17	665H17		4615		
665H20	665H20	665H20		4620H		
665H23	665H23	665H23				
665M17	665M17	665M17	34	4615		
665M20	665M20	665M20		4620		
665M23	665M23	665M23	25			
708A25		708A25				
708A30		708A30		4130		
708A37		708A37	19B	4137	1,7220	34 CrMo 4
708A40		708A40		4140	1,7225	42 CrMo 4
708A42		708A42	19C	4142	1,7225	42 CrMo 4
708A47		708A47		4147	1,7228	50 CrMo 4
708H20	708H20	708H20				
708H37		708H37		4137H	1,722	34 CrMo 4
708H42		708H42		4142H	1,7227	42 CrMo 4
708H45		708H45		4145H		
708M20	708M20	708M20				
708M40	708M40	708M40	19	4140	1,7225	42 CrMo 4
709M40	709M40	709M40	19		1,7225	42 CrMo 4
720M32	720M32	720M32			1,7361	32 CrMo 12
722M24	722M24	722M24	40B		1,7361	32 CrMo 12
735A50			47	6150	1,8159	50 CrV 4
805A17	805A17	805A17		8617	1,6523	21 NiCrMo 2
805A20	805A20	805A20		8620	1,6543	21 NiCrMo 22
805A22	805A22	805A22		8622	1,6543	21 NiCrMo 22
805A60				8660		
805H17	805H17	805H17		8617H	1,6523	21 NiCrMo 2
805H20	805H20	805H20		8620H	1,6543	21 NiCrMo 22
805H22	805H22	805H22		8622H	1,6543	21 NiCrMo 22
805H60		805H60*		8660H		
805M17	805M17	805M17	361	8617	1,6523	21 NiCrMo 2
805M20	805M20	805M20	362	8620	1,6543	21 NiCrMo 22
805M22	805M22	805M22		8622	1,6543	21 NiCrMo 22
808H17	808H17	808H17				
808M17	808M17	808M17				
815H17	815H17	815H17				
805M17	815M17	805M17	353			
817A37		817A37		4340		
817A42		817A42		4340		
817M40	817M40	807M40	24	4340	1,6565	40 CrNiMo 6
820H17	820H17	820H17				
820M17	820M17	820M17	354			
822H17	822H17	822M17				
822M17	822M17	822M17	355			
826M31	826M31	826M31	25		1,6743	32 NiCrMo 10 4
826M40	826M40	826M40	26		1,6745	40 NiMoCr 10 5
832H13	832H13	832H13			1,6657	14 NiCrMo 13 4
832M13	832M13	832M13	36C	9310	1,6657	14 NiCrMo 13 4
835H15	835H15	835H15			1,6723	15 NiCrMo 16 5
835M15	835M15	835M15	39B		1,6723	15 NiCrMo 16 5
835M30		835M30	30B		1,6747	30 NiCrMo 16 6
897M39	897M39	897M39	40C		1,8523	39 CrMoV 13 9
905M39	905M39	905M39	41B		1,8509	41 CrAlMo 7
925A60		925A60*				
945M38	945M38	945M38	100			

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Hexagon, Ball-Ended Hexagon & Torx Keys

WIXROYD QUALITY

Wixroyd hand tools are made in a strict quality controlled environment, ensuring a continually high standard of product. Buying the best quality now saves time and money normally caused by the failure of low quality alternatives. The low quality alternatives are a false economy in the long run.

MATERIAL

Chrome-vanadium steel of the highest quality is used to make these products, and is either blackened or nickel plated. In addition, our hexagon keys are chamfered to provide a quality you can feel.

A/F OF HEX KEYS AND SCREW SIZES

A/F mm	Test Torque		Min Hardness HRC	ISO 4762 (DIN 912)	Hexagon Headed Screws			ISO 4026-4029 DIN 913-916
	Hexagon Nm	Ball Ended Nm			DIN 6912	DIN 7984	ISO 10642 (DIN 7991)	
0,7	0,08	-	52-55	-	-	-	-	M1,4 M1,6 (M1,8)
0,9	0,18	-		-	-	-	-	M2
1,3	0,53	-		(M1,4)	-	-	-	M2,5
1,5	0,82	0,40		M1,6 M2	-	-	-	M3
2,0	1,90	0,98		M2,5	-	M3	M3	M4
2,5	3,80	1,60		M3	-	M4	M4	M5
3	6,60	2,90		M4	M4	M5	M5	M6
4	16	6,40		M5	M5	M6	M6	M8
5	30	12		M6	M6	M8	M8	M10
6	52	21		M8	M8	-	M10	M12 (M14)
7	78	-	50-54	-	-	M10	-	-
8	120	50		M10	M10	M12	M12	M16
10	220	92	48-52	M12	M12	M14	M14 M16	(M18) M20
12	370	250		M14	M14	M16 M18	(M18) M20	(M22) M24
14	590	-		M16 M18	M16 M18	M20 M22	(M22 M24)	-
17	980	-	45-50	M20 (M22)	M20 M22	M24	-	-
19	1360	-		M24 (M27)	M24 M27	-	-	-
22	2110	-		M30	M30	-	-	-
24	2750	-		M33	M33	-	-	-
27	3910	-		M36	M36	-	-	-
32	6510	-		M42	-	-	-	-
36	9260	-		M48	-	-	-	-

* Speicial screws () no ISO standard

TORX KEY AND SCREW SIZES

Torx®		Nm	Torx® Headed Screws								
			Metric (M)						Sheet Metal		
Size	mm		DIN 4762 DIN 912	DIN 963 DIN 965	DIN 964 DIN 966	DIN 7984 DIN 6912	DIN 7985	DIN 7991	DIN 7981	DIN 7972 DIN 7982	DIN 7973 DIN 7983
T6	1,70	0,75	*	*	*	*	*	*	*	*	*
T7	1,99	1,4	*	*	*	*	*	*	*	*	*
T8	2,31	2,2	2,5	2,5	2,5	-	2,5	-	2,9	2,9	2,9
T9	2,50	2,8	*	*	-	-	-	-	-	-	-
T10	2,74	3,7	3	3	3	3	3	3	3,5	3,5	3,5
T15	3,27	6,4	*	3,5	3,5	-	3,5	-	3,9	3,9	3,9
T20	3,86	10,5	4	4	4	4	4	4	4,2	4,2	4,2
T25	4,43	15,9	5	5	5	5	5	5	4,8 / 5,5	4,8 / 5,5	4,8 / 5,5
T27	4,99	22,5	*	*	*	*	*	*	*	*	*
T30	5,52	31,1	6	6	6	6	6	6	6,3	6,3	6,3
T40	6,65	54,1	8	8	8	8	8	8	-	-	-
T45	7,82	86,2	*	*	*	*	*	*	*	*	*
T50	8,83	132	10	10	10	10	10	10	-	-	-
T55	11,22	252	12	-	-	12	-	12	-	-	-

* Special screws

Material Specifications and Properties

authentic stainless steels

Authentic steels are non-magnetic and it is not possible to harden them by heat treatment. The only method of hardening these steels is through cold forming or deformation when strain hardening takes place rapidly. The steel can be restored to a fully softened condition by annealing, sometimes referred to as solution treatment.

Type AISI 303 S21 (form EN58AM)

Colour Code: White (Austenitic - non magnetic). Free machining quality (contains sulphur). Good corrosion resistance and weldability is fair, but oxy-acetylene is not generally recommended. Can be cold formed but severe sharp corner bends should be avoided.
Typical application - Repetitive machining, Automatics etc.

Type AISI 304 S15 (form EN58E)

Colour Code: Yellow (Austenitic - non magnetic). General purpose stainless, machineability is fair, has good general corrosion resistance, weldability is good. (Oxy-acetylene is not generally recommended.) Cold forming is very good: also has good polishing qualities. Non-magnetic when annealed, slightly magnetic when cold worked. Typical application - Suitable for General Engineering, Hospital, Laundry etc.

Type AISI 316 S16 (form EN58J)

Colour Code: Red (Austenitic - non-magnetic). High corrosion resistance, especially salt water/acid. Machineability fair. Weldability good. Cold forming good. Non-magnetic when annealed, slightly magnetic when cold worked.

Chemical Agent	Stainless Steel	
	Grade 316	Grade 303
Acetaldehyde	A	A
Acetic Acid	A	A
Acetone	A	A
Acetylene Gas	A	A
Aluminium Chloride	C	C
Ammonia, aqueous liquid	A	A
Ammonium Chloride	A	B
Anlline	A	A
Benzene (Benzol)	A	A
Borax Solutions	A	A
Butane	A	A
Butyl Acetate	A	A
Butyl Alcohol	A	A
Calcium Chloride	A	B
Calcium Hydroxide	A	A
Carbon Tetrachloride	A	A
Chloroform	A	A
Chromic Acid	B	C
Citric Acid	A	A
Cyclohexane	A	A
Diesel Oil	A	B
Ethayl Acetate	A	A
Ethyl Alcohol	A	A
Ethylene Glycol	A	A
Ferric Chloride	B	C
Formic Acid	A	B
Freon 1	B	B
Freon 21	N/A	N/A
Freon 22	N/A	N/A
Gasoline	A	A
Glycerine	A	A
Hydrogen Gas	N/A	N/A
Hydrogen Peroxide	A	B
Hydrogen Sulphide	A	B
Kerosene	A	A
Lye	A	A
Lubricating Oils SAE	A	A
Magnesium Chloride	A	B
Magnesium Sulphate	A	A
Methane	A	A
Methyl Alcohol	A	A
Motor Oil	A	A
Naphtha	A	A
Nitric Acid	A	A
Phosphoric Acid	A	A
Potassium Dichromate	A	A
Potassium Hydroxide	A	A
Sodium Carbonate	A	A
Sodium Hydroxide	A	A
Sodium Hypochloride	A	B
Sodium Sulphate	A	A
Steam	A	A
Stearic Acid	A	A
Sulphur Dioxide Gas	B	B
Sulphuric Acid	A	C
Toluene	N/A	N/A
Trichloroethylene	A	A
Turpentine	A	A
Vegetable Oils	A	A
Vinyl Acetate	N/A	N/A
Water	A	A
Xylene	N/A	N/A
Zinc Chloride	B	C

A - Good Resistance **B - Medium Resistance** **C - Low Reistance**
N/R - Not Recommended **N/A - Information not available**

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Duroplast

1. All the values reported in the tables are the result of tests carried out in our laboratories under controlled temperate and humidity (23C - 58% rh) in given conditions of use for a relatively limited time. The technical designer should consider to use an adequate safety factor for particularly heavy conditions of use.

2. "Max. limit static load" means the value over which the applied load to the element, in certain conditions of use, may cause material deformation. To establish the admissible load on the element, designers should consider an appropriate safety factor according to specific conditions of use to vibrations, and dynamic loads.

Chemical Agents Resistance	Duroplast (PF) 23C	Painted Duroplast Clean 23C
Alcohol (methanol, ethanol, isopropanol, ...)	●	●
Boiling water		
Edible Oils	●	●
Esters (methyl acetate, ethyl acetate, ...)	●	N/A
Ether (ethyl eter, oil ether, ...)	●	N/A
Fat	●	N/A
Ketons (acetone)	●	●
Mineral oils	●	●
Petrol, gas oil, benzene	●	●
Strong acids (hydrolic, nitric, sulphuric, ...)	▲	▲
Strong alkali	▲	▲
Toluene	●	(milk effect)
Water	●	●
Weak acids (butyric, oleic, lactic, ...)		good
Weak alkali		good
Xylene	●	(milk effect)

● = good resistance
= fair resistance (limited use according to working conditions)
= poor resistance (should not be used)
N.B. = blanks stand for data not

Delrin Polyacetal 150		
Mechanical Properties	**ASTM Method**	**Values Polyac. 150**
Density	D792	1,42 g/cm³
Tensile strength @ yield	D628	
-55°C		101 N/mm²
-40°C		-N/mm²
12°C		69 N/mm²
70°C		48 N/mm²
100°C		36 N/mm²
122°C		26 N/mm²
Elongation @ break	D638	
-55°C		0,38%
-40°C		- %
12°C		75%
70°C		230%
100°C		>260%
122°C		>260%
Tensile E Modulus	D638	3100 N/mm²
Shear Strength	D732	66 N/mm²
Flexural Modulus	D790	
-55°C		3650 N/mm²
-40°C		2620 N/mm²
-23°C		1550 N/mm²
-70°C		895 N/mm²
-100°C		620 N/mm²
Flexural fatigue endurance limit	D671	32 N/mm²
Compressive stress	D695	
1% deformation		36 N/mm²
10% deformation		124 N/mm²
Izod impact strength	D256	
unnotched		no break J/m
notched		
-40°C		96 J/m
23°C		123 J/m
Tensile impact strength	D1822	350 KJ/m²
Deformation under load	D621	
(14N/mm² @ 50°C)		0,5%
Hardness, Rockell	D785	M94
		R120
Water absorption	D570	
24 hours immersion		0,25%
equilibrium 50% R.H.		0,22%
equilibrium, continuous immersion		0,90%

Delrin Polyacetal 150		
Mechanical Properties	**ASTM Method**	**Values**
Coefficient of dynamic friction against steel	D1894	
no lubricant	-61T	0,10 - 0,30
water lubricated		0,10 - 0,20
oil lubricated		0,05 - 0,10
against Brass		0,15
against Aluminium		0,15
against Polyacetal		0,35
THERMAL PROPERTIES		
Melting point	D2133	175°C
Deflection temperature under flexural load	D648	
1,8 N/mm²		38°C
0,5 N/mm²		172°C
Thermal conductivity		0,37 W/mK
Specific heat		1,47 Kj/kgK
Coefficient of linear thermal expansion	D696	
-40°C - 30°C		10,4 $1x10^{-50}$°C
30°C - 60°C		12,1 $1x10^{-50}$°C
60°C - 105°C		13,7 $1x10^{-50}$°C
105°C - 150°C		14,9 $1x10^{-50}$°C
Flamability	UL94	HB
Maximum continuous use temperature		
in air		90°C
in water		65°C
Maximum intermittent use temperature		
in air		150°C
in water		80°C
Minimum continuous use temperature		-40°C
ELECTRICAL PROPERTIES		
Volume resistivity	D257	10^{-25} ohm cm
Surface resistivity	D257	10^{-25} ohm
Dielectric strength short time (2,3mm sheet)	D149	20 kV/mm
Dielectric constant 10-2HZ - 106HZ	D150	3,7
Dissipation factor (1mm sheet)	D150	
100HZ		
1kHZ		
10kHZ		
1MHZ		0,005

Plastics and Rubbers

	Tensile Strength PSI	Elongation %	Max. Continuous °C	Service Temperture Min. °C	Resistance to Weak Acids	Resistance to Strong Acids	Resistance to Weak Alkalis	Resistance to Strong Alkalis	Resistance to Organic Solvents	Resistance to Oils and Greases	Resistance to Sunlight	Shore A Hardness	Dielectric Constant Volts/ mm	Tear Strength N/m
Low-density Polyethylene	600-2300	90-800	50	-30	Fair	Fair except for oxidising acids	Good	Good	Resistant below 60°C	Attcked by some	Poor if unprotected	-	-	-
High-density Polyethylene	3100-4500	10-150	60	-65	Good	Attcked by some	Good	Good	Unaffected below 80°C	Limited	Crazes if unprotected	-	-	-
Standard PVC	700-2000	700-2000	50	-35	Limited	Limited	Limited	Limited	Poor	Limited	Good	-	-	-
Polypropylene	3900-5000	50-600	110	-25	Good	Poor	Good	Good	Unaffected below 80°C	Poor	Poor	-	-	-
EVA	1750-2500	700-800	45	-20	Good	Attacked by oxidising acids	Good	Good	Poor	Poor	Poor degrades slowly	-	-	-
PA6,6 plyamide (Nylon) 66	7600	50-300	120	-80	Poor	Poor	Poor	Poor	Attacked by some	Attacked by some	Discolours slightly	-	-	-
PA6 plyamide (Nylon) 6	5800	50-250	100	-70	Poor	Poor	Poor	Poor	Attacked by some	Attacked by some	Discolours slightly	-	-	-
Polystyrene	3000-7000	1-60	65	-20	Good	Attacked by oxidising acids	Good	Good	Soluble in some	Attacked by some	Some attack	-	-	-
Thermoplastic Rubber	980-1100	980-1100	135	-40	Excellent	Good	Excellent	Good	Attacked by some	Attacked by some	Good	-	-	-
Silicone Rubber	8,5 Mpa	230	200	-60	Poor	Poor	Fair	Fair	Poor	Attacked	Good	-	-	-
Flexible PVC	2971	300% min	66	-29	Good	Poor	Good	Poor	Poor	Poor	Fair	76-80	7442	35023
POM-Polyacetal	8800	50-70	80	-40	Poor	Poor	Good	Good	Soluble in some	Good	Fair	-	-	-
EPDM	17,6-21 (Mpa)	500-800	121	-37,2	Good	Good	Fair	Fair	Attcked by some	Poor	Good	-	-	-
High-Temp PVC	16MNm-2	225-275	200	-25	Good	Good	Good	Fair	Poor	Poor	Fair	83-93	7442	31521

Technopolymer Part 1

Chemical Agents and Solvents	Polymide (PA)			Polypropylene (PP)			NBR Rubber			Thermoplastic Elastomer (TP)		Acetal Resin (POM)		
	notes	conc.%	23C	notes	conc.%	23C	notes	conc.%	23C	notes	23C	notes	conc.%	23C
Acetic acid	Sol.	10	▲		40	●			▲		●	Sol.	20	▲
Acetone		100	●		10	●			▲		●			●
Acrylonitrile		100	●						▲					
Alimentary Oils			●		10	●			●	Up to 60°C	●			●
Aluminium Chloride	Sol.	10	●		10	●	Sol.		●		●			
Aluminium Sulphate	Sol.	10	●		10	●	Sol.		●		●			
Amonia	Sol.	10	●	Conc.		●	Sol.							
Amonia - gaseous						●			●					
Ammonium chloride	Sol.	10	●			●	Sol.		●		●	Sol.	10	●
Amyl alcohol		100	●			●			●		●			●
Aniline		100				●			▲		▲			●
Beer	Sol.	10	●			●			●		●			●
Benzoic acid	Sol.	Sat.			Sat.	●	Sol.			Up to 60°C	●			
Benzol/benzene		100	●			▲			▲		▲			●
Boiling water	Swell.					●								
Boric acid	Sol.	10	●		Sat.	●	Sol.		●		●			
Butter			●			●			●		●			●
Butyl acetate		100	●			●								
Butyl alcohol		100	●			●			●		●			●
Calcium chloride	Sol.	10	●	Sol.	50	●	Sol.		●		●			●
Carbon disulphide		100	●			●			▲		▲			
Carbon tetrachloride			●			▲			▲		▲			●
Caustic soda 10%	Sol.	5, 10	●	Sol.	5, 10	●	Sol.	5, 10			●	Sol.	10	●
Caustic sode 50%	Sol.	50		Sol.	50	●	Sol.	50	▲		●			
Citric acid	Sol.	10			10	●	Sol.		●	Up to 60°C	●			●
Cloroform		100	▲			▲			▲		▲			
Copper sulphate	Sol.	10	●			●	Sol.		●		●			●
Dichloropan											▲			
Distilled water			●			●			●		●			●
Edible fat			●						●		●			●
Ethyl acetate		100	●			●			▲					●
Ethyl alcohol		96	●		96	●					●			●
Ethyl chloride		100	●			▲			●					
Ethyl ether		100	●			●					▲			
Ethylene glycol			●			●			●					
Ferric chloride	Sol.	10	●			●	Sol.		●		●			●
Formaldehyde (formalin)	Sol.	30	●	Sol.	40	●	Sol.	40			▲			
Formic acid	Sol.	10	●	Sol.	10	●	Sat.		▲	Up to 60°C	●		100	▲
Freon 11									●					●
Freon 12	Liq.		●						●					●
Freon 13									●					●
Gas oil			●			●			●		▲			●
Glycerine			●			●			●		▲			
Glycol butylene		100	●						●					
Hydrochloric acid	Sol.	10	●	Sol.	30	●	Sol.	10		Up to 60°C	●	Sol.	10	▲
Hydrofluoric acid	Sol.	40	●	Sol.	40	●		50	▲					▲
Hydrogen peroxide	Sol.	3	●	Sol.	30	●	Sol.	80	▲			Sol.	90	▲
Iodine tincture-alcoholic			▲			●					●			
Isopropyl alcohol			●			●					●			●

Conc.	= concentration
Sol.	= solution
Liq.	= liquid
Sat.	= saturated
Swell.	= swelling

●	= good resistance
	= fair resistance (limited use according to working conditions)
▲	= poor resistance (should not be used)
N.B.	= blanks stand for data not available

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Technopolymer Part 2

Chemical Agents and Solvents	Polymide (PA)			Polypropylene (PP)			NBR Rubber			Thermoplastic Elastomer (TP)		Acetal Resin (POM)		
	notes	conc.%	23C	notes	conc.%	23C	notes	conc.%	23C	notes	23C	notes	conc.%	23C
Kerosene			●						●		▲			●
Lactic acid	Sol.	10	●	Sol.	20	●	Sol.		●		●			●
Linseed oil			●			●			●	Up to 60°C	●			●
Magnesium chloride	Sol.	10	●	Sol.	Sat.	●	Sol.		●	Up to 60°C	●			●
Mercuric chloride	Sol.	6	▲			●					●			
Mercury			●			●			●		●			
Methyl acetate		100	●								●			
Methyl alcohol		100	●		100	●								●
Methyl ethyl ketone			●						▲		●			▲
Methylene chloride		100	●						▲		▲			
Milk			●			●			●		▲			●
Mineral oil			●			●			●		●			●
Nitric acid		10	▲	Sol.	10	●	Sol.	10		Up to 60°C	●	Sol.	10	▲
Oil			●						●					●
Oil ether			●			●					▲			●
Oils for transformers			●						●		▲			●
Oleic acid		100	●	Sol.		●				Up to 60°C				●
Paraffin oil			●			●			●	Up to 60°C	●			
Petrol			●				Swell.			Up to 60°C	●			●
Petrol vapor			●	Swell.							▲			●
Phenol	Sol.		▲			●			▲		▲			▲
Phosporic acid	Sol.	10	▲	Sol.	85	●	Sol.	20			▲	Sol.	10	▲
(Caustic Potash) Potassium hydroxide 50%	Sol.	50		Sol.	50		Sol.	50	▲	Up to 60°C	●			
(Caustic Potash) Potassium hydroxide 10%	Sol.	5,10	●	Sol.	5,10	●	Sol.	5, 10			●	Sol.	10	
Potassium nitrate	Sol.	10	●	Sat.		●			●		●			
Sea, river and drinkable water			●			●			●		●			●
Silicon oil			●			●			●					
Silver nitrate			●	Sol.	20	●	Sol.				●			
Soap solution	Sol.		●	Sol.		●	Sol.		●		●			●
Sodium carbonate	Sol.	10	●	Sol.	Sat.	●	Sol.		●		●			●
Sodium chloride	Sol.	10	●	Sol.	Sat.	●	Sol.		●		●			●
Sodium hypochlorite	Sol.		●	Sol.	20	●	Sol.	10	▲		●	Sol.	5	▲
Sodium nitrate	Sol.	10	●	Sol.		●			●		●			
Sodium silicate			●			●	Sol.		●		●			
Sodium sulphate	Sol.	10	●			●	Sol.		●		●			●
Steam			●			●					●			
Sulphuric acid	Sol.	10	●		98	●	Sol.	20		Up to 60°C	●	Sol.	10	▲
Tartaric acid			●	Sol.	10	●	Sol.		●	Up to 60°C	●			●
Tetralin			●			▲			▲		▲			
Toluol/toluene			●						▲		▲			●
Trichloroethylene						▲			▲		▲			
Unleaded petrol			●	Swell.			Swell.				▲			●
Vaseline			●			●			●					
Vinegar						●					●			
Whisky			●			●			●		●			●
Wine			●			●			●		●			●
Xiyol			●			▲			▲		▲			●
Zinc chloride		10		Sol.	20	●	Sol.		●		●			●