



ISO BASIC TOLERANCES

(DIN 7155)

Basic Size Step mm	IT Quality																			
	01	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1...3	0,3	0,5	0,8	1,2	2	3	4	6	10	14	25	40	60	0,1	0,14	0,25	0,4	0,6	1	1,4
3...6	0,4	0,6	1	1,5	2,5	4	5	8	12	18	30	48	75	0,12	0,18	0,3	0,48	0,75	1,2	1,8
6...10	0,4	0,6	1	1,5	2,5	4	6	9	15	22	36	58	90	0,15	0,22	0,36	0,58	0,9	1,5	2,2
10...18	0,5	0,8	1,2	2	3	5	8	11	18	27	43	70	110	0,18	0,27	0,43	0,73	1,1	1,8	2,7
18...30	0,6	1	1,5	2,5	4	6	9	13	21	33	52	84	130	0,21	0,33	0,52	0,84	1,3	2,1	3,3
30...50	0,6	1	1,5	2,5	4	7	11	16	25	39	62	100	160	0,25	0,39	0,62	1	1,6	2,5	3,9
50...80	0,8	1,2	2	3	5	8	13	19	30	46	74	120	190	0,3	0,46	0,74	1,2	1,9	3	4,6
80...120	1	1,5	2,5	4	6	10	15	22	35	54	87	140	220	0,35	0,54	0,87	1,4	2,2	3,5	5,4
120...180	1,2	2	3,5	5	8	12	18	25	40	63	100	160	250	0,4	0,63	1	1,6	2,5	4	6,3
180...250	2	3	4,5	7	10	14	20	29	46	72	115	185	290	0,46	0,72	1,15	1,85	2,9	4,6	7,2
250...315	2,5	4	6	8	12	16	23	32	52	81	130	210	320	0,52	0,81	1,3	2,1	3,2	5,2	8,1
315...400	3	5	7	9	13	18	25	36	57	89	140	230	360	0,57	0,89	1,4	2,3	3,6	5,7	8,9
400...500	4	6	8	10	15	20	27	40	63	97	155	250	400	0,63	0,97	1,55	2,5	4	6,3	9,7

ISO BASIC TOLERANCES

1μ=0,01 mm (DIN 7160 & DIN 7161)

Outside dimensions (Shaft) fit μm						Basic Size Step mm	Inside dimensions (Hole) fit μm									
h7	h8	h10	h12	js6	js8		js9	H9	H10	H12	J9	JS6	JS8	JS9	N9	P9
0 -12	0 -18	0 -48	0 -120	±4	±9	±15	3...6	+30 0	+48 0	+120 0	±15	±4	±9	±15	0 -30	-12 -42
0 -15	0 -22	0 -58	0 -150	±4,5	±11	±18	6...10	+36 0	+58 0	+150 0	±18	±4,5	±11	±18	0 -36	-15 -51
0 -18	0 -27	0 -70	0 -180	±5,5	±13,5	±21,5	10...18	+43 0	+70 0	+180 0	+21 -22	±5,5	±13,5	±21,5	0 -43	-18 -61
0 -21	0 -33	0 -84	0 -210	±6,5	±16,5	±26	18...30	+52 0	+84 0	+210 0	±26	±6,5	±16,5	±26	0 -52	-21 -74
0 -25	0 -39	0 -100	0 -250	±8	±19,5	±31	30...50	+62 0	+100 0	+250 0	±31	±8	±19,5	±31	0 -62	-25 -88
0 -30	0 -46	0 -120	0 -300	±9,5	±23	±37	50...80	+74 0	+120 0	+300 0	±37	±9,5	±23	±37	0 -74	-30 -106
0 -35	0 -54	0 -140	0 -350	±11	±27	±43,5	80...120	+87 0	+140 0	+350 0	+43 -44	±11	±27	±43,5	0 -87	-35 -124
0 -40	0 -63	0 -160	0 -400	±12,5	±31,5	±50	120...180	+100 0	+160 0	+400 0	±50	±12,5	±31,5	±50	0 -100	-40 -143
0 -46	0 -72	0 -185	0 -460	±14,5	±36	±57,5	180...250	+115 0	+185 0	+460 0	+57 -58	±14,5	±36	±57,5	0 -115	-46 -165

Tolerances for Length and Angle

TS1980 (ISO 2768)

For length

Tolerance Class	length: mm and fit: mm							
	0,5 to 3 incl.	Over 3 to 6 incl.	Over 6 to 30 incl.	Over 30 to 120 incl.	Over 120 to 400 incl.	Over 400 to 1000 incl.	Over 1000 to 2000 incl.	Over 2000 to 4000 incl.
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

For arc and chamfer

For angle

Tolerance Class	length: mm and fit: mm			Short edge: mm, Fit : Degree and minutes				
	0,5 to 3 incl.	over 3 to 6 incl.	Over 6	10 or less	Over 10 to 50 incl.	Over 50 to 120 incl.	Over 120 to 400 incl.	Over 400
f (Fine)	±0,2	±0,5	±1	±1°	±0° 30'	±0° 20'	±0° 10'	±0° 5'
m (Medium)	±0,4	±1	±2	±1° 30'	±1°	±0° 30'	±0° 15'	±0° 10'
c (Coarse)				±3°	±2°	±1°	±0° 30'	±0° 20'
v (Very Coarse)								



Mechanical Properties of Bolts TS 3576 (DIN ISO 898)

Material Properties		3.6	4.6	4.8	5.6	5.8	6.8	8.8	9.8	10.9	12.9
Tensile Strength	Rm N/mm ²	300	400		500		600	800	900	1000	1200
Yield Strength	ReL N/mm ²	180	240	320	300	400	480	-	-	-	-
0,2 Yield Strength	Rp 0,2 N/mm ²	-	-	-	-	-	-	640	720	900	1000
% Elongation	As	25	22	14	20	10	8	12	10	9	8

Hexagon Socket Countersunk Head Cap Screws DIN 74

A - Type		Screw Size		M2	M3	M4	M5	M6	M8	M10	M12	M16	M20	
Medium (o)		Quality	d1	H13	2,4	3,4	4,5	5,5	6,6	9	11	14	18	22
			d2	H13	4,6	6,5	8,6	10,4	12,4	16,4	20,4	24,4	32,4	40,4
Fine (i)		Quality	t1		1,1	1,6	2,1	2,5	2,9	3,7	4,7	5,2	7,2	9,2
			d1		2,2	3,2	4,3	5,3	6,4	8,4	10,5	13	17	21
TS 1023/1,3,4,7	TS 432/10,11,12,14,15,16	Quality	d3		4,3	6	8	10	11,5	15	19	23	30	37
			t1		1,2	1,7	2,2	2,6	3	4	5	5,7	7,7	9,7
t2		Quality	t2		0,15	0,25	0,3	0,3	0,45	0,7	0,7	0,7	1,2	1,7
Medium (o)		Quality	d1	H13	-	3,4	4,5	5,5	6,6	9	14	18	18	22
			d2	H13	-	6,6	9	11	13	17,2	21,5	26	32	38
Fine (i)		Quality	t1		-	1,6	2,3	2,8	3,2	4,1	5,3	6	7	8
			d1	H12	-	3,2	4,3	5,3	6,4	8,4	10,5	13	17	21
TS1023/13 (DIN 7991)		Quality	d3	H12	-	6,3	8,3	10,4	12,4	16,5	20,5	25	31	37
			t1		-	1,7	2,4	2,9	3,3	4,4	5,5	6,5	7,5	8,5
t2		Quality	t2		-	0,2	0,3	0,3	0,3	0,4	0,5	0,5	0,5	0,5

Hexagon Socket Head Cap Screws DIN 974 -1, DIN 74

Screw Size		M5	M6	M8	M10	M12	M14	M16	M20	M24	M30	
d1	o - H13	5,5	6,6	9	11	14	16	18	22	26	33	
	i - H12	5,3	6,4	8,4	10,5	13	15	17	21	25	-	
d2	H13	10	11	15	18	20	24	26	33	40	48	
d3		Only burr					16	18	20	24	28	36
t	H - Type	4	4,7	6	7	8	9	10,5	12,5	14,5	-	
	J - Type	4,2	4,8	6	7,5	8,5	9,5	11,5	13,5	15,5	19,5	
	K - Type	5,7	6,8	9	11	13	15	17,5	21,5	25,5	32	

Flat Mushroom Head Screws with Hexagon Socket and Fillister Head Screw DIN 974 -2, DIN 74

Screw Size		M5	M6	M8	M10	M12	M14	M16	M20	M24	M30
d1	o - H13	5,5	6,6	9	11	14	16	18	22	28	33
	i - H12	5,3	6,4	8,4	10,5	13	15	17	21	25	-
d2	SA, TA	15	18	24	28	33	36	40	46	57	71
	H15 SB, TB	18	20	26	33	36	43	46	53	71	82
d3		Only burr					16	20	24		
t	SA, SB	4,2	4,8	6,5	8	9	10	11,5	14,5	16,5	21
	TA, TB	4,7	5,8	7,5	9	11	12	14,5	17,5	20,5	26



Comparison of Materials

Carbon Steels - Alloy steel and related materials

Material No	ASTM	ISO (683/1,10,11)	DIN 17200	SAE / AISI J 403	BS 970	NF A33-101	JIS G 4051	GB 1050,4543
1.0301	1008 1010	C10	CK10 C 10	1010	045A10 045M10	XC10	S10C	08 10
1.0401 1.1141	1015	C15E4 C15M2	C 15 CK15	1015	080M15	CC12 XC15	S15C	15
1.0402 1.1151	1020	-	C 20 CK20	1020	070M20 050A20	XC25	S20C	20
1.0528	1030	C30	C 30	1030	080A30	AF50-C30	S30C	30
1.0501	1035	C35	C 35	1035	080M36	AF50-C30	S35C	35
1.0511	1040	C40	C 40	1039 1040	080M40	AF60-C45 XC42H1	S40C	40
1.0503	1045	C45	C 45	1045 1046	060A45 080M46	AF65-C45 XC45	S45C	45
1.0540	1050	C50	C 50	1049 1050	080M50	XC50	S50C	50
1.0535	1055	C55	C 55	1055	070M55	AF70-C55	S55C	55
1.0601	1060	C60	C 60	1060	080A60	XC60	S58C	60
1.0603	1070	-	C 67	1070	080A67	XC68	-	-
1.0605	1074	-	C 75	1074	080A72	XC75	-	-

Sulfur and sulfur combined free cutting steels (TS 3051)

Material No	DIN	SAE/AISI	UNI	BS	NF / AFNOR	JIS	Notes
1.0711	9S20	1212	-	220 M 07	-	SUM21	Heat treatment isn't applied.
1.0715	9SMn20	1213	CF 9SMn28	230 M 07	S 520	SUM22	Heat treatment isn't applied.
1.0718	9SMnPb28	12L13	CF 9SMnPb28	230 M 07 Pb	S 520 Pb	SUM22L	Heat treatment isn't applied.
1.0736	9SMn36	1214	CF 9SMn36	230 M 07	S 300	SUM25	Heat treatment isn't applied.
1.0737	9SMnPb36	12L14	CF 9SMnPb36	230 M 07 Pb	S 300 Pb	SUM24L	Heat treatment isn't applied.
1.0721	10S20	1108	CF 10S20	210 M 15	13 MF 4	-	Cementation is applied.
1.0722	10SPb20	11L08	CF 10 SPb 20	-	13 MF 4 Pb	-	Cementation is applied.
1.0726	35S20	1140	-	212 M 36	-	-	Tempered is applied.
1.0727	45S20	1146	-	-	-	-	Tempered is applied.
1.0728	60S20	-	-	-	-	-	Tempered is applied.

Notes:

ISO: International Organization for Standardization / Uluslararası Standardizasyon Kurumu

AISI: American Iron and Steel Institute / Amerikan Demir Çelik Enstitüsü

SAE: Society Automotive Engineers / Otomotiv Mühendisleri Odası

BS: British Standard / İngiliz Standartları

DIN: Deutsches Institut für Normung / Alman Standartları Enstitüsü

NF: Norme Francaise / Fransız Normları

JIS : Japan Industrial Standards / Endüstriyel Japon Standartları

GB: Guo Biao Standard / Çin Standartları

UNI: Ente Nazionale Italiano di Unificazione / İtalyan Standartları Enstitüsü



Comparison of Materials

Case Hardened Steels

Material No	ISO (683/1,10,11)	SAE AISI	BS 970 Part-1	DIN	NF A35-551-554	JIS G 4052
1.5713	13NiCr6	3115	-	13NiCr6	10NC6	-
1.5752	14NiCr14	3415-3310	655H13	14NiCr14	14NC12	-
1.5919	15CrNi6	3115	S107,970-3	15CrNi6	16NC6	-
1.5920	18CrNi8	6264	080M46	18CrNi8	-	-
1.6523	21NiCrMo2	8620	805H20, 805M20	21NiCrMo2	20NCD2	SNCM220H
1.6587	17NiCrMo6	4820, 4317	820A16	17NiCrMo6	18NCD6	-
1.7015	15Cr3	5015	523M15,530A32	15Cr3	12C3, 15Cr2,18C3	-
1.7034	34Cr4	5135	530A36, 530M36	34Cr4	37Cr4, 38C4	-
1.7035	41Cr4	5140	530A40, 530M40	37Cr4	41Cr4, 42C4	-
1.7131	16MnCr5	5115	527M17, 590H17	16MnCr5	16MC5, 16MnCr5	-
1.7139	16MnCrS5	5115	527M17, 590H17	16MnCrS5	16MC5	SMnC420H
1.7147	20MnCr5	5120	-	20MnCr5	20MC5	SMnC420H
1.7149	20MnCrS5	4820, 4826	-	20MnCrS5	-	-
1.7243	18CrMo4	-	708M20	18CrMo4	18CD4	-
1.7321	20MoCr4	8620	805A22	20MoCr4	20MoCr4 KD	-
1.7323	20MoCrS4	8620	-	20MoCrS4	-	-
1.7325	25CrMo4	-	-	25CrMo4	-	-
1.7326	25CrMoS4	-	-	25CrMoS4	-	-

Tempered Steels

Material No	ISO (683/1,10,11)	SAE AISI	BS 970 Part-1	DIN	NF A35-551-554	JIS
1.6511	-	4340, 9840	817M37, 816M40	36CrNiMo4	35NCD5, 40NCD3	-
1.6580	-	4340	823M30	30CrNiMo8	30CND8	SNCM431
1.6582	-	4340, 4337	816M40, 817M40	34CrNiMo6	35NCD3	SNCM447
1.7006	-	5045, 5046	-	46Cr2	42C2, 46Cr2	-
1.7033	34Cr4	5132	530A32, 530M32	34Cr4	32C4, 34Cr4	SCr430
1.7034	37Cr4	5135	530A36, 530M36	37Cr4	38Cr4, 38C4	SCr435
1.7035	41Cr4	5140	530A40, 530M40	41Cr4	41Cr4, 42C4	SCr440
1.7218	-	4130	708A25	25CrMo4	25CD4, 25CrMo4	SCM430
1.7220	34CrMo4	4135, 4137	708A37	34CrMo4	35CrMo4, 35CD4	SCM432
1.7225	42CrMo4	4140, 4142	708M40, 3111-5/1	42CrMo4	42CD4TS	SCM440
1.7228	-	4150	708A47	50CrMo4	50CrMo4	SCM445

Bearing Steels

Material No	ISO	SAE AISI	BS	DIN	NF	JIS
1.3503	-	6443F, 51100	-	105Cr4	-	SUJ 1
1.3505	1.2067	6440K,52100	534A99	100Cr6	100C6	SUJ 2
1.3520	-	A485	535A99	100CrMn6	100CM6	SUJ 3
1.4125	X105CrMo17	440 C	-	X105CrMo17	Z100CD17	SUS 440C



Comparison of Materials

Alloy Tool Steels					
Material No	DIN	AISI	BS	NF / AFNOR	JIS
1.2080	X210Cr12	D3	BD3	Z200C12, X200Cr12	SKD1
1.2345	X50CrVMo5-1	-	-	-	-
1.2379	X155CrVMo12-1	D2	BD2	Z160CDV12	SKD11
H.2380	X220CrVMo13-4	-	-	-	-
1.2436	X210CrW12	D6	-	-	SKD2
1.2601	X165CrMoVa12	-	-	-	SKD11
Alloy Tool Steels					
Material No	DIN	AISI	BS	NF / AFNOR	JIS
1.2343	X38CrMoV5-1	H11	BH11	Z38CDV5	SKD6
1.2344	X40CrMoV5.1	H13	BH13	Z40CDV5	SKD61
1.2365	X32CrMoV3.3	H10	BH10	32CDV28	SKD7
1.2367	X38CrMoV5.3	H11	BH11	-	SKD61
1.2581	X30WCRV9 3	H21	BH21	Z30WCV9	SKD5
1.2714	X165CrMoVa12	6F3, L6	BS224	55NCDV7	SKT4
Alloy Tool Steels					
Material No	DIN	AISI	JIS	ASTM	NF / AFNOR
1.2083	X42Cr13	420	SUS 420J2	-	X41CR13KU
1.2312	40CrMnMoS8-6	P20+S	-	-	-
1.2738	40CrMnNiMo8-6-4	P20	SNCM	P20+Ni	40CMND8
Alloy Tool Steels					
Material No	DIN	AISI	BS	NF / AFNOR	JIS
1.2510	100MnCrW4	O1	-	-	SK33
1.2842	90MnCrV8	O2	BO2	90MV8	-
Spring Steels					
Material No	DIN	AISI	BS	NF / AFNOR	EN 10027-2
1.0900	38Si6	-	-	-	1.5022
1.0902	46Si7	9245	-	45S7	1.5024
1.0903	51Si7	9255	-	50S7	1.5025
1.0904	55Si7	5155H, 9225	251A58	55S7	1.5026
1.0908	60SiMn5	-	-	-	1.5142
1.0961	60SiCr7	9262	-	-	-
1.0970	38Si7	-	-	-	1.5023
1.5028	65Si7	9260H	251A61	60S7	1.5028
1.5029	71Si7	-	-	-	-
1.5225	51MnV7	-	-	-	-
1.7103	67SiCr8	9254	-	-	1.7103
1.7138	52MnCrB3	50B50	-	-	-
1.7176	55Cr3	5155	-	-	-
1.7701	51CrMoV7	-	-	-	-



Comparison of Materials

According to Tensile Strength Structural Steel

Material	DIN 17100	SAE / AISI	EN 10025-2	NF / AFNOR 35-501	UNI 7070	BS 4360	JIS G3101
1.0035	St 33	-	S185	A 33	Fe 320	-	SS330
1.0037	St 37-2	-	S235JR	E24-2	Fe 360B	40 A	-
1.0036	USt 37-2	A570Gr.33,36	-	-	-	-	-
1.0038	RSt 37-2	A570Gr.36	S235JR	E24-2 NE	-	40 B	-
1.0116	St 37-3	A284Gr.D	S235JR	E24-4	Fe 360 D	40 D	-
1.0044	St 44-2	A570Gr.40	S275JR	E28-2	Fe 430 B	43 B	SS400
1.0144	St 44-3	A578Gr.70	S275JO	E28-3	Fe 430 C	43 C	-
1.0570	St 52-3	-	S355J2+N	E36-3	Fe 510 D	50 D	-
1.0050	St 50-2	A570Gr.50	E295	A50-2	Fe 490	-	SS500
1.0060	St 60-2	-	E335	A60-2	Fe 590	-	-
1.0070	St 70-2	-	E360	A70-2	Fe 690	-	-

U - Boiling Casting, R - Calm Casting

TS - 552 Gray Cast Irons

TS - 552 Lamellar Graphite Cast Irons

Symbol	DDL-15	DDL-20	DDL-25	DDL-30
Tensile Strength N/mm ²	150	200	250	300
Features				
Hardness HB	160-190	170-210	180-250	200-240
Mikro structure	Ferritic + Pearlitic	Pearlitic + Ferritic	Pearlitic (min %90)	Pearlitic (%100)
Chemical Composition	C : 3.40-3.60	C : 3.20-3.40	C : 3.00-3.25	C : 2.95-3.10
	Si : 2.30-2.50	Si : 2.10-2.30	Si : 1.85-2.10	Si : 1.70-2.00
	Mn : 0.50-0.80	Mn : 0.50-0.80	Mn : 0.40-0.70	Mn : 0.40-0.70
	S : 0.12 max. P : 0.50 max.	S : 0.12 max. P : 0.40 max.	S : 0.12 max. P : 0.25 max.	S : 0.10 max. P : 0.20 max.

TS - 552 Comparison of Lamellar Graphite Cast Irons

TSE TS-552	EU - EN 1561	DIN 1691	ASTM A 4876	BS 1452	NF A32-101	UNI 5007	JIS G 5501
DDL-15	GJL 150	GG 15	Class 20 B	Grade 150	Ft 15 D	GG 15	FC 150
DDL-20	GJL 200	GG 20	Class 25 B	Grade 220	Ft 20 D	GG 20	FC 200
DDL-25	GJL 250	GG 25	Class 35 B	Grade 250	Ft 25 D	GG 25	FC 250
DDL-30	GJL 300	GG 30	Class 50 B	Grade 300	Ft 30 D	GG 30	FC 300

